

Dr. Clyde Mercury and Toxins in Fish

Mercury contamination in fish has turned this amazing food source into a danger zone, putting our neurological system at risk (particularly if still growing) unless we are careful to eat seafood shown to have low levels of contamination. Below are marine foods grouped together by mercury levels from lowest to highest. The data on this page is the most complete and up-to-date available on the FDA web site www.cfsan.fda.gov/~frf/sea-mehg.html (easily found by doing a search for the words FDA, mercury, and fish). To see government advisors by state for seafood for mercury as well as other toxins go to <http://epa.gov/waterscience/fish/advisories/index.html>

What is the limit of how much mercury you should consume?

The U.S. Environmental Protection Agency (EPA) and the National Academy of Sciences (NAS) recommend keeping mercury in your body low: < 5.0 µg/L in blood, or < 1.0 ppm in hair, which corresponds to a reference dose of 0.1 µg mercury/kg body weight per day. For a person who is about 150 lb (70 kg) this corresponds to 7 µg per day, or the amount of mercury in a 3-oz piece of fish containing 0.1 ppm mercury.

Unfortunately, a Harvard Medical research group (see their abstract at the end of this document) has shown that these levels of mercury during pregnancy (1.0 ppm mercury in a mother's hair) correlates to an 8% reduction in the subsequent child's measured intelligence at 6 months of age. On the other hand, this same study shows that when consuming fish low in mercury, every additional serving of fish per week low in mercury that the mother eats while pregnant increases the child's intelligence score by 4%. Since this paper effectively shows that 7 µg mercury intake per day (the recommended limit of intake by the EPA and the NAS) reduces your offspring's intelligence by 8%, I recommend consuming no more than 0.7 µg of mercury per day. By consuming no more than 10% of the government-set limits, you are not likely to have any mercury impact on your child. I also recommend that everyone, not just pregnant women, use this 0.7 µg mercury/day. While a growing child's neurological system is dramatically more susceptible to the effects of mercury, no one is immune to it. Depending on your life-stage, the brain may be more susceptible to the effects of mercury, and even if your neurons are strong and resilient, would you really want to consume fish high in mercury when your loved ones will probably be eating some as well since you are all at the same table? Whether in your womb or in your home, people you care about will likely be impacted when you eat food containing more mercury. Take the most limiting case (pregnant women) and apply it to yourself regardless of gender and physiological state to ensure the greatest health levels of everyone. For a great discussion of mercury in fish and a "mercury calculator" to see how much mercury you are consuming see www.gotmercury.org

An intake of 0.7 µg mercury/day correlates to 4.9 µg/week, 21.0 µg/month or 255.5 µg/year. If you eat some fish that are higher in mercury once in a while just use these weekly, monthly or annual limits. Remember, however, that slowly consuming small amounts of a toxin is better for you than quickly taking in a large amount even if over the year the total amount consumed is identical. Below are seafood sources the FDA has published mercury levels for and the frequency you can eat 3-oz servings before you get to your mercury limits.

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Note that seafood with no detectable mercury still contain mercury but at a level below the sensitivity of the analysis (<0.01 ppm), so I will assume they contain 0.01 ppm mercury.

For a maximum dose of 0.7 µg/day, 4.9 µg/week, 21.0 µg/month or 255.5 µg/year:

	ppm mercury	µg Hg/3 oz	x/week	x/mo.	x/year
Clam	ND	0	7.0	30.0	365.0
Shrimp	ND	0	7.0	30.0	365.0
Ocean perch	ND	0	7.0	30.0	365.0
Whiting	ND	0	7.0	30.0	365.0
Canned salmon (usually wild)	ND	0	7.0	30.0	365.0
Tilapia	0.01	0.70	7.0	30.0	365.0
Oyster	0.013	0.91	5.4	23.1	280.8
Hake	0.014	0.98	5.0	21.4	260.7
Salmon, fesh/frozen (wild & famre)	0.014	0.98	5.0	21.4	260.7
sardines	0.016	1.12	4.4	18.8	228.1
Haddock	0.031	2.17	2.3	9.7	117.7
Crawfish	0.033	2.31	2.1	9.1	110.6
Pollock	0.041	2.87	1.7	7.3	89.0
Anchovies	0.043	3.01	1.6	7.0	84.9
Herring	0.044	3.08	1.6	6.8	83.0
flatfish (flounder, plaice, sole)	0.045	3.15	1.6	6.7	81.1
mullet	0.046	3.22	1.5	6.5	79.3
catfish	0.049	3.43	1.4	6.1	75.4
N. Atlantic mackerel	0.050	3.50	1.4	6.0	73.0
Scallop	0.050	3.50	1.4	6.0	73.0
Butterfish	0.058	4.06	1.2	5.2	62.9
crab (blue, king, snow)	0.060	4.20	1.2	5.0	60.8
Shad American	0.065	4.55	1.1	4.6	56.2
Whitefish	0.069	4.83	1.0	4.3	52.9
Squid	0.070	4.90	1.0	4.3	52.1
Atlantic croaker	0.072	5.04	1.0	4.2	50.7
freshwater trout	0.072	5.04	1.0	4.2	50.7
Pacific mackerel chub	0.088	6.16	0.8	3.4	41.5
spiny lobster	0.090	6.30	0.8	3.4	41.5
cod	0.095	6.65	0.7	3.2	38.4
jacksmelt	0.108	7.56	0.6	2.8	33.8
canned light tuna	0.118	8.26	0.6	2.5	30.9
sheepshead	0.128	8.96	0.5	2.3	28.5
skate	0.137	9.59	0.5	2.2	26.6
carp	0.140	9.80	0.5	2.1	26.1
freshwater perch	0.140	9.80	0.5	2.1	26.1
Atlantic tilefish	0.144	10.08	0.5	2.1	25.3
Monkfish	0.180	12.60	0.4	1.7	20.3

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S. Atlantic Spanish Mackerel	0.182	12.74	0.4	1.6	20.1
Snapper	0.189	13.23	0.4	1.6	19.3
Buffalofish	0.190	13.30	0.4	1.6	19.2
Bass (salt, black, striped, rockfish)	0.219	15.33	0.3	1.4	16.7
Sablefish	0.220	15.40	0.3	1.4	16.7
Halibut	0.252	17.64	0.3	1.4	16.6
weakfish (sea trout)	0.256	17.92	0.3	1.2	14.3
scorpionfish	0.286	20.02	0.2	1.0	12.8
Pacific white croaker	0.287	20.09	0.2	1.0	12.7
Northern/American lobster	0.310	21.70	0.2	1.0	11.8
Tuna (yellowfin, fresh/frozen)	0.325	22.75	0.2	0.9	11.2
Bluefish	0.337	23.59	0.2	0.9	10.8
canned albacore tuna	0.353	24.71	0.2	0.8	10.3
fresh/frozen albacore tuna	0.357	24.99	0.2	0.8	10.2
average of all fresh/frozen tuna	0.383	26.81	0.2	0.8	9.5
Chilean Bass	0.386	27.02	0.2	0.8	9.5
Gulf of Mexico Spanish mackerel	0.454	31.78	0.2	0.7	8.0
grouper (all species)	0.465	32.55	0.2	0.6	7.8
marlin	0.485	33.95	0.1	0.6	7.5
Orange roughy	0.554	38.78	0.1	0.5	6.6
fresh/frozen bigeye tuna	0.639	44.73	0.1	0.5	5.7
king mackerel	0.730	51.10	0.1	0.4	5.0
Swordfish	0.976	68.32	0.1	0.3	3.7
Shark	0.988	69.16	0.1	0.3	3.7
Gulf of Mexico Tilefish	1.450	101.50	0.0	0.2	2.5

No detectable mercury (<0.01 ppm)

Clam, shrimp, ocean perch, whiting, farmed salmon (contains toxins), canned salmon

Low mercury levels (0.01-0.016 ppm) listed from lowest to highest

Tilapia, oyster, hake, wild salmon, sardines

EAT THESE NO MORE THAN TWICE PER WEEK:

Moderate mercury levels (0.031-0.072 ppm) listed from lowest to highest

Haddock, crawfish, Pollock, anchovies, herring, flatfish (including flounder, plaice, sole), mullet, catfish, N. Atlantic mackerel, scallop, butterfish, crab (including blue, king, snow), Shad American, whitefish, squid, Atlantic croaker, freshwater trout

EAT THESE NO MORE THAN TWICE PER MONTH:

High mercury levels (0.088-0.158 ppm) listed from lowest to highest

Pacific mackerel chub, spiny lobster, cod, jacksmelt, canned light tuna, sheepshead, skate, carp, freshwater perch, Atlantic tilefish

EAT THESE NO MORE THAN ONCE PER MONTH:

Very high mercury levels (0.18-0.485 ppm) listed from lowest to highest

Monkfish, S. Atlantic Spanish Mackerel, snapper, buffalofish, Bass (saltwater, black, striped and rockfish), sablefish, halibut, weakfish (sea trout), scorpionfish, Pacific white croaker, Northern/American lobster, Tuna (yellowfin, fresh/frozen), bluefish, canned albacore tuna, fresh/frozen albacore tuna, average of all fresh/frozen tuna (0.383 ppm), Chilean Bass, Gulf of Mexico Spanish mackerel, grouper (all species), marlin

EAT THESE NO MORE THAN ONCE EVERY THREE MONTHS:

Astronomical mercury levels (0.554-0.73 ppm) listed from lowest to highest

Orange roughy, fresh/frozen bigeye tuna, king mackerel

EAT THESE NO MORE THAN ONCE PER YEAR:

Don't-Even-Think-About-It mercury levels (1-1.5 ppm) listed from lowest to highest
Swordfish, shark, Gulf of Mexico Tilefish

The study showing that low-mercury fish helps, high mercury fish hurts

Environ Health Perspect. 2005 Oct;113(10):1376-80.

Maternal fish consumption, hair mercury, and infant cognition in a U.S. Cohort.

Oken E, Wright RO, Kleinman KP, Bellinger D, Amarasiriwardena CJ, Hu H, Rich-Edwards JW, Gillman MW.

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Fish and other seafood may contain organic mercury but also beneficial nutrients such as n-3 polyunsaturated fatty acids. We endeavored to study whether maternal fish consumption during pregnancy harms or benefits fetal brain development. We examined associations of maternal fish intake during pregnancy and maternal hair mercury at delivery with infant cognition among 135 mother-infant pairs in Project Viva, a prospective U.S. pregnancy and child cohort study. We assessed infant cognition by the percent novelty preference on visual recognition memory (VRM) testing at 6 months of age. Mothers consumed an average of 1.2 fish servings per week during the second trimester. Mean maternal hair mercury was 0.55 ppm, with 10% of samples > 1.2 ppm. Mean VRM score was 59.8 (range, 10.9-92.5). After adjusting for participant characteristics using linear regression, higher fish intake was associated with higher infant cognition. This association strengthened after adjustment for hair mercury level: For each additional weekly fish serving, offspring VRM score was 4.0 points higher [95% confidence interval (CI), 1.3 to 6.7]. However, an increase of 1 ppm in mercury was associated with a decrement in VRM score of 7.5 (95% CI, -13.7 to -1.2) points. VRM scores were highest among infants of women who consumed > 2 weekly fish servings but had mercury levels \leq 1.2 ppm. Higher fish consumption in pregnancy was associated with better infant cognition, but higher mercury levels were associated with lower cognition. Women should continue to eat fish during pregnancy but choose varieties with lower mercury contamination.

Toxins in farmed salmon (canned salmon is usually wild)

Due to the contaminated food fed in fish farms, farmed salmon contains significantly more toxins than the wild variety. This was first shown by Ronald Hites and coworkers in 2004 [Science, 9 Jan 2004, 303 (5655) p. 226-9]. The levels of four toxins were investigated: PCBs, dioxins, toxaphene and dieldren, all known cancer-causing agents. Polychlorinated biphenyls (PCBs) were used as industrial lubricants and coolants until the 1970s when they were banned. Dioxins are a by-product of industrial processes. Toxaphene and dieldren are banned pesticides. Although each of these carcinogens were individually lower than FDA (Food and Drug Administration) guidelines, by using the EPA (Environmental Protection Agency) guidelines the study shows that the combined amount of toxins in farmed salmon is cause for alarm. The EPA does not regulate commercial fish sales, but only provides guidance for eating what one catches on one's own recreationally. The FDA, on the other hand, has higher tolerances for toxin levels in fish sold in stores because the FDA also takes economic impact into account, meaning that it is ok to increase the chances of cancer in the general public if it is good for the economy. Over 2 tons of salmon from around the world were analyzed by Hites and coworkers. Salmon (often by species) from different regions were analyzed separately: The frequency at which you should limit your farmed salmon intake from these regions (by species, when known) is below. **Farmed chum salmon is significantly lower in toxins than other canned salmons.** Note that the vast majority of canned salmon is wild, not farmed. This is because farmed salmon does not have as tough a consistency (not as good for canning) and because wild salmon is only in season for a few months, requiring that whatever is caught that can not be sold fresh must be either frozen or canned. Wild salmon get their red color from eating krill in the ocean. The meat from farmed salmon would be grey if it did not have coloring added.

Toxin	Wild salmon	Farmed salmon
PCBs	4.8	36.7
Dioxins	0.2	1.9
Toxaphene	16.0	88.6
Dieldren	0.5	3.4

Source of the farmed salmon	Max 3-oz servings/month	
Europe, East Canada, Main, San Francisco	0.2-0.5	
Chili, Washington State, Chicago, LA, NY	1	
Denver, New Orleans	2	
South-Eastern Alaska: Chinook	1	
	Sockeye	2
	Coho, Pink	4
	Chum	8
Kodiak Alaska	Sockeye, Coho, Pink	4
	Chum	8
Oregon	Chinook	2
British Columbia	Chinook, Sockeye, Coho	2
	Pink	4
	Chum	8

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