

ROINN NA MARA

**MERCURY CONCENTRATIONS IN
FISH FROM IRISH WATERS IN 1994**

by

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Fishery Leaflet 167

Dublin 1995

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Marine Environmental Series 2/95

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Fishery Leaflet 167

September 1995

Department of the Marine

Dublin 2

Summary

During 1994, a total of 65 samples, covering the commercially important fish and shellfish species, were collected and the edible portion analysed for total mercury content in accordance with the European Commission's Decision of 19 May 1993. In fish, including prawns, the concentration of mercury ranged from 0.01 to 0.21 with a mean of 0.06 and in shellfish from 0.01 to 0.13 with a mean of 0.04 mg kg⁻¹ wet weight. These levels are low and are well within the maximum limits, 0.05 mg kg⁻¹ wet weight, set by the EC for mercury in fisheries products. This survey confirms previous studies that show Irish seafoods are effectively free from mercury contamination.

Introduction

Following the European Commission's Decision of 19 May 1993 determining analytical methods, sampling plans and maximum limits for mercury in fisheries products, staff of the Fisheries Research Centre's Environmental Unit set in place a mercury monitoring programme for fish landed at the major fishing ports and shellfish from the main shellfish growing areas. The results of this monitoring for 1992 and 1993 have been reported (Nixon *et al.* 1993, 1994) and the 1994 results are presented here.

Mercury, which occurs naturally in the earth's crust, can also be introduced into the aquatic environment from mining, agricultural and industrial activities. Once in the aquatic environment mercury is concentrated in fish tissues and for physiological reasons certain species concentrate mercury more readily than others. So as to protect consumers and to avoid possible long-term accumulation, the EC set a maximum limit for total mercury of 0.5 mg kg^{-1} wet weight in fishery products. In accordance with the objectives of public health protection, however, a higher acceptable limit of 1.0 mg kg^{-1} was set for the species listed in Annex 1. Annex 1 is not the complete list of species from the Decision, but contains all the species of relevance to Ireland.

Methods

Sample collection and preparation:

Samples of shellfish were collected from 19 of the main shellfish-growing areas (Fig. 1) and depurated for 14 hours in seawater taken from the sampling area. The edible portion was removed, washed with distilled deionised water and homogenised. Abalone samples were sent by the producer for analysis.

Fish landed at the major fishing ports of Killybegs, Rosaveel, Castletownbere, Dunmore East and Howth (Fig.1) were sampled during June and July 1994. Depending on availability, 10 fish of each species landed were sampled at each of these ports. A portion of the edible tissue was removed from each fish and stored in pre-weighed acid-washed glass jars; one jar per species. In the laboratory the samples were weighed and after freeze drying for 16 hours re-weighed and the moisture content calculated. This material was then further homogenised by grinding into a power and stored in desiccators until analysis.

Mercury analysis:

Freeze-dried tissue is refluxed with sulphuric and nitric acid for 3 hours. After cooling, potassium permanganate is added until solution remains coloured. The solution is diluted to approximately 45 ml with distilled deionised water and sufficient hydroxylamine hydrochloride is added to neutralise the excess potassium permanganate. Following reduction with stannous chloride (Hatch and Ott, 1968), the mercury is determined by cold

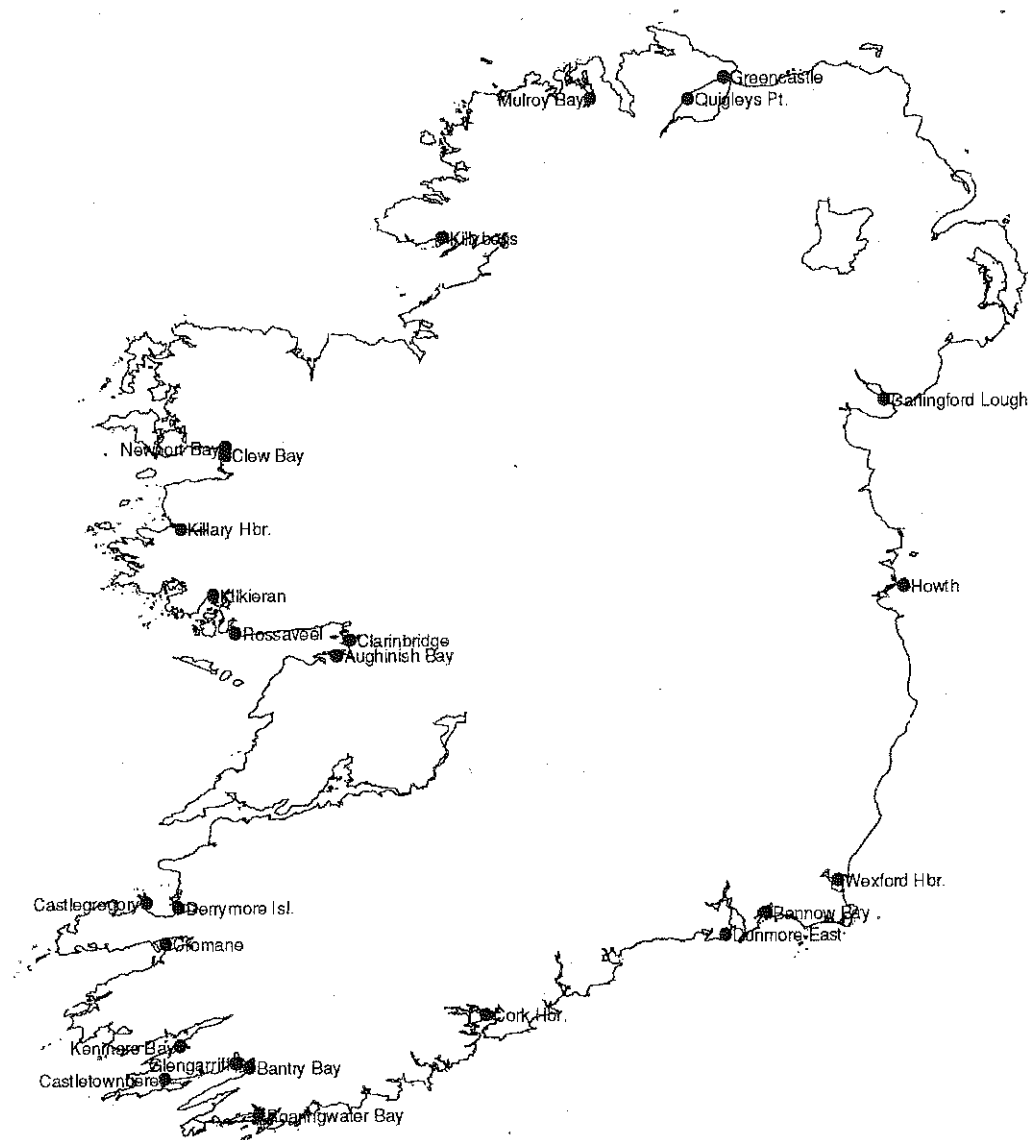


Fig. 1: Location of shellfish growing areas and fishing ports sampled during 1994.

Quality Assurance:

The quality of the data is assured through the participation in laboratory proficiency tests (QUASIMEME and ICES) and the analyses of the certified reference materials (CRM) with each batch of samples analysed. The results obtained from the analysis of the CRMs is given in Table 1.

Results and discussion

Commercial catch sampled at fishing ports:

During 1994, a variety of species from the commercial catch landed at the major Irish ports were sampled. A total of 36 samples, covering 14 different species were collected and analysed for total mercury, results are given in Table 2. The concentration of mercury in the edible portion of these fish ranged from 0.01 to 0.21 mg kg⁻¹ wet weight. The highest concentration was detected in prawns landed at Dunmore East on July 18, however, this was well within the EU human consumption tolerance level of 0.5 mg kg⁻¹ wet weight.

Of the 36 fish samples tested all fell within the European and Paris Commissions Environmental Quality Standard (EQS) for mercury, which requires that the mean concentration of mercury in the flesh should not exceed 0.3 mg kg⁻¹. When compared to the Oslo and Paris Commission's Joint Monitoring Group's (JMG) arbitrary and descriptive guidelines; the 'lower' level is loosely based on the level below which the majority of samples fall, the 'upper' level above which only a few samples which only a few samples lie, 81% are below this lower category (<0.1 mg kg⁻¹); 19% are within the medium category (0.1 - 0.3 mg kg⁻¹) and none of the samples fall into the higher JMG category (> 0.3 mg kg⁻¹).

Shellfish-growing areas:

Samples were collected on two occasions from 19 major shellfish growing areas during 1994, and together with abalone from Newport Bay were analysed for total mercury in the edible tissues. The results of these analyses are given in Table 3. All samples analysed, which included mussels, native and gigas oysters and abalone, were of commercial size. The mercury concentration ranged from 0.01 to 0.13 mg kg⁻¹ wet weight, within the human consumption tolerance limit of 0.5 mg kg⁻¹ set by the European Commission. All samples analysed lie within the JMG's 'lower' guideline value for mussels of <0.6 mg kg⁻¹ dry weight. These data confirm the low levels of mercury in Irish estuarine and nearshore waters and in the shellfish produced in these waters.

Conclusions

The total mercury concentrations in finfish from the Irish commercial catch and shellfish from the major growing areas are low and well within the EU tolerance levels for the protection of the consumer. This findings confirms previous studies (O' Sullivan *et al.*, 1991, Nixon *et al.*, 1991, Nixon *et al.*, 1993, Nixon *et al.*, 1994.) All samples tested were within the limits set by the European Commission's Decision of 19 May 1993.

Acknowledgements

The authors wish to thank Dr. Christopher Moriarty for his editorial assistance and to Maria Smyth and Martina McManus for sample collection and preparation.

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Table 1: Results of the analyses of certified reference materials obtained during this study.

	Tissue Type	Cert. Value mg kg ⁻¹	FRC Value mg kg ⁻¹	No. of Analyses
CRM 278	Mussel	0.188 ± 0.007	0.183 ± 0.012	5
Dorm-1	Dogfish Muscle	0.798 ± 0.074	0.817 ± 0.027	9
SRM 1566a	Oyster	0.0642 ± 0.0067	0.065 ± 0.0039	4

Table 2: Mercury concentrations (mg kg⁻¹ wet weight) in the edible portion of fish species landed at Irish ports during 1994.

Port Landed	Date	Species	Sample size	Length Range (mean) in cm	% Water Content	Hg mg kg ⁻¹ wet weight
Castletownbere	22 June	Cod	10	38-50 (40)	83.0	0.05
Castletownbere	22 June	Monk	10	27-43 (36)	83.1	0.02
Castletownbere	22 June	Plaice	9	28-32 (30)	81.4	0.08
Castletownbere	22 June	Sole - lemon	10	26-30 (28)	80.1	0.02
Dunmore East	18 July	Cod	5	63-79 (70)	80.0	0.01
Dunmore East	18 July	Haddock	10	31-49 (40)	77.5	0.12
Dunmore East	18 July	Hake	10	29-35 (32)	80.0	0.01
Dunmore East	18 July	Ling	5	65-80 (75)	78.4	0.07
Dunmore East	18 July	Megrim	10	31-41 (36)	82.6	0.12
Dunmore East	18 July	Monk	10	48-57 (48)	82.2	0.03
Dunmore East	18 July	Plaice	9	30-39 (34)	79.7	0.09
Dunmore East	18 July	Prawn	25	3-4 (3)	80.1	0.21
Dunmore East	18 July	Sole - black	5	31-40 (36)	80.8	0.02
Dunmore East	18 July	Sole - lemon	10	28-35 (30)	83.9	0.16
Dunmore East	18 July	Whiting	10	30-36 (29)	79.8	0.12
Howth	15 June	Cod	5	59-78 (68)	82.1	0.02
Howth	15 June	Haddock	10	32-38 (34)	79.8	0.11
Howth	15 June	Herring	10	22-27 (25)	72.3	0.02
Howth	15 June	Mackerel	10	32-37 (34)	76.7	0.05
Howth	15 June	Plaice	10	30-36 (31)	79.1	0.05
Howth	15 June	Prawn	25	2-4 (3)	78.6	0.02
Howth	15 June	Ray	10	51-62 (58)	76.6	0.02
Killybegs	5 July	Cod	10	51-69 (58)	80.5	0.07
Killybegs	5 July	Haddock	10	33-36 (35)	80.6	0.08
Killybegs	5 July	Haddock	10	44-54 (48)	79.8	0.04
Killybegs	5 July	Hake	10	42-48 (46)	78.6	0.01
Killybegs	5 July	Megrim	10	42-57 (50)	80.6	0.07
Killybegs	5 July	Monk	10	38-48 (44)	85.5	0.03
Killybegs	5 July	Whiting	10	28-35 (31)	80.8	0.04
Rossaveel	14 July	Cod	5	63-79 (72)	80.8	0.05
Rossaveel	14 July	Haddock	10	41-49 (45)	79.8	0.04
Rossaveel	14 July	Monk	10	33-46 (40)	82.6	0.03
Rossaveel	14 July	Plaice	10	30-35 (32)	80.0	0.05
Rossaveel	14 July	Prawn	25	3-5 (4)	75.9	0.09
Rossaveel	14 July	Sole - lemon	10	26-34 (29)	78.9	0.07
Rossaveel	14 July	Whiting	10	29-37 (32)	79.8	0.19

Table 3: Mercury concentrations (mg kg⁻¹ wet weight) in the edible portion of shellfish the major Irish shellfish growing areas.

Growing Area	Date Sampled	Species	Sample Size	Length Range (mean) in mm	% Water Content	Hg mg kg ⁻¹ wet weight
Aughinish Bay	15 Dec.	Oyster - <i>gigas</i>	25	103-134 (119)	77.4	0.03
Bannow Bay	10 Dec.	Oyster - <i>gigas</i>	25	72-118 (92)	74.8	0.13
Bantry Bay	29 Nov.	Mussel	25	40-50 (45)	77.2	0.08
Carlingford Lough	10 Nov.	Mussel	50	42-50 (46)	78.5	0.02
Carlingford Lough	10 Nov.	Oyster - <i>gigas</i>	25	75-122 (96)	78.3	0.11
Carlingford Lough	23 June	Oyster - <i>gigas</i>	25	78-137 (109)	77.1	0.02
Clarinbridge	15 Dec.	Oyster - native	25	63-85 (75)	76.2	0.02
Clew Bay	13 Dec.	Oyster - <i>gigas</i>	25	68-101(80)	78.4	0.08
Clew Bay	13 July	Oyster - native	25	71-90 (80)	77.7	0.03
Cork Harbour.	30 Nov.	Oyster - <i>gigas</i>	25	61-75 (67)	77.0	0.05
Cromane	20 June	Mussel	25	43-77 (61)	75.4	0.03
Cromane	28 Nov.	Mussel	50	58-86 (76)	77.5	0.06
Glengarriff	29 Nov.	Mussel	25	42-50 (46)	78.4	0.03
Greencastle	01 Nov.	Mussel	50	48-56 (52)	80.4	0.09
Greencastle	3 July	Mussel	50	53-69 (59)	80.4	0.03
Kenmare Bay	29 Nov.	Mussel	25	40-58 (49)	77.3	0.02
Kilkieran	14 July	Oyster - native	25	66-76 (72)	81.2	0.03
Kilkieran	14 Dec.	Oyster - native	25	70-92 (80)	78.4	0.01
Killary Harbour.	14 Dec.	Mussel	50	42-60 (53)	77.5	0.02
Mulroy Bay	02 Nov.	Mussel	50	41-58 (50)	74.6	0.03
Newport Bay	21 April	Abalone	5	64-71 (67)	32.7	0.07
Quigley's Pt.	2 Nov.	Mussel	50	50-68 (58)	79.2	0.02
Roaringwater Bay	30 Nov.	Mussel	25	42-50 (46)	75.6	0.05
Castlegregory	21 June	Oyster - native	25	44-101 (70)	75.1	0.02
Castlegregory	28 Nov.	Oyster - native	22	59-108 (78)	77.8	0.02
Derrymore	21 June	Oyster - native	25	67-81 (72)	74.9	0.01
Derrymore	28 Nov.	Oyster - native	25	59-89 (74)	79.7	0.01
Wexford Harbour.	10 Dec.	Mussel	50	44-64 (55)	79.4	0.03
Wexford Harbour.	19 July	Mussel	50	49-60 (55)	79.5	0.02

Annex 1: Selected species, as listed by European Commission Decision, where the higher acceptable limit of 1.0 mg kg^{-1} total mercury concentration applies.

Common Name	Species Name
Sharks	all species
Tuna	<i>Thunnus spp.</i>
Little tuna	<i>Euthynnus spp.</i>
Bonito	<i>Sarda spp.</i>
Plain bonito	<i>Orcynopsis unicolor</i>
Swordfish	<i>Xiphias gladius</i>
Sailfish	<i>Istiophorus platypterus</i>
Marlin	<i>Makaira spp.</i>
Eel	<i>Anguilla spp</i>
Bass	<i>Dicentrarchus spp</i>
Sturgeon	<i>Acipenser spp.</i>
Halibut	<i>Hippoglossus hippoglossus</i>
Redfish	<i>Sebastes marinus, S. mentella</i>
Blue ling	<i>Molva dipterygia</i>
Atlantic catfish	<i>Anarhichas lupus</i>
Pike	<i>Esox lucius</i>
Portuguese dogfish	<i>Cantroscymnes coelolepis</i>
Rays	<i>Raja spp.</i>
Scabbardfishes	<i>Lepidopus caudatus,</i> <i>Aphanopus carbo</i>
Anglerfish	<i>Lophius spp.</i>