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Summary

During 1993, a total of 81 samples, covering 18 finfish and 4 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 finfish the concentration of mercury ranged from 0.01 to 0.39 with a mean of 0.10 and in shellfish the concentration also ranged from 0.01 to 0.39 but with a mean of 0.04 $\mu g\ g^{-1}$ wet weight. These levels are low and are well within the maximum limits set by the EC for mercury in fisheries products. The total mercury concentration in Irish shellfish is very low and is generally low in the commercial catch landed at Irish ports. 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. 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, (Annex 1). So as to protect consumers and to avoid possible long-term accumulation, the EC set a maximum limit for total mercury of 0.5 $\mu g\ g^{-1}$ wet weight in fishery products and in accordance with the objectives of public health protection, a higher acceptable limit of 1.0 $\mu g\ g^{-1}$ was set for the species listed in Annex 1.

METHODS

Sample collection and preparation:
Depending on the species, 25 or 50 molluscs were collected from 19 of the main shellfish-growing areas and depurated for 14 hours in seawater taken from the sampling area. The edible portion was removed, washed with distilled deionised water and homogenised. Fish landed at the major fishing ports of Killybegs, Rossaveel, Castletownbere, Dunmore East and Howth (and herring from Dingle) were sampled during August and December 1993. 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, stored in pre-weighed acid-washed glass jars and returned to the laboratory. 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 homogenised by grinding into a power and stored in dessicators 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 potassium permanganate. Following the reduction of samples with stannous chloride (Hatch and Ott 1968), the mercury is determined by cold vapour flameless atomic absorption using a Varian SpectrAA 20 Plus fitted with VGA 76 Vapour Generator.

Quality Assurance:
The quality of the data is assured through 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.

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

	Cert Value μg g^{-1}	FRC Value μg g^{-1}	No. of Analyses
CRM 278	0.188 ± 0.007	0.20 ± 0.014	6
Dorm-1	0.798 ± 0.074	0.875 ± 0.065	11
SRM 1566a	0.0642 ± 0.0067	0.0717 ± 0.0126	8

RESULTS AND DISCUSSION

Commercial catch sampled at fishing ports:
During 1993, a variety of species from the commercial catch landed at the major Irish ports were sampled. In total 43 samples, covering 19 different species were collected and analysed for total mercury, results given in Table 2. The concentration of mercury in the edible portion of these fish ranged from 0.01 to 0.39 μg g^{-1} wet weight. The highest was detected in dogfish (0.39) and tuna (0.30) both landed at Castletownbere during August 1993, these two species are listed in Annex 1. All fish species sampled were less than the limit of 0.5 μg g^{-1} total mercury set by the EC. Of the 43 samples tested 63% fell in the Oslo and Paris Commission's Joint Monitoring Group's (JMG) lower category (<0.1 μg g^{-1}), 32% in the medium category (0.1 - 0.3 μg g^{-1}) and 5% (2 samples - dogfish and tuna), in the higher JMG category (> 0.3 μg g^{-1}).

Shellfish-growing areas:
Samples were collected on two occasions from 19 shellfish-growing areas during 1993 and analysed for total mercury in the edible tissues, Table 3. These samples consisted of mussels and both native and gigas oysters and all specimens were of commercial size. The mercury concentration in all was less than the limit of 0.5 μg g^{-1} set by European Commission and ranged from 0.01 to 0.39 μg g^{-1} wet weight. The highest concentration detected was in mussels from Cromane (0.39 μg g^{-1}) collected during November. This unexpectedly high level was confirmed by duplicate analyses on the same sample but does not reflect the level of 0.02 μg g^{-1} detected in three separate samples collected during November '92 (Nixon et al 1993) April '93 (this study) and June '94 (unpublished data). All areas sampled, with the exception of Cromane and Clew Bay each on one occasion, fell in the JMG lower category of < 0.1 μg g^{-1}. 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 concentration in Irish shellfish is very low and generally low in the commercial catch landed at Irish ports which 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.

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

Sharks	all species
Tuna	*Thunnus spp.*
Eel	*Anguilla spp*
Bass	*Dicentrarchus spp*
Halibut	*Hippoglossus hippoglossus*
Redfish	*Sebastes marinus, S. mentella*
Pike	*Esox lucius*
Rays	*Raja spp.*
Scabbardfishes	*Lepidopus caudatus, Aphanopus carbo*
Anglerfish	*Lophius spp.*

Table 2: Mercury concentration (μg g^{-1} wet weight) in the edible portion of fish species landed at Irish ports during 1993.

Port landed	Month	Species	Sample size	Length in cm range (mean)	Hg. μg g^{-1} wet weight
Castletownbere	August	Black Sole	10	36 - 45 (41)	0.24
		Cod	10	56 - 67 (63)	0.13
		Crab	10	---	0.14
		Dogfish	10	61 - 104 (77)	0.39
		Haddock	10	47 - 54 (51)	0.09
		Hake	10	43 - 62 (49)	0.06
		Lemon Sole	10	25 - 39 (30)	0.05
		Megrim	10	39 - 50 (45)	0.15
		Monk	10	29 - 62 (40)	0.17
		Plaice	10	27 - 42 (32)	0.09
		Skate	10	58 - 67 (62)	0.16
		Tuna	10	62 - 77 (66)	0.30
		Pollock	10	61 - 79 (67)	0.22
		Whiting	10	29 - 39 (33)	0.09
Dingle	December	Herring	10	23 - 28 (26)	0.08
Dunmore East	August	Black Sole	10	25 - 36 (31)	0.07
		Cod	10	38 - 60 (50)	0.09
		Lemon Sole	10	26 - 29 (27)	0.03
		Haddock	10	27 - 33 (29)	0.19
		Hake	10	30 - 37 (33)	0.09
		Mackerel	10	26 - 33 (29)	0.03
		Megrim	10	32 - 40 (30)	0.05
		Monk	10	35 - 46 (39)	0.08
		Plaice	10	28 - 37 (28)	0.04
		Scallop	5	---	0.01
		Whiting	10	32 - 38 (32)	0.03
Howth	August	Black Sole	10	22 - 25 (24)	0.04
		Lemon Sole	10	31 - 39 (34)	0.13
		Mackerel	10	26 - 28 (27)	0.01
		Plaice	10	26 - 32 (29)	0.06
		Prawn	10	---	0.08
		Whiting	10	24 - 28 (27)	0.05
Killybegs	December	Haddock	10	31 - 37 (34)	0.04
		Megrim	10	26 - 38 (33)	0.05
		Plaice	10	26 - 29 (28)	0.07
		Whiting	10	27 - 34 (29)	0.06
		Witch	9	26 - 38 (31)	0.14
Rossaveel	December	Megrim	10	27 - 51 (37)	0.13
		Haddock	10	32 - 37 (34)	0.08
		Herring	10	27 - 29 (27)	0.16
		Plaice	10	30 - 45 (37)	0.14
		Monk	10	33 - 63 (43)	0.14
		Whiting	9	30 - 39 (35)	0.05

Table 3: Mercury concentration (µg g^{-1} wet weight) in the edible portion of shellfish from 19 major Irish shellfish growing areas during 1993.

Growing area	County	Month	Species	Sample size	Length in mm range (mean)	Hg. µg g^{-1} wet weight
Aughinish	Clare	May	Oyster (Native)	25	50 - 100 (62)	0.02
		November	Oyster (Gigas)	25	75 - 118 (98)	0.05
Bantry Bay	Cork	April	Mussel	50	43 - 59 (52)	0.01
		November	Mussel	50	41 - 60 (48)	0.04
Glengarriff	Cork	April	Mussel	50	43 - 59 (53)	0.02
		November	Mussel	50	41 - 59 (49)	0.05
Roaringwater Bay	Cork	April	Mussel	50	41 - 54 (49)	0.02
		November	Mussel	50	41 - 61 (50)	0.01
Rossmore	Cork	April	Oyster (Gigas)	25	85 - 160 (115)	0.03
		November	Oyster (Gigas)	25	84 - 175 (121)	0.06
Greencastle	Donegal	May	Mussel	50	43 - 63 (56)	0.02
		November	Mussel	50	40 - 60 (53)	0.03
Mulroy Bay	Donegal	May	Mussel	50	45 - 62 (55)	0.02
		November	Mussel	50	44 - 60 (54)	0.04
Quigley's Pt.	Donegal	May	Mussel	50	47 - 63 (56)	0.02
		November	Mussel	50	42 - 63 (53)	0.04
Clarinbridge	Galway	May	Oyster (Native)	25	61 - 84 (70)	0.02
		November	Oyster (Native)	25	66 - 81 (76)	0.05
Kilkieran Bay	Galway	May	Oyster (Native)	25	70 - 88 (79)	0.03
		November	Oyster (Native)	24	67 - 88 (77)	0.07
Killary Harbour.	Galway	May	Mussel	50	47 - 62 (54)	0.02
		November	Mussel	50	41 - 60 (51)	0.06
Cromane	Kerry	April	Mussel	50	48 - 61 (57)	0.02
		November	Mussel	50	43 - 59 (54)	0.39
Kilmackillogue	Kerry	April	Mussel	50	48 - 60 (55)	0.01
		November	Mussel	50	42 - 56 (48)	0.06
Tralee Bay (Inner)	Kerry	April	Oyster (Native)	25	62 - 81 (70)	0.02
		November	Oyster (Native)	25	70 - 97 (75)	0.02
Tralee Bay (Outer)	Kerry	April	Oyster (Native)	25	59 - 100 (77)	0.02
		November	Oyster (Native)	25	63 - 92 (77)	0.06
Carlingford	Louth	April	Oyster (Gigas)	25	93 - 118 (106)	0.04
		November	Oyster (Gigas)	25	87 - 124 (102)	0.02
Clew Bay	Mayo	May	Oyster (Native)	25	69 - 89 (80)	0.02
		November	Oyster (Native)	25	70 - 96 (84)	0.12
Bannow Bay	Wexford	November	Oyster (Gigas)	25	72 - 112 (93)	0.01
		April	Oyster (Gigas)	25	78 - 124 (95)	0.01
Wexford Harbour.	Wexford	April	Mussel	50	43 - 71 (56)	0.02
		November	Mussel	50	50 - 59 (55)	0.04