The species and age of the fish is the main determining factor for mercury levels. The fish which are more likely to contain high levels of mercury tend to be longer living, larger, and at the top of the food chain. The amount of mercury in the environment also affects the levels in the fish, for example, freshwater fish in geothermal waters tend to accumulate higher levels of mercury.

6. What about fish oil products?

Fish oil products and supplements are not a major source of dietary mercury intake and there is no recommendation to restrict intake.

7. Are shellfish a concern?

Shellfish (including prawns, lobsters, oysters, and crabs) generally contain low levels of mercury and are also not frequently consumed therefore they are not considered a significant source of mercury for the average consumer.

Mercury in Fish

FURTHER INFORMATION FOR HEALTH PROFESSIONALS

The potential risks associated with the presence of contaminants in the food supply are regularly assessed in order to ensure that, for all sections of the population, these risks are minimised. Food Standards Australia New Zealand has recently undertaken risk assessments of metal contaminants in food. The results of these assessments indicated that, as a precautionary measure to protect the health of the foetus, pregnant women should control their dietary sources of mercury. No other population groups are at risk.

SOURCES OF MERCURY

Mercury occurs naturally in soils and rocks (particularly geothermal or volcanic) and exists in streams, waterways, lakes, and oceans in varying concentrations depending on environmental parameters. Mercury occurs in three forms – metallic, inorganic and organic. Organic mercury, principally in the form of methylmercury, is the most hazardous form of mercury encountered in food and food is the main source of exposure to mercury for most individuals. Consequently, the major source of mercury exposure for the foetus is through the maternal diet.

The highest levels of mercury in food are typically found in fish. Fish absorb mercury from water as it passes through their gills in the feeding process. Mercury binds to the proteins of fish tissue, including muscle. Current industrial processing and domestic cooking techniques do not appreciably reduce the concentration of mercury in fish.

Mercury tends to accumulate in some types of fish more than others. This is due to a number of key factors, including age, natural environment, and food sources. Fish that are more likely to accumulate higher levels of mercury are the predatory species; these tend to be larger in size, longer living, and higher in the food chain. Examples include shark/flake, ray, swordfish, barramundi, gemfish, orange roughy, ling and southern bluefin tuna. Freshwater fish in geothermal lakes and rivers in New Zealand may also accumulate higher levels of mercury (Kim 1997).

BENEFITS OF FISH

Notwithstanding that certain fish species can accumulate higher levels of mercury than others, it is widely recognised that there

are considerable nutritional benefits to be derived from the regular consumption of fish.

Fish is an excellent source of high biological value protein, is low in saturated fat and contributes to the unsaturated fat and long chain omega oils intake. Furthermore, the Heart Foundation recommends that fish be consumed at least twice a week for cardio-vascular benefit. Fish forms a significant component of the diet with approximately 25% of the Australian population and 20 % of the general New Zealand population consuming fish at least once a week, with up to 36% of some groups in the Maori and Pacific Islander populations consuming fish at least once a week (1995 Australian National Nutrition Survey, 1997 New Zealand National Nutrition Survey).

EFFECTS OF MERCURY

Mercury, particularly methylmercury, which is readily absorbed from the gut and rapidly distributed via the blood to tissues, can be highly toxic to humans and other mammals when ingested at very high levels. However, the levels of mercury normally found in fish, even in those species known to accumulate higher levels of methylmercury, are not sufficient to lead to high levels of intake, even for a high consumer of fish. Therefore, for the vast majority of the population, the level of mercury in fish does not pose any significant health risk.

The foetus, on the other hand, appears to be more vulnerable to the harmful effects of mercury than adults. For this reason, FSANZ has set two separate upper levels of dietary intake (known as the provisional tolerable weekly intake, or PTWIs for mercury – one for the general population and one for pregnant women to protect the foetus (FSANZ 1999, 2000). The PTWI represents the permissible human weekly exposure to those contaminants unavoidably associated with the consumption of otherwise wholesome and nutritious food. The level set for pregnant women is 2.8 micrograms mercury/kg body weight/week and is approximately half the level set for the general population (5 micrograms/kg body weight/week).

The PTWI set by FSANZ for pregnant women is based on preliminary results from a ten-year study currently being conducted with mother-infant pairs in the Republic of Seychelle where 85% of the population consume marine fish on a daily basis. The study focuses on approximately 700 pregnancies each year.

For the foetus, the critical periods of vulnerability during gestation are thought to occur in the third and fourth month of pregnancy. Typical symptoms in the infant that have been associated with pre-natal exposure to methylmercury from maternal consumption of fish are delayed achievement of developmental milestones (e.g. delayed onset of walking, talking). Such effects are quite subtle and are usually only apparent through testing. The level of mercury exposure producing these effects does not appear to produce any harmful effects in the mother. The results obtained so far from the Republic of Seychelle study indicate that any developmental delays may diminish as the child grows older. FSANZ will closely scrutinize the results of the final phase of this study when they are released.

CURRENT AND PROPOSED REGULATIONS FOR MERCURY IN FISH

The Australian *Food Standards Code* currently prescribes maximum levels for mercury in food, including fish. Two separate maximum levels are imposed for fish – a level of 1.0 mg mercury/kg for the fish that are known to contain high levels of mercury (such as swordfish, southern bluefin tuna, barramundi,

ling, orange roughy, rays and shark) and a level of 0.5 mg/kg for all other species of fish. A limit of 0.5 mg/kg is also imposed for crustaceans and molluscs. These limits ensure that the vast majority of people in the community are not exposed to any significant health risks through the presence of mercury in fish.

During the recently completed Review of the *Food Standards Code*, FSANZ undertook a risk analysis for metal contaminants in food and, as part of that process, reviewed the maximum levels set for mercury in fish. On the basis of that analysis, FSANZ has proposed that the maximum levels for mercury in fish be retained at the current levels.

CALCULATION OF THE FISH INTAKES USED IN THE ADVISORY STATEMENT

The advice on the number of portions of fish to be eaten in one day was developed by calculating the maximum amount of fish that could be eaten by each population group such that their reference health standard (PTWI) for weekly intake of mercury from all food sources would not be exceeded. The steps used in this calculation were as follows:

1. The mercury levels in different fish types were determined. Three fish types were identified according to habitat, feeding regimen, and reported mercury levels:

   - higher mercury fish (eg shark/flake, ray, swordfish, barramundi, gemfish, orange roughy, ling and southern bluefin tuna);
   - salmon; and
   - other fish.

2. The amount of each type of fish that could be consumed in a week without exceeding the PTWI was calculated, assuming people only ever eat one type of fish. The contribution of other foods to total mercury exposure was taken into account in this calculation. These amounts of fish were then expressed to the nearest ' 150 gram portion' of fish.

Table 1: Example of calculations to estimate the maximum number of fish portions for pregnant women in Australia and New Zealand

	Australian population	New Zealand population
PTWI for mercury for pregnant women	= 2.8 micrograms /kg body weight/week	= 2.8 micrograms /kg body weight/week
Total permitted mercury intake	= 184.8 micrograms /week (2.8 x 66 kg body weight)	= 179.2 micrograms /week (2.8 x 64 kg body weight)
Estimated total mercury intake from diet*	= 10.5 micrograms /week	= 14micrograms /week
Estimated mercury intake from non fish foods in diet*	= 0.7 micrograms /week (7% total)	= 0.8 micrograms /week (6% total)
Amount of mercury that can safely be consumed from fish sources	= 184.8 – 0.7 micrograms /week = 184.1 micrograms/week	= 179.2 – 0.8 micrograms /week = 178.4 micrograms /week
Amount of higher mercury fish that can be consumed per week (280 micrograms mercury /kg fish)	= 184.1 micrograms /week divided by 280 micrograms /kg fish = 658 g fish /week = 4 portions/week	= 178.4micrograms /week divided by 280 micrograms /kg fish = 637 g fish /week = 4 portions/week
Amount of salmon that can be consumed per week (10 micrograms mercury /kg fish)	= 184.1 micrograms /week divided by 10 micrograms /kg fish = 18410 g fish/week = 122 portions/week	= 178.4 micrograms /week divided by 10 micrograms /kg fish = 17840 g fish/week = 119 portions/week
Amount of other fish that can be consumed per week (90 micrograms mercury /kg fish)	= 184.1 micrograms /week divided by 90 micrograms /kg fish = 2046 g fish/week = 13 portions/week	= 178.4 micrograms /week divided by 90 micrograms /kg fish = 1982 g fish/week = 13 portions/week

* Dietary intake assessments for mercury were derived from survey data on mercury levels in foods, submitted to FSANZ for the review of the Food Standards Code, food consumption data for foods from all dietary sources and average bodyweights for women of child bearing age (16–44 years) from the 1995 Australian National Nutrition Survey or the 1997 New Zealand

National Nutrition Survey.

Data submitted to FSANZ from the Australian tuna canning industry indicate that the mercury concentration levels for canned tuna (median 80 micrograms mercury /day) is lower than that given for higher mercury fish and is comparable to the 'other fish' category .

The portions of fish that can theoretically be consumed such that the PTWI is not exceeded are summarised in Table 2. These calculations assume that fish contains an 'average' (median) amount of mercury, not the maximum reported level, recognising that mercury concentration varies considerably within each fish species.

Table 2: Theoretical portions of fish (150 g per portion) that could be consumed each week before the PTWI for mercury is exceeded[1].

Type of Fish	Pregnant women	General population
Higher mercury fish (280 micrograms mercury/kg fish)	4 portions	8 portions
Salmon, including canned salmon (10 micrograms mercury/kg fish)	119 portions	223 portions
Other fish, including canned tuna [2] (90 micrograms mercury/kg fish)	13 portions	25 portions

[1] PTWI used for pregnant women was 2.8 micrograms /kg bw, and for the general population was 5 micrograms /kg bw.

[2] Data submitted to FSANZ from the Australian tuna canning industry indicate that the mercury concentration levels for canned tuna (median 80 micrograms mercury /day) is lower than that given for higher mercury fish and is comparable to the 'other fish' category.

Reported fish intakes

Australia

In the 1995 National Nutrition Survey (NNS) food eaten in the last 24 hours were recorded for over 13500 people aged 2 years and over. Of these, 8% people in the survey reported eating fish on the day of the survey. For these people, the mean amount of marine fish eaten was 96 g (< 1 portion of fish), and for high consumers 298 g (2 portions of fish). Similarly, for women of childbearing age (16–44 years of age), 6% women in the survey reported eating fish on the day of the survey. For these women, the mean amount of marine fish eaten was 79 g (< 1 portion of fish), and for high consumers 250 g (1–2 portions of fish)

The 24–hour recall survey does not indicate how often fish was eaten during the week. From the food frequency survey undertaken at the same time as the 24–hour recall dietary survey, 25% people in the survey reported eating fish at least once a week.

New Zealand

In the 1997 National Nutrition Survey (NNS) food eaten in the last 24 hours were recorded for over 4600 people aged 15 years and over. Of these, 25% people in the survey reported eating fish on the day of the survey. For these people, the mean amount of marine fish eaten was 122 g (< 1 portion of fish), and for high consumers 372 g (2–3 portions of fish). Similarly, for women of childbearing age (16–44 years of age), 25% women in the survey reported eating fish on the day of the survey. For these women, the mean amount of marine fish eaten was 104 g (< 1 portion of fish), and for high consumers 362 g (2–3 portions of fish).

The 24–hour recall survey does not indicate how often fish was eaten during the week. From the food frequency survey undertaken at the same time as the 24–hour recall dietary survey, up to 20% people in the survey reported eating fish of one type or another at least once a week, however a larger proportion of Maori and Pacific Islander people living in New Zealand reported eating fish at least once a week (up to 36%). Although more Maori women report eating fish at least once a week and in larger amounts than other New Zealand or Australian women, their higher bodyweight compared to all New Zealand women means that they can, in theory, consume more portions of fish before the PTWI for pregnant women is exceeded.

From the survey data it seems unlikely that many women of childbearing age in Australian or New Zealand populations would be consuming fish in amounts per week that would exceed the recommended maximum amounts of fish. In addition, the model for high mercury fish is recognised as a ' worst–case' model because, in real life, people will consume more than one fish type over a period of time, and mercury levels in fish may be less than the level of 280 micrograms mercury/kg fish assumed in this model.

ADVICE FOR PREGNANT WOMEN

There are numerous nutritional benefits to be gained from regularly eating fish but g iven the on going and unresolved concerns regarding mercury exposure, it is recommended that pregnant women (and women considering pregnancy) should limit their consumption of some types of fish: shark/flake, ray, swordfish, barramundi, gemfish, orange roughy, ling, southern bluefin tuna and fish caught in geothermal waters, to four portions per week (an average portion would contain about 150 g of fish). Other fish, including canned tuna, can be consumed as often as desired. Where possible, choose to eat a variety of fish.

FURTHER READING

Food and Drug Administration (1994) Mercury in Fish: cause for concern? www.fda.gov/opacom/catalog/mercury.html

Canadian Food Inspection Agency. Consumer Fact Sheet: Mercury and fish consumption. www.cfia–acia.agr.ca/english/corpaffr/factsheets/mercury.html

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Mercury in Fish
ADVISORY STATEMENT FOR PREGNANT WOMEN
January 2001

序論
この勧告の目的は、特定の種類の魚の水銀含有量に関する情報を提供
妊婦や妊娠を考えている女性が妊娠の期間中、安全に消費することができる魚の種類や量について助言することである。
このアドバイスは、現在調査中である。
この勧告は妊娠期間中の魚の消費を控えるよう奨励するものではなく、特定の魚に関し安全に消費することができる量について勧告するものである。

魚の消費の有用性
魚を定期的に食べることは、多くの栄養的な利点がある。
魚は、優れたタンパク質源であり、飽和脂肪で低く、不飽和脂肪酸とω-3脂肪が高い。Heart Foundationは心臓血管系への保健効果のために週に2回魚を消費することに勧めている。

魚類中の水銀

水銀は環境中に自然に存在し、空気や水を通して、また食品を経由して水銀に暴露される。多くの人にとって食品、特に、魚は水銀の主要な暴露源となっている。水銀のレベルは、生息地や餌の違い等により魚種によって異なる。サメ/フレーク、エイ、メカジキ、バラマンディ、ギンサワラ、オレンジラフィー、リングやミナミマグロのような魚は高レベルの水銀を蓄積する傾向があるが、それらは大型であり、より長寿であり、食物連鎖の最上位に位置するためである。また、ニュージーランドの地熱湖や川に生息する淡水魚は、同様に高レベルの水銀を蓄積する可能性がある。
缶詰のマグロは、生鮮のマグロより水銀の含有量が少ないが、缶詰の原料となるマグロは別の種類の小型のマグロで、一般に1年未満のものが使用されるからである。

水銀に関する懸念

水銀は、高用量の暴露で人の神経系に有害な影響を与える恐れがある。
大半の人々は、有害な影響を及ぼさない程度の水銀に暴露されている。
しかし、いくつかの研究では、食品由来の水銀の影響については大人よりも胎

児の方がより感受性が強い可能性があると指摘している。
これらの影響は、出産後、幼児の成長の指標の達成において微妙な遅れ（例えば、会話や歩行の遅れなど）として明らかになるまで、一般に明白ではない。これらの影響を与える水銀の暴露レベルは、母親には何らの有害な影響も引起さないようである。胎児への水銀の影響については、現在も研究が続けられており、これらの研究が完了する迄には、妊娠中に水銀を含有する食品を過剰に消費することに対する警告は正当なものとなる。

現在の規則

規則では、すでに市販の魚中に許容される水銀の最大のレベルを定めている。これらの限度量は、ある地域の圧倒的多数の人々が魚に存在する水銀により重大な健康リスクを受けないことを保証している。

妊婦へのアドバイス

魚を定期的に消費することで多くの栄養的な利益があるが、一方で水銀の暴露による未解決の不安がある。
妊婦（妊娠を考えている女性を含む）は、以下の種類の魚については、消費を１週間当たり４食分に制限するべきである：サメ/フレーク、エイ、メカジキ、バラマンディ、ギンサワラ、オレンジラフィー、リング、ミナミマグロと地熱水域の魚（魚１食分は平均、約 150g となるだろう）。
マグロ缶詰を含むその他の魚は、頻繁に消費しても差支えない。できるだけ、多種類の魚を摂食することが望ましい。

共通の質問に対する解答

魚中の水銀

１．缶詰の魚は、生鮮の魚よりリスクが高いか？

いいえ、缶詰や冷凍などの加工によって水銀の含有量は変化しない。
実際、マグロの缶詰はミナミマグロより水銀のレベルは低い。これは缶詰に使用するマグロは、より小型の種類で一般に１才未満であるからである。

２．加熱調理は、水銀のレベルに影響を及ぼすか？