MERCURY IN IMPORTED FISH AND SHELLFISH, UK FARMED FISH AND THEIR PRODUCTS

Summary

The Food Standards Agency has conducted a survey of mercury in a wide range of imported fish and shellfish and their products, including canned and smoked fish, seafood sticks, spreads and pastes. Mercury is widely present in the environment from both natural and man-made sources and can accumulate in the food chain, particularly in fish. In the UK, fish is the main source of mercury in the diet. The aim of this survey was to provide data on fish and shellfish on which we previously had limited or no information, and to allow a more accurate and detailed estimate of dietary intakes of mercury by consumers of these products.

The results of this survey provided the basis of the Agency's precautionary advice to consumers. Interim precautionary advice on eating shark, swordfish and marlin was issued in May 2002, and following an extensive review by the independent Committee of Toxicity, additional advice to restrict tuna consumption for high risk groups of the population was issued in February 2003.

Key Facts

- Total mercury concentrations were measured in three hundred and thirty six samples of imported fish and shellfish, UK farmed fish and their products.

- Levels in most fish and shellfish were relatively low as found in a previous survey of the most commonly consumed marine fish in the UK[1]. Levels of mercury in the

- larger predatory species, shark, swordfish and marlin were higher, and in some samples of these species, exceeded the relevant EU-wide regulatory limit for mercury.

- Dietary exposures to mercury were estimated for consumers of fish and shellfish for all age groups of the population. Exposure estimates for some consumers were close to or exceeded the WHO safety guideline, which WHO had noted was not sufficiently protective for pregnant women. The FSA therefore issued precautionary advice on the consumption of fish with the highest concentrations of mercury (shark, swordfish and marlin), and requested an opinion on the risks from the independent Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT).

- The independent Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) carried out an extensive review of the possible risks for consumers of fish, and recommended that a lower safety guideline should be used in considering consumption by pregnant women, or women who may become pregnant in the next year, and breast feeding women, because of the risk to the unborn or new born baby.

- As a result of the findings of this survey and the review by the COT, the Agency issued precautionary advice that:

  - **Pregnant and breast-feeding women, and women who intend to become pregnant, should limit their consumption of tuna to no more than two medium size cans or one fresh tuna steak per week;**
  - **These women are also advised to avoid eating shark, swordfish and marlin;**
  - **Children under 16 are also advised to avoid eating shark, swordfish and marlin;**
  - **Other consumers should eat no more than one portion of shark, swordfish or marlin per week, but do not need to limit consumption of tuna**.

Background

Mercury is present in seawater, from natural sources such as rocks of the sea bed, and also as a result of pollution arising from human activities such as emissions from industrial processes and fossil fuel combustion. Mercury is taken up by marine organisms and tends to accumulate at successively higher levels of the food chain. Predatory fish can therefore contain relatively high levels of mercury, particularly in longer lived and usually the larger fish[2]. Shellfish, particularly filter feeders such as mussels and scallops, can also take-up and accumulate mercury in their viscera.

As a result, the concentrations of mercury in fish and shellfish can be relatively high compared to other foods and can contribute significantly to dietary exposure. In a multi-element survey of the 1997 UK Total Diet Study[3] which is representative of the average UK diet, fish and shellfish contained the highest average concentrations of mercury (0.043mg/kg) of any of the twenty food groups and made the greatest contribution (33%) to average population dietary exposure.

Mercury can exist in inorganic and organic forms in food, with the organic forms being more toxic following ingestion. Fish predominantly contains methylmercury, which is an organic form.

This survey has measured total mercury because of the difficulties in reliably determining methylmercury in food. However, in order to review the possible health implications for consumers of fish and shellfish, it was assumed that all mercury in fish analysed in this survey was in the form of methylmercury. This is a precautionary approach, as it will tend to slightly overestimate the magnitude of any risks.

Health effects

High levels of mercury can affect the brain and nervous system. The risk is greatest for the unborn or newborn infant, whilst the brain is still developing.

Mercury builds up in the body over time, and exposure to the developing foetus is determined by the mother's exposure over the preceding year. Some of the methylmercury in the mother's body passes into her breast milk, and so the very young breast-fed infant is also at risk.

Method

Sampling

This survey was carried out between September 1999 and February 2002 by the University of Bristol. Sampling was carried out in two phases with approximately 75 per cent of the samples taken in the first phase. The samples from the first phase were then analysed in order to guide sampling for the second phase. The original Phase I sample plan was adapted during sampling as some species, such as shark, were not readily available. Approximately 88 per cent of samples were allocated to imported products and 12 per cent to home-produced farmed salmon and trout. For imported products, sampling was based upon HM Customs and Excise trade statistics supplemented by market intelligence from major retailers. It was not feasible within a survey of this size to factor in consideration of geographical origin.

Most samples were allocated to the major retailers to reflect market share, but independent fishmongers and other independent stores were also included, as were corner stores and ethnic food outlets, as these are often sources of unusual products or brands.

The edible portion of the sample was homogenised (tins were drained of oil or brine, shellfish removed from the shell, whole fish were skinned and filleted). Chilled, frozen and fresh samples were stored at -20°C prior to analysis.

Analysis

The samples were analysed in duplicate for levels of mercury in the homogenised edible portion by ADAS Laboratories. Confirmatory analysis of samples which exceeded EC limits, and selected other samples, was carried out by Central Scientific Laboratory, York (CSL). Both ADAS and CSL are UKAS accredited for

mercury analysis in food for their respective methods and both take part in and consistently achieve satisfactory results in proficiency testing for mercury analysis.

Homogenised samples were prepared by ADAS using a food processor. Mercury in the prepared samples was measured directly using a Leco AMA 254 Advanced Mercury Analyser. In this method an aliquot of sample is combusted in pure oxygen and all evolved gasses are passed through a gold amalgamator which collects and pre concentrates any mercury present. Mercury vapour released from the amalgamator by thermal decomposition is quantified by atomic absorption spectrophotometry. Certified Reference Material (BCR 422 Cod muscle) was analysed at least once with every batch of 10 analytical samples (5 samples in duplicate) and these results were used to calculate recovery figures. Recoveries in the range 95% to 105% were accepted. Acceptable ranges for duplicate analysis ranged from +/- 5% of mean for averages >0.4mg/kg, to +/-20% of mean for averages <0.02mg/kg.

An alternative analytical method was employed for the confirmatory analysis at CSL. Aliquots of each sample and certified reference materials were digested in nitric acid by microwave heating prior to quantification by ICP-MS. Reagent blanks and reagent blanks spiked with mercury were analysed with the test samples to estimate recovery. Acceptable range for the Certified Reference Materials (CRMs) was +/- 25% of the certified value. Spike recoveries in the range 80% to 120% were accepted although the final acceptance of results of each batch was based upon the CRM analysis performance. All samples were analysed in duplicate. Duplicate results were accepted if they fell within the range +/- 20% of the mean. The primary and confirmatory analyses were in good accord. Further details can be found in the contractor's report, which is held in the FSA library (see contact details later).

Results

A summary of the results is given in Table 1. The number of samples and the minimum, maximum, median and mean levels of mercury within each species are shown. The levels of mercury reported are those from the primary analysis and have been adjusted for recovery. Individual sample results are listed in Annex 2.

Levels have been compared to the European regulatory limits. EC Regulation 466/2001[4], amended by EC Regulation 221/2002[5] sets a limit of 0.5mg/kg wet weight for mercury in fish with a higher limit of 1.0 mg/kg for certain species of fish that naturally accumulate mercury. However, the samples for this survey were not collected in accordance with EC Directive 2001/22/EC[6], laying down sampling methods for the official control of the levels of mercury in food, which specifies that samples should be composites (i.e., made up of a number of individual samples).

The highest levels of total mercury were found in fresh/frozen shark, swordfish and marlin. Mercury concentrations in the five samples of shark ranged from 1.0 to 2.2 mg/kg and were all at or above the EC limit for the species of 1.0 mg/kg. Concentrations in 17 samples of fresh/frozen swordfish ranged from 0.15 to 2.7 mg/kg, and for 4 samples of marlin between 0.4 and 2.2 mg/kg, with 11 and 2 samples above the 1.0 mg/kg limit for these species respectively.

Only one sample of fresh/frozen tuna out of the twenty collected had a mercury concentration above 1.0 mg/kg. Concentrations of mercury in all other samples of fresh or frozen tuna were much lower, with a mean concentration in fresh tuna of 0.4 mg/kg. Mercury concentrations in canned tuna were lower still with concentrations on average half that measured in fresh/frozen tuna.

The one sample of Antarctic ice fish sampled had a mercury concentration of 0.664 mg/kg, which exceeds the limit for this species of 0.5 mg/kg.

Mercury concentrations in UK farmed salmon and trout were relatively low. The maximum concentration found in 46 samples of fresh/frozen or smoked trout and salmon was 0.1 mg/kg. The levels of mercury in all samples of shellfish, trout and salmon and canned and processed fish were within the regulatory limit for the relevant species.

Given the short shelf life of the products, no action was taken with respect to those samples of fish that exceeded the regulatory limits, as the results of analyses were not available until after the products would have been consumed. Retailers of the affected products were invited to submit brief statements on these results for

inclusion in this Information Sheet, and the statements received are reproduced at Annex 1.

Estimation of Dietary Exposures

Dietary exposures were estimated for the following groups of the population: adults; infants (6-12 months); toddlers ($1^1/_2$ –$4\ ^1/_2$ year olds); young people (4-18 year olds); vegetarians (including consumers of fish) and the elderly, for those fish and shellfish for which there is reliable consumption data from the National Diet and Nutrition Survey (NDNS). A summary of these estimates is listed in table 2, with exposures expressed in units of microgram/kg bodyweight/day (µg/kg bw/day).

For fish and shellfish that are rarely consumed or for which there is no or insufficient consumption data, it was not possible to estimate dietary exposures on the above basis. This is the case for those fish with the highest mean concentrations of mercury found in the survey –shark, swordfish, marlin and fresh tuna. For these fish, the average mercury intake from eating one portion of fish a week was estimated. The portion size was taken to be the average amount of fish that a consumer from each age group of the population would consume at a single meal event, as recorded in the UK National Diet and Nutrition Survey (NDNS). These estimates are summarised in table 3. Canned tuna is included for comparison only.

Health implications and advice to consumers

For the initial risk assessment, consumer dietary intakes of mercury from fish and the rest of the diet were compared to the Joint Food and Agriculture Organisation (FAO) and World Health Organisation (WHO) Expert Committee on Food Additives (JECFA) safety guideline for weekly intake of methylmercury [7] (3.3 µg/kg bw/week, equivalent to 0.47µg/kg bw/day). As stated previously, this survey measured total mercury, because it is difficult to reliably detect methylmercury in food. However, methylmercury is the main form of mercury in fish and therefore the purposes of risk assessment we have assumed that all mercury in fish is in the form of methylmercury.

For those fish for which there is no or insufficient consumption data, and for which high levels of mercury were reported, exposures were estimated for eating one portion a week of either shark, swordfish or marlin. This level of consumption would result in children approaching or exceeding the JECFA PTWI from this source alone.

Adult consumers would approach but not exceed this guideline by eating one portion a week of any one of these fish. However, JECFA noted that pregnant women and nursing mothers may be at greater risk than the general population to adverse effects from methylmercury. This is because the developing central nervous system of the unborn and very young baby is more vulnerable to the effects of methylmercury. JECFA considered that the available data were insufficient to recommend a safety guideline for pregnant women and nursing mothers.

It is normal procedure for the FSA to request the independent expert Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) to review the results of our surveys and comment on any potential health implications for consumers. However, in this instance, given the nature of the health concerns, the Agency decided to issue precautionary advice on an interim basis, until the COT had an opportunity to consider the results of this survey. The FSA's interim precautionary advice was cleared with the chairman of the COT.

In May 2002, the Agency issued a press release advising that **pregnant women, women who intend to become pregnant, infants and children under 16 years of age should avoid eating shark, swordfish and marlin**. **Occasional consumption of shark, swordfish or marlin as part of a balanced diet by any other adults is unlikely to result in harmful effects. However, on a precautionary basis, they are advised against eating more than one portion each week of either shark or swordfish or marlin.**

This advice was passed on via the Department of Health system used to notify doctors, nurses and health professionals and relevant consumer groups were also alerted.

Review of results by the COT

The COT conducted an extensive review of the results and the toxicity of methylmercury between June 2002 and January 2003.

The COT considered the JECFA safety guideline to be sufficiently protective for the general population. However, it concluded that because of the possible effects of methylmercury on the central nervous system of the developing foetus and breast-feeding baby, pregnant women, women who may become pregnant within the next year and breast feeding mothers should be considered as high risk groups when considering the toxic effects of methylmercury. The more precautionary United States Environmental Protection Agency (US EPA) reference dose (0.1μg/kg bw/day, equivalent to 0.7 μ g/kg bw/week)[8] was considered to be more applicable for the high-risk groups. The EPA reference dose is almost five times lower than JECFA's safety guideline. The COT statement can be viewed at the Agency's website at: http://www.food.gov.uk/multimedia/pdfs/COTmercurystatement.PDF

Subsequent to the COT opinion, consumption data became available for the 2001 National Diet and Nutrition Survey of UK adults. The FSA revised the estimates for adult dietary exposure using this up-to-date consumption data prior to issuing advice to consumers. Particular attention was paid to women because of their increased fish consumption and the risks during pregnancy and breast-feeding. Although consumption data for most fish were similar to those recorded for female adults in the previous dietary survey in 1986/7, consumption of canned tuna has increased by over one fifth (22%). As a result of these revised exposure estimates and the COT opinion, the Agency issued revised advice in February 2003. The revised advice is:

- **Pregnant and breast-feeding women, and women who intend to become pregnant, should limit their consumption of tuna to no more than two medium size cans or one fresh tuna steak per week.**
- **These women are also advised to avoid eating shark, swordfish and marlin.**
- **Children under 16 are also advised to avoid eating shark, swordfish and marlin**

- **Other consumers should eat no more than one portion of shark, swordfish or marlin per week, but do not need to limit consumption of tuna.**

References

1. Ministry of Agriculture, Fisheries and Food (1998) Concentrations of Metals and Other Elements in Marine Fish and Shellfish. Food Surveillance Information Sheet No. **151**, MAFF, London.

2. Storelli M. M and G.O. Marcotriiano (2000) Fish for human consumption: risk of contamination by mercury. Food Additives and Contaminants, **17**, 1007-1011.

3. Ministry of Agriculture, Fisheries and Food (1999). 1997 Total Diet Study: Aluminium, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Tin and Zinc. Food Surveillance Information Sheet No. 191.

4. Commission Regulation (EC) No 466/2001 of 8 March 2001 setting maximum levels for certain contaminants in foodstuffs. Official Journal of the European Communities (2001) L77/1

5. Commission Regulation (EC) No 221/2002 of 6 February 2002 amending Regulation (EC) No 466/2001 setting maximum levels for certain contaminants in foodstuffs. . Official Journal of the European Communities (2002) L37/4.

6. Commission Directive No 2001/22/EC of 8 March 2001 laying down the sampling methods and the methods of analysis for the official control of the levels of lead, cadmium, mercury and 3-MCPD in foodstuffs. Official Journal of the European Communities (2001) L77/14

7. World Health Organization (2000). Safety evaluation of certain food additives and contaminants. WHO Food Additives Series **44**, World Health Organization, Geneva.

8. EPA (1997). Mercury Study Report to Congress. Vol. IV: An assessment of exposure to mercury in the United States. EPA-452/R-97-006. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards and Office of Research and Development.

Further Information

Further information on this survey can be obtained from:

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Further copies of this Information Sheet can be obtained from:

The Food Standards Agency Library
Ground Floor
Aviation House
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Tel: +44 (0) 20 7276 8281/8182
Fax: +44 (0) 20 7276 8193
E-mail: library&info@foodstandards.gsi.gov.uk

A copy of the final report of this survey has been placed in the FSA Library - address detailed above. If you wish to consult a copy please contact the library for an appointment giving at least 24 hours notice or alternatively, copies can be obtained from the library: a charge will be made to cover photocopying and postage.

Table 1: Summary of mercury levels in imported fish and shellfish, farmed fish and their products.

Number of samples	Product Type	Product Detail	Levels of Hg (mg/kg) (adjusted for recovery)			
			Minimum	Maximum	Median	Mean
8	Fresh/Frozen Fish	Halibut	0.04	0.62	0.29	0.29
2	Fresh/Frozen Fish	Hoki	0.08	0.31	0.19	0.19
2	Fresh/Frozen Fish	Monkfish	0.1	0.30	0.20	0.20
6	Fresh/Frozen Fish	Orange Roughy	0.53	0.65	0.60	0.60
13	Fresh/Frozen Fish	Other*	0.006	0.66[1]	0.04	0.11
4	Fresh/Frozen Fish	Pollack	0.007	0.02	0.01	0.01
14	Fresh/Frozen Fish	Salmon	0.03	0.08	0.05	0.05
4	Fresh/Frozen Fish	Sea Bass	0.03	0.09	0.07	0.07
4	Fresh/Frozen Fish	Sea Bream	0.05	0.06	0.05	0.05
5	Fresh/Frozen Fish	Shark	1.00	2.2	1.4	1.5
13	Fresh/Frozen Fish	Swordfish	0.15	2.7	1.4	1.4
7	Fresh/Frozen Fish	Marlin	0.41	2.2	0.88	1.1
14	Fresh/Frozen Fish	Trout	0.01	0.1	0.05	0.06
20	Fresh/Frozen Fish	Tuna	0.1	1.5	0.31	0.40
14	Fresh/Frozen Shellfish	Exotic Prawns**	0.006	0.05	0.02	0.03
4	Fresh/Frozen Shellfish	Lobster	0.009	0.23	0.03	0.08
4	Fresh/Frozen Shellfish	Mussels	0.02	0.04	0.03	0.03
9	Fresh/Frozen Shellfish	Other***	0.003	0.19	0.01	0.04
14	Fresh/Frozen Shellfish	Prawns	0.01	0.25	0.03	0.05
9	Fresh/Frozen Shellfish	Squid	0.003	0.04	0.008	0.01
9	Processed Other	Other****	0.01	0.06	0.04	0.03
9	Processed Other	Paste and pates	0.02	0.17	0.06	0.07
9	Processed Smoked	Other *****	0.01	0.93	0.23	0.31
9	Processed Smoked	Salmon	0.04	0.08	0.05	0.06
9	Processed Smoked	Trout	0.05	0.09	0.07	0.07
9	Processed Canned	Anchovy	0.03	0.06	0.05	0.05
9	Processed Canned	Other ******	0.003	0.08	0.01	0.02
9	Processed Canned	Pilchard	0.005	0.05	0.01	0.02
19	Processed Canned	Salmon (Pink)	0.008	0.04	0.03	0.03
13	Processed Canned	Salmon (Red)	0.01	0.07	0.03	0.04
9	Processed Canned	Sardine	0.01	0.10	0.03	0.04
54	Processed Canned	Tuna	0.03	0.71	0.15	0.19

[1] One sample of Atlantic icefish contained 0.66mg/kg

* Fresh/frozen fish - 'Other' included samples of: hake, red tilapia, plaice, sardines, St Peter's fish, snapper, Mekong catfish, Antarctic ice fish, haddock and anchovies.

** 'Exotic prawns' included samples of: tiger prawns, black tiger prawns, king prawns, giant tiger prawns, large king prawns and fantail prawns.

*** Fresh/frozen shellfish 'Other' included samples of: scallops, snow crab, vongoles and octopus.

**** Processed other 'Other' included samples of: surimi (seafood sticks), herring and anchovies.

***** Processed, smoked 'Other' included samples of: haddock, halibut, eel, swordfish, tuna, marlin, mussels and oysters.

****** Processed canned 'Other' included samples of: lumpfish caviar, vongole, crab, clams, oysters, cockles, cod roe, shrimps and herring.

Table 2: Estimated mean and high level dietary intakes of mercury from salmon, prawns and canned tuna for consumers of these foods

Consumer group	Mercury Intake - μg/kg bw/day [1]							
	Salmon [2]		Prawns [2]		Canned Tuna [2]		Whole Diet [3, 4]	
	Mean	97.5%	Mean	97.5%	Mean	97.5%	Mean	97.5%
Infants	0.001	0.001	0.00	0.00	0.006	0.019	0.009	0.02
Toddlers	0.026	0.076	0.019	0.064	0.12	0.35	0.12	0.29
Young People aged 4 – 6	0.026	0.056	0.013	0.049	0.076	0.23	0.11	0.26
Young People aged 7 – 10	0.016	0.051	0.009	0.021	0.056	0.18	0.089	0.20
Young People aged 11 – 14	0.013	0.033	0.006	0.019	0.046	0.14	0.061	0.17
Young People aged 15 – 18	0.011	0.021	0.006	0.016	0.039	0.097	0.051	0.12
Adults	0.009	0.034	0.006	0.02	0.036	0.089	0.05	0.12
Adults – Women only	0.009	0.026	0.006	0.017	0.039	0.089	0.049	0.11

Notes:

1. Consumption data for salmon, prawns and tuna are taken from the following sources:

- Dietary and Nutritional Surveys of British Adults
- Food and Nutrient Intakes of British Infants Aged 6-12 Months
- National Diet and Nutrition Surveys Children Aged 1.5 – 4.5 years
- National Diet and Nutrition Survey: young people aged 4-18 years. Volume 1 report of the diet and nutrition survey

2. Mercury intake from eating the named fish only, for the mean and 97.5th percentile consumers.
3. Mercury intake from consumption of fresh salmon, prawns, canned tuna together with mercury intakes from the rest of the normal UK diet (based on the 1997 Total Diet Study) for consumers of fish. The total mercury intakes do not equal the sum of the mercury intakes from the named fish…
4. The measurement of mercury does not distinguish between inorganic and organic mercury. Therefore although methylmercury is the major contributor to mercury intake from fish, the estimate of intake from the whole diet also includes inorganic mercury.

Table 3: Mercury intake from one portion per week of shark, swordfish, marlin, fresh tuna or canned tuna.

Age Group (years)	Body Weight (kg)	Average Portion Size[a] (g)	Weekly methylmercury intake assuming one portion of fish is eaten[b] (μg/kg bw/day)				
			Shark	Swordfish	Marlin	Fresh Tuna	Canned Tuna
Toddlers 1.5-4.5	14.5	50	0.75	0.66	0.54	0.20	0.094
Young People 4-6	20.5	60	0.63	0.56	0.46	0.17	0.080
Young People 7-10	30.9	85	0.60	0.53	0.43	0.16	0.074
Young People 11-14	48.0	140	0.63	0.56	0.46	0.17	0.079
Young People 15-18	63.8	105	0.36	0.32	0.26	0.094	0.044
Adults	70.1	140	0.43	0.38	0.31	0.11	0.054

Notes:

a. The average portion size that each age group of the population would consume at a single meal event for fish consumption, as recorded in the following National Diet and Nutrition Surveys (NDNS):

- 1995 National Diet and Nutrition Survey: Children aged one-and-a-half to four-and-a-half years
- 2000 National Diet and Nutrition Survey: young people aged 4 to 18 years
- 1990 The Dietary and Nutritional Survey of British Adults

b. This intake estimate does not include the intake from the rest of the diet.

Annex 1. Retailer Statements

J Sainsbury PLC

"Sainsbury's have not sold shark for over a year in response to our customer's concerns regarding the sustainability of this species.

Also its worth noting that our supplies regularly monitor predatory fish for mercury to ensure ongoing compliance with legislative requirements. However, wild fish are a highly variable commodity exposed to many external influences throughout their lifetime. The presence of mercury and other environmental contaminants will therefore vary between individual fish even when caught in similar geographic areas. For this reason the legislation includes sampling protocols requiring the analysis of several fish to provide meaningful results. We are therefore concerned that the FSA survey was based on analysis of single portion of fish.

The concerns raised by this survey affect the whole fish industry and we would ask the FSA to work with the industry to address the issues highlighted in this survey.

We would like to assure our customers that we continue to provide products that achieve the highest levels of quality and safety."

Waitrose Ltd

"Heavy metals such as mercury accumulate in fish over long period of time. Waitrose control the sourcing of these fish by stipulating a maximum size 50kg. These large fish are solitary, migratory and often swim in deep waters. They can travel a thousand miles each year and even between oceans. However, Waitrose place enormous importance in traceability and all our fish is fully traceable back to each catch. This allows Waitrose to react to trends indicated by any food safety incident.

The legislation strictly governs the level of mercury in fish and both Waitrose and its suppliers carry out frequent testing in this area. Results over the last three years are averaging at well below the current legal limits of 1mg/kg for both swordfish and marlin.

Waitrose Food Technologists carry out food safety and traceability audits of suppliers and monitor all food safety analytical results.

Waitrose no longer sells Antarctic ice fish. "

Harrods Ltd

"I am writing to you in reference to the elevated levels of mercury found in our swordfish sampled from Harrods Fish Department. Due to our lapse in time we are unable to in identify the fish suppliers for that date, but our records show that we have purchased swordfish from 7 suppliers in the last two years.

I have written to all these 7 suppliers.

As part of our annual sampling program we shall also be taking samples of swordfish and/or other large predatory fish to monitor the levels of mercury. "

W.M Morrison Supermarket PLC

"Since the sample was taken, in October 2000, the issue of mercury in swordfish has been fully investigated by Morrisons and our supplier and the following measures have been introduced:

Only loins from fish weighing less than 50kg are now used to supply Morrisons. These are younger fish which have had shorter exposure to the risk of mercury contamination.

Mercury levels in fish from different catch areas are now more frequently monitored. Supply will not be taken from areas where the catch shows raised levels.

Our suppliers has increased sampling of swordfish for mercury testing over the last year and the results indicate complaince with statutory limits. Morrisons have sampled swordfish and other fish for mercury and these results also indicate complaince."

ASDA Stores LTD

" I would like this opportunity to respond on behalf of Asda and our supplier Anchor Seafoods. I have attached an unabridged response regarding this survey from our supplier Anchor Seafoods, as you can see they are fully aware of the situation and took action to move to a positive release system based on mercury levels, early this year. The samples were taken between August 2000 and July 2001 and the results are still awaiting publication. Although we fully support this survey and its intentions we must appreciate that some of these samples are nearly two years old. For the purpose of our customers, will the publication of the results add any benefit, as any remaining stock from this batch will have sold through and in most circumstances I suspect will have been eaten.

As detailed in the response from the supplier below we have moved on in terms of testing for contaminants such as mercury, with the introduction of positive release testing, obviously we feel this would be more reassuring news to the public rather than results from samples that are nearly two years old, where in most cases the industry will be unable to act.

We have increased sampling and testing for our own due diligence, which is performed by a third party on behalf of Asda."

Anchor Seafoods: "As part of our chemical verification checks for all products we send samples for chemical analysis twice per year and the results for delivery of Shark tested in December 1999 indicated a mercury level of 0.17mg/kg. However, following a review of our sampling procedures earlier this year we have moved to a positive release system for the testing of shark and tuna for heavy metals, histamine and microbial activity. We feel that this should give the customer added confidence in the quality of the product and ensure that results as found by the FSA on this survey aren't repeated."