Fisheries Research Centre

Report for 1994-1995

FISHERY LEAFLET 172

MARINE INSTITUTE
FORAS NA MARA

ISSN 0332-1789

FISHERIES RESEARCH CENTRE
REPORT FOR 1994-1995

FISHERIES RESEARCH CENTRE, ABBOTSTOWN, DUBLIN 15.

FISHERY LEAFLET 172 March 1997

Marine Institute Dublin 2

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INTRODUCTION

DIRECTOR'S FOREWORD

David de G Griffith

This combined annual Report for the years 1994 and 1995 span a critical period in the history of the Fisheries Research Centre. During 1994 the funding support from the EC STRIDE Initiative came to an end, having achieved a notable and wholly innovative impact on marine R&D activities in Ireland. The scientific undertakings at the core of the STRIDE Programme have been maintained through a number of contract research positions at the FRC, where they continue to make a critical contribution to Irish marine science.

The year 1995 marked the culmination of almost a century of fisheries related research carried out under the direct control of the Government Service, having been initiated in 1900 by the Department of Agriculture and Technical Instruction for Ireland. On 1 January 1996 the Fisheries Research Centre transferred to the Marine Institute, and thus this FRC Report is the first to be published under the new masthead.

The future of Irish marine research, and in particular that part of it carried out at the Fisheries Research Centre, thus looks set to enjoy another boost to its continuing development, similar in impact to that created at the beginning of this century.

DEMERSAL FISHERY

NEPHROPS (DUBLIN BAY PRAWNS)

Paul Hillis, Jim Carroll

In 1994, 38 commercial samples of nephrops from Skerries and Clogherhead in the east coast fishery (ICES Division VIIa, ICES Nephrops Functional Unit 15) were examined, comprising 44,400 specimens, which included 6,500 prawns from the discards of the commercial fleet. Total landings were 1,626 tonnes.

Seven hundred and five nephrops in 6 samples were individually weighed and measured to obtain data for length-weight relationship and carapace length (the standard measurement)-tail length and tail breadth conversion for use in measuring samples landed as tails.

In 1995, from total east coast landings of 1,752 tonnes, 21 commercial samples totalling 30,400 were examined, including 5,300 from the discards. In both years discarded whiting and other commercial demersal fish were sorted by species and passed to the Demersal Fish Section for the discard studies programme.

Sampling on the west coast was carried out in 1995 at Rossaveel for the first time since 1991. Eight commercial samples examined from the Porcupine Bank (ICES Divisions VIIc and VIIk, Functional Unit 16) comprised 6,200 prawns and 13 samples from the Aran Island Grounds (ICES Division VIIb, Functional Unit 17) totalled 14,000.

A sampling programme was also initiated for the Celtic Sea, (ICES Division VIIg, Functional Unit 20-22); two commercial samples of whole nephrops examined at Dunmore East contained 1,013 males and 30 females.

In both years the annual summer cruises were supplemented by cruises during January- February to gain additional information on which to base calculations of growth-rate. These cruises were quite badly affected by bad weather, with twelve stations completed in 1994 and nine in 1995 out of 37 scheduled for sampling. However, it was possible in 1995 to examine the effect of sea bed illumination on nephrops catches by fishing repeatedly in the same areas over the periods of changing light intensity during dawn or dusk at three different depths, 21, 42 and 80 m approximately. Results showed catches varying from 13 to 2,975 per 30 minute haul at 21 m, from 134 to 8,938 at 42 m and from 92 to 562 at 80 m, showing that the effect became less marked with increasing depth.

The Irish Sea summer cruise carried out during June-July 1994 to survey the population and provide good quality ageing data also examined inter-haul variability in catches. Numbers were markedly down on previous years, the totals for thirty index stations being 33,095 compared with 69,960 in 1993, and an average of 318,786 over the previous 3 years. The 1995 cruise ran into some poor weather and only 24 stations out of 32 scheduled were sampled. However, comparisons of catches in the same area over dusk and dawn were repeated and showed numbers ranging from 58 to 3,679 at 21 m, from 233 to 7,365 at 42 m and from 150 to 1,556 at 80 m. Further analysis remains to be carried out on these variations in numbers which make this species very difficulty to survey effectively.

Work on the fitting of statistical normal curves to polymodal length-frequency distributions to estimate mean length and standard deviation of each age-group, in order to assess age at length, - and hence total mortality, continued. Indications are quite promising for males and immature females, but the ageing of the breeding female component of the population still presents substantial problems in this respect.

The work provided data for use at the ICES (International Council for the Exploration of the Sea) *Nephrops* Working Groups at Lisbon in March 1994 and Lowestoft in March 1995 to assess the stock and advise the EU in their capacity as managers on the appropriate size of catch for the ensuing years.

DEMERSAL FISH SECTION - Paul Connolly

The demersal fish stock monitoring programme consists of fish market, port and sea sampling of landings, together with various research vessel surveys and commercial charter surveys. The levels of discarding are also monitored in a number of fisheries. The results of these studies are analysed at the FRC and brought annually to the various ICES Working Groups where the state of each stock is assessed. The conclusions of the Working Groups form the basis of scientific and management advice to the EU who set the annual total allowable catch (TAC).

The stock monitoring programme covers two regional species groups. The first comprises cod, whiting, haddock, plaice, sole, megrim and monk in ICES Divisions VI (Donegal and Rockall) and VIIa (Irish Sea). These data are used for assessments carried out by the ICES Northern Shelf Working Group. The second group covers hake, monk and megrim in ICES Sub-Area VII (south and west coast of Ireland) and non-assessed stocks of cod, whiting, haddock, plaice and sole in VII b-c and VII j-k. The results are used for assessments carried out by the ICES Southern Shelf Working Group

The Section has also been involved in three EU STRIDE-funded projects: the Deep Water Fisheries Programme, the West and South Coast Non-assessed Stocks Project and, in association with the Pelagic Section, the Fleet Assessment Technician programme.

The section is also involved in four international EU funded projects; The assessment of fish biomass in the Irish Sea using the annual egg production method (EU AIR 3-94-2263); the assessment of discard rates from commercial species of fish (EU BIOECO 93-3); Improved sampling of demersal fish stocks (EU Study Contract 94-013) and Deep Water Fisheries (EU FAIR PL 95-655).

In association with the Pelagic Section a considerable amount of time was devoted to the production of the annual *Fish stocks in 1994 with management advice for 1995 and Fish stocks in 1995 with management advice for 1996* reports which are used by the Irish delegation at the annual EC negotiations on TAC's and Quotas.

COD, HADDOCK, WHITING, PLAICE AND SOLE

Paul Connolly, Helen McCormick, Nicola Donohoe

The stock monitoring and research vessel survey programmes for Donegal, Rockall, Celtic Sea and Irish Sea demersal stocks continued throughout 1994 and 1995. A total of 11,200 fish were aged and 81,300 measured in 1994 while 108,500 were measured and 12,000 aged in 1995. The FRC acted as international species co-ordinators for the assessment of cod and whiting stocks in ICES Division VIa during 1994 and full in-house assessments were performed using the latest population modelling software (Virtual Population Analyses, VPA Suite. Version 3.1). In 1995 FRC acted as international species co-ordinators for cod, whiting and haddock in ICES Division VIIa (Irish Sea).

Irish Sea (ICES Division VIIa)

Fishing mortalities remained very high in the Irish Sea and there were serious concerns about the state of the commercial stocks of cod, whiting, plaice and sole. Cod spawning stock biomass in 1994 (4,000 t) remained close to historic low levels. Whiting spawning stock biomass declined to 8,500 t in 1994, due to the diminishing effects of the strong 1991 year class and the high levels of fishing mortality. Flatfish stocks have suffered from low recruitment levels for several years. Plaice spawning stock biomass continued to decline and reached 4,250 in 1994, well below average. Sole spawning stock biomass was estimated at 3,700 t in 1994 which was close to the historic low.

Donegal (VIa) and Rockall Stocks (VIb)
Roundfish stocks in these areas have given rise to serious concerns with fishing rates excessively high and spawning biomasses critically low. The 1994 spawning stock biomass estimates for cod (14,700 t) and whiting (24,700 t) were close to their respective historic lows. Recent cod and whiting recruitment's had been below average while saithe and haddock recruitment were close to average. Haddock spawning stock biomass was estimated at 49,000 t in 1994, well below the long term average. A directed fishery for anglerfish and megrim had developed in recent years but data were not sufficient to undertake a complete assessment of the stocks.

Celtic Sea Stocks (ICES Division VIIg)
Most of the stocks in this region had experienced relatively high exploitation rates and, consequently, spawning stock biomass had declined for gadoid and flatfish stocks in recent years.

Young Fish and Ground Fish Survey Programmes.
The annual Irish Sea Juvenile Plaice Survey (1976 to 1995) on the commercial trawler *Sealgair* indicated that plaice recruitment in 1993 was average and above average in 1994. Two Irish Sea Young Fish Surveys (1985 to 1995) on the *Lough Beltra* in June and September returned numbers of juvenile cod and whiting which indicated incoming recruitment to be average for 1993 and 1994. The South Coast Young Fish Survey (1991 to 1995) was carried out in July 1994 on the *Lough Beltra*. This survey was extended in 1995 to cover the entire west and south coasts and was carried out on the *Lough Swilly* over a three week period in July. Good catches of juvenile cod and hake were recorded but, as the survey had only been carried out for four years, it would be difficult to draw any conclusions until a longer time series becomes established. The West Coast Ground Fish Survey (1991 to 1995) took place on two chartered commercial fishing vessels, *Sionnain* and *Dermot Anne* along the entire west coast in October. Results indicated a very large 1994 year class of haddock, and good signs of small anglerfish but, again, the time series is short. These survey programmes also collected samples for a number of other projects including dab and squid for University College, Cork and fish for the Martin Ryan Institute, Galway.

IRISH SEA WHITING DISCARD PROGRAMME

Paul Connolly, Helen McCormick, Nicola Donohoe

The discarding of whiting by the Irish nephrops-directed fleet is a considerable problem in the Irish Sea. A monitoring programme was set up in 1987 to estimate the level of discarding by the Irish fleet. In the 1995 programme, 25 fishing trips were sampled, some 400 fish were aged and 4,000 measured. These results were presented at the ICES Northern Shelf Working Group, for use in the Irish Sea whiting assessment. The introduction of the square mesh panel into the Irish fleet in 1994 may reduce the levels of discarding but at least two years of monitoring data will be required before any reduction may be detected.

HAKE, ANGLERFISH (MONK) AND MEGRIM

Paul Connolly, Helen McCormick, David Noone, Nicola Donohoe

A total of 3,400 fish were aged and 18,500 were measured in 1994 while 24,500 fish were measured and 4,500 fish aged in 1995. Length data were secured from landings of anglerfish, megrim and hake and the megrim ageing programme continued. Irish data were presented to the Southern Shelf Working Group in September 1994 and 1995 which concluded that the northern hake spawning stock biomass had decreased continuously since 1987, and had reached new historic lows in each year since 1991. Spawning stock biomass in 1994 was estimated at 125,000 t. There were serious concerns about the high levels of fishing mortality and the hake stock was considered to have passed outside safe biological limits. Megrim *L. whiffiagonis* in Sub-area VII showed above average spawning stock biomass levels in 1994 (80,000 t). Fishing mortality had declined from the high 1991 levels but the stock appeared to be within safe biological limits. Anglerfish *L. piscatorius* stock levels in sub-Area

VII had been decreasing continuously to a historic low in 1994 of 30,000 t, but the time series was too short to determine whether the stock was outside safe biological limits.

WEST AND SOUTH WEST COAST NON-ASSESSED STOCKS,

Paul Connolly, Maria Doherty, David Noone and Nicola Donohoe

This STRIDE funded programme (SA2) was set up to examine stocks of cod, whiting, haddock, plaice and sole off the west and southwest coasts of Ireland (ICES Divisions VIIb, c and VIIj, k). These stocks had not been previously assessed and very little was known about their population dynamics. The stocks were subject to precautionary TACs in the absence of any analytical assessment information. In 1993, a comprehensive stock monitoring programmes was established and continued throughout 1994 and 1995. A total of 5,211 fish were aged and 37,171 measured in 1995. Data on discards were collected by the Fleet Assessment Technicians (FATs) to estimate the levels of discarding from these fisheries. The FRC was appointed international species co-ordinator for these stocks and the first provisional assessments were carried out at FRC and presented to ICES. Yield per recruit analyses and fishing mortality estimates were provided for the Southern Shelf Working Group Report. The assessments indicated that these stocks were over-exploited. This programme finished in October 1995 and was replaced by EU Study Contract 94-013 (next section).

DEEP WATER FISHERIES OFF THE WEST COAST OF IRELAND

Paul Connolly and Ciaran Kelly

The FRC deep water fisheries programme, using a postgraduate studentship funded by STRIDE (SA2) commenced in October 1992. The studentship is supervised jointly by Paul Connolly and by Dr John Bracken of the Department of Zoology, University College, Dublin. In 1994 and 1995 , work continued on the biological analyses of the data collected during two deep water sampling surveys carried out on the Continental Slope to the west of Ireland and Scotland in 1993. This work has focused on three species, the roundnose grenadier *Coryphaenoides rupestris*, the bluemouth rockfish *Helicolenus dactlyopterus* and the forkbeard *Phycis blennoides*. Age and growth work on the roundnose grenadier was completed and indicated the species to be long lived (up to 65 years) and to mature at about 12 years of age.

Results from the FRC were presented in early May to an EU Advanced Workshop on Northeast Atlantic deep water fish. It emerged from this meeting that there was a dearth of information on the growth and reproduction of many of the deep water species now being targeted by the fishery. The FRC subsequently compiled and circulated a questionnaire to European fisheries laboratories in order to prepare a catalogue of ageing work and otolith collections for north east Atlantic deep water species.

The FRC conducted two deep water surveys in November 1995. The first trawl survey was carried out on the *Mary M* in the Rockall Trough and Porcupine Bank areas. An area 200 miles north of the Azores was also surveyed to assess the potential of deep water fishing in the mid Atlantic. The second longline survey was carried out on the *Sea Sparkle* in the Rockall Trough and Porcupine Bank area. This survey showed that there is potential for a deep water shark fishery if the markets for the product can be developed. Both surveys yielded valuable data and sampling material for the FRC deep water programme.

Funding was successfully secured from the EU in November 1995 for an International Project on EU Deep Sea Fisheries. The Project will run for three years and FRC will employ a postgraduate student to study deep water shark biology off the west coast of Ireland and a biologist to continue work on the biology of deep water fish species.

ASSESSMENT OF DISCARD RATES

Paul Connolly, Michael Keatinge, Fiona Woods

This project, funded by the EU BIOECO 93/3 commenced in March 1994 and was completed in September 1995. The objective was to design a cost effective, practical and statistically robust sampling scheme for monitoring discarding of commercial fish by fishing vessels at sea. The new design is based on the experience gained from existing discard work carried out by the UK, France and Ireland. The co-ordinator for this international project involving UK, (MAFF, SOAFD, DANI), France (IFREMER) and Ireland (FRC) was MAFF, Fisheries Laboratory at Lowestoft. The FRC participation focused on two main areas: the practical and logistical aspects of discard sampling and the development of an interactive discard database. Two sources of Irish data were used in the project; the FATs discard data and the data from the Irish Sea whiting discard programme. The FATs data had previously been analysed in an ad hoc manner on a variety of spreadsheets. In 1994, work commenced on the design of a discard data base. The FRC attended a meeting in Edinburgh, UK in December 1994, to discuss practical aspects of discard sampling and a meeting in Lorient, France to discuss the statistical aspects of discard sampling and analyses. The project continued throughout 1995 and the final report was submitted in august 1995. This project was managed in association with the Marine Institute.

ASSESSMENT OF IRISH SEA STOCKS USING AEP

Paul Connolly, Maria O'Neill and Helen McCormick

This 18-month, EU funded project involves UK (MAFF, DANI, IOM), Belgium and Ireland (FRC). The objectives are to carry out a fishery-independent assessment of cod, plaice and sole in the Irish Sea using the Annual Egg Production Method (AEP). Two MAFF-funded feasibility meetings were held in Lowestoft, UK in April and November 1994 in order to examine the logistics and the science involved in carrying out the method in the Irish Sea. The EU agreed to fund the project in November 1994 and work commenced on the recruitment of staff, securing research vessel time and the purchase of scientific equipment. The FRC was appointed species co-ordinators for cod.

The main scientific work was carried out in 1995. Maria O'Neill was appointed FRC Research Assistant for the project and commenced work in January. The *RV Lough Beltra* conducted two egg and larval surveys of the Irish Sea in March and April as part of an international research cruise programme involving 13 cruises between February and May. Cod population data were secured from a series of commercial vessel surveys and port landings. Histological screening of cod ovaries was carried out in order to make fecundity and atresia estimates. These data will be used to estimate the biomass of cod. Data analyses and laboratory work will continue in early 1996 and biomass estimates will be available in May 1996.

FLEET ASSESSMENT

John Molloy, Paul Connolly, Frances Bermingham, Deirdre Brogan, Jim Daly, Siobhan Moran, Fiona Woods

The Fleet Assessment Technicians, funded under the STRIDE programme continued to collect and examine fish samples from commercial fishing vessels and from local markets and processing plants. In particular they were engaged in sampling discards and by-catch while at sea and in providing data on the fishing activities of the fleets in the various ports. The data will also be used to provide scientific advice on management measures to protect fish stocks in certain areas (for example, introduction of square mesh, closed boxes, closed seasons). Technicians were centred at Howth, Dunmore East, Castletownbere, Rossaveal and Killybegs. They act as an important contact point between the FRC and the fishing industry.

Sampling was concentrated on the assessed stocks in ICES Divisions VI and VII and on the non assessed stocks on the west and southwest coasts. All the data collected were entered on the DEM 1-

4 database. In addition a number of research and exploratory surveys on herring, tuna and young fish were also covered. The FATs used new electronic measuring boards and data logging system and various suggested modifications were carried out to improve the system. They undertook 42 commercial fishing trips and spent 185 days at sea. The programme finished in November 1994 and was replaced by EU Study Contract 94-013.

IMPROVED SAMPLING OF FISH STOCKS IN ICES AREAS VI and VII

Paul Connolly, Sorcha Wheatley, Fiona Woods, Niamh Slattery, Gerry Blake, Frances Bermingham, Frank Kane, Joseph Wall, Michael Fitzpatrick.

This international project involves Portugal, Spain, Ireland and the UK and is funded by the EU for a three year period (1995-1997) (EU Study Contract 94-013). The project objective is to improve the quality of data for fish stock assessment in order to improve the quality of scientific advice to the EU for TAC and management purposes. The main aim of the Irish programme is to continue the sea sampling of landings and discards using the Fleet Assessment Technicians. The project also aims to improve the fish stock data management regime at FRC with a view to improving the quality of data provided to the various Working Groups. A very important aspect of the Irish work programme will be to improve contact and liaison with the industry. The project commenced in July 1995 and much time was spent recruiting personnel (8) and setting up the programme.

OTOLITH TRAINING AND AGE READING EXCHANGE MODULE

P. Connolly

Under the STRIDE programme a joint project was initiated between FRC and Dr Richard Fitzgerald of the Aquaculture Development Centre (ADC), University College, Cork. This 4 month collaborative project developed a pilot otolith training module (OTM) and otolith age reading exchange module (OAEM). These modules were designed for routine use in any laboratory carrying out fish ageing work. The modules are operated on a standard 486 PC with colour monitor, via a user friendly, interactive, menu-based format with a versatile graphic user interface. No special application software is required by the end user. The pilot module will be distributed to various fisheries laboratories for appraisal. The pilot modules will also be submitted to the EU and other funding agencies, to show the potential of the system and to seek funding for the development of a more comprehensive version of OTM and OAEM.

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WHELK

Edward Fahy and Paul Gleeson

A fishery for whelk has been in existence sporadically for many years supplying a niche market in the UK. From the mid-1980s it expanded to supply whelk meat to the Far East. The majority of catches are taken in the southern Irish Sea. Total landings in 1993 were estimated at 6,000 tonnes, a fourfold increase on the previous year.

Between March and July 1994, processors and landing places were visited in Cos. Wicklow and Wexford. Analysis of 44 biological samples, the majority from the southern Irish Sea constituted the material on which an age-based assessment of the fishery was undertaken.

Some trial potting was conducted out of Howth and two commercial whelk vessels were accompanied to sea. Buying-in documentation from two of the largest processors was examined and abstracted. Details were obtained of ports of landings and of the grade composition of bought-in material.

The analysis of sales data indicated that the weight of a consignment of whelk delivered to the processors has not greatly altered between 1990 and 1993, although the fishing effort per catch was estimated to have increased by approximately 44%. The average weight of consignments from three landing places in the southern Irish Sea showed little variation in the same period. There were, however, indications that the average size of whelk landed had declined. These come from comparison with length frequencies prepared in 1986 and from the interpretation of grade composition of landings in 1993. Whelk from the most heavily exploited areas displayed a pronounced Lee effect, arising from survival after discarding. These fisheries also had a tendency towards a younger age at full recruitment.

The age composition of landings to the principal ports was determined using an ALK derived from opercular readings. Samples of graded material were used to convert buying-in data to virtual population numbers. Age at full recruitment was determined at 5 years. Log/normal regressions of numbers at age after 5, provided values of the total mortality coefficient Z ranging between 0.32 (for whelk landed from the Kish fishery to Howth) and 0.97 (Courtown). Recalculating these figures from age 4 in the case of the most heavily fished areas, produced only slight differences in Z.

The biological data were amalgamated in a Thompson-Bell yield per recruit curve which indicated that F_{max} for the southern Irish Sea is at F = 0.3. Only the Howth/Kish fishery had an F level lower than this.

Yield per recruit analyses indicated that whelks are being caught at too early an age for the fishery to be sustainable. In order to introduce a measure of protection, therefore, a size limit of 50 mm was introduced for Irish whelk stocks in 1994 (S.I. 278). An account of the study was accepted for publication in *Irish Fisheries Investigations.*

Following the publication of an appraisal of the whelk fishery in the Irish Sea and the introduction of a size limit for landings in 1994, an inspection of the fishery was carried out in March 1995. Whelk samples were taken from the two principal processors in Co Wexford and some 2,400 individuals from 8 landing places, ranging from Strangford to Rosslare, were examined. As in 1994, lowest fishing pressure on this species is exerted north of Dublin but the stocks along the Wicklow and North Wexford coasts are heavily fished. At Courtown 64% of the whelk landed were beneath the legal size limit.

SHRIMP

Edward Fahy and Paul Gleeson

The purpose of the shrimp investigations is to devise a management strategy for a species which could be worth £5 million annually. As for most inshore fisheries there is a lot of concern about the future of shrimp whose fisheries attract progressively increasing numbers of fishermen.

Field work took place in May-June, July, September, October and December 1995. Essentially we are at the data collecting stage and we need to complete one year's sampling, before being in a position to process data.

The investigations have taken several simultaneous tracks:

Field work in Bantry Bay was directed at ascertaining the seasonal migration pattern of shrimp of different sizes, of ascertaining their stage of maturation etc. The survey was conducted using standard shrimp pots.

Graded samples from commercial processors were analyzed with a view to describing the size, sex composition and state of maturation of the four commercial grades. Although the definition of these differs from one processor to another they are basically fairly similar. The characteristics of each

grade did, however, vary considerably from one month to the next so that a full series of analyses will be required in order to ascertain the composition of the landings over a season.

Data were abstracted from the commercial records held by processors. These records are essentially the mechanically graded shrimp landings for which the fishermen are paid. The integration of these figures with the analyses of the bought-in material provides an account of the exploited stocks. Processors' data were abstracted from Waterford to Connemara; the greater part of the data came from six sources. The landings were recorded from 1977 in one case, but the greater part of the information was more recent, from the last four or five years.

EFFECTS OF FISHERIES ON BENTHIC ECOSYSTEMS -

Brian Munday and Nick Pfeiffer

The programme commenced in June 1994 and will continue until June 1997. It is an international collaborative project funded by the European Union under the AIR programme IMPACT II (AIR2 CT94 1664), and involves a variety of marine research institutes from the Netherlands, Germany, UK, Belgium and Ireland. The general objective is to estimate the direct and indirect effects of different types of demersal fisheries on the ecosystems of the North Sea and Irish Sea. It is hoped that essential information will be provided for the future management of marine fisheries, so that a balanced choice between nature conservation and economic benefits can be made. Under this project, and in association with the Martin Ryan Marine Science Institute, University College, Galway, information is to be obtained on the effect of the recognised *Nephrops norvegicus* fishery on the ecosystem of the north west Irish Sea. The specific FRC requirements for the IMPACT II study are to collect data on the importance of discarded materials from the nephrops otter trawl fisheries in the Irish Sea on the benthic ecosystem i.e. who is eating what, where, when, and how much ?

To this end, and in conjunction with the MRI, two sampling cruises were conducted aboard the R.V. Lough Beltra in 1994 (1 - 7 June and 28 October to 3 November) to collect benthic and fish samples from the nephrops grounds. Two further experimental cruises were carried out during 1995 (3 - 9 May and 28 August - 3 September). Benthic samples were returned to the MRI while trawl catches were first weighed and sub-sampled to determine catch composition. Representative samples of each fish species present were then frozen prior to return to the FRC for analysis of the gut contents, in order to determine some of the trophic relationships between various predators/scavengers and animals damaged or discarded by trawling activity.

PELAGIC FISHERY

HERRING

John Molloy, Liz Barnwall

Celtic Sea and ICES subdivision VIIj (south and south west coasts)
The stock in this area was assessed, as in previous years, on the basis of a detailed biological sampling programme (age, lengths, weights, maturity and vertebral counts) on the catches during the main season (October to February) combined with an acoustic survey. The main fishery during 1995 took place on the spawning grounds situated in Dingle Bay, off Cork Harbour and south of Dunmore East. Acoustic surveys were again carried out using the Northern Ireland research vessel *Lough Foyle* and consisted of two cruises, totalling 5 weeks duration, designed to obtain an estimate of the abundance of the autumn and winter spawning populations. The results of the 1995 surveys - particularly that carried out in November, suggested a decrease in the stock size in the area. The results were consistent with observations obtained from the commercial fishermen and gave cause for concern

about the ability of the stock to sustain the current level of fishing effort. A young fish survey, designed to obtain an index of recruitment for demersal and pelagic fish, was carried out in Division VIIj and Division VIIb by the *Sionnain*, a commercial fishing vessel from Dingle.

ICES Subdivision VIaS and VIIb - (west and northwest coasts)
For a number of years prior to 1994 the herring stock in this area could not be analytically assessed because no fishery-independent surveys had been made. In July 1994 an acoustic survey which covered the area from the Stanton Bank, north of Donegal to Dingle Bay was carried out using the *Lough Foyle*. This survey was again carried out in July 1995. The results from this survey, together with the biological data which was gathered as a result of the continuing sampling programme on the catches were used to estimate the size of the stock. There appears to have been a serious decline in the stock in this area in recent years. The young fish survey, already mentioned in the previous section, covered part of this area from the Skellig Rock to Galway Bay. The northern part of the area was covered by the *Marliona* from Greencastle.

ICES Subdivision VIaN - (west of Scotland)
The stock in this area is mainly assessed by acoustic and larval surveys carried out by Scottish scientists. Ireland continues to operate a biological sampling programme on catches. The stock appeared to be in a reasonably healthy state and Ireland continued to have a valuable quota in the area.

ICES Subdivision VIIaN (Irish Sea)
For a number of years the Irish fishery in this area has been at a very low level. In 1994 no directed herring fishery took place and the only herring caught were as a result of by-catch in the nephrops fishery. Some samples were obtained from these bycatches and from catches made by Northern Irish vessels, which were purchased by processors in Dublin.

MACKEREL

John Molloy, Liz Barnwall and Dermot Kennedy

The western mackerel stock, which is the most important pelagic fishery exploited by the Irish fleet, is assessed mainly on the basis of the international egg surveys which are carried out every third year. These surveys were again carried out in 1995 and Ireland, using the *Lough Foyle*, carried out a three week survey on the important spawning areas west of Ireland in May. The assessment in 1995 was based mainly on the results of the 1992 egg surveys (before the results of the 1995 exercise became available), together with the data collected from the biological sampling programme and from the annual young fish surveys. Ireland plays an important part in all of these investigations. The 1995 assessment predicted that the spawning stock would decline in the immediate future. This decline would result from the very high catches taken in recent years and because recruitment of young mackerel to the adult stock was not as abundant as had been indicated from the young fish surveys. The spawning stock was predicted to fall below the minimum level (1.8 million tonnes) considered necessary for the stock to be susutained, and as a result severe catch restrictions appeared to be desirable. The preliminary results of the 1995 egg surveys confirmed the serious decline that appears to have taken place in the stock. Mackerel were again tagged by the Norwegians off the southwest coast in May in an attempt to obtain information on stock migrations.

Mackerel Age Reading.
Elizabeth Barnwall took part in an EU funded Workshop on age reading of mackerel otoliths, held in Vigo. The workshop was deemed necessary because of serious inaccuracies in the interpretation of the otoliths and this was considered to be affecting the quality of the stock assessments.

HORSE MACKEREL

John Molloy and Liz Barnwall

No biological programme had been carried out on this important stock in recent years, although some data on length compositions was collected. Information on the abundance of young horse mackerel continued to be collected from the young fish surveys. The horse mackerel fishery in 1995, according to official statistics, is by far the most important Irish fishery in terms of quantities landed.

TUNA

John Molloy, Elizabeth Barnwall

The Irish tuna fishery was again very important in 1995, particularly to the ports in the southwest. The fishery has continued to be controversial because of the possible impact which the use of gill nets may have on marine mammals - particularly the dolphin population and on other fish and birds. A small number of samples were examined from the commercial fishery and the results will be presented to the International Commission for the Conservation of Atlantic Tuna (ICCAT).

ACOUSTIC SURVEYS

John Molloy and Kerry Blake

Acoustic surveys were carried out on the herring stocks in the Celtic Sea and off the west coast during 1995. Three surveys were carried out using the *Lough Foyle*. The biological investigations and the necessary computer back up facilities were carried out by FRC while the analysis of the data was carried out under contract to the Marine Laboratory Aberdeen. The results of these surveys form the basis of the stock assessments on which the TACs are decided.

SALMON, TROUT AND EEL

NATIONAL MICROTAGGING PROGRAMME

Niall Ó Maoiléidigh, Tom McDermott, Anne Cullen, Nigel Bond.

This is an ongoing monitoring programme initiated in 1980 and designed to evaluate the exploitation of salmon stocks in high seas fisheries and homewater commercial and recreational fisheries. It involves national co-operation with the Regional Fisheries Boards, the Salmon Research Agency, the Electricity Supply Board (ESB) and several private fishery owners in the west of Ireland. Over 300,000 hatchery-reared salmon smolts and 4,000 wild salmon smolts have been tagged and released annually since 1992. Release locations included the Burrishoole and Bunowen rivers (Co. Mayo) and Cong, Delphi, Casla and Screebe rivers (Co. Galway). These fish return as grilse in the year following release and as multi-sea winter salmon (MSW) in subsequent years. The tag recovery programme is carried out in all of the major salmon landing ports in Ireland, and over 50% of the nationally declared catch is examined each season.

Estimates of high seas exploitation by the Faroes longline fishery confirmed earlier results which showed that the exploitation of stocks of Irish origin by this fishery is low. As the Greenland driftnet fishery quota had been leased in 1993 and 1994, it was not possible to obtain new estimates of exploitation on Irish stocks there.

Survival to the coast from smolt release ranged from 5.4% to 10.7% in 1994 for hatchery stocks. Homewater exploitation by commercial nets was estimated at 76%, a higher rate than that reported over the previous four years. Survival to the river from smolt release ranged from 1.5% to 3.3%. Survival to the coast and to the river for wild stocks has been estimated at 12.1% and 3.8% respectively in recent years.

Over 100,000 tagged smolts were released into the Shannon River as part of a continuing stock rehabilitation programme. Release strategies included stocking above and below the dams by helicopter or truck. This is a joint project involving the FRC, the ESB, the Central Fisheries Board (CFB), University Colleges Galway and Cork and the Office of Public Works (OPW). Microtag information forms an important component in planning stock management for the system as well as providing basic data for the broodstock development programme.

COLLECTION OF NATIONAL SALMON CATCH STATISTICS

Niall Ó Maoiléidigh, Barney Doolan, Denis McLaughlin

A national database of salmon catches by region, district, gear and year has been established in the FRC. This information is provided by each of the seven Regional Fisheries Board managers from the licensed salmon dealers registers. The catch statistics for 1994 and 1995 indicated an increase in commercial and recreational catches compared to the previous five year period, with declared catches of 817 t and 704 t respectively. Effort in the Donegal drift net fishery was reported to be low, since protection by the Navy and the Regional Fishery Board was rigorously enforced in this area. Stocks in most rivers appear to be at a moderate level.

SALMON POPULATION CENSUS AND TELEMETRY

Niall Ó Maoiléidigh, Nigel Bond

Video-linked fish counters have been installed in ESB hydro dams at Ardnacrusha and Leixlip The count of salmon at Ardnacrusha can be separated into wild and hatchery origin, since the adipose fin is clipped during microtagging of the hatchery fish. In 1994, 773 wild and 231 reared salmon passed through Ardnacrusha and 886 wild and 1,184 reared fish were taken at Parteen.

Preliminary work was initiated on a telemetry programme for the River Liffey, using coded acoustic transmitter tags developed by LOTEK of Canada. The study investigates the behaviour of adult salmon in relation to a thermal/domestic sewage effluent entering the River Liffey at Poolbeg. Facilities for trapping, holding and tagging of adult salmon were prepared at Islandbridge in co-operation with the ESB and the Eastern Regional Fisheries Board. The basic elements of this programme are :

- A study of the movements and behaviour of the returning adult salmon and migrating juvenile salmon in relation to (1) the thermal effluent generated by the ESB oil/gas generating station in the River Liffey estuary and (2) the hydro generating station further upstream at Leixlip.

- Examination of the timing of the upstream migration and the extent of movement within the system.

- Estimation of the size of the total run of adults and juveniles.

A trial run using 20 adults, marked with external tags, was carried out to assess the potential return upriver from fish translocated from Islandbridge to Poolbeg. Five of these were recovered. The shortest time taken for an individual to reach Islandbridge was three days. One of the tagged fish took

3.5 weeks to return. Coded acoustic tags were extensively field tested in 1995 and tracking of adult salmon will commence early in 1996.

ENHANCEMENT STOCKS - ORIGIN, PROGRESS AND STATUS (ESOPS)

Niall Ó Maoiléidigh, Barney Doolan, Denis McLaughlin

This programme was initiated in 1992 to establish a database of:

- hatcheries involved in salmon enhancement or ranching programmes,
- the origin of the stocks being used in these programmes,
- the numbers of each stock being held at each development stage and
- the subsequent fate of the released stocks.

This information is considered to be a vital prerequisite to establishing the usefulness and impact of restocking and to monitor the movement or transfer of wild salmonids between rivers. Most hatcheries involved have been issued with an information form with which to fill out details of the hatchery stock on an ongoing basis.

SEA RANCHING OF SALMON

Niall Ó Maoiléidigh, Gerard Rogan

A pilot scheme has been initiated by the FRC and the Western Regional Fisheries Board on two rivers to provide information on the population size and structure of salmonids prior to ranching. The programme includes establishment of the most suitable brood stocks, based on survival of progeny, and the possible impact on the indigenous stock of escapement to the upper system. Guidelines are being developed for future ranching projects based on scientifically described methodologies. The legislation required to effectively carry out ranching without endangering wild stocks is being reviewed as part of this study. Initial results confirm that, while it is possible to ranch large numbers of salmon back to a release site, only relatively few (approx. 15 %) will be taken by rods leaving a considerable excess of ranched fish in the river. An essential element of any ranching programme must be an effective method of removing or separating these excess fish from wild spawning stocks.

PHYSIOLOGY OF SALMONID SMOLTIFICATION

Niall Ó Maoiléidigh, Mark Harvey

This programme commenced in 1991 in co-operation with the Zoology Department, University College Dublin with joint supervision by Dr T. Hayden, and is continuing. The study has provided valuable information relating to the physiological fitness of outwardly migrating smolts as an input into ongoing investigations into the collapse of sea trout stocks in the west of Ireland. Much of this work was presented to the Sea Trout Working Group in 1993 and 1994. Species under investigation include wild salmon and sea trout and hatchery reared salmon, sea trout and rainbow trout. Results from these experiments did not support the hypothesis that the collapse in sea trout stocks in the West of Ireland was primarily due to osmoregulatory dysfunction in migrating smolts. The study has also shown fundamental differences between the various salmonid species in the smoltification process and subsequent physiology while at sea.

SEA TROUT

Niall Ó Maoiléidigh, Nigel Bond, Mark Harvey

A Sea Trout Working Group was established by the Minister for the Marine in 1991 to assess the status of the sea trout, report on reasons for the collapse of some stocks and recommend measures which could be taken to halt the decline and restore stocks. FRC staff were specifically involved in providing sea trout samples for examination, and giving accurate stock size information for the Waterville and Casla stocks based on the video counter systems installed in co-operation with the Departmental engineering section, the Regional Fisheries Board (RFB) managers and private fishery owners. The results from the Waterville counter were particularly encouraging as they showed that the stock was not in decline, as had been claimed in earlier reports, and that at least 35,000 fish had entered the system during spring and summer. This led to the rebranding of the fishery by Bord Failte as a fishery of excellence. The results for 1995 confirmed the exceptionally high sea trout stock level in Lough Currane compared to other sea trout fisheries, with over 50,000 fish recorded over a slightly longer monitoring period.

Results of Irish investigations into the decline of sea trout stocks were presented at an international Study Group on Anadromous Trout held under the auspices of ICES in Trondheim in October 1994. All information and analyses were included in the 1994 and 1995 Sea Trout Working Group Reports.

SCIENTIFIC SERVICES AND ENQUIRIES

Niall Ó Maoiléidigh

During the course of 1994 and 1995, the Regional Fisheries Boards and the Gardai requested assistance with the preparation of 10 reports for use in legal proceedings. The services included examination of seized salmon and trout, identification of fish scale material and age and growth analyses. Many enquiries and requests for information were received from the public throughout 1994 and 1995. Examination of fish and scale material was also carried in some cases.

FRESHWATER EEL

Christopher Moriarty

Studies conducted by FRC over the years provided a basis for a major expansion in eel fishing on the lakes of the River Shannon. The fishing rights on the entire river catchment are owned by the Electricity Supply Board. FRC was represented on a committee set up by the ESB which initiated a major research and development plan for the fishery. While University-based teams of scientists conducted an extensive study of the stocks and management, licences were issued to 36 crews to use fyke nets in the Shannon lakes, creating employment through the summer for more than 70 people and greatly increasing the eel catch.

Analysis of long-term monitoring of eel catch by experimental fyke net in Lough Derg has shown a stable population in spite of changes in recruitment rate. However, a low catch in August 1994 hinted at the possibility of some change in environment, population structure or behaviour. Catches in the monitoring programme returned to normal levels in 1995, but a change in diet of the eels was observed. The preferred food organism, the water louse *Asellus*, was absent from or scarce in a high proportion of the stomachs examined. The parasite burden of the digestive tract of all eels sampled continues to be examined by Professor Clive Kennedy, University of Exeter in a collaborative programme established in 1982. He has noted recent changes in this, after a long period of stability.

Work on behalf of the EIFAC/ICES Working Party on Eel has continued, with particular reference to the monitoring of catches of incoming glass eel on the Atlantic coasts of Europe. Catches remained poor, but did not decrease to any lower level than had been observed over recent years. The possibility existed that the downward trend had ended and catches were either levelling out or rising.

Examination of available data from both sides of the Atlantic failed to find any anthropogenic factors which could explain all the observations. The weight of evidence therefore supports the idea that fluctuations in the catches may best be explained by changes in the ocean currents which carry the eel larvae towards the coasts.

An FRC proposal to examine and collate all available data in eight western European countries, was accepted by the EU for funding as a Concerted Action under the AIR programme. In 1995, visits were made to all the participants in their laboratories and they took part in a workshop at FRC in November. The group has prepared a data-base of information on the eel fisheries of the countries concerned with a view to formulating a Europe-wide management plan for the species.

FISHERIES ECONOMICS

Paul Hillis

The final report of the research project *Overall Optimisation of Profit in Irish Sea Fisheries: a Management, Economic, Socio-economic and Biological Study*, assisted by the European Union under its FAR programme, was accepted by the European Commission. A short report of the work done at FRC in the course of the Project was presented to the Annual Conference of the European Association of Fisheries Economists at Hieraklion, Greece, in March 1994. A paper examining the effect of differing rates of future discounting on cost benefit analysis of reduction of fishing mortality in overfished fisheries, using Irish Sea cod as an example, was delivered at the same conference.

A paper on the potential effects of mesh control, decommissioning and individual quota (not necessarily transferable) in the possible rehabilitation of the depleted fishery in the Irish Sea was presented at the 1994 ICES Annual Science Conference at St. John's, Newfoundland, and one on Irish methods and experiences in controlling fishing effort was read at the meeting of the Irish Sea Forum at Trinity College Dublin in September 1994.

An offer of a research contract supported by the European Union was also won which involves more detailed comparison of decommissioning, individual quota and mesh restrictions as methods of rehabilitating the heavily depleted Irish Sea whitefish and nephrops fisheries.

Work in 1995 included a broad analysis of the Irish Sea whitefish and nephrops fishery crises. This was summarised in a paper presented to the Annual Conference of the European Association of Fisheries Economists in Portsmouth. A comparison of European Union fisheries management with that of Iceland (where there is no *international* competition to catch the fish) was carried out jointly with Ragnar Arnason, Professor of Fisheries Economics at the University of Iceland, Reykjavik. The results were presented at the 1995 ICES Annual Science Conference at Aalborg and at the EAFE Modelling Workshop in Edinburgh.

AQUACULTURE, ENVIRONMENT AND OCEANS

SCALLOPS

Dan Minchin

In April, an investigation into the scallop populations on the south-east coast demonstrated that growth in this region is highly variable. Scallops adjacent to the Saltee Islands have high rates of growth and this declines with progression westwards towards Helvick, where the lowest rate of growth in Irish scallops is seen. Annual settlements of scallop occur in this area but the numbers vary widely from year to year.

Interest in the culture and ranching of scallops continues with several projects on the west and south-west coasts of Ireland to determine the practicality of this approach. The sown scallops are sourced from Mulroy Bay; sown scallops grow normally but not as rapidly as wildpopulations.

An EU-funded study in Connemara has shown that crabs are highly mobile and that they can continue to migrate into a scallop re-seeding area for some considerable time after the scallop sowing has taken place. Studies of predators at one site demonstrate that there are a number of swimming crab species that can cause significant scallop mortality.

SEA LICE

David Jackson

Sea lice infestation levels on all salmonid farms were monitored throughout 1994. The monitoring was carried out in line with the recommendations of the Sea Trout Task Force Report. This involved sampling a standard and a random cage for each year class of fish at each site twice a month during the critical spring period and approximately monthly thereafter, a total of fifteen sampling sessions in all. The results of this monitoring showed that during the spring period the number of ovigerous salmon lice *Lepeophtheirus salmonis* was considerably reduced, compared with the same period in 1993. The results of the monitoring also confirmed that the new management practices involved in the Single Bay Management approach were having a significant impact on reducing lice infestation levels on farms.

Two studies on larval lice behaviour were carried out. The first, a field study carried out at a range of locations, showed evidence for a vertical migration pattern associated with a tidal cue. The second, a mesocosm study, confirmed the vertical migration pattern observed in the field study.

INTRODUCED MARINE ORGANISMS

Dan Minchin

Further studies of the parasitic copepod, *Mytilicola orientalis,* in the gut of Pacific oysters were conducted at Carlingford and Dungarvan bays. In Carlingford Lough the presence of this parasite had declined, whereas in Dungarvan Bay the species was present in 15% to 35% of the Pacific oysters. Investigations into the distribution of non-native organisms in Cork Harbour took place during the summer.

PHYTOPLANKTON/SHELLFISH TOXINS

Terry McMahon and Joe Silke

The routine monitoring of toxic and potentially toxic phytoplankton species in aquaculture areas continued in 1994. Some 2,500 samples were examined in total. *Dinophysis spp* (principally *D. acuta* and *D. acuminata*), which are associated with diarrhetic shellfish poisoning (DSP) events, were recorded in samples from the southwest coast throughout the summer and in large numbers in August. In late July an exceptional algal bloom or "red tide" was observed in the central Irish Sea while in late August an extensive bloom, of the dinoflagellate *Gymnodinium* cf *nagasakiense,* was recorded off the Waterford and Wexford coasts.

In 1995 some 2,000 samples were examined. *Dinophysis spp* were recorded in samples from the south and west coasts throughout the summer. In August, blooms or "red tides " of the dinoflagellate *Gymnodinium* cf *nagasakiense* were recorded on the southeast coast, in the Waterford/Dungarvan area, as well as on the west and northwest coast in Killary Harbour, Clew Bay, Bealacragher Bay, Sligo Bay and also in Donegal Bay where counts of 6 million cells/litre were recorded. These blooms were associated with mortalities of lugworms and cockles but no mortalities of cultured finfish or shellfish were reported.

Routine monitoring for DSP toxins in shellfish from the major growing areas continued during 1994. In total some 900 bioassays were carried out, which represents an increase of 33% over the previous year. With the exception of Cork Harbour, the presence of toxins was detected for varying periods at all sampling sites tested. In the southwest of the country toxicity persisted for up to 8 months and a ban on harvesting and sale of shellfish from these areas was put in place by the Regional Health Board.

In 1995 the monitoring programme was extended to new shellfish production areas in Dungarvan Bay and Waterford Harbour with some 900 DSP rat bioassays. With the exception of Cork Harbour, Dungarvan Bay and Waterford Harbour, the presence of toxins was detected for varying periods at all sampling sites tested and the Regional Health Board banned the harvesting of shellfish in these areas. In contrast to 1994, when shellfish growing areas (particularly those in the southwest) were closed for up to 8 months, restrictions were only in place during July, August and September during 1995. In November, however, toxicity was recorded in mussels from Killary Harbour which resulted in the area being closed to harvesting. Neither the toxin involved nor the organism producing the toxin has yet been identified.

Detailed written and oral submissions were made to the Ministerial Task Force on Biotoxin Contamination and Monitoring.

A large number of sediment samples were collected from an extensive area of the continental shelf west of Ireland. These samples will be analysed for the presence of algal cysts.

CHEMICAL MONITORING

Máirín O'Sullivan

Environmental work includes assessment of applications to the Department of the Marine for licences to dump sludge and dredged material at sea under the 1981 Dumping-at-Sea Act. This is effected through participation in the interdisciplinary (chemical, biological and engineering) marine and freshwater licence vetting committees of the Department. The committees also assess applications for Foreshore Leases and provide advice to the EPA, Local Authorities and Fishery Boards in respect of the discharge of industrial wastes into the freshwater and estuarine environments.

The FRC continued to co-ordinate the monitoring programme on the fate of Chernobyl radioactivity in Irish upland lakes. Fish and sediment samples were supplied by the Regional Fisheries Boards from Loughs Anna, Derg, Finn and Gartan in Co. Donegal, Easkey, Co. Sligo, Callow, Co Mayo and Owel and Ennell in Westmeath. After length and age determination, they were forwarded to the Radiological Protection Institute for radiocaesium measurement. Monitoring results for the period 1988-92 were published.

In 1995, advice was provided to the Department of the Marine in respect of the dumping of wartime toxic nerve gases and munitions waste in deep water in the Irish Sea and with regard to the dumping of the Brent Spar oil platform in a deep-sea dumpsite to the northwest of Ireland.

Oslo-Paris convention

Following decisions taken to end the dumping of industrial waste at sea and incineration at sea, both the Oslo and Paris Conventions were reviewed and restructured in 1991 by the signatory governments. These Conventions have now been merged into one, the Oslo-Paris Convention for the Protection of the Marine Environment for the Northeast Atlantic, which opened for signature in autumn 1992. The Oslo and Paris Commissions, the bodies responsible for the assessment of the effectiveness of measures adopted to control and reduce pollution, have restructured their advisory committees to meet their responsibilities under the new convention. An action plan has been drawn up, its main objective being the preparation of a Quality Status Report (QSR) - based on regional QSRs for the whole Convention area by the year 2000.

To facilitate this objective, the Standing Advisory Committee for Scientific Advice (SACSA) has been replaced by the Environmental Assessment and Monitoring Committee (ASMO) and, likewise, the Technical Working Group (TWG) has been replaced by the Programmes and Measures Committee (PRAM). ASMO met for the first time in 1994 in Dresden and has since elaborated terms of reference for three third-level working groups - INPUT, IMPACT, and SIME (se below) - with a view to the overall assessment of the quality status of the marine environment and the preparation of QSR 2000 for the maritime area covered by the Convention. The final meeting of the Joint Monitoring Group (JMP) was held in 1994 in Dublin Castle. Its work is being continued by ASMO and its third tier groups. SIME is concerned with the monitoring collection and evaluation of information on concentrations and effects of Substances In the Marine Environment. IMPACT is dealing with the collection and evaluation of information on human activities other than those leading to inputs of substances, and on their impact on the marine environment, while INPUT is concerned with the monitoring, collection and evaluation of information on inputs of substances from all sources to the marine environment. The information collected is to be evaluated with regard to geographical/spatial distribution and temporal trends.

In regard to the implementation of the Oslo-Paris convention for the Protection of the Marine Environment, the FRC participated in the first meeting of SIME hosted in Delft, Netherlands in February 1995 (see below under *OSPARCOM Monitoring*) at which monitoring programmes, on which the QSR would be based, were elaborated and agreed. Substances and topics of concern were identified which included TBT, PCBs, nutrients etc. Detailed advice was drafted on the type of monitoring necessary in order to answer the questions which were being asked and to identify what would be needed to achieve the assessment of quality of the marine environment. At ASMO 95 held in Arc-et-Senans, France, the plans for the QSR 2000 were further developed and elaborated - one difficult area being the agreement of the monitoring programme for nutrients throughout the whole Convention area.

MARINE CHEMISTRY

Eugene Nixon, Evin McGovern, Denis McLaughlin, Ailve Rowe, Maria Smith and Brige Taaffe.

During 1994, some 1,200 samples were collected and analysed for a wide range of chemicals. This is a considerable increase in laboratory through-put over the previous year during which 600 samples were analysed. A number of new techniques were developed, including the analyses of PAHs and the full suite of DSP toxins using the GC and LC mass spectrometry equipment provided by the EU STRIDE Initiative.

Nutrients in seawater

A total of 155 samples were collected and analysed as part of ongoing monitoring programmes of the Irish Sea and the Waterford Estuary in conjunction with the Oceanography Section.

Marine algal toxins

Compared to previous years, the toxic season was exceptionally long during 1994. This is reflected in the increase in the number of samples analysed by chemical methods, from 216 during 1993 to 582 in 1994. This additional workload was accomplished as a result of the development of liquid chromatograph-mass spectrometry (LCMS) techniques, which give faster and unambiguous results for the toxins okadaic acid, DTX1, DTX2 and DTX3. Our experience during the year has shown that although there may be some variation in sensitivity using LCMS, it is superior to high performance liquid chromatography (HPLC) as a routine monitoring tool.

Ivermectin in farmed fish.

Over 90 analyses for Ivermectin in fish tissue were performed on samples collected from retail outlets or as a result of requests by fish farmers. The number of requests increased from 40 during 1993 to 60 in 1994. The concentration range detected in retail samples was similar to 1993, from not detected to 0.8 µg/kg. Level in fish flesh prior to harvesting was also similar to 1993 levels and ranged from not

detected to 4.5 with a mean concentration of 1.0 µg/kg. Although the maximum residue level recommended by the EC for farm animals is 15µg/kg liver, fish farmers were recommended not to harvest fish with levels greater than 1.0 µg/kg in the flesh. All retail samples analysed met these criteria.

Mercury monitoring.
Continuing the programme which started in 1992, samples of various species from the commercial catch and shellfish from the major shellfish growing areas were collected and analysed for mercury. This programme is designed to sample the main commercial species landed at the major Irish ports and shellfish growing areas, and to use the results for the Oslo and Paris Commission's (OSPARCOM) Joint Monitoring Programme and the EC's mercury Directives. All samples collected during 1994 have been analysed and the report is in preparation. Results of the 1993 programme were published as *Fishery Leaflet* 162.

Shellfish-growing Areas.
Under the EC Directive 923#, 20 shellfish-growing areas were visited and samples collected for analyses on two occasions during 1994. The analyses required include metals, chlorinated hydrocarbons and algal toxins in shellfish along with water quality parameters. All samples collected during 1994 have been analysed and the report is in preparation. Results of the 1993 programme were published as *Fishery Leaflet* 160 during 1994.

Marine Mammals
During 1994, samples of stranded or bycatch dolphins, harbour porpoises and other marine mammals collected by University College, Cork were analysed for chlorinated hydrocarbons at the FRC. These data give useful information on the quality of the marine environment from a regional perspective.

Quality Control.
During 1993 the laboratory participated in a number of exercises designed to monitor and improve the quality of data produced. These include an EC programme on quality assurance in marine monitoring covering nutrients in seawater, metals and chlorinated hydrocarbons in biota and sediments. For the first time, the laboratory participated in an intercomparison exercise on polyaromatic hydrocarbons (PAHs), and, although the level of comparison between laboratories would need to improve, the FRC produced reasonable results. The laboratory also participated in a joint ICES/IOC/OSPARCOM intercomparison exercise on the analysis of chlorobiphenyl congeners in marine sediments and biota. Approximately 10% of the laboratory's effort goes towards the analysis of reference materials and quality control.

Cork Harbour Survey.
The results of the October 1993 survey of Cork Harbour were reported at the 1994 Lough Beltra Workshop at University College, Cork. Fish, shellfish, sediment and water samples were analysed for priority pollutants (e.g. heavy metals, PCBs, chlorinated hydrocarbons, pesticides and PAHs) and the samples were scanned using GCMS to provide information on the range and distribution of contaminants.

Albright and Wilson - LIFE Programme.
The Fisheries Research Centre was commissioned by Albright and Wilson under an EU-funded LIFE programme to determine the levels of metals in sediments and nutrients in seawater in the Irish Sea off the Cumbria coast, following the introduction of a new waste treatment regime at their Whitehaven plant. Samples were collected from the *Lough Beltra* between 15 and 21 November from 67 stations for nutrients and 30 stations for metals in sediments.

OSPARCOM Monitoring
The Irish National Marine Monitoring Plan was prepared during 1994 and presented at the first meeting of the OSPARCOM's Working Group on Concentrations, Trends and Effects of Substances in the Marine Environment (SIME) held in Delft, Netherlands, 6-10 February 1995. As described in the National Plan, a detailed survey of Dublin Bay was undertaken during the winter 1994/5. Also collected during 1994 were samples from 8 of the more industrialised and populated estuaries and coastal areas. The results will be compared with the last such survey which was carried out in 1990 (*Fishery Leaflet* 151).

Oil and Chemical Spills.
The FRC was involved in the analyses of samples following a number of oil and chemical spills. These included incidents in Bantry Bay which, following the GCMS fingerprinting of samples identifying a possible source of the oil, resulted in a successful out of court settlement. Analysis of samples was also required following the spillage of wood preservative into the River Strule in order to assure the quality of shellfish from Lough Foyle. During July 1994, public fears were allayed following the reporting of a large oil slick in the Irish Sea which was identified as a harmless phytoplankton bloom. Staff were called as expert witnesses in a major case brought against the Department of the Marine by the owners of the vessel *Toledo*. This case was successfully defended.

TRIBUTYL TIN

Dan Minchin and Colm Duggan

The use of TBT in anti-fouling treatment has been banned by Bye-law No. 657 since 1987 on boats of less than 25m, on salmon cages and on all fixed structures. In 1993 a review of TBT contamination in Ireland was conducted, in association with Drs Joerg Oehlmann and Eberhard Stroben and Barbara Bauer of the University of Münster, Germany, using observations on imposex of the dogwhelk as an indicator. There was a significant reduction in TBT contamination in areas of aquaculture, where it had been used on fish cages, and in areas of small boat activity. In areas of shipping, however, all indications were that contamination had increased.

Two harbours, Cork and Killybegs, were investigated in detail in order to pinpoint the sources of contamination. In Cork Harbour contamination was greatest on the western side, consistent with the main input areas. The highest levels of imposex were found outside the Harbour on its western side and could be explained by the tidal flow patterns in this area. In Killybegs Harbour contamination decreased with distance from the main port area. In both of these areas a new method, intersex in periwinkles, was also used. This snail is less sensitive to the effects of TBT and may be found in areas where the dogwhelk has become extinct. This new indicator was found to be effective for areas of high TBT contamination.

OCEANOGRAPHY

Terry McMahon

In 1994 a series of 4 cruises were carried out in Waterford Harbour investigating the variation in basic oceanographic parameters (temperature, salinity, current velocity, suspended matter, chlorophyll a and inorganic nutrients) under varying conditions of river discharge and tidal (spring/neap) state.

In collaboration with scientists from University College Galway, two cruises were carried out in coastal waters off southwest Ireland investigating the relationship between local hydrography and phytoplankton species composition and biomass. Two current meter moorings, consisting of three current meters in each array, were deployed in the region of the Fastnet Rock in May. The moorings were successfully recovered in mid-August.

INFORMATION TECHNOLOGY SERVICES

COMPUTER FACILITIES

Kerry Blake

Development of the Local Area Network (LAN) installed in 1992 under the EU STRIDE Initiative came to an end in October 1994. By the end of the STRIDE programme the IT plan, drawn up before the start of STRIDE detailing the expansion and development of the LAN, had been completed. At the end of 1994, the LAN consisted of two WANG Servers running under DOS and UNIX with forty 386/486 based PC work stations attached to the system via ethernet points. Additional points were available when required to provide FRC scientists with computing facilities from anywhere in the building. Additional servers and workstations were installed for the Geographic Information System (GIS) and Relational Database Management System (RDBMS). A dial up line to Internet for e-mail has improved communication with other national and international institutes significantly. The contact for staff e-mail addresses is FRCINFO@frc.ie.

Microsoft upgrades for Word (v 6.) and Excel (v 5.) were purchased. The statistical package, SPSS, was purchased in December 1994. Training for staff members was focused on the use of Windows, Word, Excel, Powerpoint and Mail. Technical assistance was also provided in the area of system development and maintenance throughout the FRC.

RESEARCH VESSEL - *LOUGH BELTRA*

Michael Gillooly

The 1994 operational year for the vessel started on 19 January and finished on 24 November, with 31 scheduled cruises or periods open to the public, giving a total of 215 operational days. The 1995 operational year started on 16 January and finished on 25 November, with 31 cruises or periods open to the public, giving a total of 224 operational days. Demand for shiptime in 1995 exceeded 400 operational days, reflecting the improved vessel facilities and support and the increasing diversity of marine R & D. The cruises covered all areas of marine research including fisheries, phytoplankton, physical, chemical and biological oceanography; environmental monitoring, marine geology and technology development. A number of training cruises for students from the universities and RTCs took place. A course in the operation and maintenance of remotely operated vehicles (ROV) was organised in March 1994. Naval cadets were given a one day course in marine research techniques on board the vessel in each year.

New programmes undertaken in 1994 and 1995 included:

FRC - Fish egg production studies in the Irish Sea
Trinity College- BIOMAR Programme (see below)
Geological Survey, DoM, Wexford Co. Council and Forbairt - Study of sediment dynamics off the Wexford coast.
Martin Ryan Institute (MRI) -

- Microbiological studies in Greater Galway Bay
- Use of the Towed Undulating Profiler to confirm the existence of particular oceanographic frontal systems off the SW coast.
- Oceanographic studies in the Shannon estuary
- Geophysical studies as part of the Clare Island Survey
- *with Dutch partners* - Study of wave dynamics in Galway Bay using the ROV with special sonar arrays.

Department of Transport, Energy and Communications (Petroleum Affairs Division) - Study of hydrocarbon seeps in the Irish Sea

Lough Beltra was and is now involved in a number of International/EU initiatives, including:
AIR Programme

- Concerted Action Study on Scallops in Kilkieran Bay (a survey of scallops in Kilkieran involving scientists from 5 countries using a suite of Remotely Operated Vehicles and camera systems from the *Lough Beltra*).
- Assessment of impacts of trawling on the benthos (MRI)'Fish egg production survey in the Irish Sea

BIOMAR Programme Coastal Zone Mapping: identification, description and mapping of biotopes (TCD),
MAST Programme Physical Oceanography off the west coast (MRI)

The 8th *Lough Beltra* Workshop was held in University College Cork on 9 September 1994 and was attended by over 100 delegates. In all, 11 papers were presented demonstrating the multi-disciplinary nature of the vessel's work. The Workshop finished with a keynote address 'The Marine Institute and an Integrated Irish Marine RTD Plan', by the Chief Executive Officer of the National Marine Institute, Dr. Peter Heffernan, followed by an active discussion forum.

The *Lough Beltra* was featured extensively in the video cataloguing the achievements of the STRIDE Operational Programme for Ireland.

The *Lough Beltra* was open to the public in Dublin port during the European Estuarine and Coastal Sciences Association Conference in Dublin on 12th and 13th September 1995. The U.K. National Rivers Authority vessel *Coastal Guardian* was also open to the public in Dublin port at the same time. Both vessels were visited by large numbers of visitors and by Minister Eamon Gilmore, who emphasised the important role research vessels play in fostering collaborative research at international level.

The year 1994 marked the culmination of the substantial upgrade of the Lough Beltra using EU STRIDE funds. All structural modifications and new equipment installations were completed as planned. These included the commissioning of a custom-built data acquisition system which automatically logs the data from many of the vessels instruments. The system is designed so that the data gathered can be transferred to the National Marine Data Centre for archiving and processing. In this context a user friendly software package called 'CRSMAN™ was designed by the Marine Data Centre to assist scientists in the management of cruise data. The Instrument Technician continued to ensure that all vessel equipment is maintained and calibrated; he also contributed to logistical planning and project design.

Following extensive discussion and consultation during 1994 - 1995 on the options for the continued provision of the coastal Research Vessel Service, it was recommended that the *Lough Beltra* be replaced within the next few years. Accordingly, with the support of funds from the Operational Programme for Fisheries 1994 - 1999, an open tendering procedure was initiated in October 1995 to build a replacement for the *Lough Beltra*. A contract should be signed in early 1996 and anticipated delivery of the new vessel will be spring 1997. Equipment acquired during the STRIDE programme to upgrade the *Lough Beltra* will be transferred to the new vessel during its construction.

FISH HEALTH UNIT

John McArdle, Fiona Geoghegan, Cathy Hickey, Frank McKiernan, Darrell Clinton

EU SURVEILLANCE PROGRAMME

Finfish

Under Directive 91/67/EEC Ireland is recognised by the EU Commission as being an Approved Zone for the important salmonid viral diseases, *Infectious Haematopoietic Necrosis* (IHN) and *Viral Haemorrhagic Septicaemia* (VHS). To maintain this status in 1994 all fish farms were inspected and a proportion sampled for the presence of these viruses. Approximately 3,000 fish were collected and examined under this programme, although a small proportion of these were submitted for disease diagnosis.

All the samples tested were negative for the two notifiable virus diseases IHN and VHS. However, in the course of sampling a number of other fish pathogens were detected. *Aeromonas salmonicida*, the cause of furunculosis in salmon, was detected at 5 freshwater sites (four commercial salmon hatcheries and one isolate from wild fish). *Yersinia ruckeri, Type I*, the cause of the disease Enteric Redmouth was detected in three rainbow trout hatcheries and the first Irish isolation of *Yersinia ruckeri Type II* was made. *Infectious Pancreatic Necrosis* (IPN) an important virus of farmed salmonids was isolated at two sites.

Shellfish

Under directive 91/67/EEC monitoring of the serious List II diseases bonamiosis and marteiliosis has been carried out for the last two years. During 1994 a total of 52 samples of flat oysters were examined from 13 important oyster growing areas. The total number of oysters examined was 7,100. Monitoring of the Pacific oyster *Crassostrea gigas* was carried out and 8 samples amounting to 390 oysters were examined histologically.

The oyster disease bonamiosis continues to cause serious losses and has now been detected in Cork Harbour, Galway Bay, Clew Bay, Ballinakill Bay and Achill Sound. Tralee Bay, Lough Foyle, Kilkieran Bay and Belmullet yielded negative results in 1994 and appear to be free of the disease. No evidence of disease was detected in Pacific oysters sampled.

VACCINE LICENSING

Two new furunculosis vaccines were assessed and recommended for licensing. One apparent breakdown of a vaccine under trial was investigated following an outbreak of furunculosis in a group of recently vaccinated fish at a site in the west of Ireland. Investigations and rigorous testing of the vaccine allowed the conclusion that the vaccine was not at fault.

EXPORT CERTIFICATION

Approximately 7.3 million salmon eggs were inspected and certified for export in 1994, mainly to the UK, Germany and Spain. Approximately 5 tonnes of oysters were inspected and certified for relaying in the UK and 30 tonnes of mussels similarly. A small quantity of lobsters was inspected and certified for export to Norway.

EU MEETINGS

The Fish Pathologist attended several meetings of the EU Veterinary Legislation Working Group (Aquaculture), the Standing Veterinary Committee and a number of EU Council Working Groups in Brussels.

VETERINARY DIAGNOSTICS

Francis Scullion

Approximately 65% of the finfish cases handled by the Fish Health Unit involved veterinary diagnostics. The total casework attended to in investigations of health and disease of farmed and wild freshwater and marine finfish and pet fish was 150 cases (76% farmed, 17% wild and 7% pet fish) involving over 3,700 fish. Whereas EU surveillance casework doubled in 1994 diagnostic site visits decreased by 75% from the previous report. Diseases diagnosed and reported included:

Endemic diseases
Aeromonas salmonicida (Furunculosis) - There was an increase in the problem of clinical furunculosis in freshwater sites in Ireland in 1994 (8 cases). A review of available records suggested that, although there is a natural threat of disease outbreaks originating from wild sources, the majority of clinical furunculosis problems investigated can be traced to captive fish stocks.

Yersinia ruckeri (ERM) - This organism was isolated from four fish farms during 1994. Two of these farms had no previous history of this disease. The preceding report identified ERM as an increasing problem in recent years in Ireland and proposals to contain its spread have been advised.

Pancreas disease remains an important disease of salmon farmed at sea.

IPN, diagnosed in salmon parr on a fresh water site was also detected in smolts at sea originating from the same freshwater hatchery.

Novel diseases
The absence in 1994 of the unidentified bacterial disease (Bacterium X) described in the preceding report is noteworthy. The actions of the Department, the fish farm involved and the fish farm's veterinary surgeon in taking immediate steps to contain and eradicate this condition appear to have been well justified.

The situation in regard to the encephalitis condition identified in the previous report remains somewhat of a concern. Fish placed at the site where this condition occurred previously, again suffered encephalitis. This farm suffered 100% mortalities. An unidentified parasite-like organism was again associated with the condition. Fish at a new site in the same bay where the condition appeared previously have also been shown to develop subclinical parasite infestation. There have been reports of similar pathology from numerous other fish farm sites throughout Ireland during 1994.

Investigations of wild perch and roach mortalities in 1993 resulted in the isolation of a possible virus. This investigation continued in 1994 and resulted in the production of electron microscopic pictures of apparent virus particles. Transmission studies in the FHU have shown that this virus can be successfully cultured after experimental transmission in salmonids.

A submission of a single sea trout from a river in the Eastern Region during 1994 made an interesting case in that it involved use of a procedure not previously used in sea trout. The fish had severe kinks in its back and with the help of colleagues in the Veterinary College of Ireland the fish was X-rayed. The diagnosis was that of a healed traumatic spinal fracture. Although there were reports of hundreds of such fish being seen, a request for further samples was not answered. Electric shock is a likely cause of trauma sufficient to cause spinal fractures in a large number of fish. Electro-fishing is a

technique that appears to be widely applied in Irish rivers for stock surveys. Animal welfare and fisheries protection and conservation issues indicate that the implications of such a finding are worthy of follow-up.

A hepatitis in pond koi associated with high mortality is currently being researched.

Other veterinary work in relation to finfish included advising the Department on the safe movement of over 16 million fish under permit and advising in relation to fish health. The development of a National Fish Health Management Plan was considered to be an effective and efficient means of dealing with disease problems which can have an impact on all aspects of the fisheries- based industries.

INFORMATION

LIBRARY

Alice Talbot

During the past three years the library has become fully computerised and all functions are now carried out on the computerised management system. The library is accessible via e-mail, (atalbot@frc.ie), and is due to be connected to the Internet. This will allow access to other libraries and vice versa. Requests for information will become much simpler and faster.

A CD-ROM reader has been installed, giving access to all information contained in *Aquatic Sciences and Fisheries Abstracts* from 1978 onwards, *Fish and Fisheries World-wide* from 1971, *Waves*, FAO, ICES and Canadian grey literature, and *Celex*, (European Union Legislation). The introduction of the CD-ROM has reduced the work load for many searchers from hours to minutes.

The *Official Journal* of the EEC is received weekly and the ICES CM papers annually on microfiche.

The inter library loan system is operated, whereby application can be made to many other libraries both nationally and internationally to obtain, on loan, requested books or articles that are not available in the FRC.

There are over 11,000 books and reports in the Library, and over 100 different journals are taken.

PUBLICATIONS

1994

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Connolly, P. and Kelly, C Sampling surveys for deep water demersal fish in 1993. *Fishery Leaflet* 163.

Gormley, T. R. Connolly, P. and Ward, P. Evaluation of Deep Water Fish Species. *Teagasc, Farm and Food,* 4, 8-11.

Hillis, J. P. (Editor). Proceedings of the Third Annual Conference of the European Association of Fisheries Economists, Dublin, 1991. *Irish Fisheries Investigations* B 42 (1994), 197 pp.

Jackson, D. and Silke, J (1995) *Dinophysis. spp.* and the Occurrence of Diarretic Shellfish Poisons in Ireland. In Lassus, G., Arzul, E. Erard-Le Denn, P. Gentien and C. Marcaillou-Le Baut (eds.) *Harmful Marine Algal Blooms.* Paris, Lavoisier, 789-794.

McGrath, D., Minchin, D., & Cotton, D. Extraordinary occurrences of the by-the-wind sailor, *Velella velella* (L.), (Cnidaria) in Irish waters in 1992. *Irish Naturalists' Journal*

Minchin, D. Gigantism in the scallop, *Pecten maximus* (L.). in J.C. Aldrich (ed.) *27th European Marine Biology Symposium.* Japaga Press, Wicklow.

Nixon, E., A. Rowe, M. Smyth, D. McLaughlin and J. Silke. Monitoring of Shellfish Growing Areas - 1993. *Fishery Leaflet 160.* Department of the Marine, Dublin.

Nixon, E., A. Rowe and D. McLaughlin. Mercury concentrations in fish from Irish Waters in 1993. *Fishery Leaflet 162.* Department of the Marine, Dublin.

Nunn, J. D & Minchin, D. Cuthona genovae (O'Donoghue, 1926) (Mollusca: Opisthobranchia) from the north coast of Ireland. *Irish Naturalists Journal*

Ó Maoiléidigh N., J. Browne, A. Cullen, T. McDermott and M. Keatinge. Exploitation and survival of reared salmon released into the Burrishoole River system. *Fishery Leaflet* 161.

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Connolly, P., Kelly, C. J. , Gordon, J. D. M. Bergstad, O. A., (1995) Inventory of otolith collections and ageing work on north east Atlantic Deep Water Fish Species *Fishery Leaflet 165.*

Gormley, T. R. Connolly, P. and Ward, P. Evaluation of Deep Water Fish Species. *Teagasc, Farm and Food,* 4, 8-11.

Holmes, J. M. C. and D. Minchin. Parasitic copepoda associated with teleosts in Killary Harbour. *Irish Biogeographical Society.* 18: 1-6.

McMahon, T. 1994. Shellfish Poisoning in Ireland: Monitoring and Management. Environmental Health Officers Association Yearbook 1994. 19 - 22

McMahon, T., R. Raine, O. Titov and S. Boychuk, S. Some oceanographic features of northeastern Atlantic waters west of Ireland. *ICES Journal of Marine Science.* 52: 221-232.

Minchin, D., D. McGrath, and C. B. Duggan. The slipper limpet *Crepidula fornicata* (L.) in Irish waters with a review of its occurrence in the Northeast Atlantic. *Journal of Conchology, London.* 35(5): 297-301.

Minchin, D., and C. Ní Donnachada. Optimising scallop sowings for the restocking of an adult population in Mulroy bay, Ireland. *Proceedings of the 8th International Pectinid Workshop.* Ed: J.C. Dao.

Minchin, D., Oehlmann, C. B. Duggan, E. Stroben and M. Keatinge. Marine TBT antifouling contamination in Ireland, following legislation in 1987. *Marine Pollution Bulletin* (in press)

Minchin, D. Recovery of a population of the flame shell, *Lima hians* in an Irish bay previously contaminated with TBT. *Environmental Pollution* 90 (2): 259-262

Minchin, D. The red-mouthed goby, *Gobius cruentatus* (Gobiidae), from the south-west coast of Ireland. *Irish Naturalists' Journal.*

Molloy, J. The Irish Herring Fisheries in the Twentieth century : Their Assessment and Management. Went Memorial Lecture, 1991. *Royal Dublin Society Occasional Papers in Irish Science and Technology 10, 1-6.*

Moriarty, C. The Reverend W. S. Green: explorer and fishery scientist. *Royal Irish Academy National Committee for the History and Philosophy of Science; Annual Lecture Series* 1, 1-15.

O'Sullivan, M. A. T. McGarry, S. Lyons, C. McEnri, J. D. Cunningham. Radioactive monitoring in Irish upland lakes, 1988 - 1992. *Radiological Protection Institute of Ireland* 95/1, 25 pp.

O' Farrell, M., Ó Maoiléidigh N., Keatinge, M., Browne, J. and O' Connor, W. Management of Atlantic salmon (*Salmon salar*) smolt in the River Shannon, Ireland. Proceedings of the International Symposium on Fishways '95. 24 to 26th October, pp 363-370. Gifu, Japan.

Ó Maoiléidigh N., J. Browne, T. McDermott, A. Cullen, N. Bond, B. McEvoy M. O' Farrell and W. O' Connor. Exploitation and survival of River Shannon reared salmon. Fishery Leaflet 164.

CONFERENCE DOCUMENTS

1994

Anon. Report of the Study Group on Anadromous Trout, Trondheim 29 - 31 August. *ICES CM M:* 4

Anon. Report of the Workshop on Salmon Spawning Stock Targets. Bushmills, N. Ireland (7-9 December 1993). *ICES CM M:*7 1994.

Anon. Report of the Working Group on North Atlantic Salmon. ICES CM 1994/Asses. 16 Ref. M

Browne J., N. Ó Maoiléidigh, T. McDermott, A. Cullen, N. Bond, B. McEvoy, M. O' Farrell, and W. O' Connor. High seas and homewater exploitation of an Irish reared salmon stock. *ICES CM 1994 M*:10.

Connolly, P. The discarding of whiting in the Irish Sea by the Irish *Nephrops* Fleet. ICES, NoSh Working Group, Aberdeen, June 1994.

Connolly, P. The results of the FRC stock monitoring programme for cod, whiting, plaice and sole in VIIa (Irish Sea). ICES, NoSh Working Group, Aberdeen, June 1994.

Connolly, P. The results of the FRC stock monitoring programme for cod, whiting and haddock in ICES VI (Donegal and Rockall). ICES, NoSh Working Group, Aberdeen, June 1994.

Connolly, P. The results of the FRC stock monitoring programme for cod, whiting, plaice and sole in ICES Division VIIg (Celtic Sea). ICES, SoSh Working Group, Copenhagen, September 1994.

Doherty, M. The results of the FRC stock monitoring programme for cod, whiting, plaice and sole in ICES Divisions VIIj, k and VIIb, c. ICES, SoSh Working Group, Copenhagen, September 1994.

Hillis, J. P. Short Report on the EU-assisted FAR Project "Overall Profit maximisation in the Irish Sea Fisheries: A management, Economic, Socio-economic Biological Study. 6th Annual Conference, European Association of Fisheries Economists, Hieraklion, Greece.

Hillis, J. P. Time paths of the recovery of catch, revenue and profit during the rehabilitation of an overfished fishery. 6th Annual Conference, European Association of Fisheries Economists Hieraklion, Greece.

Hillis, J. P. Irish methods and experiences in controlling fishing effort. *8th Seminar, Irish Sea Forum, Trinity College, Dublin.*

Hillis, J. P. Use of swept area surveys to calculate fishing mortality (F) in commercial fish stocks; the need for survey gear development. *ICES CM 1994:* D/4.

Hillis, J. P. Restoring a depleted fishery by different methods including mesh control, decommissioning and individual quota: a bio-socio-economic comparison. *ICES CM 1994:*D/4.

Jackson, D., Minchin, D., Duggan, C., Hassett, D., Leahy, Y. and Whitaker, A. Observations on the larval stages of the salmon louse, *Lepeophtheirus salmonis* ICES CM 1994/F:14 5 pp

Jackson, D. & Minchin, D. Observations on the larval stages of the salmon louse, *Lepeophtheirus salmonis*. Special session on parasites and diseases in aquaculture. ICES CM 1994/F14, 5 pp.

Minchin, D. & Jackson, D., Monitoring of sea-lice infestations of farmed salmonids in Ireland. Special session on parasites and diseases in aquaculture. *ICES CM 1994*/F13, 12 pp.

Moriarty, C. Review of monitoring data on Atlantic elver *Anguilla anguilla* 1993-1994. Joint ICES/EIFAC Working Group on Eel, Oviedo, Spain, September

Moriarty, C. Variations in numbers of eel *Anguilla anguilla* (L.) caught by constant effort in an Irish lake, 1981-1994. Joint ICES/EIFAC Working Group on Eel, Oviedo, Spain, September.

Nixon, E. Metal Levels in Cork Harbour Mussels. Proceedings of the R.V. Lough Beltra Workshop, UCC, Cork. Sept. 1994. Department of the Marine. Dublin.

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Connolly, P. The discarding of whiting in the Irish Sea by the Irish *Nephrops* Fleet. ICES, Northern Shelf Working Group, Aberdeen, June 1994 and Copenhagen, June 1995.

Connolly, P. The results of the FRC stock monitoring programme for cod, whiting, plaice and sole in VIIa (Irish Sea). ICES, Northern Shelf Working Group, Aberdeen, June 1994 and Copenhagen 1995.

Connolly, P. The results of the FRC stock monitoring programme for cod, whiting and haddock in ICES VI (Donegal and Rockall). ICES, Northern Shelf Working Group, Aberdeen, June 1994, and Copenhagen June 1995.

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Connolly, P. and Kelly, C. (1995) Irish Research Linked with the Development of Deep Sea Fisheries in the north east Atlantic. Irish Marine Science Symposium, Galway. September.

Doherty, M. The results of the FRC stock monitoring programme for cod, whiting, plaice and sole in ICES Divisions VIIj, k and VIIb, c. ICES, Southern Shelf Working Group, Copenhagen, September 1994 and September 1995.

Fox, G. M, Ball, B. J. and B. W Munday. The IMPACT II study: preliminary observations on the effect of bottom trawling on the ecosystem of the Nephrops grounds in the Irish Sea. Irish Marine Science Symposium, Galway. September.

Gillooly, M. Vesselised not fossilised - Irish Marine Research Vessels 1845 - 1995. Irish Marine Science Symposium, Galway. September.

Hillis, J. P The Irish Sea fisheries, an example of past declines and future hopes. 7th Annual Conference, European Association of Fisheries Economists, Portsmouth, UK.

Hillis, J. P. Principles of maximisation of profit in multi-species fisheries. Address to the Public Hearing of the Fisheries Committee of the European Parliament, Brussels, 27 September, 1995.

Hillis, J. P and Arnason, R. Why fisheries cannot be managed by technical measures alone: a comparison of selected fisheries inside and outside the European Union. *ICES CM 1995: S/9.*

Hillis, J. P and Arnason, R. The inadequacy of Technical Measures compared to effort reduction in Fisheries Management with a Comparison of Selected Fisheries in the European Union and off Iceland. European Association of Fisheries Economists, 4th Bio-economic Modelling Workshop, Edinburgh, October.

Kaiser, M. J., A. S. Hill, K. Ramsey, B. E. Spencer, A. R. Brand, L. O. Veale, K. Prudden, B. Munday, B. Ball and S. J. Hawkins. The ecological effects of different demersal fishing gears on benthic communities in the Irish Sea. ECSA Conference. Dublin, 11 - 15 September.

McMahon, T., E. Nixon, J. Silke, B. Taaffe, A., Nolan, E. McGovern, and J. Doyle. Seasonal variation in Diarrhetic Shellfish Toxins in mussels from the southwest coast of Ireland in 1995. Irish Marine Science Symposium. Galway, September.

Molloy, J. The Importance of Sustainability Indicators in the Assessment and Management of Fish Stocks. E. U Forum on Sustainability Indicators, UCD.

Molloy, J. and P. Fernandes,. The Assessment of Herring Stocks around Ireland using Acoustic Techniques. Irish Marine Science Symposium, Galway, September.

Molloy, J., P. Fernandes and D. Reid. Acoustic Surveys in the Celtic Sea and Div VIIj, 1994/95

Molloy, J. and P. Fernandes. Acoustic surveys off the West coast of Ireland, 1994.

Moriarty, C, Marine science outside the universities 665 - 1978. Irish Marine Science Symposium, Galway. September.

Munday, B. Ecological effects of Nephrops trawling. Ecosystem effects of demersal fishing gears around the British Isles. Conwy, Wales. 10-11 January.

Ó Maoiléidigh N., Crozier, W., Cullen, A. Salmon farm escapees in Irish commercial catches - 1991 to 1994. North Atlantic Salmon Working Group, Copenhagen. April 1995

Ó Maoiléidigh N., Browne, J., Cullen, A., McDermott, T. and Whelan, K. (1995) Exploitation and survival of reared salmon released into the Burrishoole River system. North Atlantic Salmon Working Group, Copenhagen. April.

Ó Maoiléidigh N., McGinnity, P. and Crozier, W. Spawning stock targets for Irish salmon rivers. North Atlantic Salmon Working Group, April.

Ó Maoiléidigh N., Browne, J., McDermott, T., Cullen, A., Bond, N., O' Farrell, M and Rogan, G. Marine survival and exploitation of Irish salmon stocks. Irish Marine Science Symposium, Galway. September.

INTERNATIONAL CONFERENCES

1994

Barnwall, E. Workshop on Herring Age Reading. Ijmuiden, Netherlands, 20 - 24 January.

Connolly, P. NATO Advanced Research Workshop on Deep Water Fisheries of the North Atlantic. Symposium on Otolith Research and Applications. Hull, UK, March.

Connolly, P. ICES Northern Shelf Working Group Copenhagen, June.

Connolly, P. EU STECF (Scientific, Technical and Economic Committee for Fisheries) Meeting. Brussels, 17 to 21 October.

Doherty, M. ICES Southern Shelf Working Group. Copenhagen, Denmark. September.

Doyle J. ICES Annual Scientific Conference, St. John's Newfoundland, September.

Fernandes, P. Working Group on Fisheries Acoustics Science and Technology. Montpelier, France, 28 - 29 April.

Gillooly, M. Oceanology International 94, Brighton, England, 8-11 March.

Gillooly, M. Aquaculture and Water Resource Management, Stirling, Scotland, 21-25 June.

Gillooly, M. EIFAC Workshop on Aquaculture Effluent Treatment Systems, Stirling, Scotland, 25-26 June.

Hillis, J. P. ICES Working Group on *Nephrops* stocks, Lisbon, March.

Hillis, J. P. European Association of Fisheries Economists (EAFE) Annual General Meeting and Conference, Hieraklion, Greece, March.

Hillis, J. P. Irish Sea Forum Seminar on the Irish Sea fisheries, Trinity College, Dublin, September.

Hillis, J. P. ICES Annual Science Conference, St. Johns, Newfoundland, September.

Hillis, J. P. Seminar on fisheries economics, Memorial University, St. Johns, Newfoundland, September.

Kelly C. NATO Advanced Research Workshop on Deep Water Fisheries of the North Atlantic. Symposium on Otolith Research and Applications. Hull, UK, March.

McGovern, E. Workshop on Quality Assurance of Sampling and Sample Pretreatment of Sediments and Soils, Commission of European Communities Measurements and Testing Programme, Barcelona, 7-10 May,

McMahon, T. ICES Working Group on Phytoplankton Ecology, Copenhagen, March.

Molloy, J. ICES Herring Assessment Working Group for the area south of 62 N. Copenhagen ,21 - 31 March.

Molloy, J. Study Group on Herring Assessment and Biology in the Irish Sea and adjacent waters. Belfast, 21 - 24 February.

Molloy, J. Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, Copenhagen, 21 June - 1 July.

Molloy, J. EC Scientific Technical and Economical Committee for Fisheries. Brussels, 17 - 20 October

Moriarty, C. European Inland Fisheries Advisory Commission, 18th Session, Rome 17-25 May (Chairman, Sub-commission I)

Moriarty, C. Joint ICES/EIFAC Working Group on Eel, Oviedo, Spain, 26 September - 1 October (Chairman).

Minchin, D. AIR Concerted Action on Scallop Seabed Cultivation. Bergen, Norway 5-12 May and Connemara, September.

Minchin, D. ICES Working Group on Introductions and Transfers of Marine Organisms. Mystic Seaport, Connecticut, April.

Nixon, E. ICES Marine Chemistry Working Group. Brest, France 7 -12 February 1993.

Nixon, E. QUASIMEME Workshop on Lipids. Dublin. October.

O'Sullivan, M. OSPARCOM Joint Monitoring Group, Dublin 24-28 January.

O'Sullivan, M. OSPARCOM Environmental Assessment and Monitoring Committee. Dresden 14-18 March, Ostend 6-9 December.

Ó Maoiléidigh, N. International Commission for the Conservation of Atlantic Tuna. Madrid. 21 - 25 November.

Ó Maoiléidigh, N. ICES Study Group on Anadromous Trout, Trondheim, Norway. August.

Smith, M. QUASIMEME Workshop on Lipids. Dublin. October.

1995

Browne, J. ICES Annual Science Conference. St. Johns, Newfoundland, September.
Connolly, P. Meetings of a Group of Independent Experts to advise the EU on the fourth framework of the Multiannual Guidance Programmes; Copenhagen, September; Brussels, November.
Gillooly, M . Second MAST Days and EUROMAR Market, Sorrento, Italy. November.
Gillooly, M. Strategies and Methods in coastal and estuarine Management, 25th Annual Symposium of the Estuarine and Coastal Sciences Association, September, Dublin.
Griffith, D. de G. ICES Annual Science Conference. St. Johns, Newfoundland, September.
Hillis, J. P. ICES Working Group on Nephrops stocks, Lowestoft, UK. March.
Hillis, J. P. Scientific, Technical and Economic Committee of Fisheries, Meeting of Experts on Technical Measures in Western Waters Brussels. April.
Hillis, J. P. European Association of Fisheries Economists (EAFE) Annual General Meeting and Conference, Portsmouth, UK. April.
Hillis, J. P. ICES Annual Science Conference (Statutory Meeting), Aalborg, Denmark. September.
Hillis, J. P. EU Co-ordination Meeting on OECD Fishery Economic Management Study, Brussels. September.
Hillis, J. P. Audition of the Fisheries Committee of the European Parliament, Brussels. September.
Hillis, J. P. Meeting between the European Union and Norway on Conservation of Demersal Fish Stocks in the North Sea. Bergen. October.
Hillis, J. P. European Association of Fisheries Economists (EAFE) Modelling Workshop, Edinburgh. October.
Hillis, J. P. Scientific, Technical and Economic Committee for Fisheries, Brussels. November.
Molloy, J. ICES Working Group on the Assessment of Mackerel Horse Mackerel, Sardine and Anchovy, Copenhagen 10-19 October.
Molloy, J. ICES Herring Assessment Working Group for the Area south of 62°N. Copenhagen. March - April.
Moriarty, C. Executive Committee of European Inland Fisheries Advisory Committee, Rome. May.
Moriarty, C. AIR Workshop on European eel. FRC. November.
Ó Maoiléidigh, N. ICES North Atlantic Salmon Working Group, Copenhagen. April.
Munday, B. International Workshop on long term study influences on science and policy. Galway. May.

WORKSHOPS, COURSES and STUDY TOURS

1994

Geoghegan, F. Diagnostic methods of detection of IHN and VHS, Aarhus, Denmark, 22 - 25 November.
McArdle, J. Diagnostic methods of detection of IHN and VHS, Aarhus, Denmark, 22-25 November.
McKiernan, F. Identification of *Gyrodactulus* spp. Aberdeen, Scotland, January.
Moriarty, C. AIR study visits to eel experts in Denmark, France, Germany, Netherlands, Portugal, Spain, Sweden, UK, April and July.
O'Sullivan, M. ILAB course on Accreditation of Chemical and Microbiological Laboratories, Dublin, March.

1995

Barnwall, E. ICES Workshop on Mackerel Age Seeding, Vigo 8-14 February.
Kelly, C. Study visit to the Dr John Gordon, Scottish Association for Marine Sciences (SAMS) Oban Laboratory, UK, to view their deep water otolith collection and take part in otolith exchange exercises. The results indicated a consistent approach to the ageing of older grenadier and the ageing of young roundnose (age groups 1-5) was validated using the SAMS collection of small otoliths. October.
McMahon, T. and J. Silke .Monitoring Methods for Marine Biotoxins, Netherlands Institute for Fisheries Research, IJmuiden and IFREMER, Nantes, May 1994

McMahon, T. and J. Silke. A workshop on "Algal Toxins in Shellfish" was held at the Fisheries Research Centre on 4 and 5 May. Papers were presented by scientists from Ireland, Spain, Sweden, The Netherlands and France.

Minchin, D. External examiner for MSc Joseph Ryan B.Sc., Regional Technical College, Dundalk and Ph.D. Ulrich Wilson, B.Sc., University of Liverpool, Port Erin.

REPORTS

Anon. Report of the Sea Trout Working Group.

Browne J, Molloy, J and Connolly P. Fish Stocks in 1994 with Management Advice for 1995. December.

Browne J, Molloy, J and Connolly P. Fish Stocks in 1995 with Management Advice for 1996. December.

Connolly, P. Keatinge, M. and Woods F et al. Assessment of Discarding Rates for Commercial Species of Fish. Report to the EU Commission.

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CRUISE REPORTS

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Molloy, J. and M. Doherty. Young Fish survey, southwest coast on *Shannon*, November

Molloy, J., J. Daly and R. McCormick. Experimental fishery for tuna in the Bay of Biscay, September.

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Connolly P. Irish Sea Young Fish Survey on *Lough Beltra.* June and September

Connolly, P. Irish Sea Juvenile Plaice Survey on *Sealgair.* May

Connolly, P. South Coast Young Fish Survey on *Lough Beltra.* June.

Connolly, P and Kelly C. Deep Water Trawl Survey on the *Mary M* November 1995

Connolly, P. and Kelly C. Deep Water Longline Survey on the *Sea Sparkle* November 1995

Molloy, J. Celtic Sea Herring Survey - January 1995. *Lough Foyle*

Molloy, J. Mackerel Egg Survey, May 1995. *Lough Foyle*

Molloy, J. Herring Acoustic Survey in Divs VIaS and VIIb, July 1995, *Lough Foyle. Cruise Report* 1.

Molloy, J. Herring Acoustic Survey in Div VIIj and Celtic Sea. October-November. *Lough Foyle Cruise Report* 2.

COURSES CONDUCTED BY VISITING EXPERTS

STRIDE SA3 FISH STOCK ASSESSMENT TRAINING
Paul Connolly, Bob Mohn, Michael Keatinge.

A second "Workshop on Fish Stock Assessment Methods" was held at the FRC over the period 8 to 12 July 1994. This second course followed on from the 1993 course and was given by Dr Bob Mohn (Department of Fisheries and Oceans, Dartmouth, Canada) and Michael Keatinge (FRC Statistician/Population Modeller) to the FRC stock assessment group. The Workshop focused on modern stock assessment methods such as the analyses of CPUE data, age based assessment methods, ICES tuning methods for VPA models, running prediction programmes, biological reference points

and yield per recruit curves. A second in-house manual of fish stock assessment methods was produced and this will be a very valuable reference for workers in the area of stock assessment.

FISHERIES RESEARCH CENTRE STAFF

Inspector and Scientific Adviser	David Griffith MSc

Aquaculture, Environment and Oceans

Inspector	Jacqueline Doyle BSc
Senior Chemist	Máirín O'Sullivan PhD
Assistant Inspectors	Colm Duggan BSc
	David Jackson PhD
	Terry McMahon PhD
	Dan Minchin MSc, PhD, MIBiolI
	Eugene Nixon MSc
Chemist	Evin McGovern MSc, Dip Man, MICI, CChem MRSC
Laboratory Technicians	Denis McLaughlin Dip Polymer Sci
	Ailve Rowe BSc
	Joe Silke DipAqBiol
	Maria Smith MSc, NCEA
	Brige Taaffe *to 1995*

Stock Assesment

Inspector	John Browne MSc
Assistant Inspectors	Paul Connolly PhD
	Maria Doherty BSc
	Edward Fahy MA, Msc, PhD, FRES, MIBiolI
	Paul Hillis MPA, PhD, MIBiolI
	John Molloy BSc
	Christopher Moriarty Msc, PhD, FIBiolI, FIFM
	Niall O Maoiléidigh PhD
Laboratory Technicians	Liz Barnwall DipAppSci
	Bernard Doolan *retired 1995*
	Jim Carroll
	Anne Cullen DIT Dip
	Helen McCormick BSc
	Tom McDermott DipEnvSc
	Alan Nolan Bsc, DipTox
	David Noone
Senior Laboratory Assistant	Paul Gleeson

Fish Health Unit

Fish Pathologists	John McArdle MVB, MRCVS
	Francis Scullion PhD, MVB, MRCVS
Fish Microbiologist	Fiona Geoghegan MSc
Laboratory Technicians	Darrell Clinton DipAppBiol
	Catherine Hickey CertAqBiol
	Frank McKiernan DipAppBiol
	Caroline Dooley-Martyn DipEnvSci (seconded)

Central services

Research Vessel Manager	Michael Gillooly MSc
Senior Laboratory Technician	Dermot Kennedy CertBiochem, DipIndMicrobio
Laboratory Attendants	Nigel Bond
	Nicola Donohoe
	Martina McManus
Librarian	Mary Moore BA, DipLib, ALAI *to 1995*
	Alice Talbot DipIATI *from 1995*
Library Assistant	Anthony McDermott *to 1995*
Storekeeper	Patrick O'Shaughnessy
Reception	Ann McDaid
Driver	Sean Conway
Telephone operator	Eamon Casey

Contract Scientists for STRIDE projects

Acoustic surveying	Paul Fernandes PhD *to 1994*
Algal blooms	Joseph Wall DipAqSc
Algal cyst study	Jacqueline O'Mahony PhD *to 1994*
Benthic ecology	Sinéad Neiland PhD *to 1994*
Biometrics	Michael Keatinge BA, DipStats
Biotxins and chemical residues	Brige Taaffe DipChem
Computer development	Kerry Blake HNDIT
	Richard Quinn BAI MSc MIEI *to 1994*
Fisheries and benthic ecosystems	Brian Munday PhD
Fleet Assessment Technicians	Frances Bermingham DipAqSc
	Deirdre Brogan DipAqSc
	Jim Daly MSc
	Siobhán Moran DipAqSc
	Fiona Woods BSc
Gear Technology	Nicholas Pfeiffer CertAquaculture, BSc
Geographical information system	Yves Coupez LicGeol
Salmon ranching	Ger Rogan CertAqBiol, MSc, DipIFM

Contract scientists for other EU projects

Egg production	Maria O'Neill MSc

Research Students

Deep water fisheries	Ciaran Kelly BA
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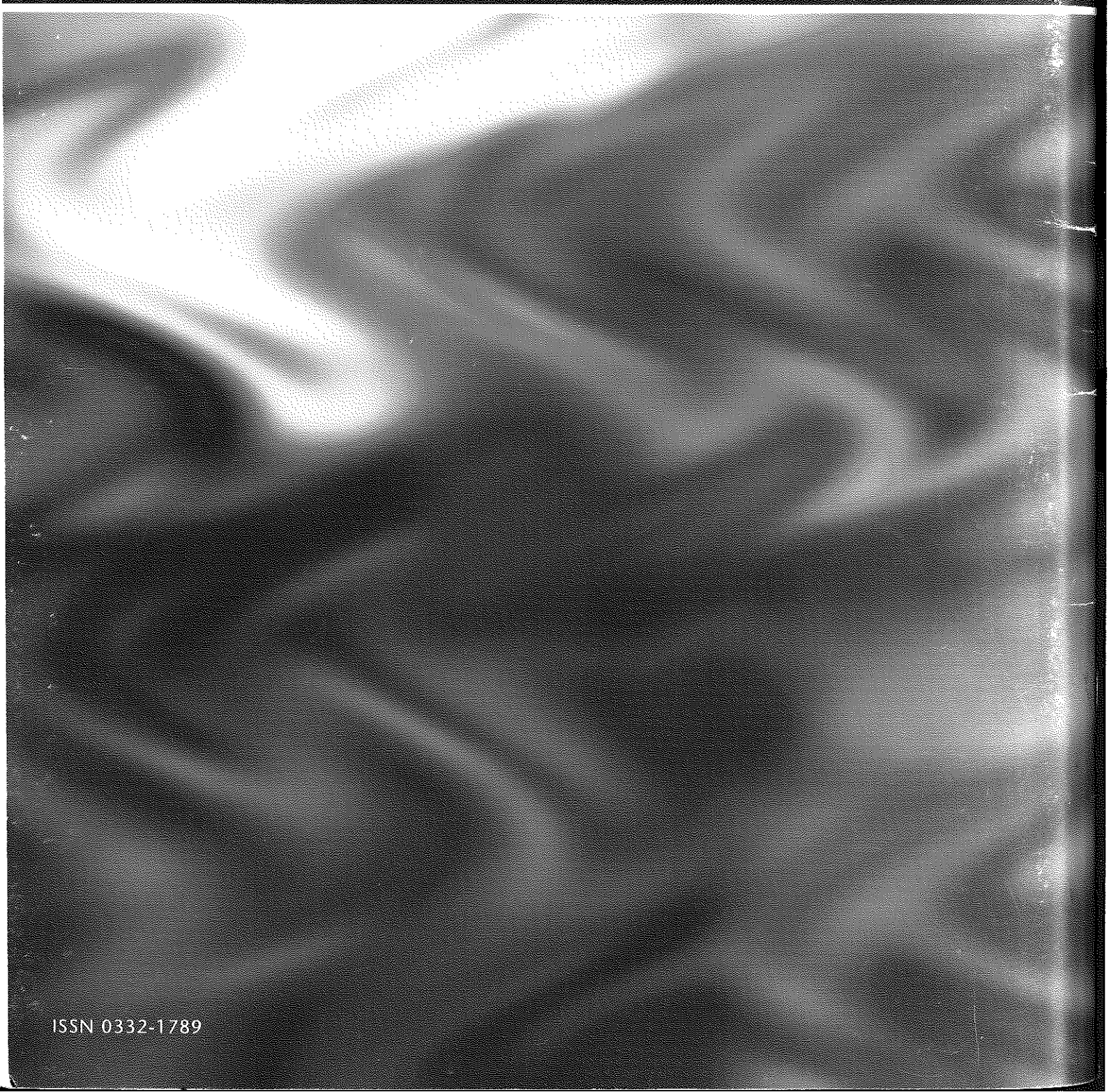

ISSN 0332-1789