

Toxic Tuna 2: New Undercover Investigation of Mercury-Contaminated Sushi in Popular San Diego Japanese Restaurants

Executive Summary

The popularity of sushi and recent FDA data showing that most tuna contains high mercury levels prompted GotMercury.Org to investigate ten top San Diego sushi restaurants to determine the levels of mercury in tuna, the most frequently ordered sushi item, and to offer public health recommendations. This was a follow-up study after GotMercury.Org's Los Angeles study.

One out of every five tuna samples were unsafe for women and children to consume because they exceeded 0.730 ppm, the average of king mackerel, which the FDA tells women and children not to eat. Half of the samples tested were more than 0.5 ppm, the maximum level under older FDA standards and used by most developed nations. Overall, the mercury levels of the tuna sampled in our study was an average of 0.584 ppm and a median of 0.601 ppm total mercury. **This reinforces the need for women and children to avoid tuna.**

The federal government has issued a health advisory about methylmercury in seafood, warning women and children to limit their consumption of tuna and to eliminate four other species of fish in their diets. However, the government does not yet require supermarkets and restaurants to post these important warnings.

The FDA currently warns women and children that they should not eat king mackerel (0.730 ppm), swordfish (0.97 ppm), shark (0.988 ppm), and tilefish (1.45 ppm). However, the FDA fails to warn women and children to avoid high-mercury tuna that is served as sushi or ahi.

A typical sushi order of a pair of nigiri sushi or a single sushi roll is around two ounces of tuna or other fish. Consumers often eat two or more orders of sushi in a single meal. An order of sashimi can be as much as 6 to 8 ounces. A child or a woman eating even one 2-ounce sushi order with the amounts of mercury found in some the tuna we tested could exceed what the EPA considers safe. No one should ever eat any tuna exceeding 1.0 ppm.

In summary, to prevent unnecessary mercury exposure, women and children should be warned about the dangers of mercury in tuna used for sushi and sashimi. Our recommendations are:

1. The FDA should revise its advisories to strengthen the warnings regarding tuna consumption by women and children.
2. The FDA should require restaurants and grocery stores that sell sushi and other seafood to post the FDA mercury advisory.
3. The FDA should improve food safety by requiring mercury testing of more fish and shellfish with inexpensive rapid testing technology now available.
4. Restaurants and grocery stores should stop selling the fish high in mercury unless seafood suppliers provide proof that that fish being sold do not exceed the FDA's 1-ppm limit.
5. In the absence of federal leadership, states and local governments should take the initiative to enact legislation that requires point-of-sale mercury warnings.
6. Women and children should not eat tuna served as sushi or sashimi.

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Introduction

According to the National Academy of Science (NAS), mercury is “widespread and persistent in the environment.”¹ Mercury primarily comes from anthropogenic sources, such as coal-fired power plants and industrial processes. Mercury also occurs naturally. Bacteria transform mercury into methylmercury, an organic form that is a neurotoxin, and bring mercury into the food chain. The NAS reported that consumption of mercury-contaminated fish is the primary source of exposure for humans. Methylmercury is particularly dangerous to those people who are exposed to high levels or who are in sensitive populations, such as women and children.

Fish highest in the food chain, such as predatory species like tuna and swordfish, build up the highest levels of mercury through bioaccumulation. Recognizing this danger, the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA) issued a joint advisory to women and children about methylmercury in seafood in March 2004.² The federal mercury advisory tells women and children to limit their consumption of tuna and to eliminate four other species of fish in their diets.



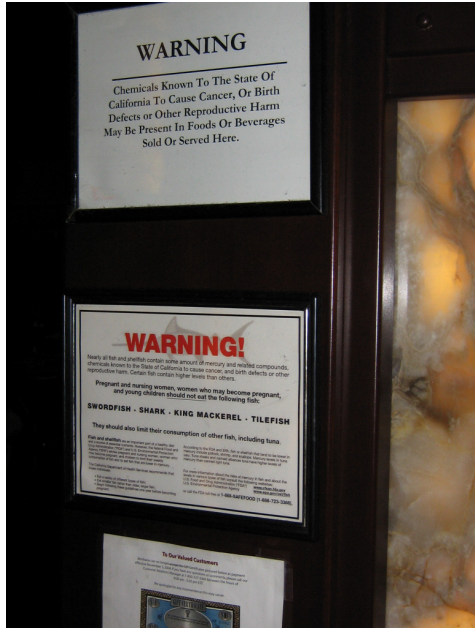
Ample scientific data have shown that methylmercury causes neurodevelopmental effects in both humans and animal studies. Exposed children show symptoms that “include poor performance on neurobehavioral tests, particularly on tests of attention, fine motor function, language, visual-spatial abilities (e.g., drawing), and verbal memory.”³ A recent Harvard study found that “higher mercury exposure in pregnancy is associated with lower offspring cognitive scores, even at these relatively low levels of exposure.”⁴ Studies have even shown links between cardiovascular disease in adults and the consumption of large volumes of fish high in mercury.⁵

It is clear that mercury is toxic and that it should be avoided whenever possible. Therefore, consumers need to know which fish and shellfish have low or no mercury so that people can avoid unnecessary exposure. No one needs to eat tuna high in mercury to get the health benefits that are associated with seafood consumption. Sushi lovers should not give up on seafood, but instead find the healthiest alternatives that are high in omega-3 fatty acids and low in mercury.

Given the popularity of sushi and the alarming results from our Los Angeles study, GotMercury.Org, with the assistance of television station KGTV San Diego, initiated a study of 10 top San Diego sushi restaurants to see the levels of mercury in tuna, the most frequently ordered sushi item.

Methodology

Sushi and Japanese cuisine has become one of the most popular types of restaurants for diners. *Zagat Survey* at the release of their 2006 guides announced that “sushi restaurants lead the Top Food and/or Most Popular lists” in “nearly all cities.”⁶ Many of the highest ranked Japanese restaurants post signs showing their *Zagat* ratings, but outside of California, restaurants are not visibly posting important mercury-in-seafood warnings.



San Diego area restaurants tested:

- Arigato
- Benihana
- Café Japengo
- Kanpai
- Mr. Sushi
- Ra Sushi (part of Benihana)
- Samurai
- Sushi Ota
- Taka Sushi
- Zenbu

From *Zagat Survey*, we picked top Japanese restaurants in San Diego. With the help of television station KGTV in San Diego, four other restaurants were chosen across a broad geographic distribution in San Diego.

We included the Benihana and a Ra Sushi (a Benihana sushi chain) in San Diego because Benihana is the “largest restaurant chain where sushi is a featured.”⁷ Benihana, in addition to being a nationally-known restaurant chain, is one of the restaurants that agreed to post California’s mercury warnings after settling with the state. (See photograph above of warnings posted at Benihana’s in Santa Monica and sign posted over the sushi bar at Benihana of San Diego on the bottom right.) Unfortunately, Benihana corporate headquarters responded to GotMercury.Org that they do not intend to warn their customers outside of California.

In each restaurant, two orders of sushi with tuna were requested. One sushi was a typical nigiri (fish on top of rice) and usually listed as maguro or tuna. Another order of tuna in a tuna roll, or makizushi, was ordered. In all the restaurants, the staff was asked what species of tuna they were serving. Tuna samples were sent to a San Diego California testing facility for total mercury analysis.



Types of Sushi

Sushi is usually served as “*nigiri*” style (“nigirizushi” in Japanese), which is rice covered with fish or shellfish and served in pairs, or as a “*maki*” style (“makizushi” in Japanese), which is roll of rice surrounding a center of fish or shellfish and possibly other ingredients. There are other types of sushi, but these are the most common and most familiar to sushi lovers.

Variations on the shape and size occur between sushi restaurants, but almost all carry tuna sushi. Nigiri zushi often comes labeled as either “*toro*” or “*maguro*.” These refer to where the meat comes from on the tuna rather than species. “*Toro*” refers to fatty tuna from the belly of the fish and is the most prized sushi. “*Maguro*” refers to generally to cuts of tuna from elsewhere on the fish.



Sashimi, another popular item at Japanese restaurants, is simply a dish of top-grade raw fish served to the consumer. The amount is equivalent to eating a steak of tuna or other fish.

Types of Tuna

There are several species of tuna served in sushi restaurants. Bluefin tuna, an extremely overfished species, is the most sought after. Bigeye tuna and yellowfin tuna are also desirable as toro and maguro sushi. Because of the popularity of albacore in the US, some sushi menus include albacore sushi, or shiromaguro, on their menus. “Ahi” the generic Hawaiian term for tuna has also become associated with sushi and sashimi. Ahi typically refers to yellowfin tuna, bigeye tuna, or albacore tuna. Although most patrons do not ask, a sushi order could include any of these various species of tuna, which also vary in their mercury levels.

Tuna Species	FDA Mercury Data	Scientific Name	Japanese Names	Hawaiian Names
Albacore	0.357 ppm	<i>Thunnus alalunga</i>	shiromaguro, tombo, bincho, binnaga	`ahipalaha, tombo `ahi
Bigeye	0.639 ppm	<i>Thunnus obesus</i>	bachu, mebachi	`ahi, `ahi po`o nui
Bluefin	NA	<i>Thunnus thynnus</i>	maguro, kuromaguro	
Bonito	NA	<i>Sarda sarda</i>	katsuo	
Skipjack	0.205 ppm	<i>Katsuwonus pelamis</i>	katsuo	aku
Yellowfin	0.325 ppm	<i>Thunnus albacares</i>	kihada	`ahi

The FDA has done limited testing of the tuna species commonly served as sushi. There is no public data available for bluefin tuna despite the popularity of sushi in the US. However, the Japanese government released test data that showed bluefin tuna averaging 1.305 ppm – well over the FDA action level.⁸

Other species of tuna exist, but the most common ones found in US sushi restaurants are discussed here to focus on the dangerous levels of mercury consumers are exposed to without warning.

Mercury in Sushi Tuna in San Diego Results

Restaurant	Mercury PPM	Tuna	Sushi
Benihana	0.967	bluefin	nigiri
Kanpai	0.900	yellowfin	roll
Benihana	0.875	bluefin	roll
Sushi Ota	0.794	bluefin	roll
Mr. Sushi	0.702	bigeye	nigiri
Café Japengo	0.697	yellowfin	nigiri
Ra Sushi	0.658	bluefin	roll
Sushi Ota	0.642	bluefin	nigiri
Mr. Sushi	0.616	bigeye	roll
Café Japengo	0.525	yellowfin	roll
Zenbu	0.417	yellowfin	roll
Zenbu	0.385	yellowfin	nigiri
Ra Sushi	0.367	bluefin	nigiri
Kanpai	0.365	yellowfin	nigiri
Taka	0.338	bigeye	nigiri
Taka	0.327	bigeye	roll
Arigato	0.282	yellowfin	roll
Arigato	0.280	yellowfin	nigiri
Samurai	0.134	yellowfin	roll
Samurai	0.128	yellowfin	nigiri

The mercury levels of the tuna sampled was an average of 0.520 parts per million (ppm) total mercury and a median of 0.471 ppm total mercury. San Diego tuna averaged 136% more than what the FDA reports for tuna.

Overall, 15% of the tuna samples were near the federal legal limit of 1.0 ppm. Benihana’s tuna had the highest levels, 0.967 ppm and 0.875 ppm, dangerously near the 1.0 ppm federal limit for all consumers, including men, women, and children. By comparison, 25% of the Los Angeles tuna sushi were at this high level.

One out of five samples (20%) exceeded 0.730 ppm of average for King Mackerel, which the FDA and EPA say women and children should never eat. Combined with our Los Angeles results, one out of four samples (25%) exceeded what is considered safe for women and children to eat in any quantity.

Half of the San Diego tuna samples exceeded 0.5 ppm. The US doubled the federal mercury standard from 0.5 ppm to 1.0 ppm in 1979. Most developed countries have a limit of 0.5 ppm and US has one of the weakest standards. In Los Angeles, 75% of tuna exceeded 0.5 ppm.

Yellowfin tuna in San Diego and Los Angeles had an average mercury concentration of 0.566 ppm and a median of 0.515 ppm. Yellowfin in our two studies had 158% more than averages that the FDA reports for yellowfin tuna, only an average of 0.325 ppm of mercury.

Bluefin tuna in San Diego and Los Angeles had an average of 0.674 ppm total mercury and a median of 0.686 ppm. The FDA has failed to publish any data of bluefin tuna on mercury levels in fish and shellfish.



Bigeye tuna, reported in only San Diego, averaged 0.496 ppm and with a median of 0.477 ppm. However, restaurants only reported that they were serving bigeye tuna in two locations.

Bigeye tuna and yellowfin tuna are difficult to distinguish at earlier life stages and even suppliers may not know. Furthermore, availability of tuna in a particular city should by not be extrapolated to apply to other cities where the types of tuna served could vary.

The most important point of this sampling is that even in the same restaurant, consumers have no way of knowing how much mercury they are exposing themselves to whenever they order tuna, whether its in sushi, sashimi, or sold as an ahi steak.

Eating sushi and sashimi has become mercury Russian roulette. High-risk groups like women and children should be especially careful to avoid tuna in sushi restaurants, but all consumers might take commonsense precautions to find safer alternatives when dining. Sushi lovers outside of California should not assume that their tuna is any safer and should expect that mercury levels could vary widely.

Food and Drug Administration Mercury in Seafood Advisory

In March 2004, the Food and Drug Administration and the Environmental Protection Agency issued a joint mercury in seafood advisory.⁹ The advisory is directed at women of childbearing age and children. The FDA and EPA advise:

1. Do not eat Swordfish, King Mackerel, Shark, or Tilefish because they contain high levels of mercury.
2. Eat up to 12 ounces (2 average meals) a week of a variety of fish and shellfish that are lower in mercury.
 - o Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, pollock, and catfish.
 - o Another commonly eaten fish, albacore ("white") tuna has more mercury than canned light tuna. So, when choosing your two meals of fish and shellfish, you may eat up to 6 ounces (one average meal) of albacore tuna per week.
3. Check local advisories about the safety of fish caught by family and friends in your local lakes, rivers, and coastal areas. If no advice is available, eat up to 6 ounces (one average meal) per week of fish you catch from local waters, but don't consume any other fish during that week.

California Proposition 65 Mercury-In-Seafood Warning Signs

In California, Proposition 65 requires any business with more than 10 employees to post mercury-in-seafood signs. After lawsuits by California Attorney General Bill Lockyer, restaurants named in the suit settled in February 2005 and began posting warnings for restaurant customers. Benihana was amongst several large restaurant chains in California that agreed to post warnings for consumers last year.

Turtle Island Restoration Network and As You Sow Foundation filed the original intent to sue notice against restaurants and supermarkets in California for failing to post Proposition 65 warnings. Attorney General Lockyer's office took up the suits and additionally filed against canned tuna companies. California supermarkets are posting warnings under an interim settlement and the canned tuna trial is currently in its final stages.

Outside of California, voluntarily posting point-of-sale mercury advisories is a growing national trend amongst conscientious retailers to protect their customers from unnecessary mercury exposure. Since 2003, Wild Oats has posted mercury warnings in all its stores. Since October 2005, Safeway has begun posting warnings outside of California. Other supermarket chains, such as Albertson's, Wal-Mart, and Trader Joe's, have made public promises to provide warning signs. Copies of the types of signs posted are available online at <http://GotMercury.Org/info>.

Policy Recommendations

There are important public health policy issues that are relevant to this discussion of tuna and sushi. Our recommendations are summarized as follows:

1. The FDA should revise its warnings to include clarification of the warnings regarding tuna consumption by women and children.
2. Restaurants and grocery stores that sell sushi or other seafood should be required to post the FDA mercury advisory.
3. The FDA should improve food safety by requiring mercury testing of more fish and shellfish with inexpensive rapid testing technology now available.
4. Restaurants and grocery stores should stop selling the fish known to be highest in mercury and that frequently exceed the FDA action levels unless seafood suppliers provide proof that that fish being sold does not exceed the FDA's limits.
5. States and local governments should take the initiative to enact legislation similar to California's Proposition 65 law that requires mercury-in-seafood warnings at the point of sale.

The FDA and Tuna Recommendations:

Our results demonstrate a need for the FDA to take action regarding the mercury levels in tuna consumed as sushi and sashimi. Several key points can be drawn from our results.

First, the levels of mercury in king mackerel reported by the FDA average 0.730 ppm. If women and children should not be eating king mackerel, then they should not be eating several species of tuna. For example, the FDA published new data in 2006 that showed bigeye tuna, popular as sushi and sashimi though also sold as "ahi", averaged 0.639 ppm – nearly as high as king mackerel. However, the FDA has failed to alert women and children to this real and specific threat, despite the fact that tuna is the second most common fish eaten by the American public. Our test results show that individual tuna sushi or sashimi can result in exposures that are considered unhealthy by the FDA and that these tuna species should be included in the FDA list of fish to avoid for sensitive populations.

Second, it should be noted again that in our sampling, about half of all the tuna tested was near or above the average mercury level of king mackerel. Given that the FDA has told women and children not to eat fish with these levels, it would be unwise for those at-risk groups to expose themselves to mercury in tuna sushi or sashimi. There are alternatives that carry lower risk or no risk of mercury exposure and should be selected as part of a diverse and balanced diet.

Third, the FDA suggests that women and children can eat up to 6 ounces of albacore tuna per week (0.353 ppm for fresh or frozen). Although this contradicts what the EPA would consider safe, the FDA continues to make this recommendation. Tuna exceeded 0.353 ppm in 26 out of 32 samples from San Diego and Los Angeles.

Fourth, comparing the FDA data to our combined results showed some alarming differences. Our yellowfin tuna samples combined averaged 0.565 ppm, but the FDA only reports at 0.325 ppm. Although our sample size is smaller, consumers should be concerned by the large discrepancy and realize that mercury levels vary and can be dangerously high. It should also be noted that the FDA has failed to report data for bluefin tuna. In our study, bluefin tuna had an average of 0.674 ppm of mercury – nearly twice the levels reported for albacore.

The FDA reports all fresh or frozen tuna at an average of 0.383 ppm. For unknown species of fresh or frozen tuna, the FDA reports an average of 0.414 ppm. Our average for all 32 samples was 0.584 ppm, which is higher than FDA data.

Comparing our results with current FDA recommendations for albacore consumption, FDA consumption recommendations should be revised for tuna used as sushi and sashimi. Women and children, not knowing what tuna they are getting or what levels of mercury are present, should avoid tuna in sushi and sashimi. These differences between our findings and the FDA also highlight the need for more extensive testing of mercury in fish and shellfish on a national level.

The FDA should respond to its own new data and other sources of information regarding the high levels of mercury in tuna and do the following:

1. Update the FDA warning to clarify tuna warnings and to include clear advice on avoiding nearly all tuna because of the risks. Tuna mercury levels merit improved warnings.
2. Require more testing of fish and shellfish on a national scale with new, affordable rapid testing technology. Currently, the FDA only tests about 1% of our national food supply. By comparison, Canada requires 15% of imported seafood to be tested. The European Union has a rapid alert system that pulls fish from the market when seafood exceeds standards.
3. The FDA should pull any fish from the market that exceeds 1 ppm of mercury.

Restaurants and Supermarkets Selling Sushi Recommendations:

Restaurants should take affirmative steps to inform consumers with mercury-in-seafood advisories and avoid liability for failure to warn customers of a known public health risk. Benihana currently warns customers in California and it should demonstrate corporate responsibility and warn consumers in all states where it sells sushi. Likewise, if California law requires postings, but no enforcement lawsuits have taken place for Los Angeles restaurants, then

sushi restaurants should avoid liability by acting now to comply with Proposition 65. Those restaurants exempt from Proposition 65 should voluntarily warn women and children as a public health service. *Zagat Survey* signs bring customers and mercury warnings will enable customers to make confident seafood choices when they dine.

Restaurants and supermarkets that sell sushi can also elect not to serve those fish known to be highest in mercury. Although mercury advisory signs are a direct, simple method for alerting consumers, businesses that sell sushi and sashimi might decide that, without better screening by the FDA, the risks to consumers are too great.

Restaurants can and should require their suppliers to test seafood before purchase. Restaurants should not take possession of any fish that has mercury levels exceeding the FDA's 1.0-ppm "actionable level." Restaurants may want to set their own levels below those of the FDA and inform their patrons that they serve seafood well below the mercury levels set by the FDA. Restaurants with higher mercury standards can provide clients with greater protection from unnecessary mercury exposure. The new rapid technology mercury technology mentioned above provides seafood suppliers with an economical tool for accomplishing greater screening for restaurants. The cost to consumers is merely pennies per pound – something worth doing to protect women and children.

Recommendations to State Legislators:

Californians currently enjoy stronger protection under Proposition 65, a consumer right-to-know law. Illinois has proposed similar legislation. States, especially coastal states where seafood consumption is highest, should pass their own laws to protect consumers by requiring businesses to post FDA advisories and any state warnings regarding mercury levels in fish and shellfish at the point of sale.

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¹ Committee on the Toxicological Effects of Methylmercury, Board on Environmental Studies and Toxicology, National Research Council. [Toxicological Effects of Methylmercury](#). (2000).

² <http://www.cfsan.fda.gov/~dms/admehg3.html>

³ Committee on the Toxicological Effects of Methylmercury, Board on Environmental Studies and Toxicology, National Research Council. [Toxicological Effects of Methylmercury](#). (2000).

⁴ Oken, E. et al. *Maternal Fish Consumption, Hair Mercury, and Infant Cognition in a U.S. Cohort*. Environmental Health Perspectives, 2005, 113:10. <http://ehp.niehs.nih.gov/members/2005/8041/8041.pdf>

⁵ Virtanen, J. K. et al., *Mercury, Fish Oils, and Risk of Acute Coronary Events and Cardiovascular Disease, Coronary Heart Disease, and All-Cause Mortality in Men in Eastern Finland*. Arterioscler Thromb Vasc Biol. 2005, 25:228-233. <http://atvb.ahajournals.org/cgi/content/abstract/25/1/228>

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⁶ <http://www.zagat.com/about/about.aspx?menu=PR43>

⁷ http://www.benihana.com/investor_relations.asp

⁸ <http://www.mhlw.go.jp/english/wp/other/councils/mercury/index.html>

⁹ <http://www.cfsan.fda.gov/~dms/admehg3.html>