Mercury in Fish: Countering Industry Misinformation

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Topics:

- Improving consumer information about mercury in fish and shellfish
- Countering industry (and other) misinformation

Background:

- Fish provides nutrients that benefit cardiovascular health. Fish eaten during pregnancy promotes fetal brain development.
- Ample evidence documents adverse effects of mercury in fish on babies' developing brains, and on the nervous system in adults who eat a lot of high-mercury fish.
- Recent studies show that both beneficial effects and damage from mercury occur at ordinary levels of fish consumption (two fish meals per week or less).

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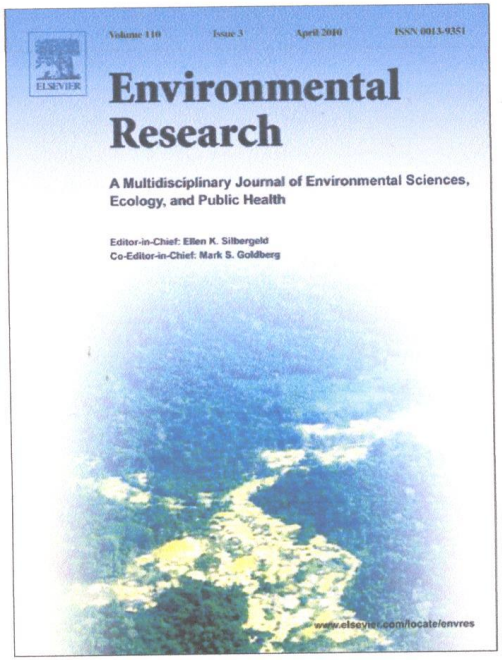

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Ranking the contributions of commercial fish and shellfish varieties to mercury exposure in the United States: Implications for risk communication ☆

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ABSTRACT

Fish and shellfish have important nutritional benefits, and US per capita seafood consumption has increased substantially since 2002. Recent research has reinforced concerns about adverse effects of methylmercury exposure, suggesting that methylmercury doses associated with typical US rates of fish consumption may pose measurable risks, with no threshold. These converging trends create a need to improve risk communication about fish consumption and mercury. The analysis performed here identifies the relative importance of different fish and shellfish as sources of mercury in the US seafood supply and proposes improved consumer advice, so that the public can benefit from fish consumption while minimizing mercury exposure. I have quantified contributions to total mercury in the US seafood supply by 51 different varieties of fish and shellfish, then ranked and sorted the 51 varieties in terms of relative impact. Except for swordfish, most fish with the highest mercury levels are relatively minor contributors to total inputs. Tuna (canned light, canned albacore and fresh/frozen varieties) accounts for 37.4 percent of total mercury inputs, while two-thirds of the seafood supply and nine of the 11 most heavily consumed fish and shellfish are low or very low in mercury. Substantial improvement in risk communication about mercury in fish and seafood is needed; in particular, several population subsets need better guidance to base their seafood choices more explicitly on mercury content. I have sorted the 51 seafood varieties into six categories based on mercury levels, as a framework for improving risk communication in this regard.

1. Introduction

Methylmercury exposure from consuming fish and shellfish is a significant public health concern in the United States (Institute of Medicine (IOM), 2006; Mahaffey et al., 2009). Fish and shellfish in the diet account for almost all methylmercury exposure (National Research Council, 2000). Seafood also has substantial nutritional benefits (IOM, 2006; Mozaffarian and Rimm, 2006); populations with high-fish diets have reduced risks of mortality from cardiovascular disease and stroke (Bouzan et al., 2005; König et al., 2005; Kris-Etherton et al., 2002), and the omega-3 polyunsaturated fatty acids supplied by some fish and shellfish are essential for prenatal development of the brain and visual system (Daniels et al., 2004). Fish consumption may also reduce the risk of Alzheimer's disease (Morris et al., 2003).

Expert authorities have therefore advised Americans to eat more fish (e.g., see American Heart Association (AHA), 2009; IOM, 2006; US Department of Health and Human Services (US DHHS), 2005). Per capita fish consumption in the US has increased in recent decades. It grew from 12.5 pounds per year in 1980 to 15.0 pounds per year in 1990, then held steady at around 15 pounds per year until 2002. But from 2003 through 2008, per capita consumption averaged 16.4 pounds per year (National Marine Fisheries Service (NMFS), 2009). Several factors may account for this increase, including changing consumer preferences, the proliferation of sushi restaurants, more widespread availability

☆ *Funding sources:* The work on this paper was done on my own time, without salary, grants or any other form of reimbursement. I have been retired since January 2004. Prior to that, I worked for 25 years at Consumers Union of US, Inc., the publisher of Consumer Reports magazine, where my responsibilities included risk analysis and risk communication on a wide variety of environmental and food safety issues, including mercury in fish. Since my retirement, I have consulted occasionally with non-governmental organizations engaged in risk communication about mercury issues. In January 2009 I submitted comments on behalf of the Mercury Policy Project to the US Food and Drug Administration, on a draft risk/benefit analysis on mercury in seafood. Those comments included a preliminary version of the analysis presented in this paper, and MPP paid me a modest fee for the time I spent drafting them. This paper expands my analysis and the discussion of risk communication implications flowing from it. It reflects my personal commitment to share this work with the larger scientific community by publishing it in a peer-reviewed journal, and the work was done, as noted, without compensation.

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Risk Communication:

- Mercury exposure must be managed via consumer choices; it can't be regulated.
- Benefits and risks are both associated with eating fish, so communication on this topic is a challenge.
- Stakeholders (nutritionists, public health scientists, the seafood industry, environmental activists, and others) offer conflicting advice on the issue.
- Some sources (the seafood industry and "contrarian" activists) actively promote misinformation.
- Consumers are poorly informed and confused.

Consumer Info Needs:

- Most consumers are unaware of mercury risks.
- Those who have heard that mercury is a concern are generally unable to name specific types of fish that are either high or low in mercury.
- This can lead to counterproductive decisions: Eating fish without discriminating by mercury content (i.e., taking needless risks), or avoiding fish altogether (i.e., foregoing benefits).
- Pregnant women and people who eat fish often (twice a week or more) need to be made aware of mercury risks, and guided to choose low-mercury fish.

Critical Information:

- Different fish and shellfish varieties differ by more than 120-fold in average mercury levels. The mercury level in the fish varieties you choose to eat is the most important driver of your mercury exposure.
- The information that could most directly support better informed, sounder consumer choices is more extensive, detailed and accurate data on the mercury content of different types of fish.
- Messages also need to be better targeted to the groups that most need this advice.

The ideal message (conveyed in "one voice"):

"Eat lots of *low-mercury* fish"

Guide to mercury levels in different varieties of fish and shellfish

LOW-MERCURY FISH AND SHELLFISH

VERY LOW	BELOW AVERAGE
Shrimp	Pollock
Sardines	Atlantic Mackerel
Tilapia	Anchovies, Herring & Shad
Oysters & Mussels	Flounder, Sole & Plaice
Clams	Crabs
Scallops	Pike
Salmon	Butterfish
Crayfish	Catfish
Freshwater Trout	Squid
Ocean Perch & Mullet	Atlantic Croaker
	Whitefish

MODERATE-MERCURY FISH AND SHELLFISH

ABOVE AVERAGE	MODERATELY HIGH
Pacific Mackerel (Chub)	Carp & Buffalofish
Smelt	Halibut
Atlantic Tilefish	Sea Trout
Cod	Sablefish
Caned Light Tuna	Lingcod & Scorpionfish
Spiny Lobster	Sea Bass
Snapper, Porgy, Sheepshead	Pacific Croaker
Skate	American Lobster
Freshwater Perch	Freshwater Bass
Haddock, Hake, Monkfish	Bluefish

HIGH-MERCURY FISH

HIGH	VERY HIGH
Canned Albacore Tuna	King Mackerel
Spanish Mackerel	Swordfish
Fresh/Frozen Tuna	Shark
Grouper	Gulf Tilefish
Marlin	Tuna Sushi/Bluefin Tuna
Orange Roughy	

Some Key Facts:

- Two-thirds of the US seafood supply is low or very low in mercury.
- Nine of the eleven top-selling seafood items are low in mercury; i.e., low- mercury choices are easy to find, familiar and popular.
- The very high-mercury category accounts for just 6 percent of overall mercury exposure.
- Tuna fish accounts for 37 percent of all the mercury in the food supply.
- Canned light tuna is the largest single source.

Improving Consumer Information on Mercury Levels in Fish and Shellfish

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College of William and Mary, Williamsburg, VA, April 24, 2010

Background

Fish contain nutrients that benefit cardiovascular health, and pregnant women should eat fish, to promote fetal brain development. Per capita fish consumption in the US has increased by 10 percent since 2002.

However, some fish, especially larger, predatory species such as shark, swordfish and tuna, contain relatively high levels of mercury. Methylmercury, the principal form found in fish, is toxic to the nervous system.

Epidemiological studies show that when women eat fish during pregnancy, babies born to mothers who ate more fish perform *better* on tests for cognitive development. But babies whose mothers had higher mercury exposure (because the fish they ate contained more mercury) perform *worse* on the same cognitive tests.

Mothers and children are not the only populations at risk. People who eat fish often (twice a week or more) are at risk of excessive mercury exposure, if the fish they choose are high in mercury. Cases of methylmercury poisoning have been diagnosed in patients who ate a great deal of fish and preferred high-mercury varieties like tuna, swordfish or sea bass. Mercury cannot be removed from oceans or food webs, and it is not practical to ban the sale of higher-mercury fish. The soundest way to manage this public-health risk is to educate consumers, especially people who eat fish often, and teach them to manage their own mercury exposure by choosing low-mercury fish.

Because beneficial and harmful effects are both associated with fish consumption, risk communication on this topic is a challenge.

The communication environment is complicated by the efforts of various stakeholders (nutritionists, health organizations, government agencies, the seafood industry, environmental and consumer NGOs), promoting messages that often conflict with each other.

Surveys indicate that consumers are confused. Less than half of the public is aware that mercury in fish is a public health concern, and even among those aware of government advisories, virtually no one can name fish varieties that are high or low in mercury.

Popular fish and seafood varieties differ by more than 120-fold in their average mercury content. The type of fish one chooses is therefore the most important factor driving mercury exposure.

There is an obvious need to provide consumers with clearer, more detailed information about mercury levels in different fish and shellfish varieties, so that more consumers can base more of their seafood choices more explicitly on mercury content.

Methods

From a risk communication perspective, messages about how consumers can reduce their exposure to methylmercury need to be based on a detailed and accurate understanding of where exposure comes from, i.e., of the relative importance of different seafood varieties as mercury exposure sources.

I carried out an analysis of the contributions of 51 different varieties of fish and shellfish to mercury exposure in the United States, then used the results to suggest improvements in consumer advice about mercury in fish.

The US Food and Drug Administration (FDA) developed the 51 categories of fish and shellfish shown in the tables below. Collectively, these 51 categories represent 98.5 percent of the US seafood market. FDA also has collected data on mercury levels in each of the 51 varieties.

I used FDA's data on the mercury content of the 51 varieties (Table 1, below) and data on the market shares for each variety from the National Marine Fisheries Service, re-analyzed by FDA to fit the 51 categories (Table 2, below), to calculate the contributions by each variety to the total amount of mercury in the US seafood supply.

I multiplied the average mercury level in a given seafood variety, in ppm, by the variety's market share, in percent. This generated a *mercury input factor* for each fish and shellfish variety. These mercury input factors (shown in Table 3, below) represent the relative contributions of each fish and shellfish variety to mercury in the seafood supply.

Next, I sorted the fish and shellfish varieties into six groups, based on their mercury content. The groups are color-coded to facilitate communication with consumers. Group boundaries are explained in two of the slides displayed immediately below, and the color-coding is used in the tables below to indicate which varieties fall in each group.

I then used the mercury input factors to rank and compare the contributions of the 51 individual seafood varieties and the six mercury-content groups to the total amount of mercury in the US seafood supply. The results are shown in Table 3, below.

For more details of this analysis, please see: Groth, E. (2010), Ranking the contributions of commercial fish and shellfish varieties to mercury exposure in the United States: Implications for risk communication, *Environmental Research* 110:226-236.

doi:10.1016/j.envres.2009.12.006.

Key Findings

Two-thirds (67 percent) of the fish and shellfish consumed by Americans are low or very low in mercury. Nine of the 11 most heavily consumed seafood varieties are in these lower-mercury categories. It is easy for consumers to find widely available, familiar low-mercury fish.

The Top 10 sources of mercury exposure account for 77 percent of the mercury in the seafood supply. I.e., efforts to reduce mercury exposure can have a substantial impact by teaching populations at risk to limit their consumption of a relatively small number of critical exposure sources.

Fish with the highest levels of mercury are generally *not* the most important sources of exposure. Swordfish is an exception; it accounts for 5 percent of total exposure. But other fish in the Very High Mercury group—Gulf tilefish, shark and king mackerel, all named in government advisories as species pregnant women should avoid—together account for only 1.4 percent of exposure, despite their high mercury levels.

Tuna fish is by far the largest source of exposure to mercury in the United States. Three varieties—canned light, canned albacore, and fresh/frozen tuna steaks—together contribute 37.4 percent of the mercury in the seafood supply, or six times as much as comes from the entire group of Very High Mercury fish (see Table 3, below).

Canned light tuna, which has an above-average mercury level, is the largest single source of US mercury exposure, because of its very large market share. It edges out canned albacore tuna (which has three times as much mercury but one-third the market share) by a slim margin.

Several other higher-mercury varieties, including grouper, American lobster, sea bass, halibut and orange roughy, can also be important sources of mercury exposure for people who eat them more than infrequently.

To help consumers reduce their mercury exposure, advice needs to address more than just Very High Mercury fish. The Above Average group, in particular, includes three varieties—canned light tuna, haddock/hake/monkfish, and cod—that collectively account for more than 30 percent of the mercury in the US diet.

The chart below lists fish and shellfish in color-coded groups by mercury content. This chart or others like it should help consumers who want to choose low-mercury seafood varieties do so, and can help anyone who eats fish regularly manage his or her mercury exposure. For some suggestions about how this chart might be combined with consumer advice, see the Discussion, below.

A Key Fact:

The weighted average methylmercury concentration in the US seafood supply is 0.086 ppm

Color-coding fish for mercury content:
Six categories
GREEN = very low = ~ 0.043 ppm
BLUE = below average = 0.044 - 0.086 ppm
GREY = above average = 0.087 - 0.172 ppm
YELLOW = moderately high = 0.173-0.344 ppm
ORANGE = high = 0.345 - 0.688 ppm
RED = very high = > 0.688 ppm

Note: Different breakpoints than FDA has used

Category boundaries

- Each boundary is a multiple of the weighted average mercury level in the seafood supply, 0.086 ppm
- Boundaries are set at 0.5, 1, 2, 4 and 8 times the US weighted average
- Each category has twice the mercury levels of the category below
- Straightforward, intuitive and easy to explain
- FDA does not classify every variety, simply lists five high-mercury fish, four "low-mercury" choices (one of which isn't low), everything else is just "other fish."

Top 10 Seafoods, 2005-2007

Color-coded for mercury content

Rank	2005 Species	2005 Lbs	2006 Species	2006 Lbs	2007 Species	2007 Lbs
1	Shrimp	4.1	Shrimp	4.4	Shrimp	4.1
2	Tuna, can	3.1	Tuna, can	2.9	Tuna, can	2.7
3	Salmon	2.43	Salmon	2.03	Salmon	2.36
4	Pollock	1.47	Pollock	1.64	Pollock	1.73
5	Catfish	1.03	Tilapia	1	Tilapia	1.14
6	Tilapia	0.85	Catfish	0.97	Catfish	0.88
7	Crab	0.64	Crab	0.66	Crab	0.68
8	Cod	0.57	Cod	0.51	Cod	0.47
9	Clams	0.44	Clams	0.44	Clams	0.45
10	Flatfish	0.37	Scallops	0.31	Flatfish	0.32

Top 10 Hg Sources

Fish	Market Share (%)	ppm Hg	Percent Hg
Tuna, all types	16.44	next slide	37.37
Haddock & Hake	4.86	0.17	9.73
Swordfish	0.44	0.976	5.06
Catfish	5.71	0.068	4.66
Cod	3.36	0.115	4.55
American lobster	1.22	0.31	4.46
Pollock	7.32	0.049	4.23
Shrimp	22.21	0.012	3.14
Salmon	6.83	0.028	2.25
Sea Bass	0.51	0.301	1.81
Total	77.26		

Tuna, by type

Type	Market %	ppm Hg	% Hg
Canned light	11.41	0.118	15.86
Canned albacore	3.81	0.353	15.85
Fresh/Frozen	1.22	0.384	5.66
Totals	16.44		37.37

(Insufficient supply data to specify contributions by tuna type to fresh/frozen category, e.g., bluefin, albacore, bigeye, etc.)

Low Mercury Fish

Very Low Hg fish are 43 percent of the US market but contain just 9.1 percent of the mercury.

Below Average Hg fish account for 24 percent of the market and 16 percent of the mercury.

Together these groups make up **67** percent of the market and provide **25** percent of the mercury.

These two lower Hg categories include **9 of the 11** "Top 10" choices.

I.e., it is very easy for consumers to find popular, familiar low-mercury fish.

Higher Mercury Fish

The **Above Average** category (with canned light tuna) is 22.5 percent of the market but provides **34.3** percent of the mercury.

Moderately High mercury fish are just 2.8 percent of the market but account for **9.6** percent of the mercury (lobster, sea bass and halibut in this group).

High mercury fish (albacore & fresh tuna, grouper, orange roughy) account for 5.6 percent of the market and **24.6** percent of the mercury.

Very High mercury fish are just 0.6 percent of the market but provide **6.5** percent of the mercury.

Table 1. Mercury levels in 51 varieties of fish and shellfish

Fish/Shellfish Variety	Mean	Mercury ppm Min	Max	No. Samples
Tilefish, Gulf of Mexico	1.450	0.05	2.73	40
Shark, all varieties	0.988	ND	4.54	553
Swordfish	0.976	ND	4.54	1,149
Mackerel, king	0.730	0.15	1.67	131
Orange roughy	0.571	0.21	0.80	19
Marlin	0.485	0.10	0.92	18
Grouper, all varieties	0.460	0.05	1.32	45
Tuna, fresh/frozen	0.384	ND	1.30	218
Mackerel, Spanish	0.360	0.05	1.50	109
Tuna, canned albacore	0.353	ND	0.85	388
Bluefish	0.340	0.14	0.63	32
Bass, freshwater	0.310	NA	NA	NA
Lobster, American	0.310	0.05	1.31	80
Croaker, Pacific	0.301	0.10	0.41	15
Bass, saltwater	0.301	ND	1.18	87
Lingcod & scorpionfish	0.290	0.02	1.76	19
Seabass	0.271	ND	0.74	102
Tuna, albacore	0.268	ND	0.78	91
Halibut	0.220	ND	1.02	49
Carp & buffalofish	0.203	0.01	0.65	6
Haddock, hake & monkfish	0.179	ND	1.02	94
Perch, freshwater	0.162	ND	0.31	6
Skate	0.157	0.04	0.36	56
Snapper, porgy & sheepshead	0.157	ND	1.57	102
Lobster, spiny	0.121	ND	0.27	9
Tuna, canned light	0.118	ND	0.85	347
Cod	0.115	ND	0.42	39
Tilefish, Atlantic	0.111	0.04	0.55	32
Smelt	0.093	0.04	0.18	16
Mackerel, Pacific (Chub)	0.088	0.01	0.57	654
Whitefish	0.073	ND	0.31	28
Croaker, Atlantic	0.073	0.01	0.25	35
Squid	0.070	ND	0.40	209
Catfish	0.068	ND	0.31	23
Butterfish	0.059	ND	0.26	89
Pike	0.056	NA	NA	NA
Anchovies, herring & shad	0.050	ND	0.34	137
Flatfish (flounder, sole & plaice)	0.050	ND	0.18	25
Crab, all varieties	0.050	ND	0.41	65
Mackerel, Atlantic	0.049	0.01	0.16	80
Pollock	0.049	ND	0.38	87
Perch, saltwater & mullet	0.047	ND	0.17	16
Trout, freshwater	0.047	ND	0.18	30
Crayfish	0.033	ND	0.05	44
Salmon	0.028	ND	0.19	57
Oysters & mussels	0.023	ND	0.25	38
Clams	0.023	ND	ND	6
Scallops	0.023	ND	0.12	46
Tilapia	0.020	ND	0.07	9
Sardines	0.016	ND	0.04	29
Shrimp	0.012	ND	0.05	24

Data are for total mercury and are rounded to two significant digits. Mercury levels in fish and shellfish are reported in units of parts per million (ppm) (micrograms (µg) per gram (g)) or parts per billion (ppb) (nanograms (ng) per gram (g)). Data are available online at http://www.fda.gov/Food/FoodSafety/Product-SpecificInformation/Seafood/FDAPublishesNewDataonMercuryLevelsinSeafood/default.htm

ND = Not detected (Limit of Detection (LOD) unavailable)

NA = Data not available. Fish are consumed freshwater but are not data from an additional freshwater because they are not commercial.

Table 2. Market shares for 51 varieties of fish and shellfish in the US, 2006

Fish/Shellfish Variety	% of Mkt
Shrimp	22.21
Tuna, canned light	11.41
Pollock	7.32
Salmon	6.83
Catfish	5.71
Haddock, hake & monkfish	4.86
Tilapia	4.83
Tuna, canned albacore	3.81
Cod	3.36
Anchovies, herring & shad	3.06
Flatfish (flounder, sole & plaice)	2.42
Oysters & mussels	2.22
Crabs, all varieties	2.12
Clams	2.04
Squid	1.92
Sardines	1.73
Scallops	1.46
Lobster, American	1.22
Tuna, fresh/frozen	1.22
Mackerel, Atlantic	1.04
Snapper, porgy & sheepshead	0.86
Lobster, spiny	0.71
Mackerel, Pacific (Chub)	0.61
Trout, freshwater	0.60
Bass, saltwater	0.51
Halibut	0.48
Perch, saltwater & mullet	0.47
Crayfish	0.47
Skate	0.46
Swordfish	0.44
Grouper, all varieties	0.40
Croaker, Atlantic	0.23
Orange roughy	0.20
Bass, freshwater	0.19
Seabass	0.19
Whitefish	0.19
Perch, freshwater	0.14
Trout, saltwater	0.10
Pike	0.10
Smelt	0.09
Shark, all varieties	0.07
Bluefish	0.06
Mackerel, Spanish	0.05
Mackerel, king	0.05
Carp & buffalofish	0.04
Butterfish	0.04
Marlin	0.02
Lingcod & scorpionfish	0.02
Tilefish, Atlantic	0.01
Tilefish, Gulf of Mexico	0.01
Croaker, Pacific	0.00
Total	98.45

Table 3. Fish and shellfish varieties sorted by mercury content, with contributions to total mercury input

Fish/Shellfish Variety	Mean Hg (ppm)	Market Share (Percent)	Hg Input Factor	Percent of Total Hg	Cumulative Percent
Very Low Mercury (<0.05 - 0.043 ppm)					
Shrimp	0.012	22.21	0.2665	3.140	
Salmon	0.028	6.83	0.1912	2.253	
Pollock	0.049	7.32	0.3587	4.226	
Oysters & mussels	0.023	2.22	0.0511	0.601	
Clams	0.023	2.04	0.0469	0.553	
Scallops	0.023	1.46	0.0336	0.396	
Sardines	0.016	1.73	0.0277	0.326	
Trout, freshwater	0.047	0.60	0.0282	0.332	
Perch, saltwater & mullet	0.047	0.47	0.0220	0.259	
Smelt	0.093	0.09	0.0084	0.099	
Group totals [weighted avg] [0.034]		24.63	0.8342	9.826	9.826
Below Average Mercury (0.044 - 0.086 ppm)					
Catfish	0.068	5.71	0.3882	4.574	
Crab	0.050	2.12	0.1060	1.249	
Anchovies, herring & shad	0.050	3.06	0.1530	1.802	
Squid	0.070	1.92	0.1344	1.583	
Flatfish (flounder, sole & plaice)	0.050	2.42	0.1211	1.426	
Crabs, all varieties	0.050	2.12	0.1060	1.249	
Tilapia, Atlantic	0.020	4.83	0.0966	1.138	
Croaker, Atlantic	0.073	0.23	0.0173	0.204	
Whitefish	0.073	0.19	0.0145	0.168	
Pike	0.056	0.10	0.0056	0.066	
Bluefish	0.050	0.06	0.0033	0.037	
Group totals [weighted avg] [0.056]		24.63	1.3460	15.854	25.680
Above Average Mercury (0.087 - 0.172 ppm)					
Tuna, canned light	0.118	11.41	1.3464	15.860	
Haddock, hake & monkfish	0.179	4.86	0.8262	9.734	
Cod	0.115	3.36	0.3864	4.551	
Snapper, porgy & sheepshead	0.157	0.86	0.1376	1.621	
Lobster, spiny	0.121	0.71	0.0859	1.012	
Skate	0.157	0.46	0.0724	0.852	
Mackerel, Pacific (Chub)	0.088	0.61	0.0537	0.634	
Perch, freshwater	0.162	0.14	0.0227	0.267	
Smelt	0.093	0.09	0.0085	0.099	
Croaker, Atlantic	0.073	0.23	0.0173	0.204	
Group totals [weighted avg] [0.125]		22.21	2.8315	33.361	59.041
Moderately High Mercury (0.173 - 0.344 ppm)					
Lobster, American	0.310	1.22	0.3782	4.456	
Halibut, Atlantic	0.220	0.48	0.1056	1.244	
Seabass	0.270	0.19	0.0513	0.605	
Bass, freshwater	0.310	0.19	0.0604	0.712	
Bass, saltwater	0.273	0.51	0.1418	0.611	
Trout, saltwater	0.240	0.10	0.0240	0.117	
Pike	0.240	0.10	0.0240	0.117	
Carp & buffalofish	0.203	0.04	0.0081	0.095	
Lingcod & scorpionfish	0.290	0.02	0.0057	0.067	
Croaker, Pacific	0.301	0.00	0.0012	0.014	
Group totals [weighted avg] [0.280]		3.81	0.8129	9.585	68.626
High Mercury (0.345 - 0.688 ppm)					
Tuna, canned albacore	0.353	3.81	1.3443	15.845	
Tuna, fresh/frozen	0.384	1.22	0.4685	5.603	
Grouper, all varieties	0.460	0.27	0.1242	1.465	
Orange roughy	0.571	0.20	0.1142	1.346	
Mackerel, Spanish	0.360	0.05	0.0180	0.212	
Marlin	0.485	0.02	0.0097	0.115	
Group totals [weighted avg] [0.375]		5.57	2.0889	24.627	92.627
Very High Mercury (> 0.688 ppm)					
Swordfish	0.976	0.44	0.4293	5.059	
Shark, all varieties	0.988	0.07	0.0692	0.815	
Mackerel, king	0.730	0.05	0.0365	0.430	
Tilefish, Gulf of Mexico	1.450	0.01	0.0145	0.171	
Group totals [weighted avg] [0.864]		0.57	0.5495	6.475	100.000

Discussion

Very High mercury fish—the category red-flagged by the FDA—are far from the most important sources of exposure (account for just 6.5 percent of inputs, and almost all of that is from swordfish).

While **High** mercury and **Moderately High** mercury fish are important exposure sources (accounting for 24.6 and 9.6 percent of inputs, respectively), it is the **Above Average** category that accounts for the lion's share of mercury inputs (34.3 percent).

Reducing exposure requires managing ***all*** exposure sources, not just the highest ones.

To Improve risk communication, we need to:

Identify populations who should try to minimize their mercury exposure (e.g., pregnant women, high-end fish eaters).

Encourage them to eat (more) fish, while guiding them to choose low-mercury fish.

Advise high-end consumers to limit intake of **High,** Moderately High and **Above Average** mercury fish, not just **Very High** mercury fish.

Provide clearer and more detailed information about the mercury content of all popular fish and shellfish choices on the market (see Guide).

Guide to mercury levels in different varieties of fish and shellfish

LOW-MERCURY FISH AND SHELLFISH

VERY LOW	BELOW AVERAGE
Shrimp	Pollock
Sardines	Atlantic Mackerel
Tilapia	Anchovies, Herring & Shad
Oysters & Mussels	Flounder, Sole & Plaice
Clams	Crab
Scallops	Pike
Salmon	Butterfish
Catfish	Catfish
Freshwater Trout	Squid
Ocean Perch & Mullet	Atlantic Croaker
	Whitefish

MODERATE-MERCURY FISH AND SHELLFISH

ABOVE AVERAGE	MODERATELY HIGH
Pacific Mackerel (Chub)	Carp & Buffalofish
Smelt	Halibut
Atlantic Tilefish	Sea Trout
Cod	Sablefish
Canned Light Tuna	Lingcod & Scorpionfish
Spiny Lobster	Sea Bass
Snapper, Porgy, Sheepshead	Pacific Croaker
Skate	American Lobster
Freshwater Perch	Freshwater Bass
Haddock, Hake, Monkfish	Bluefish

HIGH-MERCURY FISH

HIGH	VERY HIGH
Canned Albacore Tuna	King Mackerel
Spanish Mackerel	Swordfish
Fresh/Frozen Tuna	Shark
Grouper	Gulf Tilefish
Marlin	Tuna Sushi/Bluefin Tuna
Orange Roughy	

Countering Misinformation:

- Those of us who are trying to inform consumers about mercury in fish have to contend with an aggressive public relations campaign from “the other side.”
- This PR effort is mounted by the seafood industry and some professional “contrarians.”
- It began when the government first advised pregnant women to avoid high-mercury fish.
- It has continued and intensified as scientific research has heightened concerns about mercury exposure.

Campaign Elements

The industry/contrarian PR campaign:

- ***Denies*** that mercury poses any risk
- ***Exaggerates*** so-called "safety margins"
- ***Promotes*** the benefits of fish consumption
- "***Shoots*** the messenger:"
  - Criticizes scientists whose work shows risk
  - Harasses journalists whose reports reflect scientific understanding of mercury risks
  - Asserts that mercury warnings harm public health

PR Tools:

- Web sites (e.g., Mercuryfacts.com, Fishscam.com)
- Blogs (National Fisheries Institute)
- Professional PR staff who are talented, alert, ready to pounce on threats, and relentless
- Letters, e-mails, press releases, blog postings
- Modern media (e.g., YouTube)
- Aggression and chutzpah in haranguing reporters, editors and others
- No apparent shortage of resources

Who Are They?

- National Fisheries Institute: The trade association of the US seafood industry
- Some academics who agree with and often consult for the industry
- Center for Consumer Freedom: A PR shop dedicated to the propositions: (1) No risk is real, (2) It is not the job of government to protect us from risks in tobacco smoke, alcoholic beverages, obesity-generating diets, foods that contain toxic contaminants, and similar hazards.

The Truth?

- This PR campaign is based on a lattice of frankly false statements, distortions, misleading information, facts out of context, and *ad hominem* arguments.
- Since PR is about what you can get people to believe – not about what's true – the campaign tells whopper after whopper, and tells them again and again.
- The Mercury Policy Project has grown tired of seeing this industry/contrarian PR nonsense used to harass reporters and confuse consumers.
- So we're doing something about it.

A New Resource:

MPP has created a new web site:

http://mercuryfactsandfish.org

- Provides the facts on mercury issues
- Recounts seafood lobby PR "Fables"
- Shows how and why each is wrong

Some Favorite Fables:

- Mercury in fish doesn't pose any risk
- Fish are fish (as in, "Eat more fish!")
- The safe level of mercury in blood is 58 µg/l
- Mercury is a natural contaminant (and thus OK)

- I'll explain briefly why each fable is wrong.

“Mercury Not a Risk:”

This fable takes various forms:

- There is no risk at all; it’s “environmentalist hype”
- The benefits of eating fish “vastly outweigh the minuscule risks” from mercury.
- The risks are just “theoretical.”
- There has “never been a single documented case” of harm from the mercury in commercially-caught fish.

The Risk Is Real:

Whether a flat denial or more nuanced risk/benefit statement, this fable is wrong:

- Epidemiological studies show clear-cut harm to the developing brain, even at everyday exposure levels.
- Adverse effects are as large as or larger than beneficial effects from eating fish.
- There are documented cases of adults who ate too much high-mercury fish and got mercury poisoning.
- You can have all the benefits and avoid the risk ***by choosing low-mercury fish***.

“Fish Are Fish:”

The Facts:

- All fish are definitely ***not*** alike.
- Fish and shellfish varieties differ in their content of beneficial nutrients, such as omega-3 fatty acids.
- They also differ by ***more than 120-fold*** in average mercury levels.
- The types of fish you choose to eat therefore make a huge difference in terms of your mercury exposure.

Safe Doses:

This fable also takes several forms:

- The EPA's reference dose (the official definition of safe exposure) is 58 µg/l of mercury in blood (or once, 580 µg/l!)
- The safe level is 5.8 µg per *deciliter*.
- The safe dose is for lifetime exposure
- The safe dose includes a 10-fold "safety margin"

The Facts:

- The actual EPA Reference Dose is 0.1 µg/kg/day of <u>dietary intake</u>.
- The blood level that corresponds to the Reference Dose is 5.8 µg/liter.
- The PR spinners are trying to make the "safe" exposure level seem 10-fold (or briefly, 100-fold) higher than it actually is.
- The critical period is a pregnancy, not a lifetime.
- An uncertainty factor is ***not*** a "safety margin."
- Recent evidence shows adverse effects at or below the Reference Dose, which is 11 years old & needs review.

“Mercury is Natural:”

- This PR claim plays on people’s mistaken but common belief that something “natural” is less harmful.

The Facts:

- Mercury in the oceans comes from both pollution and natural sources.
- Methylmercury, the form in fish, is formed by bacteria through a natural process.
- The sources are irrelevant. Methylmercury is toxic and too much of it poses a hazard, regardless of its origin.

For More Info:

- Please see our web site.
- Many more PR fables about mercury and fish are dissected there.
- The facts about the issues are presented in varying degrees of detail, written as a resource for consumers, journalists, students and others.
- **http://mercuryfactsandfish.org**