HEAVY METAL CONTAMINANTS IN FISH CAUGHT FROM THE MERSEY ESTUARY AND INSHORE LIVERPOOL BAY

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SUMMARY

In recent times, there has been a substantial reduction in the amount of heavy metal and organic pollution discharged to the Mersey estuary. This has resulted in fish returning to the estuary in quantities that support angling activities.

This report summarises the findings of a two year study undertaken by the Industrial Ecology and Research Centre at Liverpool University, and sponsored by the National Rivers Authority, to determine the concentration of heavy metal contaminants present in angler-caught fish taken from the Mersey estuary and Inshore Liverpool Bay.

A knowledge of the contamination of fish by certain pollutants provides information about the safety of fish as food, the extent of existing and historical pollution, and a potential indication of pollution 'hot spots'.

More than 800 fish were analysed as part of the study and the following conclusions can be drawn :

- For certain metals and species the levels of contamination, in the muscle tissue of fish caught in the estuary, are elevated in comparison with the standards/guidelines specified for contaminants in fish. This is particularly true for mercury and, in the case of fish collected from one of the study sites, for lead.

- The average concentrations for mercury and lead were generally higher at inner estuary sites than further off-shore.

In the light of the data collected for the Mersey estuary, it would be prudent for anglers to heed the general advice given by MAFF that it is inadvisable to eat fish from polluted rivers and estuaries.

CONTENTS

1. FOREWARD

The North West of England, and the Mersey catchment in particular, is one of the most important areas in the United Kingdom for the production of a wide range of chemical products. Aqueous discharges from manufacturing industries, together with untreated sewage discharges, have resulted in the Mersey Estuary being heavily polluted for many years. In recent times, as a result of programmes for trade effluent improvement and treatment of crude sewage discharges, increasing numbers of fish are returning to the estuary. This trend is likely to continue as the water quality improves.

In May 1991, the Ministry of Agriculture, Fisheries and Food issued a general warning to anglers stating that it was inadvisable to eat fish taken from polluted rivers and estuaries. This concern arose primarily because of high levels of mercury found in eels caught in the River Mersey. Long-lived fatty species such as eels, which feed on organisms in sediments, are particularly likely to accumulate pollutants in their body tissues whilst resident in the estuary.

Whilst it can be demonstrated that the total load of both organic and metal pollutants discharged to the Mersey has significantly declined in recent times, there is relatively little data available about the concentrations of pollutants present in fish taken from the estuary. Monitoring fish flesh for persistent toxic chemicals is an important indicator of both existing and historic water pollution.

This report provides a summary of the findings of a two year study, carried out by the Industrial Ecology Research Centre at Liverpool University and sponsored by the National Rivers Authority, to determine the levels of heavy metal contaminants present in angler-caught fish taken from the Mersey estuary and Inshore Liverpool Bay.

2. BACKGROUND

2.1 The Mersey Estuary

The Mersey estuary is the outlet for one of the most urbanised catchment systems within the United Kingdom. The estuary receives the drainage from a large part of Cheshire and South Lancashire and smaller areas of Derbyshire, as well as the highly urbanised industrial areas of Merseyside and Manchester. The total area drained is 1,765 square miles and the area's population numbers more than five million people, a quarter of whom live along the banks of the estuary.

The Mersey was once a clean and beautiful river with sturgeon, mullet, lobsters, and oysters being caught near Warrington in the 1720s. Even salmon could be caught in Manchester until the end of the 18th Century. By 1948, there was a reported absence of fish in the estuary.

2.2 Pollution of the Mersey Estuary

Pollution of the estuary goes back to the days of the Industrial Revolution. The rapid expansion of the textile industry led to an associated growth in the dyeing, bleaching and finishing trades. The

manufacture of dyes and chemicals developed, the paper industry flourished and a heavy chemical industry developed in the Widnes and St. Helens area. All these industries required copious amounts of clean water and many produced large quantities of untreated effluent. The coal-gas making industry discharged gas liquor and tar directly into the Mersey.

As factories sprang up, people moved into towns to find work. The huge concentrations of people and factories needed vast quantities of water which, after use, was discharged untreated into the River Mersey and the estuary. By the mid-19th century the state of many of the nation's rivers was a cause of serious concern, and the Mersey was one of the worst.

Because of this legacy left by industrialisation and urbanisation, the Mersey still ranks amongst the most polluted rivers in Britain. Major sources of pollution include continuous discharges of industrial and sewage effluent; run-off from farms; seepage from waste disposal sites and mines, and intermittent discharges from unsatisfactory storm sewage overflows.

2.3 Turning the Tide

After more than 200 years of neglect, the tide of pollution in the Mersey is at last showing signs of turning. Pollution alleviation schemes, such as the treatment of crude sewage discharges on the North Bank of the estuary and industrial programmes for effluent improvement, have resulted in substantial reductions in the loads of pollutants discharged to the estuary. As a result of the Mersey Basin Campaign - a £4 billion initiative, launched in 1985 by the Government, to clean up the Mersey and its tributaries - further improvements are expected.

By 1989 the organic pollution load on the estuary had dropped by 30% compared with 1972. As oxygen levels have improved, fish have begun to return to the estuary. Beam-trawling, examining species found on cooling water intake screens on the Manchester Ship Canal, and a limited amount of electrofishing of estuarine tributaries has resulted in over 30 species being observed since 1976.

3. ANGLING PATTERNS IN THE MERSEY ESTUARY

3.1 Fishing Activity

Angling patterns in the Mersey estuary and inner Liverpool Bay can be divided into shoreline angling and boat angling. Some 40 angling clubs exist in the area, many of whom are affiliated to the North West Association of Sea Angling Clubs, which organises an annual series of competitions divided into summer and winter leagues with venues throughout the Merseyside area.

On the Wirral shoreline in the winter months, the Mersey is fished mainly between Woodside Ferry in Birkenhead and New Brighton. Additional angling stations such as Eastham, Bromborough Dock wall are fished occasionally, but are more restricted in terms of access or tides. In the summer months, Hoylake becomes a popular centre for shoreline fishing.

On the Liverpool shoreline, the number of potential angling sites is limited compared with the Wirral, the most popular being Alexandra Dock Wall (Bootle) , Seaforth Rocks (near Crosby) and Otterspool promenade.

Popular inshore locations for charter boat fishing include Formby Tower and Burbo Flats. Small boat fishing activity takes place from New Brighton, Crosby, Formby, Ainsdale and Southport beaches.

3.2 Species Landed

The species composition of the catch from any part of the Mersey estuary coastline and from boat angling activities varies greatly with season, tide and location as well as with the angling variables of bait etc. In winter, the main angling activity is devoted to fishing for codling and whiting. In December 1991, a survey of anglers fishing from the Wirral shoreline and small boats recorded the following catches:

	Shoreline Fishing	Boat Fishing
Date	21 - 30 Dec	1 Dec
No. fish caught	165	2,500
Whiting	52%	73%
Cod	32%	13%
Dab	10%	13%

Other species occasionally encountered during the winter include rockling, flounder and plaice.

In spring, the catch at most locations on the Wirral coastline is dominated by several species of flatfish including plaice. In the summer, plaice and flounder fishing becomes popular. Fishing for eels is carried out along much of the coastline but, in particular, off Otterspool promenade from June to September.

3.3 Fate of Catch

A total of 170 anglers were interviewed during the course of the survey on the Wirral in December 1991. Almost half (45%) of the anglers took home for consumption all the species of fish caught - provided they were large enough. A further 20% consumed only round fish such as cod and whiting, mainly because they consider that these are not full-time residents within the estuary and therefore less contaminated. However, 24% of the anglers questioned ate no fish at all, largely because of concerns about pollution.

A similar survey of Liverpool shoreline anglers showed 20% took all species home for consumption, 42% retained only round fish and 27% ate no fish at all.

5. RESULTS OF STUDY

Tables 1 to 6 show the results of analysis of samples of the six core species collected during the period October 1991 to August 1993. Table 7 shows the results of analysis of several "wreck" species which were collected between June and September from craft fishing offshore around charted wrecks in inshore Liverpool Bay.

The tables also include data for fish taken from the Solway Firth reference sites, during the period October 92 and May 93, for comparison with the Mersey fish data.

The analytical methods used in the study followed the procedures described in the Ministry of Agriculture, Fisheries and Food (Directorate of Fisheries Research), Aquatic Environment Protection : Analytical Methods Booklet No 3 (1989, MAFF, Lowestoft).

The results show that for certain metals and species the metal concentrations in muscle tissue of fish caught in the Mersey estuary are elevated above normal levels. In particular this is true for mercury and, to a lesser extent, for lead. Values for arsenic are slightly above background in some cases, though this is not thought to be of real significance. Concentrations of cadmium, copper, zinc and chromium are typical of those level detected in fish taken from other UK estuarine sites.

5 (i) Mercury

Mean values for mercury were generally higher in the inner estuary sites compared to the further offshore sites, this being particularly true for flounder, and for eels. Concentrations of mercury were lower in plaice than in flounder, with dab intermediate.

Some of the mercury levels recorded for flounder, and for eels in particular, exceeded the 0.5 mg per kg and 1.0 mg per kg standards specified in the recently adopted European Commission Decision (93/351/EEC) which sets maximum limits for mercury in fishery products (Appendix II). Judged against this standard very few of the cod and whiting data are of significance.

Tope and skate values from the 'wreck' samples also exceeded their standard.

5 (ii) Lead

Lead levels detected in eel and flounder samples taken from Eastham were significantly higher than those levels detected in fish taken from the other study sites. This suggests a local influence of inputs of lead from the Manchester Ship Canal.

Lead levels for eel and flounder taken from Eastham exceeded the 2.0 mg per kg wet weight standard for fish specified in the Lead in Food Regulations 1989.

5 (iii) Arsenic

Arsenic levels appear high for most species with the notable exception of eels which, it could be speculated, may be due to a difference in dietary intake for this species.

The arsenic is thought to be present as refractory organoarsenic compounds of low mammalian toxicity. Inorganic arsenic is only a very minor component of the total arsenic present and on this basis there is no direct cause for concern as regards human health.

5 (iv) Cadmium, Copper, Chromium and Zinc

The concentrations of these metals present in fish are typical of 'expected' levels present in fish and lie within the standards/guidelines for contaminants in fish.

Standards/guidelines for contaminants in fish are shown in Appendix I (taken from MAFF Aquatic Monitoring Report No 26).

6. CONSUMPTION OF FISH

As greater numbers of fish return to the Mersey estuary, concern has been expressed by the local angling community about possible health risks asssociated with the consumption of fish taken from the estuary.

Responsibility for advice on health or safety relating to the consumption of fish lies with the Ministry of Agriculture, Fisheries and Food (Chemical Safety of Food Division). In May 1991, MAFF issued a general warning to anglers, and the public, that it was inadvisable to eat fish from polluted rivers and estuaries. The concern arose because of high levels of mercury present in eels taken from the Mersey estuary.

The Mersey estuary is polluted and of poor water quality, receiving as it does large volumes of untreated industrial and sewage effluent. Long-lived fatty species such as eels, and certain other species, which feed particularly on organisms in sediments are particularly likely to accumulate pollutants in their body tissues. The estuary has been heavily polluted for many years by industrial wastes, and the sediments contain pollution from earlier years which will take a long time to reduce, even though industrial programmes of effluent improvement are in hand, and being actively pursued by the National Rivers Authority as the regulatory body.

The NRA statement concerning consumption of fish taken from the estuary is given in (Appendix III). Anglers concerned with potential risks associated with the consumption of fish taken from the Mersey should consult MAFF.

7. CONCLUSIONS

The objective of the study to obtain quantitative information about the concentrations of heavy metal pollutants in fish taken from the Mersey estuary and Inshore Liverpool Bay has been met.

The results show that for certain metals and species the levels of contamination in muscle tissue of fish caught in the estuary are

elevated above normal levels. This is particularly true for mercury and, to a lesser extent lead.

Average concentrations for lead and mercury were generally higher at inner estuary sites such as Eastham than further offshore.

TABLE 1

SPECIES: EEL (MUSCLE TISSUE)

Site	Date of Capture	Number Samples	Mean Length [cm]	Mercury [Hg]	Cadmium [Cd]	Lead [Pb]	Arsenic [As]	Zinc [Zn]	Copper [Cu]	Chromium [Cr]
				MEAN CONCENTRATION (mg/kg wet weight)						
Hoylake	May 1992	18	49.8	0.53	<0.14	<0.61	1.14	22.7	0.83	<0.26
New Brighton	Oct 1991 – June 1993	43	55.3	1.28	<0.16	0.84	1.38	25.9	0.92	<0.32
Eastham	Sept 1992	63	53.4	1.35	<0.15	2.24	0.96	25.7	0.76	<0.25
Otterspool	May 1992	50	53.6	1.33	<0.14	<0.84	0.89	25.7	1.06	<0.43
Solway Firth (Comparison Site)	April & May 1993	20	51.7	0.32	<0.12	<0.49	1.10	19.96	0.85	<0.25

< = Less Than
mg/kg is equivalent to parts per million

TABLE 2

SPECIES: FLOUNDER (MUSCLE TISSUE)

Site	Date of Capture	Number Samples	Mean Length [cm]	Mercury [Hg]	Cadmium [Cd]	Lead [Pb]	Arsenic [As]	Zinc [Zn]	Copper [Cu]	Chromium [Cr]
				MEAN CONCENTRATION (mg/kg wet weight)						
Hoylake	May 1992	25	30.3	0.27	<0.08	<0.34	5.79	11.99	0.30	<0.26
New Brighton	May 1993 – June 1993	27	32.6	0.79	<0.09	<0.74	11.61	7.90	<0.22	<0.18
Eastham	Jun 1993 & Sept 1993	29	29.1	0.80	<0.09	2.55	6.15	7.76	0.27	<0.25
Otterspool	July 1993	25	29.6	0.63	<0.08	<0.61	8.55	6.52	0.36	<0.27
Bootle	May 1992 – July 1993	20	32.4	0.47	<0.08	<0.40	13.27	6.91	0.40	<0.19
Solway Firth [Comparison Site]	Nov 1992 – May 1993	20	28.9	0.17	<0.08	<0.32	6.52	9.36	0.29	<0.16

< = Less Than

TABLE 3

SPECIES: DAB (MUSCLE TISSUE)

Site	Date of Capture	Number Samples	Mean Length [cm]	Mercury [Hg]	Cadmium [Cd]	Lead [Pb]	Arsenic [As]	Zinc [Zn]	Copper [Cu]	Chromium [Cr]
				MEAN CONCENTRATION (mg/kg wet weight)						
New Brighton	July 1992 & Oct 1992	90	25.8	0.58	<0.10	<0.41	7.73	5.32	<0.18	<0.19
Bootle	Dec 1991 & Oct 1992	20	25.3	0.35	<0.09	<0.33	7.17	5.63	0.20	<0.17
Mid Estuary	Dec 1991	28	28.0	0.41	<0.08	<0.32	5.14	5.41	0.63	<0.18
Solway Firth [Comparison Site]	Oct 1992 – May 1993	12	25.0	0.10	<0.08	<0.32	7.03	5.37	<0.18	<0.16

< = Less Than

TABLE 4

SPECIES: PLAICE (MUSCLE TISSUE)

Site	Date of Capture	Number Samples	Mean Length [cm]	Mercury [Hg]	Cadmium [Cd]	Lead [Pb]	Arsenic [As]	Zinc [Zn]	Copper [Cu]	Chromium [Cr]
				MEAN CONCENTRATION (mg/kg wet weight)						
Egremont – Vale Park	June 1993 – August 1993	82	31.7	0.36	<0.08	<0.59	10.69	5.51	<0.18	<0.20
Solway Firth [Comparison Site]	April & May 1993	7	35.7	0.14	<0.08	<0.33	10.23	7.05	0.44	<0.16

< = Less Than

TABLE 5

SPECIES: WHITING (MUSCLE TISSUE)

Site	Date of Capture	Number Samples	Mean Length [cm]	Mercury [Hg]	Cadmium [Cd]	Lead [Pb]	Arsenic [As]	Zinc [Zn]	Copper [Cu]	Chromium [Cr]
				MEAN CONCENTRATION (mg/kg wet weight)						
New Brighton	Oct 1992	25	30.4	0.29	<0.09	<0.66	3.38	4.22	0.32	<0.29
Bootle	Oct 1992	17	29.9	0.23	<0.10	<0.42	2.99	4.08	0.37	<0.19
Mid Estuary	Dec 1991	15	33.7	0.40	<0.08	<0.94	2.91	3.91	0.33	<0.17
Solway Firth [Comparison Site]	Jan 1993	20	42.6	0.10	<0.08	<0.33	4.06	4.30	0.27	0.22

< = Less Than

TABLE 6

SPECIES: COD (MUSCLE TISSUE)

Site	Date of Capture	Number Samples	Mean Length [cm]	Mercury [Hg]	Cadmium [Cd]	Lead [Pb]	Arsenic [As]	Zinc [Zn]	Copper [Cu]	Chromium [Cr]
				MEAN CONCENTRATION (mg/kg wet weight)						
Bootle	Nov 1992 & Dec 1992	6	37.7	0.19	<0.09	0.92	4.14	4.61	0.16	<0.18
Mid Estuary	Dec 1991	23	39.8	0.27	<0.08	1.10	3.35	4.40	0.37	<0.16
	Dec 1992	20	41.8	0.20	<0.10	1.28*	6.06	3.81	0.17	<0.19
Solway Firth [Comparison Site]	Jan 1993	20	42.6	0.08	<0.08	<0.31	4.28	4.69	0.21	<0.22

< = Less Than

* This mean concentration was calculated from 16 fish and did not include 4 fish with levels below the analytical limit of detection.

TABLE 7

SPECIES: OTHER FISH SPECIES

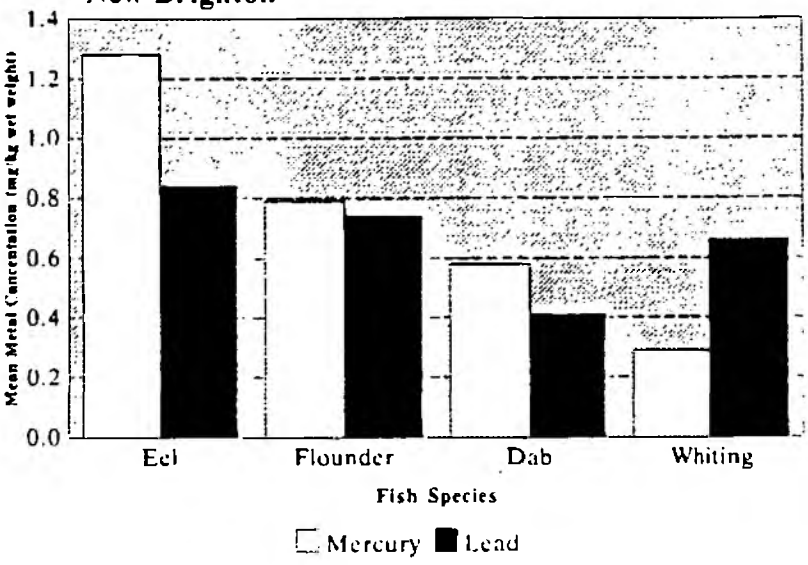
Species	Date of Capture	Number Samples	Mean Length [cm]	LIVERPOOL BAY – Charter Boat (Wreck) Fishing						
				Mercury [Hg]	Cadmium [Cd]	Lead [Pb]	Arsenic [As]	Zinc [Zn]	Copper [Cu]	Chromium [Cr]
				MEAN CONCENTRATION (mg/kg wet weight)						
Mackerel	July 1993	25	23.8	0.02	<0.08	<0.33	0.87	5.07	0.95	<0.17
Tope	July 1993	4	155.7	2.53	<0.11	0.77	9.80	3.55	<0.22	0.22
Dogfish	June 1993 – July 1993	12	57.2	0.86	<0.11	<0.62	21.29	10.69	<0.22	0.50
Skate	June 1993 – July 1993	8	72.8	1.21	<0.12	1.40	30.13	4.77	<0.23	0.26
Spotted Rays	June 1992	6	39.3	0.26	<0.08	1.79	10.10	5.33	0.45	0.20
Scad	July 1993	11	27.0	0.16	<0.08	<0.32	1.11	3.94	0.59	<0.16
Gurnard	July 1993 – August 1993	12	31.2	0.29	<0.11	<0.46	2.02	4.04	<0.23	0.32

< = Less Than

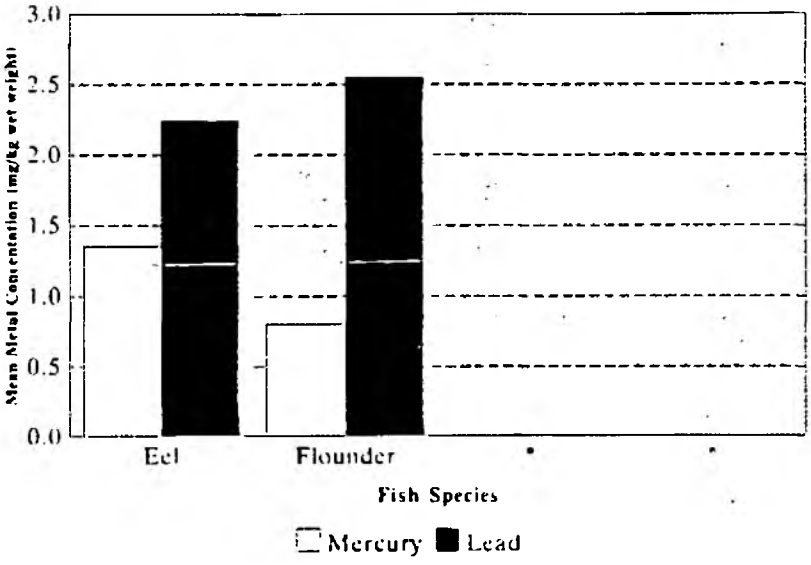
Lead And Mercury Levels In Fish Tissue Study

5.8 (i) Inner Estuary Sites

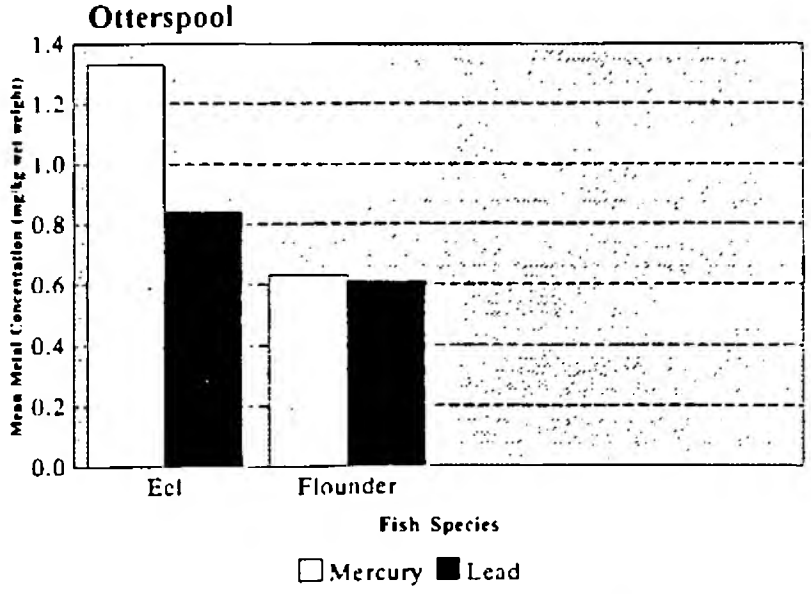
New Brighton



Eastham



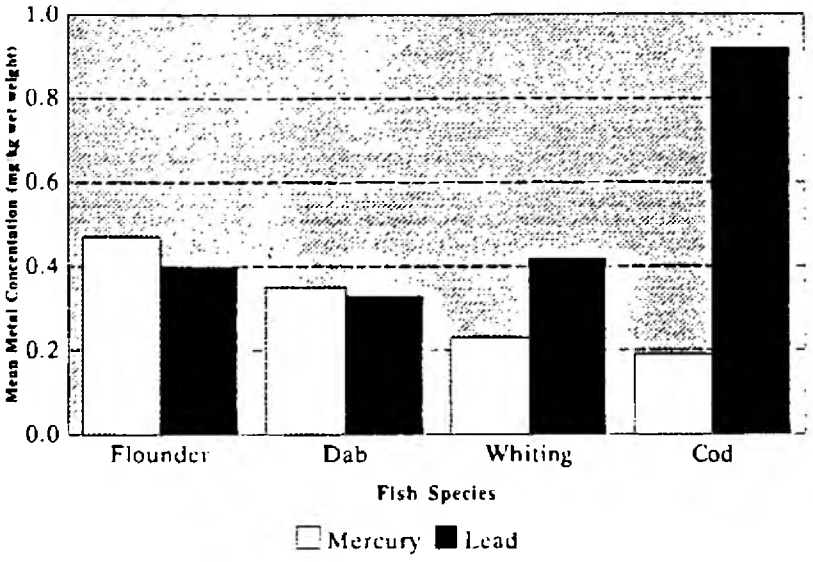
Otterspool



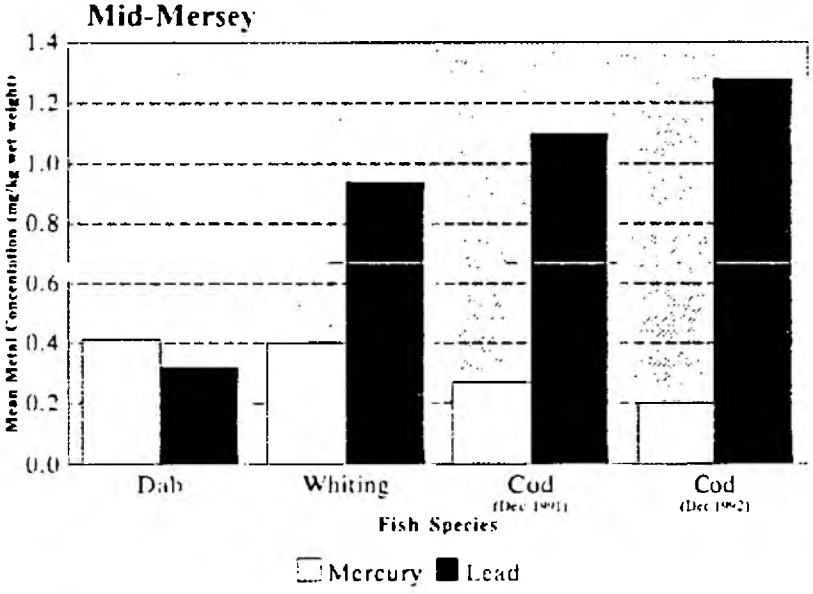
Lead And Mercury Levels In Fish Tissue Study

5.8 (ii) Outer Estuary Sites

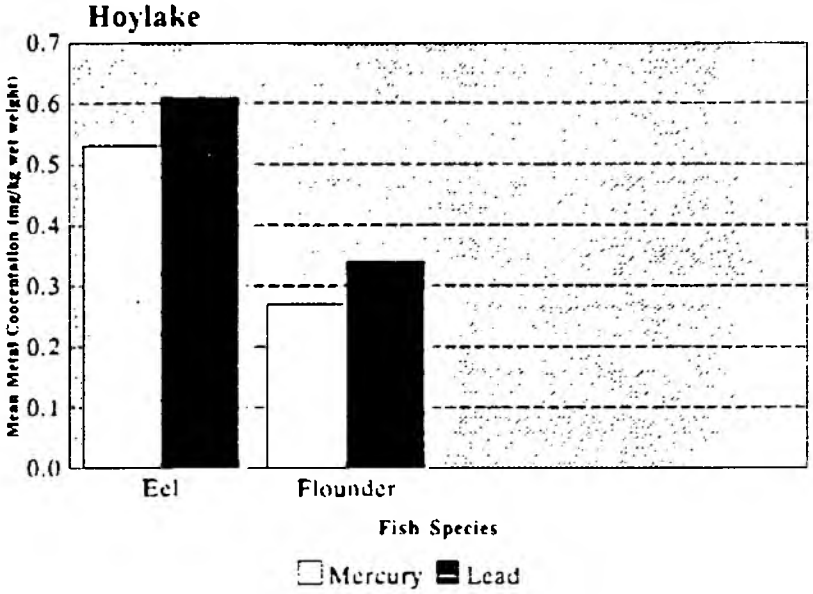
Bootle



Mid-Mersey



Hoylake



Appendix I

Standards/guidelines for contaminants in fish and shellfish (MAFF 1992)

a)Mercury [see also Appendix II]

The European and Paris Comissions have adopted an Enviromental Quality Standard (EQS) for mercury , which requires that the mean concentration of mercury in the flesh of a representative sample of fish , locally caught from areas receiving significant inputs of mercury , shall not exceed 0.3mg kg^{-1} on a wet weight basis (EC Directive Nos 82/176 and 84/156-European Communities , 1982 and 1984).

For the purposes of the Joint Monitoring Programme (JMP) of the Oslo and Paris Commisions , the following arbitrary , purely descriptive , guidelines have been adopted.

Level	Fish flesh and crustaceans	Molluscs
Lower	<0.1mg kg^{-1} wet weight	<0.6mg kg^{-1} dry weight
Medium	0.1-0.3mg kg^{-1} wet weight	0.6-1.0mg kg -1dry weight
Upper	>0.3mg kg^{-1}wet weight	>1.0mg kg^{-1}dry weight

b)Cadmium

There are no standards or guidelines in England and Wales for fish flesh.The expected values are <0.2mg kg^{-1}wet weight.

The JMP guidelines for cadmium in mussels are as follows:

Level	Mussel tissue	Approximate equivalent
Lower	<2mg kg^{-1} dry weight	(=<0.4 wet weight)
Medium	2-5mg kg^{-1}dry weight	(=0.4-1.0 wet weight)
Upper	>5mg kg^{-1}dry weight	(=>1.0 wet weight)

From past DFR work , 'expected' values (i.e. using data from estuaries not known to be severely contaminated) would be up to 0.3mg kg^{-1} wet weight for crustaceans but up to 10mg kg^{-1} wet weight for crab 'brown' meat.

c)Lead

From the Lead in Food Regulations 1979(Great Britain-Parliament 1979):lead in fish should not exceed 2.0mg kg^{-1} wet weight , and lead in shellfish 10.0mg kg^{-1} wet weight.

From past work , 'expected' values are 0.2-0.3mg kg^{-1}wet weight in fish up to 1.0mg kg^{-1}wet weight in crustaceans , and up to 4.0mg kg^{-1}wet weight in some molluscs.

d)Copper

From the Food Standards Committee's Report on Copper (MAFF 1956), revised recommendations for limits for copper content of food are as follows:

> levels of copper in food should not exceed 20mg kg^{-1} wet weight
> (but higher levels in shellfish are permitted if copper is of natural occurence).

From past DFR work , 'expected' levels in fish are up to 0.6mg kg^{-1} wet weight (in excess of 1.0mg kg^{-1} wet weight in fatty fish such as herring) up to 5.0 mg kg^{-1} wet weight for molluscs (with very much higher values for some gastropods) and 20-30 mg kg^{-1} wet weight for crustaceans.

e)Zinc

From the Food Standards Committee's Report on Zinc (Ministry of Food , 1953) , as a guideline:

> 'levels of zinc in food should not exceed 50 mg kg^{-1} wet weight (but higher levels are permitted in foods which naturally contain more than 50 mg kg^{-1} such as herring and shellfish).'

'Expected' values commonly found are up to 6.0 mg kg^{-1} wet weight in most fish flesh , (though up to 10 mg kg^{-1} in flounder and considerably more in fatty fish) , up to 100 mg kg^{-1} wet weight in crustaceans and well in excess of 100 mg kg^{-1} wet weight for some molluses.

f)Arsenic (MAFF 1982)

Controls governing the concentration of arsenic in human food in the United Kingdom originated as the Arsenic in Food Regulations , 1959(SI 1959 , No. 831) when the speciation of arsenic was not considered.The regulation refers to 'total' arsenic on the assumption that it would be mainly inorganic. The maximum permissible concentration of arsenic in food is currently 1.0 mg kg^{-1} except 'where arsenic in proportions exceeding one part per million is naturally present in that fish.' The national Arsenic in Food Survey (MAFF,1982) stated that fish which live on or close to the sea bed, such as plaice , dab , flounder and skate , have a consistently higher level of arsenic than other species.

APPENDIX II

COMMISSION DECISION DETERMINING ANALYSIS METHODS, SAMPLING PLANS AND MAXIMUM LIMITS FOR MERCURY IN FISHERY PRODUCTS (93/351/EEC)

The European Commission recently adopted a Decision determining analysis methods, sampling plans and maximum limits for mercury in fishery products (93/351/EEC) (OJL 144 93/351). The aim of the Decision is to protect human health with respect to the possible accumulation of mercury, from either anthropogenic or natural sources, in fishery products. The Decision compliments an earlier Directive on health conditions for the production and placing on the market of fishery products (91/493/EEC).

Article 1 of the Decision requires that the total mercury content of the edible portion of fishery products does not exceed 0.5 ppm of fresh product (0.5 milligrams per kilogram of fresh weight). However, for certain fish the total mercury content of the edible portion of the fresh product must not contain more than 1.0 ppm (1 milligram per kilogram of fresh weight). An Annex to the Decision lists the following fish for which the 1ppm limit applies :

Sharks (all species)
Little tuna (*Euthynnus* spp)
Plain bonito (*Orcynopsis unicolor*)
Sailfish (*Istiophorus platypterus*)
Eel (*Anguilla* spp)
Sturgeon (*Acipenser* spp)
Redfish (*Sebastes marinus, S. mentella*)
Atlantic catfish (*Anarchichas lupus*)
Rays (*Raja* spp)
Angler fish (*Lophius* spp)
Scabbardfishes (*Lepidopus caudatus*, *Aphanopus carbo*)
Tuna (*Thunnus* spp)
Bonito (*Sarda* spp)
Swordfish (*Xiphias gladius*)
Marlin (*Makaira* spp)
Bass (*Dicentrarchus labrax*)
Halibut (*Hippoglossus hippoglossus*)
Blue ling (*Molva dipterygia*)
Pike (*Esox lucius*)
Portuguese dogfish (*Centroscymnes coelolepsis*)

The Decision lays down requirements for national bodies to draw up sampling plans for fishery products. The analytical technique for determining the total mercury content is that specified by a Decision on reference methods for detecting residues of heavy metals and arsenic (90/515/EEC). The Decision stipulates that, for every lot of fish, on the Annex, that is landed, the sampling frequency will be 10 samples taken from 10 different fish. For all other fish, the frequency of sampling is 5 samples taken from 5 different fish.

It is noted in the Fishery Products Decision, that the limits laid down within it will be reviewed when new weekly permissible intakes for mercury are laid down. However, if this has not occurred within 3 years of its adoption a general review of the Decision will be undertaken on the basis of results obtained from the national monitoring programmes.

APPENDIX III

NRA

National Rivers Authority
North West Region

THE NATIONAL RIVERS AUTHORITY

NORTH WEST REGION

CONTAMINANTS IN FISH - ADVICE TO ANGLERS

In 1991, The Chemical Safety Division of MAFF (Ministry of Agriculture, Fisheries and Food) issued a general warning to anglers that it is inadvisable to eat fish caught in polluted rivers. The concern arose primarily because of high levels of mercury found in eels caught in the River Mersey.

The Mersey estuary is polluted and of poor water quality, receiving as it does large volumes of untreated sewage and industrial effluents, so the general advice of MAFF should be heeded. Eels, which feed particularly on organisms in sediments and live for a long time, are particularly likely to accumulate pollutants in their body tissues whilst resident in the estuary. The Mersey has been heavily polluted for many years by industrial wastes, and sediments contain pollution from earlier years which will take a long time to reduce, even though industrial programmes for effluent improvement are in hand, and being actively pursued by the NRA as the regulatory body.

Specific advice on health or safety relating to consumption of fish should be addressed to:

MAFF
Chemical Safety of Food Division
Ergon House
LONDON
(Tel: 071 238 6377)

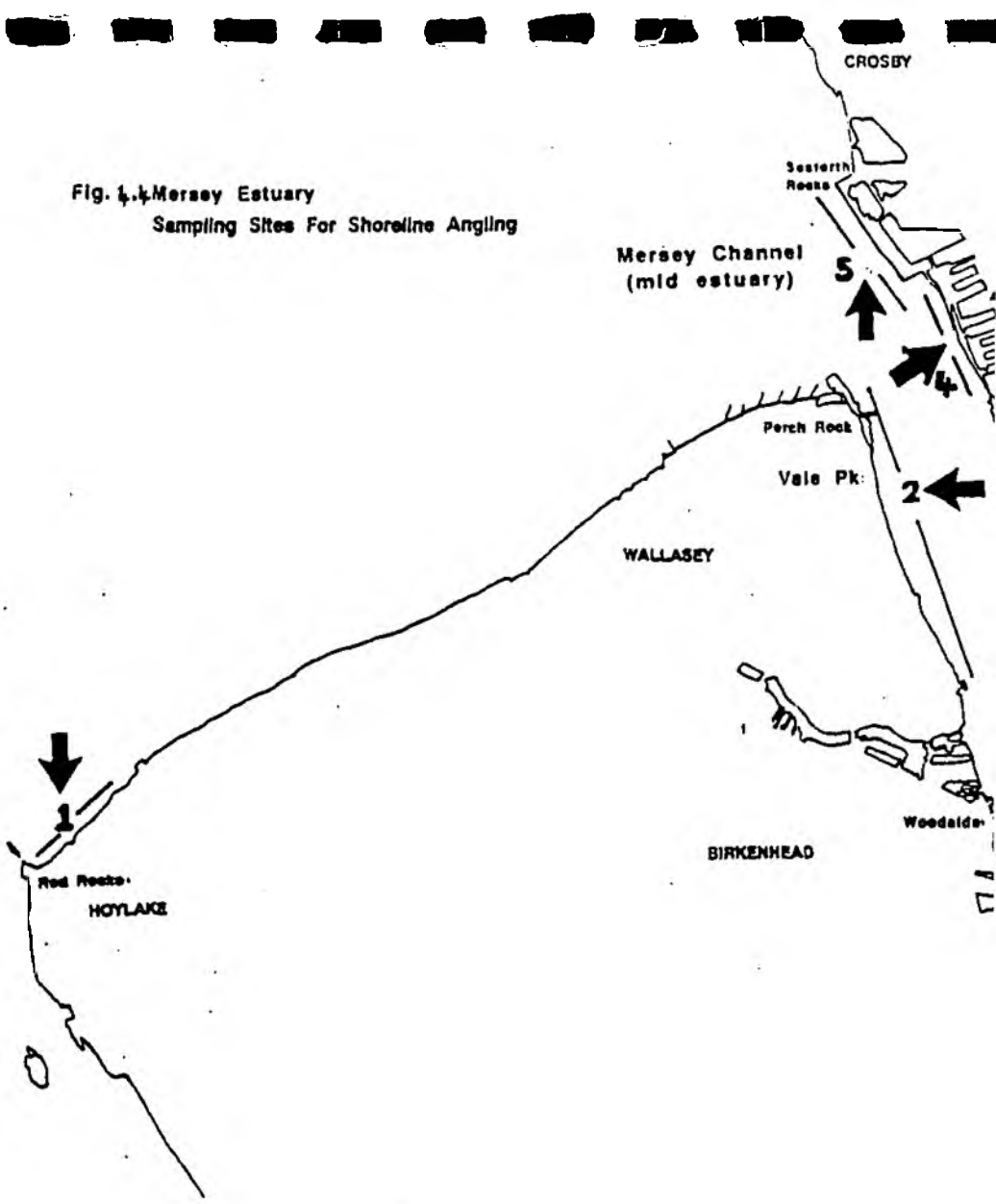
Chris Harpley

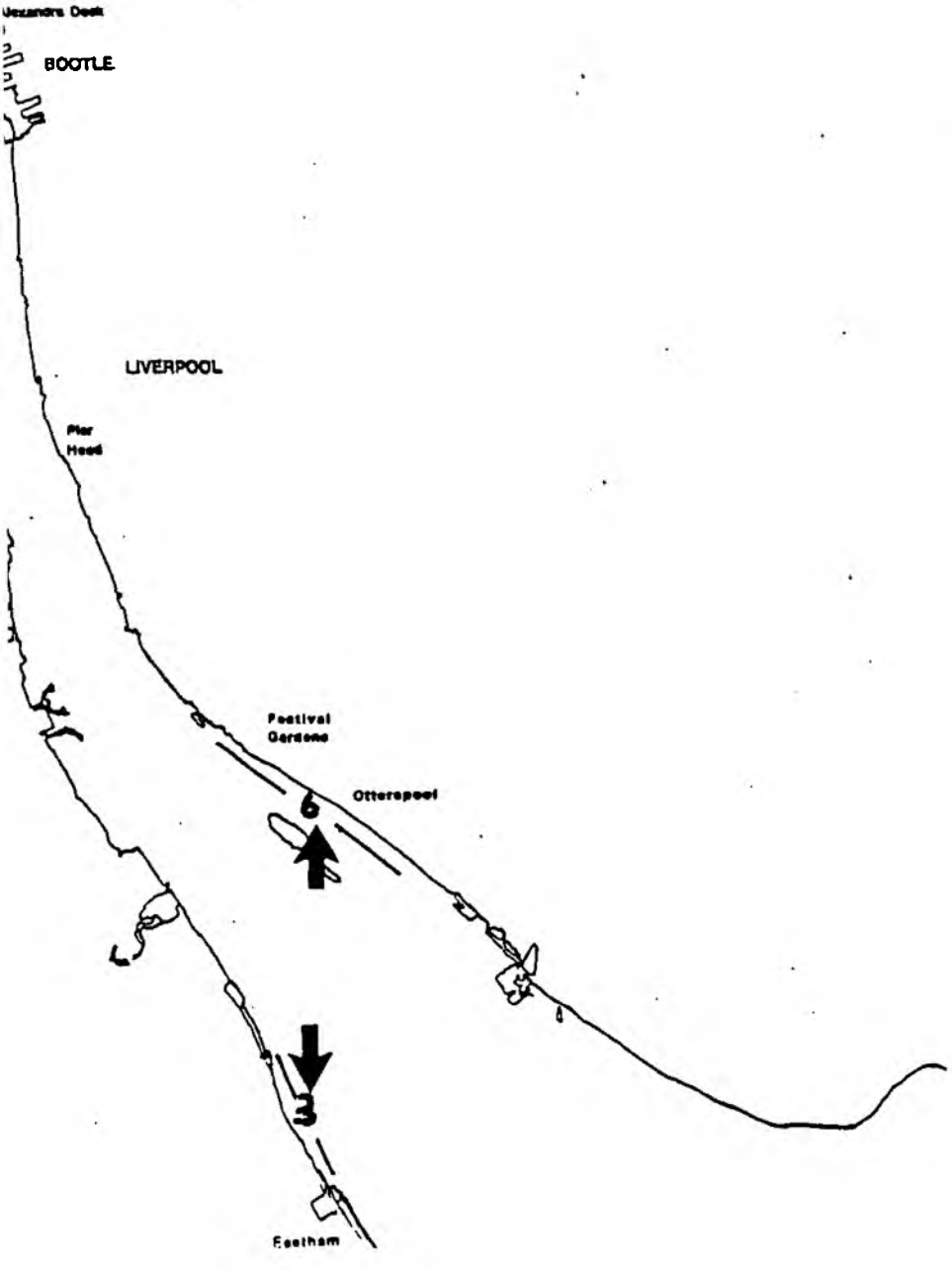
Dr Chris Harpley
Regional General Manager

Dr. C. HARPLEY Regional General Manager

P. O. Box 12 Richard Fairclough House Knutsford Road Warrington WA4 1HG Tel: (0925) 53999 Telex: 628425 Fax: (0925) 415961

Fig. 4.4 Mersey Estuary
Sampling Sites For Shoreline Angling




Alexandra Dock
BOOTLE
LIVERPOOL
Pier Head
Festival Gardens
Otterspool
Eastham