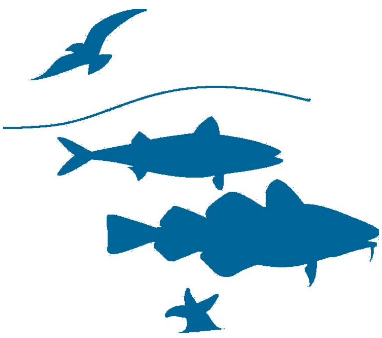
Marine Institute
Foras na Mara

Fisheries Science Services,
Galway Technology Park,
Parkmore, Galway, Ireland

THE STOCK BOOK

Report to the Minister for Communications, Marine and Natural Resources

Annual Review of Fish Stocks in 2005 with Management Advice for 2006



Throughout 2005 the FSS Team were Involved in Data Collection, Data Analysis, Conducting Assessments, Formulating and Providing Advice and Carrying out Scientific Research on Fish Stocks, both Nationally and Internationally.
The Results of this Work are Presented in the 2005 Stock Book

NOVEMBER 2005

In the 2005 Stock Book, every effort has been made to use the most up to date version of the ICES and STECF advice. However, the final official ICES ACFM and STECF Reports should be consulted for the definitive advice. For more detailed information on specific stocks the relevant ICES Working Group Reports should be consulted. The official EU journal should be consulted for definitive TAC's and Quotas for 2005.

The cover painting by Sabine Springer is based on the idea of the ecological pyramid. It shows phytoplankton, zooplankton, herring, salmon and a sea bird. In this painting, the killer whale (Orcinus orca) is the top predator. All these species are found in the Atlantic waters around Ireland. More work by Sabine Springer can be seen at www.kinvara.com/sabinespringer.

Marine Institute Headquarters
Galway Technology Park
Parkmore
Galway
Ireland

Telephone: +353 (0)91 730 400
Facsimile: +353 (0)91 730 470

E-mail Information: institute.mail@marine.ie
E-mail Webmaster: webmaster@marine.ie
Website: www.marine.ie

Table of Contents

Table of Contents	1
ICES Fishing Areas	4

Introduction	5
Ecosystem Approach To Fisheries Management	8
Implementing the Johannesburg Declaration as part of the CFP	13
The New and Evolving Framework of ICES Advice	15
Effort Limitation and Recovery Plans	21
Misreporting and Other Unaccounted Removals	24

Ecosystem Overview for Widely Distributed and Migratory Populations.	**27**

FSS Advice for Widely Distributed and Migratory Populations.	**30**
HERRING - North Sea Herring (Sub-area IV, Divisions VIId-e, Division IIIa)	34
HERRING - Norwegian Spring Spawning Herring (Sub-areas I & II)	36
MACKEREL - North East Atlantic Mackerel	43
HORSE MACKEREL - Western Horse Mackerel	54
HORSE MACKEREL - North Sea Horse Mackerel	64
BLUE WHITING - Combined Stock (Sub-areas I-IX, XII and XIV)	69
ALBACORE TUNA - North Atlantic	81
BLUEFIN TUNA - East Atlantic and Mediterranean	82
BASKING SHARK - North East Atlantic Basking Shark	83
PORBEAGLE – North East Atlantic Porbeagle	85
SPURDOG – North East Atlantic Spurdog	87

Ecosystem Overview for demersal stocks in the Waters Around Ireland	**90**

FSS Advice on Mixed Fisheries in the Irish Sea	**95**
COD - Irish Sea Cod (Division VIIa)	101
WHITING - Irish Sea Whiting (Division VIIa)	108
HADDOCK - Irish Sea Haddock (Division VIIa)	114
NEPHROPS - Irish Sea Nephrops (MA J = North of Division VIIa)	120
PLAICE - Irish Sea Plaice (Division VIIa)	124
SOLE - Irish Sea Sole (Division VIIa)	131
HERRING - Irish Sea Herring (Division VIIa North)	136

FSS Advice on Mixed Fisheries for West of Scotland and Rockall	**141**
COD - West of Scotland Cod (Division VIa)	147
COD - Rockall Cod (Division VIb)	153
HADDOCK - West of Scotland Haddock (Division VIa)	155
HADDOCK - Rockall Haddock (Division VIb)	163
WHITING - West of Scotland Whiting (Division VIa)	168

WHITING - Rockall Whiting (Division VIb)	173
MEGRIM - West of Scotland and Rockall Megrim (Sub-area VI)	175
ANGLERFISH - West of Scotland, Rockall and North Sea Anglerfish (Sub-areas IV and VI)	180
NEPHROPS - West of Scotland Nephrops (MA C = Division VIa)	189
PLAICE - West of Scotland Plaice (Sub-area VI)	193
SOLE - West of Scotland and Rockall Sole (Sub-area VI)	195
POLLACK - West of Scotland and Rockall Pollack (Sub-area VI)	197
SAITHE - North Sea Saithe (Sub-areas IV, VI and Divisions IIa, IIIa-d)	199
HERRING - West of Scotland Herring (Division VIa North)	207

FSS Advice on Mixed Fisheries in the Celtic Sea	**214**
HAKE - Northern Hake (Divisions IIa, IIIa-d, Vb, VIIIabde Sub-areas IV, VI, VIII, XII and XIV)	223
COD - Celtic Sea and Western Channel Cod (Divisions VIIe-k)	232
COD - West of Ireland Cod (Divisions VIIb,c)	239
HADDOCK - West of Ireland and Celtic Sea Haddock (Divisions VIIb-k)	241
WHITING - Celtic Sea and Western Channel Whiting (Divisions VIIe-k)	246
WHITING - West of Ireland Whiting (Divisions VIIb,c)	254
ANGLERFISH - Celtic Sea and Bay of Biscay Anglerfish (Divisions VIIb-k and VIIIa,b)	256
MEGRIM - Celtic Sea and Bay of Biscay Megrim (Sub-area VII and Divisions, VIIIa,b,d,e)	267
PLAICE - Celtic Sea Plaice (Divisions VIIf,g)	274
PLAICE - Southwest of Ireland Plaice (Divisions VIIh-k)	281
PLAICE - West of Ireland Plaice (Divisions VIIb,c)	284
SOLE - Celtic Sea Sole (Divisions VIIf,g)	287
SOLE - Southwest of Ireland Sole (Divisions VIIh-k)	296
SOLE - West of Ireland Sole (Divisions VIIb,c)	299
NEPHROPS - West of Ireland and inshore south of Ireland Nephrops (MA L = Divisions VIIbcgjk)	302
NEPHROPS - Southern Irish Sea and Celtic Sea Nephrops (MA M = Divisions VIIagh)	309
POLLACK - West of Ireland and Celtic Sea Pollack (Sub-area VII)	313
SAITHE - West of Ireland and Celtic Sea Saithe (Sub-area VII)	315
HERRING - Celtic Sea Herring (Division VIIaS, VIIg-h, VIIj-k)	317
HERRING - North west of Ireland Herring (Divisions VIa South & VIIb,c)	325

Deepwater Stocks - South of 63^0 N	**331**
FSS Advice on Deepwater Species	331
Deepwater Ecosystem	336
NEAFC and OSPAR Request on Seamounts and Vulnerable Habitats	342

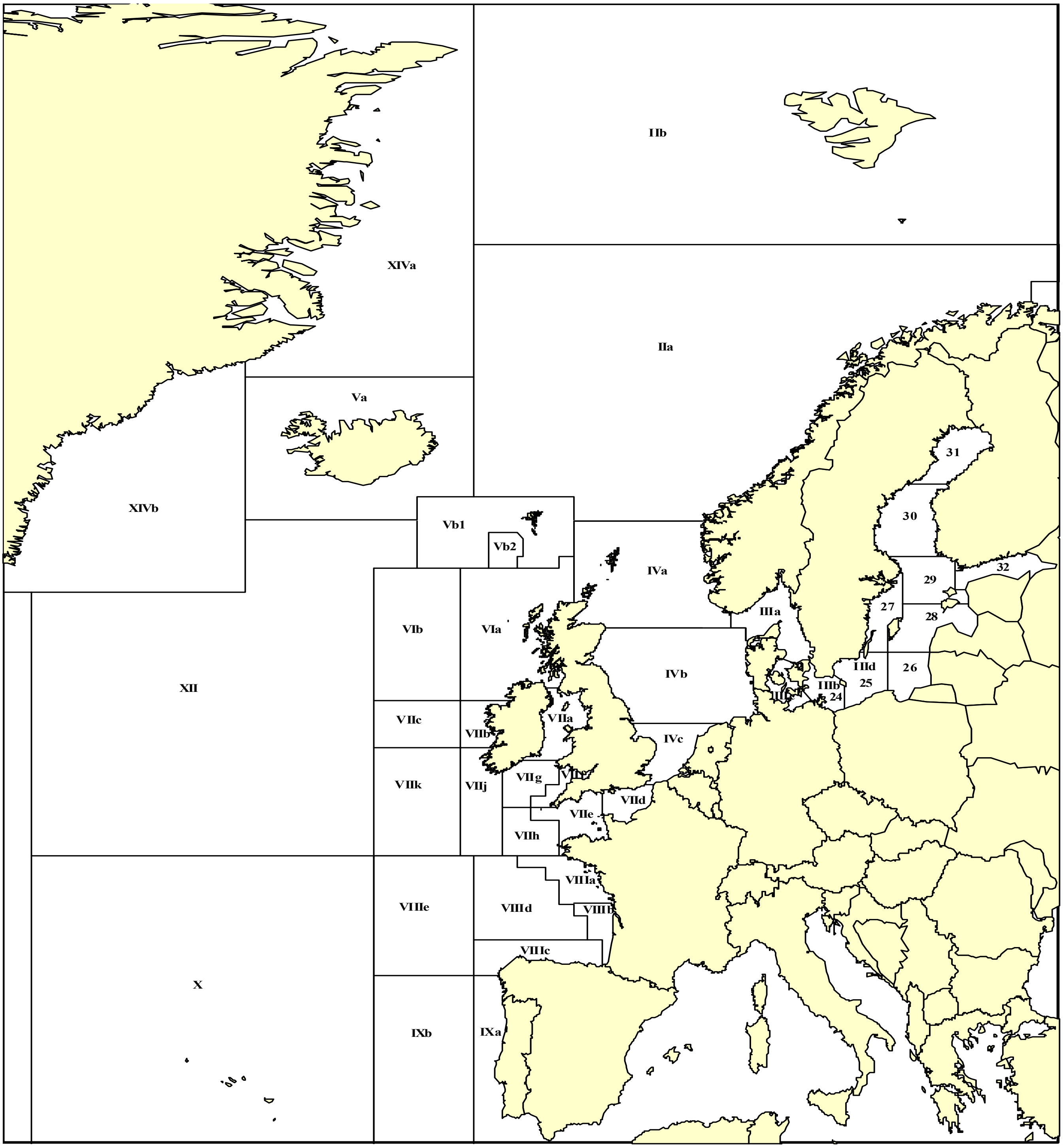
Other Stocks of Interest to Ireland	**349**
INDUSTRIAL FISHERIES - Sandeel & Norway Pout - West of Scotland (Division VIa)	349
ARCTIC STOCKS - Cod, Haddock and Saithe	351
SNOW CRAB - In West Greenland	353

SPRAT- Around Ireland - (Sub-areas VI and VII)	354
CAPELIN - (Sub-areas V and XIV and Division IIa west of 5°W)	355
SARDINES - (Sub-areas VII and Divisions VIIIa, b, d & e)	356

Inshore Fisheries Overview	**358**
Bass on all Coasts (Sub-areas VI and VII)	361
Conger Eel on all Coasts (Sub-areas VI and VII)	363
Common Cockle in the Irish Sea (Division VIIa)	364
Razor Clams on Mainly East Coast (Division VIIa)	366
Surf Clams on South and West Coasts (Sub-area VII)	369
King Escallop and Queen Escallop	371
Palourde on West Coast (Divisions VIIb, j)	374
Purple Sea Urchin on West Coast (Divisions VIa, VIIb,j)	375
Periwinkle on all Coasts (Sub-areas VI and VII)	376
Shrimp on South and West Coasts (Divisions VIa, VIIa (South Coast), b,g and j)	377
Velvet Crab on all Coasts (Sub-areas VI and VII)	379
Brown Crab on all Coasts - (Sub-areas VI and VII)	380
Spider Crab on Mainly West and South Coasts (Sub-area VII)	384
Green Crab on all Coasts (Sub-areas VI and VII)	386
Lobster on all Coasts (Sub-areas VI and VII)	387
Crawfish on Mainly Western Coasts (Sub-areas VI and VII)	388
Whelk Fishery on all Coasts (Sub-areas VI and VII)	389

Appendices	**393**
Appendix I - Nephrops Functional Units (FUs) and Management Areas (MAs) around Ireland	393
Definition of Fisheries Technical Terms and Acronyms.	394

ICES Fishing Areas

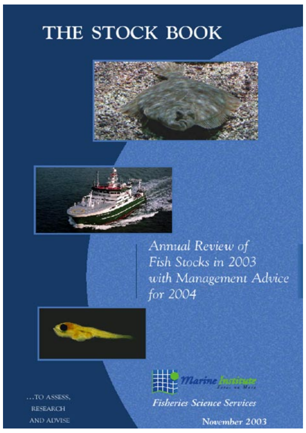


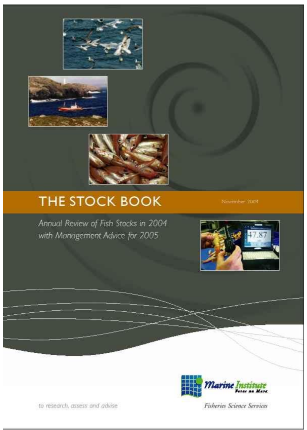
Introduction

Purpose of the Stock Book

The waters around Ireland contain some of the most productive fishing grounds in the EU. In 2004, an estimated 1.5 million tonnes of fish were harvested from the waters around Ireland with an estimated value of €1.4 million. Irish landings in 2004 were valued at €186 million. The fishing industry makes a significant contribution to the economic and social fabric of coastal communities around Irelands 7,500km coastline. Fish stocks (excluding the Inshore stocks) are managed by the EU under the Common Fisheries Policy. The main instrument of the CFP are Total Allowable Catches (TAC's) supplemented by various technical measures (e.g. effort control; mesh size). The provision of timely and accurate fisheries advice on the resource base underpins the management framework of the CFP.

The Stock Book is produced annually by the Marine Institute's Fisheries Science Services team (FSS)*. It contains impartial scientific advice developed by the team from the latest available research, assessment and advice on the fisheries resource. Its purpose is to provide the latest scientific advice on the commercially exploited fish stocks of interest to Ireland. The book is produced for the Marine Institutes main client, the Department of Communications Marine and Natural Resources (DCMNR). It is also available to the fishing industry, third level institutes, semi state agencies and the general public. The Stock Book is also available electronically on compact disc and on the Marine Institute's web site at www.marine.ie.





The information in the Stock Book is of vital importance in serving Ireland during the annual TAC negotiations at the EU Council of Ministers meeting in December. It also serves as a valuable reference throughout the year at other fisheries management meetings with the EU. The Stock Book is of interest to a wide audience, including the fishing industry, fisheries scientists, managers, third level institutes, financial institutions and others with an interest in the status and management of marine fisheries resources in the waters around Ireland.

While every effort has been made to ensure that the Stock Book contains the most up to date and accurate information, it should be noted that the advice for 2006 remain provisional at the time of going to press. However, final ICES, ICCAT and STECF reports should be consulted for the official and definitive advice. More detailed information on specific stocks is available in the relevant ICES Working Group Reports. Definitive information on TAC areas and quota allocations should be obtained from the official EU Journal.

Organisation of the Stock Book

The information contained in the Stock Book focuses on the fish stocks managed by the EU under the Common Fisheries Policy which are subjected to a Total Allowable Catch (TAC), but advice on other exploited living resources, of interest to Ireland, are also included (e.g. Inshore stocks). The stock book format continues to evolve and this year the organisation of the stock book reflects the move to develop more integrated ecosystem advice. The stock book is divided into the following parts;

- Introduction and Some Key Issues in Fisheries Science
- Ecosystem Overview for Widely Distributed and Migratory Populations
- FSS Advice for Widely Distributed and Migratory Populations
- Ecosystem Overview for Demersal Stocks in the waters around Ireland
- FSS Advice for the Mixed Demersal Fisheries in the Irish Sea
- FSS Advice for Mixed Demersal Fisheries in the West of Scotland and Rockall
- FSS Advice for Mixed Demersal Fisheries in the Celtic Sea
- Ecosystem Considerations and Advice for Deep Water Stocks
- FSS Advice for other Stocks of Interest to Ireland
- FSS Advice for Inshore Fisheries

(1) Ecosystem Overviews

This section provides a general ecosystem overview for the waters around Ireland. It includes such issues as

- Ecosystem Descriptions
- Physical and Chemical Oceanography
- Phytoplankton, Zooplankton, Benthos, Fish Communities.
- Trophic Webs
- Vulnerable Species
- Human use of the ecosystem
- Ecosystem impacts on fisheries

(2) FSS Advice on Mixed Fisheries
This section gives the advisory overviews for particular groups of stocks on an area basis. These overviews provide:

- A Summary of FSS Advice for Management in 2006 (contained in the Yellow Box)
- Mixed fisheries interactions
- Identification of critical stocks
- Fisheries Interactions
- Summary of Individual Stocks Advice
- ICES advice on fisheries management

The area based ecosystem overviews and FSS advice on mixed fisheries are followed by information on each individual stock that includes;

- FSS single stock considerations (stock advice from an Irish perspective – contained in the yellow Box)
- Additional information on the stock from an Irish perspective
- Notes on current management
- A summary of the current state of the stocks
- Relevant information on the biology, management, fisheries and assessment of these stocks.
- Short term forecast tables
- Trends in landings, fishing mortality, recruitment and spawning stock biomass.

Current Management gives the management and assessment area for the stock and provides the TAC and Irish quota for 2003. Any important points gleaned from ICES advice are highlighted in this section. A map indicates the assessment area in relation to the management area for the demersal and pelagic fish stocks. A pie chart gives the percentage national quota allocation for the TAC.

The **additional information** section provides extra information on aspects of each stock, mainly from an Irish perspective, including information that does not appear in the ICES advice – derived from the FSS stock monitoring programmes and comments from the relevant ICES Working Groups. The complete ICES advice for the stock then follows.

Special comments appear in certain stocks that warrant them in relation to the state of the stock or special measures that need to be considered. The special comments highlight important additional information that may have a significant impact on management considerations.

The length frequencies for the international catches (including discards when available) are also plotted for each stock together with the age profile and the size (length) at age of Irish catches.

For all the key stocks, FSS have produced plots of the historic trends in biomass, catches, recruitment, and fishing mortality, together with the short term predictions. The short term predictions are not included in these graphs if they are considered to be a poor basis for management advice. The precautionary reference points have been shown on these plots where possible, in order to track the historic trends in each stock relative to the reference points.

The Stock Book also addresses current issues of major interest and debate within the scientific community. This year the Stock Book contains special sections on

- Ecosystem Approach To Fisheries Management
- Implementing the Johannesburg Declaration as part of the CFP
- Effort Limitation and Recovery Plans
- Misreporting and Other Unaccounted Removals

Fisheries Science Services

Fisheries Science Services (FSS) is one of seven service teams within the Marine Institute. Its mission is to 'research , assess and advise' on marine fisheries in order to ensure the sustainable exploitation of this vital resource. The provision of impartial scientific advice is critical to achieving this. Work is carried out on demersal, pelagic, shellfisheries and inshore stocks. Data Collection, Data Management, Assessment, Advice and Research form the raw material for the advice. FSS conduct stock assessment and formulate advice at various ICES Working Groups, ACFM and STECF. FSS provide scientific advice to the DCMNR on the status and management of these stocks. FSS also conducts a wide variety of fisheries research programmes (both in-house and with third level institutes) aimed at both improving the advice and increasing our understanding of the fisheries resource and the ecosystem.

The detailed data and information required for stock assessment and collated by FSS includes:

- The length distribution of landings
- A profile of the age structure of landings
- Discard information
- The number of boats fishing in a particular area over time
- The catch, time spent fishing, gears used (fleet activity)
- Information on the annual landings into each port
- Data from various research surveys carried out by FSS

Landings are sampled at ports, fishermen's Co-operatives, fish processors and auction sites around the coast by contracted port samplers employed by FSS, as well as other FSS staff. Discards are assessed by a number of Fisheries Assessment Technicians (FAT's) based in the Institute's port facilities at Killybegs, Greencastle, Rossaveal, Castletownbere, Dunmore East and Howth. Research surveys are carried out either on contracted commercial fishing vessels, or on the Institute's own research vessels *Celtic Explorer* and *Celtic Voyager*. These data collection programmes are conducted under the EC Data Collection Regulation (EC

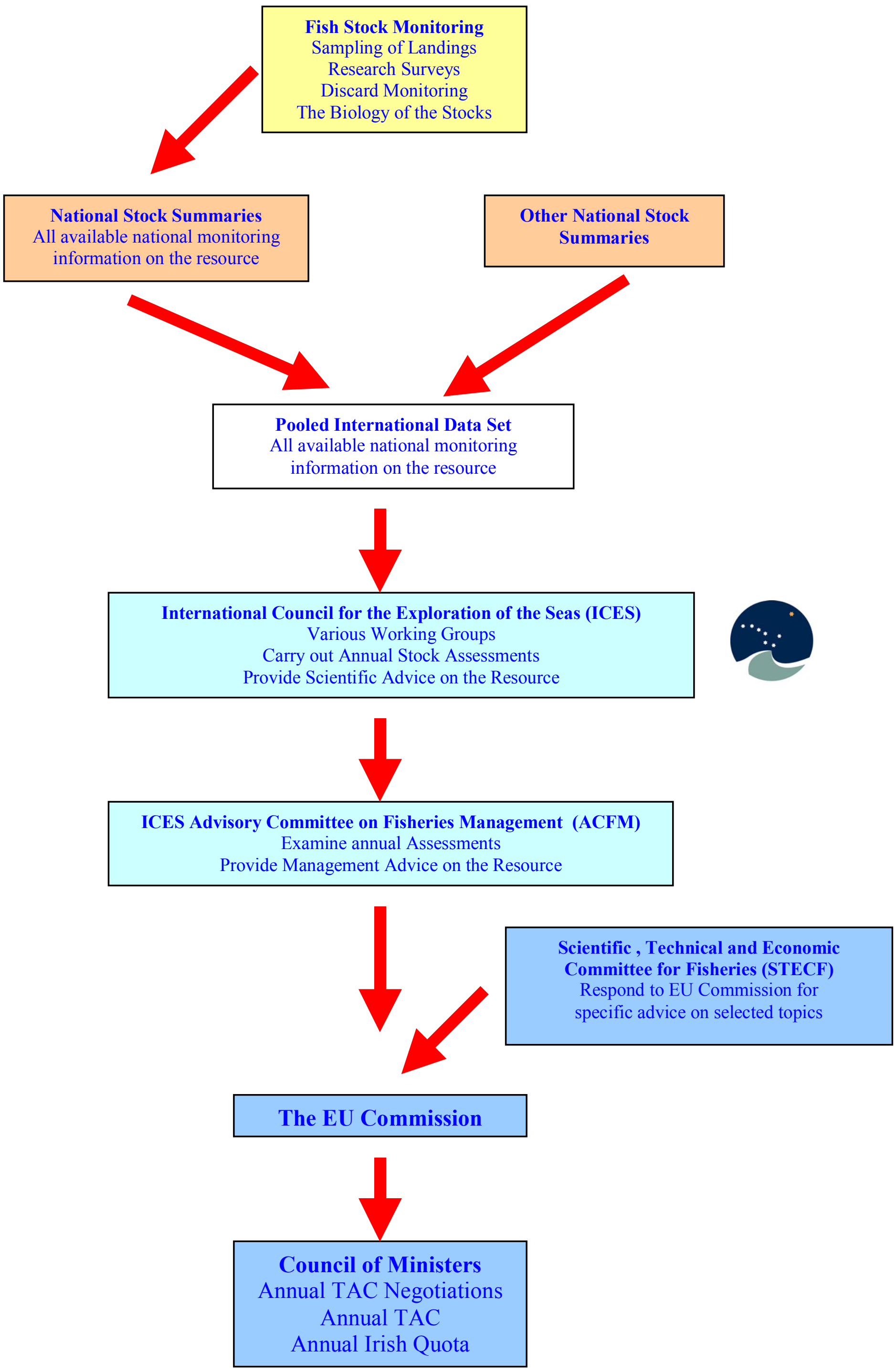
Council Regulation 1543/2000) for which the Marine Institute is the Irish National Coordinator, working closely with DCMNR and An Bord Iascaigh Mhara.

FSS sea-going missions include acoustic studies of pelagic stocks, the distribution of fish eggs, larvae and juveniles, under water TV surveys for *Nephrops,* ground fish surveys and fish tagging studies. Summaries on the status of each commercial stock are presented annually to the appropriate ICES Working Group for examination and validation by international experts. This information is then pooled with data from other countries to perform annual stock assessments.

These assessments provide scientific advice on each commercial stock, which are then reviewed by the ICES Advisory Committee on Fisheries Management (ACFM) and the EU Scientific Technical and Economic Committee on Fisheries (STECF). The final scientific advice is then delivered to the EU Commission who manage EU fish stocks under the Common Fisheries Policy.

*An explanation of the acronyms and technical terms used in the Stock Book is found in the appendices.

The Steps involved in the formulation of the annual TAC's



Ecosystem Approach To Fisheries Management (EAF)

Introduction

There is currently great debate within the scientific community on the science required for the implementation of the Ecosystem Approach to Fisheries Management (EAF). The EU have stated that they wish to see scientific advice formulated in the context of the ecosystem approach. While we may be a long way away from the implementation of 'pure ecosystem management', the first steps (e.g mixed fisheries; area based advice) have taken place but a great deal of new thinking and new methodology is still required.

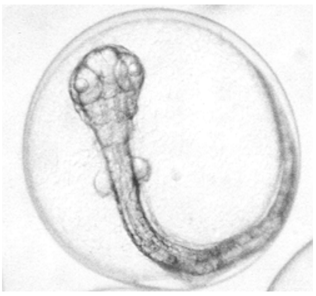
Ecosystems are complex and dynamic natural units that produce 'goods and services' beyond those of benefit to fisheries. Fisheries have a direct impact on the ecosystem (as do other human activities) and as such they need to be managed in an ecosystem context.

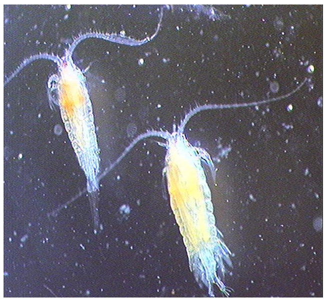
The increasing intensity of fishing throughout the world has had impacts on the marine oceans other than the targeted species. In many fisheries, by catches of seabirds and marine mammals are taken as by-catch on lines or in nets. There are many records of dolphin and albatross by-catch in the tuna fisheries of the Pacific and Southern Oceans. Other concerns about the ecosystem effects of fishing focus on the impacts of towed gears on benthic animals and habitats, the impact of fishers who use dynamite and poisons on coral reefs and the effects of fishery wastes on populations of scavenging birds and fish. Fishing can also effect food webs by removing predators such as fish that eat other fish, or prey, such as small shoaling fish that are eaten by seabirds and marine mammals. These impacts are now the focus of great debate and have given rise to the concept of the 'ecosystem approach to fisheries management'. The ecosystem approach has been around for quite a few years, but it is now a major force in influencing thinking on fisheries management.

Current fisheries management practices are based on the productivity of marine systems and the harvesting of a limited level of catch for a target species. It may consider non target species or associated species, but in general it does not sufficiently recognise the potential direct and indirect effects of fishing on the dynamics of the 'ecosystem', the conditions under which its productivity can be maintained and the existence of other societal values (e.g. preventing pollution) and uses (e.g. tourism and leisure). It is often based on management units (e,g. species, gears, jurisdictions) that take little account of the ecosystem structure in which it is operating. If conducted to a high standard, current management can provide a sound basis for the implementation of the ecosystem approach. However, it must effectively take into account the interactions that occur between fisheries and ecosystems and the fact that both are affected by natural long term variability as well as non fishery extractive and pollution activities. The ecosystem approach recognises the broader economic and social interests of all stakeholders

Ecosystem

Ecosystems are composed of living animals, plants and non living structures which to a greater or lesser extent ' interact' with each other. They can be defined at many scales, for example the area around a boulder; a reef or an entire ocean. Ecosystems can overlap and are usually spatially defined in that the are sufficiently different from adjacent areas to be recognised as a functional unit. Most ecosystems have no fixed boundaries and there is much exchange with adjacent ecosystems. One of the first tasks in implementing an ecosystem approach is to define the boundaries of the ecosystem we want to manage (e.g. is it Dublin Bay?, the Irish Sea?, the north east Atlantic?). This must be agreed by consensus with all the stakeholders. The idea here is that we are managing an ecosystem not a fish stock! Ecosystem structure, species composition and functioning change seasonally as well as between years. These long and medium term natural fluctuations result in changes in distribution, abundance and physiology of marine organisms, associated with changes in the extension, localization, structure, productivity and other characteristics of the ecosystem in which they live.





Fisheries scientists are currently developing the tools that are needed to implement the EAF. At present, the ecosystem approach is not well defined and the approach will vary depending on local and regional differences between

fisheries and between the ecosystems within which the fisheries are pursued. The underlying principles of the ecosystem approach have arisen over a considerable length of time from global scale consultations at the political and scientific scale.

The meaning of the terms "Ecosystem Management"; "Ecosystem Based Management"; "Ecosystem Approach to Fisheries" are still not universally defined and are progressively evolving. The justification of EAF is evident in the characteristics of an exploited ecosystem and the impacts resulting from fisheries and other activities. The rich set of international agreements of relevance to the EAF contains a large number of principles and conceptual objectives. Both provide a fundamental guidance and a significant challenge for the implementation of EAF. The available international instruments also provide the institutional foundations for EAF. The FAO Code of Conduct for Responsible Fisheries is particularly important in this respect and contains provisions for practically all aspects of the approach. One major difficulty of EAF lies precisely in turning the available concepts and principles into operational objectives from which an EAF management plan would more easily be developed.

The first most fundamental description of the ecosystem approach was formalised in the Stockholm Declaration in 1972. Here governments expressed the wish to work towards integrated, holistic, science based management employing decentralised, transparent decision making, involving local communities and users. These founding concepts have been reaffirmed over the past three decades in numerous declarations and agreements made within three strands of global ocean governance;

(1) UN Convention on the Law of the Sea (UNCLOS)
(2) UN Conference on Environment and Development (UNCED)
(3) UN Food and Agricultural Organisation (FAO)

What Is The Ecosystem Approach ?

Fishing activity usually affect other components of the ecosystem in ways such as by catch of non target species, physical damage to habitats, impacts on the food chain (e.g. removal of top predators – sharks) and changes in Biodiversity (removal of larger fish) . In the context of sustainable development, responsible fisheries management much consider the broader impact of fisheries on the ecosystem as a whole. The objective of the EAF is the sustainable use of the 'whole system' not just a 'targeted species'.

Generally speaking the purpose of an EAF is to *plan, develop and manage fisheries in a manner that addresses the desires of society, without jeopardising the options for future generations to benefit from the full range of 'goods and services' provided by the marine ecosystem.*

The EAF approaches fisheries management in a more 'holistic' way (i.e. taking the views of all stakeholders into account). This is not easy. Even small ecosystems can be very complex and can include a broad range of stakeholders who may have 'competing' interests and 'conflicting' views.

The EAF requires adherence to the principles of transparency and the inclusion of stakeholder views in the decision making process. This will require improved co-ordination and consultations with all stakeholders.

The EAF is neither inconsistent with, nor a replacement for current fisheries management approaches. Indeed many would argue that rigorously applying the ' precautionary approach ' and ' code of conduct for responsible fisheries ' would begin to solve some of the current fisheries problems. Such action in the past could have prevented a large number of our present ecosystem problems. The ecosystem approach in the foreseeable future is likely to be developed as an incremental extension of current fisheries management practices.

In the context of fisheries, the description of the fishers' interaction within the ecosystem requires identification of four main ecosystem compartments;

(1) a biotic compartment, including target fish resources, associated with dependent species and the living habitat ;
(2) An abiotic compartment , characterized by its topography, bottom types, water quality and local weather/climate
(3) A fishery compartment, in which harvesting and processing activities take place, with a strong

technological character

(4) An institutional compartment, comprising laws, regulations and organizations needed for fisheries governance

Humans are part of the biotic compartment of the ecosystem from which they draw resources, food, services and livelihood, as well as part of the fishery component which they drive. These components interact and are affected by non fishing activities; the global climate; other neighbouring ecosystems; socio-economic environment as reflected in the market, relevant policies and societal values.

The ecosystem approach recognises that our ability to predict ecosystem behaviour is inadequate and accepts that all ecosystems have limits that when exceeded, can result in major ecosystem change – possibly irreversibly. Maintaining biological diversity (i.e. preventing the loss of certain species ; loss of big fish) is regarded as being of major importance to ecosystem functioning and productive fisheries as well as providing flexibility for future uses. Current management practices tend to give insufficient recognition to the fact that many components are intrinsically linked in the system in a complex flow of material, energy and information.

The Four Main Ecosystem Compartments

(1) Biotic Compartment including target fish resources associated with dependent species and living habitat	**(2) Abiotic Compartment** characterised by its topography bottom types, water quality and local weather climate
(3) Fishery Compartment harvesting and processing activities take place with a strong technological character	**(4) Institutional Compartment** comprising laws, regulations, organisations needed for fisheries governance

(Garcia et al. 2003)

The ecosystem that supports fisheries, together with other economic activities, are subject to a number of alterations of significant relevance to the goods and services it can provide. We have imperfect knowledge of ecosystem structure and functioning as well as an inherent difficulty in distinguishing between natural and human induced changes.

Principles Of The Ecosystem Approach

It is recognised that fisheries have the potential to alter the structure, biodiversity and productivity of marine ecosystems. Furthermore, natural resources should not be allowed to decrease below their level of maximum productivity. Recognising these factors, the ecosystem approach respects the following principles;

- ☐ fisheries should be managed to limit their impact on the ecosystem to the least extent possible
- ☐ ecological relationships between species must be maintained
- ☐ management measures should be compatible across the entire distribution of the resource (across jurisdictions and management plans)
- ☐ the precautionary approach should be applied because the knowledge on ecosystems is incomplete
- ☐ governance should ensure both human and ecosystem well being and equity

What Is Driving The Ecosystem Approach ?

Interest in an ecosystem approach to fisheries has been motivated by

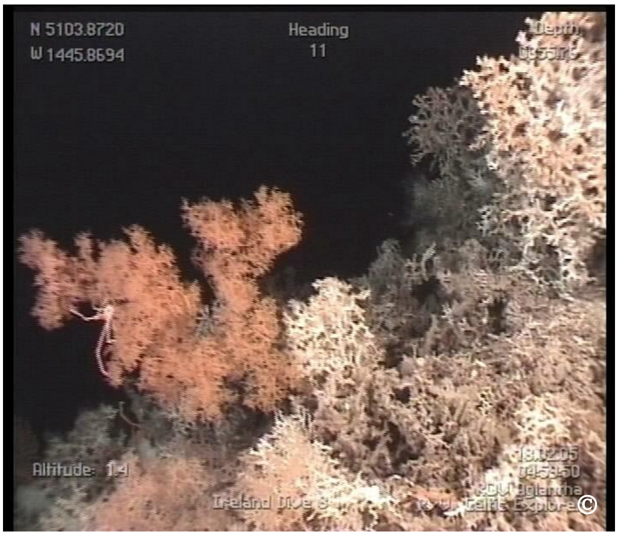
- ☐ heightened awareness of the importance of interactions among fishery resources and between fisheries resources and the ecosystem in which they exist.
- ☐ recognition of the wide range of societal objectives for and values of fisheries resources and marine ecosystems within the context of sustainable development
- ☐ poor performance of current management approaches as witnessed by the poor state of many of the worlds fisheries
- ☐ recent advances in science, which highlights knowledge and uncertainties about the functional value of ecosystems to humans (the goods and services they are capable of providing).

The need for a wider consideration of environmental and ecosystem issues in fisheries has been acknowledged by many and the principles and aspirations of the ecosystem approach have been well documented. Although a full implementation of agreed principles and aspirations might be difficult at this time, the status quo is not an acceptable option in the light of a growing understanding of the ecosystem and their uses by society.

Fishing Practices

Gear modifications, such as those used to selectively harvest the target species and minimise unwanted by catch (including protected species) will take on increasing importance as ecological objectives are broadened within the context of the ecosystem approach. The impact of some fishing gear and methods on the bottom habitat can often have a negative effect on the ecosystem. There is limited knowledge about this impact and more research is required to examine the extent of the impact of various gear. For gears known to produce serious impacts, the introduction of restrictions may be necessary and where possible, new technologies to mitigate any negative impacts will need to be developed.

Continued fishing by lost gear, emission of exhaust gas with dangerous substances to the atmosphere, pollution from oily waste litter and fish waste all have negative impacts on the ecosystem. Minimising such impacts will require development and successful introduction of alternative cost effective technologies and fishing practices.



ICES and the Ecosystem Approach

The 13th ICES Dialogue Meeting (26-27 April 2004) discussed how ICES plans to introduce an ecosystem approach. The implementation will include stakeholder interaction and will be incremental. Beginning in 2004 ICES has introduced mechanisms on an experimental basis allowing stakeholders to provide inputs to the assessments and to get better insight into the advisory process. The results will be evaluated over 2005 and 2006 and ICES will introduce appropriate adjustments to the proposal for stakeholder involvement, taking the role of the EU Regional Advisory Councils into account. The plan accepts that our understanding of the functioning of the ecosystems is confined to certain ecosystem components and that this will remain so in the foreseeable future, although our understanding of the systems improves. Our understanding is not uniform among the ecosystems; there are ecosystems for which more data and better understanding of the critical processes exist compared to other systems. Therefore, implementation of the Ecosystem Approach and ICES ability to satisfy Clients' information requirements varies among ecosystems.

ICES is currently going through a period of great change both in terms of its organisational structure and processes. In 2004, ICES restructured, leaving behind the old fisheries, environment and oceanography 'silos', to form a new structure based on the three pillars: science, advice and data. ICES has committed to the ecosystem approach to resource management as outlined in the ICES Strategy document and Action Plan 2003 to 2007. This will involve a new way of working and thinking in terms of both the science and advisory processes. In 2004, ICES took the first steps on the long road towards integrated ecosystem advice. Fisheries advice was supplemented with ecosystem considerations in terms of the impacts of fisheries on the ecosystem and the impact of ecosystems on fisheries. This process continued to evolve in 2005 when ACE, ACFM and ACME gave more integrated advice in an ecosystem context. This goal will be a long and difficult process, but it has started. In 2005, ICES began discussions on reforming the structure of its expert groups that deliver science and advice. In March 2006, a special meeting will take place at ICES to develop a 'blueprint' for the new science and advisory structures that will be required within ICES to service the demands of the ecosystem approach.

Final Comments

Global societal concerns regarding man's use of the natural resources of the planet will drive the ecosystem approach. There is no doubt that it will shape future exploitation and management of EU fisheries. This will demand a greater insight into how fishing impacts on all the animals of the ocean, the sea bed and the environment. The substance of many recent international agreements, the state of many fish stocks and an increasing awareness and concern among the public on the state of the marine ecosystem are now major drivers for change. In order to ensure sustainable fisheries in an ecosystem context,

the need for scientists, managers and industry to continue to work closely together, is greater than ever.

The ecosystem approach is a simple concept, made complex by numerous layers of sometimes unhealthy debate. The ecosystem approach, if it is to succeed, will need fundamental reorganisation of our way of thinking and working as scientists; moving away from a mindset of 'fisheries scientist' to thinking more as ' marine ecologists '. Communication with all stakeholders together with transparent and impartial science will be an essential component of the ecosystem approach.

In conclusion, the future of fisheries depends on the way in which the two fundamental concepts of fisheries management and ecosystem management and their respective stakeholders, will join efforts or collide (Garcia et al.; 2003)

Climate Change

Global warming has been confirmed by a large body of scientific data. Ireland and Europe have become measurably warmer in the past two decades. This warming is mostly attributable to the build up of greenhouse gasses (principally CO_2) in the atmosphere due to the burning of fossil fuels and changes in land use. The long lifetimes of these gases in the atmosphere means that warming is likely to continue during the rest of this century despite current efforts to reduce emissions. Climate change impacts for the marine ecosystem include increase in sea temperature, storm intensity, wave height, sea level as well as changes in ocean currents. Such changes will have a profound implications for marine life, including seafood species, estuaries, coastal areas and the way society use them.

The effect of these changes on the marine life in the waters around Ireland are likely to include

- Increased intensity of storms leading to disruption of coastal habitats and fish nursery areas
- Reduced number of commercial fishing days in winter
- An increase in mean seawater temperature leading to northerly shifts in the range of planktonic and other species including migratory fish, enhanced recruitment of some native and non- native cultured species and a decline in wild populations of some fish
- With regard to biodiversity, species losses and new arrivals due to shifts in bio-geographical range and greater incidence of invasions of non native species
- increases in phytoplankton biomasses throughout the year , changes in the timing and intensity of spring algal blooms and the structure of zooplankton communities with as yet unknown, but potentially substantive, consequences for marine food chains
- elevated summer and winter temperatures in shallow bays and inlets with corresponding changes in the structure and stability of marine plant and animal communities
- changes ion near-shore salinities, sediment loading and distribution due to alterations in river discharges and increasing sea level with potentially negative consequences for near shore food production (aquaculture, nursery areas, traditional shellfish beds)

Climate is fundamentally important for the stability and maintenance of populations and food chains. Changes in climate will result in altered physical conditions that will include water circulation, stratification and nutrient supply. These effects may result in permanent or temporal changes to existing and evolving niches such as nursery areas and will either exclude or encourage species on the fringe of their natural distribution.

References

Anon. (2003) Fisheries Management – 2. The Ecosystem Approach to Fisheries. FAO Technical Guidelines for Responsible Fisheries 4, Suppl. 2. FAO, Rome, 2003.

Anon. (2004) Report of the 13th Dialogue Meeting: Advancing scientific advice for an ecosystem approach to management: collaboration amongst managers, scientists and other stakeholders. ICES Cooperative Research Report No 267.

Bolens, R.; Minchin, D., and O'Sullivan, G. (2005). Climate Change: Implications for Ireland's Marine Environment and Resources. Marine Foresight Series. No 2. April 2005.

Garcia, S.M.; Zerbi, A.: Aliaume, C.; Do Chi, T.; Lasserre, G. (2003) The ecosystem approach to fisheries. Issues, terminology, principles, institutional foundations, implementation and outlook. FAO Fisheries Technical Paper. No 443. Rome, FAO. 2003 pp 71.

Turrell, W.R. (2004) The Policy basis of the Ecosystem approach to Fisheries Management. EuroGOOS Publication No. 21. EoroGOOS, Sweden. Pp 28.

Implementing the Johannesburg Declaration as part of the CFP

There is currently great debate throughout the EU on the implementation of the Johannesburg Declaration as part of the Common Fisheries Policy (CFP). In September 2002 the European Union committed to the outcomes of the World Summit on Sustainable Development in Johannesburg. Achieving the requirements of the Johannesburg Declaration will require agreement on new operational management objectives within the CFP, with consequent impacts on the advisory criteria of STECF, ICES and other advisory bodies.

The CFP, which has the objective of ensuring "exploitation of living marine resources that provides sustainable economic, environmental and social conditions", could be developed in accordance with the Johannesburg Declaration. This implementation is feasible after the 2002 reforms by means of management plans and recovery plans, but more progress in the adoption of implementing regulations is required. The EU Commission has up to now concentrated on the recovery of the most threatened species. It is now considering long-term management measures to implement the Johannesburg objectives as a general approach for the Community's fish stocks.

The "Rio Declaration" of 1992 established an objective that stocks should be recovered to levels that can produce maximum sustainable yields (MSY). Paragraph 31 (a) of the Johannesburg Declaration has now established a deadline of 2015 for reaching this objective.

The Johannesburg commitment to rebuilding individual stocks to the states at which they can produce maximum sustainable yields means that each fish resource should be able to produce maximum sustainable yields, within the constraints of the ecosystem that it inhabits. This excludes the possibility of attempting to manipulate ecosystem structure by over-fishing some species in order to improve the yields of others. The productive capacity of the seas and oceans is limited and it may not be possible to achieve the maximum sustainable yield that would be predicted starting from current conditions for all stocks in an ecosystem simultaneously - mainly because species compete with each other for resources. Therefore, such management must be found in a way that is robust to the uncertainty in predictions.

It has been argued that, even though $\mathbf{B}_{msy}$ is used as the aim in the Declaration, it is an inappropriate operational aim because estimating the biomass required to reach MSY is particularly problematic. These problems are related to the uncertain relationships between stock size and recruitment and to the inherent variability of the aquatic environment. Therefore, rather than using the uncertain $\mathbf{B}_{msy}$, the use of $\mathbf{F}_{msy}$ has been suggested as a more robust management goal.

In order to reach the goal of Johannesburg Declaration, the biomasses of fish stocks in year 2015 should be comprised of year-classes which have been recruited as a result of applying $\mathbf{F}_{msy}$ in earlier years. For example, consider a stock whose biomass consists mainly of age groups 3 to 7 when applying $\mathbf{F}_{msy}$. Reaching the Johannesburg objective would require the application of the $\mathbf{F}_{msy}$ mortality rate commencing 9 years before 2015 (9 years = 5 (number of age groups) + 4 (recruitment age + 1)). In this example above, $\mathbf{F}_{msy}$ is required by 2007.

Reducing fishing mortality in order to allow fish to grow more, so achieving a higher value and a higher yield is a concept that is intuitively attractive and conceptually simple. The gains to be achieved can be measured as gains due to (a) catching a larger quantity of fish; (b) the larger size of the fish that are landed and the higher market value that they will attain; and (c) lower costs incurred in catching the fish.

In March 2000, Member States committed the EU to become "the most dynamic and competitive knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion, and respect for the environment" by 2010.

The Community's fishing industries face a substantial competitive challenge. About 60% of the fish consumed in the Community is imported. Fish from stocks managed at near - MSY levels benefit from competitive advantages of stable supply (because availability can be guaranteed) and high quality (because investment in product handling is worthwhile). While stability of supplies from a variable marine environment can never be guaranteed, management to obtain higher stock sizes and lower fishing mortalities will improve stability and quality and therefore also competitiveness.

This will be a major step forward in implementing the Lisbon Agenda with respect to the fishing industry in the Community. Current situation with Respect to Achieving the target of Maximum Sustainable Yield by 2015
Meeting the commitments made to the Johannesburg Declaration will require that stringent management measures are taken well before the year 2015.

Implementing the change to a fisheries management system that delivers a maximum sustainable yield may deliver clear long-term benefits. Larger fish stocks will be able to generate more production of fish, with a higher unit value, and provide a greater guarantee of wealth. More domestic production of fish will lessen the Community's dependence on imported fish. Larger fish stocks will provide a buffer against variability in annual recruitment and will allow for more stability of employment.

The development of plans to implement the Johannesburg Declaration should be sector-based, addressing groups of

fish stocks that are caught together. Some guiding principles that could be explored include:

(a). Stakeholders and Regional Advisory Councils may be consulted about the rate of adjustment of fishing mortality rates towards the eventual targets, the stability criteria to be applied in harvest rules, and any other necessary implementation measures.

(b). The Commission may assist the Regional Advisory Councils in socio-economic evaluations. The allocation and economic management of these resources remains a decision for Member States. However, the Regional Advisory Committees are a forum at which decisions that have an impact on the economy and social structure of fishing communities can be discussed. The Commission will, when necessary, support such discussions carrying out studies for better evaluating such options.

(c). The management plans may include programmed fishing mortality reductions. The target fishing mortality to be achieved through the plans in 2015 should be no more than F_{max} (the fishing mortality that generates the highest yield assuming average recruitment) or, where there is a risk of recruitment falling below the average when fishing at F_{max}, a lower fishing mortality target, not normally be lower than $F_{0.1}$.

(d). The plans should include elements such as interannual limitations on changes in fishing opportunities designed to assure a stable and smooth transition into a system of lower fishing mortality rates, higher catches, reduced fishing effort, reduced discards and higher profitability.

(e). Management plans should be updated at intervals of around five years to allow revision of the targets in the light of new information.
(f). Effective compliance should be an integral component of the recovery process. The Commission will monitor and make corresponding proposals concerning the effective implementation of the plans.

Extract of the Implementation Plan adopted at the World Summit on Sustainable Development, Johannesburg, 2002.

31. To achieve sustainable fisheries, the following actions are required at all levels:
(a) Maintain or restore stocks to levels that can produce the maximum sustainable yield with the aim of achieving these goals for depleted stocks on an urgent basis and where possible not later than 2015;

(b) Ratify or accede to and effectively implement the relevant United Nations and, where appropriate, associated regional fisheries agreements or arrangements, noting in particular the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and the 1993 Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas;

(c) Implement the 1995 Code of Conduct for Responsible Fisheries, taking note of the special requirements of developing countries as noted in its article 5, and the relevant international plans of action and technical guidelines of the Food and Agriculture Organization of the United Nations;

(d) Urgently develop and implement national and, where appropriate, regional plans of action, to put into effect the international plans of action of the Food and Agriculture Organization of the United Nations, in particular the International Plan of Action for the Management of Fishing Capacity by 2005 and the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing by 2004. Establish effective monitoring, reporting and enforcement, and control of fishing vessels, including by flag States, to further the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing;

(e) Encourage relevant regional fisheries management organizations and arrangements to give due consideration to the rights, duties and interests of coastal States and the special requirements of developing States when addressing the issue of the allocation of share of fishery resources for straddling stocks and highly migratory fish stocks, mindful of the provisions of the United Nations Convention on the Law of the Sea and the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, on the high seas and within exclusive economic zones;

(f) Eliminate subsidies that contribute to illegal, unreported and unregulated fishing and to over-capacity, while completing the efforts undertaken at the World Trade Organization to clarify and improve its disciplines on fisheries subsidies, taking into account the importance of this sector to developing countries;

(g) Strengthen donor coordination and partnerships between international financial institutions, bilateral agencies and other relevant stakeholders to enable developing countries, in particular the least developed countries and small island developing States and countries with economies in transition, to develop their national, regional and sub-regional capacities for infrastructure and integrated management and the sustainable use of fisheries;

(h) Support the sustainable development of aquaculture, including small-scale aquaculture, given its growing importance for food security and economic development.

The New and Evolving Framework of ICES Advice

INTRODUCTION

Ocean management should take an integrative view and include ecosystem considerations, i.e. use an "Ecosystem Approach". ICES is implementing an Ecosystem Approach in its advisory work. A management approach including ecosystems considerations serves multiple objectives and should emphasize strong stakeholder participation and focus on human behaviour as the central management dimension.

FISHERIES ADVICE

The ICES fisheries advice is the result of a three-step process:

Single-stock exploitation boundaries are identified first. These are the boundaries for the exploitation of the individual fish stock and are identified on the basis of its status, consistent with the Precautionary Approach and, if target reference points have been defined or management plans which are precautionary have been decided, in relation to targets or plans. The single-stock boundaries also include considerations of the ecosystem implications of the harvesting of that specific species in the ecosystem whenever such implications are known to exist. These single-stock exploitation limits are presented in the stock summaries, and collected in a table for each area The single-stock boundaries would apply directly as advice in the absence of mixed fisheries issues and ecosystem concerns beyond the impact of fishing on that stock.

Then mixed fisheries issues are addressed. For those stocks harvested in mixed fisheries the single-stock exploitation boundaries will apply to all stocks taken together simultaneously. It is thus necessary to identify the major constraints within which mixed fisheries should operate and through this analysis identify the additional constraints that further limit the fishing possibilities. Such major constraints may be stocks in the stock assemblage which are outside precautionary limits and which therefore may become the limiting factor for all fisheries exploiting that stock. This implies that the stocks which are considered to be in the most critical state may determine the advice on those stocks which are taken together with critical stocks. The second step is therefore to identify which species within mixed fisheries have the most restrictive catch limits, because these constraints, when applied across all species in mixed fisheries, further limit the fishing possibilities. The single-stock exploitation limits are combined in relation to fisheries on an area basis.

The final consideration regards those **ecosystem concerns** which are not related to one specific stock but rather to mixed fisheries or to groups of stocks. Such concerns may for instance include habitat and biota impacts of dragged gear, incidental by-catches of non-commercial species, and food chain effects when such impacts are known to occur. Ecosystem concerns may represent further boundaries to fisheries beyond those implied by single-stock concerns and mixed fisheries issues.

The overall advice for mixed fisheries is thus threefold:

1) limit the harvest of a critical stock as bycatch or targeted catch to the limit applying to that stock across all fisheries;

2) harvest within single-stock exploitation boundaries for all other stocks;

3) in the event that further ecosystem impacts of fisheries beyond removal of the stocks included in the assessments have been identified such concerns may restrain specific fisheries further. The consequence may be that a fishery may fish less than the single-stock exploitation boundary for its target stocks if a critical stock is taken as a by-catch or other ecosystem concerns are to be addressed.

SINGLE-STOCK UPPER BOUNDARIES ON EXPLOITATION

The incremental introduction of the "Ecosystem Approach" supplements the "Precautionary Approach" implemented in the ICES advice on fisheries management since 1998. The single-stock upper exploitation boundaries that are fundamental building blocks of the ICES advice on fisheries management remain based on the Precautionary Approach biological reference points. These reference points are stated in terms of fishing mortality rates or biomass. They are predefined benchmarks (limit reference points) that should be avoided to ensure that stocks and their exploitation remain within safe biological limits and against which assessments should evaluate the status of the stock.

Risk aversion, based on the precautionary approach, defines the boundaries of management decisions for sustainable fisheries.

Within these boundaries society may define objectives relating to benefits such as maximised long-term yield, economic benefits, or other ecosystem services. The achievement of such objectives may be evaluated against another set of reference points, *target reference points*, which may

be measured in similar dimensions as limit reference points but which may also relate to money, food, employment, or other dimensions of societal objectives. Target reference points will always be bounded by limit reference points and their associated uncertainties.

REFERENCE POINTS FOR RISK AVERSION

For risk aversion ICES advises within the following framework:

The single-stock exploitation upper boundaries are aimed at restricting the risk that the spawning biomass falls below a minimum limit. The minimum spawning stock biomass benchmark is described by the symbol $\mathbf{B_{lim}}$ (the biomass limit reference point). The value of $\mathbf{B_{lim}}$ is set on the basis of historical data, and chosen such that below it, there is a high risk that recruitment will 'be impaired' (seriously decline) and on average be significantly lower than at higher SSB. When information about the dependence of recruitment on SSB is absent or inconclusive, there will be a value of SSB, $\mathbf{B_{loss}}$, below which there is no historical record of recruitment. $\mathbf{B_{lim}}$ is then set close to this value to minimize the risk of the stock entering an area where stock dynamics are unknown.

Below $\mathbf{B_{lim}}$ there is a higher risk that the stock could "collapse". The meaning of "collapse" is that the stock has reached a level where it suffers from severely reduced productivity. "Collapse" does not mean that a stock is at high risk of biological extinction. However, recovery to an improved status is likely to be slow, and will depend on effective conservation measures.

The fishing mortality rate should not be higher than an upper limit $\mathbf{F_{lim}}$ which is the fishing mortality that, if maintained, will drive the stock to the biomass limit.

Spawning biomass and fishing mortality can only be estimated with uncertainty. Therefore, operational reference points are required to take account of this. To keep the true risk low that spawning biomass falls below $\mathbf{B_{lim}}$, the estimated spawning biomass should in practice be kept above a higher level to allow for this uncertainty. Therefore, ICES applies a 'buffer zone' by setting a higher spawning biomass reference point $\mathbf{B_{pa}}$ (the biomass precautionary approach reference point). As long as the *estimate* of spawning biomass is at or above $\mathbf{B_{pa}}$, the *true* biomass should have a low probability of being below $\mathbf{B_{lim}}$. Therefore, ICES advises that when the spawning biomass is estimated to be below $\mathbf{B_{pa}}$, management action should be taken to increase the stock to above $\mathbf{B_{pa}}$. Because $\mathbf{B_{pa}}$ is a mechanism for managing the risk of the stock falling below $\mathbf{B_{lim}}$, the distance between these reference points is not fixed, but will vary with the uncertainty of the assessment and the amount of risk society is prepared to take. For example if the quality of catch data were to decline, or multi-year forecasts were required for catch advice, a higher $\mathbf{B_{pa}}$ would be needed for the same $\mathbf{B_{lim}}$. The same is true if society will only accept a very low risk that the true biomass is below $\mathbf{B_{lim}}$.

Similarly, to be certain that fishing mortality is below $\mathbf{F_{lim}}$, fishing mortality should in practice be kept below a lower level $\mathbf{F_{pa}}$ that allows for uncertainty as well. ICES advises that when fishing mortality is estimated to be above $\mathbf{F_{pa}}$, management action to reduce it to $\mathbf{F_{pa}}$ should be taken. Such advice is given even if the spawning biomass is above $\mathbf{B_{pa}}$ because fishing mortalities above $\mathbf{F_{pa}}$ are not sustainable.

ICES stresses that these precautionary reference points should not be treated as management targets, but as lower bounds on spawning biomass and upper bounds on fishing mortality. Good management should strive to keep SSB well above $\mathbf{B_{pa}}$ and fishing mortality well below $\mathbf{F_{pa}}$. If management keeps stocks very close to their precautionary reference points, then annual scientific advice will be altering conclusions on stock status and necessary management actions on the basis of assessment uncertainty as much as on the basis of true changes in stock status. Managing stocks to achieve targets well removed from the risk-based reference points would result in more stable scientific advice, as well as healthier stocks and more sustainable fisheries.

ICES gives advice on many stocks for which there is no analytical assessment and accordingly no basis for setting reference points as described above. Also in these cases ICES uses a precautionary approach, but alternative models are applied, with reference points referring to properties of the stock or fishery that can be estimated, for example catch per unit of effort instead of biomass.

Target reference points

The ICES advice is primarily risk-averse, i.e. it aims at reducing the risk of something undesirable happening to the stocks. Biological target reference points are also part of the Precautionary Approach, but setting targets for fisheries management involves socio-economic considerations. Therefore, ICES does not propose values for Target Reference Points, and until recently Management Agencies have not identified management targets based on socio-economic benefits. Hence Target Reference Points have not been directly used in the advice. This means that even if the ICES advice is followed and therefore the stock should be protected from impaired productivity, exploitation of most stocks is likely to be sub-optimal, i.e. the long-term yield is lower than it could be.

When societal objectives or targets have been identified ICES can provide advice relating to these targets. ICES may advise on the likeliness of achieving targets under different management regimes and may propose parameters and values for target points if a basis for such choices has been defined in fisheries policies.

Managers are invited to develop targets and associated management strategies. ICES will comment on these and consider if they are consistent with the precautionary approach. If they are, ICES will frame the advice to be consistent with the adopted management targets.

Language of fisheries advice

The framework used to phrase the advice in relation to the precautionary approach relies on the assessment of the status of the stock relative to precautionary reference points. When an assessment estimates that the spawning biomass is below $\mathbf{B_{pa}}$ ICES classifies the stock as being "outside safe biological limits", regardless of the fishing mortality rate.

When a stock is below $\mathbf{B_{pa}}$ ICES will provide advice to increase the spawning biomass above $\mathbf{B_{pa}}$, which may involve reducing fishing mortality to levels below $\mathbf{F_{pa}}$, possibly by a large amount. If $\mathbf{B_{pa}}$ cannot be achieved in the short term, ICES will recommend the development of a recovery plan specifying measures to increase SSB above $\mathbf{B_{pa}}$ in an appropriate time scale, depending on the biological characteristics of the stock and other relevant factors.

When an assessment shows that the stock is above $\mathbf{B_{pa}}$ but that the fishing mortality is above $\mathbf{F_{pa}}$, the stock is classified as "harvested outside safe biological limits". ICES will then recommend that the fishing mortality be reduced below $\mathbf{F_{pa}}$ in the short term.

However, referring to "safe biological limits" has in some cases mislead clients and other stakeholders to consider stocks described as being "outside safe biological limits" to be biologically threatened (i.e. close to extinction). The term "outside safe biological limits" is used in international agreements and has been used by ICES in the past to classify stocks for which the spawning biomass is below $\mathbf{B_{pa}}$. While ICES considers this language to be perfectly justified and in accordance with international practices the attention of ICES has also been drawn to instances of confusion in the public debate where "outside biological limits" has been equated to biological extinction. ICES has therefore from 2004 used a phrasing which more specifically refers to the concept on which this classification is based by referring to the reproduction capacity of the stock in relation to spawning stock biomass, and sustainable harvest in relation to fishing mortality. It should be emphasised that the expressions "outside safe biological limits" and "being at risk of reduced reproductive capacity" or "suffering reduced reproductive capacity" are considered entirely equivalent by ICES and that the change in language does not imply any change in judgement of the seriousness of the situation when a stock is outside safe biological limits and thereby outside precautionary limits.

The present ICES classification scheme is equivalent to the terminology used before:

- Biomass:
    - stock is "having full reproductive capacity" is equivalent to "inside safe biological limits";
    - stock is "being at risk of reduced reproductive capacity" or "suffering reduced reproductive capacity" is equivalent to "outside safe biological limits".
- Fishing mortality:
    - stock is "harvested sustainably" is equivalent to "harvested inside safe biological limits";
    - stock is "harvested outside precautionary limits" is equivalent to "harvested outside safe biological limits".

The following terminology for the "State of the stock" is used in this report:

For the status relative to SSB: "Based on the most recent estimates of SSB, ICES classifies the stock as …"

If $\mathbf{SSB>B}_{pa}$: "having full reproduction capacity."

If $\mathbf{B}_{lim}$ $<\mathbf{SSB<B}_{pa}$: "being at risk of reduced reproductive capacity."

If $\mathbf{SSB<B}_{lim}$: "suffering reduced reproductive capacity." OR "at a level where the stock dynamics is unknown and therefore risking reduced reproductive capacity." (in the case where $\mathbf{B}_{lim}$ is the lowest observed)

The two last categories were earlier referred to as "outside safe biological limits".

For the status relative to fishing mortality: "Based on the most recent estimates of fishing mortality ICES classifies the stock to be…"

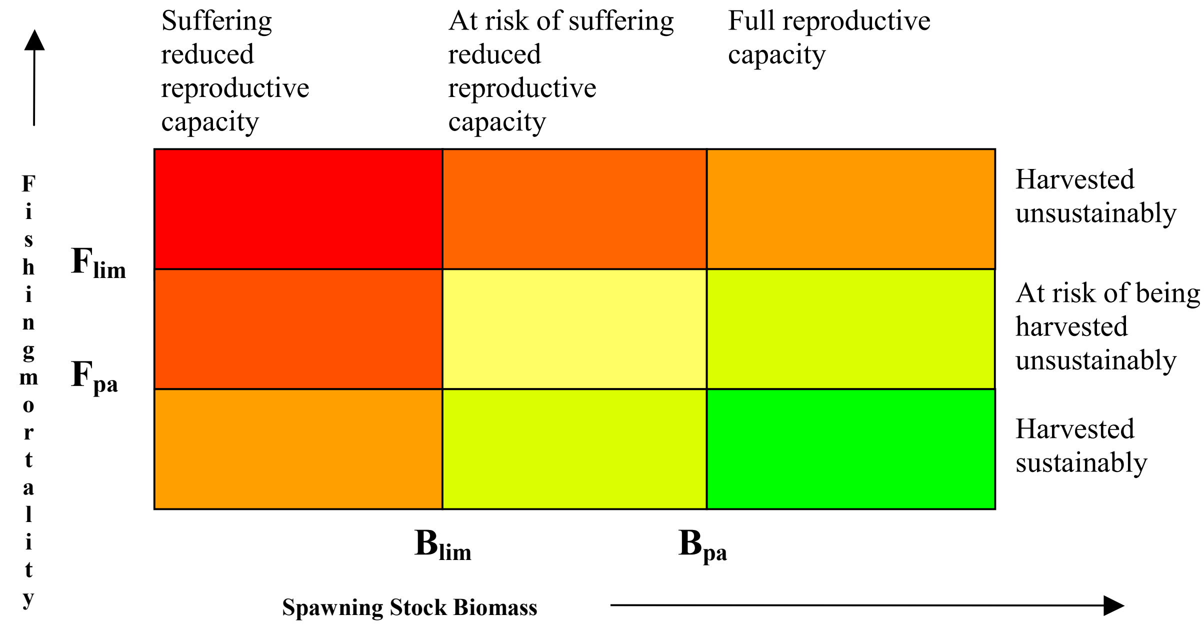
If $\mathbf{F<F}_{pa}$: "harvested sustainably."

If $\mathbf{F}_{lim}$ $>\mathbf{F>F}_{pa}$: "at risk of being harvested unsustainably."

If $\mathbf{F>F}_{lim}$: "harvested unsustainably."

Also here the two last categories were earlier referred to as "outside safe biological limits".

REFERENCE POINTS FOR THE STATUS OF FISH STOCKS



The introduction of target reference points will necessitate an expansion of categories to include situations relative to targets. This remains to be developed in concert with the development of a framework for target reference points.

MANAGEMENT ADVICE FOR MIXED FISHERIES

Once single-stock exploitation boundaries have been identified the next step in the formulation of management advice is to identify which single-stock boundaries are limiting in mixed fisheries as explained above.

ICES has worked on these issues together with scientific groups under EC STECF to develop the necessary framework and to build the required databases. Much of this work has concentrated on the North Sea demersal fisheries. Many fisheries harvest several quota species simultaneously and this poses at least two management problems. Even within a single fishery, managers must keep catches of all species within their TACs while trying not to forego catches of species whose TACs are taken up more slowly. When several fisheries all take a species in common, whether as a target species or as bycatch, managers must also allocate the safe harvest of the shared species among those fisheries in ways that allow the fisheries to take their allowable harvest of their various target species, without exceeding the total allowable catch of the shared species.

Experience from fisheries-based management in other parts of the world indicates that the provision of fishery-based advice is possible, but that it requires well-defined fisheries that are based on complete and reliable catch data. In the ICES case, model development has outpaced the compilation of appropriate data, both for defining fisheries and providing mixed fishery advice. Specifically, the lack of data on discards for most species is a principal concern. Although this is a weakness of many single-stock forecasts it becomes a fatal flaw in a mixed fisheries context. The absence of discard data will lead to inappropriate advice being given, thereby misinforming managers about the appropriate allocation of effort among fisheries consistent with desired levels of fishing mortality by species. For example, for a species under a recovery plan advice would be provided that would restrict fisheries reporting landings or bycatches of the species, but would ignore entirely fisheries that catch and discard that species, possibly at rates high enough to preclude recovery.

ICES is concerned that any approach to managing mixed fisheries that assumes a constant species composition over time implicitly discourages adaptive fishing behaviour. In many jurisdictions fishermen have demonstrated the ability to reduce bycatch of critical species, through season, area, or gear modifications, or through changes in their short-term fishing patterns. There is a danger that the allocation of fishing opportunities for different species based on past catch compositions will lock fisheries into their historical context, and provide no incentive for industry to find ways to fish without catching species that are restrictive on fleet activities. Such adaptive changes in fishing behaviour are difficult to predict but to the extent that they occur, they will limit the realism of mixed fishery forecasts.

ICES has previously advised that where industry-initiated programmes can be demonstrated (with independent and credible methods) to bring their catch rates of species under recovery plans down to near zero, then such programmes could be considered in the management of those fisheries. The pre-requisite for such programmes to be successful includes a high rate of independent observer coverage, or other fully transparent method for ensuring that catches are fully and credibly reported. This pre-requisite is not considered to be met in NE Atlantic fisheries.

In 2002 ICES established a preliminary database of North Sea demersal fleet-based landings data. This was used subsequently

by STECF in the development of illustrative fishery-based management scenarios through mixed-species TAC evaluations and under various assumptions about the priority of access of various fleets to the allowable catch of shared species. The underlying model and its software implementation (MTAC) was further developed. The model has been further developed in 2003 and 2004 and can now be considered sufficiently mature to be used for mixed fisheries management scenario evaluations provided data on past catches (landings and discards) are available.

The main obstacle is hereafter that ICES does not have access to discard data for most fisheries. Given the lack of access to discard information for many species and fleets, the available catch data are not a valid basis for mixed fishery advice. Absence of discard information will result in misleading results with respect to which fisheries should be limited to keep total catches of all species (particularly those outside safe biological limits) within bounds that will allow eventual recovery of depleted stocks. Reliable mixed fishery forecasts suitable for use in management require estimates of total catch from all fisheries.

There is therefore not much point in proceeding with quantitative mixed fisheries scenario evaluations as long as these basic data are not available. The lack of such mixed fishery forecasts necessitates the development of complementary processes that do not require analytical short-term forecasts. As per 2004 ICES is therefore basing its advice on mixed fisheries on information available on the catch composition in these fisheries even though quantitative projections cannot be made. This means that the single-stock boundaries are supplemented with qualifiers about which targeted and mixed fisheries are known to harvest the critical species as target or incidental bycatch and to which extent different stocks should be seen as linked by being taken in the same fisheries.

THE INCORPORATION OF ECOSYSTEM CONSIDERATIONS

The final step in the formulation of advice is to address those ecosystem considerations which are associated with mixed fisheries or several stocks simultaneously. Ecosystem considerations regarding single-stock fisheries are addressed as a part of the single-stock exploitation boundaries.

Ecosystem considerations include the impact of fisheries on habitats and the impact on other biota beyond the fish populations which are already included in the advice, such as incidental bycatches on non-commercial fish species or sea mammals. The removal of fish from the ecosystem will also have more overall impacts on the structure and energy flow in the ecosystem.

The impact of fisheries on the ecosystem can at present rarely be quantified or predicted in quantitative terms. The incorporation of such considerations in the advice will therefore mainly be through qualifying statements regarding the quality and direction of expected impacts.

Present knowledge about ecosystem impacts is built on studies in specific ecosystems but may not represent the overall ecosystem and can only be extended to other ecosystems in a general way. Many important ecosystem considerations regarding the impacts of fisheries will therefore be of a general, not area-specific nature. Such general considerations are therefore not dealt with in the area sections but in the general advice. As more specific knowledge is produced the advice on ecosystem impacts will move from the general to the area-specific sections.

QUALITY OF FISHERY STATISTICS

The quality of the assessments is directly linked to the quality of the fisheries data, and ICES has expressed the greatest concern in past ACFM advice over the quality of catch and effort data from most of the important fisheries in the ICES area.

The assessments presented in this report are carried out using the best catch data available to ICES. These data are not necessarily identical with the official statistics but, where appropriate, include estimates of unreported landings as well as corrections for misallocation of catches by area and species. ICES seeks information on misreported or unreported landings through a range of sources, but there is no guarantee that all instances are discovered. Often the catch data used by ICES are collated on a stock rather than an area basis, and thus straightforward comparisons between these figures and the official statistics, which are provided on an area basis, are not appropriate. The catch data used in the assessments are given in the “summary table” found in Chapter 4 under each stock. In cases where there might be doubt, it has been indicated if discards, bycatches, and estimates of unreported landings are included in the assessments. Estimates of catches landed as bycatches, especially from the industrial fisheries, are included in the assessments wherever data allow it and are included in the catch options.

In some assessments, ICES tries to estimate the total catch taken, including slipped catches, discards, landings which are not officially reported, and the composition of the industrial bycatches. These amounts of different species, which have to be included in the estimates of what has been taken from a given stock in order for the assessments to be correct, thus appear in the tables and figures in this report. These discards, slipped fish, unreported landings, and industrial bycatches vary considerably between different stocks and fisheries, being negligible in some cases and constituting important parts of the total removal from other stocks. In recent years more information on discards has been collected through observer programmes. However, few of these data have been made available to ICES for assessment purposes.

In the past there have been problems associated with discrepancies between the official landing figures reported to ICES by member countries and the corresponding catch data used by ICES. ICES recognises the need for a clear identification of the categories of the catch data used for assessments and whenever possible specifies the composition of the catch data used to estimate fishing mortalities. ICES also attempts to identify factors contributing to the total fishing mortality in the various stocks, e.g.:

- recorded landings,
- discards at sea,
- slipping of unwanted catches,
- losses due to burst nets, etc.,
- unreported landings,
- catch reported as other species,
- catch reported as taken in other areas,
- catch taken as bycatch in other fisheries.

It is recognised that it may not always be possible to reveal the sources of the data. It is, however, indicated whether the data originate from sampling programmes, field observations, interviews, etc., in order to allow ICES and other interested parties to evaluate the quality of the data, and hence the basis for the assessment.

It should be noted that some industrial fisheries take protected species above the minimum landing size. When this catch is sorted and landed for human consumption, the landings are included in the estimates of human consumption landings, both in the catch

input data and in the projected catch options. Estimates of industrial bycatches cover, in most cases, that part of the bycatch which is used for reduction purposes.

The overall responsibility for obtaining reliable, adequate and timely fisheries statistics rests with the national offices for fisheries statistics and fisheries research institutes. The national fisheries research institutes control the design and execution of the abundance surveys. These agencies are also responsible for providing the catch data needed for assessments. They should ensure that catch statistics are collected on a gear basis and that the species composition of landings is determined in the case where landings are made unsorted by species.

Fisheries statistics and data sampling are collected in cooperation with the fishing industry. This means that the quality of a significant part of the data used in ICES fisheries advisory work relies on cooperation with the fishing industry and national authorities. The quality of these data depends on the degree to which the industry adheres to the regulations, e.g., the EU TAC and Quota regulation, and to which extent research institutes are allowed to observe fishing operations or do market sampling.

It is becoming increasingly difficult to assure the quality of the data when the fishing industry is involved. There are numerous examples of such problems, e.g., access to discard data from the Dutch beam trawl fleet, and in previous years access to Danish discard data. There are reports of misreporting of landings from areas, e.g., for the fleet fishing herring in Division VIa and in Subarea IV, and there are non-reported landings in several fisheries, e.g., Scottish fishing around 2000 and recently in the Baltic cod fishery.

Until now ICES has, as a matter of policy, attempted to correct for shortcomings in the data. For non-reported landings such corrections, by their very nature, are difficult to document and are obviously open to debate. Clearly, the ICES assessments in these situations are of poor quality and it is a policy matter when ICES should refrain from providing advice at all. Disregarding data from the fisheries would mean that ICES will be unable to provide reliable estimates of current stock sizes and forecasts that have been used to set TACs. Trends in stock size and the overall status of the stock can sometimes be evaluated from research vessel surveys, but such information alone cannot be used to give the short-term TAC advice usually required.

The fishing industry has on various occasions disagreed strongly with ICES' estimates and has in such situations blamed ICES for not performing well.

ICES cannot accept responsibility for quantifying non-reporting fisheries, or ensuring access to proper discard data, when there are reservations regarding the collection and use of such data from national authorities or industry. Simply, ICES has no monitoring apparatus at its disposal. Likewise ICES has no legal authority to demand access to existing data. The responsibility for discards and non-reporting and the uncertainty regarding the extent of these phenomena rests with the national authorities and the industry.

ENVIRONMENT IMPACT ON FISH STOCKS

The reproduction of fish stocks is variable and the reasons for this variation are incompletely known.

The environment is important in determining the survival of fish eggs and the survival and growth of fish larvae and juvenile fish. A multitude of environmental factors may be involved. For some fish stocks specific hydrographic conditions are known to be important and the composition and density of the plankton, which is the food source of fish larvae and juveniles, is known to be critical for growth and survival. The abundance of predators is also an important factor in juvenile survival. One of the best understood cases is the Baltic Sea where a linkage between the reproductory success of cod and hydrographic conditions has been demonstrated.

For a number of North Sea species (cod, whiting, plaice) recruitment in most recent years has been lower than in previous decades. Some stocks, notably North Sea plaice, have shown a reduction of growth. On the other hand, other species like sea bass and red mullet with more southern distributions have increased in abundance and/or growth rates, and have at times attracted a fishery. There are also indications of changes in distribution for some stocks. There is considerable speculation on the reasons for the observed changes. Changes in the environment may have played a role in the reduced productivity of several North Sea stocks. In the last 10 years mean temperatures in the sea have increased and changes in the sea currents have also been observed.

The state of the fish stocks themselves is an important factor in determining recruitment. For several stocks a relationship between recruitment and the size of the spawning stock is apparent for low spawning stock sizes. The composition of the spawning stock may also be important because studies with some species, particularly cod, have shown that young and small spawners produce a reduced quantity of eggs which are of a reduced quality. A spawning stock dominated by young spawners could therefore have less reproductive capacity than a spawning stock of comparable size with many older spawners. Spawning stock size should therefore be supplemented with information on its composition when the reproductive capacity is evaluated.

Fishing leads to a reduction in the spawning stock and to a higher proportion of young spawners in the spawning stock. The high fishing mortalities which have been prevalent for many fish stocks have resulted in reduced spawning stocks which are dominated by first-time spawners. High fishing mortalities have thus lead to low reproductive capacity independently of the environmental conditions. If climate change or other environmental changes have also played a role in the reduced productivity of fish stocks, it therefore becomes even more essential that exploitation rates on these stocks be reduced, to sustain the stocks under conditions of lower productivity.

Effort Limitation and Recovery Plans

Summary of FSS considerations:

- Existing recovery plans are unlikely to achieve their objectives because they do not properly account for the uncertainty involved in assessing current and future stock status.
- Effort controls, as currently formulated, are not achieving the reductions in fishing mortality required to satisfy the objectives of the cod recovery regulation.
- Further restriction of effort in the 70-99mm mesh category might be avoided by demonstrating improvements in species selection.
- Effort regulations should reward good fishing practices rather than simply penalising for previous practices without giving any incentive to improve species selectivity.

Recovery Plans

Recovery plans are essentially "emergency measures" designed to facilitate the rapid rebuilding of spawning stock biomass (SSB: the number of mature fish multiplied by their weight) for stocks which are considered to be in a depleted state. The scientific terminology uses the term "recruitment impairment" to indicate that the SSB may be so low that the stock may be unable to reproduce effectively, the idea of a recovery plan is that the SSB is rebuilt to a level where the stock has full productivity. SSB can therefore be rebuilt by allowing mature fish to survive, and therefore increase in weight, and by allowing more fish to survive and reach maturity. Thus recovery plans often include measures to protect recruitment as well as reducing the exploitation on the adult fish.

Many recovery plans are initiated by a substantial reduction in TAC (to reduce exploitation), followed by special technical measures, which can aid both the reduction in exploitation and protection of recruitment. Such technical measures can include effort limitation, 'closed areas' increased mesh sizes and the use of escape panels in trawl nets. Implicit in the recovery plan concept is that control and enforcement is effectively applied.

Over the past 4 years recovery plans have been initiated by the EU in response to scientific advice that several stocks (mostly Cod) were in a state of recruitment impairment. To date specific recovery plans exist for Cod in the Irish Sea, west of Scotland, the North Sea and Kategatt, as well as for Northern Hake. With the exception of North Sea and Kategatt Cod all of these recovery plans effect Irish fishing interests.

The nature of a recovery plan, being the rebuilding of an SSB for a stock which is suffering impaired productivity, means that the recovery is likely to take more than a single year. More recently many of the recovery plans have been modified to include rules on how the TAC will be set in the years before "recovery" has been achieved. In these cases the recovery plans have come to be called Harvest Control Rules (HCR).

FSS has reviewed the Irish Sea cod recovery plan (Kelly *et al.* in press). This review suggests that, in its earlier incarnations, the Cod recovery plan lacked evaluation criteria which made the measurement of success difficult. The review suggested that the most effective means for recovery of Irish sea cod is a significant reduction in exploitation and not the protection of mature fish only during spawning. The most recent revision of the plan does not incorporate any element of uncertainty (i.e. it is deterministic). FSS would point out that this will mean that the plan has a high risk of not achieving its objectives. FSS suggest that incorporating the following criteria would improve future recovery plans;

- Where the mechanism of recovery requires a reduction in fishing opportunities, there should be a consideration of the fleet-specific reduction in revenue of such reduced exploitation.
- Performance targets must be measurable and account for the inherent uncertainty involved in both assessing the current and projecting future states of the stock.

In 2004 the European Commission consolidated and strengthened recovery measures through the introduction of specific cod and hake recovery regulations. The multi-annual recovery plans enacted by Council Regulations (EC) Nos. 423/2004 and 811/2004 represented major improvements over previous emergency measures legislation in that they clearly state their objectives, the interval over which success is envisaged and the mechanism by which control of fishing mortality is to be achieved. Specifically the plans establish measures for the recovery of cod and hake stocks by enacting:

- multi-annual processes for selection of TAC's,
- restriction of fishing effort,
- specific technical measures,
- increased control and enforcement,
- accompanying structural measures, and,
- special market measures.

Both regulations formulate harvest control rules with reference to limit and precautionary reference points. For stocks above $\mathbf{B_{lim}}$, the harvest control rules require:

1. Setting TACs that achieve certain percentage increases in the SSB from one year to the next (30% for cod stocks, 15% for hake),
2. Limiting annual changes in TAC to ± 15% (except in the first year of application), and,
3. A rate of fishing mortality that does not exceed $\mathbf{F_{pa}}$.

For stocks below $\mathbf{B}_{\mathbf{lim}}$ the Regulations specify that:

1. Conditions 1-3 will apply when they are expected to result in an increase in SSB above $\mathbf{B}_{\mathbf{lim}}$ in the year of application,
2. A TAC will be set lower than that calculated under conditions 1-3 when the application of conditions 1-3 is not expected to result in an increase in SSB above $\mathbf{B}_{\mathbf{lim}}$ in the year of application.

FSS considers that the mechanism used to achieve stock recovery is a high risk strategy. Simple limitation of TACs and their fluctuation is risky because projections on which the TACs are based require assumptions about future recruitment, but at stock levels where recruitment dynamics are poorly known. When this is done in a deterministic way the chance of success is at best 50% and, in reality, probably much lower.

Effort Limitation

As a means of ensuring that desired reductions in fishing mortality are achieved the European Commission has also introduced effort limitation. Annex XVII to Council Regulation (EC) No 2341/2002 introduced fishing effort regulation in 2003 to the West of Scotland. In 2004 effort limitation was extended to the Irish Sea (and other "cod recovery" areas) under Annex V of Council Regulation (EC) No 2287/2003. Council Regulation (EC) No 27/2005 further limited effort in the Irish Sea and West of Scotland (and other "cod recovery" areas). The restrictions for the West of Scotland and Irish Sea (per month) in 2005 were:

- Demersal trawls, seines and similar towed gears with mesh size ≥100mm: 8 days (West of Scotland), 10 days (Irish Sea),
- Beam trawls of mesh size >= 80mm and static demersal nets: 13 days,
- Demersal longlines: 16 days,
- Demersal trawls, seines and similar towed gears with mesh size 70-99mm: 21 days,
- Demersal trawls, seines or similar towed gears of mesh size 16-31mm except beam trawls: 19 days.

Additional days remained available for vessels meeting certain conditions such as track record of low cod catches. However, this was reduced to one additional day for whitefish trawlers (mesh ≥100mm) and beam trawlers (mesh ≥80mm) which spent more than half of their allocated days per month fishing in the Irish Sea, in recognition of the area closure in the Irish Sea and the assumed reduction in fishing mortality on cod.

The effort regulations have provided an incentive for some vessels previously using >100mm mesh otter trawls to switch to smaller mesh gears, thus claiming a higher number of days-at-sea. Under EC Regulation No. 850/1998 these vessels are also required to target either *Nephrops* or anglerfish, megrim, and whiting, with various catch and by-catch composition limits.

FSS notes that the introduction of Effort Regulation was not accompanied by clearly defined objectives for reduction of effort, nor for fishing mortality. Furthermore, the starting levels for effort were not firmly established. FSS also notes that the relationship between effort and fishing mortality remains unclear.

Effort Limitation in the Context of Cod Recovery Plans

In 2005 the European Commission convened meetings of the STECF's Subgroup on the Review of Stocks (SGRST) to consider cod recovery plans. SGRST's terms of reference included a request to review of "the current system for the management of fishing effort (Annex IVa of Regulation 27/2005) in the context of the cod recovery plan (Regulation 423/2004)." The SGRST evaluation of the effectiveness of effort regulations was complicated by the lack of stated objectives of the regulations in terms of intended fishing mortality reductions. The SGRST summarised recent trends in nominal effort by relevant fleets:

- For the west of Scotland effort data were reported for the whole of Division VIa rather than for the area within which effort is regulated. SGRST was therefore unable to evaluate changes in effort exerted by regulated gears to the west of Scotland.
- In the Irish Sea, there has been an overall decline of 19% from 2000-2004 in the effort exerted by vessels using 70-99mm meshes. However, there is some evidence since 2002 of a transfer of effort from trawls using ≥100 mm mesh to 70-99mm mesh.
- In the North Sea and Skagerrak, the total nominal effort for all demersal gears decreased between 2000 and 2004 by 21% (15% between 2002 and 2004). Demersal trawlers using ≥100mm mesh showed the greatest decline in effort (43% since 2000, 35% since 2002), while the effort of demersal trawlers using 70-99mm mesh increased by 54% and 12% over the same periods.
- In the Eastern Channel, total nominal effort increased between 2000 and 2004 by 22% and decreased between 2002 and 2004 by 3%. Demersal trawlers using 70-99mm mesh accounted for most of the fishing effort, and this increased by 14% between 2000 and 2004 and decreased by 3% during 2002-2004.
- In the Kattegat, total nominal effort decreased by 27% during the period 2000 to 2004 (16% between 2002 and 2004). Effort of demersal trawlers using ≥100mm mesh decreased by 79% whilst that of demersal trawlers using 70-99mm mesh decreased by 22% between 2000 and 2004.

The SGRST findings of minimal decreases / increases in the effort of trawlers using 70-99mm mesh and simultaneous decreases in the effort of ≥100mm mesh demersal trawlers indicate an overall reduction in the mesh size used in demersal fisheries. Adherence to catch composition regulations required when using 70-99mm mesh would result in high-grading and discarding of cod and other species. The SGRST report provides evidence of heavy discarding of cod, and other demersal species, particularly in the 70-99mm mesh category.

The SGRST was also provided with information on the control and enforcement of effort regulations (Commission's evaluation report: Cod recovery verification programme 2004, Working Document 9 to SGRST). The report considers that the actual reduction in terms of fishing effort by the main fleets is likely to have been modest, that high-grading and mis-declaring of cod was a common practice during 2004 and that landings composition regulations of the regulated gears were poorly enforced.

The SGRST concluded that:

- high-grading, discarding and mis-declaring of cod may compromise effort management,
- levels of fishing mortality remain higher than those required for recovery,
- reductions in fishing mortality were inadequate in the context of the cod recovery plan.

FSS agrees with the SGRST that effort controls, as currently formulated, are not achieving the reductions in fishing mortality required to satisfy the objectives of the cod recovery regulation. FSS therefore considers that the European Commission is likely to seek further restrictions on effort in the near future. Given the problems identified by SGRST with the current regulation of effort of demersal trawlers using 70-99mm mesh, FSS considers that this gear category may be targeted particularly for further effort restriction.

FSS considers that the current provisions allowing vessels to revert from using ≥100mm mesh sizes to 70-99mm mesh sizes in order to avail of a higher effort allocation to be particularly problematic. This provision runs contrary to efforts made in 2001/2002 by several Member States to increase codend mesh size. Furthermore, it effectively removes incentives to increase mesh size in order to reduce discarding by *Nephrops* / mixed demersal fisheries.

FSS stresses that further restriction of effort regulation in the 70-99mm category might be avoided by demonstrating improvements in species selection such that existing catch composition regulations can be adhered to without discarding. FSS recommends that amendments to effort regulations should reward good fishing practices rather than simply penalising particular fleet segments for previous practices without giving any incentive to improve species selectivity. FSS therefore supports proposals such as the SGRST recommendation that *Nephrops* trawls with highly selective properties for particular species (eg. grid, separator panel) be rewarded in the cod recovery plan to create positive incentives to minimize fishing mortality on cod and other weak demersal fish stocks.

However, FSS considers that the implementation of such proposals may require further measures to ensure that conservation benefits are realised. FSS supports the proactive approach made by industry representatives to the SGRST who proposed accompanying measures such as mandatory onboard observers, and spatial and temporal restrictions on fleet activity. However, such restrictions may further "pigeon-hole" fleets into narrowly defined segments. FSS therefore considers that there is a need to balance the loss of flexibility and diversification opportunities that may result against the improved fishing opportunities that may accrue to these segments.

It is clear that the European Commission considers effort regulation to be a major instrument for future fisheries management in Europe. FSS stresses that careful consideration of issues such as those raised above is essential to ensuring the effectiveness of future effort regulations.

Reference:

Kelly C.J. Codling E. & Rogan E. (In press). The Irish Sea Cod recovery plan; some lessons learned. *ICES Journal of Marine Science*.

Misreporting and Other Unaccounted Removals

Background

The conservation and management of many international fish stocks are being undermined by increasing levels of illegal, unreported and unregulated (IUU) fishing. FAO carried out a global review of IUU in 2000 and found that IUU fishing was by no means confined to the high seas, though it certainly is a major problem there (Bray; 2000a). The report shows very clearly that IUU fisheries also threaten responsible fisheries management within the EEZ of coastal states through activities such as fishing without authorisation, fishing in a manner contrary to the authorisation, failing to report catches or failing to accurately and fully report them (Bray; 2000b).

Undermining Scientific Advice

The quality of the assessments presented in the Stock Book are directly linked to the quality of the fisheries data. In 2005 ICES has expressed great concern over the poor quality of catch and effort data from most of the important fisheries in the ICES area. This year it was not possible for ICES to carry out stock assessments for a number of key stocks (including the waters around Ireland) because of the poor quality of the catch data. This is now a very serious problem for the scientific community within ICES.

Until now ICES has, as a matter of policy, attempted to correct for shortcomings in the data. For non-reported landings such corrections, by their very nature, are difficult to document and are obviously open to debate. Clearly, the ICES assessments in these situations are of poor quality and it is a policy matter when ICES should refrain from providing advice at all. Disregarding data from the fisheries would mean that ICES will be unable to provide reliable estimates of current stock sizes and forecasts that have been used to set TACs. Trends in stock size and the overall status of the stock can sometimes be evaluated from research vessel surveys, but such information alone cannot be used to give the short-term TAC advice usually required.

The fishing industry has on various occasions disagreed strongly with ICES' estimates and has in such situations blamed ICES for not performing well.

ICES cannot accept responsibility for quantifying non-reporting fisheries, or ensuring access to proper discard data, when there are reservations regarding the collection and use of such data from national authorities or industry. Simply, ICES has no monitoring apparatus at its disposal. Likewise ICES has no legal authority to demand access to existing data. The responsibility for discards and non-reporting and the uncertainty regarding the extent of these phenomena rests with the national authorities and the industry.

In his speech to the ICES Annual Science Conference in Aberdeen, in September 2005, Commissioner Borg stated that *the situation in relation to the accuracy of catch statistics remains unacceptable in many EU fisheries.*

The Problem

There are biases and inaccuracy in stock assessments through inability to account for all the fish that have been removed from the system implying there is either unaccounted fishing mortality or other unaccounted removals. Although scientists have been struggling with the problem for many years it seems to becoming more acute in recent years. For several critical stocks the problem has become so acute that scientists are no longer in a position to provide either catch forecasts or recommend precautionary catch levels. This trend in increasing uncertainty in stock assessments and forecasts is of serious concerns to scientist, managers and other stakeholders. If there is to be accurate scientific advice for management in the future then measures need to be put in place to remedy the situation. This will require developing management regimes and taking management decisions that are robust to the uncertainty that now exists.

Programmes to minimize future stock assessment data uncertainties also need to be developed. In this section the problem is discussed in general terms. Where problems have been identified for individual stocks these are discussed further in each stock section under additional information.

Misreporting

Theoretically catch controls are the most effective way of adjusting fishing mortality in an effective fisheries management system. However, there are strong incentives for fishermen to fish illegally or misreport landings, especially in a period when quotas are being reduced but economic imperatives remain to maintain catches. It is an inherent problem that practices of misreporting may develop when TAC regulations are not effectively implemented.

The majority of stock assessments methods used by ICES assume the landings data are exact. Increasingly, through direct and indirect observation ICES scientists are becoming aware that this in very often not the case. In some case misreporting is such a problem that ICES cannot perform analytical assessments on which to base the advice (e.g. Anglerfish in IV and VI). In other case ICES routinely bases the assessment on corrected or estimated landings (e.g. Northern Hake).

Misreporting is endemic in many Northeast Atlantic fisheries and may occur in the following ways:

- **Area misreporting** where landings are reported into area other than where the fish were caught.
- **Species misreporting** where one species is reported as another.
- **Under or over reporting** where the quantities landed are purposefully under or over recorded.
- **Non reporting** where none of the landings quantities are reported.
- **Illegal fisheries** where vessels fish but their activities are not documented in anyway.

Within ICES there is a growing openness and awareness of misreporting problems but this is an evolving process and transparency on this issues is not always consistent across stocks, fisheries and countries. Open and transparent handling of misreporting data has been particularly problematic for scientists. Often mis-reporting data available to the scientific community are qualitative rather than quantitative. Where quantitative estimates exist they tend to be limited in sample size and may not be representative or precise and cannot be used to accurately adjust reported landings. Notable exceptions include where Spanish landings are estimate from market sales slips rather than official logbooks. The need for increasing transparency creates problems for fisheries scientist as misreporting estimates if transparently described could be used for control and enforcement rather than scientific purposes. If this situation develops then fleets or vessels where data exists on misreporting may be prosecuted whereas fleets or vessels where no data exists but where misreporting might also be as prevalent continue operations with impunity. There is also a systemic problem in that at national level control and enforcement and management authorities have historically considered that investigation of misreporting should not be within the remit of scientists as it undermines their governance efficacy.

Discarding

A further unintended consequence of TAC management has been substantial unaccounted discarding. Within the EU discarding is legal, so rather than having TAC regime a TAL (Total Allowable Landings) system exists and the discarded component of the catch is unregulated and unrecorded. The economic realities of fishing dictate that fishermen must continuously maximize value of the landed catch. In practice this will involve discarding of no, or low value species and size grades whilst retaining the most profitable components of the catch for landing. As with unaccounted landings this also leads to substantial biases in stock assessments and forecasts. The importance of discarding is discussed on a stock-by-stock basis throughout the Stock Book.

Although scientific programmes have been developed in many countries to estimate discarding rates scientists are becoming increasingly aware that to do this accurately and precisely is extremely difficult. Discarding patterns are also very métier specific and incomplete coverage of sampling in space and time in multi métier fisheries means that integration of available discard data into assessments is not always possible. Fishers, managers and scientist need to investigate and implement mechanisms to more effectively estimate discarding where it is having a significant impact on the ability to accurately estimate stock trends.

Other unaccounted fishing mortality

In 2005 ICES established a study group to examine the problem of unaccounted fishing mortality for a considerable number of stocks on which ICES currently gives advice. This study group concluded that fishing mortality (F) could be sub-divided in several components.

$$F = Fc + Fb + Fd + Fe + Fo + Fg + Fa + Fh + Fp + Fi$$

- Landed Catch **(Fc)**: Catch mortality should include all reported or estimated commercial fishing landings, plus landings from recreational fisheries and subsistence fisheries.
- Illegal, misreported & unreported landings **(Fb)**: is the mortality of fish that should be accounted for in the landed catch but is not because the records of landings are not reported, underestimated or misreported with respect to area and/or species.
- Discard mortality **(Fd)**: is the mortality of fish actively released by fishermen after capture.
- Escape mortality **(Fe)**: is defined as the mortality of fish that actively escape from a fishing gear, prior to the catch being landed on deck.
- Drop out mortality **(Fo)**: is the mortality due to captured fish dying and dropping out of the gear, prior to the catch being landed on deck. Examples include fish washed out of a codend during trawling or haulback, or fish lost from hooks and gillnets.
- Avoidance Mortality **(Fa)**: is the mortality directly or indirectly associated with the stress, fatigue and injuries of fish actively avoiding fishing gear.
- Ghost fishing mortality **(Fg)**: is the death of fish being caught in ghost fishing gear; where ghost fishing gear is lost or discarded gear that continues to fish for an indefinite period.
- Habitat degradation mortality **(Fh)**: is any mortality associated with the degradation of an aquatic environment as a direct result of fishing activity. This may be a cumulative and potential catastrophic process.
- Predation mortality **(Fp)**: is where fishing activity increases the risk of predation either directly or indirectly.
- Infection mortality **(Fi)**: where fishing activity increase the risk of death due to disease

Misreporting and discarding are currently of the greatest concern to the ICES stock assessment working groups at present. But other potential sources of unaccounted fishing mortality as describe above may also be affecting some fisheries, but as of yet their impact has not been properly assessed.

Other unaccounted removals

The term unaccounted removals is now also appearing in the ICES advice and requires explanation. Where scientists observe assessment uncertainty and bias it may be for other reasons than those above linked to fishing activity. Two assumptions underlie most stock assessments are that a) natural mortality (M) is constant over time and b) that the assessment is covering a closed stock. In reality this is probably not the case and it is often a source of criticism from stakeholders. Again this can lead to inaccurate and biased assessments and forecasts. However, variation in these assumptions even if measurable is not readily controllable. Therefore, where they exist the management regime needs to be able to compensate for variations by controlling fishing mortality. In addition the assessment and management regime should be robust to these variations.

Conclusions and Recommendations

There is now increasing uncertainty in the accuracy of stock assessments, forecasts and scientific advice for a number of critical stocks. In a regime where stock size is low and exploitation is high, there is a high risk that management may not be sufficient to prevent stock collapses. There is now an urgent need to move to regimes of lower fishing mortality in the medium term. In addition the systemic problems of misreporting and discarding need to be addressed as a matter of urgency.

In the case of misreporting where stock assessments and catch forecasts are based on input catch data that are lower than real catches then a vicious cycle may develop (Figure 1). When misreporting cannot be estimated accurately and included in stock assessments the result will be an increasing bias in stock assessments and forecasts resulting in even more restrictive TAC's and increasing misreporting. Over time it becomes impossible to establish the real stock situation and to advise on catches that can be taken sustainably. In this situation, a TAC regulation is not adequate to regulate fishing mortality. Increasingly ICES has begun to recommend input controls (mainly effort) accompanied by measures to effectively record catches in attempt to break this 'vicious cycle'. The new advice is predicated on a belief that in a modern control and enforcement context, effort control can be very effectively regulated through limitation of days-at-sea and used of new technologies such as VMS.

Effort control as the primary management tool is not always applicable (e.g. it would not be appropriate for pelagic fisheries). Effort control is most appropriate in a mixed fisheries context. Operationalising an effort control regime is not always straightforward. This is particularly true in mixed fishery where vessels can dynamically switch targeting practices easily. In that context the relationship between effort and fishing mortality is complex and the detailed analysis and understanding of historical fleet dynamics is required. Misreporting practices may compromise the analysis. The EC advocates input controls as a management tool but implementation of a effort only regime creates significant problems as it will undoubtedly impact on relative stability.

References

Bray, K. (2000a). A Global Review of Illegal, Unreported and Unregulated (IUU) Fishing. FAO. Doc. AUS: IUU/2000/6.2000. pp53.

Bray, K. (2000b). Illegal, Unreported and Unregulated (IUU) Fishing.
International Fisheries Conference on Fisheries Monitoring, Control and Surveillance, Brussels, Belgium, October 2000.

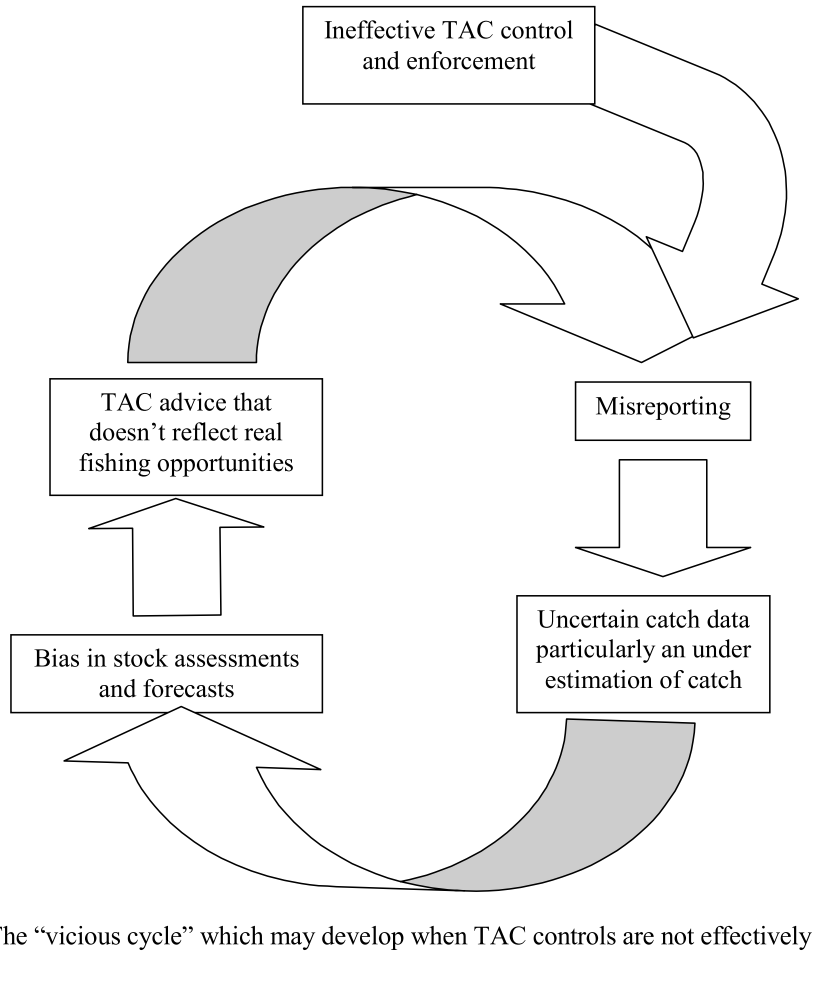


Figure 1. The "vicious cycle" which may develop when TAC controls are not effectively implemented

Ecosystem Overview for Widely Distributed and Migratory Populations.

ICES 1

Widely distributed marine populations

A number of marine populations are not confined to the individual areas considered in other sections of this report. They include sea mammals and fish species with stock units that are distributed over much wider areas such as hake and a number of deepwater species, and migratory species such as mackerel, horse mackerel, and blue whiting.

The North East Atlantic ecosystem in relation to widely distributed populations

It is difficult to characterise the whole North East Atlantic ecosystem; however, some broad descriptions are possible. Detailed information on the hydrography of this area is available from the Annual ICES Ocean Climate Status Summary (Hughes and Lavin, 2004). The most studied feature is the North Atlantic Oscillation (NAO). The NAO index is a measure of the difference in normalised sea level pressure between Iceland and the subtropical Eastern North Atlantic. When the NAO index is positive there is a strengthening of the Icelandic low and Azores high. This strengthening results in an increased north–south pressure gradient over the North Atlantic, causing colder and drier conditions over the western North Atlantic and warmer and wetter conditions in the eastern North Atlantic. During a negative NAO, a weakening of the Icelandic low and Azores high decreases the pressure gradient across the North Atlantic and tends to reverse these effects. The NAO index has been useful in the past to describe the climate of the North Atlantic region. Generally the most useful NAO index is for the winter (December through March). The winter index is called the Hurrell Index.

Following a long period of increase from an extreme and persistent negative phase in the 1960s to a most extreme and persistent positive phase during the late 1980s and early 1990s, the NAO index underwent a large and rapid decrease during the winter preceding 1996. Recent ICES Annual Ocean Climate Status Summaries (IAOCSS) describe the return of the NAO to positive conditions in the years following 1996 until a further reversal occurred over the winter preceding 2001. The NAO index is limited in that it can only describe the strength of the north–south dipole in sea level pressure (SLP) anomaly. Although this has been the predominant pattern over the last 30 years, it is not always the case. During the winter of 2002 the SLP anomaly pattern did exhibit a north–south dipole, but this was limited to the eastern region. Therefore the Hurrell NAO index was weakly positive. During 2003, the typical north-south NAO pattern was replaced by an east–west sea level pressure anomaly leading to a low value for both NAO indices in 2003. A high NAO index is believed to lead to a weakening of the warm North Atlantic current, and a stronger poleward current along the European shelf break, as well as stronger cold Labrador Sea water inflow. A low NAO index suggests a stronger North Atlantic current penetrating further into the Norwegian Sea, and a weaker slope current.

In most areas of the North Atlantic during 2003, temperature and salinity in the upper layers remained higher than the long-term average, with new records set in several regions. In Biscay, sea surface temperature in summer 2003 was the warmest in the time-series (1993–2003). Values were 1ºC above the mean from June to October and the thermocline was shallow. In the Rockall Trough the high surface temperatures and salinities continued a rise which began in 1995. Salinity values over the top 800 m were the highest on record, and corresponding temperatures were more than 0.5°C above the long-term average. Surface waters in the Faroe Shetland Channel continued the general warming trend observed over the last 20 years. Modified Atlantic Waters in the Faroe Shetland Channel were warmer and saltier in 2003 than at any period during the last 50 years. The sea surface temperature in 2003 was higher than normal over most of the Norwegian Sea. The distribution area of Atlantic water has decreased since the beginning of the 1980s, while the temperature has shown a steady increase. Since 1978 the temperature of Atlantic water has increased by about 0.6°C.

In terms of the ecosystem, probably the most important factor impacting fish stocks is the abundance of zooplankton, particularly copepods. In broad terms the long-term Continuous Plankton Recorder database provides useful data. Long-term trends in the North East Atlantic show a general decline in zooplankton abundance (Edwards *et al.*, 2004). A detailed examination of the demography of *Calanus* in the NE Atlantic is provided by Heath *et al.* (2000).

There is no fully comprehensive understanding of the links between the ecosystem and the fish stocks. However, some specific studies have illustrated particular examples:

- The distribution of mackerel prior to the pre-spawning migration and the timing of that migration appears to be related to water temperature in the northern North Sea in the winter. The temperature evolution in this area is largely modulated by the shelf edge current (Reid *et al.*, 2001a).
- The potential fecundity of mackerel appears to some extent to be modulated by feeding conditions in the Norwegian Sea in the previous autumn (Slotte and Iversen, 2004). Hence availability of zooplankton (*Calanus*) will affect the reproductive success of this species.
- The scale of the migration of western horse mackerel into the Norwegian Sea and the capture rate in the Norwegian fishery have been successfully correlated to Atlantic inflow to the North Sea and phytoplankton colour indices (Reid *et al.*, 2001b). This suggests that different patterns in the scale of inflow can influence the scale of the horse mackerel migration.
- Other changes have occurred in the spatio-temporal pattern of migration in the western mackerel over the last 30 years, which are likely to have ecosystem correlates although these have yet to be clarified. Specifically, in the 1970s the mackerel migrated from the North Sea to the spawning areas in the autumn (September/October). By the 1990s this migration occurred in January/February. This required changes in management, and in a distinct change in the timing and location of the fishery (Reid *et al.*, 2002; WD to WGMHS, 2002).
- Hake belongs to a very extended and diverse community of commercial species. The main species concerned are megrim, anglerfish, *Nephrops*, sole, seabass, ling, blue ling, greater forkbeard, tusk, whiting, blue whiting, *Trachurus spp*, conger, pout, conger, cephalopods (octopus, *Loligidae*, *Ommastrephidae* and cuttlefish), rays, etc. (Lucio *et al.* (WD to WGHMM, 2003)). The relative importance of these species in the hake fishery varies largely in relation to the different gears, sea areas, and countries involved.

The populations and their exploitation

The fisheries and their impact

The blue whiting stock is fished in Subareas II, V, VI, and VII and by a number of countries, mainly by Norway, Russia, Iceland, Denmark, Faroe Islands, United Kingdom, and Ireland. Most of the catches are taken in the directed pelagic trawl fisheries. The main fishery has

traditionally been in the spawning and post-spawning areas (Divisions Vb, VIa,b, and VIIb,c). The catches in this area have more than doubled over the last 7–8 years. In the Norwegian Sea (Subareas I and II, in Divisions Va, and XIVa,b), catches have increased dramatically over the last 8 years from 23 000 tonnes in 1996 to 964 000 tonnes in 2004. Catches are also taken in the directed and mixed fishery in Subarea IV and Division IIIa. These catches have increased by 200–300 % since the mid-1990s. The total catches in the northern areas have thus increased from 0.55 million tonnes in 1995 to 2.33 million tonnes in 2004 t. Catches in the southern areas (Subareas VIII, IX, Divisions VIId,e and g-k) have been stable in the range of 25 000–34 000 t, but increased to 85 000 tonnes in 2004. In Division IXa blue whiting is mainly taken as bycatch in mixed trawl fisheries.

The Norwegian spring-spawning herring is fished in Subareas I and II and by a number of countries, mainly by Norway, Iceland, Russia, Faroe Islands, Denmark, Netherlands, UK, Germany, and Sweden. The 2004 catches were almost 800 thousand t. Most of the catches were landed for human consumption. The spawning stock biomass was estimated at 6.5 million t in 2004.

The North Eastern Atlantic mackerel is fished in Subareas II, IV, V, VI, VII, VIII, and IX by a number of countries, mainly Norway, Russia, Ireland, UK, Ireland, Denmark, Netherlands, Germany, and the Faroe Islands. Most of the catches are taken in directed trawl fisheries in the Norwegian Sea (between 50 000 and 150 000 tonnes), in the northern part of the North Sea (between 200 000 and 400 000 tonnes), and to the west of the British Isles (200 000 to 250 000 tonnes). There are smaller-scale fisheries in Biscay and the Iberian Peninsula, where they are often taken in mixed fisheries with other pelagic species; mainly horse mackerel, sardine, and anchovy – these are dealt with in more detail in the section covering Iberian stocks. The stock is divided into three spawning components; North Sea, Western, and Southern, based on the areas in which the fish spawn. The North Sea component is no longer assessed separately, but is considered as severely depleted and around 220 000 tonnes. Before the late 1960s, the North Sea spawning biomass of mackerel was estimated at above 3 million tonnes. Due to recruitment overfishing, recruitment has failed since 1969, leading to a decline in the stock. The North Sea spawning component has increased since 1999, but it is still far below the level in the 1960s.

There are a variety of protective measures in place for this stock, including closure of the mackerel fishery in Divisions IVb,c and IIIa throughout the whole year and in Division IVa from February to July. This closure has unfortunately resulted in increased discards of mackerel in the non-directed fisheries (especially horse mackerel fisheries) in these areas as vessels at present are permitted to take only 10% of their catch as mackerel bycatch. The distribution area of the North Sea component overlaps with the western component particularly in the second half of the year, and may be implicated in the fishery at that time. The western and southern components are managed together and represent the bulk of the NEA mackerel fishery. The SSB was estimated at 2.6 million tonnes in 2005. The stock generally experiences good recruitment, although 2000 was an unusually weak year and preliminary information on the 2003 year class suggests that it may also be weak.

The western horse mackerel stock is fished in Subareas II, III IV, VI, VII, and VIII by a number of countries, mainly Norway, Ireland, UK, Ireland, Denmark, France, Netherlands, and Germany. Most of the catches are taken in directed trawl or purse seine fisheries in the Norwegian Sea (decreasing from c. 150 000 tonnes in the early 1990s to 20 000 tonnes in recent years), along the western shelf edge and in the English channel (between 120 000 and 400 000 tonnes), and in Biscay (30 000 to 75 000 tonnes). The major characteristic of this stock is the dependence of the stock abundance and the fishery on a single very strong year class (1982). Recruitment otherwise has generally been low, although 2001 may be better. The 1982 year class dominated the stock throughout the 1980s and early 1990s, and it is assumed that no major changes will occur unless another large year class appears. The SSB was not estimated in 2004 due to data inadequacy, but has been decreasing since the late 1980s, as the outstanding 1982 year class was depleted.

The northern hake landings are reported to have been at around 90 000 tonnes in the early 60s. In the recent past, landings have generally decreased from 66 500 t in 1989 to 35 000 t in 1998. Since then they have fluctuated around 40 000 t. In the early 80s, Subareas VII and VIII contributed equally to the total landings (around 30 000 t each). While landings from Subarea VII have slightly declined since then (to around 25 000 t), those from Subarea VIII have experienced a stronger decrease (to 10–15 000 t). All information available suggest that discard rates could be high (up to 95%) in some years and area, and for some fleets. The fishery employs a variety of different gears in different areas, including longlines and gillnets. The SSB was estimated at 138 000 tonnes in 2005, just below $\mathbf{B}_{pa}$.

Ecosystem impact of fisheries

Sea mammals

Bycatch in fisheries has been acknowledged to be a threat to the conservation of cetaceans in the northeast Atlantic region (CEC, 2003a; Ross and Isaacs, 2004). Cetacean bycatch in the northeast Atlantic, as elsewhere, affects mainly small cetaceans – i.e. dolphins, porpoises, and the smaller toothed whales. Species caught in the region are primarily the harbour porpoise, common dolphin, striped dolphin, Atlantic white-sided dolphin, white-beaked dolphin, bottlenose dolphin, and long-finned pilot whale (CEC, 2002a). However, other larger cetaceans, such as the minke whale, can also be affected.

An extensive review of the bycatch of cetaceans in pelagic trawls was carried out for Greenpeace in 2004 (Ross and Isaacs, 2004). This report considered published and anecdotal information. In the context of the fisheries considered here, the report identified a small number of fisheries where cetacean bycatch could be documented. These were:

- Mackerel and horse mackerel trawling SW of Ireland
- Hake trawling along the shelf edge in Biscay
- Gill netting for hake in the Celtic Sea

In all cases, the number of animals caught was low. The report identified that many countries had initiated cetacean bycatch monitoring programmes, and had generally found little or no evidence that serious bycatch had occurred.

Other interactions between cetaceans as well as other sea mammals undoubtedly occur. Many cetaceans predate on the fish covered in this overview, and may be regarded as competing with the fishery, but there is little or no data on this interaction. Anecdotal reports from observers in the mackerel fishery in the North Sea in the autumn suggest that killer whales associate with this fishery. The whales appear to target the fish discarded after the net is pumped out. The number of whales involved in this interaction is unknown, as is whether this is a subset of the population or whether it is more general.

Salmon

Post-smolt is widely distributed in the areas covered by this overview. There is a potential for bycatch of post-smolt in pelagic fisheries near the surface in the summer season. There is evidence that some post-smolt is caught, in particular in mackerel and horse mackerel fisheries, but the impact of these bycatches on the salmon stocks is still not clear.

Technical interactions between fish species

In general, mackerel and horse mackerel are caught in targeted, single-species fisheries. In the NEA mackerel fishery, particularly in the northern North Sea in quarter 4, there is some bycatch of herring. In the western area, there is relatively little interaction, except between mackerel and horse mackerel themselves. There may be interaction with blue whiting in this area as well, as the species spawn in the same area, but there is no evidence of this. The smaller scale fishery in the Iberian Peninsula has interactions between mackerel and horse mackerel, as well as other pelagic species such as sardine, anchovy, and Spanish mackerel, and possibly some demersal species. This is covered in more detail in the Iberian overview. There may be some technical interactions for mackerel in quarter 3 in the Norwegian Sea, where it may be implicated in the blue whiting fishery, but the scale of this is unclear.

The fisheries for Norwegian spring-spawning herring are largely directed fisheries with purse seine or midwater trawl, with minor interactions with other species.

As detailed by Lucio *et al.* (WD to WGHMM, 2003), the hake fishery is carried out as part of a general fishery on an extensive demersal assemblage including megrim, anglerfish, *Nephrops*, sole, seabass, ling, blue ling, greater forkbeard, tusk, whiting, blue whiting, *Trachurus spp*, conger, pout, conger, cephalopods (octopus, *Loligidae*, *Ommastrephidae* and cuttlefish), rays, etc. Interaction between hake and other species are less evident for the longline and gillnet fisheries.

References

CEC. 2002a. *Incidental catches of small cetaceans*. Report of the meeting of the subgroup on fishery and the environment (SGFEN) of the Scientific, Technical and Economic Committee for Fisheries (STECF), Brussels December 2001. SEC (2002) 376. Commission of the European Communities, Brussels.

Edwards, M., Richardson, A., Batten, S., and John, A. W. G. 2004. Ecological Status Report: results from the CPR survey 2002/2003. SAHFOS Technical Report, No. 1: 1-8. ISSN 1744-0750.

ICES. 2004. Report of the Study Group on Regional Scale Ecology of Small Pelagics. ICES CM 2004/G:06.

Heath, M., Astthorsson, O. S., Dunn, J., Ellertsen, B., Gislason, A., Gaard, E., Gurney, W., Hind, A., Irigoien, X., Melle, W., Neihoff, B., Olsen, K., Skreslet, S., and Tande, K. S. 2000. Comparative analysis of Calanus finmarchicus demography at locations around the northeast Atlantic. *ICES Journal of Marine Science*, 57, 6, 1562-1580.

Hughes, S. L., and Lavín, A. 2004. The Annual ICES Ocean Climate Status Summary 2003/2004. *ICES Cooperative Research Report* No. 269

Reid, D. G., Walsh, M., and Turrell, W. R. 2001a. Hydrography and mackerel distribution on the shelf edge west of the Norwegian deeps. Fisheries Research 50: 141–150.

Reid, P. C., Borges, M. D., and Svendsen, E. 2001b. A regime shift in the North Sea circa 1988 linked to changes in the North Sea fishery. Fisheries Research, 50, 163–171

Ross, A., and Isaac, S. 2004. The Net Effect? A review of cetacean bycatch in pelagic trawls and other fisheries in the north-east Atlantic. WDCS report for Greenpeace

Slotte, A., and Iversen, S. 2004. Variations in the fecundity, growth and condition of NEA mackerel during 1985–2003 related to environmental conditions. In: ICES Symposium on “The Influence of Climate Change on North Atlantic Fish Stocks” Bergen, Norway, May 2004.

FSS Advice for Widely Distributed and Migratory Populations

FSS ADVICE

Special Note - For Advice on

- ***Herring Stocks around Ireland see Celtic Sea, Irish Sea and West of Scotland Overviews***
- ***Northern Hake – See Celtic Sea Overview.***

For the blue whiting combined stock (Sub-areas I-IX, XII, and XIV): FSS agrees with ICES and STECF that fishing within the limits of the management plan (F=0.32) implies catches of less than 1.5 million tonnes in 2006. This will also result in a high probability that the spawning stock biomass in 2006 will be above B_{pa}. FSS would point out that the present fishing level is well above levels defined by the management plan and should be reduced.

For Norwegian spring-spawning herring: FSS agree with ICES advice that this fishery should be managed according to the agreed management plan with a fishing mortality of no more than F=0.125, implying maximum catches of 732,000 t in 2006. This is expected to lead to a spawning stock of 7.7 million tonnes in 2007.

For Northeast Atlantic mackerel, FSS agree with ICES and STECF that fishing within the agreed management plan (F = 0.15 – 0.2) would correspond to landings of between 373,000 t and 487,000 t with an expected increase in SSB of 5-10% in 2007 compared to 2005. FSS point out that to be consistent with the precautionary approach, fishing at F_{pa} = 0.17 corresponds to catches of 419,000 t in 2006.

For western horse mackerel, FSS agree with ICES and STECF advice that in the absence of a strong year class (e.g. 1982) sustainable yield is unlikely to be higher than 130 000 t for the traditional stock areas. This corresponds to catches less than 150,000 t in the revised stock area (i.e. 130,000 t for the traditional stock area, plus 20,000 t for the inclusion of Division VIIIc in the stock definition). FSS recommends that catches of horse mackerel in Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIa-c,e-k, and VIIIa-e be limited to less than 150,000 t.

For Northeast Atlantic spurdog: FSS note that the stock is depleted and may be in danger of collapse. Target fisheries should not be permitted to continue, and by-catch in mixed fisheries should be reduced to the lowest possible level. A TAC should cover all areas where spurdog are caught in the northeast Atlantic. This TAC should be set at zero for 2006.

For Northeast Atlantic porbeagle FSS agree with ICES advise that given the apparent depleted state of these stocks, no fishery should be permitted on these stocks.

For Northeast Atlantic Basking Shark: FSS agrees with ICES advice that given the perceived depleted state of this stock, a zero TAC be set for the whole distribution area of basking shark. FSS further advise that by catch in mixed fisheries should be reduced to the lowest possible level.

For albacore tuna: FSS advise that the catches in 2006 should not exceed 31,000 t.

For bluefin tuna: FSS advise that under current levels of recruitment, fishing mortality and fishing selectivity, catches over 26,000 t cannot be sustained in the long term.

Assessment and Advice regarding Fisheries

The fisheries on the widely distributed stocks are, except for hake, largely taken in single-stock fisheries, and the single-stock exploitation boundaries as presented in the Stock Book would therefore apply. They are summarised in the following tables.

The state of stocks and single-stock exploitation boundaries are summarised in the table below.

Species	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2005
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	In relation to precautionary limits	in relation to target reference points	
Mackerel	Uncertain	Harvested unsustainably	Overexploited	The agreed management plan (F between 0.15 and 0.20) would, assuming catches in the range of 433 000 t in 2005, imply landings between 373 000 t and 487 000 t in 2006 with an expected increase in SSB of 5–10% in 2007 compared to 2005.	None	none	373 000 t to 487 000 t
Western Horse Mackerel	Uncertain	Uncertain	Uncertain	No agreed management plan	None	ICES recommends that catches of horse mackerel in Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIa-c,e-k, and VIIIa-e be limited to less than 150 000 t. Note that Division VIIIc is now part of the stock definition.	150 000 t
Blue Whiting	Full reproductive capacity	Harvested unsustainably		Fishing within the limits of the management plan (F=0.32) implies catches of less than 1.5 million t in 2006. This will also result in a high probability that the spawning stock biomass in 2006 will be above $\mathbf{B}_{pa}$. The present fishing level is well above levels defined by the management plan and should be reduced. The management plan point 4 calls for a reduction of the catch of juvenile blue whiting which has not taken place. ICES recommends that measures be taken to protect juveniles.	Exploitation boundaries in relation to precautionary limits are the same as the exploitation boundaries in relation to existing management plans.		1 500 000 t

Species	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2005
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	In relation to precautionary limits	in relation to target reference points	
Norwegian spring-spawning herring	Full reproductive capacity	Harvested sustainably		The management plan implies maximum catches of 732 000 t in 2006 which is expected to lead to a spawning stock of 7.7 million tonnes in 2007.	The current long-term management plan is considered to be precautionary.	The target defined in the management plan is consistent with high-term yield and have a low risk of depletion production potential.	732 000 t
Northeast Atlantic spurdog	Unknown	Unknown	Unknown		Target fisheries should not be permitted to continue, and by-catch in mixed fisheries should be reduced to the lowest possible level. A TAC should cover all areas where spurdog are caught in the northeast Atlantic. This TAC should be set at zero for 2006.		Low bycatch. Zero TAC.
Northeast Atlantic porbeagle	Unknown	Unknown	Unknown				No fishery
Northeast Atlantic basking shark	Unknown	Unknown	Unknown				Zero TAC.

ICES Advice
1.3

ICES advice for fishery management

For the blue whiting combined stock (Subareas I-IX, XII, and XIV): ICES recommends that fishing within the limits of the management plan (F=0.32) implies catches of less than 1.5 million t in 2006. This will also result in a high probability that the spawning stock biomass in 2006 will be above B_{pa}. The present fishing level is well above levels defined by the management plan and should be reduced.

For Norwegian spring-spawning herring: ICES advises that this fishery should be managed according to the agreed management plan with a fishing mortality of no more than F=0.125, implying maximum catches of 732 000 t in 2006. This is expected to lead to a spawning stock of 7.7 million tonnes in 2007.

For NEA mackerel, ICES advises following the agreed management plan (F between 0.15 and 0.20) which would imply landings between 373 000 t and 487 000 t in 2006 with an expected increase in SSB of 5-10% in 2007 compared to 2005 (assuming catches of the order of 433 000 t in 2005).

For western horse mackerel, ICES has advised that in the absence of a strong year class sustainable yield is unlikely to be higher than 130 000 t for the traditional stock areas. This corresponds to catches less than 150 000 t in the revised stock area (i.e. 130 000 t for the traditional stock area, plus 20 000 t for the inclusion of Division VIIIc in the stock definition). Accordingly, ICES recommends that catches of horse mackerel in Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIa-c,e-k, and VIIIa-e be limited to less than 150 000 t.

For northern hake, following the agreed recovery plan, a fishing mortality of F = 0.25 is expected to lead to an SSB of around 153 000 t in 2007, with estimated landings in 2006 of 44 000 t. This implies a change in SSB of +5%.

For spurdog: The stock is depleted and may be in danger of collapse. Target fisheries should not be permitted to continue, and by-catch in mixed fisheries should be reduced to the lowest possible level. A TAC should cover all areas where spurdog are caught in the northeast Atlantic. This TAC should be set at zero for 2006.

For Northeast Atlantic porbeagle and Northeast Atlantic basking shark, ICES advises that given the apparent depleted state of these stocks, no fishery should be permitted on these stocks.

Regulations in force and their effects

In 2002 the EU, Faroe Islands, Iceland, and Norway agreed a long-term management plan for the fisheries of the blue whiting stock aimed at constraining the harvest within safe biological limits and designed to provide for sustainable fisheries and a greater potential yield. The management plan as a whole has not been implemented, because it has not been agreed between all countries participating in the fishery. The combined total of the catches exceeds the provisions of the agreed management plans.

For the Norwegian spring-spawning herring, there was no agreement between the Coastal States (European Union, Faroe Islands, Iceland, Norway, and Russia) regarding the allocation of the quota for 2005. The Norwegians increased their quota by 14%, as did the Icelanders and the Faroese. The sum of the total revised national quotas for 2005 amounts to about 1 million tonnes.

For NEA mackerel, Division IVa is closed to mackerel fishing from the 14th of February until late summer to protect the North Sea component. Management has aimed at a fishing mortality in the range of 0.15–0.2 since 1998. The fishing mortality realised since then has been in the range of 0.25 to 0.35.

For the western horse mackerel, the distributional range of this stock increased when the exceptional 1982 year class entered the fishery. This resulted in the development of unregulated fisheries outside the TAC area in the Northern North Sea. Catches outside the area covered by a TAC have been reduced in recent years. At present, the TAC for the Western areas includes Division Vb (EU waters only), Subareas VI and VII, and Divisions VIIIa,b,d,e. A separate TAC includes EU waters in Division IIa and Subarea IV. ICES allocates horse mackerel to the Western stock which is taken in Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIe–k, and VIIIa-e.

Quality of assessments and uncertainties

For blue whiting, conflicting signals in the catch and survey data influence the models in ways that could not be resolved. The assessment of blue whiting has been very uncertain in recent years with upward revisions of the historic perception of the stock size with every new assessment. This trend has been driven by exceptionally good recruitment compared to the earlier period, while at the same time little fishery-independent information has been available on the recruitment. However, the quality of the assessment and recruitment estimates have been improved in this year, mostly due to a longer recruitment survey time-series, which could be used for the first time this year.

For Norwegian spring-spawning herring there has been a tendency to overestimate the spawning stock historically. The standard deviation of the spawning stock, derived from bootstrap replicates, has increased considerably from last year. The distribution is also more skewed than last year. However, there is an overall high consistency between the current assessment and that of last year.

For NEA mackerel, due to the lack of fishery-independent data and the absence of age-disaggregated information for the spawning stock index, the results of this assessment are uncertain. In recent years, there has been a tendency to overestimate the SSB and to underestimate fishing mortality. There is a broad perception that there are substantial undeclared landings in this fishery. The assessment is strongly dependent on the catch information, both recently and in the past. Managers are encouraged to obtain reliable catch information.

For western horse mackerel, no fishery-independent estimates of SSB or recruitment are currently available. Therefore, it is not possible to determine the absolute level of SSB, recruitment, and fishing mortality. Accordingly, only relative trends in these quantities have been derived.

North Sea Herring

(Sub-area IV, Division VIId-e and Div IIIa (autumn spawners))

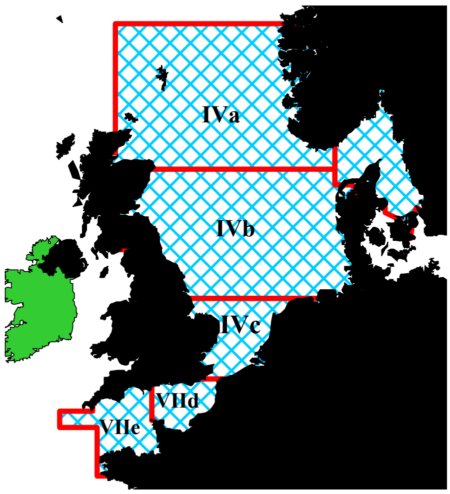
No ACFM information has been included for this stock *For latest information, see: http://www.ices.dk*

Marine Institute
Foras na Mara

Fisheries Science Services

FSS –SINGLE STOCK CONSIDERATIONS

FSS agree with the ICES and STECF advice that the present management plan is consistent with the precautionary approach and high long-term yields. The plan implies TACs and corresponding allocations among fleets as indicated in the catch options table in the ACFM summary sheet. The likely range of advised TACs is 466,000 - 537,000 t.



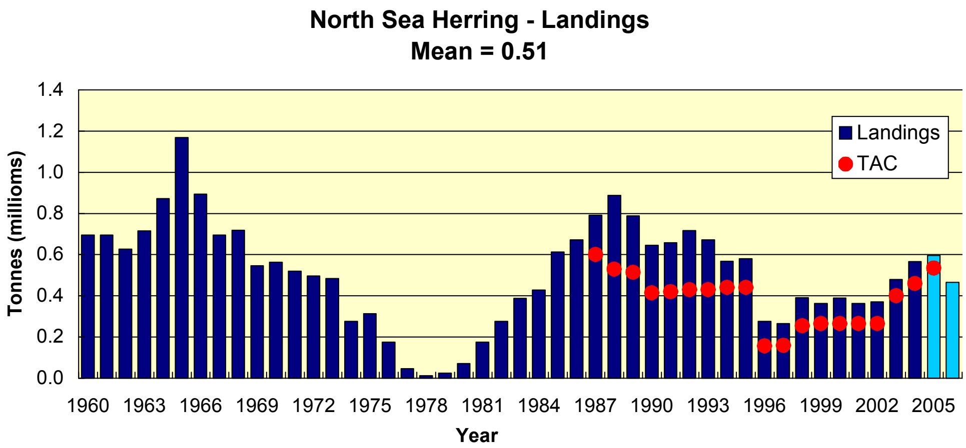
Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

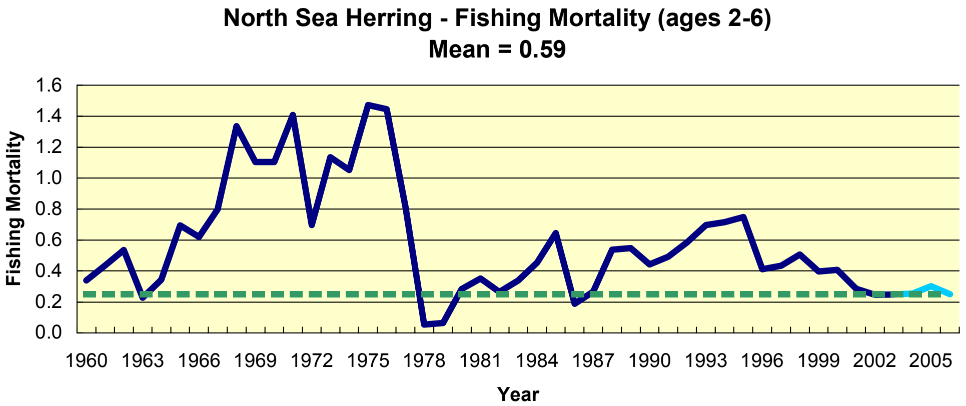
CURRENT MANAGEMENT

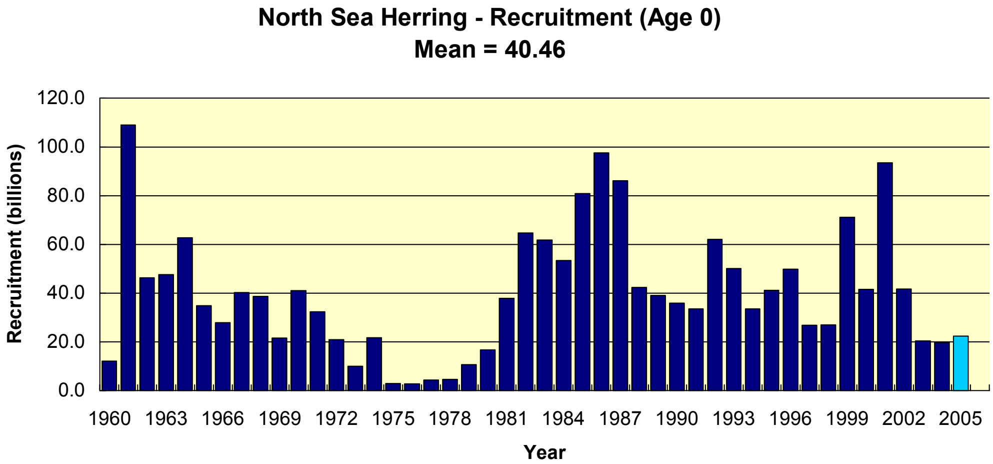
- The TAC is shared between EU and Norway and divided between a number of different fleets operating in the North Sea, the English Channel and Division IIIa. The assessment covers the TAC areas. There is a separate allocation by EU in operation for Divisions IVc and VIId (Southern North Sea and English Channel). The overall split of the TAC is 29% to Norway and 71% to the EU.
- Ireland does not take part in this fishery and has no quota, but the availability of North Sea herring impacts on the prices attained by Irish herring in European markets.
- The agreed TAC for the fishery for 2005 is 535,000 t (including landings from the industrial fisheries and some landings taken under TACs from other ICES areas). The EU share of the TAC is 306,000 t.

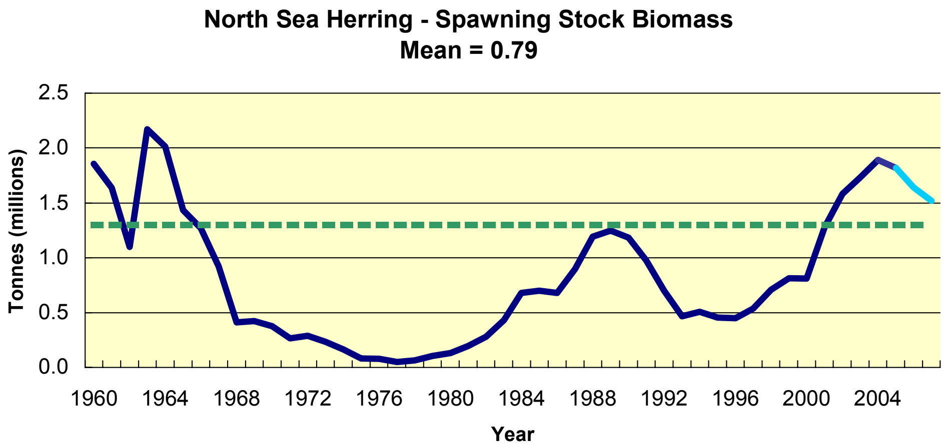
ADDITIONAL INFORMATION

1. ICES accepts the present assessment but considers that it may overestimate SSB and underestimate F.
2. The total catch in 2004 was 567,000 t, compared to 472,000 t in 2003. This is the highest catch since 1995.
3. Both the 1998 year class and the 2000 year class appear to be very strong in all surveys, but the 2002, 2003 and 2004 year classes are estimated to be among the weakest in the series.
4. Misreporting continues to be a problem in the fishery.
5. Catches are taken by Denmark, Norway, Netherlands, and United Kingdom. These include directed fleets that land fish for human consumption and fleets where herring is taken as a by-catch in mixed industrial fisheries.
6. FSS notes that the TAC in IVc and VIId should not increase faster than that for the North Sea as a whole.
7. The management of this fishery is complex and must take into consideration the variations in productivity of different components of the stock.
8. ICES is concerned at the threat posed by marine gravel and sand extraction to herring spawning and nursery areas.


North Sea Herring - Landings
Mean = 0.51
Tonnes (millioms)
Landings
TAC
Year


North Sea Herring - Fishing Mortality (ages 2-6)
Mean = 0.59
Fishing Mortality
Year


North Sea Herring - Recruitment (Age 0)
Mean = 40.46
Recruitment (billions)
Year


North Sea Herring - Spawning Stock Biomass
Mean = 0.79
Tonnes (millions)
Year

Norwegian Spring Spawning Herring

Sub-areas I and II

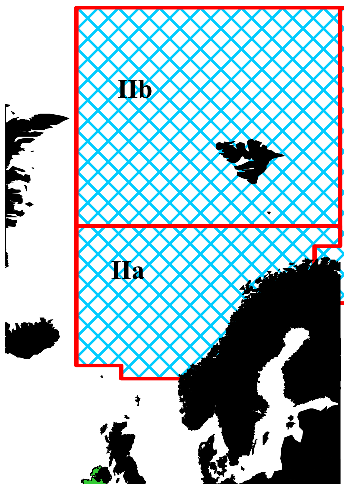
For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

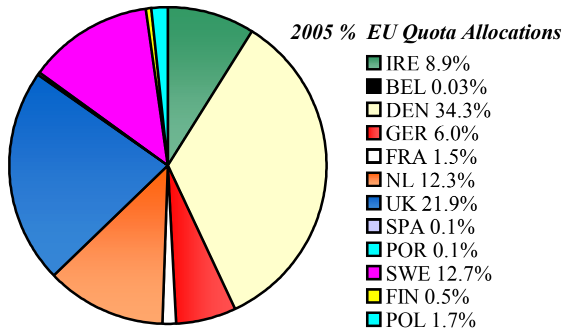
FSS agree with the ICES and STECF advice to follow the agreed management plan with a fishing mortality of no more than F = 0.125. This corresponds to landings of 732,000 t in 2006 which is expected to lead to a spawning stock of 7.7 million tonnes in 2007.



Red Boxes-TAC/Management Areas   Blue Shading– Assessment Area

CURRENT MANAGEMENT

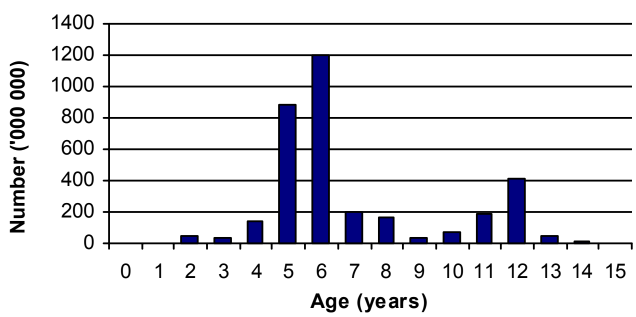
- A long term management plan has been agreed for this fishery since 1999 between the EU, Faeroe Is., Iceland, Norway and Russia. The plan aims at preventing SSB from falling below $\mathbf{B}_{lim}$ of 2.5 million tonnes, and restricting the TACs consistent with a fishing mortality of less than 0.125. Provisions are also made to reduce this F, should the SSB fall below $\mathbf{B}_{pa}$ of 5 million tonnes.
- In 2005, there was no agreement on an overall final TAC and its allocation. The sum of allocated autonomous quotas amounted to 1,000,664 t for 2005. This TAC is over 100,000 t more than the TAC recommended under the agreed management plan.
- In 2005 the EU TAC was 78,541 t, of which Ireland was allocated 6,967 t (8.9%)
- In recent years, EU vessels have not had access to the Norwegian EEZ to target this stock. Currently, no agreement has been reached for 2006 on EU access.



ADDITIONAL INFORMATION

1. The assessment is similar to last year with a small downward revision of SSB. The stock appears to have full reproductive capacity and is being harvested sustain ably.
2. The stock is characterised by large fluctuations in recruitment and depends on the appearance of sporadic strong year classes.
3. The stock has increased in biomass due to the incoming of strong year classes in 1998 and 1999. The 2002 year class also appears to be strong and will recruit to the fishery in 2006.
4. In the absence of good recruitment, over-fishing can cause the stock to collapse, as happened in the 1970s. The stock did not recover until the mid 1990s.
5. The assessment has a history of overestimating the stock size.
6. The total catch in 2004 amounted to 794,000 t and was mainly taken by Norway, Russia, Iceland and the Faeroe Is.
7. Ireland participated in this fishery for the first time in 1996 with landings of nearly 20,000 t. Landings have declined since then and are negligible in 2005 (11 t).

2004 Age Distribution: International Landings, Herring in II & VIa



ICES ADVICE
1.4.5

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
full reproductive capacity	Harvested sustainably	

Based on the most recent estimates of SSB and fishing mortality, ICES classifies the stock as having full reproductive capacity and being harvested sustainably. The 1998 and 1999 year classes dominate the current spawning stock which is estimated around 6.3 million t. in 2005. The 2002 year class is estimated to be strong and will recruit to the fishery in 2006 and 2007. Preliminary indications show that the 2004 year class may also be strong.

Management objectives

The EU, Faroe Islands, Iceland, Norway, and Russia agreed to implement a long-term management plan. This plan consists of the following elements:

1. *Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than the critical level ($\boldsymbol{B_{lim}}$) of 2 500 000 t.*
2. *For the year 2001 and subsequent years, the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of less than 0.125 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of this fishing mortality rate.*
3. *Should the SSB fall below a reference point of 5 000 000 t ($\boldsymbol{B_{pa}}$), the fishing mortality rate referred to under paragraph 2, shall be adapted in the light of scientific estimates of the conditions to ensure a safe and rapid recovery of the SSB to a level in excess of 5 000 000 t. The basis for such an adaptation should be at least a linear reduction in the fishing mortality rate from 0.125 at $\boldsymbol{B_{pa}}$ (5 000 000 t) to 0.05 at $\boldsymbol{B_{lim}}$ (2 500 000 t).*
4. *The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.*

ICES considers that this agreement is consistent with the precautionary approach.

Reference points

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B_{lim}}$ is 2.5 million t	$\mathbf{B_{pa}}$ be set at 5.0 million t
	$\mathbf{F_{lim}}$ is not considered relevant for this stock	$\mathbf{F_{pa}}$ be set at F = 0.15

Target Reference Points

Management has defined a maximum fishing mortality at 0.125

Technical basis:

$\mathbf{B_{lim}}$: MBAL	$\mathbf{B_{pa}}$: $=\mathbf{B_{lim}}$ * exp(0.4*1.645) (ICES Study Group 1998)
$\mathbf{F_{lim}}$: -	$\mathbf{F_{pa}}$: ICES Study Group 1998

Single stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

The management plan implies maximum catches of 732 000 t in 2006 which is expected to lead to spawning stock of 7.7 million tonnes in 2007.

Exploitation boundaries in relation to high long term yield, low risk of depletion of production potential and considering ecosystem effects

The target defined in the management plan is consistent with high long-term yield and has a low risk of depleting the production potential.

Exploitation boundaries in relation to precautionary limits

The current long-term management plan is considered to be consistent with the precautionary approach.

Short term implications

The catches calculated for 2006 are sensitive to the choice of projected exploitation rate of the strong 2002 year class (4 year old fish in 2006). The 2002 year class is special in that a part of it grew up in the Norwegian Sea, in contrast to all other recent strong year classes that grew up in the Barents Sea. The herring growth rate is significantly higher in the Norwegian Sea than in the Barents Sea. It is expected that this year class will mix with the older herring in the Norwegian Sea and therefore recruit early to the fishery. So for the purposes of estimating catches in 2006 exploitation rate of this yearclass is assumed to be equal to that of the 2001 year class (5 year old fish in 2006).

Outlook for 2006
Basis: Landings (2005) = 1.000[1]; $F_w(2005)^{2)} = F_{sq}$=0.185; SSB(2005)=6.133;

The fishing mortality applied according to the agreed management plan (F(management plan)) is 0.125

Rationale	Landings (2006)	Basis	F(2006)	SSB(2006)	SSB(2007)
Zero catch	0	F=0	0	6489	8490
Status quo	1054	F(2005)	0.185	6384	7366
Agreed management plan	75	F(management plan)*0.1	0.013	6482	8411
	178	F(management plan)*0.25	0.031	6471	8301
	363	F(management plan)*0.50	0.063	6453	8105
	541	F(management plan)*0.75	0.094	6436	7916
	650	F(management plan)*0.90	0.113	6425	7800
	732	F(management plan)	0.125	6418	7712
	803	F(management plan)*1.1	0.138	6411	7637
	900	F(management plan)*1.25	0.156	6400	7535

Shaded scenarios considered not consistent with the precautionary approach.
1) There was no agreement on the allocations of the TAC in 2005. The sum of autonomous allocations from the individual Parties amounts to 1,000,664 t.
2) F_w = Fishing mortality weighted by population numbers

Management considerations

This stock has shown a large dependency on the occasional appearance of very strong year classes. In recent years the stock has tended to produce strong year classes more regularly. However, if strong year classes should become more intermittent, the stock is expected to decline.

There has been no international agreement on quota allocations in the two last years. This has led to an escalation in the F exerted on the stock (F2005>Fpa), with the fisheries in 2005 probably ending close to 1 million tonnes, over 100 000 tonnes more than the TAC recommended under the long-term management plan (F=0.125).

Ecosystem considerations

Juveniles and adults of this stock form an important part of the ecosystems in the Barents Sea, the Norwegian Sea and the Norwegian coast. The herring has an important role as transformer of the plankton production to higher trophic levels (cod, seabirds, and marine mammals). Recent changes in the herring migration have led to increased proportion feeding in Faeroese and Icelandic waters in the southwestern Norwegian Sea. The growth of these herring is faster than those feeding further east and north. A relationship between climate and herring growth is used to predict weights for the short term forecast.

Factors affecting the fisheries and the stock

The Effects of Regulations

In the rebuilding phase of the stock in the 1980s and beginning of 1990s (SSB < MBAL = 2.5 million t), the objective was to keep the fishing mortality below 0.05. With the exception of few years, this objective was followed. A minimum landing size regulation of 25 cm has been in place since 1977. This has avoided the exploitation of young herring. These regulations have contributed to a rebuilding of the stock to levels well above precautionary limits. When the fishery expanded in the mid 1990s, a long term management plan was agreed; this plan is cited above.

For 2005 the coastal states (European Union, Faroe Islands, Iceland, Norway, and Russia) did not reach any agreement regarding the allocation of the quota. As per March 1st 2005 Norway increased it's the quota by 14%. The increase was followed by Iceland and the Faroes. The sum of national quotas thus reached 1 million tonnes, which according to the current assessment leads to a fishing mortality exceeding F_{pa} (0.15).

Changes in fishing technology and fishing patterns

The main catches in 2004 were taken by Norway (477 000 t), Russia (116 000 t), Iceland (101 000 t), and Faroe Islands (43 000 t). Lesser catches were taken by EU fleets (55 000 t). The fishery in general follows the migration of the stock closely as it moves from the wintering and spawning grounds along the Norwegian coast to the summer feeding grounds in the Faroese, Icelandic, Jan Mayen, Svalbard, and international areas. The Norwegian fishery exploits the stock as it migrates to and remains in the wintering areas and during the spawning period. The Icelandic fishery takes place mainly in May, June and July, and the catches were taken mainly in the international waters and the Svalbard fishery protection zone. The main Russian catches are taken along the shelf region of the Norwegian EEZ in spring as the stock moves from the spawning grounds, and also in August and September in the eastern part of the international area and along the continental slope in the NE part of the Norwegian zone. The Faroese catches, taken in summer, are mainly from the international waters and the Svalbard fishery protection zone. Most of the EU catches are taken in the international area and the Svalbard fishery protection zone. A change in the migration pattern in 2004 with concentrations of herring in the Icelandic and Faroese zones in May was observed to be more pronounced in 2005 and the fishery for larger herring in this area increased during the 2005 season compared to 2004.

A large increase in fishing effort, new technology, and environmental changes contributed to the collapse of this stock around 1970. Recruitment failed in the second half of 1960s when the SSB was reduced below 2.5 million t. Starting in 1989 a succession of above-average to very strong year classes were produced, promoting full recovery of the SSB and allowing an expansion of the fishery.. Since 1992 the coastal fishery has increased sharply. Until 1994, the fishery was almost entirely confined to Norwegian coastal waters. During the summer of 1994 there were also catches in the offshore areas of the Norwegian Sea for the first time in 26 years. The geographical extent of this fishery increased in 1995, with nine nations participating and the total catch exceeding 900 000 t. The fishery expanded further in 1996 and the annual level of the fishery was in the order of 1.2-1.5 million t in the period 1996-2000. After 2000 the fishery has dropped to a level between 700-1.000 thousand tonnes.

The environment

The Norwegian spring spawning herring carries out extensive migrations in the NE Atlantic. Feeding has mainly taken place along the polar front from the island of Jan Mayen and NE-wards towards Bear Island. Over the last 25 years the southern and western Norwegian Sea has become colder and fresher while the eastern Norwegian Sea is warmed. During the last years the waters north and northeast of Iceland have warmed, although cold Arctic water again flowed south and eastwards during the winter 2004/2005. Average zooplankton biomass in the Norwegian Sea has decreased since 2002 and is now at a comparatively low level in the central Norwegian Sea. This is probably related to a low winter NAO index over the last years.

Scientific basis

Data and methods

The advice is based on an analytical assessment, which takes into consideration catch data, acoustic surveys of adults and juveniles, larval survey, and tagging data. This year the 2004 and 2005 summer survey estimates could be included in the assessment due to change of timing of the WG meeting.

Different model formulations have been applied to assess this stock. The estimates of SSB and F are uncertain and sensitive to the choice of the model and the tuning data. After an overall evaluation, also taking into account that this assessment is an update from last years the SeaStar assessment was chosen as the final.

Uncertainties in assessment and forecast:

There is a strong retrospective pattern in the assessment, which leads to an overestimation of the spawning stock biomass. There are also difficulties to predict maturity at age and selection pattern of the big 2002 year class, which has considerably different spatial distribution compared to all year classes in recent decades. This uncertainty will however not affect the perception of the SSB in relation to precautionary limits.

An alternative model suggests ca. 15% higher SSB in 2004 which leads to significantly higher catch opportunities for 2006. This is considered to be in the range of uncertainty of the assessment.

There is an apparent shift in wintering areas and partly summer feeding areas for this stock. These dynamics could affect the survey results, which in return would affect the assessment.

Comparison with previous assessment and advice:

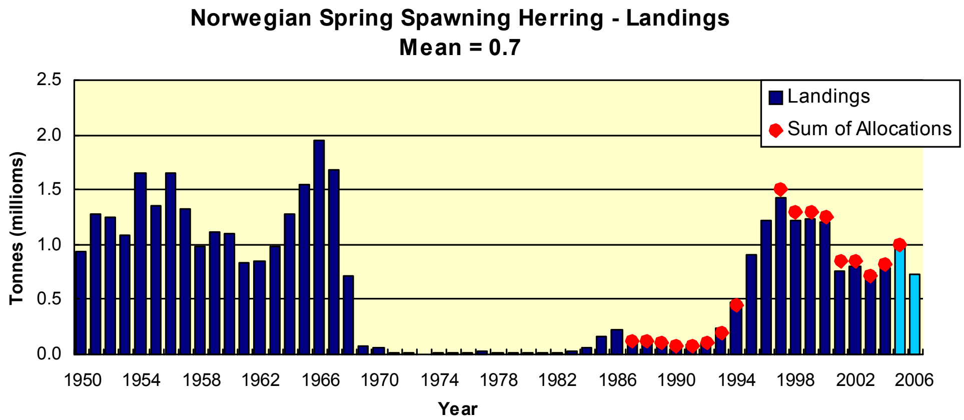
The assessment of the Norwegian spring spawning herring was done using the same model as last year. This year's assessment gives a small downward revision of SSB (10-15% in four recent years) relative to last year's assessment.

Source of information:

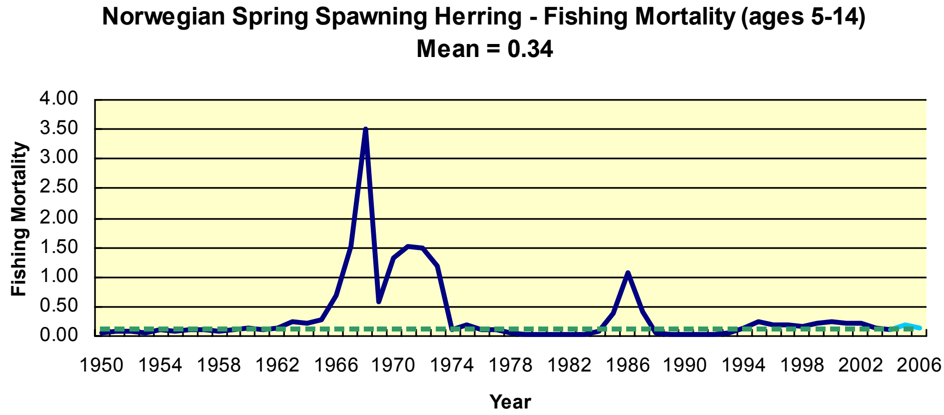
Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, 25 August – 1 September 2005 (ICES CM 2006/ACFM:05).

	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	TAC	150	115	127
1988	TAC	120–150	120	135
1989	TAC	100	100	104
1990	TAC	80	80	86
1991	No fishing from a biological point of view	0	76	85
1992	No fishing from a biological point of view	0	98	104
1993	No increase in F	119	200	232
1994	Gradual increase in F towards $\mathbf{F}_{0.1}$; TAC suggested	334	450	479
1995	No increase in F	513	None[1]	906
1996	Keep SSB above 2.5 million t	-	None[2]	1 217
1997	Keep SSB above 2.5 million t	-	1 500	1 420
1998	Do not exceed the harvest control rule	-	1 300	1 223
1999	Do not exceed the harvest control rule	1 263	1 300	1 235
2000	Do not exceed the harvest control rule	Max 1 500	1 250	1 207
2001	Do not exceed the harvest control rule	753	850	770
2002	Do not exceed the harvest control rule	853	850	809
2003	Do not exceed the harvest control rule	710	711[3)]	773
2004	Do not exceed the harvest control rule	825	825[3)]	794
2005	Do not exceed the harvest control rule	890	1.000[3)]	
2006	Do not exceed the harvest control rule	732		

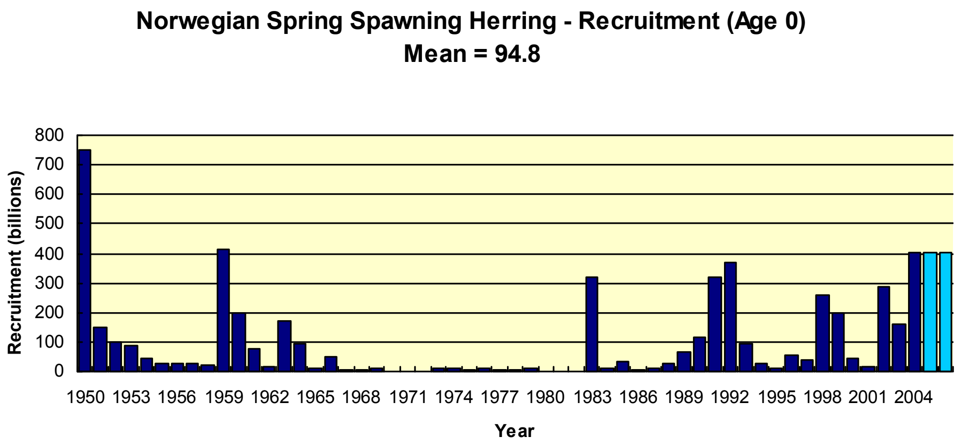
[1]Autonomous TACs totaling 900 000 t; [2]Autonomous TACs totaling 1 425 000 t were set by April 1996.
[3] There was no agreement on the TAC, the number is the sum of autonomous quotas from the individual Parties.
Weights in '000 t.



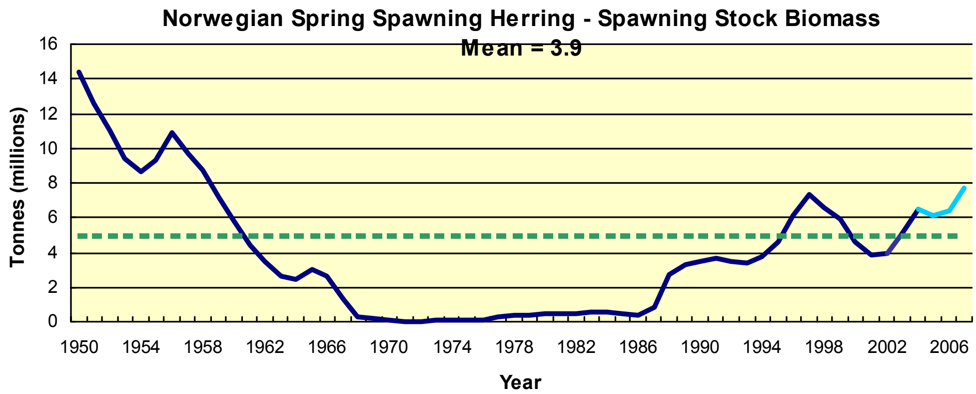
Norwegian Spring Spawning Herring - Landings
Mean = 0.7
Tonnes (milliions)
Landings
Sum of Allocations
Year



Norwegian Spring Spawning Herring - Fishing Mortality (ages 5-14)
Mean = 0.34
Fishing Mortality
Year



Norwegian Spring Spawning Herring - Recruitment (Age 0)
Mean = 94.8
Recruitment (billions)
Year



Norwegian Spring Spawning Herring - Spawning Stock Biomass
Mean = 3.9
Tonnes (millions)
Year

Table 1.4.5.1 Total catch of Norwegian spring-spawning herring (tonnes) since 1972. Data provided by Working Group members.

Year	Norway	USSR/ Russia	Denmark	Faroes	Iceland	Ireland	Nether- lands	Greenland	UK	Germany	France	Poland	Sweden	Total
1972	13,161	-	-	-	-	-	-	-	-	-	-	-	-	13,161
1973	7,017	-	-	-	-	-	-	-	-	-	-	-	-	7,017
1974	7,619	-	-	-	-	-	-	-	-	-	-	-	-	7,619
1975	13,713	-	-	-	-	-	-	-	-	-	-	-	-	13,713
1976	10,436	-	-	-	-	-	-	-	-	-	-	-	-	10,436
1977	22,706	-	-	-	-	-	-	-	-	-	-	-	-	22,706
1978	19,824	-	-	-	-	-	-	-	-	-	-	-	-	19,824
1979	12,864	-	-	-	-	-	-	-	-	-	-	-	-	12,864
1980	18,577	-	-	-	-	-	-	-	-	-	-	-	-	18,577
1981	13,736	-	-	-	-	-	-	-	-	-	-	-	-	13,736
1982	16,655	-	-	-	-	-	-	-	-	-	-	-	-	16,655
1983	23,054	-	-	-	-	-	-	-	-	-	-	-	-	23,054
1984	53,532	-	-	-	-	-	-	-	-	-	-	-	-	53,532
1985	167,272	2,600	-	-	-	-	-	-	-	-	-	-	-	169,872
1986	199,256	26,000	-	-	-	-	-	-	-	-	-	-	-	225,256
1987	108,417	18,889	-	-	-	-	-	-	-	-	-	-	-	127,306
1988	115,076	20,225	-	-	-	-	-	-	-	-	-	-	-	135,301
1989	88,707	15,123	-	-	-	-	-	-	-	-	-	-	-	103,830
1990	74,604	11,807	-	-	-	-	-	-	-	-	-	-	-	86,411
1991	73,683	11,000	-	-	-	-	-	-	-	-	-	-	-	84,683
1992	91,111	13,337	-	-	-	-	-	-	-	-	-	-	-	104,448
1993	199,771	32,645	-	-	-	-	-	-	-	-	-	-	-	232,457
1994	380,771	74,400	-	2,911	21,146	-	-	-	-	-	-	-	-	479,228
1995	529,838	101,987	30,577	57,084	174,109	-	7,969	2,500	881	556	-	-	-	905,501
1996	699,161	119,290	60,681	52,788	164,957	19,541	19,664	-	46,131	11,978	-	-	22,424	1,220,283
1997	860,963	168,900	44,292	59,987	220,154	11,179	8,694	-	25,149	6,190	1,500	-	19,499	1,426,507
1998	743,925	124,049	35,519	68,136	197,789	2,437	12,827	-	15,97119,20	7,003	605	-	14,863	1,223,131
1999	740,640	157,328	37,010	55,527	203,381	2,412	5,871	-	7	-	-	-	14,057	1,235,433
2000	713,500	163,261	34,968	68,625	186,035	8,939	-	-	14,096	3,298	-	-	14,749	1,207,201
2001	495,036	109,054	24,038	34,170	77,693	6,070	6,439	-	12,230	1,588	-	-	9,818	766,136
2002	487,233	113,763	18,998	32,302	127,197	1,699	9,392	-	3,482	3,017	-	1,226	9,486	807,795
2003	438,140	122,846	14,144	27,943	117,910	1,400	8,678	-	9,214	3,371	-	-	6,431	750,077
2004[1]	477,076	115,876	23,111	42,771	102,787	11	17,369	-	1,869	4,810		-	7,986	793,666

[1] Preliminary, as provided by Working Group members.

Table 1.4.5.2 Norwegian spring-spawning herring

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	F weighted Ages 5-14
1950	750680000	14359000	933000	0.058
1951	146355000	12635000	1278000	0.070
1952	96644000	11042000	1254000	0.073
1953	86102000	9457000	1091000	0.066
1954	42086000	8703000	1645000	0.113
1955	24971000	9324000	1360000	0.078
1956	29858000	10934000	1659000	0.110
1957	25397000	9661000	1320000	0.103
1958	23094000	8731000	987000	0.079
1959	412478000	7200000	1111000	0.113
1960	197514000	5853000	1102000	0.136
1961	76103000	4403000	830000	0.104
1962	19003000	3443000	849000	0.146
1963	168931000	2641000	985000	0.253
1964	93903000	2479000	1282000	0.226
1965	8491000	2996000	1548000	0.278
1966	51409000	2658000	1955000	0.696
1967	3947000	1304000	1677000	1.519
1968	5187000	318000	712000	3.493
1969	9785000	142000	68000	0.590
1970	661000	69000	62000	1.320
1971	236000	32000	21000	1.525
1972	957000	16000	13000	1.497
1973	12884000	86000	7000	1.173
1974	8631000	91000	8000	0.114
1975	2971000	79000	14000	0.190
1976	10068000	139000	10000	0.106
1977	5095000	288000	23000	0.111
1978	6201000	360000	20000	0.043
1979	12498000	391000	13000	0.024
1980	1474000	475000	19000	0.034
1981	1100000	509000	14000	0.022
1982	2343000	507000	17000	0.020
1983	322362000	579000	23000	0.029
1984	11528000	603000	54000	0.090
1985	35051000	502000	170000	0.379
1986	6041000	401000	225000	1.074
1987	8945000	877000	127000	0.404
1988	25009000	2738000	135000	0.045
1989	67357000	3335000	104000	0.029
1990	114598000	3490000	86000	0.022
1991	318995000	3628000	85000	0.025
1992	371421000	3496000	104000	0.029
1993	92042000	3352000	232000	0.068
1994	29993000	3775000	479000	0.139
1995	9773000	4592000	906000	0.240
1996	57485000	6113000	1220000	0.197
1997	37573000	7308000	1427000	0.187
1998	258857000	6564000	1223000	0.168
1999	196635000	5930000	1235000	0.212
2000	45323000	4635000	1207000	0.262
2001	16362000	3878000	766000	0.213
2002	288899000	3918000	808000	0.232
2003	160617000	5107000	750000	0.132
2004	401287000	6513000	794000	0.119
Average	94785636	3866527	655400	0.341

North East Atlantic Mackerel

(combined Southern, Western and North Sea spawning components)

For latest information, see: http://www.ices.dk

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

FSS agree with the ICES and STECF advice that fishing within the agreed management plan (F = 0.15-0.2) would correspond to landings in 2006 of between 373,000 t and 487,000 t, with an expected increase in SSB of 5-10% in 2007, compared to 2005. FSS points out that to be consistent with the precautionary approach, fishing at F_{pa} = 0.17 corresponds to catches of 419,000 t in 2006. FSS further notes that current F is about 0.3 which is above F_{lim}=0.26. FSS considers that it is a higher risk strategy to apply an F above F_{pa}; given that the stock had decreased to an historic low level in 2002 and that recruitment has become variable.

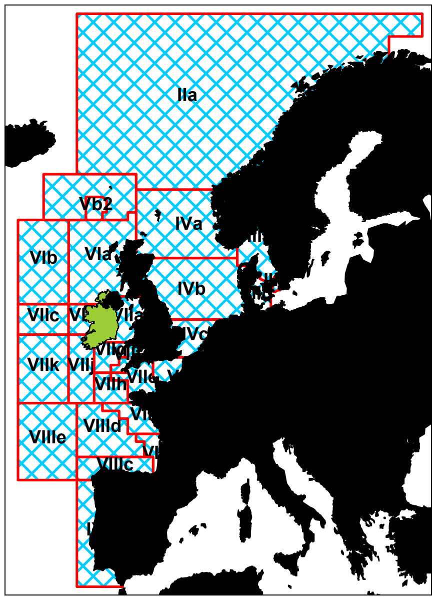
FSS agree with the additional ICES and STECF advice that;

- **The North Sea spawning component still needs the maximum possible protection;**
- **There should be no fishing for mackerel in Divisions IIIa and IVb,c at any time of the year;**
- **There should be no fishing for mackerel in Division IVa during the period 15 February-31 July;**
- **The 30 cm minimum landing size at present in force in Sub-area IV should be maintained;**
- **There should be observers placed in all fisheries where discarding of mackerel is perceived to be a problem.**

FSS also point out that discarding of small mackerel should be closely monitored, given the indications of above average recruiting year classes.

CURRENT MANAGEMENT

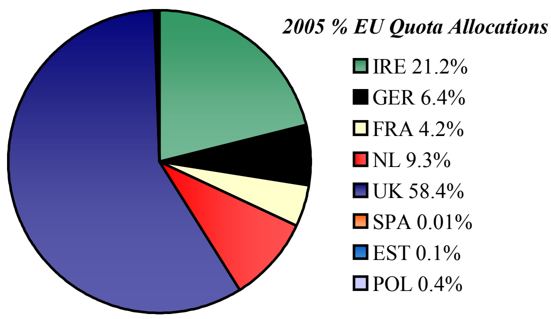
- The TAC was agreed by the Coastal States (EU, Norway and Faeroe Islands). It is divided into a number of components: North Sea TAC (EU and Norway), Western TAC (EU, Norway and Faeroes), Southern TAC (EU only) and NEAFC TAC (Coastal States, Russia and Iceland). In addition, Norway grants 1,865 t of quota to Sweden.
- There is a defined management strategy for the stock between EU, Norway and Faroe Is. This agreement is quoted overleaf in the ACFM advice summary.
- The total TAC set for 2005 was 420,000 t. The EU TAC was 267,870 t including the southern areas and the Irish share of the EU quota was 46,149 t (21 %).
- The Irish quota is allocated to the pelagic and polyvalent fleet segments in different ways. The polyvalent segment allocation is 7,000 t, and does not vary according to the size of the Irish quota. The remainder is allocated to the pelagic segment according to an allocation key.
- The Cornwall box remains closed to directed trawling for mackerel.



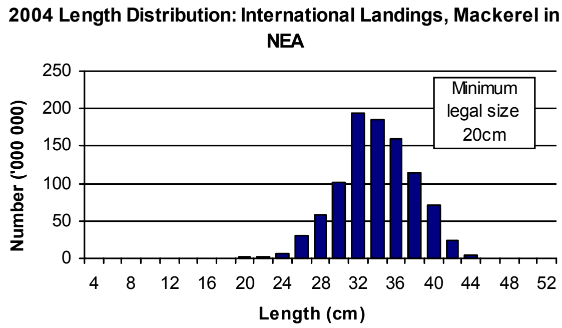
Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

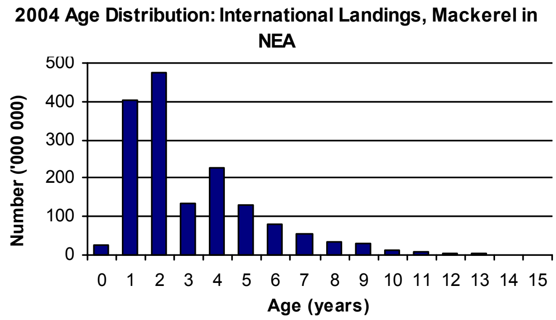
ADDITIONAL INFORMATION

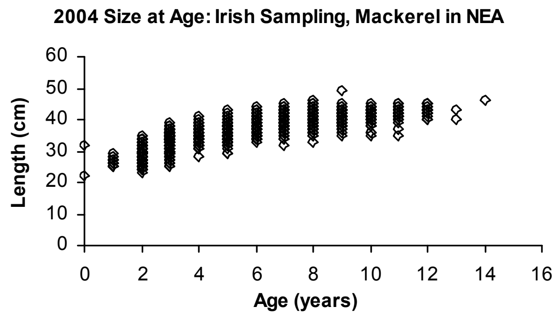
1. This stock is being harvested unsustainably. Fishing mortality is above $\mathbf{F_{lim}}$. SSB, is uncertain but declined from 1999 to 2002.
2. Over the past 4 years recruitment has fluctuated more widely than in the historic period. The 2003 year class is the lowest observed.



3. The perception of the stock changed markedly in 2004, due to a change in the treatment of the egg survey SSB estimate. For more information see the 2004 Stock Book.
4. The fishery is dominated by Norway, United Kingdom (Scotland), Ireland and Russia. The main Irish catches are taken by refrigerated sea water (RSW) vessels.
5. Underreported catches are thought to be a feature of the fishery for this stock. Due to incomplete information on misreporting and discarding, the true level of SSB cannot be estimated, however F and trends in SSB and F can be estimated without bias.
6. The total catch in 2004 was 611,461 t while the Irish catch was about 61,100 t.
7. Discard and slipping estimates are only available from three countries (11,000 t in 2004) and are considered large underestimates. High-grading might be considered common practice as the Japanese market favours larger fish. In the last few years the market for smaller fish has improved.
8. Irish and Scottish fleets are though to have similar patterns of discarding.
9. Most discards comprised two and three year old fish which belong to the two strong year classes of 2001 and 2002, this raises the concern that current discarding practices may lower the productivity of the stock.







SPECIAL REQUESTS

In 2005, ICES answered special requests on the change in perception of this stock. These requests came from NEAFC, Norway and Ireland. The Irish request to ICES was drawing attention to a letter from EAPO (European Association of Producers Organisations).

FSS presents the reply to these requests in the current Stock Book and provides additional comments on specific points of particular relevance.

FSS comments on the ICES replies to special requests

- FSS presented a detailed overview of the process by which the perception of the stock changed, in the 2004 Stock Book. The change in the perception of the stock is due to a change in the treatment of the data. This change accepts that both the reported catches and the SSB estimate from the egg surveys are biased underestimates, and aims to provide unbiased estimates of fishing mortality.
- TAC advice based on the current perception of the stock assumes that underreporting of catches will continue at the same level in 2006.
- Without accurate catch data the actual SSB and therefore the state of the stock in relation to $\mathbf{B_{pa}}$ cannot be determined.
- It is not clear if the reference points will have to be redefined. Should this be the case it is best done when the new egg survey estimate becomes available in 2007.
- FSS agrees with STECF that annual fluctuations in TAC of more than 10-15% are to be avoided. FSS suggests that ICES be asked to evaluate means to minimise large fluctuations in TAC into the advice for NEA mackerel in 2006. FSS notes that F limitations should take precedence over TAC fluctuations.
- Increasing the frequency of egg surveys should be evaluated in the context of resources across the entire stock assessment process. With current resources, an increase in egg surveys could not be accomplished without dropping other programmes.
- Using the Daily Egg Production Method as an alternative to the current method would still require that the entire distribution of the stock at peak spawning be covered. A single survey would be insufficient basis for this method. Also, it would be difficult to estimate the number of females spawning per day.
- Use of acoustic surveys is still in development, and it is currently impossible to incorporate these into the

assessment. At present it would be preferable to devote more resources to egg surveys.

- FSS agrees with ICES that improving the assessment model is less a priority than improving the input data. Thus, better landings, discards and survey data are the main problems for the assessment.
- In addition to the points raised by ICES on improving the reliability of catch data, FSS points out that: The egg survey is likely to underestimate the size of the stock by about 40%. If this bias were corrected, then the total catches would have to be increased by 116% to match the stock size estimated by the egg surveys. Therefore, improved landing and discard data are required.

ICES ADVICE
1.4.2

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Uncertain	Harvested unsustainably	Overexploited

Based on the most recent estimates of fishing mortality, ICES classifies the stock of being harvested unsustainably. Fishing mortality is estimated to be above $\mathbf{F}_{lim}$ in recent years. Because of the unknown bias in the catch information, SSB in recent years relative to $\mathbf{B}_{pa}$ cannot be accurately estimated. The 2000 year class is very poor, while both the 2001 and 2002 year classes appear to be above average. The 2002 year class is now estimated the highest in the time series. Preliminary information on the 2003 yearclass suggests that it is low.

Management objectives

The agreed record of negotiations between Norway, Faroe Islands, and EU in 1999, states:

"For 2000 and subsequent years, the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality in the range of 0.15 - 0.20 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of the fishing mortality rate."

"Should the SSB fall below a reference point of 2 300 000 tonnes ($\mathbf{B}_{pa}$), the fishing mortality rate, referred to under paragraph 1, shall be adapted in the light of scientific estimates of the conditions prevailing. Such adaptation shall ensure a safe and rapid recovery of the SSB to a level in excess of 2 300 000 tonnes."

"The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES."

ICES considers the agreement to be consistent with the precautionary approach, if F on average is kept below 0.17. The rationale for ICES proposing $\mathbf{F}_{pa}$ = 0.17 is to have a high probability of avoiding exploiting the stock above $\mathbf{F}_{lim}$. In addition, projections indicate that F =0.17 will optimize long-term yield and at the same time result in a low risk for the stock to decrease below $\mathbf{B}_{pa}$. However, the management plan does not specify measures that would apply in poor stock conditions which precludes further evaluation. Furthermore, the management plan assumes that catch information is unbiased so that absolute estimates of SSB can be produced. This condition has not been met for a number of years.

Reference points

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
There is no biological basis for defining $\mathbf{B}_{lim}$.	$\mathbf{B}_{pa}$ be set at 2.3 million t.
$\mathbf{F}_{lim}$ is 0.26, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ be set at 0.17. This F is considered to provide approximately 95% probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty in the assessments.
Target reference points	$\mathbf{F}_y$ is not defined

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 4-8	Yield/R	SSB/R
Average last 3 years	0.324	0.168	0.626
Fmax	0.681	0.176	0.370
F0.1	0.188	0.150	0.875
Fmed	0.266	0.163	0.712

Technical basis:

	$\mathbf{B}_{pa} = \mathbf{B}_{loss}$ in Western stock raised by 15%: = 2.3 million t.
$\mathbf{F}_{lim} = \mathbf{F}_{loss} = 0.26$.	$\mathbf{F}_{pa} = \mathbf{F}_{lim} * 0.65$.

The present $\mathbf{F}_{pa}$ is slightly below $\mathbf{F}_{0.1}$.

Single-stock exploitation boundaries

ICES advises that any agreed TAC should cover all areas where Northeast Atlantic mackerel are fished. ICES advises that the existing measures to protect the North Sea spawning component remain in place. These are:

- There should be no fishing for mackerel in Divisions IIIa and IVb,c at any time of the year.
- There should be no fishing for mackerel in Division IVa during the period 15 February–31 July.
- The 30 cm minimum landing size at present in force in Subarea IV should be maintained.

Exploitation boundaries in relation to existing management plans

The agreed management plan (F between 0.15 and 0.20) would, assuming catches in the range of 433 000 t in 2005, imply landings between 373 000 t and 487 000 t in 2006 with an expected increase in SSB of 5-10% in 2007 compared to 2005.

Short/medium-term implications

Outlook for 2006:

Basis: Catch(2005) = 433 (TAC plus 11 assumed discards); F(2005) =0.19; SSB(2005) = 2341.

The fishing mortality applied according to the agreed management plan [F(management plan)] is 0.15-0.20.

In 2003, ICES responded to a request from Norway to comment on the biological rationale for setting TACs by areas and to identify the implications for the TAC advice for the remaining part of the distribution area, considering a range of TAC options for the Southern area. As a consequence, in 2004 catch options were not provided by fleet. The information provided then is regarded to be still relevant. Therefore, the catch predictions also this year are not provided for the so-called "Northern" and "Southern" areas.

Rationale	Landings(2006)	F(2006 & 2007)	Basis	SSB(2006) Mid-year	SSB(2007) Mid-year
Zero catch	0	0.00	F=0	2558	3016
Status quo	689	0.29	2004	2322	2229
	129	0.05	F(management plan) *0,25	2516	2862
	254	0.10	F(management plan) *0,5	2475	2716
	373	0.15	F(management plan lower bound)	2434	2579
	419	0.17	$\mathbf{F}_{pa}$	2418	2527
	487	0.20	F(management plan upper bound)	2395	2451
	531	0.22	F(management plan) *1,1	2379	2401
	596	0.25	F(management plan) *1,25	2356	2330
	779	0.34	F(prec limits) *2	2289	2134

Weights in '000 t. Landings for 2006 exclude discards.
Shaded scenarios are not considered consistent with the management plan.

Management considerations

The exploitation boundaries in relation to the management plan given above is based on ICES interpretation that fishing mortality (F) should always be within an upper bound of 0.20. However, the management plan does not explicitly prioritise the F-based over the biomass-based decision rule, or vice versa. ICES' evaluation of the decision rule as being in accordance with the PA is based on the assumption that F should have an upper bound of 0.20.

Since 1992, there has been a downward trend in SSB, reflecting that the exploitation has not been sustainable in the sense that removals from the stock have repeatedly exceeded the annual production by the stock.

Catches have exceeded the annual TACs in most years, sometimes by a considerable amount. The degree to which estimated catches reflect the total quantity caught is unclear, but there are indications that they may be substantial underestimates. This implies that estimates of SSB, the forecast landings and probably even $\mathbf{B}_{pa}$ could be potentially biased. The advice on landings from a given SSB relative to the Bpa is only meaningful in relative terms. The estimates of SSB as well as the predicted landings are now scaled to the catches as they are reported.

The doubts about the absolute stock abundance and the large year-to-year variations in the assessments invite a reflection on long term management strategies that are less dependent on the annual analytic assessments. Mackerel was previously considered to be a candidate for a multi-year TAC management plan because the stock appeared relatively stable. In addition, survey data are available only for a three-year cycle. Multiannual management strategies can reduce some of the problems for management and industry caused by the instability in mackerel assessments. The data and preliminary tools to evaluate such management regimes by simulations are available. Underreporting of catches, both at present and in the past causes problems that need further exploration. Further development along these lines should be done in dialogue with managers and industry. ICES is prepared to enter such a dialogue.

The measures advised by ACFM to protect the North Sea spawning component aim at setting the conditions for making a recovery of this component possible. Before the late 1960s, the North Sea spawning biomass of mackerel was estimated at above 3 million

tonnes. Due to recruitment overfishing recruitment has failed since 1969, leading to a decline in the stock. The North Sea spawning component has increased since 1999, but it is still far below the level in the 1960s.

The closure of the mackerel fishery in Divisions IVb,c and IIIa throughout the whole year is designed to protect the North Sea component in this area and also the juvenile Western mackerel which are numerous, particularly in Division IVb,c during the second half of the year. This closure has unfortunately resulted in increased discards of mackerel in the non-directed fisheries (especially horse mackerel fisheries) in these areas as vessels at present are permitted to take only 10% of their catch as mackerel bycatch. No data on the actual amount of mackerel by-caught are available, but the reported landings of mackerel in Divisions IIIa and IVb,c from 1997 onwards might seriously underestimate catches due to discarded bycatch.

The advised closure of Division IVa for fishing during the first half of the year is based on the perception that the western mackerel enter the North Sea in July/August, and stay there until December before migrating back to their spawning areas. Updated observations taken in the late 1990s suggested that this return migration actually started in mid- to late February. This was believed to result in large-scale misreporting from the Northern part of the North Sea (Division IVa) to Division VIa. It was recommended that the closure date for IVa be extended to the 15th February and not the 1st February, as stated in the advice in 2002. This was adopted for the 1999/2000 fishing season onwards. Misreporting from IVa to VIa occurred again in 2003. The reasons for the misreporting in 2003 are unclear but are not thought to be linked to a change in the timing of the migration to spawning areas.

Factors affecting the fisheries and the stock

Mackerel is mainly exploited in a directed fishery for human consumption. This fishery tends to target bigger fish and this could potentially cause discarding of smaller, marketable fish (high-grading). Several sources of information indicate that the 2001 and 2002 year classes are above average. There are concerns that the appearance of such strong year classes in the fishery may have led to increased discarding.
Catches decreased in Spanish waters by almost half in 2003 due to the closure of the fishery in the first quarter after the ”Prestige” oil spill.

The effects of regulations

Management has aimed at a fishing mortality in the range of 0.15-0.2 since 1998. The fishing mortality realised since then has been in the range of 0.28 to 0.38.

Other factors

Stock components: ICES currently uses the term “North East Atlantic Mackerel**”** to define the mackerel present in the area extending from ICES Division IXa in the south to Division IIa in the north, including mackerel in the North Sea and Division IIIa. The spawning areas of mackerel are widely spread, and only the area in the North Sea is sufficiently distinct to be clearly identified as a separate spawning component. Tagging experiments have demonstrated that after spawning, fish from Southern and Western areas migrate to feed in the Norwegian Sea and the North Sea during the second half of the year. In the North Sea they mix with the North Sea component. Since it is at present impossible to allocate catches to the stocks previously considered by ICES, they are at present, for practical reasons, considered as one stock: the North East Atlantic Mackerel Stock. Catches cannot be allocated specifically to spawning area components on biological grounds, but by convention the catches from the Southern and Western components are separated according to the area where they are taken.

In order to be able to keep track of the development of the spawning biomasses in the different spawning areas, the North East Atlantic mackerel stock is divided into three area components: the Western Spawning Component, the North Sea Spawning Component**,** and the Southern Spawning Component:

Northeast Atlantic Mackerel			
Distributed and fished in ICES Subareas and Divisions IIa, IIIa, IV, Vb, VI, VII, VIII, and IXa.			
Spawning component	**Western**	**Southern**	**North Sea**
Spawning Areas	VI, VII, VIIIa,b,d,e.	VIIIc, IXa.	IV, IIIa.

The Western Component is defined as mackerel spawning in the western area (ICES Divisions and Subareas VI, VII, VIII a,b,d,e). This component currently comprises 85% of the entire North East Atlantic Stock. Similarly, the Southern Component is defined as mackerel spawning in the southern area (ICES Divisions VIIIc and IXa). Although the North Sea component has been at an extremely low level since the early 1970s, ACFM regards the North Sea Component as still existing. This component spawns in the North Sea and Skagerrak (ICES Subarea IV and Division IIIa). Current knowledge of the state of the spawning components is summarised below:

Western Component: The catches of this component were low in the 1960s, but increased to more than 800 000 t in 1993. The main catches are taken in directed fisheries by purse seiners and mid-water trawlers. Large catches of the western component are taken in the northern North Sea and in the Norwegian Sea. The 1996 catch was reduced by about 200 000 t, compared with 1995, because of a reduction in the TAC. The catches since 1998 have been stable. The SSB of the Western Component declined in the 1970s from above 3.0 million t to 2.2 million t in 1994, but was estimated to have increased to 2.7 million t in 1999. A separate assessment for this stock component is no longer required, as a recent extension of the time-series of NEA mackerel data now allows the estimation of the mean recruitment from 1972 onwards. Estimates of the spawning stock biomass, derived from egg surveys, indicate a decrease of 14% between 1998 and 2001 and a 6% decrease from 2001 to the 2004 survey.

North Sea Component: Very large catches were taken in the 1960s in the purse seine fishery, reaching a maximum of about 1 million t in 1967. The component subsequently collapsed and catches declined to less than 100 000 t in the late 1970s. Catches during the last five years have been assumed to be about 10 000 t. The 2002 and 2005 egg survey in the North Sea with limited spatial and temporal coverage both indicate a higher egg production in the North Sea area than in 1999,. However, this component is still considered to be severely depleted.

Southern Component: Mackerel is a target species for the hand line fleet during the spawning season in Division VIIIc, during which about one-third of the total catches are taken. It is taken as a bycatch in other fleets. The highest catches (87%) from the Southern Component are taken in the first half of the year, mainly from Division VIIIc, and consist of adult fish. In the second half of the year catches consist of juveniles and are mainly taken in Division IXa. Catches from the Southern Component increased from about 20 000 t in the early 1990s

to 44 000 t in 1998, and were close to 50 000 t in 2002. Estimates of the spawning stock biomass, derived from egg surveys, indicate a decrease of about 50% between 1998 and 2001. However, the SSB estimated in 2001 is similar to the survey estimates in 1995. The SSB estimated in 2004 showed a decrease of 36% over the 2001 survey.

Scientific basis

Data and methods

This assessment is based on catch numbers-at-age for the period 1972–2004 and egg survey estimates of SSB from 1992, 1995, 1998, 2001, and 2004. Exploratory assessments using different assessment models gave comparable results. The recent trend biomass is also in general agreement with measurements in acoustic surveys, and the estimate of total mortality in the past is in line with estimates from tag recapture studies. The results are sensitive to the way the surveys are used in the models. This year's assessment is an update of last year's assessment.

For mackerel, fishery-independent data of the stock size becomes available only once every 3 years from egg surveys. Inclusion of a new independent data point may result in quite large revisions of the stock size, fishing mortality, and consequently catch predictions and TAC advice.

Sampling for discards has been initiated in the EU in 2002 by legal regulations. Sampling of discards and slipping is problematic in pelagic fisheries due to high variability in discard and slipping practices, and it is uncertain whether useable information can be provided with less than 100% observer coverage.

Uncertainties in assessment and forecast

Due to the lack of fishery-independent data and the absence of age-disaggregated information for the spawning stock index, the levels of SSB are uncertain but F can be considered as indicative of the level and trend. In recent years, there has been a tendency to overestimate the SSB and to underestimate fishing mortality.

The recruitment since 2000 has been considerably more variable than that observed since the mid-1980s. This adds to the uncertainty in the forecast.

There is a broad perception that there are substantial undeclared landings in this fishery. The assessment is strongly dependent on the catch information, both recently and in the past. Managers are encouraged to obtain reliable catch information.

Comparison with previous assessment and advice

This year's assessment was an update of last year's assessment, with catch numbers at age for 2004 added. The result is in line with last year's assessment. Comparative assessments performed with different models gave similar results.

Last year, the use of the egg production indices in the assessment was changed by assuming that they were relative measures of the spawning stock instead of absolute. This change in the use of indices led to a change in the perception of the trajectory of the stock. This year ICES tested, by simulation, the trade-off between using the survey estimates as absolute or relative indices of the spawning biomass assuming biases in either the catches or the surveys. The results of this exercise confirmed that using the egg survey as relative indices when there is substantial misreporting of catches leads to unbiased estimates of fishing mortalities and underestimates of the spawning stock in the terminal year. Treating the indices as absolute leads, on the other hand, to an underestimation of the fishing mortality. As the management agreement is based on fishing mortality, the most appropriate model formulation to use is with the egg survey as relative.

Furthermore, taking the egg survey estimates as absolute measures of the spawning stock biomass leads to a potential conflict between two sources of information about stock abundance in absolute terms. In practice, the information from the catches will dominate the abundance estimates in the past while the information from the most recent egg surveys will dominate the abundance estimate for the present. This leads to estimates of abundance and SSB that are inconsistent over time. Taking the egg survey estimates as relative removes that internal inconsistency by relying on the catch data as the only source of information about absolute levels. Hence, the estimates of abundance, and accordingly, the predicted catches for the future, are scaled to the reported catches. If catches have been consistently underreported, this is reflected in both the abundance estimates and the catch predictions. The advice, as derived from the present assessments, does reflect the level of reported catches.

Some information on the estimated level of discards is available and was included in the assessment but the amount included does not appear to be sufficient to capture the scale of the problem. The forecasts have only been provided in terms of landings and not in terms of catches as used to be done.

Source of information

Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, September 6-15 2005 (ICES CM 2006/ACFM:08).

Catch data for combined area

Year	ICES Advice	Predicted catch corresp. to advice	Total Agreed TAC[3]	Official landings	Disc.[1] slip	ACFM catch[2,4]
1987	Given by stock component		442	589	11	655
1988	Given by stock component		610	621	36	680
1989	Given by stock component		532	507	7	590
1990	Given by stock component		562	574	16	628
1991	Given by stock component		612	599	31	668
1992	Given by stock component		707	723	25	760
1993	Given by stock component		767	778	18	825
1994	Given by stock component		837	792	5	821
1995	Given by stock component		645	660	8	756
1996	Significant reduction in F	-	452	493	11	564
1997	Significant reduction in F	-	470	434	19	570
1998	F between 0.15 and 0.2	498	549	647	8	667
1999	F of 0.15 consistent with PA	437	562	595	n/a	616
2000	F=0.17: $\mathbf{F}_{pa}$	642	612	579	2	675
2001	F=0.17: $\mathbf{F}_{pa}$	665	670	620	1	687
2002	F=0.17: $\mathbf{F}_{pa}$	694	683	688	24	727
2003	F=0.17: $\mathbf{F}_{pa}$	542	583	580	9	617
2004	F=0.17: $\mathbf{F}_{pa}$	545	532	559	11	611
2005	F=0.15 to 0.20	[320-420]	422			
2006	F=0.15 to 0.20	[373-487]				

[1]Data on discards and slipping from ony two fleets. [2]Landings and discards from IIa, IIIa, IV, Vb, VI, VII, VIII, and IXa. [3]All areas except some catches in international waters in II. [4] Catches updated in 2003 with revisions from SGDRAMA in 2002. n/a=not available. Weights in ‘000 t.

Catch data for western component

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Disc. slip	ACFM catch[2,4]
1987	SSB = 1.5 mill. t; TAC	380	405	11	633
1988	F = $\mathbf{F}_{0.1}$; TAC; closed area; landing size	430	573	36	656
1989	Halt SSB decline; TAC	355	495	7	571
1990	TAC; F = $\mathbf{F}_{0.1}$	480	525	16	606
1991	TAC; F = $\mathbf{F}_{0.1}$	500	575	31	647
1992	TAC for both 1992 and 1993	670	670	25	742
1993	TAC for both 1992 and 1993	670	730	18	805
1994	No long-term gains in increased F	8313	800	5	796
1995	20% reduction in F	530	608	8	728
1996	No separate advice	-	422	11	529
1997	No separate advice	-	416	19	529
1998	No separate advice	-	514	8	623
1999	No separate advice	-	520	0	572
2000	No separate advice	-	573	2	639
2001	No separate advice	-	630	1	644
2002	No separate advice	-	642	24	677
2003	No separate advice	-	548	9	592
2004	No separate advice	-	500	11	577
2005	No separate advice	-	397		
2006	No separate advice	-			

[1]TAC for mackerel taken in all areas VI, VII, VIIIa,b,d, Vb, IIa, IIIa, IVa. [2]Landings and discards of Western component; includes some catches of North Sea component. [3]Catch at *status quo* F. [4] Catches updated in 2003 with revisions from SGDRAMA in 2002. Weights in ‘000 t.

Catch data for North Sea component

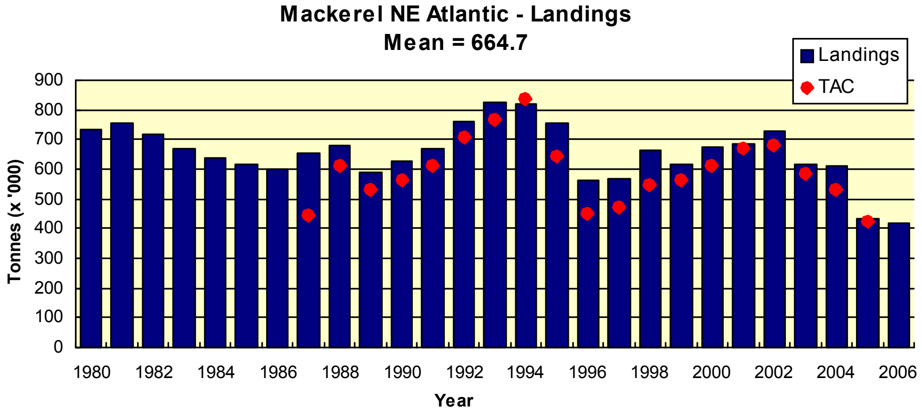
Year	ICES Advice	Predicted catch corresp. to advice[1]	Agreed TAC[2]	ACFM catch[3]
1987	Lowest practical level	LPL	55	3
1988	Closed areas and seasons; min. landing size; bycatch regulations	LPL	55	6
1989	Closed areas and seasons; min. landing size; bycatch regulations	LPL	49.2	7
1990	Closed areas and seasons; min. landing size; bycatch regulations	LPL	45.2	10
1991	Closed areas and seasons; min. landing size; bycatch regulations	LPL	65.5	-[4]
1992	Closed areas and seasons; min. landing size; bycatch regulations	LPL	76.3	[4]
1993	Maximum protection; closed areas and seasons; min landing size	LPL	83.1	-[4]
1994	Maximum protection; closed areas and seasons; min landing size	LPL	95.7	-[4]
1995	Maximum protection; closed areas and seasons; min landing size	LPL	76.3	-[4]
1996	Maximum protection; closed areas and seasons; min landing size	LPL	52.8	-[4]
1997	Maximum protection; closed areas and seasons; min landing size	LPL	52.8	-[4]
1998	Maximum protection; closed areas and seasons; min landing size	LPL	62.5	-[4]
1999	Maximum protection; closed areas and seasons; min landing size	LPL	62.5	-[4]
2000	Maximum protection; closed areas and seasons; min landing size	LPL	69.7	-[4]
2001	Maximum protection; closed areas and seasons; min landing size	LPL	71.4	-[4]
2002	Maximum protection; closed areas and seasons; min landing size	LPL	72.9	-[4]
2003	Maximum protection; closed areas and seasons; min landing size	LPL	62.5	-[4]
2004	Maximum protection; closed areas and seasons; min landing size	LPL	57.7	-[4]
2005	Maximum protection; closed areas and seasons; min landing size	LPL	44.9	-[4]
2006	Maximum protection; closed areas and seasons; min landing size			

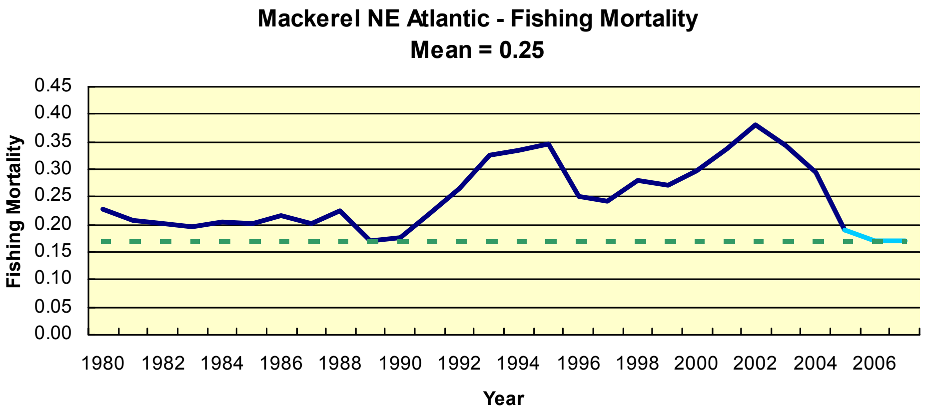
[1]Subarea IV and Division IIIa. [2]TAC for Subarea IV, Divisions IIIa, IIIb,c,d (EU zone), and Division IIa (EU zone). [3]Estimated landings of North Sea component. [4]No information. Weights in '000 t.

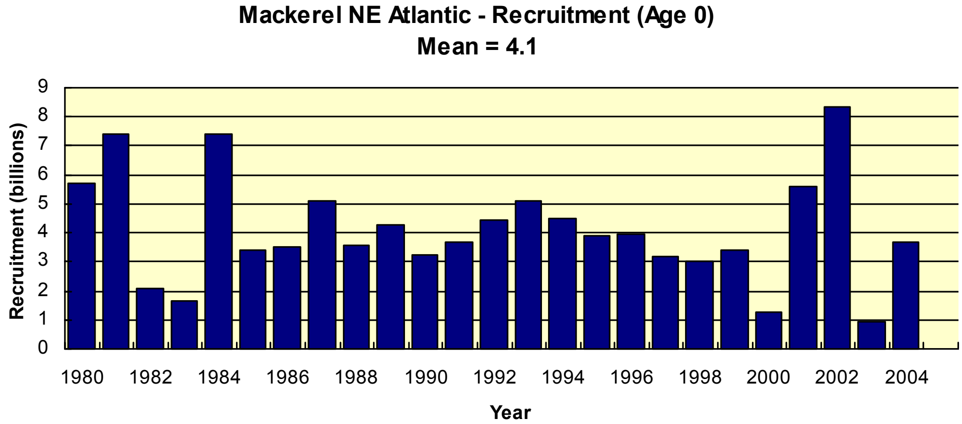
Catch data for southern component

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Catch[2]
1987	Reduce juvenile exploitation	-	36.57	22
1988	Reduce juvenile exploitation	-	36.57	25
1989	No advice	-	36.57	18
1990	Reduce juvenile exploitation	-	36.57	21
1991	Reduce juvenile exploitation	-	36.57	21
1992	No advice	-	36.57	18
1993	No advice	-	36.57	20
1994	No advice	-	36.57	25
1995	No advice	-	36.57	28
1996	No separate advice	-	30.00	34
1997	No separate advice	-	30.00	41
1998	No separate advice	-	35.00	44
1999	No separate advice	-	35.00	44
2000	No separate advice	-	39.20	36
2001	No separate advice	-	40.18	43
2002	No separate advice	-	41.10	50
2003	No separate advice	-	35.00	26
2004	No separate advice	-	32.31	35
2005	No separate advice	-	24.87	
2006	No separate advice	-		

[1]Division VIIIc, Subareas IX and X, and CECAF Division 34.1.1 (EU waters only). [2]
Catches updated in 2003 with revisions from SGDRAMA in 2002. Weights in '000 t.


Mackerel NE Atlantic - Landings
Mean = 664.7
Landings
TAC
Tonnes (x '000)
Year


Mackerel NE Atlantic - Fishing Mortality
Mean = 0.25
Fishing Mortality
Year


Mackerel NE Atlantic - Recruitment (Age 0)
Mean = 4.1
Recruitment (billions)
Year

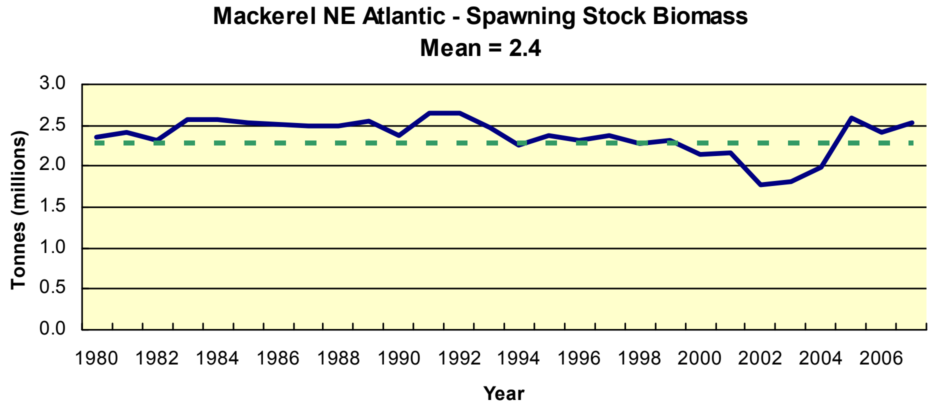

Mackerel NE Atlantic - Spawning Stock Biomass
Mean = 2.4
Tonnes (millions)
Year

Table 1.4.2.1 Catches of MACKEREL by area. Discards not estimated prior to 1978. (Data submitted by Working Group members.)

Year	Sub-area VI			Sub-area VII and Divisions VIIIa,b,d,e			Sub-area IV and III			Sub-area I,II & Divs.Vb[1]	Divs. VIIIc, IXa	Total		
	Landings	Discards	Catch	Landings	Discards	Catch	Landings	Discards	Catch	Landings	Landings	Landings	Discards	Catch
1969	4,800		4,800	47,404		47,404	739,175		739,175	7	42,526	833,912	0	833,912
1970	3,900		3,900	72,822		72,822	322,451		322,451	163	70,172	469,508	0	469,508
1971	10,200		10,200	89,745		89,745	243,673		243,673	358	32,942	376,918	0	376,918
1972	13,000		13,000	130,280		130,280	188,599		188,599	88	29,262	361,229	0	361,229
1973	52,200		52,200	144,807		144,807	326,519		326,519	21,600	25,967	571,093	0	571,093
1974	64,100		64,100	207,665		207,665	298,391		298,391	6,800	30,630	607,586	0	607,586
1975	64,800		64,800	395,995		395,995	263,062		263,062	34,700	25,457	784,014	0	784,014
1976	67,800		67,800	420,920		420,920	305,709		305,709	10,500	23,306	828,235	0	828,235
1977	74,800		74,800	259,100		259,100	259,531		259,531	1,400	25,416	620,247	0	620,247
1978	151,700	15,100	166,800	355,500	35,500	391,000	148,817		148,817	4,200	25,909	686,126	50600	736,726
1979	203,300	20,300	223,600	398,000	39,800	437,800	152,323	500	152,823	7,000	21,932	782,555	60600	843,155
1980	218,700	6,000	224,700	386,100	15,600	401,700	87,931		87,931	8,300	12,280	713,311	21600	734,911
1981	335,100	2,500	337,600	274,300	39,800	314,100	64,172	3,216	67,388	18,700	16,688	708,960	45516	754,476
1982	340,400	4,100	344,500	257,800	20,800	278,600	35,033	450	35,483	37,600	21,076	691,909	25350	717,259
1983	320,500	2,300	322,800	235,000	9,000	244,000	40,889	96	40,985	49,000	14,853	660,242	11396	671,638
1984	306,100	1,600	307,700	161,400	10,500	171,900	43,696	202	43,898	98,222	20,208	629,626	12302	641,928
1985	388,140	2,735	390,875	75,043	1,800	76,843	46,790	3,656	50,446	78,000	18,111	606,084	8191	614,275
1986	104,100		104,100	128,499		128,499	236,309	7,431	243,740	101,000	24,789	594,697	7431	602,128
1987	183,700		183,700	100,300		100,300	290,829	10,789	301,618	47,000	22,187	644,016	10789	654,805
1988	115,600	3,100	118,700	75,600	2,700	78,300	308,550	29,766	338,316	120,404	24,772	644,926	35566	680,492
1989	121,300	2,600	123,900	72,900	2,300	75,200	279,410	2,190	281,600	90,488	18,321	582,419	7090	589,509
1990	114,800	5,800	120,600	56,300	5,500	61,800	300,800	4,300	305,100	118,700	21,311	611,911	15600	627,511
1991	109,500	10,700	120,200	50,500	12,800	63,300	358,700	7,200	365,900	97,800	20,683	637,183	30700	667,883
1992	141,906	9,620	151,526	72,153	12,400	84,553	364,184	2,980	367,164	139,062	18,046	735,351	25000	760,351
1993	133,497	2,670	136,167	99,828	12,790	112,618	387,838	2,720	390,558	165,973	19,720	806,856	18180	825,036
1994	134,338	1,390	135,728	113,088	2,830	115,918	471,247	1,150	472,397	72,309	25,043	816,025	5370	821,395
1995	145,626	74	145,700	117,883	6,917	124,800	321,474	730	322,204	135,496	27,600	748,079	7721	755,800
1996	129,895	255	130,150	73,351	9,773	83,124	211,451	1,387	212,838	103,376	34,123	552,196	11415	563,611
1997	65,044	2,240	67,284	114,719	13,817	128,536	226,680	2,807	229,487	103,598	40,708	550,749	18864	569,613
1998	110141	71	110,212	105,181	3,206	108,387	264,947	4,735	269,682	134,219	44,164	658,652	8012	666,664
1999[2]§	103,964		103,964	94,290		94,290	300,616		300,616	72,848	43,796	615,514	0	615,514
2000[2]	156,031	1	156,031	115,566	1,918	117,484	273,169	165	273,334	92,557	36,074	673,397	2084	675,481
2001[2]	117,997	83	117,997	142,890	1,081	143,971	314,802	24	314,826	67,097	43,198	685,984	1,188	687,172
2002[2]	113,862	12,931	126,793	102,484	2,260	104,744	363,310	8,583	371,893	73,929	49,576	703,161	23,774	726,935
2003	116,593	91	116,684	89,492		89,492	322,241	9,390	331,631	53,701	25,823	607,849	9,481	617,330
2004	114,871	240	115,111	99,922	1,862	101,784	288,370	8,870	297,240	62,486	34,840	600,488	10,972	611,461

*Preliminary. [1]For 1976–1985 only Division IIa. Sub-area I, and Division IIb included in 2000 only [2] Data revised for Northern Ireland

§ Discards reported as part of unallocated catches

Table 1.4.2.2 Mackerel (combined Southern, Western & N.Sea spawn.comp.)

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8
1980	5693010	2360014	734951	0.227
1981	7389980	2412983	754438	0.209
1982	2098100	2313701	717267	0.202
1983	1624940	2577775	671588	0.196
1984	7416130	2569129	637606	0.206
1985	3392910	2541515	614371	0.203
1986	3486560	2520085	602200	0.215
1987	5085070	2485588	654991	0.202
1988	3578850	2490994	680492	0.225
1989	4287500	2543570	589509	0.171
1990	3239450	2386333	627511	0.175
1991	3658660	2649140	667886	0.219
1992	4421530	2648794	760351	0.264
1993	5083330	2469074	825036	0.327
1994	4481570	2259500	821395	0.336
1995	3886850	2373142	755776	0.345
1996	3963120	2322321	563612	0.252
1997	3194090	2368840	569613	0.242
1998	3034550	2272310	666682	0.279
1999	3389630	2324013	615512	0.272
2000	1265970	2151289	675479	0.297
2001	5600150	2169653	687173	0.337
2002	8330800	1779544	726935	0.381
2003	921230	1821410	617330	0.344
2004	*3672928	1984940	611461	0.295
2005	*3672928			
Average	4087876	2351826	673967	0.257

*Geometric mean (1972-2001)

Western Horse Mackerel

(Divisions IIa, IVa, Vb, VIa, VIIa–c,e–k, VIIIa,b,d,e)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

FSS agree with ICES and STECF that in the absence of a strong year class (e.g. 1982) sustainable yield is unlikely to be higher than 130,000 t for the traditional stock areas which corresponds to catches less than 150,000 t in the revised stock area (i.e. 130,000 t for the traditional stock area, plus 20,000 t for the inclusion of Division VIIIc in the stock definition). Catch data indicate high recruitment in 2001, but the strength of the 2001 year class will only become apparent once it fully matures. The recommended TAC of 150,000 t would translate into an Irish quota of 30,691 t.

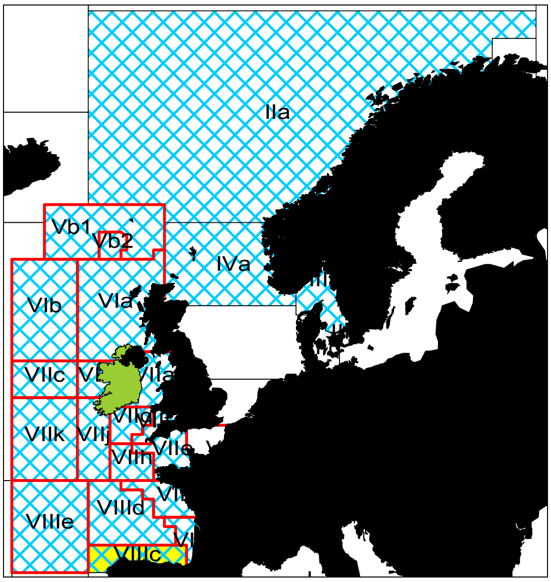
FSS note that the strength of the 2001 year-class, though apparently stronger than recent recruitments, is not of the same strength as that of 1982.

FSS note that the fishery for this stock is increasingly targeting juveniles. FSS points out that such targeting reduces the potential yield per recruit (weight) of the stock, and therefore the yield of the 2001 year class will not be as high as the yield in 1982.

FSS point out that the TAC management areas do not correspond to the assessment area of western Horse Mackerel and should extend to all areas where western Horse Mackerel are caught. If these measures are taken, special attention has to be given to the juvenile fishery that has developed in VIId (western stock) and the adjacent VIIe (North Sea stock) as there will be a motive for misreporting between the two areas and over-exploitation of the juveniles from the western stock. Therefore FSS advises that measures to protect juveniles should be introduced in <u>all</u> areas where horse mackerel is fished, such as imposing separate TAC for the juvenile area of both neighbouring stocks.

CURRENT MANAGEMENT

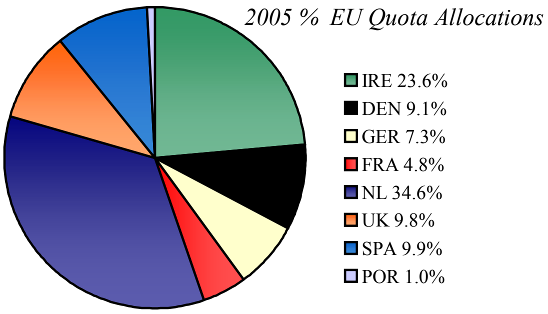
- The TAC does not correspond to the distribution and assessment area of the western Horse Mackerel stock. There are three TACs under which the western Horse Mackerel stock is fished but these also cover parts of the North Sea and the Southern stocks: One TAC is set for Divisions Vb, (EU waters), Sub-areas VI and VII, and Divisions VIIIa,b,d,e. Another TAC is set for EU waters in Division IIa and Sub-area IV and the third TAC covers the area of the southern stock and parts of the western stock in VIIIc and IX.
- The TAC only applies to EU waters. There are unregulated fisheries outside the TAC areas mainly by Norwegian vessels. Catches in these unregulated fisheries accounted for ca. 10,000 t in 2004.
- Since 2005, management advice of the western stock includes a TAC allocation for Division VIIIc as this area has now been included in the western stock definition.
- The agreed TAC for 2005 in Divisions Vb, (EU waters), Sub-areas VI and VII, and Divisions VIIIa,b,d,e. was 137,000 t. The Irish quota for this area was 31,454 t.
- There is no management plan or management objective for this fishery, though it may become a candidate for management under the EU-Norway agreement.
- The Northwest Pelagic Management Committee manages the Irish fishery.



Red Boxes-TAC/Management Areas Blue Shading– Assessment Area
Blue/Yellow area—New Area added to stock

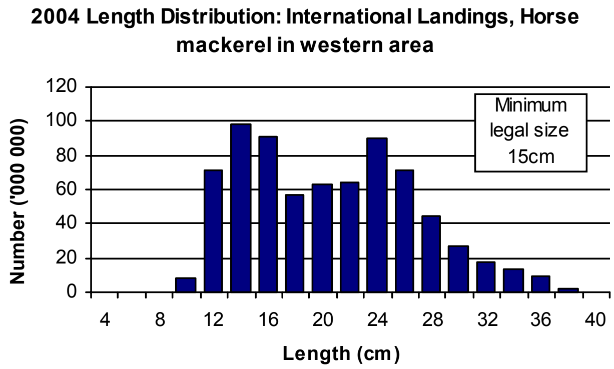
ADDITIONAL INFORMATION

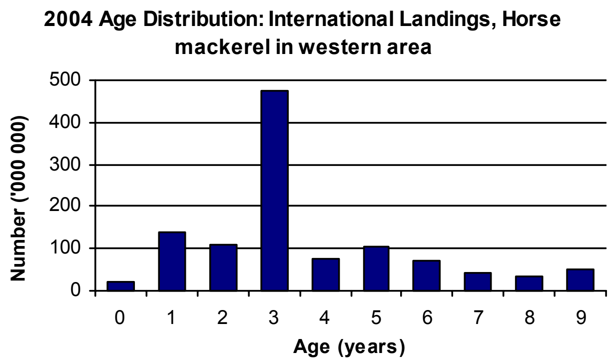
1. In the absence of reliable fisheries independent data, absolute levels of SSB and F cannot be determined. However the assessment is indicative of relative trends and shows that SSB has been declining in line with the decline of the strong year class in 1982.
2. The total catch of western horse mackerel in 2004 was 157,700 t, which was 32,500 t less than in 2003.

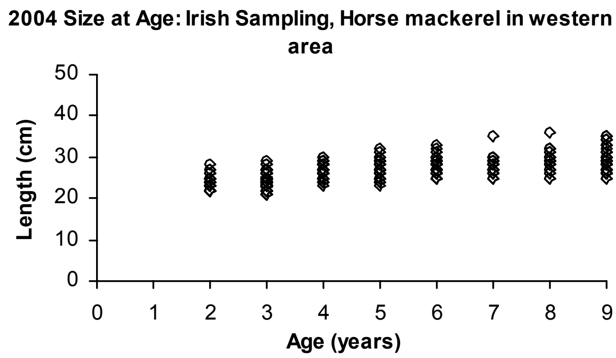


These figures include 16,000 t catches in Division VIIIc.

3. Absolute catch figures are uncertain as anecdotal information suggests substantial misreporting for which numerical information is not available for most countries.
4. The main catches are taken by the Dutch, German and French freezer trawler fleet, the Irish refrigerated sea water (RSW) vessels and the Danish Industrial Fishery. In VIIIc the Spanish fleet take substantial catches.
5. The Irish catch in 2004 was about 26,430 t and was mainly caught west and south of Ireland in Quarter 1 (VIIb, VIIh, VIIIa) and northwest of Ireland in Quarter 3 (VIa).
6. Large catches of western horse mackerel were caught in the juvenile areas of the western English channel and South Brittany (VIIe,f,h; VIIIa,b,d).
7. In total, 53% of the catch in numbers was from the 2001 year class. The high catch rates of the 2001 year class suggest a strong recruitment in that year. In the Irish fishery this year class was represented by 45%.
8. The collection of biological data has improved since 1998 but still remains poor and there is a lack of sampling data for many important horse mackerel fishing countries.







ICES ADVICE
1.4.3

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Uncertain	Uncertain	Uncertain	Uncertainty of absolute level of SSB and F; SSB has been decreasing in the last 15 years.

Based on new research information on stock identity, the Western horse mackerel stock unit has been redefined and now includes Division VIIIc.

In the absence of defined reference points and a full analytical assessment, the state of the stock is uncertain. Data exploration indicates that the SSB has been decreasing since the late 1980s, as the outstanding 1982 year class was depleted. Relative high catch rates of the 2001 year class in 2002-2004 suggest that this year class is stronger than those observed in recent years. Fishing mortality also appears to have been declining in recent years and is believed to be relatively low.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No reference points have been defined for the revised stock unit.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

An $\mathbf{F}_{0.1}$ was calculated in an earlier assessment, but in view of the uncertainties in the selection profile, $\mathbf{F}_{0.1}$ cannot be updated at the present time.

Exploitation boundaries in relation to precautionary considerations

ICES has advised that in the absence of a strong year class sustainable yield is unlikely to be higher than 130 000 t for the traditional stock areas. This corresponds to catches less than 150 000 t in the revised stock area (i.e. 130 000 t for the traditional stock area, plus 20 000 t for the inclusion of Division VIIIc in the stock definition). Accordingly, ICES recommend that catches of horse mackerel in Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIa-c,e-k, and VIIIa-e be limited to less than 150 000 t.

Short-term implications

Given the uncertainty of the absolute levels of SSB, F, and R, and in the absence of a full analytical assessment, short-term forecasts have not been computed.

Management considerations

In the absence of outstanding year classes, sustainable yield is unlikely to be higher than about 150 000 t for the current stock area, dependent on the exploitation pattern. Exploitation at $F_{0.1}$ will produce yields of this order on the basis of average recruitment excluding the extremely large year classes. It is therefore clear that catches should not exceed such level unless another outstanding year class is produced.

As the new definition of the stock unit now also includes Division VIIIc, the TAC advice has been adjusted, starting in 2004, by adding average catches from Division VIIIc, which were in the range of 20 000 t in the 2000-2003 period**.**

The stock has continued to decline since the late 1980s despite progressive reductions of the catches to 157 600 t (including Division VIIIc) in 2004. Given the absence of an analytical assessment, continuing stock decline, and no clear evidence of outstanding year classes (such as that of 1982), catches need to be effectively limited to less than 150 000 t. It is therefore clear that catches will have to be maintained at this level unless another exceptional year class like the 1982 year class is produced.

The SSB of Western Horse Mackerel has been dominated by an outstanding 1982 year class and reached a maximum in 1988. This year class has been gradually fished out and since then no other outstanding year classes have appeared, while the spawning biomass has slowly declined. There are indications that the 2001 year class might be a relatively strong year class. As there are no recruitment indices available, the strength of this year class can only be verified when it fully enters the spawning stock, which may take several years. Therefore, fishing should be kept at a low level in the coming years.

Major catches of juvenile horse mackerel, particularly the 2001 year class, may be a sign of the strength of this year class. As the fishery has increasingly targeted juvenile horse mackerel (see below), separating this effect from the presence of a strong year class might be difficult in the absence of fishery-independent information on the strength of incoming year classes.

More than half of the total international catch in both 2003 and 2004 consisted of one- to three-year-old fish. The juvenile fishery on the western stock has mainly taken place in Divisions VIIe,f,g,h and VIIIa,b,c, d. This may change if juveniles become targeted in other areas, or if a new large year class appears. In the ICES advice in 2003, the issue of juvenile and adult fishery was investigated (*ICES Cooperative Research Report No. 261*, 2003). An area-based management identifying juvenile and adult fisheries separately was recommended.

The TAC has only been given for parts of the distribution and fishing areas (EU waters). ICES advises that if a TAC is set for this stock, it should apply to all areas where western horse mackerel are caught, i.e. Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIa–c, e–k and VIIIa-e, and to all participants in the fishery. Note that Div. VIIIc is now included in the Western stock distribution area. If the management area limits were revised, measures should be taken to prevent misreporting of juvenile catch between VIIe,h and VIId (the latter then belonging to the North Sea stock management area). This could be done for example by imposing a separate TAC for the juvenile areas of both neighboring stocks.

Factors affecting the fisheries and the stock

The effects of regulations

The geographical range of this stock increased when the exceptional 1982 year class entered the fishery. This resulted in the development of unregulated fisheries outside the TAC area in the Northern North Sea. Catches outside the area covered by a TAC have been reduced in recent years. At present, the TAC for the Western areas includes Division Vb (EU waters only), Subareas VI and VII and Divisions VIIIa,b, d,e. A separate TAC includes EU waters in Division IIa and Subarea IV. Horse mackerel taken in Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIe–k, and VIIIa-e are allocated by ICES to the Western stock.

Changes in fishing technology and fishing patterns

From about 1994 onwards, the fishery shifted from a fishery on adults towards a fishery on juveniles. This may be due to the lack of older fish (decline of the 1982 year class) and the development of a market for juveniles. The fishing pattern appears to have changed again in recent years, but it is not clear if this is due to a strong year class or a response to actual changes in fishing practices (targeting). The percentage of catch (in weight) in the juvenile areas increased gradually from about 40% in 1997 to about 65% in 2003 and dropped to 50% in 2004. In 2004, 53% of catch in numbers in this area was from the 2001 year class.

Discard information has been lacking in recent years. However, given the high market value of smaller fish the discarding of small fish is unlikely to be a problem.

The environment

Research over the last decade has shown strong links between horse mackerel migration into northern areas and water mass transport patterns in the north-eastern Atlantic (see section 1.2, this volume).

Other factors

Western horse mackerel is taken in a variety of fisheries exploiting juvenile fish for the human consumption market, mid-aged fish mostly for the Japanese market, and older fish either for human consumption purposes (mostly for the African market) or for industrial purposes.

The history of this stock reflects the development of a single large year class within the period of 22 years for which data are available. The frequency of the occurrence of such large year classes cannot be evalu-

ated on the basis of the short time-series.

Scientific basis

A wide range of assessment approaches have been explored this year, none of which being considered to provide a reliable assessment. Nevertheless, these are indicative of relative trends and suggest that SSB has been declining since the late 1980s and that the current exploitation is relatively low.

The egg production index has been extended to include Division VIIIc to reflect the new stock definition.

Data and methods

As in previous years and despite the data sampling regulation for EU countries, some countries with major catches did not carry out biological sampling programs. Though this has improved since 1998, the lack of biological data severely hampered the assessment in earlier years. It is important to note that a sufficient sampling coverage is a prerequisite for the timely detection of a strong recruiting year class, explicitly the verification of the possibly strong 2001 year class. Only this would allow for the implementation of management measures early enough to protect such a year class from being overexploited or discarded.

Uncertainties in assessment and forecast

As it is not possible to determine the absolute level of recruitment, abundance and fishing mortality, only relative trends in these quantities have been derived and no catch forecasts are provided.

Comparison with previous assessment and advice

The perception of stock trends is consistent with last year's estimates.

Source of information

Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 6-15 September 2005 (ICES CM 2006/ACFM:08).

Year	ICES Advice	Predicted catch corresp. to advice[2]	Agreed TAC[1]	ACFM Landings[2]	Disc. Slip[2]	ACFM Catch[2]
1987	Not assessed	-	155	157	-	157
1988	No increase in catches	102	169	184	4	188
1989	If sustained catches required; TAC	100	153	267	1	269
1990	TAC	~200	203	363	10	373
1991	Within safe biological limits	-	230	328	5	334
1992	Within safe biological limits	-	250	369	2	371
1993	Within safe biological limits	-	250	424	9	433
1994	Prudent not to increase F	-	300	385	4	389
1995	Reduction in catch	-	300	509	2	511
1996	Reduction in catch	-	300	379	17	397
1997	Reduction in F	173	300	440	3	443
1998	Reduction in F to 0.15	150	320	296	1	304
1999	Effectively limit catches to 200 000 t	<200	265	274	-	274
2000	Effectively limit catches to 200 000 t	<200	240	175	-	175
2001	Effectively limit catches to 224 000 t	<224	233	191	-	191
2002	Effectively limit catches to 98 000 t	<98	150	172	-	172
2003	Effectively limit catches to 113 000 t	<113	137	190[3]	-[3]	190[3]
2004	Limit catches to less than 130 000 t	<130	137	157[3]	1[3]	158[3]
2005	Limit catches to less than 150 000 t	<150[3]	137			
2006	Limit catches to less than 150 000 t	<150[3]				

[1]Division Vb (EU waters only), Subareas VI and VII, Divisions VIIIa,b,d,e.
[2]Divisions IIa, IVa, Vb, VIa, VIIa-c,e-k, VIII a,b,d,e ,
[3]Including VIIIc,
Weights in '000 t.

Table 1.4.3.1 Landings (t) of HORSE MACKEREL in Subarea II. (Data as submitted by Working Group members.)

Country	1980	1981	1982	1983	1984	1985	1986	1987
Denmark	-	-	-	-	-	-	-	39
France	-	-	-	-	1	1	-[2]	-[2]
Germany, Fed.Rep	-	+	-	-	-	-	-	-
Norway	-	-	-	412	22	78	214	3,272
USSR	-	-	-	-	-	-	-	-
Total	-	+	-	412	23	79	214	3,311

	1988	1989	1990	1991	1992	1993	1994	1995
Faroe Islands	-	-	9643	1,115	9,157[3]	1,068	-	950
Denmark	-	-	-	-	-	-	-	200
France	-2	-	-	-	-	-	55	-
Germany, Fed. Rep.	64	12	+	-	-	-	-	-
Norway	6,285	4,770	9,135	3,200	4,300	2,100	4	11,300
USSR / Russia (1992 -)	469	27	1,298	172	-	-	700	1,633
UK (England + Wales)	-	-	17		-	-	-	-
Total	6,818	4,809	11,414	4,487	13,457	3,168	759	14,083

	1996	1997	1998	1999	2000	2001	2002	2003
Faroe Islands	1,598	799[3]	188[3]	132[3]	250[3]	-		
Denmark	-	-	1,755[3]			-		
France	-	-	-			-		
Germany	-	-	-			-		
Norway	887	1,170	234	2,304	841	44	1,321	22
Russia	881	648	345	121	84[3]	16	3	2
UK (England + Wales)	-	-	-			-		
Estonia	-	-	22					
Total	3,366	2,617	2,544	2557	1175	60	1,324	24

	2004[1]
Faroe Islands	-
Denmark	-
France	-
Germany	-
Norway	42
Russia	
UK (England + Wales)	-
Estonia	-
Total	42

[1]Preliminary.
[2]Included in Subarea IV.
[3]Includes catches in Division Vb

Table 1.4.3.2 Landings (t) of HORSE MACKEREL in North Sea Subarea IV and Skagerrak Division IIIa by country. (Data submitted by Working Group members). Catches partly concern the North Sea horse mackerel.

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	8	34	7	55	20	13	13	9	10
Denmark	199	3,576	1,612	1,590	23,730	22,495	18,652	7,290	20,323
Faroe Islands	260	-	-	-	-	-	-	-	-
France	292	421	567	366	827	298	231[2]	189[2]	784[2]
Germany, Fed.Rep.	+	139	30	52	+	+	-	3	153
Ireland	1,161	412	-	-	-	-	-	-	-
Netherlands	101	355	559	2,029[3]	824	160[3]	600[3]	850[4]	1,060[3]
Norway[2]	119	2,292	7	322	[3]	203	776	11,728[4]	34,425[4]
Poland	-	-	-	2	94	-	-	-	-
Sweden	-	-	-	-	-	-	2	-	-
UK (Engl. + Wales)	11	15	6	4	-	71	3	339	373
UK (Scotland)	-	-	-	-	3	998	531	487	5,749
USSR	-	-	-	-	489	-	-	-	-
Total	2,151	7,253	2,788	4,420	25,987	24,238	20,808	20,895	62,877

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Belgium	10	13	-	+	74	57	51	28	-
Denmark	23,329	20,605	6,982	7,755	6,120	3,921	2,432	1,433	648
Estonia	-	-	-	293	-		17	-	-
Faroe Islands	-	942	340	-	360	275	-	-	296
France	248	220	174	162	302		-	-	-
Germany, Fed.Rep.	506	2,469[5]	5,995	2,801	1,570	1,014	1,600	7	7,603
Ireland	-	687	2,657	2,600	4,086	415	220	1,100	8,152
Netherlands	14,172	1,970	3,852	3,000	2,470	1,329	5,285	6,205	37,778
Norway	84,161	117,903	50,000	96,000	126,800	94,000	84,747	14,639	45,314
Poland	-	-	-	-	-	-	-	-	-
Sweden	-	102	953	800	697	2,087	-	95	232
UK (Engl. + Wales)	10	10	132	4	115	389	478	40	242
UK (N. Ireland)	-	-	350	-	-		-	-	-
UK (Scotland)	2,093	458	7,309	996	1,059	7,582	3,650	2,442	10,511
USSR / Russia (1992 -)	-	-	-						
Unallocated + discards	12,482[4]	-317[4]	-750[4]	-278[6]	-3,270	1,511	-28	136	-31,615
Total	112,047	145,062	77,904	114,133	140,383	112,580	98,452	26,125	79,161

Country	1998	1999	2000	2001	2002	2003	2004[1]
Belgium	19	21	19	19	1,004	5	4
Denmark	2,048	8,006	4,409	2,288	1,393	3,774	8,735
Estonia	22	-	-				
Faroe Islands	28	908	24	-	699	809	
France	379	60	49	48	-	392	174
Germany	4,620	4,071	3,115	230	2,671	3,048	4,905
Ireland	-	404	103	375	72	93	379
Netherlands	3,811	3,610	3,382	4,685	6,612	17,354	21,418
Norway	13,129	44,344	1,246	7,948	35,368	20,493	10,709
Russia	-	-	2	-	-	-	
Sweden	3,411	1,957	1,141	119	575	1,074	665
UK (Engl. + Wales)	2	11	15	317	1,191	1,192	2,552
UK (Scotland)	3,041	1,658	3,465	3,161	255	1	1
Unallocated + discards	737	-325	14613	649	-149	-14,009	-19,103
Total	31,247	64,725	31583	19,839	49,691	34,226	30,435

[1]-Preliminary. [2] Includes Division IIa. [3] Estimated from biological sampling. [4] Assumed to be misreported. [5] Includes 13 t from the German Democratic Republic. [6] Includes a negative unallocated catch of -4000 t.

Table 1.4.3.3 Landings (t) of HORSE MACKEREL in Subarea VI by country.
(Data submitted by Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Denmark	734	341	2,785	7	-	-	-	769	1,655
Faroe Islands	-	-	1,248	-	-	4,014	1,992	4,450[3]	4,000[3]
France	45	454	4	10	14	13	12	20	10
Germany, Fed. Rep.	5,550	10,212	2,113	4,146	130	191	354	174	615
Ireland	-	-	-	15,086	13,858	27,102	28,125	29,743	27,872
Netherlands	2,385	100	50	94	17,500	18,450	3,450	5,750	3,340
Norway	-	5	-	-	-		83	75	41
Spain	-	-	-	-	-		-[2]	-[2]	-[2]
UK (Engl. + Wales)	9	5	+	38	+	996	198	404	475
UK (N. Ireland)						-	-	-	-
UK (Scotland)	1	17	83	-	214	1,427	138	1,027	7,834
USSR	-	-	-		-	-	-	-	-
Unallocated + disc.						-19,168	-13,897	-7,255	-
Total	8,724	11,134	6,283	19,381	31,716	33,025	20,455	35,157	45,842

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Denmark	973	615	-	42	-	294	106	114	780
Faroe Islands	3,059	628	255	-	820	80	-	-	-
France	2	17	4	3	+	-	-	-	52
Germany, Fed. Rep.	1,162	2,474	2,500	6,281	10,023	1,430	1,368	943	229
Ireland	19,493	15,911	24,766	32,994	44,802	65,564	120,124	87,872	22,474
Netherlands	1,907	660	3,369	2,150	590	341	2,326	572	498
Norway	-	-	-	-	-	-	-	-	-
Spain	-2	-2	1	3	-	-	-	-	-
UK (Engl. + Wales)	44	145	1,229	577	144	109	208	612	56
UK (N.Ireland)	-	-	1,970	273	-	-	-	-	767
UK (Scotland)	1,737	267	1,640	86	4,523	1,760	789	2,669	14,452
USSR/Russia (1992-)	-	44	-	-	-	-	-	-	-
Unallocated + disc.	6,493	143	-1,278	-1,940	-6,960[4]	-51	-41,326	-11,523	837
Total	34,870	20,904	34,456	40,469	53,942	69,527	83,595	81,259	40,145

Country	1998	1999	2000	2001	2002	2003	2004[1]
Denmark	-	-	-	-	-	-	-
Faroe Islands	-	-	-	-	-	-	-
France	221	25,007	-	428	55	209	172
Germany	414	1,031	209	265	149	1,337	1,413
Ireland	21,608	31,736	15,843	20,162	12,341	20,915	15,702
Netherlands	885	1,139	687	600	450	847	3,701
Spain	-	-	-	-	-	-	-
UK (Engl. + Wales)	10	344	41	91	-	46	5
UK (N.Ireland)	1,132	-	-			453	
UK (Scotland)	10,447	4,544	1,839	3,111	1,192		377
Unallocated +disc.	98	1,507	2,038	-21	3	-553	559
Total	34,815	65,308	20,657	24,636	14,190	23,254	21,929

[1]Preliminary.
[2]Included in Subarea VII.
[3]Includes Divisions IIIa, IVa,b and VIb.
[4]Includes a negative unallocated catch of -7000 t.

Table 1.4.3.4 Landings (t) of HORSE MACKEREL in Subarea VII by country. Data submitted by the Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	-	1	1	-	-	+	+	2	-
Denmark	5,045	3,099	877	993	732	1,477[2]	30,408[2]	27,368	33,202
France	1,983	2,800	2,314	1,834	2,387	1,881	3,801	2,197	1,523
Germany, Fed.Rep.	2,289	1,079	12	1,977	228	-	5	374	4,705
Ireland	-	16	-	-	65	100	703	15	481
Netherlands	23,002	25,000	27,500[2]	34,350	38,700	33,550	40,750	69,400	43,560
Norway	394	-	-	-	-	-	-	-	-
Spain	50	234	104	142	560	275	137	148	150
UK (Engl. + Wales)	12,933	2,520	2,670	1,230	279	1,630	1,824	1,228	3,759
UK (Scotland)	1	-	-	-	1	1	+	2	2,873
USSR	-	-	-	-	-	120	-	-	-
Total	45,697	34,749	33,478	40,526	42,952	39,034	77,628	100,734	90,253

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Faroe Islands	-	28	-	-	-	-	-	-	-
Belgium	-	+	-	-	-	1	-	-	18
Denmark	34,474	30,594	28,888	18,984	16,978	41,605	28,300	43,330	60,412
France	4,576	2,538	1,230	1,198	1,001	-	-	-	27,201
Germany, Fed.Rep.	7,743	8,109	12,919	12,951	15,684	14,828	17,436	15,949	28,549
Ireland	12,645	17,887	19,074	15,568	16,363	15,281	58,011	38,455	43,624
Netherlands	43,582	111,900	104,107	109,197	157,110	92,903	116,126	114,692	81,464
Norway	-	-	-	-	-	-	-	-	-
Spain	14	16	113	106	54	29	25	33	-
UK (Engl. + Wales)	4,488	13,371	6,436	7,870	6,090	12,418	31,641	28,605	17,464
UK (N.Ireland)	-	-	2,026	1,690	587	119	-	-	1,093
UK (Scotland)	+	139	1,992	5,008	3,123	9,015	10,522	11,241	7,931
USSR / Russia (1992-)	-	-	-	-	-	-	-	-	-
Unallocated + discards	28,368	7,614	24,541	15,563	4,0103	14,057	68,644	26,795	58,718
Total	135,890	192,196	201,326	188,135	221,000	200,256	330,705	279,100	326,474

Country	1998	1999	2000	2001	2002	2003	2004[1]
Faroe Islands	-	-	550	-	-	-	-
Belgium	18	-	-	-	1	-	+
Denmark	25,492	19,223	13,946	20,574	10,094	10,867	11,529
France	24,223	-	20,401	11,049	6,466	7,199	8,083
Germany	25,414	15,247	9,692	8,320	10,812	13,873	16,352
Ireland	51,720	25,843	32,999	30,192	23,366	13,533	8,470
Netherlands	91,946	56,223	50,120	46,196	37,605	48.222	41,123
Spain	-	-	50	7	0	1	27
UK (Engl. + Wales)	12,832	8,885	2,972	8,901	5,525	4,186	7,178
UK (N.Ireland)	-	-	-	-	-		
UK (Scotland)	5,095	4,994	5,152	1,757	1,461	268	1,146
Unallocated + discards	12,706	31,239	1,884	11,046	2,576	24,897	18,485
Total	249,446	161,654	137,766	138,042	97,906	123,046	112,393

[1]Provisional.
[2]Includes Subarea VI.

Table 1.4.3.5 Landings (t) of HORSE MACKEREL in Subarea VIII by country. (Data submitted by Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Denmark	-	-	-	-	-	-	446	3,283	2,793
France	3,361	3,711	3.073	2,643	2,489	4,305	3,534	3,983	4,502
Netherlands	-	-	-	-	-[2]	-[2]	-[2]	-[2]	-
Spain	34,134	36,362	19,610	25,580	23,119	23,292	40,334	30,098	26,629
UK (Engl. + Wales)	-	+	1	-	1	143	392	339	253
USSR	-	-	-	-	20	-	656	-	-
Total	37,495	40,073	22,684	28,223	25,629	27,740	45,362	37,703	34,177

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Denmark	6,729	5,726	1,349	5,778	1,955	-	340	140	729
France	4,719	5,082	6,164	6,220	4,010	28	-	7	8,690
Germany, Fed. Rep.	-	-	80	62	-		-	-	-
Netherlands	-	6,000	12,437	9,339	19,000	7,272	-	14,187	2,944
Spain	27,170	25,182	23,733	27,688	27,921	25,409	28,349	29,428	31,081
UK (Engl. + Wales)	68	6	70	88	123	753	20	924	430
USSR/Russia (1992 -)	-	-	-	-	-	-	-	-	-
Unallocated + discards	-	1,500	2,563	5,011	700	2,038	-	3,583	-2,944
Total	38,686	43,496	46,396	54,186	53,709	35,500	28,709	48,269	40,930

Country	1998	1999	2000	2001	2002	2003	2004[1]
Denmark	1,728	4,818	2,584	582	-	-	
France	1,844	74	7	5,316	13,676	-	2,161
Germany	3,268	3,197	3,760	3,645	2,249	4,908	72
Ireland	-	-	6,485	1,483	704	504	1,882
Netherlands	6,604	22,479	11,768	36,106	12,538	1,314	1,047
Russia	-	-	-	-	-	6,620	
Spain	23,599	24,190	24,154	23,531	22,110	24,598	16,245
UK (Engl. + Wales)	9	29	112	1,092	157	982	516
UK (Scotland)	-	-	249	-	-	-	
Unallocated + discards	1,884	-8658	5,093	4,365	1,705	2,785	2,202
Total	38,936	46,129	54,212	76,120	54,560	41,711	24,125

[1]Preliminary.
[2]Included in Subarea VII.

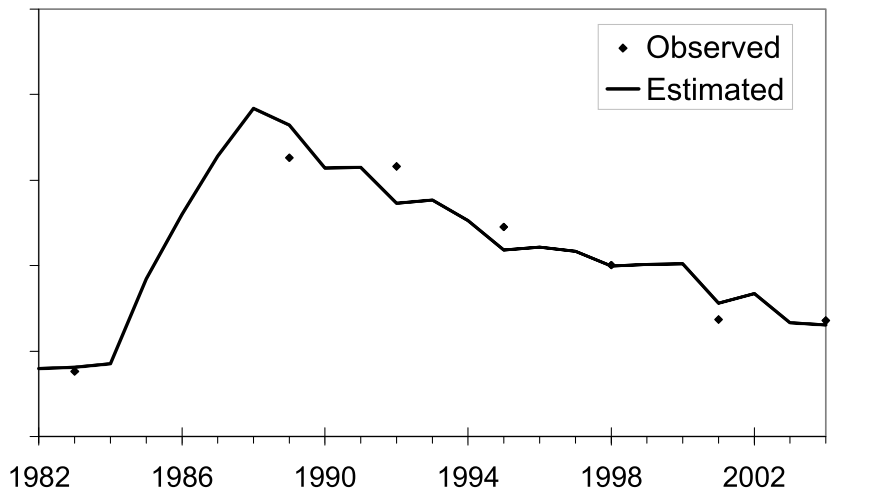
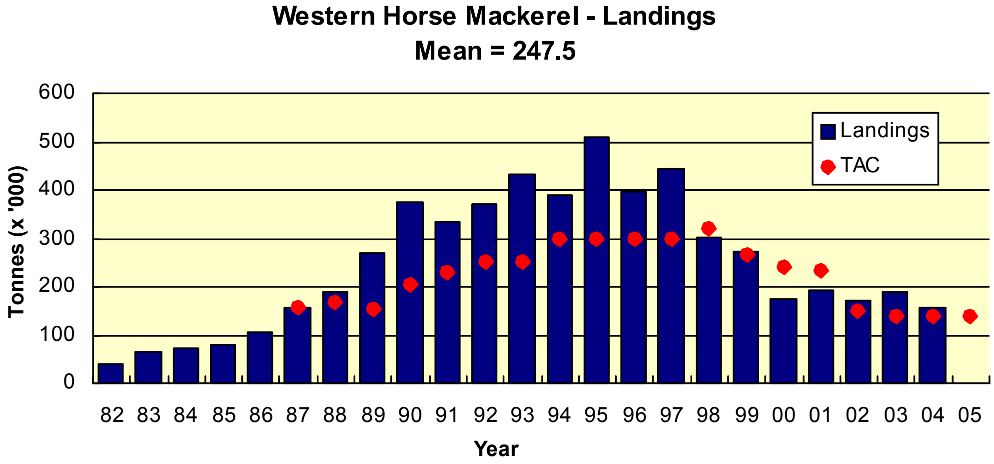


Figure 1.4.3.1 Relative index of the stock spawning biomass (Estimated line) compared to the trend observed in the egg production in the survey (Observed points).



North Sea Horse Mackerel

(Division IIa (eastern part), Divisions IVb,c,VIId)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – ADVICE

FSS note that the available information is inadequate to evaluate spawning stock or fishing mortality relative to risk, so the state of the stock is unknown. Catches have been increasing rapidly since the late 1990s and remain high.

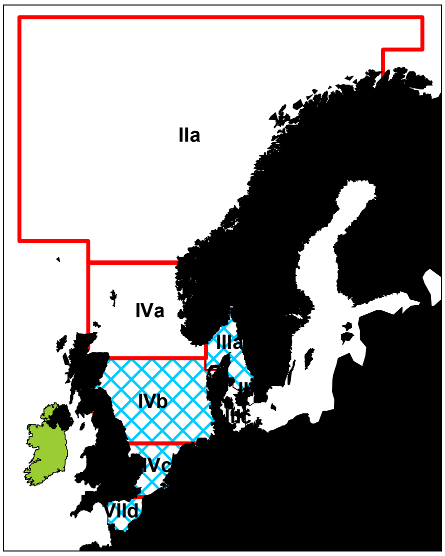
FSS agree with the ICES and STECF advice for this stock that catches should be limited to 18,000 t (based on the average catches from 1982-1997) in order to constrain the expansion of the fishery until these catches can be shown to be sustainable. This translates to an Irish quota in 2006 of about 690 t.

FSS advise that because recruitment to the North Sea and western horse mackerel stocks are strongly linked, measures to protect juveniles should be applied to both stocks. FSS notes that a considerable fishery for juvenile horse mackerel has developed in VIId. This fishery is spatially contiguous with juvenile fishery in VIIe (western stock). FSS notes that the TAC set for this stock has not been precautionary or restrictive, while those set for the adjacent western horse mackerel stock have. FSS highlights that unless the TAC for North Sea horse mackerel is restrictive, this could lead to area misreporting, and/or overexploitation of the juveniles from the western horse mackerel stock.

FSS agree with the ICES advice that the TAC for North Sea horse mackerel should apply to the areas in which North Sea horse mackerel are fished (IIIa eastern part, IVbc and VIId).

CURRENT MANAGEMENT

- The assessment area is Divisions IIIa, IVb,c and VIId.
- There is no management plan for the fishery.
- The agreed TAC applies to EU waters in Division IIa and Sub-area IV and does not correspond with the distribution and fishery of the stock.
- In the last two years the TAC was 42,000 t and 43,000 t respectively; it has been set consistently above the catch and the advice and is therefore not restrictive.

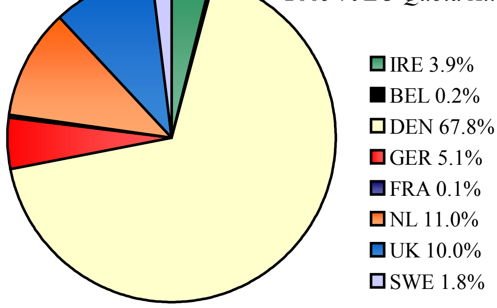


Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

ADDITIONAL INFORMATION

1. No assessment of North Sea horse mackerel has been carried out due to poor sampling and lack of signals in relative cohort strength. There is also a lack of reliable fishery-independent abundance indices. Egg surveys have been carried out in the early nineties but historical SSB estimates are considered unreliable due to the likelihood that horse mackerel is an indeterminate spawner. Current North Sea mackerel egg surveys do not cover the horse mackerel spawning grounds.
2. The intensity and quality of age sampling is low with only 38% of the catch covered in 2004.
3. Length frequency data from the IBTS bottom trawl surveys in the North Se were explored for the potential of a length-based assessment, but they do not show consistent signal to allow the tracking of cohorts through this stock.
4. Catches increased from an average 18,000 t during the period 1982-1997 to over 48,000 t in 2000. In 2004, catches were 35,150 t, which was 3,000 t more

2005 % EU Quota Allocations



than in 2003. While Irish catches were significant in the late nineties (over 8,000 t) they have reduced to almost zero catches in 2004.

5. Large Norwegian catches in IVa (estimated at 10,000 t) were included in the western catches.
6. The major part of the increased catches was taken in Division IVIId in quarters 1 and 4, which is adjacent to the boundary of the western stock. It is also adjacent to an area where juveniles of the western horse mackerel stock are found.
7. Catch at age data show that the proportion of young fish has increased since 2000. This can be partly explained by a change of abundance and partly by a change in the fishery. In previous years catches were mainly taken as by-catch from the small mesh industrial fishery, but recently a large proportion of the catch has been taken in a directed fishery for human consumption, which favours small fish for the Japanese market.
8. The horse mackerel fishery creates by-catches of juvenile and adult mackerel.

ICES ADVICE
1.4.21

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Unknown	Unknown	Unknown	No assessment available, due to limited data.

The available information is inadequate to evaluate spawning stock or fishing mortality relative to risk, so the state of the stock is unknown. Catches increased rapidly in late 1990s and have remained high since.

Management objectives

No explicit management objectives have been established for this stock.

Reference points

Not available.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

ICES reiterates the recommendation made in 2004 to limit the catches to below the 1982-1997 average of 18 000 t, in order to constrain the fishery until there is more information about the structure of horse mackerel stocks, and sufficient information to show that higher exploitation rates are sustainable.

Short-term implications

No forecast can be made for this stock.

Management considerations

ICES advised in 1999 to constrain an expansion of the fishery until there was a scientific basis for advice, because high catch rates can be maintained in pelagic fisheries even when the stock is in decline.

North Sea horse mackerel migrate to areas where they mix with the western horse mackerel stock. The present agreed TAC is for the North Sea and Division IIa, and these areas do not correspond to the distribution area of the stock. The TAC should apply only to those areas where the North Sea horse mackerel are fished, i.e. Divisions IIIa, IVb,c and VIId.

The allocation of catches to the different horse mackerel stocks is based on the temporal and spatial distribution of the fishery. It is therefore important that catches be reported by ICES rectangle and by quarter.

The points listed below should be taken into account when considering management options for the North Sea horse mackerel:

1) The stock units are incompatible with the management units.
2) Catches have increased during the last decade. The major part of the increased catches is taken in Division VIId in quarters 1 and 4, which is adjacent to the boundary of the western stock. It is also adjacent to an area where juveniles of the western horse mackerel stock are found.
3) Recent catches are above the advised TACs of 18 000 t. The average annual catch in the period 1995-2004 was 31 000 t.
4) There is a bycatch of mackerel in the horse mackerel fishery.

Factors affecting the fisheries and the stock

Changes in fishing technology and fishing patterns

In earlier years, the majority of the catch was taken as bycatch in the small-mesh industrial fishery. In recent years, most of the catch has come from a directed fishery for human consumption, mainly in Division VIId. This has led to a change in the age composition of the landings with a higher proportion of younger age groups.

Scientific basis

Data and methods

The stock cannot be assessed because sampling is insufficient and fishery-independent indices of abundance are lacking.

Eggs surveys for horse mackerel were carried out during the 1988-1991 period. New information indicates that horse mackerel is probably an indeterminate spawner. Therefore, it is not possible currently to provide a realistic estimate of the spawning biomass. The mackerel egg surveys in the North Sea do not cover the spawning area of horse mackerel.

Comparison with previous assessment and advice

There is no assessment on which to base the status of this stock. The current advice reiterates last year's advice based on average catches observed between 1982 and 1997.

Source of information

Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, September 2005 (ICES CM 2006/ ACFM:08).

Year	ICES Advice	Predicted catch corresp. To advice	Agreed TAC[1]	ACFM landings[2]
1987	Not assessed	-	30	12
1988	No advice	-	50	24
1989	No advice	-	45	33
1990	No advice	-	40	19
1991	No advice	-	45	12
1992	No advice	-	55	15
1993	No advice	-	60	14
1994	No advice	-	60	6
1995	No advice	-	60	17
1996	No advice	-	60	19
1997	No advice	-	60	20
1998	Develop and implement management plan	-	60	31
1999	Develop and implement management plan	-	60	37
2000	Develop and implement management plan	-	51	48
2001	No increase in catch	-	51	46
2002	No increase in catch from 1982-1997 average	<18	58	23
2003	No increase in catch from 1982-1997 average	<18	50	32
2004	No increase in catch from 1982-1997	<18	42	35
2005	No increase in catch from 1982-1997	<18	43	
2006	No increase in catch from 1982-1997	<18		

[1]Division IIa and Subarea IV (EU waters only). [2]Catch of North Sea stock (Divisions IIIaE, IVb,c & VIId). Weights in '000 t.

Table 1.4.21.1 Landings and discards of HORSE MACKEREL (t) by year and Division, for the North Sea, Western, and Southern horse mackerel. (Data submitted by Working Group members.)

Year	IIIa	IVa	IVb,c	Discards	VIId	**North Sea Stock**	IIa	IIIa	IVa	VIa,b	VIIa-c,e-k	VIIIa,b,d,e	VIIIc	Disc	**Western Stock**	**Southern Stock** (IXa)	All stocks
1982	2,788[1]		-		1,247	4,035	-		-	6,283	32,231	3,073	19,610	-	61,197	39,726	104,958
1983	4,420[1]		-		3,600	8,020	412		-	24,881	36,926	2,643	25,580	-	90,442	48,733	147,195
1984	25,893[1]		-		3,585	29,478	23		94	31,716	38,782	2,510	23,119	500	96,744	23,178	149,400
1985	-		22,897		2,715	26,750	79		203	33,025	35,296	4,448	23,292	7,500	103,843	20,237	150,830
1986	-		19,496		4,756	24,648	214		776	20,343	72,761	3,071	40,334	8,500	145,999	31,159	201,806
1987	1,138		9,477		1,721	11,634	3,311		11,185	35,197	99,942	7,605	30,098	-	187,338	24,540	223,512
1988	396		18,290		3,120	23,671	6,818		42,174	45,842	81,978	7,548	26,629	3,740	214,729	29,763	268,163
1989	436		25,830		6,522	33,265	4,809		85,304[2]	34,870	131,218	11,516	27,170	1,150	296,037	29,231	358,533
1990	2,261		17,437		1,325	18,762	11,414	14,878	112,753[2]	20,794	182,580	21,120	25,182	9,930	398,645	24,023	441,430
1991	913		11,400		600	12,000	4,487	2,725	63,869[2]	34,415	196,926	25,693	23,733	5,440	357,288	21,778	391,066
1992			13,955	400	688	15,043	13,457	2,374	101,752	40,881	180,937	29,329	24,243	1,820	394,793	26,713	436,548
1993			3,895	930	8,792	13,617	3,168	850	134,908	53,782	204,318	27,519	25,483	8,600	458,628	31,945	504,190
1994			2,496	630	2,503	5,689	759	2,492	106,911	69,546	194,188	11,044	24,147	3,935	413,022	28,442	447,153
1995	112		7,948	30	8,666	16,756	13,133	128	90,527	83,486	320,102	1,175	27,534	2,046	538,131	25,147	580,034
1996	1,657		7,558	212	9,416	18,843	3,366		18,356	81,259	252,823	23,978	24,290	16,870	420,942	20,400	460,185
1997			14,078	10	5,452	19,540	2,617	2,037	65,073[3]	40,145	318,101	11,677	29,129	2,921	471,700	27,642	518,882
1998	3,693		10,530	83	16,194	30,500	2,540[4]		17,011	35,043	232,451	15,662	22,906	830	326,443	41,574	398,523
1999			9,335		27,889	37,224	2,557[5]	2,095	47,316	40,381	158,715	22,824	24,188		298,076	27,733	363,033
2000			25,954		22,471	48,425	1,169[6]	1,105	4,524	20,657	115,245	32,227	21,984		196,911	27,160	272,496
2001	85	69	8,157		38,114	46,356	60	72	11,456	24,636	100,676	54,293	20,828		212,090	24,911	283,357
2002			12,636	20	10,723	23,379	1,324	179	36,855	14,190	86,878	32,450	22,110	305	194,292	23,665	241,336
2003	48	623	10,309		21,098	32,078	24	1,974	21,272	23,254	101,948	21,732	19,979		190,183	19,570	241,831
2004	351		18,348		16,455	35,154	47		11,841	21,929	98,984	8,353	15,772	701	157,627	23,581	216,361

[1]Divisions IIIa and IVb,c combined

[2]Norwegian catches in IVb included in Western horse mackerel.

[3] Includes Norwegian catches in IVb (1,426 t).

[4]Includes 1,937 t from Vb.

[5]Includes 132 t from Vb.

[6]Includes 250 t from Vb.

Table 1.4.21.2 Landings (t) of HORSE MACKEREL in Subarea IV and Division IIIa by country. (Data submitted by Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	8	34	7	55	20	13	13	9	10
Denmark	199	3,576	1,612	1,590	23,730	22,495	18,652	7,290	20,323
Faroe Islands	260	-	-	-	-	-	-	-	-
France	292	421	567	366	827	298	231[2]	189[2]	784[2]
Germany, Fed.Rep.	+	139	30	52	+	+	-	3	153
Ireland	1,161	412	-	-	-	-	-	-	-
Netherlands	101	355	559	2,029[3]	824	160[3]	600[3]	850[4]	1,060[3]
Norway[2]	119	2,292	7	322	[3]	203	776	11,728[4]	34,425[4]
Poland	-	-	-	2	94	-	-	-	-
Sweden	-	-	-	-	-	-	2	-	-
UK (Engl. + Wales)	11	15	6	4	-	71	3	339	373
UK (Scotland)	-	-	-	-	3	998	531	487	5,749
USSR	-	-	-	-	489	-	-	-	-
Total	2,151	7,253	2,788	4,420	25,987	24,238	20,808	20,895	62,877

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Belgium	10	13	-	+	74	57	51	28	-
Denmark	23,329	20,605	6,982	7,755	6,120	3,921	2,432	1,433	648
Estonia	-	-	-	293	-		17	-	-
Faroe Islands	-	942	340	-	360	275	-	-	296
France	248	220	174	162	302		-	-	-
Germany, Fed.Rep.	506	2,469[5]	5,995	2,801	1,570	1,014	1,600	7	7,603
Ireland	-	687	2,657	2,600	4,086	415	220	1,100	8,152
Netherlands	14,172	1,970	3,852	3,000	2,470	1,329	5,285	6,205	37,778
Norway	84,161	117,903	50,000	96,000	126,800	94,000	84,747	14,639	45,314
Poland	-	-	-	-	-	-	-	-	-
Sweden	-	102	953	800	697	2,087	-	95	232
UK (Engl. + Wales)	10	10	132	4	115	389	478	40	242
UK (N. Ireland)	-	-	350	-	-		-	-	-
UK (Scotland)	2,093	458	7,309	996	1,059	7,582	3,650	2,442	10,511
USSR / Russia (1992 -)	-	-	-						
Unallocated + discards	12,482[4]	-317[4]	-750[4]	-278[6]	-3,270	1,511	-28	136	-31,615
Total	112,047	145,062	77,904	114,133	140,383	112,580	98,452	26,125	79,161

Country	1998	1999	2000	2001	2002	2003[1]	2004
Belgium	19	21	19	19	1,004	5	4
Denmark	2,048	8,006	4,409	2,288	1,393	3,774	8738
Estonia	22	-	-				
Faroe Islands	28	908	24	-	699	809	
France	379	60	49	48	-	392	2532
Germany	4,620	4,071	3,115	230	2,671	3,048	4912
Ireland	-	404	103	375	72	93	1
Netherlands	3,811	3,610	3,382	4,685	6,612	17,354	26301
Norway	13,129	44,344	1,246	7,948	35,368	20,493	
Russia	-	-	2	-	-		
Sweden	3,411	1,957	1,141	119	575	1,074	97
UK (Engl. + Wales)	2	11	15	317	1,191	1,192	5634
UK (Scotland)	3,041	1,658	3,465	3,161	255	1	2
Unallocated + discards	737	-325	14613	649	-149	-14,009	-13068
Total	31,247	64,725	31583	19,839	49,691	34,226	35154

[1]-Preliminary. [2] Includes Division IIa. [3] Estimated from biological sampling. [4] Assumed to be misreported.
[5] Includes 13 t from the German Democratic Republic. [6] Includes a negative unallocated catch of -4,000 t.

Blue Whiting Combined Stock

(Sub-areas I-IX, XII and XIV)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

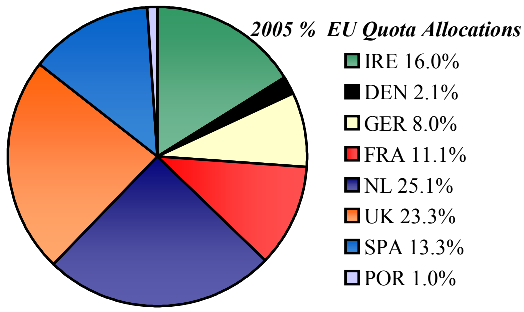
FSS agree with ICES and STECF advice that fishing within the limits of the management plan (F = 0.32) implies catches of less than 1.5 million tonnes in 2006. This will also result in a high probability than the SSB in 2007 will be above B_{pa}. FSS further agree with the ICES advice that current fishing mortality is too high and should be reduced.

FSS point out that the agreed TAC for 2006 is not consistent with the Precautionary Approach.

ICES advises that the primary means to reduce the catch of juveniles is to reduce overall exploitation, and if this cannot be achieved then measures to protect juveniles need to be taken. However FSS continues to advise that additional measures to protect juvenile blue whiting also be taken.

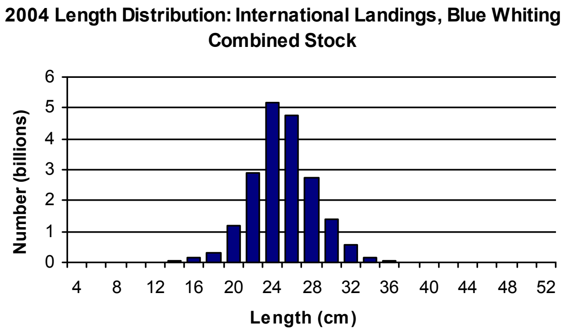
CURRENT MANAGEMENT

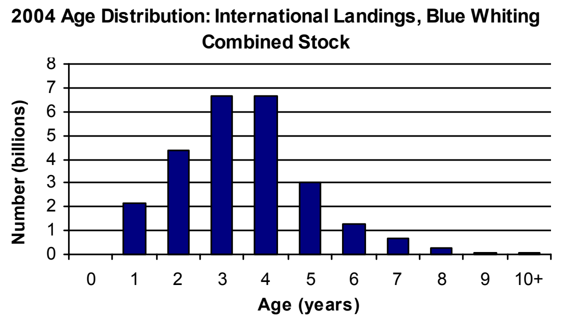
- There is no TAC that is applied to the total fishery for this stock. However, there is a draft management plan that has not been implemented.
- The EU, Faeroe Islands, Iceland and Norway agreed in 2001 to implement a long term management plan for the fisheries. This is aimed at maintaining the stock within safe biological limits. The plan, outlined in the ICES summary sheet below, is aimed at preventing the stock falling below $\mathbf{B_{lim}}$ (1.5 million tonnes) and permitting catches in 2003 and subsequent years that would generate a fishing mortality less than 0.32. If the stock should fall below $\mathbf{B_{pa}}$ (2.25 million tonnes) then the fishing mortality rate should be adjusted accordingly.
- Ireland has a share (8.65%) of the EU quota. In 2005, the Irish quota was 75,893 t.
- In 2005, the coastal states (EU, Norway, Iceland and Faeroe Islands) agreed a sharing arrangement for the blue whiting stock. This arrangement provides for catches in 2006 of 2 million tonnes, allocated as follows: EU 30.5%, Faeroe Islands 26.125%, Norway 25.745% and Iceland 17.63%. Russia will be accommodated by transfers from some of the coastal states and additional catches in the NEAFC regulatory area.

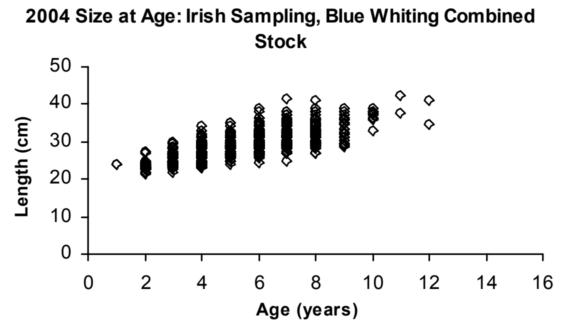


ADDITIONAL INFORMATION

1. The assessment for this stock is problematic. There are conflicting signals in the survey and catch at age data. Models relying more on survey data give higher estimates of SSB in recent years.
2. Based on the most recent estimates of fishing mortality and SSB, ICES classifies the stock as having full reproductive capacity, but being harvested unsustainably.
3. The catches in 2004 were over 2.4 million tonnes the highest in the series. In 2005, estimated landings have been about 2 million tonnes. The reduced catch in 2005 has been attributed to increased fuel prices and/or reduced abundance.
4. Current SSB is estimated to be about 5.1 million tonnes which is above the $\mathbf{B_{pa}}$ of 2.25 million tonnes.
5. The fishing mortality has increased dramatically since the late 1990s. Fishing mortality is estimated to be = 0.57. ICES considers the current exploitation rate is not sustainable, with a high probability that F is close to $\mathbf{F_{lim}}$. The current precautionary reference points may not be appropriate because the current assessment suggests that the stock has been at a higher level in the historic period than previously thought. The maximum fishing mortality which would be in accordance with precautionary limits $\mathbf{F_{pa}}$ = 0.32.
6. A number of very strong year classes have recruited to the stock in recent years – particularly those of 1997, 1998, 2000 and 2001. A few recent year classes support the fishery. The stock could not sustain the current high catches if the recruitment returns to lower levels.
7. Area misreporting may be a problem in this fishery. Catches taken by some countries within the EU zone are believed to be reported as having been taken outside the zone.
8. There have been increased proportions of juveniles in the catches. There is more fishing in the northern areas, where juveniles predominate.







ICES ADVICE
1.4.4

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
full reproductive capacity	harvested unsustainably	

Based on the most recent estimates of fishing mortality and SSB, ICES classifies the stock as having full reproductive capacity, but being harvested unsustainably. SSB has increased to a historical high in 2003 but has decreased in 2004 and 2005. Although the estimates of SSB and fishing mortality are uncertain, the estimate of SSB appears to be well above B_{pa}. The estimated fishing mortality is well above $\mathbf{F_{pa}}$, and is estimated to have exceeded $\mathbf{F_{lim}}$ in 2004. Recruitment in the last decade appears to be at a much higher level than earlier, and the good recruitment appears to have continued in 2004.

Management objectives

In 2002 the EU, Faroe Islands, Iceland, and Norway agreed a long-term management plan for the fisheries of the blue whiting stock aimed at constraining the harvest within safe biological limits and designed to provide for sustainable fisheries and a greater potential yield. The plan consisted of the following:

1. *Every effort shall be made to prevent the stock from falling below the minimum level of Spawning Stock Biomass (SSB) of 1 500 000 tonnes.*
2. *For 2003 and subsequent years, the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality less than 0.32 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of the fishing mortality rate.*
3. *Should the SSB fall below a reference point of 2 250 000 tonnes ($\mathbf{B_{pa}}$) the fishing mortality rate, referred to under paragraph 1, shall be adapted in the light of scientific estimates of the conditions then prevailing. Such an adaptation shall ensure a safe and rapid recovery of the SSB to a level in excess of 2 250 000 tonnes.*
4. *In order to enhance the potential yield, the Parties shall implement appropriate measures, which will reduce catches of juvenile blue whiting.*
5. *The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.*

The management plan as a whole has not been implemented, because it has not been agreed between all countries participating in the fishery. The combined total of the catches exceed the provisions of the agreed management plans.

ICES has not evaluated the management plan in relation to the precautionary approach.

Reference points

(established in 1998)

	ICES considers that:	**ICES proposed that:**
Limit reference points	$\mathbf{B_{lim}}$ is 1.5 mill t	$\mathbf{B_{pa}}$ be set at 2.25 million t
	$\mathbf{F_{lim}}$ is 0.51	$\mathbf{F_{pa}}$ be set at 0.32
Target reference points		$\mathbf{F_y}$ is not identified

Yield and spawning biomass per Recruit F-reference points:

	Fish Mort Ages 3-7	Yield/R	SSB/R
Average Current	0.57	0.053	0.11
F_{max}	undefined		
$F_{0.1}$	0.28	0.050	0.18

Technical basis:

B_{lim}: B_{loss}	**B_{pa}: B_{lim}** exp(1.645*σ) σ=0.25
F_{lim}: F_{loss}	**F_{pa}: F_{med}** (1998)
	F_y:

Single stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

Fishing within the limits of the management plan (F=0.32) implies catches of less than 1.5 million t in 2006. This will also result in a high probability that the spawning stock biomass in 2007 will be above B_{pa}. The present fishing level is well above levels defined by the management plan and should be reduced. The management plan point 4 calls for a reduction of the catch of juvenile blue whiting which has not been taken place. The primarily approach to reduce catch of juveniles is to reduce overall fishing mortality. Catches of juveniles in the last 4 years are much greater than in earlier periods. If an overall reduction of fishing mortality cannot be achieved then specific measures should be taken to protect juveniles.

Exploitation boundaries in relation to precautionary limits

Exploitation boundaries in relation to precautionary limits are the same as the exploitation boundaries in relation to the existing management plan.

Short term implications

Catch forecast for 2006:

The fishing mortality applied according to the agreed management plan (F(management plan)) is 0.32
The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.32

Outlook for 2006:

Basis: Catch(2005) =2 Mt (Catch constraint, best estimate); F(2005) = 0.47; SSB(2005) = 5.0 Mt

Rationale	Catch (2006)[1]	Basis	F (2006)	SSB (2006)	SSB (2007)	%SSB change [1)]	% TAC change [2)]
Zero catch	0	F=0	0	5.5	7.1	29	
Target reference point		F_{target} or B_{target}					
Status quo	2.4	F_{sq}	0.57	4.9	4.4	-10	
Agreed management plan	0.2	F(man. plan) * 0.1	0.03	5.5	6.9	26	
	0.4	F(man. plan) * 0.25	0.08	5.4	6.6	22	
	0.8	F(man. plan) * 0.50	0.16	5.3	6.2	16	
	1.1	F(man. plan) * 0.75	0.24	5.2	5.8	10	
	1.3	F(man. plan) * 0.90	0.29	5.2	5.6	7	
	1.5	F(man. plan)	0.32	5.2	5.4	5	
	1.6	F(man. plan) * 1.1	0.35	5.1	5.3	3	
	1.8	F(man. plan) * 1.25	0.40	5.1	5.1	0	

Management considerations

Total landings in 2004 were 2.4 mill t, almost the same as in 2003. Recent large landings are supported by the current high recruitments, and are much higher than in earlier years. Most of the catches are taken in the spawning- and post spawning areas along the continental edge, and in the Norwegian Sea. In the latter, the share of the total catch has increased from 5% in the mid nineties to about 40% in 2003 and 2004. A larger proportion of the catch there consists of young fish. As a result, the age structure in the stock has changed considerably, and the stock now largely misses fish older than 6 years.

The fishing effort is much above what the stock can sustain if it returns to a lower recruitment regime. Now only a few year-classes support the fishery and the spawning biomass, which makes the stock very vulnerable to overfishing. In this respect, there is an urgent need for the implementation of the agreed management plan, a reduction of fishing effort and a close monitoring of the stock. Immediate management action is required if smaller recruitments occur.

Factors affecting the fisheries and the stock

In 2002 to 2004, and in the absence of agreements on TACs and their allocation, the Coastal States (EU, Faeroe Islands, Iceland and Norway) and the Russian Federation implemented unilateral measures to limit blue whiting catches. TACs were set by EU, Norway and Iceland. During 2003, EU increased its TAC for international waters by 250 000 t and during 2004 by 350 000 t applicable to all areas. The fisheries by Russia and Faeroe Islands were not restricted by TACs.

Changes in fishing technology and fishing patterns

The fishing effort has increased substantially in the last 10 years, as did the catches. There has been a change in the fishing pattern with an increased proportion of juveniles in the catches and with a more northerly distribution of the fishery, where juveniles dominate.

Scientific basis

Data and methods

For blue whiting 4 assessment models were used to explore the data, and the results for all these approaches were similar in general. All models utilized catch at age data from commercial catches from 1981 onwards. Different survey time series were available (1990-2005), but still none of the surveys covers the entire distribution area of the stock.

The exploration revealed a conflict between catch data and survey data. Models relying more on surveys estimated a larger spawning stock in recent years. This conflict in the data could not be resolved by the use of any of the models and leads to an additional source of uncertainty.

All four models make assumptions about selection pattern which may not be fully valid as the description of the fishery indicates substantial changes in the fishing pattern in the last 15 years. Within these assumptions the finally chosen model (AMCI model) allows for limited deviations from constant exploitation pattern.

This year a number of recruitment indices were analysed, and the conclusion was that reasonable estimates could be obtained for the most recent year classes (2003 and 2004 year class). However, none of the recruitment surveys covers the entire distribution area. For the final assessment, data from spawning ground surveys were used for 1990-2005, and from juvenile area surveys since 2000.

Information from the fishing industry

Information from the fishing industry suggests that catches in 2005 are about 20% lower than in 2003 and 2004. There are indications that the reduced catch is caused by a reduced availability of blue whiting (i.e. denser but smaller schools), and/or by economic factors such as an increase in fuel prices.

Uncertainties in assessment and forecast

Conflicting signals in the catch and survey data influence the models in ways that could not be resolved. The assessment of blue whiting has been very uncertain in recent years with upward revisions of the historic perception of the stock size with every new assessment (Figure 1.4.4.1). This trend has been driven by exceptionally good recruitment compared to the earlier period, while at the same time little fishery independent information has been available on the recruitment. However, the quality of the assessment and recruitment estimates have been improved in this year, mostly due a longer recruitment survey time series, which could be used for the first time this year.

The uncertainty in the assessment conditional on the assessment model used this year (AMCI) is illustrated in Figure 1.4.4.2. It indicates interdependence of F and SSB and their variance estimated in bootstrap replicates.

Limited information was available on discarding. This was not included in the assessment but it is not believed to impact the assessment.

Environment conditions

Comparison with previous assessment and advice

The present assessment resulted - as in a few previous years - in a marked upward revision of the SSB.

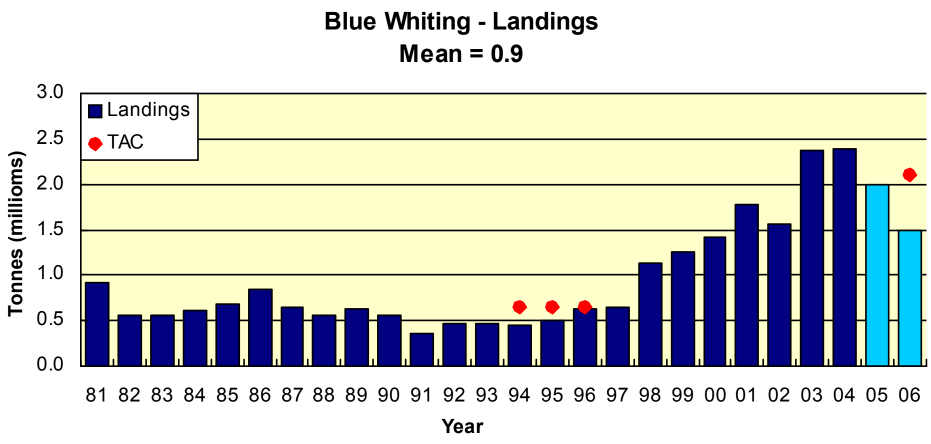
Last year the advice was to limit catches to 1.1 Mt in order to achieve a fishing mortality of less than $\mathbf{F}_{pa}$=0.32. This year the advice is on a similar basis and corresponds to predicted landings of 1.5 Mt. The increase in predicted landings is due to the continued high recruitment in recent years.

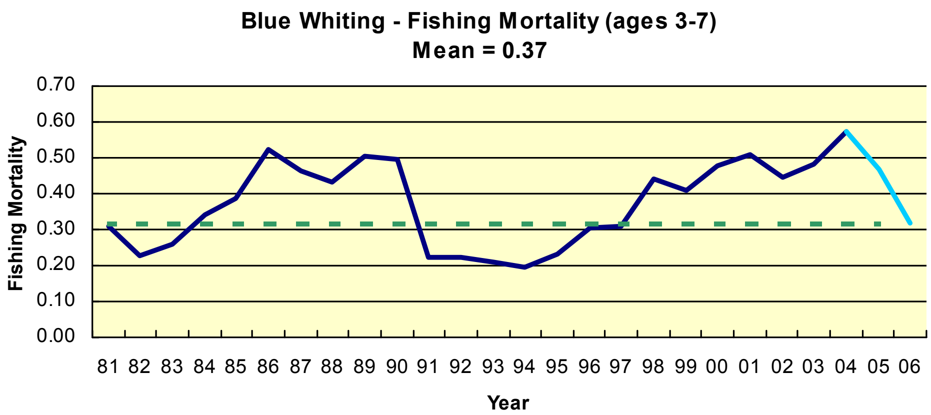
Source of information

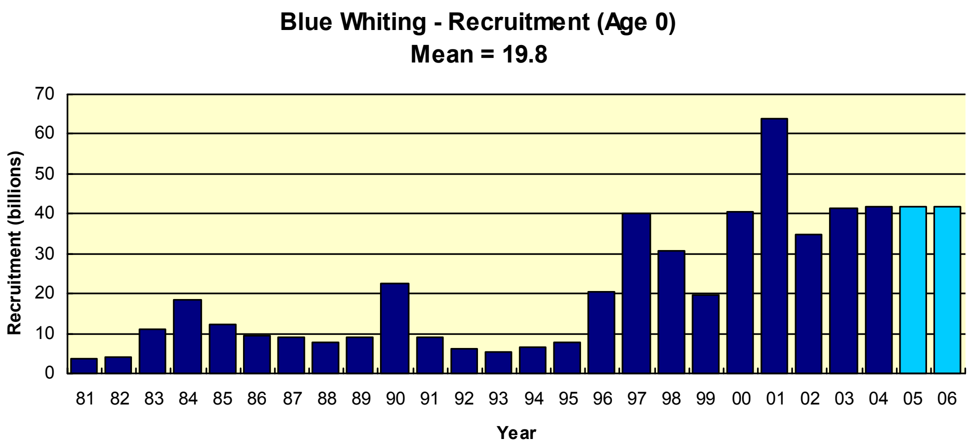
Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, 25 August – 1 September 2005 (ICES CM 2006/ACFM:05)

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM catch
1987	TAC for northern areas; no advice for southern areas	950	-	665
1988	TAC for northern areas; no advice for southern areas	832	-	558
1989	TAC for northern areas; no advice for southern areas	630	-	627
1990	TAC for northern areas; no advice for southern areas	600	-	562
1991	TAC for northern areas; no advice for southern areas	670	-	370
1992	No advice	-	-	475
1993	Catch at *status quo* F (northern areas); no assessment for southern areas	490	-	481
1994	Precautionary TAC (northern areas); no assessment for southern areas	485	650[1]	459
1995	Precautionary TAC for combined stock	518	650[1]	579
1996	Precautionary TAC for combined stock	500	650[1]	646
1997	Precautionary TAC for combined stock	540		672
1998	Precautionary TAC for combined stock	650		1125
1999	Catches above 650 000 t may not be sustainable in the long run	650		1256
2000	F should not exceed the proposed $\mathbf{F}_{pa}$	800		1412
2001	F should not exceed the proposed $\mathbf{F}_{pa}$	628		1780
2002	Rebuilding plan	0		1556
2003	F should be less than the proposed $\mathbf{F}_{pa}$	600		2321
2004	Achieve 50% probability that F will be less than $\mathbf{F}_{pa}$	925		2378
2005	Achieve 50% probability that F will be less than $\mathbf{F}_{pa}$	1075		
2006	F = F management plan	1500		

[1]NEAFC proposal for NEAFC regions 1 and 2. Weights in '000 t


Blue Whiting - Landings
Mean = 0.9
Landings
TAC
Tonnes (millioms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06
Year


Blue Whiting - Fishing Mortality (ages 3-7)
Mean = 0.37
Fishing Mortality
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06
Year


Blue Whiting - Recruitment (Age 0)
Mean = 19.8
Recruitment (billions)
70
60
50
40
30
20
10
0
81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06
Year

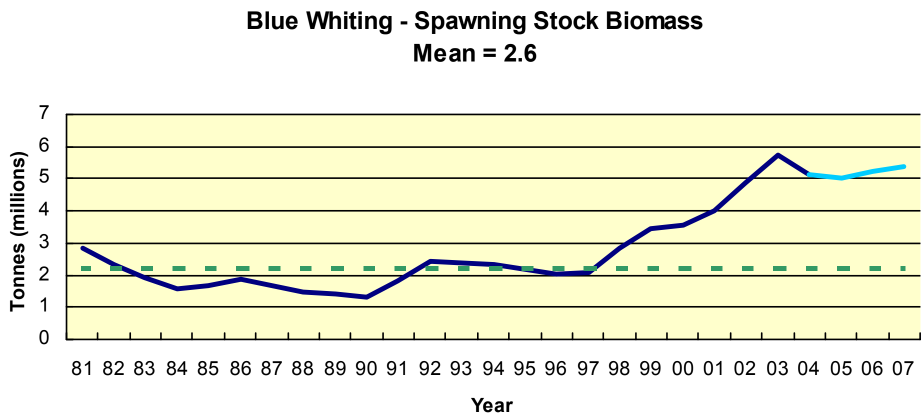

Blue Whiting - Spawning Stock Biomass
Mean = 2.6
Tonnes (millions)
7
6
5
4
3
2
1
0
81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07
Year

Table 1.4.4.1 Landings (tonnes) of BLUE WHITING from the directed fisheries (Sub-areas I and II, Division Va, XIVa and XIVb) 1987–2004, as estimated by the Working Group.

Country	1987	1988	1989 [3)]	1990	1991	1992	1993	1994 [2)]	1995 [3)]	1996	1997	1998	1999	2000	2001	2002	2003	2004
Denmark	-	-	-	-	-	-	-	-	-	-	-	-	15	7,721	5,723	13,608	38,226	23,437
Estonia	-	-	-	-	-	-	-	-	-	377	161	904	-	-	-	-	-	
Faroes	9,290	-	1,047	-	-	-	-	-	-	345	-	44,594	11,507	17,980	64,496	82,977	115,755	109,380
Germany	1,010	3	1,341	-	-	-	-	2	3	32	-	78	-	-	3117	1,072	813	488
Greenland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Iceland	-	-	4,977	-	-	-	-	-	369	302	10,464	68,681 [4)]	96,295	155,024	245,814	195,483	312,334	322,247
Latvia	-	-	-	-	-	-	-	422	-	-	-	-	-	-	-	-		
Netherlands	-	-	-	-	-	-	-	-	72	25	-	63	435	-	5180	906	592	1,365
Norway [5)]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64,581	100,922	215,075	302,166
Norway [6)]	-	-	-	566	100	912	240	-	-	58	1,386	12,132	5,455	-	28,812	-	-	22167
Poland	56	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Scotland																		64
Sweden	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	850	57,206	15,794
USSR/ Russia [1)]	112,686	55,816	35,250	1,540	78,603	61,400	43,000	22,250	23,289	22,308	50,559	51,042	65,932	103,941	173,860	145,649	191,507	166,677
Total	123,042	55,829	42,615	2,106	78,703	62,312	43,240	22,674	23,733	23,447	62,570	177,494	179,639	284,666	591,583	541,467	931,508	963,785

[1]) From 1992 only Russia

[2]) Includes Vb for Russia.

[3]) Icelandic mixed fishery in Va.

[4]) include mixed in Va and directed in Vb.

[5)] Directed fishery

[6)] By-catches of blue whiting in other fisheries.

Table 1.4.4.2 Landings (tonnes) of BLUE WHITING from directed fisheries (Division Vb,VIa,b, VIIa,b,c and Sub-area XII) 1987–2004, as estimated by the Working Group.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 [1]	1999	2000	2001	2002	2003	2004
Denmark	2,655	797	25	-	-	3,167	-	770	-	269	-	5051	19,625	11,856	18,110	2,141	17,813	44,992
Estonia	-	-	-	-	-	6,156	1,033	4,342	7754	10,605	5,517	5,416	-	-	-	-	-	[4]
Faroes	70,625	79,339	70,711	43,405	10,208	12,731	14,984	22,548	26,009	18,258	22,480	26,328	93,234	129,969	188,464	115,127	208,427	206,078
France	-	-	2,190	-	-	-	1,195	-	720	6,442	12,446	7,984	6,662	13,481	13,480	14,688	13,365	-
Germany	3,850	5,263	4,073	1,699	349	1,307	91	-	6,310	6,844	4,724	17,891	3,170	12,655	15,862	15,378	21,866	13,813
Iceland	-	-	-	-	-	-	-	-	-	-	-	-	64,135	105,833	119,287	91,853	189,159	99,832
Ireland	3,706	4,646	2,014	-	-	781	-	3	222	1,709	25,785	45635	35,240	25,200	29,854	17,723	22,484	62,730
Japan	-	-	-	-	-	918	1,742	2,574	-	-	-	-	-	-	-	-	-	-
Latvia	-	-	-	-	-	10,742	10,626	2,160	-	-	-	-	-	-	-	-	-	-
Lithauen	-	-	-	-	-	-	2,046	-	-	-	-	-	-	-	-	-	-	-
Netherlands [2])	5,627	800	2,078	7,280	17,359	11,034	18,436	21,076	26,703	17,644	23,676	27,884	35,408	46,128	68,415	33,365	45,239	82,520
Norway	191,012	208,416	258,386	281,036	114,866	148,733	198,916	226,235	261,272	337,434	318,531	519,622	475,004	460,274	399,932	385,495	502,320	486,843
UK (Scotland)	3,315	5,071	8,020	6,006	3,541	6,849	2,032	4,465	10,583	14,325	33,398	92,383	98,853	42,478	50,147	26,403	27,136	56,326
Sweden	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	-
USSR/ Russia [3])	165,497	121,705	127,682	124,069	72,623	115,600	96,000	94,531	83,931	64,547	68,097	79,000	112,247	141,257	141,549	144,419	163,812	179,400
Total	446,287	426,037	475,179	463,495	218,946	318,018	347,101	378,704	423,504	478,077	514,654	827,194	943,578	989,131	1,045,100	846,602	1,211,621	1,232,534

[1]) Including some directed fishery also in Division IVa.

[2]) Revised for the years 1987, 1988, 1989, 1992, 1995,1996,1997

[3]) From 1992 only Russia

[4]) Reported to the EU but not to the ICES WGNPBW. (Landings of 19,467 tonnes)

Table 1.4.4.3 Landings (tonnes) of BLUE WHITING from directed fisheries and by-catches caught in other fisheries (Divisions IIIa, IV) 1987–2004, as estimated by the Working Group.

Country	1987	1988	1989	1990	1991	1992	1993 [3)]	1994	1995	1996	1997	1998 [2)]	1999	2000	2001	2002	2003	2004
Denmark [4)]	28,541	18,144	3,632	10,972	5,961	4,438	25,003	5,108	4,848	29,137	9,552	40,143	36,492	30,360	21,995			
Denmark [5)]			22,973	16,080	9,577	26,751	16,050	14,578	7,591	22,695	16,718	16,329	8,521	7,749	7,505	35,530	26,896	21,071
Faroes [4) 6)]	7,051	492	3,325	5,281	355	705	1,522	1,794	-	6,068	6,066	-	-	-	60	7,317	5,712	6,864
Faroes [5) 6)]												296	265	42	6,741			
Germany [1)]	115	280	3	-	-	25	9	-	-	-	-			-	81	-	36	19
Ireland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4		4
Netherlands	-	-	-	20	-	2	46	-	-	-	793			-	-	50	0	0
Norway [4)]	24,969	24,898	42,956	29,336	22,644	31,977	12,333	3,408	78,565	57,458	27,394	28,814	48,338	73,006	21,804	85,062	117,145	107,311
Norway [5)]															58,182			
Russia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	69	-	-	
Scotland																		35
Sweden	2,013	1,229	3,062	1,503	1,000	2,058	2,867	3,675	13,000	4,000	4,568	9,299	12,993	3,319	2,086	17,689	8,326	3,289
UK	-	100	7	-	335	18	252	-	-	1	-	-	-	-	-	-	65	
Total	62,689	45,143	75,958	63,192	39,872	65,974	58,082	28,563	104,004	119,359	65,091	94,881	106,609	114,476	118,523	145,652	158,180	138,593

[1)] Including directed fishery also in Division IVa.

[2)] Including mixed industrial fishery in the Norwegian Sea

[3)] Imprecise estimates for Sweden: reported catch of 34265 t in 1993 is replaced by the mean of 1992 and 1994, i.e. 2,867 t, and used in the assessment.

[4)] Directed fishery

[5)] By-catches of blue whiting in other fisheries.

[6)] For the periode 1987-2000 landings figures also include landings from mixed fisheries in Division Vb.

Table 1.4.4.4 Landings (tonnes) of BLUE WHITING from the Southern areas (Sub-areas VIII and IX and Divisions VIIg-k and VIId,e) 1987–2004, as estimated by the Working Group.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Germany	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	600 [2)]	88 [2)]	973
Ireland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	98 [2)]	96 [2)]	12,659
Netherlands	-	-	-	450	10	-	-	-	-	-	-	10 [1)]	-	-	-	3208 [2)]	2471,8 [2)]	11,426
Norway	4	-	-	-	-	-	-	-	-	-	-			-	-	-	-	39197
Portugal	9,148	5,979	3,557	2,864	2,813	4,928	1,236	1,350	2,285	3,561	2,439	1,900	2,625	2,032	1,746	1,659	2,651	3,937
Russia																		685
Scotland																		603
Spain	23,644	24,847	30,108	29,490	29,180	23,794	31,020	28,118	25,379	21,538	27,683	27,490	23,777	22,622	23,218	17,506	13,825	15,612
UK	23	12	29	13	-	-	-	5	-	-	-	-	-	-	-	-	181	
France	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	784	
Total	32,819	30,838	33,695	32,817	32,003	28,722	32,256	29,473	27,664	25,099	30,122	29,400	26,402	24,654	24,964	23,071	20,097	85,093

1) Directed fisheries in VIIIa

2) Landings reported as Directed fisheries and included in the Catch-at-Age calculations of that fisheries

Table 1.4.4.5 Total landings of blue whiting by country and area for 2004 in tonnes. Landing figures provided by Working Group members and these figures may not be official catch statistics and therefore can not be used for management purposes.

Area	Denmark	Faroe Islands	France	Germany	Iceland	Ireland	Norway	Portugal	Russia	Scotland	Spain	Sweden	Netherlands	Grand Total
I							63							63
IIa	23,437	95,868		386	183,322		314,690		137,430	64		15,794	1,365	772,355
IIb				103	392		591		28,976					30,062
IIIa	4,274	53					383					2,730		7,440
IVa	16,368	6,627		19		4	106,344			35		532	0	129,929
IVb	429	184					584					27	0	1,224
IXa							0	3,937						3,937
Va		13,512			96,097		8,989							118,598
Vb	12,935	111,036		395	95,090	1,653	18,790		104,371	1,364			3,143	348,777
VIa	31,935	44,632		13,196		42,506	67,890			53,587			62,944	316,690
VIb					4,742		320,364		69,096					394,202
VIIa						0	0							0
VIIb				2		1,524	0			1,376			140	3,042
VIIc	122	47,247		220		15,538	69,616		871				16,293	149,906
VIIg						4	0							4
VIIIabd							0						131	131
VIIIc+IXa							0				15,612			15,612
VIIj				31		925	0			603			895	2,454
VIIk				942		11,730	39,197		685				10,400	62,955
XII		3,163				1,509	10,183		5,062					19,917
XIVb							0		271					271
Grand Total	89,500	322,322	[1)]	15,293	379,643	75,393	957,684	3,937	346,762	57,028	15,612	19,083	95,311	2,377,569

[1)] Reported to the EU but not to the ICES WGNPBW. (Landings of 19,467 tonnes)

Table 1.4.4.6 Blue whiting combined stock (Sub-areas I-IX, XII & XIV)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1981	3634925	2840186	922980	0.3102
1982	4074635	2340060	550643	0.2275
1983	10886489	1903785	553344	0.2608
1984	18346767	1548446	615569	0.3409
1985	12241432	1651896	678214	0.3858
1986	9473497	1855547	847145	0.5231
1987	8982703	1655472	654718	0.4617
1988	7684032	1469257	552264	0.4306
1989	8938635	1412695	630316	0.5067
1990	22336699	1335867	558128	0.4962
1991	9008614	1803269	364008	0.2213
1992	6160528	2437900	474592	0.2242
1993	5525903	2385790	475198	0.2096
1994	6505223	2354832	457696	0.1960
1995	7617300	2180177	505175	0.2331
1996	20406428	2019352	621104	0.3047
1997	40137767	2062619	639680	0.3104
1998	30806559	2827013	1131954	0.4408
1999	19527741	3434783	1261033	0.4093
2000	40592635	3562036	1412449	0.4773
2001	64009279	4005004	1771805	0.5093
2002	34671620	4881275	1556954	0.4460
2003	41366871	5729501	2365319	0.4834
2004	41950091	5113236	2383503	0.5725
Average	19786932	2617083	915991	0.3742

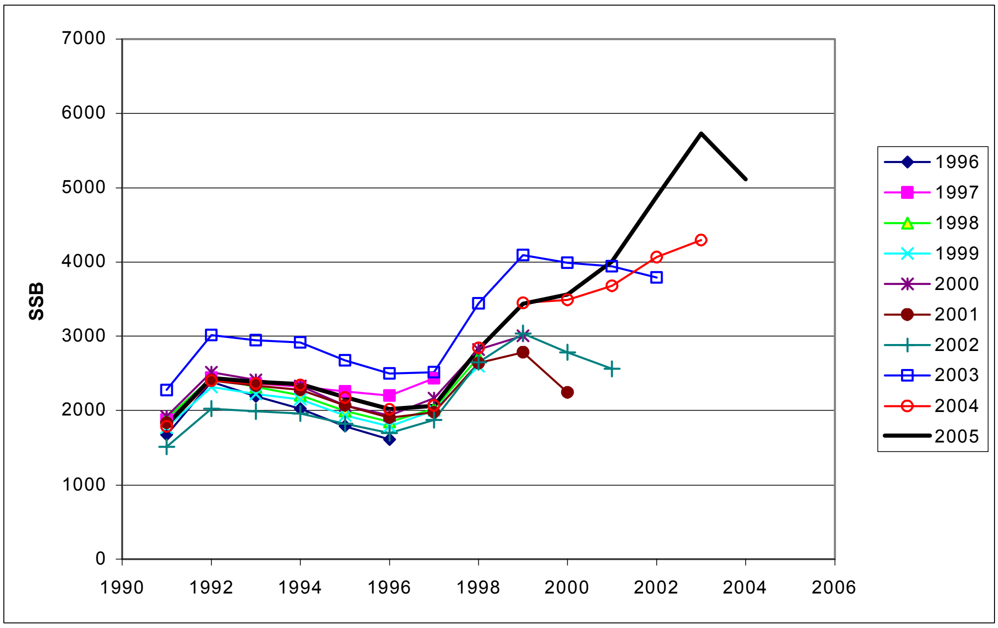


Figure 1.4.4.1 Estimates of SSB in historical assessments of the blue whiting stock (assessment year in the legend).

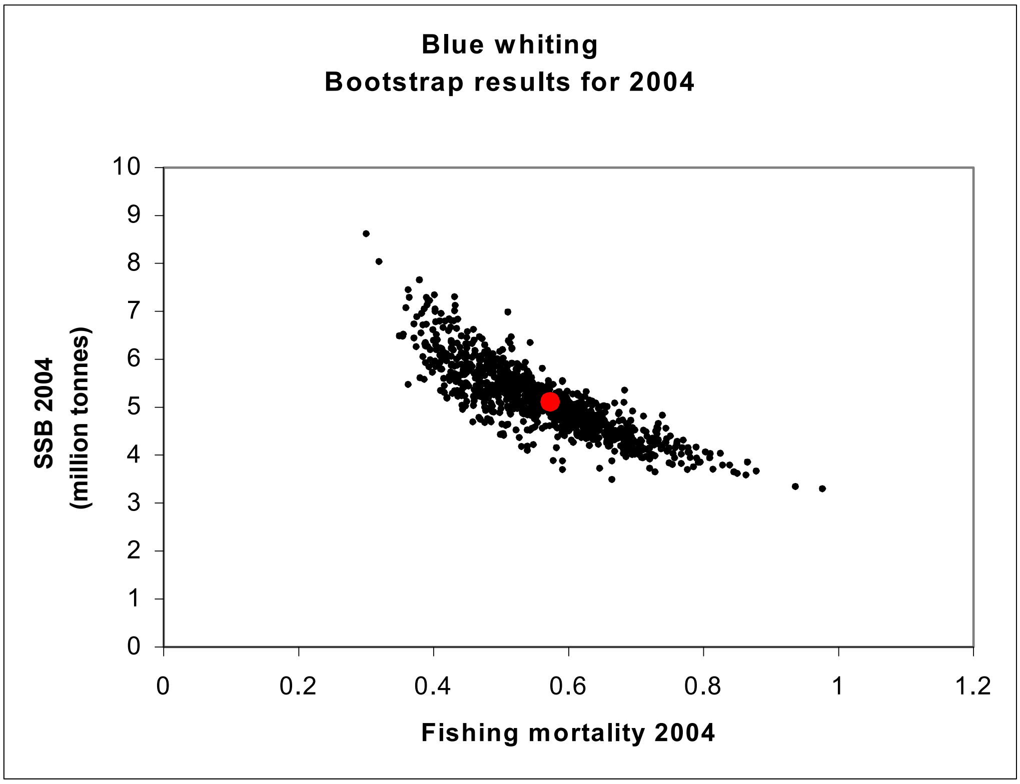


Figure 1.4.4.2 Interdependence between estimated SSB and fishing mortality in the terminal year in the AMCI bootstrap replicates.

Albacore Tuna - North Atlantic

Marine Institute
Foras na Mara

Fisheries Science Services

The Standing Committee on Research and Statistics (SCRS) of the International Commission for the Conservation of Atlantic Tunas (ICCAT) is responsible for the assessment of the albacore tuna stocks and provides management advice to ICCAT.

FSS – ADVICE

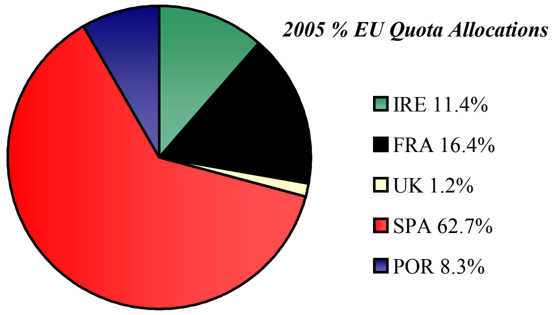
The only information updated on this stock is the landings and CPUE series. The catches are still well below the TAC and the CPUE data suggest a stable or declining trend. Based on the last assessment in 2000, FSS considers that SSB (in 2000) was below what would sustain maximum long-term yields. For this reason FSS advise that the catches in 2006 should not exceed 31,000 t.

North Atlantic Albacore TACs, Catches and Advice

Year	TAC	Catch	FSS Advice
2000	No TAC	33,754	
2001	34,500	25,186	
2002	34,500	22,465	
2003	34,500	25,516	
2004	34,500	25,459	
2005	34,500		Catches in 2005 not to exceed 31,000 t
2006	34,500		Catches in 2006 not to exceed 31,000 t

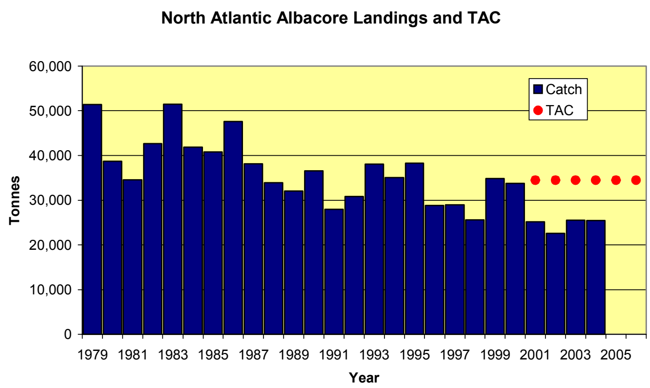
CURRENT MANAGEMENT

- The management area and the assessment area for North Atlantic albacore tuna cover the whole of the Atlantic, north of 5° N.
- In 2001 a TAC was agreed for the first time and set at 34,500 t and continues in subsequent years. Of this 28,712 t (83%) is subsequently allocated to the EU with Ireland receiving a quota of 3,158 t (11%).
- Fishing capacity is not permitted to exceed the average number of vessels prosecuting the fishery in the period 1993 to 1995.
- Since 2002 there has been a complete ban on the use of drift nets for albacore in EU waters.



ADDITIONAL INFORMATION

1. There has been no assessment on this stock since 2000, therefore the current state of the stock is uncertain.
2. Catches have declined from about 60,000 t in 1964 to 25,459 t in 2004.
3. There are large uncertainties in the catch at age data, which precluded an assessment being carried out in 2003, the next assessment is scheduled for 2007.
4. CPUE trends in the Bay of Biscay troll fisheries have declined since the mid 1980s. CPUE series in the western Atlantic are stable.
5. The Irish catch has declined from 3,464 t in 2000 to 175 t in 2004. This is mainly due to the ban of drift nets, the preferred gear for Irish vessels targeting tuna.
6. The main albacore tuna catching country is Spain (15,739 t), followed by Chinese Taipei (4,278 t), France (2,537 t), and Japan (1,169 t). The gear types used are trolling, long lines, bait boats and paired mid water trawls.



Bluefin Tuna

(East Atlantic and Mediterranean)

Marine Institute
Foras na Mara

Fisheries Science Services

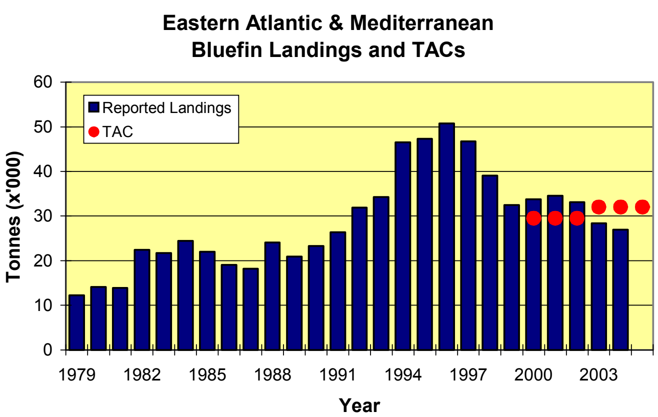
FSS – ADVICE

The only information updated on this stock is the landings and CPUE series. The landings data are considered unreliable in recent years. FSS advise that under current levels of recruitment, fishing mortality and fishing selectivity, catches over 26,000 t cannot be sustained in the long term. Based on the last assessment in 2002 FSS advise that this stock is still likely to be overexploited. FSS is concerned that recent substantial underreporting of catches gives a false impression of the potential for improved stock conditions.

Bluefin Tuna TACs, Catches and Advice 2000-2006

Year	TAC	Catch	FSS Advice
2003	32,000	28,205	
2004	32,000	29,961*	
2005	32,000		Catches greater than 26,000 t not sustainable in long term
2006	32,000		Catches greater than 26,000 t not sustainable in long term

** Reported landings for 2004 are incomplete and this figure is expected to rise.*



CURRENT MANAGEMENT

- The TAC is set at 32,000 t until 2006.
- The following minimum landing sizes apply:
  - There is a minimum landing size of 6.4 kg, with a 10% tolerance in number of individuals.
  - No landing, retaining onboard or selling of fish smaller than 3.5 kg is permitted in the East Atlantic
  - No landing, retaining onboard or selling of fish smaller than 4.8 kg is permitted in the Mediterranean.
- No longlining in the Mediterranean by vessels greater than 24m in length is permitted.
- No purse seining in the Mediterranean from 16th July to the 15th August in permitted.
- The use of drift nets for pelagic fisheries in the Mediterranean is forbidden.
- No increase of catch by large scale tuna longline vessels in the Atlantic north of 10°N and between 30°W and 45°W is allowed.

ADDITIONAL INFORMATION

1. The stock was last assessed in 2002, and suggested that F was well above $\mathbf{F_{msy}}$.
2. There are no recent estimates of recruitment.
3. Reported catches increased from about 14,000 t in 1971 to about 51,000 t in 1996. Recent reported catches (about 30,000 t) are considered to be underestimates.
4. Intense fishing pressure on small fish is contributing to growth over-fishing. Moreover the abrupt increase of catches of large fish since 1994 gives cause for concern.
5. Monitoring the removal rates of fish from the stock to fattening units is required.
6. The main countries catching East Atlantic and Mediterranean Blue fin tuna in 2004 were: France (7,030 t) Spain (5,154 t), Italy (4,686 t), Morocco (2,780 t), Japan (2,624 t).
7. Bluefin tuna caught by Irish vessels are taken as by-catch in directed fisheries for other pelagic species and accounted for by the EU by-catch quota. In the last four years a small number of fish have been caught each year by angling vessels.
8. The main gears used to catch bluefin tuna are purse seines, longlines, traps and bait boats.

North East Atlantic Basking Shark

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

FSS agree with the ICES advice, that given the perceived depleted stock status, a zero TAC be set for the whole distribution area of basking shark. Further, FSS advise that by-catch in mixed fisheries should be reduced to the lowest possible level.

CURRENT MANAGEMENT

- A zero TAC for EU member states in EU waters has been agreed (ICES Sub-areas IV, VI and VII Annex ID of Council Regulation 2555/2001). This regulation has been in effect since 2002.
- In the past, Norway had a quota in EU waters for basking shark livers, but the EU no longer provides for this entitlement.
- EC Regulation 1185/2003 prohibits the removal of shark fins and subsequent discarding of the body. This regulation is binding on EU vessels in all waters and non-EU vessels in Community waters. Because carcasses and fins can be landed separately in different locations, the effectiveness of this regulation is questionable.

ADDITIONAL INFORMATION

1. There is no information to evaluate stock status, but landings and anecdotal information suggest that the stock is severely depleted.
2. At present there are no directed fisheries for this species. Irish targeted fisheries ceased in the early 1980s. The species continues to be a by-catch and discard in several Irish fisheries. Discarding of basking sharks in several fisheries is known to occur and the discard mortality is high.
3. Since 2002, this species has been included in Appendix-II of the CITES convention, meaning that they may only be exported, re-exported or introduced from the high seas if a permit has been issued by the relevant national authorities. Such a permit may only be issued when the management authorities are satisfied that such trade will not be detrimental to the survival of the species.
4. UK legislation (Schedule 5 of the Wildlife and Countryside Act of 1981) specifies that no basking sharks can be caught within 12 miles of the coast and none landed even if caught outside territorial limits. They are also protected in UK (Isle of Man) waters. There is a proposal in November 2005 to include Basking shark in the Convention on Migratory Species in Appendix-II.
5. The currently high price of shark fins implies that the decline in landings are not market driven.
6. The Norwegian fleet targeting basking shark with harpoons no longer exists. At present, all catches reported by Norway are taken as by-catch in gill nets.
7. This species is vulnerable to mortality due to collisions with shipping.

ICES ADVICE
1.4.8

State of the stock

There is no information to evaluate stock status, but landings and anecdotal information suggest that the stock is severely depleted.

Management objectives

None have been suggested nor adopted.

Reference points

Not defined.

Single-stock exploitation boundaries

Given the perceived depleted stock status, ICES recommends a zero TAC for the whole distribution area of Basking shark.

Management considerations

At present there are no directed fisheries for this species.

Since 2002, this species has been included in Appendix-II of the CITES convention, meaning that they may only be exported, re-exported or introduced from the high seas if a permit has been issued by the relevant national authorities. Such a permit may only be issued when the management authorities are satisfied that such trade will not be detrimental to the survival of the species. UK legislation (Schedule 5 of the Wildlife and Countryside Act of 1981) specifies that no basking sharks can be caught within 12 miles of the coast and none landed even if caught outside territorial limits. They are also protected in UK (Isle of Man) waters. In Swedish waters the species is on the national Red List and therefore it is forbidden to fish or land the species. There is a proposal in November 2005 to include Basking shark in the Convention on Migratory Species in Appendix-II.

The currently high price of shark fins implies that the decline in landings is not market driven.

Ecosystem considerations

Factors affecting the fisheries and the stock

The Effects of Regulations

A zero TAC for EU member states in EU has been agreed (ICES Sub-areas IV, VI and VII Annex ID of Council Regulation 2555/2001). This regulation has been in effect since 2002.

In the past, Norway had a quota in EU waters for basking shark livers, but the EU no longer provides for this entitlement. Discarding of basking sharks in several fisheries is known to occur and the discard mortality is high.

EC Regulation 1185/2003 prohibits the removal of shark fins of Basking shark, and subsequent discarding of the body. This regulation is binding on EC vessels in all waters and non-EC vessels in Community waters. Because carcasses and fins can be landed separately in separate locations, the effectiveness of this regulation is questionable.

Changes in fishing technology and fishing patterns

The Norwegian fleet targeting basking shark with harpoons no longer exists. At present, all catches reported by Norway are taken as by-catch in gill nets.

Other factors

This species is vulnerable to mortality due to shipping.

Scientific basis

Data and methods

There is no assessment of this stock. The evaluation is based on landings data and anecdotal information.

Comparison with previous assessment and advice

ICES has never provided advice for this stock.

Source of information

Report of the Working Group on Elasmobranch Fishes 2005 (ICES CM 2005/ACFM:03).

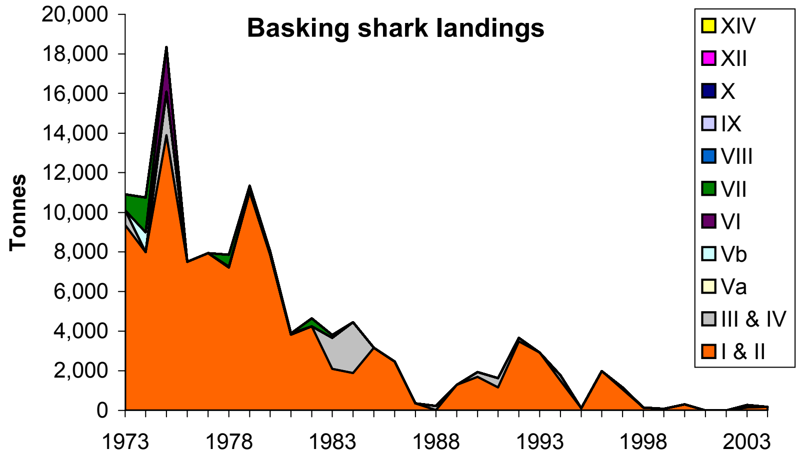
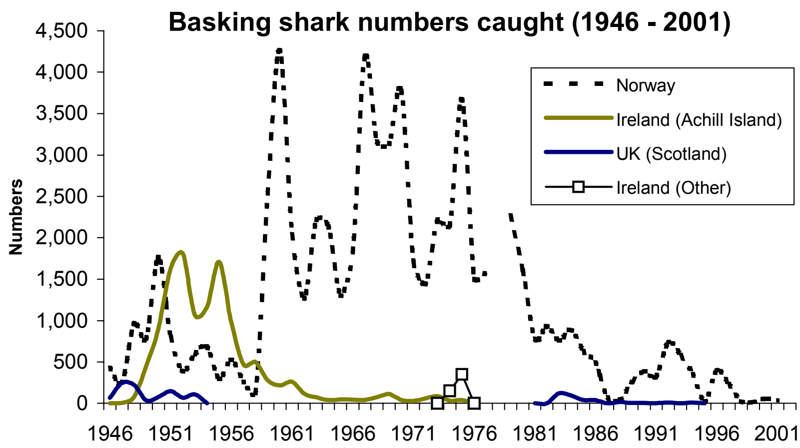


Figure 1.4.8.1 Landings of basking shark by subarea.



North East Atlantic Porbeagle

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

FSS agree with ICES that given the apparent depleted state of this stock, no fishery should be permitted. Further, FSS advise that by-catch in mixed fisheries should be reduced to the lowest possible level.

CURRENT MANAGEMENT

- EC Regulation 1185/2003 prohibits the removal of shark fins of this species, and subsequent discarding of the body. This regulation is binding on EC vessels in all waters and non-EC vessels in Community waters (see basking shark section).

ADDITIONAL INFORMATION

1. There is no information to evaluate stock status. The directed fishery for porbeagle stopped in the late 1970s due to very low catch rates. Sporadic small fisheries have occurred since that time.
2. The high market value of this species means that a directed fishery would develop again if abundance increased. There are no indications of stock recovery.
3. The species is a valuable by-catch in several Irish fisheries, caught in small numbers.
4. Porbeagle is a highly migratory and schooling species. Sporadic targeted fisheries develop on these schools and such fisheries are highly profitable.
5. High seas tuna fisheries may take porbeagle as a by-catch.
6. The productivity of the recently assessed NW Atlantic stock is likely to be similar to that of the NE Atlantic stock. Landings declined from over 8,000 t to about 500 t by the early 1970s. Landings of around 350 t in the 1970s and 1980s appeared sustainable and the stock recovered slowly. In the 1990s, landings increased to about 2,000 t annually, and the stock declined. It can be concluded that recovery time for the NE Atlantic stock is likely to be at least as long (>25 years), even if catches are at lowest possible level.
7. Landings data for porbeagle may be reported as porbeagle, as "various sharks nei" and as "Sharks, rays, skates, etc. nei" in the official statistics. This means that the landings reported as porbeagle is likely an underestimation of the total landing of porbeagle from the NE Atlantic. If fishing on this stock is continued, a minimum requirement would be to record catches by species.

ICES ADVICE
1.4.7

State of the stock

There is no information to evaluate stock status. The directed fishery for porbeagle stopped in the late 1970s due to very low catch rates. Sporadic small fisheries have occurred since that time. The high market value of this species means that a directed fishery would develop again if abundance increased. There are no indications of stock recovery.

Management objectives

None have been suggested nor adopted.

Reference points

Not defined.

Single-stock exploitation boundaries

Given the apparent depleted state of this stock, no fishery should be permitted on this stock.

Management considerations

Porbeagle is a highly migratory and schooling species. Sporadic targeted fisheries develop on these schools and such fisheries are highly profitable.

Porbeagle catches are often only recorded as sharks without further detail of the species. If fishing on this stock is continued, a minimum requirement would be to record catches by species.

Effort has increased in recent years in pelagic longline fisheries for bluefin tuna (Japan, Republic of Korea and Taiwan Province of China) in the North East Atlantic. These fisheries may take porbeagle as a by-catch. This fishery is likely to be efficient at catching considerable quantities of this species.

The productivity of the recently assessed NW Atlantic stock is likely to be similar to that of the NEA stock. Landings declined from over 8 000 t to about 500 t by the early 1970s. Landings of around 350 t in the 1970s and 1980s appeared sustainable and the stock recovered slowly. In the 1990s, landings increased to about 2 000 t annually, and the stock declined. It can be concluded that recovery time for the NE Atlantic stock is likely to be at least as long (>25 years), even if catches are at lowest possible level.

Factors affecting the fisheries and the stock

The Effects of Regulations

EC Regulation 1185/2003 prohibits the removal of shark fins of this species, and subsequent discarding of the body. This regulation is binding on EC vessels in all waters and non-EC vessels in Community waters. For further details see section on basking shark see section 1.4.8 *this volume*.

Scientific basis

Data and methods

Landing data for porbeagle may be reported as porbeagle, as "various sharks nei" and as "Sharks, rays, skates, etc. nei" in the official statistics. This means that the landings reported as porbeagle is likely an underestimation of the total landing of porbeagle from the NE Atlantic.

There is no fishery independent information on this stock.

Source of information

Report of the Working Group on Elasmobranch Fishes 2005 (ICES CM 2005/ACFM:03).

Table 1.4.7.1 Available landing data for porbeagle in ICES area. From Eurostat/ICES database. Must be considered an underestimate.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Channel Islands	15	14							1	+	2	2	2
Denmark	46	85	80	91	94	86	71	69	85	107	73	76	42
Faeroe Islands	14	7	20	76	48	44	7	9	7	10	13	8	10
France	551	300	496	633	820	565	267	315	219	318	410	368	461
Germany					22					+	17	1	3
Iceland	+	+	1	3	4	6	5	3	4	2	2	3	2
Ireland										8	1	6	3
Norway	44	32	42	24	25	27	28	17	28	33	22	17	19
Portugal	2	1									6	2	
Spain							31	124	679	1001	1184	1007	
Sweden	2	2	4	3	2	2	1	1	1	1	1	1	+
United Kingdom										6	6	10	7
Total	674	441	643	830	1015	730	410	538	1024	1486	1737	1501	549

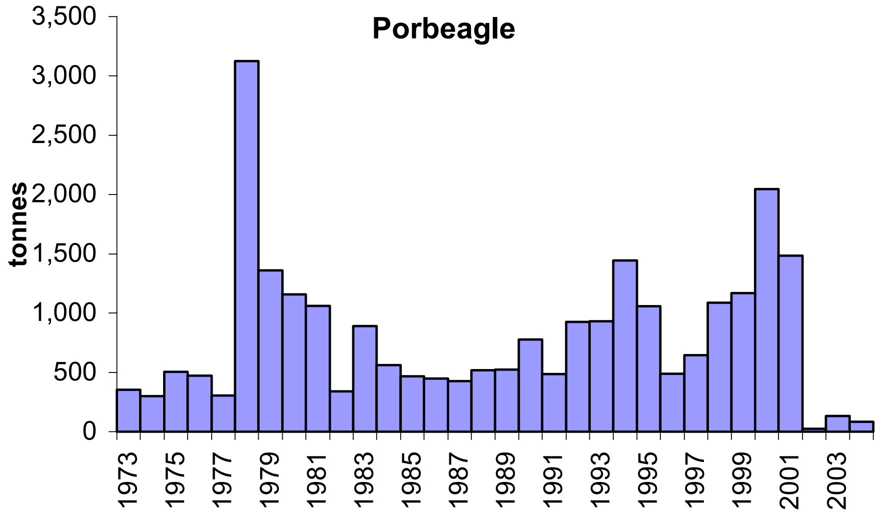


Figure 1.4.7.1 Available landings data for NEA porbeagle. It is not clear if data are complete for any year.

North East Atlantic Spurdog

For latest information, see: http://www.ices.dk

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

FSS agree with ICES advice that the stock is depleted and may be in danger of collapse. Target fisheries should not be permitted to continue, and by-catch in mixed fisheries should be reduced to the lowest possible level. A TAC should cover all areas where spurdog are caught in the northeast Atlantic. This TAC should be set at zero for 2006.

CURRENT MANAGEMENT

- There is no international agreement on a TAC that covers the distribution area of northeast Atlantic spurdog.
- A TAC has been introduced for the EU waters of Sub-area IV and Division IIa in 1999. This TAC has been reduced from 8,870 t to 1,136 t in 2005.
- Norway has a 70 cm maximum landing size to protect mature females, but it is not known if this is effective.

ADDITIONAL INFORMATION

1. The stock is depleted. All experimental assessments indicate that the stock is at a record low level. Frequency of occurrence of spurdog in trawl surveys has declined and although large shoals are still caught, the frequency of these has declined.
2. Landings increased to more than 60,000 t in the early 1960s, when target fisheries took place in Scotland and Norway. Landings in the Norwegian directed longline fishery decreased during the 1970s. In the 1980s, international landings increased slightly due directed fisheries by UK (longline) and Irish (gillnet) vessels. Landings declined from the late 1980s again. Most target fisheries have ceased due to low catch rates, though they still exist in certain areas and certain times as schools appear. Spurdog is now largely taken as a by-catch in mixed demersal trawl fisheries.
3. The level of exploitation is unknown, but the continuous decline in landings indicates that fishing mortality has been, and continues to be well above sustainable levels.
4. Spurdogs are long-lived, slow growing and have a high age at maturity and are particularly vulnerable to high levels of fishing mortality. They also have a low population productivity, with low fecundity and a protracted gestation period.
5. Spurdog in the ICES area are considered to be a single stock, ranging from the Barents Sea (ICES Sub-area I) to the northern Bay of Biscay (ICES Division VIIIa).
6. Spurdog forms size and sex specific schools and these have been subject to directed fisheries targeting large females. Because of the low population productivity, a ban on the catching of these large females is considered a minimum requirement for population rebuilding.
7. This is a valuable species for Irish fishermen, caught in both target (mainly gillnet) and as a by-catch in demersal mixed fisheries.

ICES ADVICE
1.4.6

State of the stock

The stock is depleted. All experimental assessments indicate that the stock is at a record low level. Frequency of occurrence of spurdog in trawl surveys has declined and although large shoals are still caught, the frequency of these has declined. The level of exploitation is unknown, but the continuous decline in landings indicates that fishing mortality has been, and continues to be well above sustainable levels.

Management objectives

None have been suggested nor adopted.

Reference points

Not defined.

Single-stock exploitation boundaries

The stock is depleted and may be in danger of collapse. Target fisheries should not be permitted to continue, and by-catch in mixed fisheries should be reduced to the lowest possible level. A TAC should cover all areas where spurdog are caught in the northeast Atlantic. This TAC should be set at zero for 2006.

Management considerations

Spurdogs are long-lived, slow growing and have a high age at maturity and are particularly vulnerable to high levels of fishing mortality. Population productivity is low, with low fecundity and a protracted gestation period.

Spurdog in the ICES area are considered to be a single stock, ranging from the Barents Sea (ICES Sub-area I) to the northern Bay of Biscay (ICES Division VIIIa).

Spurdog are largely taken as by-catch. TACs only regulate the landings. A low TAC on bycatch species could induce more discards. Because spurdog are caught as a by-catch in demersal fisheries, they would benefit from a reduction in overall demersal fishing effort.

Spurdog forms size and sex specific schools and these have been subject to directed fisheries specifically targeted large females. Because of the low population productivity, a ban on the catching of these large females is considered a minimum requirement for population rebuilding.

Ecosystem considerations

Spurdog are an important component of the pelagic and demersal ecosystems, predating on a variety of pelagic fishes, such as herring.

Factors affecting the fisheries and the stock

The Effects of Regulations

There is no international agreement on a TAC that covers the distribution area of northeast Atlantic spurdog.

A TAC has been introduced for the EU waters of Sub-area IV and Division IIa in 1999. This TAC has been reduced from 8,870 tonnes to 1,136 tonnes in 2005.

Norway has a 70cm maximum landing size, but it is not known if this is effective at reducing exploitation of mature females.

Changes in fishing technology and fishing patterns

Landings increased to more than 60,000 tonnes in the early 1960s, when target fisheries took place in Scotland and Norway. Landings in the Norwegian directed longline fishery decreased during the 1970s. In the 1980s, international landings increased slightly due directed fisheries by UK (longline) and Irish (gillnet) vessels. Landings declined from the late 1980s again. Most target fisheries have ceased due to low catch rates, though they still exist in certain areas and certain times as schools appear. Spurdog is now largely taken as a by-catch in mixed demersal trawl fisheries.

The environment

Studies in the North-west Atlantic indicate that males tend to occupy deeper, more saline water than females, and that spurdog tend to prefer waters of 7-15ºC.

Scientific basis

Data and methods

Survey data and landings data are available. A number of different methods have been explored, including surplus production models, separable age-based assessments, length-structured approaches and frequency of occurrence in survey hauls. All methods indicate similar stock trends.

Uncertainties in assessment and forecast

Particular problems identified with the data include:

- uncertainties in the historical level of catches due to landings being reported by generic 'dogfish' categories
- limited catch composition information from countries other than UK (E&W)
- the aggregating behaviour of spurdog means that trawl survey catch rates are highly variable, with many zero catches and occasional high catches. Hence, calculated CPUE series are unlikely to provide an accurate indication of stock size

Information from the fishing industry

Those spurdog that are landed are mostly from a mixed demersal fishery. The fishing industry provided anecdotal information that catches recorded as spurdog and others mostly consist of spurdog only. Other demersal catches do not have spurdog in the hauls. By-catches of spurdog in other fisheries (e.g pelagic trawl) are likely but these will not generally be landed.

Comparison with previous assessment and advice

This is the first year that ACFM has presented advice on this stock.

Source of information

Report of the Working Group on Elasmobranch Fishes 2005 (ICES CM 2006/ACFM:03).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp to advice	Predicted catch corresp to single-stock exploitation boundaries	Agreed TAC[1]	ACFM Landings[2]
1991	None					29.4
1992	None					28.8
1993	None					23.2
1994	None					21
1995	None					20.2
1996	None					16.7
1997	None					15
1998	None					14.1
1999	None				8.9	11.2
2000	None				8.9	15.5*
2001	None				8.9	16.0*
2002	None				7.1	9.1
2003	None				5.6	8.8
2004	None				4.5	5.1
2005	None				1.1	
2006	TAC	F=0	0			

* May include some mis-reported deep-sea sharks or other species
1) Landings for total stock area: Sub-areas I-VIII.
2) TAC for ICES sub-areas IV, Division IIa (EC).
Weights in '000 t.

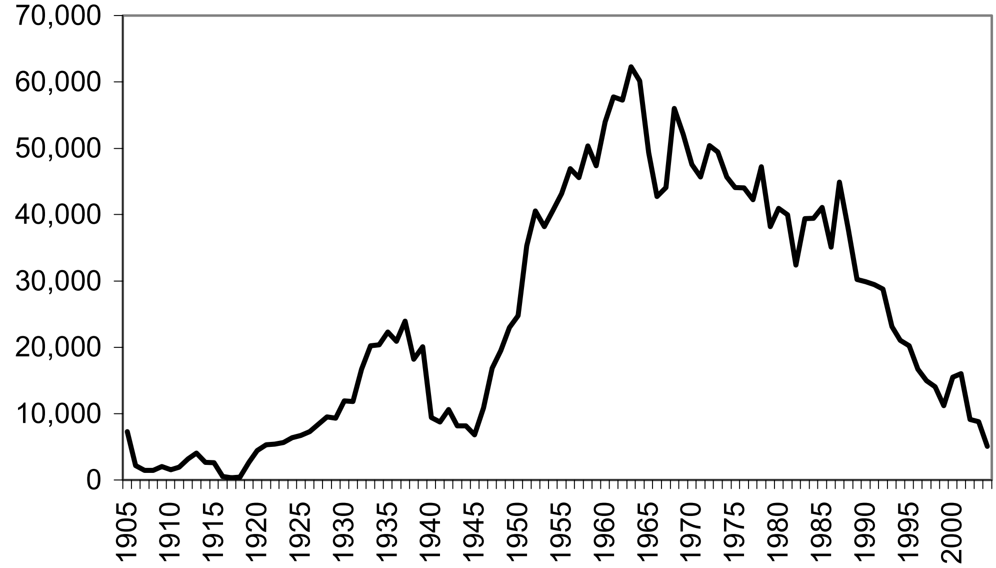


Figure 1.4.6.1 Landings of spurdog in the North-east Atlantic (Sub-areas I-VIII).

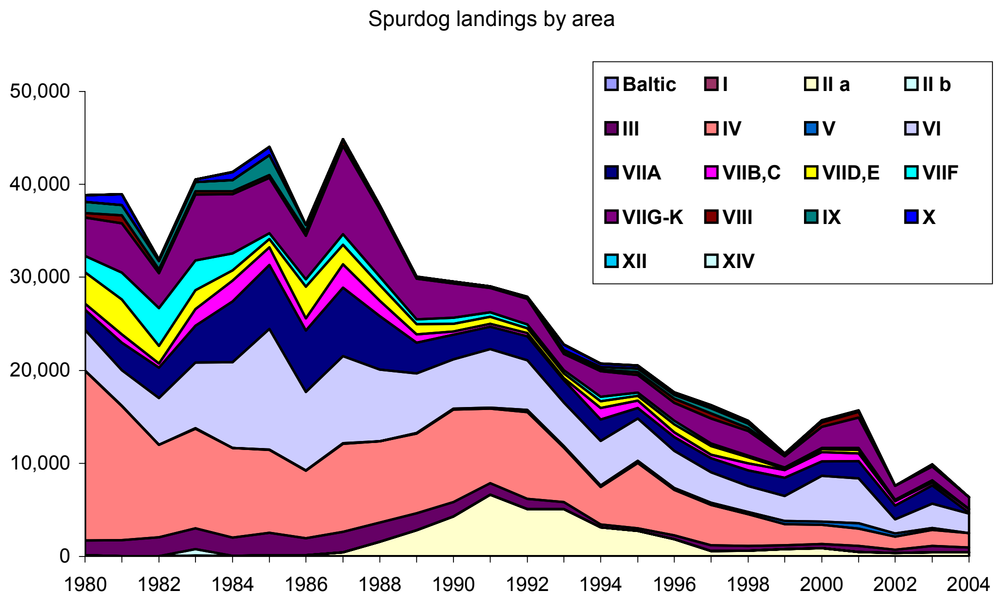


Figure 1.4.6.2 Recent landings of spurdog by area.

ICES
1

Ecosystem components

Bottom topography substrate and circulation

In the Celtic seas (ICES Subareas VI and VII) the continental shelf is of variable width. The Celtic Sea, south of Ireland is an extended shelf which for the most part is shallower than 100 m. It is limited to the west by the slope of the Porcupine seabight and the Goban Spur. In these areas the slope is rather gentle and sedimentary. To the west of Ireland the Porcupine Bank forms a large extension of the shelf limited to the west by the Rockall Trough. The transition between the Porcupine Bank and the trough is a steep and rocky slope along which reefs of deepwater corals occur. Further north and to the west of Scotland the slope of the Rockall Trough is closer to the coast line, particularly off NW Ireland, and at the Hebrides. West of the shelf break and the Rockall Trough is the Rockall Plateau with depths of less than 200 m. The shelf area itself contains mixed substrates, generally with soft sediments (sand and mud) in the western part and tending towards rockier, pinnacle-like areas in the eastern part. At these latitudes (55° to 58°N) the continental slope is mainly sedimentary and a trawl fishery for mid-slope fish such as roundnose grenadier, blackscabbard fish, deep sea squalids, blue ling, and orange roughy have been operating since the late 80s. The eco-region also contains several important seamounts: Anton Dohrn, the Hebrides, and Rosemary Bank, which have soft sediments on top and rocky slopes. The Irish Sea is distinct from the rest of the eco-region as a semi-enclosed sea area, with mostly soft substrates and an indigenous fish population.

The water circulation in this area is dominated by the poleward flowing slope current. This persists throughout the year north of the Porcupine Bank, and is stronger in the summer. South of the bank the current is present in the winter months, but breaks down in the summer, when the flow becomes complex. There is also a weaker current flowing north from Brittany and splitting east and west along the Irish coast (OSPAR QSR 2000). Porcupine Bank and the Rockall plateau tend to be retention zones. The Irish Sea has limited inflows from the shelf to the south and probably has an internal gyre circulation.

Summer frontal systems are formed at the Ushant Front, in the English Channel, the Celtic Sea front at the southern entrance to the Irish Sea, and the Irish shelf front west of Galway. These represent changes from stratified inshore and mixed offshore waters. The other major feature is the very high amplitude tide in the Celtic Sea area and the Bristol Channel in particular.

Physical and chemical oceanography

Temperature/salinity

The slope current introduces warm saline water from further south into the whole area. The ICES Annual Ocean Climate Status Summary (IAOCSS) does not deal with this eco-region as a whole, but data are available for the Rockall Trough area in detail. More extensive and synoptic data are undoubtedly available, but this could not be collated in the context of the WGRED meeting. The report suggests that the Rockall trough has been warming steadily since the mid 1980s. Similar trends appear for salinity (see Figure 2.14 below).

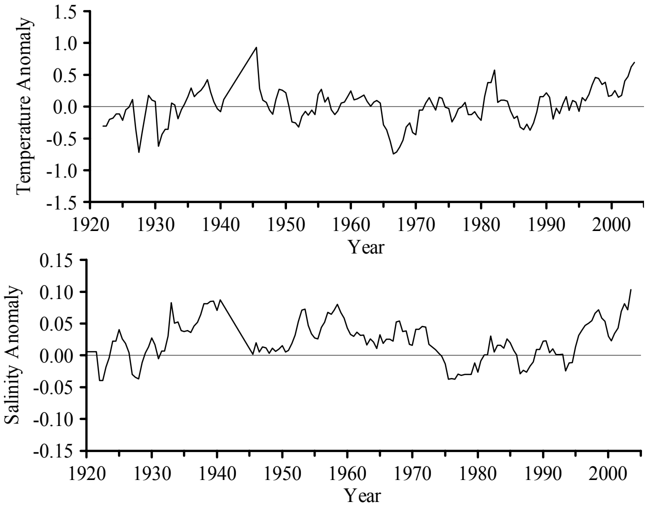


Figure 2.14. Rockall Trough temperature and salinity anomalies for the upper ocean (0–800 m) of the northern Rockall Trough. Average across section, seasonal cycle removed.

Input of freshwater

The major river inputs in the Celtic Sea area are into the Bristol Channel, the Irish Sea, and the Malin Sea north of Ireland. These inputs are important in reducing salinity locally.

Broad-scale climate and oceanographic features

See general text on this topic in the separate section on the Northeast Atlantic (Section 2.1).

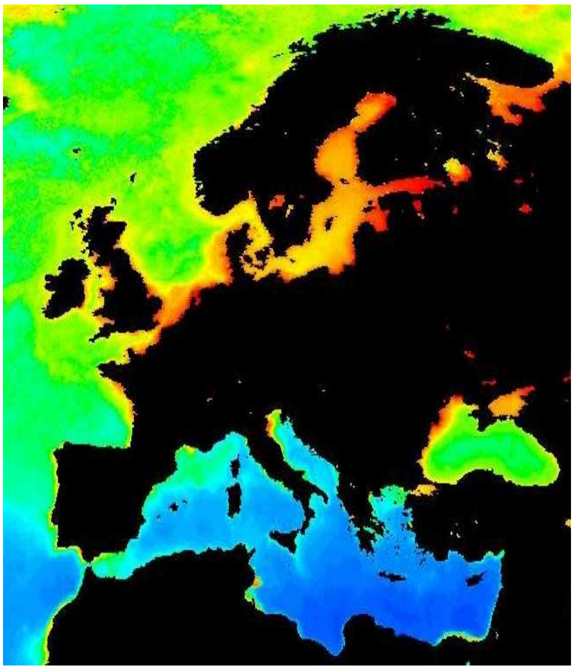


Figure 2.15. Spring chlorophyll (1998–2003).

Phytoplankton

For phytoplankton, the main feature is the strong primary productivity found along the shelf break. Figure 2.15 shows the chlorophyll concentration in various European waters. High levels of chlorophyll usually indicates a high primary production.. This is stimulated by the warmer, nutrient rich waters found here. Productivity is reasonably strong on the shelf but drops rapidly west of the shelf break. Based on CPR greenness records for this area the spring bloom occurs around April and collapses by October, although in recent years it has continued into December. CPR data also suggests that there has been a steady increase in phytoplankton colour index across the whole area, at least over the last 20 years. Details on the taxa involved have not been located but are assumed to be dominated by diatoms (at least in the spring bloom), but will also include dinoflagellates.

Zooplankton

Like the adjacent North Sea waters, the overall zooplankton abundance in the Celtic Sea has declined in recent years. CPR areas C5, D5, and E5 all show substantial drops in Calanus abundance and are now below the long-term mean. *Calanus finmarchicus* is known to overwinter in the Faroe-Shetland channel and the abundance of this species is known to have been reduced in recent years. The distribution of Calanus in deep waters further south is unknown. More detailed information should be available from the CPR programme, but it is not available at present.

Benthos, larger invertebrates (cephalopods, crustaceans, etc.), biogenic habitat taxa

Several large fisheries exist for *Nephrops*. It is targeted by trawl fisheries on the shelf west of Scotland, the Rockall plateau, and south and west of Ireland.

There are major fisheries dredging for scallops and some smaller bivalves exist in the western Channel, the Irish Sea, around Ireland and west of Scotland. Pot fisheries exploit the lobster *Homarus gammarus* and the edible crab *Cancer pagurus* and spider crab in the waters around the Channel Islands, Ireland, off France and around the UK. Estimated landings of whelk (*Buccinum undatum*) may be as high as 20 000 t/year. A major cuttlefish exists in the Channel where they are targeted by pot fishery, but trawl catches are much higher and target juveniles in coastal waters in some areas.

In addition to a major aquaculture activity for oysters and mussels, some natural beds of oysters and buried bivalves (such as cockles *Cardium edule*) are exploited by professional and recreational fisheries.

The benthos of the Celtic seas is largely influenced by shelf sea dynamic processes that generate areas with high levels of seabed stress and erosion. Coastal faunas are dominated by relatively small-sized bivalve and polychaete infauna with a highly mobile epifauna. Further offshore larger body-sized bivalves, suspension and filter-feeders dominate the assemblage. Benthic habitat diversity is high in the Celtic seas, varying from sand, through mud to bedrock in some places. Biogenic reefs of horse mussels *Modiolus modiolus*, maerl and Serpulid worms occur in specific locations (Irish Sea, west coast of Scotland). The latter can support benthos of conservation interest such as sea fans and structurally complex bryozoans. Offshore areas on the shelf slope support reefs of deep water corals such as *Lophelia pertusa*.

Fish community

This eco-region includes two distinct types of ecosystems: shelf seas and deepwater communities. There are commercial fisheries for *Nephrops*, cod, haddock, and whiting and a number of flatfish species in the northern part of the area (the Irish Sea, west of Ireland and Scotland). Hake and anglerfish are also fished across the whole area. The Rockall plateau is subject to a haddock and slope fisheries. Commercial fisheries for *Nephrops*, cod and flatfish are conducted in the Irish Sea. The whole area is also characterised as a spawning area for a number of key wide-ranging, migratory species, notably mackerel, horse mackerel, and blue whiting. These species are also commercially exploited within the area. Key pelagic species are herring, considered as consisting of a number of different stocks, as well as sardine, in the southern part of the area, and sprat, particularly in the Celtic Sea proper. The area also includes considerable stocks of argentines (two species) and large numbers of small mesopelagic myctophids along the shelf break.

The shelf slope (500–1800 m) comprises a quite different species assemblage including roundnose grenadier, black scabbard fish, blue ling, and orange roughy as well as deep-sea squalids (sharks) and macrouridae (rabbit fish, etc.). Several of these stocks are likely to have been severely depleted by the deepwater fisheries carried out in this area. A notable example would be orange roughy, which has probably been largely fished out. All these fish are characterised as being long-lived, slow-growing, and having a low fecundity, making them very vulnerable to overfishing.

The Celtic Sea groundfish community consists of over a hundred species of which the most abundant 25 comprise 99 percent of the total estimated biomass and around 93 percent of the total estimated numbers (Trenkel and Rochet, 2003). Population and community analyses have shown that fishing has impacted a number of commercial species, primarily because individuals of too small a size have been killed in the past (Trenkel and Rochet, 2003). This can be considered as resulting partly from observed large discards (Rochet *et al.*, 2002).

Table 2.1. The indicators for the demersal fish community of the Celtic Sea (From Bertrand, 2004).

1. Category of Indicator	2. Indicator	3. Direction of change
Population	Abundance of populations	1 in 43 decreasing, 9 in 43 increasing
	Mean size in the population	9 in 43 decreasing, 1 in 43 increasing
Community	Total abundance	Stable
	Total biomass	Stable
	Mean weight in the community	Decreasing
	Mean size in the community	Stable
	Multispecies size spectra Slope Intercept	 decreasing Stable

The elasmobranchs

The demersal elasmobranch fauna of the Celtic seas is relatively diverse. The main species caught in these areas can be divided into two groups – rays and skates, and sharks.

The main skates are thornback ray *Raja clavata*, spotted ray *Raja montagui*, blonde ray *Raja brachyura*, and cuckoo ray *Leucoraja naevus*. The dominant skates in the inshore waters are *Raja clavata* and *Raja montagui*. Blonde ray is also relatively widespread in the area, though it tends to be more abundant in particular areas. Cuckoo ray is more common on the offshore fishing grounds in the Irish Sea and on the continental shelf of the Celtic Sea. Smalleyed ray *Raja microocellata* is abundant in the Bristol Channel (VIIf), with occasional individuals taken in the Celtic Sea (VIIg), southern Irish Sea (VIIa), and western English Channel (VIIe). Other rays that are less common, but are recorded in low numbers in fishing surveys include shagreen ray *Leucoraja fullonica*, sandy ray *R. circularis*, and undulate ray *Raja undulata*. *R. fullonica* and sandy ray tend to be most abundant in offshore areas, particularly the Porcupine and Rockall Banks Vib and VIIc. *R. undulata* forms small, perhaps discrete populations on the west coast of Ireland, with occasional records in the English Channel.

Common skate *Dipturus batis* is known to have declined in the Irish Sea and elsewhere and is only recorded very occasionally in the inshore waters of the area, though they are still encountered in the Celtic Sea and along the edge of the continental shelf. *Rostroraja alba* and *Dipturus oxyrynchus* became very infrequent in the 20th century, though there were known to be taken in fisheries in the 19th century. Other batoids in the area include stingray *Dasyatis pastinaca*, marbled electric ray *Torpedo marmorata,* and electric ray *T. nobiliana*, though these species may be regarded as vagrants from more southern waters, and these species are generally discarded if caught.

In this region the demersal fauna has a wide diversity of demersal sharks and rays and skates. Within the sharks are the following species: lesser spotted dogfish *Scyliorhinus canicula*, bull huss *S. stellaris*, smoothhound *Mustelus mustelus*, starry smoothhound *M. asterias*, blackmouth catshark *Galeus melastomus*, and angel shark *Squatina squatina*. *S. stallaris* and *S. squatina* are inshore species, with strong habitat preferences. *S. stellaris* is abundant on the west coast of Wales (VIIa).

Widely migratory and migratory sharks that occur in this region include: blue shark *Prionace glauca*, shortfin mako *Isurus oxyrynchus*, porbeagle *Lamna nasus*, tope *Galeorhinus galeus*, and spurdog *Squalus acanthias*. Some of these are taken in mixed demersal fisheries, others in pelagic fisheries, especially for tuna and swordfish. Blue shark and shortfin mako shark are trans-North Atlantic stocks. Spurdog, porbeagle, and tope shark are thought to comprise unitary stocks in the NE Atlantic. The deepwater slopes of the region have a large diversity of different species, and these are dealt with elsewhere.

Trophic web

The trophic relationships of four main commercial demersal predators (cod, hake, megrim, and whiting) and three forage species (blue whiting, pouts (*Trisopterus* spp.), and mackerel) were analysed by Trenkel *et al.* (in press). This study concluded that the main predator species in the Celtic Sea are generalist feeders which exhibit size-dependent, temporal and spatial prey-switching behaviour. These results from the Celtic Sea Proper (limited to the north by Ireland, and between the longitudes of 4°E and 12°W) are the same in other areas. The studied forage species are present seasonally in the Celtic Sea, resulting in prey-shifting behaviour by predators.

No major studies of forage fish have been conducted in the northern of the eco-region. Sand eel, sprat, and Norway pout are known to be present; however, their role and importance in the ecosystem is unclear. No known major industrial fisheries are currently exploiting these species.

A major component of the ecosystem is the spring migration into the area of a large abundance of migratory small pelagic fish, principally blue whiting and mackerel, but also including horse mackerel. All three species spawn and feed extensively in the area, prior to migrating north out of the eco-region in the summer.

Fish taken from the shelf edge areas of the Celtic Seas tend overall to be less planktivorous and from a higher trophic level than those in the North and Baltic Seas (c.f. Heath, 2005). For instance, the secondary production required per unit of landed fish from the southern part of the Celtic Seas is twice that for North Sea fish. In this area zooplankton production accounts for only a small fraction of the secondary production demands of the fisheries. In the Celtic Seas benthos production can be seen as a 'bottom-up' driver for fisheries production, which seems to be independent of variability in plankton production. As this situation is very different to the situation in the North Sea (see NS section), climate change and fishing pressures can be expected to influence these regional fisheries in very different ways. Overall, there appear to be strong spatial patterns in the fish food web structure and function, which should be important considerations in the establishment of regional management plans for fisheries.

Vulnerable species

While blackspot (=red) seabream (*Pagellus bogaraveo*) used to be an important target species of English fishery in the 30s (Desbrosses, 1932), catches in the Celtic seas declined well before the collapse of the fishery in region G (see this chapter for a longer account on this species). The species can now be considered as eradicated from the Celtic seas.

The red lobster (*Palinurus elephas*) was exploited by pot fisheries prior to the late 1990s, and current catches and stock of this species can be considered as residual.

Dominant species composition, size composition, biomass/ abundance of species with a crucial role in the food chain, status of species which are particularly vulnerable or protected (especially if not included in the single-stock annexes)

As mentioned above, numbers of species of deepwater fish and elasmobranch species are considered as being severely depleted and meriting protection.

Fishery effects on benthos and fish communities

This eco-region is characterized by the presence of a number of important benthic features which are considered important and vulnerable to fishing activity. These include cold water corals, and particularly the Darwin mounds, other biogenic reefs, and natural reefs. Coldwater coral structures have been identified in many areas, including the Porcupine Bank, Rockall, the slope areas west of Scotland and Ireland, and on the seamounts. The Darwin mounds are found at depths of about 1000 m northwest of Cape Wrath, Scotland. These structures are all vulnerable to trawling, but particularly deepwater trawling, which uses larger and heavier gears. Most of these structures have actually been identified by fishing activity, and there is the possibility that other

such structures exist in unfished areas.

The impact of fishing activities on the shelf fish communities is unclear, although there are numbers of severely depleted stocks e.g. cod, whiting and plaice and hake. It can be assumed that size spectra and community changes occurring in this area are similar to those reported for the North Sea. Trawling in the deep waters has almost certainly caused substantial changes in the community structures of the deeper waters west of the shelf break. Initial studies of catch rates from surveys west of Scotland in the 1980s compared to the last 5–10 years suggest substantial reductions in large, slow-growing species and a switch to smaller, faster-growing fish.

Based on the above, the sustainability of deep water trawling should be reconsidered given the vulnerability of both the fish communities and the benthic habitats.

Common dolphins are taken as by-catch in Celtic Sea fisheries and dead common dolphins with injuries attributable to fishing are found stranded on coasts adjacent to the Celtic Sea. ICES (2005- reference to Technical Annex accompanying ICES May 2005 advice to EC) provide a detailed review of stranding records for common dolphins on the UK, French, Irish, Spanish and Portugese coasts. Many of these strandings were linked to damage and mortality attributable to fisheries. On the south-western UK coast, for example, entanglement in fishing gear was cited as the most common cause of death accounting for 57.9% (n = 179) of the total number of reported strandings (n = 302) on the English coastline from 1990 to 2003.

Based on available by-catch records, the two types of fishery are responsible for most common dolphin mortality are pelagic trawl and bottom-set gillnet fisheries. While by-catches have been reported in some fisheries, such as the UK pelagic pair trawl fishery for bass in the western Channel, the Irish and English offshore hake/ pollack gillnet fishery and Irish and French pelagic pair trawl fisheries, by-catches are not being regularly and comprehensively recorded in all fisheries that may catch cetaceans (ICES, 2005).

The significance of reported rates of by-catch mortality depends on the capacity of the cetacean populations to tolerate that mortality. At present, both the abundance and population structure of most cetacean populations impacted by fisheries are poorly known and further research is essential to assess the impacts of by-catch at the population level.

Major environmental signals and implications

No obvious environmental signals were identified that should be considered in assessment or management in this area. The major trends in the ecosystem noted above are the steady warming of the area, particularly in the context of the slope current. The Rockall trough waters have been warming steadily for some years and are currently at an all time high. The general and continuing reduction of copepod abundance is also of major concern given the major role of these organisms in the food web.

Both these factors are likely to have an impact on the life histories of many species, but particularly on the migratory pelagic species; mackerel, horse mackerel, and blue whiting. Both mackerel and horse mackerel migrations are closely associated with the slope current. Mackerel migration is known to be modulated by temperature (Reid *et al*., 2001). Continued warming of the slope current is likely to affect the timing of this migration. The timing and location of spawning by all these species is also likely to be affected this general warming. The impact on recruitment is difficult to assess, as mackerel generally recruits well, and the horse mackerel stock depends on very rare massive recruitments. No ecosystem link has been identified for either species.

Data gaps

In general this eco-region has attracted less attention than areas such as the North Sea. It is probably not because the data do not exist, but because they have not been correlated and integrated in the context of eco-regions. For example, the ICES Annual Ocean Climate Status Summary does not address this area as a whole. It has been recommended that ICES develops an inclusive approach to the use of eco-regions so that all output data can be matched up easily. The CPR programme samples within the area, but detailed breakdown of these data have not been carried out. As noted above, the primary, and hence presumably the secondary production changes substantially from the shelf to the shelf break and on to the open ocean. Therefore, data aggregated over all these systems is likely difficult to interpret. No single assessment working group is responsible for the fisheries in the area. These are covered by both northern and southern shelf demersal WGs, WGMHSA, HAWG, WGNEPH, WGDEEP, and even WGNPBW and WGNEW. This also makes the integration of data by eco-region more complex.

The human use of the ecosystem

The fisheries and their impact

Most of the demersal fisheries in this area have a mixed catch. Although it is currently possible to associate specific target species with particular fleets, various quantities of cod, whiting, hake, anglerfish, megrim, sole, plaice, and *Nephrops* are taken together, depending on gear type. Some fleets have also a large part of valuable non-TAC species in their catch (elasmobranch, squids, cuttlefish, John dory, turbot, brill, witch, red mullet, etc.). This is particularly the case for coastal fleets.

Since the 1930s, hake has been the main demersal species supporting trawl fleets on the Atlantic coasts of France and Spain. Spain took around 60% of the landings, France 30%, UK 5%, Denmark 3%, and Ireland 2%. Hake are caught throughout the year, the peak landings being made in spring-summer months. The three main gear types used by vessels fishing for hake as a target species are lines (England and Wales, Spain), fixed-nets and trawls (all countries), mostly bottom trawls, and recently also Very High Opening trawls (Spain).

In the Celtic Sea and Western Channel, fisheries for demersal species, mainly cod, whiting, sole, and plaice, are conducted by Belgium, France, Ireland, and the UK. The principal gears used are otter trawls and beam trawls.

The targeting of sole and plaice using beam trawls became prevalent during the mid-1970s, leading to an increase in the landings of these two species. More recently, cuttlefish have become an important component of beam trawl landings, particularly during the winter months. The gradual replacement of otter trawls by beam trawls has occurred in the Belgian and UK fleets. In the Bay of Biscay there has been a substantial replacement of inshore trawling by gillnet fisheries targeting sole since the 1980s.

A trawl fishery for anglerfish by Spanish and French vessels developed in the Celtic Sea, on the shelf edge around the 200-m contour to the south and west of Ireland and Bay of Biscay in the

1970s and expanded until 1990. This fishery used single and twin rig otter trawls in medium and deep water in Divisions VIIb,c,e-k. Bycatch species include hake, megrim, and to a lesser extent *Nephrops*. Although effort in most fleets appears to have declined since the early 1990s the increasing use of twin trawls may have increased the overall efficiency. In addition, a gillnet fishery targeting anglerfish developed in the Celtic Sea and has since proliferated along on the shelf edge around the 200-m contour and into deeper waters since the 1990s. This fishery is of concern as it appears to have substantial discarding is prone to gear loss and associated ghost fishing and is largely unregulated (Hareide, et al 2005).

Megrim in the Celtic Sea, west of Ireland and in the Bay of Biscay are caught predominantly by Spanish and French vessels, which together have reported more than 60% of the total landings, and by Irish and UK demersal trawlers. Most UK landings of megrim are made by beam trawlers fishing in Divisions VIIe,f,g,h. Otter trawlers account for the majority of Spanish landings from Subarea VII, prosecuting a mixed fishery for anglerfish, hake, and megrim on the shelf edge around the 200-m contour to the south and west of Ireland. Irish megrim landings are largely made by multi-purpose vessels fishing in Divisions VIIb,c,g for gadoids as well as plaice, sole, and anglerfish. Megrim landings have remained fairly stable over the period 1986–2004.

Nephrops are an important component of the fisheries in this area. These fisheries developed in the 1970s and 1980s. Fishing effort has decreased continuously since the early 1990s. However, gear efficiency has increased in recent years and this may have helped maintaining LPUE at relatively high levels. In the Bay of Biscay, since 1st January 2000, the mesh size used when fishing for *Nephrops* has increased and is now similar to the one used for other demersal fish (70 mm). Management of these fisheries needs to be sensitive to bycatches of other stocks.

Demersal elasmobranchs are taken in a variety of fisheries, with bycatches being a significant portion of most demersal fisheries in the region. In inshore areas, small-scale target fisheries exist for ray, skate, and migratory sharks. These fisheries use trawl, longline, and gillnets.

Fisheries for demersal gadoids, flatfish, and *Nephrops,* using otter or beam trawls all have bycatches of rays and skates. These fisheries are carried out by UK, Ireland, France, Spain, and Belgium. In the southern Irish Sea, there is also a small target fishery for rays, by Irish otter trawls in VIIa. The main species in these fisheries are *L. naevus, R. clavata, R. montagui*, and *R. brachyura.*

More offshore fisheries for hake, anglerfish, megrims, and *Nephrops* also have a bycatch of demersal elasmobranchs. The bycatch in these fisheries is more dominated by *Leucoraja fullonica, L. circularis*, and *Dipturus* spp. that are less abundant in the shallower areas.

Large migratory sharks such as basking shark, porbeagle, and tope are caught in mixed demersal fisheries in this area, and in some cases several sharks may be taken in an individual haul. A large target spurdog directed fisheries around Ireland and in the Irish Sea during the 1980s has largely collapsed. Currently targeting takes place only sporadically. Vessels engaged in mixed fisheries occasionally catch large schools of spurdogs. These catches are often the result of targeting by vessels whilst engaged in mixed fisheries for other species. Fisheries for tunas take a bycatch of pelagic sharks in this area.

There are separate pelagic trawl fisheries targeting herring in the Celtic Sea and mackerel and horse mackerel in the whole area. In the past the herring fishery in this area was principally a "roe" fishery; in recent years the number of vessels in this fishery has declined substantially, and the fishery has changed to targeting herring for human consumption. There is also a small directed fishery for sprat in the Channel and around Ireland.

References

Bertrand, J. A. 2004. L'état des communautés exploitées au large des côtes de France. Application d'indicateurs à l'évaluation de l'impact de la pêche. IFREMER report, DRV/RH/RS/04-001, 170 pp.

Guéguen, J. 1969. Croissance de la dorade, *Pagellus centrodontus* Delaroche. Rev. Trav. Inst. Peches Marit., Nantes, 33, 3, 251–264.

Heath, M. R. 2005. Changes in the structure and function of the North Sea fish foodweb, 1997–2000, and the impacts of fishing and climate. *ICES Journal of Marine Science*, 62: in press

Heath, M. R. in prep. Regional variability in the trophic requirements of shelf sea fisheries in the northeast Atlantic, 1973–2000. Submitted to ICES Journal of Marine Science,

Hareide, N-R, Garnes, G, Rihan, M., Mulligan, M., Tyndall P. , Clark, M., Connolly, P., Misund, P. , McMullen P. , Furevik D., Humborstad O.B., Høydal K., Blasdale, T. 2005 A preliminary Investigation on Shelf Edge and Deepwater Fixed Net Fisheries to the West and North of Great Britain, Ireland, around Rockall and Hatton Bank.

Reid, D. G., Walsh, M., and. Turrell, W. R. 2001. Hydrography and mackerel distribution on the shelf edge west of the Norwegian deeps. Fisheries Research 50: 141–150.

Rochet, M.-J., Péronnet, I., Trenkel, V. M. 2002. An analysis of discards from the French trawler fleet in the Celtic Sea. *ICES Journal of Marine Science*, 59: 538–552.

Trenkel, V. M., and Rochet, M.-J. 2003. Performance of indicators derived from abundance estimates for detecting the impact of fishing on a fish community. Canadian Journal of Fisheries and Aquatic Sciences, 60: 67–85.

FSS Advice on Mixed Fisheries in the Irish Sea

FSS ADVICE

FSS advise that mixed fisheries characteristics be taken into account when managing demersal fisheries in the Irish Sea. Cod, whiting and spurdog are the overriding concerns in the management advice. In 2006, fisheries in the Irish Sea should be managed according to the following rules, which should be applied simultaneously:

If fisheries are permitted they should fish:

- **without by-catch or discards of cod and spurdog, and with minimal catch of whiting;**
- **without jeopardizing the recommended reduction in fishing mortality of haddock;**
- **within the precautionary limits for all other stocks (see text table above).**

Furthermore, unless ways can be found to harvest species caught in mixed fisheries within precautionary limits for <u>all</u> those species individually then fishing should not be permitted.

FSS advise that only demersal fisheries that can demonstrate that they fish without catch or discards of cod, whiting or spurdog may be permitted. All other stocks in the Irish Sea should be fished within precautionary limits. FSS recognise that the 'zero catch option' for cod, whiting and spurdog would effectively mean a closure of the mixed demersal and *Nephrops* fisheries in the Irish Sea. FSS agree with ICES that a closure of all fisheries catching cod, whiting or spurdog provide the highest probability of recovery for these stocks.

FSS note that ICES has previously advised for zero catch of cod and whiting, but that managers, because of social and economic considerations, have never implemented this advice. FSS recognise that the zero catches advised are difficult to implement in the current management framework but given the extremely depleted state of the cod, spurdog and whiting stocks this stringent management action is require if these stocks are to be sustained.

Therefore FSS advise that the following rules should be followed in the management of mixed fisheries in the Irish Sea:

- **Once the TAC is exhausted for a critical stocks then <u>all</u> fisheries which catch that stock should be closed,**
- **Fisheries should only be permitted when they demonstrate that they take zero catch of stocks where the TAC is exhausted,**
- **All other stocks should be exploited within precautionary limits.**

FSS note the poor performance of TACs, as implemented, in reducing fishing mortality. FSS stress that the required reductions in fishing mortality can only be achieved if reductions in effort are included in management, and effective deterrents to discarding are implemented.

FSS advise that a well defined 'management plan' is necessary to recover the cod and whiting stocks and to fish them sustainably once they have recovered. FSS advise that such a plan should aim to manage properly defined métiers with clearly defined objectives that will ensure a high probability of recovery to agreed levels within a specified time frame.

IDENTIFICATION OF CRITICAL STOCKS

ICES have identified the critical stocks as cod, whiting and spurdog. For Cod and whiting stocks the SSB is lower than $\mathbf{B}_{lim}$. Spurdog is assessed to be in a critical state. These stocks are the overriding concerns in the management advice for all fisheries where the interactions between stocks taken in the same fisheries should be considered:

- for cod the advice is for zero catch;
- for spurdog the advice is for zero catch;

- for whiting the advice is to reduce catch to the lowest possible levels.
- Another stock for which reduction in exploitation is required is haddock.

SPECIAL FSS NOTE ON MIXED FISHERIES ADVICE

Mixed Fisheries analyses have previously been attempted with the aim of allowing certain fisheries to continue whilst achieving the conservation objectives for critical stocks. FSS now considers that the provision of such mixed fisheries advice, and its implementation in management, have reached an impasse.

ICES is attempting to inform "managers about the appropriate allocation of effort among fisheries consistent with desired levels of fishing mortality by species". However, the compilation of necessary and appropriate data has not been achieved (except perhaps in the North Sea). ICES considers that the paucity of data on discards is a "fatal flaw" in a mixed fisheries context. In the absence of acceptable analytical methods and data, ICES has provided "technical interaction matrices" to indicate mixed-fisheries relationships. The Irish Sea interaction matrix is given on the following pages. FSS considers that these matrices cannot be used to quantitatively calculate of potential fishing opportunities in a mixed-fisheries context.

Notwithstanding the difficulties in mixed fisheries analysis, FSS considers that major impediments prevent the proper implementation of mixed fisheries advice. The current management system simply cannot implement appropriate allocations of effort among fisheries consistent with desired levels of fishing mortality by species. The main obstacles preventing this are conflicts with the principle of Relative Stability and a reluctance to manage fishing effort by fleet or to constrain fleet dynamics in other ways.

FSS considers that progress is required on both the analysis and implementation if scientifically credible mixed fisheries analysis is to be undertaken, and mixed fisheries advice is to be sensibly implemented. FSS considers that the data quality issues raised by ICES will be overcome. However, the inclusion of new discard data into assessments is not straightforward and progress may take several years. In the interim FSS considers that a debate is overdue on the means by which mixed-fisheries advice will be implemented by the current, or a modified management framework. FSS views the Regional Advisory Councils as an appropriate forum for this debate. FSS agree with the STECF that it will not be possible to correctly implement mixed fisheries advice within the current management framework.

In the absence of quantitative mixed-fisheries advice from ICES, the European Commission has attempted to obtain such advice from sub-groups of the STECF. An STECF sub-group met in late 2005, but could only present mixed fishery forecasts for the North Sea. FSS therefore concurs with the STECF that the mixed fisheries analyses for the Irish Sea are misleading and totally unsuitable for management purposes.

ICES
1

Fisheries in the Irish Sea

The majority of vessels in the Irish Sea target *Nephrops* with either single- or twin-rig otter trawls. These vessels use either 70-mm diamond mesh with an 80-mm square mesh panel or an 80-mm diamond mesh in their codends, and (by regulation) their landings must consist of at least 35% *Nephrops* by live weight. These vessels have bycatches of whiting (most of which are discarded) and haddock, cod, and plaice. Twin-rig otter trawl were first introduced in the early 1990s. Recent studies show that the use of twin-rigs increases the proportion of roundfish bycatch in *Nephrops* fisheries compared with single-rig otter trawls. *Nephrops* catches are highly seasonal with the highest *Nephrops* catches in the summer months. Catch rates are also dependent on tidal conditions, with higher catches during periods of weak tide.

The roundfish fisheries in the Irish Sea are conducted primarily by vessels from the UK and Ireland. A Northern Irish semi-pelagic trawling for cod and whiting developed in the early 1980s. As the availability of whiting declined this fleet switched to mainly targeting cod and haddock. Irish, Northern Irish, and English and Welsh otter trawlers target plaice, haddock, whiting, and cod, with smaller bycatches of anglerfish, hake, and sole. Some Irish vessels participate in a fishery for rays in the southern Irish Sea. Since 2001, these trawlers have adopted mesh sizes of 100–120 mm and other gear modifications, depending on the requirements of recent EU technical conservation regulations and national legislation.

Fishing effort in the semi-pelagic effort increased rapidly between the early 1980s and early 1990s before decreasing somewhat in the mid-1990s. Fishing effort in the England and Wales otter trawl vessels longer than 12m declined rapidly after 1989, and from 1999 to 2004 was less than 25% of the effort reported in the 1980s. There has been a declining trend in fishing effort for Northern Irish otter trawlers also since the early 1990s. Fishing effort for Irish otter trawlers has declined in recent years as many vessels switched from targeting roundfish to *Nephrops*.

There is also a beam trawl fishery which takes place mainly in the eastern Irish Sea with vessels from Belgium, Ireland, and the UK. This fishery mainly catches sole with important bycatches of

plaice, rays, brill, turbot, anglerfish, and cod. The fishing effort of the Belgian beam-trawl fleet varies in response to the catch-rates of sole in the Irish Sea relative to catch-rates in other areas in which the fleet operates. Fishing effort peaked in the late 1980s following a series of strong year classes of sole, but is presently only about 60% of the peak value.

The other gears employed to catch demersal species are gillnets and tangle nets, notably by inshore boats targeting cod, bass, grey mullet, sole, and plaice, and the bottom VHVO trawl targeting hake.

The main pelagic fishery in the Irish Sea is for herring. In recent years, it has been predominantly operated by one pair of trawlers from Northern Ireland. The size of this fleet has declined to a very low level in recent years.

There are also a number of inshore fisheries in the Irish Sea that target stocks not currently assessed by ICES. These include pot fisheries for crab, lobster, and whelk, hydraulic dredge fisheries for razor clams, and dredge fisheries for scallops.

Decommissioning at the end of 2003 permanently removed 19 out of 237 UK demersal vessels that operated in the Irish Sea, representing a loss of 8% of the fleet by number and 9.3% by tonnage. Of these vessels, 13 were vessels that had used demersal trawls with mesh size >=100 mm and had more than 5% cod in their reported landings. The previous round of de-commissioning in 2001 removed 29 UK(NI) *Nephrops* and whitefish vessels and 4 UK(E&W) vessels registered in Irish Sea ports at the end of 2001. Of these, 13 were vessels that used demersal trawls with mesh size >=100 mm and had more than 5% cod in their reported landings.

Fisheries interactions in the Irish Sea

Demersal fisheries in the area are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. In these cases management advice must consider both the state of individual stocks and their simultaneous exploitation in demersal fisheries. Stocks in the poorest condition, particularly the critical stocks, necessarily become the overriding concern for the management of mixed fisheries where these stocks are exploited either as a targeted species or as a bycatch.

Four main fishery units can be described in the Irish Sea: these are *Nephrops* otter trawlers, roundfish otter trawlers, semi-pelagic trawlers, and beam trawlers. As trends in stocks of various species are generally not in synchrony, advice provided on the basis of the status of individual species may result in advised fishing mortalities for a group of co-harvested species that cannot be realized simultaneously within the context of mixed fisheries. Stocks in need of special conservation efforts, such as those affected by recovery plans, present particularly difficult challenges. For instance, the reduction of fishing mortality (and effort) required for cod makes it very unlikely that TACs, which would be sustainable for healthier stocks in the mixed fisheries could be taken. The needs of the stock(s) under recovery plans could be met most directly by simply setting the TACs for all species in mixed fisheries to correspond to the fishing mortality intended for the species under recovery plans, which would result in large foregone yields in many healthier stocks. The foregone yield could be reduced somewhat if effort could be adjusted on a fleet-by-fleet basis to comply with the total fishing mortality in the proposed recovery plan, while allowing as much harvesting of other species as possible. However, such an approach requires reliable information on the catch-at-age for all species in all fisheries, and is still likely to leave substantial potential harvestable biomass of several species unavailable to any fishery.

Possibly the strongest mixed fishery interaction in the Irish Sea is between the *Nephrops* fishery and the whiting stock. Discard estimates for fleets targeting *Nephrops* are incomplete and considered imprecise, but demonstrate that the selectivity of *Nephrops* trawls for whiting remains relatively poor despite the obligatory use of square mesh panels for vessels targeting *Nephrops* with 70-mm cod-end mesh since 1994. ICES points out that in addition to effort restrictions, further technical measures (e.g. increased cod-end and square mesh panel mesh sizes, separator panels, and fixed grids) should be investigated and may substantially reduce by-catch and discarding of whiting in this *Nephrops* fishery.

The cod fishery was traditionally carried out by otter trawlers targeting spawning cod in spring and juvenile cod in autumn and winter. Activities of these vessels have decreased, whilst a fishery for cod and haddock using large pelagic trawls increased substantially during the 1990s. Cod are also taken as a bycatch in the *Nephrops*-directed fishery Although discard estimates for cod in the Irish Sea are not available discard rates are not thought to be substantial. However, misreporting and under-reporting of cod is thought to occur in some VIIa fisheries. Estimates of mis-reporting for some nations are included in the assessment, but the scientific advice for zero catch of the cod stock requires that the practice be terminated.

The extent to which the stocks are taken in the same fisheries cannot be quantified on basis of the available data. The existing information suggests that the stocks are caught together to a high (H), medium (M), low (L) extent, or not at all (0), as indicated in the table below. The information in the table relates to catches and the linkage is thus indicated as high also in cases where the catches of most of one stock taken in a fishery with another stock is discarded.

Technical Interactions Matrix	Cod in Division VIIa	Haddock VIIa	*Nephrops* FU 15 & FU 14	Plaice VIIa	Sole VIIa	Whiting VIIa	Rays VIIa	Herring VIIaN	Scallops	Whelks	Razor Fish
Cod in Division VIIa		H	M	M	M	M	L	0	0	0	0
Haddock VIIa	White fish trawl, Semi-pelagic trawl, Seine-net		M	M	L	M	L	0	0	0	0
Nephrops FU 15 & FU 14	*Nephrops* trawl fishery	*Nephrops* trawl fishery		M	L	H	L	0	0	0	0
Plaice VIIa	Flat fish beam trawl, *Nephrops* trawl	*Nephrops* trawl	*Nephrops* trawl		H	L	M	0	0	0	0
Sole VIIa	Flat fish beam trawl, Nephrops trawl	Flat fish beam trawl	*Nephrops* trawl	Flat fish beam trawl		L	M	0	0	0	0
Whiting VIIa	Semi-pelagic trawl, *Nephrops* trawl, White fish trawl	White fish trawl, Semi-pelagic trawl, Seine-net	*Nephrops* trawl	*Nephrops* trawl	Beam trawl		L	0	0	0	0
Rays VIIa	Ray otter and beam trawl fishery	Ray otter and beam trawl fishery	*Nephrops* trawl	Beam trawl	Beam trawl	Ray otter and beam trawl fishery		0	0	0	0
Herring VIIaN	None	None	None	None	None	None	None		0	0	0
Scallops	None	None	None	None	None	None	None	None		0	0
Whelks	None	None	None	None	None	None	None	None	None		0
Razor Fish	None	None	None	None	None	None	None	None	None	None	

Single-stock exploitation boundaries (Irish Sea)

The state and the limits to exploitation of the individual stocks are presented in the stock sections. The state of stocks and single-stock exploitation boundaries are summarised in the table below.

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2005 and % reduction in F
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	in relation to precautionary limits	in relation to target reference points	
Cod in Division VIIa	Reduced reproductive capacity	Harvested unsustainably	Overexploited	Zero catch in 2006 provides only 50% probability of rebuilding SSB to $\mathbf{B}_{lim}$ in 2007.	Zero		Zero
Haddock VIIa	Undefined	Unknown	Unknown				Substantial reduction in effort
Nephrops FU 15 & FU 14 (Management area J)		Uknown					Effort not allowed to increase. Fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and bycatch fish.
Whiting in Division VIIa	Unknown, low SSB	Unknown	Unknown		Lowest possible level		Lowest possible level
Plaice VIIa	Full reproductive capacity	Harvested sustainably	Harvested sustainably		5 900 t		5 900 t
Sole VIIa	Unknown	Unknown	Unknown		Recent (2002–2004) catch levels.		930 t
Herring	Uncertain	Unknown	Unknown		Estimates of SSB and fishing mortality for recent years are uncertain and ICES cannot advise on catch levels in relation to PA limits		*Status quo* catch ~ 4 800 t.
Spurdog	Uncertain	Unknown	Unknown		Unknown in relation to PA points but the stock is severely depleted		Target fisheries should not be permitted to continue, and by-catch in mixed fisheries should be reduced to the lowest possible level. A zero TAC should cover all areas where spurdog are caught for 2006.

ICES - Identification of critical stocks

The table above identifies the stocks outside precautionary reference points.

The critical stocks are cod and whiting. For these stocks the SSB is lower than $\mathbf{B}_{lim}$. Also, spurdog is assessed to be in a critical state.

These stocks are the overriding concerns in the management advice for all fisheries where the interactions between stocks taken in the same fisheries should be considered:

- for cod the advice is for zero catch;
- for spurdog the advice is for zero catch;
- for whiting the advice is to reduce catch to the lowest possible levels.
- Another stock for which reduction in exploitation is required is haddock.

ICES - Advice on fisheries management

Fisheries in the Irish Sea should in 2006 be managed according to the following rules, which should be applied simultaneously:

They should fish:

- **without bycatch or discards of cod and spurdog, and with minimal catch of whiting;**
- **without jeopardizing the recommended reduction in fishing mortality of haddock;**
- **within the biological exploitation limits for all other stocks (see text table above).**

Furthermore, unless ways can be found to harvest species caught in mixed fisheries within precautionary limits for <u>all</u> those species individually then fishing should not be permitted.

Irish Sea Cod

(Division VIIa)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

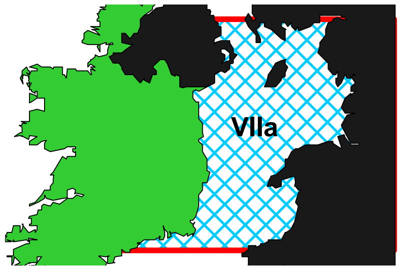
(See Irish Sea Overview for Mixed Fishery Advice)

Considerable problems still exist with this assessment. Misreporting remains a serious problem in this fishery. In 2004 the total international removals were estimated at 3.6 times the reported landings. Since 2003 UK and Irish scientists have been denied full access to samples in major ports. Catch-at-age data therefore is highly uncertain in 2003 and 2004. The stock assessment estimates misreporting, assuming that the misreported catch have the same age composition as reported landings. The present stock estimates are therefore highly uncertain and should be considered to be indicative of stock trends.

Despite the change in assessment methodology the overall trends in biomass and recruitment are consistent. The perception of the stock from this year's assessment does not differ qualitatively from that obtained last year. Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as having reduced reproductive capacity and as being harvested unsustainably. SSB remains below B_{lim}, recent recruitments are amongst the lowest in the time series and F is above F_{lim}.

In 2004 the EC implemented a recovery plan for this stock (EC Reg. No 423/2004). This plan involves an SSB rebuilding target of 30% when above B_{lim}. Despite assessment uncertainties the stock is almost certainly below this threshold. The most plausible forecast assumes a total removal in 2005 that is 25% greater than the agreed TAC. The forecast indicates that a zero catch in 2006 provides only 50% probability of rebuilding SSB to B_{lim} in 2007. The simulations indicate that a 30% increase in SSB during 2006 could be achieved with a high probability, but only with a reduction in fishing mortality to below 25% of the 2004 level.

FSS therefore agree with the ICES advice that the precautionary approach demands a zero catch until the estimate of SSB is above B_{lim}. FSS further agrees that rebuilding requires that F is significantly reduced in the long term. FSS advise that closed areas will only be effective if they are strengthened, i.e. no derogation, and are accompanied by commensurate effort reductions that substantially reduce F.



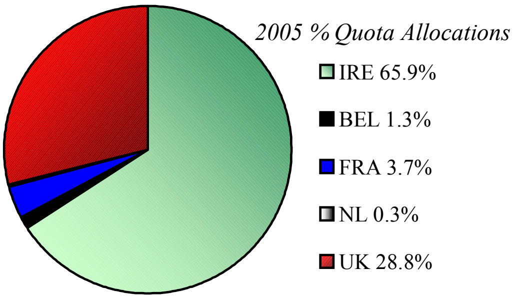
Red Box-TAC/Management Area *Blue Shading– Assessment Area*

CURRENT MANAGEMENT

- The TAC Area covers Division VIIa and corresponds to the assessment area.
- The 2005 TAC was 2,150 t with an associated Irish quota of 1,416 t.
- A spawning closure was introduced in 2000 for 10 weeks from mid-February to maximise the reproductive output of the stock (EU Regulations 304/2000 and 2549/2000). The measures have since been revised annually, involving a continued, but smaller spawning ground closure, derogations for certain gears and changes in net design to improve selectivity and protect juvenile fish. FSS has previously examined the impact of the closed areas for Cod in VIIa using simulations. The results indicate that closed areas need to be more stringent to have a measurable effect above the assessment uncertainty.
- Measures established for the recovery of cod stocks include multi-annual processes for selection of TACs, restriction of fishing effort, technical measures, control and enforcement, accompanying structural measures and market measures. These measures are discussed in greater detail in the Section: "Recovery Plans and Effort Limitation".

ADDITIONAL INFORMATION

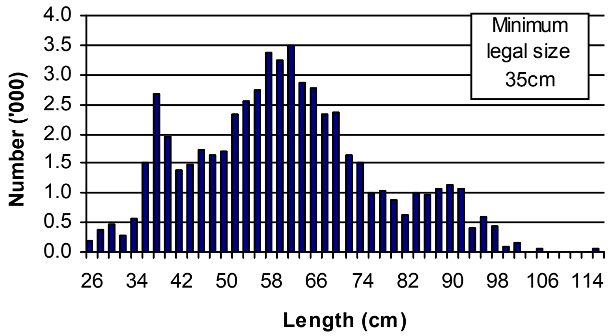
1. ICES has traditionally included estimates of misreported landings within the unallocated landings figures reported for this stock. These unallocated landings have represented adjustments to nominal landings figures to correct for misreporting. As the misreporting estimates are for one country only, and there is evidence that the practice is more widespread, ICES is no longer able to provide catch estimates partially corrected for misreporting for the recent years 2003 and 2004.
2. There has been a consequent change in the assess-



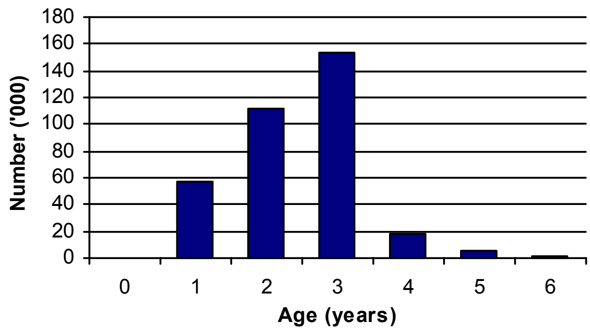
ment model this year. The assessment is based on a catch-at-age analysis of reported landings, calibrated with several series of survey indices. In addition, the model estimates missing removals as a bias in landings, assuming that they have the same age composition as reported landings.

3. Results from FSS simulations show that, given the uncertainties in the assessment, any stock rebuilding effects to date from the closed area are difficult to show conclusively. These simulations suggest that in order to be able to measure short-term recovery in cod, more stringent actions in addition to the closed area are required.
4. Irish landings in 2004 were reported to be 261 t, substantially below the Irish quota of 1,416 t.
5. The landings were mainly made by otter trawlers targeting whitefish, otter trawlers targeting *Nephrops* and beam trawlers. Irish gill net landings of around 110 t in the southern Irish Sea were attributed to the Celtic Sea stock and not included in this assessment.
6. The seasonal migration of cod between the Irish Sea and the Celtic Sea was investigated by the FSS cod tagging programme. A special STECF meeting was held in Dublin in 2000 to evaluate available tagging data. The results indicated that, while some cod move from the Irish Sea into the Celtic Sea, they constitute a very small proportion of the Celtic Sea cod stock. Furthermore cod tagged in the Celtic Sea were not recovered in the Irish Sea. More recent tagging studies off Greencastle in VIa has resulted in some recaptures in VIIa suggesting minor movement from VIa to VIIa.
7. The closure of the spawning grounds during the spring from 2000 onwards has mainly affected semi- pelagic trawlers and whitefish otter trawlers. It has caused displacement of effort into surrounding regions and in some cases switching to *Nephrops* trawl gear to take advantage of the derogation for *Nephrops* fishing within the closure.
8. Recovery measures have since been complemented by a system of fishing effort limitation which regulates the number of fishing days allowed for various vessel categories deploying gears with specified mesh sizes. The introduction of effort regulation, has effectively encouraged vessel operators to reduce mesh size and shift to other fisheries, particularly *Nephrops* trawling, in order to gain more days at sea. It is not possible to evaluate whether the mesh size changes and effort limitations may have affected cod without information on the level of adherence to catch composition regulations required when using smaller mesh sizes.
9. There have also been significant changes in the VIIa fleet in recent years. Some Irish vessels have been replaced, tied up or modernised. Decommissioning removed 29 UK(NI) Nephrops and whitefish vessels and 4 UK (E&W) vessels registered in Irish Sea ports at the end of 2001. A further round of decommissioning at the end of 2003 permanently removed 19 out of 237 UK vessels that operated in the Irish Sea, representing a loss of 8% of the fleet by number and 9.3% by tonnage.
10. The impact on fishing mortality of the imposition of effort regulation and concurrent decommissioning is difficult to determine since there have been parallel efficiency increases and redistribution of quota. Trends in nominal effort indicate an overall decrease in effort of 19% between 2000 and 2004 (STECF-SGRST, 2005. Evaluation of the Cod Recovery Plan).
11. There is evidence that some of the historical variation in recruitment of Irish Sea cod can be explained by year-to-year changes in sea temperature with a negative correlation between Spring Sea Surface Temperature and recruitment. However, the large reduction in egg production associated with the decline in both the biomass and age structure of the spawning stock in the 1990s must be considered a primary cause of the reduction in average recruitment compared with earlier years.

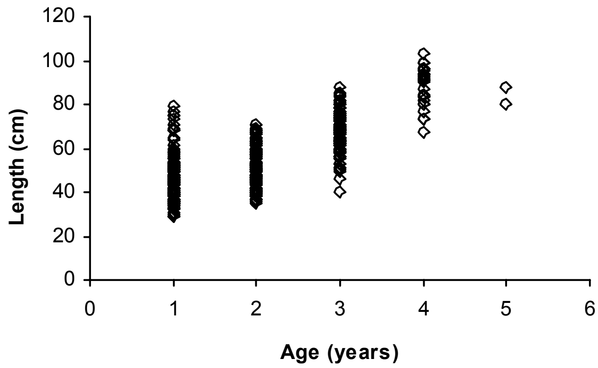
2004 Length Distribution: Irish Landings (Beam & Otter trawlers), Cod in VIIa



2004 Age Distribution: Reported International Landings, Cod in VIIa



2004 Size at Age: Irish Sampling, Cod in VIIa



ICES ADVICE
1.4.1

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target
Reduced reproductive capacity	Harvested unsustainably	Overexploited	Not defined

Based on the most recent estimates of SSB and fishing mortality, ICES classifies the stock as having reduced reproductive capacity and as being harvested unsustainably. Fishing mortality had been around $\mathbf{F}_{pa}$ until the mid-1980s. It has increased close to, or above $\mathbf{F}_{lim}$ since 1988. SSB is below $\mathbf{B}_{pa}$ and has been below to $\mathbf{B}_{lim}$ since the mid-1990s. Recruitment has been below average for the past sixteen years and the three most recent year-classes are amongst the four lowest on record. At the average rate of exploitation estimated for recent years, SSB will remain at sizes where the risk of continued poor recruitment is high.

Management objectives

The European Commission has enacted a Council Regulation ((EC) No 423/2004) which establishes measures for the recovery of cod stocks.

For stocks above $\boldsymbol{B}_{lim}$, the harvest control rule (HCR) requires:

1. *setting a TAC that achieves a 30% increase in the SSB from one year to the next,*
2. *limiting annual changes in TAC to ± 15% (except in the first year of application), and,*
3. *a rate of fishing mortality that does not exceed $\boldsymbol{F}_{pa}$.*

For stocks below $\boldsymbol{B}_{lim}$ the Regulation specifies that:

1. *conditions 1-3 will apply when they are expected to result in an increase in SSB above $\boldsymbol{B}_{lim}$ in the year of application,*
2. *a TAC will be set lower than that calculated under conditions 1-3 when the application of conditions 1-3 is not expected to result in an increase in SSB above $\boldsymbol{B}_{lim}$ in the year of application.*

This plan has not yet been evaluated by ICES. However, the management plan requires annual predictions of spawning stock size, which is not available given the recent poor catch data. In that situation a management plan that does not require such a precision should be considered.

Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is 6 000 t	$\mathbf{B}_{pa}$ be set at 10 000 t
	$\mathbf{F}_{lim}$ is 1.0	$\mathbf{F}_{pa}$ be set at 0.72
Target reference points		$\mathbf{F}_{y}$ not defined

Yield and spawning biomass per Recruit (from 2004 Assessment)
F-reference points

	Fish Mort Ages 2-4	Yield/R	SSB/R
Average last 3 years	1.028	1.677	1.869
$\mathbf{F}_{max}$	0.310	2.153	7.999
$\mathbf{F}_{0.1}$	0.180	2.009	12.746

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$-$\mathbf{F}_{max}$.

Technical basis

$\mathbf{B}_{lim}$: $\mathbf{B}_{loss}$	$\mathbf{B}_{pa}$: This is the previously agreed MBAL with signs of reduced recruitment. It affords a high probability of maintaining the SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments. Below this value the probability of below-average recruitment increases.
$\mathbf{F}_{lim}$: $\mathbf{F}_{med}$	$\mathbf{F}_{pa}$: $\mathbf{F}_{med}$* 0.72. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$. Fishing mortalities above Fpa have been associated with observed stock decline.

Single-stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

The most plausible forecast assumes a total removal in 2005 that is 25% greater than the agreed TAC. The forecast indicates that a zero catch in 2006 provides only 50% probability of rebuilding SSB to B_{lim} in 2007. The simulations indicate that a 30% increase in SSB during 2006 could be achieved with a high probability, only with a reduction in fishing mortality to below 25% of the 2004 level.

Exploitation boundaries in relation to precautionary limits

Given the low stock size, recent poor recruitment, continued substantial catch well above the TAC, the uncertainty in the assessment, and the inability to reliably forecast catch, it is not possible to identify any non-zero catch which will be compatible to the precautionary approach. Rebuilding can only be achieved if fishing mortality is significantly reduced on a longer term.

Management considerations

It is an inherent problem that practices of misreporting may develop when TAC regulations are not efficiently implemented. When decisions on TACs are taken on basis of catch forecasts this may result in a vicious circle if the forecasts are based on catch data which are lower than the real catches. If misreporting cannot be estimated accurately and included in stock assessments the result will be an increasing bias in stock assessments and forecasts resulting in even more restrictive TACs and increasing misreporting. Over time it becomes impossible to establish the real stock situation and to advice on catches which may be taken sustainably. In this situation, a TAC regulation such as that currently implemented is therefore not adequate to regulate fishing mortality within sustainable limits and to normalise the situation. In such situations, ICES would often advise on a precautionary TAC based on recent landings. However, when the landing data are not reliable due to misreporting a relevant number for such a TAC cannot be established and a TAC regime does not regulate fishing mortality. Therefore, ICES has concluded that in such situations a possible route is to change management to focus on effort, which can be controlled through instruments like VMS, in order to reintroduce effective control of the fishery and to restore a reliable future data base for advice and management decisions. It is an integral part of such a change that a detailed and stringent programme, including the mandatory reporting of both catch and effort data in logbooks should be established to collect high quality effort and landings data. When the situation is normalised and reliable data have been established the future different management schemes can then be considered.

The present stock estimates are relatively uncertain due, in part, to the lack of access to port sampling in 2003 and only limited access in 2004. Without a resumption of sampling at all major ports, there will continue to be larger uncertainties in the stock status and a further deterioration in the ability to provide advice.

There are strong indications that management control is not effective in limiting the catch.

The advised measures are required if the cod stock is to reach a level where it can regain historic productivity.

As cod is taken in mixed demersal fisheries, following the advice should result in greatly reduced harvesting of other stocks, particularly haddock and *Nephrops*, unless these fisheries can demonstrate zero by-catches of cod. Management needs to take this into account.

Time and area closures have not been sufficient to lead to rebuilding of this stock. The consequence of displacing effort, caused by the closures, needs to be considered in determining the role of such measures in the recovery plan.

Management plan evaluations

There are reports of significant non-reported landings and therefore the current implementation of the TAC system is not able to restrict fishing. Unless recovery measures are able to restrict the fishery they are not precautionary.

Factors affecting the fisheries and the stock

The Effects of Regulations

The fishery is managed by TACs that do not restrict landings.

Several regulations have been introduced in the Irish Sea in recent years. These regulations and their impact on the fisheries have been discussed in detail in the overview. To rebuild the SSB a closure, which was intended to maximize the reproductive output of the stock was introduced in 2000 for ten weeks from mid-February (EU Regulations 304/2000 and 2549/2000). The measures were revised in 2001, 2002, and 2003, involving a continued, but smaller spawning-ground closure, coupled with changes in net design to improve selectivity. Various derogations were introduced for gears not targeting cod.

These recovery measures have since been complemented by a system of fishing effort limitation. This is done by adjustment of the number of fishing days allowed for various vessel categories deploying gears with various mesh sizes. The introduction of effort regulation, has effectively encouraged vessel operators to reduce mesh size and shift to other fisheries, particularly *Nephrops* trawling, in order to gain more days at sea. It is not possible to evaluate whether the mesh size changes and effort limitations may have benefited cod without information on the level of adherence to catch composition regulations required when using smaller mesh sizes. Trends in nominal effort in this area are presented in the report of the STECF Sub-group SGRST (STECF, 2005. Evaluation of the Cod Recovery Plan) and indicate an overall decrease in effort of 19% between 2000 and 2004.

The continued decline in the stock indicates that these measures alone have not proven sufficient to rebuild the stock to precautionary levels. Detailed analysis of the impact of the regulations will not be possible until data of sufficient quality become available.

Scientific basis

Data and methods

The assessment model is based on a catch-at-age analysis of reported landings, calibrated with several series of survey indices. In addition, the model estimates missing removals as a bias in landings, assuming that they have the same age composition as reported landings.

The assessment is indicative of stock trends, but cannot be used as a basis for sufficiently precise forecasts.

Recent discard estimates available for some fleets indicate a variable, but very high discard rate of ages 0 and 1. These estimates are not used in the assessment due to the short time-series available.

Information from the fishing industry

The UK Fisheries Science Partnership (FSP) survey of the western Irish Sea cod spawning grounds in spring 2004 and 2005, carried out using a commercial pelagic trawler, indicated similar abundance

and age structure of adult cod in the two years, although catch-rates were generally poor on the spawning grounds. The equivalent FSP survey of the eastern Irish Sea in spring 2005 indicated low catch rates of 3-year-old and older cod.

Uncertainties in assessment and forecast

The present stock estimates are highly uncertain because of sampling problems due to a lack of access to ports for sampling in some years. The need to estimate and project missing catch components introduces greater uncertainty into the assessment and forecast.

Comparison with previous assessment and advice

Traditionally, ICES has included estimates of mis-reported landings within the unallocated landings figures reported for this stock. These unallocated landings have represented adjustments to nominal landings figures to correct either for mis-reporting or for differences between official statistics and data obtained by national scientists. As the mis-reporting estimates are for one country only, and there is evidence that the practice is more widespread, ICES is no longer able to provide catch estimates partially corrected for mis-reporting for the recent years 2003 and 2004 and hence, the change in assessment model this year.

The overall trends in biomass and recruitment appear well-estimated and the perception of the stock from this year's assessment does not differ qualitatively from that obtained last year. The basis of the advice this year is the same as last year.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official Landings	ACFM Landings
1987	No increase in F; interaction with *Nephrops*		10.3		15	13.2	12.9
1988	No increase in F; interaction with *Nephrops*		10.1		15	15.8	14.2
1989	No increase in F		13.4		15	11.31	12.8
1990	F at $\mathbf{F}_{med}$; TAC		15.3		15.3	9.91	7.4
1991	Stop SSB decline; TAC		6		10	7.01	7.12
1992	20% of F(90) ~ 10 000 t		10		10	7.4	7.72
1993	$\mathbf{F}_{med}$ ~ 10 200 t		10.2		11	5.9	7.62
1994	60% reduction in F		3.7		6.2	4.5	5.42
1995	50% reduction in F		3.9		5.8	4.5	4.62
1996	30% reduction in F		5.4		6.2	5.3	4.962
1997	30% reduction in F		5.9		6.2	4.44	5.862
1998	No increase in F		6.2		7.1	4.96	5.312
1999	Reduce F below $\mathbf{F}_{pa}$		4.9		5.5	2.96	4.782
2000	Lowest possible F		0		2.1	1.42	2.182
2001	Lowest possible F		0		2.1	2.03	3.602
2002	Establish recovery plan		-		3.2	2.7	4.422
2003	Closure of all fisheries for cod		-		1.95	1.5	n/a
2004		Zero catch		0	2.15	n/a	n/a
2005		Zero catch		0	2.15		
2006		Zero catch		0			

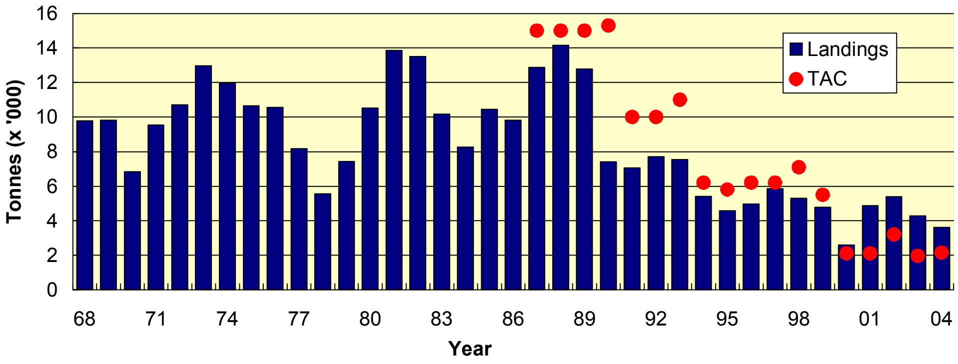
[1]Preliminary. [2]Incomplete data. Weights in '000 t.

Table 1.4.1.1 Nominal catch (t) of COD in Division VIIa as officially reported to ICES.

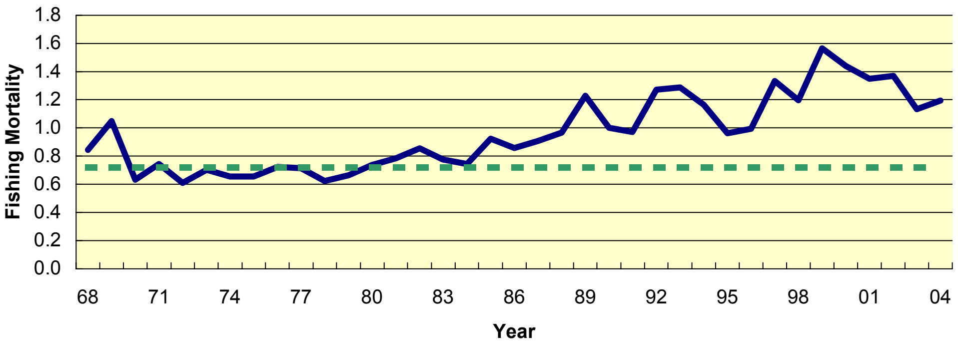
Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003[1]	2004[1]
Belgium	174	169	129	187	142	183	316	150	60	283	318	183	104
France	916	686	208	166	148	268	269[1]	85[1]	53	74	116	146[2]	n/a
Ireland	2,260	1,328	1,506	1,414	2,476	1,492	1,739	966	455	751	1,111	594	n/a
Netherlands	-	-	-	-	25	29	20	5	1	-	-	-	
UK (England & Wales)[3]	3,529	3,244	2,274	2,330	2,359	2,370	2,517	1,665	799	885	1,134	527[4]	660[4]
UK (Isle of Man)	129	57	26	22	27	19	34	9	11	1	7	7	n/a
UK (N. Ireland)	…	…	…	…	…	…	…	…	…	…	…	…	
UK (Scotland)	393	453	326	414	126	80	67	80	38	32	29	…	n/a
Total	7,401	5,937	4,469	4,533	5,303	4,441	4,962	2,960	1,417	2,026	2,708	1,457	n/a

[1]Preliminary. [2]Revised. [3]1989–2004 N. Ireland included with England and Wales. [4]includes Scotland n/a = not available

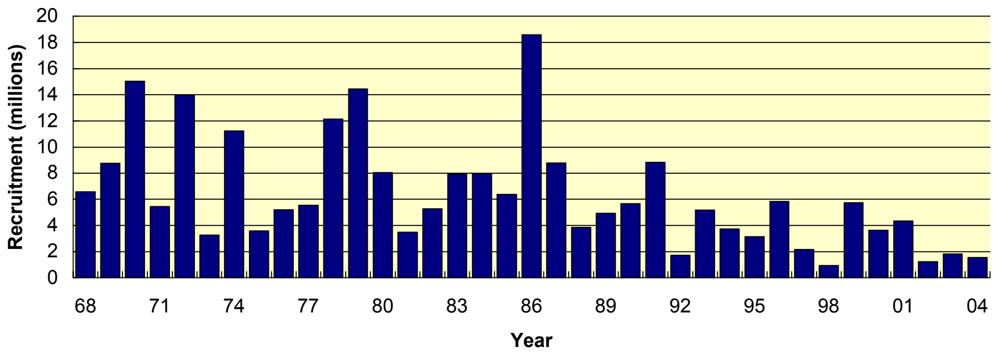
Cod VIIa - Total Removals
Mean = 8.6



Cod VIIa - Fishing Mortality
Mean = 0.96



Cod VIIa - Recruitment (Age 1)
Mean = 6.5



Cod VIIa - Spawning Stock Biomass
Mean = 11.1

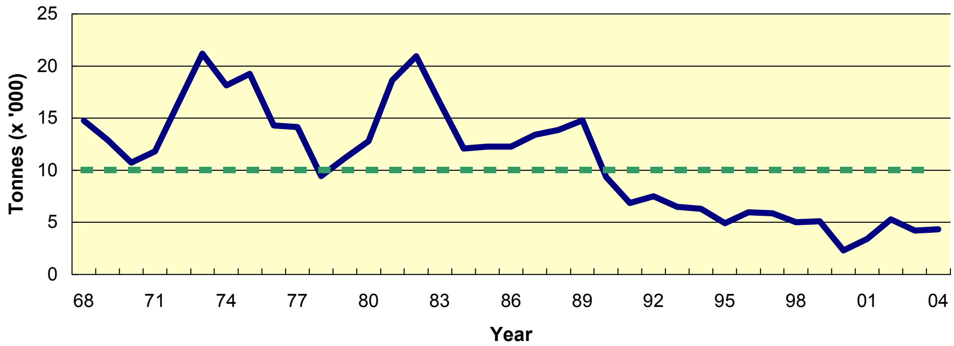


Table 1.4.1.2. Cod in Division VIIa (Irish Sea).

	RECRUITS Age 0	TOTSPBIO	TOTAL REMOVALS	RECORDED LANDINGS	FBAR 2- 4
1968	6570	14765	9779	8541	0.8438
1969	8771	12895	9834	7991	1.0492
1970	15024	10737	6831	6426	0.631
1971	5434	11813	9549	9246	0.7436
1972	13973	16519	10710	9234	0.6083
1973	3257	21167	12968	11819	0.7023
1974	11241	18147	11955	10251	0.6556
1975	3601	19253	10650	9863	0.6558
1976	5215	14289	10557	10247	0.7229
1977	5557	14147	8173	8054	0.7128
1978	12139	9432	5556	6271	0.6221
1979	14437	11161	7430	8371	0.6648
1980	8046	12778	10534	10776	0.7362
1981	3484	18634	13858	14907	0.7832
1982	5285	20962	13503	13381	0.8565
1983	7938	16524	10183	10015	0.7744
1984	7975	12064	8274	8383	0.7444
1985	6393	12278	10442	10483	0.9247
1986	18601	12273	9819	9852	0.8567
1987	8791	13398	12891	12894	0.9066
1988	3841	13854	14166	14168	0.9657
1989	4938	14775	12781	12751	1.2279
1990	5672	9346	7400	7379	1.0005
1991	8853	6864	7074	7095	0.9716
1992	1722	7506	7715	7735	1.2705
1993	5170	6498	7551	7555	1.2872
1994	3732	6294	5404	5402	1.1641
1995	3140	4913	4587	4587	0.9619
1996	5848	5947	4962	4964	0.9935
1997	2152	5857	5858	5859	1.3351
1998	943	4995	5309	5310	1.1971
1999	5746	5104	4785	4784	1.5645
2000	3632	2297	2594	1273	1.4408
2001	4348	3424	4873	2251	1.3493
2002	1231	5263	5391	2704	1.3684
2003	1829	4185	4273	1276	1.1311
2004	1557	4339	3616	1007	1.1952
Arith. Mean	6381	10938		7922	0.9627
Units	(Thousands)	(Tonnes)		(Tonnes)	

Irish Sea Whiting

(Division VIIa)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Irish sea Overview for Mixed Fishery Advice)

FSS consider that the poor quality of the input data prohibits an analytical assessment of this stock. Survey data show poor consistency and discard estimates are imprecise. However, the principal difficulties preventing an assessment are the combination of low sampling levels and very small landings.

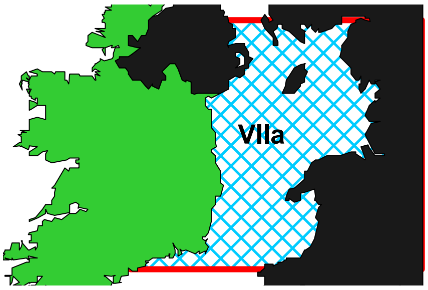
Despite the absence of an analytical assessment FSS consider that all evidence indicates that the stock size is very low. FSS agree with the ICES advice that catches of whiting in 2006 should be the lowest possible.

FSS therefore consider that a recovery plan which ensures rapid rebuilding of SSB must be implemented. FSS considers that current high levels of discarding mean that restricting landings alone will not achieve the necessary increase in SSB. FSS stress that the cornerstone of any rebuilding plan should be measures that significantly reduce the discarding of whiting in the *Nephrops* fishery.

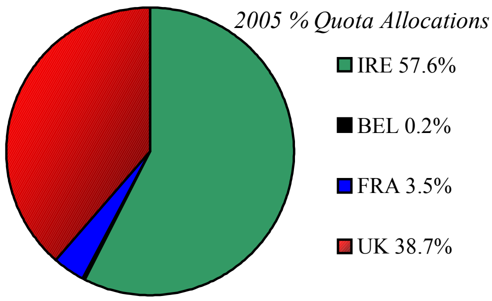
FSS consider that a well defined 'management plan' is necessary to recover the cod and whiting stocks and to fish them sustainably once they have recovered. FSS consider that such a plan requires clearly defined objectives that will ensure a high probability of recovery to agreed levels within a specified time frame.

CURRENT MANAGEMENT

- The TAC area covers Divisions VIIa and corresponds to the assessment area.
- The TAC in 2005 was 514 t with an associated Irish quota of 296 t.
- The spring closure of the western Irish Sea to whitefish fishing, designed to protect cod, has been continued, but is unlikely to have affected whiting catches, which are mainly by-catch in the derogated *Nephrops* fishery.
- The operation of days-at-sea effort limitations in the Irish Sea in 2004 and 2005 is not expected to have resulted in a significant reduction in fishing mortality for whiting. The effort regulations have provided an incentive for trawlers previously using >100mm mesh to switch to smaller mesh gears, in order to claim more days-at-sea (up to 21 days/month). Discarding rates may therefore have actually increased
- There are no explicit management objectives or a management plan for this stock. There are reports of significant non-reported landings indicating that the current implementation of the TAC system is unable to restrict fishing.



Red Box-TAC/Management Area Blue Shading– Assessment Area



ADDITIONAL INFORMATION

1 The denial of access to several major ports in Northern Ireland for biological sampling since 2003 is a major problem. Unless full sampling is resumed at all major ports, there will be larger uncertainties in the stock status and thus more precautionary advice.

2 Most of the landings are taken by UK (Northern Ireland), Ireland and UK (England and Wales). UK (Northern Ireland) fleets are take most of their landings from the Western Irish Sea, while the UK (England) fleet takes most of its landings from the Eastern Irish Sea. Whiting is taken mainly as by-catch in the mixed otter trawl fisheries for *Nephrops*, cod and other demersal species and in the Northern Ireland pelagic fishery for cod.

3 Reported landings in 2004 were only 96.3 t, down from ~11,000 t in the late 1980s. The Irish landings

were estimated to be 95 t in 2004. Misreporting is known to occur making catch-based assessments unreliable.

4 Vessels operating out of Dunmore East, Clogherhead and Howth traditionally take most of the Irish catches. Most of the recent Irish landings were from the Southern Irish Sea and may in fact be fish from the Celtic Sea stock.

5 Ireland has a high quota for this stock (58%) due to the Hague preference agreement.

6 Discarding data shows that individuals in excess of the MLS (27 cm) are discarded. In addition, the discard data indicates that very large numbers of whiting below this size are caught in the *Nephrops* fishery and discarded. Full protection of juvenile whiting will require minimising discards of juvenile whiting in the *Nephrops* fishery.

7 It has proved difficult to evaluate the success of measures, such as the mandatory use of square mesh panels in *Nephrops* trawls since 1994, as there have been very few direct observations of size and age compositions of catches prior to discarding (much of the discards data are from fisher self-sampling schemes that do not record total catch). Experimentally these measures reduce substantially whiting discarding. However, monitoring programmes are needed to evaluate if these experimental benefits have been realised in the commercial fishery.

ICES ADVICE
1.4.5

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target
Unknown, low SSB	Unknown	Unknown	Unknown

Long term information on the historical yield and catch composition all indicate that the present stock size is low. The last assessment in 2003 indicated a decrease in SSB of a factor of 10 from 1980s to the 1990s. Survey information from the 1990s indicates that the stock has remained at the low level.

Management objectives

No explicit management objectives have been set for this stock.

Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is 5 000 t	$\mathbf{B}_{pa}$ be set at 7 000 t
	$\mathbf{F}_{lim}$ is 0.95	$\mathbf{F}_{pa}$ be set at 0.65
Target reference points		$\mathbf{F}_{y}$ not determined

$\mathbf{B}_{lim}$: $\mathbf{B}_{loss}$. The lowest observed spawning stock biomass as estimated in previous assessment. There is no clear evidence of reduced recruitment at the lowest observed SSB's.	$\mathbf{B}_{pa}$: = $\mathbf{B}_{loss}$ * 1.4: This is considered to be the minimum SSB required to ensure a high probability of maintaining SSB above its lowest observed value, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$: This is the fishing mortality estimated to lead to a potential stock collapse.	$\mathbf{F}_{pa}$: This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$ and is consistent with a high probability of remaining above $\mathbf{B}_{pa}$ in the long run. It implies an equilibrium SSB of 10.6 kt, and a relatively low probability of SSB < $\mathbf{B}_{pa}$ (= 7 kt), and is within the range of historic Fs.

Single stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

On the basis of the stock status, ICES advises that catches of whiting in 2006 should be the lowest possible.

Management considerations

Landings of whiting by all vessels, and discards of whiting estimated for *Nephrops* fisheries, have declined substantially since the 1990s and whiting is now a relatively minor by-catch in the demersal fisheries. Due to the small catches and low value of the catch, a high proportion of whiting are discarded. Age profiles observed on these surveys are very steep indicating either a continuing high mortality or some emigration effect. Fishing mortality cannot be managed by a TAC on whiting, and measures restricting landings alone will not be sufficient to allow recovery of the stock.

The substantial drop in landings demonstrates the need for concern for this stock, but as current catches are virtually all taken as discards in the valuable *Nephrops* fishery, measures to protect whiting would require constraints on the *Nephrops* fishery. Measures in place to protect cod will not protect whiting as there are derogations for the *Nephrops* fishery. By-catch mitigation measures (square mesh panels) are in place in the *Nephrops* fishery, but the fishery is still generating substantial discards.

Management plan evaluations

There are reports of significant non-reported landings and therefore the current implementation of the TAC system is not able to restrict fishing. Unless management measures are able to restrict the fishery within TAC limits they are not precautionary.

Factors affecting the fisheries and the stock

The Effects of Regulations

Various technical measures have been introduced in the past to mitigate by-catch of whiting in the *Nephrops* fishery, which operates on the whiting nursery grounds. It has proved difficult to evaluate the success of measures such as the mandatory use of square mesh panels in *Nephrops* trawls since 1994, as there have been very few direct observations of size and age compositions of catches prior to discarding (much of the discards data are from fisher self-sampling schemes that do not record total catch). Experimentally these measures reduce substantially whiting discarding, however, monitoring programmes are needed to evaluate if these experimental benefits have be realised in the commercial fishery

Due to the by-catch of cod in fisheries taking whiting, the regulations affecting Division VIIa whiting remain linked to those implemented under the Irish Sea cod recovery plan. The regulations implemented for cod are detailed in the single-species advice for cod (Section 4.6.1, *this volume*). The closure of the western Irish Sea to whitefish fishing from mid-February to the end of April, designed to protect cod, has been continued, but is unlikely to have affected whiting catches, which are mainly by-catch in the derogated *Nephrops* fishery.

Similarly the extension of days-at-sea limitations into the Irish Sea in 2005 is not expected to result in a significant reduction in fishing mortality for whiting since the *Nephrops* fleet are still permitted to fish for up to 21 days/month.

The minimum landing size (MLS) for whiting is 27 cm, however, discard data shows that individuals in excess of that size are also discarded. In addition, the discard data indicates that very large numbers of whiting below this size are caught in the *Nephrops* fishery and discarded.

Since the mid 1990's square mesh panel legislation has been mandatory for UK and Irish vessels specifically to reduce the fishing mortality on juvenile whiting in the *Nephrops* fishery. These measures have remained in place in 2004 and 2005. There are no specific recovery plans for whiting in Division VIIa, however, the technical measures for cod described in Section 1.4.1 *this volume* will also impact on vessels catching whiting.

Other factors

The stock structure of whiting in the Irish Sea is uncertain with differences in the population structure observed between the eastern and western components however whiting interchange between the western Irish Sea and other areas within the Irish Sea and this precludes treating different areas within the Irish Sea as containing functionally separate stocks.

It is not known if the severe decline of the population of adult whiting in the western Irish Sea represents a localised depletion of a more broadly distributed stock, or the depletion of a local sub-population. Survey catch-rates of whiting above the MLS of 27 cm have declined continuously in the western region since 1992, reflecting the rapid decline in commercial landings, whilst survey catch-rates in the eastern region are much higher and show little or no trend over time. The commercial fishery has become more concentrated in the western region in recent years as the English and Welsh fleets, which operate mainly in the east, have declined over time.

Scientific basis

Data and methods

Historically, the sampling of catch for length and age has been relatively poor for this stock. The unreliability of the catch numbers remained in 2004 due to a combination of low sampling levels and small landings (reported landings in 2004 only 96.3 t, down from ~11,000 t in the late 1980s). Nonetheless, issues with misreporting meant that a catch based assessment would have been unreliable.

Information from the fishing industry

Some information was available from the fishing industry. Ireland has established a trial self-sampling scheme (ECONEPH) in co-operation with the *Nephrops* fleet to augment discard sampling in the *Nephrops* fishery. The UK(NI) industry participated in an *ad hoc* workshop on Irish Sea whiting in the spring of 2005 where their information on the fishery was used to inform on the perception of stock structure.

Uncertainties in assessment and forecast

The major deficiency is poor quality of the input data. An examination of the survey data indicates poor internal and external consistency at tracking year-classes. In addition, the most recent estimates from different surveys give conflicting signals. Discard estimation and raising procedures are problematic and discard estimates may be imprecise.

Comparison with previous assessment and advice

The last analytical assessment was undertaken in 2003 based on a catch-at-age analysis using catch estimates and the western Irish Sea survey. There was no analytical assessment carried out for this stock in 2004 and again, no analytical assessment was possible this year. The advice this year is the same as last year.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official Landings	Disc.[2]	ACFM Catch
1987	Reduce F		16.0		18.2	11.7	3.8	14.4
1988	No increase in F; enforce mesh regulations		12.0		18.2	11.5	1.9	11.9
1989	F = $\mathbf{F}_{high}$; enforce mesh regulations		11.0		18.2	11.3	2.0	13.4
1990	No increase in F; TAC		8.3[1]		15.0	8.2	2.7	10.7
1991	Increase SSB to SSB(89); TAC		6.4[1]		10.0	7.4	2.7	9.9
1992	80% of F(90)		9.7[1]		10.0	7.1	4.3	12.8[3]
1993	70% of F(91) ~ 6 500 t		6.5		8.5	6.0	2.7	9.2[3]
1994	Within safe biological limits		-		9.9	5.6	1.2	7.9[3]
1995	No increase in F		8.3[1]		8.0	5.5	2.2	7.0[3]
1996	No increase in F		9.8[1]		9.0	5.6	3.5	8.0[3]
1997	No advice given		-		7.5	4.5	1.9	4.2[3]
1998	20% reduction in F		3.8[4]		5.0	3.4	1.3	3.5[3]
1999	Reduce F below $\mathbf{F}_{pa}$		3.5[4]		4.41	2.0	1.1	2.8[3]
2000	Reduce F below $\mathbf{F}_{pa}$		<1.6[4]		2.64	1.1	2.1	2.9[3]
2001	Lowest possible F		~0		1.39	1.1	1.0	1.7[3]
2002	Lowest possible F		~0		1.00	0.7	0.7	1.5[3]
2003	Lowest possible F		~0		0.50	0.5	n/a	n/a
2004		zero catch		0	0.514	0.1	n/a	n/a
2005		zero catch		0	0.514			
2006		lowest possible catch		-				

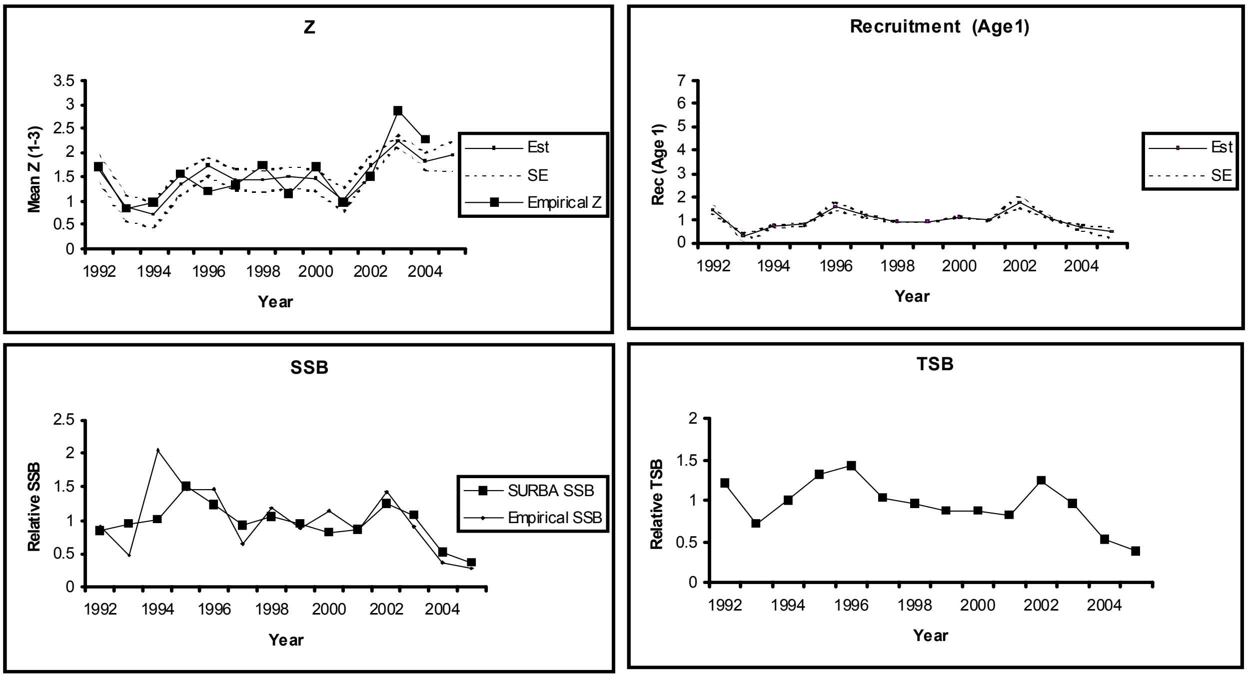
[1]Not including discards from the *Nephrops* fishery. [2]From *Nephrops* fishery. [3]Including estimates of misreporting.
[4]Landings only, no discards included. Weights in '000 t.

Table 1.4.5.1 Nominal catch (t) of WHITING in Division VIIa, 1988-2004, as officially reported to ICES and Working Group estimates of discards.

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	90	92	142	53	78	50	80	92	80	47	52	46	30	27	22	13	11
France	1,063	533	528	611	509	255	163	169	78	86	81*	150*	59	25*	33	26	n/a
Ireland	4,394	3,871	2,000	2,200	2,100	1,440	1,418	1,840	1,773	1,119	1,260	509	353	482	347	265	n/a
Netherlands									17	14	7	6	1				
UK(Engl. & Wales)[a]	1,202	6,652	5,202	4,250	4,089	3,859	3,724	3,125	3,557	3,152	1,900	1,229	670	506	284	….	85.3
Spain																85	
UK (Isle of Man)	15	26	75	74	44	55	44	41	28	24	33	5	2	1	1	1	
UK (N.Ireland)	4,621																
UK (Scotland)	107	154	236	223	274	318	208	198	48	30	22	44	15	25	27	31	
UK																130	
Total human consumption	11,492	11,328	8,183	7,411	7,094	5,977	5,637	5,465	5,581	4,472	3,355	1,989	1,130	1,066	714	551	96.3
Estimated Nephrops fishery discards used by the WG[b]	1,611	2,103	2,444	2,598	4,203	2,707	1,173	2,151	3,631	1,928	1,304	1,092	2,118	1,012	740	n/a	n/a

[a] 1989-2002 Northern Ireland included with England and Wales.
[b] Based on UK(N.Ireland) and Ireland data.
* Preliminary.

(a)



(b)

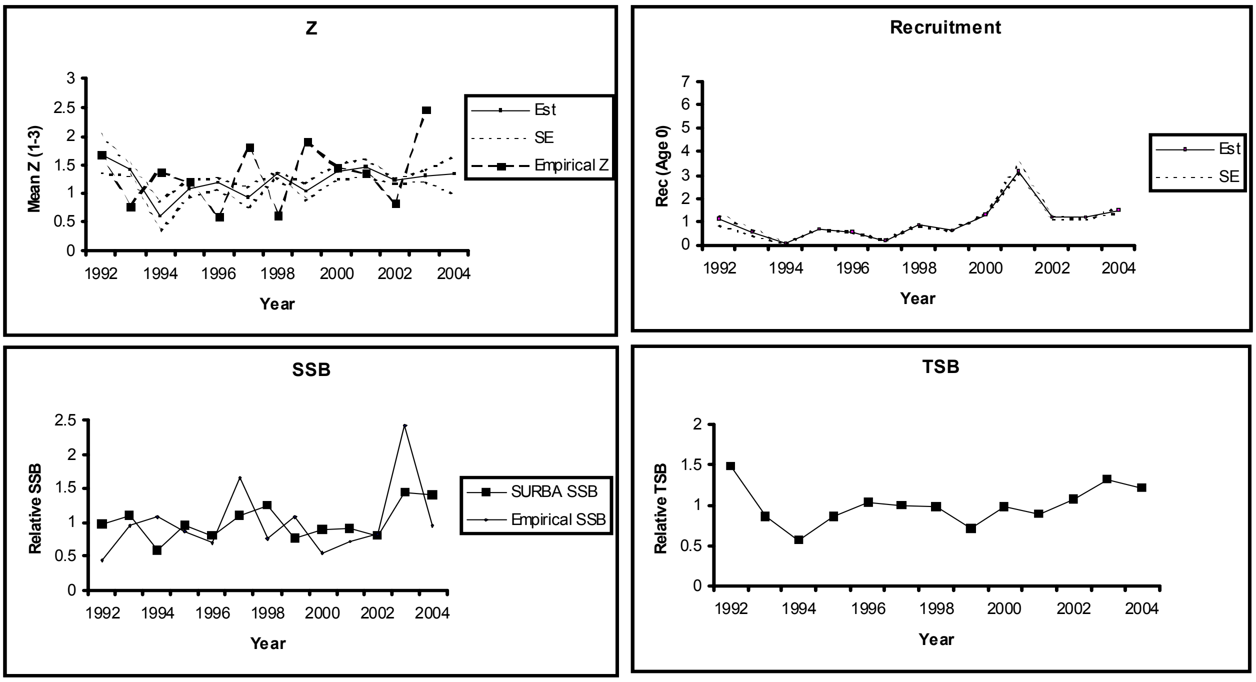


Figure 1.4.5.2 Summary plots of (a) NIGFS March and (b) NIGFS October SURBA showing mean standardized plots for Z, recruitment, SSB and TSB.

Irish Sea Haddock

(Division VIIa)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Irish sea Overview for Mixed Fishery Advice)

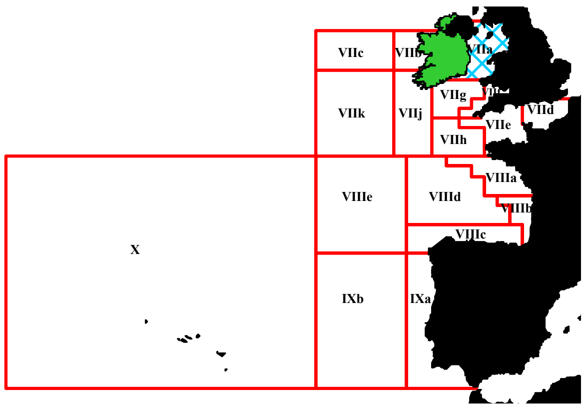
FSS consider the assessment to be very poor and indicative only of trends in SSB and recruitment. FSS agree with ICES that recent trends in fishing mortality are uncertain. Information on landings in 2003 and 2004 was not reliable due to the denial of access to several major ports in the UK (Northern Ireland) and Ireland for biological sampling and evidence of extensive misreporting.

Long Term Considerations
FSS consider that a well defined 'management plan' is necessary for Irish Sea mixed fisheries. FSS therefore recommend that stakeholders should develop and implement a long term management plan with clearly defined objectives that will ensure a high probability of fishing within safe biological limits. FSS consider that the current implementation of TACs has proved to be an ineffective means of accommodating variation in recruitment because of the long time interval between assessment and implementation. FSS recommend that long term management plans recognise that species such as haddock are subject to highly sporadic recruitment which will result in substantial variation in catches and SSB from year to year. FSS therefore recommend that a within-year review of management controls, taking into account real-time information, would allow a more effective means of exploiting the periodic recruitment that is characteristic of haddock stocks.

Short Term Considerations
FSS note that information on the actual level of catches is now so poor that it is not possible to advise on appropriate fishing mortality. FSS note that SSB is not depleted and therefore advise that as a precautionary measure the TAC for the first six months of 2006 should be set at 50% of the 2005 level, with a mid-year review.

TAC Area	2005		2006 Proposals [a]	
	TAC	Irish quota	TAC Jan-June	Irish quota Jan-June
VII,VIII,IX,X	11,520	2,560	5760	1280
Of which no more than … can be taken in VIIa	1,500	649	750	325

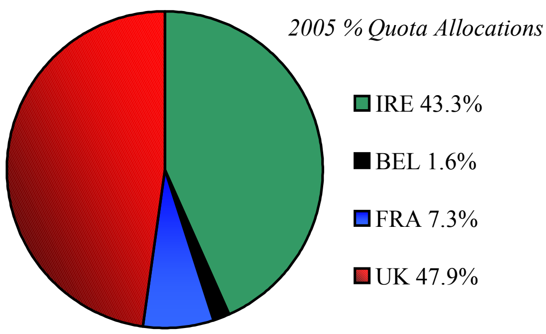
[a]: 50% of the 2005 level, contingent on a mid-year review in 2006.



Red Boxes-TAC/Management Areas Blue Shading– Assessment Area

CURRENT MANAGEMENT

- The TAC area traditionally covers Sub-areas VII, VIII, IX and X.
- The assessment area covers Division VIIa only.
- The 2005 TAC for haddock of 11,520 t was set for the whole of Divisions VII to X, of which no more than 1,500 t could be taken from Division VIIa.
- There are no explicit management objectives or a management plan for this stock.
- FSS recommend that management objectives be established and that a management plan be developed and implemented for fisheries catching haddock.



ADDITIONAL INFORMATION

1 Recent estimates of the age composition and levels of landings are considered unreliable because of poor sampling from some major fleets and extensive misreporting. An analytical catch-based assessment could therefore not be performed. Unless the quality of the available data improves substantially, there will be larger uncertainties in the stock status in future assessments and thus more precautionary advice.
2 The assessment is based on survey data only.
3 Recent discard estimates available for some fleets indicate a variable, but very high discard rate of younger fish. These estimates are not used in the assessment due to the short time-series available.
4 There is no biological basis for defining reference points in this stock and ACFM has proposed a precautionary $\mathbf{F_{pa}}$ of 0.5 in view of the rapid expansion of this fishery. The true exploitation pattern of this stock is not well estimated.
5 The fishery is dominated by the UK (NI) and Irish fleets. The haddock stock is mainly confined to the western Irish Sea where important mixed species fisheries for *Nephrops*, haddock, whiting and cod take place.
6 Irish catches are mainly made by otter trawl vessels operating out of Howth and targeting whitefish or switching between targeting whitefish and *Nephrops*. There is also some by-catch in the *Nephrops* and to a lesser extent seine and beam trawl fisheries.
7 The Irish landings were estimated to be 287 t in 2004.
8 The extent to which the cod and haddock fisheries are linked has not been quantified. This linkage is not one-to-one, but it is evident and likely to be highly variable, particularly in response to variable year-class strength.
9 FSS believe that there are no known biological reasons why haddock production could not be sustained in the Irish Sea. However the large fluctuations in recruitment characteristic of haddock stocks may mean that landings will fluctuate greatly in response to the strength of incoming year-classes.

ICES ADVICE
1.4.3

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target
Undefined	Unknown	Unknown	Not defined

The assessment is indicative of trends in SSB and recruitment and is based on survey results. Recent trends in fishing mortality are uncertain. Survey information indicates that fishing mortality remains at a high level relative to taking high long-term yields and that SSB has been sustained by recent high recruitment. The SSB increased since 2001 as a result of the stronger 1999 and 2001 year-classes. The 2003 and 2004 year-classes appear to be above average and should result in increased SSB.

Management objectives

There are no explicit management objectives for this stock.

Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is not defined	**B**pa is not defined
	$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ be set at 0.5
Target reference points		Not defined

Yield and spawning biomass per Recruit (from 2004 Assessment)
F-reference points

	Fish Mort Ages 2-4	Yield/R	SSB/R
$\mathbf{F}_{max}$	0.347	0.511	1.232
$\mathbf{F}_{0.1}$	0.180	0.469	2.009

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$-$\mathbf{F}_{max}$.

Technical basis:

There is currently no biological basis for defining appropriate reference points, in view of the rapid expansion of the stock size over a short period (ACFM, October 2002). ACFM proposed that **F**pa be set at 0.5 by association with other haddock stocks.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

Recent estimates of fishing mortality have been in excess of 1.0 and there will be no gain to the long-term yield by having fishing mortalities above $\mathbf{F}_{max}$ (0.35). Fishing at such lower mortalities would lead to higher SSB and, therefore, lower risks of fishing outside precautionary limits.

Exploitation boundaries in relation to precautionary limits
The fishing mortality should be reduced in order to make the fishery less sensitive to variable recruitment. Recent estimates of fishing mortality have been in excess of 1.0, compared to an $\mathbf{F}_{pa}$ of 0.5. Effort and catches should be reduced considerably to approach F_{pa}. Given the poor information on the actual catches it is not possible to quantify this reduction.

Management considerations

The EU Cod Recovery Plan regulation implemented in the Irish Sea from 2004 will impinge upon the management measures for 2006 for species caught in related fisheries, including haddock. The current directed fishery for haddock in the Irish Sea is likely to generate by-catches of cod in the same area.

Limited sampling schemes since the 1990s have shown high rates of discarding of haddock less than 3 years old, and variable discarding of 3-year-olds in fisheries using 70-80 mm mesh nets. Data for whitefish vessels since the introduction of 100+ mm mesh and other recent technical measures are too few to form a basis for evaluation. However, any measures to reduce discards will result in increased future yield.

Management plan evaluations

There are strong indications that management control is not effective in limiting the catch, and has resulted in very uncertain data on quantities of fish caught by the fleet.

The extent to which F could be reduced in 2006 by management measures such as effort limitation could not be reliably evaluated by ICES.

Factors affecting the fisheries and the stock

The effects of regulations

Due to the by-catch of cod in the haddock fishery, the regulations affecting Division VIIa haddock remain linked to those implemented under the Irish Sea cod recovery plan. The regulations implemented for cod are detailed in the overview for the Irish Sea. The extent to which fishing mortality may have been reduced in 2005 by management measures such as effort limitation and decommissioning of vessels in 2003 could not be reliably evaluated.

Scientific basis

Data and methods

Landings data for this stock are uncertain because of species misreporting, which has been estimated from quayside observations in one country only. Restrictive quotas for some countries caused extensive misreporting during the 1990s prior to the introduction of a separate TAC allocation for the Irish Sea. Estimates of misreporting prior to 2003 have been included in the estimates of landings.

The present stock estimates are relatively uncertain due to a lack of access to port sampling in 2003 and only limited access in 2004. There will continue to be uncertainties in the estimated stock status unless full sampling is resumed at all major ports. The official landings for 2004 of 445 t may thus substantially underestimate the true removal by the fishery. The misreporting levels for haddock have been highly variable in recent years, making it impossible for ICES to provide a reasonable estimate of the 2004 landings.

Estimates of the age composition are considered adequate prior to 2003. The accuracy of the 2004 estimates remains low because of poor sampling from some major fleets. Consequently, in the absence of reliable landing data and catch-at-age data no analytical catch-based assessment could be performed.

Recent discard estimates available for some fleets indicate a variable, but very high discard rate of younger fish. These estimates are not used in the assessment due to the short time-series available.

The assessment of recent stock trends is based on survey data only using the March survey data up to 2005.

Uncertainties in assessment and forecast

Some discarding information is available, which indicates that discarding is substantial for younger age-classes. Comparisons were made of relative trends in recruitment and SSB from this year's survey based assessment and last year's catch-based assessment. The methods indicate similar trends in SSB and recruitment estimates.

The survey-based assessment provides only relative trends in stock parameters.

Comparison with previous assessment and advice

The perception of the stock from this year's assessment does not differ qualitatively from that obtained last year and the basis of the advice is the same as last year.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2005 (ICES CM2006/ACFM:13).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	ACFM Landings
1987	Not dealt with					1.287	1.287
1988	Not dealt with					0.747	0.747
1989	Not dealt with					0.560	0.560
1990	Not dealt with					0.582	0.582
1991	Not dealt with					0.616	0.616
1992	Not dealt with					0.656	0.703
1993	Not dealt with					0.730	0.813
1994	Not dealt with					0.681	1.043
1995	Not dealt with				6[1]	0.841	1.753
1996	No advice				7[1]	1.453	3.023
1997	Means of setting catch limits required				14[1]	1.925	3.391
1998	Catch limit for VIIa		3.0		20[1]	3.015	4.902
1999	No increase in F; Catch limit for VIIa		7.0		4.99[2]	2.370	4.139
2000	Reduce F below $\mathbf{F}_{pa}$		<2.8		3.4[2]	2.447	1.430
2001	Reduce F below $\mathbf{F}_{pa}$		<1.71		2.7[2]	2.238[3]	2.50
2002	Reduce F below $\mathbf{F}_{pa}$		<1.20		1.3[2]	1.111[3]	1.972
2003	No cod catches		-		0.6[2]	0.638	n/a
2004	[4)]	F<**F**pa	[4]	<1.5	1.5	0.445[3]	n/a
2005	[4)]	F<**F**pa	[4]	<1.37	1.5		
2006	[4)]	Substantial reduction in fishing mortality	[4]	-			

1 Precautionary TAC for VII, VIII, IX, X. 2 VIIa allocation of precautionary TAC. 3 Incomplete data. 4 Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in 000 t.

Table 1.4.3.1 Nominal catch (t) of HADDOCK in Division VIIa as officially reported to ICES.

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992
Belgium	3	4	5	10	12	4	4	1	8
France	38	31	39	50	47	n/a	n/a	n/a	26
Ireland	199	341	275	797	363	215	80	254	251
Netherlands	-	-	-	-	-	-	-	-	-
UK (England & Wales)[1]	29	28	22	41	74	252	177	204	244
UK (Isle of Man)	2	5	4	3	3	3	5	14	13
UK (N. Ireland)	38	215	358	230	196	…	…	…	…
UK (Scotland)	78	104	23	156	52	86	316	143	114
Total	387	728	726	1,287	747	560	582	616	656

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	18	22	32	34	55	104	53	22	68
France	41	22	58	105	74	86	n/a	49	183
Ireland	252	246	320	798	1,005	1,699	759	1,238	652
Netherlands	-	-	-	1	14	10	5	2	-
UK (England & Wales)[1]	260	301	294	463	717	1,023	1,479	1,061	1,238
UK (Isle of Man)	19	24	27	38	9	13	7	19	1
UK (N. Ireland)	…	…	…	…	…	…	…	…	…
UK (Scotland)	140	66	110	14	51	80	67	56	86
Total	730	681	841	1,453	1,925	3,015	2,370	2,447	2,228

Country	2002	2003	2004
Belgium	44	20	15*
France	72	111	
Ireland	401	229	
Netherlands	-	-	
UK (England & Wales)[1]		248	
UK (Isle of Man)		0	
UK (N. Ireland)	…	…	
UK (Scotland)		30	
United Kingdom	598		430*
Total	1,115	638	445*

*Preliminary.
[1]1989–2001 Northern Ireland included with England and Wales.
n/a = not available.

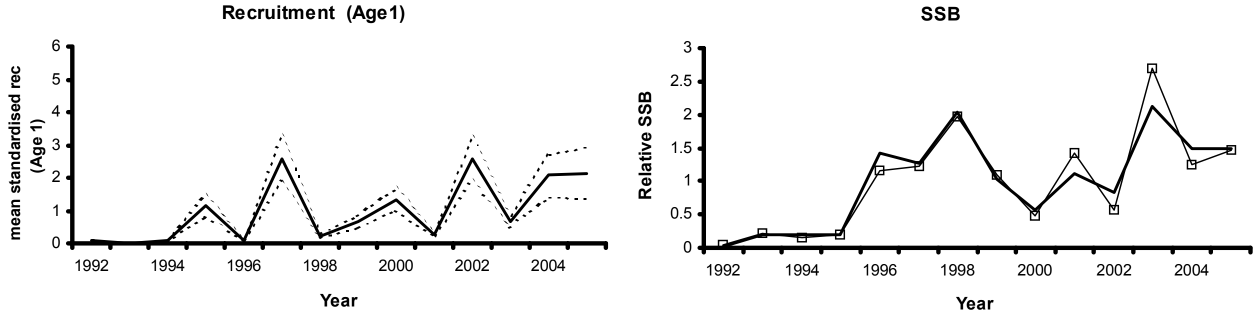


Figure 1.4.3.1 Haddock VIIa: Results of survey-based assessment. Dotted lines are +/- 1 SE in the left-hand panel. Empirical estimates of SSB from the raw survey data are shown in the right-hand panel (connected boxes).

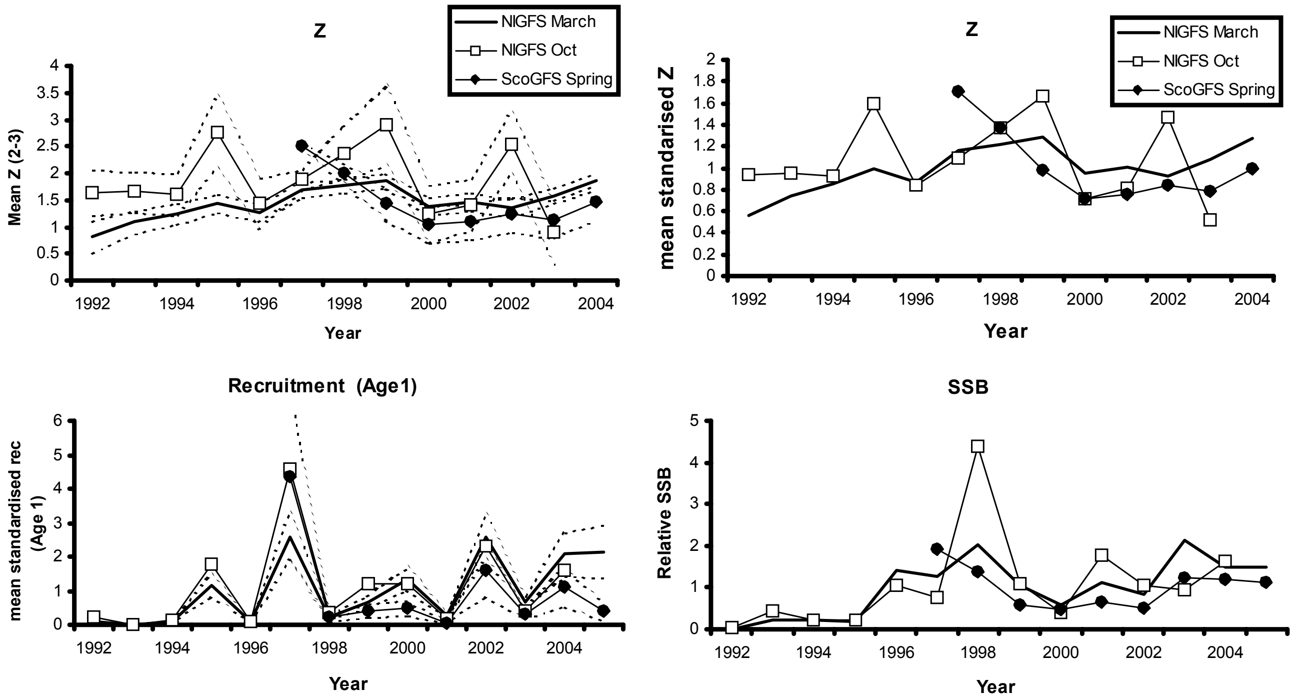


Figure 1.4.3.2 Haddock in VIIa: Comparison of SURBA 3.0 runs using NIGFS Mar, NIGFS Oct and ScoGFS Spring survey data. Dotted lines are +/- 1SE. Z estimates given as absolute and relative.

Irish Sea Nephrops

(WG - MA J = Division VIIa excluding Rectangles 33E2-E5 and 34E3-E5)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

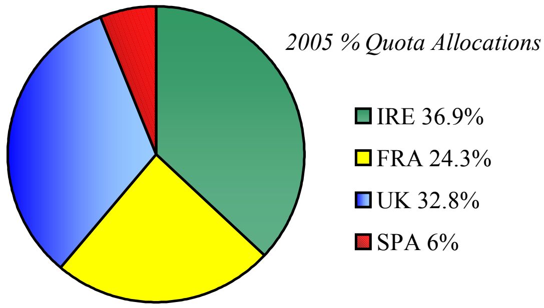
(See Irish Sea Overview for Mixed Fishery Advice)

ICES considers two stocks in this area FU 14 and 15. The states of these stocks are unknown in relation to precautionary reference points. These stocks have been sustained with high levels of fishing effort and discard rates for many years and all indicators suggest that the stock have not declined substantially in recent years.

FSS agree with the ICES advice that the effort in this fishery should not be allowed to increase and the fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and by-catch species. FSS considers that basing a TAC on recent landings is not appropriate as there is both substantial discarding and some uncertainty surrounding the accuracy of the reported landings.

CURRENT MANAGEMENT

- A 'precautionary' TAC area covers Sub-area VII. ICES have suggested a separate TAC for Division VIIa since the current large TAC area may result in unbalanced exploitation.
- The 2005 agreed TAC for all of Sub-area VII was 19,544 t, of which Ireland's quota was 7,207 t.
- WG-MA J contains two fisheries in the east (FU 14) and the west (FU 15).
- There are no explicit management objectives or a management plan for this stock. FSS recommend that management objectives be established and that a management plan be developed with stakeholders and implemented for fisheries catching *Nephrops*.
- The following TCMs are in place for *Nephrops* in VIIa after EC 850/98: *Minimum Landing Sizes (MLS)*; total length >70 mm, carapace length >20 mm, tail length >37 mm. *Mesh Size Restrictions*; Towed gears targeting *Nephrops* having at least 35% by weight of this species on board will require 70 mm diamond mesh plus an 80 mm square mesh panel as a minimum or having at least 30% by weight of *Nephrops* on board will require 80 mm diamond mesh.
- A days-at-sea effort limitation has been in place for Irish Sea *Nephrops* vessels since 2004 (See section on Effort Limitation and Recovery Plans).



ADDITIONAL INFORMATION

1. The Marine Institute in co-operation with DARDNI commenced an UWTV survey for the FU 15 stock in 2003. The results whilst still preliminary suggest a decline in the absolute population abundance since 2003. This survey series may become the main basis for the assessment and advice on this stock in future years once an adequate survey time series exists and the performance of the survey as a stock indicator can be fully evaluated.
2. Irish landings from VIIa in 2004 were estimated to be 2,850 t (42% of the total Irish *Nephrops* landings).
3. The LPUEs of Irish *Nephrops* vessels indicates that landable catches fluctuated around 50kg/hr.
4. In 2004, 67 Irish vessels reported *Nephrops* landings from VIIa. Of these 41 reported significant annual landings in excess of 10 t. This *Nephrops* fleet is by far the largest fleet segment in the Irish Sea. Vessels operating out of Howth, Clogherhead and Skerries take most of the Irish landings. Irish activity is concentrated on FU 15 (the western Irish Sea).

Management Area	Functional Units	ICES Landings advice	Comment
WG-MA J	14, 15	Not given	No increase in effort Average landings 2000-2002 ~8,100 t
WG-MA L	16, 17, 18, 19	3,300	Average landings 2000-2002
WG-MA M	20-22	4,600	Average landings 2000-2002
Sub-area VII	14 to 22	Not given	Average landings 2000-2002 ~16,100 t

5. The western Irish Sea *Nephrops* fishery is concentrated on an area that is also a whiting nursery ground. Discarding of juvenile whiting in the *Nephrops* fishery has contributed significantly to the reduction of the VIIa whiting stock.
6. Irish *Nephrops* vessels report small by-catches of cod but it is unclear whether this is the true situation.
7. There is also considerable discarding of small *Nephrops* in this fishery. In 2004 Irish vessels discarded an estimated 750 t (22% of catch by weight) of small *Nephrops* or 34% of the total numbers caught by the Irish fleet. High *Nephrops* discard rates have been sustained in this fishery for many years and the discards component of the catch is well sampled and included in the assessment.
6. There is no sampling data for these stocks from the commercial fishery in Northern Ireland since 2003 due to non co-operation between the industry and scientists.

ICES ADVICE
1.4.38

There are two Functional Units in this Management Area: a) Irish Sea East (FU 14) and b) Irish Sea West (FU 15).

State of the stock/exploitation

The status of the stocks in this Management Area is unknown.

a) Irish Sea East: Annual LPUEs fluctuating, but generally lower in the 1990s and 2000s than in the late 1970s and early 1980s. Landings fairly stable since the mid-1980s.
b) Irish Sea West: CPUEs and LPUEs for the Northern Ireland fleet have remained relatively constant since 1995, with the slight drop in 2000 and 2001 being recovered in 2002. Republic of Ireland CPUE data available from 1995 showed a steady increase followed by a slight drop since 1999.

Management objectives

This is managed as a total TAC for Division VII. There are no management objectives set for this fishery.

Reference points

No reference points have been determined for *Nephrops*.

Single stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

The effort in this fishery should not be allowed to increase and the fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and by-catch species.

Management considerations

The *Nephrops* trawl fisheries take considerable by-catches of other species. The management of these fisheries should be seen in the context of mixed fisheries (see section 1.1.2, *this volume*).

Evidence of under-reporting of landings creates problems with using commercial data for analytical assessments and in TAC recommendations. Despite evidence of under-reporting, the *Nephrops* fisheries in Division VIIa have been sustained for over 20 years with similar high levels of fishing effort.

The landings from all FUs in this TAC area VII are presented in Table 1.4.38.1. Because of some uncertainty on the accuracy of recent landings the advice for these FUs (14 & 15) is based on effort whereas the advice for other *Nephrops* stocks (see section 1.4.40 & 1.4.41) within the TAC area is based on recent average landings (2000-2002). There is no information on the accuracy of landings for these other *Nephrops* stocks.

Factors affecting the fisheries and the stock

The Effects of Regulations

The minimum landing size for *Nephrops* is 20 mm carapace length (CL) which is appropriate for the gears used in this area. Almost all of the discarded catch are above the minimum landings size and discard sampling indicates than *Nephrops* over 25 mm CL are mainly retained.

Separator trawls were introduced in the Irish fishery in 2000 in an attempt to reduce cod by-catches. The uptake of separator trawls has increased in recent years (to around 80% of vessels in 2002).

Scientific basis

Data and methods

The underwater TV surveys performed in 2003, 2004 and 2005 provide additional information but the survey is still in its development phase. These surveys demonstrate promise to contribute to assessments of these stocks in the future when more information is available and the method has been consolidated.

Comparison with previous assessment and advice

Previously advice has been based largely on historical landings but there are now concerns over the accuracy of official landings and effort statistics. Evidence of under-reporting of landings creates problems with using commercial data for analytical assessments and in quota advice.

Source of information:

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

Year	ICES advice	Recommended TAC	Agreed TAC [1]	Official landings
1987				10.3
1988				9.3
1989				12.4
1990				12.0
1991				13.1
1992		8.9	20.0	8.0
1993		9.4	20.0	8.6
1994		9.4	20.0	8.7
1995		9.4	20.0	9.3
1996		9.4	23.0	8.3
1997		9.4	23.0	10.9
1998		9.4	23.0	9.1
1999		9.4	23.0	11.3
2000		9.4	21.0	8.9
2001		9.4	18.9	8.1
2002	Set TAC in line with 1995-99 landings	9.55	17.79	7.3
2003	Set TAC in line with 1995-99 landings	9.55	17.79	7.5
2004	Set TAC in line with 1995-99 landings	9.55	17.45	4.9
2005	Set TAC in line with 1995-99 landings	9.55	19.544	
2006	No increase in effort	9.55		

(Weights in '000 t) [1)] Subarea VII.

Table 1.4.38.1 ICES best estimates of *Nephrops* landings from ICES Sub-area VII by Functional Unit.

Year	**FU 14 - Irish Sea East**	**FU 15 - Irish Sea West**	**FU 16 - Porcupine**	**FU 17 - Aran Grounds**	**FU 18 - Ireland North West coast**	**FU 19 - Ireland South West and South East coast**	**FUs 20+21+22 - All Celtic Sea FUs combined**	**Other statistical rectangles - Outside FUs**	**Total Landings ICES Sub-area VII**
1978	1039	4867	1744	272	0	0	4056	249	12226
1979	1010	5944	2269	481	0	0	4542	237	14484
1980	799	3022	2925	452	0	0	3535	205	10938
1981	873	4301	3381	442	0	0	3680	382	13060
1982	897	5004	4289	414	1	2	3316	238	14161
1983	765	5152	3426	210	0	0	3732	182	13467
1984	619	4500	3686	131	0	2	3691	190	12819
1985	520	4522	3967	324	0	1	3602	194	13129
1986	693	5393	2591	208	0	0	2638	117	11640
1987	475	5169	2499	147	0	2	2842	348	11483
1988	497	5447	2375	62	1	2	2769	299	11451
1989	438	8147	2115	831	17	899	3801	356	16604
1990	644	8308	1895	344	7	754	4050	360	16361
1991	859	9568	1640	519	0	1077	3132	350	17145
1992	495	7548	2015	412	2	888	4018	645	16023
1993	582	8112	1857	372	10	905	4374	735	16948
1994	513	7618	2512	729	126	390	4869	859	17614
1995	637	7799	2936	866	26	695	5223	727	18909
1996	511	7257	2230	525	46	888	4611	881	16949
1997	597	9979	2409	841	15	756	4027	637	19260
1998	389	9145	2155	1410	78	827	3835	663	18501
1999	625	10786	2132	1140	16	572	3532	471	19273
2000	567	8370	872	880	9	686	4579	299	16263
2001	532	7378	1163	913	2	809	4644	409	15850
2002	577	6914	1282	1154	14	1288	4603	389	16223
2003*	376	6921	831	933	16	1230	4929	**N/A**	15237
2004[1]*	472	7209	1365	525	25	1065	4146	**N/A**	14808
Average	**630**	**6829**	**2317**	**575**	**15**	**509**	**3955**		**15216**

[1]Preliminary. *Incomplete data.

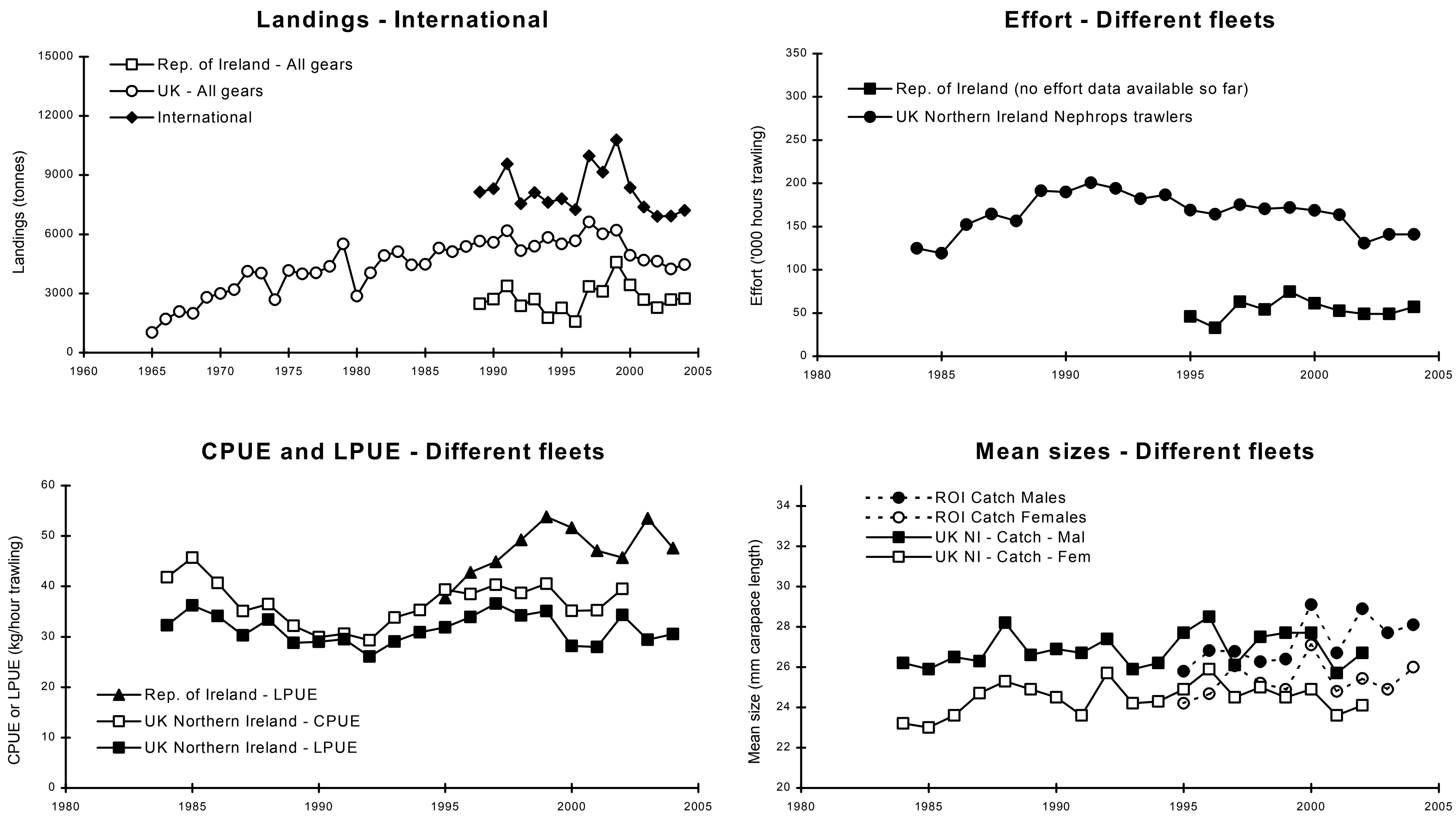


Figure 5.12.7. - Irish Sea West (FU 15): Long-term trends in landings, effort, CPUEs and/or LPUEs, and mean sizes of Nephrops.

Irish Sea Plaice

(Division VIIa)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

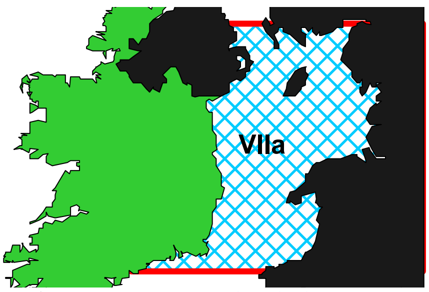
FSS – SINGLE STOCK CONSIDERATIONS

(See Irish Sea Overview for Mixed Fishery Advice)

FSS consider the most recent assessment to be more optimistic, and of improved quality compared to previous assessments. The principal reason is the heavier reliance on survey data in the assessment.

Based on the most recent estimates of SSB and fishing mortality, FSS agrees with the ICES classification of this stock as having full reproductive capacity and being harvested sustainably. The SSB in 2004 was almost four times B_{pa} and average fishing mortality in the last three years has been below F_{pa}.

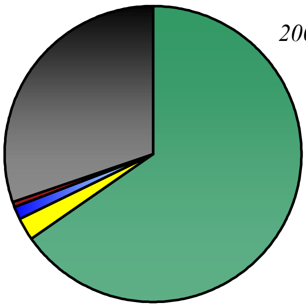
FSS note the ICES advice that little long-term gain is achieved by increasing fishing mortality towards F_{pa}. The FSS advice differs from the ICES long-term advice which is that F should not be allowed to increase above current levels. Given the current state of the stock FSS suggest that F_{max} would be an appropriate short-term target F. This corresponds to landings of less than 4,900 t in 2006 translating to an Irish quota of about 3,200 t.



Red Box-TAC/Management Area Blue Shading– Assessment Area

CURRENT MANAGEMENT

- The TAC area (Division VIIa) corresponds to the assessment area.
- The TAC for 2005 was 1,608 t with an associated Irish quota of 1,051 t. The Hague preference agreement enables Ireland to claim an enhanced share of the TAC.
- There are no explicit management objectives or a management plan for this stock.
- FSS recommend that management objectives be established and that a management plan be developed and implemented for fisheries catching plaice.



ADDITIONAL INFORMATION

1 Fishing mortality on this stock has been maintained above F_{pa} for much of the time-series, but declined through the 1990s. SSB has been above B_{pa} throughout the period of assessment.

2 Previous assessments of this stock tended to overestimate SSB, under estimate fishing mortality and provide poor consistency in estimation of recent recruitment. These tendencies have been reduced in the most recent assessments due to the exclusion of commercial tuning fleet data resulting in increased reliance on the survey data.

3 FSS therefore considers the most recent assessment to be of improved quality compared to previous assessments. However, FSS notes that the surveys indicate a substantial increase in abundance of plaice in recent years that is not apparent from commercial catch data. Estimates of rapidly increasing biomass should be treated with some caution until the discrepancy between the survey and commercial data can be better explained.

4 Preliminary investigations suggest that a considerable proportion of the catch may be discarded. Measures to reduce discarding would therefore be beneficial to the stock.

5 Data at younger ages remains poor and discard estimates are still not included in the assessment. However, the results of preliminary analyses indicate that the current perception of exploitation levels is not dramatically revised when estimates of discard levels are included.

6 Misreporting is not considered a problem in this fishery.

7 UK (England) usually takes over 40% of the total landings. The Irish and Belgian fleets each tradition-

ally take about a quarter of the landings. Effort in the UK and Belgian beam trawl fleets increased in the late 1980s, but declined in the early 1990s. Belgian beam trawl effort has increased markedly over the last three years.

8 The Irish landings were estimated to be 327 t in 2004.

9 The Irish landings of this stock are taken mainly by otter trawl (targeting mixed species such as cod, whiting and Nephrops), but also by beam trawlers targeting sole in quarters 1 and 4. Vessels operating out of Howth, Kilmore Quay, Waterford and Clogherhead take most of the Irish catch.

ICES ADVICE
1.4.7

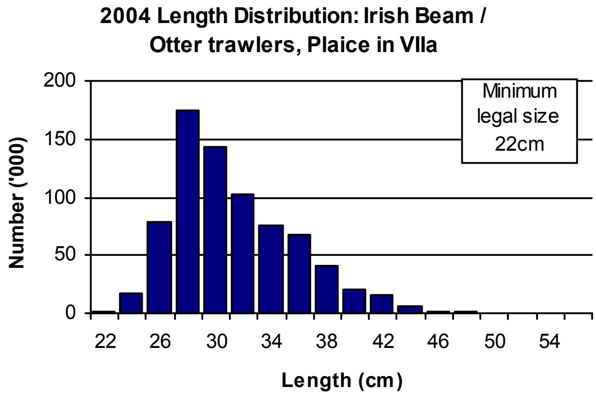
State of the stock

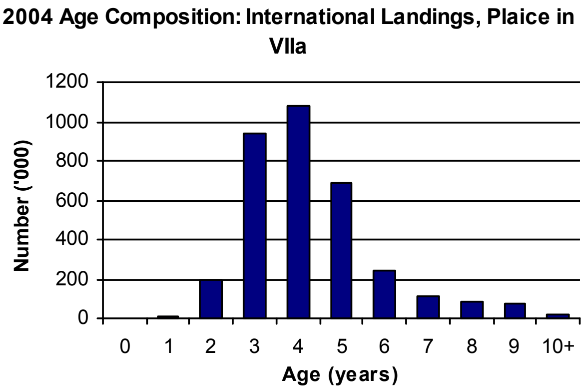
Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target
Full reproductive capacity	Harvested sustainably	Harvested sustainably	Harvested sustainably

Based on the most recent estimate of SSB and fishing mortality, ICES classifies the stock as having full reproductive capacity and being harvested sustainably. The SSB in 2004 was above $\mathbf{B}_{pa}$ and average fishing mortality in the last three years has been below $\mathbf{F}_{pa}$. Fishing mortality on this stock has been maintained above $\mathbf{F}_{pa}$ for much of the time-series, but declined through the 1990s. SSB has been above $\mathbf{B}_{pa}$ throughout the period of assessment.

Management objectives

There are no explicit management objectives for this stock.





Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is not defined	$\mathbf{B}_{pa}$ be set at 3,100t
	$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ be set at 0.45
Target reference points		$\mathbf{F}_{y}$ not defined

Yield and spawning biomass per recruit
F-reference points

	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	0.157	0.199	1.170
Fmax	0.357	0.216	0.600
F0.1	0.133	0.191	1.317
Fmed	0.564	0.213	0.407

Technical basis

$\mathbf{B_{lim}}$: There is no biological basis for defining B_{lim} as the stock-recruitment data are uninformative.	$\mathbf{B_{pa}} = \mathbf{B_{loss}}$
$\mathbf{F_{lim}}$: There is no biological basis for defining F_{lim} as F_{loss} is poorly defined.	$\mathbf{F_{pa}} = \mathbf{F_{med}}$ in a previous assessment, and in long-term considerations. This is considered to provide a high probability that SSB remains above $\mathbf{B_{loss}}$ in the long-term.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

Fishing mortality is estimated to be below $\mathbf{F_{max}}$ (0.36) and close to $\mathbf{F_{0.1}}$ (0.13). There will be little gain to the long-term yield by increasing fishing mortalities above current levels. Fishing at such lower mortalities would lead to higher SSB and, therefore, lower risks of fishing outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

In order to harvest the stock within precautionary limits, fishing mortality should be kept below $\mathbf{F_{pa}}$ (0.45). This corresponds to catches less than 5 900 t in 2006 and will lead to a reduction in SSB to 11 200 t in 2007. Average fishing mortality in the last three years has been below $\mathbf{F_{pa}}$ and no long-term gains are obtained by increasing the current fishing mortality towards $\mathbf{F_{pa}}$.

Short-term implications

Outlook for 2006:

Basis: F(2005) = F_{sq} = mean F(02-04) = 0.16; R64-02 = GM = 14.1 million; SSB(2005) = 12.35kt; SSB(2006) = 13.61kt; landings (2005) = 2.18kt.

Rationale	TAC(2006)([1])	Basis	F(2006)	SSB(2007)
Zero catch	0	F=0	0.00	16,800
High long term yield	1983	F(long term yield)	0.13	14,900
Status quo	1000	F_{sq} *0.4	0.06	15,800
	1240	Fsq *0.5	0.08	15,600
	1477	Fsq *0.6	0.10	15,400
	1709	Fsq *0.7	0.11	15,200
	1938	Fsq *0.8	0.13	15,000
	2163	Fsq *0.9	0.14	14,700
	2384	F_{sq}	0.16	14,500
	2602	Fsq *1.1	0.18	14,300
Precautionary Limits	721	TAC(Fpa)*0.1	0.05	16,100
	1742	TAC(Fpa)*0.25	0.11	15,100
	3294	TAC(Fpa)*0.5	0.23	13,700
	4577	TAC(Fpa)*0.75	0.34	12,400
	5435	TAC(Fpa)*0.9	0.41	11,700
	5913	Fpa (~2.8*Fsq)	0.45	11,200
	6369	TAC(Fpa) *1.1	0.50	10,800
	7016	TAC (Fpa) *1.25	0.56	10,200
	8001	TAC (Fpa) *1.5	0.68	9,300
	8883	TAC (Fpa) *1.75	0.79	8,500
	9673	TAC (Fpa) *2	0.90	7,800
	10381	TAC (Fpa) *2.25	1.01	7,100

Shaded scenarios not in line with precautionary approach
[1]It is assumed that the TAC will be implemented and that the landings in 2005 therefore correspond to the TAC.

Management considerations

Plaice are taken in a mixed demersal fishery, the regulations affecting plaice in Division VIIa, and other demersal stocks, remain linked to those implemented under the Irish Sea cod recovery plan. The regulations implemented for cod are detailed in the single-species summary sheet for cod (see section 1.4.1 *this volume*).

The EU Cod Recovery Plan regulation implemented in the Irish Sea from 2004 will impinge upon the management measures for 2006 for species caught in related fisheries, particularly in relation to controlling effort.

Scientific basis

Data and methods

The assessment is based on catch-at-age analysis using landings data and data from one survey. Landings are at the lowest level in the time series but information on misreporting is not available. Discard levels are substantial in the fishery but are not currently incorporated into the assessment.

Uncertainties in assessment and forecast

There are conflicting signals in the survey and commercial tuning fleet indices. The commercial tuning fleet indices are not used in the assessment. The assessment may thus be biased, but it is not known to what extent. Surveys indicate a substantial increase in abundance of plaice in recent years that is not apparent from commercial catch data. The assessment is strongly influenced by survey trends and the resulting estimates of rapidly increasing stock biomass should be treated with some caution until the discrepancy between these two data sources can be better explained.

Discards are not currently incorporated into the assessment. The results of preliminary analyses indicate that the current perception of exploitation levels is not dramatically revised when estimates of discard levels are included. However, discard levels are substantial in this fishery and methods for estimating previous discard levels are still being investigated. Systematic collection of discard information is required for improved assessment and advice.

Comparison with previous assessment and advice

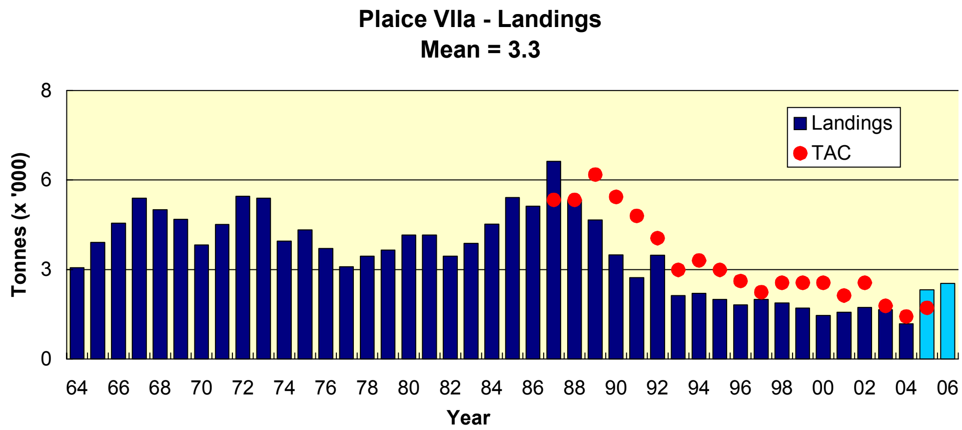
The commercial CPUE data could not be used as a reliable source of tuning information and this year's assessment is more optimistic than that of last year. The principal reason is that the commercial fleets have been removed from the tuning, resulting in a heavier weighting of the survey data in the assessment. Levels of fishing mortality have declined markedly in recent years and fishing mortality in 2004 is estimated to have declined further to a very low level. The basis of the advice is the same as last year.

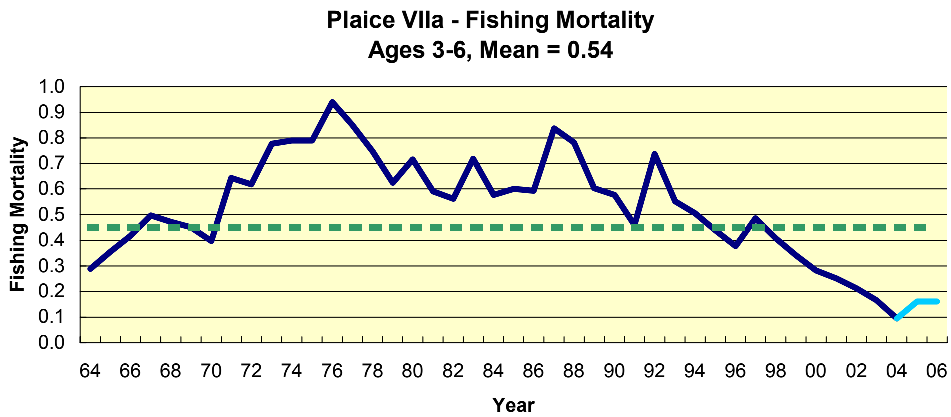
Source of information

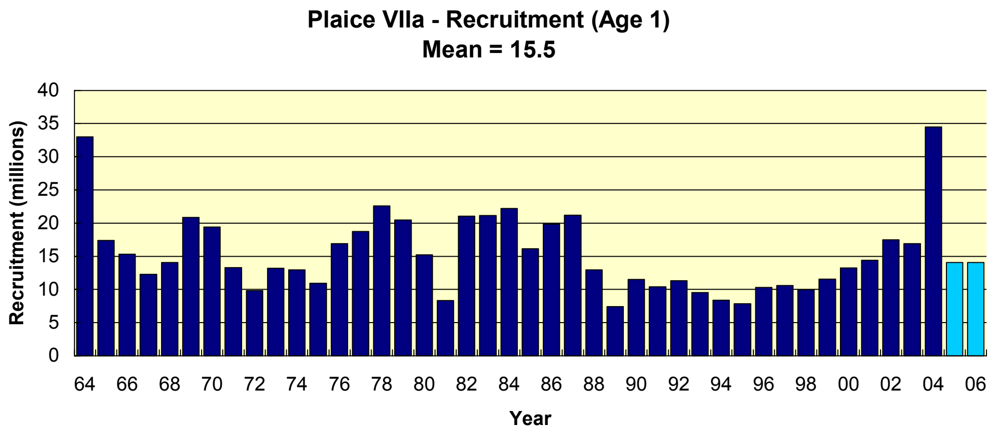
Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	ACFM Landings
1987	F high; no long-term gains in increasing F		5.0		5.0	5.6	6.2
1988	No increase in F		4.8		5.0	4.4	5.0
1989	80% of F(87); TAC		5.8		5.8	4.2	4.4
1990	Halt decline in SSB; TAC		5.1		5.1	4.0	3.3
1991	Rebuild SSB to SSB(90); TAC		3.3		4.5	2.8	2.6
1992	70% of F(90)		3.0		3.8	3.2	3.3
1993	F = 0.55 ~ 2 800 t		2.8		2.8	2.0	2.0
1994	Long-term gains in decreasing F		<3.7		3.1	2.1	2.1
1995	Long-term gains in decreasing F		2.4[1]		2.8	2.0	1.9
1996	No long-term gain in increasing F		2.5		2.45	1.9	1.7
1997	No advice		-		2.1	2.0	1.9
1998	No increase in F		2.4		2.4	1.8	1.8
1999	Keep F below $\mathbf{F}_{pa}$		2.4		2.4	1.6	1.6
2000	Keep F below $\mathbf{F}_{pa}$		<2.3		2.4	1.5	1.4
2001	Keep F below $\mathbf{F}_{pa}$		<2.4		2.0	1.5	1.5
2002	Keep F below $\mathbf{F}_{pa}$		<2.8		2.4	1.5	1.6
2003	No increase in F		1.9		1.675	1.5	1.5
2004	[3]	$F<\mathbf{F}_{pa}$		1.6	1.34	0.8[2]	1.1
2005	[3]	$F<\mathbf{F}_{pa}$		2.97	1.608		
2006	[3]	$F<\mathbf{F}_{pa}$		5.9			

Weights in '000 t. [1]Catch at *status quo* F. [2] Incomplete statistics. [3] Single-stock boundary, the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.


Plaice VIIa - Landings
Mean = 3.3
Tonnes (x '000)
Landings
TAC
Year


Plaice VIIa - Fishing Mortality
Ages 3-6, Mean = 0.54
Fishing Mortality
Year


Plaice VIIa - Recruitment (Age 1)
Mean = 15.5
Recruitment (millions)
Year

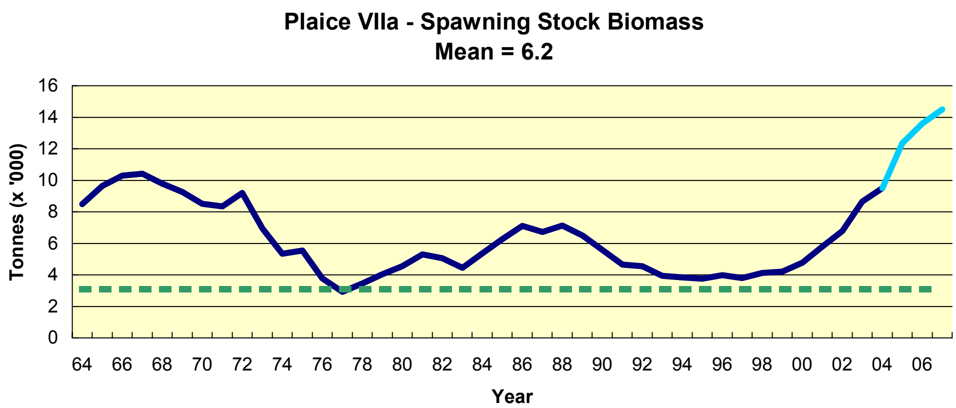

Plaice VIIa - Spawning Stock Biomass
Mean = 6.2
Tonnes (x '000)
Year

Table 1.4.7.1 Nominal landings (t) of PLAICE in Division VIIa as officially reported to ICES.

Country	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004[1]
Belgium	138	321	128	332	327	344[3]	459	327	275	325	482	636	628	430
France	20	42	19	13	10	11	8	8	5	14	9[1]	8	7	
Ireland	900	1,355	654	547	557	538	543	730	541	420	378	370	490	
Netherlands	-	-	-	-	-	69	110	27	30	47	-	-	-	
UK (Eng.&Wales)[2]	1,584	1,381	1,119	1,082	1,050	878	798	679	687	610	607	569	418	372
UK (Isle of Man)	51	24	13	14	20	16	11	14	5	6	1	1	1	
UK (N. Ireland)	…	…	…	…	…	…	…	…	…	…	…	…	…	
UK (Scotland)	104	70	72	63	60	18	25	18	23	21	11	7	…	
UK (Total)														
Total	2,797	3,193	2,005	2,051	2,024	1,874	1,954	1,803	1,566	1,443	1,488	1,591	1,544	802
Discards	-	-	-	-	-	-	-	-	-	-	-	-	-	
Unallocated	-243	74	-9	15	-150	-167	-83	-38	34	-72	-15	31	-24	313
Total figures used by the Working Group for stock assessment	2,554	3,267	1,996	2,066	1,874	1,707	1,871	1,765	1,600	1,371	1,473	1,622	1,520	1,115

[1]Provisional.
[2]1989–1999 Northern Ireland included with England and Wales.
[3]Final Statlant 27a data.
{UK (Total) excludes Isle of Man data}.

Table 1.4.7.2 Plaice in Division VIIa (Irish Sea).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1964	33020	8495	2879	0.28740
1965	17400	9650	3664	0.35510
1966	15300	10290	4268	0.41740
1967	12270	10430	5059	0.49760
1968	14070	9789	4695	0.47170
1969	20870	9250	4394	0.45110
1970	19420	8508	3583	0.39700
1971	13300	8336	4232	0.64370
1972	9823	9199	5119	0.61810
1973	13180	6942	5060	0.77710
1974	12960	5344	3715	0.78970
1975	10890	5543	4063	0.78930
1976	16900	3781	3473	0.94010
1977	18730	2918	2904	0.85180
1978	22610	3461	3231	0.74820
1979	20490	4047	3428	0.62380
1980	15210	4541	3903	0.71650
1981	8315	5294	3906	0.59030
1982	21050	5053	3237	0.56210
1983	21130	4447	3639	0.71870
1984	22180	5367	4241	0.57740
1985	16140	6275	5075	0.60010
1986	19810	7109	4806	0.59380
1987	21190	6710	6220	0.83770
1988	12950	7132	5005	0.78270
1989	7410	6503	4372	0.60320
1990	11520	5579	3275	0.57630
1991	10400	4651	2554	0.45990
1992	11290	4553	3267	0.73830
1993	9516	3943	1996	0.55190
1994	8375	3832	2066	0.50580
1995	7844	3753	1874	0.44040
1996	10300	3985	1707	0.37710
1997	10610	3799	1871	0.48530
1998	9968	4127	1765	0.40660
1999	11570	4216	1600	0.34130
2000	13250	4764	1371	0.28210
2001	14410	5790	1473	0.25020
2002	17460	6777	1622	0.21210
2003	16880	8646	1554	0.16540
2004	34510	9488	1115	0.09496
2005	14080	12354		
Average	15443	6302	3348	0.53974

Irish Sea Sole

(Division VIIa)

For latest information, see: http://www.ices.dk

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Irish Sea Overview for Mixed Fishery Advice)

FSS consider that the poor quality of the input data prevents an analytical assessment of this stock. The principal cause of the poor data quality was the low sampling of the catch from the Belgian fleet.

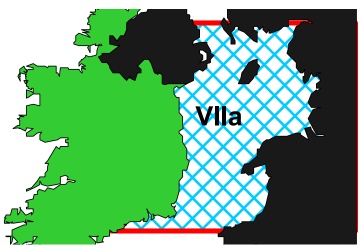
Despite the absence of an analytical assessment FSS notes that commercial CPUE and survey information both indicate a stable stock situation in recent years.

Long Term Considerations

FSS advise that longer-term strategies and multi-annual management be explored for this stock, given the stability exhibited over the time series.

Short Term Considerations

FSS agree with the ICES recommendation for a precautionary TAC in 2006 based on recent catch levels. This advice corresponds to landings of 930 t in 2006, translating to an Irish quota of 114 t.

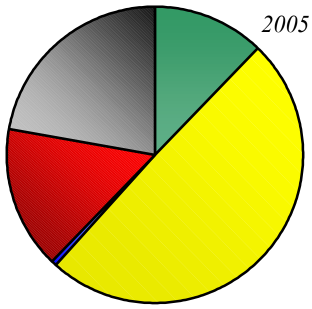


Red Box-TAC/Management Area Blue Shading– Assessment Area

CURRENT MANAGEMENT

- The TAC area (Division VIIa) corresponds to the assessment area.
- The TAC in 2005 was 960 t with an Irish quota of 117 t.
- FSS recommend that management objectives be established and that a management plan be developed and implemented for fisheries catching sole.

2005 % Quota Allocations



ADDITIONAL INFORMATION

1. The general performance of the sole assessment was reasonably consistent until this year. Inadequate sampling of the Belgian catch in 2002 and 2003 created such substantial problems with the data that an analytical assessment was not accepted.
2. There are indications that area misreporting of sole occurs, and there are also indications that some fleets are not limiting their uptake to their quota
3. Estimated Irish landings were about 77 t in 2004.
4. The Irish Sole fishery in VIIa is mainly undertaken by beam trawlers in quarters 1 and 4. Sole are also a by-catch in demersal otter trawl fisheries.
5. Information on discards is very limited, but indicates that discarding rates are relatively low (<5% by weight).
6. There are cod by-catches in the sole fishery but the closures of cod spawning-grounds in place since 2000 are unlikely to have had a big impact on the sole fishery. In 2000 the closure covered the Western and Eastern Irish Sea. Since then, closure has been mainly in the Western part, whereas the main sole fishery is taken place in the Eastern part of the Irish Sea.

ICES ADVICE
1.4.12

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target
Unknown	Unknown	Unknown	

The available information is inadequate to evaluate spawning stock or fishing mortality relative to risk, so the state of the stock is unknown. Commercial CPUE indicates a stable stock situation in recent years and this is confirmed by survey information.

Management objectives

There are no explicit management objectives for this stock.

Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is 2 800 t, the lowest observed spawning stock in an earlier assessment.	$\mathbf{B}_{pa}$ be set at 3 800 t, which is considered to be the minimum SSB required to ensure a high probability of maintaining SSB above its lowest observed value, taking into account the uncertainty of assessments.
	$\mathbf{F}_{lim}$ is 0.4. Although poorly defined, there is evidence that fishing mortality in excess of 0.4 has led to a general stock decline and is only sustainable during periods of above-average recruitment.	$\mathbf{F}_{pa}$ be set at 0.30. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$.
Target reference points		Not defined.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 4-7	Yield/R	SSB/R
Average last 3 years	0.279	0.193	0.719
$\mathbf{F}_{max}$	0.396	0.195	0.517
$\mathbf{F}_{0.1}$	0.146	0.173	1.237
$\mathbf{F}_{med}$	0.268	0.192	0.745

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$-$\mathbf{F}_{pa}$.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa} \sim \mathbf{B}_{lim} * 1.4$
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$ poorly defined; based on historical considerations	$\mathbf{F}_{pa}$ = see above

Single-stock exploitation boundaries

There are not sufficient data available to a quantitative catch prediction. Indications from recent CPUE and effort data are that the stock situation has been stable in recent years. As a precautionary measure a TAC based on recent catch levels is recommended (2002-2004).

Management considerations

There are indications that area misreporting of sole occurs, and there are also indications that some fleets are not limiting their uptake to their quota. Such practices have the potential of masking the true stock trends for sole. Sole is caught both in a targeted fishery and as a by-catch in the plaice fishery. Information on discards is very limited, but information from 2003 is indicative of discard ranges up to 5% in weight.

Factors affecting the fisheries and the stock

The Effects of Regulations

Technical measures in force are minimum mesh sizes and minimum landing size (24 cm). Limited observations indicate that the rate of discarding of sole is relatively low.

The closures of cod spawning-grounds that have been in force since 2000 are unlikely to have had a big impact on the sole fishery. In 2000 the closure covered the Western and Eastern Irish Sea. Since then, closure has been mainly in the Western part, whereas the main sole fishery is taken place in the Eastern part of the Irish Sea.

Scientific basis

Data and methods

Uncertainties in assessment and forecast

Low sampling levels in 2002 and 2003 for one of the major fleets did result in substantial problems with the data (anomalously low weights-at-age and exploitation pattern). In addition, the 2004 age distributions of the different countries were not in coherence and investigations revealed that the absence of older fish in some fleets gave inconsistent results. Consequently an analytical assessment was not accepted.

Comparison with previous assessment and advice

An analytical assessment was not possible this year and consequently, the basis of the advice is different from that of last year.

Source of information:

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	ACFM Landings[2]
1987	No increase in F		1.9		2.1	2.0	2.8
1988	80% of F(86); TAC		1.6		1.75	1.9	2.0
1989	80% of F(87); TAC		< 1.48		1.48	1.8	1.8
1990	Interim advice		1.05[3]		1.5	1.6	1.6
1991	90% of F(89); TAC		1.3		1.5	1.2	1.2
1992	No long-term gains in increased F		1.2[1]		1.35	1.2	1.3
1993	F = F(91) ~ 920 t		0.92		1.0	1.0	1.0
1994	No long-term gains in increased F		1.51[1]		1.5	1.4	1.4
1995	20% reduction in F		0.8		1.3	1.3	1.3
1996	20% reduction in F		0.8		1.0	1.0	1.0
1997	20% reduction in F		0.8		1.0	1.0	1.0
1998	20% reduction in F		0.85		0.9	0.9	0.9
1999	Reduce F below $\mathbf{F}_{pa}$		0.83		0.9	0.8	0.9
2000	Reduce F below $\mathbf{F}_{pa}$		< 1.08		1.08	0.8	0.8
2001	Reduce F below $\mathbf{F}_{pa}$		< 0.93		1.1	1.0	1.1
2002	Keep F below $\mathbf{F}_{pa}$		<1.10		1.1	1.0	1.1
2003	Keep F below $\mathbf{F}_{pa}$		<1.01		1.01	1.0	1.0
2004	[4]	Maintain SSB above $\mathbf{B}_{pa}$		<0.79	0.80	0.6	0.7
2005	[4]	$F<\mathbf{F}_{pa}$		<1.00	0.96		
2006	[4]	Recent catch levels (2002-2004)		<0.93			

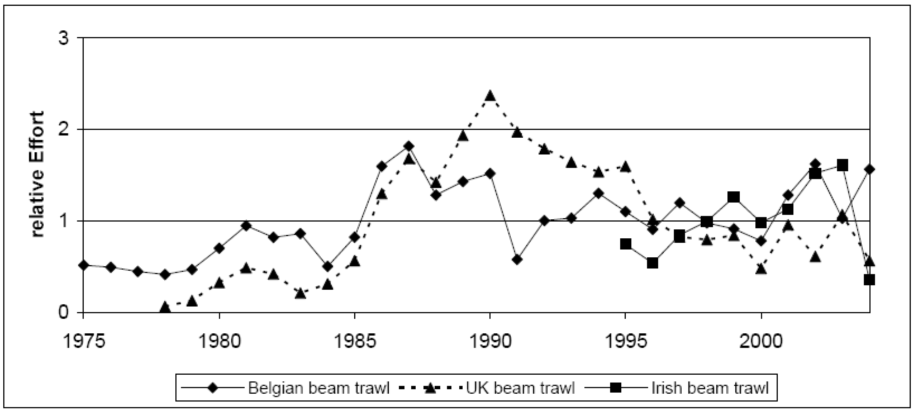
[1]Catch at *status quo* F. [2] Not including misreporting. [3]Revised in 1990 to 1.5. [4]Single-stock boundary; the exploitation of this stock should be conducted in the context of mixed fisheries.
Weights in '000 t.

Table 12.2.1 Irish Sea Sole. Nominal landings (tonnes) as officially reported by ICES

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Belgium	930	987	915	1010	786	371	531	495	706	675	533
France	17	5	11	5	2	3	11	8	7	5	5
Ireland	235	312	366	155	170	198	164	98	226	176	133
Netherlands	-	-	-	-	-	-	-	-	-	-	149
UK (Engl.& Wales)[1]	637	599	507	613	569	581	477	338	409	424	194
UK (Isle of Man)	1	3	1	2	10	44	14	4	5	12	4
UK (N. Ireland)[1]	50	72	47								
UK (Scotland)	46	63	38	38	39	26	37	28	14	8	5
United Kingdom											
Total	1,916	2,041	1,885	1,823	1,576	1,223	1,234	971	1,367	1,300	1,023
Unallocated	79	767	114	10	7	-11	25	52	7	-34	-21
Total used by Working Group in Assessment	1,995	2,808	1,999	1,833	1,583	1,212	1,259	1,023	1,374	1,266	1,002

Country	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	570	525	469	493	674	817	687	524
France	3	5 *	1 *	3	4	4	4	n/a
Ireland	130	134	120	135	135	96	103	n/a
Netherlands	123	60	46	60	-	-	-	-
UK (Engl.& Wales)[1]	189	161	165	133	...	...	...	...
UK (Isle of Man)	5	3	1	1	+	+	+	+
UK (N. Ireland)[1]								
UK (Scotland)	7	9	8	8	4	3	3	n/a
United Kingdom					195	165	217	107
Total	1,027	897	810	833	1,012	1,085	1,014	631
Unallocated	-24	14	54	-15	41	2	1	68
Total used by Working Group in Assessment	1,003	911	863	818	1,053	1,087	1,015	699

* Preliminary
[1] 1989 onwards: N. Ireland included with England & Wales



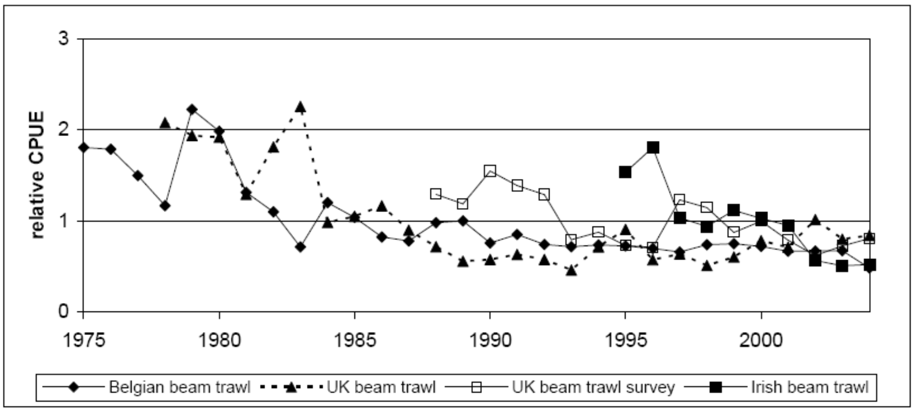


Figure 1.4.12.1

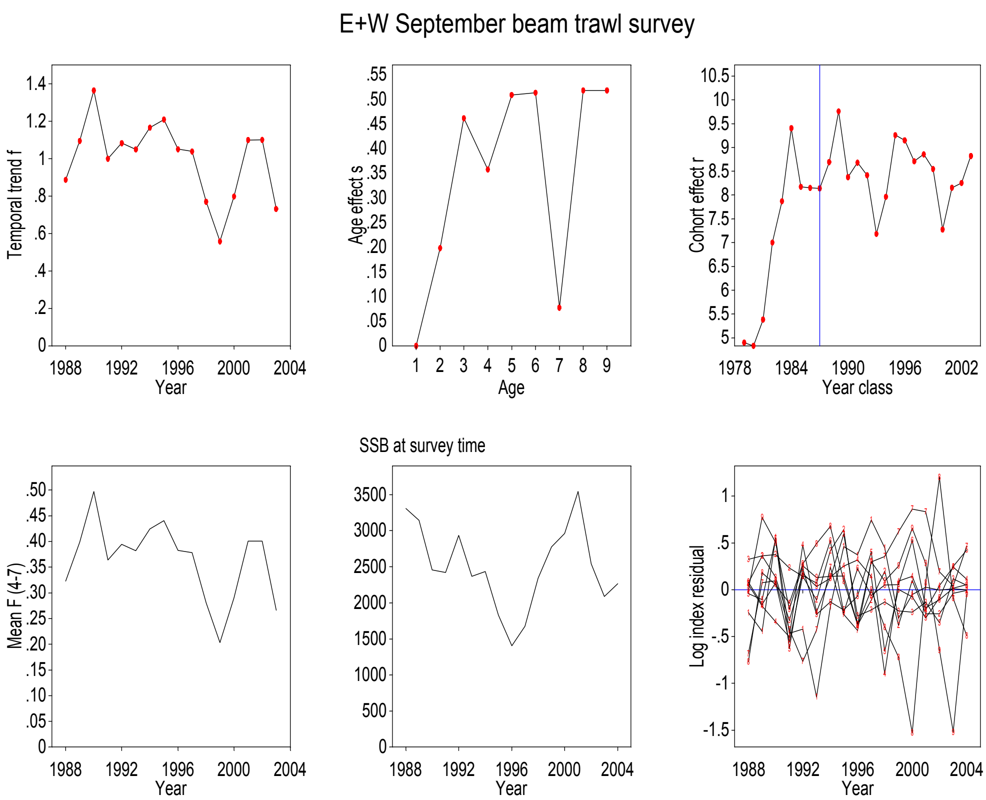


Figure 1.4.12.2 Results from Surba analysis for UK(E&W) September beam trawl survey

Irish Sea Herring

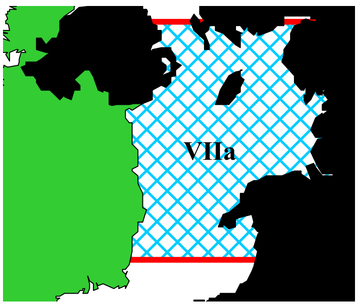
(Division VIIa North)

For latest information, see: http://www.ices.dk

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

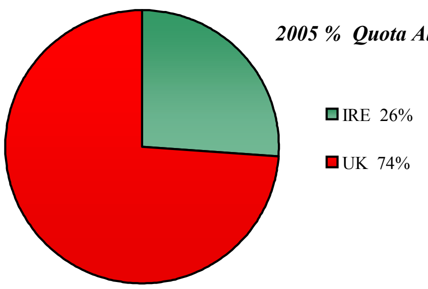
FSS agree with the ICES and STECF advice that catches of 4,800 t in 2006 should not be detrimental to the stock. This is the same TAC as 2005 and therefore the likely Irish quota in 2006 would be 1,250 t.



Red Box-TAC/Management Area Blue Shading– Assessment Area

CURRENT MANAGEMENT

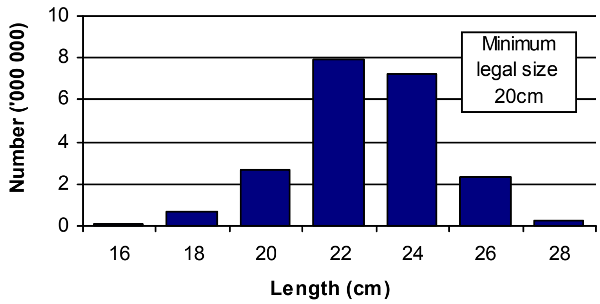
- The assessment area (Division VIIa North) is the same as the TAC area.
- The TAC for this stock is set by EU and remains at 4,800 t for 2006. The Irish share of the TAC is 1,250 t (26%).
- There is no overall management objective or management plan for this stock.
- There are a number of closed areas in operation to protect the spawning stock during part of the spawning season and to prevent exploitation of juveniles. The latter measure was introduced during the period of the industrial fishery in the Irish Sea (1969 – 1979).



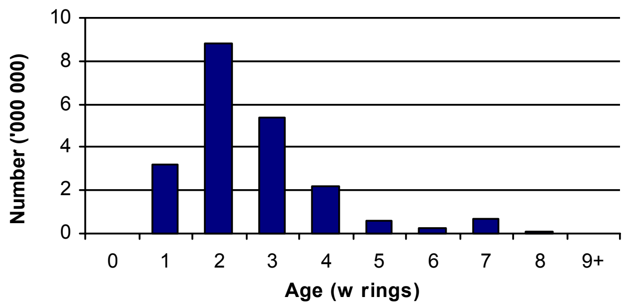
ADDITIONAL INFORMATION

1. The assessment conducted in 2005 was not accepted but it is considered indicative of past trends and levels in the stock. Based on this, the stock is considered to have been stable at a low level near $\mathbf{B_{pa}}$ for the past ten years.
2. The total catch taken from this fishery in 2004 was estimated to be 2,531 t, just over half the TAC.
3. The quality of the catch statistics is poor.
4. The fleet fishing for Irish Sea herring is now very small. In 2004 trawlers from Northern Ireland caught 1,782 t with the remaining 749 t being caught by boats from the Republic of Ireland.
5. The stock identity is complex and currently subject to the EU multi-disciplinary stock discrimination project WESTHER. Adult fish are known to migrate from the Irish sea after spawning while tagging experiments carried out by FSS in 1990 and work carried out by University College, Dublin, have demonstrated that young herring in the Irish Sea recruit to the adult population in the Celtic Sea. Therefore the state of this stock has an effect on the well being of the important Celtic Sea fishery and all relevant conservation measures should be supported.
6. Productivity in this stock appears to have declined since the 1970s.

2004 Length Distribution: International Landings, Herring in VIIaN



2004 Age Distribution: International Landings, Herring in VIIaN



ICES ADVICE
1.4.15

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Uncertain	Unknown	Uncertain

Based on the most recent estimates of SSB and fishing mortality ICES classifies the state of the stock as uncertain. It seems likely that the stock has been relatively stable for the last 10 years, and that the fishing mortality does not appear to be increasing above the recent average. There are no recruitment indices for this stock.

Management objectives

There are no explicit management objectives for this stock.

Reference points

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is 6000 t	$\mathbf{B}_{pa}$ be set at 9 500 t
	$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ is not defined
Target reference points	Not defined	Not defined

Technical basis

$\mathbf{B}_{lim}$: lowest observed SSB	$\mathbf{B}_{pa}$: $\mathbf{B}_{lim}$ *1.58
$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ is not defined

Yield and spawning biomass per Recruit
F-reference points

Reference point	F multiplier	Absolute F
F_{max}	undefined	
$F_{0.1}$		0.164
$F_{35\%SPR}$		0.139

Single stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

The TAC of 4 800 t which has been implemented in recent years is not expected to be detrimental to the stock.

Management considerations

Ecosystem considerations

Herring in this area may be an important food source for sea birds, sea mammals, and many piscivorous fish; however, that has not been investigated in this area.

Factors affecting the fisheries and the stock

Regulations and their effects

Areas closed to herring fishing around the east coast of Ireland and west coast of Britain were put in place to protect juveniles when an industrial fishery operated in the 1970s. A closed area exists to the east of the Isle of Man to protect the spawning aggregations.

Other factors

The stock identity is complex as the juveniles mix with those of the Celtic Sea and the adults migrate from the Irish Sea after spawning. The stock identity is being reviewed by an EU-funded project.

Scientific basis

Data and methods

The assessment of the stock relies on survey data. As time-series are becoming longer the assessment appears to be gaining in precision; however, the retrospective pattern is still noisy.

Separation of trawl catches of juveniles into autumn and winter spawning components, based on otolith microstructure and/or length composition, could result in acoustic and trawl survey indices of juveniles appropriate for the Irish Sea assessment.

Uncertainties in assessment and forecast

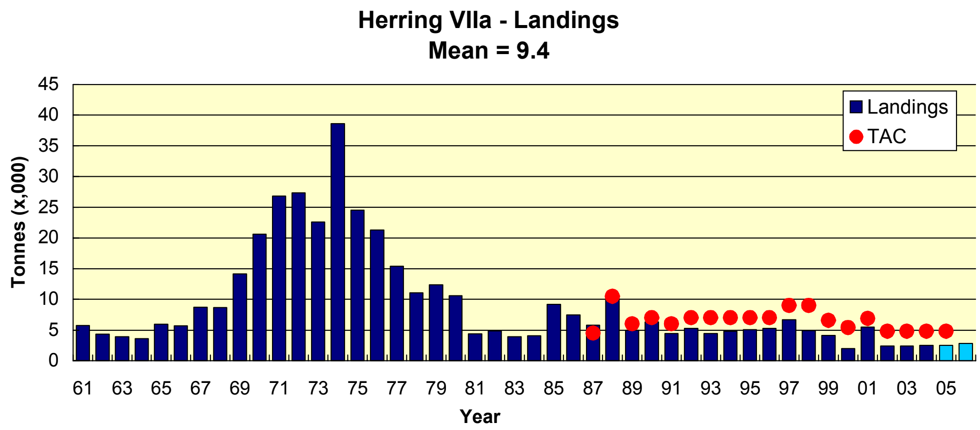
The assessment is not considered reliable with respect to recent F and SSB, but it is indicative of trends and levels in the past. Estimates of recent recruitments are based on catch and survey information. The current estimate of high 2004 recruitment is not reliable.

Source of information

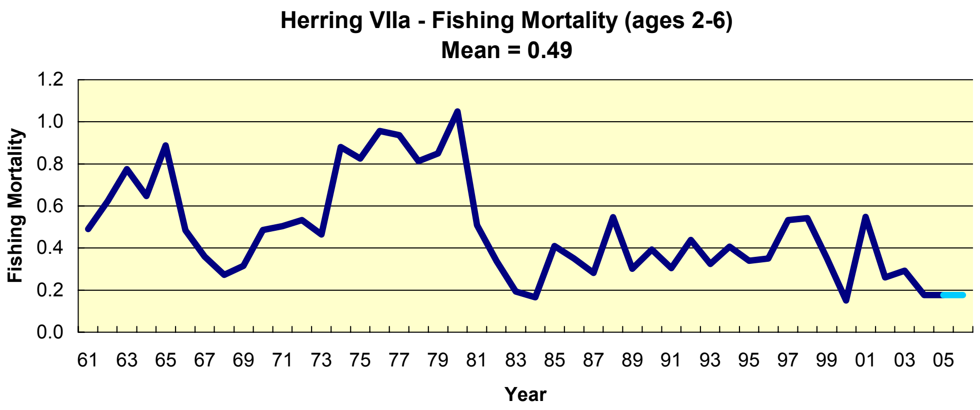
Report of the Herring Assessment Working Group for the Area South of 62°N, 8–17 March 2005 (ICES CM 2005/ACFM:16).

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	TAC	4.3	4.5	5.8
1988	TAC (Revised advice in 1988)	10.5 (5.6)	10.5	10.2
1989	TAC	5.5	6.0	5.0
1990	Precautionary TAC	5.7	7.0	6.3
1991	TAC	5.6	6.0	4.4
1992	TAC	6.6	7.0	5.3
1993	TAC	4.9-7.4	7.0	4.4
1994	Precautionary TAC	5.3	7.0	4.8
1995	Precautionary TAC	5.1	7.0	5.1
1996	If required, precautionary TAC	5.0	7.0	5.3
1997	No advice given	-	9.0	6.6
1998	*Status quo* F	6.5	9.0	4.9
1999	F=Proposed $\mathbf{F}_{pa}$=0.36	4.9	6.6	4.1
2000	F=90% F(98)=0.31	3.9	5.4	2.0
2001	*Status quo* F= 0.26	5.1	6.9	5.5
2002	Average catch of 1996-2000	4.8	4.8	2.4
2003	2002 TAC	4.8	4.8	2.4
2004	Advice 2003 catch	4.8	4.8	2.5
2005	*Status quo* TAC	4.8	4.8	
2006	*Status quo* TAC	4.8		

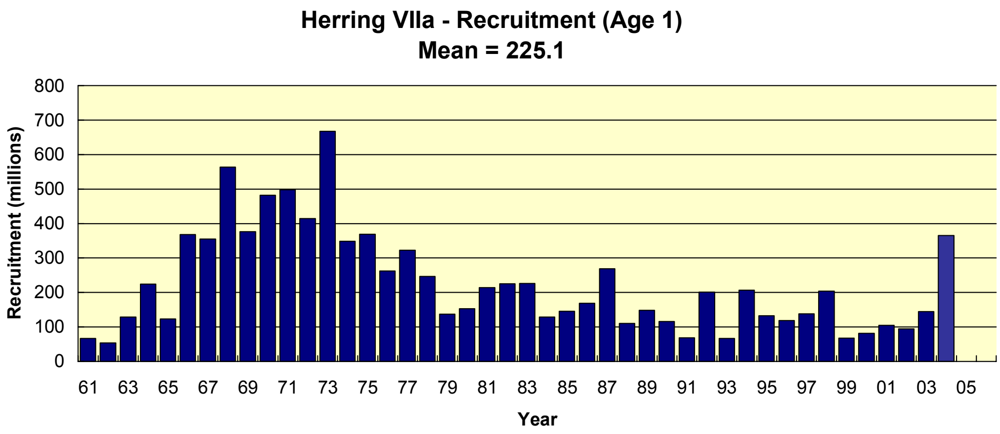
Weights in '000 t.



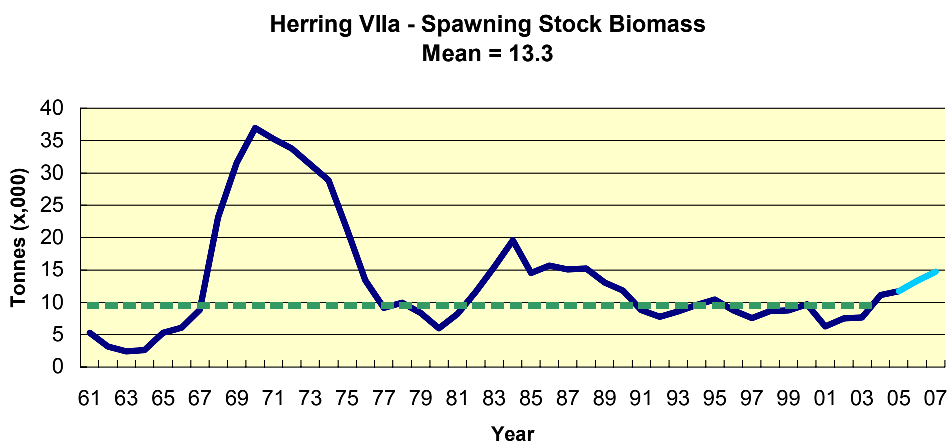
Herring VIIa - Landings
Mean = 9.4
Tonnes (x,000)
Landings
TAC
Year



Herring VIIa - Fishing Mortality (ages 2-6)
Mean = 0.49
Fishing Mortality
Year



Herring VIIa - Recruitment (Age 1)
Mean = 225.1
Recruitment (millions)
Year



Herring VIIa - Spawning Stock Biomass
Mean = 13.3
Tonnes (x,000)
Year

Table 7.1.1 Irish Sea Herring Division VIIa(N). Working group catch estimates in tonnes by country, 1987-2004. The total catch does not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995
Ireland	1,200	2,579	1,430	1,699	80	406	0	0	0
UK	3,290	7,593	3,532	4,613	4,318	4,864	4,408	4,828	5,076
Unallocated	1,333	-	-	-	-	-	-	-	-
Total	5,823	10,172	4,962	6,312	4,398	5,270	4,408	4,828	5,076

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004
Ireland	100	0	0	0	0	862	286	0	749
UK	5,180	6,651	4,905	4,127	2,002	4,599	2,107	2,399	1782
Unallocated	22	-	-	-	-	-		-	-
Total	5,302	6,651	4,905	4,127	2,002	5,461	2,393	2,399	2531

FSS Advice on Mixed Fisheries in the West of Scotland

FSS ADVICE

FSS advise that mixed fisheries characteristics be taken into account when managing demersal fisheries in the West of Scotland. Cod, whiting and spurdog are the overriding concerns in the management advice. In 2006, fisheries in west of Scotland and at Rockall should be managed according to the following rules, which should be applied simultaneously:

If fisheries are permitted they should fish:

- **without catch or discards of cod in Sub-area VI;**
- **without catch or discards of spurdog;**
- **no directed fishery for haddock in Division VIb;**
- **within the precautionary limits for all other stocks (see table above).**

FSS advise that only demersal fisheries that can demonstrate that they fish without catch or discards of cod or spurdog in Sub-area VI or haddock in Division VIb may be permitted. All other stocks in the west of Scotland should be fished within precautionary limits. FSS recognise that the 'zero catch option' for cod, and spurdog would effectively mean a closure of the mixed demersal and *Nephrops* fisheries in the West of Scotland. FSS agrees with ICES that a closure of all fisheries catching cod, haddock or spurdog provide the highest probability of recovery for these stocks.

FSS note that ICES has previously advised for zero catch of cod and lowest possible levers for Rockall haddock, but that managers, because of social and economic considerations, have never implemented this advice. FSS recognise that the zero catches advised are difficult to implement in the current management framework but given the extremely depleted state of the cod, spurdog and Rockall haddock stocks this stringent management action is require if these stocks are to be sustained.

Therefore FSS advise that the following rules should be followed in the management of mixed fisheries in the West of Scotland and Rockall:

- **Once the TAC is exhausted for a critical stocks then <u>all</u> fisheries which catch that stock should be closed,**
- **Fisheries should only be permitted when they demonstrate that they take zero catch of stocks where the TAC is exhausted,**
- **All other stocks should be exploited within precautionary limits.**

FSS note the poor performance of TACs, as implemented, in reducing fishing mortality. FSS stress that the required reductions in fishing mortality can only be achieved if reductions in effort are included in management, and effective deterrents to discarding are implemented.

FSS advise that a well defined 'management plan' is necessary to recover the cod and spurdog stocks in Sub-area VI and haddock in VIb. and to fish them sustainably once they have recovered. FSS advise that such a plan should aim to manage properly defined métiers with clearly defined objectives that will ensure a high probability of recovery to agreed levels within a specified time frame.

IDENTIFICATION OF CRITICAL STOCKS

ICES have identified the critical stocks as cod, whiting and spurdog. The table on the following page identifies the stocks that are below $\mathbf{B}_{\mathrm{lim}}$, i.e. cod in Division VIa and haddock in Division VIb. These stocks are the overriding concerns in the management advice of all demersal fisheries:

- for cod in Division VIa ICES recommends a zero catch;
- for haddock in Division VIb the catches should be reduced to the lowest possible level;
- for spurdog the catches should be zero.
- For Deepwater shark the catch should be zero (Dealt with under deepwater advice)

SPECIAL NOTE ON MIXED FISHERIES

Mixed Fisheries analyses have previously been attempted with the aim of allowing certain fisheries to continue whilst achieving the conservation objectives for critical stocks. FSS now consider that the provision of such mixed fisheries advice, and its implementation in management, have reached an impasse.

ICES is attempting to inform "managers about the appropriate allocation of effort among fisheries consistent with desired levels of fishing mortality by species". However, the compilation of necessary and appropriate data has not been achieved (except perhaps in the North Sea). ICES considers that the paucity of data on discards is a "fatal flaw" in a mixed fisheries context. In the absence of acceptable analytical methods and data, ICES has provided "technical interaction matrices" to indicate mixed-fisheries relationships. The West of Scotland interaction matrix is given on the following pages. FSS considers that these matrices cannot be used to quantitatively calculate of potential fishing opportunities in a mixed-fisheries context.

Notwithstanding the difficulties in mixed fisheries analysis, FSS consider that major impediments prevent the proper implementation of mixed fisheries advice. The current management system simply cannot implement appropriate allocations of effort among fisheries consistent with desired levels of fishing mortality by species. The main obstacles preventing this are conflicts with the principle of Relative Stability and a reluctance to manage fishing effort by fleet or to constrain fleet dynamics in other ways.

FSS consider that progress is required on both the analysis and implementation if scientifically credible mixed fisheries analysis is to be undertaken, and mixed fisheries advice is to be sensibly implemented. FSS consider that the data quality issues raised by ICES will be overcome. However, the inclusion of new discard data into assessments is not straightforward and progress may take several years. In the interim FSS consider that a debate is overdue on the means by which mixed-fisheries advice will be implemented by the current, or a modified management framework. FSS views the Regional Advisory Councils as an appropriate forum for this debate. FSS agree with the STECF that it will not be possible to correctly implement mixed fisheries advice within the current management framework.

In the absence of quantitative mixed-fisheries advice from ICES, the European Commission has attempted to obtain such advice from sub-groups of the STECF. An STECF sub-group met in late 2005, but could only present mixed fishery forecasts for the North Sea. FSS therefore concurs with the STECF that the mixed fisheries analyses for the Irish Sea are misleading and totally unsuitable for management purposes.

ICES
1

Fisheries to the West of Scotland and Rockall

The main fleets operating in Division VIa include the mixed roundfish otter trawl fleet, the *Nephrops* otter trawl fleet, the otter trawl fleet targeting anglerfish, megrim, and hake, and the fleet targeting saithe and/or deep-sea species. To a large extent, the roundfish fishery in Division VIa is an extension of the similar fishery in the North Sea. The demersal fisheries in Division VIa are predominantly conducted by otter trawlers fishing for cod, haddock, anglerfish, and whiting, with bycatches of saithe, megrim, and lemon sole.

The majority of the vessels in the demersal fishery are locally-based Scottish trawlers using light-trawls, but trawlers from Ireland, Northern Ireland, England, France, and Germany also participate in this fishery. The importance of Scottish seiners targeted mainly at haddock has been declining in recent years as many of these vessels have been converted to trawlers. Part of the fleet of light trawlers has diversified into a fishery for anglerfish that has been expanding into deeper water off the northern coast of Scotland. Bycatches in this fishery include megrim, ling, and tusk.

About 200 Scottish trawlers also take part in the fisheries for *Nephrops* on inshore grounds. In recent years Irish vessels have also been targeting *Nephrops* in Division VIa, mainly on offshore grounds. These *Nephrops* vessels also land smaller quantities of haddock, cod, whiting, and small saithe, but discard large amounts of whiting and haddock.

The development of a directed fishery for anglerfish has led to considerable changes in the way the Scottish fleet operates. Part of this is a change in the distribution of fishing effort; effort in the roundfish fisheries has shifted away from the traditional inshore areas to more offshore areas and deeper waters. The expansion in area and depth-range fished has been accompanied by the development of specific trawls and vessels to exploit the stock. These vessels mainly use large twin-rig otter trawls with >100-mm mesh. A smaller Irish fleet also targets anglerfish, megrim, and hake on the Stanton bank with 90-mm to 100-mm mesh. This fleet has declined in numbers in recent years.
The fishery for anglerfish has expanded into deeper waters with an associated increase in catches. The expansion of this fishery has been further accelerated by the diversion of fishing effort from other stocks subject to more restrictive quotas in recent years and by market opportunities. A gillnet fishery has developed on the continental slopes to the West of the British Isles, North of Shetland, at Rockall and the Hatton Bank. A preliminary investigation of this fishery suggests high levels of gear loss, widespread dumping of netting, high catch & discarding levels (particularly of monkfish), and a lack of effective management. These fisheries are occurring in areas believed to have been a refuge for adult anglerfish, increasing the vulnerability of the stock to over-exploitation. Immature fish are subjected to exploitation for a number of years prior to first maturity.

The larger Scottish and Irish trawlers fish for haddock at Rockall when opportunities arise for good catches from the Division VIb stock. Vessels from the Russian Federation have fished for haddock and other demersal species at Rockall since 1999 when part of the Bank was designated as being in international waters. Although young saithe are caught by coastal trawlers in Subarea VI,

the fishery for saithe essentially takes place on the shelf edge to the west and northwest of Scotland. Traditionally, this fishery has largely been operated by the larger deep-sea French trawlers. However, the number of these vessels has declined in recent years. Since the late 1980s, some of these vessels diverted their activity toward deep-sea species, notably orange roughy, and some medium-sized trawlers also participate in the fishery for deep-sea species during summer in some years.

The pelagic fishery for herring is mainly operated by UK, Dutch, and German vessels in the north, and by Irish vessels in the south. Substantial misreporting of catches from the North Sea and between the northern and southern stocks occurred in the past, but UK licensing regulations are thought to have reduced misreporting since 1997. In recent years TACs for the northern stock have not been restrictive, presumably because of low effort and a weak market. The Clyde herring fishery has declined sharply in recent years as the stock has suffered from a series of low recruitments. Recent TACs have not been taken and the catches have been less than 1 000 t since 1991.

There is a directed trawl fishery for mackerel and horse mackerel in the area. The mackerel fishery mainly takes place in the fourth and first quarter of the year, when the mackerel is returning from the feeding area to the spawning area. The horse mackerel is mainly fished in the second half of the year. In addition, there are fisheries for blue whiting in the area.

The industrial fisheries in Division VIa are much smaller than in the North Sea. The Scottish sandeel fishery started in the early 1980s, peaking in 1986 and 1988. It is irregular, depending on the availability of the resource and of processing facilities at Shetland, Denmark, and the Faroes. Bycatches in this fishery are very small. The Norway pout fishery is conducted mainly by Danish vessels.

Fisheries interactions to the West of Scotland and Rockall

Demersal fisheries in the area are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. Roundfish are caught in otter trawl and seine fisheries, with a 120-mm minimum mesh size that comprises mixed demersal fisheries with more specific targeting of individual species in some areas and/or seasons. Cod, haddock, and whiting form the predominant roundfish catch in the mixed fisheries, although there can be important bycatches of other species, notably saithe and anglerfish in the deeper water and of *Nephrops* on the more inshore *Nephrops* grounds. Static gear fisheries with mesh sizes generally in excess of 140 mm are also used to target cod. Saithe are mainly taken in a directed trawl fishery in deeper water along the shelf in Subarea VI. There is thought to be little bycatch of other demersal species associated with the directed fishery.

Large *Nephrops* fisheries take place in discrete areas that comprise appropriate muddy seabed sediment. Targeted *Nephrops* fisheries on these grounds are taken predominantly in trawls with mesh sizes of less than 100 mm or less (particularly in the more southerly regions) using single- or multiple-rig trawls. *Nephrops* fishing grounds are mainly inshore grounds although there are smaller offshore fisheries at Stanton Bank and west of the Hebrides. The bycatch and discarding of other demersal species in the *Nephrops* fisheries is highly variable.

There are trawl and gillnet fisheries targeting hake and anglerfish and otter trawl fisheries targeting hake, megrim, and anglerfish in Subarea VI. The catch of other demersal species associated in these fisheries is uncertain.

There is an international fishery targeting haddock, grey gurnards, and other species at Rockall using small mesh. Successful application of TACs for this stock would require that there is a simple relationship between recorded landings and effort exerted. This assumption is unlikely to be true for Rockall haddock especially when coupled with ways of evading TACs including misreporting, high-grading, and discarding. In the case of Rockall haddock these may occur to a large extent due to the remote nature of the fishery and the processing of catches at sea by some fleets. Direct effort regulation is therefore suggested as a means of controlling fishing mortality on Rockall haddock.

	Anglerfish IV+VI	**Megrim**	**Cod VIa**	**Haddock VIa**	**Whiting VIa**	**Nephrops VIa**	**Saithe IV+VIa**	**Herring VIa**	**NEA Mackerel**	**Deepwater fish**
Anglerfish IV+VI		OTB, GND	OTB	OTB	OTB	NEP OTB	OTB	PTM	PTM	OTB Deep, GND
Megrim	Strong		OTB	OTB	OTB	NEP OTB	OTB	PTM	OTB Deep	OTB Deep
Cod VIa	Weak	Weak		OTB, PT	OTB, PT	OTB, NEP OTB	OTB, OTB Deep, PT	PTM	PTM	OTB Deep
Haddock VIa	Weak	Weak	Strong		OTB, PT	NEP OTB	OTB, PT	PTM	PTM	OTB Deep
Whiting VIa	Weak	Medium	Strong	Strong		NEP OTB	OTB	PTM	PTM	OTB Deep
Nephrops VIa	Medium	Medium	Medium	Strong	Strong		OTB	PTM	PTM	OTB Deep
Saithe IIIa+IV+VIa	Weak	Weak	Medium	Medium	Weak	Weak		PTM	PTM	OTB Deep
Herring VIa	0	0	0	0	0	0	0		PTM	OTB Deep
NEA Mackerel	0	0	0	0	0	0	Weak	Medium		OTB Deep
Deepwater fish	Strong	Medium	Weak	Weak	0	Weak	Weak	0	0	

Interaction

Weak	Weak	**OTB Deep**	Otter Trawls in deepwater	**PTM**	Pelagic Midwater Trawl
Medium	medium	**OTB Nep**	Otter Trawl *Nephrops* directed	**PT**	Pair Trawl
Strong	strong	**GND**	Gill nets demersal & deepwater		

Single-stock exploitation boundaries and critical stocks (West of Scotland)

The state and the limits to exploitation of the individual stocks are presented in the stock sections. The state of the stocks and single-stock exploitation boundaries are summarised in the table below.

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	in relation to precautionary limits	in relation to target reference points	
Cod West of Scotland	Reduced reproductive capacity	Unknown	Unknown	ICES is not in a position to give quantitative forecasts and can therefore not evaluate the management plan and provide upper bounds to a TAC.	Since no recovery has been observed in this stock, ICES advises zero catch of cod in 2006.	There will be no gain in the long-term yield by having fishing mortalities above $\mathbf{F}_{max}$ (0.19).	Since no recovery has been observed in this stock, ICES advises zero catch of cod in 2006.
Hake – Northern stock (Division IIIa, Subareas IV, VI and VII, and Divisions VIIIa, b, d)	Increased risk	Harvested sustainably	Overexploited	Following the agreed recovery plan, a fishing mortality of F = 0.25 is expected to lead to an SSB of around 153 000 t in 2007, with estimated landings in 2006 of 44 000 t. This implies a change in SSB of +5%.	The current fishing mortality, estimated at 0.24, is above fishing mortalities that are expected to lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.17). This indicates that long-term yield is expected to increase at fishing mortalities well below the historic values.	The fishing mortality should be below $\mathbf{F}_{pa}$ and SSB should be above $\mathbf{B}_{pa}$ equivalent to the recovery plan. A fishing mortality of F = 0.25 is expected to lead to an SSB of around 153 000 t in 2007, with estimated landings in 2006 of 44 000 t.	Landings of less than 44,000 t
Cod in Division VIb (Rockall)							No assessment.
Haddock West of Scotland	Full reproductive capacity	Harvested sustainably	Overexploited		Maintain SSB above **B**pa in 2007, requires a reduction in fishing mortality to less than 0.35.		Landings less than 8000 t.
Haddock in Division VIb (Rockall)	Unknown	Unknown	Unknown		Catches reduced to the lowest possible level.		Catches reduced to the lowest possible level.
Whiting West of Scotland	Unknown	Unknown	Unknown		Lowest possible level.		Lowest possible level.

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	in relation to precautionary limits	in relation to target reference points	
Whiting in Division VIb (Rockall)							No assessment.
Megrim in Subarea VI (West of Scotland and Rockall)	Uncertain	Uncertain	Uncertain		Catches in 2006 should be no more than the recent (2002–2003) landings of about 2300 t. This includes landings of Division VIa and VIb and unallocated landings in Subarea IV.		2300 t
Anglerfish in Division IIIa, Subarea IV, and Subarea VI	Unknown	Unknown	Unknown		No increase in effort.		Effort not allowed to increase. Fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and bycatch fish.
Norway pout West of Scotland							No assessment
Sandeel in Division VIa							No assessment
Nephrops in Division VIa (Management Area C)		Three functional units; all three harvested at sustainable levels			No increase in effort.		Effort not allowed to increase. Fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and bycatch fish.
Herring West of Scotland (Division VIa)	Full reproductive capacity	Reference points are not defined					26 400 t. The present level of fishing mortality appears to be sustainable and has lead to a rise in SSB. Fishing at $\mathbf{F}_{sq}$ is sustainable.

ICES Identification of critical stocks

The table above identifies the stocks that are below $\mathbf{B}_{lim}$, i.e. cod in Division VIa and haddock in Division VIb. These stocks are the overriding concerns in the management advice of all demersal fisheries:

- for cod in Division VIa ICES recommends a zero catch;
- for haddock in Division VIb the catches should be reduced to the lowest possible level;
- for spurdog the catches should be zero.

ICES Advice on fisheries management

Demersal fisheries in Subarea VI should in 2006 be managed according to the following rules, which should be applied simultaneously:

They should fish:

- **without catch or discards of cod in Subarea VI;**
- **without catch or discards of spurdog;**
- **no directed fishery for haddock in Division VIb;**
- **concerning deep water stocks fished in Subarea VI, Volume 10;**
- **within the biological exploitation limits for all other stocks (see table above).**

Furthermore, unless ways can be found to harvest species caught in mixed fisheries within precautionary limits for all those species individually then fishing should not be permitted.

West of Scotland Cod

(Division VIa)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

Despite the uncertain state of the stock all indicators (survey and catch data) suggest that the stock is at an historic low. The survey SSB estimates indicate that the stock has declined to a historical low. Recruitment estimates have also declined in the last decade to the lowest levels observed. Recruitment since 2002 has been the weakest observed. This perception of the stock status is qualitatively the same as that obtained last year.

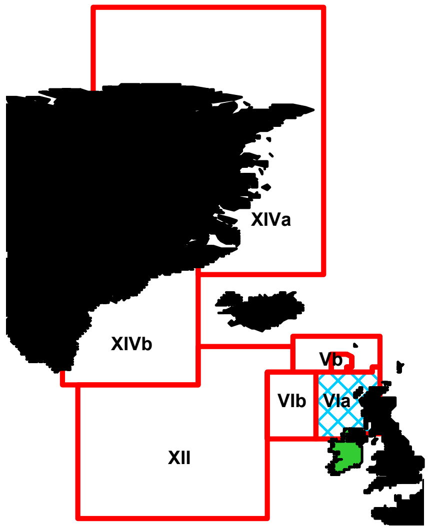
As there is currently no adequate basis for quantitative forecasts it is not possible to advise on catch levels in relation to the recovery plan implemented in 2004 for this stock (EC Reg. No 423/2004). This plan involves a SSB rebuilding target of 30% when the stock is above B_{lim}, and hence requires annual predictions of spawning stock size. FSS advises that amendments to the recovery plan that do not require annual quantitative predictions of SSB should be agreed. Survey-based SSB limit points are yet to be defined, but ICES and FSS consider recent survey SSB estimates to be below any likely candidates for a survey-based B_{lim}.

FSS agree with the ICES advice of zero catch of cod in 2006. FSS advise that fisheries in VIa should be allowed only when they have:

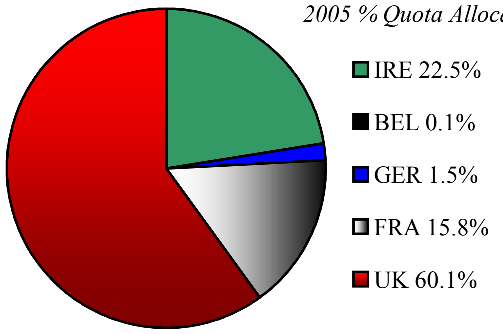
- **a weak interaction with cod,**
- **stringent restriction on the catch and discard rates of cod,**
- **effective monitoring of compliance with these restrictions.**

CURRENT MANAGEMENT

- The TAC Area covers Sub-areas Vb, VI, XII and XIV, with a further restriction on the TAC in Vb and VIa. The assessment covers VIa only. FSS considers that the management area should correspond to the assessment area.
- The 2005 TAC was 721 t for Sub-areas Vb, VI, XII and XIV. The Irish quota was 162 t for Sub-areas Vb, VI, XII and XIV (further restricted to no more than 156 t in Vb and VIa).
- Emergency measures in place for this stock since 2001 have been replaced with the cod recovery plan (EC Reg. 423/2004). This plan established measures for the recovery of cod stocks including multi-annual processes for selection of TAC's, restriction of fishing effort, technical measures, control and enforcement, accompanying structural measures and market measures. It is currently too early to evaluate their actual benefit of these measures to the stock and fishery. However, the introduction of effort regulation is thought to have encouraged vessels to switch to smaller mesh gears with consequent increases in discarding and high-grading. These issues are discussed in greater detail in the Section: "Recovery Plans and Effort Limitation".
- A new closed area for Cod west of Scotland, known as the "windsock", was established in 2004 (detailed in Annex IV, EC Reg. 2287/2003).
- The Irish fishery off Greencastle, Co. Donegal that traditionally targets juvenile cod has been closed



Red Boxes-TAC/Management Areas Blue Shading– Assessment Area

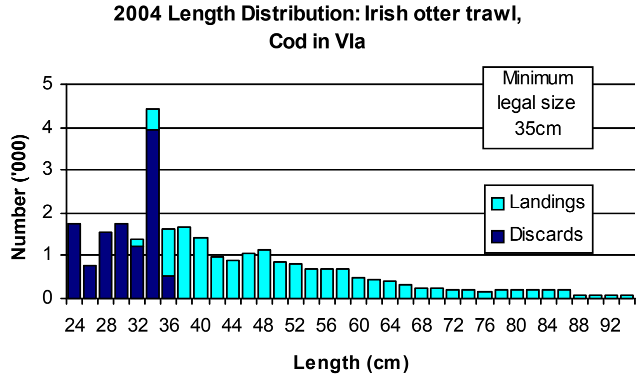


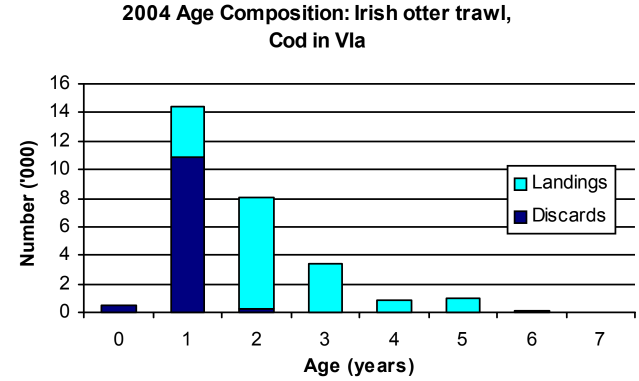
2005 % Quota Allocations

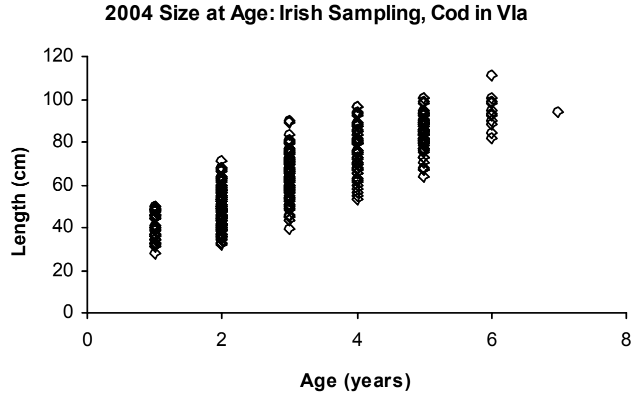
every winter since 2003. The closure was instigated by the local fishing industry to allow an assessment of seasonal closure as a potential management measure. Over 11,500 cod have been tagged and released during the closure. STECF has welcomed this initiative by the Irish industry and is pleased that a unilateral research program has accompanied the conservation measures. The unilateral closure of the Greencastle fishery has been re-instated from 14 November 2005 - 14 February 2006.

ADDITIONAL INFORMATION

1. There has been a mismatch between survey and catch data for this stock for many years. The survey data indicates higher stock size than the catch-at-age data. Decoupling survey data from the catch data back in time results in a survey-based assessment which estimates catches to be several times more than those reported. Substantial misreporting of cod landings (species and quantity) is known to occur and directly affects the perception of the stock. Because of the considerable uncertainty around the catch data ICES could not provide a quantitative assessment or short-term catch forecasts for the stock. This also implies that catches consistent with the rebuilding targets in the recovery plan cannot be accurately estimated.
2. The reported Irish landings in 2004 of 33 t is the lowest in the time series and only 30% of that reported in 2003.
3. Demersal trawlers from Killybegs and Greencastle have traditionally undertaken the Irish cod fishery. There have been considerable changes in the fleet composition in recent years.
4. The proportion of fish discarded has been high. Regulations to improve the exploitation pattern of cod have been taken in 2002 and 2003 yet discarding rates in the Irish otter trawl fleet are estimated to be high (see length and age composition plots).
5. FSS are also concerned that industrial fisheries continue to operate in Sub-area VI with the potential to take large numbers of juvenile cod.







ICES ADVICE
1.4.21

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Reduced reproductive capacity	Unknown	Unknown	Not defined	The state of the stock is uncertain, but all indicators point towards the stock being at an historical low.

The spawning stock biomass is at an all time low but the rate of exploitation is uncertain. The survey SSB estimates indicate that the stock has been declining and is presently at an historical low. Recruitment estimates indicate a decline in recruitment in the last decade, correlated with a decline in the spawning stock to the lowest levels observed.

Recruitment since 2002 has been the weakest in the survey time series.

Management objectives

The European Commission has enacted a Council Regulation ((EC) No 423/2004) which establishes measures for the recovery of cod stocks:

For stocks above $\boldsymbol{B}_{lim}$, the harvest control rule (HCR) requires:

1. *setting a TAC that achieves a 30% increase in the SSB from one year to the next,*
2. *limiting annual changes in TAC to ± 15% (except in the first year of application), and,*
3. *a rate of fishing mortality that does not exceed $\boldsymbol{F}_{pa}$.*

For stocks below $\boldsymbol{B}_{lim}$ the Regulation specifies that:

1. *conditions 1-3 will apply when they are expected to result in an increase in SSB above $\boldsymbol{B}_{lim}$ in the year of application,*
2. *a TAC will be set lower than that calculated under conditions 1-3 when the application of conditions 1-3 is not expected to result in an increase in SSB above $\boldsymbol{B}_{lim}$ in the year of application.*

This plan has not yet been evaluated by ICES. However, the management plan requires annual predictions of spawning stock size, which is not available given the recent poor catch data. In that situation a management plan that does not require such a precision should be considered.

Reference points

	ICES considers that:	ICES proposes that:
Limit reference points	$\mathbf{B}_{lim}$ is 14 000 t	$\mathbf{B}_{pa}$ be set at 22 000 t
	$\mathbf{F}_{lim}$ is 0.8	$\mathbf{F}_{pa}$ be set at 0.6
Target reference points		$\mathbf{F}_{y}$ not determined

Yield and spawning biomass per Recruit (from 2004 Assessment, assuming the selection pattern at that time)
F-reference points:

	Fish Mort Ages 2-5	Yield/R	SSB/R
$\mathbf{F}_{max}$	0.191	1.138	8.637
$\mathbf{F}_{0.1}$	0.132	1.088	11.440

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$-$\mathbf{F}_{max}$.

Technical basis:

$\mathbf{B}_{lim}$ = $\mathbf{B}_{loss}$, the lowest observed spawning stock estimated in previous assessments.	$\mathbf{B}_{pa}$ **:** This is considered to be the minimum SSB required to ensure a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments. This also corresponds with the lowest range of SSB during the earlier, more productive historical period.
$\mathbf{F}_{lim}$: Fishing mortalities above this have historically led to stock decline.	$\mathbf{F}_{pa}$: This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$.

The advice is based on information from abundance surveys. Reference points have not been estimated from the surveys. However, recovery of the stock will require substantial and persistent increase of both SSB and recruitment. The recent survey SSB estimates are below any likely candidates for a survey-based SSB limit point.

Single-stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

ICES is not in a position to give quantitative forecasts and can therefore not evaluate the management plan and provide upper bounds to a TAC.

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

There will be no gain in the long-term yield by having fishing mortalities above $\mathbf{F}_{max}$ (0.19). Fishing at such lower mortalities would lead to higher SSB and, therefore, lower risks of fishing outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

Since no recovery has been observed in this stock, ICES advises zero catch of cod in 2006.

Management considerations

Management of cod fisheries must deal with the combined effects of assessment bias (of which unreliable catch data are a major contributing factor) and the inability of management to control catch. As long as these two interrelated conditions persist and substantial effort is permitted for fisheries which catch cod, rebuilding cannot be achieved. Survey information shows that the total removal of cod in

Division VIa may have been underestimated in the past decade relative to earlier periods. The effect of the fishery on the stock has therefore been evaluated in relative terms and advice on absolute levels of future catches is not possible.

The advised measures are required if the cod stock is to reach a level where it can regain historic productivity.

As cod is taken in mixed demersal fisheries, following the advice will likely result in greatly reduced harvesting of other stocks, particularly haddock, whiting and *Nephrops*. Management needs to take this into account.

Time and area closures for particular fisheries may be a tool for rebuilding this stock. The consequence of displacing effort, caused by the closures, needs to be considered in determining the role of such measures in the recovery plan.

Management plan evaluations

There are reports of significant non-reported landings and therefore the current implementation of the TAC system is not able to regulate fishing mortality. Unless recovery measures are able to restrict the fishery they are not precautionary.

Factors affecting the fisheries and the stock

The effects of regulations

The fishery is managed by a TAC that does not, however, seem to be restricting catches.

Several regulations have been introduced for West of Scotland in recent years. These regulations and their impact on the fisheries have been discussed in detail in the overview. Emergency EU measures were established in the first half of 2001 and led to short-term area closures in the north of the Division and, on a smaller scale, in the Clyde Sea area. These closures were intended to allow as many cod as possible to spawn. The Clyde closure continued in 2002 and 2003 under national UK legislation. Various derogations were introduced for gears not targeting cod. A new closed area was implemented west of Scotland in 2004 (EC Reg. 2287/2003).

The proportion of discarded fish has been high. In 2002 and 2003 regulations to improve the exploitation pattern of cod were implemented. It is not clear if it is possible to evaluate potential impacts of these measures to the stock and fishery.

Increases in cod-end mesh sizes have been introduced into the fishery to improve selectivity. The increase in minimum mesh size from 100 to 120 mm in 2001/2002 (before the introduction of effort regulation 27/2005) partly caused a shift to 80 mm mesh sizes in the mixed fishery trawls due to the loss of valuable *Nephrops* catch. Catch composition regulations for this mesh size may have resulted in increased discarding and high grading.

The regulation is complemented by a system of fishing effort limitation. This is done by adjustment to the number of fishing days for various vessel categories deploying gears with various mesh sizes. The introduction of effort regulation, has effectively further encouraged vessel operators to reduce mesh size and shift to other fisheries, particularly *Nephrops* trawling, in order to gain more days at sea. It is not possible to evaluate whether the mesh size changes and effort limitations may have benefited cod without information on the level of adherence to catch composition regulations required when using smaller mesh sizes.

However, the continued decline in the stock indicates that these measures alone have not proven sufficient to rebuild the stock to precautionary levels. Detailed analysis of the impact of such regulations is not possible until data of sufficient quality become available.

Changes in fishing technology and fishing patterns

From mid September 2003 to mid July 2004 the Irish trawl fishery off Greencastle, Co. Donegal that traditionally targets juvenile cod was closed. The closure was instigated by the local fishing industry to allow an assessment of seasonal closure as a potential management measure. The fishing industry again called for and received a statutory instrument closing the fishery from November 2004 until mid-February 2005. Most of the cod catch is normally taken in the fourth quarter. During 2000-2002 50% of the Irish catch weight of cod in VIa (61% by number) was taken in the fourth quarter. The closure is expected to have reduced the Irish fishing mortality on cod that would otherwise have occurred in 2003 and 2004.

Scientific basis

Data and methods

A survey based assessment was used to evaluate trends in spawning stock biomass and recruitment.

Uncertainties in assessment and forecast

Some changes have been made to the survey design in the past, but surveys are considered to provide an indicator of long-term stock trends.

Comparison with previous assessment and advice

The last analytical assessment was undertaken in 2003 based on a catch-at-age model using estimates of landings-at-age, discards-at-age, and survey CPUE data. There was no analytical assessment carried out for this stock in 2004 and again, no analytical assessment was possible this year. This year's assessment is based on survey information alone but the perception of the state of the stock remains unchanged. The advice this year is the same as last year.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

Year	ICES advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official landings	ACFM landings
1987	Reduce F towards $\mathbf{F}_{max}$		18.0		22.0	19.2	19.0
1988	No increase in F; TAC		16.0		18.4	19.2	20.4
1989	80% of F(87); TAC		16.0		18.4	15.4	17.2
1990	80% of F(88); TAC		15.0		16.0	11.8	12.2
1991	70% of effort (89)		-		16.0	10.6	10.9[2]
1992	70% of effort (89)		-		13.5	9.0	9.7[3]
1993	70% of effort (89)		-		14.0	10.5	11.8[3]
1994	30% reduction in effort		-		13.0	9.1	10.8[3]
1995	Significant reduction in effort		-		13.0	9.7	9.6[3]
1996	Significant reduction in effort		-		13.0	9.6	9.4
1997	Significant reduction in effort		-		14.0	7.0	7.0
1998	20% reduction in F		9.5[5]		11.0	5.7	5.7
1999	F reduced to below $\mathbf{F}_{pa}$		<9.7[5]		11.8	4.3	4.2
2000	Recovery plan, 60% reduction in F		<4.2		7.48	2.8[4]	3.0
2001	Lowest possible F, recovery plan		-		3.7	2.5	2.3
2002	Recovery plan or lowest possible F		-		4.6	2.0	2.1
2003	Closure		-		1.81	1.3	n/a
2004		Zero catch	[6]	0	0.85	0.5	n/a
2005		Zero catch	[6]		0.72		
2006		Zero catch	[6]				

[1]TAC is for the whole of Subareas Vb1, VI, XII and XIV. [2]Not including misreporting. [3]Including ACFM estimates of misreporting. [4]Incomplete data. [5]For VIa only. [6]Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

Table 1.4.21.1 Cod in Division VIa. Official catch statistics in 1985–2004, as reported to ICES.

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Belgium	48	88	33	44	28	-	6	-	22	1	2
Denmark	-	-	4	1	3	2	2	3	2	+	4
Faroe Islands	-	-	-	11	26	-	-	-	-	-	-
France	7,411	5,096	5,044	7,669	3,640	2,220	2,503	1,957	3,047	2,488	2,533
Germany	66	53	12	25	281	586	60	5	94	100	18
Ireland	2,564	1,704	2,442	2,551	1,642	1,200	761	761	645	825	1,054
Netherlands	-	-	-	-	-	-	-	-	-	-	-
Norway	204	174	77	186	207	150	40	171	72	51	61
Spain	28	-	-	-	85	-	-	-	-	-	16
UK (E., W., N.I.)	260	160	444	230	278	230	511	577	524	419	450
UK (Scotland)	8,032	4,251	11,143	8,465	9,236	7,389	6,751	5,543	6,069	5,247	5,522
UK											
Total landings	18,613	11,526	19,199	19,182	15,426	11,777	10,634	9,017	10,475	9,131	9,660

Country	1996	1997	1998	1999	2000	2001	2002	2003*	2004*
Belgium	+	11	1	+	+	2	+		
Denmark	2	-	-	+	-	-	-		
Faroe Islands	-	-	-	-	-	-	-		
France	2,253	956	714*	842*[2]	236	391	208	172	
Germany	63	5	6	8	6	4	+	+	
Ireland	1,286	708	478	223	357	319	210	120	
Netherlands	-	2	1	-	-	-	-	-	
Norway	137	36	36	79	114*	40*	88	46	10
Spain	+	6	42	45	14	3	11	3	
UK (E., W., N.I.)	457	779	474	381	280	138	195	79	
UK (Scotland)	5,382	4,489	3,919	2,711	2,057	1,544	1,519	879	
UK									458
Total landings	9,580	6,992	5,671	4,289	2,767	2,439	2,231	1,299	468

* Preliminary.

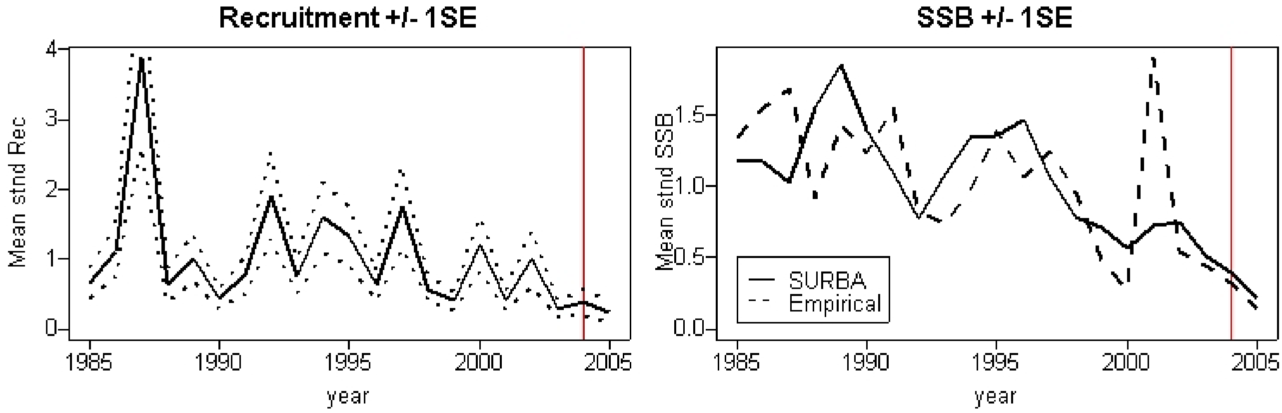


Figure 1.4.21.1 Cod in Division VIa. Survey-based estimates of recruitment and SSB (both mean-standardised). Empirical estimates of SSB from the raw survey data are shown as dashed lines in the right-hand panel.

Rockall Cod

(Division VIb)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

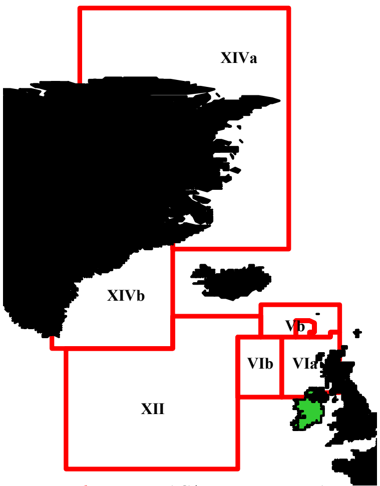
Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See West of Scotland and Rockall Overview for Mixed Fishery Advice)

There is no information of the status of cod in VIb. The only information available is official landings data. This data show a serious and substantial declining trend in landings to the lowest in the time series (circa 100 t) in most recent years. Official catch data are incomplete.

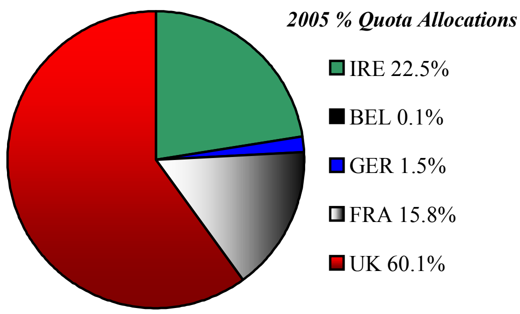
ICES does not give advice for this stock. Given the landings trend and critical condition of the adjacent cod stock in Via, FSS advise zero catch of cod in 2006 for VIb. This is also broadly consistent with the advice for haddock in this area.



Red Boxes-TAC/Management Areas

CURRENT MANAGEMENT

- Due to the rapid decline in cod catches in Division VIa the official landings reported from VIb now accounts for about 25 % of the catch in Sub-area VI.
- The TAC 2005 was 721 t, with an associated Irish quota of 162 t.
- There are no explicit management objectives or plans for this stock.



ADDITIONAL INFORMATION

1. There is no assessment data for this stock. The stock definition is uncertain. Cod in this area may in fact be migrants from other areas and therefore may not constitute a separate stock.
2. Estimated landings in VIb by the Irish fleet were only 7 t in 2004.
3. Mis-reporting and under-reporting are considered to be a problem in this fishery.
4. The fishery is dominated by the UK (Scotland), with 56% of the 2003 official landings. Norwegian landings comprise 24% of the total landings for cod in VIb. Norway has reported longline landings of between 50-150 t in recent years. Irish bottom trawl landings were 11% of the total.
5. Cod is a minor by-catch in an Irish fishery targeting mainly haddock and megrim.

ICES ADVICE
1.4.22

State of the stock

There is no information on the status of cod in Division VIb. Official catch data are incomplete.

Management considerations

Due to the rapid decline in cod catches in Division VIa the official landings reported from this area have in some of the most recent years accounted for about 25% of the catch in Subarea VI. TAC set for Division VIb cod should not jeopardise a rebuilding plan for cod in Division VIa, nor management measures for haddock in this area.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

Table 1.4.22.1 Cod in Division VIb (Rockall). Official catch statistics.

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Belgium	-	-	-	1	-	-	-	-	-	-	-
Faeroe Islands	-	5	3	22	40	10	92	75	2	77	112
France	320	1,128	4	4	3	1	2	1	4	27	97
Germany	-	-	-	-	-	-	111	136	443	-	195
Ireland	-	-	-	-	-	3	-	-	-	-	-
Norway	-	3	-	8	3	69	138	80	134	51	462
Poland	8	-	-	-	-	-	-	-	-	-	-
Portugal	-	-	-	-	-	-	-	-	-	-	-
Russian Federation	.	.	.	.	.	.	.	.	.	.	.
Spain	-	-	-	-	-	-	-	33	70	58	42
UK - Eng+Wales+N.Irl.	1	-	28	77	89	285	129	1	67	3	163
UK – Scotland	128	39	98	61	33	384	198	370	143	157	35
USSR	26	-	110	1,398	-	-	-	-	-	-	-
TOTAL	**483**	**1,175**	**243**	**1,571**	**168**	**752**	**670**	**696**	**863**	**373**	**1,106**

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Belgium	-	-	-	-	-	-	-	-	-	-	-
Faeroe Islands	18	-	1	-	31	5	-	-	-	1	-
France	9	17	5	7	2	-	-	-	-	-	-
Germany	-	3	-	-	3	-	-	126	2	-	-
Ireland	-	-	-	-	-	-	400	236	235	472	280
Norway	373	202	95	130	195	148	119	312	199	199	120
Poland	-	-	-	-	-	-	-	-	-	-	-
Portugal	-	-	-	-	-	-	-	-	-	-	-
Russian Federation	.	.	.	.	.	.	.	.	-	-	-
Spain	241	1,200	1,219	808	1,345	-	64	70	-	-	-
UK - Eng+Wales+N.Irl.	161	114	94	69	56	131	8	23	26	103	25
UK – Scotland	221	437	187	284	254	265	758	829	714	322	236
USSR	-	-	-	-	-	-	-	-	.	.	.
TOTAL	**1,023**	**1,973**	**1,601**	**1,298**	**1,886**	**549**	**1,349**	**1,596**	**1,176**	**1,097**	**661**

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	*2004
Belgium	-	-	-	-	-	-	-	.	.	.
Faeroe Islands	-	-	-	-	-	.	-	.	.	.
France	-	-	-	-	.	-	.	-	-	.
Germany	-	10	22	3	11	1	-	-	-	-
Ireland	477	436	153	227	148	119	40	18	11	7
Norway	92	91	55	52	85	152	89	28	25	23
Poland	-	-	-	-	-	-	-	.	.	.
Portugal	-	-	5	-	-	-	-	.	.	.
Russian Federation	-	-	-	-	-	7	26	-	-	.
Spain	2	5	1	6	4	3	1	-	6	.
UK - Eng+Wales+N.Irl.	90	23	20	32	22	4	2	2	3	-
UK – Scotland	370	210	706	341	389	286	176	67	57	45
USSR	.	.	.	.	.	.	.	.	.	.
TOTAL	**1,031**	**775**	**962**	**661**	**659**	**572**	**334**	**115**	**102**	**75**

* Preliminary.

West of Scotland Haddock

(Division VIa)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS - SINGLE STOCK CONSIDERATIONS

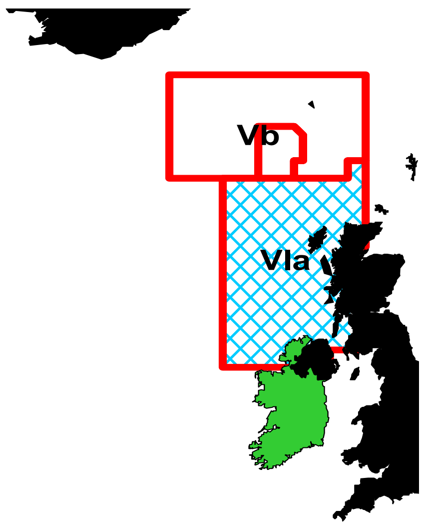
(See West of Scotland and Rockall Overview for mixed fishery advice).

The quality of this assessment is poor due to conflicting signals from survey and commercial catch data. Survey information indicates an increase in unaccounted removal from this stock most likely due to under-reporting of landings and/or problems with the estimation of discards. The level of bias caused to SSB estimates is uncertain. However, the relatively high SSB in recent years implies that the stock remains in a relatively healthy state despite the unaccounted catches.

Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as having full reproductive capacity and being harvested sustainably. However, fishing mortality has been above F_{pa} in every year since 1987, except for 2003 and 2004.

Long-term advice
FSS considers that a well defined 'management plan' is necessary for West of Scotland mixed fisheries. FSS therefore recommends that stakeholders should develop and implement a long term management plan with clearly defined objectives that will ensure a high probability of fishing within safe biological limits. This is a typical haddock stock with sporadic exceptional year-classes (eg. 1999) followed by periods of high abundance. FSS considers that the current implementation of TACs has proved to be an ineffective means of accommodating such variations in recruitment because of the long time interval between assessment and implementation. FSS recommends that long term management plans recognise that species such as haddock are subject to highly sporadic recruitment which will result in substantial variation in catches and SSB from year to year. FSS recommends that a within-year review of management controls, taking into account real-time information, would allow a more effective means of exploiting the periodic recruitment characteristic of haddock stocks and help to overcome assessment uncertainty.

Short-term advice
If managers want to maximise short-term catches and harvest the stock within precautionary limits then fishing mortality should be maintained below F_{pa} and SSB should be above B_{pa}. ICES recommends a reduction in fishing mortality to less than 0.35 to maintain SSB above B_{pa}. In order to better accommodate the uncertainty in the assessment, and the heavy reliance of short-term catch forecasts on assumed recruitment, FSS advises that the TAC for 2006 should be initially set for the first six months of 2006 at 50% of the forecasted 2006 catch, and then reviewed mid-year. This corresponds to landings in VIa of less than 4,000 t from January to June 2006 inclusive. This translates to an Irish quota for the first six months of 2006 of 621 t or 315 t (depending on whether the percentage allocated to Ireland is based on the 2004 or 2005 VIa, Vb TAC and quota).



Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

CURRENT MANAGEMENT

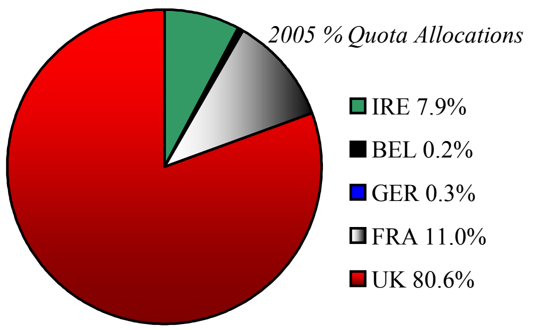
- In 2004 the TAC area was revised to cover Vb and VIa. The assessment area covers Division VIa only.
- The 2004 TAC allocated to this stock was 6,503 t, with

TAC Area	2005		2006 Proposals [a]		
	TAC	Irish quota	TAC Jan-June	Irish quota Jan-June based on 2004 Irish allocation of 16%	Irish quota Jan-June based on 2005 Irish allocation of 8%
Vb,VIa	7,600	598	4000	621	315

[a]: 50% of the forecasted 2006 catch level that maintains SSB above $\mathbf{B_{pa}}$, contingent on a mid-year review in 2006

an Irish quota of 1,010 t (15.5%). The 2005 TAC allocated to this stock was 7,600 t, with an Irish quota of 598 t (8%).

- Since February 2003 a days-at-sea effort control regime was implemented in VI as part of Cod recovery measures. FSS point out that the days-at-sea regulations in VIa appear to have lead to considerable changes in fishing patterns and there may have been incentives for vessel to switch to targeting anglerfish, megrim or Nephrops to avail of a higher effort allocations. Detailed quantitative information on the likely impact of this on the haddock fishery is not yet available. However, the incentive created in the effort regulation for vessels to switch to smaller mesh gears in to avail of greater effort allocations is thought to have resulted in increased discarding and high-grading. These issues are discussed in greater detail in the Section: "Recovery Plans and Effort Limitation".
- There are no explicit management objectives or a management plan for this stock. FSS recommends that management objectives be established and that a management plan be developed and implemented by stakeholders for all fisheries catching haddock.



ADDITIONAL INFORMATION

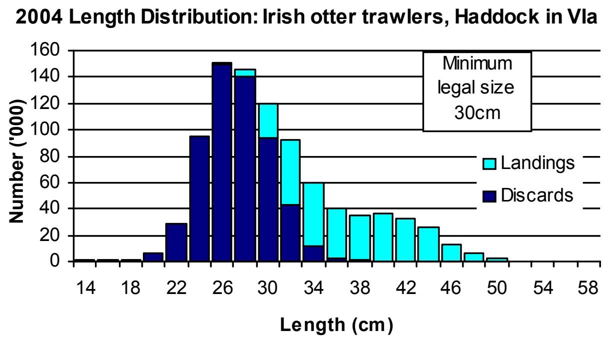
1 This assessment is highly uncertain with substantial retrospective bias in the estimation of F and SSB. The reasons for this appear to be unaccounted for removals from this stock. Misreporting has been a serious problem in the fishery for those countries with restrictive quotas. Corrections have been made for misreporting during 1992-1994. Misreporting of landings has occurred in recent years, but no quantitative information was provided on possible large-scale misreporting for the period 1995-2004, so no adjustments were made to the landings data. Previous examination of the 'perceived accuracy' of the short-term forecasts for recent years indicates that landings in the interim year have been over-estimated by over 200% in some years. Recruitment is reasonably well estimated. The stock has increased due to the strong 1999 year class to a relatively good condition. In the near future the 1999 year class will contribute less to SSB and SSB is expected to decline. If fishing mortality remains high it will result in the stock being depleted very quickly.

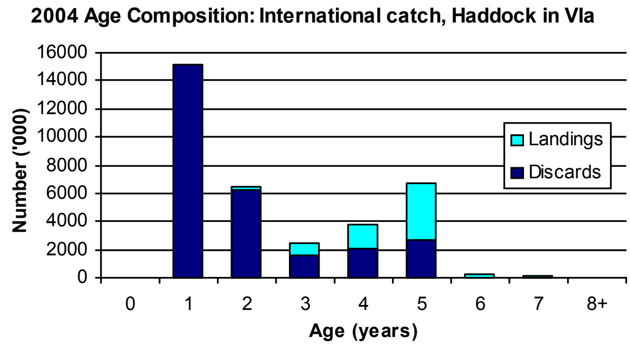
2 Irish landings in 2004 were reported to be about 194 t, a decline of 60% on 2003 landings.

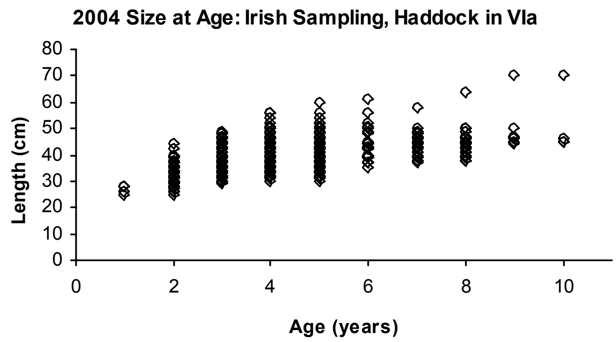
3 Otter trawlers from Killybegs and Greencastle have traditionally carried out the Irish haddock fishery. This is generally a mixed fishery targeting haddock, cod, whiting, megrim and monkfish. In recent years there has been a decline in effort in VIa due to decommissioning and displacement of effort to Sub-area VII (see also the Section "Recovery Plans and Effort Limitation").

4 The mesh size increase implemented in recent years as part of the cod recovery plan will theoretically improve the selection pattern substantially for haddock in VIa. These benefits may have contributed to a recent reduction in F observed in the assessment but given the level of uncertainty in this assessment it is not yet possible to conclude this definitively.

5 The proportion of haddock discarded has been high. Discarding rates in the Irish otter trawl fleet are estimated to be high (see length and age composition plots).







ICES ADVICE
1.4.23

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Full reproductive capacity	Harvested sustainably	Overexploited	Not defined	

Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as having full reproductive capacity and harvested sustainably. Fishing mortality has been above $\mathbf{F}_{pa}$ in every year since 1987, except in the most recent years. Fishing mortality has fallen steadily from a peak in 1999. SSB varied around $\mathbf{B}_{pa}$ during the 1990s. The very strong 1999 year class has caused SSB to increase from a level near the historic low in 2000 to above $\mathbf{B}_{pa}$ since 2001. More recent year classes are close to average except the 2003 and 2004 year classes, which are estimated to be low. The SSB is thus expected to decrease in the short-term.

Management objectives

There are no explicit management objectives for this stock.

Reference points

	ICES considers that:	ICES proposes that:
Limit reference points	$\mathbf{B}_{lim}$ is 22 000 t	$\mathbf{B}_{pa}$ be set at 30 000 t
	$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ be set at 0.5
Target reference points		$\mathbf{F}_{y}$ not determined

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss,}$ the lowest observed spawning stock estimated in previous assessments.	$\mathbf{B}_{pa} = \mathbf{B}_{lim}$ * 1.4. This is considered to be the minimum SSB required to have a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is not defined.	$\mathbf{F}_{pa}$: The F below which there is a high probability of avoiding SSB<$\mathbf{B}_{pa}$ in the long term.

Yield and spawning biomass per Recruit from 2004 assessment F-reference points:

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 3 years	0.493	0.083	0.361
Fmax	0.184	0.118	0.935
F0.1	0.123	0.112	1.232
Fmed	0.555	0.076	0.316

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$-$\mathbf{F}_{max}$.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

The current estimated fishing mortality is 0.49. There will be no gain to the long-term yield by having fishing mortalities above $\mathbf{F}_{max}$ (0.21). Fishing at such lower mortalities would lead to higher SSB and, therefore, lower risks of fishing outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

In order to maintain SSB above $\mathbf{B}_{pa}$ in 2007, ICES recommends a reduction in fishing mortality to less than 0.35. This corresponds to landings less than 8 000 t in 2006. Due to recent poor recruitments and in order to maintain SSB above $\mathbf{B}_{pa}$ also after 2007, a TAC for 2006 well below 8 000 t should be considered.

Short-term implications

Outlook for 2006:

Basis: F(2005) = Fsq = mean F(02-04) = 0.49; R82-02 = GM = 15.6 million; SSB(2005) = 49kt; SSB(2006) = 36.4kt; landings (2005) = 12.8kt
The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.5
The fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock (F(long term yield)) is not defined

Rationale	TAC(2006) (1)	Basis	F(2006)	SSB(2007)	%SSB change	%TAC change
Zero catch	0	F=0	0	42.6	17%	-100%
Status quo	10.5	Fsq	0.49	26.1	-28%	38%
High long term yield	5.01	F(long term yield)	0.21	34.67	-5%	-34%
Status quo	4.8	Fsq *0.4	0.2	35	-4%	-37%
	5.75	Fsq *0.5	0.25	33.52	-8%	-24%
	6.9	Fsq *0.6	0.29	31.7	-13%	-9%
	7.81	Fsq *0.7	0.34	30.31	-17%	3%
	8.8	Fsq *0.8	0.39	28.8	-21%	16%
	9.67	Fsq *0.9	0.44	27.42	-25%	27%
	10.5	Fsq *1	0.49	26.1	-28%	38%
	11.24	Fsq *1.1	0.54	24.92	-32%	48%
Precautionary limits	1.25	TAC(Fpa) *0.1	0.05	40.6	12%	-84%
	3.08	TAC(Fpa) *0.25	0.13	37.7	4%	-60%
	5.85	TAC(Fpa) *0.5	0.25	33.35	-8%	-23%
	8.48	TAC(Fpa) *0.75	0.38	29.28	-20%	12%
	9.82	TAC(Fpa) *0.9	0.45	27.18	-25%	29%
	10.65	Fpa = Fsq *1.02	0.5	25.86	-29%	40%
	11.4	TAC(Fpa) *1.1	0.55	24.66	-32%	50%
	12.71	TAC(Fpa) *1.25	0.63	22.58	-38%	67%
	15.25	TAC(Fpa) *1.5	0.75	18.57	-49%	101%
	17.8	TAC(Fpa) *1.75	0.88	14.57	-60%	134%
	20.34	TAC(Fpa) *2	1	10.57	-71%	168%
	22.88	TAC(Fpa) *2.25	1.13	6.56	-82%	201%

(1) It is assumed that the TAC will be implemented and that the landings in 2006 therefore correspond to the TAC.
All weights in thousand tonnes
Shaded scenarios are not considered consistent with the precautionary approach.
1) SSB 2007 relative to SSB 2006.
2) TAC 2006 relative to TAC 2005.

Management considerations

Measures to reduce discards and to improve the exploitation pattern would be beneficial to the stock and to the fishery. The more widespread use of 110-mm mesh nets in 2002 as well as the requirement to fit square mesh panels to certain towed gears since late 2000, may have improved the selection pattern for haddock.

The likelihood that mortality will stay at the reduced levels observed over the last 4 years is increased by recent substantial reductions in Scottish fleet size (~30% reduction from 2001-2004) due to decommissioning. Further reductions in F may be expected through the effort regulations controlling days at sea. They are likely to lead to additional reductions in mortality on haddock if properly implemented and enforced.

Special attention needs to be given to considering the sporadic nature of haddock recruitment and how to manage periods of low recruitment interspersed with large, occasional pulses. In recent years over 50% of the total catch in weight is discarded, so restricting landings alone may not achieve the necessary increase in SSB. Recent recruitment has been poor.

There are reports of significant non-reported landings and therefore a TAC system may not be able to restrict fishing. The conflicting signals in the survey and the catch-at-age information indicate that there is unaccounted removal from the system. The problem does not appear to be as severe as for whiting and cod, but this has not been fully evaluated.

Factors affecting the fisheries and the stock

The effects of regulations

The fishery is regulated by a TAC that does not, however, seem to be restricting catches.

The increase in minimum mesh size from 100 to 120 mm in 2001/2002 (before the introduction of effort regulation 27/2005) partly caused a shift to 80 mm mesh sizes in the mixed fishery trawls due to the loss of valuable *Nephrops* catch. Poorer selectivity at this mesh size may have resulted in increased discarding and high grading.

With the introduction of effort regulation, vessel operators have effectively been further encouraged to reduce mesh size and shift to other

fisheries, particularly *Nephrops* trawling, in order to gain more days at sea. It is not possible to evaluate whether the mesh size changes and effort limitations may have benefited haddock without information on the level of adherence to catch composition regulations required when using smaller mesh sizes.

Changes in fishing technology and fishing patterns

Haddock in Division VIa are caught mainly by Scottish trawlers. Since 1976, Scottish heavy trawl and seine effort has declined, whilst that of light trawlers (shorter than 90 feet) has generally increased.

Other factors

Haddock in Division VIa are fully exploited by age group 3, and also reach full maturity at that age. Immature fish are subject to comparatively high fishing mortality, and comprise a large fraction of the discarded catch. High fishing mortality on immature haddock increases the susceptibility of the stock to over-exploitation.

Scientific basis

Data and methods

The analytical age-based assessment is based on landings-at-age data, discard-at-age data, and indices from research vessel surveys.

Uncertainties in assessment and forecast

Survey information indicates an increase in unaccounted removal from this stock. Absolute biomass estimation may thus be biased, but it is not known to what extent. The relatively high SSB in recent years implies that the unaccounted catches have not caused harm to the stock in recent years.

Since effort data are unreliable (due to effort reporting not being mandatory in logbooks) commercial CPUE data are not used as tuning inputs.

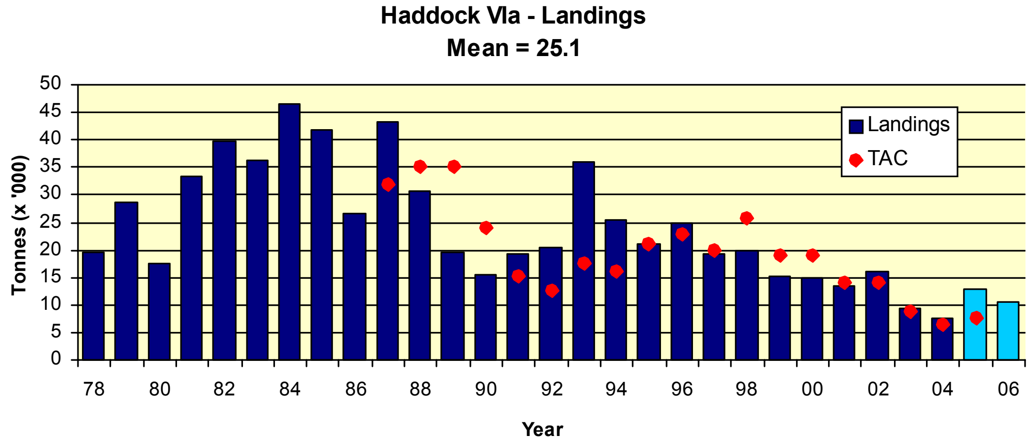
Weights-at-age have shown a declining trend in this stock. Continuation of such trends would render forecast too optimistic. Forecasts are highly dependent on assumed average recruitment.

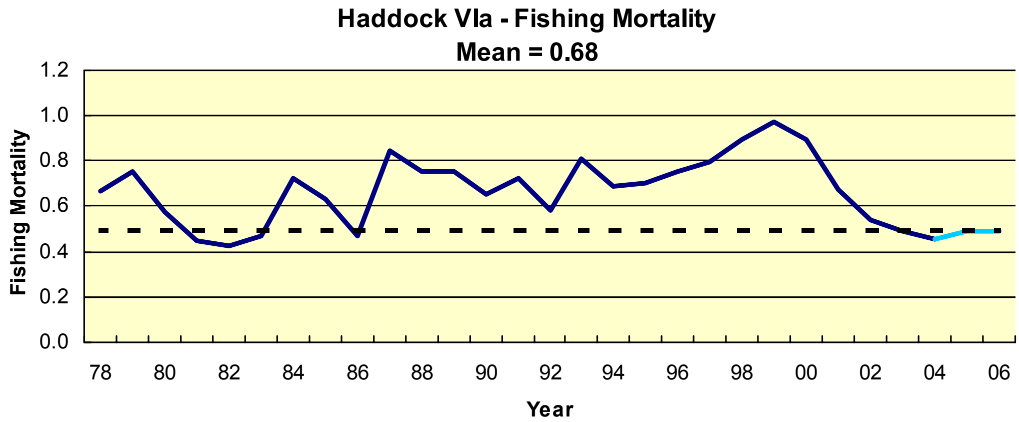
Comparison with previous assessment and advice

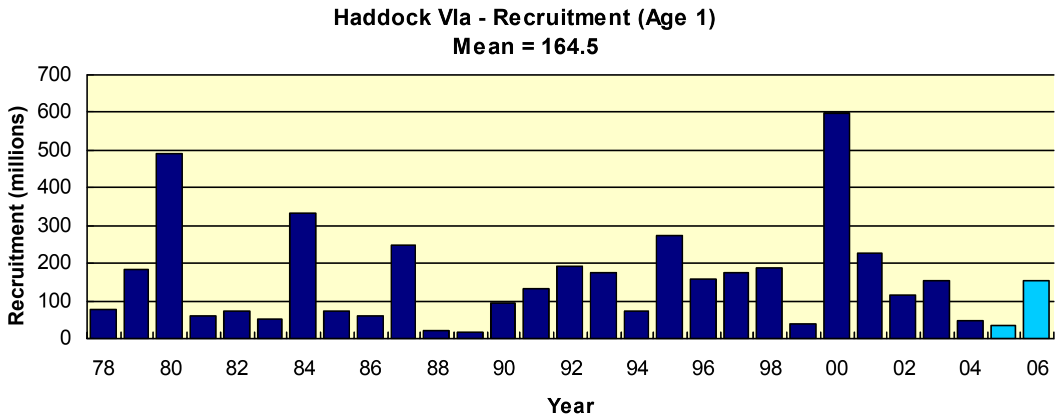
The perception of the state of the stock from this year's assessment does not differ from that obtained last year and the basis for the single-stock fishery advice is the same as last year.

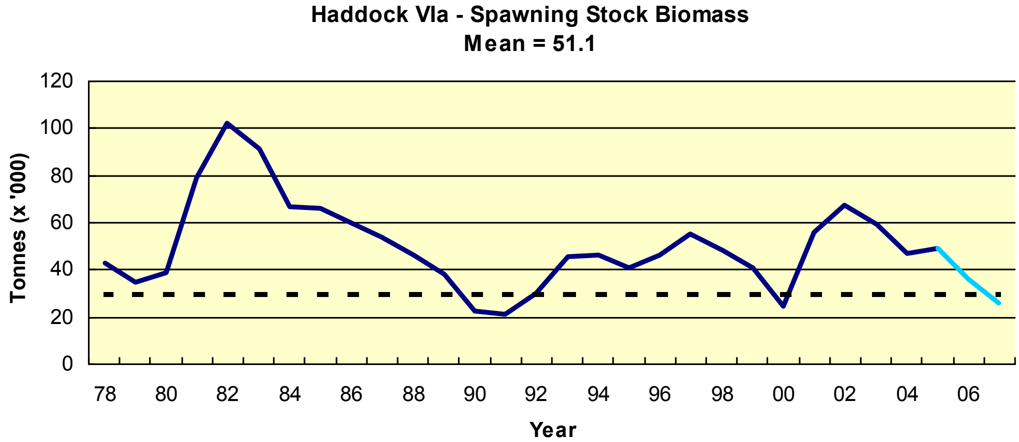
Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).


Haddock VIa - Landings
Mean = 25.1
Tonnes (x '000)
Landings
TAC
Year
0
5
10
15
20
25
30
35
40
45
50
78
80
82
84
86
88
90
92
94
96
98
00
02
04
06


Haddock VIa - Fishing Mortality
Mean = 0.68
Fishing Mortality
Year
0.0
0.2
0.4
0.6
0.8
1.0
1.2
78
80
82
84
86
88
90
92
94
96
98
00
02
04
06


Haddock VIa - Recruitment (Age 1)
Mean = 164.5
Recruitment (millions)
Year
0
100
200
300
400
500
600
700
78
80
82
84
86
88
90
92
94
96
98
00
02
04
06


Haddock VIa - Spawning Stock Biomass
Mean = 51.1
Tonnes (x '000)
Year
0
20
40
60
80
100
120
78
80
82
84
86
88
90
92
94
96
98
00
02
04
06

Year	ICES Advice	Single-Stock Exploitation Boundaries	Predicted catch corresp. to advice	Predicted catch corresp. to Single-Stock Exploitation Boundaries	Agreed TAC[1]	Official Landings	ACFM Landings	Discard Slip.	ACFM Catch
1987	Reduce F towards $\mathbf{F}_{max}$		20.0		32.0	27	27.0	16.2	43.2
1988	No increase in F; TAC		25.0		35.0	21	21.1	10.2	31.3
1989	80% of F(87); TAC		15.0		35.0	24	16.7	3.2	19.9
1990	80% of F(88); TAC		14.0		24.0	13	10.1	5.4	15.5
1991	70% of effort (89)		-		15.2	10	10.6	9.2	19.8
1992	70% of effort (89)		-		12.5	7	11.4[2]	9.4[2]	20.8[2]
1993	70% of effort (89)		-		17.6	13	19.1[2]	16.9[2]	36.0[2]
1994	30% reduction in effort		-		16.0	9	14.2[2]	11.2[2]	25.4[2]
1995	Significant reduction in effort		-		21.0	13	12.4	8.8	21.2
1996	Significant reduction in effort		-		22.9	13	13.4	11.8	25.3
1997	Significant reduction in effort		-		20.0	13	12.9	6.6	19.5
1998	No increase in F		20.8[3]		25.7	14	14.4	5.7	20.1
1999	F reduced to $\mathbf{F}_{pa}$		14.3[3]		19.0	11	10.4	5.1	15.6
2000	Maintain F below $\mathbf{F}_{pa}$		<14.9[3]		19.0	7	6.9	8.2	15.2
2001	Reduce F below $\mathbf{F}_{pa}$		<11.2[3]		13.9	7	6.7	7.2	14.0
2002	Reduce F below $\mathbf{F}_{pa}$		<14.1[3]		14.1	7	6.7	8.6	15.2
2003	No cod catches		-		8.7	4.9	5.3	4.2	9.6
2004	[4]	$\mathbf{F}_{pa}$		12.2	6.5	3.0	n/a	n/a	n/a
2005	[4]	¾*Fpa		7.6	7.6				
2006	[4]	0.7*Fpa		8.0					

[1]TAC is set for Divisions VIa and VIb (plus Vb1, XII & XIV), combined with restrictions on the quantity that can be taken in VIa from 1990. [2]Adjusted for misreporting. [3] For VIa only. [4] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

Table 1.4.23.1 Haddock, Division Via. Nominal catch (–2004, as officially reported to ICES.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Belgium	-	29	8	9	-	9	1	7	1	+
Denmark	+	+	+	+	+	+	1	1	-	1
Faroe Islands	1	-	-	13	-	1	-	-	-	-
France	4956	5,456	3,001	1,335[1,2]	863[1,2]	761[1,2]	761	1,132	753	671
Germany, Fed.Rep.	25	21	4	4	15	1	2	9	19	14
Ireland	2026	2,628	2,731	2,171	773	710	700	911	746	1,406
Norway	45	13	54	74	46	12	72	40	7	13
Spain	-	-	-	-	-	-	-	-	-	-
UK (E & W)[3]	222	425	114	235	164	137	132	155	254	322
UK (N. Ireland)	1	1	35							
UK (Scotland)	12955	18,503	15,151	19,940	10,964	8,434	5,263	10,423	7,421	10,367
UK (total)										
Netherlands										
Total	20,385[1]	27,076	21,098	23,781	12,825	10,065	6,932	12,678	9,201	12,794

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004[1]
Belgium	1	3	2	2	1	2	+	+	
Denmark	1	-	+	-	-	-	-	+	-
Faroe Islands	-	-	-	-	n/a	n/a			
France	445	270	394[1]	788	282	159[1]	151	180	
Germany, Fed.Rep.	2	1	1	2	1	1	+	-	
Ireland	1,399	1447	1,352	1054	677	744	672	497	
Norway	16[1]	21[1]	28	18	70[1]	33[1]	30	23	4
Spain	-	-	2	4	9	4	4	5	
UK (E & W)[3]	448	493	458	315	199	201	237		
UK (N. Ireland)	...	...	…	...	…	…	…		
UK (Scotland)	10,790	10,352	12,125	8,630	5,933	5,886			
UK (total)							6225	4,688	3002
Netherlands									1
Total	13,102	12,587	14,360	10,813	7,163	7,030	7,113	4,884	3007

[1]Preliminary. [2]Includes Divisions Vb(EC) and VIb. [3]1989–2002 N. Ireland included with England and Wales. n/a = not available.

Table1.4.23.2 Haddock in Division VIa (West of Scotland).

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1978	76612	42996	19505	0.664
1979	184464	34613	28678	0.755
1980	489559	39170	17474	0.578
1981	58611	79250	33281	0.450
1982	74028	102049	39698	0.428
1983	49936	91263	36192	0.466
1984	333420	66838	46355	0.724
1985	71622	66373	41837	0.630
1986	61037	59931	26714	0.472
1987	247894	53991	43205	0.847
1988	21367	46438	30672	0.754
1989	16278	38331	19669	0.751
1990	93692	22553	15522	0.656
1991	132547	21464	19248	0.727
1992	194137	30334	20513	0.582
1993	175992	45878	35871	0.808
1994	73589	46680	25342	0.689
1995	272516	40955	20920	0.701
1996	158324	46594	24817	0.752
1997	174447	55063	19344	0.792
1998	185725	48412	19936	0.894
1999	37720	40965	15321	0.976
2000	599068	24212	14851	0.894
2001	225177	56018	13389	0.677
2002	115176	67554	15977	0.539
2003	155004	59488	9438	0.488
2004	45850	47059	7579	0.453
2005	35873	48977		
Average	155702	50837	24494	0.672

Rockall Haddock

(Division VIb)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See West of Scotland and Rockall Overview for Mixed Fishery Advice)

The state of the stock is unknown and no qualitative assessment was possible in 2005 due to inadequacies in the data (see additional information).

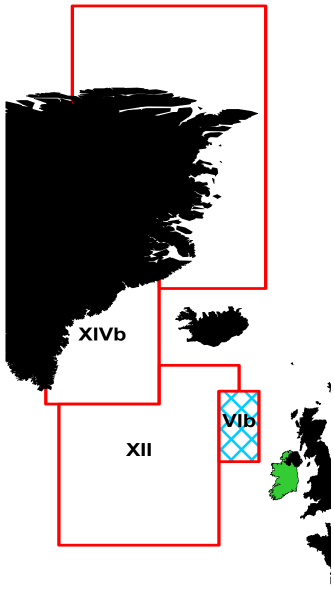
Survey-based indices of SSB show a decline since 1995 and indicate that the stock was at an historical low in 2002, but may have increased in subsequent years. Recruitment indicates a relatively strong 2001 year-class.

FSS agree with ICES that catches in 2006 should be reduced to the lowest possible level. FSS also advise that a longer-term management approach is required. This should include improving selection pattern in the fishery, reducing fishing mortality substantially to a longer-term target, thereby rebuilding SSB substantially so that there is a buffer stock that is robust to occasional weak recruitments. FSS notes that the sporadic recruitment characteristic of other Haddock stocks has not been observed for Rockall Haddock.

Part of the fishery lies in international waters where catches are unregulated. FSS therefore advise that proper control and enforcement measures, such as those outlined in the EC recovery proposal, should be implemented immediately. FSS notes that the EC proposal also advises for an effective TAC covering all fisheries. However, in the long-term FSS considers that TACs are unlikely to be effective in this fishery (see additional information). FSS therefore advises that effort regulation should be used as the means of controlling fishing mortality on Rockall haddock, and as the basis for long-term management of the stock.

CURRENT MANAGEMENT

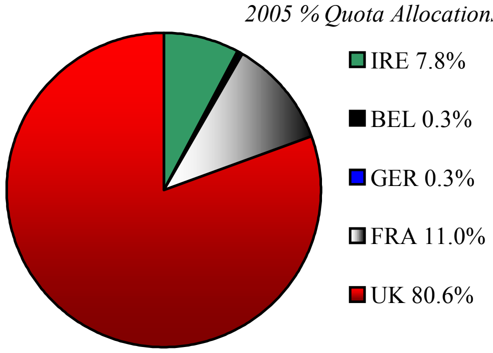
- Prior to 2004, the EU TAC was set as a total for Sub-area VI, with a limit on how much of the catch could be taken in Division VIa. The 2004 and 2005 (EU) TACs set a specific TAC for the EU fleets operating in Divisions VIb, XII and XIV.



Red Boxes-TAC/Management Areas Blue Shading– Assessment

- The 2005 TAC was 702 t. The associated Irish quota was 55 t.
- Part of Division VIb falls (since 1999) within international waters fished by non-EU vessels (mainly Russian) which are not subject to TAC. This allows for an unregulated fishery in the Rockall area.
- In consultation with the Russian Federation, a recovery plan has been proposed by the European Commission in October 2003. The recovery plan is designed to be facilitated by quota and technical regulations. No aspects of the plan have yet been implemented by NEAFC.
- Following the NEAFC agreement in March 2001, NEAFC have maintained an area closure to all fishing (except long-lining) in the SW corner of the Rockall Bank. Data are inadequate to fully evaluate the impact of this measure on the stock status.

2005 % Quota Allocations



ADDITIONAL INFORMATION

1 FSS has serious concerns about continuing inadequacies in the data for the assessment of this stock. These concerns have made it impossible to carry out an analytical assessment for this stock in the last two years.

2 There is no likelihood of an assessment in the short term. Therefore this stock is a good candidate for a multi-annual management plan. Over the past decade there has been significant changes in the EU fleets fishing at Rockall (accompanied by changes in the spatial and temporal distribution of their effort), possible mis-reporting of landings, considerable discarding and high-grading in this fishery. In 1999 a Russian fishery commenced mainly using smaller mesh gears in the international part of the Rockall bank. This fleet now accounts for the majority of the catches.

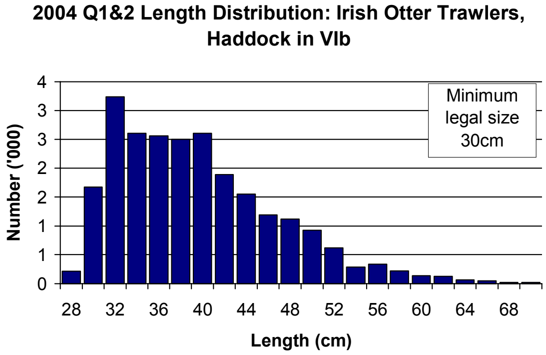
3 The fisheries independent data for the stock is poor with a Scottish research vessel survey-taking place only every two years. There are some concerns about the coverage and reliability of this survey for the stock. In 2004-2005 a new trawl acoustic survey was carried out by the Russian Federation and a point estimate of the biomass of Rockall haddock was calculated.

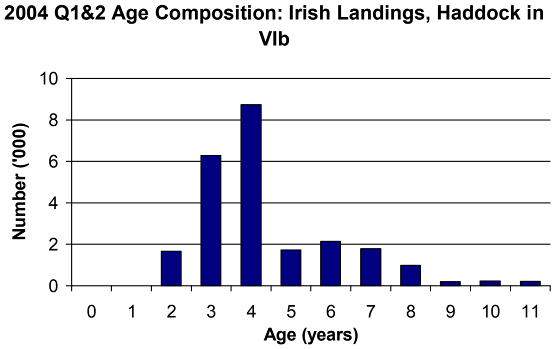
4 TACs are likely to be effective only if the fishery strictly adheres to them. This assumption is unlikely to be true for Rockall haddock, especially when coupled with ways of evading TACs including mis-reporting, high-grading, and discarding. In the case of Rockall haddock such practices may be prevalent due to the remote nature of the fishery and the processing of catches at sea by some fleets.

5 The proposed recovery plan aims to secure the rapid recovery and long-term conservation of the stock to within safe biological limits as defined by ICES, as well as attainment of long-term sustainable yield in accordance with the principles of the precautionary approach. ICES evaluated this plan in 2004 but certain aspects could not be fully evaluated due to data deficiencies and the lack of an adequate assessment. Nevertheless there are several recommendations in the ICES evaluation such as incentive-based management measures, suggestions for improved data collection and remote Vessel Monitoring System, strict entry and exit conditions, observer schemes etc. FSS considers that these control and enforcement measures are still valuable despite the absence of a quantitative assessment.

6 Limited discard data are available indicating there is substantial and highly variable discarding of haddock by EU fleets.

7 Ireland took about 19 t in 2004. In the mid 1990s 5–7 otter trawlers from Killybegs and Greencastle carried out the Irish haddock fishery. Very few Irish vessels have participated in the fishery since 2003. This is generally a mixed fishery targeting haddock, megrim and monkfish.





ICES ADVICE
1.4.24

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target
Unknown	Unknown	Unknown	Not defined

The state of the stock is uncertain. Historical perspectives of fishing mortality indicate that they have been high, but the current exploitation rate is unknown. Survey-based indices of SSB show a decline since 1995 and indicate that the stock was at an historical low in 2002, but may have increased in subsequent years. Recruitment indicates a relatively strong 2001 year-class.

Management objectives

In consultation with the Russian Federation, a recovery plan has been proposed by the EC, but has not yet been implemented. The recovery plan is designed to be facilitated by quota and technical regulations.

Reference points

	ICES considers that:	ICES proposes that:
Limit reference points	$\mathbf{B}_{lim}$ is 6 000 t	$\mathbf{B}_{pa}$ be set at 9 000 t
	$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ be set at 0.4
Target reference points		$\mathbf{F}_{y}$ not determined

Technical basis

$\mathbf{B}_{lim} = \mathbf{B}_{loss,}$ the lowest observed spawning stock estimated in previous assessments.	$\mathbf{B}_{pa} = \mathbf{B}_{lim} * 1.4$. This is considered to be the minimum SSB required to have a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is not defined due to uninformative stock recruitment data	$\mathbf{F}_{pa}$: This F is adopted by analogy with other haddock stocks as the F that provides a small probability that SSB will fall below $\mathbf{B}_{pa}$ in the long term.

Single-stock exploitation boundaries

Catches in 2006 should be reduced to the lowest possible level.

Management considerations

Previous to 2004, the EU TAC was set as a total for Division VI, with a limit on how much of the catch could be taken in Division VIa. The 2004 and 2005 (EU) TACs set a specific limit for the EU fleets operating in Division VIb. In addition, part of Division VIb falls (since 1999) within international waters where non-EU vessels are not subject to TAC. This allows for an unregulated fishery in the Rockall area. An international TAC applicable only to Division VIb, including international waters, would improve prospects for sustainability in the fishery in Division VIb.

However, the application of TACs implies that there is a simple relationship between recorded landings and effort exerted, and TACs are therefore likely to be effective only if the fishery strictly adheres to them. Such assumptions are unlikely to be true for Rockall haddock, especially when coupled with ways of evading TACs including misreporting, high grading, and discarding. In the case of Rockall haddock these may occur to a large extent due to the remote nature of the fishery and the processing of catches at sea by some fleets. Therefore, effort regulation should be considered as a means of controlling fishing mortality on Rockall haddock.

There is a need for an internationally agreed management plan. Such a plan should involve extensive collaboration between stakeholders, scientists, and management authorities in both the design and the monitoring of conservation measures. ICES notes that this is a mixed fishery that currently includes substantial catches of blue whiting and non-assessed species such as grey gurnard.

Factors affecting the fisheries and the stock

The effects of regulations

Following the NEAFC agreement in March 2001, an area of the NEAFC zone around Rockall was closed to fishing. It is too early to quantify the effect that this closure has had on the haddock stock for several reasons: An analytical assessment was not possible this year. It is necessary to know that there is effective compliance with the closed area regulations, and that the closed area continues to encompass a sufficient proportion of the population of young fish. It is also necessary to establish that the selection pattern of the fishery has improved, or the overall effort has been reduced, and that improved survival of young fish has occurred as a result.

Scientific basis

Data and methods

Information about age composition in the landings is incomplete. The total catch composition has been estimated but it is not possible to validate these estimates. Survey estimates are available from 1988-2003. In 2004-2005 new data on biology and distribution were obtained, a trawl acoustic survey was carried out and the biomass of haddock from the Rockall Bank was estimated (Oganin *et al*. 2005).

Uncertainties in assessment and forecast

The survey covers only part of the currently known distributional area of haddock. The survey index may thus in part reflect changes in distributional pattern, and not only in stock dynamics. An annual survey covering the whole of the distributional area may improve assessment of the stock status if managed under a TAC regime.

There is an urgent requirement for well-designed scientific monitoring programmes capable of delivering accurate data on trends in abundance and composition of the fish fauna throughout the area, in a form that can support the development and implementation of a management plan for Rockall Bank.

Comparison with previous assessment and advice

The assessment and the advice are the same as last year. The 2005 assessment attempted to take into account some previously unavailable data regarding discards, incomplete catch-at-age data, and discontinuous survey data.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

Oganin I.A., Ratushny S.V., Astakhov A.Yu., Khlivnoy V.N. & V.I. Vinnichenko (2005). Preliminary results from the Trawl-Acoustic survey for haddock (*Melanogrammus aeglefinus*) stock on the Rockall Bank in 2005. Working Document to the Working Group on the Assessment of Northern Shelf Demersal Stocks, 2005.

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official Landings	ACFM Landings
1987	Precautionary TAC		10.0			8.0	8.4
1988	Precautionary TAC		10.0			7.6	7.9
1989	*Status quo* F; TAC		18.0			6.6	6.7
1990	Precautionary TAC		5.5			8.2	3.9
1991	Precautionary TAC		5.5			5.9	5.7
1992	Precautionary TAC		3.8			4.5	5.3
1993	80% of F(91)		3.0			4.1	4.8
1994	If required, precautionary TAC		-			3.7	5.7[2]
1995	No long-term gain in increasing F		5.1[3]			5.5	5.6
1996	No long-term gains in increasing F		6.9[3]			6.8	7.1
1997	No advice given		4.9[3]			5.2	5.2
1998	No increase in F		4.9			5.1	4.5
1999	Reduce F below $\mathbf{F}_{pa}$		3.8			6.0	5.1
2000	Reduce F below $\mathbf{F}_{pa}$		< 3.5			5.7[4]	5.3[5]
2001	Reduce F below $\mathbf{F}_{pa}$		< 2.7			2.3[4]	2.0[5]
2002	Reduce F below 0.2		<1.3			3.0	3.3
2003	Lowest possible F		-			6.1	6.2
2004	[6]	Lowest possible catch		-	0.702*	6.3	6.4
2005	[6]	Lowest possible catch			0.702*		
2006	[6]	Lowest possible catch					

[1]TAC is set for Divisions VIa and VIb (plus Vb1, XII & XIV), combined with restrictions on the quantity that can be taken in VIa from 1990. [2]Including misreporting. [3]Landings at *status quo* F. [4]Incomplete data. [5]Russian data adjusted to exclude fish below MLS of 30 cm. [6] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

* Agreed EU TAC for VIb, XII and XIV

Table1.4.24.1 Nominal catch (tonnes) of HADDOCK in Division VIb, 1986–2004, as officially reported to ICES.

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003[1]	2004[1]
Faroe Islands	-	-	-	-	-	-	-	-	-	-	-	n/a	n/a			
France	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	-	-	-[*]		5	2[*]	+	1	
Germany, Fed. Rep.	1	-	-	-	-	-	-	-	-	-	-	-	-			
Iceland	-	-	-	-	-	-	-	-	+	-	167	-	-	-		
Ireland	-	620	640	571	692	956	677	747	895	704	1,021	824	357	206	169	19[5]
Norway	47	38	69	47	68	75	29	24	24	40	61	152[*]	70[*]	49	60	32
Portugal	-	-	-	-	-	-	-	-	-	4	-	-	-			
Russian Federation	-	-	-	-	-	-	-	-	-	-	458	2,154	630	1,630	4,237	5,844
Spain	337	178	187	51	-	-	28	1	22	21	25	47	51	7	19	
UK (E, W & NI)	272	238	165	74	308	169	318	293	165	561	288	36	-	-	56	
UK (Scotland)	5,986	7,139	4,792	3,777	3,045	2,535	4,439	5,753	4,114	3,768	3,970	2,470	1,205	1,145[3]	1,606	411[3]
United Kingdom															1,662	
Total	6,643	8,213	5,853	4,520	4,113	3,735	5,491	6,818	5,220	5,098	5,990	5,688	2,315	3,037	6,148	6,306
Unallocated catch	85	4,329	-198	800	671	1,998	-379	-543	-591	-599	-851	-357	-279	299	94	139
WG estimate	6,728	3,884	5,655	5,320	4,784	5,733	5,112	6,275	4,629	4,499	5,139	5,331[4]	2,036[4]	3,336[4]	6,242[4]	6,445

[1]Preliminary.
[2]Included in Division VIa.
[3]Includes UK England, Wales and NI Landings
[4]includes the total Russian catch
[5] non-official
n/a = not available.

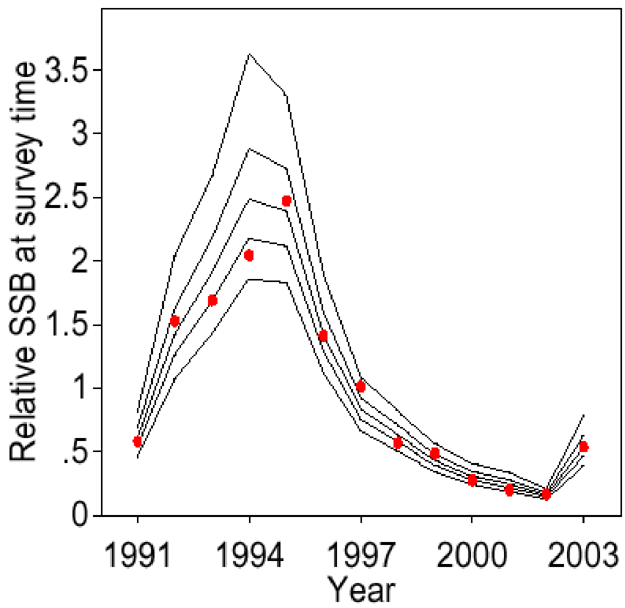


Figure 1.4.24.1 Relative trends in SSB based on the Scottish Groundfish Survey. The lines represent SSB indices of individual age groups.

West of Scotland Whiting

(Division VIa)

For latest information, see: http://www.ices.dk

Marine Institute Foras na Mara

Fisheries Science Services

FSS - SINGLE STOCK CONSIDERATIONS

(See West of Scotland and Rockall Overview for mixed fishery advice).

The state of this stock is unknown, but all the indicators are that the stock is low. The quality of the catch data has deteriorated significantly in recent years. The survey SSB estimates indicate that the stock has declined to a very low level. Survey-based SSB limit points are yet to be defined, but ICES and FSS consider recent survey SSB estimates to be below any likely candidates for a survey-based B_{lim}.

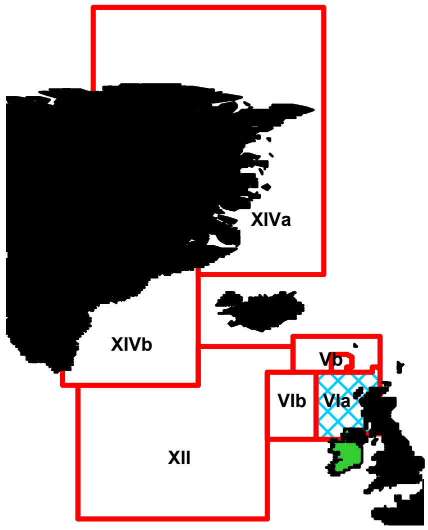
FSS considers that a well defined 'management plan' is necessary to rebuild the whiting stock and to fish it sustainably once it has recovered. FSS considers that such a plan requires clearly defined objectives that will ensure a high probability of recovery to agreed levels within a specified time frame. FSS advise that stock recovery will require substantial and persistent increase in both SSB and recruitment.

FSS advise that this stock should be managed on a long term basis using F_{max} (F = 0.23) as a target fishing mortality. This would result in higher long term yield from the stock.

FSS advise that if fishing for whiting is permitted in 2006, then catches should be at the lowest possible level. However, FSS considers that the mixed fisheries associations for the West of Scotland and in particular for those stocks outside safe biological limits should ultimately determine the 2006 TAC for whiting.

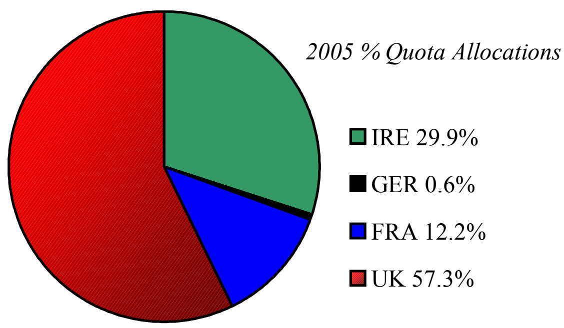
CURRENT MANAGEMENT

- The TAC area covers EC waters in Divisions Vb and Sub-areas VI, XII and XIV.
- The assessment area covers Division VIa only but landings from other areas are negligible.
- The TAC in 2005 was 1,600 t with an associated Irish quota of 478 t.



Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

- There are no explicit management objectives or a management plan for this stock.
- FSS recommends that management objectives be established and that a management plan be developed and implemented for fisheries catching whiting, based on long term considerations.
- Whiting is taken with cod and haddock in mixed demersal fisheries and management advice should be considered in that context.
- Mesh size and days at sea management regulations are summarised in the west of Scotland and Rockall overviews.
- The minimum landing size for whiting in the human consumption fishery in this area is 27 cm.



ADDITIONAL INFORMATION

1 The assessment uses survey based information to evaluate trends in SSB and recruitment. Fishing mortality is not well-estimated by the survey-based assessment and has therefore not been used as a

basis for management advice.

2 Concerns over the quality of commercial catch-at-age data have been increasing in recent years, due largely to declining stocks, restrictive TACs, and the consequently greater likelihood of discarding, misreporting and high-grading.

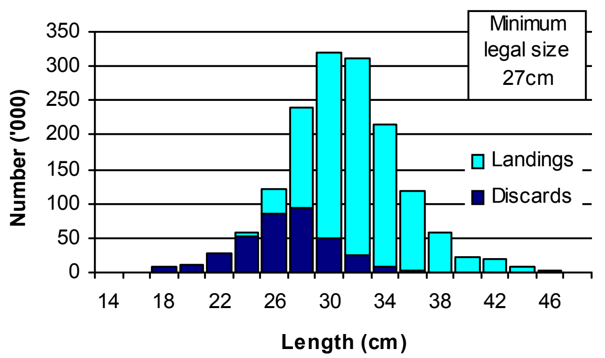
3 The Irish reported landings of about 355 t in 2004 are the lowest ever recorded.

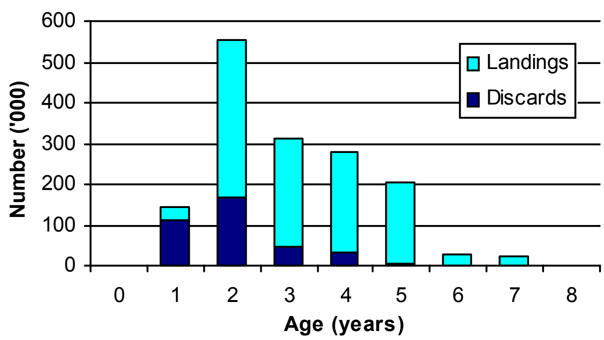
4 The fishery is dominated by the UK-Scotland (70-75% of landings) and Irish (15-20% of landings) fleets. French whiting landings have declined considerably since the late 1980s.

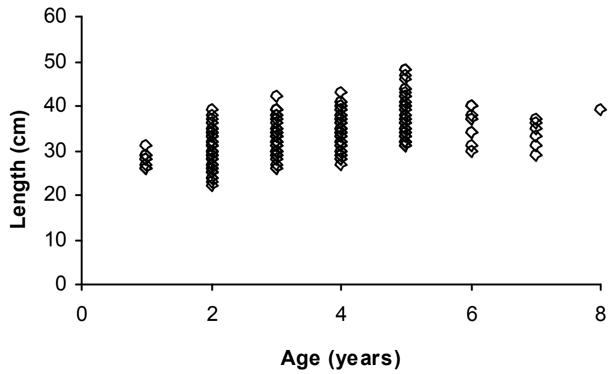
5 Otter trawl vessels fishing out of Killybegs and Greencastle take most of the Irish catch of this stock. There has been a significant reduction in the number of Irish vessels targeting the mixed gadoid fishery in VIa in recent years. Most of these landings are taken from the Donegal Bay, Tory and Aran and Stanton Banks grounds.

6 The proportion of whiting discarded has been very high and appears to have increased in recent years. Due to low market demand, there is considerable discarding of small whiting. This is a major impediment to stock rebuilding.

7 It is not yet possible to measure the effects that the recovery plan for cod in Division VIa has had on the stock and fishery for whiting in Division VIa.







ICES ADVICE
1.4.25

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Unknown	Unknown	Unknown	Not defined	The state of the stock is unknown, but all indicators point towards the stock being at an historical low.

Long term information on the historical yield and catch composition all indicate that the present stock size is low. The last assessment in 2003 indicated a decrease in SSB of a factor of 5 from 1980s to the 1990s. Survey information from the 1990s indicates that the stock has remained at the low level.

Management objectives

There are no explicit management objectives for this stock.

Reference points

	ICES considers that:	ICES proposes that:
Limit reference points	B_{lim} is 16 000 t	B_{pa} be set at 22 000 t
	F_{lim} is 1.0	F_{pa} be set at 0.6
Target reference points		F_y not defined

Yield and spawning biomass per Recruit (from 2004 assessment)
F-reference points:

	Fish Mort Ages 2-4	Yield/R	SSB/R
$\mathbf{F}_{max}$	0.229	0.104	0.624
$\mathbf{F}_{0.1}$	0.138	0.097	0.870
$\mathbf{F}_{med}$	0.680	0.076	0.240

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$-$\mathbf{F}_{max}$.

Technical basis:

$\mathbf{B}_{lim}$ = $\mathbf{B}_{loss}$(1998), the lowest observed spawning stock estimated in previous assessments.	$\mathbf{B}_{pa}$ = $\mathbf{B}_{lim}$ * 1.4. This is considered to be the minimum SSB required to have a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is the fishing mortality above which stock decline has been observed.	$\mathbf{F}_{pa}$ = 0.6 * $\mathbf{F}_{lim}$. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$.

The advice is based on information from abundance surveys. Reference points have not been estimated from the surveys. However, recovery of the stock will require substantial and persistent increase of both SSB and recruitment. The recent survey SSB estimates are below any likely candidates for a survey-based SSB limit point.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

There will be no gain in the long-term yield by having fishing mortalities above $\mathbf{F}_{max}$ (0.23). Fishing at such lower mortalities would lead to higher SSB and, therefore, lower risks of fishing outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

Catches in 2006 should be reduced to the lowest possible level. Survey and catch-at-age data are inconsistent, indicating substantial unaccounted removals. Based on the survey data the stock is at a low level similar to the one in the early 1990s but official catches are now much lower than during this period; however, the exact catch level is not known.

Management considerations

There are strong indications that management control is not effective in limiting the catch. Survey information shows that the total removal of whiting in Division VIa may be underestimated in the past decade relative to earlier periods. The effect of the fishery on the stock has therefore been evaluated in relative terms and advice on absolute levels of future catches is not possible.

The proportion of fish discarded is very high and appears to have increased in recent years. Approximately half of the annual catch weight comprises undersized or low-value whiting which are discarded. Measures to reduce discards and to improve the exploitation pattern would be beneficial to the stock and to the fishery.

Management plan evaluations

There are reports of significant non-reported landings and therefore the current implementation of the TAC system is not able to regulate fishing mortality. Unless management measures are able to restrict the fishery they are not precautionary.

Factors affecting the fisheries and the stock

The Effects of Regulations

The fishery is regulated by a TAC that does not, however, seem to restrict catches.

The more widespread use of 110-mm mesh nets in 2002 as well as the requirement to fit square mesh panels to certain towed gears since late 2000, may have temporarily improved the selection pattern for whiting. However, the increase in minimum mesh size from 100 to 120 mm in 2001/2002 (before the introduction of effort regulation 27/2005) partly caused a shift to 80 mm mesh sizes in the mixed fishery trawls due to the loss of valuable *Nephrops* catch. Poorer selectivity at this mesh size may have resulted in increased discarding and high grading.

With the introduction of effort regulation, vessel operators have effectively been further encouraged to reduce mesh size and shift to other fisheries, particularly *Nephrops* trawling, in order to gain more days at sea. It is not possible to evaluate whether the mesh size changes and effort limitations may have benefited whiting without information on the level of adherence to catch composition regulations required when using smaller mesh sizes.

The continued decline in the stock indicates that these measures alone have not proven sufficient to rebuild the stock to precautionary levels. Detailed analysis of the impact of the regulations will not be possible until data of sufficient quality become available.

Changes in fishing technology and fishing patterns

Whiting in Division VIa are caught mainly by Scottish trawlers. There has been a reduction in trawl and seine effort, but with a more moderate reduction by *Nephrops* trawlers. At present a higher proportion of the overall effort is by relatively small-meshed trawls. There has been a tendency to shift from the use of heavy groundgear (like rockhopper) to lighter groundgear.

Scientific basis

Data and methods

A survey based assessment was used to evaluate trends in SSB and recruitment.

Uncertainties in assessment and forecast

Some changes have been made to the survey design in the past, but surveys are considered to be a reasonable indicator of long-term stock trend. Jumps in survey indices are observed in occasional years. Survey information indicates an increase in unaccounted removal from this stock. Absolute biomass estimation may thus be biased, but it is not known to what extent. Thus, an analytical catch-at-age assessment is not acceptable as a basis for management advice. Advice has therefore been conditioned to the survey-based assessment patterns. The decrease in survey biomass in recent years implies that the unaccounted catch is causing harm to the stock.

Comparison with previous assessment and advice

This year's assessment is based on survey information alone. Fishing mortality is not well estimated by the survey based assessment and has therefore not been used as a basis for advice.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2005 (ICES CM2006/ACFM:13).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Catch corresponding to single-stock boundaries	Agreed TAC[1]	Official Landings	ACFM Landings	Discards slip	ACFM catch
1987	No increase in F		15.0		16.4	12.4	11.5	6.9	18.4
1988	No increase in F; TAC		15.0		16.4	11.9	11.4	11.8	23.1
1989	No increase in F; TAC		13.0		16.4	7.7	7.5	4.1	11.6
1990	No increase in F; TAC		11.0		11.0	6.0	5.6	4.4	10.0
1991	70% of effort (89)		-		9.0	6.9	6.7	5.3	12.0
1992	70% of effort (89)		-		7.5	6.0	6.0	9.4	15.4
1993	70% of effort (89)		-		8.7	6.8	6.9	8.5	15.4
1994	30% reduction in effort		-		6.8	5.8	5.9	8.9	14.8
1995	Significant reduction in effort		-		6.8	6.3	6.1	7.6	13.7
1996	Significant reduction in effort		-		10.0	6.6	7.2	6.9	14.1
1997	Significant reduction in effort		-		13.0	6.2	6.3	4.9	11.2
1998	No increase in F		6.5		9.0	4.7	4.6	5.8	10.5
1999	Reduce F below $\mathbf{F}_{pa}$		4.3		6.3	4.7	4.6	3.1	7.7
2000	Reduce F below $\mathbf{F}_{pa}$		<4.3		4.3	3.2	3.0	6.7	9.7
2001	Reduce F below $\mathbf{F}_{pa}$		<4.2		4.0	2.5	2.4	2.4	4.9
2002	SSB>$\mathbf{B}_{pa}$ in short term		<2.0		3.5	1.7	n/a	n/a	n/a
2003	No cod catches		-		2.0	1.3	n/a	n/a	n/a
2004	[2]	SSB>$\mathbf{B}_{pa}$ in short term	[2]	<2.1	1.6	0.8	n/a	n/a	n/a
2005	Exploitation not allowed to increase			<1.6	1.6				
2006	Lowest possible level			-					

[1]TAC is set for Divisions VIa and VIb combined. [2] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

Table 1.4.25.1 Nominal catch (t) of WHITING in Division VIa, 1989–2004, as officially reported to ICES.

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004[1]
Belgium	1	-	+	-	+	+	+	-	1	1	+	+	-		-	
Denmark	1	+	3	1	1	+	+	+	+	-	-	-	-		0	0
France	199[1,2]	180	352[1,2]	105	149	191	362	202	108	82[1]	300[1]	48	54[1]	21	[11]	[11]
Germany	+	+	+	1	1	+	-	+	-	-	+	-	-	+	+	
Ireland	1,315	977	1,200	1,377	1,192	1,213	1,448	1,182	977	952	1,121	793	764	577	568	354
Netherlands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Spain	-	-	-	-	-	-	1	-	1	2	+	-	2	n/a	n/a	
UK (E&W)[3]	44	50	218	196	184	233	204	237	453	251	210	104	71	…	…	
UK (N.I.)	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
UK (Scot.)	6,109	4,819	5,135	4,330	5,224	4,149	4,263	5,021	4,638	3,369	3,046	2,258	1,654	…	…	
UK (total)														1,137	786	457
Total landings	7,669	6,026	6,908	6,010	6,751	5,786	6,278	6,642	6,178	4,657	4,677	3,203	2,545	1,735	1365	822

[1]Preliminary. [2]Includes Divisions Vb (EC) and VIb. [3]1989–2002 N. Ireland included with England and Wales.
n/a = Not available.

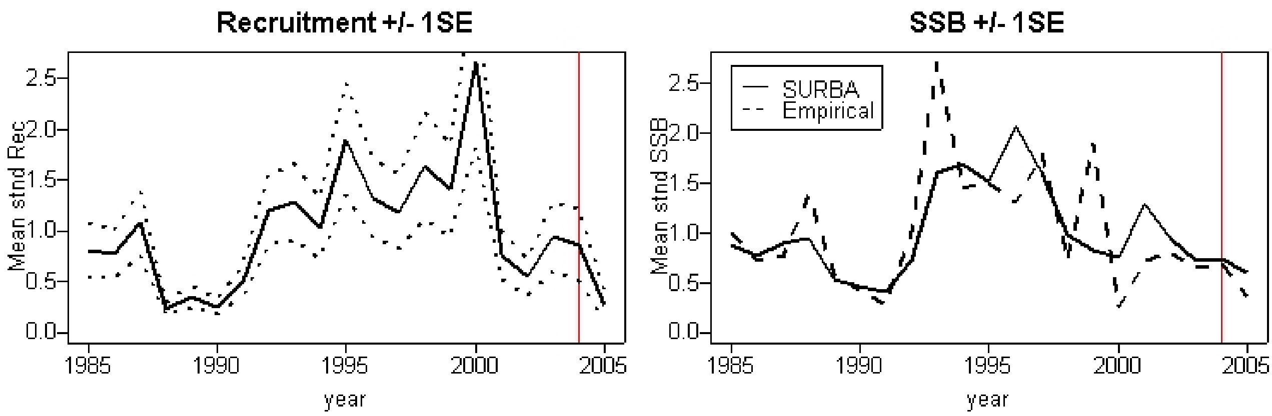


Figure 1.4.25.1 Whiting in VIa. Survey-based estimates of recruitment and SSB (both mean-standardised). Empirical estimates of SSB from the raw survey data are shown as dashed lines in the right-hand panel.

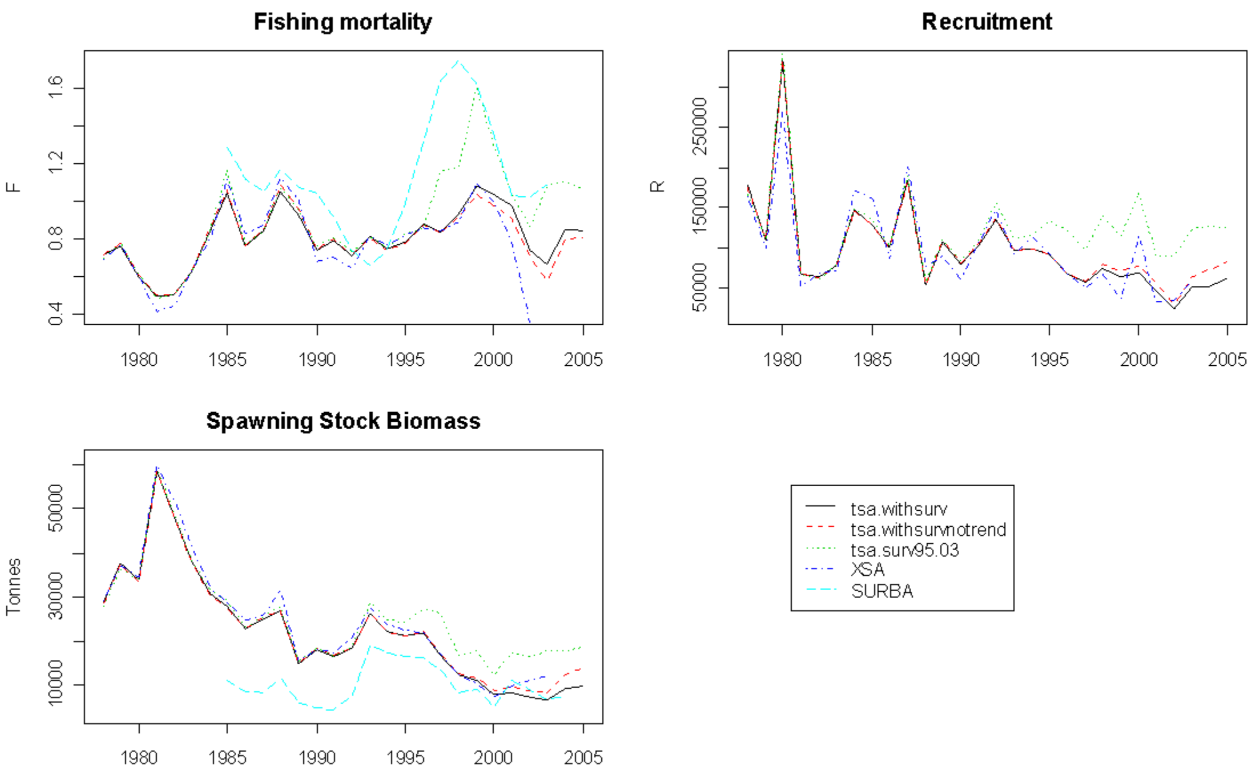


Figure 1.4.25.2

Rockall Whiting

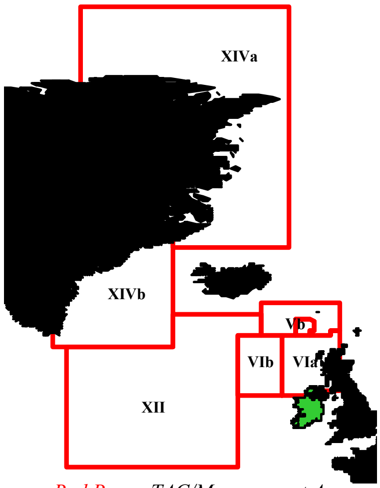
(Division VIb)

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See West of Scotland and Rockall Overview for Mixed Fishery Advice)

FSS consider that whiting catches from VIb are so insignificant that there is no merit in providing scientific advice for this area.



Red Boxes-TAC/Management Areas

ICES ADVICE
1.4.26

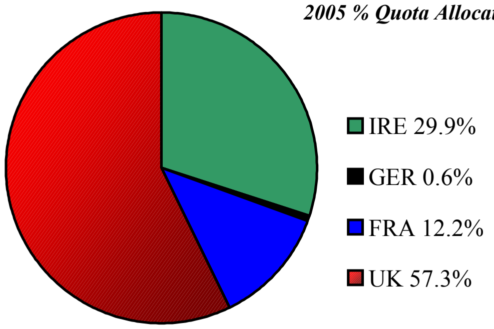
State of the stock

Landings of whiting from Division VIb are negligible. No assessment has been carried out on this stock.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

2005 % Quota Allocations



CURRENT MANAGEMENT

- The TAC area covers Sub-areas Vb, VI, XII and XIV.
- The TAC in 2005 was 1,600 t with an associated Irish quota of 478 t.

ADDITIONAL INFORMATION

1 Irish vessels reported landings of 2.7 t of whiting in Division VIb in 2004.
2 It is likely that whiting caught at Rockall are migrants from VIa rather than a discrete VIb stock.
3 UK-Scottish landings during the early 1990s are probably linked to area misreporting of other species such as haddock and anglerfish into Division VIb.

Table 1.4.26.1 Nominal catch (t) of WHITING in Division VIb (Rockall), 1988–2004, as officially reported to ICES.

Country	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**
Faeroe Islands	-	1	-	-	-	-	-	-	-	-	-
France	62	-	-	-	-	-	-	3	-	-	-
Ireland	-	-	-	-	-	1	-	-	-	-	-
Spain	-	-	-	-	-	-	-	-	196	112	88
UK - Eng+Wales+N.Irl.	-	-	-	3	2	5	1	-	-	-	-
UK – Scotland	1	-	12	15	5	24	2	59	-	-	5
TOTAL	**63**	**1**	**12**	**18**	**7**	**30**	**3**	**62**	**196**	**112**	**93**

Country	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
Faeroe Islands	-	-	-	-	-	-	-	-	-	-	-
France	3	2	-	-	-	-	-	-	-	-	-
Ireland	-	-	-	-	-	-	-	-	-	32	10
Spain	16	123	-	-	-	-	-	-	-	-	-
UK - Eng+Wales+N.Irl.	2	-	5	4	-	16	6	1	5	10	2
UK – Scotland	25	6	13	108	23	18	482	459	283	86	68
TOTAL	**46**	**131**	**18**	**112**	**23**	**34**	**488**	**460**	**288**	**128**	**80**

Country	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**[1]
Faeroe Islands	-	-	-	-	-	.	.	.	.	.
France	-	-	-	-	.	-	.	.	.	.
Ireland	4	23	3	1	-	-	10	.	2	.
Spain	-	-	-	-	-	-	-	.	.	.
UK - Eng+Wales+N.Irl.	5	26	49	20	-	-	-	-	-	-
UK – Scotland	53	36	65	23	44	58	4	7	11	1
TOTAL	**62**	**85**	**117**	**44**	**44**	**58**	**14**	**7**	**13**	**1**

[1] Preliminary

West of Scotland and Rockall Megrim

(Sub-area VI)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS - SINGLE STOCK CONSIDERATIONS

(See West of Scotland and Rockall Overview for mixed fishery advice).

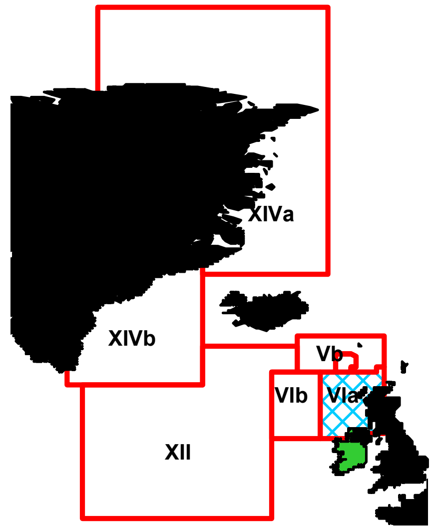
The state of this stock is unknown. Commercial catch and effort data for the main fleets exploiting this stock is poor due to area misreporting, changes in fishing patterns (rapid expansion of the anglerfish fishery into deeper water coupled with efficiency increases), discarding and non reporting of effort.

FSS advise that the 'precautionary TAC' should be adjusted downwards in line with most recent landings. FSS therefore agrees with ICES that catches in 2006 should be no more than the recent (2002-2003) landings in Divisions VIa and VIb and unallocated landings from the North Sea (Sub-area IV) totalling about 2,300 t. This translates into an Irish quota of 298 t.

FSS advise that measures should be implemented immediately to ensure that reliable commercial data is collected for this and other stocks in VI. This should include mandatory reporting of gear parameters and catch and effort with fine-scale spatial, temporal and bathymetric data.

CURRENT MANAGEMENT

- The TAC covers Sub-areas VI, XII, XIV and Division Vb. The 2005 TAC was set at 2,880 t with an Irish quota of 373 t (13%).
- FSS advise that management objectives be established and that a management plan be developed and implemented for the mixed fisheries catching megrim.
- FSS point out that the effort regulations in VIa appear to have led to considerable changes in fishing patterns and there may have been incentives for vessel to switch to targeting anglerfish and megrim to avail of a higher effort allocation. Detailed quantitative information on this is not yet available.



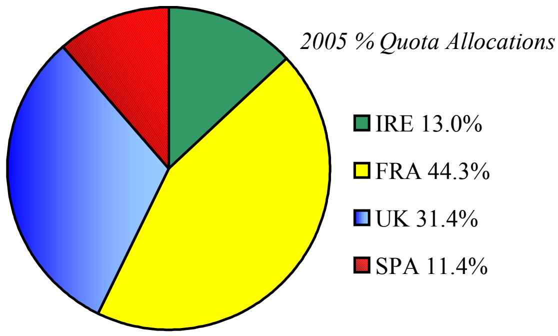
Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

ADDITIONAL INFORMATION

1 Assessment of this stock is hampered by poor commercial catch and effort data for the main fleets due to misreporting, changes in fishing patterns, discarding and non-mandatory reporting of effort. The research vessel surveys do not appear to provide a reliable index for this stock due to low and variable catch rates and a mis-match between the coverage of the survey and distribution of the stock.

2 In the past the misreporting of anglerfish landings into Sub-area IV has led to an associated misreporting of the megrim component of the catch for some fleets. This has lead to serious concerns about the accuracy of the landings data and large unallocated catches in the Working Group estimates of landings.

3 The long-term landings trends suggest that landings have declined substantially since 1996 and the 2003 landings are the lowest in the time series. 2004 official landings are incomplete. Irish landings in 2004 were reported to be 320 t (278 t and 42 t, for VIa



and VIb, respectively).

4 Irish landings in Sub-area VI are mainly taken by otter trawlers fishing at the Stanton, Rockall and in Donegal Bay. Megrim and anglerfish fish landings on a trip-by-trip basis are correlated for Irish otter trawl vessels fishing at Rockall. However, this correlation is not apparent in Division VIa.

4 Two species of megrim are caught. The majority of landings are *Lepidorhombus whiffiagonis*. Landings of *L. boscii* are negligible.

5 Irish discard sampling between 1995-2003 suggest that between 30-50% of the megrim catch by number and between 8-21% by weight are discarded. Male megrim grow to a smaller maximum size than females, and as a consequence the majority of males in the catches are discarded and the bulk of fish landed comprise of females. Improving the selection pattern by increasing the mesh size in this fishery would probably result in higher longer-term yields.

6 FSS point out that megrim are caught in mixed fisheries which may include catches of species outside precautionary limits in Sub-area VI.

ICES ADVICE
1.4.28

State of the stock

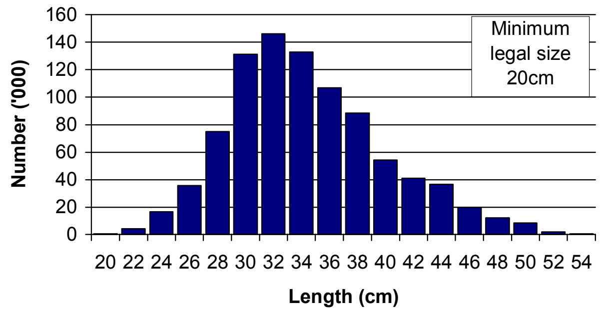
Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target
Uncertain	Uncertain	Uncertain	Uncertain

The available information is inadequate to evaluate spawning stock or fishing mortality relative to risk, so the state of the stock is unknown.

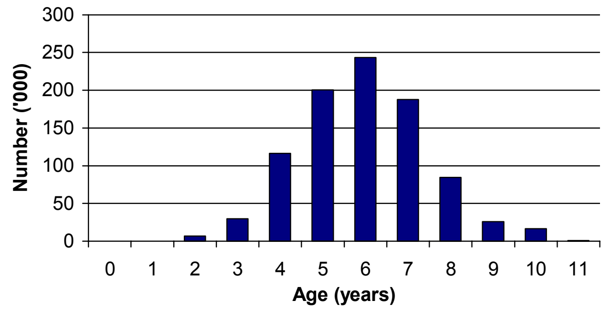
Management objectives

There are no explicit management objectives are set for this stock.

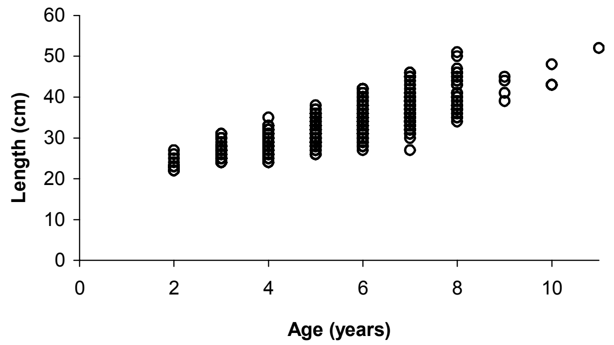
2004 Length Distribution: Irish Otter Trawlers, Megrim in VIa



2004 Age Composition: Irish Landings, Megrim in VIa



2004 Size at Age: Irish Sampling, Megrim in VIa



Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	B_{lim} is not defined	B_{pa} is not defined
	F_{lim} is not defined	F_{pa} is not defined
Target reference points		F_y is not defined

Single stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

Catches in 2006 should be no more than the recent (2002-2003) landings of about 2300 t. This includes landings of Division VIa and VIb and unallocated landings in Subarea IV.

Management considerations

Although the international megrim landings in recent years have been below the precautionary TAC, some national quotas are restrictive and this may have led to under-reporting of catches.

Area misreporting has been prevalent as megrim catches were misreported from Subarea VI into Subarea IV due to restrictive quotas for anglerfish (i.e. vessels targeting anglerfish misreported all landings including megrim from Subarea VI into Subarea IV). In order to avoid misreporting by area the TAC should include Subarea IV.

In the past, management of the megrim stock has been linked to that for anglerfish on the assumption that landings were correlated in the fishery. It was assumed that the anglerfish management would also constrain fishing mortality on megrim. This may no longer be true due to recent changes in the fishing pattern of certain fleets, and the dynamics of the species are probably not linked.

The minimum landings size (MLS) of megrim was reduced in January 2000 to 20 cm (EC Regulation No 850/98). Despite this extremely small size the catch is routinely high graded and large numbers of fish continue to be discarded above this MLS.

Factors affecting the fisheries and the stock

The effects of regulations

New effort regulations provided an incentive for some vessels previously using >100 mm mesh in otter trawls to switch to smaller mesh gears to obtain the right to more days-at-sea. This would also require these vessels to be targeting either *Nephrops* or anglerfish, megrim and whiting with various catch and by-catch composition limits after EC Regulation No 850/98. No detailed information was available to quantify how many vessels have switched to using smaller meshes as a result of effort regulation as this information is not reliably recorded in logbook information for some countries.

Changes in fishing technology and fishing patterns

There have been recent changes to the UK Scottish fleets with decommissioning schemes removing 96 of the 298 demersal trawlers (mesh sizes >= 100 m) between 2001 and 2004. This will have affected the effort but due to uncertainty in the effort statistics it is not know to what extent effort has been reduced. The Irish fleet has also reduced substantially in recent years and now the majority of the reported landings are made by only 12 vessels. In the case of the Irish fleet a large number of older vessels have been replaced by fewer modern whitefish vessels as part of a national whitefish renewal scheme. A further Irish decommissioning scheme is planned for 2005 and 2006.

No information is available on changes in the French and Spanish fleets operating in this area.

Scientific basis

Data and methods

The stock was evaluated using information on landing composition provided by Scotland and catch compositions provided by Ireland.

The quality of the available landings data, specifically the area misreporting and lack of effort and CPUE data for the main fleet in the fishery, severely hampers the ability of ICES to carry out an assessment for this stock. For stocks like megrim and anglerfish on the northern shelf, there is a general need for improved spatio-temporal resolution of commercial catch and effort data.

There is currently no survey series adequately covering this stock. Scottish and Irish ground fish surveys catch low numbers of megrim due to unsuitable gear and survey design. In addition, the Irish GFS survey series consists of only two years.

Uncertainties in assessment and forecast

The quality of the landing statistics is unknown and discard information and CPUEs from the main fleet are lacking. The surveys only cover a limited range of the known distribution of the stock and are not suitable for a survey based assessment/forecast approach.

Comparison with previous assessment and advice:

Last year there was no analytical assessment for this stock and the management advice was based on average landings. ICES has serious concerns about the accuracy of the landings data which are area mis-reported and under-reported for this stock. This year the advice is based on effort rather than landings.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official Landings[3]	ACFM Landings[4]
1987	Not assessed		-		4.4	3.9	-
1988	Not assessed		-		4.84	4.5	-
1989	Not assessed		-		4.84	2.7	-
1990	Not assessed		-		4.84	2.7	3.7
1991	No advice		-		4.84	3.2	3.7
1992	No advice		-		4.84	3.2	4.8
1993	No long-term gain in increased F		-		4.84	3.0	4.3
1994	No long-term gain in increased F		-		4.84	3.0	4.3
1995	No advice		-		4.84	3.3	4.6
1996	No advice		-		4.84	2.9	5.3
1997	No advice		-		4.84	2.8	4.6
1998	Adequate catch controls		-		4.84	2.7	4.2
1999	Maintain current TAC		4.84		4.84	2.5	3.8
2000	Maintain current TAC		4.84		4.84	2.4	3.6
2001	Maintain current TAC		4.84		4.36	2.4	3.3
2002	Maintain current TAC		4.36		4.36	1.6	2.3
2003	Maintain current TAC		4.36		4.36	1.7	2.3
2004	[5]	Reduce TAC to recent landings		3.60	3.60	n/a	n/a
2005	[5]	Reduce TAC to recent landings		2.3	2.88		
2006	[5]	Reduce TAC to recent landings		2.3			

[1]Vb(EC), VI, XII and XIV. [2] Incomplete data. [3] VIa and VIb [4] Landings in VIa and VIb and unallocated landings from IV. Landings in Vb (EC), XII, and XIV are negligible. [5] Single-stock boundaries and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in ‘000 t.

Table 1.4.28.1 Nominal catch (t) of MEGRIM in Sub-area VI (West of Scotland and Rockall), as officially reported to ICES and WG best estimates of landings for Division VIa.

Megrim in Division Via (West of Scotland)

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Belgium	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
France	398	455	504	517	408	618	462	192	172	0	135	252	79	92	n/a
Ireland	317	260	317	329	304	535	460	438	433	438	417	509	280	344	n/a
Netherlands	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Spain	91	48	25	7	1	24	22	87	111	83	98	92	89	98	n/a
UK - Eng+Wales+N.Irl.	25	167	392	298	327	322	156	123	65	42	20	7	14	13	-
UK – Scotland	1093	1223	887	896	866	952	944	954	841	831	754	770	643	558	-
UK															484
Offical Total	1924	2154	2125	2047	1907	2451	2044	1795	1622	1394	1424	1630	1105	1105	n/a
Unallocated	286	278	424	674	786	1047	2010	1477	1083	1254	823	843	723	537	n/a
As used by WG	2210	2432	2549	2721	2693	3498	4054	3272	2705	2648	2247	2473	1828	1642	1328
Area Mispreported landings	339	338	466	735	871	1126	2062	1556	1156	1066	868	829	731	544	421

Megrim in Division VIb (Rockall)

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
France	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
Ireland	196	240	139	128	176	117	124	141	218	127	167	176	87	83	n/a
Spain	363	587	683	594	574	520	515	628	549	404	427	370	120	93	n/a
UK - Eng+Wales+N.Irl.	19	14	53	56	38	27	92	76	116	57	57	42	41	74	0
UK - England & Wales	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UK – Scotland	226	204	198	147	258	152	112	164	208	278	309	236	207	382	0
UK															414
Offical Total	804	1045	1073	925	1046	816	843	1009	1091	866	964	824	455	632	n/a
As used by WG	804	1045	1073	925	1046	816	843	1009	1091	866	964	825	456	632	n/a

Total Megrim in Sub-area VI (West of Scotland and Rockall)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Offical Total	2728	3199	3198	2972	2953	3267	2887	2804	2713	2260	2388	2454	1560	1737	n/a
As used by WG	3014	3477	3622	3646	3739	4314	4897	4281	3796	3514	3211	3298	2284	2274	n/a

n/a = not available

West of Scotland Rockall and North Sea Anglerfish

(Sub-areas IV and VI)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS - SINGLE STOCK CONSIDERATIONS

(See West of Scotland and Rockall Overview for mixed fishery advice).

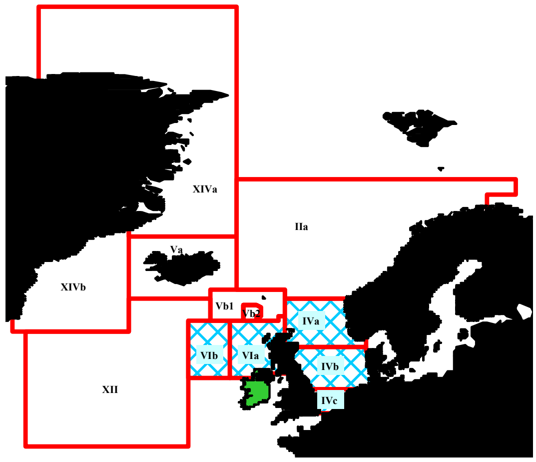
The state of the stock is unknown as it has not been possible to carry out an assessment due to serious problems with the available input data. Commercial catch and effort data for the main fleets exploiting this stock are inaccurate due to substantial misreporting (area and volume in most recent years), changes in fishing patterns (rapid expansion into deeper water coupled with efficiency increases), discarding (particularly in poorly documented deepwater static gear fisheries) and non-mandatory reporting of effort (for the main Scottish fleets). The fishery independent data from surveys are also inadequate to assess the stock reliably. However, the development of commercial CPUE data from Scottish skipper diaries suggest that the stock is not in decline.

FSS consider that non-compliance with TACs is a widespread and serious problem in this fishery and unless stricter control and enforcement can be implemented then TAC control appears to be inadequate to regulate fishing mortality within sustainable limits. This situation has led ICES to the following advice: "effort in this fishery should not be allowed to increase and the fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and by-catch fish".

FSS agree with this advice but acknowledge concerns that removing the TAC may allow further undesirable expansion of the fishery. These concerns meant that in 2005 a less restrictive TAC was maintained. FSS considers that the most important short-term management action should be to ensure that effort does not increase. FSS therefore advises that effort should be capped at the current level and access to the fishery should be restricted. FSS suggest that access to the fishery should also be conditional on implementation of a detailed internationally co-ordinated data collection program and a stringent control and enforcement program.

FSS continues to have serious concerns about exploitation of this stock. A longer-term management strategy is more appropriate for a long-lived species like anglerfish. This would involve improving the selection pattern in the fishery by minimising catches of juvenile fish, ensuring that sufficient SSB is conserved to maintain recruitment and by developing a harvest control rule with longer-term targets.

FSS point out that an offshore gillnet fishery for anglerfish exists with little effective regulation. Rates of mortality in this fishery are thought to be high due to "ghost fishing" and high discard rates. FSS advise that this fishery should not be allowed to continue without effective regulation of effort and measures in place to minimise ghost fishing and discarding.

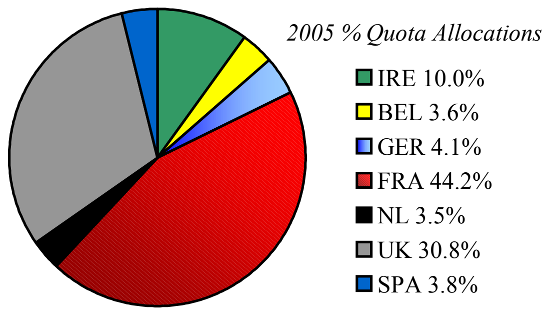


Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

CURRENT MANAGEMENT

- There are two TACs covering the assessment area in 2005: 10,310 t for Division IIa (EC waters), North Sea (EC waters) and 4,690 t for Sub-areas VI, XII, XIV and Division Vb (EC Waters). Ireland takes its quota (469 t in 2005) exclusively from Sub-Area VI.
- FSS recommends that management objectives be established and that a management plan be developed and implemented for fisheries catching anglerfish. This would include mandatory reporting of gear parameters and catch and effort with fine scale spatial, temporal and bathymetric data. It would also involve improving the selection pattern in the fishery and ensure that enough fish are left to contribute to spawning. FSS considers that a longer-term management strategy is more appropriate for a long-lived species like anglerfish.

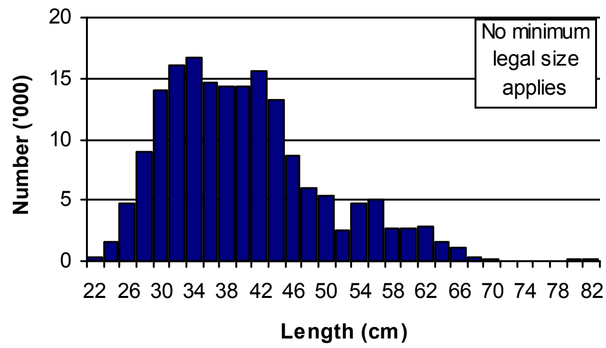
- Since February 2003 an effort control regime was implemented in VI as part of Cod recovery measures. FSS point out that the effort regulations in VIa appear to have led to considerable changes in fishing patterns and there may have been incentives for vessels to switch to targeting anglerfish and megrim to avail of a higher effort allocations. Detailed quantitative information on this is not yet available.
- In the past the lack of TAC regulation in the adjacent Sub–area IV encouraged mis-reporting of landings into that area and undermined management for Sub-area VI. Estimates which account for this area misreporting indicated that the percentage of the catch taken in Division IIIa and Sub-area IV, and in Divisions VIa & VIb in the years 1993-2002 averaged 60% and 40%, respectively. In previous years, these proportions have been used to allocate TAC between these areas. However, given the concerns about the veracity of the recent reported landings data, FSS considers that the continued use of this proportionate split is no longer appropriate.



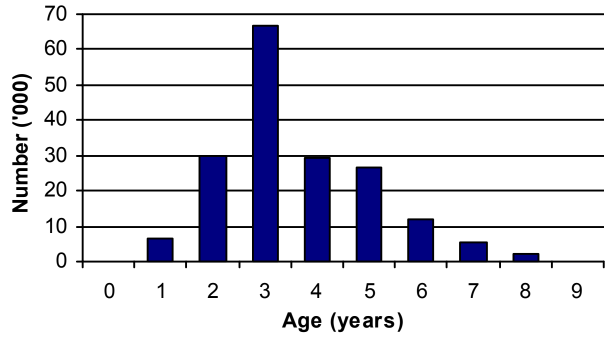
ADDITIONAL INFORMATION

1. A number of data deficiencies made an analytical assessment impossible (see ICES summary sheet). There are strong indications that catches have been substantially under reported in recent years.
2. Estimated Irish landings were approximately 233 t in 2004, a decrease of about 33% on the 2003 landings.
3. The Irish fleet exploiting this fishery is mainly composed of otter trawl vessels from Greencastle and Killybegs.
4. Mesh regulation offer little protection to this species since their shape means that even the small individuals are easily retained in the gear. However, the use of selective devices, such as rigid grids, to minimize catches of juvenile anglerfish have been studied in France with promising results. Industry-initiated programmes to improve current exploitation pattern (where the catch is dominated by small fish) should be used in fisheries catching juvenile anglerfish. Reducing catches of juvenile anglerfish would lead to increases in yield and increase their potential contribution to the future SSB. This would lead to a larger 'buffer stock' where there are a broad range of age groups in the population and SSB and catches are robust to occasional weak recruitments.
5. The assessment is mainly based on data concerning *Lophius piscatorius*. The Irish fishery catches more black-bellied monkfish *L.. budegassa* than other fisheries on the northern shelf. Ratios of black-bellied to white-bellied anglerfish are not well estimated over time but black bellied anglerfish could constitute up to 30% of Irish landings. It may be beneficial to the Irish fisheries managers to take this into account when considering future management options for this stock.
6. FSS expresses serious concerns about the impact of deep-water gill and tangle net fisheries on this stock and recommend that efforts should be made to regulate these fishing vessels.
7. FSS point out that anglerfish are caught in mixed fisheries which may include catches of species outside precautionary limits in Sub-area VI.
8. FSS is currently involved in a process to develop a joint industry-science survey for angler in this area in co-operation with the Irish and Scottish fishing industries and the Marine Laboratory in Aberdeen. A dedicated anglerfish survey will commence in 2005, led by the Scottish Marine Laboratory.

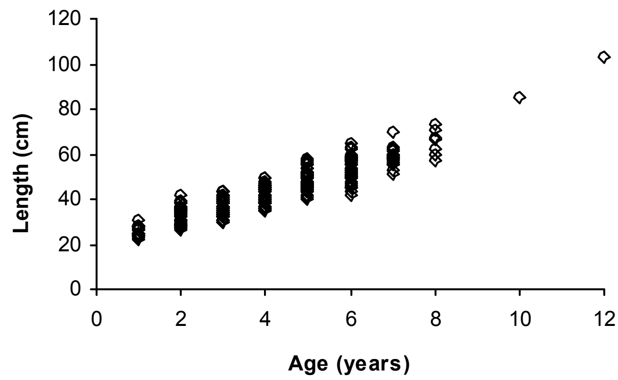
2004 Q1, 2 & 3 Length Distribution: Irish Otter Trawlers, Anglerfish in VIa



2004 Q1, 2 & 3 Age Composition: Irish Otter Trawlers, Anglerfish in VIa



2004 Size at Age: Irish Sampling, Anglerfish in VIa



ICES ADVICE
1.4.29

Two species occur in these areas, *Lophius piscatorius* and *L. budegassa*, although catches are almost exclusively of the former.

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Unknown	Unknown	Unknown	

There are major uncertainties about catch and effort data for anglerfish, as well as limited knowledge about population dynamics and distribution. The available information is inadequate to evaluate spawning stock or fishing mortality relative to risk. The development of commercial CPUE from a logbook study indicates that the stock is not in decline.

Management objectives

There are no explicit management objectives for this stock; the European Community and Norway are in discussions regarding the joint management of this shared stock.

Reference Points

ICES considers that:	ICES proposes that:
There is currently no biological basis for defining $\mathbf{B}_{lim}$ or $\mathbf{F}_{lim}$.	$\mathbf{F}_{35\%SPR}$= 0.30 be chosen as $\mathbf{F}_{pa}$. This fishing mortality corresponds to 35% of the unfished SSB/R. It is considered to be an approximation of $\mathbf{F}_{MSY}$.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

The effort in this fishery should not be allowed to increase and the fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and by-catch fish.

Management considerations

For a number of years, anglerfish in Sub-areas VI, XII, XIV and Division Vb (EU zone) were subjected to a precautionary TAC (8600 t) based on average landings in earlier years. In 2002 the TAC was set at 4770 t and was further reduced to 3180 t in 2003 and 2004. The TAC for 2005 has been increased to 4686 t. Wtihin ICES it was highlighted that the reduction of the TAC in 2003 to just two-thirds of that in 2002 would likely imply an increased incentive to mis-report landings and increase discarding unless fishing effort was reduced accordingly (Section 6.4.6, ICES WGNSDS 2003/CM 2003/ACFM:XX). Anecdotal information from the fishery in 2003 and 2004 appears to suggest that the TAC did not restrict the catches in these years. The official statistics for 2003 and 2004 are therefore likely to be particularly unrepresentative of actual landings.

The absence of a TAC for the adjacent Sub-area IV prior to 1998, means that prior to then, landings in excess of the TAC in other areas were likely to be misreported into the North Sea. In 1999, a precautionary TAC was introduced for North Sea anglerfish, but unfortunately for current and future reporting purposes, the TAC was set in accord with recent catch levels from the North Sea which includes a substantial amount misreported from Sub-area VI. The area misreporting practices have thus become institutionalised. Estimates which account for this area misreporting indicate that the percentage of the catch taken in Division IIIa and Subarea IV, and in Divisions VIa & VIb in the years 1993-2002 average 60% and 40%, respectively. In previous years, these proportions have been used to allocate TAC between these areas. However, given the concerns about the veracity of the recent reported landings data, such proportionate split may no longer be appropriate.

A TAC regulation such as that currently implemented is therefore not adequate to regulate fishing mortality within sustainable limits. However, it is implicit in the inadequate landings and effort data that a reliable estimation of $\mathbf{F}_{sq}$ would also be impossible, as such a TAC would continue to result in misreporting.
In this situation the most productive way forward would be a two stage approach. The first stage would be to substantially improve the quality and quantity of data collected on the fishery while maintaining exploitation at its current level. This was the basis of ICES' recommendation (ACFM 2004) to allow the fishery to continue with the current effort (inasmuch as this can be determined). This was to be accompanied by a detailed and stringent monitoring programme, including the mandatory reporting of both catch and effort data in logbooks, as well as use of VMS data. The programme would also include the development of a targeted, industry collaboration trawl survey to start in 2005.

A key point in this recommendation was that the restrictive TAC in 2004 and previous years had led to extensive mis-reporting. Management aimed at maintaining effort at or below that of 2004, but without a specific TAC, would have allowed the accurate reporting of catch and effort. In the event, a TAC based regime was retained, although at an increased level. To date it is not clear if this has improved the quality of the landings data, however, the TAC is still perceived as restrictive by the industry. The existing tally book scheme is to be continued and extended, and observers will be placed on as many vessels as is feasible. The targeted survey is planned to go ahead in the autumn of 2005 and analysis of VMS data at approximately the same time. More robust management measures to control the targeted fishery have been proposed in the UK.

This first stage of data collection would be expected to take at least five years to establish useable time series of fisheries dependent and independent data. The second stage could then be launched to use these data to examine alternative management approaches and harvest control rules appropriate to this fishery in a similar fashion to that used elsewhere within this response; e.g. North Sea cod and plaice. Should evidence appear of a decline in the state of the stock during this period of data collection, the management of this stock should be

revisited and appropriate management measures initiated.

The following should be considered:

- A detailed and stringent programme, including the mandatory reporting of both catch and effort data in logbooks should be established in all countries fishing for anglerfish to ensure high quality effort and landings data.
- Small size anglerfish are known to be discarded. Routine sampling schemes should be implemented in order to estimate levels of discarding.
- Female anglerfish reach 50% maturity at a length of about 90 cm. A high proportion of anglerfish catches consist of small anglerfish. Technical measures improving the selectivity of gears used in these fisheries should be implemented.

Ecosystem considerations

Ghost fishing and discarding of fish not suitable for consumption due to long soaking times are known to be problems within some offshore gillnetting carried out by "flag-vessels" targeting anglerfish in Sub-areas VI and VII.

Factors affecting the fisheries and the stock

Until the mid-1980s, anglerfish was taken mainly as a by-catch in bottom trawl groundfish fisheries. Restrictive TACs for other species in Division VIa led to increased fishing pressure on anglerfish in that area, where they are now caught in a targeted anglerfish fishery and as a bycatch in other demersal fisheries, including roundfish fisheries in Division VIa, the haddock fishery on Rockall Bank, *Nephrops* fisheries, and fisheries in deeper waters. In the North Sea, anglerfish are caught as a by-catch in demersal fisheries, *Nephrops* and *Pandalus* fisheries in the northern and eastern parts of the North Sea, the Fladen Ground, and the Norwegian Deeps. In the Norwegian Deeps anglerfish has also been targeted by some demersal trawlers. A Norwegian large-mesh gillnet fishery targeting fish above 60-65 cm has been developed along the Norwegian coast since the early 1990s.The distribution of anglerfish in the North Sea, Kattegat, and Skagerrak is associated with the distribution to the West of Scotland (Division VIa & VIb). It is likely that catches from these areas come from the same biological stock. Genetic studies have found no evidence of separate stocks and particle-tracking studies have indicated interchange of larvae between areas.

The fishery has expanded into deeper waters, areas believed to have been a refuge for adult anglerfish, and this new fishery therefore increases the vulnerability of the stock to over-exploitation. Immature fish are subjected to exploitation for a number of years prior to first maturity.

Other factors

The key features of the species' life history in relation to its exploitation are the location of the main spawning areas in relation to the exploited areas, and whether or not there is any systematic migration of younger fish back into the deeper waters to spawn. At present, despite the large increase in catches, there is no apparent contraction in distribution; fish are still recruiting to relatively inshore areas such as the Moray Firth and along the Norwegian coast in the northern North Sea. The fact that spawning appears to occur largely in deep water off the edge of the continental shelf may offer the stock some degree of refuge. It is therefore likely that the current expansion of the fisheries into deeper water will have a negative effect on the stock.

Scientific basis

Data and methods

Information on catch-at-length distribution is available from Scottish market sampling covering Divisions VIa, VIb and IVa. Irish length frequency data are also available for the West of Scotland (Division VIa). Danish length samples of landings covering mainly Division IVa are available from 2002. The Norwegian sampling-at-sea by the coast guard began in 2003 and covers also the eastern part of Division IVa. Catch and corresponding effort data based on official Danish logbook records covering the fisheries where anglerfish are caught were presented to ICES in 2005. It is hoped that together with UK data they could provide useful information on stock development. Logbook information from the Norwegian fisheries is not yet available.

Information from the fishing industry

Personal logbook information from Scottish vessels has recently been made available to scientists but could not be incorporated in the assessment because data mostly covered only a short time period. There were also some contradictions in the trends from these logbooks, particularly in recent years. As these data become available over a longer time span, methods should be developed to use them in an assessment on the status of the stock. There was no evidence of a decline in LPUE in any of the areas considered and in some areas there was strong indication of increasing LPUE.

Uncertainties in assessments and forecasts

Although historical catches for the combined area are believed to have been adequately estimated there is uncertainty in the recent level of landings due to misreporting and therefore these data cannot be used as the basis for stock assessment. There are inconsistencies in the survey data and traditional groundfish surveys do not appear to be useful indicators of anglerfish stock abundance. The weakness in the recruitment index and the problems in landings data would suggest that previous assessments may also be unreliable.

A targeted survey has been initiated this year (2005). Normally, it takes at least 5 years before the time-series is sufficiently long to allow quantitative use of such data.

Comparison with previous assessment and advice

Analytical assessments have not been made since 2003. The assessment model used was a modified catch-at-length analysis, which requires reliable landings-at-size data and can make use of effort data, and a survey index. However, there are problems identified in the data sources:

- Anecdotal evidence from the fishery suggests that there has been substantial misallocation and discarding, making the overall level of landings and the length structure unreliable. Hence the landings data may not be reliable.
- In 2003 ACFM identified a conflict between model and survey indices of recruitment. Further analyses indicated that this conflict was severe and included other surveys considered.
- No new effort data have been available for the Scottish fishery for 5 years, requiring assumptions to be made about recent changes in effort. Recent decommissioning schemes mean that assumptions of constant effort over recent years are no longer valid, but it is not possible to quantify any reduction in effort.
- Lack of information on stock structure and basic biology.

The advice in previous years was based on a reference value for F established from the analytical assessment. Due to the lack of assessments since 2004, only general advice based on the precautionary principle has been possible.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

Subarea IV – North Sea

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	ACFM Landings
1990	Not assessed	-	-	-	-	10.6	9.5
1991	Not assessed	-	-	-	-	11.8	10.6
1992	Not assessed	-	-	-	-	13.3	11.7
1993	Not assessed	-	-	-	-	15.5	13.1
1994	Not assessed	-	-	-	-	18.2	15.4
1995	Not assessed	-	-	-	-	20.9	15.8
1996	Not assessed	-	-	-	-	27.3	16.2
1997	Not assessed	-	-	-	-	25.8	18.2
1998	Not assessed	-	-	-	22.1	19.0	14.0
1999	Not assessed	-	-	-	22.1	14.9	11.7
2000	40% reduction in catches	-	<9.7	-	17.66	14.0	11.6
2001	2/3 of the catches in 1973-1990	-	5.7	-	14.13	14.7	Na
2002	2/3 of the catches in 1973-1990	-	5.7	-	10.50	12.3	Na
2003	Reduce F below $\mathbf{F}_{pa}$	-	<6.7[2]	-	7.0	9.3	Na
2004	[1]	Reduce F below $\mathbf{F}_{pa}$		<8.8	7.0	9.7	Na
2005	[1]	No effort increase		-	10.31		
2006	[1]	No effort increase		-			

Weights in '000 t. [1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. [2] Advice for Division IIIa, Subarea IV, and Subarea VIa combined.

Subarea VI – West of Scotland and Rockall

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official landings	ACFM landings[2]
1987	Not assessed		-		7.8	5.2	5.6
1988	Not assessed		-		8.6	7.7	7.7
1989	Not assessed		-		8.6	6.0	7.3
1990	Not assessed		-		8.6	6.4	6.6
1991	No advice		-		8.6	6.0	6.3
1992	No advice		-		8.6	6.6	9.2
1993	No long-term gain in increased F		-		8.6	6.2	10.1
1994	No long-term gain in increased F		-		8.6	6.0	8.8
1995	A precautionary TAC not exceeding recent catch levels		-		8.6	7.2	12.3
1996	A precautionary TAC not exceeding recent catch levels		-		8.6	7.0	18.2
1997	Reduction in fishing effort		-		8.6	6.2	13.7
1998	Reduction in fishing effort		-		8.6	5.4	10.6
1999	Reduce fishing effort, effective implementation of the TAC		-		8.6	5.3	8.4
2000	40% reduction in catches		<7.4		8.0	4.4	7.5
2001	2/3 of the catches in 1973-1990		4.3		6.4	4.0	Na
2002	2/3 of the catches in 1973-1990		4.3		4.8	3.0	Na
2003	Reduce F below $\mathbf{F}_{pa}$		<6.7[3]		3.18	3.0	Na
2004	[4]	Reduce F below $\mathbf{F}_{pa}$		[4]	3.18	1.2	Na
2005		No effort increase		-	4.69		
2006		No effort increase		-			

[1]Vb(EC), VI, XII, and XIV. [2]Division VIa only. [3]Advice for Division IIIa, Subarea IV, and Subarea VIa combined. [4]Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

Division IIIa, Subarea IV, and Subarea VI combined

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official landings	ACFM landings[2]
2003	Reduce F below $\mathbf{F}_{pa}$		<6.7		10.2	12.3	n/a
2004	[2]	Reduce F below $\mathbf{F}_{pa}$	[2]	<8.8	10.2	10.9	n/a
2005		No effort increase	[2]	-	15.0		
2006		No effort increase	[2]	-			

[1]Vb(EC), VI, XII, and XIV. [2] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

Table 1.4.29.1 Nominal catch (t) of Anglerfish in Division IIIa, 1990–2004, as officially reported to ICES.

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	15	48	34	21	35	-	-	-	-	-	-	-	-	
Denmark	493	658	565	459	312	367	550	415	362	377	375	371	217	311
Germany	-	-	1	-	-	1	1	1	2	1	+	+	+	
Netherlands														4
Norway	64	170	154	263	440	309	186	177	260	197	200	241	187*	130
Sweden	23	62	89	68	36	25	39	33	36	27	46	55	71	55
Total	595	938	843	811	823	702	776	626	660	602	621	667	475	500

*Preliminary.

Table 1.4.29.2 Nominal catch (t) of ANGLERFISH in the North Sea, 1989–2004, as officially reported to ICES.

Northern North Sea (IVa)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	2	9	3	3	2	8	4	1	5	12	-	8	1	
Denmark	1,245	1265	946	1,157	732	1,239	1,155	1,024	1,128	1,087	1,289	1,308	1,517	1,538
Faroes	1	-	10	18	20	-	15	10	6	n/a	2		2	
France	124	151	69	28	18	7	7	3*	18[1*]	8	9	7	6	
Germany	71	68	100	84	613	292	601	873	454	182	95	95	65	
Netherlands	23	44	78	38	13	25	12	-	15	12	3	8	9	38
Norway	587	635	1,224	1,318	657	821	672	954	1,219	1,182	1,212	928	771*	999
Sweden	14	7	7	7	2	1	2	8	8	78	44	56	8	5
UK(E, W&NI)	129	143	160	169	176	439	2,174	668	781	218	183	98	104	…
UK (Scotland)	7,039	7,887	9,712	11,683	15,658	22,344	18,783	13,319	9,710	9,559	10,024	8,539	6,033	…
UK (total)														6,357
Total	9,235	10,209	12,309	14,505	17,891	25,176	23,425	16,860	13,344	12,338	12,861	11,047	8,516	8,937

* Preliminary. [1]Includes IVb,c.

Central North Sea (IVb)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	357	538	558	713	579	287	336	371	270	449	579	435	178	258
Denmark	345	421	347	352[1]	295	225	334	432	368	260	251	255	190	271
Faroes	-	-	2	-	-	-	-	-	-	n/a		9		
France	-	1	-	2	-	-	-	-*	…[2]*	-	-	-	-	
Germany	4	2	13	15	10	9	18	19	9	14	9	17	11	
Ireland													1	
Netherlands	285	356	467	510	335	159	237	223	141	141	123	62	42	25
Norway	17	4	3	11	15	29	6	13	17	9	15	10	13*	22
Sweden	-	-	-	3	2	1	3	3	4	3	2	9	2	1
UK(E, W&NI)	669	998	1,285	1,277	919	662	664	603	364	423	475	236	167	…
UK (Scotland)	845	733	469	564	472	475	574	424	344	318	378	210	241	…
UK (total)														258
Total	2,522	3,053	3,144	3,447	2,627	1,847	2,172	2,088	1,517	1,617	1,832	1,243	845	835

* Preliminary. [1]Includes 2 tonnes reported as Sub-area IV. [2]Included in IVa.

Southern North Sea (IVc)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	13	12	34	37	26	28	17	17	11	15	15	16	9	5
Denmark	2	-	-	-	-	-	-	+	+	+	+	+	+	+
France	-	-	-	-	-	-	-	10	…[1]*	+	-	+	-	
Germany	-	-	-	-	-	-	-	-	-	+	-	+	+	
Netherlands	5	10	14	20	15	17	11	15	10	15	6	5	1	
Norway	-	-	-	-	+	-	-	-	+	-	+	-	-*	-
UK(E&W&NI)	6	17	18	136	361	256	131	36	3	1	+	+	10	…
UK (Scotland)	-	-	-	17	-	3	1	+	+	+	+	+	-	…
														10
Total	26	39	66	210	402	304	160	78	24	31	21	21	20	15

* Preliminary. [1]Included in IVa.

Total North Sea

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Total	11,783	13,301	15,519	18,162	20,920	27,327	25,757	19,026	14,885	13,986	14,714	12,311	9,381	9,787
WG estimate	10,566	11,728	13,078	15,432	15,794	16,240	18,217	14,027	11,719	11,564	12,677	10,334	8,273	9,027
Unallocated	-1,217	-1,573	-2,441	-2,730	-5,126	-11,087	-7,540	-4,999	-3,166	-2,422	-2037	-1,977	-1,108	-760

* Preliminary.

Table 1.4.29.3 Anglerfish in Subarea VI. Nominal landings (t) as officially reported to ICES.

Anglerfish in Division VIa (West of Scotland)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	3	2	9	6	5	+	5	2	+	+	+	+	+	
Denmark	1	3	4	5	10	4	1	2	1	+	+	-	+	
France	1,910	2,308	2,467	2,382	2,648	2,899	2,058	1,634	1,814[1]	1,132	943	732	1,166	
Germany	1	2	60	67	77	35	72	137	50	39	11	3	27	
Ireland	250	403	428	303	720	717	625	749	617	515	475	304	322	
Netherlands	-	-	-	-	-	-	27	1	-	-	-	-	-	
Norway	6	14	8	6	4	4	1	3	1	3	2	1	+*	+
Spain	7	11	8	1	37	33	63	86	53	82	70	101	196	
UK(E&W&NI)	270	351	223	370	320	201	156	119	60	44	40	32	30	
UK(Scotland)	2,613	2,385	2,346	2,133	2533	2,515	2,322	1,773	1,688	1,496	1,119	1,100	705	
UK (total)														885
Total	5,061	5,479	5,553	5,273	6,354	6,408	5,330	4,506	4,284	3,311	2,660	2,273	2,446	885
Unallocated	296	2,638	3,816	2,766	5,112	11,148	7,506	5,234	3,799	3,114	2,068	1,882	985	1,938
As used by WG	5,357	8,117	9,369	8,039	11,466	17,556	12,836	9,740	8,083	6,425	4,728	4,155	3,431	2,823

*Preliminary. [1]Includes VIb.

Anglerfish in Division VIb (Rockall)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Estonia														+
Faroe Islands	-	2	-	-	-	15	4	2	2		1			
France	-	-	29	-	-	-	1	1	…[1]	48	192	42	99	
Germany	-	-	103	73	83	78	177	132	144	119	67	35	63	
Ireland	272	417	96	135	133	90	139	130	75	81	134	51	26	
Norway	18	10	17	24	14	11	4	6	5	11	5	3	6*	5
Portugal	-	-	-	-	-	-	-	+	429	20	18	8	4	
Russia	-	-	-	-	-	-	-	-	-	-	1	-	-	
Spain	333	263	178	214	296	196	171	252	291	149	327	128	59	
UK(E&W&NI)	99	173	76	50	105	144	247	188	111	272	197	133	133	
UK(Scotland)	201	224	182	281	199	68	156	189	344	374	367	317	160	
UK (total)														347
Total	923	1,089	681	777	830	602	899	900	1401	1074	1309	717	550	352
Unallocated									-9	17	-162	-40	145	121
As used by WG	923	1,089	681	777	830	602	899	900	1392	1091	1147	677	695	473

*Preliminary. [1]Included in VIa.

Total Anglerfish in Sub-area VI (West of Scotland and Rockall)

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Total official	5,984	6,568	6,234	6,050	7,184	7,010	6,229	5,406	5,685	4,385	3,969	2,990	2,996	1237
Total ICES	6,280	9,206	10,050	8,816	12,296	18,158	13,735	10,640	9,475	7,516	5,875	4,832	4,126	3,296

*Preliminary.

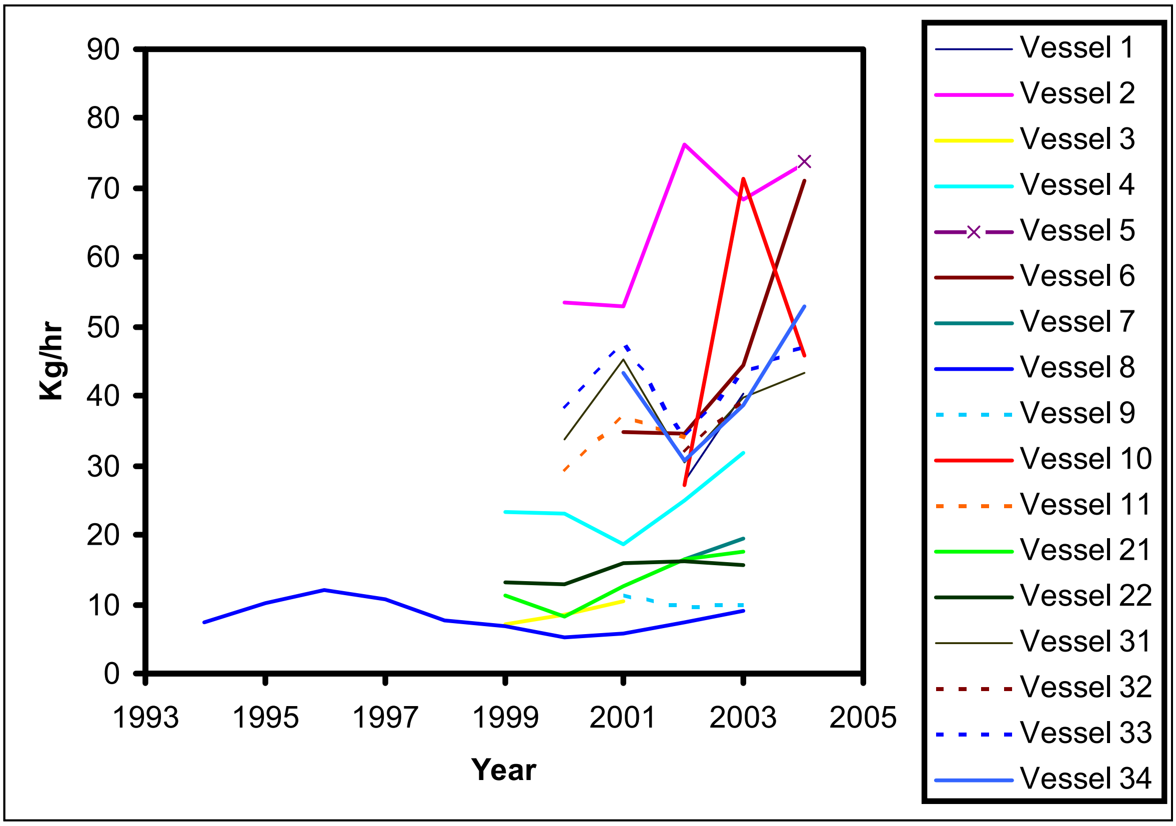


Figure1.4.29.1 Anglerfish in Subarea VI. Annual catch rates (Kg/hr) from Scottish vessels supplying diary information.

Northwest of Ireland and West of Scotland *Nephrops*

(WG -MA C = Division VIa)

For latest information, see: http://www.ices.dk

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See West of Scotland and Rockall for Mixed Fisheries Advice)

There are three stocks assessed using UWTV survey data in this area the North Minch FU 11, South Minch FU 12, Clyde FU 13. In addition there are important catches including the majority of Irish landings from other areas outside FUs. All indicators suggest that the stocks are stable or even increasing at current levels of exploitation. However, there is considerable uncertainty about landings, discard and effort data for these stocks. In particular under-reporting of landings is thought to be a problem rendering the previous advice based on average reported landings inappropriate.

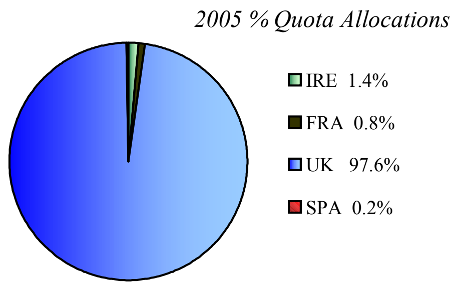
A harvest rate based on individuals caught in the fishery and the population numbers from UWTV surveys would be appropriate if landings were known. In the absence of this both ICES and STECF have investigated analytical approaches to defining appropriate precautionary harvest rates for these stocks. FSS notes that these analytical approaches are based on growth and recruitment assumptions that are not well understood for *Nephrops*. Nevertheless a harvest ratio in the range of what is being suggested by ICES and STECF 15-20% seems to be in the range of mortality that can be sustained without risk to the stock in the short term and this could be adaptively adjusted upwards or downwards as stocks develop in future years.

FSS considers that to try and re-align the reported and true landings the higher harvest -ratio as suggested by STECF of 20% should be implemented in 2006. This translates to a TAC of 18,085 t and Irish quota of 245 t. This is based on landings of 17,675 t for FUs 11-13 and an additional allocation of 410 t for fisheries outside those FUs based on average landings (2002-2004).

This advice represents a 72% increase in landings relative to advice based on recent average landings. In this context FSS advise that an input control regime which limits overall effort in the *Nephrops* fishery is required. FSS further advise that any increase in TAC must be accompanied by strong and effective control of inputs (access and effort), outputs (catch) and improved data collection requirements (detailed validated logbooks). Effective enforcement measures must form the basis for long-term management of this stock.

CURRENT MANAGEMENT

- The TAC area covers Sub-area VI and Division Vb this incorporates WG-MAs B C and D. To ensure balanced exploitation *Nephrops* stocks should be managed at an appropriate geographic scale i.e. FU.
- WG-MA C contains three main fisheries in the North Minch (FU 11), South Minch (FU 12) and Firth of Clyde (FU 13) an assessment based on a time series of UWTV surveys are carried out for all three of these.
- Irish landings come from the component of this stock which is currently not assessed using UWTV surveys.
- The TAC in 2005 was 12,700 t with an Irish quota of 172 t.
- FSS point out that the effort regulations implemented in VIa appear to have led to considerable changes in fishing patterns with vessels switching to targeting *Nephrops* to avail of a higher effort allocations. Anecdotal evidence suggest that vessels are manipulating their catch composition by retaining *Nephrops* aboard to avail of higher effort allowances.
- There are no explicit management objectives or a management plan for this stock. FSS recommend that management objectives be established and that a management plan be developed with stakeholders and implemented for fisheries catching *Nephrops*.
- The following TCMs are in place for *Nephrops* in VIa after EC 850/98: *Minimum Landing Sizes (MLS)*; total length >70 mm, carapace length >20 mm, tail length >37 mm. *Mesh Size Restrictions*; Towed gears targeting *Nephrops* having at least 35% by weight of this species on board will require 70 mm diamond mesh plus an 80 mm square mesh panel as a minimum or having at least 30% by weight of *Nephrops* on board will require 80 mm diamond mesh.



ADDITIONAL INFORMATION

1. ICES has given assessments and advice for three stocks (FU 11, 12 & 13) in this Management Area based on UWTV surveys for the first time this year. Previously the advice was based on average landings rather than forecasted landings from this analytical assessment. This is because of concerns about whether the assessment method is appropriate for a stock where the age structure is modelled rather than measured annually. Multiple lines of evidence (CPUE trends, mean size, assessment) suggest that this stock remains in a healthy state therefore recent catch levels are considered sustainable by ICES.
2. There is no quantitative information available to scientists but anecdotal information from the industry suggests under-reporting is substantial and true landings are at least 60% higher than the reported landings in this stock.
3. *Nephrops* are caught by Irish otter trawlers from Greencastle and Killybegs. Up until 1999 Irish landings of *Nephrops* from this area were negligible since then landings have substantially increased from Donegal Bay and the Stanton Bank.
4. FSS would also point out that there may be some potential to expand *Nephrops* fisheries in new areas within MA C but mainly outside current assessed FUs. There is also anecdotal evidence that *Nephrops* are occurring in commercial quantities in areas where they were not previously abundant possibly as a result of reduced predation by cod and other fish species. These include fisheries at Stanton Bank, in Donegal Bay and in deepwater. Fisheries independent methods such as underwater television surveys could be used to evaluate the potential for increased *Nephrops* yields. However, the current Irish quota allocation in this area is low and may restrict the potential for Irish vessels to develop new *Nephrops* fisheries in Division VIa.

ICES ADVICE
1.4.36

There are three Functional Units in this Management Area: a) North Minch (FU 11), b) South Minch (FU 12) and c) Clyde (FU 13).

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Unknown	Unknown	Unknown

The available fishery information is inadequate to use analytical methods to evaluate spawning stock or fishing mortality relative to risk. Results from TV surveys, however, suggest that the stock in this Management Area appear to be exploited at a sustainable level.

a. North Minch: The TV survey estimate of abundance for *Nephrops* in the North Minch suggests that the population remained relatively stable between 1994 and 2001, but has increased sharply between 2001 and 2003. The higher level of abundance observed in 2003 has been maintained in 2004. The increase in abundance observed between 2001 and 2003 coincides with the increases in CPUE observed in the catch data, particularly for the smaller size category, interpreted as increase in recruitment.

b. South Minch: The TV survey estimate of abundance for *Nephrops* in the South Minch suggests that the population fluctuated without trend between 1995 and 2000, but appears to have remained more stable and at a slightly higher level from 2001 to 2003. The survey suggests a further increase in abundance in 2004. The increase to the more stable level of abundance observed after 2001 coincides with the increase in CPUE and reduction in mean size observed in the catch data, particularly for the smaller size category, interpreted as increase in recruitment.

c. Clyde: Two TV surveys are conducted in the area. The TV survey estimate of abundance for *Nephrops* in the Firth of Clyde suggests that the population has increased steadily since 1999. Reductions in the mean size in catches coincident with increases in CPUE The increase to the more stable level of abundance observed after 2001 coincides with the increase in CPUE suggest strong recruitments in 1995, 1998 and 2003. A series of good recruitments would be consistent with the increase in abundance observed from the TV surveys. The higher levels of discarding observed in recent years are associated with the increase in CPUE of smaller individuals. The TV survey estimate of abundance for *Nephrops* in the Sound of Jura suggest that the population increased between the mid 1990s and 2002 (although there is a gap in the survey time series and no survey was available in 2004), but appears to have declined from the high 2002 figure in 2003.

d. *Nephrops* are also caught outside these areas. TV surveys in deepwater suggest widespread distribution at low density and surveys in sea lochs, where an important creel fishery occurs, suggest widespread distribution there also.

Management objectives

There are no management objectives set for this fishery.

Reference points

No reference points have been determined for *Nephrops*.

Single stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

Information on these stocks is considered inadequate to provide an advice based in precautionary limits. The effort in this fishery should not be allowed to increase and the fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and by-catch species.

Short term implications

Outlook for 2006:

The harvest ratio is a proxy for relative effort. Historically for this stock the harvest ratio has been around 15%. As an indication of relation between landings (tonnes) and effort the table below shows calculated landings for the three functional units for a range of harvest ratios applied to TV survey biomass results.

Harvest ratio %	North Minch	South Minch	Clyde	Total
15	3150	7037	3068	13255
20	4201	9383	4091	17675
25	5251	11729	5113	22093

Shaded options are not in accordance with the advice as this implies increased effort

Management considerations

The *Nephrops* trawl fisheries take considerable by-catches of other species. The management of these fisheries should be seen in the context of mixed fisheries (see Volume 5 Section 1.1.2).

Factors affecting the fisheries and the stock

The effects of regulations

The minimum landing size for *Nephrops* is 20 mm carapace length (CL), and less than 0.5 % of the animals are landed under size. Discarding takes place at sea. The main by-catch species is haddock, although whiting, Norway pout and flatfish also feature significantly in discards.

Scientific basis

Data and methods

There is considerable uncertainty about landings, discard and effort data for these stocks. The 2003 and 2004 underwater TV surveys indicate higher stock abundance than in recent years.

Comparison with previous assessment and advice:

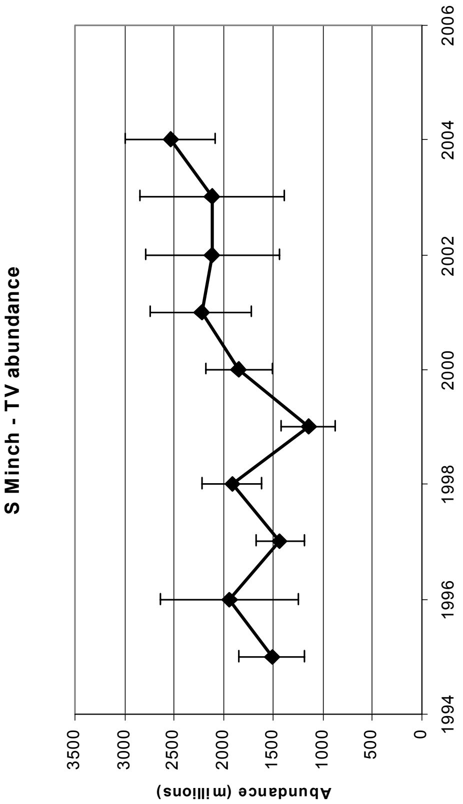
Previously advice has been based largely on historical landings but there are now concerns over the accuracy of official landings and effort statistics. There is considerable doubt about the quality of fisheries data and assessments cannot be based on these data, i.e. catch and LCPUE. The advice is therefore for no increase in effort as it is not possible to provide a catch prediction based on fisheries data. As reliable fisheries data are not available the TV underwater survey biomass estimates are used to indicate landings associated with various effort levels.

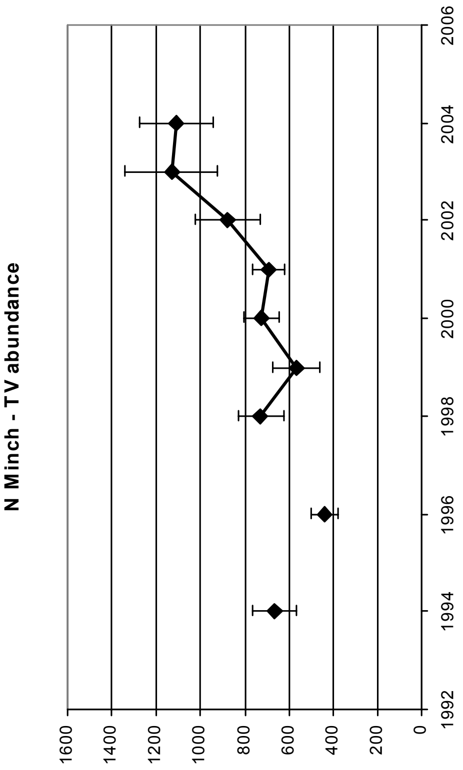
Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

Year	ICES advice	Recommended TAC	Agreed TAC	Official landings	ACFM catch
1989				11.0	n/a
1990				10.0	n/a
1991				10.5	n/a
1992	maintain current effort	~11.4	12.0	10.8	n/a
1993	maintain current effort	~11.3	12.0	11.3	n/a
1994	maintain current effort	11.3	12.6	11.1	n/a
1995	maintain current effort	11.3	12.6	12.8	n/a
1996	maintain current effort	11.3	12.6	11.2	n/a
1997	as for 1996	11.3	12.6	11.2	n/a
1998	maintain current effort	11.3	12.6	11.2	n/a
1999	as for 1998	11.3	12.6	11.5	n/a
2000	maintain current effort	11.3	12.6	11.0	n/a
2001	as for 2000	11.3	11.34	10.9	n/a
2002	maintain current effort	11.3	11.34	10.5	n/a
2003	as for 2002	11.3	11.34	10.7	n/a
2004	maintain current effort	11.3	11.3	10.3	n/a
2005	as for 2004	11.3	12.7		
2006	No increase in effort	-			

(Weights in '000 t)





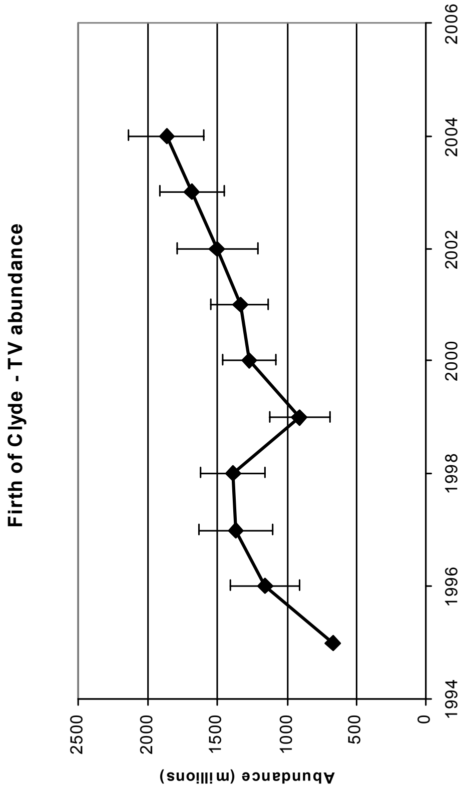


Figure 1.4.36.1

West of Scotland and Rockall Plaice

(Sub-area VI)

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See West of Scotland and Rockall Overview for Mixed Fishery Advice)

The status of this stock is unknown.

FSS notes that the STECF and ICES advice for other West of Scotland and Rockall stocks is predicated primarily on the need to rebuild cod and haddock stocks. FSS endorses this approach as being consistent with the precautionary approach to fisheries management.

FSS point out that plaice are caught in mixed fisheries which may include catches of species outside safe biological limits in Sub-area VI.

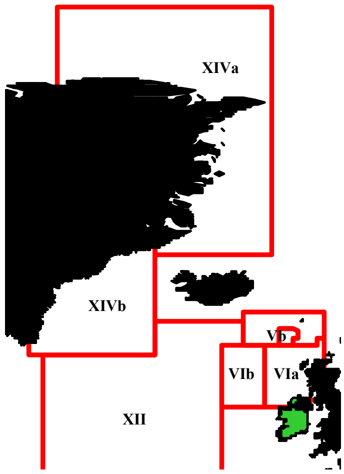
The TAC has not been restrictive but the landings have decreased since 1990. In the absence of ICES advice for this stock FSS considers that this indicates a decline in stock abundance and therefore advises that the 'precautionary TAC' should be adjusted downwards in line with recent landings. Average landings during the period 2002-2004 are around 360 t. If a TAC was sent in line with this figure it would translate to an Irish quota of around 134 t. However, the mixed fisheries advice given for mixed fisheries west of Scotland and at Rockall particularly in relation to stocks outside safe biological limits should determine the TAC for plaice.

CURRENT MANAGEMENT

- The TAC area covers Sub-areas, VI and XII and XIV and Division Vb.
- The TAC in 2005 was 982 t with an associated Irish quota of 358 t.
- There are no explicit management objectives or plans for this stock.
- FSS advises that management objectives be established and that a management plan be developed and implemented for the fishery catching plaice.

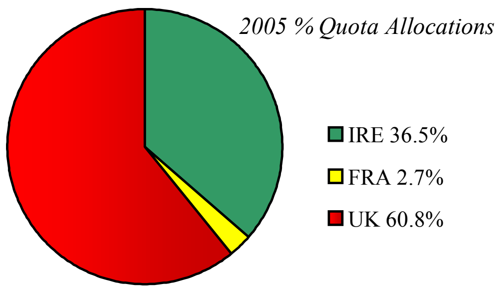
ADDITIONAL INFORMATION

1. The Irish quota is not restrictive but this fishery is important to the smaller inshore boats operating in the south of Division VIa.

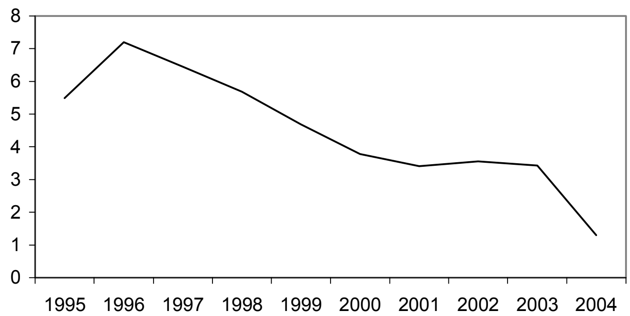


Red Boxes-TAC/Management Areas

2. Plaice in VIa are caught mainly by demersal otter trawls. The main fisheries are at the Stanton, Stags and Donegal Bay fishing grounds.
3. Discarding practices are not well quantified but FSS sampling has indicated that discarding does occur in this fishery.
4. LPUE estimates for Irish demersal trawlers have been declining since 1996 possibly reflecting a decline in the stock abundance.



Plaice VIa LPUE kg/hr



Plaice Division VIa landings by country as estimated by FSS. EU TAC and Irish quota also shown.
(Source of International data: ICES STATLANT 27A database)

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	5	2	-	1	-	-	-	-	-	-	-	-	-	-	3	1
Denmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
France	-	-	31	44	-	66	67	58	50	44	55	40	57	57	49	44
Ireland	222	280	328	463	487	352	338	392	464	425	565	649	660	403	516	649
Netherlands	-	15	-	-	-	-	1	-	-	-	-	-	-	204	-	-
Spain	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
UK - Eng+Wales+N.Irl.	128	142	158	142	176	127	90	66	62	67	40	45	31	38	26	33
UK – Scotland	537	755	969	916	887	731	864	1,049	1,065	947	967	1,070	1,065	1,046	1,149	1,000
USSR	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**892**	**1,194**	**1,492**	**1,566**	**1,550**	**1,276**	**1,360**	**1,565**	**1,641**	**1,483**	**1,628**	**1,804**	**1,813**	**1,748**	**1,743**	**1,727**
EU TAC[2]										1810	1810	1810	1810	1810	1810	1810
Irish Quota										660	660	660	660	660	660	660

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	1	-	-	-	25	8	30	13	19	19	18	19	9	.	.	.
Denmark	-	7	-	-	-	-	-	-	-	-	-	-	-	.	-	.
France	24	62	23	19	16	4	6	1	2	1	.	1	-	-	-	.
Ireland[1]	579	670	560	357	339	360	401	499	528	418	309	233	187	146	150	.
Netherlands	-	-	-	-	-	-	-	-	19	11	-	-	-	.	.	.
Spain	-	-	-	-	-	-	-	-	-	-	-	-	-	.	.	.
UK - Eng+Wales+N.Irl.	27	11	37	61	80	135	77	62	67	39	34	18	10	18	6	5
UK – Scotland	1,185	1,097	1,433	1,292	1,095	1,181	1,344	1,266	1,052	973	657	387	491	323	243	130
USSR	-	-	-	.	.	.	.	.	.	.	.	.	.	.	.	.
TOTAL	**1,816**	**1,847**	**2,053**	**1,729**	**1,555**	**1,688**	**1,858**	**1,841**	**1,687**	**1,461**	**1,018**	**658**	**697**	**487**	**399**	**135**
EU TAC[2]	2000	2000	2000	2400	2400	2400	2400	2400	2400	2400	2400	2400	1920	1728	1534	982
Irish Quota	730	730	730	870	870	870	880	880	880	880	880	880	700	630	559	358

Plaice Division VIb landings by country as estimated by FSS.
(Source of International data: ICES STATLANT 27A database)

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Faeroe Islands	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
France	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
Ireland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Russian Federation	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Spain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UK - Eng+Wales+N.Irl.	-	-	-	1	1	1	-	-	-	-	-	1	-	-	-	1
UK – Scotland	-	-	-	-	-	2	-	1	-	-	-	1	3	3	8	7
Un. Sov. Soc. Rep.	-	60	6	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**0**	**60**	**6**	**1**	**1**	**5**	**0**	**2**	**0**	**0**	**0**	**2**	**3**	**3**	**8**	**8**

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Faeroe Islands	-	-	-	-	-	-	-	-	-	-	-	.	.	.	.	.
France	-	-	-	-	-	-	-	-	-	-	.	-	.	.	.	.
Ireland[1]	-	-	-	-	5	1	2	4	-	-	2	-	1	.	.	.
Russian Federation	.	.	.	-	-	-	-	-	-	-	-	88	-	-	-	.
Spain	-	-	-	-	-	-	-	-	-	-	-	-	4	.	.	.
UK - Eng+Wales+N.Irl.	-	1	-	3	2	5	2	9	15	15	-	1	-	-	-	-
UK – Scotland	6	80	53	27	5	7	12	5	5	7	6	63	7	1	7	-
Un. Sov. Soc. Rep.	-	-	-	.	.	.	.	.	.	.	.	.	.	.	.	.
TOTAL	**6**	**81**	**53**	**30**	**12**	**13**	**16**	**18**	**20**	**22**	**8**	**152**	**12**	**1**	**7**	**0**

[1] Ireland landings since 1995 estimated from DCMNR Logbook databases
[2] TAC area is Vb, VI, XII, XIV
*Data are preliminary for 2004

West of Scotland and Rockall Sole

(Sub-area VI)

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See West of Scotland and Rockall Overview for Mixed Fishery Advice)

The status of this stock is unknown.

FSS notes that the STECF and ICES advice for other West of Scotland and Rockall stocks is predicated primarily on the need to rebuild cod and haddock stocks. FSS endorses this approach as being consistent with the precautionary approach to fisheries management.

FSS point out that Irish vessels catch sole in mixed fisheries which may include catches of species outside safe biological limits in Sub-area VI.

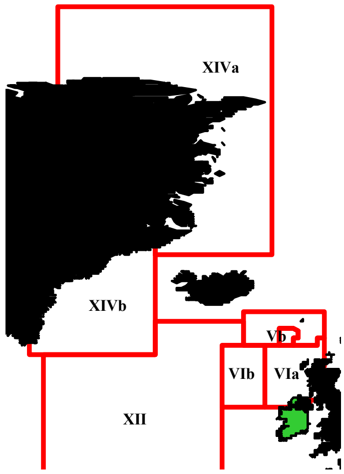
In the absence of ICES advice for this stock, FSS advise that there is a declining trend in landings for this sole stock since the mid- nineties and that the 'precautionary TAC' should be adjusted downwards in line with recent landings. Landings remain at the lowest level in the time-series. Average landings during the period 2002-2004 are around 30 t. If the TAC was sent in line with this figure it would translate to an Irish quota of around 24 t.

CURRENT MANAGEMENT

- The TAC area covers Sub-areas VI and XII and XIV and Division Vb.
- The TAC in 2005 was 68 t with an associated Irish quota of 54 t.
- There are no explicit management objectives or plans for this stock.
- FSS advises that management objectives be established and that a management plan be developed and implemented for the fishery catching sole.

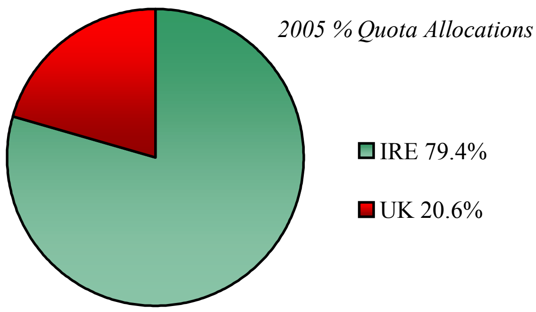
ADDITIONAL INFORMATION

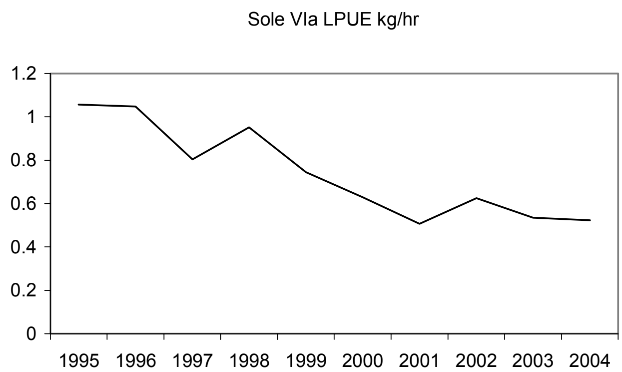
1. The Irish quota is not restrictive but this fishery is important to the small inshore boats operating in the south of Division VIa.



Red Boxes-TAC/Management Areas

2. Sole in VIa are caught mainly by demersal otter trawls. The main fisheries are at the Stanton, Stags and Donegal Bay fishing grounds.
3. FSS data on discarding of sole in this area is limited but discarding is not considered to be a problem.
4. Irish otter trawl LPUE have been declining since 1998 possibly reflecting a decrease in the abundance of the stock.





Sole Division VIa landings as estimated by FSS. EU TAC and Irish quota also shown.
(Source of International data: ICES STATLANT 27A database)

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
France	11	3	1	-	3	7	-	1	1	1	-	-	1	-	-	-
Ireland	14	16	19	38	30	20	24	23	35	57	54	48	39	33	42	71
Netherlands	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-
Spain	31	21	7	-	-	-	-	-	-	-	-	-	-	-	-	-
UK - Eng+Wales+N.Irl.	4	4	5	7	2	2	1	1	1	2	3	9	13	4	2	1
UK – Scotland	8	-	8	5	8	8	9	10	10	12	8	7	9	14	17	18
TOTAL	**68**	**44**	**40**	**50**	**43**	**38**	**34**	**35**	**47**	**72**	**65**	**64**	**62**	**52**	**61**	**90**
EC TAC								50	70	70	70	70	70	90	110	130
Irish Quota								40	55	55	55	55	55	70	90	105

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	*2004
Belgium	-	-	-	-	1	4	11	2	9	8	3	3	1	.	.	.
France	-	-	-	-	1	-	1	-	-	-	.	1	.	.	-	.
Ireland[1]	89	80	53	40	40	65	63	74	71	79	45	36	27	26	26	22
Netherlands	-	-	-	-	-	-	-	-	7	-	-	-	-	.	.	.
Spain	-	-	-	-	-	-	-	-	-	-	-	-	-	.	.	.
UK - Eng+Wales+N.Irl.	2	1	4	20	22	19	21	20	19	13	12	6	5	4	6	2
UK – Scotland	17	11	15	15	13	10	8	8	7	9	4	3	3	2	1	2
TOTAL	**108**	**92**	**72**	**75**	**77**	**98**	**104**	**104**	**113**	**109**	**64**	**49**	**36**	**32**	**33**	**26**
EC TAC	130	50	70	130	155	155	155	155	155	155	155	155	155	125	125	68
Irish Quota	105	40	55	105	125	125	125	125	125	125	125	125	125	100	100	54

Sole Division VIb

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Germany	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
UK - Eng+Wales+N.Irl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
UK – Scotland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
TOTAL	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	*2004
Germany	.	.	-	-	-	-	-	-	-	1	-	-	-	.	.	.
UK - Eng+Wales+N.Irl.	-	-	-	-	-	-	-	1	1	-	-	-	-	.	.	.
UK – Scotland	-	-	-	-	-	-	-	-	-	1	1	2	1	.	.	.
TOTAL	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**2**	**1**	**2**	**1**	**0**	**0**	**0**

[1] Ireland landings from 1995 from DCMNR Logbook database
*Data are preliminary for 2004

West of Scotland and Rockall Pollack

(Sub-area VI)

Marine Institute
Foras na Mara

Fisheries Science Services

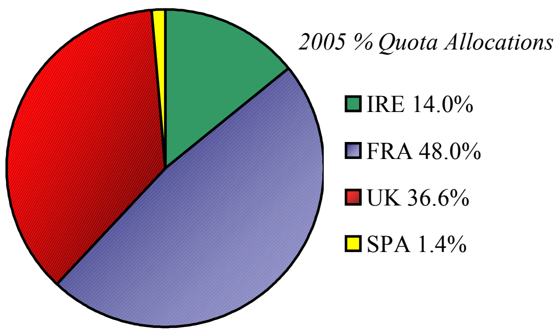
FSS – SINGLE STOCK CONSIDERATIONS

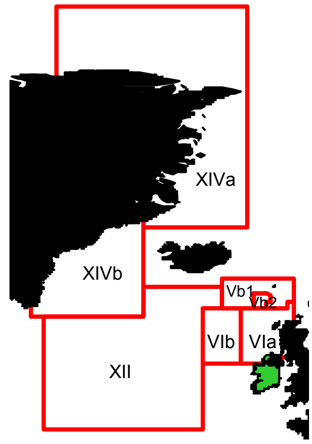
(See West of Scotland and Rockall Overview for Mixed Fishery Advice)

The status if this stock is unknown. There are no accurate international landings data for several recent years.

FSS advise that there is no scientific basis for the current TAC which has been in excess of recent annual landings. FSS would point out that pollack are mainly distributed and fished in inshore areas and the current TAC area may contain several smaller stocks. In this case the current TAC management system may not be appropriate and localise stock depletion may still occur. FSS would advise that pollack stocks should be assessed and managed on a smaller geographical scale within this area.

In the absence of assessment data, FSS advise that the 2006 TAC should not increase (563 t in 2004) with an associated Irish quota of 79 t. Programmes should be put in place to estimate sustainable exploitation levels for pollack stocks. However, the advice given for west of Scotland and Rockall stocks, particularly in relation to stocks in need of recovery, should determine the TAC for pollack.





Red Boxes-TAC/Management Areas

CURRENT MANAGEMENT

- The TAC covers Vb, VI, XII and XIV.
- The 2005 TAC was 563 t with an associated Irish quota of 79 t.
- There are no explicit management objectives or plans for this stock.
- FSS advises that management objectives be established and that a management plan be developed and implemented for fisheries catching pollack.

ADDITIONAL INFORMATION

1. Estimated Irish landings were 69 t in 2004.
2. This fishery is important to the smaller boats mainly operating in inshore waters.
3. There is little scientific information on biology and stock structure of pollack in this area.
4. FSS do not sample pollack in Sub-area VI.

Pollack in Sub-area VI landings by country as estimated by FSS. EU TAC also shown.
(Source of International data: ICES STATLANT 27A database)

Country	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**
France	2	6	0	7	196	196	310	36	342	274	333	212
Ireland	0	0	0	0	0	0	0	0	0	0	0	0
Spain	0	0	0	0	0	0	0	0	55	95	86	222
UK - Eng+Wales+N.Irl.	118	101	106	132	171	164	80	51	61	1	32	38
UK – Scotland	394	277	294	402	324	389	270	182	124	102	116	156
*Other	4	9	6	9	5	5	0	0	0	0	0	0
TOTAL	**518**	**393**	**406**	**550**	**696**	**754**	**660**	**269**	**582**	**472**	**567**	**628**
EC TAC												

Country	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
France	225	145	109	133	111	76	31	26	44	36	65	29
Ireland	0	223	103	163	103	150	145	23	12	26	83	97
Spain	283	2,217	860	1,925	0	0	4	0	0	0	0	0
UK - Eng+Wales+N.Irl.	17	10	24	13	26	12	45	68	105	157	119	76
UK – Scotland	311	177	235	208	153	180	144	136	182	122	235	134
*Other	1	0	0	0	1	2	1	0	5	2	5	1
TOTAL	**837**	**2772**	**1331**	**2442**	**394**	**420**	**370**	**253**	**348**	**343**	**507**	**337**
EC TAC		**715**	**710**	**1,100**	**1,100**	**1,100**	**1,100**	**1,100**	**1,100**	**1,100**	**1,100**	**1,100**

Country	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
France	15	21	0	14	8	10	3	0	
Ireland	69	60	73	62	108	26	88	0	
Spain	0	0	0	0	0	0	0	0	
UK - Eng+Wales+N.Irl.	91	66	39	30	17	32	51	17	
UK – Scotland	72	81	97	86	84	64	60	48	
*Other	3	1	3	2	2	1	3	4	
TOTAL	**250**	**229**	**212**	**194**	**219**	**133**	**205**	**69**	
EC TAC	**1,100**	**1,100**	**1,100**	**1,100**	**1,100**	**880**	**880**	**704**	**563**

*Other includes Belgium, Faeroe Islands, Germany, Netherlands and Norway
Preliminary data for France also comprises Sub-areas XII and XIV and Division Vb.

North Sea and West of Scotland Saithe

(Sub-areas IV & VI and Division IIIa)

For latest information, see: http://www.ices.dk

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See West of Scotland and Rockall Overview for Mixed Fishery Advice)

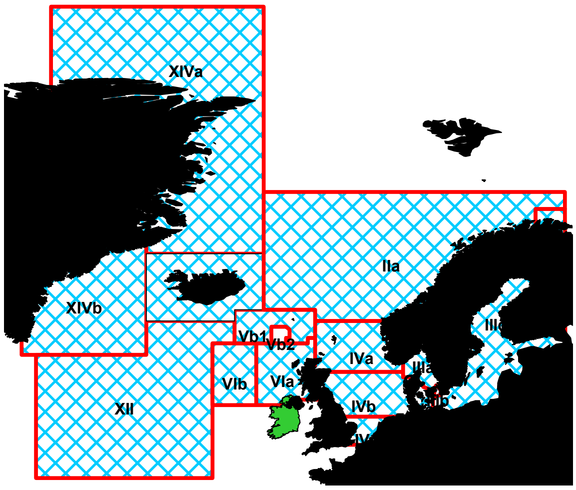
The assessment and forecasts for this stock is uncertain due to the lack of survey data and poor recruit estimates. Recent landings forecasts have been substantially higher than the realised catch.

Based on the most recent estimates of SSB and fishing mortality, ICES classifies the stock as being within safe biological limits. FSS considers that this stock is a good example of a stock that has recovered from low levels when fished below F_{pa}.

In 2004 EU and Norway agreed to implement a long-term plan for the saithe stock which is designed to provide for sustainable fisheries and high yields. ICES advises at the present SSB level 244,000 t, F should be below 0.3 to be in accordance with the management plan. This corresponds to catches of less than 108,700 t in 2006. The management plan restricts the overall TAC changes by 15%, which would correspond to catches of 136,000 t. This translates to a 2006 TAC in VI of 12,750 t and an Irish quota of 309 t. The short-term prognosis is made using the F_{sq} assumption for the intermediate year. An F_{sq} landings for 2005 corresponds to 99,000 t, which is far below the agreed TACs (145,000 t for the North Sea plus IIIa, and 15,000 t for Division VIa).

CURRENT MANAGEMENT

- The assessment area comprises two TAC areas; the first TAC area comprises Divisions IIa, IIIabcd, and Sub-area IV, the second TAC area covers Division Vb as well as Sub-areas VI, XII and XIV.
- The total TAC for Division Vb and Sub-areas VI, XII and XIV in 2005 was 15,044 t, with an allocated Irish quota of 494 t.
- There is a long-term management plan for this stock based on the EU- Norway agreement that states that every effort be made to maintain SSB above 106,000 t (**B_{lim}**) and a TAC consistent with F = 0.3.

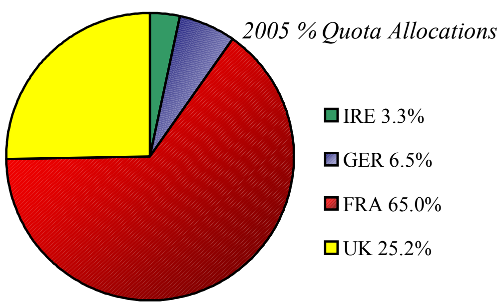


Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

Should SSB fall below **B_{pa}** this fishing mortality will be adapted in the light of the prevailing conditions (see ACFM advice for detailed description of the management plan).

ADDITIONAL INFORMATION

1. The assessment is considered to be uncertain because of incomplete catch information, residual patterns in catchability, retrospective bias in *F* and SSB estimates, and uncertain recruitment estimates. The age range used to compute mean F uses ages not fully recruited.
2. The most serious problem with stock forecasts for saithe is the lack of reliable information about year-class strength before age 3. The annual revisions of recruitment (which was large before) seems to improve when age 3 is used as recruits instead of age 1. Since acceptable tuning data for age 1 and 2 do not exist, and since the catches of these ages are very low and variable (due to the inshore distribution of these ages) the working group decided to use age 3 as recruits. A problem with this assessment is the re-



quired use of commercial CPUE for tuning (the survey series which are used only contain usable information for age 3-6). To address this problem the Institute of Marine Research (IMR, Norway) plans to conduct an annual 0-group survey.

3. Total estimated international landings in Sub-area VI and Sub-area IV and IIIa for 2004 were 4,500 t and 100,000 t, respectively. This stock yielded landings of over 250,000 t for most of the 1970s. Landings subsequently declined and have been close to 100,000 t since the late 1980s.
4. Ireland landed an estimated 94 t in 2004.
5. Saithe in the North Sea are mainly taken in a direct trawl fishery in deep water near the Northern Shelf edge and the Norwegian deeps. The majority of the catches are taken by Norwegian, French, and German trawlers. In recent years the French fishery deployed less effort along the Norwegian deeps, while the German and Norwegian fisheries have maintained their effort there. The main fishery developed in the beginning of the 1970s. Recently trawlers have also been targeting deep sea fish, and it is necessary to take account of that when tuning series are established. The fishery in Area VI consists largely of a directed French, German, and Norwegian deep-water fishery operating on the shelf edge, and a Scottish fishery operating inshore. In both areas most of the saithe do not enter the main fishery before age 3, because the younger ages are staying in inshore waters.
6. In Sub-area VIS Saithe is usually caught in mixed gadoid fisheries by trawlers operating out of Killybegs and Greencastle.
7. There is no long term gain in yield by increasing current fishing mortality. Medium-term analysis indicated that, at the *status quo* fishing mortality, there is a low probability of falling below $\mathbf{B_{pa}}$ in the medium term.

ICES ADVICE
1.4.12

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to agreed target
Full reproductive capacity	Harvested sustainably	Appropriate

Based on the most recent estimates of SSB and fishing mortality, ICES classifies the stock as having full reproductive capacity and being harvested sustainably. Fishing mortality declined since 1986, and appears to be below $\mathbf{F_{pa}}$ since 1997. SSB was below $\mathbf{B_{pa}}$ from 1984 to 1997 (and was below $\mathbf{B_{lim}}$ from 1990–1993), but increased in the late 1990s and is estimated to have been at or near $\mathbf{B_{pa}}$ since 1997.

Management objectives

In 2004 EU and Norway *"agreed to implement a long-term plan for the saithe stock in the Skagerrak, the North Sea and west of Scotland, which is consistent with a precautionary approach and designed to provide for sustainable fisheries and high yields. The plan shall consist of the following elements:*

1. *Every effort shall be made to maintain a minimum level of Spawning biomass (SSB) greater than 106 000 tonnes (B_{lim}).*
2. *Where the SSB is estimated to be above 200 000 tonnes the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of no more than 0.30 for appropriate age groups.*
3. *Where the SSB is estimated to be below 200 000 tonnes but above 106 000 tonnes the TAC shall not exceed a level which, on the basis of a scientific evaluation by ICES, will result in a fishing mortality rate equal to 0.30-0.20*(200 000-SSB)/94 000.*
4. *Where the SSB is estimated by the ICES to be below the minimum level of SSB of 106 000 tonnes the TAC shall be set at a level corresponding to a fishing mortality rate of no more than 0.1.*
5. *Where the rules in paragraphs 2 and 3 would lead to a TAC which deviates by more than 15% from the TAC the preceding year the Parties shall fix aTAC that is no more than 15% greater or 15% less than the TAC of the preceding year.*
6. *Notwithstanding paragraph 5 the Parties may where considered appropriate reduce the TAC by more than 15% compared to the TAC of the preceding year.*
7. *A review of this arrangement shall take place no later than 31 December 2007.*
8. *This arrangement enters into force on 1 January 2005."*

The saithe management plan has not been evaluated by ICES.

Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B_{lim}}$ is 106 000 t	$\mathbf{B_{pa}}$ be set at 200 000 t
	$\mathbf{F_{lim}}$ is 0.6	$\mathbf{F_{pa}}$ be set at 0.4
Target reference points	Target F according to the management plan is 0.3	

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	0.268	0.824	1.903
$\mathbf{F}_{max}$	0.216	0.829	2.399
$\mathbf{F}_{0.1}$	0.105	0.756	4.479
$\mathbf{F}_{med}$	0.349	0.807	1.392

Technical basis

$\mathbf{B}_{lim}$=$\mathbf{B}_{loss}$=106 000 t (estimated in 1998)	$\mathbf{B}_{pa}$ = 200 000 t affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$.
$\mathbf{F}_{lim}$=$\mathbf{F}_{loss}$=0.6, the fishing mortality estimated to lead to stock falling below $\mathbf{B}_{lim}$ in the long term.	$\mathbf{F}_{pa}$ = 0.4 implies that $\mathbf{B}_{eq}$ > $\mathbf{B}_{pa}$ and P(SSB_{MT} < $\mathbf{B}_{pa}$) < 10%.

Single-stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

At the present SSB level, F should be below 0.3 to be in accordance with the management plan. This corresponds to catches of less than 108.7 kt in 2006. Unless paragraph 6 is invoked the management plan limits the annual deviation of the TAC to 15% which would correspond to catches of 136 kt.

Short-term implications

The short-term prognosis is made using the $\mathbf{F}_{sq}$ assumption for the intermediate year. An $\mathbf{F}_{sq}$ landings for 2005 corresponds to 99 000 t, which is far below the agreed TACs (145 000 t for the North Sea plus IIIa, and 15 000 t for Division VIa).

Outlook for 2006:

Basis: F(2005) =0.27;SSB(2006) = 235; catch (2005) = 99.1.

Rationale	TAC (2006)[1]	TAC IIIa & IV (2006)[3]	TAC VI (2006)[3]	Basis	F 2006	SSB 2007	%SSB change [1)]	% TAC change [2)]
Zero catch	0			F=0	0	332	41	
Target reference point				Ftarget or Btarget				
Status quo	99.6	90.6	9	$\mathbf{F}_{sq}$	0.27	234	0	-38
High long-term yield	42.9	39	3.9	F(long-term yield)	0.1	289	23	-73
Agreed management plan	10.9	9.9	1	TAC(man. plan) * 0.1	0.02	320	36	-93
	27.2	24.8	2.4	TAC(man. plan) * 0.25	0.06	304	30	-83
	54.4	49.5	4.9	TAC(man. plan) * 0.50	0.13	278	18	-66
	81.5	74.2	7.3	TAC(man. plan) * 0.75	0.21	252	7	-49
	97.8	89	8.8	TAC(man. plan) * 0.90	0.26	236	1	-39
	108.7	98.9	9.8	TAC(man. plan)	0.3	225	-4	-32
	119.6	108.8	10.8	TAC(man. plan) * 1.1	0.34	215	-8	-25
	135.9	123.3	12.2	TAC(man. plan) * 1.25	0.4	200	-15	-15
Precautionary limits	13.7	12.5	1.2	TAC($\mathbf{F}_{pa}$)* 0.1	0.03	318	35	-91
	34.3	31.2	3.1	TAC($\mathbf{F}_{pa}$)* 0.25	0.08	298	27	-79
	68.5	62.3	6.2	TAC($\mathbf{F}_{pa}$)* 0.5	0.17	265	13	-57
	102.8	93.5	9.3	TAC($\mathbf{F}_{pa}$)* 0.75	0.28	232	-1	-36
	123.3	112.2	11.1	TAC($\mathbf{F}_{pa}$)* 0.90	0.35	212	-10	-23
	135.9	123.3	12.2	$\mathbf{F}_{pa}$ (= $\mathbf{F}_{sq}$ *1.48)	0.4	200	-15	-15
	150.7	137.1	13.6	TAC($\mathbf{F}_{pa}$)* 1.1	0.46	185	-21	-6
	171.3	155.9	15.4	TAC($\mathbf{F}_{pa}$)* 1.25	0.54	165	-30	7

Weights in '000 t. [1)] SSB 2007 relative to SSB 2006. [2)] TAC 2006 relative to TAC 2005.
[3)]Landings split according to the average in 1993–1998, i.e., 91% in IIIa&IV and 9% in VI.

Shaded scenarios are not considered consistent with the Precautionary Approach**.**

Management considerations

Before 1999, saithe in Subarea VI and saithe in Subarea IV and Division IIIa were assessed as two separate stocks. The ICES advice now applies to the combined areas IIIa, IV, and VI.

The reported landings have been much lower than the TAC the last four years. Information from fishers indicates that very low prices on saithe combined with high fuel prices are causing these reductions in landings. These factors may also have led to increased discarding, although information was not available to quantify this.

The saithe management plan has not been evaluated by ICES. A requirement for consistency with the Precautionary Approachis that the SSB decision parameters are used as lower bounds on SSB, and not as targets and that par 6 will be invoked whenever there is high risk that the SSB may fall below B_{lim} in the short term.

Ecosystem considerations

Because of its life-history, saithe in the North Sea is partly geographically protected from heavy exploitation as juveniles and as large adults.

The geographical distribution of juvenile (< age 3) and adult saithe differs. Typical for all saithe stocks are the inshore nursery grounds. Juvenile saithe in the North Sea are therefore mainly distributed along the west and south coast of Norway, the coast of Shetland, and the coast of Scotland. Around age 3 the individuals gradually migrate from the coastal areas to the northern part of the North Sea (57°N–62°N). The age at maturity is between 4 and 6 years, and spawning takes place in January–March at about 200-m depth along the Northern Shelf edge and the western edge of the Norwegian deeps.

Tagging experiments by various countries have shown that exchange takes place between all saithe stock components in the northeast Atlantic.

Factors affecting the fisheries and the stock

The effects of regulations

Management of saithe is by TAC and technical measures. In January 2002 the minimum mesh size (in bottom trawls for human consumption) was changed from 100 to 110 mm in EU-waters and from 100 to 120 mm in Norwegian waters (the minimum mesh size for Norwegian vessels was set to 120 mm both in Norwegian and EU waters). This regulation was not strictly enforced in the first half of 2002 to allow a transition period, i.e. the implementation of larger mesh sizes probably happened gradually during 2002. Minimum landing size is 35 cm in the EU zone, 32 cm in the Norwegian zone.

Changes in fishing technology and fishing patterns

Variations in EU and Norwegian mesh size regulations in the saithe fishery in 2001–2003 might have contributed to changes in the exploitation pattern (spatial and temporal changes in size-specific fishing mortality between years).

Scientific basis

Data and methods

There are no discard estimates for the majority of the fishery, and they were thus not included in the assessment.

The stock assessment is based on an XSA model, calibrated by three commercial CPUE series and two survey indices.

Information from the fishing industry

The reported catch in 2004 was much lower than the TAC and the reported effort was also considerably lower than in 2003. Information from fishers indicates that very low prices on saithe are causing these reductions.

The fishers' survey corresponds with the outcome of the assessment.

Uncertainties in assessment and forecast

The assessment is considered to be uncertain because of incomplete catch information, residual patterns in catchability, retrospective bias in *F* and SSB estimates, uncertain recruitment estimates, the age range used to compute mean F uses ages not fully recruited, and there is no logical explanation for the steady decline in F since the mid-1980s given a rather constant level of landings and an increase in SSB.

The most serious problem with stock forecasts for saithe is the lack of reliable information about year-class strength before age 3. An annual 0-group survey has been conducted by the Institute of Marine Research (IMR, Norway) since 1999 in the northern North Sea, but this will not be continued due to lack of relationship between the 0-group index and later XSA population estimates for the year classes 1999–2001 (the 0-group index for the 2000 year class is extremely high, while this year class is estimated to be around average for age 4 in this year's assessment). IMR considers starting a new survey along the west coast of Norway to measure the relative abundance of saithe between 1 and 3 years old (when the saithe is distributed along the coast).

Comparison with previous assessment and advice

The estimate of 2004 SSB is about 10% less than the previous estimate, while the 2003 F was estimated to be similar.

Source of information

Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, September 2005 (ICES CM 2006/ ACFM:09).

Saithe in IIIa and IV

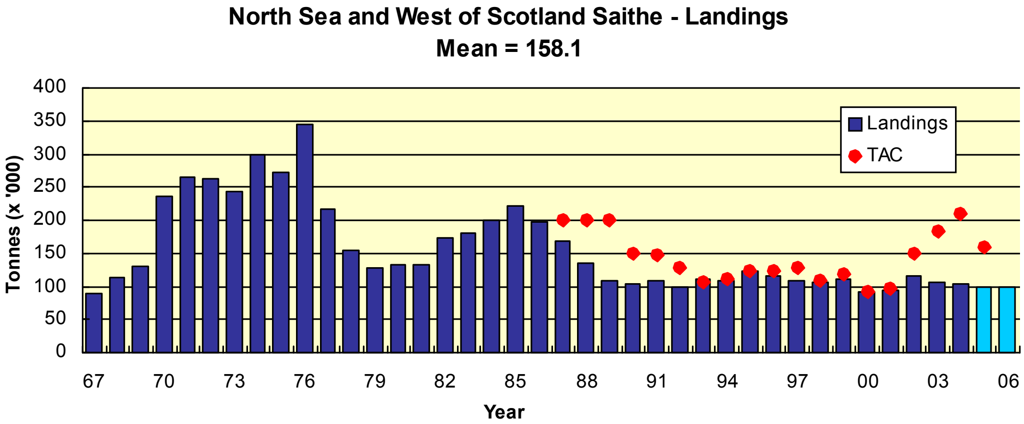
Year	ICES Advice	Single-Stock Exploitation Boundaries	Predicted landings corresp. to advice	Predicted landings correp. to single-stock exploitation boundaries	Agreed TAC	Official landings	ACFM landings
1987	Reduce F		<198		173	154	149
1988	60% of F(86); TAC		156		165	113	107
1989	No increase in F; TAC		170		170	92	92
1990	No increase in F; TAC		120		120	85	88
1991	No increase in F; TAC		125		125	93	99
1992	No increase in F; TAC		102		110	92	92
1993	70% of F(91) ~ 93 000 t		93		93	99	105
1994	Reduce F by 30%		72		97	90	102
1995	No increase in F		107		107	97	113
1996	No increase in F		111		111	96	110
1997	No increase in F		113		115	86	103
1998	Reduce F by 20%		97		97	88	100
1999	Reduce F to $\mathbf{F}_{pa}$		104		110	108	107
2000	Reduce F by 30 %		75		85	85	87
2001	Reduce F by 20 %		87		87	88	90
2002	F < $\mathbf{F}_{pa}$		<135		135	113	117
2003	F < $\mathbf{F}_{pa}$		<176		165	105	102
2004	*	F < $\mathbf{F}_{pa}$	*	<211	190	87	100
2005	*	F according to man. plan	*	<137	145		
2006	*	F according to man. plan (< $\mathbf{F}_{pa}$)	*	<123			

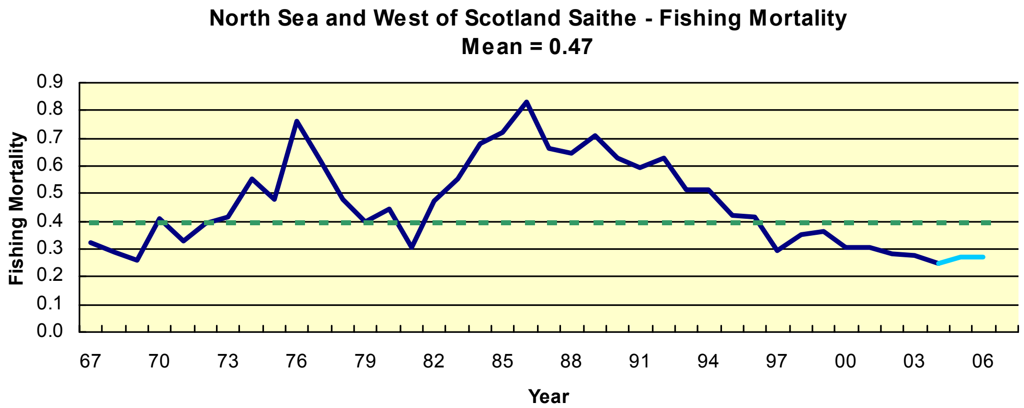
Weights in '000 t. * Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries.

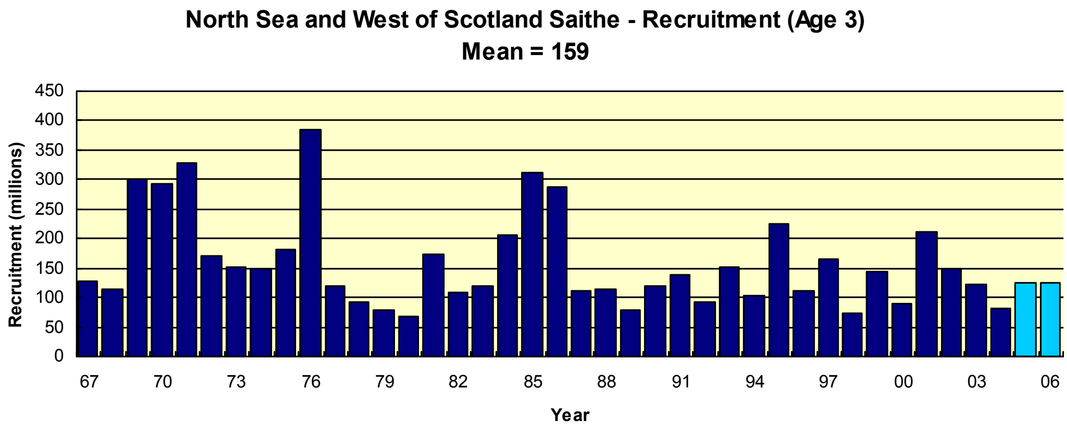
Saithe in VI

Year	ICES Advice	Single-stock exploitation boundaries	Predicted landings corresp. to advice	Predicted catch corresp to single-stock exploitation boundaries	Agreed TAC	Official landings	ACFM landings
1987	F reduced towards $\mathbf{F}_{max}$		19		27.8	32.5	31.4
1988	80% of F(86); TAC		35		35	32.8	34.2
1989	F < 0.3; TAC		20		30	22.4	25.6
1990	80% of F(88); TAC		24		29	18.0	19.9
1991	Stop SSB decline; TAC		21		22	17.9	17.0
1992	Avoid further reduction in SSB		<19		17	10.8	11.8
1993	F = 0.21		6.3		14	14.5	13.9
1994	Lowest possible F				14	13.0[2]	12.8
1995	Significant reduction in effort		-		16	10.6[2]	11.8
1996	No increase in F		10.2[1]		13	9.4[2]	9.4
1997	Significant reduction in F				12	8.6[2]	9.4
1998	60% Reduction in F		4.8		10.9	7.4[2]	8.4
1999	60% reduction in F		4.8		7.5	6.8	7.3
2000	Reduce F by 30 %		6.0		7	6.4	5.9
2001	Reduce F by 20 %		9.0		9	8.7	8.4
2002	F < $\mathbf{F}_{pa}$		<13		14	5.6	5.2
2003	F < $\mathbf{F}_{pa}$		<17		17.1	5.0	5.3
2004	F < $\mathbf{F}_{pa}$	F < $\mathbf{F}_{pa}$	<21	<21	20	1.6	4.4
2005	F < $\mathbf{F}_{pa}$	F according to man. plan	<14	<14	15		
2006	*	F according to	*	<12			

Weights in '000 t.
[1]*Status quo* catch. [2] Incomplete data. * Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries.


North Sea and West of Scotland Saithe - Landings
Mean = 158.1
Tonnes (x '000)
Landings
TAC
Year


North Sea and West of Scotland Saithe - Fishing Mortality
Mean = 0.47
Fishing Mortality
Year


North Sea and West of Scotland Saithe - Recruitment (Age 3)
Mean = 159
Recruitment (millions)
Year

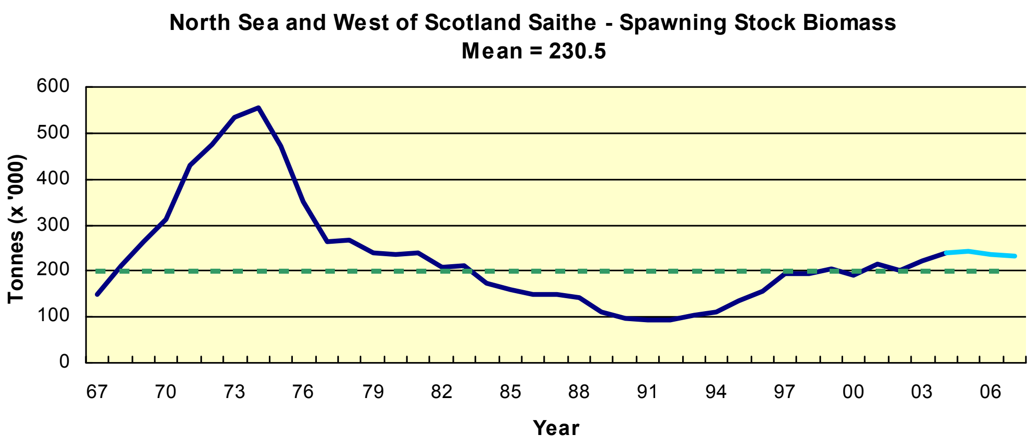

North Sea and West of Scotland Saithe - Spawning Stock Biomass
Mean = 230.5
Tonnes (x '000)
Year

Table 1.4.12.1 Nominal catch (in tonnes) of Saithe in Subarea IV and Division IIIa and Subarea VI, 1998–2004, as officially reported to ICES.

SAITHE IV and IIIa

Country	1998	1999	2000	2001	2002	2003	2004[*]
Belgium	249	200	122	24	107	44[*]	21
Denmark	3967	4494	3529	3575	5668	6954	7983
Faroe Islands	1298	1101					
France	11786[*]	24305[1*]	19200	20472	25441	18001	
Germany	10117	10481	9273	9479	10999	8956	9589
Greenland	-	-	601[2*]	1526[2*]	-[*]		
Ireland	-	-	1	-	-		
Netherlands	7	7	11	20	6	11[*]	3
Norway	50254	56150	43665	43725[*]	58983[*]	61690[*]	61128
Poland	813	862	747	727	752	734[*]	
Russia	-	-	67	-	-	-	
Sweden	1857	1929	1468	1627	1863	1876	2245
UK (E/W/NI)	2293	2874	1227	1186	2521	1215	456
UK (Scotland)	5353	5420	5484	5219	6596	5829	5920
Total reported	87994	107823	85395	87580	112936	105310	87346
Unallocated	12269	-510	2281	2093	3852	-3771	12406
W. G. Estimate	100263	107314	87676	89673	116788	101539	99752[3]
TAC	97000	110000	85000	87000	135000	165000	190000

[*]Preliminary. [1]Reported by TAC area, IIa(EC),IIIa-d(EC) and IV. [2]Preliminary data reported in Division IVa.
[3]Age 3+

SAITHE VI

Country	1998	1999	2000	2001	2002	2003	2004[*]
Belgium	-	-	-	-	-	-[*]	
Denmark	-	-	-	-	-	-	
Faroe Islands		2					
France	3635[*]	3467[1*]	3310	5157	3062	3499	
Germany	506	250	305	466	467	54	4
Ireland	216	320	410	399	91		
Norway	41	126	58	92[*]	136[*]	22[*]	16
Portugal	-	-	-	-	-	-	
Russia	-	3	25	1	1	6	
Spain	54	23	3	15	4		
UK (E/W/NI)	526	503	276	273	307	263	29
UK (Scotland)	2402	2084	2463	2246	1567	1189	1555
Total reported	7380	6778	6850	8649	5635	5033	1610
Unallocated	1056	564	-960	-1831	-449	217	2876
W. G. Estimate	8436	7342	5890	6818	5186	5250	4486[3]
TAC	10900	7500	7000	9000	14000	17119	20000

*Preliminary. 1Reported by TAC area, Vb(EC),VI, XII and XIV.
[3]Age 3+

SAITHE IV, IIIa and VI

	1998	1999	2000	2001	2002	2003	2004
WG estimate	108699	114655	93566	96491	121974	106789	104237

Table 1.4.12.2 Saithe in Subarea IV, Division IIIa (Skagerrak) & Subarea VI.

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1967	127000	150800	88300	0.322
1968	114000	211700	113800	0.291
1969	301000	264000	130600	0.262
1970	292000	312000	235000	0.408
1971	328000	429600	265400	0.329
1972	171000	474100	261900	0.395
1973	153000	534500	242500	0.416
1974	149000	554900	298400	0.556
1975	181000	472000	271600	0.482
1976	384000	351500	344000	0.760
1977	118000	263100	216400	0.615
1978	92000	268000	155100	0.477
1979	78000	240900	128400	0.396
1980	67000	234900	131900	0.443
1981	172000	240800	132300	0.307
1982	110000	209800	174400	0.471
1983	118000	213100	180000	0.552
1984	205000	175000	200800	0.683
1985	311000	158500	220900	0.720
1986	286000	148900	198600	0.831
1987	112000	149100	167500	0.663
1988	114000	143800	135200	0.648
1989	77000	109900	108900	0.711
1990	120000	96500	103800	0.628
1991	138000	92400	108000	0.591
1992	93000	94700	99700	0.630
1993	152000	102300	111500	0.516
1994	103000	111300	109600	0.516
1995	224000	134400	121800	0.422
1996	110000	155300	115000	0.417
1997	164000	195300	107300	0.294
1998	72000	193900	106100	0.353
1999	143000	203700	110700	0.364
2000	89000	192000	91300	0.308
2001	211000	214600	95100	0.304
2002	148000	202500	116000	0.283
2003	122000	221100	105600	0.277
2004	81000	237700	104200	0.245
2005	124000	244000		
Average	157795	230836	158095	0.471

West of Scotland Herring

(Division VIa (North))

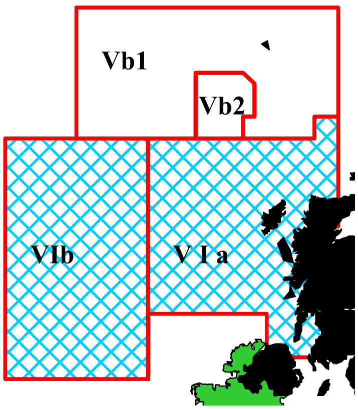
For latest information, see: http://www.ices.dk

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

FSS agree with ICES and STECF advice that the present level of fishing mortality appears to sustainable. Fishing at F_{pa} would result in catches of 26,400 t in 2006.

However, FSS point out that ICES suggests that exploitation might be governed by a harvest control rule where fishing mortality (F) is set at 0.25 when the SSB exceeds 75,000 t (B_{pa}) with an optional year-on-year TAC restraint. This would result in a TAC of 34,000 t in 2006, with an Irish quota of 5,023 t.



Red Boxes-*TAC/Management Areas* *Blue Shading*– *Assess-*

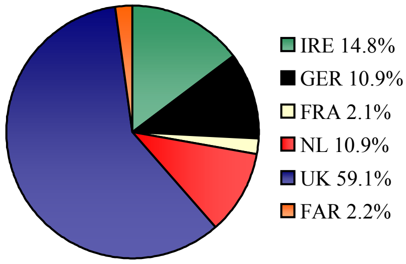
CURRENT MANAGEMENT

- There are no explicit management objectives for this stock.
- The agreed TACs continue to be above the actual catches taken from the stock.
- The overall TAC in 2005 was 31,000 t. The EU share of the total TAC is 29,340 t while the Irish share of the EU quota was 4,432 t.

ADDITIONAL INFORMATION

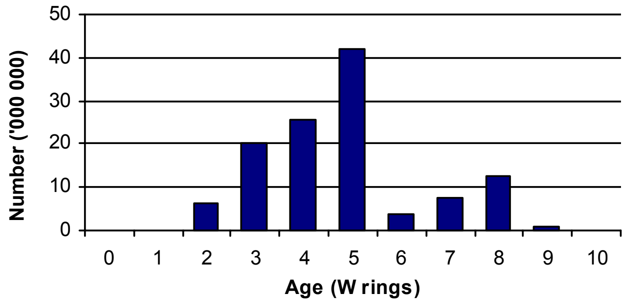
1. The assessment of this stock has improved in recent years and can be used as the basis for management advice. ICES estimate this stock to be at full reproductive capacity with a relatively stable SSB.

2005 % Quota Allocations

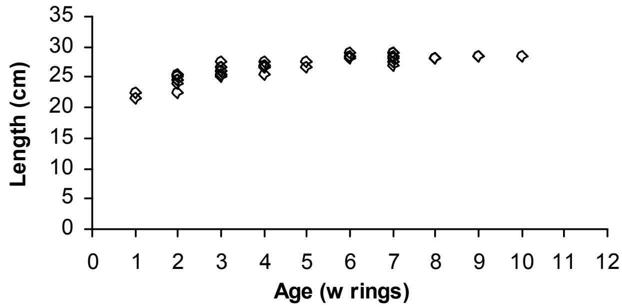


2. The 1998 year class remains the strongest to enter the fishery in recent years while that of 2001 appears to be weak. Initial indications suggest the 2002 year class is strong but there is not as yet sufficient data to confirm this.
3. In 2004, landings were 23,000 t and the TAC has generally not been restrictive. The Irish landing was 1,900 t.
4. Historically there has been misreporting where by official landings were higher than the actual catches.
5. The major landings are taken by the U.K (Scotland) purse seine and midwater trawl fleets. Ireland, Netherlands, Germany and France also report landings.
6. ICES has explored a harvest control rule (HCR) for this stock.

2004 Age Distribution: International Landings, Herring in VIaN



2004 Size at Age: Irish Sampling, Herring in VIaN



ICES ADVICE
1.4.30

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Full reproductive capacity	Reference points are not defined	-

Based on the most recent estimates of SSB, ICES classifies the stock as having full reproductive capacity. The assessment shows a relatively stable SSB with a small decline due to reduced recruitment this year, though the stock is still substantially higher than the previous ten years. Fishing mortality has stabilised at a low level. Current fishing mortality is at a level where the stock remains within PA bounds. The 2001 year class is small.

Management objectives

There are no explicit management objectives for this stock.

Reference points –defined in 2004

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is at 50 000 t	$\mathbf{B}_{pa}$ is at 75 000 t
	$\mathbf{F}_{lim}$ not defined	$\mathbf{F}_{pa}$ not defined

Technical basis

$\mathbf{B}_{lim}$: lowest reliable estimate of SSB	$\mathbf{B}_{pa}$: Approximately 1.5 $\mathbf{B}_{lim}$
$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ is not defined

Yield and spawning biomass per Recruit
F-reference points

Reference point	F multiplier	Absolute F
$\overline{F}_{(3-6)(2002-2004)}$	1.00	0.19
$\mathbf{F}_{0.1}$	0.85	0.16
$\mathbf{F}_{35\%SPR}$	0.90	0.17
$\mathbf{F}_{low}$	0.33	0.06
$\mathbf{F}_{med}$	1.48	0.27

In absence of defined PA reference points for fishing mortality, candidates for target reference points are between $\mathbf{F}_{0.1}$ and $\mathbf{F}_{med}$. The Yield-per-Recruit curve rises slowly above $\mathbf{F}_{0.1}$ and there is a 12% gain in long-term yield by fishing at the higher fishing mortality of $\mathbf{F}_{med}$.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

The present level of fishing mortality ($\mathbf{F}_{sq}$) appears to be sustainable and has led to a rise in SSB. The candidate HCR presented below also seems to maintain the stock inside precautionary limits.

Short-term implications

Outlook for 2006

Basis: F(2005) = *Status quo* = 0.19; SSB(2005) = 136 672; catch (2005) = 25 057 t

Rationale	Catches (2006)	Basis	F(2006)	SSB(2006)	SSB(2007)
Zero catch	0	F=0	0	160	191
proportional	16.4	0.6 *$\mathbf{F}_{sq}$	0.11	149	164
proportional	21.5	0.8* $\mathbf{F}_{sq}$	0.15	146	156
$\mathbf{F}_{sq}$	26.4	$\mathbf{F}_{sq}$	0.19	142	148
Proportional	33.5	1.3* $\mathbf{F}_{sq}$	0.24	137	138
Proportional	40.2	1.6* $\mathbf{F}_{sq}$	0.30	133	128
Proportional	46.6	1.9* $\mathbf{F}_{sq}$	0.35	128	119
$\mathbf{F}_{0.1}$	21.5	$\mathbf{F}_{0.1}$	0.17	144	152

Weights in ‘000 t.

Management considerations

Exploration of options for management plans

ICES has explored HCR candidates and offers the following reflections:

Herring in Division VIa(N) has experienced higher productivity in the period 1957-1974 than in the subsequent period. It is unclear why this is the case. One possible reason is that the SSB has not been allowed to rise high enough to reach this potential. ICES has explored HCRs with a range of Fs from 0.2 to 0.4 for this stock. The results show that if the stock is required to be managed to allow for expansion then F must be kept well below F=0.35. However, as transition to this more productive state cannot be guaranteed, all predictions presented here follow stock recruit relationships that infer only the current level of productivity.

An HCR with the following rule is shown to be sustainable and delivering a reasonably high yield:

F=0.25 if SSB > 75 000 t Optional year-on-year TAC constraint.
F=0.2 if SSB < 75 000 t No constraint on TAC.

The rule should be supplemented with a requirement for F = 0 if SSB falls below $\mathbf{B}_{\mathrm{lim}}$. The short-term prediction based on this HCR for 2006 would be:

Rationale	Catches (2006)	Basis	F(2006)	SSB(2007)
HCR	34 000 (only valid within an agreed HCR)	F(long-term yield) HCR F=0.25	0.25	136 000

These simulations provide a good basis for selecting the main components of a HCR. The HCR above might be adopted subject to an evaluation of a year-on-year TAC constraint, if required.

Ecosystem considerations

Herring in this area is an important food source for sea birds, sea mammals, and many piscivorous fish.

Factors affecting the fisheries and the stock

Changes in fishing technology and fishing patterns

Historically, catches have been taken from this area by three fisheries:

i) A Scottish domestic pair trawl fleet and the Northern Irish fleet operating in shallower, coastal areas, principally fishing in the Minches and around the Island of Barra in the south; younger herring are found in these areas. This fleet has reduced in recent years.

ii) The Scottish single-boat trawl and purse seine fleets, with refrigerated seawater tanks, targeting herring mostly in the northern North Sea, but also operating in the northern part of Division VIa (N). This fleet now operates mostly with trawls, but many vessels can deploy either gear.

iii) An international freezer-trawler fishery has historically operated in deeper water near the shelf edge where older fish are distributed. These vessels are mostly registered in the Netherlands, Germany, France, and England, but most are Dutch owned.

In recent years the composition of the catch of these last two fleets has become more similar and has been dominated by younger adults resulting from increased recruitment into the stock.

In 2004, the Scottish trawl fleet fished both in areas similar to the freezer trawler fishery, and in the coastal areas in the southern part of Division VIa (N), unlike the previous year where the Scottish fleet tended to omit the coastal areas.

As a result of perceived problems of area misreporting of catch from Division IVa into Division VIa (N), Scotland introduced a fishery regulation in 1997 with the aim to improve reporting accuracy. Under this regulation, Scottish vessels fishing for herring were required to hold a license either to fish in the North Sea or in the west of Scotland area (Division VIa (N)). However, in 2004 the requirement to carry only a single license was rescinded. Area misreporting of catch taken in Division IVa into Division VIa (N) seems to have increased. Reinstating this single-area license requirement should be considered as it appears to be helpful to management for this area.

Other factors

The stock identity is uncertain and is being reviewed by an ongoing EU-funded project.

Scientific basis

Uncertainties in assessment and forecast

Catch estimates from observer programs indicate that misreporting of the catches has decreased until 2003 and risen again in 2004. The figure for misreporting used for 2004 is 6 000 tonnes. Better information on the catches has been obtained and biological sampling of catches has improved over the last 4–5 years, but it declined in 2004. Satellite surveillance data has improved knowledge of vessel behaviour.

Comparison with previous assessment and advice

The perception of the state of the stock is largely consistent with last year's assessment, but there is a small downward revision in SSB over the last 3 years and a corresponding upwards revision of F.

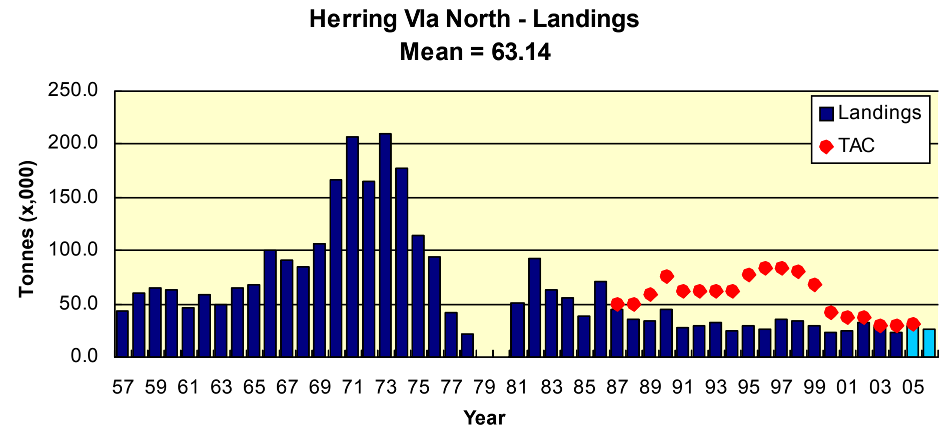
The assessment in 2005, like the assessment in 2004, is less uncertain than in previous years, reflecting the stability of the input data over the last three to four years. Estimates of fishing mortality are reasonably reliable.

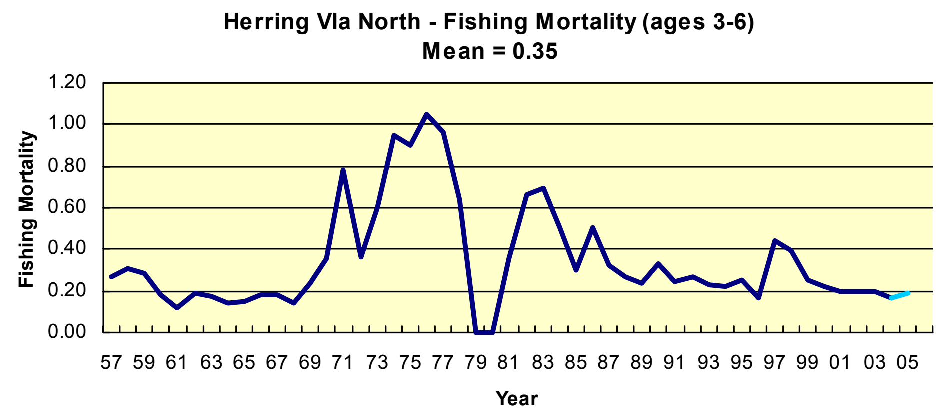
Source of information

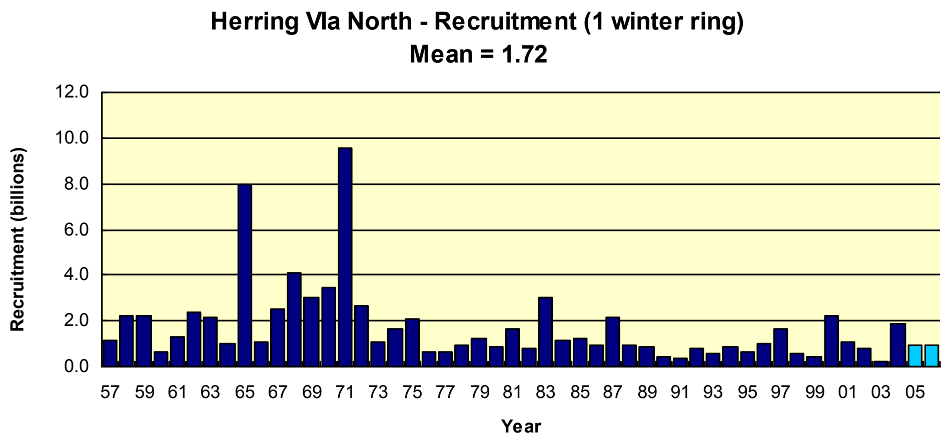
Report of the Herring Assessment Working Group for the Area South of 62°N, 8–17 March 2005 (ICES CM 2005/ACFM:16).

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Disc. slip.	ACFM Catch[1]
1987	Reduce F to $\mathbf{F}_{0.1}$/*status quo* F	38-55	49.7		44
1988	TAC	46	49.8		36
1989	TAC	58	58	1.6	34
1990	TAC	61	75	1.3	45
1991	TAC	57	62	1.2	29
1992	TAC	62	62	0.2	29
1993	Catch at *status quo* F	54-58	62	0.8	32
1994	Catch at *status quo* F	50-60	62	0.7	24
1995	No specific advice	60[2]	77		30
1996	No advice because of misreporting	-	83.57		26
1997	Catch at *status quo* F		83.57	0.1	33[3]
1998	Catch at *status quo* F	59	80.37	0.9	33
1999	Average catches, 1991–1996	28	68		30
2000	Average catches, 1991–1996	28	42		23
2001	Average catches, 1991–1999	30	36.36		25
2002	Average catches, 1991–1999	30	36.36		32
2003	Catch at *status quo* F	30	30		29
2004	F=0.30	41	30	0.1	23
2005	Catch at *status quo* F	30	30.1		
2006	Catch at *status quo* F	26.4			

Weights in '000 t.
[1]Adjusted for misreporting. [2]Catch at *status quo* F. [3]Revised down from 60 in 1999.


Herring VIa North - Landings
Mean = 63.14
Landings
TAC
Tonnes (x,000)
250.0
200.0
150.0
100.0
50.0
0.0
57 59 61 63 65 67 69 71 73 75 77 79 81 83 85 87 89 91 93 95 97 99 01 03 05
Year


Herring VIa North - Fishing Mortality (ages 3-6)
Mean = 0.35
Fishing Mortality
1.20
1.00
0.80
0.60
0.40
0.20
0.00
57 59 61 63 65 67 69 71 73 75 77 79 81 83 85 87 89 91 93 95 97 99 01 03 05
Year


Herring VIa North - Recruitment (1 winter ring)
Mean = 1.72
Recruitment (billions)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
57 59 61 63 65 67 69 71 73 75 77 79 81 83 85 87 89 91 93 95 97 99 01 03 05
Year

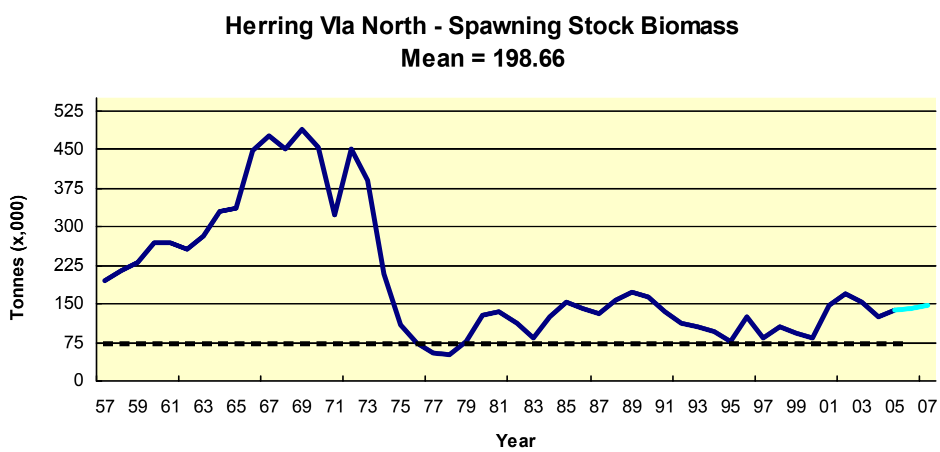

Herring VIa North - Spawning Stock Biomass
Mean = 198.66
Tonnes (x,000)
525
450
375
300
225
150
75
0
57 59 61 63 65 67 69 71 73 75 77 79 81 83 85 87 89 91 93 95 97 99 01 03 05 07
Year

Table 1.4.30.1. Herring in VIa(N). Catch in tonnes by country, 1982-2004. These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**
Denmark			96					
Faroes	74	834	954	104	400			
France	2069	1313		20	18	136	44	1342
Germany	8453	6283	5564	5937	2188	1711	1860	4290
Ireland					6000	6800	6740	8000
Netherlands	11317	20200	7729	5500	5160	5212	6131	5860
Norway	13018	7336	6669	4690	4799	4300	456	
UK	38471	31616	37554	28065	25294	26810	26894	29874
Unallocated	18958	-4059	16588	-502	37840	18038	5229	2123
Discards								1550
Total	92360	63523	75154	43814	81699	63007	47354	53039
Area-Misreported			-19142	-4672	-10935	-18647	-11763	-19013
WG Estimate	**92360**	**63523**	**56012**	**39142**	**70764**	**44360**	**35591**	**34026**
Source (WG)	1984	1985	1986	1987	1988	1989	1990	1991

Country	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Denmark								
Faroes	326	482						
France	1287	1168	119	818	274	3672	2297	3093
Germany	7096	6450	5640	4693	5087	3733	7836	8873
Ireland	10000	8000	7985	8236	7938	3548	9721	1875
Netherlands	7693	7979	8000	6132	6093	7808	9396	9873
Norway	1607	3318	2389	7447	8183	4840	6223	4962
UK	38253	32628	32730	32602	30676	42661	46639	44273
Unallocated	2397	-10597	-5485	-3753	-4287	-4541	-17753	-8015
Discards	1300	1180	200		700			62
Total	69959	50608	51578	56175	54664	61271	64359	64995
Area-Misreported	-25266	-22079	-22593	-24397	-30234	-32146	-38254	-29766
WG Estimate	**44693**	**28529**	**28985**	**31778**	**24430**	**29575**	**26105**	**35233***
Source (WG)	1992	1993	1994	1995	1996	1997	1997	1998

Country	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Denmark							
Faroes					800	400	228
France	1903	463	870	760	1340	1370	625
Germany	8253	6752	4615	3944	3810	2935	1046
Ireland	11199	7915	4841	4311	4239	3581	1894
Netherlands	8483	7244	4647	4534	4612	3609	8232
Norway	5317	2695					
UK	42302	36446	22816	21862	20604	16947	17706
Unallocated	-11748	-8155			878	-7	
Discards	90						123
Total	65799	61514	37789	35411	36283	28835	29854
Area-Misreported	-32446	-23623	-14626	-10437	-4496		-6762
WG Estimate	**33353**	**29736**	**23163**	**24974**	**31787**	**28835**	**23092**
Source (WG)	1999	2000	2001	2002	2003	2004	2005

*WG estimate for 1997 has been revised according to the Bayesian assessment (see text section 5.1.3).

Table 1.4.30.2 Herring in Division VIa (North).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1957	1142600	195006	43438	0.2668
1958	2233280	214239	59669	0.3102
1959	2210650	230608	65221	0.2826
1960	650960	267233	63759	0.1800
1961	1316730	267140	46353	0.1205
1962	2397760	256605	58195	0.1915
1963	2168180	281103	49030	0.1721
1964	990370	329003	64234	0.1443
1965	7944920	336409	68669	0.1504
1966	1072530	447179	100619	0.1837
1967	2514340	476691	90400	0.1828
1968	4109110	451299	84614	0.1397
1969	3001080	489299	107170	0.2367
1970	3442590	452907	165930	0.3528
1971	9583050	322748	207167	0.7792
1972	2677210	450283	164756	0.3609
1973	1075830	388841	210270	0.6015
1974	1674820	206519	178160	0.9510
1975	2116220	108846	114001	0.9016
1976	617140	75124	93642	1.0531
1977	628720	53731	41341	0.9664
1978	920880	50606	22156	0.6385
1979	1219120	76967	60	0.0007
1980	894760	126894	306	0.0004
1981	1667470	134101	51420	0.3565
1982	775930	112097	92360	0.6640
1983	3044640	83577	63523	0.6977
1984	1162470	123779	56012	0.5038
1985	1215220	153372	39142	0.3031
1986	903510	139572	70764	0.5059
1987	2136720	130666	44360	0.3271
1988	922040	155513	35591	0.2706
1989	887290	172677	34026	0.2364
1990	451370	164571	44693	0.3328
1991	391520	134519	28529	0.2456
1992	789720	110920	28985	0.2684
1993	591700	104992	31778	0.2319
1994	866950	95777	24430	0.2182
1995	673990	76860	29575	0.2559
1996	976180	125104	26105	0.1675
1997	1654100	82719	35233	0.4386
1998	553870	106749	33353	0.3980
1999	395980	93223	29736	0.2526
2000	2204430	82857	23163	0.2210
2001	1045060	147507	24974	0.1970
2002	810990	170175	31787	0.1966
2003	187860	155027	28835	0.1938
2004	1863770	124145	23092	0.1662
2005	925834*	136672		
Average	1708193	197397	63138	0.3503

* geometric mean

FSS Advice on Mixed Fisheries in the Celtic Sea

FSS ADVICE

In the absence of a mixed fishery analysis for Divisions VIIb,c,j-k, FSS advise that the following general rules should be followed in the management of mixed fisheries west and southwest of Ireland and in the Celtic Sea.

If fisheries are permitted they should fish:

- **With no catch or discard of spurdog;**
- **without jeopardizing the recommended reduction in fishing mortality, catches or effort for**
    - **megrim in Divisions VIIbc,e-k and VIIIabd;**
    - **cod in Divisions VIIe-k;**
    - **sole and plaice in Divisions VIIfg;**
    - **plaice and sole in Division VIIe;**
    - **sole in Divisions VIIIab;**
    - **Celtic Sea herring;**
- **within the precautionary limits for all other stocks (see text table above).**

FSS advise that two general rules should be followed in the management of mixed fisheries west and southwest of Ireland and in the Celtic Sea.

1) **Once the TAC is exhausted for a particular stock then <u>all</u> fisheries which catch that stock should be closed.**
2) **Fisheries should only be permitted when they demonstrate that they take zero catch of stocks where the TAC is exhausted.**

FSS advise that mixed fisheries characteristics be taken into account when managing demersal and *Nephrops* fisheries in the Celtic Sea and West of Ireland Area. Stocks of spurdog, deep water species, megrim, northern hake, Celtic Sea herring, Celtic Sea sole (VIIf,g) and Celtic Sea plaice (VIIf,g) are the overriding concerns in the management advice for fisheries in Divisions VIIb,c,j-k. These species are caught in mixed fisheries.

FSS note the poor performance of TACs, as implemented, in reducing fishing mortality. FSS stress that the required reductions in fishing mortality can only be achieved if reductions in effort are included in management, and effective deterrents to discarding are implemented.

FSS advise that a well defined 'management plan' is necessary to recover stocks caught in mixed fisheries in the Celtic Sea, west and southwest of Ireland and that stocks must be fished sustainably once they have recovered. FSS advise that such a plan should aim to manage properly defined métiers with clearly defined objectives that will ensure a high probability of recovery to agreed levels within a specified time frame.

IDENTIFICATION OF CRITICAL STOCKS

ICES have identified the following critical Celtic Sea stocks;

- Spurdog is in a critical state.
- Stocks for which reduction in exploitation is required are megrim in Divisions VIIbc,e-k and VIIIabd;
- cod in Divisions VIIe-k;
- sole and plaice in Divisions VIIfg;
- plaice and sole in Division VIIe;
- Celtic Sea herring.

These stocks are the overriding concerns in the management advice for all fisheries where the interactions between stocks taken in the same fisheries should be considered:

- For spurdog the advice is for a zero catch;
- For sole and plaice in Division VIIe, and plaice in Division VIIf,g: either catches in 2006 as indicated in the table below, or recovery plans to define the limits within which the fisheries can take place and which ensure a large reduction in F in 2006;

Reduction in fishing mortality has been advised for megrim in Divisions VIIbc,e-k and VIIIabd; for cod in Divisions VIIe-k; for sole and plaice in Divisions VIIfg; for plaice and sole in Division VIIe; for sole in Divisions VIIIab; and for Celtic Sea herring.

SPECIAL FSS NOTE ON MIXED FISHERIES ADVICE

FSS considers that the provision of mixed fisheries advice, and its implementation in management, have reached an impasse. ICES is attempting to inform "managers about the appropriate allocation of effort among fisheries consistent with desired levels of fishing mortality by species". However, the compilation of necessary and appropriate data has not been achieved (except perhaps in the North Sea). ICES considers that the paucity of data on discards is a "fatal flaw" in a mixed fisheries context. In the absence of acceptable analytical methods and data, ICES has provided "technical interaction matrices" to indicate mixed-fisheries relationships. FSS considers that these matrices cannot be used to quantitatively calculate of potential fishing opportunities in a mixed-fisheries context.

Notwithstanding the difficulties in mixed fisheries analysis, FSS considers that major impediments prevent the proper implementation of mixed fisheries advice. The current management system simply cannot implement appropriate allocations of effort among fisheries consistent with desired levels of fishing mortality by species. The main obstacles preventing this are conflicts with the principle of Relative Stability and a reluctance to manage fishing effort by fleetor to constrain fleet dynamics in other ways.

FSS considers that progress is required on both the analysis and implementation if scientifically credible mixed fisheries analysis is to be undertaken, and mixed fisheries advice is to be sensibly implemented. FSS considers that the data quality issues raised by ICES will be overcome. However, the inclusion of new discard data into assessments is not straightforward and progress may take several years. In the interim FSS considers that a debate is overdue on the means by which mixed-fisheries advice will be implemented by the current, or a modified management framework. FSS views the Regional Advisory Councils as an appropriate forum for this debate. FSS agrees with the STECF that it will not be possible to correctly implement mixed fisheries advice within the current management framework.

In the absence of quantitative mixed-fisheries advice from ICES, the European Commission has attempted to obtain such advice from sub-groups of the STECF. An STECF sub-group met in late 2005, but could only present mixed fishery forecasts for the North Sea. FSS therefore concurs with the STECF that the mixed fisheries analyses for the Irish Sea are misleading and totally unsuitable for management purposes.

Stock interaction table	Anchovy VIII	Anglerfish budegassa VIIb-k, VIIIabd	Anglerfish piscatorius VIIb-k, VIIIabd	Cod VIIe-k	Haddock VIIb-k	Hake Northern	Herring Celtic Sea and Division VIIj	Herring VIa(S) and VIIbc	Horse Mackerel Southern	Horse Mackerel Western	Mackerel North East Atlantic	Megrim VII, VIIIabd	Nephrops Area L: VIIbcjk	Nephrops Area M: VIIfgh+VIIa	Nephrops VIIIa,b	Nephrops VIIIc	Plaice VIIbc	Plaice VIIe	Plaice VIIfg	Plaice VIIhjk	Sardine VIIIc, IXa	Sole VIIbc	Sole VIIe	Sole VIIfg	Sole VIIhjk	Sole VIIIab	Sprat VIIde	Whiting VIIe-k	Seabass	Skates and rays	Pelagic and migratory sharks	Demersal sharks
Anchovy VIII		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Anglerfish budegassa VIIb-k, VIIIabd	N		H	L	L	M	0	0	0	0	0	M	M	L	M		L	L	L	L	0	L	L	L	L	M		L		H		H
Anglerfish piscatorius VIIb-k, VIIIabd	N	T		L	L	M	0	0	0	0	0	M	M	M	M		L	L	L	L	0	L	L	L	L	M		L		H		H
Cod VIIe-k	N	T	T		H	L	0	0	0	0	0	L	L	M	0	0	0	L	M	L	0	0	L	L	L	0	0	H/M		H	L	H
Haddock VIIb-k	N	T	T	T		L	0	0	0	0	0	L	M	M	0	0	L	L	L	L	0	L	L	L	L	0	0	H	0	H	L	H
Hake Northern	N	T	T	T			0	0	0	0	0	M	M	L	M		L		0	L	0	L		0	L	L		L		H	L	H
Herring Celtic Sea and Division VIIj	N	N	N	N	N	N		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0		0
Herring VIa(S) and VIIbc	N	N	N	N	N	N	N		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0		0
Horse Mackerel Southern	N	N	N	N	N	N	N	N		0	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Horse Mackerel Western	N	N	N	N	N	N	N	N	N		H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Mackerel North East Atlantic	N	N	N	N	N	N	N	N				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Megrim VII, VIIIabd	N	T, BT	T, BT	T		T	N	N	N	N	N		H	M	M		L			L	0	L		L	L	0		L		H		H
Nephrops Area L: VIIbcjk	N	NT	NT	NT	NT	NT	N	N	N	N	N	NT		0	0	0	L	0	0	L	0	L	0	0	L	0	0	M		L		L
Nephrops Area M: VIIfgh+VIIa	N	NT	NT	NT	NT	NT	N	N	N	N	N	NT	N		0	0	0	0	0	L	0	0	0	L	L	0	0	M		L		L
Nephrops VIIIa,b	N	NT	NT	N	N	NT	N	N	N	N	N	NT	N	N		0	0	0	0	0	0	0	0	0	0	M	0	0		L		L
Nephrops VIIIc	N			N	N		N	N	N	N	N		N	N	N		L		0	0	0	L	0	0	0	0		0		L		L
Plaice VIIbc	N			N			N	N	N	N	N		NT	N	N			0	0	0	0	L	0	0	0	0	0	L	0	H		M
Plaice VIIe	N	OT, BT	OT, BT	OT, BT	N		N	N	N	N	N		N	N	N		N		0	0	0	0	H	0	0	0	0	L		H		M
Plaice VIIfg	N	OT, BT	OT, BT	OT, BT	OT, BT	N	N	N	N	N	N		N	N	N	N	N	N		0	0	0	0	H	0	0	0	L		H		M
Plaice VIIhjk	N			BT, OT			N	N	N	N	N		NT	N	N		N	N	N		0	0	0	0	L	0	0	L	0	H		M
Sardine VIIIc, IXa	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N		0	0	0	0	0	0	0	0	0		0
Sole VIIbc	N			N			N	N	N	N	N		N	N	N			N	N	N	N		0	0	0	0	0	L	0	H		M
Sole VIIe	N	BT, OT	BT, OT	BT, OT	N		N	N	N	N	N		N	N	N	N	N	BT, OT	N	N	N	N		0	0	0	0	L		H		M
Sole VIIfg	N	BT, OT	BT, OT	BT, OT	BT, OT	N	N	N	N	N	N	BT	N	NT	N	N	N	N	BT, OT	N	N	N	N		0	0	0	L		H		M
Sole VIIhjk	N			BT, OT			N	N	N	N	N		N	N	N		N	N	N	T, BT	N	N	N	N		0	0	L	0	H		M
Sole VIIIab	N	BT	BT	N	N	BT	N	N	N	N	N	N	N	N	NT	N	N	N	N	N	N	N	N	N	N		0	0	0	H		M
Sprat VIIde	N	N	N	N	N				N	N	N		N	N	N		N	N	N	N	N	N	N	N	N	N		0				
Whiting VIIe-k	N	T	T	T	T		N	N	N	N	N		NT	NT	N		N	N	BT, OT		N	N	N	BT, OT		N			0	H		H
Seabass	N						N	N	N	N	N										N					N		0				
Skates and rays	N	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	N	N	N	N	N	BT, OT	NT	NT	NT	NT	BT, OT	BT, OT	BT, OT	BT, OT	N	BT, OT		BT, OT	BT, OT	BT	N	BT,OT				H
Pelagic and migratory sharks	NA	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	N	N	N	N	N	BT, OT					BT, OT	BT, OT	BT, OT	BT, OT	N	BT, OT		BT, OT	BT, OT	BT	N	BT,OT				
Demersal sharks	N	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	N	N	N	N	N	BT, OT	NT	NT	NT	NT	BT, OT	BT, OT	BT, OT	BT, OT	N	BT, OT		BT, OT	BT, OT	BT	N	BT,OT		BT,OT		

H; the stocks are taken together in most fisheries where they are taken and their fisheries linkage is therefore high; M: the stocks are taken together in some but not all important fisheries and their fisheries linkage is therefore medium; L: the stocks

T: Trawl; BT: Beam trawl; OT: Otter trawl; NT: Nephrops trawl; N: none

Single-stock exploitation boundaries and critical stocks

The state and the limits to exploitation of the individual stocks are presented in the stock sections. The state of stocks and single-stock exploitation boundaries are summarised in the table below:

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	In relation to precautionary limits	In relation to target reference points	
Anglerfish in Divisions VIIb–k and VIIIa,b *(L. piscatorius* and *L. budegassa)*	Full reproductive capacity	Increased risk (*L. piscatorius*) Harvested sustainably (*L. budegassa*)	Overexploited	-	In order to harvest the stock within precautionary limits fishing mortality should be kept below $\mathbf{F}_{pa}$ and SSB should be above $\mathbf{B}_{pa}$ for both species. Fishing at $\mathbf{F}_{pa}$ for *L. piscatorius* is expected to result in landings of 25 400 t, leading to an SSB of 64 000 t in 2007. Given the link between the two species, this corresponds to a fishing mortality of 0.18 for *L. budegassa*, corresponding to landings of at most 8 500 t in 2006. The predicted SSBs are well above $\mathbf{B}_{pa}$ in all scenarios.	For *L. piscatorius* the *status quo* fishing mortality is estimated at 0.24 which is above fishing mortalities that would lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.05 and $\mathbf{F}_{max}$ = 0.09). For *L. budegassa* the *status quo* fishing mortality is estimated at 0.18 which is above fishing mortalities that would lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.15). This indicates that long-term yield is expected to increase at fishing mortalities below the historic values. Fishing at such a lower mortality would lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.	ICES Stock area advice = 33 900 t for both species combined (25 400 t *L. piscatorius,* and 8 500 t *L. budegassa*) FSS advice for combined TAC area ie VII and VIIIabde = 34,346 t
Cod in Divisions VIIe-k	Unknown	Unknown	Unknown	-	The reduction of effort which has taken place since 1999 may not have reduced fishing mortality to sustainable levels. Reduction of effort would improve yields and reduce risks to the stock in the longer term. Therefore, in view of the uncertainty of the data and the high fishing mortality estimated for 2002 effort should be reduced to ensure a longer-term reduction in fishing mortality towards sustainable levels. Adequate monitoring including discard monitoring should be implemented	-	-

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	In relation to precautionary limits	In relation to target reference points	
Haddock in Divisions VIIb-k	Unknown	Unknown	Unknown	-	Because of the strong 2002 year class SSB has increased but ICES is unable to provide a reliable estimate of current stock size in relation to precautionary limits. Future catches and SSB will be highly dependent on the strength of incoming year classes and their discard mortality. In this context the stock should be managed by ensuring that the effort is not allowed to increase, rather than by TAC management.	Current fishing mortality is unknown.	-
Hake – Northern stock (Division IIIa, Subareas IV, VI and VII, and Divisions VIIIa, b, d)	Increased risk	Harvested sustainable	Overexploited	Following the agreed recovery plan, a fishing mortality of F = 0.25 is expected to lead to an SSB of around 153 000 t in 2007 with estimated landings in 2006 of 44 000 t. This implies a change in SSB of +5%.	The fishing mortality should be below $\mathbf{F}_{pa}$ and SSB should be above $\mathbf{B}_{pa}$. This is equivalent to the recovery plan. A fishing mortality of F = 0.25 is expected to lead to an SSB of around 153 000 t in 2007 with estimated landings in 2006 of 44 000 t. This implies a change in SSB of +5% and in TAC of 3%.	The current fishing mortality, estimated at 0.24, is above fishing mortalities that are expected to lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.17). This indicates that long-term yield is expected to increase at fishing mortalities well below the historic values. Fishing at such a lower mortality is expected to lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.	44 000 t F < $\mathbf{F}_{pa}$
Megrim in Divisions VIIb, c,e-k and VIIIa,b,d (*L. whiffiagonis and L. boscii*)	Full reproductive capacity	Increased risk	Overexploited	-	In order to harvest the stock within precautionary limits fishing mortality should be below $\mathbf{F}_{pa}$ and SSB should be above **B**pa. A recommended 23% reduction in F is needed to achieve a fishing mortality at $\mathbf{F}_{pa}$ (0.30). This corresponds to landings of less than 13 600 tonnes in 2006. The predicted SSB is well above **B**pa if F is below $\mathbf{F}_{pa}$.	The current fishing mortality ($\mathbf{F}_{sq}$) is estimated as 0.39, which is above rates that would lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.16). Fishing at $\mathbf{F}_{max}$ is expected to lead to high long term landings and SSB.	ICES Advice = 13 600 t. 23% reduction in F FSS Advice= 14,727 t based on long term equilibrium yield.
Nephrops in Divisions VIIb,c,j,k (Management Area L)	Unknown	Unknown	Unknown	-	There are no exploitation boundaries for this stock. In view of the relative stability of landings, landings from FU16-19 should not exceed 3 300 tonnes for 2006, based on the average landings of 2000–2002.	-	< 3 300 t

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	In relation to precautionary limits	In relation to target reference points	
Nephrops in Divisions VIIf,g,h, FU20-22 (Management Area M)	Unknown	Unknown	Unknown	-	Due to uncertainty in the available data ICES is not able to reliably forecast catch. There are no exploitation boundaries for this stock. In view of the relative stability of landings, landings from FU20-22 should not exceed 4.6 thousand tonnes for 2006, based on the average landings of 2000–2002. The landings from all FUs in this TAC area is presented in section 1.4.36 (*Nephrops* in VIIa).	-	
Plaice in the Celtic Sea (Divisions VIIf and g)	Increased risk	Unknown	Overexploited	There is no management plan for this stock.	A 50% reduction in F is needed to increase SSB to around $\mathbf{B}_{pa}$ in 2007. This corresponds to landings of less than 400 tonnes in 2006. If such a large reduction in F is not achievable in the short term, ICES recommends that a recovery plan be developed. This plan should include a sustained reduction of fishing mortality is implemented to rebuild the stock above $\mathbf{B}_{pa}$ in the medium term. Catch and effort reductions are required to promote such a reduction in fishing mortality.	Target reference points have not been agreed for this stock. $\mathbf{F}_{sq}$ (0.54) is above the possible target reference points $\mathbf{F}_{0.1}$ and $\mathbf{F}_{max}$.	390 t F reduced by 50%
Plaice in Division VIIe (Western Channel)	Increased risk	Increased risk	Overexploited	There are no agreed management plans.	Given the low stock size, recent poor recruitment, increasing fishing mortality, the uncertainty in the assessment, and the inability to reliably forecast catch, ICES recommends a substantial reduction in catch until the estimate of SSB is above $\mathbf{B}_{lim}$ or other strong evidence of rebuilding is observed.	The recent fishing mortality, estimated at 0.69, is well above fishing mortalities that, given the current exploitation pattern, would lead to high long-term yields ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.22). This indicates that long-term yield would increase substantially (around 10%) at fishing mortalities well below the historic values. Fishing at such a lower mortality would lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.	Substantial reduction in catch

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	In relation to precautionary limits	In relation to target reference points	
Plaice Southwest of Ireland (Division VIIh-k)	Unknown	Unknown	Unknown	-	Catches in 2005 should be no more than the recent average (2002–2004) of around 245 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.	-	245 t
Plaice West of Ireland (Division VIIb,c)	Unknown	Unknown	Unknown	-	Catches in 2005 should be no more than the recent average (2002–2004) of around 65 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.	-	65 t
Sole in the Celtic Sea (Divisions VIIf and g)	Full reproductive capacity	Harvested unsustainably	Overexploited	There is no management plan for this stock.	A 26% reduction in F is needed to reduce F below $\mathbf{F}_{pa}$. This corresponds to landings of less than 880 tonnes in 2006.	Target reference points have not been agreed for this stock. The present F (0.50) is well above the possible candidate reference points $\mathbf{F}_{0.1}$ and $\mathbf{F}_{max}$.	880 t 26% reduction in F
Sole in Division VIIe (Western Channel)	Increased risk	Harvested unsustainably	Overexploited	There is no agreed management plan.	ICES continues to recommend that a recovery plan be implemented which ensures a safe and rapid rebuilding of SSB to levels above $\mathbf{B}_{pa}$. Rebuilding the stock in one year requires that fishing mortality be reduced by at least 80%. This corresponds to landings of less than 240 tonnes in 2006.	Target reference points have not been agreed for this stock, but a target reference point close to $\mathbf{F}_{0.1}$ (0.11) maximises the return from the fishery whilst being consistent with the precautionary approach. The present fishing mortality (0.45) is above the candidate reference point $\mathbf{F}_{0.1}$..	< 240 t At least 80% reduction in F

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	In relation to precautionary limits	In relation to target reference points	
Sole Southwest of Ireland (Division VIIh-k)	Unknown	Unknown	Unknown	-	Catches in 2006 should be no more than the recent average (2002-2004) of around 380 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.	-	380 t
Sole West of Ireland (Division VIIb,c)	Unknown	Unknown	Unknown	-	Recent catches have been close to the TAC of 65 t. Catches should not be allowed to increase unless it can be shown that an expansion of the fishery is sustainable.	-	65 t
Whiting in Divisions VIIe–k	Full reproductive capacity	Unknown	Overexploited	There is no management plan for this stock	No $\mathbf{F}_{pa}$ has been defined for this stock. As there is no long-term gain in yield and result in a reduction in spawning stock, fishing mortality should not increase, corresponding to landings of at most 10 800 t in 2006.	The current fishing mortality, estimated at 0.51, is above a fishing mortality that would lead to high long-term yields ($\mathbf{F}_{0.1} = 0.18$) ($\mathbf{F}_{max}$ is not well defined). Fishing at a lower mortality would lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.	10 800 t
Celtic sea herring	Uncertain, but likely at risk of reduced reproductive capacity	Unknown	Unknown	-	The current level of SSB is uncertain, but may be below **B**pa and possibly even below $\mathbf{B}_{lim}$. Given the risk to the stock indicated by weak recent recruitment, exploitation should be significantly reduced in 2006. Supplementary measures: e.g. the re-closure of the eastern section of the Celtic Sea.	-	6 700 t Further reduction 60% of average catch 2002–2004
Herring in VIa south and VIIb,c	Unknown, but likely at risk of reduced reproductive capacity	Unknown	Unknown	-	Catches should not be allowed to increase from the recent average levels of 14 000 t, until there is clear evidence that SSB has been rebuilt to be above **B**pa.	-	14 000 t F change not known
Spurdog	Uncertain	Unknown	Unknown		Unknown in relation to PA points but the stock is severely depleted		Target fisheries should not be permitted to continue, and by-catch in mixed fisheries should be reduced to the lowest possible level. A zero TAC should cover all areas where spurdog are caught for 2006.

ICES
1

Mixed fisheries and fisheries interactions (Celtic Sea and western Channel)

Demersal fisheries in the area are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. In these cases management advice must consider both the state of individual stocks and their simultaneous exploitation in demersal fisheries. The stocks in poorest condition, particularly those outside precautionary limits, necessarily become the overriding concern for the management of mixed fisheries where these stocks are exploited either as a targeted species or as a bycatch.

Many of the fleets in the area operate on a mixture of demersal species. As trends in stocks of various species are generally not in synchrony, advice provided on the basis of the status of individual species may result in advised fishing mortalities for a group of co-harvested species that cannot be realized simultaneously within the context of mixed fisheries. Stocks in need of special conservation efforts, such as those affected by recovery plans, present particularly difficult challenges. The reduction of fishing mortality (and effort) required for stocks outside safe biological limits makes it very unlikely that TACs, which would be sustainable for healthier stocks in the mixed fisheries, could be taken in this case. The needs of the stock(s) under recovery plans could be met most directly by simply setting the TACs for all species in mixed fisheries to correspond to the fishing mortality intended for the species under recovery plans, which would result in large foregone yields in many healthier stocks. The foregone yield could be reduced somewhat if effort could be adjusted on a fleet-by-fleet basis to comply with the total fishing mortality in the proposed recovery plan, while allowing as much harvesting of other species as possible. However, such an approach requires reliable information on the catch-at-age for all species in all fisheries, and is still likely to leave substantial potential harvestable biomass of several species unavailable to any fishery. Formulating advice in relation to mixed fisheries is a two-step procedure. First, ICES establishes limits for the exploitation of each species on the basis of its status, consistent with the Precautionary Approach. The second step is to identify the major constraints within which mixed fisheries should operate and through this analysis identify the additional constraints that further limit the fishing possibilities.

The main interactions between the stocks in the Celtic Sea, Southwest of Ireland, Western Channel, and northern part of the Bay of Biscay are between:

- anglerfish, megrim, and hake in the otter board trawl fishery in medium to deep water;
- *Nephrops*, cod, and whiting in the *Nephrops* fishery in the Celtic Sea, and between *Nephrops* and hake in the Bay of Biscay;
- gadoids (cod, haddock, and whiting) within the trawl fishery for roundfish, mainly within Divisions VIIf,g;
- sole and plaice in the beam trawl fishery in Divisions VIIf,g and VIIe, and sole and anglerfish in VIIIa,b;
- haddock, whiting, cod, sole, plaice, hake, megrim, anglerfish, squid, elasmobranchs, and other species within the mixed demersal trawl fisheries.

The directed fisheries for hake (trawl, longlines, and gillnets) and Bay of Biscay sole (gillnets) have few interactions with other stocks:

ICES Identification of critical stocks

The table above identifies the stocks outside precautionary reference points.

Spurdog is in a critical state. Stocks for which reduction in exploitation is required are megrim in Divisions VIIbc,e-k and VIIIabd; cod in Divisions VIIe-k; sole and plaice in Divisions VIIfg; plaice and sole in Division VIIe; sole in Divisions VIIIab; and Celtic Sea herring.

These stocks are the overriding concerns in the management advice for all fisheries where the interactions between stocks taken in the same fisheries should be considered:

- For spurdog the advice is for a zero catch;
- For sole and plaice in Division VIIe, and plaice in Division VIIf,g: either catches in 2006 as indicated in the table above, or recovery plans to define the limits within which the fisheries can take place and which ensure a large reduction in F in 2006;
- Reduction in fishing mortality has been advised for megrim in Divisions VIIbc,e-k and VIIIabd; for cod in Divisions VIIe-k; for sole and plaice in Divisions VIIfg; for plaice and sole in Division VIIe; for sole in Divisions VIIIab; and for Celtic Sea herring.

ICES Advice on fisheries management

Fisheries in the Celtic Sea, Southwest of Ireland, Western Channel, and northern part of the Bay of Biscay should in 2006 be managed according to the following rules, which should be applied simultaneously:

They should fish:

- **With no catch or discard of spurdog;**
- **without jeopardizing the recommended reduction in fishing mortality of megrim in Divisions VIIbc,e-k and VIIIabd; cod in Divisions VIIe-k; sole and plaice in Divisions VIIfg; plaice and sole in Division VIIe; sole in Divisions VIIIab; and Celtic Sea herring;**
- **concerning deepwater stocks fished in Subareas VII and VIII,;**
- **within the biological exploitation limits for all other stocks (see text table above).**

Furthermore, unless ways can be found to harvest species caught in mixed fisheries within precautionary limits for all those species individually then fishing should not be permitted.

Northern Hake

(Division IIa, IIIa-d, Vb, VIIIabde and Sub-areas IV, VI, VII, XII & XIV)

For latest information, see: http://www.ices.dk

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

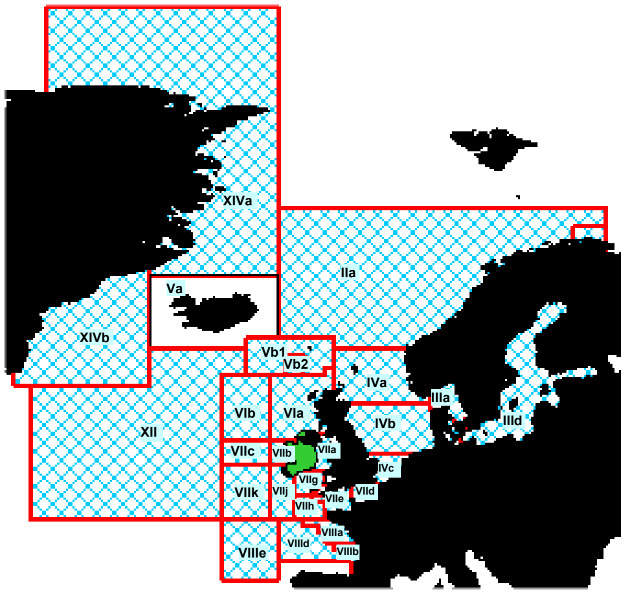
(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

This assessment is relatively consistent from year to year despite serious concerns about the quality of the input data used.

Based on the most recent estimates of SSB and fishing mortality, ICES classifies the stock as being harvested sustainably but at risk of being at reduced reproductive capacity

Managers are obliged to follow the agreed management plan (EC Reg. No 811/2004) which establishes measures for the recovery of the northern hake. This plan has not yet been fully evaluated by ICES in relation to the precautionary approach. The plan involves fishing at F = 0.25. This is expected to lead to an SSB of 153,000 t in 2007 with estimated landings in 2006 of 43,900 t. This implies a change in SSB of +5% with an associated Irish quota of 1,358 t . Given the uncertainties in the assessment, FSS considers that such small changes in SSB may not be detectable in future assessments. FSS therefore advise that a risk-based framework, which incorporates uncertainty, would be more appropriate than a deterministic projection for determining an appropriate TAC consistent with this management plan.

Long-term Advice
The recovery plan sets F_{pa} as a target. FSS considers that this is an inappropriate long-term target, an appropriate long-term target could be F_{max} or $F_{0.1}$ where yield is maximised and there is minimal risk of stock collapse



Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

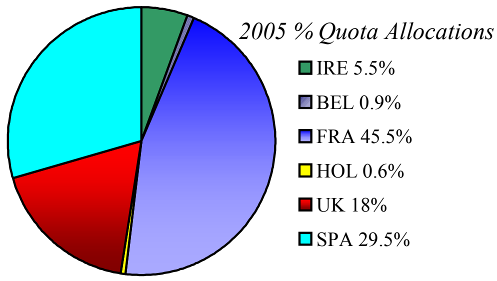
CURRENT MANAGEMENT

- Emergency measures have been in place for the Northern hake stock since 2001. These have been consolidated into EC Reg. No 811/2004, which established measures for the recovery of the northern hake stock. Further detail of this regulation is given in the Section on Effort Limitations and Recovery Plans.
- The current assessment area covers Sub-areas III, IV, V, VI, VII and VIIIabde which corresponds to four TAC areas (see Table).
- The TAC has been overshot considerably since 2001. The poor performance of TACs, as implemented, in reducing fishing mortality, leads FSS to reiterate that the required reductions in fishing mortality can only be achieved if reductions in effort are included in management, and effective measures to reduce discarding are implemented.
- The 2005 TAC was 28,888 t with an associated Irish quota of 1,318 t.

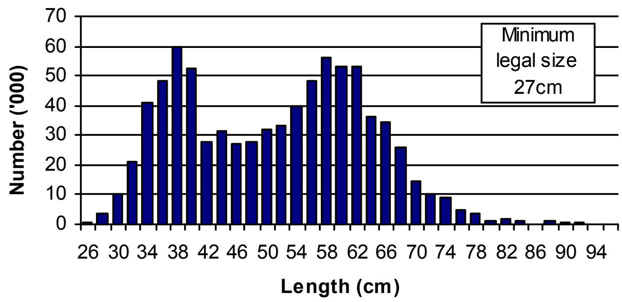
TAC 2006							
Basis	IIIbcd(EC waters)	IIa(EC waters), North Sea (EC waters)	Vb(EC waters), VI,VII,XII,XIV	VIIIabde	All Areas Combined	2006 Irish quota	% Change 2005
F_{max}	949	1,106	17,664	11,781	31,500	975	-26%
$F_{Advised}$	1,323	1,542	24,617	16,418	43,900	1,358	3%

ADDITIONAL INFORMATION

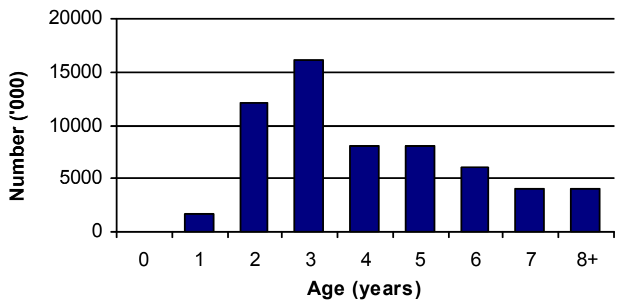
1. The assessment methodology and results are very similar to last year. Although this assessment appears to be consistent from year to year there are some serious concerns about the accuracy of the age estimation methodology, discard estimates, misreporting and the quality of the tuning data used. Discards were not included in this years assessment due to incomplete data. Previous discard estimates were likely to be inaccurate under-estimates of the true situation.
2. FSS considerations on the efficacy of recovery plans are documented in Section on Effort Limitations and Recovery Plans.
3. Estimated landings by Irish fleet in 2004 were 1,048 t, an increase of 1% from 2003.
4. Hake are a very important component in the mixed species demersal trawl fisheries in most Irish ports. Ireland has important trawl, seine and gill-net fisheries for hake all along the western shelf and in the Celtic Sea and Stanton Bank area. The most important ports are Castletownbere, Dunmore East and Killybegs. Large volumes of hake are also landed into Irish ports by vessels from other EU countries.
5. There are indications of a strong 2004 year-class from the Spanish groundfish surveys.
6. FSS recognise that hake is caught in nearly all fisheries in Sub-areas VII and VIII. Therefore hake are therefore caught with other stocks that are outside safe biological limits.
7. There is a proposal to ban gill netting in waters >200m, this may have an impact on fisheries for Northern Hake
8. Concerns over the accuracy of ageing data and the calculation of catch-at-age data are based on a French pilot study. The results of the study suggest that current ageing procedures may over estimate hake ages. If growth of hake is underestimated, the stock is likely to be smaller and fishing mortality higher.



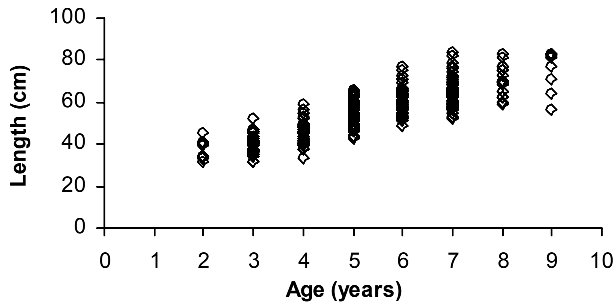
2004 Length Distribution: Irish Landings, Hake in VII



2004 Age Distribution: International Landings, Hake in VII



2004 Size at Age: Irish Sampling, Hake in VII



ICES ADVICE
1.4.1

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target (=0.25)	Comment
Increased risk	Harvested sustainably	Overexploited	F is around agreed target	

Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as being at risk of reduced reproductive capacity and being harvested sustainably.

After the mid-1980s SSB declined and was at $\mathbf{B}_{lim}$ during most of the 1990s. Thereafter SSB increased and is presently estimated to be just below $\mathbf{B}_{pa}$. Fishing mortality is estimated to have declined in recent years to just below $\mathbf{F}_{pa}$.

Management objectives

There are explicit management objectives for this stock under the EC Reg. No 811/2004 establishing measures for the recovery of the northern hake stock.

The main Articles of interest adopted by this Regulation are:

"*__Article 1. Subject matter.__ This Regulation establishes a recovery plan for the northern hake stock which inhabits the ICES division III a, ICES subarea IV, ICES divisions V b (Community waters), VI a (Community waters), ICES subarea VII and ICES divisions VIII a, b, d, e (the northern hake stock).*

__Article 2. Purpose of the recovery plan.__ The recovery plan referred to in Article 1 shall aim to increase the quantities of mature fish of the northern hake stock concerned to values equal to or greater than __140 000__ tonnes.

__Article 3. Reaching of target levels.__ Where the Commission finds, on the basis of advice from ICES and following agreement on that advice by the Scientific Technical and Economic Committee for Fisheries (STECF), that for two consecutive years the target level for the northern hake stock concerned has been reached, the Council shall decide by qualified majority on a proposal from the Commission to replace the recovery plan by a management plan for the stock in accordance with Article 6 of Regulation (EC) No 2371/2002.

__Article 4. Setting of TACs.__ A TAC shall be set in accordance with Article 5 where, for the northern hake stock concerned the quantities of mature northern hake have been estimated by the STECF, in the light of the most recent report of ICES, to be equal to or above __100 000__ tonnes.

Article 5. Procedure of setting TACs.

1. Each year, the Council shall decide by qualified majority on a proposal from the Commission on a TAC for the following year for the northern hake stock concerned.

2. For 2004, the TAC shall be set at a level corresponding to a fishing mortality of __0,25__, 4 % less than status quo fishing mortality. For the subsequent years of the recovery plan, the TAC shall not exceed a level of catches which scientific evaluations carried out by the STECF, in the light of the most recent reports of ICES, indicate will correspond to a fishing mortality rate of 0,25.

3. The Council shall not adopt a TAC whose capture is predicted by the STECF, in the light of the most recent report of the ICES, to lead to a decrease in spawning stock biomass in its year of application.

4. Where it is expected that the setting of the TAC for a given year in accordance with paragraph 2 will result in a quantity of mature fish at the end of that year in excess of the target level indicated in Article 2, the Commission will carry out a review of the recovery plan and propose any adjustments necessary on the basis of the latest scientific evaluations. Such a review shall in any event be carried out not later than three years following the adoption of this Regulation with the aim of ensuring that the objectives of the recovery plan are achieved.

5. Except for the first year of application of this Regulation, the following rules shall apply:

(a) where the rules provided for in paragraph 2 or 4 would lead to a TAC for a given year which exceeds the TAC of the preceding year by more than 15 %, the Council shall adopt a TAC which shall not be more than 15 % greater than the TAC of that year or;

(b) where the rule provided for in paragraph 2 or 4 would lead to a TAC for a given year which is more than 15 % less than the TAC of the preceding year, the Council shall adopt a TAC which is not more than 15 % less than the TAC of that year.

__Article 6. Setting of TACs in exceptional circumstances.__ Where the quantities of mature fish of the northern hake stock concerned have been estimated by the STECF, in the light of the most recent report of the ICES, to be less than 100 000 tonnes, the following rules shall apply:

(a) Article 5 shall apply where its application is expected to result in an increase in the quantities of mature fish of the northern hake stock concerned, at the end of the year of application of the TAC to a quantity equal to or greater than 100 000 tonnes;

(b) where the application of Article 5 is not expected to result in an increase in the quantities of mature fish of the northern hake stock concerned, at the end of the year of application of the TAC, to a quantity equal to or greater than 100 000 tonnes, the Council shall decide by a qualified majority, on a proposal from the Commission, on a TAC for the following year that is lower than the TAC resulting from the application of the method described on Article 5."

ICES has not yet evaluated the current recovery plan in relation to the precautionary approach but intends to carry out an evaluation of possible management approaches before the end of 2006.

Reference points

Precautionary reference points were updated in 2003 following a revision of the assessment model and input data in recent years. The basis for setting reference points remained unchanged.

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is 100 000 t	$\mathbf{B}_{pa}$ be set at 140 000 t
	$\mathbf{F}_{lim}$ is 0.35	$\mathbf{F}_{pa}$ be set at 0.25
Target reference points		Not defined

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 3 years	0.243	0.284	0.823
Fmax	0.170	0.292	1.162
F0.1	0.097	0.272	1.784
Fmed	0.292	0.274	0.674

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$-$\mathbf{F}_{max}$.

Technical basis:

B_{lim} = **B_{loss}** the lowest observed biomass in the 2003 assessment.	**B_{pa}** ~ **B_{lim}** * 1.4
F_{lim} = **F_{loss}**	**F_{pa}** ~ **F_{lim}** * 0.72

Single-stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

Following the agreed recovery plan, a fishing mortality of F = 0.25 is expected to lead to an SSB of around 153 000 t in 2007 with estimated landings in 2006 of 44 000 t. This implies a change in SSB of +5%.

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

The current fishing mortality, estimated at 0.24, is above fishing mortalities that are expected to lead to high long-term yields and low risk of stock depletion (**$F_{0.1}$** = 0.10 and **F_{max}** = 0.17). This indicates that long-term yield is expected to increase at fishing mortalities well below the historic values. Fishing at such a lower mortality is expected to lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

The fishing mortality should be below **F_{pa}** and SSB should be above **B_{pa}**. This is equivalent to the recovery plan. A fishing mortality of F = 0.25 is expected to lead to an SSB of around 153 000 t in 2007 with estimated landings in 2006 of 44 000 t.

Short term implications

Outlook for 2006:

Basis: Fsq =mean F(02-04)=0.24; R04-05 = GM 1987-2002=196 millions; landings (2005) = 41.3; SSB(2006) = 146. The fishing mortality applied according to the agreed recovery plan (F(recovery plan)) is 0.25. The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.25. The fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock (F(long term yield)) is 0.18

Rationale	Landings (2006)	Basis	F total (2006)	SSB (2007)	%SSB change 1)	%TAC change 2)
Zero catch	0.0	F=0	0.00	208.7	43%	-100%
High long term yield	31.5	F(long term yield)	0.17	168.7	16%	-26%
Status quo	5.0	Fsq *0.1	0.02	202.4	39%	-88%
	9.8	Fsq *0.2	0.05	196.2	34%	-77%
	23.3	Fsq *0.5	0.12	179.1	23%	-45%
	33.5	Fsq *0.75	0.18	166.1	14%	-21%
	39.3	Fsq *0.9	0.22	158.8	9%	-8%
	42.9	Fsq *1	0.24	154.2	6%	1%
	46.5	Fsq *1.1	0.27	149.7	3%	9%
	51.6	Fsq *1.25	0.30	143.3	-2%	21%
Agreed management plan	5.1	F(management plan) *0.1	0.03	202.2	38%	-88%
	12.4	F(management plan) *0.25	0.06	192.9	32%	-71%
	23.9	F(management plan) *0.5	0.13	178.4	22%	-44%
	34.3	F(management plan) *0.75	0.19	165.1	13%	-20%
	40.1	F(management plan) *0.9	0.23	157.7	8%	-6%
	43.9	F(management plan) *1	0.25	153.0	5%	3%
	47.5	F(management plan) *1.1	0.28	148.4	2%	11%
	52.7	F(management plan) *1.25	0.31	141.9	-3%	24%
Precautionary limits	5.1	F(prec limits) *0.1	0.03	202.2	38%	-88%
	12.4	F(prec limits) *0.25	0.06	192.9	32%	-71%
	23.9	F(prec limits) *0.5	0.13	178.4	22%	-44%
	34.3	F(prec limits) *0.75	0.19	165.1	13%	-20%
	40.1	F(prec limits) *0.9	0.23	157.7	8%	-6%
	43.9	Fpa = Fsq *1.03	0.25	153.0	5%	3%
	47.5	F(prec limits) *1.1	0.28	148.4	2%	11%
	52.7	F(prec limits) *1.25	0.31	141.9	-3%	24%
	60.7	F(prec limits) *1.5	0.38	131.7	-10%	43%
	68.2	F(prec limits) *1.75	0.44	122.3	-16%	60%
	75.6	F(prec limits) *2	0.50	112.9	-23%	77%
	85.0	F(prec limits) *2.25	0.56	101.0	-31%	100%

All weight in '000 tonnes ; Shaded scenarios are not considered consistent with the precautionary approach
1) SSB 2007 relative to SSB 2006; 2) Predicted landings 2006 relative to TAC 2005 (42.6 thousand tonnes)

Management considerations

Hake is caught in nearly all fisheries in Subareas VII and VIII and also in some fisheries of Subareas IV and VI.

The Northern hake emergency plan (EC 1162/2001, EC 2602/2001 and EC 494/2002) has been followed up by a recovery plan in 2004 (EC 811/2004). The recovery plan is aimed at achieving a SSB of 140 000 tonnes (B_{pa}). This is to be achieved by limiting fishing mortality to F=0.25 and by allowing a maximum change in TAC between years of 15%. Targeting F well below F=0.25 is expected to increase long term yield.

The TAC has been overshot considerably in recent years.

The major fleets exploiting Northern hake have shown in the longer term a decrease in nominal fishing effort.

Discards of juvenile hake can be substantial in some areas and fleets. Surveys suggest that juvenile hake may be much more widespread than hitherto assumed. Therefore a general increase in the minimum mesh size is expected to offer more protection of juvenile hake.

Ecosystem considerations

Hake movements have been studied from the seasonal distribution of catches. From the beginning of the year until March/April adult hake are present in the North of the Bay of Biscay. They appear on the shelf edge in the Celtic Sea in June and July. Between August and December a large hake fishery is centred to the west and southwest of Ireland, with a decline in catch rates in shallower waters.

Hake belongs to a diverse community of species including megrim, anglerfish, *Nephrops*, sole, seabass, ling, blue ling, greater forkbeard, tusk, whiting, blue whiting, *Trachurus spp*, conger, pout, cephalopods (octopus, *Loligidae*, *Ommastrephidae* and cuttlefish), and rays. The relative importance of these species in the hake fishery varies between years depending on gears, sea areas and biological conditions.

Hake is preyed upon by sharks and other fishes. Cannibalism on juveniles by adults is well known. Adults feed on fish (mainly on blue whiting and other gadoids, sardine, anchovy, and other small pelagic fish); juvenile hake prey mainly upon planktonic crustaceans (above all euphausids, copepods, and amphipods).

Factors affecting the fisheries and the stock

The effects of regulations

The minimum mesh size was increased from 55/65 mm to 70 mm in the Bay of Biscay in 2000.

Since June 2001 an Emergency Plan was implemented for the Northern hake stock (Council Regulations N°1162/2001, 2602/2001 and 494/2002). Firstly, a 100-mm minimum mesh size has been implemented for otter-trawlers when hake comprises more than 20% of the total amount of marine organisms retained onboard. This measure did not apply to vessels less than 12 m in length and which return to port within 24 hours of their most recent departure. Secondly, two areas have been defined, one in Subarea VII SW of Ireland and the other in Subarea VIII Bay of Biscay, where a 100-mm minimum mesh size is required for all otter-trawlers, whatever the amount of hake caught. The fishing mortality of juvenile hake (in the landings) is estimated to have decreased since around 1997. No apparent change has been observed since the introduction of the hake emergency plan in 2001.

Council Regulation (EC) No 1954/2003 established measures for the management of fishing effort in a ‘biologically sensitive area’ in Subareas VIIb, VIIj, VIIg, and VIIh. Effort exerted within the ‘biologically sensitive area’ by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998-2002).

The hake recovery plan (EC Reg. No 811/2004) came in operation in 2004 and replaced the emergency plan. It is aimed at increasing the quantities of mature fish to values equal or greater than 140 000 t. This is to be achieved by limiting fishing mortality to 0.25 and by allowing a maximum change in TAC between years of 15%.

Changes in fishing technology and fishing patterns

Since the introduction of the high opening trawls in the mid 1990s, no significant changes in fishing technology have been observed.

Due to quota restriction the Spanish fleet stopped fishing up to two months in 2001, 2002, and 2003 and one month in 2004. However, this temporary cessation of the fishery is not mirrored in the overall trends in fishing effort.

Other factors

The main part of the fishery (close to 80% of the total landings) was conducted in five Fishery Units, three of them from Sub-area VII: FU 4 (Non-*Nephrops* trawling in medium to deep water in Sub-area VII), FU 1 (Long-line in medium to deep water in Sub-area VII), and FU 3 (Gill nets in Sub-area VII), and two from Sub-area VIII: FU 13 (Gill nets in shallow to medium water) and FU 14 (Trawling in medium to deep water in Sub-area VIII), representing respectively 20%, 18%, 14%, 12%, and 14% of the total landings in 2004.

Spain accounts for the main part of the landings with 62% of the total in 2004. France is now taking 26% of the total, UK 5%, Denmark 3%, Ireland 2% and other countries (Norway, Belgium, Netherlands, Germany, and Sweden) contributing small amounts.

Scientific basis

Data and methods

An age based assessment (XSA) assessment using 4 commercial CPUE series and 3 surveys was performed. Discards were not included in the assessment. Some discard data were available but it was not possible to incorporate these in a consistent way.

There are indications about a strong yearclass in 2004 but survey estimates are too uncertain to be used in the assessment.

Information from the fishing industry

The fishing industry and scientists have met at the national level to discuss information that can be used in the assessments. Some CPUE time series have been provided by the fishing industry. Qualitative information has also been provided and has contributed to the assessment process.

Uncertainties in assessment and forecast

Some preliminary results on growth and accuracy of age determination from otolith reading were obtained from a tagging study conducted in 2002 in the Bay of Biscay. They show an underestimation of growth and inaccuracy in the current ageing criteria used by hake otoliths readers. However, the small size of the sample analysed and its spatial and temporal coverage makes it difficult to draw reliable conclusions.

Following concerns over the accuracy of aging data and the calculation of historic catch-at-age data, an alternative assessment was explored assuming faster growth. The results indicate that the perception of trends in stock dynamics is similar but the absolute levels are heavily dependent on the ageing criteria. If growth of hake is underestimated, the stock is likely to be smaller and fishing mortality higher.

Discards were not included in those assessments. Some improvement in discard data availability (number of fleets sampled and area coverage) have been observed. However, sampling do not cover all fleets contributing to hake catches, discards rates of several fleets are simply not known and when data are available, it is not possible to incorporate them in a consistent way.

Comparison with previous assessment and advice

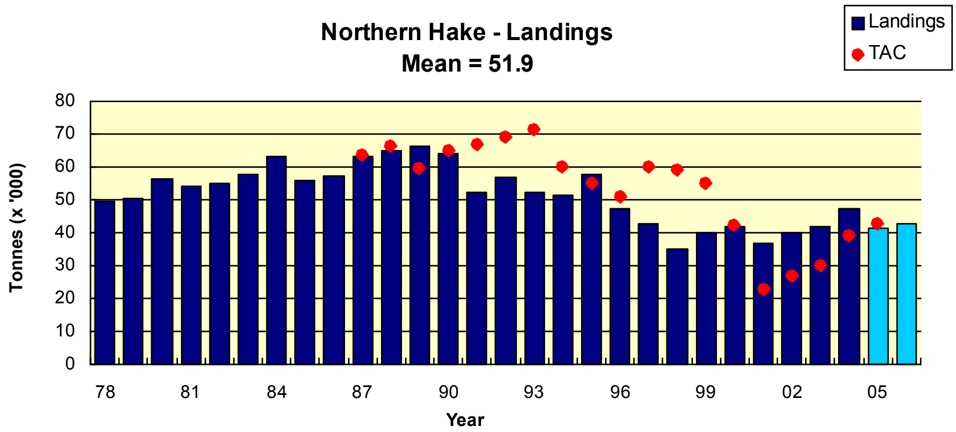
The assessment and advice are consistent with last year. The estimated low stock abundance in 2000 (90 000 t.) was the basis for the ICES advice for a recovery plan for Northern hake. The recent estimate of SSB in 2000 (100 000 t.) is still very low, so that the basis for a recovery plan advice would still be valid.

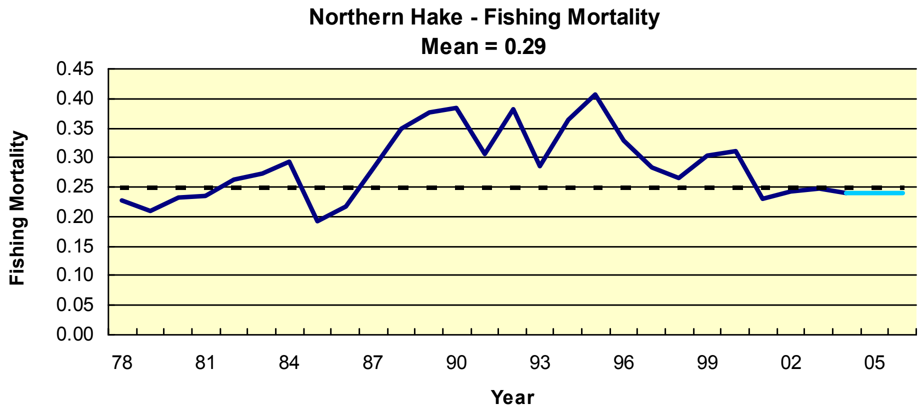
Sources of information

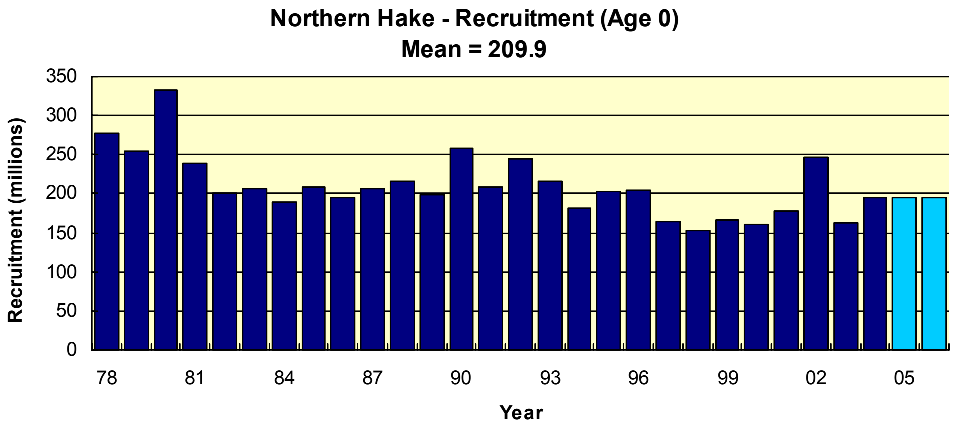
Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2005 (ICES CM 2006/ ACFM:01).

	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp to advice	Predicted catch corresp to single-stock exploitation boundaries	Agreed TAC[1]	ACFM landings	Disc. slip.	ACFM Catch***
1987	Precautionary TAC; juvenile protection		-		63.5	63.4	2.0	65.3
1988	Precautionary TAC; juvenile protection		54		66.2	64.8	2.0	66.8
1989	Precautionary TAC; juvenile protection		54		59.7	66.5	2.3	68.8
1990	Precautionary TAC; juvenile protection		59		65.1	59.9	1.5	61.4
1991	Precautionary TAC; juvenile protection		59		67.0	57.6	1.7	59.3
1992	If required, precautionary TAC		61.5		69.0	56.6	1.7	58.3
1993	Enforce juvenile protection legislation		-		71.5	52.1	1.5	53.6
1994	F significantly reduced		<46		60.0	51.3	1.9	53.1
1995	30% reduction in F		31		55.1	57.6	1.2	58.9
1996	30% reduction in F		39		51.1	47.2	1.5	48.8
1997	20% reduction in F		54		60.1	42.6	1.8	44.4
1998	20% reduction in F		45[2]		59.1	35.0	0.8	35.8
1999	Reduce F below $\mathbf{F}_{pa}$		<36[2]		55.1	39.8	0.8	40.6
2000	50% reduction in F		<20[2]		42.1	42.0	0.6	42.6
2001	Lowest possible catch, recovery plan		-		22.6	36.7	0.5	37.2
2002	Lowest possible catch / recovery plan		-		27.0	40.0	0.3	40.3
2003	Lowest possible catch / recovery plan		-		30.0	41.8	- **)	-
2004	*)70% reduction in F or recovery plan		*)	<13.8	39.1	47.1		-
2005	F=0.19			33	42.6			
2006	F=0.25			44				

[1]Sum of area TACs corresponding to Northern stock plus Division IIa (EC zone only). [2]Landings. Weights in '000 t.
*) Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries.
**) in 2003, no estimations of discards were available.
***) ACFM catch not used in the assessment. Assessment based on landings only.


Northern Hake - Landings
Mean = 51.9
Landings
TAC
Tonnes (x '000)
0
10
20
30
40
50
60
70
80
78
81
84
87
90
93
96
99
02
05
Year


Northern Hake - Fishing Mortality
Mean = 0.29
Fishing Mortality
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
78
81
84
87
90
93
96
99
02
05
Year


Northern Hake - Recruitment (Age 0)
Mean = 209.9
Recruitment (millions)
0
50
100
150
200
250
300
350
78
81
84
87
90
93
96
99
02
05
Year

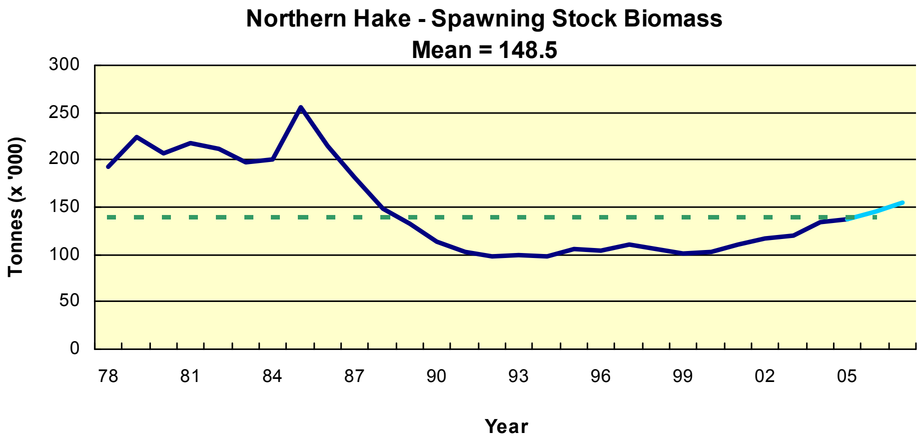

Northern Hake - Spawning Stock Biomass
Mean = 148.5
Tonnes (x '000)
0
50
100
150
200
250
300
78
81
84
87
90
93
96
99
02
05
Year

Table 1.4.1.1 Estimates of catches ('000 t) for the Northern Hake by area for 1961-2003.

	Landings (1)					Discards (2)	Catches (3)
Year	IVa+VI	VII	VIIIa,b	Unallocated	Total	VIIIa,b	Total
1961	-	-	-	95.6	95.6	-	95.6
1962	-	-	-	86.3	86.3	-	86.3
1963	-	-	-	86.2	86.2	-	86.2
1964	-	-	-	76.8	76.8	-	76.8
1965	-	-	-	64.7	64.7	-	64.7
1966	-	-	-	60.9	60.9	-	60.9
1967	-	-	-	62.1	62.1	-	62.1
1968	-	-	-	62.0	62.0	-	62.0
1969	-	-	-	54.9	54.9	-	54.9
1970	-	-	-	64.9	64.9	-	64.9
1971	8.5	19.4	23.4	0	51.3	-	51.3
1972	9.4	14.9	41.2	0	65.5	-	65.5
1973	9.5	31.2	37.6	0	78.3	-	78.3
1974	9.7	28.9	34.5	0	73.1	-	73.1
1975	11.0	29.2	32.5	0	72.7	-	72.7
1976	12.9	26.7	28.5	0	68.1	-	68.1
1977	8.5	21.0	24.7	0	54.2	-	54.2
1978	8.0	20.3	24.5	-2.2	50.6	2.4	52.9
1979	8.7	17.6	27.2	-2.4	51.1	2.7	53.8
1980	9.7	22.0	28.4	-2.8	57.3	3.2	60.5
1981	8.8	25.6	22.3	-2.8	53.9	2.3	56.3
1982	5.9	25.2	26.2	-2.3	55.0	3.1	58.1
1983	6.2	26.3	27.1	-2.1	57.5	2.6	60.1
1984	9.5	33.0	22.9	-2.1	63.3	1.9	65.1
1985	9.2	27.5	21.0	-1.6	56.1	3.8	59.9
1986	7.3	27.4	23.9	-1.5	57.1	3.0	60.1
1987	7.8	32.9	24.7	-2.0	63.4	2.0	65.3
1988	8.8	30.9	26.6	-1.5	64.8	2.0	66.8
1989	7.4	26.9	32.0	0.2	66.5	2.3	68.8
1990	6.7	23.0	34.4	-4.2	59.9	1.5	61.4
1991	8.3	21.5	31.6	-3.9	57.6	1.7	59.3
1992	8.6	22.5	23.5	2.1	56.6	1.7	58.3
1993	8.5	20.5	19.8	3.3	52.1	1.5	53.6
1994	5.4	21.1	24.7	0	51.3	1.9	53.1
1995	5.3	24.1	28.1	0	57.6	1.2	58.9
1996	4.4	24.7	18.0	0	47.2	1.5	48.8
1997	3.3	18.9	20.3	0	42.6	1.8	44.4
1998	3.2	18.7	13.1	0	35.0	0.8	35.8
1999	4.3	24.0	11.6	0	39.8	0.8	40.6
2000	4.0	26.0	12.0	0	42.0	0.6	42.6
2001	4.4	23.1	9.2	0	36.7	0.5	37.2
2002	2.9	21.1	15.9	0	40.1	0.3	40.4
2003	2.8	23.7	15.3	0	41.9	-	41.9
2004	4.4	27.2	15.5	1	47.1	-	47.1

(1) Spanish data for 1961-1972 not revised, data for Subarea VIII for 1973-1978 include data for Divisions VIIIa,b only. Data for 1979-1981 are revised based on French surveillance data. Includes Divisions IIIa, IVb,c from 1976. There are some unallocated landings moreover for the period 1961-1970.

(2) Discards have been estimated from 1978 and only for Divisions VIIII a,b.

(3) From 1978 total catches used for the Working Group.

Table 1.4.1.2 Hake - Northern stock (IIIa, IV, VI, VII, VIIIa,b)

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1978	277660	192665	49521	0.2270
1979	254460	224837	50637	0.2110
1980	332232	207347	56473	0.2329
1981	239684	217613	53920	0.2361
1982	201512	211917	54996	0.2623
1983	206859	197230	57508	0.2731
1984	188651	200204	63288	0.2921
1985	209204	256321	56100	0.1929
1986	194203	214833	57093	0.2173
1987	206934	182306	63368	0.2797
1988	215365	148887	64824	0.3493
1989	198140	133370	66472	0.3765
1990	257601	113316	64288	0.3855
1991	209319	102910	52373	0.3052
1992	245583	97291	56618	0.3815
1993	215587	99118	52146	0.2850
1994	182469	98324	51259	0.3634
1995	202876	105559	57619	0.4081
1996	205133	103595	47213	0.3276
1997	163568	110252	42600	0.2833
1998	152210	106421	35010	0.2664
1999	165520	100635	39814	0.3028
2000	160058	101919	42022	0.3102
2001	177149	111059	36675	0.2296
2002	247375	116462	40105	0.2428
2003	161838	119884	41877	0.2477
2004	195919*	134930	47123	0.2398
2005	195919*	137521		
Average	209394	148915	51887	0.2863

* GM for 1990-2002

Celtic Sea and Western Channel Cod

(Divisions VIIe-k)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

The state of this stock is unknown in relation to precautionary reference points. The last available assessment for 2002 based on landings indicated that the stock was above B_{pa} but was being harvested unsustainably. Effort in the main fleet targeting this stock (French), has been declining since the late 1990s. This suggests that fishing mortality may have been reduced but the current SSB in relation to B_{pa} is uncertain. Historical recruitment is highly variable but indications from survey data suggest that recent recruitments have been low.

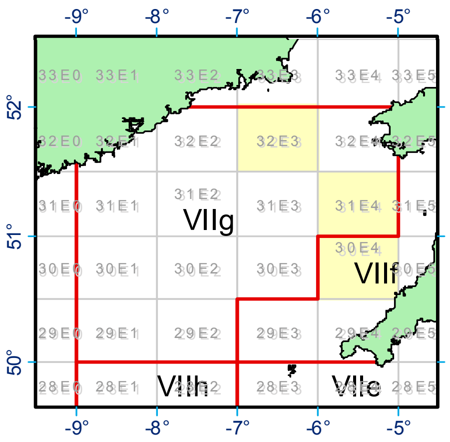
Long Term Considerations
FSS advise that this stock should be managed on a long term basis by reducing F to levels which will be associated with high long term yields. Although current fishing mortality is unknown, an appropriate management plan would be to maintain F at a low precautionary target level to ensure that any recruiting year classes survive and contribute to SSB and yield.

Short Term Considerations
Continuation of the February-March closure in 2006, (see map) may reduce landings by about 10% (Biseau 2005). FSS advise that the closure should restrict all fleets including Belgium. FSS suggest that it should also be accompanied a TAC reduction as a necessary protection should effort redistribution result in the closure failing to fully achieve its objectives.

Whilst cod fishing mortality is expected to be reduced despite fishing effort redistribution following the area closure, this may not be the case for all species. Potential effort redistribution towards other species for which effort restrictions are also needed may require that further effort control measures are implemented.

CURRENT MANAGEMENT

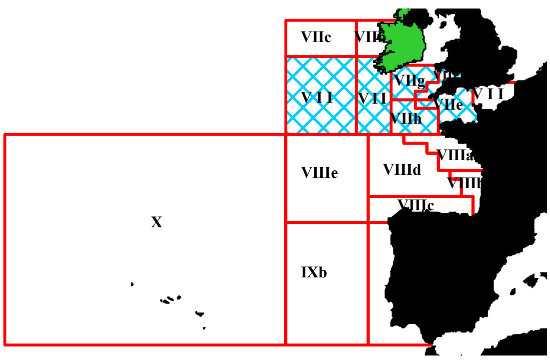
- The TAC area covers Divisions VIIb-k, and Sub-areas VIII, IX and X.
- The assessment area covers Divisions VIIe-k.
- The 2005 TAC was 6,200 t with an associated Irish quota of 849 t.
- There are no explicit management objectives or management plan for this stock.
- FSS recommend that management objectives be established and that a management plan be developed and implemented for fisheries catching cod.
- In 2005 an area closure in February - March was implemented at the instigation of the French, UK and Irish industries. Belgium received a derogation. The closure was intended to reduce landings by at least 13% but was not accompanied by equivalent TAC decreases. This implied that a re-distribution of effort was possible and may have reduced the effectiveness of the closure.



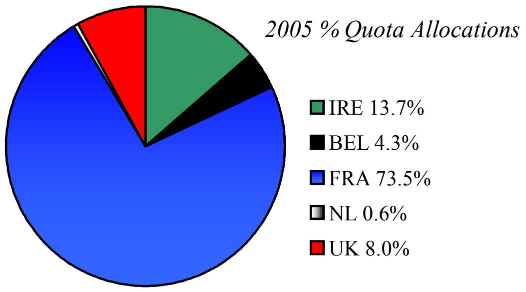
First quarter cod area closures

ADDITIONAL INFORMATION

1. There was no accepted assessment for this stock in 2004.
2. Irish landings in 2004 were 647 t in Divisions VIIe-k. This is an increase of 23% from the 2003 landings.
3. There is no information on misreporting for this stock but it is suspected given the restrictive TACs in recent years. Under-reporting and area misreporting is a problem in some fleets and may also be a major source of



Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*



uncertainty in this assessment. There is not sufficient information to provide a quantitative estimate of this.

4. France took about 68% of the total reported landings in VIIe-k in 2004. Ireland, the UK and Belgium landed about 19%, 8% and 5% of the 2004 landings respectively.
5. Most of the reported French landings are from the Lorient-based gadoid fleet.
6. Demersal trawlers from Dunmore East and Castletownbere and other ports in south-west Ireland have traditionally targeted Celtic Sea cod during the spring. There is a well established gill net fishery in the south east ports and in recent years a targeted gill net fishery involving boats from Dingle has also become important.
7. Discards in Irish fisheries in recent years have been estimated at less than 1% of landings from Divisions VIIg and VIIj. A major problem for the assessment of this stock is the lack of discard information. There is no discard information for the main French fleet in which discarding and high-grading is thought to be substantial in recent years. Previous Irish discard studies suggest that discarding of cod is low, while for the UK otter trawlers discarding can be as high as 64% in number. These are not accounted for in assessment.

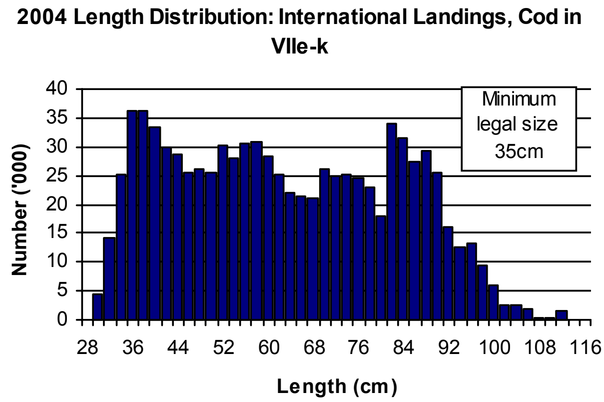
Reference:

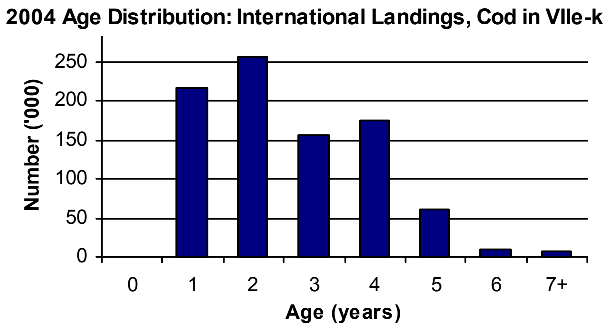
Biseau, A. (2005). Working document to the 2005 Working Group on the Assessment of Southern Shelf Demersal Stocks - Effect of the Cod closure (ICES rectangles 30E4, 31E4, 32E3) in the Celtic Sea on the fishing behaviour.

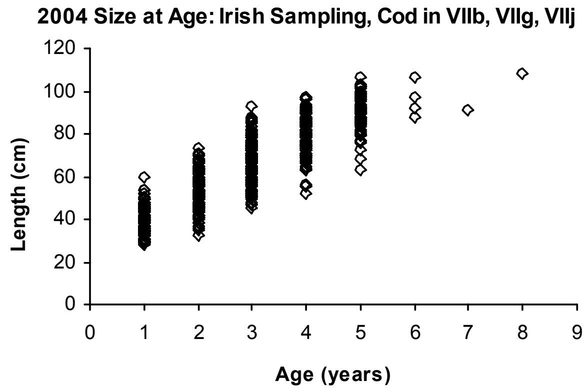
ICES ADVICE
1.4.2

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Unknown	Unknown	Unknown







The last reliable assessment for 2002 based on landings indicated that the stock was above $\mathbf{B}_{pa}$ and was being harvested unsustainably. Effort in the main fleet targeting this stock has been declining since the late 1990s. This suggests that fishing mortality may have been reduced, but the current SSB in relation to $\mathbf{B}_{pa}$ is uncertain. Historically, recruitment is highly variable, but indications from survey data suggest that recent recruitments have been low.

Management objectives

There are no specific management objectives for this stock or a management plan.

Reference points

$\mathbf{B}_{lim}$ and $\mathbf{B}_{pa}$ were revised in 2004.

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is 6 300 t, the lowest observed spawning stock biomass.	$\mathbf{B}_{pa}$ be set at 8 800 t. Biomass above this value affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the variability in the stock dynamics and the uncertainty in assessments.
	$\mathbf{F}_{lim}$ is 0.90, the fishing mortality estimated to lead to potential collapse.	$\mathbf{F}_{pa}$ be set at 0.68. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$ and maintaining SSB above $\mathbf{B}_{pa}$ in the medium term, taking into account the uncertainty assessments.

Due to recent changes in discarding and high grading practices the present exploitation pattern is not known and therefore yield and spawning biomass per recruit relevant for the present fishery cannot be calculated.

Technical basis

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$.(B76)	$\mathbf{B}_{pa} = \mathbf{B}_{lim} * 1.4$
$\mathbf{F}_{lim}$ = based on historical response of the stock	$\mathbf{F}_{pa} = 5^{th}$ percentile of $\mathbf{F}_{loss}$

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

The reduction of effort which has taken place since 1999 may not have reduced fishing mortality to sustainable levels. Reduction of effort would improve yields and reduce risks to the stock in the longer term. Therefore, in view of the uncertainty of the data and the high fishing mortality estimated for 2002, effort should be reduced to ensure a longer-term reduction in fishing mortality towards sustainable levels. Adequate monitoring, including discard monitoring should be implemented.

Management considerations

An appropriate management plan would be to maintain fishing mortality at a low precautionary target level to ensure that any recruiting year classes survive and contribute to SSB and yield. Historically, fishing mortality has always been well above any potential targets and although effort targeting cod has reduced in recent years due to fleet changes and closed areas, further measures are required to reduce fishing mortality in the short term.

ICES has made preliminary explorations of a possible management plan option to reduce F to reach levels associated with high long-term yields. For illustrative purposes only, Figure 1.4.2.2 shows one of these preliminary explorations based on assumptions that recent fishing mortality has been maintained at a high level until 2004 and that future recruitment will be variable around the average when SSB is either above $\mathbf{B}_{lim}$ or reduced to below $\mathbf{B}_{lim}$. The absolute numerical results are very sensitive to the recruitment assumptions and these assumptions need to be fully investigated before quantitative predictions are used for management purpose. However, the general trends are informative and demonstrate that a gradual reduction of fishing mortality, if implemented efficiently may imply small immediate losses to yield, while gains in terms of both increased yield and reduced risk to SSB will materialise within a short time after implementation of such a strategy. A dialogue between managers and stakeholders will be required to define an appropriate management plan for this fishery.

Restrictive quotas have resulted in a change in discarding practices (i. e. high grading of catch such that only larger cod were reported as landed) for the main fleet exploiting this stock in 2003 and 2004. Substantial underreporting of landings is also known to occur but cannot yet be adequately quantified. Cod in this area is a fast-growing and early-maturing fish, and the future SSBs are highly dependent on the strength of incoming year classes. Indications from survey data suggest that recent recruitments have been low.

In 2005, part of the Celtic Sea was temporarily closed for trawlers. The impact of this closure on the fishing mortality cannot yet be quantified.

The assessment area covers Divisions VIIe-k and the ICES advice applies to these areas only, and this does not correspond to the TAC area. The TAC is set for Divisions VIIb-k, Subareas VIII, IX, X, and CECAF 34.1.1. Within this larger area there is no control over where the catches will be taken. Current management measures for Divisions VIIe-k include cod in Divisions VIIbc and cod in Division VIId. Cod in Division VIId is assessed together with cod in the North Sea.

Ecosystem considerations

Most cod spawning in the Celtic Sea occurs off northern Cornwall in mid- to late March. There is also some spawning off southeast Ireland and a little in the Western Channel.

Tagging studies have given no evidence of cod movement out of Division VIIe and into VIIfg, where there appears to be a simple inshore-offshore migration between deepwater wrecks and reefs in the summer and inshore spawning areas in the winter. Recent tagging work in the Irish Sea suggests that only a small component of cod landings from the Celtic Sea are fish which spawn in the Irish Sea. Furthermore, no cod tagged in the Celtic Sea were recaptured in the Irish Sea.

Cod in the Celtic Sea are at the southern limit of the range of the species in the Northeast Atlantic. The warmer waters means that growth rates in the Celtic Sea are among the fastest observed for the species. It is also known that at the southern limits of their range recruitment tends to decrease in warmer waters (above 8.5°C) and that cod are not found in waters warmer than 12°C. It is unclear to what extent the recent poor recruitments are linked to an increase in water temperature. Fishing mortality remains an important factor in fish productivity.

Factors affecting the fisheries and the stock

Cod in Divisions VIIe-k are taken in mixed trawl fisheries. Landings are made mainly by French gadoid trawlers, which prior to 1980 were mainly fishing for hake in the Celtic Sea. Landings of cod by French *Nephrops* trawlers have fluctuated between 10% and 20% of the total French cod landings from this stock in recent years. UK (England and Wales) accounts for about 10% and Ireland for 15%, while Belgian vessels take about 5%. Landings occur throughout the year, but mainly in the winter months during November to April, with a peak in February–March.

The effects of regulations

Technical measures applied to this stock are a minimum mesh size for beam and otter trawlers in Subarea VII and a minimum landing size (35 cm). There is a specific minimum landing size of 40 cm applied to Belgian trawlers that land in Belgium. Minimum landing sizes do not prevent cod from being caught (and thrown back dead), but might prevent targeting juvenile cod.

Council Regulation (EC) No. 27/2005, Annex III, part A 12 (b) prohibited fishing in ICES rectangles 30E4, 31E4, and 32E3 during January–March 2005. This prohibition did not apply to beam trawlers during March. Fishing effort for the French fleets operating in the 3 closed rectangles was mainly displaced to other fishing grounds outside the Celtic Sea and to areas within the Celtic Sea with lower LPUE values for cod. Some vessels have also switched to another metier targeting anglerfish and megrim in the rest of the Celtic Sea. However, the results were too preliminary to draw any firm conclusions on the impact of this on the fishing mortality.

From the beginning of 2003, French trawlers were subject to trip landing restrictions. The restriction was suspended from May 2005 due to reduced catch rates. French vessels were also prohibited from landing the smallest size categories of cod from 2003. These two management controls were responsible for an increase in discarding due to high-grading of catches. Irish vessels are also subject to monthly quota limitations for cod.

Underreporting of landings is known to be a problem in some fleets.

Management regulations, particularly effort control regimes in other areas (Division VIIa, Subareas VI & IV), became increasingly restrictive in 2004 and 2005 and should not be allowed to result in a displacement of effort into the Celtic Sea.

Changes in fishing technology and fishing patterns

In recent years there has been a substantial behavioural change in the main fisheries with regard to discarding. Discarding (and probably underreporting) occurred in the last quarter of 2002 as the French fishery was closed when the cod quota was exhausted. In 2003 and 2004 it is thought that there was substantial high-grading of marketable cod in order to prevent a new closure of the fishery.

Analysis of French logbook data from 1999–2003 shows a large increase in the incidence of fishing operations where no cod has been landed. This is considered to be indicative of either increased discarding or avoidance of cod due to trip-by-trip limitation.

Scientific basis

Data and methods

No analytical assessment could be carried. The landings-at-age data which formerly were the basis of the assessment are thought to be biased and unreliable since 2003. This is due to the substantial changes in discarding practices described above.

Information from the fishing industry

Meetings with representatives of the fishing industry were held prior to WGSSDS 2005 in France, Ireland, and the UK.

Uncertainties in assessment and forecast

A major problem for the assessment of this stock is the lack of discard information. There is no discard information for the main French fleet in which discarding and high-grading of marketable catch is thought to be substantial in recent years. Previous Irish discard studies suggest that discarding of cod is low, while for the UK otter trawlers discarding can be as high as 64% in number. These are not accounted for in the assessment.

Underreporting and area misreporting is a problem in some fleets and may also be a major source of uncertainty in this assessment. There is not sufficient information to provide a quantitative estimate of this.

There is very little fishery-independent information for this stock. Because of the low cod abundance, the calculated abundance indices for both the UK and French surveys are based on very few cod caught. Therefore, one should be careful when drawing firm conclusions from those data. Nevertheless, both surveys give some indication of year class strength, especially when a very large year class comes through.

Comparison with previous assessment and advice

The analytical assessment was not accepted due to unreliable input data. Last year an analytical assessment could be performed, but this is now considered unreliable also.

Last year, ICES recommended a 17% reduction in F in order to bring SSB above $\mathbf{B}_{pa}$ in 2006. This year, due to the uncertainty on the current levels of F and SSB no forecast was carried out. ICES recommends that fishing effort should not be allowed to increase.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Landings[6]
1987	Reduce F	< 6.4[2]		10.2
1988	No increase in F; TAC	7.0[2]		17.2
1989	No increase in F; TAC	8.6[2]		19.8
1990	No increase in F; TAC	9.2[2]		12.7
1991	TAC; SSB = mean	4.5[2]		9.3
1992	Appropriate to reduce F	-		9.7
1993	20% reduction in F	6.5[2]	19.0	10.4
1994	20% reduction in F	5.6[2]	17.0	10.6
1995	20% reduction in F	4.7[3]	17.0	11.7
1996	20% reduction in F	4.7[3]	20.0	12.6
1997	20% reduction in F	7.4[4]	20.0	12.0
1998	10% reduction in F	8.8[4]	20.0	11.4
1999	Reduce F below $\mathbf{F}_{pa}$	9.2[4]	19.0	9.9
2000	Reduce F below $\mathbf{F}_{pa}$	< 7.6[5]	16.0	6.9
2001	40% reduction in F	< 4.3[5]	10.5	8.2
2002	45% reduction in F	< 5.3[5]	8.7	8.7
2003	60% reduction in F	< 3.8[5]	6.7	6.0
2004	90% reduction in F or management plan	<0.7	5.7	3.4
2005	17% reduction in F	<5.2	6.2	
2006	No increase in effort	Cannot be estimated		

Weights in '000 t.
[1]TAC covers Subareas VII (except Division VIIa) and VIII. [2] For the VIIf+g stock component. [3] For the VIIf-h stock component.
[4] For the VIIe-h stock component. [5] For the VIIe-k stock component. [6]ACFM landings for the period 1988–2002 revised.

Table 1.4.2.1. Nominal landings of Cod in Divisions VIIe-k used by the Working Group.

Year	Belgium	France	Ireland	UK	Others	Total
1971						**5782**
1972						**4737**
1973						**4015**
1974						**2898**
1975						**3993**
1976						**4818**
1977						**3058**
1978						**3647**
1979						**4650**
1980						**7243**
1981						**10596**
1982						**8766**
1983						**9641**
1984						**6631**
1985						**8317**
1986						**10475**
1987						**10228**
1988	554	13863	1480	1292	2	17191
1989	910	15801	1860	1223	15	19809
1990	621	9383	1241	1346	158	12749
1991	303	6260	1659	1094	20	9336
1992	195	7120	1212	1207	13	9747
1993	391	8317	766	945	6	10425
1994	398	7692	1616	906	8	10620
1995	400	8321	1946	1034	8	11709
1996	552	8981	1982	1166	0	12681
1997	694	8662	1513	1166	0	12035
1998	528	8096	1718	1089	0	11431
1999	326	6820	1883	897	0	9926
2000	208	4690	1302	744	0	6944
2001	347	5914	1091	838	0	8190
2002	555	6897	694	618	0	8764
2003	136	5018	517	346	0	6017
2004*	153	2299	647	282	0	3381

*Provisional.
Scaled landings 1971–1987 (SSDS WG 1999).

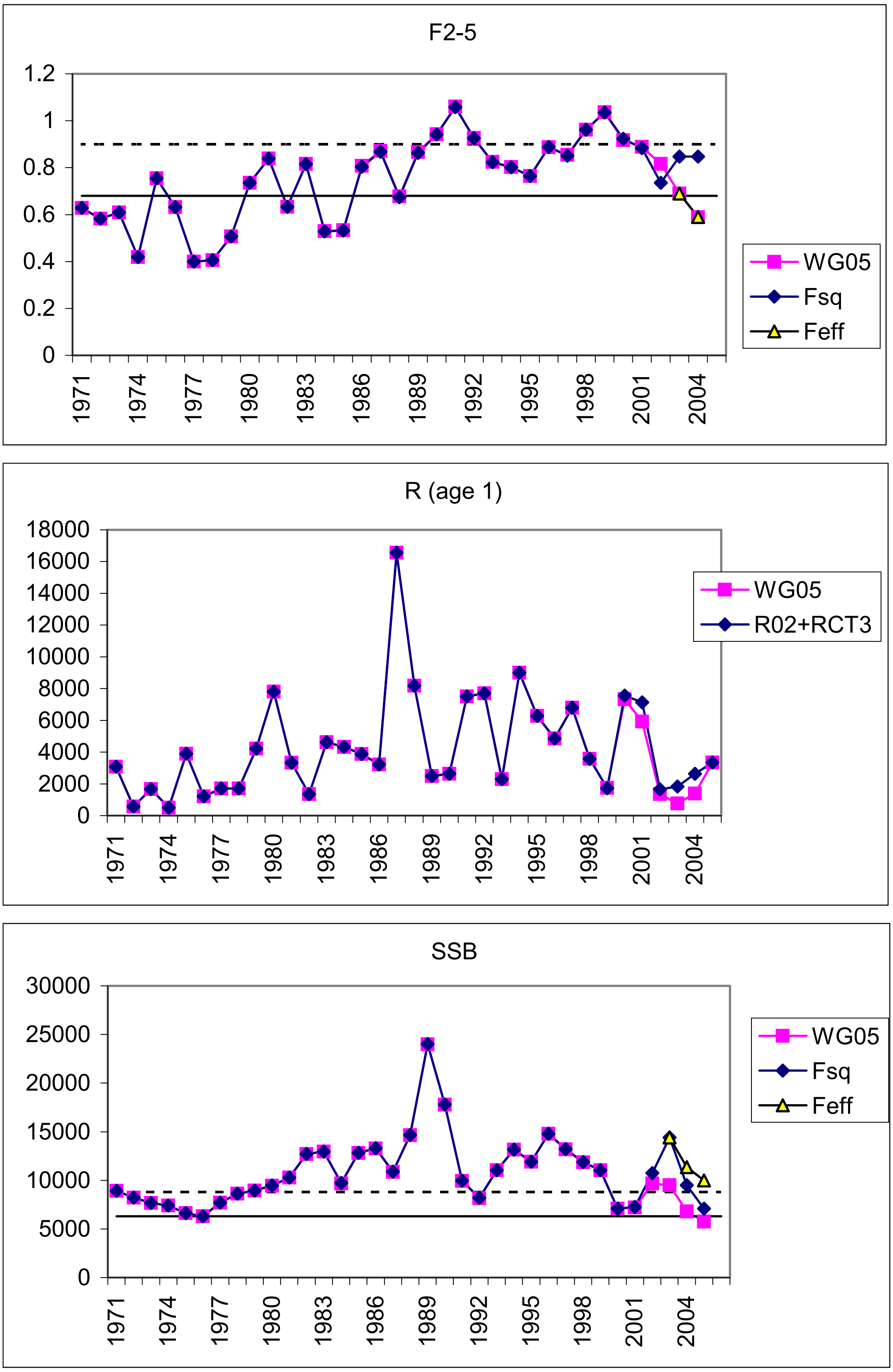


Figure 1.4.2.1 Cod in VIIe-k: Trends in fishing mortality for ages 2-5 (F2-5), recruitment and spawning stock biomass, and SSB.

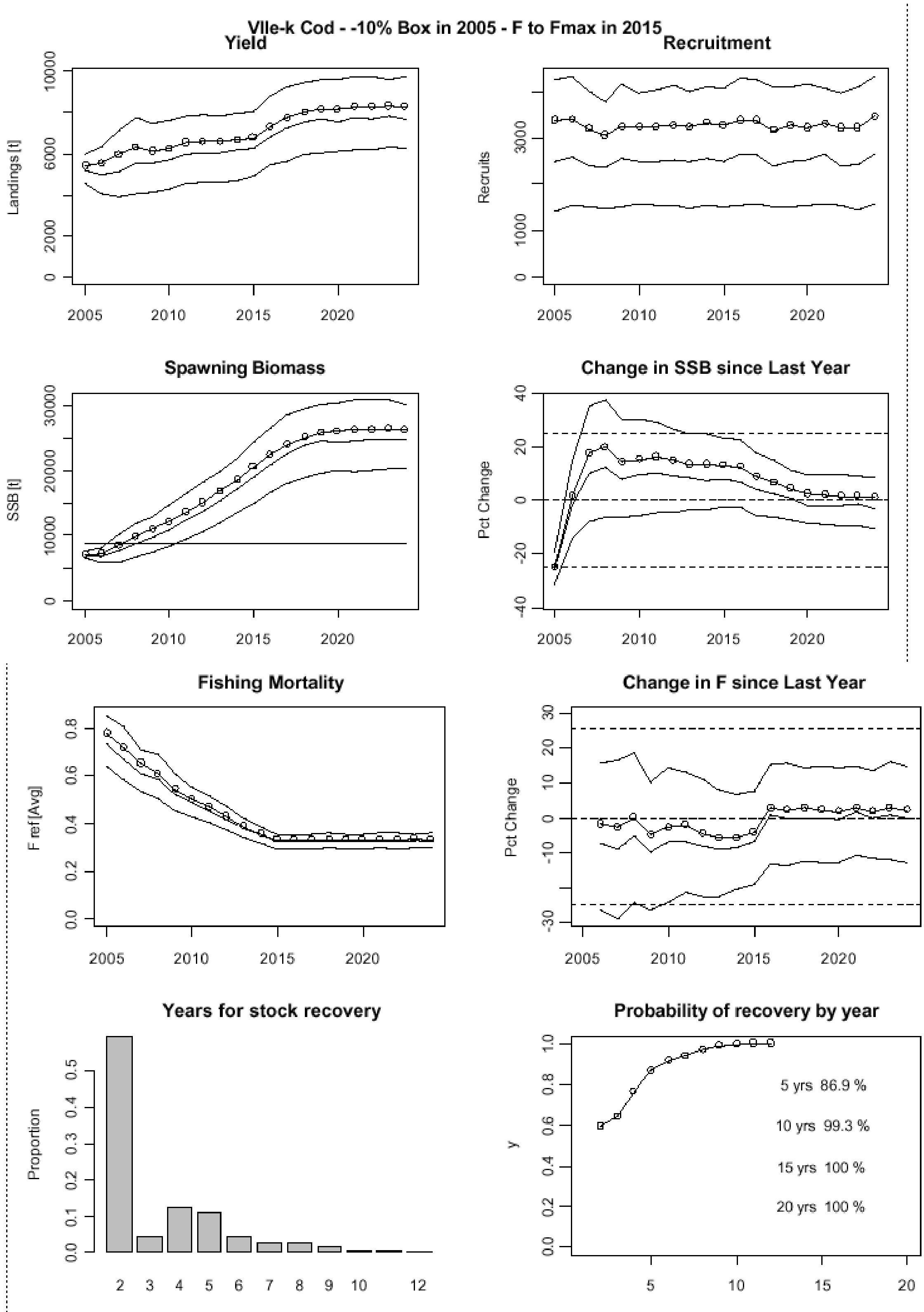


Figure 1.4.2.2 Management strategy simulation for Cod in VIIe-k: Progressive reduction in F by equal annual increments to reach $\mathbf{F}_{max}$ 0.33 in 2015. In deriving the scenario it was assumed that Fs in 2003 and 2004 were equal to the mean 2000–2002 ($\mathbf{F}_{sq}$=0.85), and that recruitment is independent of SSB (with log normal error) when SSB > $\mathbf{B}_{lim}$. This scenario also assumes that the seasonal closure implemented in 2005 has reduced F by 10%.

West of Ireland Cod

(Divisions VIIb,c)

Marine Institute
Foras na Mara

Fisheries Science Services

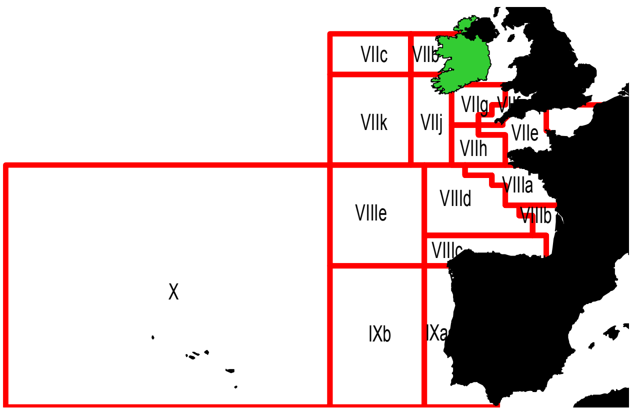
FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

The state of this stock is unknown.

Short Term Considerations
Catches in 2006 should be no more than the recent average (2000 to 2002) of around 155 t in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment. This translates to an Irish quota of 90 t.

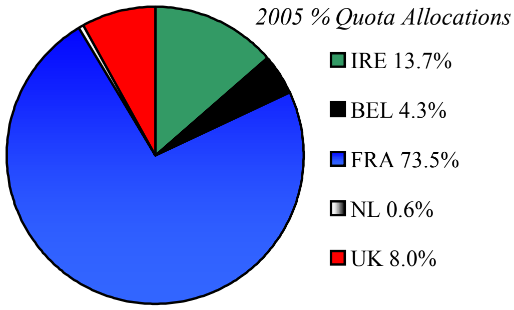
Cod in Divisions VIIb,c are included in the management area VIIb-k. There was no ICES advice for this stock



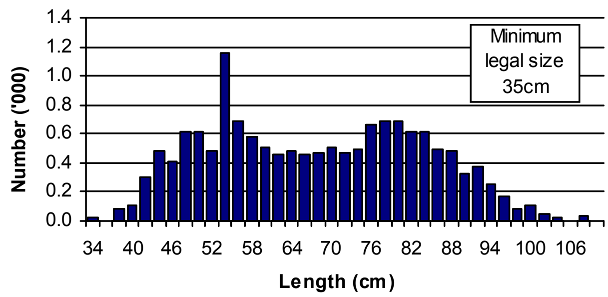
Red Boxes-TAC/Management Areas

ADDITIONAL INFORMATION

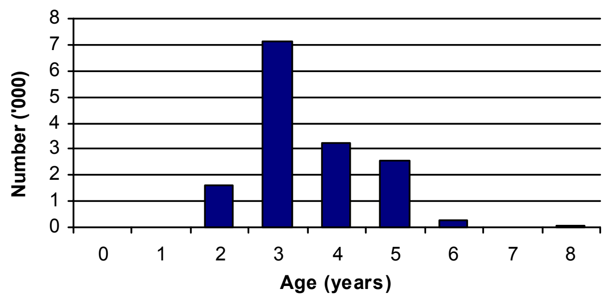
1. There is no official ICES advice for this stock.
2. The TAC area covers Divisions VIIb-k, Sub-areas VIII, IX X and CECAF 34.1.1 (Madeira). The TAC in 2005 was set at 6,200 t with an associated Irish quota of 849 t.
3. Irish landings in 2004 were 59 t, (estimate) a 48% increase of last years landings of 40 t.
4. The level of misreporting in this area is unknown.
5. Ireland is the major participant in this fishery. The UK and France land the remainder. Cod are caught in mixed species otter trawl fisheries in VIIb,c by vessels operating from Killybegs, Rossaveal and Dingle.
6. Cod are an economically valuable by-catch in fisheries targeting anglerfish, megrim and *Nephrops* in this area.
7. FSS sampling indicates that the length distribution of Cod VIIb is dominated by 3 year olds.
8. FSS data on discarding of cod in this area is limited but discards are considered to be negligible.
9. The linkages between Cod VIIb,c and adjacent areas is unclear. Until the dynamics of these cod stocks are resolved the ICES Assessment Working Group will continue the collation of data on VIIb,c cod.



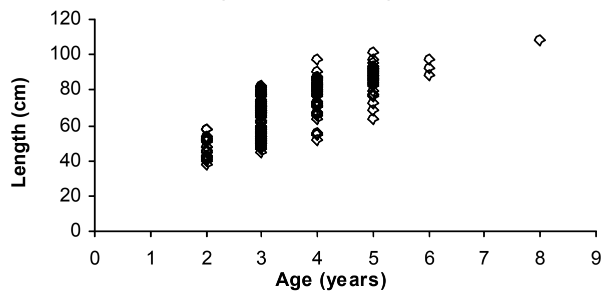
2004 Length Distribution: Irish Landings, Cod in VIIb,c



2004 Age Distribution: Irish Landings, Cod in VIIb,c



2004 Size at Age: Irish Sampling, Cod in VIIb,c



Nominal Landings (t) of Cod in Division VIIb,c for 1995-2004

Country	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
France	91	115	71	44	…[1]	44	38	54	21	
Germany	-	-	3	-	-	-	-	-		
Ireland	282	353	177	234	154	141	107	59	58	
Netherlands	-	-	-	-	-	-	+	-	1	
Norway	3	1	6		11	+*	1	5		
Spain	6	3		6	2	3	1	1		
UK(E/W/NI)	25	35	37	25	4	4	2	1	8	
UK(Scotland)	66	12	7	9	1	-		1		10.2
Total	**473**	**519**	**301**	**318**	**172**	**192**	**150**	**122**	**88**	**10.2**
Unalllocated										75.03

West of Ireland and Celtic Sea Haddock

(Divisions VIIb-k)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

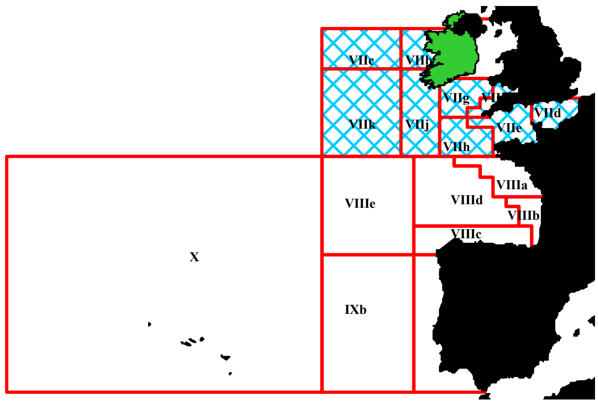
The state of the stock is unknown in relation to precautionary limit reference points. However analysis shows that there is no indication of a declining trend in SSB. There were strong 1995 and 2002 year classes.

Long Term Considerations
FSS consider that a well defined 'management plan' is necessary for Celtic Sea mixed fisheries. FSS therefore recommends that stakeholders should develop and implement a long term management plan, with clearly defined objectives, that will ensure a high probability of fishing within safe biological limits. FSS considers that TAC management has proved to be an ineffective means of accommodating variation in recruitment, because of the long time-interval between assessment and implementation. FSS recommend that long term management plans recognise that species such as haddock are subject to highly sporadic recruitment, which will result in substantial variation in catches and SSB from year to year. FSS recommend that a within-year review of management controls, taking into account real-time information, would allow a more effective means of exploiting the periodic recruitment characteristics of haddock stocks.

Short Term Considerations
Because of the strong 2002-year class SSB has increased but ICES is unable to provide a reliable estimate of current stock size in relation to precautionary limits. Future catches and SSB will be highly dependent on the strength of incoming year classes and their discard mortality. In this context the stock should be managed by ensuring that the effort is not allowed to increase, rather than by TAC management. FSS therefore agree with the ICES advice that effort is not allowed to increase. FSS note that information on the level of catches is now so poor that it is not possible to advise on appropriate fishing mortality. FSS note that SSB is not depleted and therefore advise that as a precautionary measure the TAC for six of twelve months should be set at 50% of the 2005 level, with a mid-year review.

TAC Area	TAC 2005	Irish quota 2005	Proposed TAC 2006 Jan - June[(a)]	Proposed Irish quota 2006 Jan - June
VII,VIII,IX,X	11,520	2,560	5,760	1,280
Separate TAC for VIIa since 2004	1,500	649	750	325

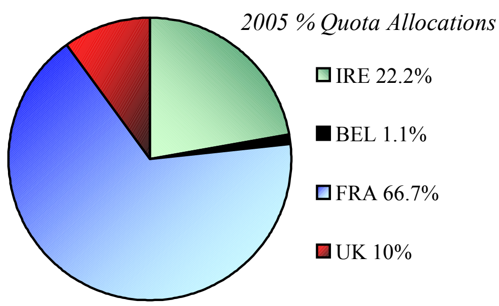
[a]: 50% of the 2005 TAC and quota, contingent on a mid-year review in 2006.



Red Boxes-TAC/Management Areas Blue Shading– Assessment Area

CURRENT MANAGEMENT

- The TAC area traditionally covers Sub-areas VII, VIII, IX, X and CECAF 34.1.1 with a separate TAC introduced for VIIa in 2004.
- In 2005, the TAC for Divisions VII, VIII, IX, X and CECAF 34.1.1 was 11,520 t with an associated Irish quota of 2,560 t
- There are no explicit management objectives or a management plan for this stock.

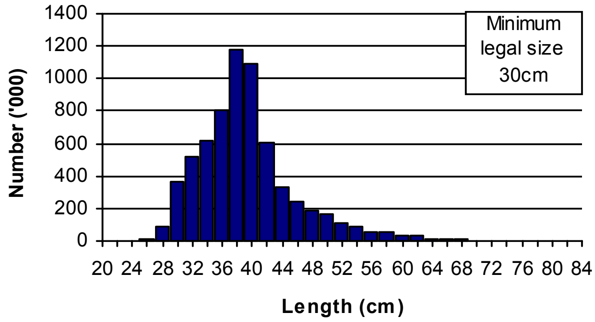


- FSS recommend that management objectives be established and that a management plan be developed and implemented for fisheries catching haddock.

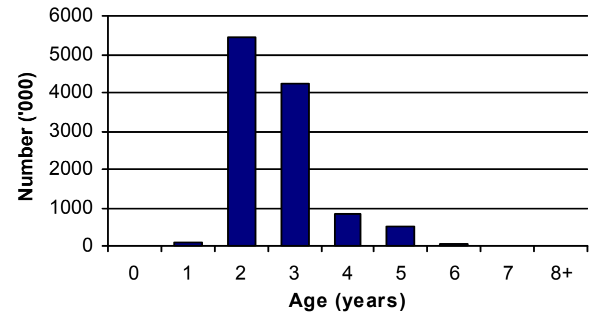
ADDITIONAL INFORMATION

1. Direct comparison between the assessment carried out at the 2005 and 2004 WGSSDS is not possible due to the differences in settings used. There is inadequate data on discarding available so F was calculated at the 2004 WGSSDS for ages 3-5 rather than ages 2-4. Nevertheless, both assessments show similar increases in SSB and a general decline in F. Survey estimates of recruitment also indicate that the 2002 year class is large.
2. The final assessment was carried out with ages 3-8+ in the catch numbers at age matrix to circumvent the inability to estimate discard information. Consequently this assessment only reflects the state of the fished component of the stock in the fishery but prevents an estimate of recruitment at younger ages.
3. Irish landings in 2004 were estimated to be 1,710 t.
4. Haddock are caught in a mixed demersal fishery targeting haddock, cod and whiting. Management advice needs to be considered in that context.
5. Levels of misreporting are unknown for this fishery. Misreporting was previously not considered to be a problem because the TAC has always been in excess of landings. There is evidence of underreporting for some of the fleets although it remains difficulty to quantify. Recent reductions in the TAC have brought the TAC to a level closer to recent landings. Problems associated with mis-reporting may be exacerbated as quotas become increasingly restrictive. Despite the fact that the total reported landings for this stock remain below the TAC, fleets may be restricted by their individual quota allocation.
6. Irish groundfish survey data from 2003 and 2004 suggest that Division VIIb may be an important haddock nursery area for the Celtic Sea.
7. France takes about 50-60% of the landings. Ireland usually accounts for 25-40% with the remainder taken mostly by Belgium, the UK and Spain.
8. Even though discards were not included in the assessment, data from Irish and UK vessels operating in VIIg and VIIj indicate that discarding of the 2002 and 2003 year-classes is high. The length composition suggests that discarding of the 2004 year-class is also substantial in VIIb. These data indicate that estimates of F and catch numbers are too low, particularly at younger ages. The discard estimates are highly variable between areas, year classes and fleets and there is a clear difference in length distributions between areas. This may be attributed to seasonality, differences in selectivity or growth rates.

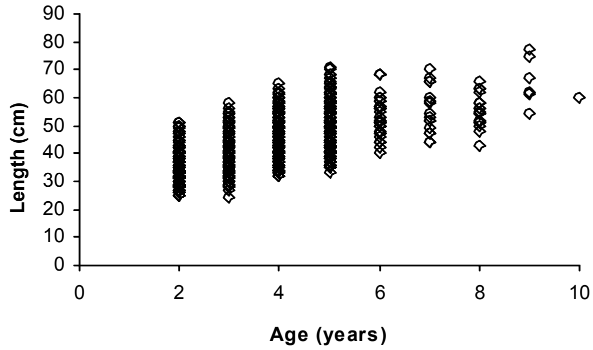
2004 Length Distribution: International Landings, Haddock in VIIb-k



2004 Age Distribution: International Landings, Haddock in VIIb-k



2004 Size at Age: Irish Sampling, Haddock in VIIb, g, & j



ICES ADVICE
1.4.4

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Unknown	Unknown	Unknown

The state of the stock is unknown in relation to precautionary reference points. Exploratory analysis shows no indication of a declining trend in SSB. Fishing mortality also appears to be relatively stable. Recruitment is highly variable and there were strong 1995 and 2002 year classes.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No precautionary reference points have been established.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

Current fishing mortality is unknown.

Exploitation boundaries in relation to precautionary considerations

Because of the strong 2002 year class SSB has increased, but ICES is unable to provide a reliable estimate of current stock size in relation to precautionary limits. Future catches and SSB will be highly dependent on the strength of incoming year classes and their discard mortality. In this context the stock should be managed by ensuring that the effort is not allowed to increase, rather than by TAC management.

Outlook for 2006

Due to large uncertainties in estimates of stock size and fishing mortality, no deterministic forecast can be presented for haddock in Divisions VIIb-k.

Management considerations

The nature of haddock as a species indicates that large pulses in recruitments are likely to occur for this stock. The survival of any big year class (e.g. 2002) is uncertain due to the expected mortality associated with discarding for these young fish. Continuing to set TACs based on average landings without regard for expected increases in SSB will increase the propensity for discarding and misreporting. Management by TAC is not effective for this stock.

An increase in mesh size or other technical measures to minimize discarding would be of huge benefit to this stock and have a substantial impact on medium-term yield. Haddock is a relatively low value species and targeting practices in the fishery are highly dependent on availability and market demand.

Factors affecting the fisheries and the stock

Haddock in Divisions VIIb-k are mainly taken in mixed trawl fisheries. These are the same fisheries fishing for cod and whiting.

The effects of regulations

The TAC for haddock is set for all of Subareas VII, VIII, IX, and X. Quotas in recent years have been based on average landings and as the strong 2002 year class recruited to the fishery underreporting, species misspecification of landings and high grading are know to have increased. Technical measures applied to this stock include a minimum landing size (≥ 30 cm) and the minimum mesh sizes applicable to the mixed demersal fisheries. Given the observed discarding rates in some towed gears there is a mismatch between minimum mesh sizes in these mixed demersal fisheries and the MLS.

Within the large management area there is no control over where the catches will be taken. Current management measures for Divisions VIIb-k include haddock in Division VIIa. Whatever management measures are implemented, they must be consistent with the assessment area.

Council Regulation (EC) No. 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in Divisions VIIb, VIIj, VIIg. and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average national annual effort (calculated over the period 1998–2002).

Council Regulation (EC) No. 27/2005, Annex III, part A 12 (b) prohibited fishing in ICES rectangles 30E4, 31E4, and 32E3 during January–March 2005. The impact of this on the haddock stock is not yet known.

Scientific basis

Data and methods

An exploratory assessment was carried out, but the available data were not considered sufficient to provide a reliable indication of stock trends. A major shortcoming is the lack of a timeseries of discard data and recent underreporting estimates. Survey information was available, but these data require closer examination before they can be used to assess the stock.

Information from the fishing industry

Meetings with representatives of the fishing industry were held prior to the assessment group ($WGSSDS_{2005}$) in Ireland and the UK. No specific concerns were raised about the state of this stock or its assessment.

Uncertainties in assessment and forecast

Only exploratory analytical assessment could be carried out for this stock.

The stock structure is uncertain. Stocks of haddock in Divisions VIa, VIIa, and VIIb-k have shown different growth rates and patterns of recruitment variation during the 1990s. This may reflect latitudinal variations in environmental conditions. Catches of haddock along the Atlantic seaboard of the British Isles are recorded more or less continuously between the west coast of Scotland and the Celtic Sea. Significant genetic differences have been found between samples collected at much smaller spatial scales than the entire west coast of the British Isles (ICES: WGNSDS 1999). The implications of this result for evaluating the present stock management units remain unclear. Further investigation is needed to better define the biological stock units.

Comparison with previous assessment and advice

Last year an analytical assessment was accepted as indicative of stock trends. However, the new information on the extent of discarding and misreporting meant that ICES no longer considers this assessment to be reliable.

The advice is consistent with last year.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

Year	ICES Advice	Predicted catch corresp. To advice	Agreed TAC[1]	Official Landings[2]	ACFM landings
1987	Not dealt with			3.0	2.6
1988	Not dealt with			4.0	3.6
1989	Not dealt with			4.2	3.2
1990	Not dealt with			2.9	2.0
1991	Not dealt with			2.6	2.3
1992	Not dealt with			2.9	2.7
1993	Not dealt with			3.4	3.3
1994	Not dealt with			4.1	4.1
1995	Not dealt with		6	4.5	4.5
1996	Not dealt with		7[3]	6.7	6.8
1997	Not dealt with		14	10.3	10.8
1998	Not dealt with		20	7.4	7.7
1999	Not dealt with		22[5]	5.2	5.0
2000	No expansion of catches		16.6[5]	6.7	7.6
2001	No expansion of catches		12[5]	9.7	8.7
2002	No expansion of catches	8.0	9.3[5]	7.0	6.8
2003	No expansion of catches	7.2	8.185[5]	6.9	8.4
2004	No increase in F	-	9.600[5]	0.8[4]	7.9
2005	No increase in effort	-	11.520[5]		
2006	No increase in effort	-			

Weights in '000 t.
[1]Applies to Subareas VII, VIII, IX, and X. [2]Possible underestimates due to misreporting. [3]Increased in-year to 14 000 t. [4]Incomplete official statistics. [5]Includes separate Division VIIa allocation.

Table 1.4.4.1 Haddock in VIIb-k (Celtic Sea and West of Ireland). Nominal landings (t) of haddock in Divisions VIIb,c,e-k as officially reported to ICES and total landings as used by the Working Group.

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Belgium	-	4	6	12	64	117	22	18	21	51	123	189	133	246	142	51	90	165	132	118	135.2
France	3,328	2,438	2,279	2,380	3,275	3412	2110	1,247	1,461	1,839	2,788	2,964	4,527	6,581	3,674*	2,725	3,088	4,842	4,289	4,469	
Ireland	646	794	317	314	275	323	461	1,020	1,073	1,262	908	966	1,468	2,789	2,788	2,034	3,066	3,608	2,188	1867	
Netherlands								-	-	-	-	-	-	-	3	-	-				
Norway	17	4	86	-	-	27	31	38	26	-	17	64	38	31	49	71	13*	19	21*		
Spain	532	561	-	-	-	-	-	-	-	-	-	19	48	54	260	88	110	646	85	82	
UK (Channel Islands)	-	-	-	-	-	-	-		-	-	1	-	-	-	-	-	-				328
UK (England & Wales)	340	168	188	194	405	278	123	137	220	189	193	228	432	554	410	273	287	409	313	342	
UK (Scotland)	63	7	57	79	4	17	195	113	86	67	47	38	7	15	35	5	2	13	2	7	
United Kingdom																					312.5
Total	4926	3976	2933	2979	4023	4174	2942	2573	2887	3408	4077	4468	6653	10270	7361	5247	6656	9702	7030	6885	775.7
Unallocated										-60	54	2	103	557	307	-220	970	-956	-217	1,486	7112
Total as used by the Working Group										3,348	4,131	4,470	6,756	10,827	7,668	5,027	7,626	8746	6813	8371	7888

* Preliminary

Celtic Sea and Western Channel Whiting

(Division VIIe-k)

For latest information, see: http://www.ices.dk

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

ICES classifies this stock as having full reproductive potential. The stock is considered to be overfished in relation to long term yield. Since 1996 the TAC has been far in excess of scientific advice.

Short Term Considerations
No F_{pa} has been defined for this stock. Fishing at higher F would not result in a long term gain in yield and could result in a reduction in spawning stock. Therefore fishing mortality should not increase, corresponding to landings of at most 10,800 t in 2006.

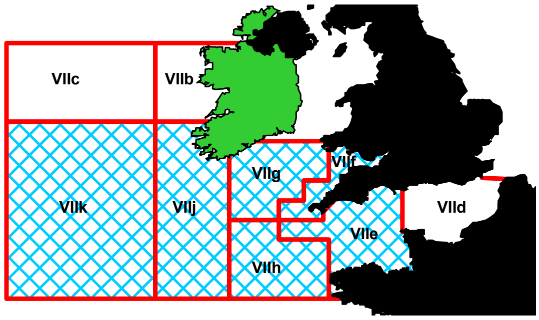
A considerable part of the whiting catch is discarded. Any measures to reduce discarding and to improve the fishing pattern should be encouraged.

FSS strongly advise that Division VIId should be included as part of the North Sea management area. Whiting in VIId is considered part of the North Sea stock and is assessed as such.

TAC Area	TAC 2005	Proposed TAC 2006	Basis
VIIe-k		10,800	Assessment
VIId		5,300	Average 2002-2004 landings
VIIb,c, VIII, IX, & X		521	Average 2001-2003 landings
Total TAC	21,600	16,621	Assessment
Irish quota	6,006	4,422	

CURRENT MANAGEMENT

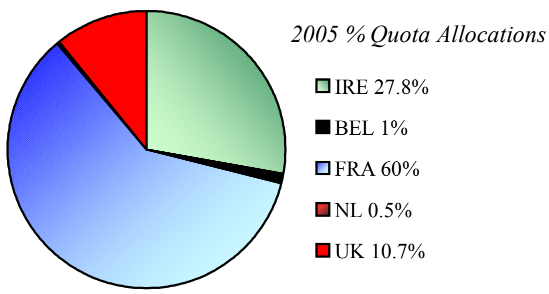
- The TAC area covers Divisions VIIb-k, and the assessment area covers Divisions VIIe-k.
- The 2005 TAC was 21,600 t with an associated Irish quota of 6,006 t.
- There are no explicit management objectives or plan for this stock.
- FSS recommend that management objectives be established and that a management plan be developed and implemented for fisheries catching whiting.



Red Boxes-TAC/Management Areas   Blue Shading– Assessment Area

ADDITIONAL INFORMATION

1. Discard levels of whiting are very high and are not included in this assessment this leads to considerable assessment uncertainty particularly when strong year classes enter the fishery. Appropriate long-term target fishing mortalities such as $F_{0.1}$ are not possible to predict accurately given the extent of discarding in this stock.
2. Irish landings in 2004 were estimated to be about 4,260 t.
3. The level of misreporting of this stock is not known. Under-reporting has previously been considered unlikely because the TAC has been in excess of recent landings. There is some recent evidence of over-reporting, caused by species misreporting, in some fleets. However the WG was not able to quantify whether this has occurred over an extended period, or in all fleets.
4. Demersal trawlers from Dunmore East and Castletownbere and other ports in south-west Ireland have traditionally targeted Celtic Sea whiting in a mixed trawl fishery. Poor catches elsewhere have attracted vessels from Greencastle, Co. Donegal to this fishery in recent years.
5. The international catch is dominated by a broad range of age groups.
6. Data collected under the EU Data Collection Regulations has been provided to the WG by some countries and indicates that discarding rates are generally high in their fisheries. However, the levels of discarding by



the major trawl fleets in the Celtic Sea (French), were not available for evaluation by the WG. Substantial discarding levels may imply that estimates of F and catch numbers are too low, particularly at younger ages.

ICES ADVICE
1.4.6

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Full reproductive capacity	Unknown	Overexploited

Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as having full reproductive capacity. SSB reached high levels in 1995 and 1996, and has decreased until 1999 though remaining well above $\mathbf{B}_{pa}$. SSB increased in 2001 as the strong 1999 year class matured. The 2000–2004 year classes are estimated to have been below average. Fishing mortality was very high during the 1980s, decreased in the early 1990s, and is currently estimated to be around 0.45.

Management objectives

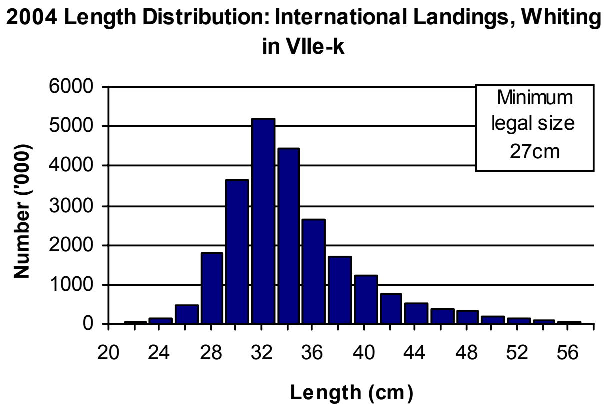
There are no specific management objectives for this stock.

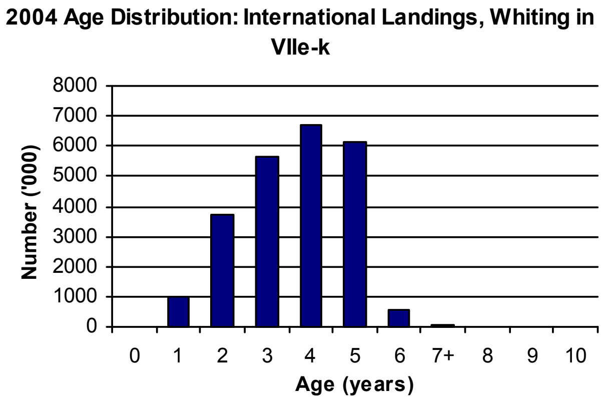
Reference points

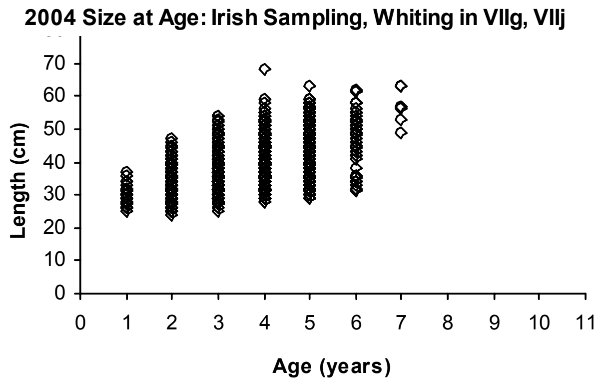
Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 2-5	Yield/R	SSB/R
Average last 3 years	0.514	0.190	0.537
$\mathbf{F}_{0.1}$	0.181	0.168	0.994
$\mathbf{F}_{med}$	0.981	0.188	0.376

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the reproductive potential of the stock may be around $\mathbf{F}_{0.1}$.







	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is 15 000 t, the lowest observed spawning stock biomass.	$\mathbf{B}_{pa}$ be set at 21 000 t. Biomass above this affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of the assessment.
	$\mathbf{F}_{lim}$ is not defined.	$\mathbf{F}_{pa}$ not proposed.

Technical basis

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa} = \mathbf{B}_{lim} * 1.4$
$\mathbf{F}_{lim}$ not proposed.	$\mathbf{F}_{pa}$ not proposed.

Single-stock exploitation boundaries

Exploitation boundaries in relation to management plan

There is no management plan for this stock.

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

The current fishing mortality, estimated at 0.51, is above a fishing mortality that would lead to high long-term yields ($\mathbf{F}_{0.1}$ = 0.18) ($\mathbf{F}_{max}$ is not well defined). Fishing at a lower mortality would lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

No $\mathbf{F}_{pa}$ has been defined for this stock. As there is no long-term gain in yield, which will result in a reduction in the spawning stock, fishing mortality should not increase, corresponding to landings of, at the most, 10 800 t in 2006.

Short-term implications

Outlook for 2006

Basis: F(2005) = $\mathbf{F}_{sq}$ = mean F(02-04) = 0.51; $R_{04\text{-}05}$ = GM = 76.4 million; SSB(2005) = 29.26 kt; SSB(2006) = 32.41 kt; landings (2005) = 10.83 kt.
The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.51.
The fishing mortality which is consistent with taking a high long-term yield and achieving low risk of depleting the productive potential of the stock (F(long-term yield)) is 0.18.

Rationale	TAC(2006)	Basis	F(2006)	SSB(2007)	%SSB change
Zero catch	0.00	F=0	0.00	46.9	45%
Status quo	10.84	$\mathbf{F}_{sq}$	0.51	35.6	10%
High long-term yield	4.42	F(long-term yield)	0.18	42.3	30%
	1.35	$\mathbf{F}_{sq}$ *0.1	0.05	45.5	40%
	3.23	$\mathbf{F}_{sq}$ *0.25	0.13	43.5	34%
	6.09	$\mathbf{F}_{sq}$ *0.5	0.26	40.5	25%
Status quo	8.60	$\mathbf{F}_{sq}$ *0.75	0.39	37.9	17%
	9.98	$\mathbf{F}_{sq}$ *0.9	0.46	36.5	13%
	10.84	$\mathbf{F}_{sq}$ *1	0.51	35.6	10%
	11.66	$\mathbf{F}_{sq}$ *1.1	0.56	34.8	7%
	12.82	$\mathbf{F}_{sq}$ *1.25	0.64	33.6	4%
Mixed Fisheries					

All weights in thousand tonnes.

Geometric mean recruitment assumptions account for 68% of the forecast SSB (2007).

Management considerations

The assessment area covers Divisions VIIe-k and the ICES advice applies to these areas; however, this does not correspond to the TAC area. The TAC is set for Divisions VIIb-k. Within this larger area there is no control over where the catches will be taken. Current management measures for Division VIIe-k include whiting in Division VIIbc and whiting in Division VIId. Whiting in Division VIId is assessed together with whiting in the North Sea (Subarea IV).

A considerable part of the whiting catch is discarded. Any measure to reduce discarding and to improve the fishing pattern should be encouraged. Such measures might include increased cod end mesh size, square mesh panels, separator trawls, and increased top sheet mesh in towed gears.

Whiting are taken in a mixed demersal trawl fishery with cod, haddock, plaice, and *Nephrops*, and management advice needs to be considered in that context.

Whiting are a relatively low value species and targeting practices in the fishery are highly dependent on availability and market demand. In the past the TAC has been substantially higher than the realised catches and has not been restricting the fishery. There is some evidence that other species have been misreported as whiting in 2004 in some fleets.

Ecosystem considerations

The main spawning areas of whiting in the Western Channel and Celtic Sea are off Start Point (VIIe), off Trevose Head (VIIf), and southeast of Ireland (VIIg).

Returns of adult whiting tagged in the Western Channel indicated more movement into the Celtic Sea than between the Western and Eastern Channel. Whiting released in the Bristol Channel moved south and west towards the two spawning grounds off Trevose Head and southeast of Ireland. There was no evidence of emigration out of the Celtic Sea area. Tagging experiments have indicated movement of whiting from the Irish Sea VIIa into the Celtic Sea.

Factors affecting the fisheries and the stock

Celtic Sea whiting are taken in mixed species (cod, whiting, hake, *Nephrops*) fisheries. French trawlers account for about 60% of the total landings, Ireland takes about 30%, and the UK (England and Wales) 7%, while Belgian vessels take less than 1%. The French *Nephrops* trawlers have for several years adopted a larger mesh, following bycatch restrictions and market demand for larger *Nephrops*.

The main Irish fleets in Divisions VIIf,g,h are inshore and offshore otter trawlers and seiners based in Dunmore East and Kilmore Quay. However, in recent years there has been an increase in the number of Irish beamers (+6 vessels) offshore in Division VIIg, targeting anglerfish and megrim with whiting as bycatch. Irish landings of whiting from Division VIIj–k are taken in both a mixed fisheries (cod/whiting/anglerfish/megrim and *Nephrops*) and in a directed fishery in the first quarter.

The main UK fisheries in Divisions VIIe-h are inshore between Newlyn and Salcombe and off the north Cornish coast, the bulk of the landings (> 60%) being made in the winter months between November and March. UK landings in the 1950s were 4–5 times higher than at present. The main gears used in the Western Channel are otter trawls targeting a wide range of species, and beam trawls targeting sole, anglerfish, and plaice.

The effects of regulations

The stock is managed by a TAC and technical measures. Technical measures applied to this stock are a minimum landing size (≥ 27 cm) and the minimum mesh sizes applicable to the mixed demersal fisheries set depending on areas. There is substantial discarding above the minimum landing size due to economic or other factors.

Management regulations, particularly effort control regimes in other areas (VIIa, VI, & IV), became increasingly restrictive in 2004 and 2005 and have resulted in a displacement of effort into the Celtic Sea.

Council Regulation (EC) No. 27/2005, Annex III, part A 12 (b) prohibited fishing in ICES rectangles 30E4, 31E4, and 32E3 during January–March 2005. This prohibition did not apply to beam trawlers during March. The effect of the closure of the three rectangles during the fist quarter of 2005 cannot yet be quantified.

Changes in fishing technology and fishing patterns

Fishing effort for the French fleets operating in the 3 closed rectangles was mainly displaced to other fishing grounds outside the Celtic Sea and to areas within the Celtic Sea. The impact on whiting has not been evaluated. Some vessels have also switched to another métier targeting anglerfish and megrim in the rest of the Celtic Sea.

Scientific basis

Data and methods

Analytical assessment based on catch-at-age (landings only) data, commercial CPUE, and survey data.

Information from the fishing industry

Meetings with representatives of the fishing industry were held in France, Ireland, and the UK prior to when the assessment was done. Their information suggests that the area closure has had a major impact on the distribution of the fishery in 2005.

Uncertainties in assessment and forecast

Although discarding is considered to be significant, the assessment does not include discard information because insufficient data are available. Not including discards biases the recruit estimates. This is apparent with the 1999 year class which was revised by assessments in successive years. This bias and uncertainty in the assessment has contributed to overly optimistic recent forecasts. Although the current forecast remains uncertain the bias appears to have reduced as the proportion of this strong year class in landings and SSB has declined. Geometric mean recruitment assumptions account for 68% of the forecast SSB (2007).

The shape of yield-per-recruit will change significantly with the introduction of discards. Therefore, the current long-term reference points, i.e. $\mathbf{F}_{max}$ and $\mathbf{F}_{0.1}$ are rather uncertain.

Comparison with previous assessment and advice

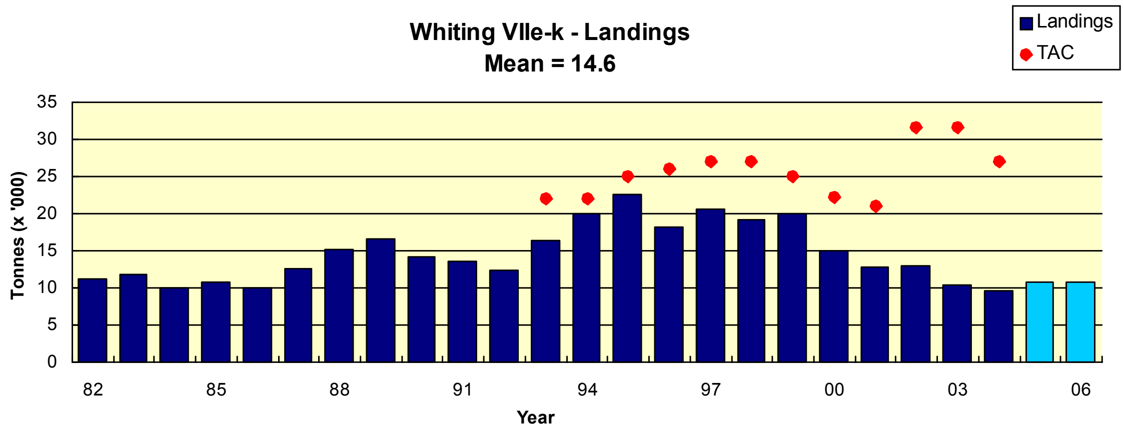
The results of this year's and last year's assessments show remarkably consistent estimates of recent F and SSB. The perception of the state of the stock is unchanged and the advice remains the same: no increase in fishing mortality.

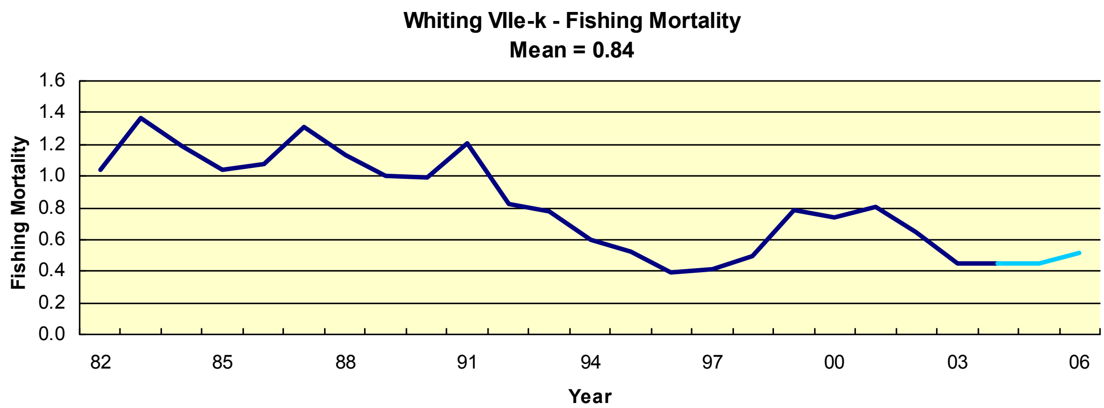
Source of information

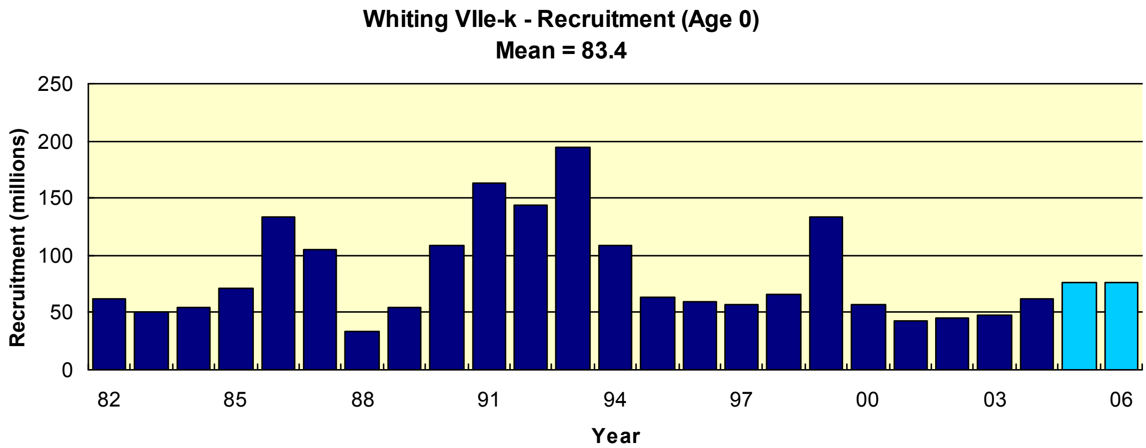
Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Landings
1987	*Status quo* F; TAC	7.1[2]		12.7
1988	Precautionary TAC	7.0[2]		13.6
1989	Precautionary TAC	7.9[2]		16.5
1990	No increase in F; TAC	8.4[2]		14.1
1991	Precautionary TAC	8.0[2]		13.5
1992	If required, precautionary TAC	8.0[2]		12.4
1993	Within safe biological limits	6.6[2]	22.0	16.3
1994	Within safe biological limits	< 9.4[2]	22.0	20.0
1995	20% reduction in F	8.2[3]	25.0	22.7
1996	20% reduction in F	8.6[3]	26.0	18.3
1997	At least 20% reduction in F	< 7.3[4]	27.0	20.5
1998	At least 20% reduction in F	< 8.2[4]	27.0	19.2
1999	No increase in F	12.4[4]	25.0	19.9
2000	17% reduction in F	< 13.1[4]	22.2	14.9
2001	No increase in F	13.5[4]	21.0	12.9
2002	No increase in F	27.7[4]	31.7	13.1
2003	No increase in F	20.2[4]	31.7	10.4
2004	No increase in F	14.0	27.0	9.6
2005	No increase in F	10.6	21.6	
2006	No increase in F	10.8		

Weights in t.
[1] TAC covers Subarea VII (except Division VIIa). [2] For the VIIf+g stock component. [3] For the VIIf-h stock component. [4] For the VII e-k stock component.


Whiting VIIe-k - Landings
Mean = 14.6
Landings
TAC
Tonnes (x '000)
35
30
25
20
15
10
5
0
82
85
88
91
94
97
00
03
06
Year


Whiting VIIe-k - Fishing Mortality
Mean = 0.84
Fishing Mortality
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
82
85
88
91
94
97
00
03
06
Year


Whiting VIIe-k - Recruitment (Age 0)
Mean = 83.4
Recruitment (millions)
250
200
150
100
50
0
82
85
88
91
94
97
00
03
06
Year

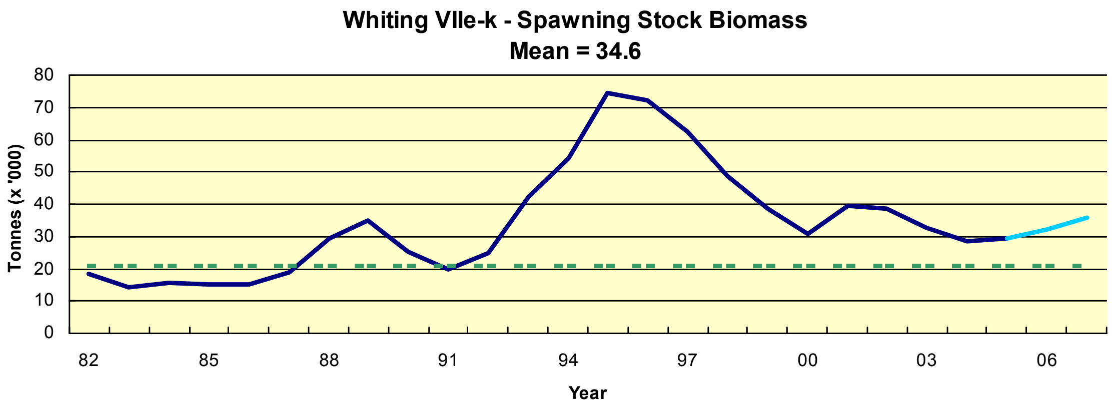

Whiting VIIe-k - Spawning Stock Biomass
Mean = 34.6
Tonnes (x '000)
80
70
60
50
40
30
20
10
0
82
85
88
91
94
97
00
03
06
Year

Table 1.4.6.1 WHITING in Divisions VIIe-k. Nominal landings (t) as reported to ICES, and total landings as used by the Working Group.

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Belgium	135	161	167	107	111	159	296	308	292	107	145
Denmark											
France	8,982	7,171	7,820	7,647	10,054	11,410	12,171	10,464	9,956	9,165	10,771
Germany										14	
Ireland	1,487	1,301	2,241	1,309	1,452	398	2,817	1,478	1,258	1,691	3,631
Netherlands		398		124							
Spain											
UK (E/W/NI)	1,177	954	610	765	1,035	1,598	1,252	1,782	1,969	1,379	1,756
UK(Scotland)						1	5	74	33	8	17
United Kingdom											
Total	11,781	9,985	10,838	9,952	12,652	13,566	16,541	14,106	13,508	12,364	16,320
Unallocated	0	0	0	0	0	1,562	0	0	0	0	0
Total as used by Working Group	11,781	9,985	10,838	9,952	12,652	15,128	16,541	14,106	13,508	12,364	16,320

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003[c]	2004
Belgium	228	205	268	449	479	448	194	171	149	42	181
Denmark											
France	12,634	13,400	9,936	11,370	11,711[a]	16,418[b]	9,077[a]	7,203[a]	7,326[a]	4,679	N/A
Germany											
Ireland	5,618	6,077	6,115	6,893	5,226	5,807	4,795	5,008	5,332	4092	N/A
Netherlands			8		1			5	4	9	18
Spain		4	31	24	53	21	11	9	12		
UK (E/W/NI)	1,548	1,804	1,728	1,742	1,709	1,346	1,252	946	844	704	715
UK(Scotland)	6	23	34	42	68	3	2	11	12		
United Kingdom											
Total	20,034	21,513	18,120	20,520	19,247	24,043	15,331	13,353	13,679	9,526	913
Unallocated	0	1,165	140	12	-2	-4,126	-421	-498	-596	909	8,711
Total as used by Working Group	20,034	22,678	18,260	20,532	19,245	19,917	14,910	12,855	13,083	10,435	9,624

a: Preliminary.
b: Preliminary. Reported as VIIb-k.
c: As available from Eurostat in June 2005 (http://www.europa.eu.int/comm/eurostat).

Table 1.4.6.2 Whiting in Divisions VIIe-k.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1982	62000	18200	11200	1.043
1983	50000	14400	11800	1.366
1984	54000	15500	10000	1.187
1985	71000	15400	10800	1.039
1986	133000	15300	10000	1.072
1987	105000	18800	12700	1.314
1988	33000	29600	15100	1.136
1989	55000	34700	16500	1.001
1990	109000	25200	14100	0.991
1991	163000	19900	13500	1.204
1992	144000	25000	12400	0.820
1993	194000	42200	16300	0.780
1994	109000	54300	20000	0.598
1995	64000	74500	22700	0.524
1996	59000	72400	18300	0.396
1997	57000	62500	20500	0.415
1998	66000	48600	19200	0.497
1999	134000	38600	19900	0.787
2000	57000	30800	14900	0.742
2001	43000	39400	12900	0.800
2002	45000	38800	13100	0.643
2003	48000	32800	10400	0.446
2004	76000*	28600	9600	0.452
2005	76000*	29300		
Average	83625	34367	14604	0.837

*GM 82-02.

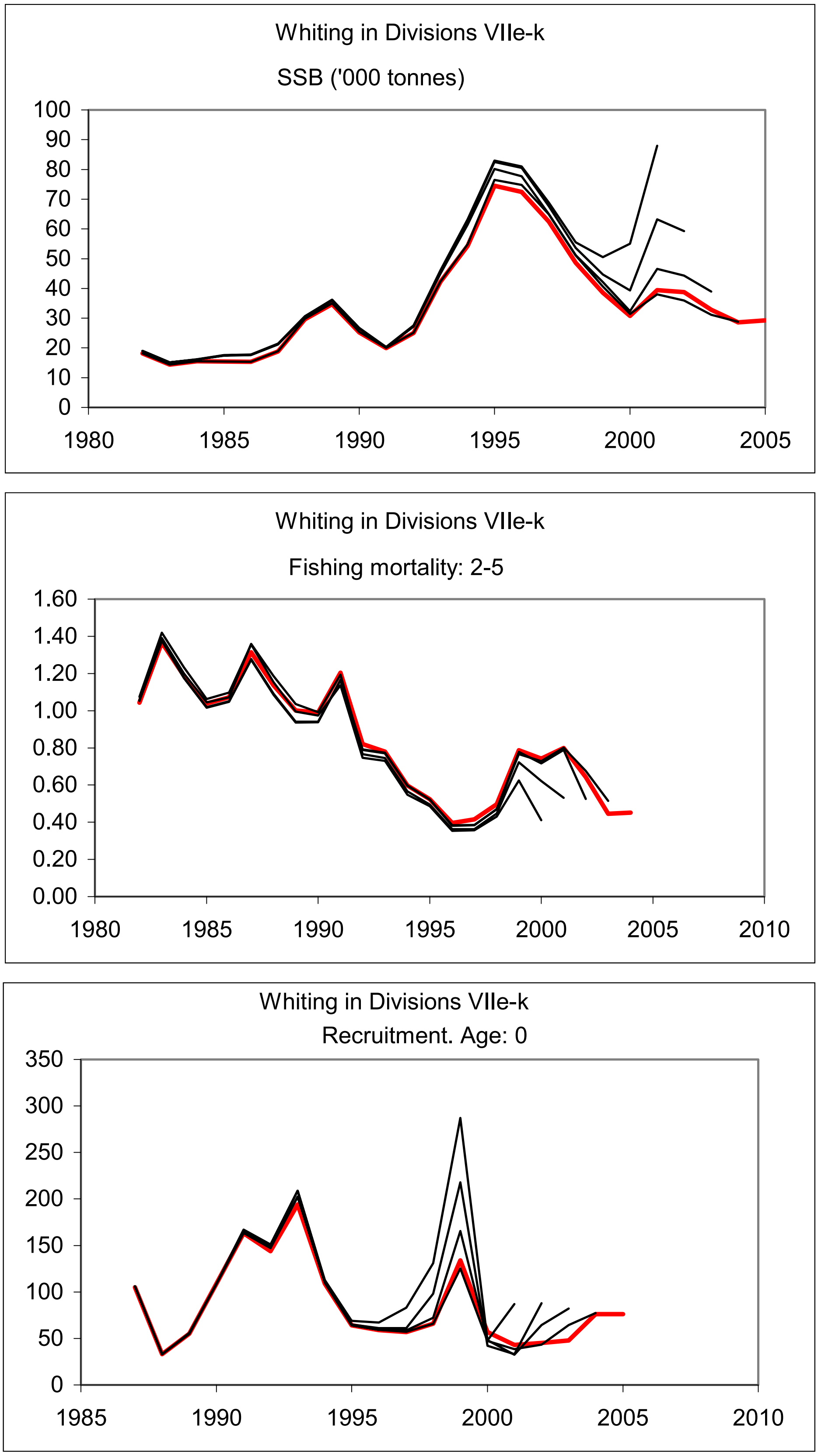


Figure 1.4.6.1 Comparison with previous assessments. The current assessment is shown in red.

West of Ireland Whiting

(Divisions VIIb,c)

Marine Institute
Foras na Mara

Fisheries Science Services

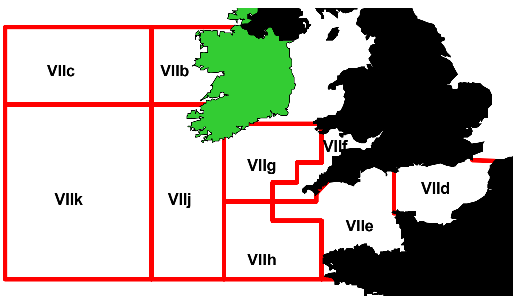
FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

The state of this stock is unknown.

Short Term Considerations
Catches in 2006 should be no more than the recent average (2001 to 2003) of around 521 t in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

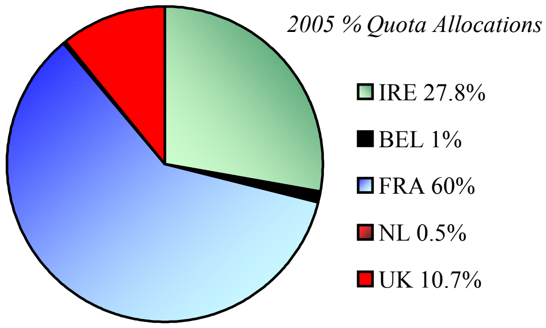
Whiting in Divisions VIIb,c are included in the management area VIIb-k. There was no ICES advice for this stock.



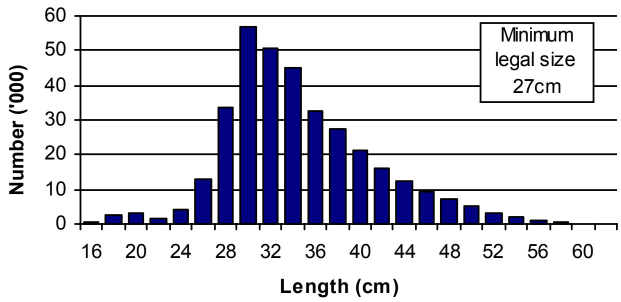
Red Boxes-TAC/Management Areas

ADDITIONAL INFORMATION

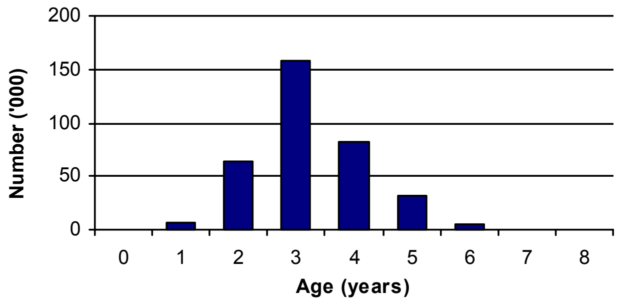
1. The TAC in 2005 was set at 21,600 t
2. Irish landings in 2004 were estimated to be 134 t. This is an decrease of 47% on the 2003 landings.
3. Ireland is the major participant in this fishery.
4. FSS sampling shows that the stock is dominated by 3 year olds.
5. Discarding practices are not well quantified but FSS sampling has indicated that discarding does occur in this fishery.
6. The linkages between whiting VIIb,c and adjacent areas is unclear. Until the dynamics of these whiting stocks is resolved the ICES Assessment Working Group will continue collating data on VIIb,c whiting.



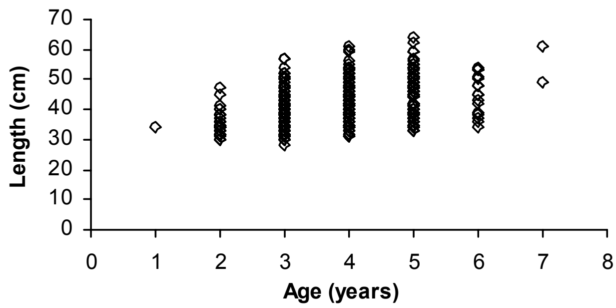
2004 Length Distribution: Irish Landings, Whiting in VIIb,c



2004 Age Distribution: Irish Landings, Whiting in VIIb,c



2004 Size at Age: Irish Sampling, Whiting in VIIb,c



Nominal Landings (t) of Whiting in Divisions VIIb,c for 1995-2004

COUNTRY	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
France	57	76	65	37*	…1*	107	114	125	131	
Ireland	1,894	1,233	403	323	206	563	357	386	423	
Netherlands	-	-	-	-	-	-	2	-	3	
Spain	+	+	-	27	1	4	-	6		
UK(E/W/NI)	24	96	75	49	10	6	5	4	5	1.2
UK(Scotland)	71	17	4	27	-	19	1	+	-	
TOTAL	**2,046**	**1,422**	**547**	**463**	**217**	**699**	**479**	**521**	**562**	
Unallocated										226

*1See VIIg-k.

Celtic Sea and Bay of Biscay Anglerfish

(Sub-area VIIb-k and Divisions VIIIa,b)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

FSS has grave concerns about the quality of the assessments on which the ICES advice is predicated (see Additional Information). Misreporting is thought to be a serious problem in several fisheries exploiting these stocks and there are no reliable estimates of this problem.

Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock of *Lophius piscatorius* as having full reproductive capacity and being at risk of being harvested unsustainably, and the stock of *L. budegassa* as having full reproductive capacity and being harvested sustainably.

Long-term Advice
FSS considers that a longer-term management strategy is more appropriate for long-lived species like anglerfish. This would involve improving the selection pattern in the fishery by minimising catches of juvenile fish, ensuring that sufficient SSB is conserved to maintain recruitment and by developing a harvest control rule with longer-term targets.

For *L. piscatorius* the *status quo* fishing mortality, estimated at 0.24, is well above fishing mortalities that would lead to high long-term yields and low risk of stock depletion ($F_{0.1}$ = 0.05 and F_{max} = 0.09). For *L. budegassa* the *status quo* fishing mortality, estimated at 0.18, is above fishing mortalities that would lead to high long-term yields and low risk of stock depletion ($F_{0.1}$ = 0.10 and F_{max} = 0.15). Fishing at such lower mortalities would lead to higher SSB and lower the risk of the stock falling outside precautionary limits.

Reducing fishing mortality to F_{max} or $F_{0.1}$ in 2006 would imply substantially reduced short-term catches with a single TAC (e.g. a combined TAC of < 17,000 t in 2006 using the F_{max} of *L. piscatorious*). Therefore FSS recommends that stakeholders should develop and implement an agreed Harvest Control Rule that moves towards fishing at these low target-fishing mortalities in a series of quantifiable steps.

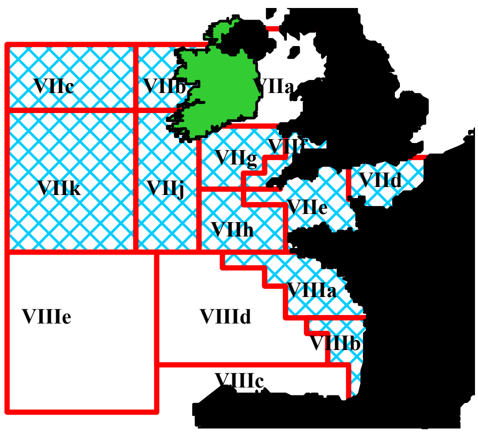
Short-term Advice
If managers want to maximise short-term catches and harvest the stock within precautionary limits then fishing mortality should be maintained below F_{pa} and SSB should be above B_{pa} for both species. Fishing at F_{pa} for *L. piscatorius* is expected to result in landings of 25,400 t in 2006, leading to an SSB of 64,400 t in 2007. Given the link between the two species, this corresponds to a fishing mortality of 0.18 for *L. budegassa*, corresponding to landings of at most 8,300 t in 2006. The predicted SSBs are well above B_{pa} in all scenarios.

FSS would again point out that the assessment area does not include Division VIIa. Therefore an additional TAC allocation of 646 t (based on average landings 2001-2003) for VIIa should be added to the recommended TAC for VIIb-k to attain a TAC for the entire Sub-area VII. This translates to a TAC of 27,028 t for VII and an Irish quota of 2,048 t.

FSS recognise that anglerfish are an important component of mixed fisheries taking hake, megrim, sole, cod, plaice, and *Nephrops*. Anglerfish are caught with other stocks that are outside precautionary limits.

Basis	TAC 2006			2006 Irish quota	% Change 2005
	VII*	VIIIabde	Total Combined		
$F_{Long\text{-}term}$	13,406	3,540	16,946	1,016	-45%
$F_{Short\text{-}term}$	27,028	7,318	34,346	2,048	8%

***Including and additional allocation of 646 t in the VII TAC component for VIIa (mean of 2001-2003 landings)**



Red Box-TAC/Management Area Blue Shading– Assessment Area

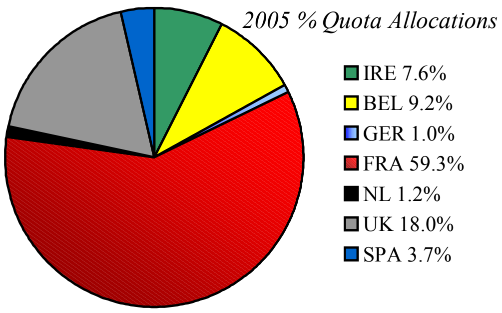
Official landings table for ICES Division VIIa

Country	1997	1998	1999	2000	2001	2002	2003*
Belgium	115	103	63	60	128	171	175
France	35	41	…1	41	61	56	59
Ireland	759	424	196	227	213	200	188
Netherlands	10	2	I	2	+	--	
UK(E/W/NI)	355	287	263	166	190	228	...
UK (Isle of Man)	27	28	9	5	2	I	+
UK (Scotland)	22	17	10	9	19	20	...
United Kingdom							227
Total	**1,323**	**902**	**542**	**510**	**613**	**676**	**624**

***Estimated Irish landings for VIIa**

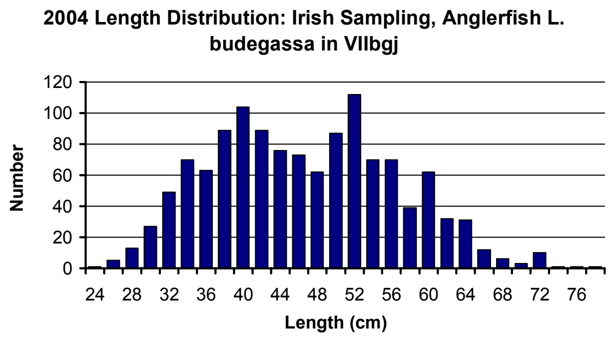
CURRENT MANAGEMENT

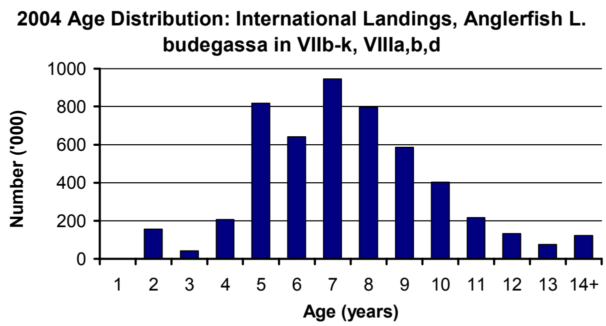
- There are two separate TACs for this stock Sub-area VII and a TAC for Divisions VIIIabde. These TAC areas do not correspond to the assessment area (Divisions VIIb-k and VIIIa,b). An additional allocation needs to be made for VIIa.
- Two species (*L. piscatorious* and *L. budegassa*) are caught in the management and assessment area. These species are not routinely separated by the industry therefore a combined TAC is set for both species.
- The 2005 TAC for Sub-area VII was 25,082 t with an associated Irish quota of 1,901 t.
- There are no explicit management objectives or plans for this stock.
- There is no minimum legal landing size for anglerfish.
- FSS advises that management objectives be established and that a management plan incorporating the harvest controls rules suggested in the advice be developed and implemented for fisheries taking anglerfish.



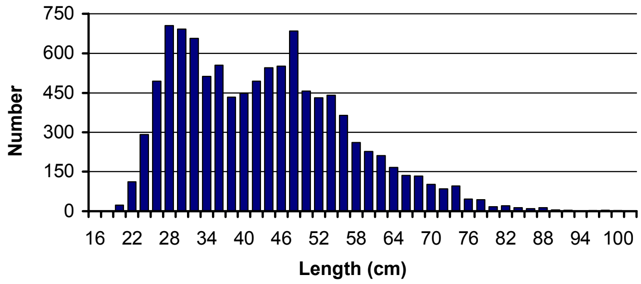
ADDITIONAL INFORMATION

1. Both assessments are of poor quality with a 5% upward revision in SSB estimates of *L. piscatorious* and a 3% downward revision in SSB estimates of *L. budegassa* in 2004 compared to last year's assessment
2. The quota for this stock is restrictive for the Irish and most other fleets. Reported landings in recent years have been in excess of the TACs and misreporting continues to be a serious problem in this stock. FSS continues to be concerned that inaccurate landings data may cause the assessment to be inaccurate.
3. Estimated landings from the Irish fleet were 2,001 t in 2004, a 16% increase from 2003.
4. Irish landings for this stock are mainly taken in otter trawls and, increasingly by twin-rigs. Anglerfish are the main target species along the western shelf for demersal vessels from Killybegs, Rossaveal, Dingle, Castletownbere, Union Hall, Dunmore East and many other smaller ports.
5. FSS recommends that technical measures such as fixed grids be introduced into this fishery to reduce catches of juvenile anglerfish and improve the exploitation pattern for these species. The use of selective devices, such as rigid grids, which have been studied in France with promising results, should be further evaluated.
6. There is a proposal to ban gill netting in waters >200m, this may have an impact on fisheries for Anglerfish.

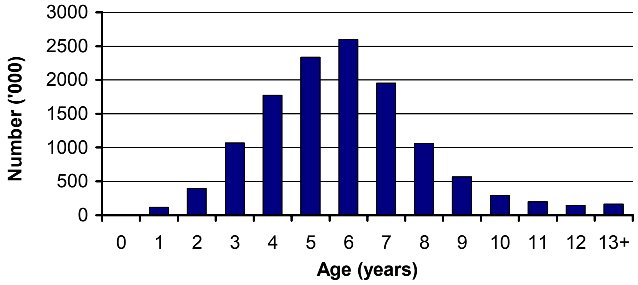




2004 Length Distribution: Irish Sampling, Anglerfish L. piscatorious in VIIbgj



2004 Age Distribution: International Landings, Anglerfish L. piscatorious in VIIb-k,VIIIa,b,d



2004 Size at Age: Irish Sampling, Anglerfish L. piscatorious in VIIb-k,VIIIa,b,d

ICES ADVICE
1.4.20

State of the stock

L. piscatorius

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target
Full reproductive capacity	Increased risk	Overexploited	Unknown

Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as having full reproductive capacity and being at risk of being harvested unsustainably.

L. budegassa

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target
Full reproductive capacity	harvested sustainbly	Overexploited	Unknown

Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as having full reproductive capacity and being harvested sustainably.

SSB of both stocks decreased from 1986 until 1993, then increased up to 1995-1996 and at present are stable above $\mathbf{B}_{pa}$. For both stocks, fishing mortality in most years has been above $\mathbf{F}_{pa}$. In 2004 fishing mortality is estimated to be around $\mathbf{F}_{pa}$ for *L. budegassa* and *L. piscatorius*. Recent recruitments (1997-2002 year classes) for both species are above average.

Management objectives

There are no explicit management objectives for this stock.

Reference points

***L. piscatorius*:**

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is undefined	$\mathbf{B}_{pa}$ = 31 000 t.
	$\mathbf{F}_{lim}$ is 0.33	$\mathbf{F}_{pa}$ = 0.24
Target reference points		$\mathbf{F}_{y}$: not defined

Candidates for target reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F_{0.1}}$-$\mathbf{F_{max}}$.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3-8	Yield/R	SSB/R
Average last 3 years	0.243	0.853	2.042
Fmax	0.088	1.084	6.910
F0.1	0.054	1.019	10.303
Fmed	0.241	0.856	2.070

Technical basis:

B$_{lim}$: Not defined.	**B**$_{pa}$ = **B**$_{loss}$. There is no evidence of reduced recruitment at the lowest biomass observed. **B**$_{pa}$ is equal to the lowest observed SSB in 1993 as estimated in 2000.
F$_{lim}$: **F**$_{loss}$, the fishing mortality estimated to lead to potential stock collapse.	**F**$_{pa}$: **F**$_{lim}$ x 0.72. This F is considered to have a high probability of avoiding **F**$_{lim}$, taking into account the uncertainty in the assessment.

***L. budegassa*:**

	ICES considers that:	**ICES proposed that:**
Limit reference points	**B**$_{lim}$ is undefined	**B**$_{pa}$ = 22 000 t.
	F$_{lim}$ is undefined	**F**$_{pa}$ = 0.23
Target reference points		**F**$_{y}$**:** Not defined

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 6-10	Yield/R	SSB/R
Average last 3 years	0.225	0.490	1.882
Fmax	0.151	0.512	3.059
F0.1	0.097	0.484	4.691
Fmed	0.255	0.475	1.575

Candidates for target reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of **F**$_{0.1}$**-F**$_{max}$.

Technical basis:

B$_{lim}$= Not defined.	**B**$_{pa}$= **B**$_{loss.}$ There is no evidence of reduced recruitment at the lowest biomass observed (SSB for 1993 as estimated in 2002).
F$_{lim}$= Not defined.	**F**$_{pa}$ =**F**$_{med}$ as estimated in 2000. This F is consistent with the proposed **B**$_{pa}$.

Single stock exploitation boundaries

Exploitation boundaries in relation to high long term yield, low risk of depletion of production potential and considering ecosystem effects

For *L. piscatorius* the *status quo* fishing mortality is estimated at 0.24 which is above fishing mortalities that would lead to high long-term yields and low risk of stock depletion (**F**$_{0.1}$ = 0.05 and **F**$_{max}$ = 0.09). For *L. budegassa* the *status quo* fishing mortality is estimated at 0.18 which is above fishing mortalities that would lead to high long-term yields and low risk of stock depletion (**F**$_{0.1}$ = 0.10 and **F**$_{max}$ = 0.15). This indicates that long-term yield is expected to increase at fishing mortalities below the historic values. Fishing at such a lower mortality would lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

In order to harvest the stock within precautionary limits fishing mortality should be kept below **F**$_{pa}$ and SSB should be above **B**$_{pa}$ for both species. Fishing at **F**$_{pa}$ for *L. piscatorius* is expected to result in landings of 25 400 t, leading to an SSB of 64 400 t in 2007. Given the link between the two species, this corresponds to a fishing mortality of 0.22 for *L. budegassa* (fishing at **F**$_{sq}$), corresponding to landings of at most 8 300 t in 2006. The predicted SSBs are well above **B**$_{pa}$ in all scenarios.

Short term implications

Outlook for 2006:

L. Piscatorius: Basis: Fsq =mean F(02-04)=0.24; R04-05 = GM 1987-2002=21 millions; landings (2005) = 25.5; SSB(2006) = 66.4
L. budegassa: Basis: Fsq =mean F(02-04)=0.22; R04-05 = GM 1987-2001=16 millions; landings (2005) = 8.1; SSB(2006) = 30.8
The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.24 (*L. Piscatorius*), and 0.23 (*L. budegassa*)

The fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock (F(long term yield)) is 0.09 (*L. Piscatorius*), and 0.16 (*L. budegassa*)

					L. piscatorius			*L. budegassa*			
Rationale	**Landings *L. Pisc.* (2006)**	**Landings *L. Bud.* (2006)**	**Combined landings (2006)**	**Basis**	**F (2006)**	**SSB (2007)**	**%SSB change 1)**	**F (2006)**	**SSB (2007)**	**%SSB change 1)**	**%TAC change 2)**
Zero catch	0.0	0.0	0.0	F=0	0.00	91.8	38%	0.00	39.7	29%	-100%
High long-term yield	10.6	5.8	16.3	F(long-term yield)	0.09	80.3	21%	0.15	34.2	11%	-48%
Status quo	3.0	0.9	3.9	F_{sq} *0.1	0.02	88.5	33%	0.02	38.8	26%	-87%
	5.9	1.8	7.7	F_{sq} *0.2	0.05	85.4	29%	0.04	38.0	23%	-75%
	14.0	4.4	18.4	F_{sq} *0.5	0.12	76.6	15%	0.11	35.5	15%	-41%
	20.1	6.4	26.5	F_{sq} *0.75	0.18	70.1	6%	0.17	33.6	9%	-15%
	23.5	7.6	31.1	F_{sq} *0.9	0.22	66.4	0%	0.20	32.5	6%	0%
	25.7	8.3	34.0	F_{sq} *1	0.24	64.1	-3%	0.22	31.8	3%	9%
	27.8	9.1	36.8	F_{sq}*1.1	0.27	61.8	-7%	0.25	31.1	1%	18%
	30.8	10.1	40.9	F_{sq} *1.25	0.30	58.7	-12%	0.28	30.1	-2%	31%
Precautionary Limits	25.4	-	-	**Fpa**	0.24	64.4	-3%	-	-	-	-

All weights in '000 tonnes
Shaded scenarios are not considered consistent with the precautionary approach

1) SSB 2007 relative to SSB 2006
2) Landings 2006 relative to TAC 2005 = 31.202
Note: Fmultipliers on F precautionary limits are not consistent between the two species.

Management considerations

L. piscatorius and *L. budegassa* are both caught on the same grounds and by the same fleets, and are usually not separated by species in landings and the fishing mortalities are linked. Both species show similar trends in stock trajectories (figure 1.4.20.1). So far the stocks have developed synchronously but this may not be so in the future in which case they should be managed separately.

Management measures for both species must be considered together and in conjunction with other species caught in these fisheries (sole, cod, rays, megrim, *Nephrops*, and hake).

There are two separate TACs for these stocks: in Subarea VII and in Divisions VIIIa,b,d,e. The assessment is carried out on a smaller area (Divisions VIIb-k and VIIIa,b) than the management area and will thus be a underestimate of the overall stock size. However, the assessment cover the majority of the area as recent landings in Division VIIa have been relatively small compared to the total TAC.

The majority of the anglerfish catch consists of young fish. An improvement of the selection pattern is expected to give a higher long term yield.

Factors affecting the fisheries and the stock

The effects of regulations

There is no minimal landing size for anglerfish but a Council Regulation (2406/96) laying down common marketing standards for certain fishery products fixes a minimum weight of 500 g for anglerfish. When the minimum landing size does not fit with the selective properties of the gears, this is expected to lead to discarding of undersized fish.

Council Regulation (EC) No 1954/2003 established measures for the management of fishing effort in a biologically sensitive area in Subareas VIIb, VIIj, VIIg, and VIIh. Effort exerted within the biologically sensitive area by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998-2002). These measures have not resulted in a decrease in fishing effort for fleets fishing for anglerfish.

Changes in fishing technology and fishing patterns

No significant changes in recent years.

The environment

The spawning of the *Lophius* species is very particular, with eggs extruded in a buoyant, gelatinous ribbon that may measure more than 10 m. This particular spawning pattern results in a highly clumped distribution of eggs and newly emerged larvae. Although this could result in recruitment being sensitive to environmental variations, this has not been observed.

Other factors

Anglerfish are an important component of mixed fisheries taking hake, megrim, sole, cod, plaice, and *Nephrops*. A trawl fishery by Spanish and French vessels developed in the Celtic Sea and Bay of Biscay in the 1970s, and overall annual landings may have attained 35-40 000 t by the early 1980s. Landings decreased between 1981 and 1993 and since 2000, landings have shown an increasing trend. France and Spain together still report more than 75% of the total landings of both species combined. The remainder is taken by the UK and Ireland (around 10% each) and Belgium (less than 5%).

Otter-trawls (the main gear used by French, Spanish, and Irish vessels) currently take about 80% of the total landings of *L. piscatorius*, while around 60% of UK landings are by beam trawlers and gillnetters. Over 95% of the total international landings of *L. budegassa* are taken by otter trawlers. There has been an expansion of the French gillnet fishery in the last decade in the Celtic Sea and in the north of the Bay of Biscay, mainly by vessels landing in Spain and fishing in medium to deep waters. Otter-trawling in medium and deep water in ICES Subarea VII appears to have declined, even though the increasing use of twin trawls by French vessels may have increased significantly the overall efficiency of the French fleet.

Scientific basis

Data and methods

Age-based (XSA) assessments for each species separately are based on landings, one survey, and four (*piscatorius*) or five (*budegassa*) commercial CPUE series.

Information from the fishing industry

The fishing industry and scientists have met at the national level to discuss information that can be used in the assessments. Some CPUE time series have been provided by the fishing industry. Qualitative information has also been provided and has contributed to the assessment process.

The UK Fisheries Science Partnership report on the anglerfish was made available to the WG as a Working Document.

Uncertainties in assessment and forecast

Retrospective patterns exist in the absolute estimations of SSB, Recruitment, and F. For *L. piscatorius* there is a strong underestimation of SSB and overestimation of fishing mortality in recent years. For *L. budegassa*, the historical pattern is uncertain in the overall level of stock size. The recruitment estimates of the most recent years appear to be very uncertain.

The main factors contributing to the uncertainties for this stock are:

- Stock definition is problematic.
- Discards are not included in the assessment and discards are known to be partly dependent on market conditions and TAC restrictions.
- There are conflicting signals in the commercial CPUE series which could be caused by different targeting behaviour (changes in spatial and temporal fishing patterns).
- Fishery-independent data is insufficient to assess the state of the stock because the only survey does not cover the whole stock distribution (in depth).

Comparison with previous assessment and advice:

For *L. piscatorius* fishing mortality and recent recruitments are revised downward and SSB upward, and for *L. budegassa* recent recruitments and SSB are revised downward and fishing mortality upward.

Source of information:

Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2005 (ICES CM 2006/ ACFM:01).

Year	ICES Advice	Single-Stock Exploitation Boundaries	Predicted catch corresp. to Single-Stock Exploitation Boundaries	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Landings	Landings of *L. piscat.*	Landings of *L. budeg.*
1987	Not assessed		-		39.08	29.5	21.9	7.6
1988	Not assessed		-		42.99	28.5	20.1	8.4
1989	Not assessed		-		42.99	30.0	20.5	9.5
1990	Not assessed		-		42.99	29.4	19.8	9.6
1991	No advice		-		42.99	25.1	16.2	8.8
1992	No advice		-		42.99	21.1	12.8	8.3
1993	Concern about *L. pisc.* SSB decrease		-		25.1	20.1	13.5	6.7
1994	SSB decreasing, still inside safe biological limits		-		23.9	21.9	16.1	5.8
1995	No increase in F		20.0		23.2	26.8	19.7	7.1
1996	No increase in F		30.3		30.4	30.2	22.1	8.1
1997	No increase in F		34.3		34.3	29.8	21.7	8.1
1998	No increase in F		33.0		34.3	28.2	19.6	8.6
1999	No increase in F		32.9		34.3	24.5	17.2	7.3
2000	At least 20% decrease in F		< 22.3		29.6	22.0[3]	14.9[3]	7.1[3]
2001	Reduce F below $\mathbf{F}_{pa}$		< 27.6		27.6	22.2[3]	16.5[3]	5.7[3]
2002	Reduce F below $\mathbf{F}_{pa}$		< 19.9		23.7	26.7[3]	20.1[3]	6.5[3]
2003	At least 30% decrease in F		< 16.4		21.0[4]	31.7	23.6	8.1
2004	At least 10% decrease in F		< 26.7		26.7	34.9	27.3	7.6
2005	Maintain F below Fpa		< 37.8		31.2			
2006	Maintain F below Fpa		<33.9					

[1] Includes Division VIIa and Divisions VIIId,e;
[2] applies to both species.
[3] Revised.
[4] TAC was changed during 2003 from 19 400t. to 21 000t. following fast-track advice from ICES.
*) Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weights in '000 t.

Table 1.4.20.1 Landings (tonnes) of both specie s of anglerfish in Divisions VIIb-k and VIIIa,b,d
Working group estimates

Year	VIIb-k	VIIIa,b,d	Total
1977			19,895
1978			23,445
1979			29,738
1980			38,880
1981			39,450
1982			35,285
1983			38,280
1984	28,847	7,909	36,756
1985	28,491	7,161	35,652
1986	25,987	5,897	31,883
1987	22,295	7,233	29,528
1988	22,494	5,983	28,477
1989	24,731	5,276	30,007
1990	23,434	5,950	29,384
1991	20,385	4,684	25,069
1992	17,554	3,530	21,084
1993	16,633	3,507	20,140
1994	18,093	3,841	21,934
1995	21,922	4,862	26,784
1996	24,132	6,102	30,233
1997	23,928	5,846	29,774
1998	23,295	4,876	28,171
1999	21,288	3,224	24,512
2000	19,250	2,711	21,962
2001	19,357	2,838	22,195
2002	22,990	3,674	26,664
2003*	27,408	4,317	31,725
2004**	28,983	5,920	34,903

* revised
** preliminary

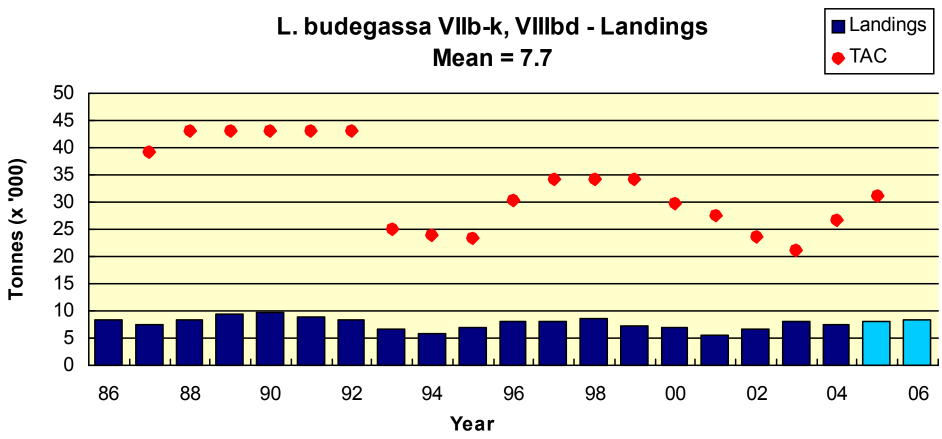
Table 1.4.20.2. Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d.
Landings in tonnes by Fishery Unit

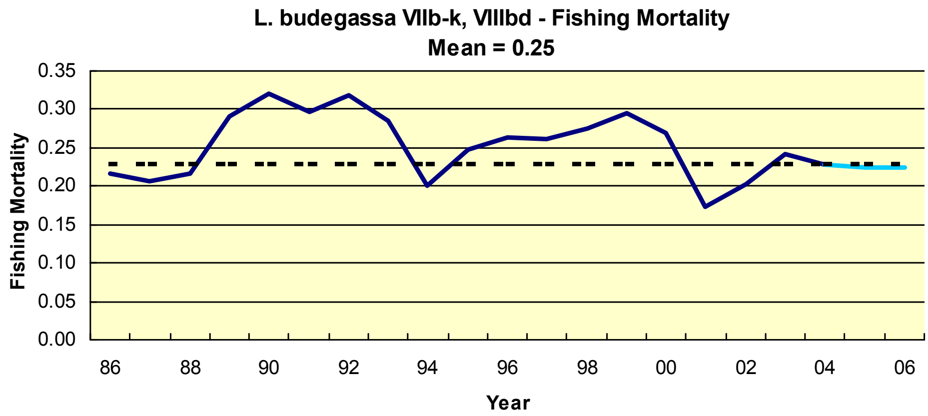
	VIIb,c,e-k						VIIIa,b,d				
		Medium/ Deep	Shallow		Shallow/ med.			Shallow	Medium/ Deep		TOTAL
Year	Gill-Net	Trawl	Trawl	Beam Trawl	Neph.Trawl	Other	Neph.Trawl	Trawl	Trawl	Unalloc.	VII +VIII
	(Unit 3)	(Unit 4)	(Unit 5)	(Unit 6)	(Unit 8)		(Unit 9)	(Unit 10)	(Unit 14)		
1986	429	13781	2877	1437	1021		746	720	2657		23666
1987	560	11414	2900	1520	787		1035	542	3152		21909
1988	643	9812	3105	1814	774		927	534	2487		20095
1989	781	8448	5259	2342	754		673	444	1772		20474
1990	1021	8787	3950	1736	880		410	391	2578		19753
1991	1752	7565	2806	1196	752		284	218	1657		16229
1992	1773	6254	1489	1052	887		254	166	942		12818
1993	1742	5776	2125	1281	969		360	278	950		13481
1994	1377	7344	2595	1523	1236		261	198	1586		16120
1995	1915	8461	3195	1805	1242		501	429	1954		19502
1996	2244	9796	2637	2189	1149		441	379	2229	938	22003
1997	2538	9225	2945	2031	964	39	429	376	2045	1068	21660
1998	3398	8714	2138	1722	812	3	397	149	1699	542	19572
1999	2912	8343	2257	1407	743	19	97	117	1292	0	17186
2000	2299	7340	1853	1457	838	5	100	84	949	0	14925
2001	1806	7978	2243	1982	866	17	136	75	1405	0	16508
2002	2731	9679	2644	1836	922	5	223	88	2002	0	20130
2003*	3087	11957	2622	1978	925	81	377	124	2440	0	23591
2004**	3982	12773	3055	2454	869	14	461	180	3523	0	27313

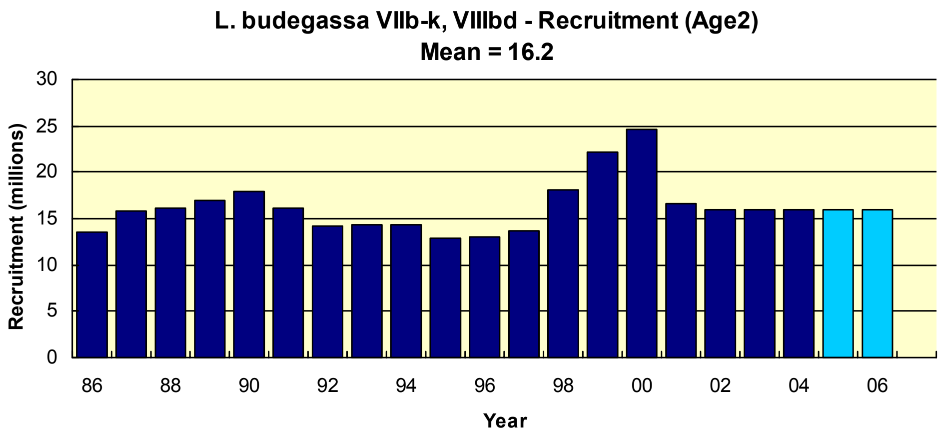
Table 1.4.20.3. **Lophius budegassa in Divisions VIIb-k and VIIIa,b,d**
Landings in tonnes by Fishery Unit

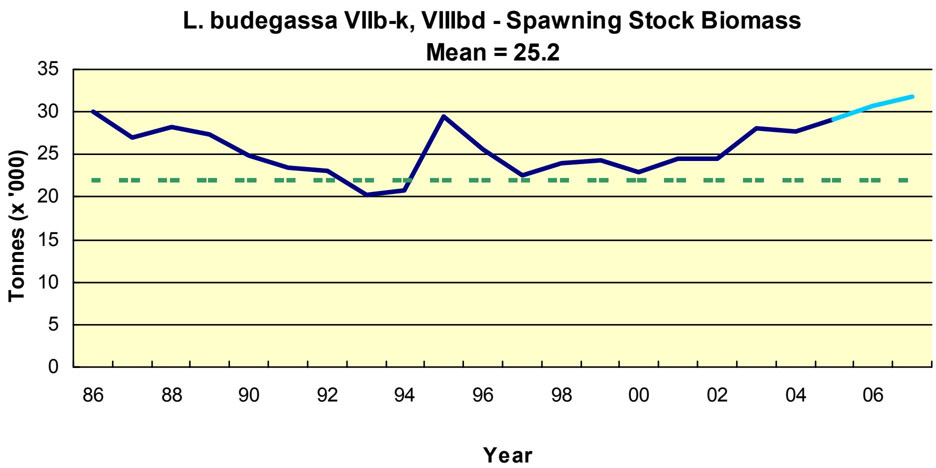
	VIIb,c,e-k						VIIIa,b,d				TOTAL
Year	Gill-Net (Unit 3)	Medium/Deep Trawl (Unit 4)	Shallow Trawl (Unit 5)	Beam Trawl (Unit 6)	Shallow/ medium Neph.Trawl (Unit 8)	Other	Neph.Trawl (Unit 9)	Shallow Trawl (Unit 10)	Medium/Deep Trawl (Unit 14)	Unallocated	VII +VIII
1986	23	5126	348	540	406	0	443	150	1181	0	8217
1987	30	3493	696	462	434	0	483	116	1904	0	7619
1988	34	4072	1095	751	394	0	435	102	1498	0	8382
1989	40	4398	976	1217	515	0	446	112	1829	0	9533
1990	53	4818	631	905	653	0	550	156	1865	0	9632
1991	88	4414	921	384	507	0	475	117	1933	0	8840
1992	90	4808	301	305	594	0	459	191	1518	0	8266
1993	93	3415	429	405	399	0	433	101	1385	0	6659
1994	70	2935	265	209	540	0	232	49	1515	0	5814
1995	110	3963	455	159	617	0	312	62	1286	90	7053
1996	118	4587	477	245	524	28	374	109	1239	392	8092
1997	134	4836	602	132	474	9	313	17	1128	471	8114
1998	179	5565	246	230	288	1	258	72	1454	305	8599
1999	16	4872	115	285	319	0	146	76	1496	0	7325
2000	68	4675	187	261	267	0	136	36	1407	0	7037
2001	36	3761	107	260	301	0	114	28	1080	0	5688
2002	31	4354	151	251	386	0	102	12	1247	0	6534
2003*	79	5647	320	346	362	5	155	32	1189	0	8134
2004**	107	4720	265	349	394	0	259	8	1489	0	7590

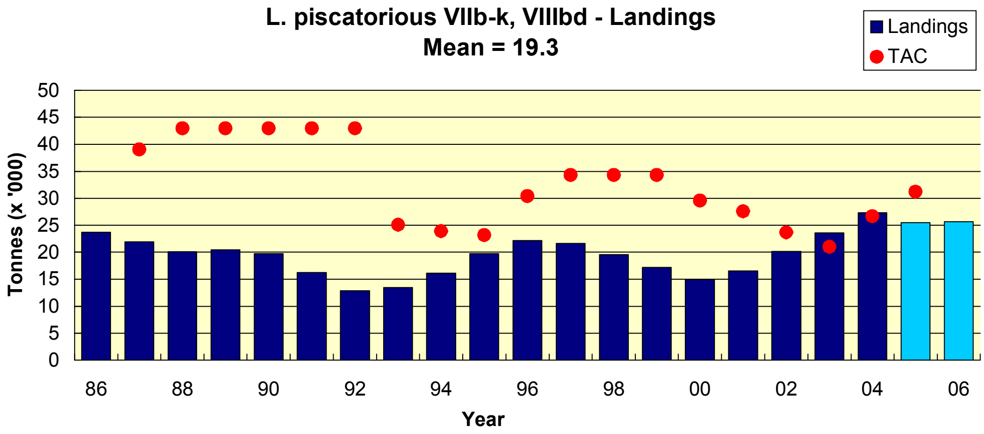
* revised
** preliminary

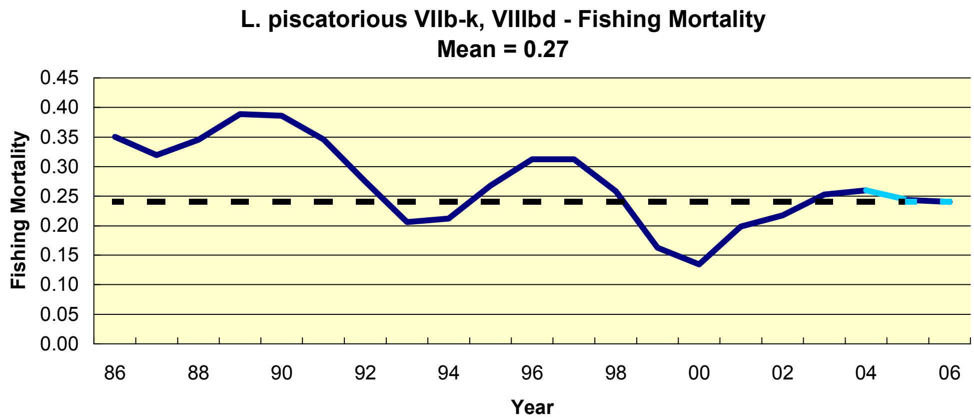

L. budegassa VIIb-k, VIIIbd - Landings
Mean = 7.7
Landings
TAC
Tonnes (x '000)
Year

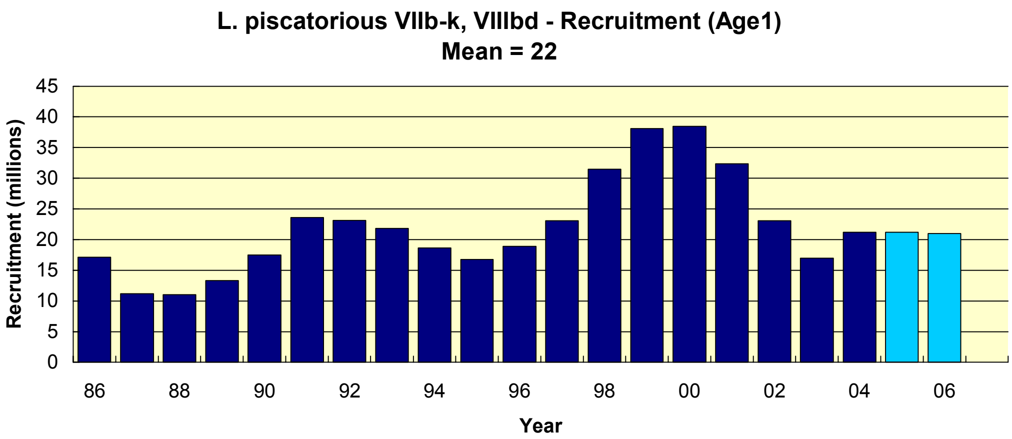

L. budegassa VIIb-k, VIIIbd - Fishing Mortality
Mean = 0.25
Fishing Mortality
Year

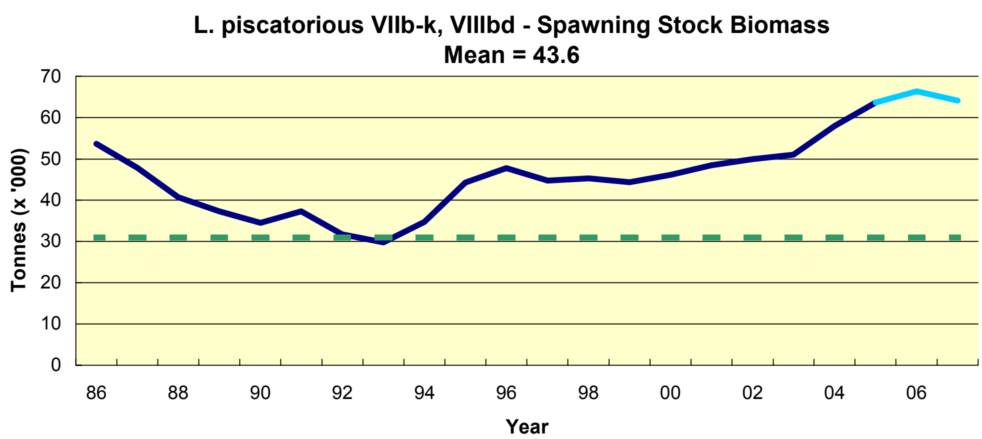

L. budegassa VIIb-k, VIIIbd - Recruitment (Age2)
Mean = 16.2
Recruitment (millions)
Year


L. budegassa VIIb-k, VIIIbd - Spawning Stock Biomass
Mean = 25.2
Tonnes (x '000)
Year


L. piscatorious VIIb-k, VIIIbd - Landings
Mean = 19.3
Landings
TAC
Tonnes (x '000)
50
45
40
35
30
25
20
15
10
5
0
86
88
90
92
94
96
98
00
02
04
06
Year


L. piscatorious VIIb-k, VIIIbd - Fishing Mortality
Mean = 0.27
Fishing Mortality
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
86
88
90
92
94
96
98
00
02
04
06
Year


L. piscatorious VIIb-k, VIIIbd - Recruitment (Age1)
Mean = 22
Recruitment (millions)
45
40
35
30
25
20
15
10
5
0
86
88
90
92
94
96
98
00
02
04
06
Year


L. piscatorious VIIb-k, VIIIbd - Spawning Stock Biomass
Mean = 43.6
Tonnes (x '000)
70
60
50
40
30
20
10
0
86
88
90
92
94
96
98
00
02
04
06
Year

Celtic Sea and Bay of Biscay Megrim

(Sub-area VII and Divisions VIIIa,b,d,e)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

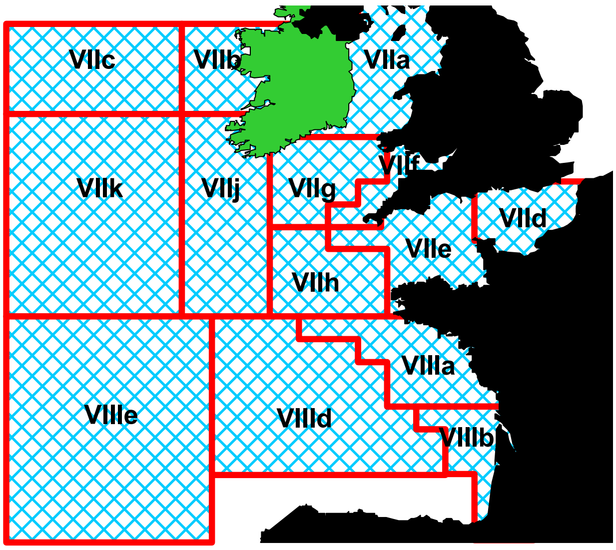
Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

The quality of this assessment is poor due to concerns about the reliability of the discard data and other data used (see Additional Information). France has not provided the required catch-at-length, catch-at-age, and survey data for 2003 and 2004. This degraded the quality of the input data.

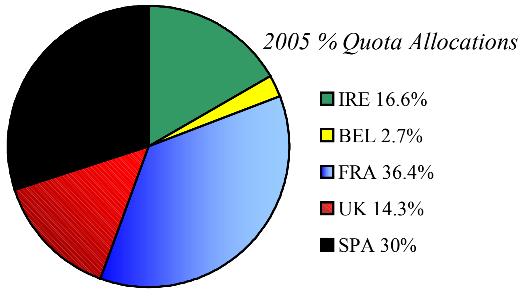
FSS considers that the current assessment is probably not an improvement on historical assessments which have been revised substantially and cannot be considered a reliable basis from which to predict short-term catches. In the absence of this the FSS advice is based on catches at long-term equilibrium yield fishing at F_{max}. This translates to landings in 2006 of 14,727 t including a 5% contribution for landings of *L.boscii*.



Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

CURRENT MANAGEMENT

- There are two TAC areas covering the assessment area for this stock; Sub-area VII and Divisions VIIIa,b, d,e. The assessment area for this stock is Sub-area VII and Divisions VIIIa,b,d,e. As for anglerfish, landings from VIIa are not considered in the assessment and advice. However, recent official data suggests landings are minor (<50 t).
- The TAC is also set for two species, *Lepidorhombus whiffiagonis* and *L. boscii*, combined. *L. boscii* accounts for around 5% of the landings.
- FSS advises that a management plan be developed and implemented for fisheries taking megrim.
- The minimum landing size of *Lepidorhombus* spp. is 20 cm. Discarding occurs above this size in some fisheries mainly due to market reasons.



ADDITIONAL INFORMATION

1. CONCERNS OVER THE ASSESSMENT QUALITY INCLUDE
   - Limited discards data are available in the time series and filling in of the missing years is problematic because both discarding practices in the fisheries are variable over time.
   - France has not provided the required catch-at-length, catch-at-age, and survey data for 2003 and 2004. This degraded the quality of the input data.
   - The commercial CPUE data used to calibrate the assessment give conflicting signals.
   - There have been large annual changes in the perception of recent stock dynamics particularly recruitment (see Figure 1) in the assessments presented by ICES.

	Landings 2006 Combined	TAC 2006		2006 Irish quota	% Change 2005
		VII	VIIIabde		
Longterm Equilibrium Yield	14,727	13,854	1,609	2,294	-28%

2. Irish landings of megrim in this area were 2,287 t (estimate) in 2004.
3. Megrim are a very valuable by-catch for Irish demersal trawlers from Killybegs, Castletownbere, Waterford and Rossaveal. In recent years megrim have also become important to the Irish beam trawl and twin-rig fleets.
4. The fishery consists of two species. Irish sampling indicates that catch rates of *L. boscii* are negligible in landings. Irish fishermen don't separate the two species. Due to their smaller average size *L. boscii* are more common in discards particularly in deeper waters.
5. The selection pattern remains poor with the fishery takes a disproportionate amount of small fish. Further technical measures such as increases in mesh size to reduce the catches of small fish should be encouraged for this stock.

ICES ADVICE
1.4.19

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target
Full reproductive capacity	Increased risk	Overexploited	Unknown

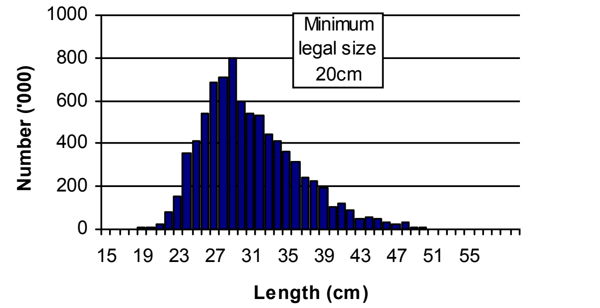
Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as having full reproductive capacity and at risk of being harvested unsustainably.

SSB has been above $\mathbf{B}_{pa}$ since 1994. The fishing mortality has been around $\mathbf{F}_{pa}$ in the 1990s, and appears to have increased since. The 2001 year class is estimated to be strong.

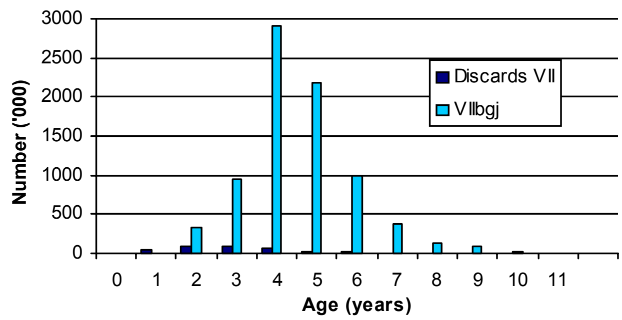
Management objectives

There are no specific management objectives for this stock.

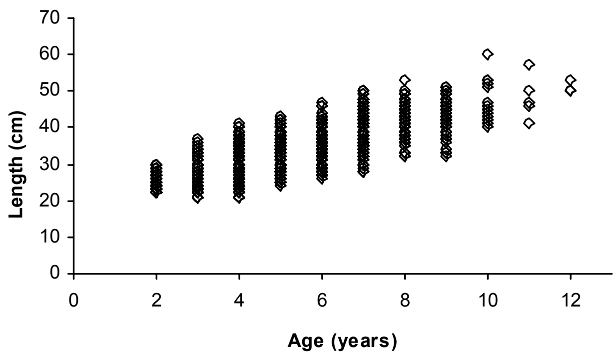
2004 Length Distribution: Irish Landings, Megrim in VIIbgj



2004 Age Distribution: Irish Landings, Megrim in VIIbgj; Discards Area VII



2004 Size at Age: Irish Sampling, Megrim in VIIbgj



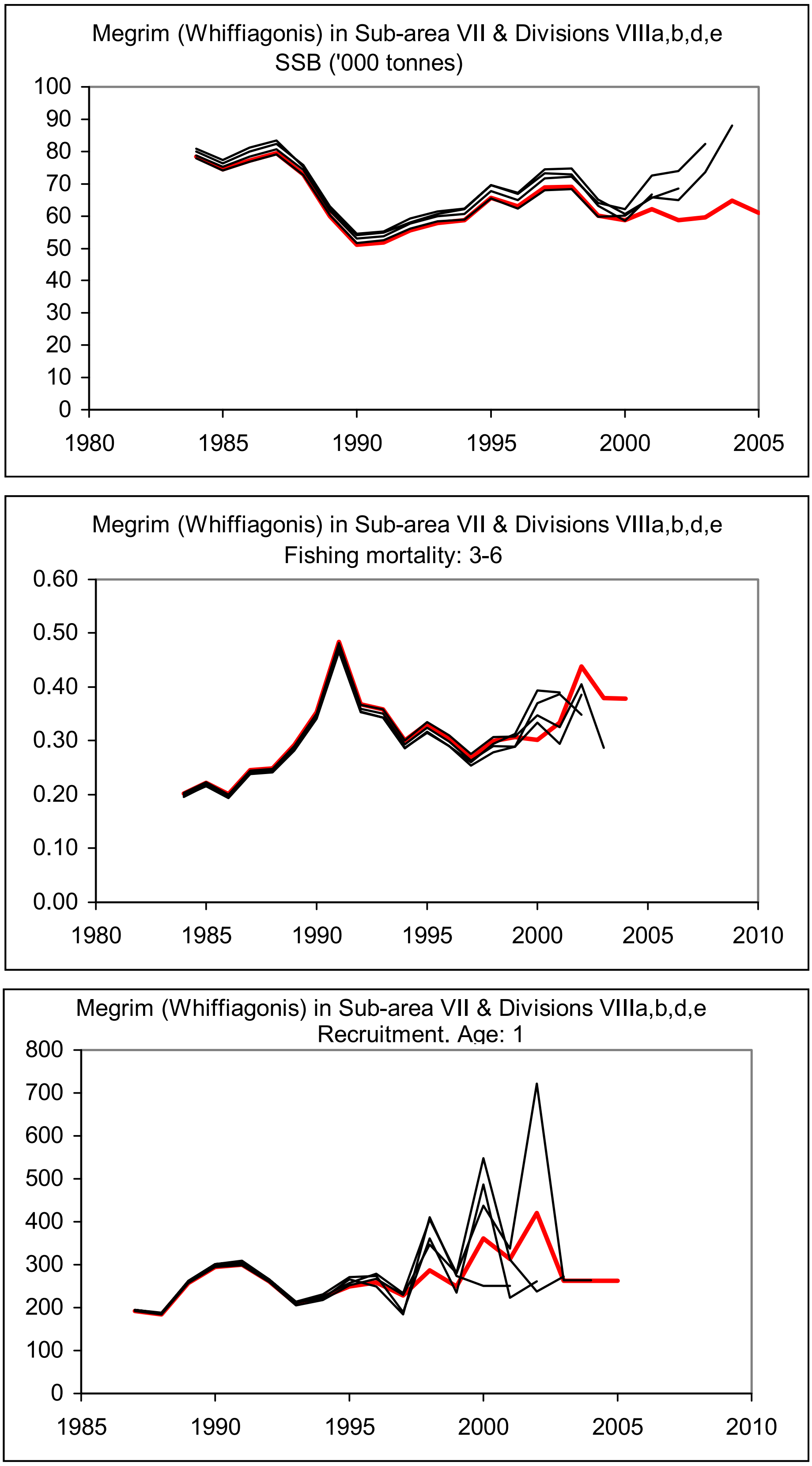


Figure 1. Plots of SSB, Fishing Mortality and Recruitment for historic ICES assessments showing large inter-annual changes reflecting the uncertainty in this assessment. The current assessment is shown in red.

Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is not defined.	$\mathbf{B}_{pa}$ be set at 55 000 t.
	$\mathbf{F}_{lim}$ is 0.44.	$\mathbf{F}_{pa}$ be set at 0.30
Target reference points		$\mathbf{F}_{y}$ is not defined

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	0.399	0.061	0.193
Fmax	0.229	0.064	0.334
F0.1	0.139	0.061	0.515
Fmed	0.311	0.063	0.247

Technical basis:

Blim = Not defined	$\mathbf{B}_{pa} = \mathbf{B}_{loss}$. There is no evidence of reduced recruitment at the lowest biomass observed and $\mathbf{B}_{pa}$ was therefore set equal to the lowest observed SSB
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$	$\mathbf{F}_{pa} = \mathbf{F}_{med}$; this implies a less than 45% probability that ($SSB_{MT} < \mathbf{B}_{pa}$)

Single stock exploitation boundaries

Exploitation boundaries in relation to high long term yield, low risk of depletion of production potential and considering ecosystem effects

The current fishing mortality ($\mathbf{F}_{sq}$) is estimated as 0.39, which is above rates that would lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.16). Fishing at $\mathbf{F}_{max}$ is expected to lead to high long term landings and SSB.

Exploitation boundaries in relation to precautionary limits

In order to harvest the stock within precautionary limits fishing mortality should be below $\mathbf{F}_{pa}$ and SSB should be above $\mathbf{B}_{pa}$. A recommended 23% reduction in F is needed to achieve a fishing mortality at $\mathbf{F}_{pa}$ (0.30). This corresponds to landings of less than 13 600 tonnes in 2006. The predicted SSB is well above $\mathbf{B}_{pa}$ if F is below F_{pa}.

Short term implications

Outlook for 2006:

Basis: Fsq =mean F(02-04)=0.4; R04-05 = GM 1987-2002=262 millions; landings (2005) = 17.8; SSB(2006) = 58.8
The fishing mortality applied according to the agreed management plan (F(management plan)) is not defined
The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.3

Rationale	Landings (2006)	Basis	F total (2006)	F HCons (2006)	F disc (2006)	Disc (2006)	Catch (2006)	SSB (2007)	%SSB change 1)	%TAC change 2)
Zero catch	0.0	F=0	0.00	0.00	0.00	0.0	0.0	79.9	36%	-100%
High long-term yield	8.1	F(long-term yield)	0.17	0.13	0.04	1.1	9.1	68.8	17%	-62%
Status quo	2.1	$\mathbf{F}_{sq}$ *0.1	0.04	0.03	0.01	0.3	2.4	77.0	31%	-90%
	4.1	$\mathbf{F}_{sq}$ *0.2	0.08	0.06	0.02	0.5	4.6	74.3	26%	-81%
	9.6	$\mathbf{F}_{sq}$ *0.5	0.20	0.15	0.05	1.3	10.8	66.8	14%	-55%
	13.6	$\mathbf{F}_{sq}$ *0.75	0.30	0.23	0.07	1.8	15.4	61.3	4%	-37%
	15.8	$\mathbf{F}_{sq}$ *0.9	0.36	0.27	0.09	2.2	18.0	58.3	-1%	-26%
	17.2	$\mathbf{F}_{sq}$ *1	0.40	0.30	0.10	2.4	19.6	56.4	-4%	-20%
	18.5	$\mathbf{F}_{sq}$ *1.1	0.44	0.33	0.10	2.6	21.1	54.6	-7%	-14%
	20.4	$\mathbf{F}_{sq}$ *1.25	0.50	0.38	0.12	2.8	23.3	52.1	-11%	-5%
Precautionary limits	1.6	F(prec limits) *0.1	0.03	0.02	0.01	0.2	1.8	77.7	32%	-93%
	3.9	F(prec limits) *0.25	0.08	0.06	0.02	0.5	4.4	74.6	27%	-82%
	7.4	F(prec limits) *0.5	0.15	0.11	0.04	1.0	8.4	69.8	19%	-66%
	10.6	F(prec limits) *0.75	0.23	0.17	0.05	1.4	12.1	65.3	11%	-51%
	12.5	F(prec limits) *0.9	0.27	0.21	0.06	1.7	14.1	62.8	7%	-42%
	13.6	$\mathbf{F}_{pa} = \mathbf{F}_{sq}$ *0.75	0.30	0.23	0.07	1.8	15.5	61.3	4%	-37%
	14.8	F(prec limits) *1.1	0.33	0.25	0.08	2.0	16.8	59.7	2%	-31%
	16.4	F(prec limits) *1.25	0.38	0.29	0.09	2.2	18.6	57.5	-2%	-24%
	18.9	F(prec limits) *1.5	0.45	0.34	0.11	2.6	21.5	54.1	-8%	-12%
	21.2	F(prec limits) *1.75	0.53	0.40	0.13	3.0	24.2	51.0	-13%	-1%
	23.4	F(prec limits) *2	0.60	0.46	0.14	3.3	26.7	48.1	-18%	9%

The fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock (F(long term yield)) is 0.165
All weight in '000 tonnes
Shaded scenarios are not considered consistent with the precautionary approach

1) SSB 2007 relative to SSB 2006
2) Predicted landings 2006 relative to TAC 2005 (21 500 t.)

Management considerations

Megrim is caught in a mixed demersal fishery, both as a targeted fishery and as a valuable bycatch.

Technical measures applied to other species will affect the management of megrim. Management measures directed at the reduction of discards of megrim will have an effect on other target species (e.g. hake).

Factors affecting the fisheries and the stock

The effects of regulations

The 2005 TAC was set at 21 500 t, including a 5% contribution of *L. boscii* in the landings for which stock there is no assessment.

The minimum landing size of megrim was reduced from 25 to 20-cm length in 2000 partially explaining the observed decrease in discards in 2000-2002. Since then high-grading appears to have lead to an increase in discarding again.

Council Regulation (EC) No 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in Subareas VIIb, VIIj, VIIg, and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998-2002). These measures appear not to have resulted in a decrease in fishing effort for fleets fishing for megrim.

Changes in fishing technology and fishing patterns

No significant changes in recent years.

Other factors

French trawlers operating in the Celtic Sea and targeting demersal species catch megrim as a bycatch. Spanish fleets have a targeted fishery for megrim and also catch megrim in mixed fisheries for hake, anglerfish, *Nephrops*, and other species. Otter trawlers account for the majority of the Spanish landings from Subarea VII. Most UK landings of megrim are made by beam trawlers fishing in ICES Divisions VIIe,f,g,h. Irish megrim landings are largely made by multi-purpose vessels fishing in Divisions VIIb,c,g for gadoids, plaice, sole, and anglerfish.

Scientific basis

Data and methods

An age-based assessment (XSA) using landings and discards data, calibrated by three commercial CPUE series and two surveys was carried out. Incomplete discard estimates were used.

Information from the fishing industry

The fishing industry and scientists have met at the national level to discuss information that can be used in the assessments. Some CPUE time series have been provided by the fishing industry. Qualitative information has also been provided and has contributed to the assessment process.

Uncertainties in assessment and forecast

- Limited discards data are available in the time series and filling in of the missing years is problematic because both discarding practices in the fisheries are variable over time.
- France has not provided the required catch-at-length, catch-at-age, and survey data for 2003 and 2004. This degraded the quality of the input data.
- The commercial CPUE data used to calibrate the assessment give conflicting signals.

Comparison with previous assessment and advice

In this year assessment, there is a substantial upward revision of F and a downwards revision of SSB. This could be due to the conflicting signals in the CPUE series.

The advice this year, although consistent in basis with last year, results in a substantial reduction in the advised catch. This is due to the more pessimistic view of the stock in the current assessment.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2005 (ICES CM 2006/ ACFM:01).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	ACFM Landings	Disc. slip.	ACFM Catch
1987	Not assessed		-		16.46	17.1	1.7	18.8
1988	Not assessed		-		18.1	17.6	1.7	19.3
1989	Not assessed		-		18.1	19.2	2.6	21.8
1990	Not assessed		-		18.1	14.4	3.3	17.7
1991	No advice		-		18.1	15.1	3.3	18.4
1992	No advice		-		18.1	15.6	3.0	18.6
1993	Within safe biological limits		-		21.46	14.9	3.1	18.0
1994	Within safe biological limits		-		20.33	13.7	2.7	16.4
1995	No particular concern		-		22.59	15.9	3.2	19.1
1996	No long-term gain in increased F		16.6		21.20	15.1	3.0	18.1
1997	No advice		14.3		25.0	14.3	3.1	17.3
1998	No increase in F		15.2		25.0	14.3	5.4	19.7
1999	Reduce F below $\mathbf{F}_{pa}$		14.6[1]		25.0	13.7	3.1	16.9
2000	Reduce F below $\mathbf{F}_{pa}$		<14.2[1]		20.0	15.0	2.3	17.3
2001	Reduce F below $\mathbf{F}_{pa}$		< 14.1[1]		16.8	15.8	1.3	17.1
2002	Reduce F below $\mathbf{F}_{pa}$		< 13.0[1]		14.9	15.9	1.5	17.4
2003	Reduce F below $\mathbf{F}_{pa}$		< 16.1[1]		16.0	15.6	3.1	18.8
2004	Reduce F below $\mathbf{F}_{pa}$		< 20.2[1]		20.2	14.3	4.5	18.8
2005	Reduce F below $\mathbf{F}_{pa}$		< 22.6[1]		21.5			
2006	Reduce F below F_{pa}		<13.6					

[1]Includes *L. boscii*.
Weights in '000 t.

Table1.4.19.1 Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Nominal landings and catches (t) provided by the Working Group.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total landings	18927	17114	17577	19233	14371	15094	15600	14929	13685	15862
Total discards	2321	1705	1725	2582	3284	3282	2988	3108	2700	3206
Total catches	21248	18819	19302	21815	17655	18376	18588	18037	16385	19068
Agreed TAC [1]		16460	18100	18100	18100	18100	18100	21460	20330	22590

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total landings	15109	14230	14345	13715	14485	15806	15988	15414	14300	
Total discards	3026	3066	5371	3135	1033	1275	1466	3147	4511	
Total catches	18135	17296	19716	16850	15517	17081	17454	18561	18811	
Agreed TAC [1]	21200	25000	25000	25000	20000	16800	14900	16000	20200	21500

[1] For both Megrim species and catches from Division VIIa included.

Table 1.4.19.2 Megrim (*Whiffiagonis*) in Sub-area VII & Divisions VIIIa,b,d,e

Year	Recruitment Age 1 thousands	SSB tonnes	Catches tonnes	Mean F Ages 3-6
1984	233931	78336	18828	0.2020
1985	229827	74488	19597	0.2219
1986	209480	77246	21248	0.2008
1987	192002	79363	18819	0.2460
1988	184033	72814	19302	0.2491
1989	257421	59964	21815	0.2923
1990	295330	51079	17655	0.3533
1991	299758	51846	18376	0.4843
1992	261476	55567	18588	0.3682
1993	209564	57915	18037	0.3586
1994	224132	58751	16385	0.3002
1995	249527	65577	19068	0.3317
1996	258823	62969	18135	0.3047
1997	228353	68934	17296	0.2674
1998	287011	69124	19716	0.2999
1999	249886	60070	16850	0.3064
2000	361635	58650	15517	0.3019
2001	313018	62150	17081	0.3333
2002	420561	58770	17454	0.4385
2003	262166*	59633	18561	0.3794
2004	262166*	64712	18811	0.3784
2005	262166*	61023		
Average	261467	64045	18435	0.3152

*GM 1992 -2003

Celtic Sea Plaice

(Division VIIfg)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

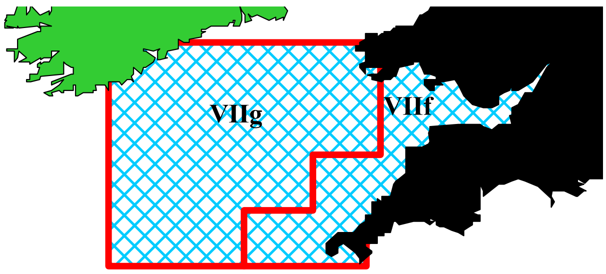
FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

ICES classify this stock at being at risk of suffering reduced reproductive capacity. This stock is considered to be overfished.

Long Term Considerations
FSS would advise managers that this stock should be managed on a long term basis using F max (F = 0.32). This would result in higher long term yield and achieve a low risk of depleting the productive potential of the stock. Average fishing mortality for the past three years (F = 0.54) is far in excess of F max and a management plan should be put in place based on long term considerations.

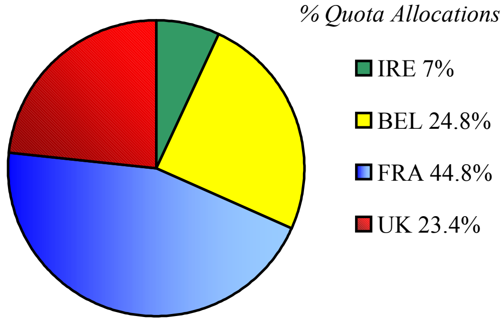
Short Term Considerations
FSS agree with ICES advice that a 50% reduction in F is required to achieve SSB at B_{pa} in 2007. This translates to landings of 400 t in 2006, and an Irish quota of 27 t. This would have very restrictive implications for the Irish fleet.



Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

CURRENT MANAGEMENT

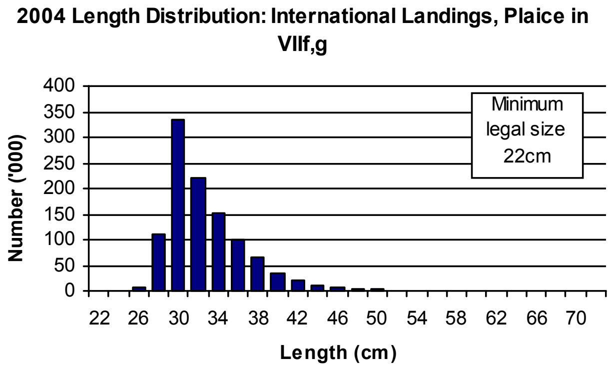
- The 2005 TAC was 476 t with an associated Irish quota of 202 t.
- There are no explicit management objectives or plans for this stock.

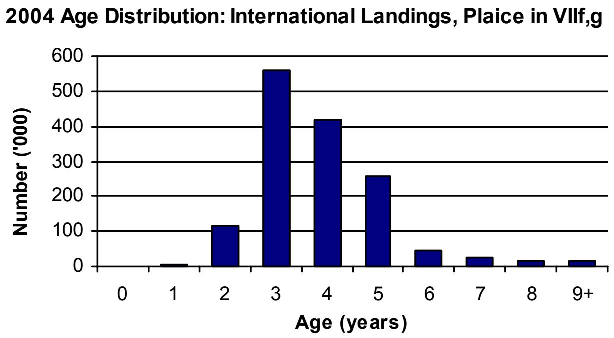


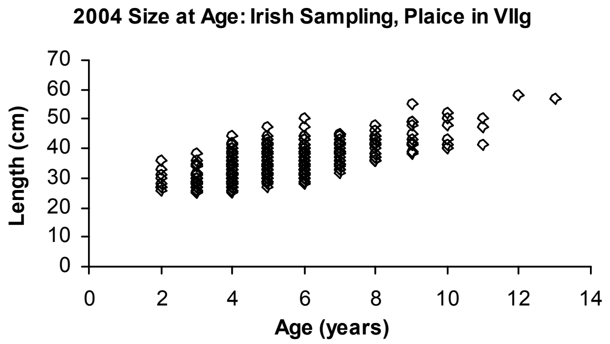
ADDITIONAL INFORMATION

1. Recent assessments have shown a good level of consistency. Estimates of fishing mortality have been revised upwards slightly but the overall results show good consistency with little or no change in the perception of the stock.
2. Estimates of discarding are not included in this assessment. Discard rates are believed to be high for this stock in some seasons/fleets and their non-inclusion may represent a major deficiency in the assessment.
3. Irish estimated landings in 2004 were 44 t, similar to 2003 landings (45 t).
4. Misreporting has been considered a problem for this stock in earlier years. Under-reporting and misreporting of catches from ICES Division VIIg to VIIj may have taken place in the most recent years, but no information is available on the scale of the problem.
5. In the 1970s, the Divisions VIIf,g plaice fishery was mainly carried out by Belgian beam trawlers and Belgian and UK otter trawlers. Effort in the UK and Belgian beam-trawl fleets increased in the late 1980s, but has since declined. Recently, many of these otter trawlers have been replaced by beam trawlers, which target sole.
6. Routine discard monitoring began in 2002-3 following the introduction of the EU data collection regulations. Discards data for 2002-2004 are available for the UK(E&W) fleets; for 2003-2004 from the Belgium fleets; and for 1996-2004 from Irish fleets (although sampling levels prior to 2003 were not high). Initial indications are that discard rates, although variable, may be substantial in some fleets/periods.
7. There were no early closures of the fishery for plaice in 2004, except for Belgian vessels for the last two weeks of the year.

ICES ADVICE
1.4.8







State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Increased risk	Unknown	Overexploited

Based on the most recent estimates of SSB, ICES classifies the stock as being at risk of suffering reduced reproductive capacity. SSB peaked in 1988–1990, following a series of good year classes, then declined rapidly and has since 2000 remained close to, but above $\mathbf{B}_{lim}$. No F reference points have been defined. Fishing mortality has fluctuated around an average level (0.60) for the entire time-series. Recruitment has been below average in the most recent years.

Management objectives

There are no specific management objectives for this stock.

Reference points

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 1 100 t, the lowest observed spawning stock biomass $\mathbf{B}_{loss}$.	$\mathbf{B}_{pa}$ be set at 1 800 t. Biomass above this affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ not defined.	$\mathbf{F}_{pa}$ not defined.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	0.541	0.238	0.486
$\mathbf{F}_{max}$	0.327	0.245	0.834
$\mathbf{F}_{0.1}$	0.160	0.224	1.633
$\mathbf{F}_{med}$	0.555	0.238	0.473

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$-$\mathbf{F}_{max}$.

Technical basis

$\mathbf{B}_{lim}=\mathbf{B}_{loss}$.	$\mathbf{B}_{pa}=\mathbf{B}_{lim}$ * 1.64.
$\mathbf{F}_{lim}$=Not defined.	$\mathbf{F}_{pa}$ not defined.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

Target reference points have not been agreed for this stock. $\mathbf{F}_{sq}$ (0.54) is above the possible target reference points $\mathbf{F}_{0.1}$ and $\mathbf{F}_{max}$.

Exploitation boundaries in relation to precautionary considerations

A 50% reduction in F is needed to increase SSB to around $\mathbf{B}_{pa}$ in 2007. This corresponds to landings of less than 400 tonnes in 2006.

If such a large reduction in F is not achievable in the short term, ICES recommends that a recovery plan be developed. This plan should include a sustained reduction of fishing mortality to rebuild the stock above $\mathbf{B}_{pa}$ in the medium term. Catch and effort reductions are required to promote such a reduction in fishing mortality.

Short-term implications

Outlook for 2006

Basis: F(2005) = $\mathbf{F}_{sq}$ = mean F(02-04) = 0.54; SSB(2006) = 1.41 kt; landings (2005) = 0.66 kt. R05-06=GM89-03=3.2 million.

Rationale	TAC(2006) (1)	Basis	F(2006)	SSB(2007)	%SSB change	%TAC change
Zero catch	0	F=0	0	2.19	55%	-100%
Status quo	0.71	$\mathbf{F}_{sq}$	0.54	1.51	7%	49%
High long-term yield	0.47	F(long-term yield)	0.33	1.73	23%	-1%
	0.09	$\mathbf{F}_{sq}$ *0.1	0.05	2.1	49%	-82%
	0.25	$\mathbf{F}_{sq}$ *0.31	0.17	1.94	37%	-47%
	0.39	$\mathbf{F}_{sq}$ *0.5	0.27	1.81	28%	-17%
Status quo	0.56	$\mathbf{F}_{sq}$ *0.75	0.41	1.65	17%	17%
	0.65	$\mathbf{F}_{sq}$ *0.9	0.49	1.56	10%	37%
	0.71	$\mathbf{F}_{sq}$ *1	0.54	1.51	7%	49%
	0.76	$\mathbf{F}_{sq}$ *1.1	0.59	1.46	3%	60%
	0.84	$\mathbf{F}_{sq}$ *1.25	0.68	1.38	-2%	76%
Mixed Fisheries						

(1) It is assumed that the TAC will be implemented and that the landings in 2006 therefore correspond to the TAC.
All weights in thousand tonnes
Shaded scenarios are not considered consistent with the Precautionary Approach.

Management considerations

The TACs have been gradually reduced over the last 20 years in line with ICES advice. Nevertheless, fishing mortality has remained stable and high. This may indicate that the total removal from the stock has not been reduced despite the reductions in TACs and landings. In such cases, the estimate of the fishing mortality is likely to be realistic while the estimate of stock size might be unreliable.

ICES has explored simulations with long-term target Fs below 0.65 for this stock. These show a range of fishing mortalities from 0.25 to 0.56 which are predicted to result in the highest long-term yields (around 740 t), whilst posing little risk of being below $\mathbf{B}_{lim}$ in the long term (Figure 1.4.8.1). A Harvest Control Rule should therefore be developed to reduce F to this type of target level in the medium term whilst minimizing the risk of SSB decreasing below $\mathbf{B}_{lim}$. A dialogue between managers and stakeholders will be required to define an appropriate management plan for this fishery.

The high level of discarding indicated in this mixed fishery would suggest a mis-match between the mesh size employed and the size of the fish landed. Increases in the mesh size of the gear should result in fewer discards and, ultimately, in increased yield from the fishery. The use of larger mesh gear should be encouraged in this fishery in instances where mixed fishery issues allow for it.

Ecosystem considerations

There is some evidence from tagging that plaice from the southern and western coasts of Wales move southwards to join the adult population off the north Cornish coast during spawning.

Factors affecting the fisheries and the stock

In the 1970s, the Divisions VIIf,g plaice fishery was mainly carried out by Belgian beam trawlers and Belgian and UK otter trawlers. Effort in the UK and Belgian beam-trawl fleets increased in the late 1980s, but has since declined. Recently, many otter trawlers have been replaced by beam trawlers targeting sole. Landings gradually

increased until 1989, then declined rapidly in 1991. The main fishery occurs in the spawning area off the north Cornish coast, at depths greater than 40 m, about 20 to 25 miles offshore. Although plaice are taken throughout the year, the larger landings occur during February–March after the peak of spawning, and again in September.

Regulations and their effects

Plaice in the Bristol Channel and Celtic Sea (ICES Divisions VIIf and VIIg) are managed by TAC and technical measures. Misreporting is known to occur as quotas become more restrictive.

Technical measures in force for this stock are minimum mesh sizes, minimum landing size, and restricted areas for certain classes of vessels. Technical regulations regarding mesh sizes allowable for specific target species, and associated minimum landing sizes, came into force on 1 January 2000. The minimum landing size for plaice in Divisions VIIf&g is 27 cm.

Council Regulation (EC) No. 27/2005, Annex III, part A 12 (b) prohibited fishing in ICES rectangles 30E4, 31E4, and 32E3 during January–March 2005. This prohibition did not apply to beam trawlers during March 2005. The effects of the area closure cannot yet be evaluated, but is the closure coincides with an area and time of high plaice abundance.

Scientific basis

Data and methods

The analytical age-based assessment (XSA) is based on landings, one survey index, and two commercial CPUE series.

Uncertainties in assessment and forecast

This assessment is conditional on the accuracy of the commercial CPUE and total catch data. Misreporting and under-reporting of landings is suspected as quotas become more restrictive. Discards are substantial. Due to the short time-series discards are not included in the assessment.

There is a strong retrospective bias of overestimation of SSB and underestimation of fishing mortality. Recent forecasts for this stock have been overly optimistic, probably due to this bias problem. The GM assumptions of average recruitment in the most recent years contribute little to forecasted landings.

The shape of the yield-per-recruit relationship will change significantly with the introduction of discards in the calculations and therefore the current long-term reference points ($\mathbf{F}_{max}$ and $\mathbf{F}_{0.1}$) are rather uncertain.

Comparison with previous assessment and advice

There has been little change in the perception of the state of the stock.

The advice for an F reduction to rebuild above $\mathbf{B}_{pa}$ or to implement a recovery/management plan is consistent with last year's advice.

Source of information

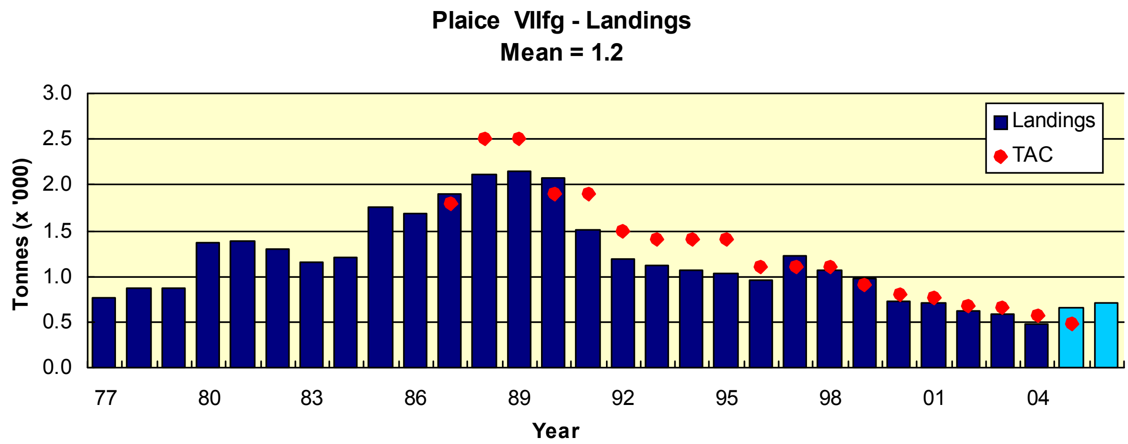
Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

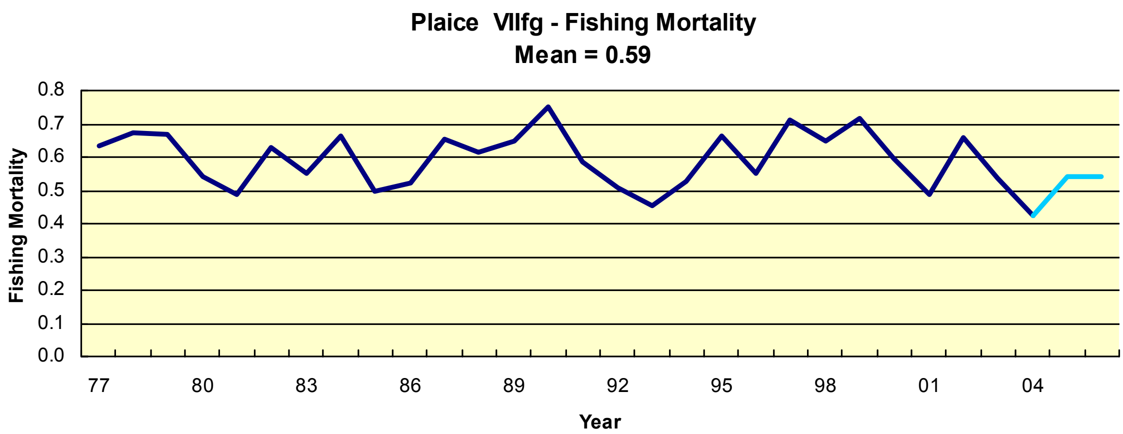
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	ACFM Landings
1987	TAC not to be restrictive on other species		-		1.8	1.91	1.90
1988	TAC not to be restrictive on other species		-		2.5	2.19	2.12
1989	TAC not to be restrictive on other species		-		2.5	2.58	2.15
1990	F likely to be F(88)		~1.9		1.9	2.22	2.08
1991	F likely to be F(89)		~1.7		1.9	1.83	1.50
1992	No long-term gains in increasing F		-		1.5	1.36	1.19
1993	No long-term gains in increasing F		-		1.4	1.30	1.11
1994	No long-term gains in increasing F		-		1.4	0.98	1.07
1995	No increase in F		1.29		1.4	0.96	1.03
1996	20% reduction in F		0.93		1.1	0.98	0.95
1997	20% reduction in F		1.10		1.1	1.26	1.22
1998	20% reduction in F		1.00		1.1	1.15	1.07
1999	35% reduction in F		0.67		0.9	0.66	0.97
2000	30% reduction in F		0.70		0.80	0.72	0.74
2001	40% reduction in F		0.60		0.76	0.68	0.72
2002	At least 35% reduction in F		0.68		0.68	0.62	0.63
2003	At least 40% reduction in F		<0.66		0.66	0.51	0.59
2004	[1]	F < 0.10 or recovery plan	[1]	<0.21	0.56	0.30	0.49
2005	[1]	70% Reduction in F or recovery plan	[1]	<0.25	0.48		
2006	[1]	50% reduction in F or Recovery plan	[1]	<0.40			

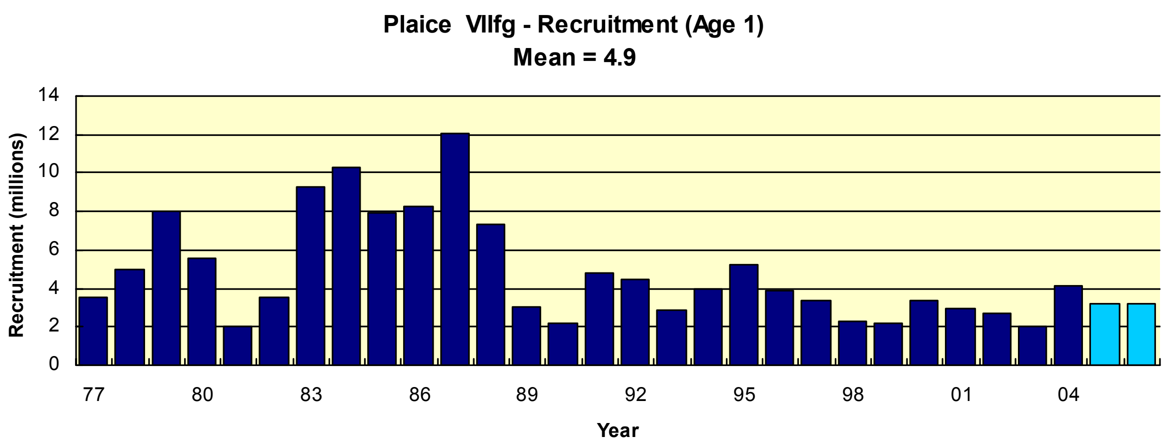
Weights in '000 t.

[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

[Official landings figures have been corrected following the discovery of errors in the time-series]


Plaice VIIfg - Landings
Mean = 1.2
Tonnes (x '000)
Landings
TAC
3.0
2.5
2.0
1.5
1.0
0.5
0.0
77
80
83
86
89
92
95
98
01
04
Year


Plaice VIIfg - Fishing Mortality
Mean = 0.59
Fishing Mortality
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
77
80
83
86
89
92
95
98
01
04
Year


Plaice VIIfg - Recruitment (Age 1)
Mean = 4.9
Recruitment (millions)
14
12
10
8
6
4
2
0
77
80
83
86
89
92
95
98
01
04
Year

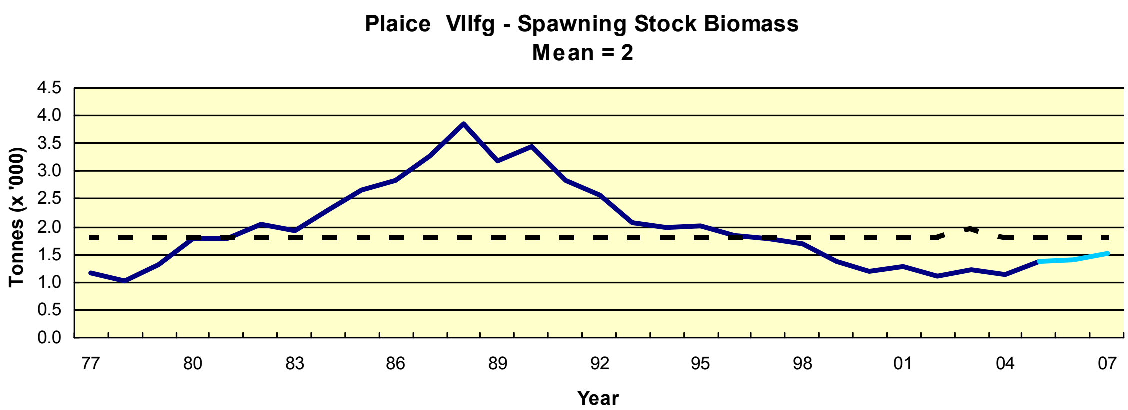

Plaice VIIfg - Spawning Stock Biomass
Mean = 2
Tonnes (x '000)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
77
80
83
86
89
92
95
98
01
04
07
Year

Table 1.4.8.1 Plaice in Divisions VIIfg. Nominal landings (t) as reported to ICES, and total landings as used by the Working Group.

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Belgium	214	196	171	372	365	341	314	283	357	665	581	617	843	794
UK (Engl. & Wales)	150	152	176	227	251	196	279	366	466	529	496	629	471	497
France	365	527	467	706	697	568	532	558	493	878	708	721	1089	767
Ireland	28	0	49	61	64	198	48	72	91	302	127	226	180	160
N. Ireland												1		
Netherlands										9				
Scotland	0	0	0	7	0	0	0	0	0	1				1
Total	757	875	863	1373	1377	1303	1173	1279	1407	2384	1912	2194	2583	2219
Unallocated	0	0	0	0	0	0	-27	-69	345	-693	-11	-78	-432	-137
Total as used by WG	757	875	863	1373	1377	1303	1146	1210	1752	1691	1901	2116	2151	2082

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Belgium	836	371	542	350	346	410	594	540	371	224	241	248	221	211
UK (Engl. & Wales)	392	302	290	251	284	239	258	176	170	134	136	105	127	87
France	444	504	373	298	254	246	329	298	NA	287	255	185	164	NA
Ireland	155	180	89	82	70	83	78	135	115	76	45	79	NA	NA
N. Ireland														
Netherlands														
Scotland		5	9	1	2									
Total reported	1827	1362	1303	982	956	978	1259	1149	656	721	677	617	512	298
Unallocated	-326	-174	-189	88	72	-26	-42	-82	312	-2	33	13	80	190
Total as used by WG	1501	1188	1114	1070	1028	952	1217	1067	968	719	710	630	592	488

Table 1.4.8.2 Celtic Sea plaice (Divisions VIIf and g).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1977	3582	1170	757	0.632
1978	4965	1010	875	0.673
1979	8006	1323	863	0.666
1980	5554	1789	1373	0.541
1981	2051	1793	1377	0.488
1982	3552	2056	1303	0.629
1983	9289	1943	1146	0.550
1984	10247	2308	1210	0.666
1985	7928	2654	1752	0.498
1986	8241	2842	1691	0.522
1987	12089	3283	1901	0.654
1988	7320	3848	2116	0.616
1989	3073	3194	2151	0.649
1990	2189	3456	2082	0.750
1991	4790	2825	1501	0.588
1992	4506	2580	1188	0.510
1993	2902	2068	1114	0.451
1994	3967	1975	1070	0.525
1995	5258	2018	1028	0.665
1996	3844	1829	952	0.550
1997	3351	1792	1217	0.714
1998	2264	1684	1067	0.648
1999	2212	1387	968	0.717
2000	3400	1186	719	0.595
2001	2970	1279	710	0.487
2002	2705	1123	630	0.660
2003	2061	1218	592	0.537
2004	4125	1149	488	0.426
2005	3164*	1369		
Average	4814	2005	1209	0.593

* GM 98-03

Southwest of Ireland Plaice

(Divisions VIIh-k)

For latest information, see: http://www.ices.dk

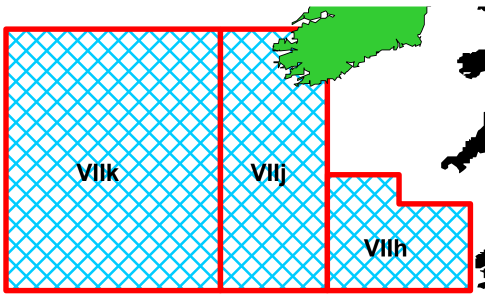
Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

The state of this stock is unknown.

Short Term Considerations
FSS agree with ICES advice that catches in 2006 should be no more than the recent average (2002 to 2004) of around 245 t in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment. This translates to an Irish quota of 107 t.

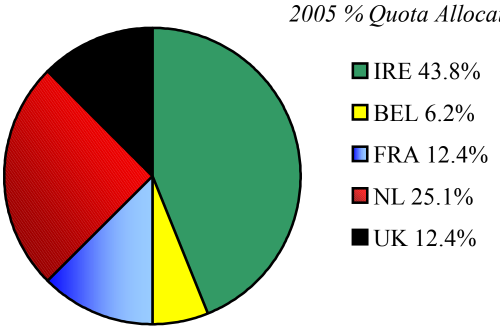


Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

CURRENT MANAGEMENT

- The 2005 TAC was 466 t with an associated Irish quota of 204 t.
- There are no explicit management objectives or plan for this stock. Ireland has an opportunity as the main participant in this fishery to propose a management strategy for this stock.

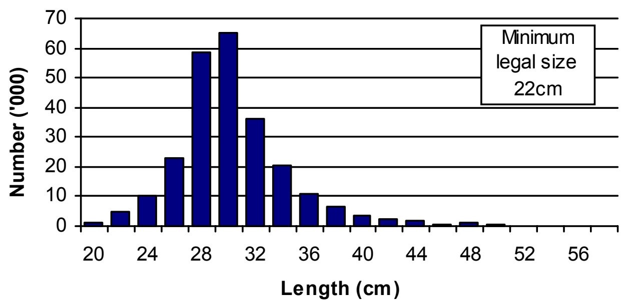
2005 % Quota Allocations



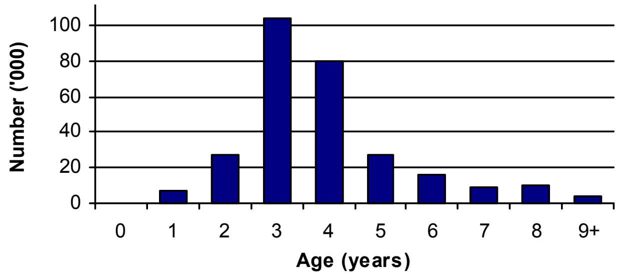
ADDITIONAL INFORMATION

1. Irish estimated landings in 2004 were 90 t, a 27% decrease from last year.
2. Area misreporting may be a problem in this fishery (see Celtic Sea Plaice).
3. Ireland has accounted for on average about 90% of the landings in this fishery since 1996. Belgium, the UK and France take most of the remaining catch.
4. Plaice are mainly caught in mixed species otter trawl fisheries in inshore parts of VIIj by vessels from Dingle, Castletownbere, Union Hall, Baltimore and Schull. Otter trawls accounted for 89% of the landings in 2004.
5. The level of discards is not well quantified but FSS sampling has indicated that discarding does occur in this fishery.

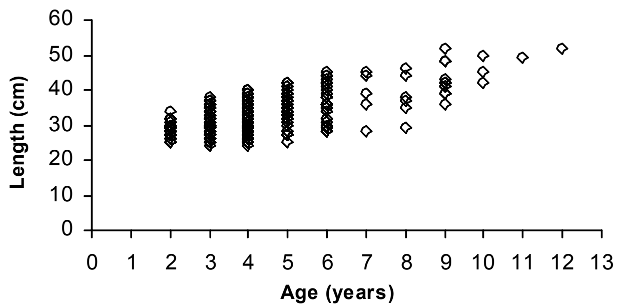
2004 Length Distribution: Irish Landings, Plaice in VIIj



2004 Age Distribution: Irish Landings, Plaice in VIIj



2004 Size At Age: Irish Sampling, Plaice in VIIj



ICES ADVICE
1.4.10

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Unknown	Unknown	Unknown

The state of the stock is unknown. No assessment was performed, due to the short series of data and lack of reliable tuning indices.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No precautionary reference points have been established.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Catches in 2005 should be no more than the recent average (2002–2004) of around 245 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Management considerations

Landings are substantially below the TAC and have been declining. The 2004 landings are the lowest observed in the time-series. The advice based on recent average landings may not be precautionary enough if this stock is in decline. Plaice are taken as part of a mixed demersal fishery by otter trawlers. Management options proposed for plaice should also take into consideration other demersal fish species taken in the fishery.

Factors affecting the fisheries and the stock

The effects of regulations

Plaice is managed through a precautionary TAC and technical conservation measures. The agreed TAC for plaice in 2004 and 2005 is 466 t, following a TAC of 582 t in 2003. Boat quota restrictions were imposed on Irish vessels for hake, cod, and anglerfish and these are likely to have impacted the plaice landings.

Council Regulation (EC) No. 1954/2003 established measures for the management of fishing effort in a ‘biologically sensitive area’ in areas of Divisions VIIb, VIIj, VIIg, and VIIh. Effort exerted within the ‘biologically sensitive area’ by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998–2002).

Changes in fishing technology and fishing patterns

Ireland, UK, and France are the major participants in this fishery. Plaice are predominantly caught within mixed species otter trawl fisheries in Division VIIj. Irish vessels operate from the ports of Castletownbere, Dingle, Union Hall, Baltimore, and Schull. Increasingly these Irish vessels target mainly hake, anglerfish, and megrim and not the more traditional inshore species (plaice, sole, whiting, and cod). Otter trawlers accounted for the majority, with beam trawlers and seiners taking smaller catches of plaice.

Scientific basis

Data and methods

Data update and screening methods only. No analytical assessment was performed.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	ACFM landings
1993	-		-		-	652
1994	-		-		-	578
1995	-		-		-	541
1996	-		-		-	431
1997	-		-		-	639
1998	-		-		-	439
1999	-		-		-	456
2000	-		-		-	363
2001	-		-		1215	276
2002	-		-		1080	325
2003	Reduce TAC to recent average (1998–2000)		450		582	213
2004	[1]	Reduce TAC to recent average (2000–2002)	[1]	320	466	NA
2005		Reduce TAC to recent average (2001–2003)		271	466	
2006		Reduce TAC to recent average (2002–2004)		245		

[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weights in t.

Table 1.4.10 Plaice in Divisions VII h-k (Southwest Ireland).
Nominal landings (t), 1996–2004, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004
Belgium	304			44.2	3.5	27.3	68.8	19	66.6
France	244	69	49		54	50	45	31	N/A
Ireland	388	344	286	299	199.5	160	155	127	N/A
Netherlands	52		12.6	1.3	2				
Spain					5	3	2	6	N/A
UK (England & Wales)	191	138	106	82	75	73.1	59.7	47	36.3
UK (Scotland)	1				1	0.1			
Portugal									8
Total	1180	551	454	427	340	314	331	230	111
Unallocated	-749	88	-15	29	23	-38	-6	26	-95
Totals used by Working Group	431	639	439	456	363	276	325	204	206

West of Ireland Plaice

(Divisions VIIb,c)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

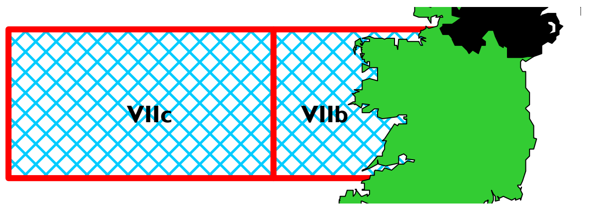
Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

The state of this stock is unknown.

Short Term Considerations
FSS agrees with ICES advice that catches in 2006 should be no more than the recent average (2002 to 2004) of around 65 t in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment. This translates to an Irish quota of 58 t.



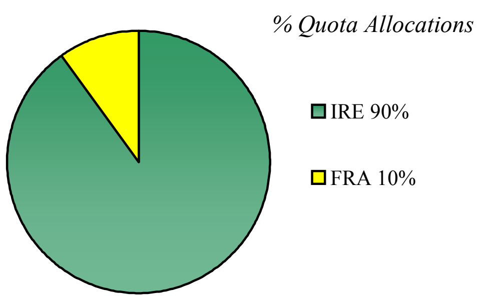
Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

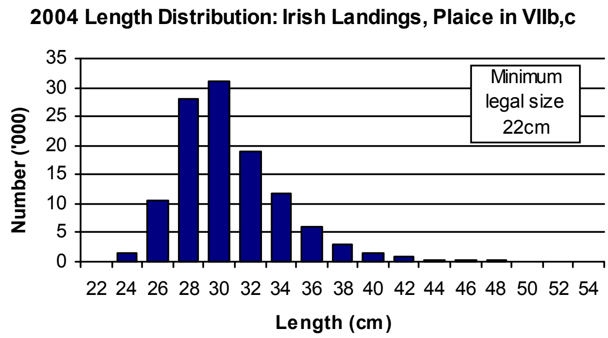
CURRENT MANAGEMENT

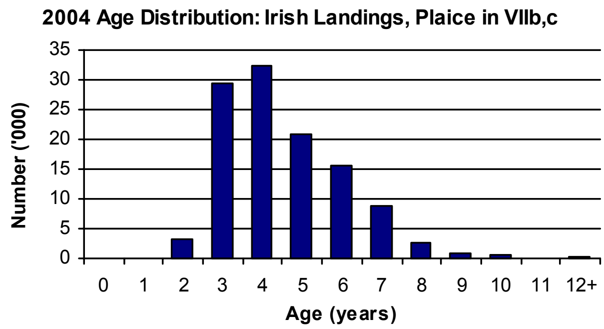
- The 2005 TAC was 160 t with an associated Irish quota of 128 t.
- There are no explicit management objectives or plan for this stock. Ireland has an opportunity as the main participant in fisheries in this area to develop and implement a management strategy for these fisheries.

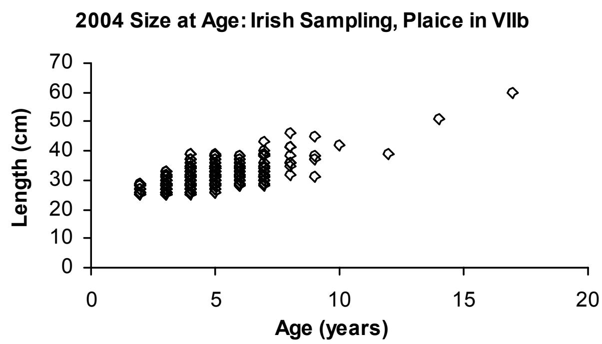
ADDITIONAL INFORMATION

1. A tentative assessment was carried out on this stock. No short term or medium predictions were carried out due to the short time series of data available.
2. Irish estimated landings in 2004 were 38 t. This is a 30% decrease from the 2003 landings.
3. Misreporting is not considered to be a problem in this fishery.
4. On average, Ireland had 89% of total international landings between 1997-2002.
5. The majority of the landings, are taken by otter trawls (90%).
6. The level of discards is not well quantified but FSS sampling has indicated that discarding does occur in this fishery.









ICES ADVICE
1.4.11

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Unknown	Unknown	Unknown

The state of the stock is unknown but landings show a declining trend in recent years. No assessment was performed, due to the short series of data and lack of reliable tuning indices.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No precautionary reference points have been established.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Catches in 2005 should be no more than the recent average (2002–2004) of around 65 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Management considerations

Landings have been declining and 2004 landings are the lowest observed in the time-series. The advice based on recent average landings may not be precautionary enough if this stock is in decline. Plaice are taken as part of a mixed demersal fishery by otter trawlers. Management options proposed for plaice should also take into consideration other demersal fish species and *Nephrops* taken in the VIIb,c fishery.

Factors affecting the fisheries and the stock

Ireland is the major participant in this fishery with around 90% of the international landings between 1993–2003. Plaice are normally caught in mixed species otter trawl fisheries in Division VIIb. These vessels mainly target other demersal fish species and *Nephrops*.

The effects of regulations

Plaice is managed by a precautionary TAC and technical measures. The agreed TACs have been 160 t since 2003.

Council Regulation (EC) No. 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in areas of VIIb, VIIj, VIIg, and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998–2002).

Scientific basis

Data and methods

Data update and screening methods only. No analytical assessment was performed.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	ACFM landings
1993	-		-		-	197
1994	-		-		-	215
1995	-		-		-	315
1996	-		-		-	240
1997	-		-		-	213
1998	-		-		-	183
1999	-		-		-	172
2000	-		-		-	108
2001	-		-		240	87
2002	No advice		-		180	71
2003	Reduce TAC to recent landings		160		160	72
2004	[1]	Reduce TAC to recent av. landings (2000–2002)	[1]	90	160	N/A
2005		Reduce TAC to recent av. landings (2001–2003)		77	160	
2006		Reduce TAC to recent av. landings (2002–2004)		65		

[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weights in t.

Table 1.4.11.1 Nominal landings (t) of plaice in Divisions VIIb,c 1996–2004, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001*	2002	2003	2004
France	1	3	-*	8*	31	8	17	9	N/a
Ireland	248	206	160	157	99	70	51	56	N/a
Spain	-	-	-	-	+	+	-		
UK(Eng & Wales)	2	+	1	+	+	+	2	+	
UK(Scotland)	+	+	+	2	+	-	-	+	
Total	251	209	161	159	130	78	70	65	
Unallocated	11	-4	-22	-13	22	-9	-1	7	-53
Total figures as used by the WG	240	213	183	172	108	87	71	72	53

Celtic Sea Sole

(Divisions VIIfg)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

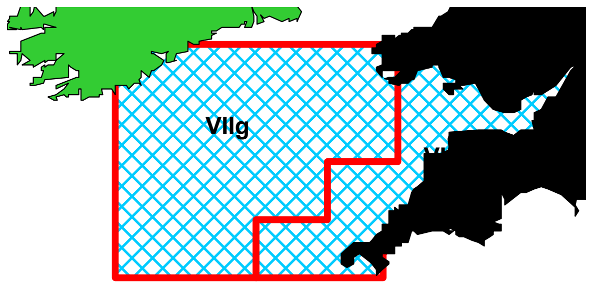
FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

ICES classifies this stock as having full reproductive capacity, but considered it to be overfished.

Long Term Considerations
FSS would advise managers that this stock should be managed on a long term basis using F_{max} (F = 0.23). This would result in higher long term yield and achieve a low risk of depleting the reproductive potential of the stock. Average fishing mortality for the past three years (F = 0.50) is far in excess of F_{max} (F = 0.23) and a management plan should be put in place based on long term considerations.

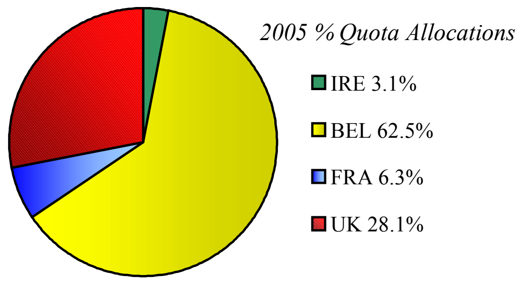
Short Term Considerations
FSS endorse ICES advice that a 26% reduction in F is required to reduce F below F_{pa}. This translates to a 2006 TAC of 880 t with an associated Irish quota of 27 t.



Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

CURRENT MANAGEMENT

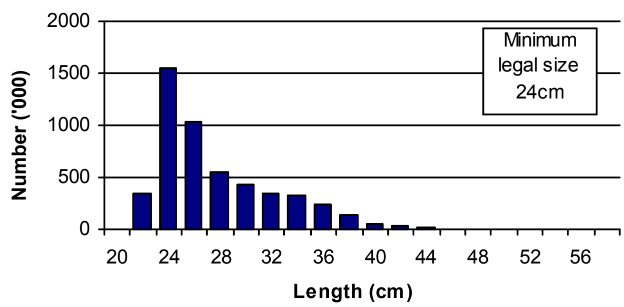
- The 2005 TAC was 1,000 t with an associated Irish quota of 31 t, similar to that of 2004.
- There are no explicit management objectives or plans for this stock.



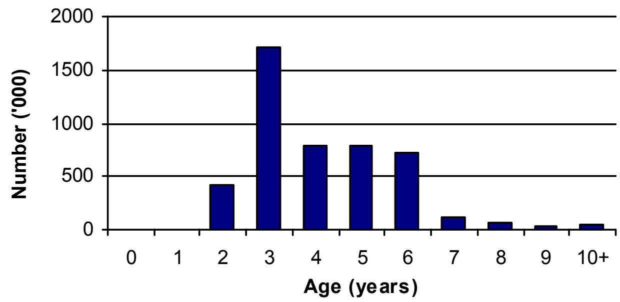
ADDITIONAL INFORMATION

1. The trends and estimates of fishing mortality, SSB and recruitment were very consistent with last year's assessment, except for an upward revision of F in 2003.
2. Irish estimated landings in 2004 were 32 t. This is a slight increase on the 2003 landings (21 t).
3. Misreporting from ICES Division VIIg to VIIj is considered to be a problem for this stock and the level of misreporting has probably substantially increased, as a result of the exceptionally strong 1998 year class in association with more restrictive quotas. It is known that misreporting occurs to surrounding areas and this has been taken into account where possible.
4. Recent discard estimates are available for the UK beam trawler, the Irish otter trawler and the Belgian beam trawler fleets. Discarding of sole is considered to be negligible.

2004 Length Distribution: International Landings, Sole in VIIf,g



2004 Age Distribution: International Landings, Sole in VIIf,g



5. As well as technical measures including minimum mesh sizes and minimum landing size there are also restricted areas for certain class vessels. The fishery for sole was closed for the Belgian fleet from 15th December 2004 until the end of the year.

ICES ADVICE
1.4.13

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Full reproductive capacity	Increased risk	Overexploited

Based on the most recent estimates of SSB, ICES classifies the stock as having full reproductive capacity. SSB has declined steadily since the early 1970s and reached the lowest observed value in 1998. The exceptional year class of 1998 which is the strongest in the time-series has increased SSB to above the long-term average, but as the contribution of this year class on SSB wanes, SSB declines again. Based on the most recent estimates of fishing mortality, ICES classifies the stock as being at risk of being harvested unsustainably. Fishing mortality increased in the late 1970s, exceeding $\mathbf{F}_{pa}$ in the early 1980s, and has been fluctuating around a high level since the mid-1980s. Recruitment has fluctuated with some peaks.

Management objectives

There are no specific management objectives for this stock.

Reference points

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is not defined.	$\mathbf{B}_{pa}$ be set at 2 200 t. There is no evidence of reduced recruitment at the lowest biomass observed and $\mathbf{B}_{pa}$ can therefore be set equal to the lowest observed SSB.
$\mathbf{F}_{lim}$ is 0.52, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ be set at 0.37. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$ and maintaining SSB above $\mathbf{B}_{pa}$ in 10 years, taking into account the uncertainty of assessments.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 4-8	Yield/R	SSB/R
Average last 3 years	0.498	0.189	0.457
$\mathbf{F}_{max}$	0.229	0.200	1.028
$\mathbf{F}_{0.1}$	0.101	0.180	2.026
$\mathbf{F}_{med}$	0.344	0.196	0.681

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$–$\mathbf{F}_{max}$.

Technical basis

$\mathbf{B}_{lim}$: Not defined	$\mathbf{B}_{pa}$: $\mathbf{B}_{loss}$
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$	$\mathbf{F}_{pa}$: $\mathbf{F}_{lim}$ x 0.72; implies a less than 5% probability that (SSB_{MT}< $\mathbf{B}_{pa}$)

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

Target reference points have not been agreed for this stock. The present F (0.50) is well above the possible candidate reference points $\mathbf{F}_{0.1}$ and $\mathbf{F}_{max}$.

Exploitation boundaries in relation to precautionary limits

A 26% reduction in F is needed to reduce F below $\mathbf{F}_{pa}$. This corresponds to landings of less than 880 tonnes in 2006.

Outlook for 2006

Basis: F(2005) = $\mathbf{F}_{sq}$ = mean F(02-04) = 0.5; $R_{05\text{-}06}$ = GM = 4.8 million; SSB(2005) = 2.89 kt;
SSB(2006) = 2.76 kt; landings (2005) = 1.12 kt.

The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.37.

The fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock (F(

Rationale	TAC(2006) (1)	Basis	F(2006)	SSB(2007)	%SSB change	%TAC change
Zero catch	0.00	F=0	0.00	4.02	46%	-100%
Status quo	1.13	$\mathbf{F}_{sq}$	0.50	2.66	-4%	13%
High long-term yield	1.06	F(long-term yield)	0.46	2.74	-1%	6%
Status quo	0.14	$\mathbf{F}_{sq}$ *0.1	0.05	3.85	40%	-86%
	0.27	$\mathbf{F}_{sq}$ *0.2	0.10	3.69	34%	-73%
	0.88	$\mathbf{F}_{sq}$ *0.74	0.37	2.95	7%	-12%
	0.89	$\mathbf{F}_{sq}$ *0.75	0.38	2.93	6%	-11%
	1.04	$\mathbf{F}_{sq}$ *0.9	0.45	2.76	0%	4%
	1.13	$\mathbf{F}_{sq}$ *1	0.50	2.66	-4%	13%
	1.21	$\mathbf{F}_{sq}$ *1.1	0.55	2.55	-7%	21%
	1.34	$\mathbf{F}_{sq}$ *1.25	0.63	2.40	-13%	34%
Precautionary limits	0.10	TAC($\mathbf{F}_{pa}$) *0.1	0.04	3.89	41%	-90%
	0.25	TAC($\mathbf{F}_{pa}$) *0.25	0.09	3.71	35%	-75%
	0.48	TAC($\mathbf{F}_{pa}$) *0.5	0.19	3.43	25%	-52%
	0.69	TAC($\mathbf{F}_{pa}$) *0.75	0.28	3.18	15%	-31%
	0.81	TAC($\mathbf{F}_{pa}$) *0.9	0.33	3.04	10%	-19%
	0.88	$\mathbf{F}_{pa}$ = $\mathbf{F}_{sq}$ *0.74	0.37	2.95	7%	-12%
	0.96	TAC($\mathbf{F}_{pa}$) *1.1	0.41	2.86	4%	-4%
	1.06	TAC($\mathbf{F}_{pa}$) *1.25	0.46	2.73	-1%	6%
	1.23	TAC($\mathbf{F}_{pa}$) *1.5	0.56	2.54	-8%	23%
	1.38	TAC($\mathbf{F}_{pa}$) *1.75	0.65	2.36	-15%	38%
	1.52	TAC($\mathbf{F}_{pa}$) *2	0.74	2.19	-20%	52%
	1.64	TAC($\mathbf{F}_{pa}$) *2.25	0.83	2.04	-26%	64%
Mixed Fisheries						

(1) It is assumed that the TAC will be implemented and that the landings in 2006 therefore correspond to the TAC.
All weights in thousand tonnes.
Shaded scenarios are not considered consistent with the Precautionary Approach.

Management considerations

ICES has explored simulations with long term-target Fs below 0.72 for this stock. These show a range of fishing mortalities from 0.37 to 0.22 that are predicted to result in the highest long-term yields (around 950 t), whilst posing little risk of being below $\mathbf{B}_{lim}$ in the long term (Figure 1.4.13.1). A Harvest Control Rule (HCR) should therefore be developed to reduce F to this type of target level in the medium term whilst minimizing the risk of SSB decreasing below $\mathbf{B}_{lim}$. A dialogue between managers and stakeholders will be required to define an appropriate management plan for this fishery.

In recent years, fishing mortality has been high. SSB declined until 1998; since then it has increased somewhat due to the contribution of some good year classes, particularly the 1998 year class. As the contribution of this year class wanes, SSB is predicted to decline again. At current levels of fishing mortality, there is a high probability that SSB will be below $\mathbf{B}_{pa}$ in some years. SSB levels just above $\mathbf{B}_{pa}$ are still low compared to the values observed in the past.

Effort restrictions are in place for many areas but not in the Celtic Sea, which makes the latter vulnerable to unrestricted increases in effort. This is undesirable where stocks are already overexploited. There was a substantial effort increase by the major fleet (Belgian fleet) in 2004.

Sole is mainly taken in a beam-trawl fishery as part of a mixed demersal fishery, predominantly with plaice. Fishing mortality has remained extremely high since the early 1980s.

Factors affecting the fisheries and the stock

The fisheries for sole in the Celtic Sea and Bristol Channel involve vessels from Belgium, taking two thirds, the UK one quarter, and France and Ireland taking minimal amounts of the total landings. The sole fishery is concentrated on the north Cornish coast off Trevose Head and around Lands End.

Sole are taken mainly in a beam trawl fishery that started in the early 1960s and, to a lesser extent, in the longer established otter trawl fisheries. In the 1970s, the fishery was mainly carried out by Belgian beam trawlers and Belgian and UK otter trawlers. The use of beam trawls (to target sole and plaice) increased during the mid-1970s, and the Belgian otter trawlers have now been almost entirely replaced by beam trawlers. Effort in the Belgium beam-trawl fleet increased in the late 1980s as vessels normally operating in the North Sea were attracted to the west by improved fishing opportunities. Beam trawling by UK vessels increased substantially from 1986, reaching a peak in 1990 and decreasing thereafter. In the Celtic Sea, the beam and otter trawl fleets also take plaice, rays, brill, turbot, and anglerfish.

The main spawning areas for sole in the Celtic Sea are in waters 40–75 m deep, off Trevose Head, and spawning usually takes place between February and April. Juvenile sole are found in relatively high abundance in depths up to 40 m, and adult sole (fish aged 3 plus) are generally found in deeper water. Spawning and nursery grounds are well defined.

The results of recent tagging experiments suggest that there is only limited movement of sole between the Bristol Channel and adjacent areas.

The effects of regulations

Management of sole in VIIf,g is by TAC and technical measures. The agreed TACs in 2004 and 2005 are 1050 t and 1000 t, respectively. Technical measures in force for this stock are minimum mesh sizes and minimum landing size (24 cm). There are also restricted areas for certain classes of vessels.

In 2004, effort limitations (due to e.g. recovery plans for cod in the Irish Sea and the Eastern Channel) on most fishing grounds where the Belgian fleet normally operates resulted in a concentration of the Belgian effort into the Celtic Sea, where no such effort restrictions were in place.

Council Regulation (EC) No. 27/2005, Annex III, part A 12 (b) prohibited fishing in ICES rectangles 30E4, 31E4, and 32E3 during January–March 2005. This prohibition did not apply to beam trawlers during March. The effects of the area closure cannot yet be evaluated.

Changes in fishing technology and fishing patterns

No known change in fishing pattern, and no information available on technological aspects. There is evidence of a switch to targeting other species by the main beam trawl fleet in this area.

Scientific basis

Data and methods

The analytical age-based assessment is based on landings, two commercial CPUE series, and one survey index.

Information from the fishing industry

A pre-Working Group industrial briefing meeting at CEFAS (UK) was held in June 2005 together with Fisheries Science Partnership. The available information showed that catch rates were highest in the area off the coast of North Cornwall and sole up to 25 cm were discarded in relative small numbers. It was also noted that the strong 1998 year class at age 7 was still very much abundant in the fisheries.

Uncertainties in assessment and forecast

The use of commercial tuning data may result in a biased perception of stock trends and the assessment is conditional on the accuracy of this data. A comparison of a survey-tuned assessment shows higher levels of SSB and lower fishing mortalities than the current assessment.

The contribution of recruitment of the incoming year class to the short-term forecast is low, and last year's forecast was close to the realised catches.

Comparison with previous assessment and advice

Results are very close to those of the previous assessment, although the estimate of F in 2003 has been revised upwards. The perception of the stock has not changed and the basis for the advice is similar.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

Year	ICES advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	ACFM Landings
1987	*Status quo* F; TAC		1.6		1.6	1.22
1988	F = F(pre-86); TAC		0.9		1.1	1.15
1989	F at F(81–85); TAC		1.0		1.0	0.99
1990	No increase in F		1.2		1.2	1.19
1991	No increase in F		1.1		1.2	1.11
1992	No long-term gains in increasing F		1.1		1.2	0.98
1993	No long-term gains in increasing F		-		1.1	0.93
1994	No long-term gains in increasing F		-		1.1	1.01
1995	No increase in F		1.0		1.1	1.16
1996	20% reduction in F		0.8		1.0	1.00
1997	20% reduction in F		0.8		0.9	0.93
1998	20% reduction in F		0.7		0.85	0.88
1999	Reduce F below $\mathbf{F}_{pa}$		0.81		0.96	1.01
2000	Reduce F below $\mathbf{F}_{pa}$		<1.16		1.16	1.09
2001	Reduce F below $\mathbf{F}_{pa}$		< 0.81		1.02	1.17
2002	Reduce F below $\mathbf{F}_{pa}$		< 1.00		1.07	1.35
2003	Reduce F below $\mathbf{F}_{pa}$		< 1.24		1.24	1.39
2004	[1]	Reduce F below $\mathbf{F}_{pa}$	[1]	< 1.00	1.05	1.25
2005	[1]	Reduce F below $\mathbf{F}_{pa}$	[1]	< 0.84	1.00	
2006	[1]	Reduce F below $\mathbf{F}_{pa}$	[1]	< 0.88		

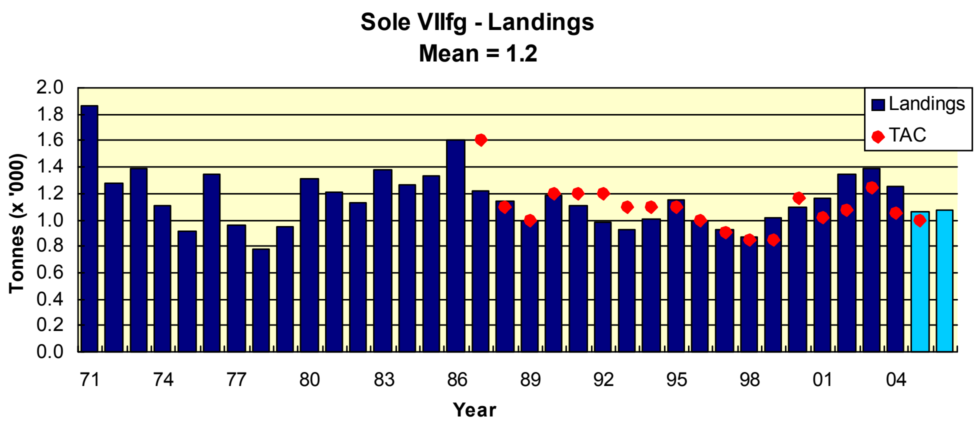
Weights in '000 t.
[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

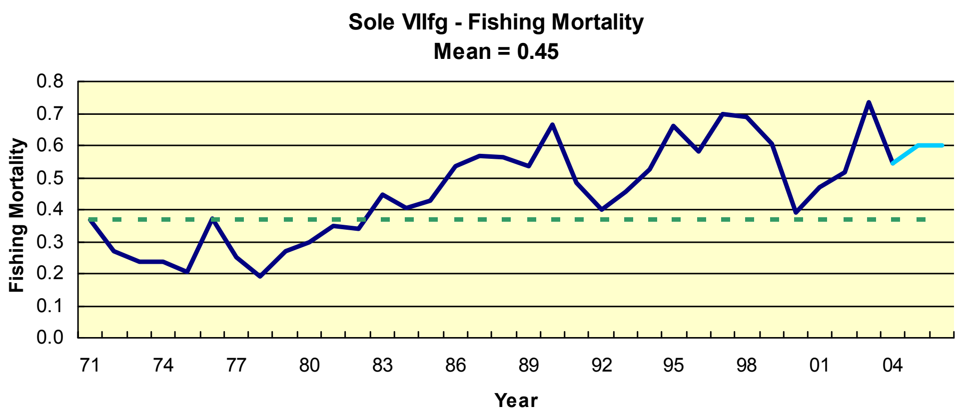
Table1.4.13.1 Celtic Sea SOLE. Divisions VIIf and VIIg. Official Nominal landings (t), 1986–2004 and data used by the Working Group.

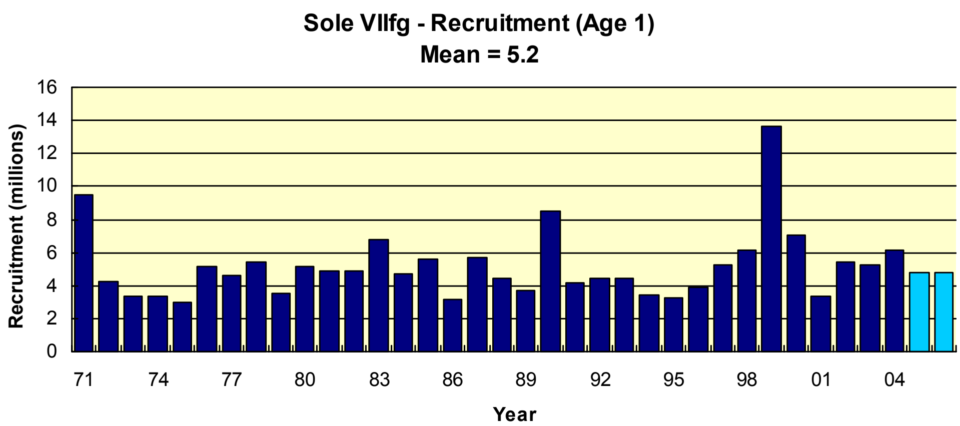
Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Belgium	1039*	701*	705*	684*	716*	982*	543*	575*	619*	763*	695*
Denmark	2	-	-	-	-	-	-	-	-	-	-
France	146	117	110	87	130	80	141	108	90	88	102
Ireland	188*	9	72	18	40	32	45	51	37	20	19
UK(E. & W,NI.)	611*	437	317	203	353	402	325	285	264	294	265
UK(Scotland	-	-	-	-	0	0	6	11	8	-	0
Netherlands	3	-	-	-	-	-	-	-	-	-	-
Total	1,989	1,264	1,204	992	1,239	1,496	1060	1030	1,018	1,165	1081
Unallocated	-389	-42	-58	-	50	-389	-79	-102	-9	-8	-86
Total used in assessment	1,600	1,222	1,146	992	1,189	1,107	981	928	1,009	1,157	995

Country	1997	1998	1999	2000	2001	2002	2003	2004[1]
Belgium	660*	675*	604	694	720	703	715	734.6
Denmark	-	-	-	-	-	-	-	-
France	99	98	61	74	77	66	77	n/a
Ireland	28	42	51	29	35	32	26	n/a
UK(E. & W,NI.)	251	198	231	243	288	318	342	283.4
UK(Scotland	0	-	0	-	-	+	+	-
Netherlands	-	-	-	-	-	-	-	-
Total	1038	1013	886	1,040	1,120	1,119	1,133	1,018
Unallocated	-111	-138	65	51	48	226	232	231
Total used in assessment	927	875	1,012	1,091	1,168	1,345	1,392	1,249

[1]Preliminary.
* including VIIg-k.


Sole VIIfg - Landings
Mean = 1.2
Tonnes (x '000)
Landings
TAC
Year


Sole VIIfg - Fishing Mortality
Mean = 0.45
Fishing Mortality
Year


Sole VIIfg - Recruitment (Age 1)
Mean = 5.2
Recruitment (millions)
Year

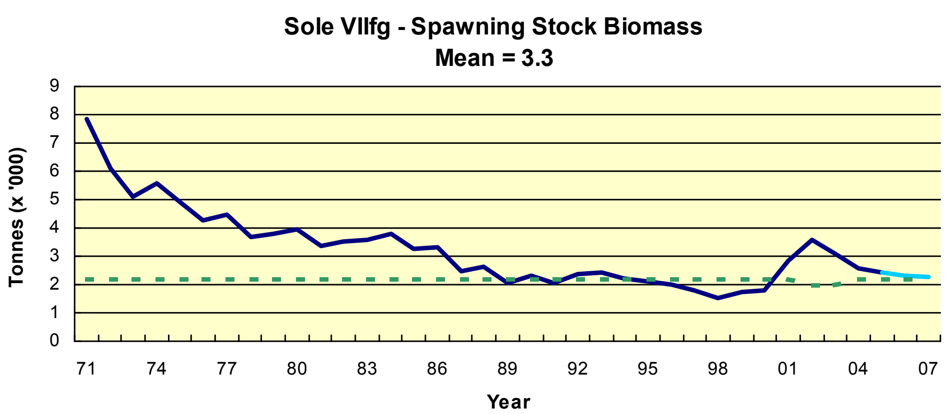
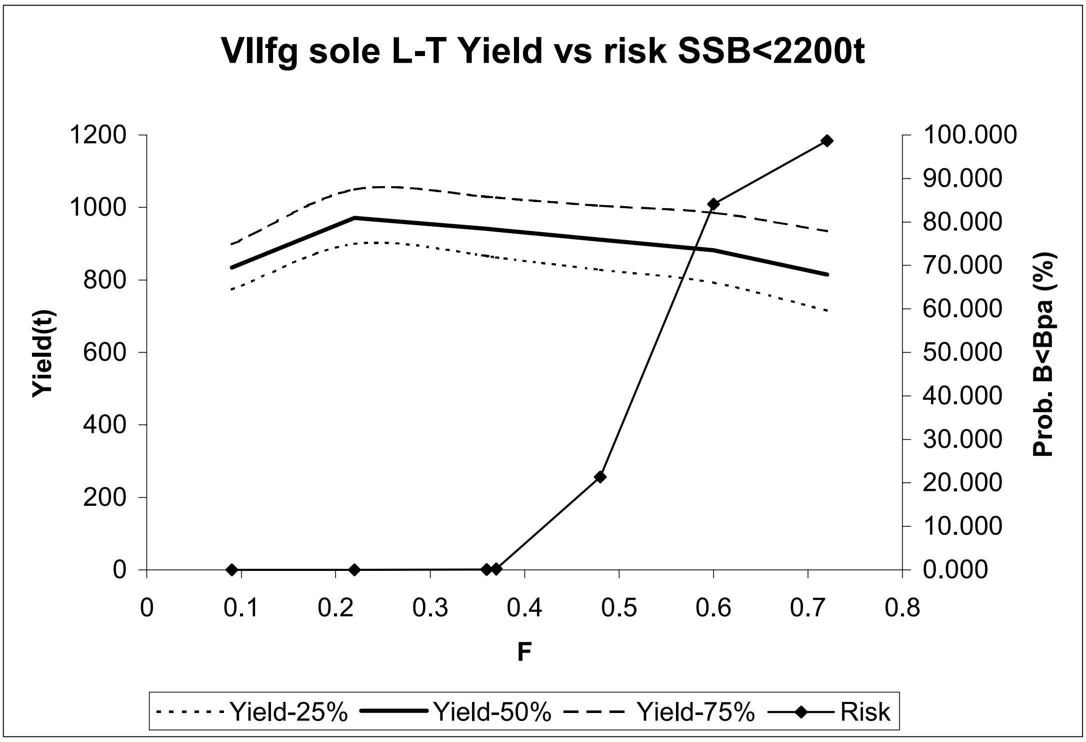

Sole VIIfg - Spawning Stock Biomass
Mean = 3.3
Tonnes (x '000)
Year

Table 1.4.13.2 Sole in Divisions VIIf and g (Celtic Sea).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8
1971	9506	7817	1861	0.370
1972	4241	6164	1278	0.272
1973	3356	5147	1391	0.236
1974	3372	5495	1105	0.238
1975	2956	4882	919	0.203
1976	5174	4232	1350	0.371
1977	4613	4541	961	0.251
1978	5472	3656	780	0.190
1979	3521	3785	954	0.270
1980	5115	3938	1314	0.296
1981	4842	3350	1212	0.350
1982	4870	3486	1128	0.338
1983	6757	3590	1373	0.446
1984	4672	3836	1266	0.403
1985	5632	3249	1328	0.429
1986	3147	3308	1600	0.534
1987	5708	2471	1222	0.565
1988	4467	2647	1146	0.557
1989	3716	2051	992	0.530
1990	8549	2339	1189	0.657
1991	4192	2050	1107	0.480
1992	4439	2366	981	0.397
1993	4403	2432	928	0.452
1994	3393	2210	1009	0.521
1995	3301	2097	1157	0.652
1996	4014	2020	995	0.576
1997	5415	1778	927	0.688
1998	6269	1552	875	0.683
1999	14264	1775	1012	0.589
2000	7400	1872	1091	0.376
2001	3429	2973	1168	0.440
2002	5633	3828	1345	0.465
2003	5416	3376	1392	0.588
2004	6299	2959	1249	0.440
2005	4848*	2888		
Average	5211	3319	1165	0.437

* R2004 assumed to be GM71-02.



*Note these simulations have used the WG assessment as the starting point and not the final assessment. This is a slightly more pessimistic starting point to simulations.

Figure 1.4.13.1 An exploration of potential long-term Fishing Mortality targets for Sole VIIfg. Showing yield and risk in the long term (2023).

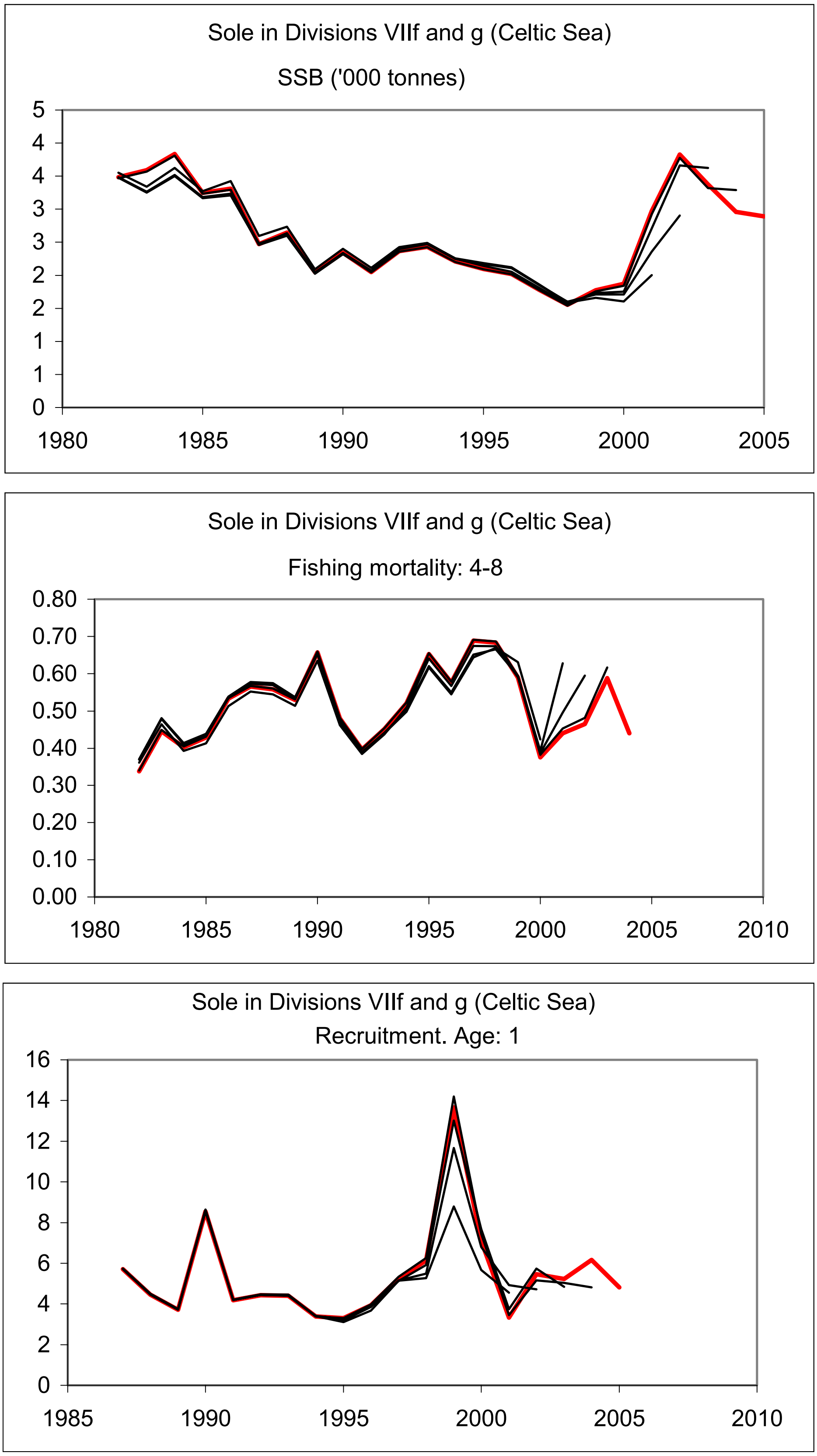


Figure 1.4.13.2 Comparison between present and previous assessments. The current assessment is shown in red.

Southwest of Ireland Sole

(Divisions VIIh-k)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

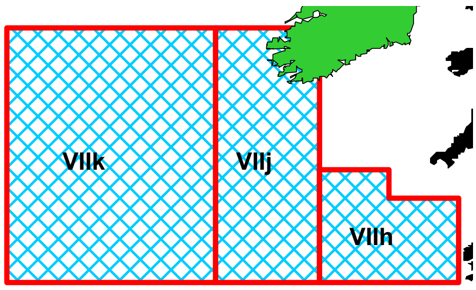
Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

The state of this stock is unknown.

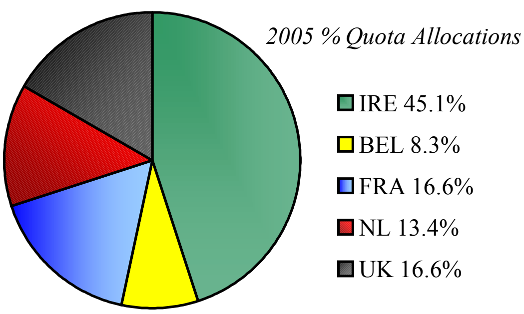
Short Term Considerations
FSS agree with ICES advice that catches in 2006 should be no more than the recent average (2002 to 2004) of around 380 t in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment. This translates to an Irish quota of 171 t.



Red Boxes-TAC/Management Area *Blue Shading– Assessment Area*

CURRENT MANAGEMENT

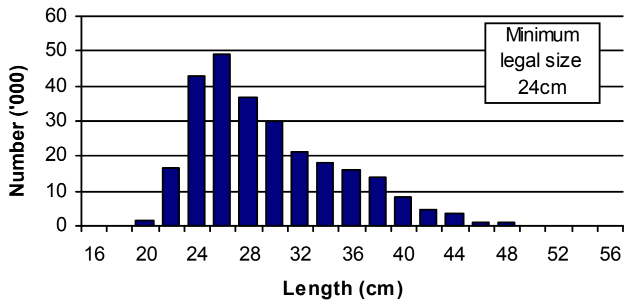
- The 2005 TAC was 650 t with an associated Irish quota if 293 t, a 66% increase on the 2004 TAC.
- There are no explicit management objectives or plan for this stock. Ireland has an opportunity as the main participant in fisheries in this area to develop and propose a management strategy for these fisheries.



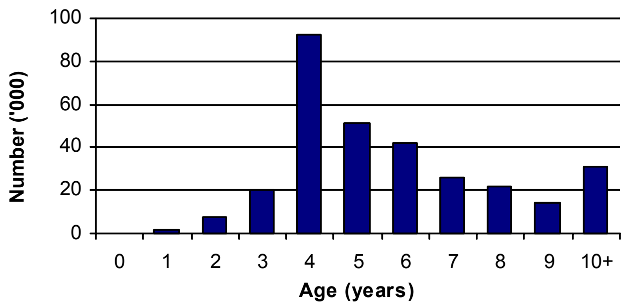
ADDITIONAL INFORMATION

1. Irish estimated landings in 2004 were 110 t. A slight increase on the 105 t landed in 2003.
2. Area misreporting may be a problem in this fishery (see Celtic Sea Sole).
3. In 2004, Belgium took most of the landings (44%) followed by, Ireland, UK and France.
4. The majority of the Irish landings for this fishery are taken by otter trawls (68%) and beam trawls (31%). This is a very important target fishery for the inshore Irish otter trawl fleet, particularly in Dingle, Castletownbere, Baltimore and Union Hall.
5. FSS sampling indicates that the Irish landings in 2004, were dominated by 4 year olds. Older age groups are well represented in the landings.
6. FSS data on discarding of sole in this area is limited but discarding is not considered to be a problem.

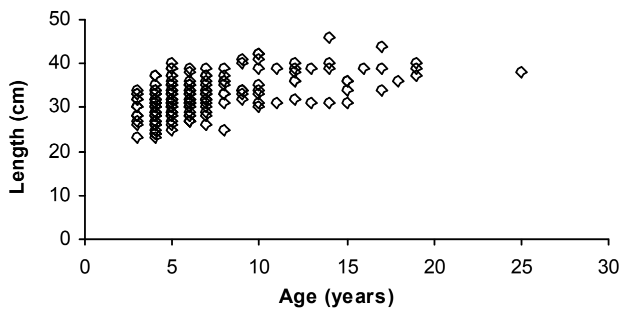
2004 Length Distribution: Irish Landings, Sole in VIIj



2004 Age Distribution: Irish Landings, Sole in VIIj



2004 Size at Age: Irish Sampling, Sole in VIIj



ICES ADVICE
1.4.34

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Unknown	Unknown	Unknown

The state of the stock is unknown. No assessment was performed, due to the short series of data and lack of reliable tuning indices.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No precautionary reference points have been established.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Catches in 2006 should be no more than the recent average (2002–2004) of around 380 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Short-term implications

No forecast.

Management considerations

Sole are taken as part of a mixed demersal fishery by otter trawlers. Management options proposed for sole should also take into consideration other demersal fish species taken in the fishery.

Area misreporting from VIIf,g into VIIhjk is known to be a problem in some fleets, but landings data have not been corrected for this. The extent of other misreporting is not known.

Factors affecting the fisheries and the stock

Sole are predominantly caught in mixed species otter trawl fisheries in Division VIIj. These vessels target mainly hake, anglerfish, and megrim. Sole are also caught in flatfish-directed beam trawler fisheries. Seiners generally take a lesser catch of sole. Ireland and Belgium are the major participants in this fishery.

The effects of regulations

Sole is managed through TAC and technical conservation measures. Boat quota restrictions were imposed on Irish vessels for hake, cod, and anglerfish, and these are likely to have impacted the sole landings.

Council Regulation (EC) No. 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in Divisions VIIb, VIIj, VIIg, and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998–2002).

Changes in fishing technology and fishing patterns

Ireland, UK, and France are the major participants in this fishery. Sole were predominantly caught by Irish otter trawl vessels in Division VIIj, within a mixed species fishery. Irish otter trawl vessels operate from the ports of Castletownbere, Dingle, Union Hall, Baltimore, and Schull. Increasingly these Irish vessels target mainly hake, anglerfish, and megrim and not the more traditional inshore species (plaice, sole, whiting, and cod). The Irish beam trawlers and seiners generally take a lesser catch of sole. Other international fleets operating in this area are the UK, French otter trawl, and Belgian beam trawl fleets.

Scientific basis

Data and methods

Data update and screening methods only. No analytical assessment was performed.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	ACFM landings
1993	No advice		-		-	495
1994	No advice		-		-	398
1995	No advice		-		-	403
1996	No advice		-		-	443
1997	No advice		-		-	564
1998	No advice		-		-	423
1999	No advice		-		-	381
2000	No advice		-		-	329
2001	No advice		-		650	325
2002	No advice		-		650	430
2003	Reduce TAC to recent landings		330		390	374
2004	[1]	Reduce TAC to recent average (2000–2002)	[1]	360	390	354
2005		Reduce TAC to recent average (2001–2003)		335	650	
2006		Reduce TAC to recent average (2002–2004)		380		

Weights in t.
[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

Table 1.4.34.1 Sole in Divisions VII h-k (Southwest Ireland).
Nominal landings (t), 1996–2004, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004 [3]
Belgium		368	346	101	8	13	154	170	157
France		58	74*	77[1]*	78	99	108	64	N/a
Ireland		203	221	207	111	125	130	105	N/a
Spain							1 [2]		
Netherlands			7	1	10	-	-		
UK (England & Wales)		113	11	97	95	111	124	78	79
UK (Scotland)									
Portugal									1
Total	0	742	585	406	302	348	516	417	238
Unallocated	443	-178	-162	-25	27	-23	-86	43	117
Total figures used by Working Group	443	564	423	381	329	325	430	374	354

*To be updated.[1] Reported as. [2] *Solea* spp.[3] Preliminary figures.

West of Ireland Sole

(Divisions VIIb,c)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

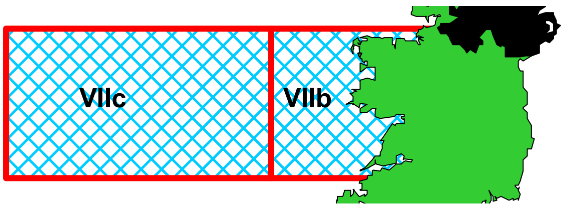
Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

The state of this stock is unknown.

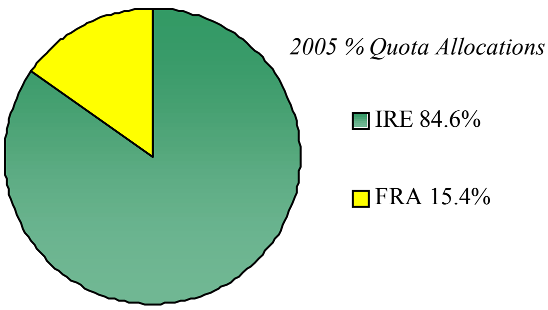
Short Term Considerations
FSS agree with ICES advice that the precautionary TAC should remain in place. This corresponds to catches in 2006 of around 65 t. This TAC should avoid an expansion of the fishery until there is more information to facilitate an adequate assessment. This translates to an Irish quota of 58 t.



Red Boxes-TAC/Management Areas Blue Shading– Assessment Area

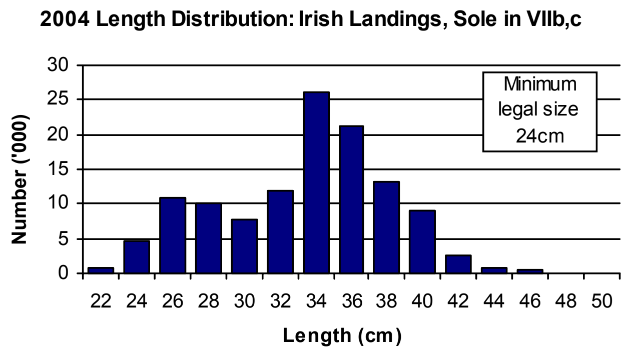
CURRENT MANAGEMENT

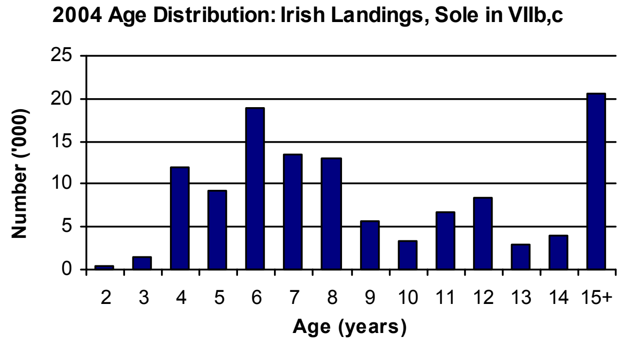
- The 2005 TAC was 65 t with an associated Irish quota of 55 t.
- There are no explicit management objectives or plan for this stock. Ireland has an opportunity as the main participant in fisheries in this area to develop a management strategy for these fisheries.



ADDITIONAL INFORMATION

1. Irish estimated landings in 2004 were 48 t, similar to those in 2003.
2. Misreporting is not perceived to be a problem in this fishery.
3. Ireland took 80 % of total international landings between 1993-2003.
4. Sole are caught in mixed species otter trawl fisheries (accounting for 98 % of the landings in 2004) mainly in inshore areas of VIIb.
5. FSS sampling indicates that the Irish landings were mainly comprised of 4 to 8 year old fish. Older age groups are also well represented in the landings.
6. FSS data on discarding of sole in this area is limited but discarding is not considered to be a problem.





ICES ADVICE
1.4.35

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Unknown	Unknown	Unknown

The state of the stock is unknown. No assessment was performed, due to the short series of data and lack of reliable tuning indices.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No precautionary reference points have been established.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Recent catches have been close to the TAC of 65 t. Catches should not be allowed to increase unless it can be shown that an expansion of the fishery is sustainable.

Short-term implications

No forecast.

Management considerations

The recent average catches (2002–2004) were 64 t. Sole are taken as part of a mixed demersal fishery by otter trawlers. Management options proposed for sole should also take into consideration other demersal fish species and *Nephrops* taken in the VIIb,c fishery.

Factors affecting the fisheries and the stock

Ireland is the major participant in this fishery with around 75% of the international landings in recent years. Sole are normally caught in a mixed species otter trawl fisheries in Division VIIb. These vessels mainly target other demersal fish species and *Nephrops*.

The effects of regulations

Sole is managed by a precautionary TAC and technical measures. The agreed TAC for 2004 and 2005 was 65 t, which is a decrease from the previous TAC of 80 t for 2001–2003.

Council Regulation (EC) No. 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in Divisions VIIb, VIIj, VIIg, and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998–2002).

Changes in fishing technology and fishing patterns

Sole are opportunistically exploited in otter trawl fisheries in this area and there is no known change in fishing technology and fishing patterns in this area.

Scientific basis

Data and methods

Data update and screening methods only. No analytical assessment was performed.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	ACFM landings
1993	-		-		-	60
1994	-		-		-	70
1995	-		-		-	59
1996	-		-		-	57
1997	-		-		-	55
1998	-		-		-	66
1999	-		-		-	72
2000	-		-		-	57
2001	-		-		80	60
2002	No advice		-		80	61
2003	Reduce TAC to recent landings		65		80	64
2004	[1]	Reduce TAC to recent landings (1998–2002)	[1]	65	65	N/A
2005		Reduce TAC to recent landings (1999–2003)		62	65	
2006		No increase in catches		64		

Weights in t.

[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

Table 1.4.35.1 Nominal landings (t) of sole in Divisions VIIb,c 1993–2004, as officially reported to ICES.

Country	1993	1994	1995	1996	1997	1998
France	1	1	2	2	3	-*
Ireland	59	60	59	52	51	49
UK(E/W/NI)	+	+	+	+	1	+
Total	60	61	61	54	55	49
Unallocated	0	-9	2	-3	0	-17
Total figures used by the working group	60	70	59	57	55	66

Country	1999	2000	2001	2002	2003	2004
France	2*	12	7	14	19	N/A
Ireland	68	65	53	50	50	N/A
UK(E/W/NI)	-	+	-	+	+	+
Total	70	77	60	64	86	N/A
Unallocated	-2	20	0	3	22	-66
Total figures used by the working group	72	57	60	61	64	66

* Preliminary.

West of Ireland and inshore south of Ireland Nephrops

(WG-MA L = Divisions VIIb,c,j,k, VIIg (Rectangles 31E1, 32E1, 32 E2) and VIIa (Rectangles 33E2 and 33E3))

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

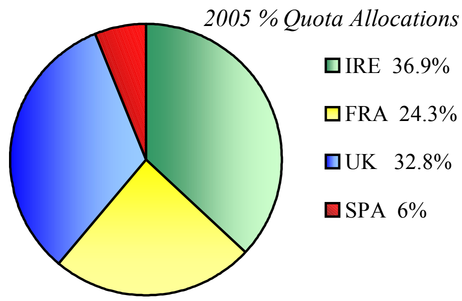
(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

ICES considers four different stocks in this area. The Porcupine Bank stock (FU 16) appears to have declined up to 2000 but since then landings and LPUEs have increased somewhat. The other stocks FU 17, FU 18 and FU 19 appear to be stable.

FSS considers that there is no basis to revise the advice given previously that the combined catches should thus not exceed 3,300 t.

CURRENT MANAGEMENT

- A 'precautionary' TAC area covers Sub-area VII, whereas the WG-MA L is Divisions VIIb,c,j,k and inshore rectangles south of Ireland (31E1, 32E1, 32E2, 33E2, 33E3). This large TAC area may result in unbalanced exploitation of individual FUs.
- The WG-MA L contains two main fisheries on the Porcupine Bank (FU 16) and in outer Galway Bay, off the Aran Islands (FU 17). The WG-MA L also includes very small inshore fisheries to the north (FU 18) and numerous small-scattered inshore fisheries off the south-west and south coasts (FU 19).
- The 2005 agreed TAC for all of Sub-area VII was 19,544 t, of which Ireland's quota was 7,207 t.
- There are no explicit management objectives or a management plan for this stock. FSS recommend that management objectives be established and that a management plan be developed with stakeholders and implemented for fisheries catching *Nephrops*.
- The following TCMs are in place for *Nephrops* in VII (excluding VIIa) after EC 850/98: *Minimum Landing Sizes (MLS)*; total length >85 mm, carapace length >25 mm, tail length >46 mm. *Mesh Size Restrictions*; Towed gears targeting *Nephrops* having at least 35% by weight of this species on board will require 70 mm diamond mesh plus an 80 mm square mesh panel as a minimum or having at least 30% by weight of *Nephrops* on board will require 80 mm diamond mesh.



ADDITIONAL INFORMATION

1. Assessments for these stocks are hampered by poor quality sampling data or by a short time series of sampling data and are considered highly uncertain. The advice is based on average landings rather than forecasted landings from analytical assessments.
2. Multiple lines of evidence (CPUE trends, mean size, assessment) all suggest that the FU 16 stock declined substantially up to 2000 but it now appears to be increasing from low levels. The LPUEs and mean size for the FU17 stock has remained relatively stable and recent catch levels may be sustainable. The status of the FU 19 stock is unknown since the many discrete populations present sampling problems and in fact may represent multiple stocklets that should be sampled and assessed independently. The recent expansion of Irish effort for this stock is undesirable given the uncertainty that this is sustainable. FSS

Management Area	Functional Units	ICES Landings advice	Comment
WG-MA J	14, 15	Not given	No increase in effort Average landings 2000-2002 ~8,100 t
WG-MA L	16, 17, 18, 19	3,300	Average landings 2000-2002
WG-MA M	20-22	4,600	Average landings 2000-2002
Sub-area VII	14 to 22	Not given	Average landings 2000-2002 ~16,100 t

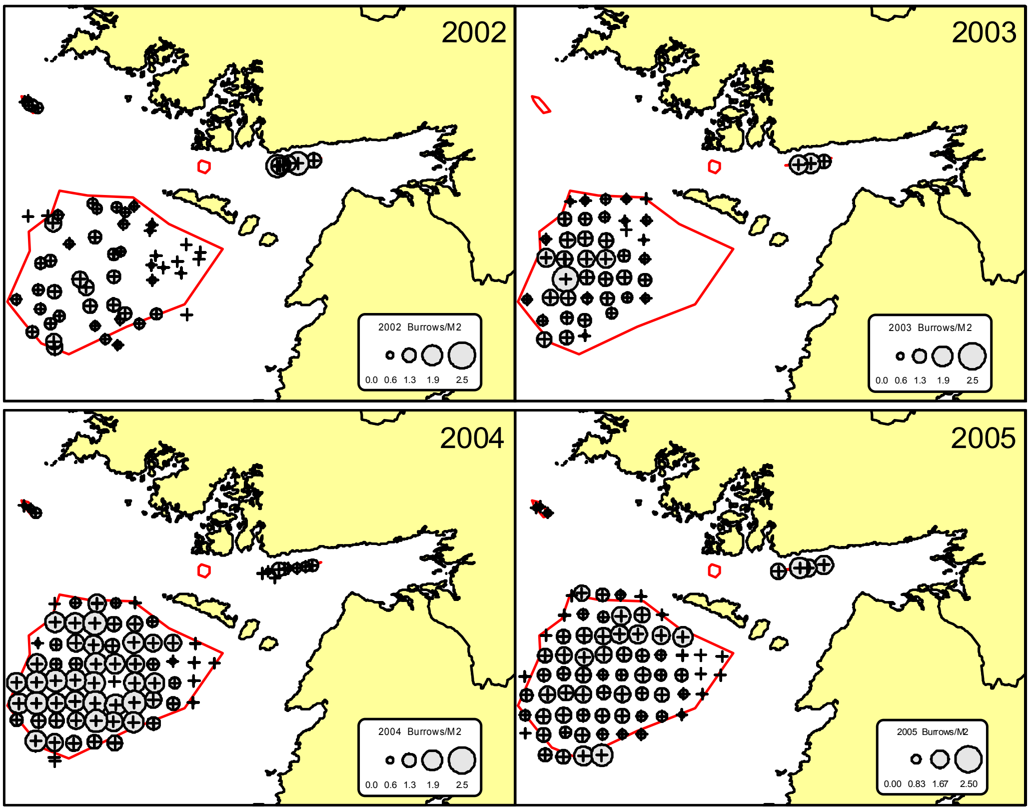
considers that fisheries independent data is needed for these stocks to more accurately assess their status.

3. In recent years there has been progress in understanding the fisheries biology of *Nephrops* in FU 17. In addition for the first time fishery independent data are becoming available as *Nephrops* directed underwater TV surveys have been successfully carried out in FU 17 since 2002. The abundance estimates for the Aran Grounds has fluctuated in the surveys around 1 billion burrows with a mean density of around 1/m^2. The densities in Galway Bay are higher and on Slyne Head are somewhat lower.
4. *Nephrops* in FU 17, 18 and 19 are almost exclusively exploited by Irish vessels. In FU 16 Ireland takes around 1/3 of the total landings that tend to consist of high value larger *Nephrops* compared with more costal stocks.
5. The Irish fishery consists of otter trawl vessel and increasingly in recent years twin-rig vessels. Vessels from Rossaveal, Dingle, Union Hall, Dunmore East and Kinsale mainly exploit the fishery.

Nephrops UWTV survey abundance estimates for grounds in FU 17 from 2002-2005.

Ground	Year	Number of stations	Area Surveyed (M^2)	Burrow count	Mean Density (No./M^2)	CV	Raised abundance estimate (million burrows)
Aran Grounds	2002	49	9,450	7,599	0.81	0.07	787
	2003	42	11,398	11,652	1.09	0.06	1,000
	2004	64	13,040	18,742	1.38	0.06	1,406
	2005	70	12,373	13,321	1.06	0.06	1,053
Galway Bay	2002	7	1,299	2,017	1.58	0.08	n/a
	2003	3	591	941	1.60	0.09	n/a
	2004	9	2,312	1,625	0.73	0.18	n/a
	2005	4	661	1,107	1.67	0.05	n/a
Slyne Grounds	2002	5	1,216	1,027	0.85	0.09	4
	2003						
	2004	3	827	531	0.68	0.19	3
	2005	3	531	294	0.55	0.05	3

Maps of *Nephrops* UWTV survey abundance estimates for grounds in FU 17 from 2002-2005.



ICES ADVICE
1.4.40

There are 4 Functional Units in this Management Area: a) Porcupine Bank (FU 16), b) Aran Grounds (FU 17), c) Ireland SW and SE Coast (FU 19) andd) Ireland NW Coast (FU 18).

The TAC area applies to the whole of area VII, including VIIa (section 1.4.38)

State of the stock

No quantitative assessment of this stock is available.

For FU 16 (Porcupine bank) landings have been variable over time. Maximum landings of more than 4000 t. were observed in early 1980s and the lowest observed landing was 872 t (in 2000). Recent landings have fluctuated around 1000 t. For most fleets, landings and effort are at low levels in recent years. LPUEs for all fleets in this fishery reached a minimum in 2000, and there are conflicting signals since then.

For FU 17 (Aran Grounds) maximum landings of 1 400 t have been recorded. Landings fluctuated around 1 000 t in recent years but in 2004 landings dropped to 525 t. The LPUEs have been relatively stable but show a substantial decrease in 2004.

The Irish Aran Grounds UWTV survey was initiated in 2002. In 2004 this survey showed an increase in burrow densities on the main Aran grounds and a substantial increase in the biomass estimate over the three years which contradicts the signal from the LPUE series.

For FU 19 (Ireland SW and SE coast) landings have been variable throughout the time series but show an increasing trend since 2000 which could be attributed to an increasing numbers of vessels targeting this fishery. Effort increased substantially after 2000. In 2004 the LPUE decreased to 17kg/hr which is close to the series minimum.

For FU 18 (Ireland NW coast) landings have shown a decrease in the time series: maximum landings of 126 t were taken in 1994 and minimum landings of 25 t in 2004. No effort data is available for this fishery.

Management objectives

There are no management objectives set for this fishery

Reference points

There are no reference points for this fishery. There is no yield per recruit table for this fishery.

Single stock exploitation boundaries

There are no exploitation boundaries for this stock. In view of the relative stability of landings, landings from FU16-19 should not exceed 3.3 thousand tonnes for 2006, based on the average landings of 2000-2002. The landings from all FUs in this TAC area is presented in section 1.4.38 (*Nephrops* in VIIa).

Management considerations

Management area L is part of the larger Sub-area VII TAC area. Landings in management area L have recently been in the order of 3000 tonnes. The VII TAC for 2005 was 19.5 thousand tonnes. Therefore there is a risk that inappropriate levels of effort may occur for stocks in Management Area L due to effort shifts from other areas.

Fishing effort directed at *Nephrops* will have implications for the hake stock in the mixed fisheries unless species and size selectivity of gears can be improved.

Factors affecting the fisheries and the stock

Changes in fishing technology and fishing patterns

In FU 16 (Porcupine bank) landings from Spanish and French vessels have declined. Spain still has the largest contribution of the international landings, but Irish landings now form the second contribution to the international landings.

In FU 17 (Aran Grounds) the typical vessel length is 13-38m compared to 15-25m in 2003, engine power ranges from 120-870kW compared to 150-550 kW in 2003. The most recent change in the fishery is the proportion of twin-rig vessels, which has increased to over 90 % of the fleet in the past eight years. This implies that nominal fishing effort is not an appropriate indicator of effective fishing effort.

In FU 19 (Ireland SW and SE coast) there has been a shift of effort to *Nephrops* by Irish vessels due to a combination of factors. With increasing enforcement of the anglerfish quota, resulting in the detention of a number of Irish vessels, several vessels in the 20-24m category based in the southwest of Ireland have converted to *Nephrops*. Due to the low price of whitefish species during 2004 and in early 2005 a number of Irish seine net vessels have also switched to *Nephrops*. The number of vessels reporting landings in this area has increased from 34 in 2000 to 71 in 2003

No information is available on FU 18 (Ireland NW coast).

Scientific basis

Data and methods

There are some length structured data available but growth rates cannot be well determined. Analytical assessments are not feasible at present.

For FU 16 (Porcupine bank) annual landings length compositions for males and females are available from Spain (1986-2004), France (1995-2004) and Ireland (1995-2004). LPUE and effort data are available for the Spanish (SP-CORUTR7), French (FR-PORCUPINE) and Irish fleets (figure 1.4.40.1). No analytical assessment of this stock was carried out.

For FU 17 (Aran Grounds) landings length compositions by sex are available for 1995-2000. Since 2001 a catch and discard sampling programme has been in place which shows the discarding of smaller individuals. An effort and LPUE data set for Irish trawlers from 1995-2004 is available (figure 1.4.40.2). Results of the TV survey for this stock are shown in table 1.4.40.1. No analytical assessment of this stock was carried out.

For FU 19 (Ireland SW and SE coast) length frequency data of the landings were collected on an irregular basis in the years 1996-1997, 1999, 2002 and 2004. Spatial and temporal coverage is problematic because landings from FU 19 originate from several discrete grounds. In 2004 length frequency data were only available for quarters 1 and 2. Since 2001 a catch and discard sampling programme has been in place which shows the discarding of smaller individuals. Effort and LPUE data are available for the Irish *Nephrops* fleet in FU 19 from 1995-2004 (figure 1.4.40.3). No analytical assessment of this stock was carried out.

FU 18 (Ireland NW coast) only landing data are available. No analytical assessment of this stock was carried out.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2005 (ICES CM 2006/ ACFM:01).

Year	ICES advice	Recommended TAC	Agreed TAC [1]	ACFM landings [2]
1987				4.5
1988				3.9
1989				4.0
1990				3.1
1991				3.4
1992		3.8	20.0	3.7
1993		~4.0	20.0	3.6
1994		~4.0	20.0	4.3
1995		~4.0	20.0	4.9
1996		4.0	23.0	4.3
1997		4.0	23.0	4.4
1998		4.0	23.0	5.0
1999		4.0	23.0	4.2
2000		4.0	21.0	2.7
2001		4.0	18.9	3.3
2002		4.44	17.79	4.0
2003		4.44	17.79	2.9
2004	Restrict landings to 2000-2002 levels	3.3	17.45	2.9
2005	Restrict landings to 2000-2002 levels	3.3	19.5	
2006	Restrict landings to 2000-2002 levels	3.3		

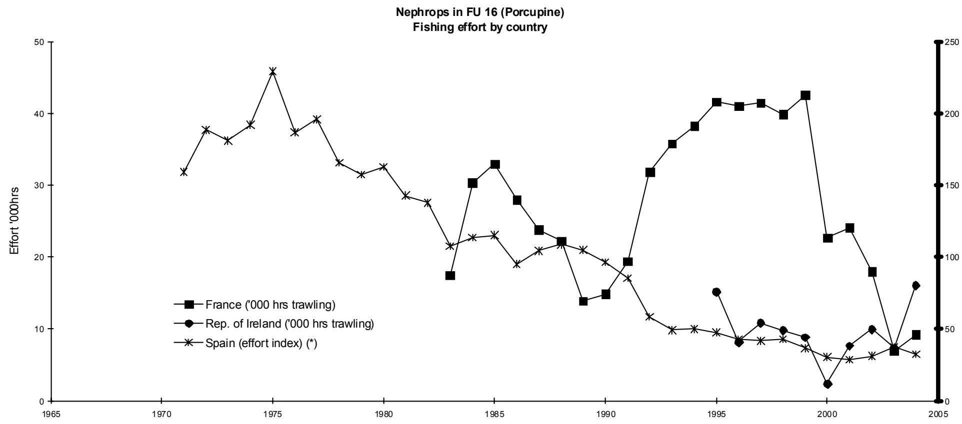
Table 1.4.40.1 UWTV survey of Nephrops in FU17 (Aran grounds)

Ground	Year	Number of stations	Raised abundance estimate (million burrows)	Total Biomass estimate (tonnes)
Aran Grounds	2002	49	787	14,667
	2003	42	997	17,687
	2004	64	1,406	21,787

Table 1.4.40.2 Total Nephrops landings (in tonnes) in MA L

Year	FU 16	FU 17	FU 18	FU 19*	TOTAL MA L
1965	514				514
1966	0				0
1967	441				441
1968	441				441
1969	609				609
1970	256				256
1971	1944				1944
1972	1738				1738
1973	2946				2946
1974	2794	477			3271
1975	2150	822			2972
1976	1327	131			1458
1977	1545	272			1817
1978	1744	481			2225
1979	2269	452			2721
1980	2925	442			3367
1981	3381	414			3795
1982	4289	210			4499
1983	3426	131			3557
1984	3571	324			3895
1985	3919	207			4126
1986	2591	147			2738
1987	2499	62			2561
1988	2375	828			3203
1989	2115	344			2459
1990	1895	519			2414
1991	1640	410			2050
1992	2015	372			2387
1993	1857	372	10	905	3144
1994	2512	729	126	390	3757
1995	2936	866	26	695	4523
1996	2230	525	46	888	3689
1997	2409	841	15	756	4021
1998	2155	1410	78	827	4470
1999	2132	1140	16	572	3859
2000	872	880	9	686	2448
2001	1163	913	2	809	2888
2002	1282	1154	14	1288	3739
2003	831	933	16	1079	2859
2004	1365	525	25	997	2913

* Irish data for 1993-95 exclusive of landings from rectangles that were previously in FUs 20-22, and that are now in FU 19



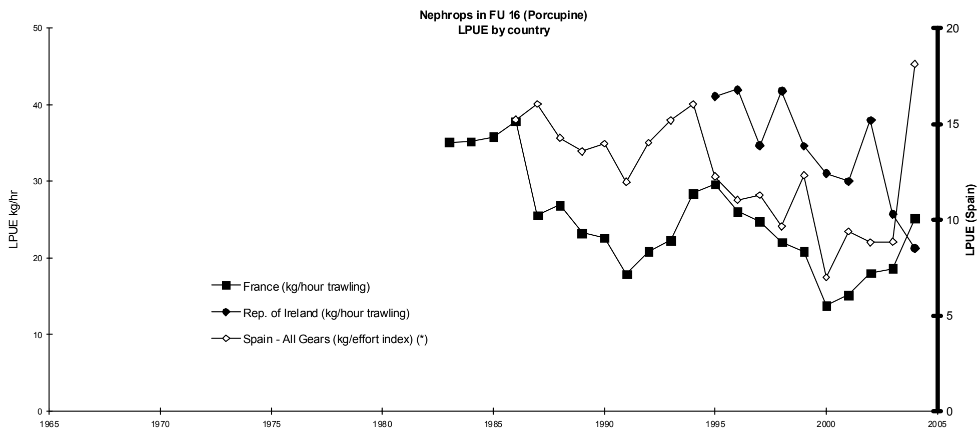
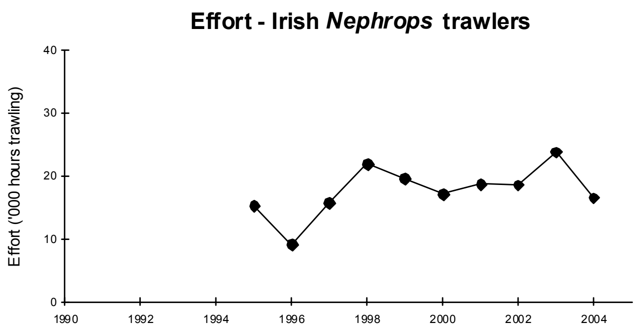


Figure 1.4.40.1 Effort and LPUE of *Nephrops* in FU16 (Porcupine)



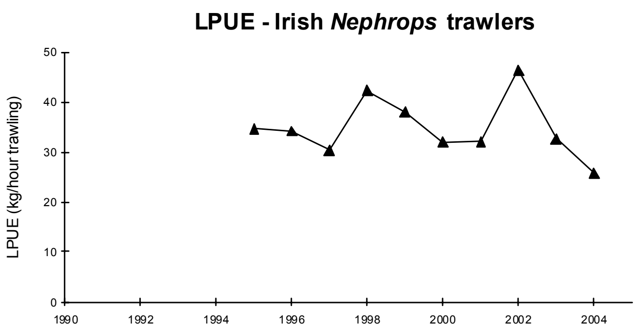
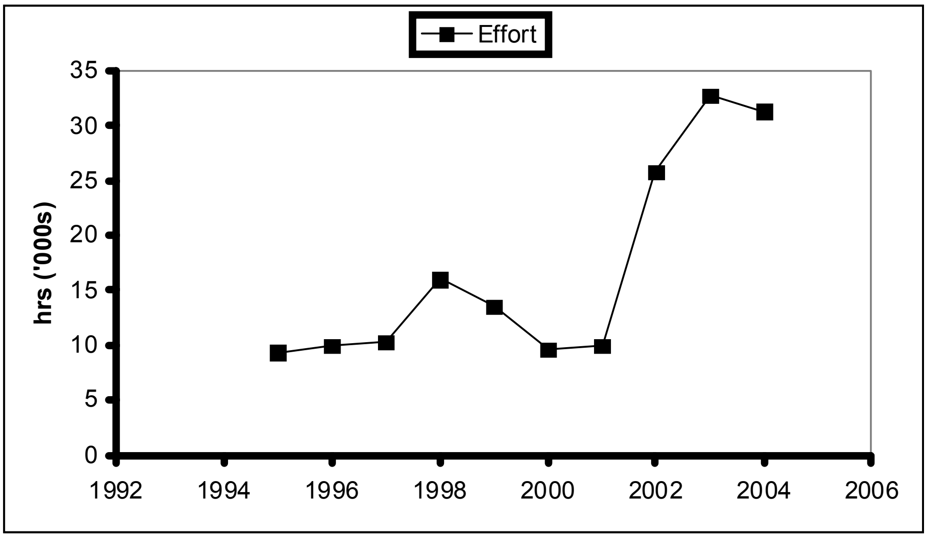


Figure 1.4.40.2 Effort and LPUE on *Nephrops* in FU17 (Aran grounds)



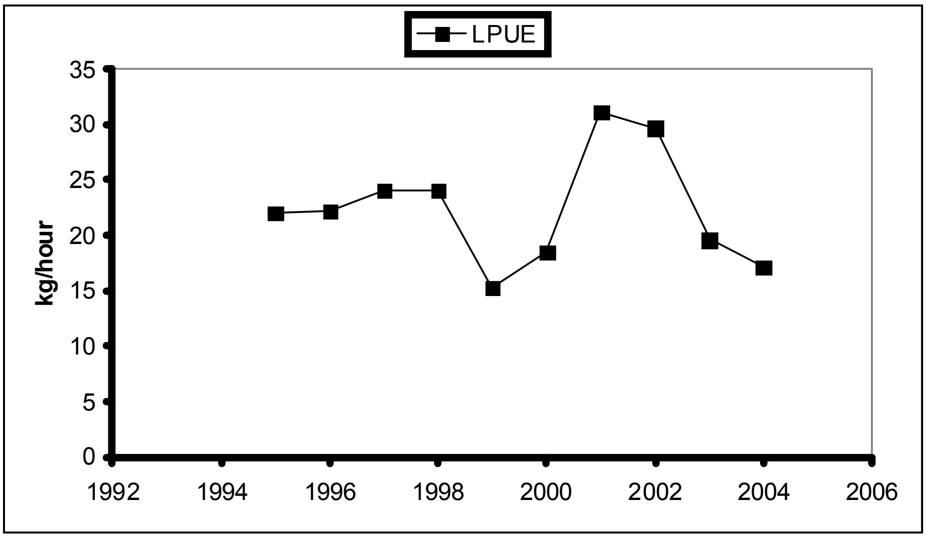


Figure 1.4.40.3. Effort and LPUE on *Nephrops* in FU19 (SE and SW Ireland)

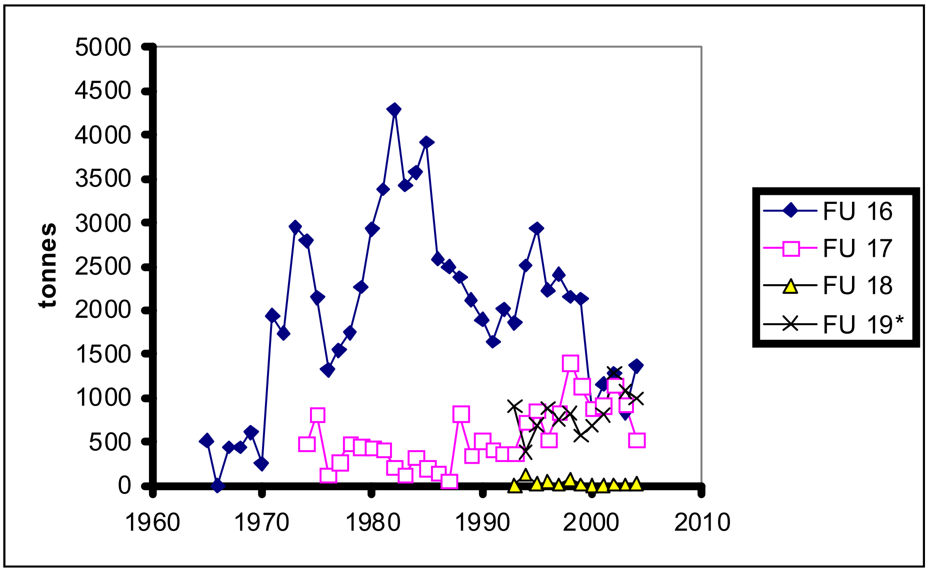


Figure 1.4.40.4 Landings of *Nephrops* in Management Area L by functional unit.

Southern Irish Sea and Celtic Sea *Nephrops*

(WG - MA M = Division VIIa South of 53°N and Divisions VIIg,f,h excluding inshore rectangles south of Ireland (31E1, 32E1, 32E2, 33E2, 33E3))

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

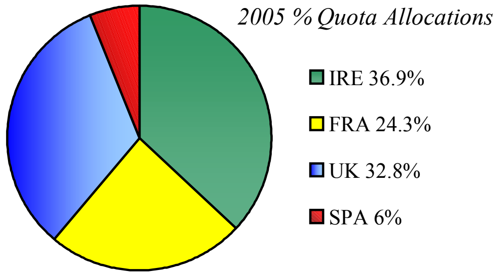
(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

The state of the stock is unknown but there are no indications from landings and LPUE data that the stock has declined.

There is no basis to revise the advice given previously. FSS recommends that landings from Management Area M should not exceed 4,600 t for 2005.

CURRENT MANAGEMENT

- The 'precautionary' TAC covers Sub-area VII, whereas Management Area M comprises Division VIIa South of 53°N and Division VIIg,f,h and excluding inshore rectangles south of Ireland (31E1, 32E1, 32E2, 33E2, 33E3). This large TAC area may result in unbalanced exploitation of individual FUs.
- The Management Area M contains several discrete fisheries south and east of the Smalls and east of the Labadie bank (FU 20-22). The MA also includes numerous smaller-scattered fisheries where the substrate is suitable.
- The 2005 agreed TAC for all of Sub-area VII was 19,544 t, of which Ireland's quota was 7,207 t.
- There are no explicit management objectives or a management plan for this stock. FSS recommend that management objectives be established and that a management plan be developed with stakeholders and implemented for fisheries catching *Nephrops*.
- The following TCMs are in place for *Nephrops* in VII (excluding VIIa) after EC 850/98: *Minimum Landing Sizes (MLS)*; total length >85 mm, carapace length >25 mm, tail length >46 mm. *Mesh Size Restrictions*; Towed gears targeting *Nephrops* having at least 35% by weight of this species on board will require 70 mm diamond mesh plus an 80 mm square mesh panel as a minimum or having at least 30% by weight of *Nephrops* on board will require 80 mm diamond mesh.



ADDITIONAL INFORMATION

1. This area consists of several different discrete populations and adequate geo-referenced catch, effort data and sampling data are not yet available on which to base an analytical assessment. Indicators such as size structure and catch rates on surveys and from the fishery are relatively stable. Recent Irish LPUE data does show a substantial decrease in 2003 and 2004 (from ~50kg/hr to 30kg/hr) but it is not clear if this is due to a decline in abundance. There are thought to have been some changes in targeting practices by the Irish fleet with vessels switching more to targeting larger, higher value *Nephrops* in areas with lower abundance that the traditional areas such as the Smalls where large numbers of small *Nephrops* are fished.
2. The importance of these *Nephrops* grounds to the Irish fleet has increased in recent years. Most of the Irish landings from this fishery were from the grounds south of the Smalls. Effort has increased and in 2004 effort was around 40% higher than in the late 1990s.
3. The Irish fishery consists of otter trawl vessels and, increasingly in recent years, twin-rig vessels. Vessels from Dunmore East, Howth and Clogherhead mainly exploit the fishery.

Management Area	Functional Units	ICES Landings advice	Comment
WG-MA J	14, 15	Not given	No increase in effort Average landings 2000-2002 ~8,100 t
WG-MA L	16, 17, 18, 19	3,300	Average landings 2000-2002
WG-MA M	20-22	4,600	Average landings 2000-2002
Sub-area VII	14 to 22	Not given	Average landings 2000-2002 ~16,100 t

4. FSS considers that the current application of a TAC to the whole of Sub-area VII may lead to unbalanced exploitation of *Nephrops* stocks and may also hinder management of *Nephrops* fisheries in a mixed fisheries context. FSS considers that individual *Nephrops* stocks should be managed and effort be controlled on a more appropriate geographical scale i.e. Functional Unit.

ICES ADVICE
1.4.41

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Unknown	Unknown	Unknown

In the absence of defined reference points, the state of the stock cannot be evaluated in this regard. Landings show an increasing trend up to 1995; since then landings have fluctuated between 3500 t and 5000 t (mostly around 4000 t). The landings per unit effort (LPUE) series for the French *Nephrops* trawlers indicate an increase from a low in 1999 to the highest in the series in 2002.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No reference points have been established.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Due to uncertainty in the available data ICES is not able to reliably forecast catch. In view of the relative stability of landings, landings from FU 20-22 should not exceed 4.6 thousand tonnes for 2006, based on the average landings of 2000–2002. The landings from all FUs in this TAC area is presented in Section 1.4.36 (*Nephrops* in Division VIIa).

Management considerations

Management for *Nephrops* stocks should be conducted on an appropriate geographic scale (e.g. Functional Unit). Currently the TAC is set for Subarea VII and this may allow unrestricted catches for stocks where catches should be limited.

Nephrops in these functional units are known to occur in several areas of muddy sediment and the stock structure is uncertain. The *Nephrops* fisheries target different areas and have very different size structures in *Nephrops* catches and landings. These fisheries also have differences in non-*Nephrops* bycatch composition.

Discarding of *Nephrops* is substantial. This shows that trawls currently used to target *Nephrops* are not technically adapted to select marketable *Nephrops*. Discarding of other fish species is a problem in *Nephrops* fishery. Technical measures such as separator trawls can substantially reduce discarding and should be encouraged. Currently there are no pot fisheries for *Nephrops* in this area. Pot fisheries can be very selective in reducing discards and have less impact on the broader ecosystem. However, in other areas pots are known to have higher catches of female *Nephrops* than trawls and pots may therefore have a greater impact on SSB per tonnes landed.

Ecosystem considerations

Nephrops occur in discrete patches where the sediment is suitable for them to construct their burrows. There is a larval phase where there may be some mixing with *Nephrops* from other areas depending on the oceanographic conditions, but the mechanisms for this in the Celtic Sea are not currently known.

Cod has been identified as a predator of *Nephrops* in some areas, and the generally low level of the cod stock is likely to have resulted in reduced predation on *Nephrops*.

Factors affecting the fisheries and the stock

Landings from this stock are reported by France, the Republic of Ireland, and the UK. Up to 1993, the French landings represented at least 80% of the international *Nephrops* landings from the Celtic Sea but this proportion has declined somewhat since then. There has been a considerable increase in Irish landings, from around 700 t in the early 1990s to around 1 500 t from the mid-1990s until the present. There has also been increasing effort by Irish vessels targeting *Nephrops* in the Celtic Sea in recent years.

The effects of regulations

Although the minimum landing size for *Nephrops* in this area is 25 mm CL there is substantial discarding above this size by the French fleet due to market conditions.

Changes in fishing technology and fishing patterns

There has been increasing diversification into different *Nephrops* fisheries within this area by the Irish fleet.

Other factors

Although *Nephrops* is the main target species for two specialized fleets, cod, whiting, and to a lesser extent haddock are the main bycatches.

Scientific basis

Data and methods

The basic source of information on the structure and dynamics of *Nephrops* stocks is the length composition of catches, landings, and discards. Interpretation of these data is complicated by uncertainties in stock structure and the lack of geo-referenced sampling data. Age and growth for *Nephrops* stocks in this area is unknown.

There is limited fishery independent survey data for this stock and no survey specifically targeted at *Nephrops*.

French discard data are available for some years only (1985, 1991, and 1997). It is expected that the new Irish catch sampling programme implemented in 2002 will improve the quality of the series for future assessment. More frequent discard samplings of the French fleet would greatly improve the quality of the length-frequency data, the more so since (a) the minimum landing sizes applied by the two fleets are different (25 mm CL in Ireland vs. 35 mm CL in France), and (b) discarding by the French fleet is substantial (owing to the large commercial minimum landing size).

Information from the fishing industry

Prior to the assessment (WGSSDS 2005) a meeting was held with the Irish and French industry. No specific concerns were raised about this stock.

Comparison with previous assessment and advice:

Previously this stock has been assessed every two years and the advice based on various stock indicators (size, LPUE trends, XSA assessment). This year no assessment could be carried out due to limited and uncertain input data.

As in previous years the advice is based on recent average landings.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

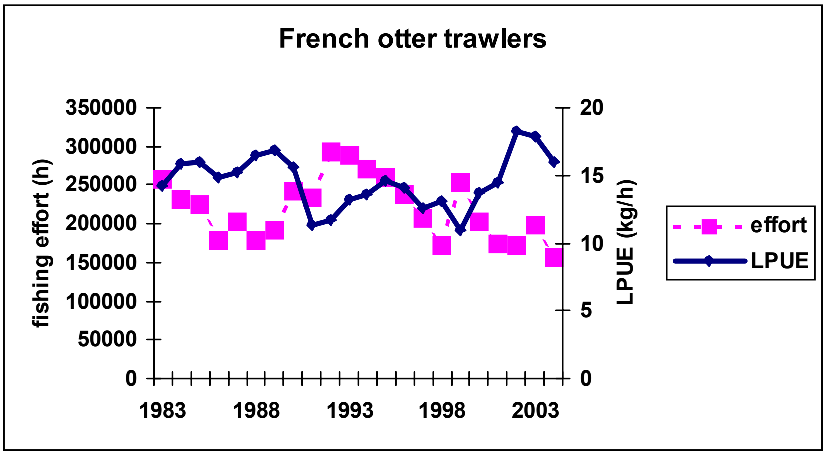
Year	ICES advice	Recommended TAC	Agreed TAC[1]	ACFM landings[2]
1987				3.1
1988				2.9
1989				4
1990				4.3
1991				3.3
1992		~3.8	20	4.3
1993		3.8	20	4.374
1994		3.8	20	4.869
1995		3.8	20	5.223
1996		3.8	23	4.611
1997		3.8	23	4.027
1998		3.8	23	3.835
1999		3.8	23	3.532
2000		3.8	21	4.579
2001		3.8	18.9	4.644
2002		3.8	17.79	4.603
2003		3.8	17.79	4.92
2004	Adjust TAC in line with landings of most recent 10 years	4.6	17.45	4.146
2005	Adjust TAC in line with landings of most recent 10 years	4.6	19.544	
2006	Recent average landings 2000–2002	4.6		

Weights in '000 t.
[1)] Subarea VII. [2)] Does not include discards

Table 1.4.41.1 *Nephrops* in VIIgh. Nominal landings (t) in Division VIIgh as used by Working Group.

Year	France	Rep. of Ireland	UK	Other Countries[1]	Total reported	Unallocated	Total
1983	3667						
1984	3653						
1985	3599						
1986	2638						
1987	3080	329					
1988	2926	239					
1989	3221	784					
1990	3762	528					
1991	2651	644					
1992	3415	750					
1993	3815	770	63	0	4648	-274	4374
1994	3658	1415	68	2	5143	-274	4869
1995	3803	1575	125	2	5505	-282	5223
1996	3363	1377	86	2	4828	-217	4611
1997	2589	1552	95	4	4240	-213	4027
1998	2241	1619	64	1	3925	-90	3835
1999	2745	824	41	0	3610	-78	3532
2000	2782	1793	47	1	4623	-44	4579
2001	2532	2123	21	1	4677	-33	4644
2002	3134	1496	15	8	4653	-50	4603
2003	3511	1390	19	N/A	4901	0	4920
2004	2511	1599	36	N/A	4110	0	4146

[1]Other countries includes Belgium.



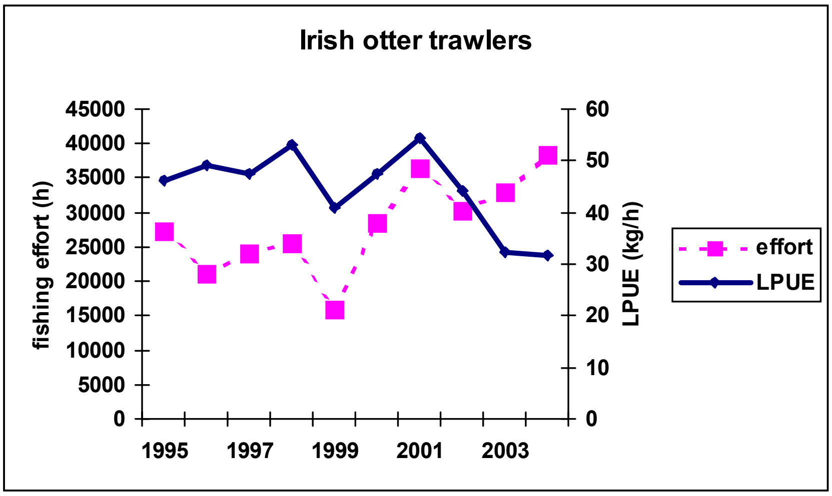


Figure 1.4.41.1 Fishing effort and landings per effort unit (LPUE) in *Nephrops* fisheries.

West of Ireland and Celtic Sea Pollack

(Sub-area VII)

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

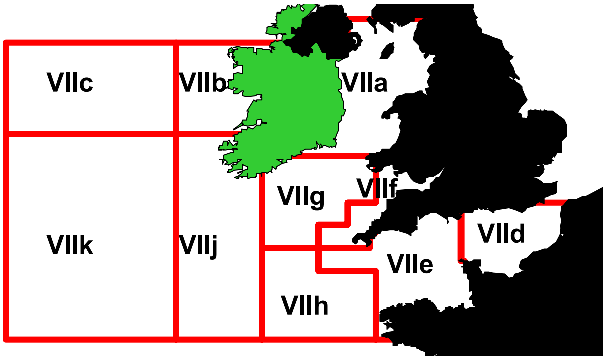
(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

The status of this stock is unknown.

FSS advise that there is no scientific basis for the current TAC which is far in excess of recent annual landings. FSS note that pollack are mainly distributed and fished in inshore areas and the current TAC area may contain several smaller stocks. In this situation the current TAC management system may not be appropriate and localised stock depletion may still occur. FSS advise that pollack stocks should be assessed and managed on a smaller geographical scale within this area. FSS suggest that catches in local areas are limited to recent averages and programmes be put in place to estimate sustainable exploitation levels for pollack stocks.

Irish landings and LPUEs have been relatively stable in recent years perhaps indicating that the stocks around the Irish coast are sustainably exploited. Reducing the international TAC would make the Irish quota restrictive.

In the absence of ICES advice for this stock, FSS advise the current TAC of 17,000 t be maintained in 2006. This translates to an Irish quota of 1,298 t. However, FSS point out that the French quota uptake is less than ¼ of the TAC, therefore increased quota uptake by the French may alter the stock status.



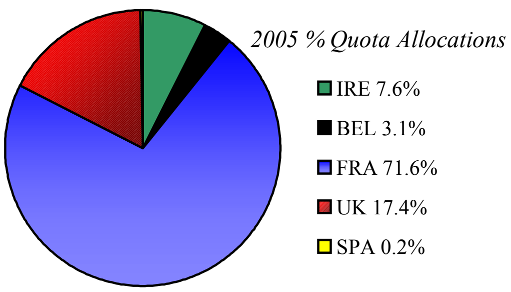
Red Boxes-TAC/Management Areas

CURRENT MANAGEMENT

- The TAC area covers Sub-area VII.
- The 2005 TAC was 17,000 t with an associated Irish quota of 1,298 t.
- There are no explicit management objectives or plans for this stock.
- FSS advises that management objectives be established and that a management plan be developed and implemented for the fishery catching pollack.

ADDITIONAL INFORMATION

1. Estimated Irish landings were 1,050 t in 2004.
2. Total international landings in 2003 were estimated at 5,309 t.
3. The Irish quota is not restrictive but this fishery is particularly important to smaller Irish vessels operating off the southwest and west coasts.
4. Pollack is taken in many localised inshore fisheries.
5. There is little scientific information on the biology and stock structure of pollack in Sub-area VII.



Pollack in Sub-area VI landings as estimated by FSS. EU TAC and Irish quota also shown.
(Source of International data: ICES STATLANT 27A database)

Country	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**
Belgium	89	299	295	339	157	186	151	237	244	154	167	207	269
France	-	-	-	-	3,569	5,496	5,119	5,242	5,814	4,253	6,214	3,927	3,741
Ireland	-	-	-	-	-	-	-	-	-	-	-	-	-
Spain	-	-	-	-	-	-	-	1	23	32	26	486	20
UK - Eng+Wales+N.Irl.	127	218	258	363	374	459	667	737	683	959	991	1,050	962
UK – Scotland	-	5	2	3	4	5	9	16	72	50	36	36	47
*Other	3	13	47	59	89	94	115	24	28	13	18	14	13
TOTAL	**219**	**535**	**602**	**764**	**4,193**	**6,240**	**6,061**	**6,257**	**6,864**	**5,461**	**7,452**	**5,720**	**5,052**

Country	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
Belgium	241	149	191	145	133	76	62	55	94	88
France	4,574	5,213	5,211	3,893	4,831	3,211	2,849	2,325	2,621	2,315
Ireland	1,335	848	1,066	994	1,066	1,045	1,014	1,137	921	1,107
Spain	17	19	22	18	26	22	19	7	8	4
UK - Eng+Wales+N.Irl.	1,757	1,964	1,713	1,457	1,870	1,919	1,847	2,064	2,369	2,066
UK – Scotland	28	32	20	10	16	30	14	53	11	63
*Other	10	14	7	20	28	13	28	18	11	41
TOTAL	**7,962**	**8,239**	**8,230**	**6,537**	**7,970**	**6,316**	**5,833**	**5,659**	**6,035**	**5,684**
TAC	8,670	10,610	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000

Country	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	****2004**	**2005**
Belgium	94	99	92	86	71	100	116	113	104	
France	2,684	2,443	2,375	-	2,422	2,515	2,481	2,247	-	
Ireland	1,190	984	886	976	1,069	1,274	1,308	1,151	-	
Spain	5	7	11	19	5	9	17	12	-	
UK - Eng+Wales+N.Irl.	2,390	2,429	2,206	1,617	1,706	1,921	1,948	1,717	1,628	
UK – Scotland	86	65	78	9	6	9	8	16	16	
*Other	49	50	64	80	98	57	43	53	10	
TOTAL	**6,498**	**6,077**	**5,712**	**2,787**	**5,377**	**5,885**	**5,921**	**5,309**	**1,758**	**N/A**
TAC	14,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000

*Other includes Norway, Netherlands, Channel Islands, Germany and Denmark

** Data are preliminary for 2004

N/A = Not available

West of Ireland and Celtic Sea Saithe

(Sub-area VII)

Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

(See Celtic Sea, West and Southwest of Ireland Overview for Mixed Fisheries Advice)

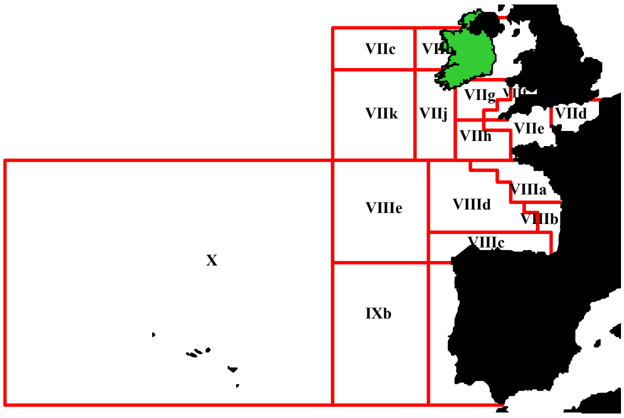
The status of this stock is unknown. There is no ICES assessment for this stock. International landings data are incomplete in recent years.

FSS note that there is no scientific basis for the proposed TAC and that the current TAC is far in excess of recent annual landings. Irish landings and LPUEs have been relatively stable in recent years perhaps indicating that the stock is sustainably exploited. Reducing the international TAC would make the Irish quota restrictive. Therefore, in the absence of ICES advice for this stock, FSS considers that the catches in 2006 should not exceed the 2005 TAC of 5,574 t. This translates into an Irish quota of 1,568 t.

FSS advises that a programme should be initiated to evaluate stock status, so that management objectives and a management plan can be formulated for this stock. However, the mixed fisheries advice given for fisheries in the Celtic Sea, particularly in relation to stocks outside safe biological limits, should determine the TAC for saithe.

CURRENT MANAGEMENT

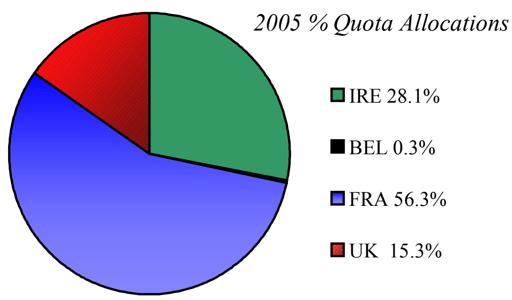
- The TAC covers VII, VIII, IX, and X.
- The 2005 TAC was 5,574 t with an associated Irish quota of 1,568 t.
- Currently the TAC is not restrictive.
- There are no explicit management objectives or plans for this stock.
- FSS advises that management objectives be established and that a management plan be developed and implemented for fisheries catching saithe.



Red Boxes-TAC/Management Areas

ADDITIONAL INFORMATION

1. International landings increased to around 10,000 t in the late 1980s and early 1990s. Between 1992 and 1996 landings were around 6,000 t to 7,000 t. However, landings have declined somewhat since 1997 and catch data are incomplete for some countries.
2. There are no precautionary reference points proposed for this stock.
3. Estimated Irish landings were 500 t in 2004.
4. The Irish fishery takes place mainly in VIIg and VIIj by vessels using gillnets and otter trawls. There are also some catches made with other gears including seine nets.
5. Saithe are a pelagic shoaling species and the stock structure and biology of this species is poorly understood.



Saithe Division VII official nominal landings by country
(Source: ICES STATLANT 27A database)

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Belgium	21	53	34	30	10	9	9	19	12	13	6	10
Channel Is	-	-	-	-	-	-	-	-	-	5	5	6
Denmark	-	-	1	5	1	19	7	6	-	-	-	-
France	5916	4339	3780	2923	2573	2098	1698	2317	4563	4061	4760	3697
Germany	5	-	4	-	15	16	3	46	-	-	11	5
Ireland	893	785	1045	1362	1083	1451	1632	2220	2197	2367	2383	2374
Isle of Man	-	-	-	-	-	-	41	19	36	34	16	27
Netherlands	74	75	106	106	52	44	35	84	100	22	7	-
Norway	-	-	-	-	-	-	-	-	-	-	3	-
Poland	101	1	78	43	1	-	-	-	-	-	-	-
Spain	444	490	603	-	632	-	-	-	266	179	70	118
UK - Eng+Wales+N.Irl.	916	731	523	449	567	432	337	410	761	1291	898	1379
UK – Scotland	7	8	61	6	10	106	34	56	94	119	138	140
USSR	54	49	68	61	-	-	-	-	-	-	-	-
TOTAL	**8,431**	**6,531**	**6,303**	**4,985**	**4,944**	**4,175**	**3,796**	**5,177**	**8,029**	**8,091**	**8,297**	**7,756**

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Belgium	31	25	20	23	15	9	5	2	4	9	8	5
Channel Is	13	2	3	4	3	3	-	1	-	-	8	2
Denmark	-	-	-	-	-	-	-	-	-	1	-	-
France	6070	8220	6156	6169	8278	6625	7286	1885	1718	3216	2089	2088
Germany	-	-	-	124	30	-	-	-	-	-	-	-
Ireland	2177	1739	1624	1400	2,165	976	1273	1481	2010	1,915	2,376	2,060
Isle of Man	9	6	3	4	2	3	10	8	5	4	11	11
Netherlands	-	-	-	-	-	-	1	-	-	-	-	3
Norway	3	40	2	1	16	24	29	38	-	7	14	13
Poland	-	-	-	-	-	-	-	-	-	-	-	-
Spain	118	-	-	-	-	-	-	-	-	-	12	25
UK - Eng+Wales+N.Irl.	1374	1281	943	1245	1152	1017	1036	1207	966	1019	952	1271
UK – Scotland	477	488	1064	142	131	1030	1087	703	1107	977	853	872
USSR	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**10,272**	**11,801**	**9,815**	**9,112**	**11,792**	**9,687**	**10,727**	**5,325**	**5,810**	**7,148**	**6,323**	**6,350**

Country	1997	1998	1999	2000	2001	2002	2003	2004
Belgium	9	8	7	4	7	13	3	1
Channel Is	4	-	2	-	-	-	-	-
Denmark	-	-	-	-	-	-	-	-
France	1585	1503	-	2604	631	499	342	-
Germany	-	-	-	-	-	-	-	-
Ireland	1,383	1421	1288	1255	1579	1143	711	-
Isle of Man	9	7	2	1	-	4	4	.
Netherlands	2	-	-	-	-	-	-	-
Norway	7	-	5	1	67	3	-	3
Poland	-	-	-	-	-	-	-	-
Spain	22	63	30	32	17	12	8	-
UK - Eng+Wales+N.Irl.	909	567	400	290	306	285	338	304
UK – Scotland	541	374	298	161	33	6	24	36
USSR	-	-	-	-	-	-	-	-
TOTAL	**4,471**	**3,943**	**2,032**	**4,348**	**2,640**	**1,965**	**1,430**	**344**

[1] Official landings data were available from ICES for Sub-area VII
Ireland landings from 1995 from DCMNR Logbook databases

Celtic Sea Herring

(Divisions VIIaS,VIIg-k)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

FSS –SINGLE STOCK CONSIDERATIONS

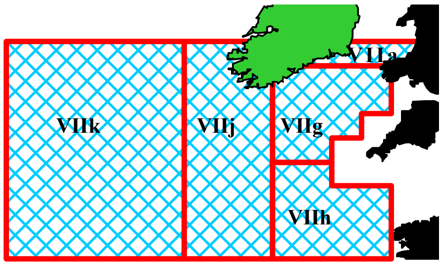
FSS agree with the ICES and STECF advice that the state of this stock is uncertain, but maybe below B_{pa} and possibly below $B_{lim.}$ There is no short-term forecast on which to base catch advice for 2006. However, given the risk to the stock indicated by weak recent recruitment, exploitation should be significantly reduced in 2006. The TAC advised for 2006 is 6,700 t, corresponding to 60% of the average catch in 2002–2004.

FSS agree with ICES (point 2 of answer to special request below) that the less stringent advice in 1991, the last time that such weak recruitment was observed, was associated with an SSB level above B_{pa}. Therefore it is not possible to compare the current stringent advice with the advice in 1991.

Given that the current advise is driven by the size of recent recruitment, FSS considers that a mid-year review would be appropriate. FSS considers that a mid-year review of the TAC should be carried out after ACFM in May 2006.

FSS points out that a re-closure of the eastern section of the Celtic sea (i.e. East of Mine Head) would offer a means of reducing exploitation, particularly on first time spawners. FSS and ICES considers that this would be an effective measure to reduce exploitation as most of the herring catches have been taken in this area since the voluntary closure was removed in December 2003. FSS points out that a closure of the area east of Mine Head, as suggested by ICES and FSS, would have a greater impact on the dry hold sector that targets the stock in this area during the winter months. FSS agrees with ICES (point 1 of answer to special request below) that this is an additional measure to the TAC reduction, and not an alternative.

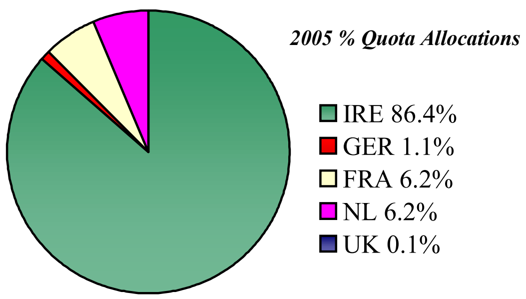
FSS restates that actions that perturb herring spawning beds or increase turbidity after spawning are likely to have a negative affect on recruitment to the stock. Such activities include aggregate extraction and dumping of dredge spoil.



Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

CURRENT MANAGEMENT

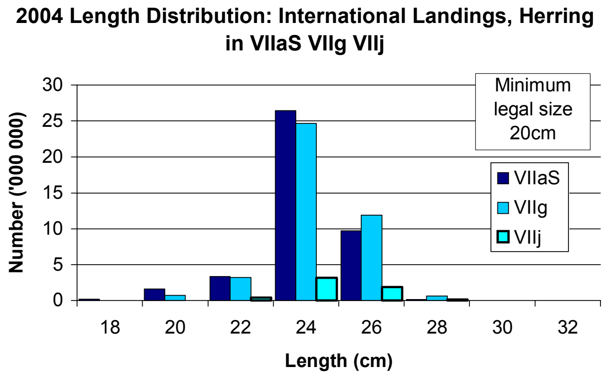
- The TAC is set on an annual basis but the assessments are carried out on a seasonal basis (1 April – 31 March).
- The TAC in 2005 was 13,000 t, with an Irish quota of 11,236 t.
- There is no internationally agreed management plan for this fishery. However in 2001 the Irish South and West Pelagic Advisory Committee was set up to;
    - o To build the stock to a level whereby it can sustain annual catches of around 20,000 t.
    - o In the event of the stock falling below the level at which these catches can be sustained the Committee will take appropriate rebuilding measures.
    - o To introduce measures to prevent landings of small and juvenile herring, including closed areas and/or appropriate time closures.
    - o To ensure that all landings of herring should contain at least 50% of individual fish above 23 cm.
    - o To maintain, and if necessary expand the spawning box closures in time and area.
    - o To ensure that adequate scientific resources are available to assess the state of the stock.
    - o To participate in the collection of data and to play an active part in the stock assessment procedure.
- This management committee has extensive consultations with FSS on an on-going basis. The status of the stock was discussed in a number of meetings before and after the Working Group. Consultations resulted in additional sampling throughout the summer of 2005.

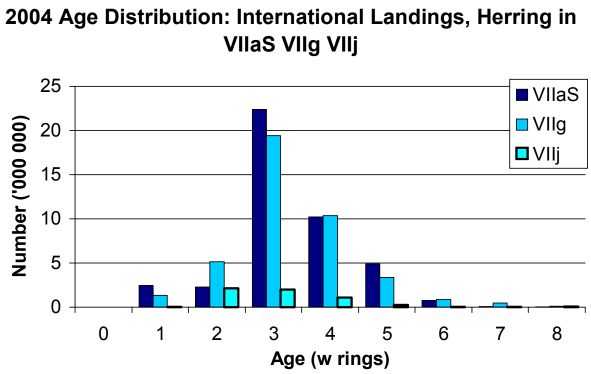


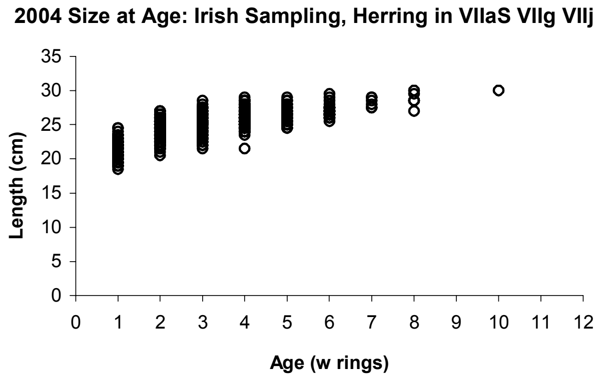
- Selected spawning grounds are closed each year in this fishery on a rotational basis. These closures, (see map at end of section), are designed to provide some protection for the spawning shoals and should be maintained. In 2005/2006 Box C will be closed.

ADDITIONAL INFORMATION

1. The current estimate of SSB is very uncertain but suggests that SSB may be below $\mathbf{B}_{pa}$, and may even be below $\mathbf{B}_{lim}$.
2. Current fishing mortality is uncertain and may be very high.
3. In 2004, the total landings were 11,000 t, corresponding to the Irish catch, similar to landings in 2002 and 2003.
4. Recruitment of the 2001/2002 year class was estimated as the weakest on record. This is based on two observations of this year class in the catches, extensive sampling of the 2005/2006 summer fishery, of demersal by-catches of herring and the 2005/2006 acoustic survey (see graph).
5. The results of the acoustic survey in 2004/2005 are consistent with poor recruitment.
6. The assessment was highly uncertain but shows that the SSB is low. Irrespective of whether the acoustic survey is included in the assessment, the stock is at risk of reduced reproductive capacity.
7. No information is available on unallocated catches from foreign fleets.
8. There is no information on discarding in this fishery, and better information is required to show that this is not a problem for the fishery.
9. Celtic Sea juveniles are known to mix with those of the Irish Sea. The effect of this mixing on recruitment to the fishery and stock is unquantified.







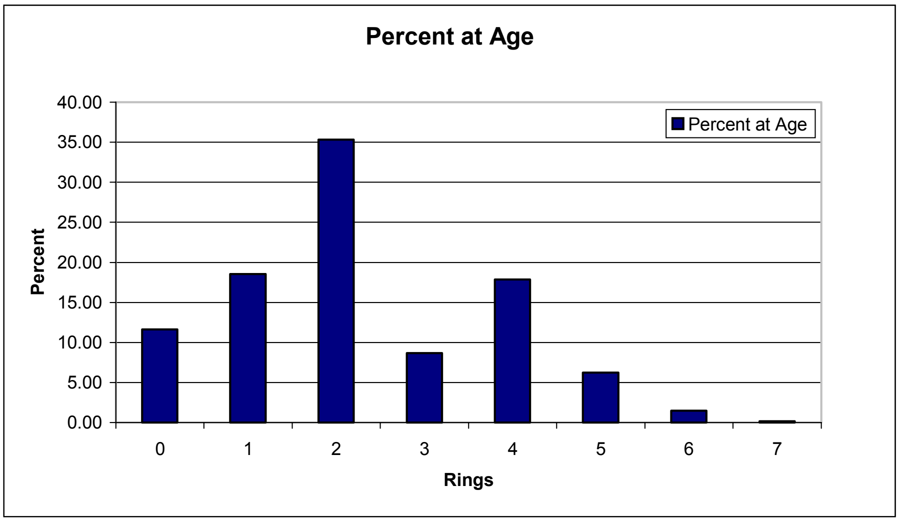


Figure 1. Celtic Sea Herring Acoustic Survey October 05. Herring Percent at age values

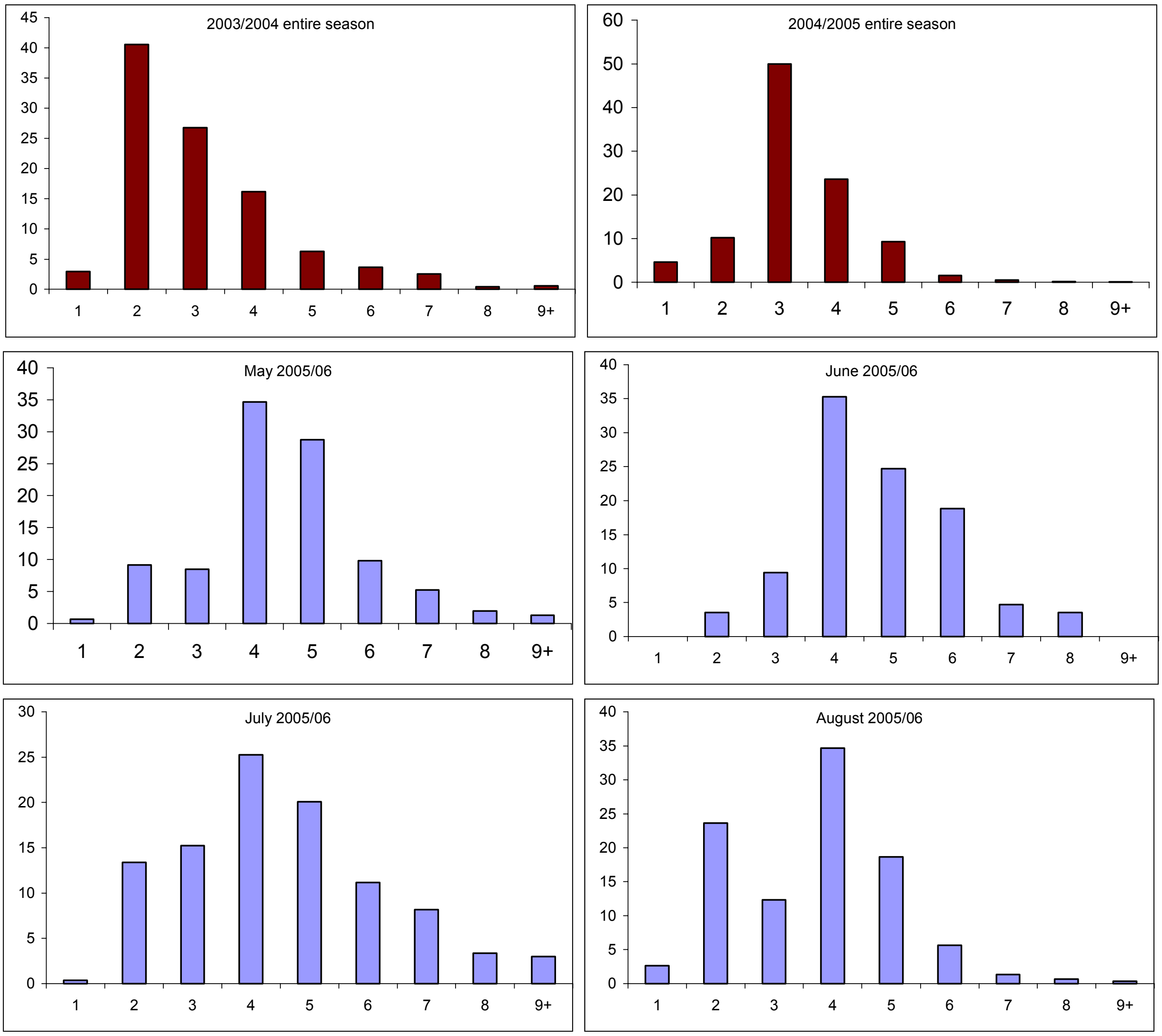


Figure 2. Herring Percent at age in seasons 2003/2004 to 2005/2006

Special Note

The Southwest Pelagic Management Advisory Committee made a special request for clarification of the ICES advice. This request was brought to the attention of ICES, by means of a letter from Ireland. The text of special request for advice is as follows:

Concerning the Celtic Sea herring you inform me that representatives of the Irish industry requested the Irish administration to seek an opinion from ICES on the following two points:

1. *Comment on the benefit to the stock of an indefinite closure of Box area C in Division VIIa as an alternative to reduction of the advised catches by 40% in 2006.*

2. *As this stock is characterised by variable recruitment, to comment on whether the advised reduction of 40% in catches for 2006 is too severe, given that it is driven by recent low recruitments and bearing in mind that similarly low recruitments have been recorded in the past, most recently in 1991.*

After consultation with ACFM, ICES made the following reply:

1. The basis advice for 2006 is a reduction in fishing mortality corresponding to a reduction in catches by 60% of the recent average catches (2002-2004). ICES advises that measures such as the re-closure of Box C may be helpful in achieving this catch reduction. ICES considers that this would be an effective measure to reduce exploitation as most of the herring catches have been taken in this area since the voluntary closure was removed in December 2003.

   Thus, the box closure is a supplementary measure that is intended to support the main advice to reduce catch in 2006. The closure of Box C is not an alternative to the reduction in TAC.

2. The current state of this stock in terms of F and SSB is not known, but the weakness of the 2001 year class is now clear. There are now two observations of the strength of this year class and both show that it is weak. Additional sampling during the summer of 2005, in Irish targeted fisheries and in by-catches of herring in demersal fisheries also confirm the weakness of the year class.

The 1989 year class was very weak, and this was recorded as weak recruitment of 1-ringers in 1991. However, at that time, the SSB was larger (>$\mathbf{B}_{pa}$) than at present. Although current SSB is uncertain, it seems low, below $\mathbf{B}_{pa}$ and maybe even below $\mathbf{B}_{lim}$. Hence, the more conservative advice at present is based on the current perception of the stock and an analogy between the two situations are not justified.

ICES ADVICE
1.4.16

State of stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Uncertain, but likely at risk of reduced reproductive capacity	unknown	unknown

The current estimate of SSB is very uncertain but suggests that SSB may be below $\mathbf{B}_{pa}$, and may even be below $\mathbf{B}_{lim}$. Recent recruitment is weak, particularly of the 2001/2002 year class. Current fishing mortality is very uncertain and may be very high.

Management objectives

The Irish Southwest Pelagic Management Committee was established to manage the Irish fishery for this herring stock. This Committee manages the Irish quota and implements measures in addition to the EU regulations. The Committee has the following objectives:

- To build the stock to a level whereby it can sustain annual catches of around 20 000 t.
- In the event of the stock falling below the level at which these catches can be sustained the Committee will take appropriate rebuilding measures.
- To introduce measures to prevent landings of small and juvenile herring, including closed areas and/or appropriate time closures.
- To ensure that all landings of herring should contain at least 50% of individual fish above 23 cm.
- To maintain, and if necessary expand the spawning box closures in time and area.
- To ensure that adequate scientific resources are available to assess the state of the stock.
- To participate in the collection of data and to play an active part in the stock assessment procedure.

Reference points

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is 26 000 t	$\mathbf{B}_{pa}$ be set at 44 000 t
	$\mathbf{F}_{lim}$: not defined	$\mathbf{F}_{pa}$: not defined

Technical basis

$\mathbf{B}_{lim}$: The lowest stock observed	$\mathbf{B}_{pa}$: Low probability of low recruitment
$\mathbf{F}_{lim}$: not defined	$\mathbf{F}_{pa}$: not defined

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

The current level of SSB is uncertain, but may be below $\mathbf{B}_{pa}$ and possibly even below $\mathbf{B}_{lim}$. There is no short-term forecast on which to base catch advice for 2006. However, given the risk to the stock indicated by weak recent recruitment, exploitation should be significantly reduced in 2006. Such a reduction should include a further reduction on recent catch levels, i.e. 6 700 t corresponding to 60% of the average catch in 2002–2004. Furthermore, supplementary measures should put in place to reduce exploitation. Such measures could include the re-closure of the eastern section of the Celtic sea (i.e. East of Mine Head). ICES considers that this would be an effective measure to reduce exploitation as most of the herring catches have been taken in this area since the voluntary closure was removed in December 2003.

Management considerations

Though the state of the stock is uncertain, SSB is considered to be at a relatively low level. In addition there are indications that the most recent recruitment is weak. Given the age structure of the population and the current uncertainty, ICES considers that there is a high risk for reduced stock productivity.

Factors affecting the fisheries and the stock

Box closure

The area east of Mine Head was closed from 2001 to December 2003. This closure may have afforded protection to recruiting "first-time spawners" over this period. The strongest year class to enter the fishery in recent years was that which spawned for the first time in 2001/2002. This cohort was dominant in catches from the closed area, when this area was re-opened in 2003. It has subsequently dominated catches throughout the Celtic Sea (though not in Division VIIj).

Changes in fishing technology and fishing patterns

The number of vessels targeting this stock has been static at around 20 for the last two seasons. The Irish Southwest Pelagic Management Committee has introduced measures that have changed the pattern of the fishery. For the past two seasons an increasing proportion

of the catch was taken during the summer. The summer fishery is restricted to refrigerated sea water vessels (RSW) and is conducted offshore. The remainder of the fishing is on inshore spawning grounds.

The environment

This stock is at the southern limit of species distribution. The mean sea surface temperature in the Celtic Sea has increased over the past three decades, and this may negatively affect the productivity of this stock.
Recruitment to the Celtic Sea may be affected by larvae drift into the Irish Sea.

Scientific basis

Data and methods

The current management regime has resulted in catch data which are thought reasonably reliable.

Assessment period and TAC

Celtic Sea and Division VIIj herring are assessed on a seasonal basis, the 1st April to the 31st March, while TACs are set by the calendar year.

Information from the fishing industry

The industry, through the Irish Southwest Pelagic Management Committee, has provided information and biological samples. Fishing was concentrated in Divisions VIIa south and VIIg. Landings from Division VIIj were comparatively few and the abundance of fish in this area has been lower than previously.

The industry points out that it has taken measures to avoid catches of small first-time spawning fish (<23 cm). The industry is concerned that this measure may be leading to the perception that the abundance of these fish is low. However, ICES notes that the low abundance of these fish in 2003 catches has been confirmed by relatively low abundances as age 2 in 2004.

Uncertainties in assessment and forecast

A tentative assessment and forecast was undertaken in 2005, but the results display a poor model fit. Hence, the level of SSB and F in the most recent year is therefore very uncertain. However, it is clear that there are low abundances of older fish both in the catches and the population. Also, it is clear that SSB has declined since the mid-1990s. In addition, the marked absence of 2-year-old fish is confirmed by the acoustic survey and other fishery independent data. In a fishery that is based on only a few age classes, this is a cause for concern as there may be a high risk to the reproductive capacity of the stock from such a series of events.

Comparison with previous assessment and advice

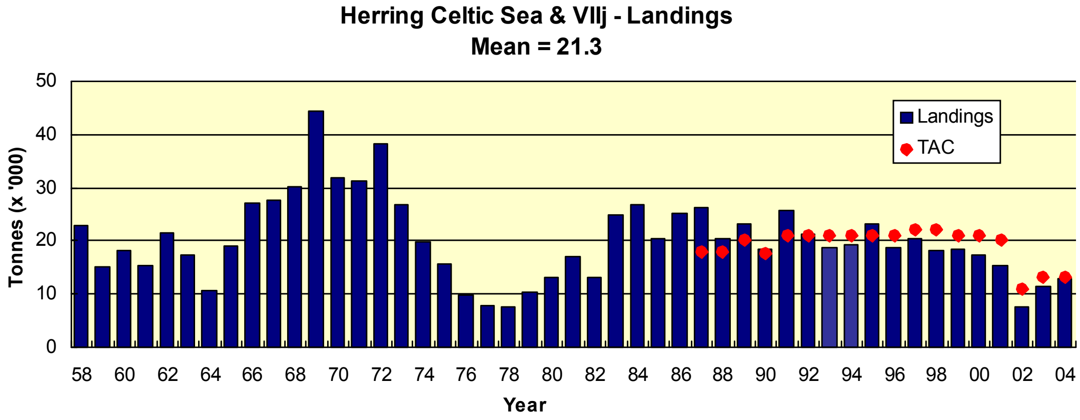
The perception of the stock status this year is influenced by the new perception of poor recruitment, and the advice for 2005 reflects this.

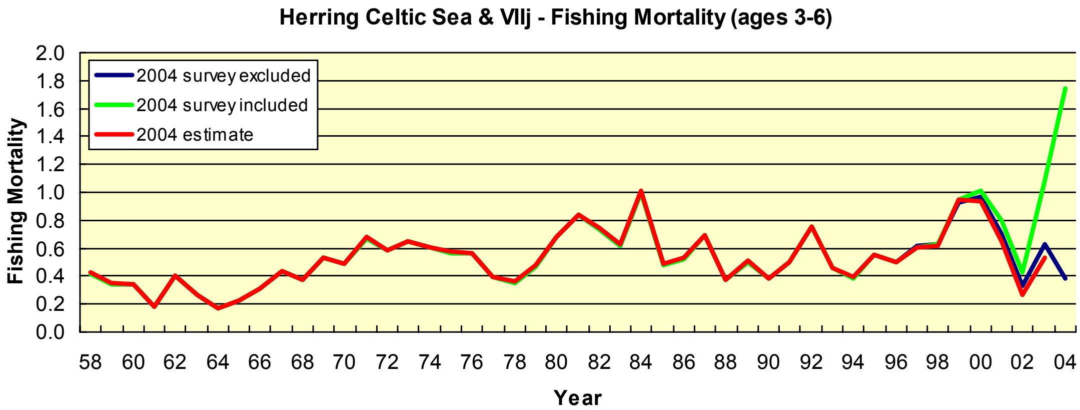
Source of information

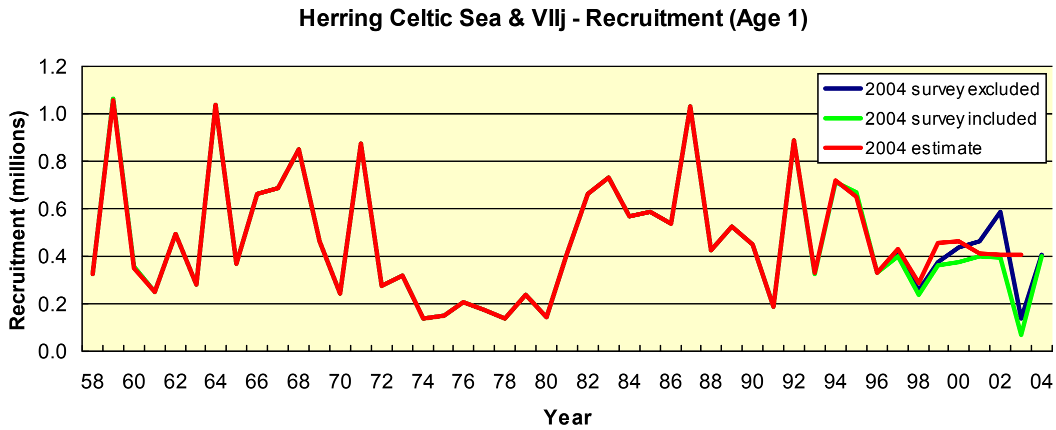
Report of the Herring Assessment Working Group for the Area South of 62°N, 8–17 March 2005 (ICES CM 2005/ACFM:16).

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings	Discards	ACFM Catch[1]
1987	Precautionary TAC	18	18	18	4.2	27.3
1988	TAC	13	18	17	2.4	19.2
1989	TAC	20	20	18	3.5	22.7
1990	TAC	15	17.5	17	2.5	20.2
1991	TAC (TAC excluding discards)	15 (12.5)	21	21	1.9	23.6
1992	TAC	27	21	19	2.1	23
1993	Precautionary TAC (including discards)	20–24	21	20	1.9	21.1
1994	Precautionary TAC (including discards)	20–24	21	19	1.7	19.1
1995	No specific advice	-	21	18	0.7	19
1996	TAC	9.8	16.5 – 21[2]	21	3	21.8
1997	If required, precautionary TAC	< 25	22	20.7	0.7	18.8
1998	Catches below 25	< 25	22	20.5	0	20.3
1999	F = 0.4	19	21	19.4	0	18.1
2000	F < 0.3	20	21	18.8	0	18.3
2001	F < 0.34	17.9	20	17.8	0	17.7
2002	F<0.35	11	11	11.3	0	10.5
2003	Substantially less than recent catches	-	13	13	0	12
2004	60% of average catch 1997–2000	11	13	11	-	11
2005	60% of average catch 1997–2000	11	13			
2006	Further reduction 60% avg catch 2002–2004	6.7				

Weights in '000 t.
[1]By calendar year. [2]Revised during 1996 after ACFM May meeting.


Herring Celtic Sea & VIIj - Landings
Mean = 21.3
Tonnes (x '000)
Landings
TAC
Year


Herring Celtic Sea & VIIj - Fishing Mortality (ages 3-6)
Fishing Mortality
2004 survey excluded
2004 survey included
2004 estimate
Year


Herring Celtic Sea & VIIj - Recruitment (Age 1)
Recruitment (millions)
2004 survey excluded
2004 survey included
2004 estimate
Year

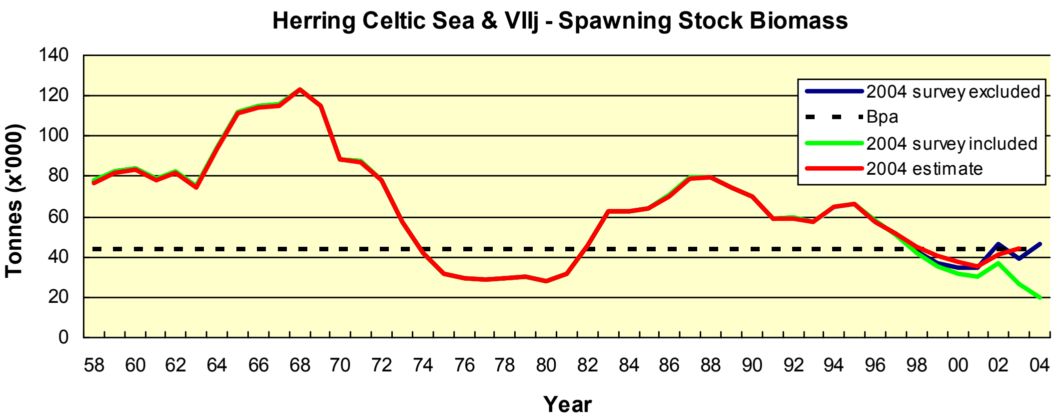

Herring Celtic Sea & VIIj - Spawning Stock Biomass
Tonnes (x'000)
2004 survey excluded
Bpa
2004 survey included
2004 estimate
Year

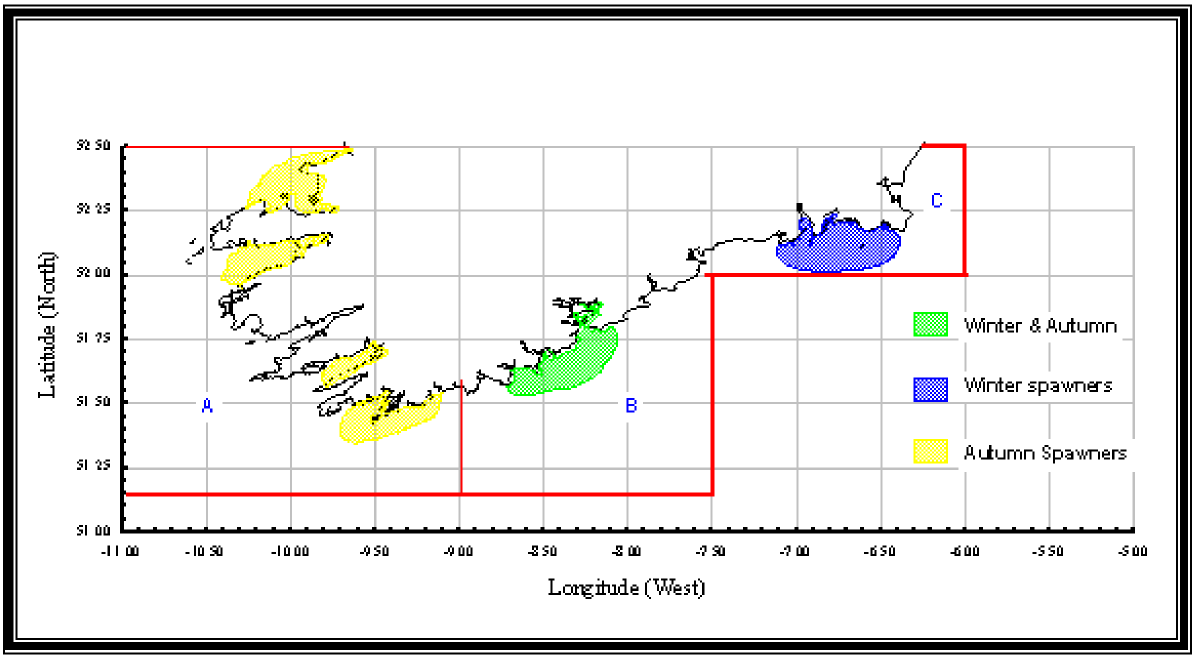
Table 1.4.16.1 Celtic Sea and Division VIIj herring landings by calendar year (t), 1988–2004 (Data provided by Working Group members.) These figures may not in all cases correspond to the official statistics and cannot be used for management purposes.

Year	France	Germany	Ireland	Netherlands	U.K.	Unallocated	Discards	Total
1988	-	-	16,800	-	-	-	2,400	19,200
1989	+	-	16,000	1,900	-	1,300	3,500	22,700
1990	+	-	15,800	1,000	200	700	2,500	20,200
1991	+	100	19,400	1,600	-	600	1,900	23,600
1992	500	-	18,000	100	+	2,300	2,100	23,000
1993	-	--	19,000	1,300	+	-1,100	1,900	21,100
1994	+	200	17,400	1,300	+	-1,500	1,700	19,100
1995	200	200	18,000	100	+	-200	700	19,000
1996	1,000	0	18,600	1,000	-	-1,800	3,000	21,800
1997	1,300	0	18,000	1,400	-	-2,600	700	18,800
1998	+	-	19,300	1,200	-	-200	-	20,300
1999		200	17,900	1300	+	-1300	-	18,100
2000	573	228	18,038	44	1	-617	-	18,267
2001	1,359	219	17,729	-	-	-1578	-	17,729
2002	734	-	10,550	257	-	-991	-	10,550
2003	800	-	10,875	692	14	-1,506	-	10,875
2004	801	41	11,024	-	-	-801	-	11,065

Table 1.4.16.2 Celtic Sea & Division VIIj herring landings (t) by season (1 April–31 March) 1988/1989-2002/2004 (Data provided by Working Group members.) These figures may not in all cases correspond to the official statistics and cannot be used for management purposes.

Year	France	Germany	Ireland	Netherlands	U.K.	Unallocated	Discards	Total
1988/1989	-	-	17,000	-	-	-	3,400	20,400
1989/1990	+	-	15,000	1,900	-	2,600	3,600	23,100
1990/1991	+	-	15,000	1,000	200	700	1,700	18,600
1991/1992	500	100	21,400	1,600	-	-100	2,100	25,600
1992/1993	-	-	18,000	1,300	-	-100	2,000	21,200
1993/1994	-	-	16,600	1,300	+	-1,100	1,800	18,600
1994/1995	+	200	17,400	1,300	+	-1,500	1,900	19,300
1995/1996	200	200	20,000	100	+	-200	3,000	23,300
1996/1997	1,000	-	17,900	1,000	-	-1,800	750	18,800
1997/1998	1,300	-	19,900	1,400	-	-2100	-	20,500
1998/1999	+	-	17,700	1,200	-	-700	-	18,200
1999/2000		200	18,300	1300	+	-1300	-	18,500
2000/2001	573	228	16,962	44	1	-617	-	17,191
2001/2002	-	-	15,236	-	-	-	-	15,236
2002/2003	734	-	7,465	257	-	-991	-	7,465
2003/2004	800	-	11,536	610	14	-1,424		11,536
2004/2005	801	41	12,702	-	-	-801	-	12,743

Herring Spawning boxes off the South coast.



North West of Ireland Herring

(Divisions VIa South and VIIb,c)

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

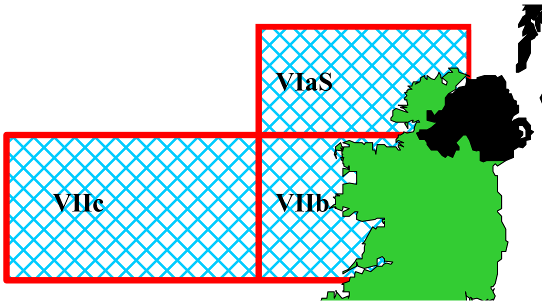
Fisheries Science Services

FSS – SINGLE STOCK CONSIDERATIONS

FSS agree with ICES and STECF advice that the catch in 2005 should not exceed recent average levels of 14,000 t. This would translate to an Irish quota of 12,727 t.

FSS support the Irish North West Pelagic Advisory Committee in their efforts to rebuild this stock and to assist in the collection of adequate scientific data for stock assessment.

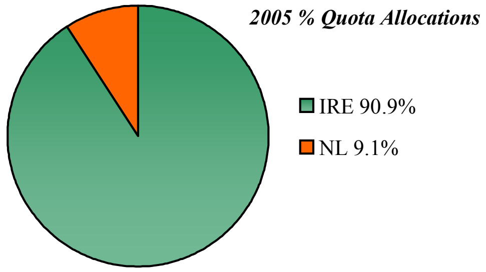
FSS advise that actions which disturb herring spawning beds or increase turbidity after spawning are likely to have a negative affect on recruitment to the stock. Such activities include aggregate extraction and the dumping of dredge spoil.



Red Boxes-TAC/Management Areas *Blue Shading– Assessment Area*

CURRENT MANAGEMENT

- The TAC is set by the EU and for 2006 is 14,000 t. The Irish share in 2006 is 12,727 t.
- There are no internationally agreed management objectives or plans for this stock.
- In 2000 the Irish Northwest Pelagic Advisory Committee was established and manages the Irish fishery of this stock. This committee has a stated aim to rebuild this stock to above the $\mathbf{B_{pa}}$ level of 110,000 t. The time period over which this can be achieved will depend on the annual catches and recruitment. In the longer term it is the policy of the committee to further rebuild the stock to the level at which it can sustain annual catches of around 25,000 t. The committee have also continued the imposition of closed seasons for the fishery.
- The Irish quota is controlled by a number of catch restriction measures.

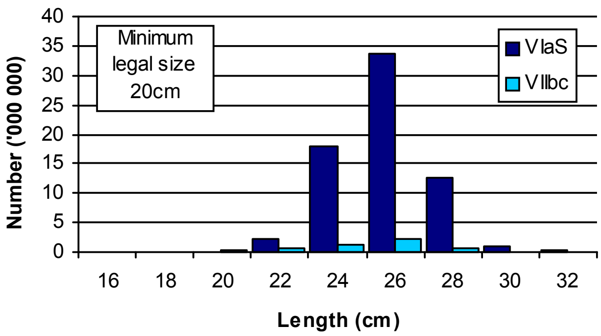


ADDITIONAL INFORMATION

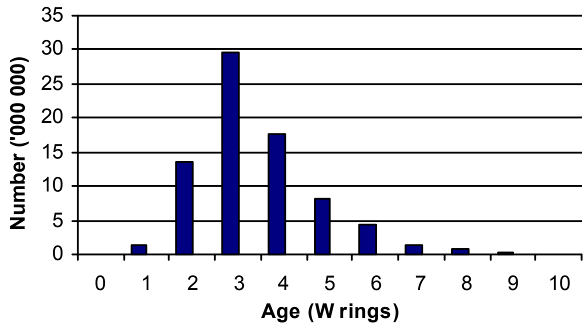
1. The state of the stock is considered to be uncertain and may be below $\mathbf{B_{pa}}$. Three trial assessments were carried out in 2005 but in the absence of tuning indices none of these could be accepted. Nonetheless they may be considered as indicative of recent trends in the stock.
2. These trends indicate that the decline in SSB from its 1998 peak value of 300,000 t has been arrested. However SSB is still thought to be below the $\mathbf{B_{pa}}$ value of 110,000 t.
3. Fishing mortality has declined from the high values estimated for the late 1990s.
4. Recruitment is thought to be stable at a low level and may even have increased slightly. There are no fishery independent indices of recruitment.
5. Landings of 12,289 t were recorded in 2004 and this is the lowest value from the fishery since before 1970.
6. Irish landings from this stock have decreased sharply since 1999. The availability of more valuable species at a time of low herring prices has deflected effort from the stock. The main catches (over 96 %) are taken by Ireland.
7. In the past there has been large scale misreporting of catches for this fishery and large catches taken in Div. VIa South were reported as having been taken in adjoining Div. VIa North. This presented considerable difficulties for the accurate assessment of this stock.
8. Recent changes to the management of the fishery are thought to have reduced the level of misreporting and under-reporting of catches in the area and improved the quality of the catch statistics and the assessment.
9. Because of the opportunistic nature of the fishery, catch at age data may not give a reliable indication of the abundance of different year classes.
10. The relationship between this stock and adjacent stocks is being investigated through the EU funded multi-disciplinary stock discrimination project WESTHER.
11. The acoustic surveys of the last two years have pro-

duced the highest biomass estimates in the series. Both surveys are considered not to have contained the stock and are therefore underestimates. The utilisation of the acoustic survey series as tuning indices will be reviewed at the end of 2006 survey.

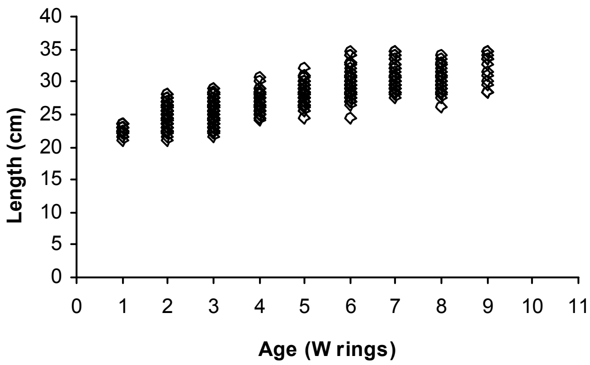
2004 Length Distribution: International Landings, Herring in VIaS VIIbc



2004 Age Distribution: International Landings, Herring in VIaS, VIIbc



2004 Size at Age: Irish Sampling, Herring in VIaS, VIIbc



ICES ADVICE
1.4.17

State of stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield
Unknown, but likely at risk of reduced reproductive capacity	unknown	unknown

The results of a tentative assessment suggest that the sharp decline in SSB may have stopped. The current level of SSB is uncertain, but below B_{pa}. There is no evidence that large year classes have recruited to the stock in recent years and F appears to have been reduced due to the reduction in catch.

Management objectives

The Irish Northwest Pelagic Management Committee manages the Irish fishery for this stock. In recent years, Ireland has taken almost all the catch. The Committee has the following objectives:

- To rebuild this stock to above the $\mathbf{B}_{pa}$ level of 110 000 t.
- In the event of the stock remaining below this level, additional conservation measures will need to be implemented.
- In the longer term it is the policy of the Committee to further rebuild the stock to the level at which it can sustain annual catches of around 25 000 t.
- Implement a closed season from March to October.
- Regulate effort further through boat quotas allocated on a weekly basis in the open season.

The plan appears to be effective at constraining catches to not exceed the TAC and at providing reliable catch data, but it is uncertain if the current catch limitations are sufficient to rebuild the stock

Reference points (changed in 1999)

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is 81 000 t	$\mathbf{B}_{pa}$ be set at 110 000 t
	$\mathbf{F}_{lim}$ is 0.33	$\mathbf{F}_{pa}$ be set at 0.22

Technical basis

$\mathbf{B}_{lim}$: Lowest reliable estimated SSB	$\mathbf{B}_{pa}$: Approximately 1.4 $\mathbf{B}_{lim}$
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$	$\mathbf{F}_{pa}$: = $\mathbf{F}_{med}$(98)

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

Catches should not be allowed to increase from the recent average levels of 14 000 t, until there is clear evidence that SSB has been rebuilt to be above B_{pa}.

Management considerations

The management of the Irish fishery (which takes most of the catch) has improved in recent years and catches have been considerably reduced since 1999. The reduced catches over this period have resulted in a reduction in fishing mortality, although it is not possible to be precise about the current levels.

The sharp decline in SSB may have stopped. Though the peak in SSB in the 1980s may have been an isolated event, ICES suggests that this stock should be exploited with caution, particularly as the current state of the stock is uncertain. F appears to have been substantially reduced since 1998, but may still be high. Though little information on recruitment is available, it is unlikely that it is above average. Certainly, every effort should be made to maintain catches at or below the current level. In particular ICES recognized that strict enforcement of catch quotas is necessary.

Factors affecting the fisheries and the stock:

Regulations and their effects

Changes in the management of this stock have changed how the fishery is prosecuted in space and time.

Changes in fishing technology and fishing patterns

The pattern of this fishery has changed over time. In the early part of the 20th century the main fisheries were in winter on spawning grounds in VIa south (off Co. Donegal). In the 1970s and 1980s the main fishery was earlier (in autumn) and further south in VIIb (along west Connacht, and in Counties Galway and Mayo). More recently the distribution of catches has shifted northwards again and the grounds in VIa south have become more important. Remaining fishing grounds in Division VIIb are concentrated near the boundary to Division VIa south (between Clew Bay and Killala).

Other factors

The fishery exploits a mixture of autumn- and winter/spring-spawning fish. The winter/spring-spawning component is distributed in the northern part of the area. The main decline in the stock appears to have taken place on the autumn-spawning component.

Scientific basis

There are essentially two fleets exploiting this stock, the smaller dry-hold vessels tend to target the stock more than the larger boats. Although ICES notes that increased accuracy in the catch data over the past 3 years gives a greater confidence in the perception of stock development, it will be necessary to collect biological data from each fleet, in order to refine the information from catch-at-age data. In order to obtain a proper assessment of this stock for the most recent years, reliable survey data are required.

Data and methods

Recent changes to the management of the fisheries on this stock are likely to have reduced the impact of misreporting and under-reporting of catches in this area. These changes add to the reliability of the catch data and should improve the assessment, which is solely based on catch-at-age data. However, in addition to consistent data a tuning index is needed before it will be possible to produce reliable estimates of final year SSB and review the appropriateness of the reference points.

Information from the fishing industry

Information from the dedicated component of the fleet indicates that in 2004 herring fishing in this area was the best in many years in terms of the availability of the fish aggregations. Catches have been good and fish were easily located. Fishing on the traditional inshore spawning grounds around Mayo and Donegal performed very well. The autumn roe fishery in particular was reported to be very strong in 2004 with large marks of fish encountered in traditional grounds off Mayo. There were also strong aggregations of fish along and north of the line dividing this area from Division VIaN.

Uncertainties in assessment and forecast

In the absence of tuning data the assessments have been carried out by assuming various terminal F values on the catch-at-age data. These assessments appear to have poorly estimated F, but general trends in stock development are similar over a range of F values, using the same choice of terminal F. Tuning indices are necessary to gain precision in estimates.

Environment conditions

Herring catch data were analysed in relation to oceanographic variation. Long-term trends in herring catches showed herring abundance decreasing with a warming of the sea surface temperature in the 1930s–1940s. Short-term fluctuations of catches are believed to reflect real fluctuations in herring abundance on a cycle of about 10 years and were correlated with (ICES CM 2005/G:06):

- Salinity in western approaches, especially in the two winter quarters with a lag period of 3 years;
- Sea surface temperature on the shelf and west of the shelf, especially in November, December, and January with a lag period of 3–4 years. Although herring correlated negatively to temperature in the long term, short-term variations were positively correlated.

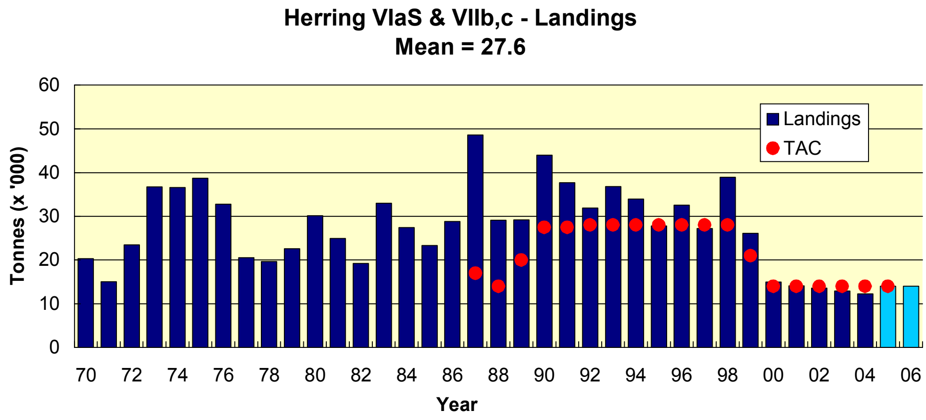
Comparison with previous assessment and advice

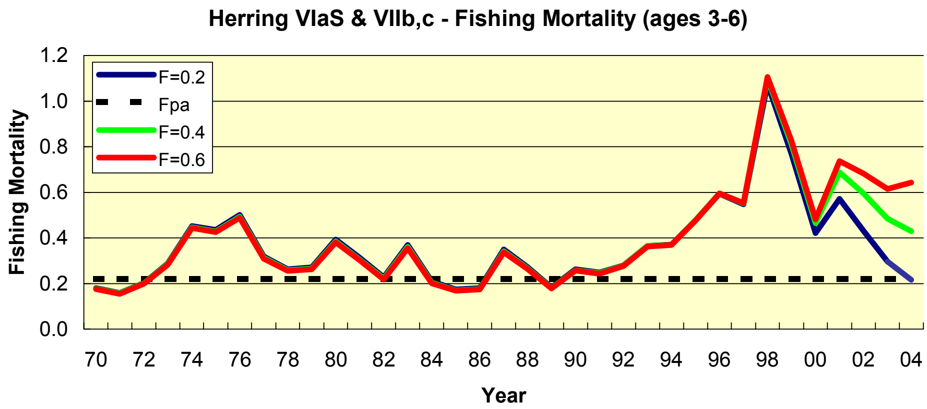
The assessment reviewed in 2004 was considered to be illustrative of trends only. It does not give a substantial change in perception compared to last year, with F and SSB in the same range.

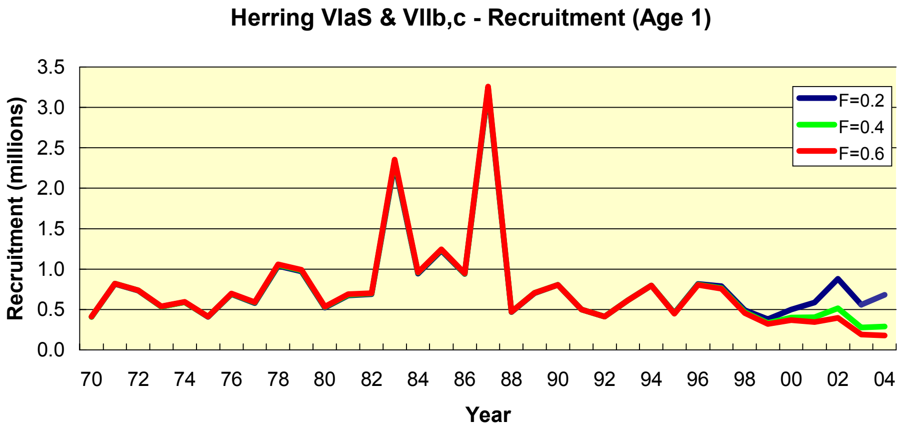
Source of information

Report of the Herring Assessment Working Group for the Area South of 62°N, 8–17 March 2005 (ICES CM 2005/ACFM:16).

	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings	Disc. slip.	ACFM Catch
1987	TAC	18	17	17	-	49
1988	TAC depending on whether 1987 TAC is taken	11–18	14	15	-	29
1989	TAC	15	20	21	1.0	29
1990	TAC depending on whether 1989 TAC is taken	25–27	27.5	28	2.5	44
1991	TAC	< 26	27.5	23	3.4	38
1992	TAC (including discards)	29	28	27	0.1	32
1993	Precautionary TAC (including discards)	29	28	30	0.3	37
1994	Precautionary TAC	28	28	27	0.7	34
1995	Precautionary TAC (including discards)	36	28	27	-	28
1996	If required, precautionary TAC	34	28	25	-	33
1997	Catches below 25	< 25	28	28	0.1	27
1998	Catches below 25	< 25	28	28	-	39
1999	F 70% of F(97)	19	21	18	-	26
2000	F 40% of F(98) =Proposed $\mathbf{F}_{pa}$	14	14	10	-	15
2001	F 40% of F(99) F = 0.2	14	14	13	-	14
2002	No increase in catches	14	14	14	-	13.6
2003	No increase in catches	14	14	14	-	14
2004	No increase in catches	14	14	11	-	12
2005	No increase in catches	14	14			
2006	No increase in catches	14				


Herring VIaS & VIIb,c - Landings
Mean = 27.6
Tonnes (x '000)
Landings
TAC
Year


Herring VIaS & VIIb,c - Fishing Mortality (ages 3-6)
Fishing Mortality
F=0.2
Fpa
F=0.4
F=0.6
Year


Herring VIaS & VIIb,c - Recruitment (Age 1)
Recruitment (millions)
F=0.2
F=0.4
F=0.6
Year

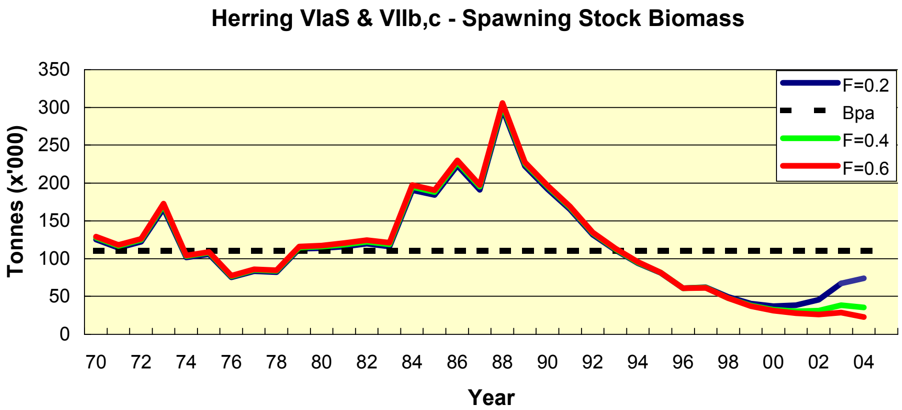

Herring VIaS & VIIb,c - Spawning Stock Biomass
Tonnes (x'000)
F=0.2
Bpa
F=0.4
F=0.6
Year

Table 1.4.17.1 Herring in Divisions VIa(S) & VIIb,c. Estimated Herring catches in tonnes, 1988–2004.
These figures do not in all cases correspond to the official statistics and cannot be used for management purposes

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
France	-	-	+	-	-	-	-	-	-	-	-	-	-	-	515	-	-
Germany, Fed.Rep.	-	-	-	-	250	-	-	11	-	-	-	-	-	-	-	-	-
Ireland	15,000	18,200	25,000	22,500	26,000	27,600	24,400	25,450	23,800	24,400	25,200	16,325	10,164	11,278	13,072	12,921	10,950
Netherlands	300	2,900	2,533	600	900	2,500	2,500	1,207	1,800	3,400	2,500	1,868	1,234	2,088	366	-	64
UK (N.Ireland)	-	-	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UK (England + Wales)	-	-	-	-	-	-	50	24	-	-	-	-	-	-	-	-	-
UK Scotland	-	+	-	+	-	200	-	-	-	-	-	-	-	-	-	-	-
Unallocated	13,800	7,100	13,826	11,200	4,600	6,250	6,250	1,100	6,900	-700	11,200	7,916	3,607	695	366	-	1,375
Total landings	29,100	28,200	41,439	34,300	31,750	36,550	33,200	27,792	32,500	27,100	38,900	26,109	15,005	14,060	13,587	12,921	12,289
Discards	-	1,000	2,530	3,400	100	250	700	-	-	50	-	-	-	-	-	-	-
Total catch	29,100	29,200	43,969	37,700	31,850	36,800	33,900	27,792	32,500	27,150	38,900	26,109	15,005	14,060	13,587	12,921	12,289

Deepwater Stocks South of 63^{0}N

For latest information, see: http://www.ices.dk

Marine Institute
Foras na Mara

Fisheries Science Services

In 2005, some new advice was produced by ICES. This new advice can be divided into four parts:

1. Advice for deepwater sharks.
2. Advice for fisheries management of deepwater species.
3. Reply to special request from the European Union on management areas and on harvest control rules for these species.
4. Reply to special request from NEAFC and OSPAR on seamounts and vulnerable habitats.

The text of the replies to the special requests are contained in the Stock Book, and FSS provides a short overview to these requests.

1. Deepwater sharks in the northeast Atlantic (ICES Sub-areas V-XIV), mainly Portuguese dogfish and leafscale gulper shark

FSS ADVICE

FSS agree with ICES that the rates of exploitation and stock sizes of deepwater sharks cannot be quantified. However, based on the CPUE information, the stocks of Portuguese dogfish and Leafscale Gulper shark are considered to be depleted and likely to be below any candidate limit reference point. Given their very poor state, ICES recommends a zero catch of deepwater sharks.

CURRENT MANAGEMENT

- A series of TACs is set for EU waters and EU vessels in international waters of V-XII. The TAC applies to all deepwater sharks. The sum of these TACs is 7,000 t for 2005 and 2006.
- The TAC for areas V, VI, VII, VIII and IX is 6,763 t, for Sub-area X 14 t and for Sub-area XII 243 t. These quotas apply to the following list of species: Portuguese dogfish (*Centroscymnus coelolepis*), Leafscale gulper shark (*Centrophorus squamosus*), Birdbeak dogfish (*Deania calceus*), Kitefin shark (*Dalatias licha*), Greater lanternshark (*Etmopterus princeps*), Velvet belly (*Etmopterus spinax*), Black dogfish (*Centroscyllium fabricii*), Gulper shark (*Centrophorus granulosus*), Blackmouth dogfish (*Galeus melastomus*), Mouse catshark (*Galeus murinus*), Iceland catshark (*Apristuris* spp.). In Sub-area XII, *Deania histicosa* and *Deania profundorum* are also included in the TAC.
- These sharks are often taken in mixed fisheries. An effort restriction regime is in place since 2003 (EC 2347/2002, 27/2005) for fisheries taking these sharks in EU waters and for EU vessels in international waters.
- Norwegian vessels in EU waters are subject to a multi-species quota for these species and spurdog. This quota is about equal to recent Norwegian catches of deepwater sharks in EU waters.

ADDITIONAL INFORMATION

- Portuguese dogfish (*Centroscymnus coelolepis)* and leafscale gulper shark *(Centrophorus squamosus)* are depleted according to substantial declines in CPUE series in Sub-areas VI, VII and XII. Total international catch of these species combined, has risen from very low levels to around 8 000 t. The status of other deepwater sharks is unknown
- Deepwater sharks are caught in a mixed fishery for deepwater species and as a targeted fishery using longlines and gillnets. Most of the catches of deepwater sharks are taken in the mixed fishery in the northern area. In order to reduce catches in the mixed fishery, effort needs to be reduced.
- In sub-areas VI, VII and XII, CPUE has declined over the history of the fishery while catch levels have increased to high levels. Landings in Sub-area IXa have been more stable and the decline in CPUE appears to be less pronounced.
- Despite the increased landings, the CPUE information suggests that the stock abundance of these two species is depleted.
- The two species have very different vulnerabilities in relation to exploitation. Most of the international catch is in the northern area (V-VII). In this area, no pregnant leafscale gulper sharks are caught. In contrast, all reproductive stages of Portuguese dogfish, including mature and pregnant female, are found in this area. It is well established that targeting mature females is detrimental to shark stock status, and thus Portuguese dogfish stock is more vulnerable to exploitation.
- Preliminary information from retrieval surveys of gillnets suggest that excessive soak time is leading to high discards rates of sharks. In addition, lost or discarded gillnets ("ghost" fishing) leads to deepwater sharks mortality.
- These species are a low value by-catch in all Irish deepwater fisheries. Leafscale gulper shark is usually discarded by trawlers.

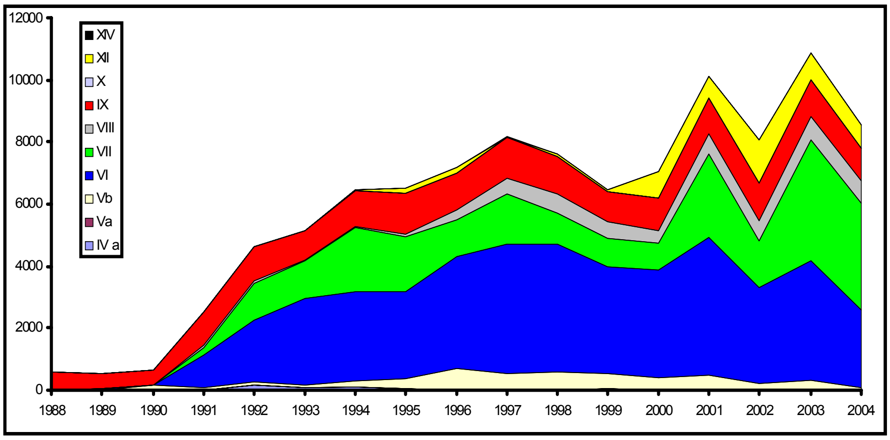


Figure 1.1 CES estimates of total landings of deepwater sharks (mainly Portuguese dogfish and leafscale gulper shark) by subarea.

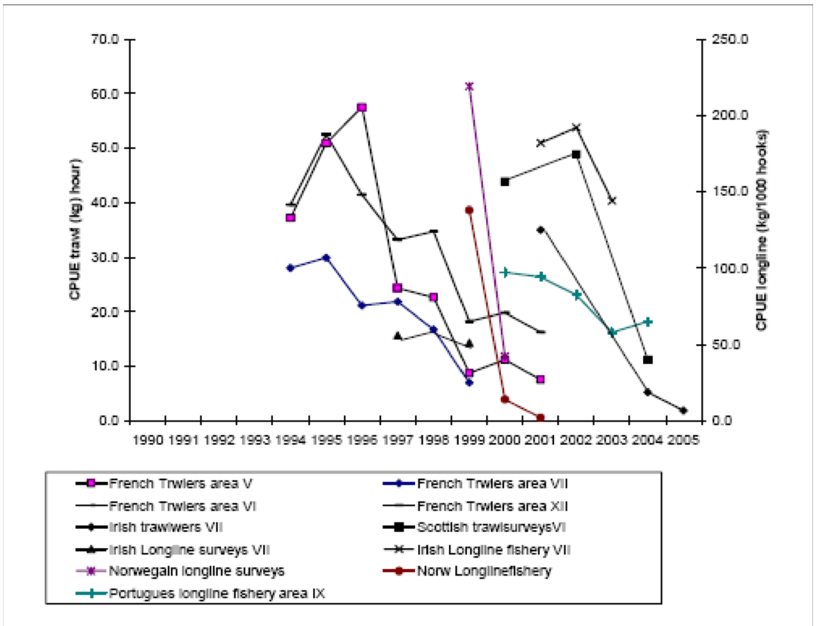


Figure 1.2. Portuguese dogfish (*C. coelolepis*). CPUE series from trawls fisheries, longline fisheries and surveys.

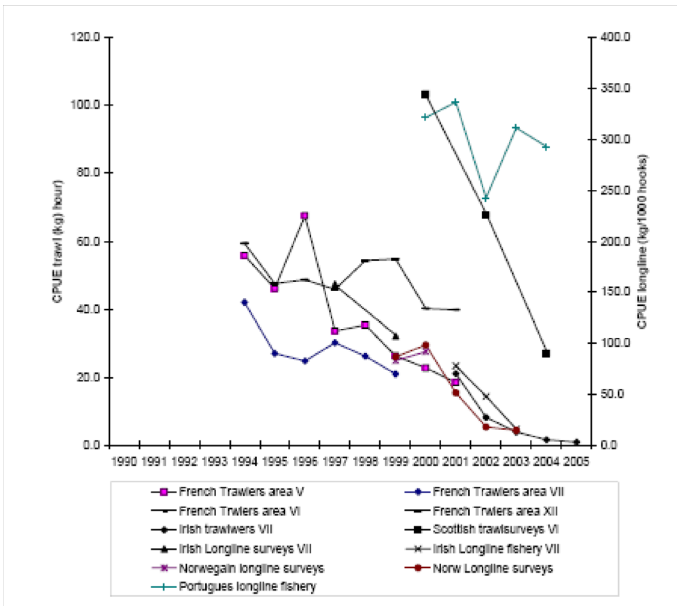


Figure 1.3. Leafscale gulper shark *(Centrophorus squamosus)*. CPUE series from trawl fisheries, longline fisheries and surveys.

2 Advice for fisheries management for deepwater species.

FSS ADVICE

FSS agree with the ICES and STECF advice that stocks of Portuguese dogfish and leafscale gulper shark are considered to be depleted. Given their very poor state, ICES recommends a zero catch of deepwater sharks. FSS points out that this advice implies that fisheries taking these species should not continue. This advice takes precedence over other advice on deepwater species for 2006.

FSS agree with the ICES and STECF advice that as ling and tusk usually taken together the advised effort reduction, calculated on the basis of ling, should apply to all fisheries taking ling and tusk as their main catch. In addition FSS points out that ling and tusk fisheries often have a small by-catch of deepwater sharks species.

FSS reiterates the ICES advice that technical measures such as spawning area closures should be implemented for blue ling.

FSS points out that new deepwater fisheries cannot be developed without a likely by-catch of deepwater sharks. Any fishery by trawl, longline or gillnet in the ICES area south of 63^0N will have a shark by-catch. Therefore, new fisheries that have the potential to catch deepwater sharks should not be allowed to develop.

FSS advise that fisheries targeting hake, anglerfish and megrim should not proceed if there is a by-catch of deepwater sharks. There is a medium by-catch of deepwater sharks in these fisheries, because some, but not all of these fisheries catch deepwater sharks. Due to the unique biological characteristics of these species, FSS does not consider that gear modifications are appropriate for the mitigation of shark by-catch in deepwater fisheries

ICES advice on deepwater fisheries in 2005:

"Most exploited deepwater species are considered to be harvested unsustainably; however, it is currently not possible to provide advice for specific fisheries for deep-sea species. Consistent with a precautionary approach, ICES recommends immediate reduction in established deep-sea fisheries unless they can be shown to be sustainable. Measures should also be implemented to reduce exploitation of deep-sea species by fisheries primarily targeting shelf species (hake, anglerfish, and megrim). New deep-sea fisheries or expansion of existing fisheries into new fishing areas should not be permitted unless the expansion is very cautious, and is accompanied by programmes to collect data which allow evaluation of stock status as the basis for determining sustainable exploitation levels.

Ling and tusk are in many fisheries taken together and therefore the advised effort reduction, calculated on the basis of ling should apply to all fisheries taking ling and tusk as their main catch. The advised reduction is 30% compared to the 1998 effort level.

Concerning blue ling, there should be no directed fisheries. Technical measures such as closed areas on spawning aggregations should be implemented to minimize catches of this stock in mixed fisheries."

In addition ICES advises regarding deepwater sharks:

The stocks of Portuguese dogfish and Leafscale Gulper shark are considered to be depleted. Given their very poor state, ICES recommends a zero catch of deepwater sharks.

3. Reply to special request from EU

(see text below for a more detailed extract).

a. **Subdivision of the management areas for these species:** FSS points out that these proposed subdivisions are to facilitate more appropriate spatial scale management. They should not be construed as being revisions to the stock areas of these species nor to the areas to which ICES advice should apply. In addition, no change to the overall TACs is implied by the change in management areas.

b. **Harvest control rules:** FSS points out that the advice on deepwater fisheries management produced by ICES in 2005 is presented in a mixed fisheries context. FSS points out that this mixed fisheries advice takes precedence over the replies to the special request from the EU. The only updated advice on stock status is for deepwater sharks and kitefin shark. In the interaction table (see below) it is evident that deepwater sharks are associated, usually strongly, with most species and all gear types (trawls, longlines and gillnets), taken in the deepwater fishery in the ICES area. The ICES advice on deepwater sharks is for zero catch (TAC=0) for 2006. This advice implies that those fisheries taking deepwater sharks should not proceed.

Extract from:

1.3.3.1 Advice on deepwater stocks (EC FISH)

(For the complete text please see: http://www.ices.dk)

ICES received the following request from the EC:

a) *Advice on the biological basis and practicality of possible subdivisions of the management areas for the following stocks:*
   Deep-sea sharks in Subareas V, VI, VII, and IX;
   Black scabbardfish in Subareas I, II, III, and IV;
   Black scabbardfish in Subareas V, VI, VII, and XII;
   Alfonsinos in Subareas III, IV, V, VI, VII, VIII, IX, X, and XII;
   Roundnose grenadier in Subareas VII, IX, XII and XIV;
   Orange roughy in Subareas I, II, III, IV, V, VIII, IX, X, XII, and XIV.

b) *Recommend harvest rules that would govern either or both TACs and effort levels for deep sea species, taking account of availability of data and knowledge concerning these resources and the need to conform to the precautionary approach and the UN straddling stocks agreement.*

In considering options for a) the new divisions and subdivisions of the ICES area were used (new as of 2005).

Item a) of the request

For most of these species, only very little or no biological information is available on which to base possible subdivisions of the management areas. When it comes to practicality, there is concern about serial depletion and ICES therefore suggests that TACs be set for areas where no catches have yet been taken in order to avoid misreporting. ICES has not considered whether these proposed subdivisions are manageable with regards to controlling the landings.

Deep-sea sharks in Subareas V, VI, VII, VIII, and IX

The category “deep-sea sharks” includes several species that all share the characteristics of low fecundity and long life spans. For none of the species is the stock structure known. Advice for deep-water sharks is given elsewhere (see section 1.4.1).

There is no information on stock structure or biology that would suggest that subdividing of the current management area is justified or practical at the present time. However, it is reiterated that an aim should be to collect and compile species-specific data on areas of distribution, landings, and exploitation levels. Sharks are often taken in mixed fisheries along with e.g. roundnose grenadier and black scabbardfish, and the management should be consistent for all these species.

Black scabbardfish in Subareas I, II, III, and IV and black scabbardfish in Subareas V, VI, VII, and XII

Recommendations

In the mixed bottom trawl fisheries to the west and north of the British Isles, black scabbardfish and roundnose grenadier are caught together. It is therefore justified to subdivide management areas for these two species in the same way. The suggestions for management area for black scabbardfish below are therefore based on management areas proposed for roundnose grenadier (option 1); if option 2 is chosen for roundnose grenadier this should also be reflected in management areas for black scabbardfish. Of these areas, significant landings have only been reported from two subareas. However, in order to avoid misreporting into other areas, it is suggested that management areas with set TACs are implemented for all of them. Assuming that the new management area scheme should not imply an increase in the overall TAC, the following management areas are proposed:

-Subareas I, II, III, and IV

There have been no significant landings reported in these subareas. In order to avoid misreporting in this area, this area should be regarded as a management area and a TAC should be set.

-Subareas V, VI, VII and Divisions XIIb and XIIa2

This management area includes the new ICES Division XIIb and Subdivision XIIa2. The latter includes only depths greater than 2000 m but is included in this area in order not to leave areas without quota regulation which potentially may be used for misreporting.

-Divisions XIIa1, XIVb1, and XIIc

These Divisions constitute a management zone for the Mid-Atlantic Ridge. There have been no significant landings reported in these subareas. In order to avoid misreporting in this area, this area should be regarded as a management area and a TAC should be set.

-Subareas VIII and IX

There have been no significant landings reported in Subarea VIII. In order to avoid misreporting in this area, this area should be regarded as a management area and a TAC should be set.

- Subarea X

There have been no significant landings reported in Subarea X. In order to avoid misreporting in this area, this area should be regarded as a management area and a TAC should be set.

Roundnose grenadier in Subareas VII, IX, XII, and XIV

Recommendation

New management areas

The previous proposal for management areas of roundnose grenadier was based upon inferences of possible population structure derived from bathymetric and hydrographical features in the north Atlantic. No new data of population structure were available and the stock assessments and CPUE trends in previous years do not provide evidence for different trends between areas. As a consequence the advice below is still based upon the bottom and water mass structure in the northeast Atlantic Basin.

Moreover, in the mixed bottom trawl fishery to the west of the British Isles, roundnose grenadier and black scabbardfish are caught together. Therefore, it is justified to set consistent management areas for these two species.

Catches from ICES Subarea XII come mainly from the Mid-Atlantic Ridge and the Western slopes of Hatton Bank. The

Northern part of the Western slope of Hatton Bank is included in the new ICES SubdivisionVIb1, while the southern part of the western slope is included in the new ICES Division XIIb. There is no natural boundary between these two parts of the slope of the Hatton Bank and the distribution of the species is continuous throughout the slopes of these areas. Therefore, the catches in these areas are most likely to be from the same population and they should be managed under a single management area.

The roundnose grenadier on the Mid-Atlantic Ridge and the Hatton Bank are separated by a major oceanic basin and may constitute separated populations, although there is no firm evidence for it (see above).

If effort displacement from the slope to international waters is a concern an option may be to separate the Hatton Bank area to the Eastern Rockall and European slope area. Two possible subdivisions of the management areas are therefore presented.

Option 1 [the Hatton Bank not separated from the Eastern Rockall and European slope]

- ICES Subareas VIII and IX
- The ICES Subarea X
- Vb, VI, VII, XIIa2, XIIb (addition of the new ICES Divisions XIIa2 and XIIb to the former management zone Vb, VI, VII)
- New ICES Divisions XIVb1, XIIa1, XIIc (management zone for catch on the Mid-Atlantic Ridge).

Option 2

- ICES Subareas VIII and IX
- The ICES Subarea X
- Divisions Vb, VIa, VIb2, VII, XIIa2
- Divisions VIb1, XIIb (Hatton Bank)
- New ICES Divisions XIVb1, XIIa1, XIIc (management zone for catch on the Mid-Atlantic Ridge).

Subdivision XIIa2, which does not include slope depths but only grounds deeper than 2000 m was added to XIIb, Vb, VI, and VII in order to prevent areas without quota regulation being used for misreporting.

The new ICES Division XIVb2 and XIIa3, lying within the Greenland EEZ, as well as Division XIIa4 lying within Iceland's EEZ are under the jurisdiction of these countries. Therefore, the Divisions XIVb1, XIIa1, and XIIc should not be managed independently of these.

Recommendation on TAC per new management area

The sum of the TACs for the new management areas should not exceed the TAC which would be set for the present management area (Subareas VII, IX, XII, and XIV).

There have been no significant landings reported in Subareas VIII+IX and X and all other areas not mentioned above. In order to avoid misreporting in all areas, TACs should be set in all areas.

Orange roughy in I, II, III, IV, V, VIII, IX, X, XII, and XIV

Recommendations

Orange roughy are typically associated with seamounts or similar features. Because these features tend to be sequentially depleted, there is a potential for the fishery to expand out of Subareas VI and VII as fisheries decline. Fisheries are developing in Subareas VIII–XII.

Experience from around the world shows that management units need to be small as topographical features may be inhabited by separate populations. ICES is of the opinion that management should be at the level of these separate populations.

International information suggests that this species is subject to serial depletion and the recovery time is long. This is confirmed by experience in the EU waters where indications are that the majority of subpopulations in Subareas VI and VII have been depleted.

Therefore, where the small scale distribution is known, this should be used to define smaller and more meaningful management units. Current management units are therefore completely inadequate for orange roughy.

Recent information to ICES does not have a sufficient level of spatial resolution to identify individual exploited aggregations. Because of insufficient spatial information, the depletion of many subpopulations, and the very low quotas involved, it is not currently possible to manage a sustainable fishery of this species.

Conclusion and recommendations

Biomass (state) and fishing mortality (impact) are used as indicators in the ICES advisory framework. For the deep-sea species, the state and impact indicators are difficult to measure and in addition, because of the life cycle length, it will require a long time to monitor a response or before positive effects can be expected. Consequently, ICES recommends that pressure indicators such as effort be used supplementary in the management of these stocks.

Most deep-sea species can only sustain low rates of exploitation. Fisheries on such species should be permitted only when they are accompanied by programmes to collect data and should expand very slowly until reliable assessments indicate that increased harvests are sustainable.

This advice identifies the basic harvest control rule for deep-sea stocks. Fisheries on these species should only be allowed to expand when indicators and reference points for future harvest have been identified and a management strategy, including appropriate monitoring requirements has been decided upon and is implemented. A management strategy for these fisheries would thus consist of an initial low fishery which is closely monitored, and identification of a long-term strategy for sustainable harvest on the basis of this information. A gradual expansion of the fishery should only be allowed to the extent such a strategy can be identified and has been decided. Such gradual expansion should be accompanied by close monitoring, enabling adjustment of the management plan according to the outcome of the fisheries.

The initial situation will be different for existing and new fisheries:

- For existing fisheries, the fishing pressure should be reduced considerably to low levels and should only be allowed to expand again very slowly if and when reliable assessments indicate that increased harvests are sustainable.
- When new fisheries develop or existing fisheries spread into new areas, relevant pressure, state, and impact indicators should be established on the basis of small, initial fisheries which should only be allowed to expand very slowly if and when reliable assessments indicate that increased harvests are sustainable.

For both existing and new fisheries in the longer term, when state reference points such as U_{max} have been established through closely monitored fisheries at low level, a harvest control rule on the basis of these reference points and including decision rules about maintaining the pressure within sustainable bounds could be implemented.

ICES ADVICE

1 Deep-water Fisheries Resources South of 63ºN

The term deep water (or deep sea) includes the waters below the continental shelves. That is all the water deeper than about 200 meters. ICES uses the term deepwater fisheries for those fisheries in depths greater than 400 m. The deep water in the ICES area covers the deep parts of ICES Subareas I, II, III, V-X, XII, and XIV.

1.1 The ecosystem

It can be questioned to what extent the deep-sea constitutes a homogeneous ecosystem. It covers a huge area of several million km^2, spans from the arctic north to the sub-tropical south, and it covers ridges and underwater sea mountains often with a quite unique biology. However, in light of the present, very limited knowledge of the ecosystem(s) it seems to be a useful definition for the purpose of management advice.

Productivity is very low in the deep water. Without light the deep water has no primary productivity via the photosynthesis of plants and algae except in the surface waters. Furthermore, nutrient concentrations in the surface water are low, and overall there is very little food compared to the shallow shelf seas. This, together with low temperatures in the deep water results in very low productivity of the organisms living here. Many animals migrate at night up into the surface waters to feed. Otherwise the deep-sea food web is fuelled by a rain of dead plants and animals from surface waters, and the impingement of mesopelagic organisms on the slopes.

The diversity of deep-sea life history strategies is considerable, but many species of fish targeted by fisheries and their communities are particularly vulnerable to disturbance because they grow slowly, mature late in life, and form aggregations easily accessible to fisheries. Recovery rates are much slower than in shallower waters. Examples are the archetypal long-lived fish species orange roughy and grenadiers, but also vulnerable benthic species such as cold-water corals that form important habitats for many fishes.

The knowledge of central biological characteristics such as stock identity, migration, recruitment, growth, feeding, maturation, and fecundity of most deep-sea species still lags considerably behind that of commercially exploited shelf-based species. Such information is required to expand our understanding of the population dynamics of deep-sea fishes, which in turn is needed to underpin stock assessments.

1.2 The human use of the ecosystem

1.2.1 The species

In some parts of the northeast Atlantic where the continental shelf is narrow, such as off Portugal (including Madeira and the Azores), there are traditional fisheries, for example for black scabbardfish (*Aphanopus carbo*) and red (=blackspot) seabream (*Pagellus bogaraveo*), which have been exploiting deepwater species for many years. Other traditional species are ling, blue ling, and tusk, which have supported large fisheries in wide areas for several decades. The existence of other potentially exploitable stocks in the ICES area has been known since the 1960s and 1970s. However, before the 1980s, with the exception of a fishery for species such as roundnose grenadier (*Coryphaenoides rupestris*) there was little interest from the fishing industry in exploiting stocks in international waters. Since the 1980s, dwindling resources on the continental shelves of the North Atlantic have encouraged the development of fisheries in deeper waters. There has been a tendency for fisheries for species such as anglerfish and Greenland halibut to extend into deeper waters, and new fisheries have developed to target the new deepwater species that have been found there. Deepwater species such as the argentine or greater silver smelt (*Argentina silus*) and roundnose grenadier (*Coryphaenoides rupestris*), which were previously bycatch species have been targeted within the ICES area for the last two decades. Orange roughy (*Hoplostethus atlanticus*) has been a target species since the early 1990s.

The following were identified as some of the most important deepwater species for the commercial fishery.

***List of deepwater species* (species either targeted by deepwater fisheries or occurring as bycatch)**

Alepocephalus bairdii	Baird's smoothhead
Aphanopus carbo	Black scabbardfish
Argentina silus	Argentine, greater silver smelt
Beryx splendens	Golden eye perch
Beryx decadactylus	Red bream, alfonsino
Brosme brosme	Tusk
Chimaera monstrosa	Rabbitfish
Coryphaenoides rupestris	Roundnose grenadier
Epigonus telescopus	Big eye, deepwater cardinal fish
Helicolenus dactylopterus	Bluemouth
Hoplostethus atlanticus	Orange roughy
Hoplostethus mediterraneus	Silver roughy
Lepidopus caudatus	Silver scabbardfish
Macrourus berglax	Roughhead grenadier
Molva molva	Ling
Molva dypterygia	Blue ling
Mora moro	Mora
Pagellus bogaraveo	Red (=blackspot) seabream
Phycis blennoides	Greater forkbeard
Polyprion americanus	Wreckfish
Trachyrhynchus trachyrhynchus	Roughnose grenadier
Chaecon (Geryon) affinis	Deepwater red crab
Aristeomorpha foliacea	Giant red shrimp

Advice on deepwater sharks is provided in *ICES Cooperative Research Report No. 225* (2002). The main shark species caught in deepwater fisheries are:

Centrophorus granulosus	Gulper shark
Centrophorus squamosus	Leafscale gulper shark
Centroscyllium fabricii	Black dogfish
Centroscymnus coelolepis	Portuguese dogfish
Centroscymnus crepidater	Longnose velvet dogfish
Dalatias licha	Kitefin shark
Deania calcea	Birdbeak dogfish
Etmopterus princes	Great lantern shark
Etmopterus spinax	Velvetbelly
Scymnodon ringens	Knifetooth dogfish

Advice on some other species, which might be considered as deepwater species, is already provided in Section 3.9:

Micromesistius poutassou	Blue whiting
Reinhardtius hippoglossoides	Greenland halibut
Sebastes spp	Redfish

In addition, there are other species which have been fished on the continental shelf, but whose distribution extends into deeper waters. This group includes hake (*Merluccius merluccius*), anglerfish (*Lophius* spp.), megrim (*Lepidorhombus* spp.), and conger (*Conger conger*). An extension of fishing into deeper waters for these species occurs in ICES Subareas VI, VII, VIII, and IX. Advice is provided on some of these species in Sections 3.5-3.7.

1.2.2 The fisheries

In ICES Subareas I+II there are directed longline and gillnet fisheries for ling (*Molva molva*) and tusk (*Brosme brosme*). There is also a directed bottom and pelagic trawl fishery for *Argentina silus* and a minor fjord fishery for roundnose grenadier (*Coryphaenoides rupestris*). Roughhead grenadier (*Macrourus berglax*) is taken as bycatch in the trawl, gillnet, and longline fisheries for Greenland halibut and redfish.

In ICES Division IIIa (Skagerrak) there is a targeted trawl fishery for roundnose grenadier and greater silver smelt *Argentina silus*. These species are also a bycatch of the *Pandalus* and *Nephrops* fisheries with trawls, and probably only a minor part of this bycatch is landed.

In ICES Subarea IV (North Sea) there is a bycatch of *Argentina silus* from the industrial trawl fishery. There is a longline fishery for tusk and ling with forkbeard (*Phycis blennoides*) and some roughhead grenadier as a bycatch. There is a bycatch of some deepwater species in the trawl fisheries targeting *Lophius* spp. and Greenland halibut. On the edge of the Wyville-Thompson Ridge (Subareas IV, V, and VI) there is a trawl fishery for redfish (*Sebastes* spp.) and Greenland halibut *Reinhardtius hippoglossoides*, with a bycatch of blue ling *Molva molva* and roughhead grenadier *Macrourus berglax*. Deepwater sharks are not found in the colder waters, north of the Iceland-Faeroe-Shetland ridge, though there are several skates present. These are starry ray *Amblyraja radiata*, spinytail ray *Bathyraja spinicauda*, and Arctic skate *Raja hyperborean.*

In ICES Subarea V there are trawl fisheries which target blue ling (*Molva dypterygia*), redfish, argentine (*Argentina silus*), and occasionally orange roughy (*Hoplostethus atlanticus*). Bycatch species are typically roundnose grenadier, roughhead grenadier, black scabbard fish (*Aphanopus carbo*), anglerfish (*Lophius piscatorius*), bluemouth (*Helicolenus dactylopterus*), mora (*Mora moro*), greater forkbeard (*Phycis blennoides*), argentine (*Argentina silus*), deepwater cardinal fish (*Epigonus telescopus*), and the deepwater sharks, mainly Portuguese dogfish *Centroscymnus coelolepis* and rabbit fish (*Chimaera monstrosa*). There are traditional longline fisheries for ling and tusk and these species are also bycatches in trawl and gillnet fisheries. There are also targeted trawl and gillnet fisheries for Greenland halibut and *Lophius* spp which have deepwater bycatch of, e.g. deepwater red crab (*Chaceon affinis*). There have also been trap fisheries for the deepwater red crab (*Chaceon* (formerly *Geryon*) *affinis*). Deepwater sharks are also discarded in fisheries in this area.

In ICES Subareas VI and VII there are directed trawl fisheries for blue ling, roundnose grenadier, orange roughy (*Hoplostethus atlanticus*), black scabbard fish, and the deepwater sharks *Centroscymnus coelolepis* and *Centrophorus squamosus*. The *Argentina silus* and blue ling landings from directed fisheries increased until 2002, but then declined in 2003. Bycatch species in these areas include bluemouth (*Helicolenus dactylopterus*), greater forkbeard (*Phycis blennoides*), argentine (*Argentina silus*), deepwater cardinal fish (*Epigonus telescopus*), and chimaerids, of which *Chimaera monstrosa* is the most important. There are directed longline fisheries for ling and tusk and also for hake. There are about 10 deepwater shark species that are discarded in this fishery (see advice for deepwater sharks).

A target fishery for deepwater sharks using longlines takes place in Subareas VI and VII. However, most of these boats are now using gillnets or pots. There is a directed gillnet fishery for deepwater sharks and deepwater red crab *Geryon affinins* that takes place in Subareas VI, VII, and XII (Hatton and Rockall Banks). This fishery is very poorly documented, but there is a bycatch of mora and forkbeard. The fleet that operates in this area also targets anglerfish with tangle nets. There is a directed fishery for deepwater red crab, using pots, in this area also.

In ICES Subarea VIII there is a longline fishery that mainly targets greater forkbeard (*Phycis blennoides*). There are also some trawl fisheries targeting species such as hake, megrim, anglerfish, and *Nephrops* that have a bycatch of deepwater species. These include *Molva* spp., *Phycis phycis, Phycis blennoides, Pagellus bogaraveo, Conger conger, Helicolenus dactylopterus, Polyprion americanus,* and *Beryx* spp.

In ICES Subarea IX some deepwater species are a bycatch of the trawl fisheries for crustaceans. Typical species are bluemouth (*Helicolenus dactylopterus*), greater forkbeard (*Phycis blennoides*), conger eel (*Conger conger*), blackmouth dogfish (*Galeus melastomus*), kitefin shark (*Dalatias licha*), and gulper shark (*Centrophorus squamosus*). There is a directed longline fishery for black scabbard fish (*Aphanopus carbo*) with a bycatch of the deepwater sharks. There is also a longline (Voracera) fishery for *Pagellus bogaraveo*. Elsewhere along the coast of Subarea IX there are directed longline fisheries for deepwater sharks.

In ICES Subarea X the main fisheries are by handline and longline near the Azores, and the main species landed are red (=blackspot) seabream (*Pagellus bogaraveo*), wreckfish (*Polyprion americanus*), conger eel (*Conger conger*), bluemouth (*Helicolenus dactylopterus*), golden eye perch (*Beryx splendens*), and alfonsino (*Beryx decadactylus*). At present the catches of kitefin shark (*Dalatias licha*) are made by the longline and handline deepwater vessels and can be considered as accidental. There are no vessels at present catching this species using gillnets. Outside the Azorean EEZ there are trawl fisheries for golden eye perch (*Beryx splendens*), orange roughy (*Hoplostethus atlanticus*), cardinal fish (*Epigonus telescopus*), black scabbard fish (*Aphanopus carbo*), and wreckfish (*Polyprion americanus*).

In ICES Subarea XII there are trawl fisheries on the mid-Atlantic Ridge for orange roughy, roundnose grenadier, and black scabbard fish. There is a multispecies trawl and longline fishery on Hatton Bank, and some of this occurs in this subarea, some in Subarea VI. There is considerable fishing on the slopes of the Hatton Bank, and effort may be increasing. This fishery takes an assemblage of species similar to the mixed trawl fishery in VI and VII. However, smoothheads that were normally discarded previously are now being landed.

In ICES Subarea XIV there are trawl and longline fisheries for Greenland halibut and redfish that have bycatches of roundnose grenadier, roughhead grenadier, black dogfish *Centroscyllium fabricii*, greater lanternshark *Etmopterus princeps*, and tusk.

Stock status and fisheries impacts

Fisheries on deepwater species have developed rapidly and the

resources which they exploit are generally especially vulnerable to overexploitation. Within the ICES area species/stocks have been depleted before appropriate management measures have been implemented. It is also of concern that the landings statistics that are available may not reflect the true scale of the recent fishing activity, especially in waters outside the national EEZs.

Experience shows that some deep-sea species with life history strategies characterised by long life-spans, high age at maturity, and slow growth (e.g. orange roughy, blue ling) can be depleted very quickly and that recovery will be slow. Regeneration and growth are so slow that abundance does not increase in the depleted populations in the short or medium term. Other species with higher productivity have also been severely impacted by fisheries, but show greater resilience and potential for recovery in the medium term.

The survival rates of discards and of fish encountering gears and escaping are unknown, but many species are expected to be very vulnerable to injury, and therefore would be expected to die even if they escaped through meshes. The body shape of many deepwater fish combined with a high age/length at maturity often means that there can be a high fishing mortality of immature fish. Some species, such as blue ling, orange roughy, red sea bream, and alfonsinos aggregate in shoals, often associated with seamounts, and the fisheries have high catch rates once the shoals are located. Localized sub-units of the population can be quickly depleted by fisheries, even within a single season. Sub-units of some species (e.g. red sea bream, blue ling, and orange roughy) are known to have collapsed in some ICES areas.

It is evident that high catch rates can be maintained by moving from one concentration to another and progressively depleting the stock. Furthermore, many deepwater fisheries are on mixtures of species, making it difficult to manage the species components individually.

Fisheries for deepwater species have been developing and changing in areas inside and outside national jurisdictions since the 1970s. But the actual exploitation rates have been difficult to assess and even the current level is unknown. During the last decade exploitation appeared to be increasing on a number of species, as fishing extended into deeper waters or new areas. However, the quantities recorded were not always well estimated, and some landings are reported in grouped categories because of difficulties in separating species. Effort data were frequently uncertain and incomplete. In many cases significant proportions of the catch are discarded at sea and not recorded. All these factors make it difficult to determine which level of exploitation is sustainable. Fisheries on deepwater species have often developed and expanded before sufficient information was available on which to base management advice.

In 2002 ICES concluded that most exploited deepwater species were considered to be harvested outside safe biological limits, and recommended immediate reductions in the fisheries unless they could be shown to be sustainable. New fisheries should be permitted only when they expanded very slowly, and were accompanied by programmes to collect data which would allow evaluation of the stock status. While there has been increasing research activity in deep water the fisheries have expanded more rapidly.

The development in the most recent years prior to 2003 was that some fisheries actually expanded (e.g. orange roughy), whereas most others continued at more or less the same levels of landings. Some fisheries were regulated by unilateral or internationally agreed TACs in 2003, and this may have curbed the expansions. In the NEAFC regulatory area, effort was recommended to be frozen in 2003 and 2004 and an effort regulation has been implemented in EU deep-sea fisheries. But as in 2002 few satisfactory stock assessments could be made in 2004, and information on exploitation rates remains uncertain. Under a precautionary approach regime, and given that no new assessments could be made, the conclusion on stock status in 2004 remains similar to that made in 2002.

In 2004 ICES presented the summary below of the status of the exploited species for which at least some information exists to evaluate abundance is given.

Species	**ICES Subarea/division**	**Assessment type and final year of data**	**Salient features Indicators of stock status**	**Concerns / comments**
Ling *(Molva molva)*	IIa,IVa,V,VI and VII	Catch curves in late 90s. Preliminary age-based assessment for Vb. Trends in CPUEs. 2003.	Average Z very high in late 90s. Survey indices declining in Va. Commercial CPUEs in other areas.	Continued limited provision of data from some major fisheries. Length and age data series still inadequate for analytical assessments.
Blue ling *(Molva dypterygia)*	I-XII and XIV	Indicative holistic assessment for V, VI & VII based on CPUE data. 2003	Strong decline in CPUE. CPUEs probably not reliable as stock indicators due to fishing on aggregations.	Fishing on spawning concentrations implies that CPUE trend may underestimate the stock trends and should be treated with caution.
Tusk *(Brosme brosme)*	IIa,IVa,V,VI	Catch curves in late 90s and trends in CPUEs. CPUE series truncated in mid -1990s. 2003.	Historical CPUE data show strong decline over the past decade in most areas. Trends in most recent years uncertain.	Length and age data series still inadequate for analytical assessment.

Species	ICES Subarea/division	Assessment type and final year of data	Salient features Indicators of stock status	Concerns / comments
Greater Silver Smelt *(Argentina silus)*	Mainly IIa,III,V,VI,VII	No recent assessment. 2003.	Available CPUEs from IIIa and Vb probably not indicative of stock development.	Decline in landings in recent years has been observed for all ICES divisions, except Div. IIa.
Orange Roughy *(Hoplostethus atlanticus)*	Mainly VI, VII, X and XII	No assessments. CPUE data only. 2003	Strong fluctuations in CPUE. Due to the aggregational behaviour of this species CPUEs are not readily indicative of stock density .	The fluctuations in CPUE may reflect both fluctuations in fish density on successively exploited aggregations and sequential discovery of new aggregations Recent high landings in VII are unlikely to be sustainable.
Roundnose Grenadier *(Coryphaenoides rupestris)*	IIIa,V, VI VII and XII. Data mainly from V,VI & VII	Preliminary age-based assessment for stock in V,VI & VII indicates declining stock. Preliminary acoustic assessment for XII.	No clear trends in CPUEs for IIIa, V, VI, VII. Russian CPUEs for XII & XIV, 1975-2003, declining	Requirement for age data. Number of large fish declining. Discard data should be collected. Full review of data for area XII and X needed. Mis-reporting suspected in XII (Hatton Bank).
Black Scabbardfish *(Aphanopus carbo)*	Mainly V,VI,VII,VIII and IX	ASPIC model. CPUE data. 2003	Consistent decline in CPUE in V, VI and VII, but increase in 2002 for VI and VII. CPUE in IXa stable.	Stock structure unknown. Information on reproductive tactics and dynamics is needed.
Golden Eye Perch *(Beryx splendens)*	Mainly X	No assessment, because of lack of satisfactory data. 2003		Concern about sequential depletion and underreporting from international waters.
Red (blackspot) Seabream *(Pagellus bogaraveo)*	Mainly in X and IX, and residual in VI, VII, VIII	No assessment attempted due to lack of data. 2003		
Greater forkbeard ***(****Phycis blennoides)*	All areas but mainly VI, VII, VIII and IX	No assessment 2003	CPUE data not used because landings statistics may include landings of Morids and concerns about CPUE of bycatch species.	Mainly bycatch.
Deepwater sharks mainly *Centroscymnus coelolepis* and *Centrophorus squamosus*	Entire ICES area	CPUE trends only	All available CPUE data show declines. Stocks depleted	Declines in CPUE more pronounced in the northern area. This is where most of the catch comes from
Kitefin shark *Dalatias licha*	Mainly X	Production model	Stock depleted	No longer a target fishery. Bycatches possible in other fisheries

1.3 Assessments and advice

Fisheries advice

Mixed fisheries and fisheries interactions

Satisfactory comprehensive quantitative descriptions of fisheries exploiting deep-sea species have not been compiled, but efforts were initiated in 2004 to define fisheries by areas and fleets. This work will continue with an aim to develop future fisheries-based advice.

Most fisheries in outer shelf and continental slope waters have more than one target species, and may thus be considered mixed fisheries exploiting communities or suites of species. There are exceptions, however, e.g. the target fishery for *Argentina silus* by midwater or semipelagic trawls. Catches from most bottom trawl fisheries consist of 1-3 target species, a further few species that are marketable, and a variable unmarketable fraction that may eventually be discarded. Seamount fisheries or fisheries targeting aggregations (e.g. orange roughy, blue ling, alfonsino) may have catches that are less diverse than trawl fisheries

targeting less aggregating slope species (e.g. grenadier, sharks). Longline fisheries for e.g. ling, tusk, and black scabbardfish, usually have more well-defined targets, but may also have a significant bycatch, some of which is unmarketable. Discarding practices vary, and data are being or have been collected from some major fisheries, but not always in a standardised and regular manner.

A further complication in defining fisheries is that several of the species on the deep-sea species list are actually only, or to a very high degree, exploited as bycatch in target fisheries for other species such as e.g. cod, hake, monkfish, and redfish. This is particularly the case for deepwater species that during their life history inhabit a wide depth range from relatively shallow waters of the shelf and coasts into slope waters beyond 400 m. Ling (*Molva molva*) is an example, partly also tusk (*Brosme brosme*) which are valuable and marketed even when catches are small. While a high proportion of ling and tusk are landed from aimed longline fisheries where ling is the target, a significant fraction stems from landings by trawl and longliner fleets targeting other species. Greater forkbeard *Phycis blennoides* is an example of a species almost solely exploited as bycatch and is not landed consistently.

The interactions between the various species in mixed fisheries are presented in the table below.

	Ling	Tusk	Blue ling	Roundnose grenadier Vb,VIa, VIb2,VII,XIIa2	Roundnose grenadier VIII, IX	Roundnose grenadier X	Roundnose grenadier VIb1, XIIb	Roundnose grenadier XIVb1, XIVa1, XIIc	Orange roughy V	Orange roughy VI	Orange roughy VII	Orange roughy VIII, IX	Orange roughy X, XII	Black scabbardfish V,VI,VII, XII	Black scabbardfish VIII, IX, X	Greater forkbeard	Mora	Red seabream V,VI and VII	Red seabream IX	Red seabream X	Alfonsinos VI, VII, VIII, IX	Alfonsinos X	Portuguese dogfish NEA	Leafscale gulper shark NEA	Rabbitfish	Wreckfish	Deepwater red crab	Kitefin shark	Anglerfish (N Shelf)	Anglerfish (S shelf)	Anglerfish (Iberia)	Baird's smoothheads (VIb1, XIIb)
Ling	A	B	B	0	0	0	0	0	0	0	0	0	0	0	0	S	S	0	0	0	0	0	S	S	M	0	0	0	B	B	0	0
Tusk	A		B	0	0	0	0	0	0	0	0	0	0	0	0	S	S	0	0	0	0	0	S	S	M	0	0	0	0	0	0	0
Blue ling	A	A	T,G	B	S	S	B	B	B	B	B	S	S	B	S	B	M	0	0	0	0	0	S	S	M	0	0	0	L	L	0	0
Roundnose grenadier Vb,VIa, VIb2,VII,XIIa2			T		0	0	0	0	B	B	B	0	B	B	B	M	S	0	0	0	0	0	B	B	B	0	S	0	0	0	0	0
Roundnose grenadier VIII, IX			T			0	0	0	0	0	0	S	0	0	S	S	S	0	0	0	0	0	S	S	S	0	S	0	0	0	0	0
Roundnose grenadier X			T				0	0	0	0	0	0	B	0	0	M	S	0	0	0	0	0	M	M	M	0	S	0	0	0	0	0
Roundnose grenadier VIb1, XIIb			T				T	0	0	0	0	0	B	B	0	B	S	0	0	0	0	0	B	B	B	0	S	0	0	0	0	B
Roundnose grenadier XIVb1, XIVa1, XIIc			T						0	0	0	0	B	B	0	B	S	0	0	0	0	0	B	B	B	0	S	0	0	0	0	0
Orange roughy V			T	T					T	0	0	0	0	B	0	B	S	0	0	0	0	0	M	M	M	0	S	0	0	0	0	0
Orange roughy VI			T	T						T	0	0	0	B	0	B	S	0	0	0	0	0	B	B	B	0	S	0	0	0	NA	0
Orange roughy VII			T	T							T	0	0	B	0	B	S	0	0	0	0	0	B	B	B	0	S	0	0	0	NA	0
Orange roughy VIII, IX			T		T					O		T	0	0	B	B	S	0	0	0	0	0	B	B	B	0	NA	0	0	0	NA	0
Orange roughy X, XII			T	T		T	T	T		O			T	B	0	M	S	0	0	0	0	0	B	B	B	0	NA	B	0	0	NA	B
Black scabbardfish V,VI,VII, XII			T	T			T	T	T	T	T	T	T		B	B	S	0	0	0	0	0	B	B	B	0	S	B	0	0	NA	B
Black scabbardfish VIII, IX, X			L	T	T	T				O		T	T		T	B	B	0	S	S	S	S	B	B	B	0	0	B	0	0	NA	0
Greater forkbeard	A	A	T, L	T	T	T	NA	NA	T	T	T	T	T	T	L		M	0	S	S	S	S	B	B	B	0	NA	M	M	M	NA	B
Mora	A	A	L	T	T	T	T	T	T	T	T	T	T	T	L	L,G,A		S	S	S	S	S	B	B	M	NA	M	B	L	L	S	S
Red seabream V,VI and VII															L	L	L		0	0	M	0	S	S	S	NA	S	S	0	0	NA	0
Red seabream IX															L	L	L			0	NA	0	S	S	S	NA	NA	S	0	0	NA	0
Red seabream X															L	L	L			L	0	B	S	S	M	NA	NA	S	0	0	NA	0
Alfonsinos VI, VII, VIII, IX															L	L	L	T				0	S	S	S	B	NA	S	0	0	NA	0
Alfonsinos X															L	L	L			L		L	S	S	S	B	NA	S	0	0	NA	0
Portuguese dogfish NEA	A	A	A,T,G	T	T	T	T	T	T	T	T	T	T	T	L	L,T,G,A	L,G,A		T	L		L	L (IXa)	B	B	NA	NA	B	M	M	NA	B
Leafscale gulper shark NEA	A	A	A,T,G	T	T	T	T	T	T	T	T	T	T	T	L	L,T,G,A	L,G,A		T	L		L		L (IXa)	B	NA	NA	B	M	M	NA	B
Rabbitfish	A	A	A,T,G	T	T	T	T	T	T	T	T	T	T	T	L	L,T,G,A	L,G,A		T	L		L	L,T,G,A	L,T,G,A		NA	NA	B	M	M	NA	B
Wreckfish																						L	L	L	L	!	NA	NA	0	1	NA	0
Deepwater red crab																G	G						G	G	G		P	NA	M	M	NA	0
Kitefin shark	A	A	A,T,G	A		T	T	T			T	T	T	L	L	L	L		L	L		L	L,T,G	L,T,G	L,T,G	L,T,G		L,G (X)	0	0	NA	0
Anglerfish (N Shelf)	T		T													T							T,G	T,G	T,G		G			0	0	0
Anglerfish (S shelf)	T		T													T							T,G	T,G	T,G		G				0	0
Anglerfish (Iberia)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		0
Baird's smoothheads (VIb1, XIIb)			T				T						T	T		T							T	T	T							
T = trawl; A = Autoline; L = Artisanal longline; G = Gillnet; P = Crab pots. Target fisheries indicated, by gear in main diagonal.	B; the stocks are taken together in most fisheries where they are taken and their fisheries linkage is therefore high; M: the stocks are taken together in some but not all important fisheries and their fisheries linkage is therefore medium; S: the stocks are taken together in some fisheries but are mainly caught independently of each other and their fisheries linkage is therefore low; 0: the stocks are never or only rarely caught together and they are thus not linked in the fisheries; na: information not available.																														

Advice for fisheries management

ICES provides advice on individual deep water species every second year, last time in 2004 (ICES 2004). In 2005 ICES has supplemented the advice with advice on deep water sharks. The advice given for other deep water stocks than sharks in 2004 was:

"Most exploited deepwater species are considered to be harvested unsustainably; however, it is currently not possible to provide advice for specific fisheries for deep-sea species. Consistent with a precautionary approach, ICES recommends immediate reduction in established deep-sea fisheries unless they can be shown to be sustainable. Measures should also be implemented to reduce exploitation of deep-sea species by fisheries primarily targeting shelf species (hake, anglerfish, and megrim). New deep-sea fisheries or expansion of existing fisheries into new fishing areas should not be permitted unless the expansion is very cautious, and is accompanied by programmes to collect data which allow evaluation of stock status as the basis for determining sustainable exploitation levels.

Ling and tusk are in many fisheries taken together and therefore the advised effort reduction, calculated on the basis of ling should apply to all fisheries taking ling and tusk as their main catch. The advised reduction is 30% compared to the 1998 effort level.

Concerning blue ling, there should be no directed fisheries. Technical measures such as closed areas on spawning aggregations should be implemented to minimize catches of this stock in mixed fisheries."

In addition ICES advises regarding deepwater sharks:

The stocks of Portuguese dogfish and Leafscale Gulper shark are considered to be depleted. Given their very poor state, ICES recommends a zero catch of deepwater sharks.

Management considerations

Deepwater sharks are caught in a mixed fishery for deepwater species and as a targeted fishery using longlines and gillnets. Most of the catches of deepwater sharks are taken in the mixed fishery in the northern area. Zero catch of deep water shark in the mixed fisheries will require that means are found to avoid any bycatches of deep water sharks in these fisheries. If this is not possible, in order to reduce catches in the mixed fishery, effort needs to be reduced to the lowest possible level in mixed fisheries taking deepwater sharks as a by-catch.

For several species there is a concern that catch rates can only be maintained by sequential depletion of relatively isolated concentrations/sub-units of a stock. The smallest unit for which data are reported at present is the ICES Subarea and Division, and this spatial resolution may not be appropriate for monitoring or managing this type of fishing activity. The depth range within an area may be very wide, and the sizes of the areas are very different. It is therefore recommended that systems are developed and implemented for recording effort and catches at a finer temporal and geographical scale, and that management actions are implemented that take into account spatial resolution at a finer scale than at present.

Management plan evaluations

ICES has been requested to provide advice on management strategies for deep water fisheries. The advice is presented in Section 1.3.3.1. The management plan advice is based on the advice which ICES has given for several years regarding deepwater species, i.e. that most deep-sea species can only sustain low rates of exploitation. Fisheries on these species should only be allowed to expand when indicators and reference points for future harvest have been identified and a management strategy including appropriate monitoring requirements has been decided and is implemented.

For existing fisheries, the fishing pressure should be reduced considerably to low levels and should only be allowed to expand again very slowly if and when reliable assessments indicate that increased harvests are sustainable.

When new fisheries develop or existing fisheries spread into new areas, relevant pressure, state and impact indicators should be established on basis of small, initial fisheries which should only be allowed to expand very slowly if and when reliable assessments indicate that increased harvests are sustainable.

For both existing and new fisheries in the longer term, when state reference points such as U_{max} have been established through closely monitored fisheries at low level, a harvest control rule on basis of these reference points and including decision rules about maintaining the pressure within sustainable bounds could be implemented.

Short-term implications

The short-term consequence of the advice on management plans is that such plans, if implemented, will imply considerable reductions to low levels in the activity and/or capacity of major fleets, in particular trawler fleets traditionally targeting the most long-lived target species (e.g. orange roughy, grenadier, blue ling) and aggregating species of which severe depletions have been documented.

The new ICES advice is that the deepwater sharks *Centroscymnus coelolepis* and *Centrophorus squamosus* are depleted. The technical interaction table above shows that these species are associated, usually strongly, with most other species and in most fisheries using trawl, longline, and gillnet. ICES has advised a zero TAC for these species, and this advice has implications for most of the deepwater fisheries in the area.

It is likely that most target areas for deep-sea fisheries have been explored and that there is limited scope for expansion into new areas or development of new fisheries. In recent years, new developments have occurred mainly in relatively remote waters of, e.g. the Hatton Bank and the mid-Atlantic Ridge. The exploitation rate on the Hatton Bank seems now rather high and many nations are engaged in the fisheries there. On the mid-Atlantic Ridge, fisheries for e.g. roundnose grenadier have a long history back to the 1970s, but the interest seems now to increase. An implication of the current advice is that any further development in these areas (and other areas that are re-visited or explored) should not be permitted unless a proper evaluation of stock status and

4 NEAFC and OSPAR on seamounts and vulnerable habitats

The text of the ICES replies to these requests is presented below. FSS points out that the mixed fisheries implications of the advice on deepwater sharks (see above) implies that deepwater fisheries using trawls, long-lines and gillnets that have associated by-catches of deepwater sharks should not continue. FSS considers that the overall advice for deepwater fisheries is predicated by the zero catch advice for deepwater sharks. This would imply zero effort in most deepwater fisheries in the NEAFC regulatory area,. FSS considers the protection of vulnerable habitats should be dealt with in the context of those remaining fisheries that have small associated catches of sharks, e.g. the targeted fisheries for ling and tusk. Insufficient information exists on the impacts of longlines on deepwater corals and other sensitive habitats. In the absence of such information, closed areas as a means of protecting vulnerable habitats should apply to all gear types.

EXTRACT FROM THE ICES ADVISORY REPORT 2005

NEAFC and OSPAR Request on Seamounts and Vulnerable Habitats

1 Seamounts, Distribution of Cold-Water Corals and other Valuable Deep-Water Habitats

The requests from both OSPAR and NEAFC are related. Therefore, ICES provides one set of advice to both customers as this will avoid the risk that Clients may assume that ICES is sending different messages to different Clients. ICES will also copy this advice to the European Commission as it affects their area of interest.

In February 2005 OSPAR submitted a request to ICES for advice to

Review the information and references listed at Annex A [a list of references provided by OSPAR], and any other relevant information, to provide advice on the threats to, and/or decline of, the benthic communities and the benthopelagic and pelagic communities associated with seamounts, with a focus on:

a) *direct or indirect evidence of damage to seamount communities from different types of fishing activities both within the OSPAR maritime area and elsewhere;*
b) *assessing the degree of threats to seamount communities in the OSPAR regions from types of fishing activity;*
c) *identifying whether and where there are threats from fishing activities within the OSPAR maritime area, and;*
d) identifying whether there are indications of vulnerability as a result of the genetic isolation of seamount communities.

In relation to the proposal for the protection of vulnerable deep-water habitats (Document NEAFC AM2004/28), NEAFC has requested ICES:

a) *To provide information on recent fishing effort in the areas closed to trawling and static gear in the NEAFC Regulatory Area;* [ICES has interpreted recent fishing effort as fishing effort before the area closures]
b) *To evaluate if the boundary lines of the closed areas in the NEAFC Regulatory Area reflect the spatial distribution of vulnerable deep-water habitats in those areas;*
c) *To provide information on the distribution of cold-water corals on the Hatton Bank;*
d) *Provide information on the percentage of vulnerable deep-water habitats in the Regulatory Area covered by the proposal;* [ICES has interpreted the proposal to mean the 5 closed areas agreed by NEAFC in November 2004, plus the proposed closure on the Hatton Bank]
e) *Provide information on the distribution of cold-water corals on the Western slopes of the Rockall Bank to indicate appropriate boundaries of any closure of areas where cold-water corals are affected by fishing activities;*
f) *Evaluate the destructiveness of different fishing gears with respect to vulnerable deep-water habitats.*

General introduction

Both the OSPAR and NEAFC requests relate broadly to the issue of areas affected by fishing in deeper waters of the North-East Atlantic, but approach the issue from different perspectives. The OSPAR request is concerned primarily with the impacts of fishing on deepwater habitats, while NEAFC is concerned with using closed areas to manage fishing activities in such a way as to reduce or minimise damage to valued habitats.

In responding to this request, ICES has necessarily considered the significance of factors that fall outside the specific remit of the OSPAR and NEAFC requests, but must be considered as part of the ecosystem approach. At Rockall Bank the cold-water coral habitat extends throughout the region into the jurisdictions of both NEAFC and the EU. In applying an ecosystem approach ICES used all available information on the distribution of cold-water corals and fishing activity to provide advice for the protection of the entire habitat, rather than only for that part under the jurisdiction of NEAFC and for which specific advice was requested. To consider options for deep-water habitat protection only within NEAFC waters risks inadvertently displacing effort into other areas supporting cold-water coral. This will have implications in adjacent EU waters, and ICES therefore consider it important to make the European Commission aware of these implications. Recommendations for closed areas at Rockall Bank are therefore holistic and include adjacent EU waters. This advice may be considered part of that provided in response to the letter from the European Commission to ICES in July 2000 asking ICES to identify areas where cold-water corals may be affected by fishing and subsequent more general requests of a similar nature.

1.1 Recommendations and advice

OSPAR request

In providing this advice, the term seamount was applied only to those bathymetric features rising at least 1000 m above the surrounding seafloor. This is important because in many documents relating to the OSPAR area, seamounts and banks are often dealt with together.

(a) direct or indirect evidence of damage to seamount communities from different types of fishing activities both within the OSPAR maritime area and elsewhere

A review of information available to ICES found a lack of studies assessing direct or indirect damage to benthic communities on seamounts in the OSPAR area. The lack of studies meant that there was no local evidence of fishing impacts on these communities. Based on knowledge of fishing impacts on benthic communities associated with seamounts in other areas, it is likely that damage to the benthic communities associated with seamounts has occurred in the OSPAR area. However, it cannot be assumed that all seamounts in the OSPAR area have been impacted as some are beyond the fishing range of gear that might damage the benthic communities, while others may not have been fished, for reasons such as a natural lack of fish aggregations. From this it can be inferred that the extent of any damage to benthic communities on the seamounts would depend on the ways fishing gears are deployed and the degree of spatial association between the stocks and seamounts. Neither the details of gear deployment in the seas of seamounts nor the interaction between fishes and seamount habitats have been fully described or quantified for the OSPAR region.

(b) assessing the degree of threats to seamount communities in the OSPAR regions from types of fishing activity

Extensive research of shelf sea and deep-water fisheries and their effects, in ICES and the wider science community, supports several conclusions. Trawl gears that impact the seabed pose the greatest threat to sensitive benthic habitats on seamounts, followed by bottom-set gill-nets and long-lines. Any other gear that has bottom contact also has the potential to threaten sensitive benthic habitats. . The degree of threat will be affected by the sensitivity of the habitats on each particular seamount and by the intensity of the fishing activity. For example, an intensive fishery by gill-nets on a sensitive habitat that has a long recovery time could have as much impact as a lower intensity of a more damaging activity (e.g. trawling). The degree of threat to benthopelagic and pelagic communities on seamounts has not been evaluated, but would again relate to the intensity of each fishery and the catchability and sustainable mortality rate of each species of fish in the community.

(c) identifying whether and where there are threats from fishing activities within the OSPAR maritime area

The absence of comprehensive information on the distribution of seamounts and fishing activity limits the capacity of ICES to advise on the areas where seamounts may be threatened by fishing. Knowledge of the structure of habitats on all seamounts in the OSPAR area is inadequate, so this limits us to providing general advice based on common ecological principles. The information needed to identify threat would be a catalogue of all seamounts and their characteristics (e.g. depth of summit) in the OSPAR area, and geographically disaggregated information on fishing effort by gear that would enable fishing activities on seamounts to be identified. Information from satellite monitoring systems on fishing vessels would also be essential to corroborate records of fishing activities.

(d) identifying whether there are indications of vulnerability as a result of the genetic isolation of seamount communities.

There have been few studies in the OSPAR area of the genetics of species occurring on seamounts. These studies and those from elsewhere suggest that there will be a mix of species types present, ranging from some endemics on a few seamounts to species that show no genetic variation across wide areas. At present, there are insufficient studies to show whether the proportions of species in these categories differ from other deep-water habitats within the OSPAR area.

1.1.1 NEAFC Request

(a) To provide information on recent fishing effort in the areas closed to trawling and static gear in the NEAFC Regulatory Area; [ICES has interpreted recent fishing effort as fishing effort before the area closures were implemented]

There are no accurate data on recent fishing effort in the areas of the Regulatory Area that are now closed. Data at the relevant spatial scale has not been made available to ICES, and perhaps does not exist. Fishing effort statistics and landings data for the entire Regulatory Area remain uncertain due to incomplete or imprecise reporting.

All vessels fishing in the Regulatory Area are obliged to report activity (via VMS and logbooks) and landings to NEAFC and national authorities. Unfortunately there is no mechanism whereby these data are made available routinely to ICES. ICES understands that NEAFC has been unable to compile all effort and landings data from this area, and the effort summaries in the Technical Annex do not include data for 2005.

b) To evaluate if the boundary lines of the closed areas in the NEAFC Regulatory Area reflect the spatial distribution of vulnerable deep-water habitats in those areas;

There is insufficient information available on the complete and continuous distribution of vulnerable deep-water habitats in the NEAFC Regulatory Area to assess how the boundaries of the closed areas proposed by NEAFC relate to the distribution of vulnerable habitats. Little new information of relevance to the state of the resources or habitats in the NEAFC Regulatory Area was submitted to ICES. The experts therefore had to rely on published information, working documents provided by national delegates (in 2005 and earlier), and expert judgement, to evaluate the situation and respond to the specific requests.

There are several ongoing programmes, including the current MAR-ECO project (ends 2008), which may ultimately help to assess the distribution of vulnerable deep-water habitats in parts of the NEAFC area. ICES notes that by protecting vulnerable habitats, such as those that are expected to be found in the suggested closed areas, through closing these areas to fishing gears that would damage them, the actions of NEAFC are consistent with a precautionary approach.

c) To provide information on the distribution of cold-water corals on the Hatton Bank;

Most records of the occurrence of cold water corals at Hatton Bank correspond to records of *L. pertusa* recovered in trawls or dredge nets. Therefore, they give no information on whether or not the sites support reef structures, or how extensive they may be. However, the frequency and distribution of records of occurrence suggests that sizeable cold-water coral reefs are present on Hatton Bank, generally within the 1000 m isobath and more frequently on the northern half of the Bank (Fig 1.1).

Information on the occurrence of cold-water corals at Hatton Bank is available in the literature from three published sources and three cruise reports. Geological investigation at Hatton Bank in the year 2000 used a sub-bottom profiler and dredge to identify reef-like features, consistent with *Lophelia pertusa* structures, and also a substantial number of mound-like elevations supporting large quantities of live *Lophelia pertusa* and *Madrepora oculata*, and/or *Primnoa resaediformis* colonies, together with various other coral species.

Other information on coral occurrence on Hatton Bank will be available in the fishing records of skippers, but a properly planned habitat mapping exercise based on wide-area acoustic survey with adequate visual ground-truthing (with e.g. an ROV), will be required to provide a true picture of the distribution of cold-water corals. Until such a survey is completed, it is also not possible to identify areas where cold water corals do not occur. Three further habitat surveys over Hatton (and Rockall) Banks will occur or are planned in the near future by UK and Spain.

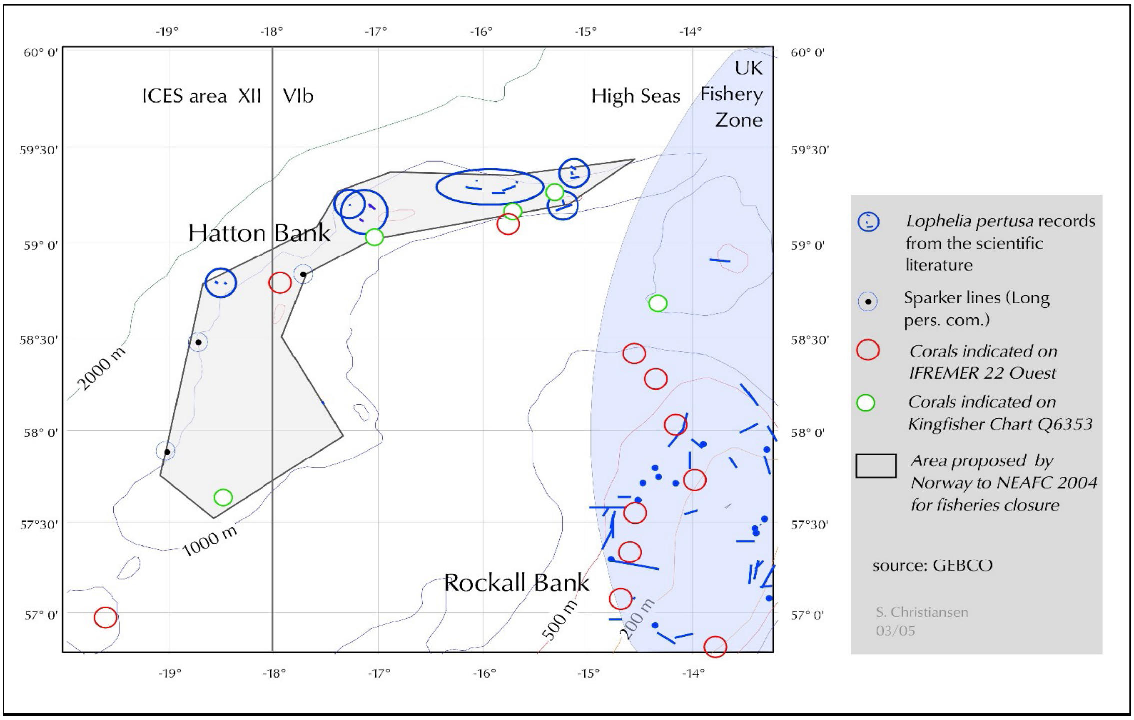


Figure 1.1 Known and likely locations of cold-water coral on Hatton Bank.

d) *Provide information on the percentage of vulnerable deep-water habitats in the Regulatory Area covered by the proposal;* [ICES has interpreted the proposal to mean the 5 closed areas agreed by NEAFC in November 2004, plus the proposed closure on the Hatton Bank]

There are no data available to estimate the percentage of vulnerable deep-water habitats in the NEAFC Regulatory Area that are covered by the closed area proposals. A complete wide-area habitat mapping survey would be required to make this assessment.

e) *Provide information on the distribution of cold-water corals on the Western slopes of the Rockall Bank to indicate appropriate boundaries of any closure of areas where coldwater corals are affected by fishing activities;*

There are two separate issues which ICES considered when dealing with this request. First, closed areas could be used to protect cold-water corals where there was evidence of fishing activity damaging known concentrations of coral. Second, protection could also be afforded by protecting known areas of reef which are away from areas of high fishing activity, in order to maintain their less or unimpacted status. In response to the former issue, and consistent with the focus of the NEAFC request, ICES identified closure boundaries in areas where cold-water corals are affected by fishing activities. However, in response to the latter issue, ICES assumed that NEAFC were also asking ICES to identify closed areas that would provide the greatest benefits for corals. Consistent with this assumption, ICES has also identified closures that would maintain the less or unimpacted status of corals in areas where there was no or low fishing activity.

Thus, ICES applied two alternative sets of criteria to define areas suitable for closure to protect cold-water corals. These criteria were:

- Areas containing recorded coral concentrations where there was no or low fishing activity.
- Areas containing recorded coral concentrations where fishing activity was high.

ICES defined both types of closed areas to protect cold-water corals on Rockall Bank, using information on the distribution of cold-water corals from scientific observation, supported by records of coral areas, and knowledge of the location of fishing vessels from satellite monitoring of fishing vessels.

Using the first set of criteria, four areas were selected, the NW Rockall flank, South Rockall, Logachev Mounds and

W Rockall Mounds. These are illustrated on Figure 8.4.1 with the box already closed to protect haddock.

The four proposed closed areas, the Logachev Mounds, the West Rockall Mounds, and the north-west flank of Rockall Bank, were selected based on evidence of known or expected presence of cold water corals, and the absence of extensive previous fishing activity (Figure 8.4.1). It was expected that closures at these four sites would not result in displaced fishing effort to other areas that contain unimpacted cold water corals. The latitude and longitude of each corner point is given in Table 8.4.1. Closures at these sites are expected to provide greater benefit for cold-water corals than the alternate closures proposed in areas that have already been frequently fished.

Between the NW Rockall flank and South Rockall areas is the Rockall haddock Closed Area. In spring 2002, the EU component of statistical rectangle 42D5 was closed to trawling activities. The international waters element of this rectangle was also recently closed to all fishing activities except long-lining (NEAFC, 2005). Due to the location of the Haddock box it could be considered part of a closure meeting the criteria for areas containing recorded coral concentrations where there was no or low fishing activity , although the coral that occurs within the Haddock box may already be damaged by previous fishing activity.

Using the criterion areas containing recorded coral concentrations where fishing activity was high , two areas were selected, one in SW Rockall and one on the eastern flank of Rockall, (Table 8.4.2; Figure 8.4.2). Closure of these two areas is likely to result in the displacement of fishing effort, possibly into areas that currently are relatively unaffected by fishing activity. In addition, it is likely that corals that were present in this area when fisheries were started have already been seriously damaged, but further survey and more comprehensive VMS data will be needed to confirm this.

ICES recommends that all closures should be permanent. It would not be appropriate to close an area of importance to cold-water coral on a temporary basis, unless this is a step towards a permanent closure. The justification is that the recovery time of cold-water corals following fishing impacts will be decades to centuries, so temporary or rotational closures of corals would only change the schedule at which damage occurred, and not prevent it. Temporary or rotational closures will also lead to more frequent effort displacement, and this is expected to increase the overall extent of the area where cold-water corals are impacted by fishing.

The Rockall Bank straddles the area managed under the European Union s Common Fisheries Policy and that regulated by NEAFC. The distribution of habitat is continuous in relation to this boundary and a closure in the NEAFC area could displace fishing effort into EU waters where other areas of coral would be damaged.

Table 8.4.1 Co-ordinates of the corner locations of the four areas within which coral is known to occur and in which there was no or low fishing activity. Locations are accurate to nearest minute of latitude and longitude.

SUGGESTED CLOSURE AREA	LATITUDE AND LONGITUDE OF CORNER POINTS
North west Rockall	57°00 N, 14°53 W
	57°37 N, 14°42 W
	57°55 N, 14°24 W
	58°15 N, 13°50 W
	57°57 N, 13°09 W
	57°50 N, 13°14 W
	57°57 N, 13°45 W
	57°49 N, 14°06 W
	57°29 N, 14°19 W
	57°22 N, 14°19 W
	57°00 N, 14°34 W
Logachev Mounds	55°17 N, 16°10 W
	55°34 N, 15°07 W
	55°50 N, 15°15 W
	55°33 N, 16°16 W
South Rockall	56°00 N, 16°00 W
	56°16 N, 16°00 W
	56°18 N, 15°03 W
	56°30 N, 15°00 W
	56°30 N, 14°26 W
	56°20 N, 14°29 W
	56°00 N, 15°00 W
West Rockall Mounds	57°20 N, 16°30 W
	57°05 N, 15°58 W
	56°21 N, 17°17 W
	56°40 N, 17°50 W

Table 8.4.2 Co-ordinates of the corner locations of the two areas within which coral concentrations have been recorded and in which fishing activity was high. Locations are accurate to nearest minute of latitude and longitude.

SUGGESTED CLOSURE AREA	LATITUDE AND LONGITUDE OF CORNER POINTS
SW Rockall	56°16 N, 15°46 W
	56°30 N, 15°33 W
	56°23 N, 15°46 W
	56°44 N, 15°00 W
	56°30 N, 15°00 W
	56°17 N, 15°03 W
Rockall eastern flank	56°59 N, 13°16 W
	57°06 N, 13°28 W
	57°21 N, 13°37 W
	57°46 N, 12°58 W
	57°41 N, 12°52 W
	57°35 N, 12°48 W
	57°31 N, 12°49 W
	57°26 N, 12°52 W
	57°12 N, 12°55 W

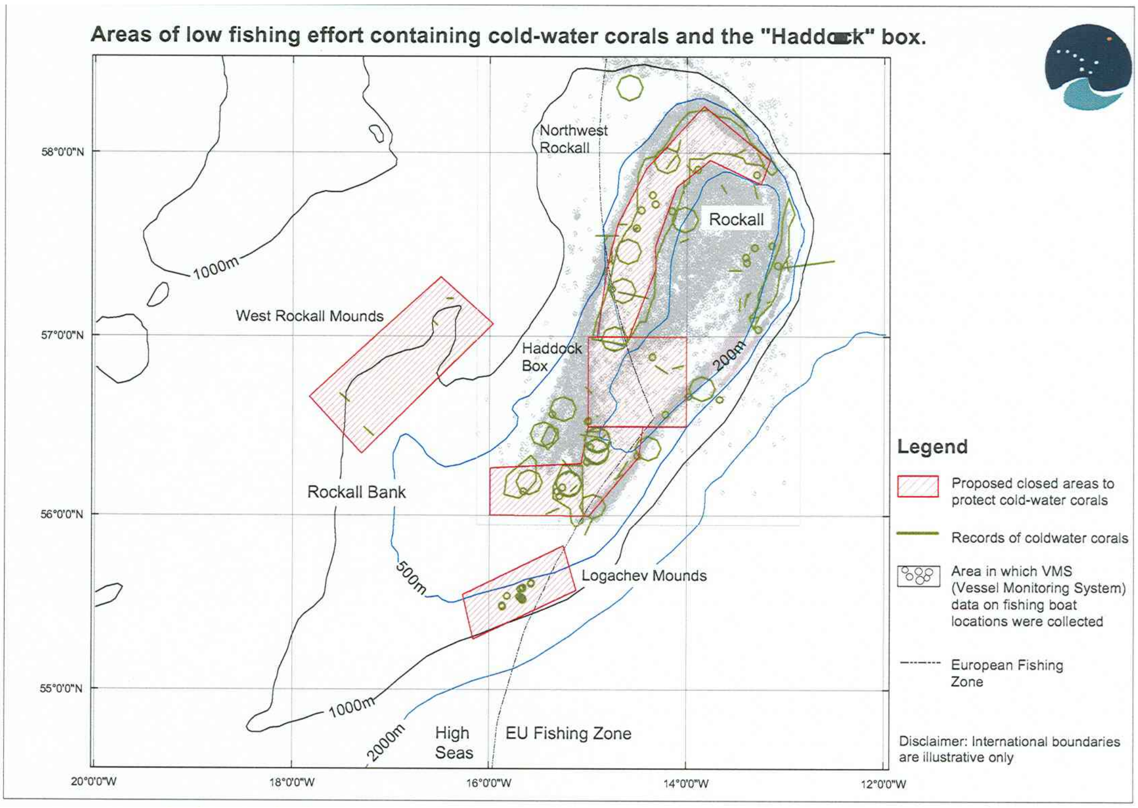


Figure 8.4.1. The Haddock Box and the four areas appropriate for closure to protect cold-water corals on the Rockall Bank, based primarily on VMS and scientific records. Recommendations are based on areas

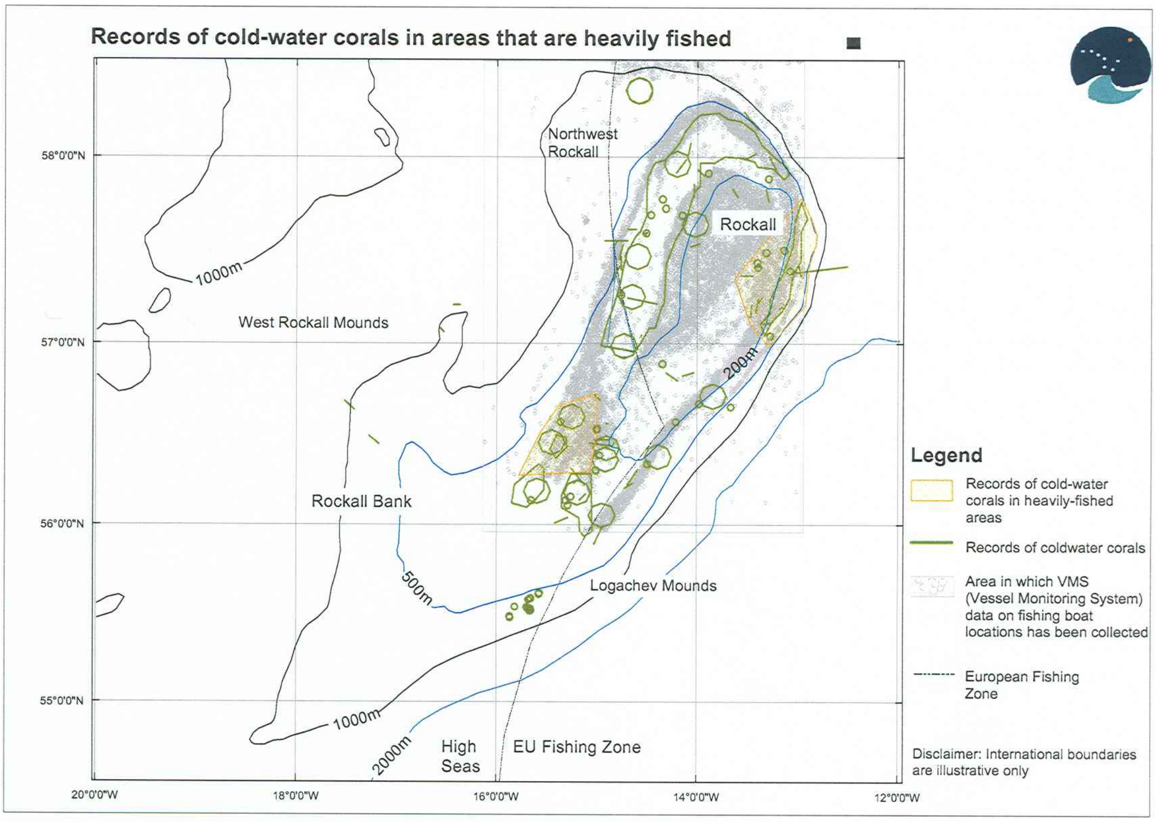


Figure 8.4.2. Two areas appropriate for closure to protect cold-water corals on the Rockall Bank, based primarily on VMS and scientific records. Recommendations are based on areas of known coral corresponding with areas of high fishing effort.

ICES has previously advised (2003) on the closure of an area for the protection of cold water corals (Darwin Mounds). This closure was advised in the absence of VMS data but with substantial knowledge of the occurrence of coral in the area. The boundary of the proposed closed area was adjusted to allow for the length of towing warp between a trawler and a net being fished on the seabed. This was because fishing vessels bottom trawling in the region need a minimum towline length of twice the depth of the water in which they are fishing. Since the Darwin Mounds were in water of 1000 m to 1100 m deep, the expected minimum lengths of towing warp were 2000 to 2200m. The suggested site boundary for the Darwin Mounds thus comprised the smallest rectangle based on whole degrees/minutes (to two decimal places), which would include the Mounds area, plus a margin of 2.2 km to allow for possible impacts of trawling on the margin of the closed area. In the case of Rockall, ICES has chosen not to advise on such a margin as VMS data are available for the area showing where vessels usually fish. If the ICES advice is implemented this will stabilise the current boundary of damage rather than allowing additional impacts within a newly created boundary zone.

ICES also previously noted (2003) that fisheries monitoring near the Darwin Mounds was likely to use the satellite-based VMS system. Thus the frequency with which VMS transmissions are sent to enforcement agencies will determine whether vessels can enter a closed area without detection. If VMS transmissions are infrequent (e.g. at the 2 hour intervals used in most EU waters), then the boundary of any proposed closed area would have to be significantly extended to ensure that no fishing activity took place in the closed area. Such boundary extensions to the proposed closed areas would significantly increase the proportion of the Rockall Bank area closed to fishing. Rather than extend the proposed closure areas, ICES recommend that the frequency of position updates from the VMS is increased in the vicinity of Rockall.

f) *evaluate the destructiveness of different fishing gears with respect to vulnerable deep-water habitats*

The impact of fishing gear on vulnerable deep water habitat depends on the type of gear, the degree of contact with the seabed and the frequency of contact. Based on extensive research reported by ICES and the wider science community, bottom trawl gears are expected to have the greatest impact on complex biogenic habitats, followed by bottom-set gill-nets and longlines. Any other gear that has bottom contact also has the potential to impact deep-water habitats. The impact of fishing gears is greatest when contact with the seabed is continuous and intense (e.g. trawl gears) and where the biogenic habitat has complex three-dimensional structure. However, the degree of threat of any fishing gear will be determined by the intensity of the fishing activity, and gears with low impact per unit effort per unit area per unit time can have a significant total impact when used frequently. Relatively little is known about the sensitivity of soft sediment habitats in deep water to the disturbance caused by fishing gears, but they are expected to be more vulnerable to fishing disturbance than soft sediment habitats in shallow areas that are subject to more frequent and intense natural disturbance.

Industrial fisheries West of Scotland (Division VIa)

No ACFM information has been included for these stocks *For latest information, see: http://www.ices.dk*

Marine Institute
Foras na Mara

Fisheries Science Services

Sandeel
Division VIa

FSS – ADVICE

ICES does not provide advice for this stock. FSS recommend that the current catches of less than 12,000 t should be maintained in 2006. FSS advises that the impact of F on the stock and the ecosystem should be considered as part of an overall management plan. FSS advise that by-catch in this fishery should be quantified and made available to ICES.

CURRENT MANAGEMENT

- The current management regime for the sandeel fishery uses a multi-annual TAC of 12,000 t per year with the fishery closed from 31 July. Access is limited to vessels with a track record. These arrangements took effect in 1998 for a period of three years and were renewed in 2001.

ADDITIONAL INFORMATION

1. The state of the stock is unknown. When last assessed in 1996 this stock was inside safe biological limits.
2. Landings and effort in this fishery have declined in recent years and are estimated to be only 566 t in 2004. There are no landings recorded by the Irish fleet and the UK is the only country exploiting this fishery in recent years.
3. The fishery is irregular, depending on the availability of the resource and of processing facilities at Shetland, Denmark and the Faeroes.
4. By-catch from this fishery is believed to be very small.
5. Fishing grounds are close inshore and often adjacent to large colonies of seabirds for which the sandeel population is an important food supply, especially during the breeding season.

International Sandeel Landings in VIa

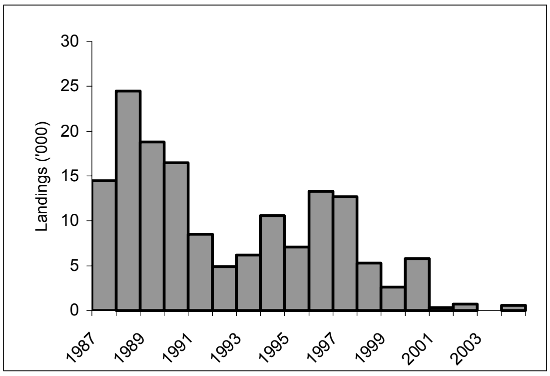


Table 1 Sandeel, Division VIa Landings (tonnes), 1981-2004, as officially reported to ICES.

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Denmark	-	-	-	-	-	-	-	-	-	-	-	-
UK, Scotland	5972	10786	13051	14166	18586	24469	14479	24465	18785	16515	8532	4935
United Kingdom												
Total	5972	10786	13051	14166	18586	24469	14479	24465	18785	16515	8532	4935

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Denmark	80	-	-	-	-	-	-	-				
UK, Scotland	6156	10627	7111	13257	12679	5320	2627	-				
United Kingdom							5771		295	706	-	566
Total	6236	10627	7111	13257	12679	5320	2627	5771	295	706	-	566

Norway pout
Division VIa

FSS – ADVICE

Norway pout in Division VIa is managed as part of the North Sea TAC and is not regulated on how much of this TAC may be removed from VIa. FSS point out that even an extremely small by-catch (in terms of percentage of catch) of either herring, cod or whiting could be a significant cause of fishing mortality on these stocks, especially in the Stanton Bank area. FSS advise that by-catch in this fishery should be quantified and made available to ICES. Given that there is a recovery plan for cod in the area, it is important to show zero by-catch in this fishery.

ADDITIONAL INFORMATION

- There are no specific management objectives for the fisheries exploiting this stock. The EU fishery is not managed by TAC. Although Norway does not currently fish in Via, it is allowed to fish in VIa North of 56°30'N as part of the conditions of its IIa, Skagerrak and Kattegat, North Sea (EC waters) quota allocation.
- The fishery is a small mesh trawl fishery operated by Danish vessels. Catches are highly variable depending on the availability of the resource and of processing facilities at Shetland, Denmark, and the Faeroes.
- The fishery is known to take place on the Stanton Bank, which is an important nursery area for whitefish species in VIa, especially cod and whiting.
- There is no other information available on which to base scientific advice. By-catches in this fishery should be quantified and made available to ICES.

Norway pout in Division VIa (West of Scotland)

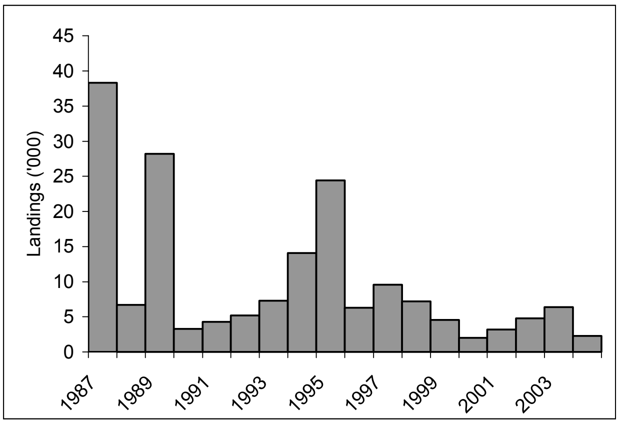


Table 2 Norway pout in Division VIa. Officially reported landings (tonnes)

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996
Denmark	5849	28180	3316	4348	5147	7338	14147	24431	6175
Faroes	376	11	-	-	-	-	-	-	-
Germany	-	-	-	-	-	-	-	1	-
Netherlands	-	-	-	-	10	-	-	7	7
Norway	-	-	-	-	-	-	-	-	-
Poland	-	-	-	-	-	-	-	-	-
UK (E+W)	-	-	-	-	1	-	1	-	-
UK (Scotland)	517	5	-	-	-	-	+	-	140
Total	6742	28196	3316	4348	5158	7338	14148	24439	6322

Country	1997	1998	1999	2000	2001	2002	2003	2004
Denmark	9549	7186	4624	2005	3214	4815	6397	2281
Faroes	-	-	-	-	-	-	-	-
Germany	-	-	-	-	-	-	-	-
Netherlands	-	-	1	-	-	-	-	-
Norway	-	-	-	-	-	-	-	-
Poland	-	-	-	-	-	-	-	-
UK (E+W)	-	-	-	-	-	-	-	-
UK (Scotland)	13	-	-	-	-	-	-	4
Total	9562	7186	4625	2005	3214	4815	6397	2285

Arctic Stocks (Cod, Haddock and Saithe)

No ACFM information has been included for these stocks *For latest information, see: http://www.ices.dk*

Marine Institute
Foras na Mara

Fisheries Science Services

There are a number of Arctic stocks in which Ireland has an interest. EU quota allocations for this area include a portion of the annual TAC for the Irish fleet.

Ireland has taken part in these fisheries in recent years and the main catches have been taken by a small number of trawlers that started fishing in the 1990s. In 2000 and 2001 new Irish vessels (under the white fish fleet renewal programme), including long liners, have been involved in this increasingly important fishery. These fisheries are important to Norway and Russia but a number of other countries including Iceland, Faroe Is. United Kingdom, Spain, Poland and Greenland also take catches.

The main stocks that are exploited by the Irish fleet are Cod, Haddock, and Saithe. Summaries of the state of each stock and of the ICES advice for each stock are presented below. The full analyses of these stock carried out by ICES are presented in the ICES Report of the Northern Pelagic and Blue Whiting Working Group and in the Report on the Arctic Fisheries Working Group.

Cod in Sub areas I and II

North-East Arctic Cod

FSS – ADVICE

FSS agree with ICES and STECF advice that the management plan implies a TAC of 471,000 t in 2006. This catch projection includes catches that, in earlier years, were non-reported. If enforcement continues to be ineffective the TAC should be reduced accordingly.

CURRENT MANAGEMENT

- Management strategies for cod and haddock should take into account the following:
  - Conditions for high long-term yield from the stocks
  - Achievement of year-to-year stability in TACs
  - Full utilization of all available information on stock development
- On this basis, the Parties determined the following decision rules for setting the annual fishing quota (TAC) for Northeast Arctic cod (NEA cod):
  - Estimate the average TAC level for the coming 3 years based on $\mathbf{F}_{pa}$. TAC for the next year will be set to this level as a starting value for the 3-year period.
  - The year after, the TAC calculation for the next 3 years is repeated based on the updated information about the stock development, however the TAC should not be changed by more than +/- 10% compared with the previous year's TAC.
  - If the spawning stock falls below $\mathbf{B}_{pa}$, the procedure for establishing TAC should be based on a fishing mortality that is linearly reduced from $\mathbf{F}_{pa}$ at $\mathbf{B}_{pa}$, to F= 0 at SSB equal to zero. At SSB-levels below $\mathbf{B}_{pa}$ in any of the operational years (current year, a year before and 3 years of prediction) there should be no limitations on the year-to-year variations in TAC.
  - The Parties agreed on similar decision rules for haddock, based on $\mathbf{F}_{pa}$ and $\mathbf{B}_{pa}$ for haddock, and with a fluctuation in TAC from year to year of no more than +/-25% (due to larger stock fluctuations)."

ADDITIONAL INFORMATION

1. Surveys indicate that the 2001 year class was poor, 2002 and 2004 were found to be average, while 2003 was again poor.
2. The total catch taken from this fishery in 2004 was estimated to be about 579,500 t. The Irish catch was 301 t in the Norwegian zone and there were no reported Irish catches in the Svalbard zone.
3. The main catches are taken by Norway, and Russia.
4. Concerns of misreporting in 2002-04 remain. Estimates for this period are around 20% of the official reported landings. The assessment of this stock includes the estimate of non-reporting.
5. The main gears used are trawls in off shore waters and gillnets, longlines, handlines and Danish seines in inshore waters.
6. The fishery is an important source of revenue for a small number of Irish vessels.
7. The management regime in operation for this fishery includes inspections at sea and continuous surveys during the main fishing seasons.
8. The state of the cod stock appears to be strongly linked to the capelin stock, which has increased in recent years and is expected to be at an intermediate level in 2005. Capelin is an important source of food for cod and therefore a strong capelin stock is beneficial to the cod stock.
9. If the capelin stock is low it is thought this will have a detrimental affect on the cod both from a lack of prey items, but also due to increased predation from other species including harp seals.

North-East Arctic Haddock

FSS – ADVICE

FSS agree with ICES and STECF advice for this fishery recommends that, the fishing mortality should be reduced to below F_{pa} = 0.35 corresponding to catches of less than 112,000 t in 2006. Current fishing mortality is estimated at 0.37 above F_{pa} of 0.35.

CURRENT MANAGEMENT

- See North-East Arctic cod.

ADDITIONAL INFORMATION

1. The agreed TAC for 2005 is 117,000 t.
2. The dynamics of this stock has been driven by sporadic strong year classes that have led to wide fluctuations in SSB. Year classes from 1997 onwards are estimated to be above or at the long-term average.
3. The total catch taken from this fishery in 2004 was about 116,000 t. This related to an Irish catch of 38 t. The Irish catch is taken predominantly in the first quarter using longlines.
4. The main catches are taken by Norway and Russia. Small catches were taken by a number of other countries.
5. The main catches are taken by directed fisheries and also as by-catch in the fisheries for cod. Restrictions of haddock catches therefore depend on the management of North-East Arctic Cod.
6. The fishery, like that for the Arctic cod, is closely monitored and regulated.
7. The harvest control rule proposed by the joint Norwegian – Russian Fisheries Commission was evaluated by ICES and found not to be consistent with the precautionary approach.

North-East Arctic Saithe

FSS – ADVICE

FSS agree with the ICES and STECF advice that fishing mortality for this stock should be below F_{pa}. This corresponds to catches in 2006 less than 202,000 t.

CURRENT MANAGEMENT

- The 2005 TAC set by Norwegian authorities for Sub-areas I and II is 145,000 t. The EU has a quota for 2005 of 3,600 t.
- In addition to TAC regulations there are minimum mesh sizes, minimum landing size (increased in 1999) and closed area regulations in operation.
- Ireland is permitted to take a by-catch of saithe in the cod fishery.
- Management strategy for this stock is under development and should be implemented in the coming years.

ADDITIONAL INFORMATION

1. The SSB of this stock has been well above $\mathbf{B_{pa}}$ since 1994, showing good recovery after a long period of low stock size.
2. Fishing mortality is stable and has been below $\mathbf{F_{pa}}$ since 1996.
3. The total catch taken from this fishery in 2004 was 162,000 t.
4. The main catches were taken by Norway. Small catches were taken by a number of other countries.
5. The main fishery is prosecuted by trawls, purse seine and gillnets respectively.
6. The main catches are taken as by-catch in the cod fishery, in addition to a traditional targeted gill net fishery for spawning saithe.

Snow Crab in West Greenland

(NAFO Zone 1)

Fisheries Science Services

Limited information was available to FSS on this stock at the time the Stock Book was going to press.

The fisheries agreement between the European Community and the Government of Denmark and the local government of Greenland expires on 31/12/06. A mid term review was conducted in early 2004 and allowed for the introduction of EU quotas of 1,000 t of snow crab in accordance with scientific advice. Ireland's share of this EU quota was 125 t. This is Irelands first quota in the NAFO area. No Irish vessels participated in the fishery in 2004 and none have done so in 2005.

FSS ADVICE

The latest scientific advice allocates an EU quota of 1,000 t for 2005, with an associated Irish Quota of 125 t. The scientific advice for 2006 will be re-viewed when more information becomes available to FSS for this stock.

OVERVIEW

Snow crab (*Chionoecetes opilio*), also referred to as Queen crab, are found throughout the North Pacific and in the North West Atlantic from Greenland to the Gulf of Maine. They prefer deep, cold water conditions and are found on sandy seafloors at depths between 350 and 1,500 meters. Snow crab are fecund, but relatively late to mature. It takes 5 or 6 years for juveniles to grow to harvestable size. Their maximum lifespan is about 12-13 years. While harvest is limited to large males, mortality from capture stress leads to the death of up to 25% of all crabs released. Major predators of snow crab include groundfish, seals and other snow crab. Natural variability in recruitment , as well as increasing exploitation have lead to a wide fluctuation in Alaska's and Canada's landings. Snow crab has become very important to the fishing economy of eastern Canada as cod and other groundfish have declined. The fishery for snow crab is currently the third largest in Greenland waters (economically). The fishery takes place in areas 62-70^{0}N.

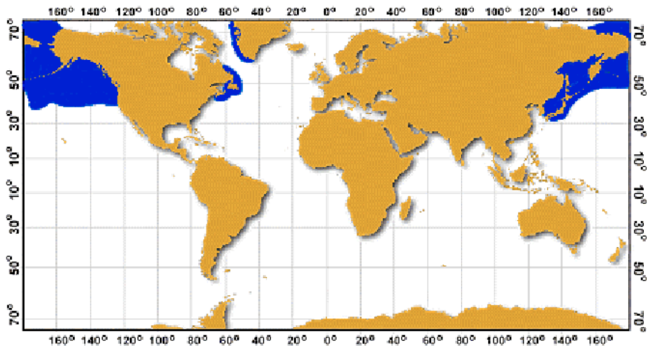
CURRENT MANAGEMENT

Greenland, a protectorate of the kingdom of Denmark, maintains a relatively small snow crab fishery on the west coast of the landmass. Snow crab are fished using large metal framed traps, baited with chopped herring. Most of Greenland's crab fishing fleet is small, local vessels and the fishery was established by the Danes in the late 1960's. Greenland's snow crab fishery is managed by Denmark who develop management plans, issue commercial fishing licences, inspect commercial landings and administer the Danish Fishing fleet. Management measures in place include permit requirements, quotas, gear limitations, area closures, sex and size restrictions.

STATE OF THE STOCK

The stock is considered to be under-exploited to fully exploited (FAO 1997). The biomass of snow crab is believed to be decreasing in Greenland waters. It has been exploited since the mid 1990's in the west Greenland inshore waters and since 1999 in the offshore waters. Total landings are estimated at 12,400 t in 2002, the majority coming from inshore waters (about 2,802 t from offshore waters). The TAC for 2003 was 27,000 t. CPUE has been declining from all offshore areas (Source: ICES NWWG Report, 2004).

Range of snow and Tanner crabs shown in blue. Map courtesy United Nations Food and Agriculture Organization.



2003 Landings for Offshore West Greenland

Offshore:	Vessels	tonnes	discard
G.halibut	17	9502	18
A.halibut	1	20	0
Shrimp	20	58623	9
Redfish sp.	14	2349	0
Roundn. grenadier	7	46	30
Cod	10	728	0
Inshore:			
Snow crab	12	2802	41
Scallops	4	2215	0

*vessels number included vessels from EU, Norway and Iceland

Sprat

(Sub-areas VI and VII)

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – ADVICE

Sprat fisheries display large inter-annual variation both spatially and temporally. FSS advise that the development of this fishery should be monitored, and better data collected to assess sustainable catch levels.

CURRENT MANAGEMENT

- There are no management regulations for sprat fisheries around Ireland.
- There are no TAC's for sprat in Irish waters.

ADDITIONAL INFORMATION

1. A number of vessels using mid water trawls take part in the fishery. The fishery takes place in shallow inshore areas mainly during autumn.
2. A summer fishery has also developed along the south coast. The 2004 catches from this area showed a large variation in size distributions and tended to be dominated by juvenile fish, resulting in poor market prices.
3. Most of the catch is frozen whole for export to the continental markets.
4. Irish sprat catches in Donegal, which were monitored in 2000, did not show any significant by catch of juvenile herring.
5. Fishing effort is generally concentrated along the south, mid-west and northwest coasts, with dry hold vessels taking the bulk, if not all of the current landings. However, due to quota restrictions and a continuation of poor market prices for Celtic Sea herring some of the larger RSV vessels now target this sprat along the south coast.
6. This fishery is set to become increasingly important in the Irish sector.
7. Better information is required to determine if other species such as herring are reported as sprat.

Catches (in tonnes) by country of sprat around the Irish coast 1996-2004. Irish landings are taken from EU logbook data, other countries' data from FISHSTAT database.

Country	Division	1996	1997	1998	1999	2000	2001	2002	2003	2004
Denmark	VIa	-	-	40	-	-	-	.	887	.
Ireland	VIa	269	1,596	94	2,533	3,447	4	1,333	1,060	97
Netherlands	VIa	-	-	-	-	-	-	.	.	.
Norway	VIa	-	-	-	-	.	.	.	.	.
UK	VIa	2,350	5,313	3,467	8,471	4,238	1,392	2,657	2,593	.
UK	VIIa	-	2	3	146	371	372	306	592	.
Ireland	VIIa	.	.	.	.	.	.	.	.	341
Ireland	VIIb	21	28	331	5	698	138	11	38	68
Ireland	VIIg	661	43	210	1,683	1,727	172	42	701	2264
Netherlands	VIIg	-	-	-	-	-	-	.	.	.
Ireland	VIIj	3,263	418	936	1,580	37	134	343	46	1802
UK	VIIj	-	6	-	-	-	-	.	.	.
Ireland	VIIa	-	-	7	25	123	7	.	3,103	.
UK	VIIa	-	-	-	-	-	-	-	.	.

Capelin in the Iceland, East Greenland, Jan Mayen area

(Sub-areas V and XIV and Division IIa west of 5°W)

Fisheries Science Services

FSS – ADVICE

FSS agree with the ICES and STECF advice for this stock that the fishery be closed unless the results of the March 2006 survey indicate a biomass estimate which exceeds the current reference point.

CURRENT MANAGEMENT

- The fishery is managed according to a two-part harvest control rule which ensures a minimum SSB of 400,000 t at the end of the fishing season.
- The TAC is set in two parts. The first part of the TAC, which applies for only the first half of the season, is limited to 2/3 of the total advised TAC for the entire season. The TAC for the remainder of the season is reviewed to ensure that the SSB at the end of the season will be above 400,000 t.
- Iceland, Greenland and Norway are currently responsible for the management of this stock.
- ICES has not evaluated the management plan with respect to its conformity to the precautionary approach for this stock.

ADDITIONAL INFORMATION

1. The assessment is based on acoustic surveys only. Results from the autumn 2004/winter 2005 survey program did not encounter any immature fish for the second year running.
2. The fishery is based on maturing capelin (2-3 group in the autumn), which spawn at ages 3-4 in March of the following year.
3. The main catches are taken by purse seiners from Iceland, Greenland and Norway for reduction to fishmeal.
4. Ireland has not participated in this fishery to date. However, this is set to change in the near future, as the EU has a quota allocation of approximately 121,000 t.
5. Future EU participation in this fishery will mean the provision of resources to help manage the stock.
6. ICES have highlighted this stock as a research priority in terms of ecosystem impacts of industrial fishing practices.

Sardines

(Sub-areas VII and Divisions VIIIa, b, d & e)

Fisheries Science Services

FSS – ADVICE

The southwest and Celtic Sea sardine fishery may increase in importance in the coming years due to the management restrictions placed on the herring fishery in this area. To date no quota restrictions apply to Sub-areas VII or VIII. However insufficient information exists upon which to base management advice.

CURRENT MANAGEMENT

- Currently no management or assessment regulations exist for sardine fisheries outside of ICES Divisions VIIIc or IXa.
- There are no TACs for sardines in Irish waters or indeed in ICES Sub-areas VII or VIII

ADDITIONAL INFORMATION

1. Total reported catch in 2004 was 110,833 t, divided as follows: 48% of the catches by Portugal, 31% by Spain and 16% by France. The remaining 5% catches are reported for division VIIa-j by Ireland, England & Wales and Germany and in divisions VIIIa,b by Ireland. Catches in VIIIc & IXa amount to 80% of the total sardine catches.
2. The main fishery takes place in the north part of the bay of Biscay (VIIIa – 13,850 t). A total of 82% of the catches are taken by purse seiners while the remaining 18% is reported by pelagic trawlers (mainly pair trawlers).
3. A French acoustic survey is routinely carried out each year in spring in the Bay of Biscay and information on sardine distribution and abundance is available, with a time series starting 2000 onwards. The spring 2005 survey estimates sardine biomass at 429, 521 t
4. Incidental catches of sardines are sometimes taken during the Celtic Sea herring fishery in the early Autumn.
5. Occurrence of this species appears sporadic, with strong inter-annual variation.
6. Little evidence exists for directed fisheries in inshore traditional herring grounds areas along the south coast by the dry hold fleet.
7. Irish catches of sardines are primarily taken in the Celtic Sea, areas VIIg and VIIj. A directed fishery takes place in the English channel and the western approaches (VIIe and VIIh). A small number of the large RSW fleet from Killybegs have participated in this fishery over several years, mainly in quarter 3.
8. The importance of this fishery is set to increase as further restrictions are imposed on the Celtic Sea herring fishery.
9. The Dutch industrial fleet operate a large fishery for sardines in Biscay area (VIIIa-b).
10. At present it is not possible to quantify the misreporting of sardines with other small pelagics, including herring and mackerel.

Table 1. Sardine catches in ICES areas VII and VIII 1985-2004

Area	Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
VII	Denmark	-	-	-	-	-	-	-	336	-	-
VII	Denmark	-	17	-	-	-	-	-	-	-	-
VII	Denmark	-	-	-	-	-	443	-	-	100	247
VII	Denmark	-	-	-	-	-	-	-	-	308	-
VII	France	.	.	.	.	.	.	.	.	.	.
VII	France	-	-	-	-	-	-	-	-	-	-
VII	Denmark	3,111	3,585	1,573	3,234	4,667	5,670	4,462	17,507	13,295	20,557
VII	France	2,089	2,570	965	2,586	1,219	1,128	1,963	1,777	1,135	1,285
VII	Germany						107	8	4		2
VII	Ireland										
VII	Netherlands					11	6		41	109	20
VII	Norway										
VII	Poland										
VII	Spain										
VII	UK	1,936	1,374	1,991	1,777	1,660	2,078	2,952	4,493	4,917	2,081
VII	Un. Sov. Soc. Rep.										
VIII	France	8,162	10,230	7,665	7,808	8,811	8,543	12,482	8,847	8,805	8,604
VIII	Germany										
VIII	Ireland										
VIII	Netherlands										
VIII	Spain							35	43	45	
VIII	UK										

Area	Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
VII	Denmark	-	-	-	-	-	-	-			
VII	Denmark	-	-	-	-	-	-	-			
VII	Denmark	238	645	-	12,008	2,421	988	-		.	742
VII	Denmark	-	-	-	-	124	-	-	.	.	.
VII	France	.	.	.	.	.	.	265	.	.	.
VII	France	-	-	-	-	.	-	.	.	26	.
VII	Denmark	9,365	751	1,124	2,308	1,069	694				
VII	France	1,282	1,563	3,346	1,974		1,667	9,360	8,642	12,307	8,302
VII	Germany	33		13	97	133	270	329	130	13	60
VII	Ireland					3,195	2,430	2,209	4,479	2,058	1,043
VII	Netherlands	107	48	414	1,644	5,097	6,541	426	1,815	6,543	
VII	Norway										
VII	Poland										
VII	Spain					8			10		3
VII	UK	7,133	7,304	7,280	6,873	4,815	4,353	10,375	7,858	4,358	2,150
VII	Un. Sov. Soc. Rep.										
VIII	France	9,877	8,604	10,706	9,778		11,301	10,982	12,963	10,852	10,158
VIII	Germany				68	11	38	135	4		
VIII	Ireland						162		114	1,865	1,412
VIII	Netherlands		24		26	9	32	321	18	67	
VIII	Spain				873	2,384	1,989		2,881	2,408	342
VIII	UK								276	68	

*preliminary from WGMHSA 2005
all other data from Statlant

Inshore Fisheries Overview

In 2004, the Irish inshore fleet landed some 17,500 tonnes of inshore species with an estimated value of € 32.4 million (source DCMNR). The main species (there are other less important species) taken by Inshore vessels, with associated value are given in Table 1. These fisheries are very important to coastal communities from a social and economic perspective.

The Irish inshore fleet is primarily made up of vessels under 12m in length and the majority of these fish within 6 miles of the coast. There are over 1,000 vessels of this size currently on the Irish fishing boat register with an additional 700 currently in the process of registration under the 'Scheme for the Licensing of Traditional Pot Fishing Boats in the Irish Inshore Fleet'. Approximately 50% of the fleet are open vessels less than 6 m in length and less than 1.5 Gross Tonnes (GT) capacity, powered by outboard engines. Inshore vessels comprise about 80% of the Irish fleet and provide 50% of the employment in the catching sector.

The vessels under 12m generally fish with static gear, primarily pots. These are used to target brown crab, lobster, shrimp, velvet crab, spider crab, crayfish, green crab and whelk. Drift netting for salmon is very important to the sector in June and July and this takes pressure off the lobster and crab fisheries in particular at that time. Gill netting for whitefish and mackerel and dredging for scallop, razor clams and other clam species is also locally important.

There are approximately 350,000 fishing traps/pots in the inshore sector. The most common trap type (over 200,000) is the soft eye creel, which is used to capture brown crab and lobster. Over 88,000 shrimp pots are used on the south and west coasts. Top entrance inkwell pots are used to target spider crab on the south west and increasingly on the west coast.

The management of inshore waters is largely under the control of the member state of the European Community

Table 1. Landings (weights and values) in 2000 and 2004 from certain open access "inshore" fisheries. Source: DCMNR and data collected by FSS.

	Landings (t) 2000	Landings (t) 2004	% change	Values (€) 2000	Values (€) 2004	% change
Surf clam	302	27	-91	817,750	51,640	-94
Cockle	9	207	2,106	6,199	445,409	7,085
Crawfish	42	80	92	589,279	1,784,059	203
Lobster	605	853	41	8,382,863	10,705,162	28
Green crab	268	268	0	390,495	70,834	-82
Palourde	1	2	100	5,585	11,000	97
Periwinkle	2,609	1,683	-35	2,821,677	2,518,437	-11
Razor clam	486	400	-18	1,106,903	1,364,330	23
Sea urchin	1	0	-100	1,300	0	-100
Shrimp	392	414	6	2,692,886	2,547,183	-5
Spider crab	163	180	10	162,758	180,418	11
Velvet crab	269	291	8	623,680	646,172	4
Whelk	4,474	4,845	8	2,200,403	3,309,135	50
Edible crab*	5,012	8,214	64	6,523,842	8,707,166	33
Totals	**14,633**	**17,464**	**19**	**26,325,620**	**32,340,945**	**23**

60% captured inshore

from 12 nautical miles and under exclusively national control from 6 nm to the shore. Certain EU technical conservation measures must be enforced within the coastal band unless the member state itself applies more stringent conservation regulations.

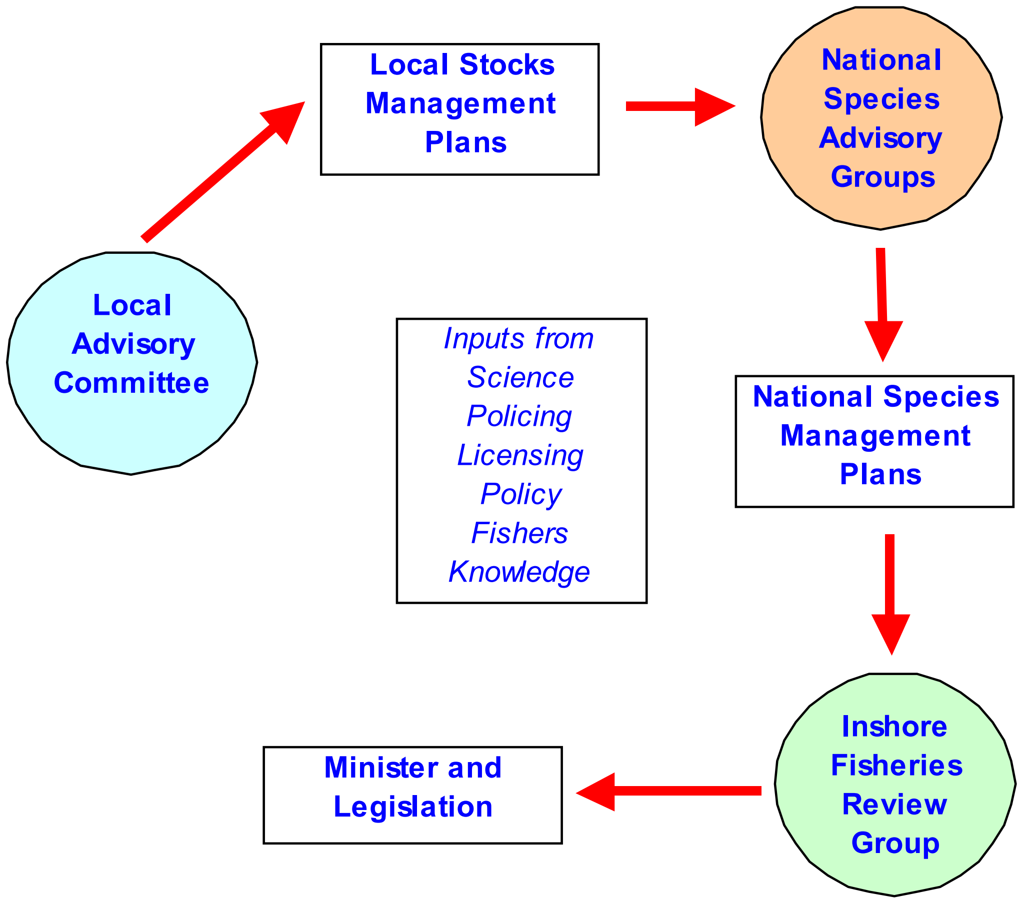
In addition to yielding a fin and shell-fish harvest, inshore waters also contain many important spawning and nursery grounds. Inshore areas are fished with a greater variety of gears than any other sea area. Some member states have attempted to confine access to their near-shore fishing grounds to smaller vessels. However, three have been reports that some Irish inshore waters are also exploited by very large vessels from time to time. These include beam, bottom and pelagic trawls which fish close to headlands.

July 2001 saw the launch of an initiative to put the management of inshore waters onto a more organized footing. A conference was organized by An Bord Iascaigh Mhara in Carna, Co Galway. Local fishers and international scientists with a track record administering inshore artisinal fisheries discussed the issues related to laying the foundation for a better regulated sector. This initiative was considered necessary because of the perceived over-fished status of the resource.

What has happened since then can be summarised using a number of indicators. In Table 1, the landings of a selection species which are regarded as the natural target of smaller inshore boats are compared in 2000 and 2004. Constituent species are treated individually in the Stock Book. These are not the only species captured in inshore waters and for some, like escallops, the allocation of landings to inshore and offshore/other nations' waters is too complicated for a brief comparison. At first glance, the bottom line suggests a stable and even gradually improving scenario. However, this could not be further from the truth and the comparisons of individual species over the brief period indicates the great turmoil which more accurately characterises what is going on. Effort is serially directed at individual species and inshore stocks tend to go from ' boom to bust '. Edible crab has contributed the greatest volume of increase in landings, but these stocks are showing signs of over-fishing. At a conference of industry and scientists organized by BIM in Galway in 2005, prominent buyers of crab warned that landings should be smaller in order to avoid marketing problems.

Figure 1. The New Inshore Framework

(Source Anon, 2005)



Under the Principle of Subsidiary national governments are now required by the EU to regulate their inshore effort. Ireland's fleet register for under 12 m boats has not been finalised. The recognition at the end of the last century that a large proportion of the fleet was unlicensed raised a dilemma: either the extant licensing regulations could be enforced or a new category of "polyvalent pot licence" (ppl) might be introduced, gratis, to regularise the situation. The latter course was selected but it is not known whether this regime will, in turn, be enforced.

In 2005 an institutional framework was devised to promote consensual policy making within the inshore sector (Anon., 2005). This framework concentrates on 15 species and over 25 stocks. It is comprised of a number of advisory committees who will work at local, regional and national level to produce fishery management plans (See Figure 1). Four National Species Advisory Groups (SAG's) will develop national management plans for crab (3 species), lobster (2 species), shrimp (1 species) and molluscs (8 species). Management Plans produced by the SAG's will be presented to the Inshore Fisheries Review Group (IFRG), who will review the plans prior to their consideration by the Minister. Connecting local fishermen and their representative organisations to the framework will be achieved mainly through the Local Advisory Committees (LAC's) comprising local fishermen who will be encouraged to produce local plans and present them to the SAG's. Ultimately the framework will provide integrated management by 'joining up' the relevant functions of the DCMNR, State agencies and the industry. There is little mention of enforcement in all this. It is essential that the management plans that emerge are effectively enforced and regulated.

Since the Carna conference in July 2001, two statutory instruments regulating inshore stocks have come into existence: SI 232 of 2003 concerns the regulation of shrimp fisheries and is not considered adequate for its purpose. SI No 179 of 2002 deals with the capture of crawfish by tangle net and needs to be rigorously enforced. The suite of EU technical conservation measures which regulate inshore stocks also need to be rigorously enforced. Of the sixteen inshore species/groups which are updated in this stock book, consistent and effective enforcement is applied only to bass for which the regional fisheries boards and individuals within DCMNR have successfully brought prosecutions over the past three years.

However easy it might be to be despondent, a new concept is gradually becoming established for the inshore sector. Until now the debate has been largely between scientists and fishermen who were often perceived as the only stake-holder group in coastal waters. Other voices are making themselves heard. Anglers who depend on the same fish stock as commercial fishermen are more numerous and potentially at least as influential. The Blair report published in the UK in 2004 (Anon., 2004) concluded that some local fisheries would be of greater benefit and generate larger profits to the nation if they were not exploited by commercial methods but left to recreational groups. Then there are the ancillary leisure industries which increasingly seek water-based attractions to fill their accommodation (e.g. boating). Furthermore the Community requirement for a healthy ecosystem which means setting certain fishery resources aside for conservation purposes need to be fully implemented.

References

Anon. (1999) Irish Inshore Fisheries Sector. Review and Recommendations. BIM, May 1999.

Anon. (2005). Managing Ireland's Inshore Fisheries. BIM 2005.

Bass on all Coasts

(Sub-areas VI and VII)

Dicentrarchus labrax

Fisheries Science Services

FSS – ADVICE

FSS recommend that bass should continue to be managed as an angler's rather than a commercial species. Bye-laws and regulations that are currently in place should remain and should be enforced. FSS also advise that efforts should be made to obtain wider protection through the European Union for the species which is seen to be vulnerable in Irish waters. There is a need for more data collection on bass in Irish waters but collection is difficult in the absence of a commercial fishery. All agencies involved with fisheries management and angling should continue to co-operate in the management of this species.

STATE OF THE STOCK

Irish bass landings are dominated by occasional large recruitments. Fish of 1989 and 1990 are still plentiful but the 1995 year class, which is robust among UK fish, is not strongly represented in Irish waters. The stock is seen to be greatly depleted since the 1960s and 1970s. Enforcement of the conservation regulations is taking place but the illegal fishery for bass continues although it is not possible to quantify it. There are no statistics on the clandestine trade in this species other than the records of prosecutions and seized illegally-caught bass from which the Marine Institute and Central Fisheries Board staff occasionally obtain scales and length measurements.

CURRENT MANAGEMENT

Bass in Irish waters are protected by a number of measures whose effect has been to extinguish the commercial fishery for the species. The Bass (Conservation of Stocks) Order, 1990, regulates the activities of Irish fishermen within ICES sub-areas VI and VII: fishing for bass is prohibited, the taking of bass using nets is prohibited, and Irish fishing boats must not have bass on board or engage in transhipment of bass. This order also sets the legal size of capture of bass at 40 cm.

Two further measures are renewed annually. The Bass (Restrictions on Sale) Order prohibits the sale or offer for sale of bass (other than bass which have been imported into the State) for a 12 month period. The Bass Fishing Conservation bye-law imposes a bag limit of two bass in any one period of 24 hours and it provides a ban on angling for bass during the spawning season (15 May – 15 June). They are renewed usually on or about 1st July.

These regulations have the effect of confining the exploitation of bass to anglers. Bass is the only marine fish species which is managed in this way in Ireland. These regulations are enforced by the Regional Fisheries boards in association with the Central Fisheries board and prosecutions are made. Some enforcement is also undertaken by DCMNR's fisheries officers.

ADDITIONAL INFORMATION

1. Ireland's bass are genetically part of a European panmixia. The origin of our broodstock is not established beyond doubt and it is possible that some, at least, are distributed as eggs and larvae to our coastal waters from spawning concentrations of the adults from the south coast of England/north west France. Once here, bass establish strong affinities with summer feeding areas to which they return in successive years. The distribution of bass has a southern emphasis. However, global warming has encouraged its northward extension and the removal of top predators like cod has provided a niche into which bass have been able to expand. The capture of bass by fishermen in Northern Ireland is becoming more frequent.
2. Bass is reserved for anglers in Ireland and in support of this policy commercial fishing for the species by Irish fishermen is not permitted. The only available indicators of bass abundance are the records which anglers maintain. One such log, from the Cork Angling Club, which has been in existence since 1963 demonstrates the decline in the species in recent years although a slight improvement in landings per angler has been evident over the past five years approximately (Fig 1).
3. Age composition of bass landings is dominated by occasional strong year classes (Fig 2) The 1989 year class was regarded in the UK as of similar strength to the 1959 one which dominated the catches of the later 1960s and 1970s; while the 1989 and 1990 year classes were well represented in Ireland, they were relatively short lived. A strong 1995 year class in Britain is not much in evidence in Ireland. The 1989 and 1990 year classes continue to exponentially decline in abundance but no single year class to date has proved as strong as either of them.
4. Strong pre-recruit year classes frequently carry through into the exploited year classes. The only clear signal for good year classes since juvenile surveys were undertaken by the Marine Institute (in association with the Central and Regional Fisheries Boards)

between 1996 and 2005 inclusive was 2002 and 2004 (Fig 3). Age at full recruitment in bass is approximately 7+.

5. When they occur strong year classes tend to extend across the species's geographical range although there have been some differences between Ireland and the UK [a detail which supports the view that bass in Irish waters should be regarded as a separate stock for management purposes]. In 2005, poor densities of bass were recorded from nursery areas in the south east of Ireland. The pre-recruit survey is conducted in the estuarine waters of the Slaney, Blackwater and Barrow catchments (Fig 4).
6. The southern distribution of bass in Ireland reflects its preference for warmer waters. 0 group bass are sampled in the last week in August; their longer mean lengths in August 2003 resulted from the very warm conditions of that summer; slower growth was observed in 2004 and the best growth in the series to date was recorded in 2005 (Fig 5). Growth success in the first year is believed to increase the strength of the year class recruiting to the fishery.

Sources of information: Report of the study group on bass ICES CM 2004/ACFM Ref. Lowestoft, England, August 2004

Fig 1. Landings of bass per rod day to shore anglers belonging to the Cork sea angling club, 1961 – 2004 inclusive.

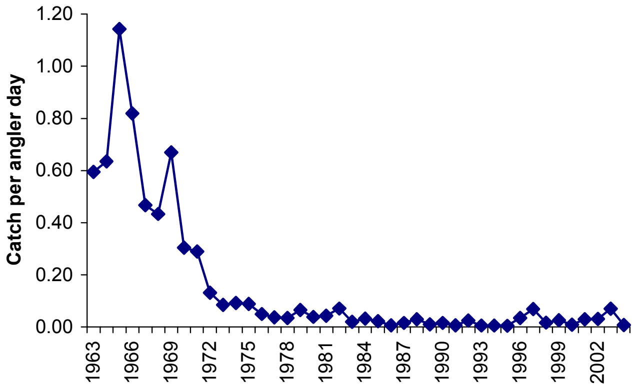


Fig 2. Age composition of bass landings to anglers, 1996 – 2004 inclusive. Three principal age groups are identified: 1989 and 1990 year classes, 1995-1997 year classes inclusive and all others.

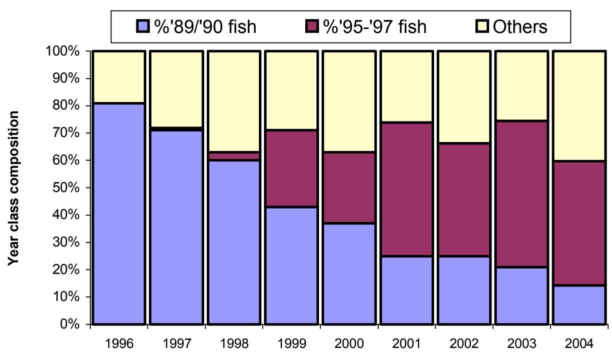


Fig 3. Juvenile densities of 0 group pre-recruit bass in south east Ireland, 1996 – 2005 inclusive. The horizontal line indicates the average for the period 1996 – 2005.

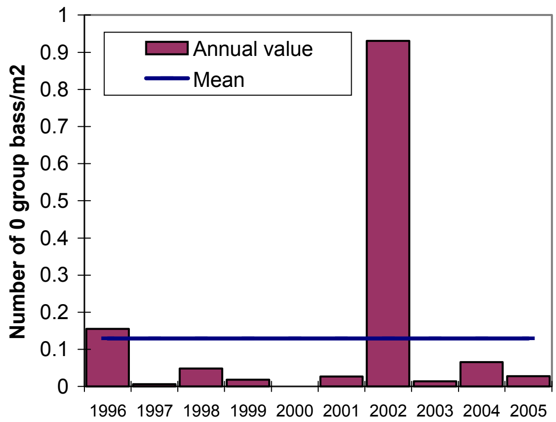


Fig 4. Locations at which the densities of juvenile pre-recruit bass were sampled in 2005.

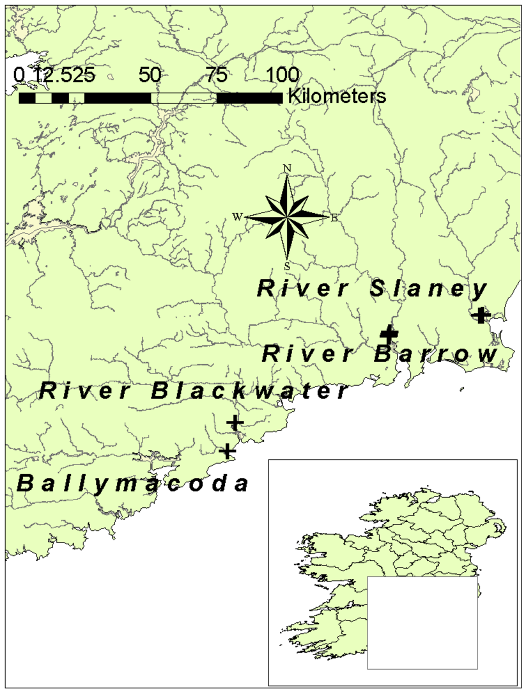
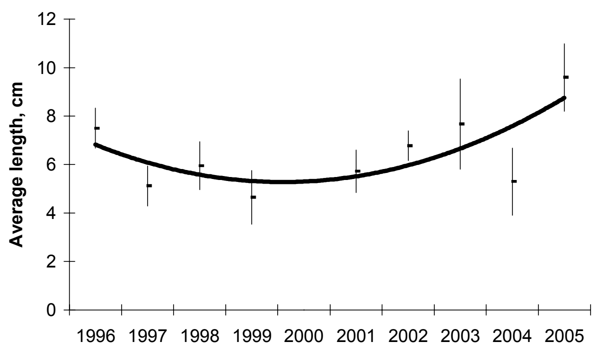


Fig 5. Mean length (+/- 1 s.d.) of 0 group pre-recruit bass sampled annually from 1996 – 2005.



Conger eel on all Coasts

(Sub-areas VI and VII)

Conger conger

Fisheries Science Services

FSS – ADVICE

In recent years an inshore longline fishery targeting conger eel has become established. Consideration should be given to whether this is preferable to conger as a recreational angling target species. The wider question of the need for conservation measures for this species is also worthy of consideration, particularly in the context of the disimproving status of freshwater eel, ***Anguilla anguilla*****.**

STATE OF THE STOCK

Unknown.

CURRENT MANAGEMENT

None.

ADDITIONAL INFORMATION

1. Conger eel is captured by the trawl fishery, in pots baited for larger crustaceans and it is an important component species of the recreational angling fishery. Since the mid-1990s there have been attempts to establish an inshore long line fishery for the species. In 2004, landings of 443 t, valued at €0.32 m were registered by Ireland (Fig 1).
2. Congers captured offshore are smaller in size and larger individuals, some of which have returned from spawning, probably in the vicinity of the Azores, can be much larger.
3. Landings of conger by western European nations from the Atlantic reached a peak in 1996 but from 1999 they have moved sharply downwards (Fig 2).
4. Landings to Ireland rose until 1998 when the long line fishery commenced.

Sources of information: O'Sullivan, S (2002) Biology of the conger eel in Irish waters. Unpublished Ph.D. thesis. National University of Ireland, Cork.

Fig 1. Landings to Ireland and average first sale price (€) per tonne of conger eel, 1990-2004. Source: DCMNR.

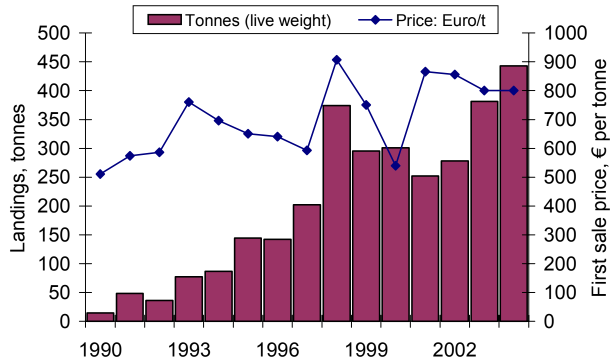
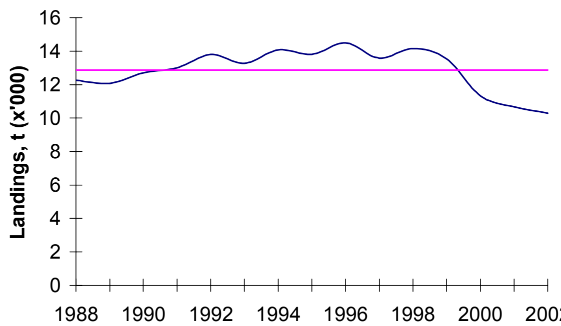


Fig 2. Landings of conger eel from the north east Atlantic, 1988 – 2002, the average shown as a horizontal line. Source FAO.



Common Cockle in the Irish Sea

(Division VIIa)

Cerastoderma edule

Fisheries Science Services

FSS – ADVICE

This fishery urgently requires a management initiative which recognizes the inherent restrictions on exploitation imposed by European conservation legislation. There is also a need to cap fishing effort which continues to expand in Dundalk Bay, probably resulting in damage to juvenile cockles by serially discarding the same animals. A close season should be put in place by regulation and enforced. A number of initiatives in cockle management have been used elsewhere, notably the UK and the Netherlands, and their implementation should be considered. They include periodic closures and rotation of fishing areas and TACs. The polyvalent system of licensing vessels means that capping effort is problematical.

STATE OF THE STOCK

Unknown. For as long as observations are available on this fishery it has been a low density shellfish producer. Currently it appears to be heavily fished and this source of mortality is additional to predation by overwintering birds.

CURRENT MANAGEMENT

- The only regulation which currently applies is the EC Directive 79/223 which specifies that water quality in areas from which shellfish are harvested, should be of a certain standard.
- There is no management regime, although attempts have been made by DCMNR to establish a voluntary code of conduct among fishermen to reduce conflict between suction dredging and artisanal rake sectors.
- The quality of cockle landings is good and many of the fishermen have voluntarily respected a close season in the spring months when settlement is taking place. Not all have however and increasing competition for the resource is likely to intensity fishing effort throughout the year.
- Over the past year efforts have been made to ensure that only licensed vessels work in this fishery but the fact that a polyvalent licence is sufficient for a dredger is unlikely to dampen effort.
- Initiatives are under consideration to set aside small areas of the Bay for mariculture which, in a public fishery, is unlikely to be as effective as restricting fishing to certain parts of the Bay.
- Two European Community Directives which are relevant to development in the Bay have been enacted. Council Directive 79/409, EEC, the Birds Directive, designated Dundalk Bay an SPA (Special Protection Area), because of its international importance as an over-wintering area for migratory birds. The Directive seeks to protect the environmental qualities of the Bay and to prevent disturbance of feeding birds. Council Directive 92/43, EEC, the Habitats Directive, also applies to the Bay which has been designated a cSAC (candidate Special Area of Conservation). Exactly how these directives (92/43 weakens some of the provisions in 79/409) will affect the cockle fishery has yet to be discovered. The current rate of exploitation within the Bay is probably approaching one third of the biomass, which has been used as an acceptable harvest regime in other cockle fisheries. However, the implementation of a conservation regime in this Bay is likely to reduce the permissible harvest: one estimate has given the biomass of cockles required to support winter migrant birds in a particular year as 1,500 tonnes.

ADDITIONAL INFORMATION

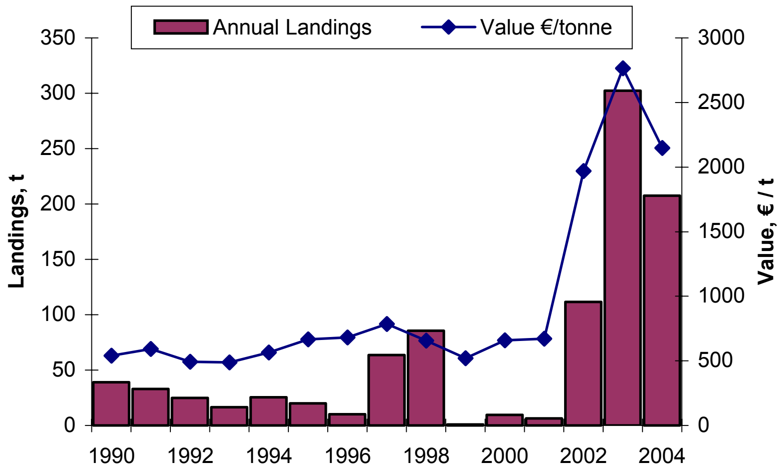
1. Landings and values per tonne of cockles to Ireland are given in Fig 1. Irish cockles are harvested almost entirely in Dundalk Bay and the development of an organized fishery there has both increased the tonnage put onto the market and increased the price; the product is of high quality.
2. The cockle fishery occupies the sand and mud flats of Dundalk Bay. Fishing by suction dredging is close inshore where some of the grounds are briefly accessible only at the highest spring tides. Landings in 2004 showed a decline on those in the previous year. Serial discarding is believed to damage juvenile and undersized discards and it is likely to have long term consequences for the stock.
3. The latest interest in commercial fishing in Dundalk Bay is traced to 2001 when 3 vessels dredged almost 9 tonnes; the following year an estimated 2-3 boats and a small artisanal rake fishery accounted for almost 169 tonnes. In 2003 the number of dredgers rose to between 8 and 10 and landings of 177 tonnes were recorded from these. Landings are incomplete for 2005 and difficulties are anticipated in arriving at a precise total because of vessel licensing and other problems in the fishery.

4. The life span of cockles in the Dundalk fishery ranges up to 8+ but the majority belong to the 0 and 1 year classes (Fig 2).
5. The cockle stock was surveyed in Spring 2004. Preliminary estimates suggest the bay contained approximately 1,650 tonnes of cockles numbering 143 million. Densities of cockles are generally low at this time of year due to the depredations of overwintering birds, particularly oystercatcher (*Haemotopus ostralegus*).
6. The resource is currently (2005) regarded as depleted by fishermen working in Dundalk Bay.

Sources of information.

Edward Fahy, Jim Carroll and Sean Murran (2005) The Dundalk cockle *Cerastoderma edule* fishery in 2003 – 2004. Irish Fisheries Investigations No 14: 16 pp.

Fig 1. Landings and first sale value of cockle 1990 – 2004 (Source: DCMNR).



Razor Clams on Mainly East Coast

(Division VIIa)

Ensis siliqua

Marine Institute
Foras na Mara

Fisheries Science Services

FSS– ADVICE

Razor clams are slow growing and late maturing and successful spatfalls may be erratic. Special and urgent consideration should be given to devising a management policy for them. Controls in this fishery should include closed areas and fallowing periods. To monitor progress in this and other bivalve fisheries, a combined logbook/gatherer's document should be introduced and its use should be enforced.

Methods of harvesting have improved but they need to be reviewed and possibly controlled to limit incidental damage to associated fauna as well as to the target species. Diving for razor clams is currently prohibited by law but there are reasons for revising that prohibition, under stringent controls. Divers would be more selective in what they take back to the surface and they would cause less disturbance to the substratum. Divers would also take a more marketable and less stressed animal from soft substrata where dredging can cause considerable damage to the shellfish, lessening the prospect of depuration resulting in its rejection by buyers.

The market for razor clams is small and there is a case for restricting landings at times when demand is low in order to raise prices and to prevent dumping of unwanted product.

STATE OF THE STOCK

Currently, there are virtually no landings to the west coast. The larger east coast beds of *E. siliqua* in class A waters had been fished down to point there harvesting became uneconomic. Improving technology enabled some of them to be revisited. In the early years of this fishery (1997 –1999) it was feasible to trace all landings from the Gormanstown bed which was the only one open to exploitation; since then, other areas have been opened to harvesting some of them in waters of poorer quality from which shellfish must be cooked before export.

Small razor beds for the species *Ensis arcuatus* on the western seaboard have been depleted and few *E. siliqua* are currently harvested there.

CURRENT MANAGEMENT

Razor clams are subject to size limit by EU regulation (Annex XII of 950/98). The minimum size is 10 cm. Harvesting of razor clams is permitted only in waters whose quality is specified in Council Directive on the quality required in shellfish waters 79/923 EEC. The principal beds for E. siliqua on the east coast are shown on Fig 1.

ADDITIONAL INFORMATION

1. Two species of razor clam, *Ensis siliqua* and *E. arcuatus*, have contributed to the landings, *E. arcuatus* coming from the Atlantic coast. The fishery for them commenced in the late 1990s, rose of a peak in 2000 and declined, although landing statistics for part of 2003 exceed those of the year before. The value of landings in 2004 was €1.4 m (Fig 2).
2. The two species have distinctive habitat preferences, *E. arcuatus* frequenting coarse (maërl) sand, *E. siliqua* living in finer sediments.
3. Locally, *Ensis* spp. are frequently the most abundant bivalves. Harvesting them has been carried out by dredging and although techniques have improved since the first blade or harrow fluidised bed dredges were used in the late 1990s, the technique still causes considerable incidental damage and disturbance to razor clams and associated fauna. Rejection and discard rates as a result of breakage and bruising have declined from the estimated 60% which used to accompany the early dredgers but the consequences of fishing by these methods are not completely quantified.
4. The harvestable proportion of a razor clam bed can be as high as 90% of the invertebrate biomass.
5. Both species of razor clams are long lived, longevity extending to 16 – 18 years. Growth becomes asymptotic after 10 years. The spawning period appears to be extensive although investigations have revealed there is only one spat fall per year in the case of *E. arcuatus*.
6. FSS staff have made occasional observations on both west and east coast razor clam beds but most investigative effort has been concentrated on the Gormanstown bed (Fig 3) which was the original focus of effort for fluidised bed hydraulic dredging in 1997. Net removals from Gormanstown are shown in Fig 4.
7. As in the case of most razor clam beds, the clams themselves make up most of the biomass of the bed and at Gormanstown the Shannon-Wiener index of

macroinvertebrate diversity (Fig 5) has shown little variation as a result of dredging there. It rose in value once dredging commenced and has since declined although, in the eight years during which observations continued, the index has not regained the original low levels.

8. Applying an ALK devised for *E. siliqua* to length frequencies of sampled clams at Gormanstown (Fig 6), the older age groups which were removed by dredging have not yet been replaced and there is evidence of only one sizeable spatfall, although spatfalls may be difficult to identify because they are dependent on prevailing wind conditions which may disperse them to areas which are not sampled. However, razor clams are typical K-selected species and populations of such species are characterised by relatively fewer offspring.

Sources of information:

DCMNR (2005) Molluscan shellfish production areas, sample points and co-ordinates for biotoxin and phytoplankton samples. Mimeo.

Fahy, E and J Carroll (in preparation) – working title - Medium term consequences of hydraulic dredging for the Gormanstown razor clam bed, Co Meath, Ireland.

Fig 1. Location of razor clam dredging areas in the Irish Sea (source: DCMNR).

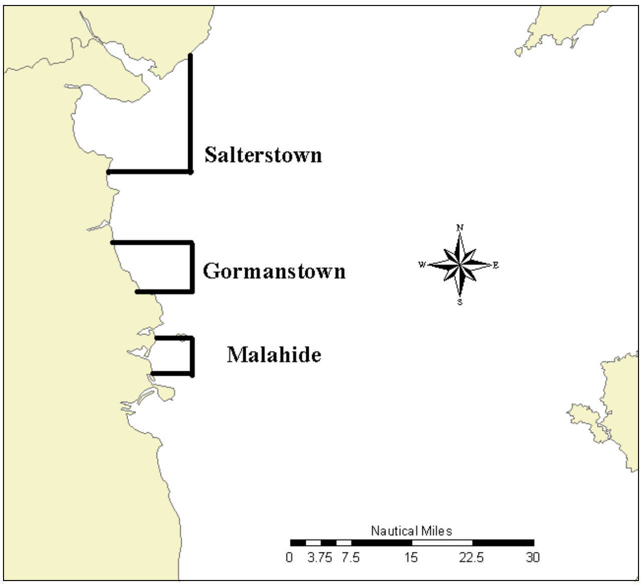


Fig 2. Landings and price per 100 kg of razor clams since 1997 when the hydraulic dredge fisheries commenced (source: DCMNR).

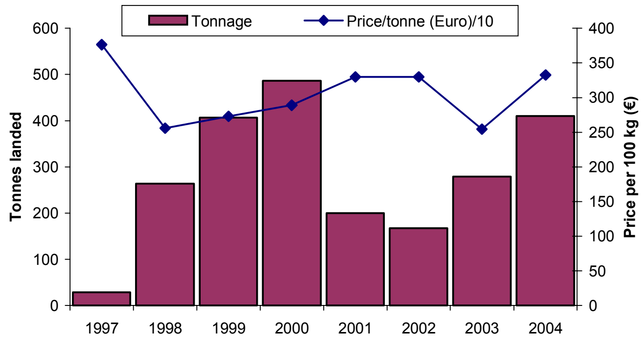


Fig 3. Map of the Gormanstown razor clam bed showing (dots) the location of landings deciphered from gatherers' dockets and the location of samples collected by the dredge fishery and attributed to the bed. The rectangular area indicates where investigations have been concentrated.

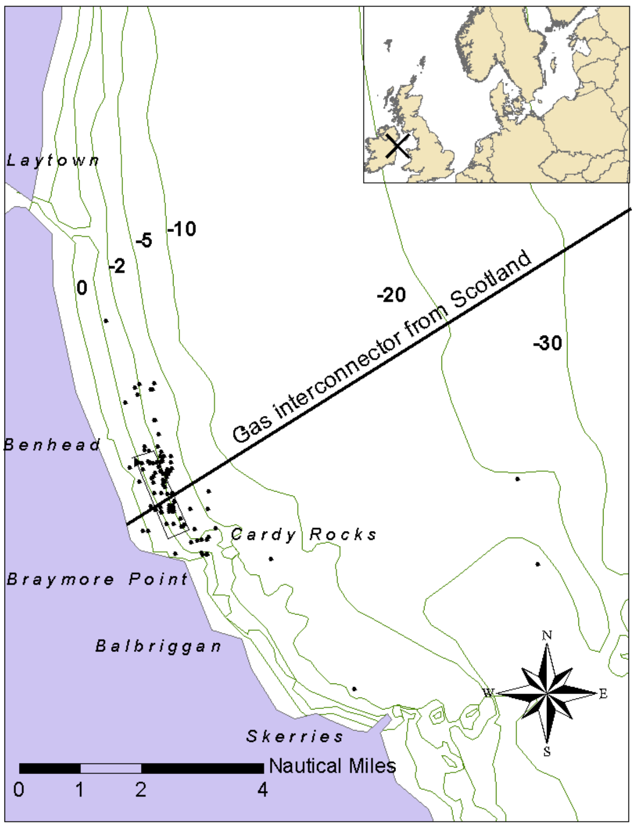


Fig 4. Net removals of *Ensis siliqua* from the Gormanstown clam bed, 1997 – 2004 inclusive.

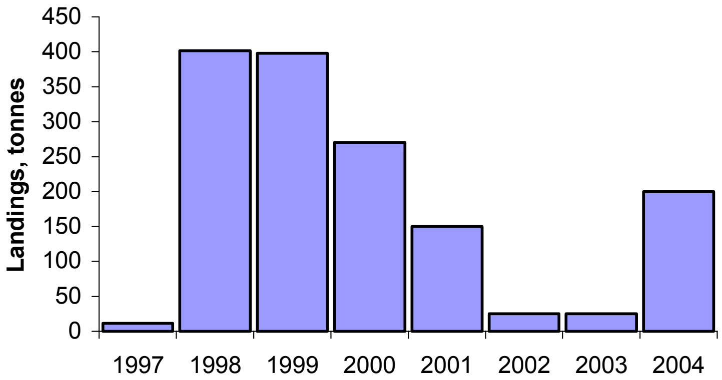


Fig 5. The Shannon-Wiener index of macroinvertebrate diversity on the Gormanstown bed, 1998 – 2005 inclusive.

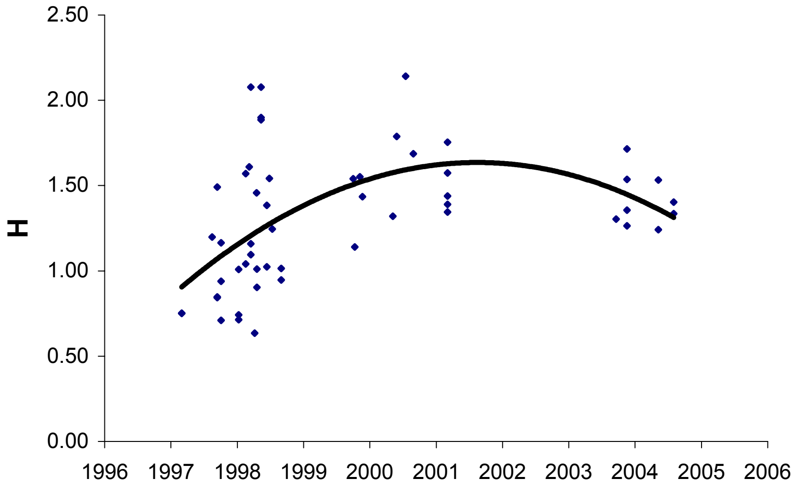


Fig 6. Age frequency distribution of *Ensis siliqua* from the Gormanstown bed, 1998 – 2005 ,omitting 2003. More than 10% representation by numbers is emphasised.

ges	1998	1999	2000	2001	2002	2003	2004	2005
15+	8	6	7	8	3		3	1
14	11	9	11	11	4		6	3
13	9	7	7	9	5		6	6
12	10	8	10	10	5		8	4
11	9	7	8	10	7		9	9
10	6	4	5	6	2		5	2
9	8	7	6	9	11		12	15
8	7	5	5	7	10		9	13
7	4	3	3	4	6		6	8
6	7	6	5	8	16		11	18
5	6	8	5	8	15		6	13
4	4	7	3	4	9		4	6
3	4	8	8	3	5		3	2
2	5	6	15	3	1		9	0
1	1	6	3	1	1		3	0

Surf Clams on South and West Coasts

(Sub-areas VII)

Spisula* mainly *solida

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – ADVICE

The minimum size limit should be enforced. In fact, there is little incentive for not doing so because smaller animals obtain very low prices. However, such is the state of dredge fisheries at present that even sub-sized animals sometimes find a market. Species like surf clams form small beds that would ideally be managed locally by fishermen who exploit them when an optimal size has been reached and administrative arrangements might be usefully directed at fostering the circumstances in which co-operative enterprises of this kind flourish. Surf clams are easily aged so that occasional surveys should serve to predict when harvesting is appropriate. A simple box dredge is the ideal way to exploit these animals although repeated dredging of a bed will cause mortalities among non-target age and size groups. It is important that fishermen's groups should insist that appropriate bar spacing on their dredges is introduced and that dredges are not overloaded to the point where this sorting mechanism does not operate.

The limited circumstances in which surf clams proliferate are vulnerable to environmental change, particularly to harbour and channel dredging operations when spoil clogs the interstices of the coarse sand in which the clams live and this should be noted where EISs are being compiled.

STATE OF THE STOCK

Spisula fisheries exist as isolated stocklets. With the exception of one, all of those examined to date had previously been exploited and the growth curves of the animals displayed characteristics of fished, some of them heavily fished, populations. This resource is a relatively limited one on which is being directed excess capacity from other dredge fisheries.

CURRENT MANAGEMENT

- The only management measure is an EU regulation (Annex XII of 850/98) specifying a minimum size limit of 25 mm in length. Some attempts have been made to manage these fisheries locally by fishermen staying away from beds while they recover from heavy exploitation or beds which have had a large recruitment below harvest threshold size.
- Harvesting of *Spisula* is permitted only in waters whose quality is specified in Council Directive on the quality required in shellfish waters 79/923 EEC.

ADDITIONAL INFORMATION

1. Surf clam landings in 2004 totalled 26.6t valued at €1.9/kg, €50,540 (Fig 1). This is the second successive year on which such low prices, the lowest since 1990, were obtained and they probably reflect the low quality of the product which is now sourced in over-fished stocklets.
2. Fisheries for surf clams developed as an offshoot of the razor clam fishery in the late 1990s.
3. Beds of these interstitial clams so far discovered are small in extent, c 1-2 km^2 or smaller They usually occur in special circumstances of strong current and in a medium or large sand grains composed of shell or *Lithothamnium* sand (known as *Spisula* sand) which can be vulnerable to clogging by siltation.
4. To date *Spisula solida* is the only species encountered in the commercial landings.
5. The clams have a life expectancy of up to 10 years; they reach legal size at about age 3 – 4. Most rapid growth is made in the early years and relatively little weight is added in later ones. Surf clams require fewer years in which to reach asymptotic size than, say, razor clams, so that planning a phased harvesting regime is more realistic for *Spisula*.
6. It is feasible to age the animal relatively easily using external shell sculpture making verification of predictions about year class strength straightforward (Fig 2).
7. A disadvantage in this species (and possibly other interstitial species also) is irregular spatfalls which undermine continuity of supply. Factors which influence spatfall are unknown but the small size of the beds in which the species usually occurs may be a factor.
8. Fisheries for surf clams should ideally be managed on a co-operative basis.
9. Clam dredges should be equipped with a bar spacing of a minimum 11 mm to accommodate the size limit.

Source of information: E Fahy, J Carroll, M O'Toole and J Hickey (2003) A preliminary account of fisheries for the surf clam *Spisula solida* (L) (Mactracea) in Ireland. Fisheries Bulletin No 21; 27 pp.

Fig 1. Landings and first sale price of surf clams 1990 – 2004 (Source DCMNR).

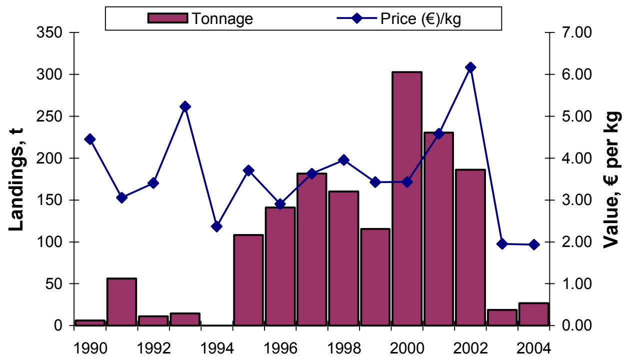
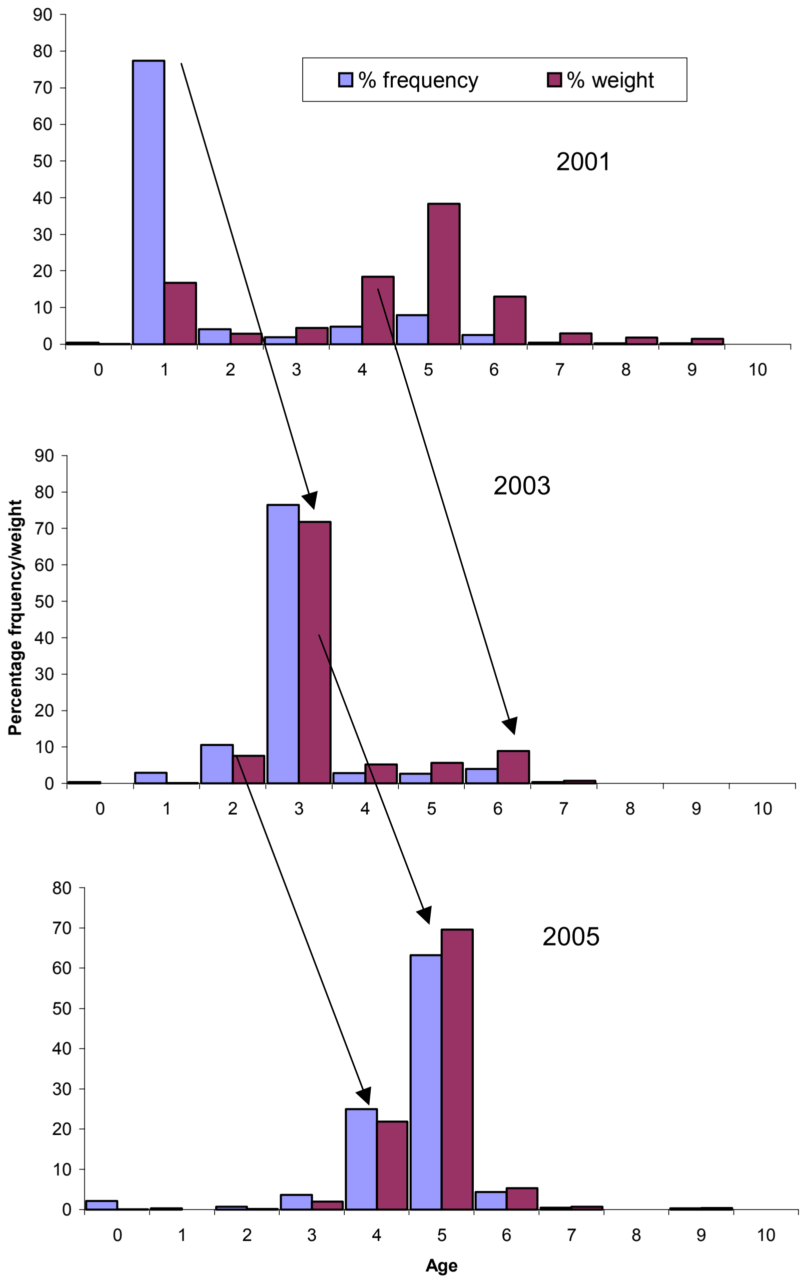


Fig 2. Age and biomass composition of a Spisula bed in Waterford Harbour in 2001, 2003 and 2005 (samples from 2005 kindly contributed by BIM). Strong year classes are traced over the period.



King escallop and Queen escallop

Pecten maximus and Aequipecten opercularis

Marine Institute
Foras na Mara

Fisheries Science Services

King escallop is a typically inshore species, harvested in sheltered bays. In the 1970s escallops were fished close to the Irish coast but in the following two decades the fleet sought these shellfish progressively further afield and some of the most recently exploited stocks are closer to the coasts of Britain and France than to Ireland. The size and distribution of this fishery changed dramatically in 2005 following the curtailment of fishing in sub-area VII.

The latest landings for this species are summarised in Table 1. In 2004 landings were down on the previous year.

Landings of king escallop have averaged 1,400 t annually since 1999 but the price per tonne in 2003, €2,000 (a 40% reduction on 2001), was the lowest since 1992 (Fig 1) and it 2004 it had not improved, probably as a result of the long steaming time between fishing grounds and market -causing the landed product to be in poor condition. The total value of king escallop landings in 2003 was €2.91 m.

Queen escallop landings have fluctuated but in 2003 39 t, valued at €46,511 were made, mainly from the Malin Head and Southern Irish Sea fisheries (Fig 2). In 2004 110 tonnes were landed.

CURRENT MANAGEMENT

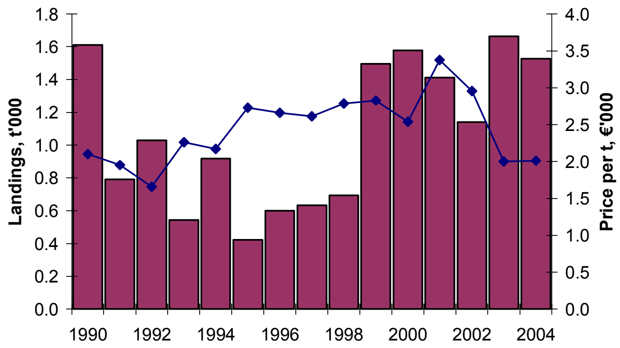
Escallop landings are animals of greater than 100 mm maximum width by EU regulation (Annex XII of 850/98). Harvesting of escallops is permitted only in waters whose quality is specified in Council Directive on the quality required in shellfish waters, 493/91 EEC.

The maximum length of the shell of queen scallop must be a minimum of 40 mm to conform with EU regulation (Annex XII of 850/98).

Table 1. Landings of king escallop (t) by Irish vessels, 1995 - 2004. Source, DCMNR

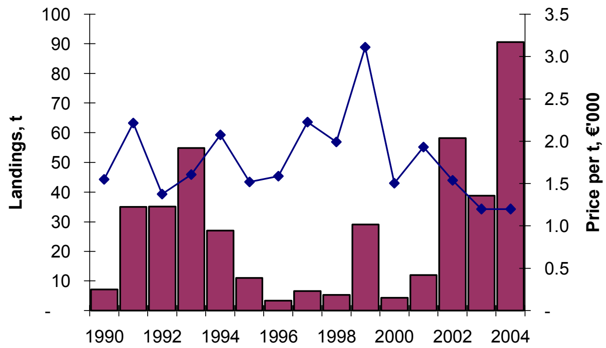
Port	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Totals
Achill				0.5						0.6	1.1
Arklow	1.5			1.5	13.0	12.0			1.0		29.0
Baltimore	-				0.1				4.4		4.5
Bantry	2.2							2.7	4.9		9.8
Carna							4.8		25.0	3.0	32.8
Castlegregory							0.2				0.2
Castletownbere							2.9	0.9	25.0		28.8
Crosshaven				0.7							0.7
Cleggan			0.6								0.6
Cobh	0.5	1.1	1.6	1.4	0.7	1.2	1.3	1.5	2.5	0.5	12.3
Duncannon	0.5			-	59.7	116.7	74.1		4.0	78.0	333.0
Dingle				13.8	69.0		64.3	12.4	14.5	8.9	182.9
Downings							37.7	53.2			90.9
DunmoreEast	147.6	88.6	168.9	32.9	292.0	198.3	72.4	44.3	70.8	50.5	1,166.3
Dunmanus								2.5	5.0		7.5
Galway					0.3						0.3
Garnish/Travara							1.4				1.4
Glengariff								0.8	0.5		1.3
Greencastle					0.6	4.7	22.8	36.0	13.9		78.0
Howth	8.2		0.2	53.0	137.2	77.8	62.0	74.5	100.5	39.9	553.3
Kenmare							0.3	1.4	33.7		35.4
Killybegs						0.6					0.6
KilmoreQuay	0.1	248.9	336.6	451.6	745.5	870.2	368.7	608.2	734.3	545.3	4,909.3
Rosslare	2.1	-	2.4	4.3	5.7	82.1	356.1	99.7	98.7	250.4	901.5
Rossaveal		0.1	6.2	12.3	38.1	-	34.9				91.6
Sneem							3.2	6.0			9.2
Schull									4.4		4.4
Tully/Renvyle							0.4				0.4
Valentia							13.8		17.5		31.3
Waterford	11.0	3.5	12.4	8.6	90.9	31.0	20.3	76.0	50.9	85.6	390.3
Westport							5.5				5.5
Wicklow				2.5			1.2				3.7
France									5.0		5.0
UK		-	0.1	10.7	37.6	13.1	262.1	119.0	447.3	344.4	1,234.3
Netherlands										53.0	53.0
Spain									0.1		0.1
Belgium										0.4	0.4
Totals	173.7	342.2	529.0	593.8	1,490.4	1,407.7	1,410.4	1,139.1	1,664.0	1,460.4	10,210.7

Fig 1. Landings and price per tonne of king escallop, 1990 – 2004 inclusive



(Source: DCMNR)

Fig 2. Landings and price per tonne of queen escallop, 1990 – 2004 inclusive



(Source: DCMNR)

South east escallop fisheries

Divisions VIIa, g.

Pecten maximus

FSS ADVICE

FSS advise that a precautionary approach which would protect spawning stock in this fishery should be implemented. Although knowledge of this stock is currently limited, it is assumed that increased recruitment would result from a larger biomass (although this relationship does not always hold).

The management priority in this fishery is reducing fishing effort (through reducing the number of dredges per vessel, reducing the number of boats and/or reducing the number of days at sea). Reducing the catch in the short term as through the operation of regional, individual or fleet sector quota is another approach.

Higher growth rates of scallop in smaller inshore grounds suggests that these might be suitable places into which translocation of juveniles for on-growing might be attempted. Different minimum landing sizes for different stock(lets) and area closures might be conducive to higher yield per recruit.

STATE OF THE STOCK

The amount of gear per vessel has been increasing. The fishing power and effort are currently in excess of what the resource can sustain. Fishing mortality and fishing effort are regarded as currently too high and unsustainable.

ADDITIONAL INFORMATION

1. This fishery lands the majority of escallops caught by the Irish fleet. Total landings from the south east escallop fisheries to Ireland in 2004 accounted for 1,060 t, 64% of all landings in that year.
2. Fishing activity of the south east escallop fleet increased between 1995 and 2002. Pre-1997 only 103 dredges were operated; these increased to 198 between 1997 and 2000 and in 2002 the number was 528 although not all of the increased effort went into VIIa, g.
3. In 1970 only two small inshore grounds were fished but by 2002 fishing activity was distributed throughout the southern Irish Sea, western English Channel and north west of Brittany [VIIe, f, h] (Stock Book, 2003).
4. Catch data examined from two sources, E.U. logbooks and private diaries, provided conflicting results. The diaries indicated significant reductions in escallop per effort post-1999. As a result of inshore depletion, escallops have been sought offshore and further south.
5. The following findings emerged from research conducted in 2001 on the grounds closest to Ireland (B&H, Tuskar, Ship and Barrels):
   a. Highest densities of commercial and undersized scallop in an area directly south of the Waterford estuary, to a distance of 30 nm offshore.
   b. Growth rates were highest on the inshore grounds and in the eastern part of the fishery.
   c. Age-based cohort analysis indicated an average F on commercial class sizes of 0.81, an exploitation rate of 55%.
   d. Landings were dominated by escallops of 4-6 y.o. and some 3 y.o. had also recruited.
   e. Stock size (ages 3-10) was estimated at 52.7 m.
   f. Recruitment appears to take place regularly in this fishery.
   g. The stock(lets) in different parts of this fishery have different characteristics suggesting that individual sub-area management strategies might be effective.

Source of information: O Tully, A Hervas and J Hickey (2002) Fishing activity and stock assessment of scallops off the south east coast of Ireland 1995-2002 BIM, Dublin

South west escallop fisheries

Divisions VIIj.

Pecten maximus

FSS ADVICE

FSS advise that management objectives be established for local fisheries in this area. Effort should be constrained until it can be established that the fishery can sustain its expansion. Small closed areas may be the most appropriate management tool.

STATE OF THE STOCK

Preliminary assessments in 2002 suggested this stock was fully exploited. Other than that the state of the stock is unknown. There are no data on recruitment in these fisheries and landings data are only recently available.

ADDITIONAL INFORMATION

1. Escallop fisheries in VIIj landed 9 t in 2004.
2. Preliminary estimates of fishing mortality in 2002 indicated that F was between 0.63 and 0.68; $\mathbf{F}_{max}$ was 0.55 and F0.1 was 0.30.
3. There were uncertainties in the construction of a catch curve concerning the catchability of older escallops which might have led to current fishing mortality being over-estimated.
4. Yield per recruit analysis suggested that reducing fishing mortality by c 50% to F0.1 (a precautionary level) resulted in a 6% reduction in yield and a 50% increase in spawning stock.

Escallop off the North Coast

Division VIa

Pecten maximus

FSS ADVICE

Further information should be sought on the bionomics of this stock

STATE OF THE STOCK

Unknown.

ADDITIONAL INFORMATION

1. Survey data from BIM in 2002 indicate commercially exploitable stocks north east of Malin Head in 40 –85 m of water, centred off the north and extending eastwards on the Antrim coast. The Malin Head stock is possibly a component of a larger metapopulation whose sources of recruitment are not known.
2. The fishery has been irregularly exploited in recent years; no landings into Northern ports were recorded in 2004.
3. In 2002 more than 60% of scallops caught were 4 – 5 years old.

Queen escallop in the Irish Sea and off the North coast.

Divisions VIa and VII a

Aequipecten opercularis

FSS ADVICE

FSS recommend the collection of further data on the biology and distribution of this species.

STATE OF THE STOCK

Unknown

ADDITIONAL INFORMATION

1. The majority of queen escallops landed in 2002 were harvested from a new directed fishery off Malin Head (96 t were landed into Greencastle in 2004) and from the southern Irish Sea (although less than 1 t was landed into Howth and Waterford combined in 2004).
2. Surveys conducted by BIM in 2001 recorded queen scallop in discrete patches separated by few or no scallops over a wide area in the Irish Sea.
3. Average size of queen scallop sampled was 60 mm shell height. This corresponds approximately to 63 mm shell length.
4. Recruitment was complete at age 3 and animals of this age made up 45% of the catch in 2001.

Palourde on West Coasts

(Divisions VIIb, j)

Tapes decussates

Marine Institute
Foras na Mara

Fisheries Science Services

FSS– ADVICE

FSS advise that further data should be sought on the biology and ecology of this species.

STATE OF THE STOCK

Unknown. Occasionally strong spatfalls may be in part responsible for irregular landings.

CURRENT MANAGEMENT

There is a minimum size limit of 40 mm length (annex XII of EU regulation 850\98).

ADDITIONAL INFORMATION

1. Landings of palourde fluctuate considerably from one year to the next (Fig 1); the species is a valuable one. Between 1990 and 2001, first sale prices have ranged between €3.9 and €5.6 per kg. From 2002 no landings have been registered by DCMNR. It is possible that small landings were overlooked in the collection of statistics. Industry sources report approximately 1.3 tonne landed in 2003 valued at €6,500. In 2004 less than 1 tonnes were landed (provisional). It is supposed that much of the exploitation of this species is for personal consumption which is, hence, not recorded in national statistics. Landings and first sale prices from 2002 are based on occasional information.
2. In 1992 288 t were landed, with a first sale value of almost € 1.91m.
3. Palourde are interstitial bivalves which are dug out of the sand at low spring tides.
4. Growth data were obtained from commercial samples in 2003. The L_{inf} at 47.1 mm, is not far above the minimum size limit of 40 mm in length.
5. Age classes represented in the commercial landings ranged between 2 and 14. Before age 6 they were not representatively sampled.
6. Occasional surveys of this species suggest it is limited to small patches (<0.5-1.0 hectares) of appropriate sediment grades which are accessible at not necessarily spring tides. Many of these occurrences are probably well known locally. The density distributions of palourde within two of them in Co Kerry in 2005 are shown in Fig 2. In one, the average weight of palourde was 13.3 g and the average age 4.3 years; in the other the average weight was 13.2 g and the average age 2.4 years.

Fig 1 Landings (t) of palourde 1900 – 2004 and average price (€) per tonne. Source: DCMNR until 2001, occasional industry sources afterwards.

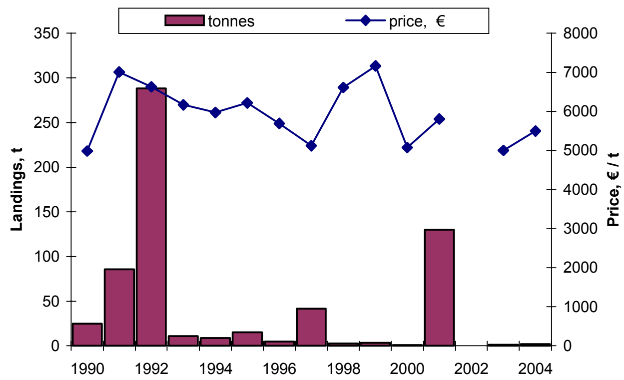
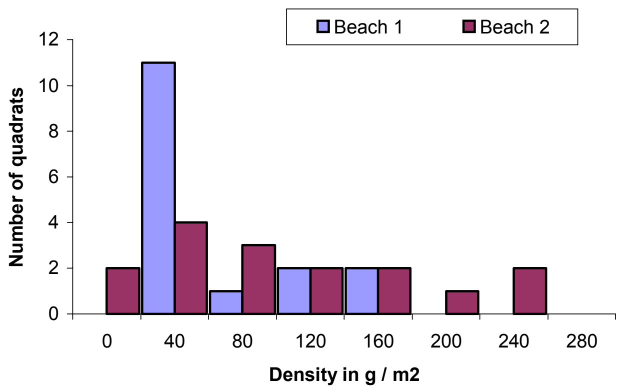


Fig 2 Frequency density distribution (g / m2) of palourde on two Co Kerry beaches in 2005.



Purple Sea Urchin on West Coast

(Divisions VIa, VIIb, j)

Paracentrotus lividus

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – ADVICE

Harvesting of this species should only be by special permit, referring to a specific and detailed location, issued after considering the status of the stock in question and specifying the amount to be harvested. The operation should be supervised. This species should continue to be listed among the landings recorded by DCMNR.

STATE OF THE STOCK

- Landings of *Paracentrotus lividus* declined from 375 tonnes in 1976 and for 2003 and 2004 DCMNR did not list the species among the landings in these years (Fig 1); this may be due to under-recording because some, probably no more than 3 tonnes nationwide, are believed to have been harvested annually in the last two years; the trend in landings represents its depleted status.
- The species is widely regarded as locally extinct in tidal locations and some pools which held this species in the recent past do not do so any longer. The extent and status of sub-tidal populations is not known.

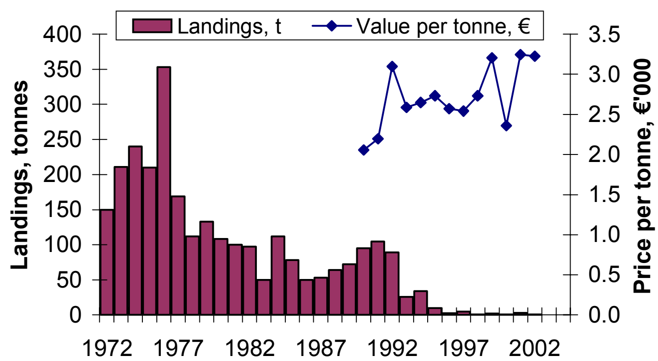
CURRENT MANAGEMENT

- Some protection is available to this species under S.I. No 94 of 1997 but its conservation status is otherwise unclear and it should be put on a formal protected footing.

ADDITIONAL INFORMATION

1. This species is universally regarded as vulnerable to over-exploitation and slow to regenerate its numbers from depleted stocks. Attempts are being made elsewhere to rear it artificially for human consumption.
2. The Wildlife (Amendment) Act, 2000, Section 32 allows the Minister to make regulations excluding any species of fish or aquatic invertebrate from the provisions of the Act. The Wildlife (Fish and Aquatic Invertebrate Animals) (Exclusion) Regulations, 2001 (S.I. No 372 of 2001) Part 2 lists Aquatic Invertebrate Animals which are not protected and which may be commercially exploited. Paracentrotus lividus is not among them. This would suggest it is a protected species. On the other hand, the species is not on the fifth schedule of the Wildlife Act (1976) which would confer a protected status. Thus it appears to occupy a no-man's land in which it is neither exploitable nor protected.
3. Within an SAC (Special Area of Conservation) the species is protected under the European Communities Act, 1972, Council Directive 92/43/EEC of 21 May 1972 (the Habitats Directive) which is transposed into national legislation by S.I. No 94 of 1997 making its commercial harvesting notifiable to a statutory authority (presumably DCMNR) which gives consent to the activity; alternatively the activity should be notified to the Minister for Arts, Heritage, Gaeltacht and the Islands. However, this requirement also applies to periwinkles which are included in the Part 2 schedule of S.I. No 372 of 2001.

Fig 1 Landings of *Paracentrotus lividus* from 1972 to 2004 inclusive and first sale price, standardised to € values, from 1990.



Periwinkle on all Coasts

(Sub-areas VI and VII)

Littorina littorea

Fisheries Science Services

FSS – ADVICE

A size limit should be established and enforced in a way which ensures undersized animals are not removed from the sea shore. Consideration should be given to establishing a close season in the months of June and July or from May to August when high temperatures cause mortalities. Consideration might also be given to a close season between January and April when spawning is taking place.

STATE OF THE STOCK

- Periwinkle populations should be regarded as stocklets rather than belonging to a single stock unit. There is no assessment of any of these hence, the state of the entire stock is unknown.
- A frequent complaint about the quality of landings in recent years suggests that too many juveniles are gathered. Although landings have been declining, they are still high and would appear to be sustainable. That said, there is considerable volatility in the production of different areas of coastline which might indicate over-exploitation of certain stocklets.
- An added complication to evaluating this species is the ageing population of gatherers which harvest these gastropods so that decreased local harvests might simply indicate a lack of interest.

CURRENT MANAGEMENT

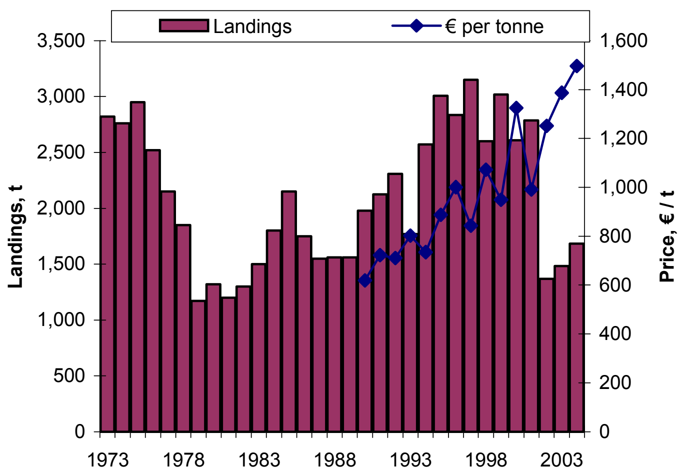
This is an open access fishery. The only regulation which applies to it is the EU directive on shellfish hygiene (91/492 E.E.C.).

ADDITIONAL INFORMATION

1. The periwinkle fishery had landings of 1,683 t in 2004 with an estimated first sale value of €2.5 m.
2. Periwinkles are gathered on virtually all Irish coasts to supply an export trade to the United Kingdom, Belgium, the Netherlands, France and Spain.
3. Annual landings of periwinkle fell from 2,400 tonnes in the 1970s to 1,600 t in the following decade. They increased again in the 1990s but have tended downward since mid-decade. Since 2002 landings have stabilised at approximately 1,500 tonnes annually. Wholesalers report a decline in the quality of landings, indicating too many small animals are being gathered.
4. The price for periwinkle has increased more than for any other shellfish over the past decade.

Source of information: Cummins, V, S Coughlan, O McClean, N Connolly, J Mercer and G Burnell (2002) An assessment of the potential for the sustainable development of the edible periwinkle, *Littorina littorea*, industry in Ireland. Marine Institute, Marine Resource Series, No 22, 79 pp.

Fig 1. Landings, t and price (€) per tonne of periwinkle in 1973- 2004 (source: DCMNR).



Shrimp on South and West Coasts

(Divisions VIa, VIIa (south coast), b,g and j)

Palaemon* mainly *serratus

Marine Institute
Foras na Mara

Fisheries Science Services

FSS– ADVICE

The Shrimp (Fisheries Management and Conservation) Order, 2003 [S.I. No 232 of 2003] introduced a close season for the period 13 June to 1 August 2003, and, in subsequent years from 1 May to 1 August. It should be re-introduced on a permanent basis for the approximate period from the end of January to the end of August. The requirements of the Order, which are to prevent fishing for shrimp or landing them during the spring and summer months, should be enforced. Shrimp are intensively fished within the range of this fishery and fishing effort (number of pots) should be capped.

STATE OF THE STOCK

Shrimp probably occur as a number of local stocks rather than as a single stock unit. The animals are small, hence they are eaten by a wide range of predators. This and their short lives (about 2 years), makes stock size prediction problematical. Recruitment may occur cyclically and the species may be susceptible to growth overfishing.

CURRENT MANAGEMENT

The only management measure is a brief close season at the only time in the year when shrimp are not berried, hence it is unlikely to have any beneficial value.

ADDITIONAL INFORMATION

1. This fishery commenced in the mid-1970s in south west Ireland whence it has extended north to Connemara and east to Co Waterford; more recently, though to a more limited extent, into Co Donegal (Fig 1). It is carried on using plastic Chinese-hat-ended creels. As is general in the inshore sector, fishing effort has risen with elapsed time. The fishing season has also extended and in some parts of Ireland fishing now takes place all the year round.
2. Landings of shrimp rose throughout the 1990s to peak in 1999 after which they fell; they are now improving again (Fig 2). First sale price for shrimp has shown no trend since 1990 other than being higher in years when landings are more sparse. The likely isolated nature of many stocks means that shrimp should probably be managed on a local basis.
3. The total landings in 2004 amounted to 413 tonnes.
4. The average weight of shrimp captured per day indicates the strength of the 0 group in the population. A larger 0 group presence (lower average individual weight) is associated with heavier catches (larger daily consignments). In recent years the December average weight has tended to indicate relatively few 0 group animals were present, suggesting recruitment failure. These details are summarised in Fig 3. Recruitments in shrimp may be cyclical but there is a possibility that growth overfishing contributes to poor performance of this fishery.
5. The average weight of a consignment of shrimp (1 day's fishing) in a year has been shown to be loosely related to the annual landings over the decade 1991-2001. Date for 2004 are at present incomplete but the values are similar to those of the previous year (Fig 4).

Sources of information: Fahy, Edward and Jim Carroll (in preparation, working title) Change in yield and population structure of the shrimp *Palaemon* spp landings in the Irish fisheries during the 1990s.

Fig 1. Known fishing areas in which shrimp are harvested (black) and landing places for catches (x), 1990 – 2004.

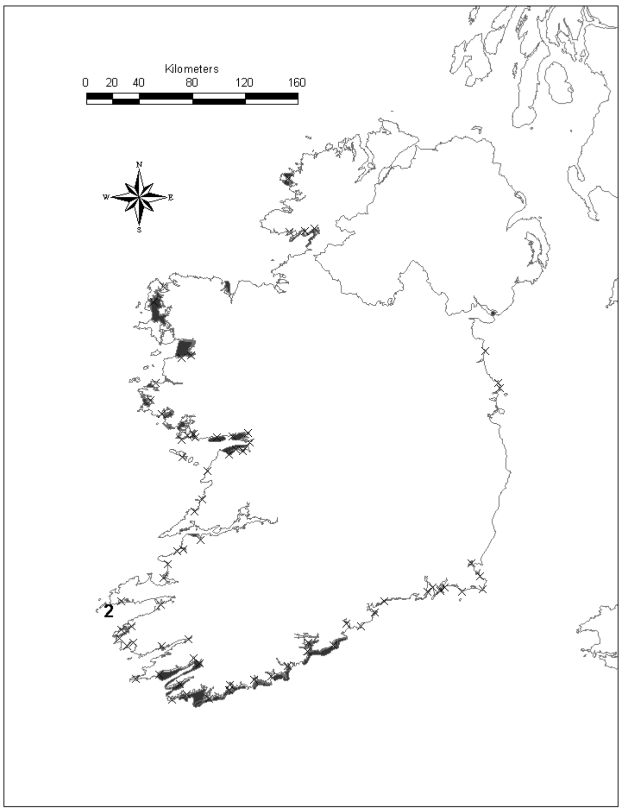


Fig 2. Annual landings of shrimp, 1975 – 2004 and annual average prices per kg, 1990 – 2004 (Source, DCMNR).

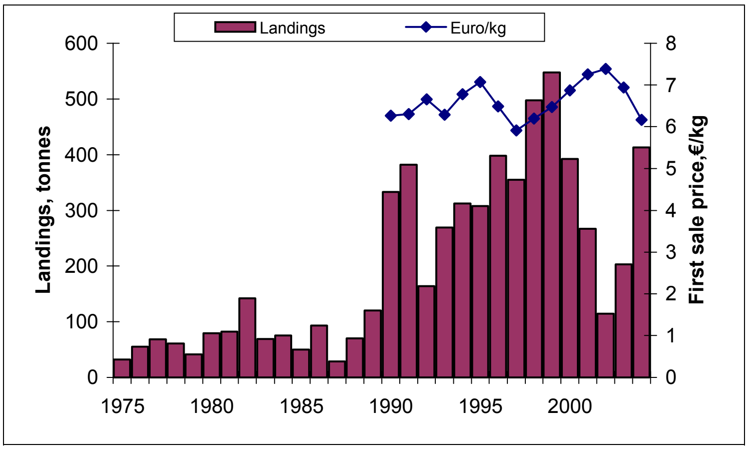


Fig 3. Trends in (a) local recruitment indices, (b) annual landings and average daily landing weights of shrimp, from 1991.

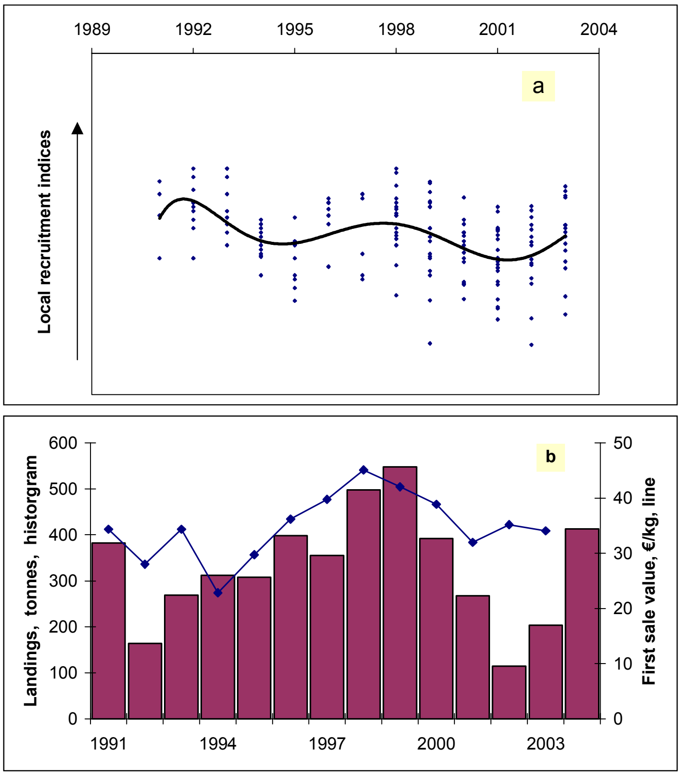
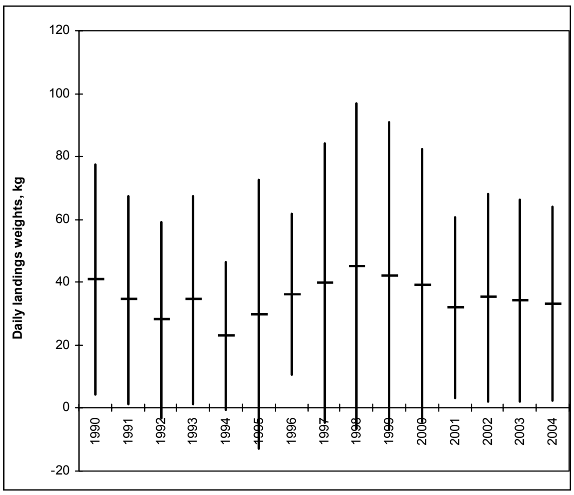


Fig 4. Average weight (+/- 1 s.d.) of shrimp landed daily by inshore vessels, various fisheries in 2004.



Velvet Crab on all Coasts

(Sub-areas VI and VII)

Necora puber

Fisheries Science Services

FSS – ADVICE

The desirability of capping effort in this mixed crustacean pot fishery with a view to stabilising exploitation is stressed.

STATE OF THE STOCK

Unknown.

CURRENT MANAGEMENT

None

ADDITIONAL INFORMATION

1. 291 t of velvet crab worth €0.646 million were recorded in 2004. Landings have remained stable at approximately 300 t over the past nine years, after an abrupt decline from almost 500 t in 1995 (Fig 1). Three phases are discernible in the landings: a growth of interest in the species in the 1990s which culminated in a peak of exploitation in 1995 and an apparently stable period after that.
2. Landings of this species are a component – most often a by-catch rather than a target species - of the pot fishery for larger crustaceans. The species occurs very close inshore. There are some, limited, instances of directed winter fishing for it.
3. Landings are probably a reflection of fishing effort for large crustaceans generally, larger catches being made in the earlier part of the fishing year. When, in the later summer and autumn, fishing effort moves offshore, landings of velvet crab decline. However, velvets suffer high mortalities in storage and this may militate against their retention everywhere. This species is likely to be discarded more than any of the other large crustaceans with which it is captured.
4. Processors report the loss of larger size grades from the landings and surveys indicate that length frequency composition of landings is variable (Fig 2).

Fig 1 Landings & first sale value of velvet crab (t), 1990-2004: Source, DCMNR

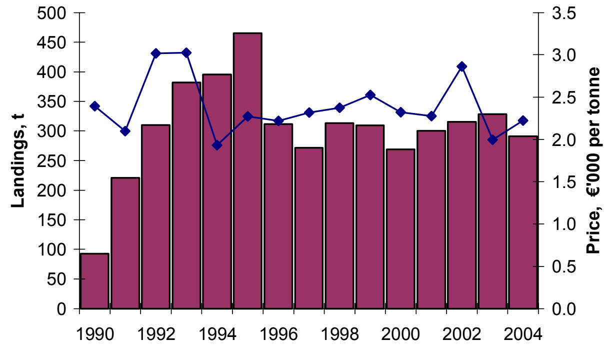
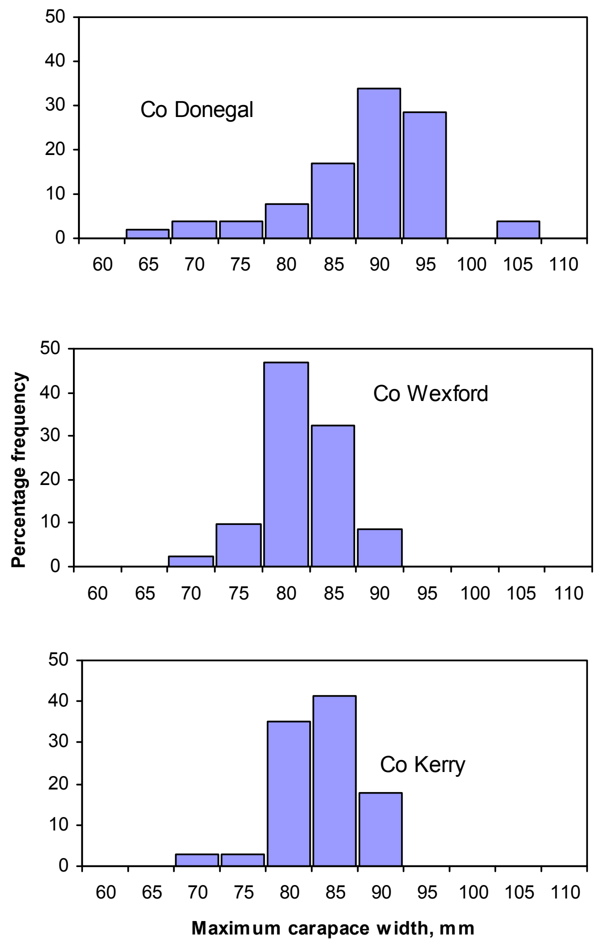


Fig 2 Length frequencies of male velvet crab from three locations.



Brown Crab on all Coasts

(Sub-areas VI and VII)

Cancer pagurus

Marine Institute
Foras na Mara

Fisheries Science Services

OVERVIEW

This is one of the most important constituent species of inshore fisheries. In 2004, landings of 13,690 t live weight had a first sale value of €14.5 m (source, DCMNR). Progressively larger proportions of the landings have been made by offshore super-crabber vessels in recent years. Insofar as inshore fisheries have a socio-economic value to local coastal communities, the further expansion of the offshore fleet which is considerably less labour intensive, should be taken into consideration where the allocation of this resource between the two sectors is concerned.

The structure of Irish brown crab stocks is not known but a major divide is proposed between crab in VIa, which make up the largest fishery and which, in 2004, contributed 63% of the national landings, and crab from south east Ireland which contributed 6.3%. Both have distinctive migration patterns, females in VIa migrating out to the shelf edge. Tagged crab in the northern stock have been recovered from as far south as Co Galway. In the south east, females migrate south into VIIg and possibly into VIIf, their migration patterns being guided by the circulation patterns around the Nymphe Bank in the Celtic Sea. Some tagged females have been returned from the Scilly Isles, off Cornwall and by the Roscoff super-crabber fleet.

The most distinctive differences between the northern and south eastern stocks is the LPUE which in the south east in 2002 was approximately half the value recorded in the Donegal offshore fishery.

Landings of brown crab have expanded considerably in recent years but the price per kg has not risen accordingly (Fig 1). Processed crab, harvested in the autumn months, is an important component of Irish crab exports accounting for 40% of its volume and 75% of total value. Exports of live and fresh crab have shown a decline in value in recent years. The argument has been made that landings are currently too high and that a solution may lie in limiting fishing effort. This coincides with signs of over fishing on some brown crab and suggests that available fishing effort might usefully be cut back.

Northern Brown crab stock

Sub Area VI, Division VIIb

FSS ADVICE

ICES data indicates that LPUE has declined from 2.75 kg/pot in 1991 to 1.4 kg/pot in 2003 in the offshore fishery. Studies on the inshore component estimate a loss of between 37 and 57 % LPUE over the past 15 years.

FSS agrees with the STECF that:

- **there has been a decline in abundance,**
- **current levels of effective effort are very high,**
- **current regulations are unable to effectively control effort in this fishery.**

FSS therefore agree with the STECF that the current fishing effort regime, as established in Council Regulations 1954/2003 and 1415/2004, is inadequate for sustainable exploitation of edible crab (*Cancer pagurus*) stocks.

FSS therefore support the STECF conclusion that effective effort would be better regulated by restricting the number of pots and number of pot hauls in the fishery, and that regulation of effective effort should apply to all vessels prosecuting this fishery, rather than just those >15m.

FSS note that during the mid 1990s LPUE was sustained at a stable level. FSS therefore agrees with the STECF suggestion that the average annual effective effort (as proposed above) over this period could be used as an appropriate level of effort that may sustain the fishery.

STATE OF THE STOCK

The state of this stock is unknown but the available indicators give cause for concern. An account of the decline of offshore LPUE was provided in the previous Stock Book; a reconstruction of the inshore LPUE series for the autumn fishery by the Malin Head fleet is shown in Fig 2. A Schaefer analysis conducted on this series is set out in Fig 3 and comparison is made with the a similar model for the Donegal inshore crab fishery.

The Malin Head inshore fleet accounts for approximately 30% of MSY of the Co Donegal share of brown crab landings and approximately 20% of the effort required to achieve MSY. The $F_{0.1}$ level has been exceeded by the Malin Head fleet according to the calculations.

Effort, in terms of pot hauls, has increased six-fold over the period 1992-2004 (for a group of offshore vessels) (Tully et al. 2005). Effort (pot hauls) increased rapidly in the period 1990-1994, was relatively stable from 1994-2000 and has since increased rapidly to the series maximum in 2004.

ICES LPUE data in the offshore fishery has gone through three discernible phases: between 1991 and 1994 it declined as older crab in the virgin stock were fished down, between 1994 and 2002 LPUE was stable but in 2001 and 2002 it showed a decline which is regarded as ominous. Declining LPUE appears to coincide with periods of expansion of capacity and effort in the fishery. In addition, available landings and effort data indicate that recent high levels of effort have realised only small increases in landings and that LPUE has declined linearly with increasing effort. The STECF considers that the observed decline in LPUE indicates a decline in abundance.

The latest SGCRAB report, not available at time of going to press, will report a further reduction in mean annual LPUE from 1.59 to 1.4 kg per pot lift in the offshore fishery. In spite of being well documented, the available indices do not provide a conclusive account of brown crab abundance in the northern fishery. The offshore fleet is mobile, moving gear to the highest densities of crab hence the prevailing high LPUE data for this fleet may not represent the true abundance of the animals; the area in which fishing takes place is known to have expanded considerably since the super-crabber sector came into existence in the early 1990s. Inshore LPUE data are collected at a time when the animals migrate into shallow water where they are concentrated so that these data might not be a good indicator of true abundance either.

CURRENT MANAGEMENT

Landings of brown crab in this fishery are subject to the EU size limit of 130 mm across the maximum width of the carapace (Annex XII of regulations 850/98); at the most northern limit of the fishery the appropriate size limit might be 140 mm. There appears to be no recent change in the average size of crabs in the landings and the cumulative size distribution of landings indicates that landing of crabs does not occur until they are significantly larger that the minimum landing size (Minimum legal size: 130mm, landing size is generally (>95%) >150 mm). Maturity ogives presented indicate that 50% of crabs are mature at 120mm and all crabs by 130mm. This implies that a significant proportion are able to spawn before capture. However, these figures relate to combined sex data: size at 50% maturity for female crabs in this fishery varies from 133 to 138mm dependent on area (ICES 2004). The prohibition of landing claws which exceed 5% of crab whole weight landed also applies.

The "western waters" regulation (1954/2003/EC) anticipated that the Commission would revise and update effort ceilings for edible crab and spider crab by which effort would be allocated on the basis of kilowatt/days. The limits for the northern crab stock, applying to vessels greater than 15 m in length, were published in document 1415/2004/EC. STECF considers these regulations ineffective because:

1. The new regulations actually provided for a marked increase of the total allowable effort compared to previously observed levels. Information on the level of uptake is incomplete, but it is believed that some Member States do not fully utilise their effort allocations. STECF considers that there is therefore a considerable amount of latent capacity (in nominal effort) available.
2. The increase in numbers of pots hauled in the presented data since the implementation of the 2004 effort regulations also demonstrates that these regulations have not restricted effective effort. The combination of latent capacity and the ability of the fleet to increase effective effort by deploying more gear render the effort regulations ineffective.
3. Effort is more accurately expressed in terms of pots lifted per vessel rather than the time spent fishing.

These regulations only regulate large vessels. Smaller inshore boats whose range now overlaps that of the super-crabber fleet, are capable of handling large quantities of gear (currently up to 700 pots per day by vessels of 12 m). Effective effort may be considerably enlarged by extending soak time. Currently a soak time of 2 days is becoming established allowing a double set of pots to be operated by the same vessel. In theory the potential exists to fish three sets of pots simultaneously.

ADDITIONAL INFORMATION

1. Landings of brown crab from the northern fishery in 2003 were 8,625 t valued at €9.14 m (€1,220 per tonne) (Source: DCMNR).
2. The extent of the Northern crab stock has been investigated by tagging experiments. In 2001 the range of crab tagged at Malin Head extended northwards to latitude 56°, westwards to the continental slope and south to Galway. The prevailing direction of crab movement is westwards against the current, which moves eastwards in Co Donegal; the larvae are presumably washed back against the adults' trajectory.
3. This, the largest of Ireland's brown crab stocks, is shared with Scotland and may extend further north of 56° latitude. It has offshore and inshore fishery sectors which are likely to exploit the same stock; there is close similarity in LPUE in both sectors; currently the inshore sector is less well documented than the offshore.
4. The offshore sector consists of 5 Irish vessels of >15 m.
5. The more labour intensive inshore sector has been equally dividing the landings with the offshore boats until recently but this equal sharing is unlikely to persist indefinitely even if the offshore fleet ceases to expand further.
6. Because crabs cannot be aged, this fishery has been monitored using LPUE data and the offshore sector is well documented. However, LPUE data must be interpreted with caution in a crab fishery whose inshore sector is likely to be occupied by an

aggregation or concentration of animals during the summer months. Data for the offshore sector may provide a good indication of stock abundance, provided they are collected in the same way and in the same place each year. Instead, it was demonstrated using GPS that between 1991 and 1996 effort in the northern fishery intensified and the area over which fishing took place expanded (Stock book, 2003).

7. LPUE in the offshore sector of the Northern fishery, declined from almost 3 kg per pot lift in 1991 to approximately 2 kg per pot lift in 1994; thereafter it stabilized until 2000 when it declined from 1.8 to 1.37 and then increased to 1.4 kg per pot hauled in 2004.
8. In the course of a mark-recapture experiment carried out in 2001, an estimated 25% of the crab stock was removed by fishing in a five week period, indicating a heavy exploitation rate.

Reference:

Tully, O., Robinson, M., Cosgrove, R., O Keeffe, E., Doyle, O. & Lehane, B. (2005). The Brown Crab (Cancer pagurus L.) fishery: Analysis of the resource in 2004-2005. Report compiled for the Crab Advisory Group, Ireland.

South East Brown crab

Divisions VIIa, g

FSS ADVICE

FSS advise that the TCMs which are currently law, should be strictly enforced. The official statistics for the fishery have, in the past, been shown to be inaccurate by a factor of 2-3 and the method by which they are estimated needs to be overhauled and standardised. This stock is in need of management. It is exploited along with a number of other crustacean species. A compulsory logbook system should be introduced and its use monitored, data abstracted and accurate catch trends ascertained on a regular basis. Further technical measures to discourage the harvesting of poor quality (recently moulted) crab for use as whelk bait should be considered. A cap on gear is believed to be essential and that question has been under review for several years by virtue of its relevance to the management of the associated lobster fishery.

STATE OF THE STOCK

Assessment of crab stocks is complicated by the fact that they cannot be aged. One approach is to monitor LPUE with a view to stabilising it. Such indicators as are available, suggest that LPUE in this fishery has declined but the data could be explained as more fishermen sharing the resource. It is very likely that brown crab in this area hyper-aggregate in inshore waters during summer and autumn months and the exploitation of heavily concentrated numbers of animals can give a misleading account of their abundance

CURRENT MANAGEMENT

Two EU TCMs apply to this stock (see Annex XII of regulation 850/98): One fixes the minimum length of the maximum carapace width at 130 mm, the second prohibits the landing of crab claws which exceed 5% of the weight of whole crab. The carapace dimension cannot be deduced from claw size hence the restriction on claw landings serves to clarify compliance with the size limit. In the event neither regulation is enforced so that whereas there is little direct evidence for the size limit not being complied with there is circumstantial evidence that it is not.

ADDITIONAL INFORMATION

1. This fishery extends from longitude –6.3° to – 7.0°. It is conducted within 8 nm of the coast and it has an offshore component. Few animals tagged in 2002 and 2003 were retaken as far west as Helvic Head so they may have returned to deeper water at that longitude. Larger females (>18 cm width) have since been returned after two years without having moulted in the interim, two from the Scilly Isles, suggesting that the southward range and size of this stock are both large.
2. The fishery is conducted throughout the year, effort increasing to a maximum in the late autumn. Female crab are in their best condition and they are therefore at their most valuable at that time.
3. This fishery is highly productive, yielding >900 t to an inshore area with an estimated maximum extent of <500 km² and a coastline of approximately 55 km in 2002. In 2004 landings of 826 t with a value of €0.66 m (€794 per tonne, Source DCMNR) were made. A large proportion of crab landed in this fishery are of poor quality, used as bait to trap whelk.
4. In spring the landings consist largely of males which are fairly sedentary and they are joined by progressively greater numbers of females as the year advances. The females migrate into coastal waters in order to moult and mate; they move back to deeper waters in winter.
5. Current levels of LPUE are, in part at least, a consequence of increasing fishing effort. In the period 1972 – 1980 inshore fishing effort directed on larger crustaceans in this fishery by pots and traps doubled; the following decade it further increased by 128%. Thirty years after 1968 the number of pots per km of fishery had increased by 241 %. In 1998 the number of pots and traps fished per km of coastline stood at 191; the latest census, prepared for 2002 provided an estimate of in excess of 292 pots per km (Source John Hickey, BIM). In a period of 14 years, fishing effort was therefore more than 347% greater than in 1988, the number of pots having risen from approximately 50 per km of coastline in the early 1970s. Increasing pot numbers is a conservative estimate of fishing power, unquantifiable technological innovation also having contributed much in the interim.
6. At its maximum in October 2002, the fishery had >14,000 pots operated by up to 69 vessels.

Sources of information:

Anon (2005) Crab conference 12 May 2005, Radisson Hotel Galway: presentations by Nicolas Ranninger and Jaques Person.

Anon (2005) Report of the Study Group on the biology and life history of crabs (SGCRAB) ICES CM 2005, unavailable as yet.

Fahy, E, J Carroll and D Stokes (2002) The inshore pot fishery for brown crab (*Cancer pagurus*) landing into south east Ireland: estimate of yield and assessment of status. Irish Fisheries Investigations, 11: 26 pp

Fahy, E, J Hickey, N Perella, A Hervas, J Carroll and C Andray (2004) Bionomics of brown crab *Cancer pagurus* in the south east Ireland inshore fishery. Irish Fisheries Investigations No 12: 30 pp.

Meredith, D and E Fahy (in press) The status of the inshore component of the Northern crab fishery assessed from a time series of LPUE constructed from historical sources.

Robinson, M, A O'Leary, and O Doyle (2002) Population assessment of the Malin Head edible crab (*Cancer pagurus* L) stock, BIM

Tully, O, R Cosgrove, Fergal Nolan, R McCormick, E Hannigan, G Breslin, C O'Donnell, A O'Donnell and G Gallagher (1998) MRM project reference number A14. Marine Institute. Development of computerised systems for visualisation and mapping of shellfisheries data: a case study using the Donegal crab fishery

Fig 1. Landings, t and price per tonne of brown crab in 1990 - 2004.

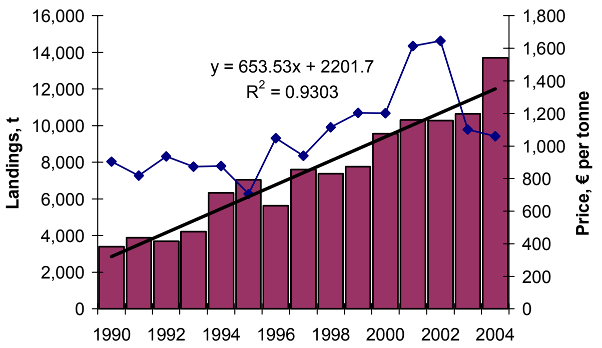


Fig 2. Annual average consignment weight, pot numbers and LPUE series for the Malin Head inshore fleet, 1979 - 2004.

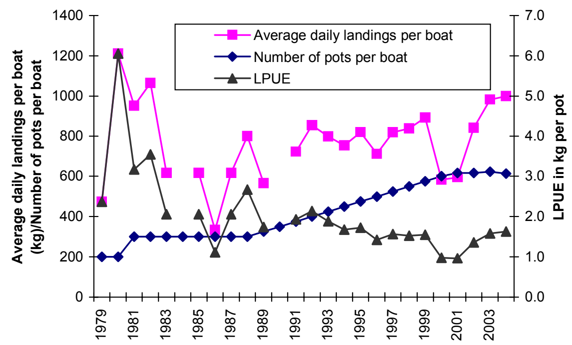
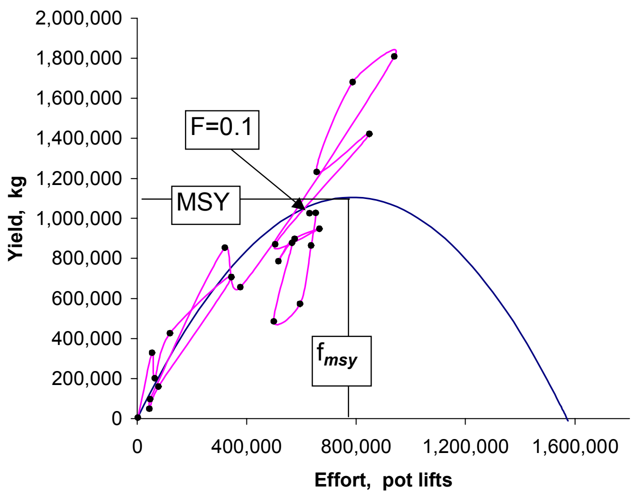


Fig 3. Schaefer analysis of the Malin Head inshore fleet performance.



Spider Crab on Mainly West and South Coasts

(Sub-area VII)

Maja brachydactela

Marine Institute
Foras na Mara

Fisheries Science Services

FSS– ADVICE

FSS advise that the national size limits for this species be enforced. There should also be a ban on the use of tangle nets to which the species is susceptible. A recent development has been the landing of male claws by vessels using tangle nets. In fisheries like Magharees, the only one which has targeted spider crab in Ireland over a period of more than 20 years, there should be a cap on gear in use. Because much spider crab is unsuitable to supply a quality market, there has been a tendency to use immatures and small adults as whelk bait and this is not desirable; enforcement of EU and national TCMs would eliminate the practice.

STATE OF THE STOCK

Spider crab appear to be increasing in abundance and the range of the species may be extending northwards.

A problem for the interpretation of spider crab landings data is the fact that the species has been poorly recorded. In some years the landings of spider crab landed into one fishery, Magharees in Co Kerry, have exceeded the total tonnage recorded nationally by DCMNR.

Despite increasing fishing effort and rising landings, the fishery for human consumption is not believed to be endangering spider crab stocks. The market demands a high quality product which is available in limited quantities but adult crab are generally plentiful, many are discarded live and egg bearing females are numerous; a large proportion of both sexes are not commercially worth landing (Fig 1). Provided exploitation of smaller animals for bait or as a by-catch in tangle nets does not inflict damage on the reproductive segment of a population, no immediate problem is foreseen other than the fact that there are inherent dangers for any fishery which depends on a single year class and this has increasingly become the situation in Magharees, Co Kerry.

Exploitation of this species may substantially increase with a rise in price; such a rise did take place locally in 2005.

CURRENT MANAGEMENT

- Annex XII of EU regulation 850/98 imposes a size limit of 120 mm carapace length on this species. The Spider crab (Conservation of stocks) order, 2001 [S.I. No. 321 of 2001] substituted a national size limit of 125 mm carapace length on female spider crab and 130 mm carapace length on males. Although there are good biological reasons for the national regulation, it was introduced at the behest of the industry in Magharees to ensure a product of reasonable quality for export. Outside Magharees enforcement of the regulations is, at best, poor.
- Local efforts have been made in Magharees to cap pot numbers in order to stabilise fishing effort. They have not been successful and without government support they are unlikely to succeed.

ADDITIONAL INFORMATION

1. In 2004 180 tonnes of spider crab worth an estimated €180,418 were landed (source DCMNR) (Fig 2).
2. Although they occur on all Irish coasts, spider crab are considered to be at the northern limit of their range in Ireland and Scotland. The main fishery for them in the eastern Atlantic, is in the vicinity of Galicia and the Channel Islands.
3. The commercial problem with spider crab is their low value (compared with, say, lobster) and the absence of a home market for them. Most of those landed in Ireland are consumed in France and Spain. At the same time it has proved problematical to collect sufficient animals of high quality to economically justify their transport to the Continent.
4. The heaviest local concentration of spider crab in Ireland is in Tralee and Brandon Bays which together constitute the Magharees fishery. Since the 1980s spider crabs have been targeted there for export. There are currently 10,000 pots fishing in Magharees.
5. Landings from the Magharees were, in the first years of the fishery, until 1989, relatively high after which they then declined, with the exception of a later temporary rise in yield (from 1996 to 1999). Periodic increases in yield of this kind might occur cyclically in spider crab populations.
6. The pattern of yield which has developed is explained by the fact that virgin fisheries consist of several year classes of spider crab in their terminal moult. Unlike other crabs, spider crabs do not further grow once they have reached that stage. However, a spider

crab in its terminal moult may survive for up to 10 years hence, unexploited populations contain a higher proportion of animals in this developmental stage. Once exploitation begins, spider crabs in their terminal moult are depleted until, in a heavily fished stock, a single year class supplies all the adults in a fishery.

7. Adult male spider crab have a large range in size, from 100 to 170 mm carapace length. The reason for this variation is not known although it is suspected that in certain favourable conditions, an extra instar may be introduced to the life cycle. This is surmised from the higher incidence of larger spider crabs in the stocks in France in certain years but the phenomenon remains to be proved.

8. Since the Magharees fishery for spider crabs commenced in the 1980s, the behaviour of the fishermen there has changed and a progressively higher proportion of the catch is made in the spring months.

9. There may be potential for a small spider crab fishery along much of the west coast; in its early years it will yield males of good quality. Whether these will be sufficient to sustain an export market remains to be seen.

Fig 1. Length frequency distributions of male and female spider crab protected by size limit and acceptable to the market, surveyed in the Magharees fishery in 2005

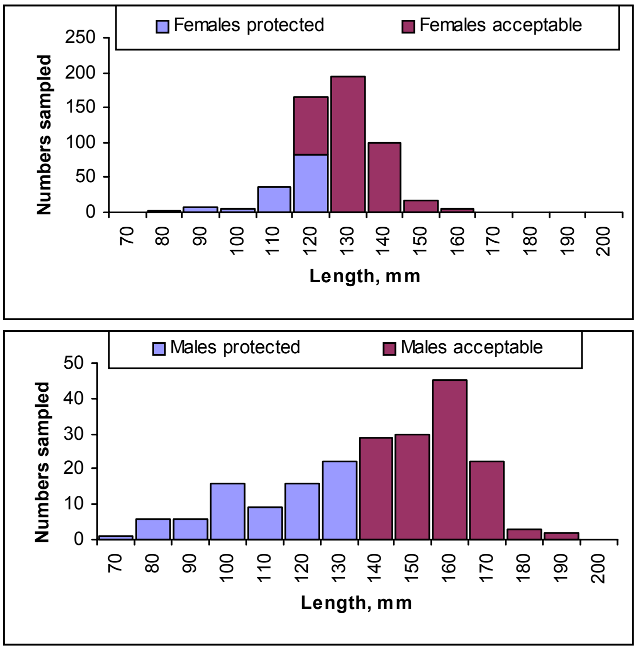
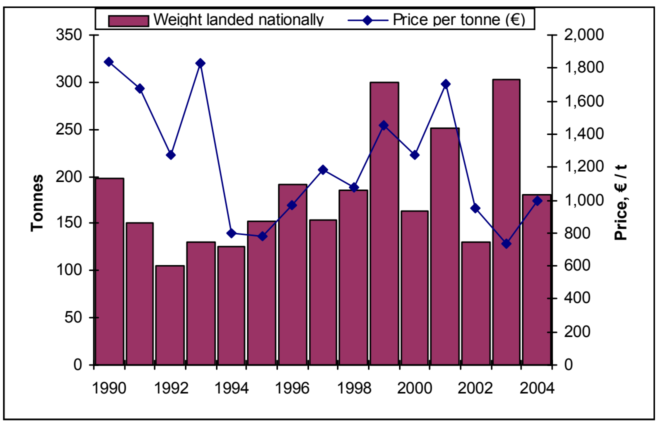


Fig 2. Landings and first sale price of spider crab 1990 – 2004 (source DCMNR).



Green Crab on all Coasts

(Sub-areas VI and VII)

Carcinus maenas

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – ADVICE

None

STATE OF THE STOCK

Unknown. There is likely to be a number of stocklets rather than a single stock.

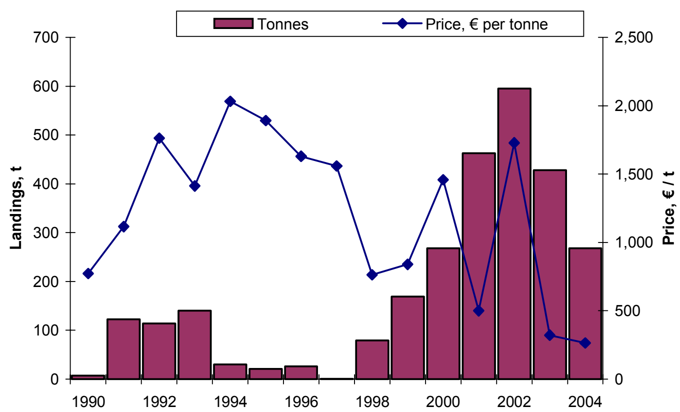
CURRENT MANAGEMENT

None to enhance its status. The removal of green crab from shellfish beds is rewarded by bounty.

ADDITIONAL INFORMATION

1. Landings of green crab in 2004, were 268 t valued at €71 k.
2. Green crab is a successful scavenger and predator, which has extended its range in other continents where it has a pest status in mariculture.
3. The fishery for green crab has been expanding since 1998, reached a peak in 2002 and has declined since: green crab can be used as bait in whelk fisheries. It also provides ingredients for food processing. Anglers use newly moulted green crab as bait, particularly for sea bass which is an important predator of the species.
4. The main market for green crab is currently in France where its capacity in 2002 was estimated at 1,000 t.
5. The removal of green crab from shell fish layings contributes to better survival of juvenile bivalves. BIM offers a bounty for the destruction of this species in such circumstances.

Fig 1. Weight and value (€) of green crab landings, 1990 – 2004. Source: DCMNR.



Lobster on all Coasts

(Sub-areas VI and VII)

Homarus gammarus

Fisheries Science Services

FSS– ADVICE

This species is managed by a number of TCMs. TCMs are effective only where fishing effort is stabilised. There is a need for restrictions on entry to this fishery and a cap on the amount of gear in use. FSS advises that such a fishery regime be introduced. The current range of conservation measures (minimum size and V-notching) should be continued and enforcement of the regulations should be intensified. Consideration should be given to the introduction of a maximum size limit at 120 – 125 mm carapace length, to protect previously V-notched females whose tail fins have repaired.

STATE OF THE STOCK

Egg per recruit is low, calculated at 7% of virgin egg production. Catch rates have been stable or increasing over the past decade despite strong increases in fishing effort, this suggesting that recruitment has been strong. Stocks may be vulnerable to a further reduction in egg production and recruitment in a less favourable recruitment environment.

CURRENT MANAGEMENT

In Europe and North America a management strategy for lobster is to increase natural egg production by the use of TCMs and by limiting fishing effort. The minimum landing size is currently 87 mm carapace length (850/98 EU) and it is illegal to land lobsters which have V-notched or damaged tail fins.

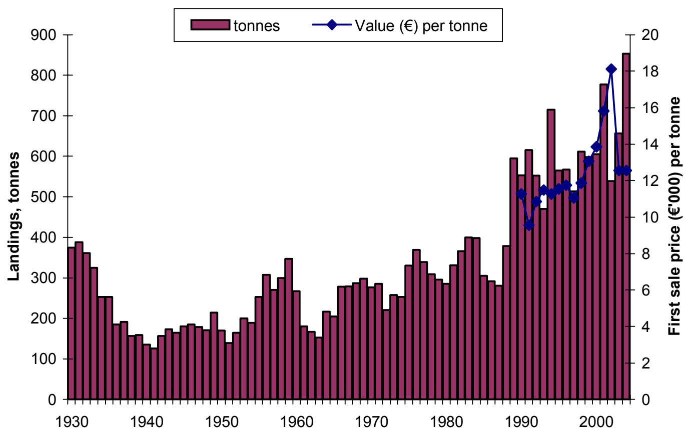
ADDITIONAL INFORMATION

1. Lobster landings to Ireland totalled 857 t valued at €10.7 m in 2004 (Source: DCMNR).
2. Lobster management is funded by government through BIM and administered locally by co-operatives. The purpose of size limits and V-notching programmes is to enhance natural egg production. Our latest information on the programme dates from 2002.
3. Since the practice was introduced in 1990, >100,000 female lobsters had been V-notched and released. A voluntary logbook scheme to record target and incidental catch rates of legal, undersized and V-notched lobsters was introduced in 1995 by BIM in Co Wexford and this was extended to all coasts in 2002.
4. Catch rates of V-notched lobsters represented 20 – 30 % of the population of legal sized female lobsters in 2002. V-notched lobsters were larger in size and of greater fecundity than the average female lobster.
5. Size at maturity (at which 50% of the animals are expected to spawn) is 95 mm carapace length which is 8 mm above the minimum landing size at present.
6. Catch rates in 2002 varied by region and were strongest in the southwest (25 lobsters per 100 pots hauled) and weakest in the south east (5-10 lobsters per 100 pots hauled).
7. Although catch rates have been strong over the past 10 years, they are 3 times lower than in the 1960s.
8. V-notches persist for up to three moults after which they grow out; during this time the lobster may increase in size by up to 30 mm carapace length.

Source of information:

Browne, R M, J P Mercer and M J Duncan (2001) An historical overview of the Republic of Ireland's lobster (*Homarus gammarus* Linnaeus) fishery, with reference to European and North American (*Homarus americanus* Milne Edwards) lobster landings. Hydrobiologia 465: 49 – 62.

Fig 1. Landings of Lobster to Ireland, 1930 – 2004 inclusive, values per tonne (standardised in €) from 1990 (source, DCMNR, data collated by Browne *et al* (2001).



Crawfish on Mainly Western Coasts

(Sub-areas VI and VII)

Palinurus elephas

Marine Institute
Foras na Mara

Fisheries Science Services

FSS – ADVICE

FSS advise that crawfish stocks are overfished and in need of urgent remedial measures. An outright ban on the use of "cray nets" would be more effective and greatly preferable to the current restrictions on what those nets are permitted to catch. Further opportunities to reduce fishing pressures on this species should be sought in an effort to rebuild the population.

Two closed areas have been established in which crawfish tangle netting is prohibited but the prohibition is not enforced and the animals have been captured in large numbers by this method in the closed area in Co Kerry.

STATE OF THE STOCK

The only information currently available is landings data which suggest that crawfish are in decline (Fig 1).

CURRENT MANAGEMENT

E.U. TCMS (Annex XII of regulation 850/98) specify a minimum size limit of 110 mm carapace length. The Crawfish (Conservation of Stocks) order, 2001 [S.I. No 322 of 2001] adopts this in Irish law. The Crawfish (Fisheries Management and Conservation) Order, 2002 [S.I. no 179 of 2002] bans the taking of crawfish by net in two areas off the Galway and Kerry coasts (Fig 2). Use of the nets is however allowed for flat fish species. Their use is poorly monitored and substantial numbers of crawfish are probably captured in this gear.

ADDITIONAL INFORMATION

1. In 2004, 80 t of crawfish landings were priced first sale at €22,000 per tonne, a reduction from the previous year. (Source: DCMNR) making this the most valuable of the larger crustacean species.
2. Crawfish have been in decline at least since 1992 (Fig 1) although landings stabilised over the past four years and increased in 2004.
3. Crawfish are known to be vulnerable to a number of fishing methods, including towed gears (trawls and scallop dredges) the latter of which may kill the animals without recovering them. Tangle nets ("cray nets") which were introduced to target this species and which are also used to capture fin fish, are credited with playing a large role in their decline.

Fig 1 Crawfish landings and first sale prices 1971-2004 (Source: DCMNR).

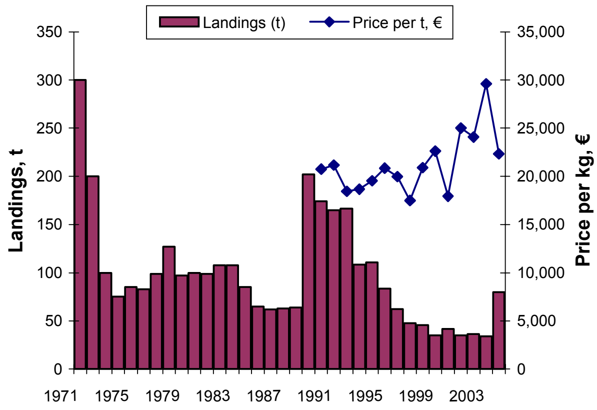
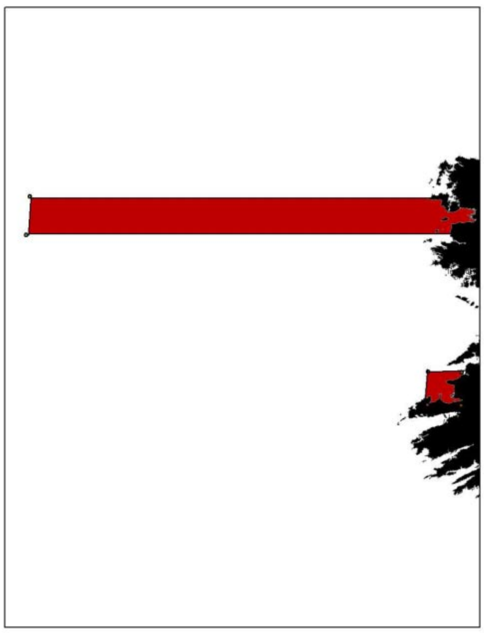


Fig 2 Conservation areas for crawfish.



Whelk Fishery on all coasts

(Sub-areas VI and VII)

Buccinum undatum

Fisheries Science Services

Whelk in South West Irish Sea

Division VIIa

FSS – ADVICE

FSS are concerned about the large landing of undersized whelk in this fishery. This has been normal practice for as long as processing lines have been mechanised but the 2005 assessment confirms it continued despite some signs of an improvement in compliance early in the season. National and EU conservation regulations for this species should be enforced, particularly the provision that undersized whelk are segregated and immediately returned to the water. This is an inshore fishery and entry to it should be confined to smaller vessels, this emphasising the need for a limited entry. In view of the marketing problems affecting whelk, it is most desirable that the fishery maintains a sustainable output because disruption of harvest is likely to result in customer loss.

STATE OF THE STOCK

Following the highest landings in fifteen years, catches in 2004 halved from the previous year; less than 5,000 t fetched a first sale price of €3.3 m (Fig 1). The fishery has been intensively monitored for ten years and landings may have returned to the pattern of 1997 – 2000, in the aftermath of exceptional recruitments in 2001 – 2003 (Fig 2). SSB has fallen below the ten year average for the first time since 2000 while fishing mortality (F) remains high. The index of recruitment has also fallen. The age at full recruitment is increasing and this is regarded as significant, in 2004 it was calculated at 4.39 years for the south west Irish Sea. Only preliminary data are available for but, going on fleet activity patterns of previous years, more than 75% of all landings have now been made. In each of the four assessment sectors the age at full recruitment returned to 5.0 years again in 2005.

CURRENT MANAGEMENT

For details of the assessment procedure in this fishery and the definition of sectors in the south west Irish Sea, refer to previous Stock Books.

The Whelk (Conservation of Stocks) Order, 2001 (S.I. 294 of 2001) makes it an offence to have on board, tranship or offer for sale whelk that are less than 25 mm in width across the broadest part of the shell, this corresponding to an approximate length of 50 mm; the order further directs that sub-sized animals should be carefully handled and returned immediately to the water. Annex XII of EU regulation 850/98 imposes a size limit of 45 mm length, which has approximately the same effect. Neither regulation is enforced.

ADDITIONAL INFORMATION

1. The general scarcity of whelk is reflected in the economics of the fishery in 2004. The number of boat-fishing-days (6,196) was the lowest since 1998 within the decade which commenced in 1995. The estimated return per boat-day (€534) was lower than in the previous year, which is likely to have dissuaded fishers from pursuing this target species. In other respects, the activity of the fleet did not differ from previous years.
2. The fishery is a relatively inexpensive one to become involved in and boats have entered and left it in response to the state of the market and, particularly at the southern periphery of the fishery, the local depletion of stock. A record recruitment in 2002 attracted more effort into the fishery. A mis-match of effort and catches in 2003 precipitated a fall in LPUE which was followed by a withdrawl of fishing effort.
3. The trade in whelk has been disrupted on a number of occasions for commercial reasons which are likely to have discouraged participation in the fishery. An unstable commercial environment has in the past contributed positively to the conservation of stocks.
4. Whelk are exported, largely to the Far East and sustaining this trade is problematical. Continuity of supply is essential to the survival of this market.
5. For assessment purposes the Irish Sea fishery is divided into four sectors; landings from Dublin and Wexford, at the northern and southern ends respectively, are characterised by larger whelk and, usually, few juveniles. The centre Arklow and Courtown sectors, in contrast, yield large volumes of small whelk. These centre sectors may be the spawning grounds for some whelk which on-grow in the Dublin and Wexford sectors. A large proportion of the S.W. Irish Sea fishery is made up of spawning and nursery ground.
6. The four sectors have performed differently in the course of the expansion of this fishery: landings to the Dublin one declined and rose again; the yield from Wexford declined irreversibly, despite the fact that virtually no juvenile whelk are landed there,

while landings from the Arklow sector have greatly increased and now dominate the fishery.

7. In spite of a temporary reduction in the landings of undersized whelk early in 2005, preliminary figures indicate an increase in three of the assessment sectors, including the Arklow/Wicklow one which accounts for the majority of the landings from the south west Irish Sea (Table 1).
8. Coefficients of annual mortality (Z) were also higher in three sectors of the fishery in 2005 despite a reduction in recruitment (Table 2; Fig 2).

Northern Whelk fishery

Division VIa

FSS – ADVICE

FSS advise that the size limits imposed on whelk fisheries by national and European measures should be strictly enforced. Buyers should ensure that the product conforms to these requirements. Fishermen should be discouraged from exploiting nursery areas which may be identified from catches containing a high proportion of individuals of sub-legal size. In view of their importance as a food item for brown crab, consideration should be given to the possible ecosystem interactions and consequences for the crab fishery of depleting local whelk populations.

STATE OF THE STOCK

The status of this stock is unknown but in view of its close similarity with whelk in the Wexford and Dublin sectors of the south west Irish Sea fishery and with patches of whelk in the vicinity of Kilmore Quay (the latter being better known as a fishery for large crustacean species), the Northern fishery is assumed to be a vulnerable one, susceptible to rapid depletion and requiring a long period of recovery after being fished down.

CURRENT MANAGEMENT

The Whelk (Conservation of Stocks) Order, 2001 (S.I. 294 of 2001) makes it an offence to have on board, tranship or offer for sale whelk that are less than 25 mm in width across the broadest part of the shell, this corresponding to an approximate length of 50 mm; the order further directs that sub-sized animals should be carefully handled and returned immediately to the water. Annex XII of EU regulation 850/98 imposes a size limit of 45 mm length, which has approximately the same effect.

ADDITIONAL INFORMATION

1. Landings of whelk have been irregularly made from Division VIa into Greencastle, Malin, Buncrana and Burtonport (Fig 3) since 1991. In 2003 an exploratory effort commenced exploitation of whelk on the Cape grounds; this has been intensified by the depletion of stock in the south west Irish Sea fishery in 2004. Landings declined by 50% in 2004.
2. The Northern fishery consists of whelk which are thick shelled, as opposed to the thin shelled animals which are harvested in the southwest Irish Sea. Thick shelled whelk typically occur in crustacean fisheries and the largest Irish brown crab stock occurs in Division VIa. These whelk are likely to be the survivors which were able to withstand predation by crab by virtue of their heavy armament rather than being a different genetic strain.
3. The exploited animals have few juveniles and undersized among them (approximately 6.1 and 6.7% by number were beneath the size limit in landings examined in 2003 and 2004 respectively) and this population structure is typical of whelk in the Wexford and Dublin sectors of the south west Irish Sea fishery; the length frequency of landings examined in 2004 is very similar to that of whelk in the Dublin sector in the mid-1990s. Few undersized whelk indicate either the industry is complying with conservation regulations (smaller whelk being sieved out and discarded) or it could signify a relatively slow rate of recruitment.
4. The exploited Northern Stock is fully recruited at 5 years and had a mortality coefficient (Z) value of 0.48 (2003) which reduced to 0.25 in 2004.
5. A depletion regression based on landings data suggested that fishing removed approximately 30% of the exploited stock(s) in 2003, probably in a localised geographical area. The approximate halving of landings from 2003 to 2004 may be significant in this context.

Source of information: Fahy, Edward. Jim Carroll, Margaret O'Toole, Claire Barry and Lee Hother_Parkes (2005) Fishery-associated changes in the whelk *Buccinum undatum* stock in the southwest Irish Sea, 1995 -2003. Irish Fisheries Investigations No 15: 26 pp

Fig 1. Landings and first sale price of whelk from the south west Irish Sea, 1990 – 2004 inclusive (Source: DCMNR mainly, until 2004 when industry supplied details)

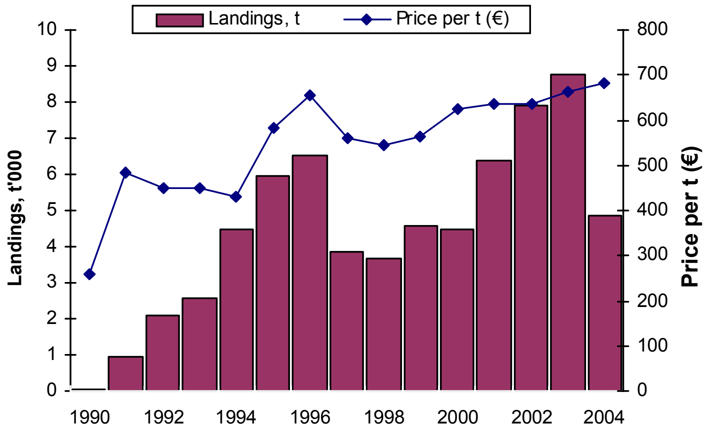


Fig 2. Summary diagrams showing landings, SSB, F values and recruit index, 1995 – 2004.

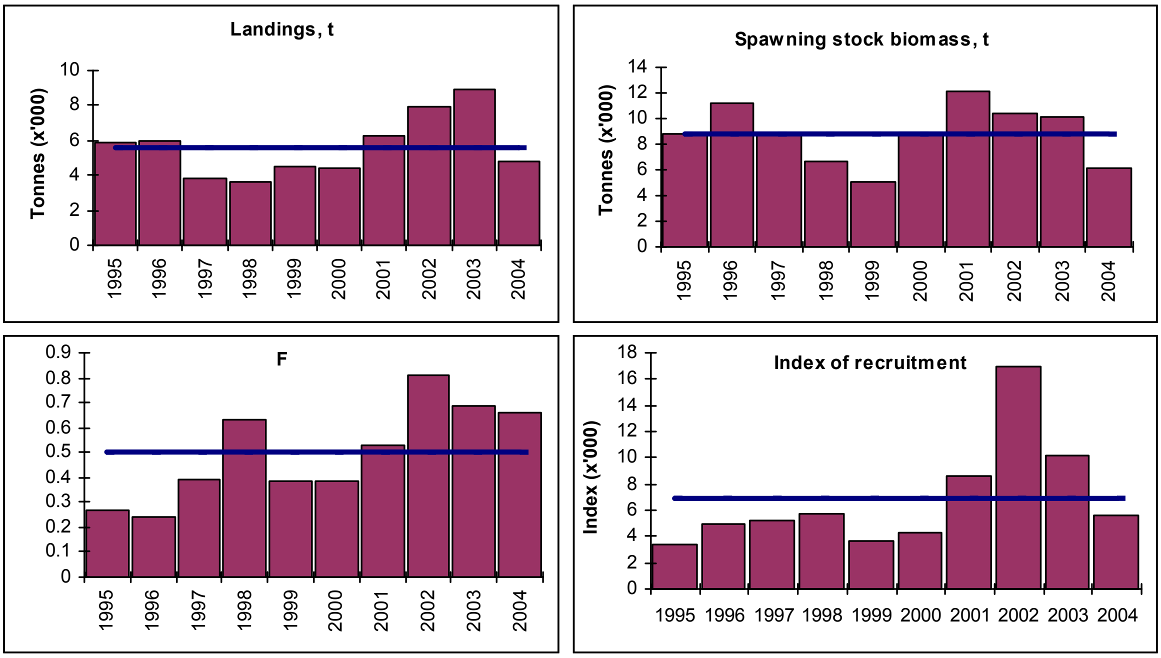


Fig 3. Landings of whelk from VIa, 1991 – 2004 (Source: DCMNR and, in 2003, industry).

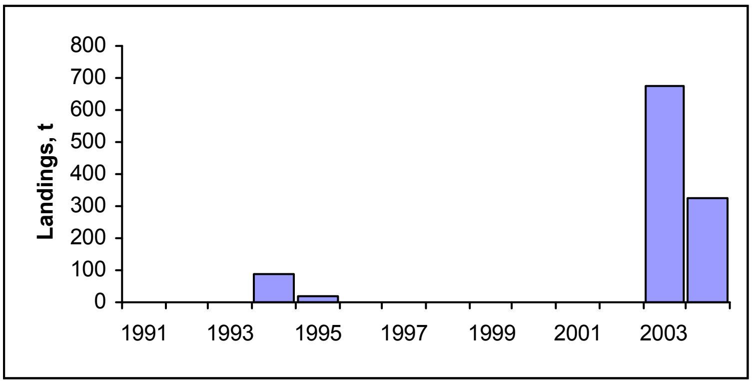


Table 1. Percentage undersized whelk (<50 mm in length), by number, landed in each fishery sector annually. Data for 2005 are provisional and incomplete.

	Dublin	Arklow	Courtown	Wexford	Weighted average
1992					
1993					
1994	27.5	32.6	51.1	7.9	
1995	***16.1***	***30.1***	***49.4***	***10.0***	25.1
1996	4.6	27.5	47.6	12.0	20.9
1997	***13.9***	***35.3***	***34.4***	***9.8***	26.9
1998	23.2	43.1	21.1	7.6	39.6
1999	12.3	33.8	48.9	8.8	30.5
2000	9.7	40.0	48.9	8.8	27.3
2001	24.4	36.1	16.3	5.7	30.8
2002	47.0	47.4	37.8	1.7	45.6
2003	23.1	43.1	21.1	7.6	36.4
2004	54.5	39.2	30.6	14.5	39.2
2005	42.9	40.0	37.0	21.8	
Average, from 1994 - 2005	24.9	37.3	37.0	9.7	
standard deviation	15.7	5.8	12.5	4.9	
coef var	0.63	0.16	0.34	0.51	

interpolated

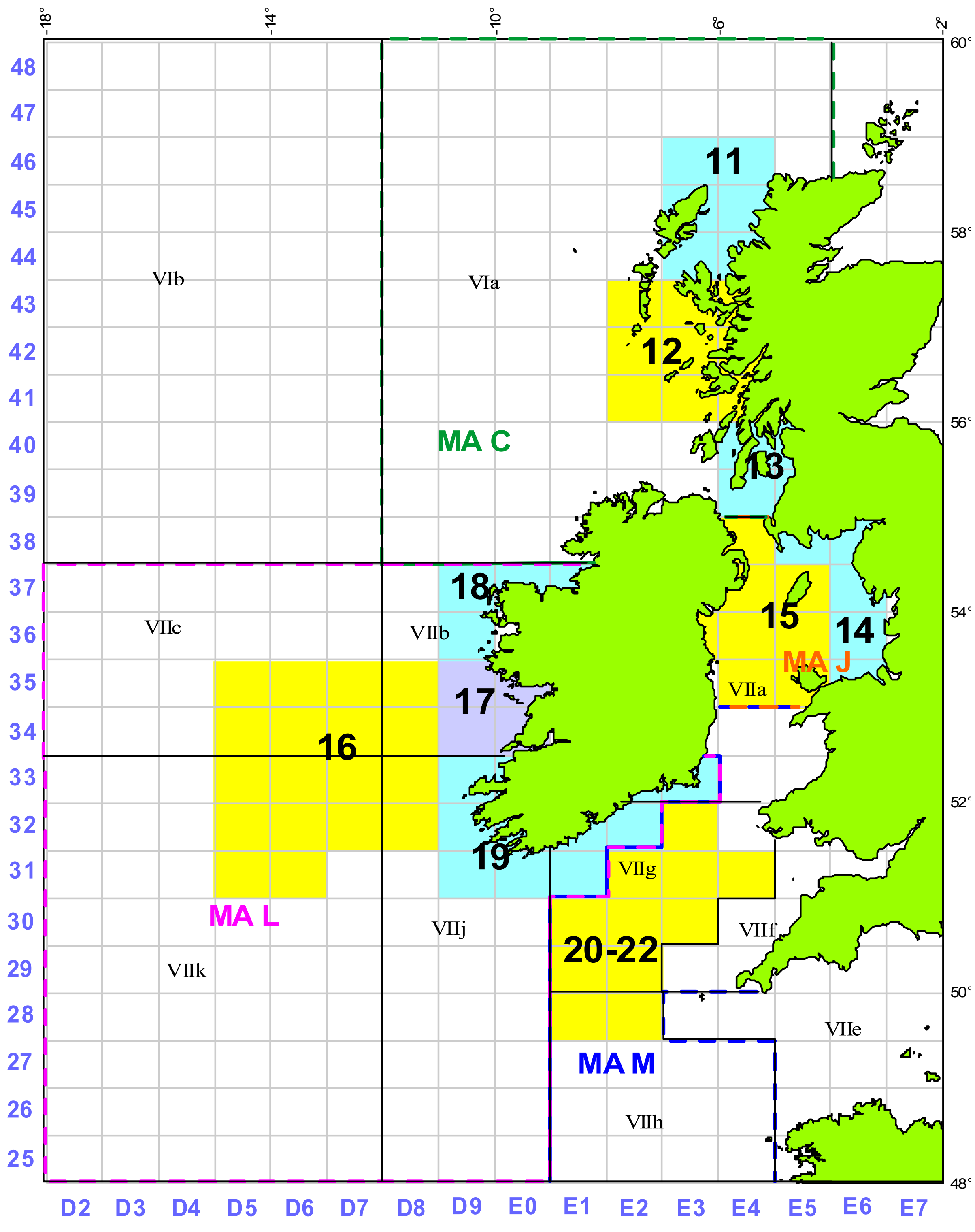
Table 2. Mortality coefficient Z calculated for each sector and for the entire fishery in each year since 1994. Values for 2005 are incomplete and provisional.

	Dublin	Arklow	Courtown	Wexford	Weighted average
1994	0.40	0.56	0.66	0.48	
1995	***0.33***	***0.52***	***0.65***	***0.44***	0.49
1996	0.26	0.48	0.64	0.40	0.44
1997	***0.35***	***0.68***	***0.74***	***0.41***	0.58
1998	0.43	0.88	0.84	0.42	0.83
1999	0.24	0.68	0.88	0.62	0.61
2000	0.46	0.68	0.86	0.21	0.58
2001	0.62	0.77	0.83	0.60	0.73
2002	0.82	1.03	1.33	0.82	1.01
2003	0.90	0.88	1.00	0.77	0.88
2004	0.77	0.90	0.91	0.52	0.86
2005	0.96	0.94	0.75	0.83	
Average, from 1994-2005	0.54	0.75	0.84	0.54	0.70
standard deviation	0.26	0.18	0.19	0.19	0.19
coef var	0.47	0.24	0.23	0.35	0.27

interpolated

Appendix I

Nephrops Functional Units (FUs) and Management Areas (MAs) around Ireland



DEFINITION OF FISHERIES TECHNICAL TERMS AND ACRONYMS

Marine Institute
Foras na Mara

Fisheries Science Services

Abundance Index Information obtained from samples or observations and used as a measure of the weight or number of fish which make up a stock.

ACFM Advisory Council on Fisheries Management – This ICES group is responsible for compiling and analysing all available fish stock information to compile advice on stock levels and strategies for management.

Acoustic surveys Acoustic surveys use sound waves emitted from a "transducer" to estimate the density of plankton and fish shoals. The survey vessel tows the transducer under water, which is linked to an echo sounder in the vessel which records the shoals of fish as "marks" on a screen or paper trace. The density of these marks is used to calculate total biomass of a stock.

Age The number of years of life completed, here indicated by an Arabic numeral, followed by a plus sign if there is any possibility of ambiguity (age 5, age 5+) **(see http://www.efan.no)**

Annual (or seasonal) Total Mortality Rate The number of fish which die during a year (or season), divided by the initial number. Also called actual mortality rate, coefficient of mortality.

Benthic Anything living on, or in, the bottom of the sea.

BIM An Bord Iascaigh Mhara, The Irish Sea Fisheries Board, charged with responsibility for development of the fishing and aquaculture industries in Ireland. **(see http://www.bim.ie)**

Biomass Measure of the quantity, usually by weight in metric tons (2,205 pounds = 1 metric ton), of a stock at a given time.

Biological reference points Various reference points can been defined for fished stocks. These can be used as a management target or a management trigger (i.e. point where more stringent management action is required) Examples include fishing mortality reference points $F_{0\cdot1}$, F_{max}, F_{med}, F_{pa} and biomass reference points B_{pa} and B_{lim}.

B_{lim} The B_{lim} is the limit of the spawning stock biomass, below which recruitment is impaired or the dynamics of the stock are unknown.

B_{pa} B_{pa} is the Spawning Stock Biomass (SSB) level above which the stock should be maintained to ensure that recruitment is not impaired. In stocks where there has been no evidence of reduced recruitment below a certain SSB size, B_{pa} has been calculated by multiplying B_{loss} (the lowest observed SSB) by uncertainty factor ($e^{-1.645}$) to take into account assessment uncertainty.

By-catch Refers to discarded catch (see Discards) plus incidental catch not purposely targeted by the fishermen.

CECAF Fisheries Committee for the Eastern Central Atlantic – a committee of FAO (see below) and web page **http://www.fao.org/fi/body/rfb/cecaf/cecaf_home.htm**

CFP Common Fisheries Policy – The instrument of fisheries management within the European community **(see http://europa.eu.int/comm/fisheries/policy_en.htm)**

CFB / Central Fisheries Board is responsible for National inland fisheries development plans, administration of funding programmes, fresh water and sea angling promotion and management of fish rearing operations. **(see http://www.cfb.ie/index.htm)**

CPUE /Catch Per Unit of Effort The catch of fish, in numbers or in weight, taken by a defined unit of fishing effort. Also called catch per effort, fishing success, or availability.

DCR / Data Collection Regulation EU Council Regulations 1543/2000 and 1639/2001 established a community framework for the collection and management of the data needed to conduct the common fisheries policy. Each member state must collect data on the biology of the fish stocks, on the fleets and their activities and on economic and social issues. **(see http://europa.eu.int/comm/fisheries/policy_en.htm)**

DELASS Developing Elasmobranch Stock Assessments – An EU-funded project aimed at species identification, stock identification and discrimination, as well as data preparation and exchange on elasmobranch species such as sharks and rays.

Demersal Fish, such as cod, whiting, haddock, sole, plaice, skates and rays, that normally swim in midwater at or close to the sea floor.

Discard Discards are defined as that part of the catch returned to the sea as a result of economic, legal or other considerations.

Discard rate The percentage (or proportion) of the total catch which is discarded.

Ecosystems are composed of living animals, plants and non living structures that exist together and 'interact' with each other. Ecosystems can be very small (the area around a boulder), they can be medium sized (the area around a coral reef) or they can be very large (the Irish Sea or even the eastern Atlantic).

Effective fishing effort Fishing effort or intensity standardised in some way e.g. hours fished in an area.

Elasmobranchs Fish, such as skates, rays, sharks and dogfish, whose skeletons are cartilagenous rather than boney (as in the teleost species such as cod, whiting, plaice and herring).

Emergency Measures Measures adopted by the EU prior to the introduction of cod and hake as part of the recovery plan. See the section on "Some Key Issues in Fisheries Management" for details of these measures.

Exploitation pattern The distribution of fishing mortality over the age composition of the fish population determined by the type of fishing gear, area and seasonal distribution of fishing, and the growth and migration of the fish. The pattern can be changed by modifications to fishing gear, for example, increasing mesh or hook size, or by changing the ratio of harvest by gears exploiting the fish (e.g., gill net, trawl, hook and line, etc.).

Exploitation rate The proportion of a population at the beginning of a given time period that is caught during that time period (usually expressed on a yearly basis). For example, if 720,000 fish were caught during the year from a population of 1 million fish alive at the beginning of the year, the annual exploitation rate would be 0.72.

FAO Fisheries and Agriculture Organization – Based in Rome, this organization is part of the United Nations (see **http://www.fao.org/fi/default.asp**).

FAT Fisheries Assessment Technician – regionally-based sea-going staff employed by FSS.

Fishing Effort The total fishing gear in use for a specified period of time. When two or more kinds of gear are used, they must be adjusted to some standard type

Fishing Mortality Deaths in a fish stock caused by fishing.

F_{lim} is the limit fishing mortality. F_{lim} should be avoided with high probability because it is associated with unknown stock dynamics or stock collapse.

F_{max} The rate of fishing mortality for a given exploitation pattern rate of growth and natural mortality, that results in the maximum level of yield-per-recruit.

$F_{0.1}$ The fishing mortality rate at which the increase in yield-per-recruit in weight for an increase in a unit-of-effort is only 10 percent of the yield-per-recruit produced by the first unit of effort on the unexploited stock (i.e., the slope of the yield-per-recruit curve for the $F_{0.1}$ is only one-tenth the slope of the curve at its origin).

F_{pa} is a precautionary reference point designed to ensure that there is a high probability that F_{lim} will be avoided and that spawning stock biomass will remain above the threshold (Bpa) below which the probability of good to average recruitment is decreased.

F_{sq} is some estimate of recent fishing mortality. A three year average is used for most stocks since in most assessments the most recent F estimate is the most uncertain.

Gadoids An important family of food fish, including cod, haddock, rocklings, hake, whiting, blue whiting and ling. Usually characterised by the presence of a barbel on the chin.

Gill nets Static nets suspended in the water column to trap fish by the gills.

Groundfish Species of demersal fish dwelling on, or close to the sea floor, as targeted in the annual FSS groundfish surveys around the Irish coast.

Growth overfishing Occurs when fishing mortality exceeds $\mathbf{F}_{max}$

FSS / Fisheries Science Services – One of seven service areas of the Marine Institute, FSS's mission is to Assess, Research and Advise on the marine fisheries resource in Irish waters – **(see: http://www.marine.ie/)**

Fleet A physical group of vessels sharing similar characteristics in terms of technical features and/or major activity (e.g. the Irish beam trawler fleet < 300 hp, regardless of which species or species groups they are targeting).

Fishery Group of vessel voyages targeting the same (assemblage of) species and/or stocks, using similar gear, during the same period of the year and within the same area (e.g. the Irish flatfish-directed beam trawl fishery in the Irish Sea).

Harvest Control Rule A predefined rule governing the exploitation of fish stock such that management targets are achieved. These vary from the simple to the extremely complex.

ICES International Council for the Exploration of the Seas –Ireland shares the Total Allowable Catches TACs for many stocks we exploit with our European Union partners. Because of this international dimension many stocks need to be assessed in an international fora such as ICES. **(see: http://www.ices.dk/)**

ICCAT International Commission for the Conservation of Atlantic Tuna – **(see: http://www.iccat.es/)**

IFREMER France's national marine research agency – **(see: http://www.ifremer.fr/anglais/)**

Inshore fisheries There are various definitions of inshore fisheries including those fisheries that are conducted within 12 miles of the shore, including demersal, pelagic, shellfish and sea angling fisheries.

ISWPAC – Irish South and West Pelagic Advisory Committee

Management Plan is a agreed plan to mange a stock. With defined objectives, implementation measures, review processes and stakeholder agreement and involvement.

Maximum Sustainable Yield The largest average catch or yield that can continuously be taken from a stock under existing environmental conditions. (For species with fluctuating recruitment, the maximum might be obtained by taking fewer fish in some years than in others.) Also called maximum equilibrium catch, maximum sustained yield, sustainable catch.

Marine Institute The Marine Institute is Ireland's national agency with the following general functions : "to undertake, to co-ordinate, to promote and to assist in marine research and development and to provide such services related to marine research and development, that in the opinion of the Institute will promote economic development and create employment and protect the environment." Marine Institute Act, 1991 – **(see: http://www.marine.ie/)**

Métier Homogeneous Subdivision of a fishery by vessel type (e.g. the Irish flatfish-directed beam trawl fishery by vessels < 300 hp in the Irish Sea).

MPA / Marine Protection Area A conservation area in the sea usually designated for the protection and maintenance of biological diversity and natural and cultural resources.

Natural Mortality Deaths in a fish stock caused by predation, illness, pollution, senility, etc., but not fishing.

NEAFC / North Eastern Atlantic Fisheries Commission – A commission that manages fisheries off Scandinavia and north-eastern Europe - **(see http://www.neafc.org/)**

Nominal catch The sum of the catches that are landed (expressed as live weight or equivalents). Nominal catches do not include unreported discards.

NOAA / National Oceanic and Atmospheric Administration FSS co-operate with NOAA, our US counterparts, on a number of strategic projects.**(see http://www.noaa.gov)**

Pelagic Fish that spend most of their life swimming in the water column, as opposed to resting on the bottom, are known as pelagic species.

Precautionary Approach The precautionary approach should be widely applied to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment. The absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures.

Quota A portion of a total allowable catch (TAC) allocated to an operating unit, such as a Vessel class or size, or a country.

Rate Of Exploitation The fraction, by number, of the fish in a population at a given time, which is caught and killed by man during the year immediately following. The term may also be applied to separate parts of the stock distinguished by size, sex, etc. Also called fishing coefficient.

Rebuilding Plan (See Recovery Plan)

Recovery Plan This is a multi-annual plan to recover seriously depleted stock. The plans general involve agreed Harvest control Rules, Technical Measures, effort controls and various control and enforcement measures.

Recruitment The amount of fish added to the exploitable stock each year due to growth and/or migration into the fishing area. For example, the number of fish that grow to become vulnerable to the fishing gear in one year would be the recruitment to the fishable population that year. This term is also used in referring to the number of fish from a year class reaching a certain age. For example, all fish reaching their second year would be age 2 recruits.

Recruitment overfishing The rate of fishing above which the recruitment to the exploitable stock becomes significantly reduced. This is characterised by a greatly reduced spawning stock, a decreasing proportion of older fish in the catch, and generally very low recruitment year after year.

Relative Abundance An estimate of actual or absolute abundance; usually stated as some kind of index; for example, the average catch per tow on a survey.

Sample A proportion or a segment of a fish stock which is removed for study, and is assumed to be representative of the whole. The greater the effort, in terms of both numbers and magnitude of the samples, the greater the confidence that the information obtained is a true reflection of the status of a stock (level of abundance in terms of numbers or weight, age composition, etc.)

Shellfish Fisheries Those fisheries were the target species are either crustaceans (e.g. *Nephrops*, lobsters, crabs and crayfish) or molluscs (Cephalopods, scallops, oysters etc.).

STECF The Scientific Technical and Economic Committee on Fisheries was established by the European Commission and comprises fisheries scientists and economists from the member states. The role of STECF is to advise the European Commission on scientific, technical and economic issues related to the management of fisheries resources that are exploited worldwide by members of the European Union.

Stock A "stock" is a population of a species living in a defined geographical area with similar biological parameters (e.g. growth, size at maturity, fecundity etc.) and a shared mortality rate. A thorough understanding of the fisheries biology of any species is needed to define these biological parameters.

Stocklettes Is a small localised population of a species living in a defined geographical area that mixes with other populations at a meta-population level perhaps during breeding phase of the life-cycle but may have different biological parameters and mortality rates.

SSB / Spawning stock biomass The total weight of all sexually mature fish in the population. The size of SSB for a stock depends on abundance of year classes, the exploitation pattern, the rate of growth, fishing and natural mortality rates, the onset of sexual maturity and environmental conditions.

Spawning stock biomass-per-recruit (SSB/R) The expected lifetime contribution to the spawning stock biomass for a recruit of a specific age (e.g., per age 2 individual). For a given exploitation pattern, rate of growth, and natural mortality, an expected equilibrium value of SSB/R can be calculated for each level of F. A useful reference point is the level of SSB/R that would be realised if there were no fishing. This is a maximum value for SSB/R, and can be compared to levels of SSB/R generated under different rates of fishing. For example, the maximum SSB/R for Georges Bank haddock is approximately 9 kg for a recruit at age 1.

Sustainable yield The number or weight of fish in a stock that can be taken by fishing without reducing the stock biomass from year to year, assuming that environmental conditions remain the same.

TAC / Total allowable catch is the total regulated catch from a stock in a given time period, usually a year.

Tangle nets Static nets lain on the bottom of the sea, aimed at trapping fish and shellfish by entanglement in their meshes.

Teleost Fish species – such as cod, mackerel, plaice and sole - have skeletons made of bone, as opposed to elasmobranches – such as sharks and rays – whose skeleton is composed of cartilage.

TCM / Technical Conservation Measures These measures take the form of closed areas, increased mesh sizes and gear modifications (such as separator panels) and are aimed at protecting specific stocks, or age-classes within that stock, from overfishing (See also Recovery Plans).

U An index of exploitable biomass. Notation used for deepwater stocks by ACFM in May 1998.

U_{lim} For deepwater stocks has been calculated as 0.2 * $\mathbf{U_{max}}$ (may be a smoothed abundance index).

U_{pa} For deepwater stocks has been calculated as 0.5 * $\mathbf{U_{max}}$. For redfish $\mathbf{U_{pa}}$ =0.5 or 0.6 * $\mathbf{U_{max}}$.

Unaccounted mortality Any mortality that is not accounted for properly in a stock assessment model. Potential causes of unaccounted mortality include illegal or misreported landings; escapement or avoidance mortality that occurs when fish are injured by fishing gear but are not captured; and ghost fishing mortality, caused by lost gear (e.g., traps and gillnets) that continues to catch fish.

Unaccounted removals Any removal that are not accounted for properly in a stock assessment model. Potential causes include unaccounted mortality, migrations changes in natural mortality due to starvation, competition, predation, disease or mass mortality events.

Whitefish Term used to describe demersal species such as cod, plaice, ray etc., as opposed to pelagic or salmonid species.

Year class (or cohort) Fish in a stock born in the same year. For example, the 1987 year class of cod includes all cod born in 1987, which would be age 1 in 1988. Occasionally, a stock produces a very small or very large year class which can be pivotal in determining stock abundance in later years.

Yield-per-recruit The expected lifetime yield-per-fish of a specific age (e.g., per age 2 individual). For a given exploitation pattern, rate of growth, and natural mortality, an expected equilibrium value of Y/R can be calculated for each level of F.