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WHAT'S ON THE HOOK?

MERCURY LEVELS AND FISH CONSUMPTION SURVEYED AT A GULF OF MEXICO FISHING RODEO

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EXECUTIVE SUMMARY:

In the past few years, seafood lovers have become increasingly concerned about mercury levels in Gulf of Mexico fish. Unfortunately, anglers have not had the information they need to help them decide which fish may be safer to eat, despite the fact that recreational anglers and their families typically eat more fish than the average population. In fact, recent studies have found that people who live in coastal areas of the United States have higher levels of mercury in their blood than residents from inland areas.[1] The purpose of this report is to help provide information to recreational anglers in the Gulf of Mexico on which fish may be higher in mercury than others, which would be safer to eat, and which species are in need of further monitoring.

Oceana sponsored and partnered with the 73rd annual Alabama Deep Sea Fishing Rodeo on July 15-17, 2005, to sample fish for mercury levels, with the invaluable help of Rodeo anglers. Oceana also conducted a pilot survey of fish preferences and consumption rates among attendees. This report provides data on 190 fish from 30 species, some of which were tournament winners. Since the number of samples from any one species is small, and since mercury levels often increase with fish size, the results from the Rodeo alone are not a comprehensive assessment of Gulf of Mexico fish mercury levels. Rather, these results offer a glimpse of possible mercury levels in fish that Rodeo anglers land. Our comparisons of Rodeo fish results with those from other Gulf states give a more representative assessment of where problems may exist and more monitoring is warranted.

MAJOR FINDINGS:

- Nearly half of the species (fourteen out of thirty sampled) had average mercury concentrations above 0.5 parts per million (ppm), the level at which Florida and Louisiana issue consumption advisories. The species with levels above 0.5 ppm included cobia (ling), Spanish mackerel, blackfin tuna, amberjack, black drum, gag grouper, barracuda, wahoo, bluefish, bonito, king mackerel, gafftopsail catfish, crevalle jack, and ladyfish. Four of these: king mackerel, barracuda, cobia, and bonito; had average mercury levels exceeding 1 ppm, the United States Food and Drug Administration (FDA) action level and the level at which Alabama and Mississippi currently issue advisories for no consumption.

- Most people surveyed eat a wide variety of seafood. The first five species listed above are consumed moderately to frequently, according to Oceana's survey. However, many popular species are relatively low in mercury. The lowest average mercury levels were observed in vermilion snapper, tripletail (blackfish), flounder, dolphin (mahi mahi), and gray triggerfish.

- Highest mercury levels in individual samples were from the two king mackerel (3.97 and 3.56 ppm), followed by a cobia (ling) (3.24 ppm). These were the only samples over 3 ppm mercury.

- Five of the fish species had the highest mercury levels for individual fish ever recorded for the Gulf based on the limited Gulf data available. These included (in ppm): a cobia (3.24), an amberjack (1.57), a bonito (little tunny) (1.60), a yellowfin tuna (0.60), and a hardtail (0.83).

- Average mercury levels of groupers, one of the most frequently consumed fish, were similar to albacore tuna, a fish that is targeted for limited consumption in the most recent FDA/Environmental Protection Agency (EPA) fish advisory for women of childbearing age and children.

- In our survey, the most frequently consumed fish – snappers, groupers and yellowfin tuna – average in the low to mid-range for mercury. However, government data on the two most consumed species, red snapper and yellowfin tuna, in the Gulf of Mexico, are woefully lacking.

RECOMMENDATIONS:

- Rodeo and other available Gulf data suggest that cobia (ling), blackfin tuna, barracuda, amberjack, bluefish, large Spanish mackerel, gafftopsail catfish, and crevalle jack warrant consumption advisories in the Northern Gulf.

- Due to its popularity and high rate of consumption in the Gulf region, grouper may also warrant consumption advisories.

- Women of childbearing age and children should not eat Gulf king mackerel, tilefish, and shark, as recommended by the FDA and EPA.

- States and the EPA should aggressively work to reduce mercury emissions and releases from sources such as chlor-alkali plants and coal-fired power plants, and to clean up mercury from hazardous waste sites.

- Alabama, Mississippi, Louisiana, and the Northern Florida Gulf should share monitoring data for under-sampled, popular northern Gulf fish common to non-state waters and coordinate fish advisory information for recreational anglers.

- Government agencies should develop and fund a systematic research and testing program that would:

  - Determine whether there are certain sizes of higher mercury fish that may be safer to consume.

  - Increase monitoring for fish that are higher in mercury and/or are popularly consumed, but for which there is a paucity of data, such as red snapper and yellowfin tuna.

  - Refine understanding of Gulf fish consumption levels and identify at-risk groups.

  - Fill data gaps in our understanding of mercury in the Gulf of Mexico, such as those identified by the Federal Interagency Working Group on Methylmercury.[2]

INTRODUCTION:

MERCURY is a naturally occurring element that exists in several forms. While mercury can be emitted by natural processes such as volcanoes and forest fires, it is estimated that human activities have increased the amount of mercury in the environment by a factor of two to five.[3] There are many sources of inorganic mercury to the Gulf of Mexico, including chlorine production, oil and gas production, emissions from coal-fired power plants, loading from rivers, and other past and present industrial practices. Moreover, recent studies reveal that the Gulf region has some of the highest atmospheric mercury deposition in the United States.[4] Mercury deposited to water or in runoff can be converted by naturally occurring bacteria to methylmercury, the more toxic organic form that accumulates in fish. The numerous wetlands, shallow bays, warm waters, and other conditions in the Gulf region likely provide good environments for producing methylmercury. However, much more research is needed on methylmercury formation in marine environments and its incorporation into Gulf fish.[5]

People are exposed to mercury primarily from eating fish. Some types of fish contain more mercury than others, due to differences in feeding habits, growth rate, size, and location. Slow-growing, longer-living, top predator species, particularly larger individuals, tend to have the highest amounts of mercury, because methylmercury is not easily eliminated and accumulates over time as fish grow. Fish containing higher levels of mercury or that are eaten more frequently are of greatest concern, especially for sensitive groups of people. In 2004, the EPA and FDA advised women of childbearing age and young children not to eat king mackerel, shark, swordfish, and tilefish due to high levels of mercury, and to limit their consumption of fresh tuna and canned albacore (or white tuna) to no more than one meal (6 oz.) a week. Although tuna species typically have lower levels of mercury than the other four fish named in the advisory, tuna is eaten far more frequently. In addition, the EPA advises limiting sport-caught fish to one meal a week if no local advisories are available. King mackerel is the only coastal sport fish under advisory in Alabama. At present, there is a different advisory for king mackerel for each Gulf state, but a coordinated Gulf-wide advisory is being developed. Outside of Florida, king mackerel is the only coastal sport fish under a state fish consumption advisory in the Gulf.

Concerns about mercury in Gulf of Mexico fish surfaced several years ago following reports of high concentrations in several kinds of popular recreational and commercial fish and elevated mercury levels in some Alabama Gulf residents who consumed these fish frequently.[6] Because they tend to consume more fish, recreational anglers may be exposed to more mercury than others. In fact, recent studies have found that people who live in coastal areas of the US have higher levels of mercury in their blood than do residents from inland areas.[7] Due to these concerns, Oceana sponsored and partnered with the 73rd Annual Alabama Deep Sea Fishing Rodeo (ADSFR or Rodeo) in Dauphin Island, Alabama to sample recreational fish for mercury. Oceana also conducted a pilot survey of fish preferences and consumption among attendees of the Rodeo during July 15-17, 2005.

Recent studies have found that people who live in coastal areas of the US have higher levels of mercury in their blood than do residents from inland areas.

Our goals were to:

- Sample a wide variety of recreational fish for mercury levels with the help of Rodeo anglers.
- Compare our results to other Gulf monitoring data in order to estimate which species of fish without advisories have mercury levels of concern and which are safer to consume.
- Estimate preferences and consumption rates of fish landed at the Rodeo in order to help determine where more testing is needed.

The benefits of working with the Rodeo, the oldest salt water fishing tournament in the nation, were many. First, this competition lands more species of fish than any other tournament in the US. With the invaluable help of participating anglers, we were able to obtain samples from many species that otherwise would have been very costly to sample. Second, we benefited from a Rodeo tradition that allows scientists easy access to the large variety of fish landed. This popular event also draws many spectators whom Oceana could survey for fish preferences and consumption rates. Finally, anglers' participation in this study helps to raise awareness about levels of mercury in fish. This awareness should help protect the health of these high fish consumers and that of their families, while still allowing them to enjoy the many low-mercury Gulf fish.

At the Rodeo, Oceana sampled 190 fish representing 30 species, some of which were tournament winners. We did not focus on fish species for which fish consumption advisories already exist, such as king mackerel and shark (we sampled only two of the former and none of the latter). We also conducted a pilot survey of fish preferences and consumption rates among 63 Rodeo attendees.

Since the number of samples from any one species is small, and since mercury levels often increase with fish size, the results from the Rodeo alone are not a comprehensive assessment of Gulf of Mexico fish mercury levels. Rather, these results offer indications of mercury levels in fish landed by Rodeo and other recreational anglers. Comparisons of Rodeo fish results with those from other Gulf states (see Table A2) provide a more complete picture of where concerns may exist and more testing is warranted.

RESULTS:
MERCURY LEVELS

A summary of average mercury data on 30 species from the 2005 ADSFR is presented in Table 1. Raw data on the 190 individual fish are in Appendix Table A1. This study provides the first Gulf mercury data of which we are aware for some fish (e.g., gray triggerfish and bigeye tuna) and significantly increases the amount of publicly available Gulf mercury data for several other species, including yellowfin tuna, vermilion snapper, hardtail, wahoo, Warsaw grouper, and scamp grouper.

Mercury results from individual samples ranged from less than 0.04 ppm (parts per million or mg mercury per kg of wet fish tissue) to 3.97 ppm (Table A1). Forty-three percent of individual samples were at or above 0.5 ppm mercury, the level at which Florida and Louisiana issue limited consumption advisories. The remaining 57 percent were below 0.5 ppm. Alabama and Mississippi currently issue "no consumption" advisories when mercury levels exceed 1 ppm. In this analysis, 13% of fish tested exceeded that level.

The highest mercury levels were from the two sampled king mackerel (3.97 and 3.56 ppm), followed by cobia (ling) (3.24 ppm), the only 3 samples over 3 ppm mercury.

The mercury levels (in ppm) for five Rodeo fish: a cobia (3.24), an amberjack (1.57), a bonito (little tunny) (1.60), a yellowfin tuna (0.60), and a hardtail (0.83) are the highest known from available and often limited Gulf data.

Four species – king mackerel, barracuda, cobia (ling), and bonito (little tunny) -- had average mercury concentrations exceeding 1 ppm, the current FDA, Alabama, and Mississippi "no consumption" advisory levels (Table 1). In addition to the Gulf and Federal king mackerel advisories, Florida lists barracuda, cobia, and bonito in their "Do not eat" advisory for women of childbearing age and children and advises limiting consumption to one meal per month for all others.[8] Our single crevalle jack sample also exceeded 1 ppm. This species is on Florida's limited consumption advisory list.

Nine additional species had average mercury concentrations exceeding 0.5 ppm: blackfin tuna, wahoo, ladyfish, amberjack, bluefish, Spanish mackerel, gafftopsail catfish, black drum, and gag grouper. Florida advises that women of childbearing age and children "Do not eat" blackfin tuna and to limit consumption of these other fish (except black drum) to one meal per month. Florida advises the same group to limit black drum meals to one meal per week.

Five species, including several snappers and groupers, had average mercury concentrations roughly between 0.5 ppm and the more conservative 0.3 ppm EPA fish tissue methylmercury criterion set to protect human health. This criterion is a concentration of methylmercury in fish that is expected to be without appreciable risk to human health, based on the average US fish consumption level. Reportedly, Alabama is now considering adoption of the more conservative EPA approach in issuing its recreational fish consumption advice.[9] The remaining 11 species had average mercury levels below any present government criteria or action levels.

	Mercury (ppm)		
Fish common name	Average	Range	# Samples
Above 1 ppm (FDA, Alabama, and Mississippi Advisory Level)			
King Mackerel	**3.76**	3.56-3.97	2
Barracuda (Great)	**1.66**	1.40-1.90	3
Cobia (ling)	**1.64**	0.70-3.24	8
Bonito (Little tunny)	**1.44**	1.20-1.60	5
Crevalle Jack	**1.01**		1
Above 0.5 ppm (Florida and Louisiana Advisory Level)			
Blackfin tuna	**0.90**	0.31-1.20	6
Wahoo	**0.82**	0.27-1.29	5
Ladyfish	**0.79**	0.67-1.08	5
Amberjack (Greater)	**0.77**	0.44-1.57	13
Bluefish	**0.68**	0.51-0.83	7
Spanish Mackerel	**0.64**	0.21-1.23	6
Gafftopsail catfish	**0.60**	0.49-0.70	5
Black Drum	**0.54**	0.19-0.89	2
Gag grouper	**0.51**	0.28-0.71	10
Above 0.3 ppm (EPA Methylmercury criterion)			
Hardtail (blue runner)	0.45	0.10-0.83	5
Grey Snapper	0.45	0.33-0.56	8
Red Snapper	0.39	0.09-0.81	10
Red Grouper	0.32	0.18-0.56	7
Speckled trout	0.31	0.09-0.70	10
Below present government criteria levels			
Sheepshead	0.29	0.09-0.62	5
Scamp grouper	0.24	0.09-0.42	8
Yellowfin tuna	0.22	0.06-0.60	10
White trout	0.22		1
Warsaw Grouper	0.20	0.20-0.20	2
Gray Triggerfish	0.18	0.02-0.59	8
Bigeye Tuna	0.18	0.05-0.30	2
Dolphin	0.15	0.02-0.25	10
Flounder (Southern)	0.09	0.02-0.17	8
Blackfish (Atlantic tripletail)	0.06	0.02-0.22	10
Vermilion Snapper (Beeliner)	< 0.04	< 0.04	8

Table 1. Mercury levels in Rodeo landed fish species.

Government agencies frequently recommend that anglers choose smaller sized fish for consumption to reduce mercury exposure from any particular fish species.

COMPARISONS TO OTHER DATA FROM THE GULF

While the mercury levels in these samples may be typical of the fish Rodeo anglers land, the large size of the tournament fish may mean that values reported here are higher than those typically caught by recreational anglers. For 18 species we tested one or more tournament winners (1st, 2nd, or 3rd place, labeled with an asterisk {*} next to the weights in Appendix table A1). For perspective, we compared the mercury levels and size data of our Rodeo fish with data on other Gulf fish where possible (Table A2).

For most fish species, the Rodeo average lengths are similar to the average lengths of one or more Gulf States data sets. However, the average size of Rodeo landed grey snapper, gag grouper, black drum, sheepshead, and speckled trout are considerably larger than those from surrounding states. This greater size may explain, in part, their higher average mercury levels. For example, the average mercury level for 62 speckled trout from Alabama's monitoring program is 0.18 ppm, considerably lower than those we sampled at the Rodeo (0.31 ppm) (Table A2).

On the other hand, the average mercury levels for cobia, blackfin tuna, amberjack, bluefish, barracuda, gafftopsail catfish, and crevalle jack appear consistently elevated (above 0.5 ppm) in surrounding state monitoring data (Table A2), and are thus consistent with the Rodeo mercury levels for these species.

Government agencies frequently recommend that anglers choose smaller sized fish for consumption to reduce mercury exposure from any particular fish species. Tournament anglers, however, target the largest individuals, while the size class with the lower mercury level may be near the legal size limit. From the data available to us, it appears that many of the pelagic and migratory species (see Table A2) follow the expected trend – mercury levels increase with the size of the fish. Most of these pelagic fish (those that feed from the water), except dolphin, achieve quite high mercury levels as they grow, so it is important to be aware of this mercury/fish size relationship. On the other hand, mercury levels in several reef fish do not appear to increase with the size of the fish. This is particularly true of some groupers and snappers. One possible explanation is that site specific differences in mercury levels associated with different reefs may be more important than the size of the fish in determining its mercury levels. Clearly, more research and monitoring are needed to better understand this important question.

FISH CONSUMPTION

Because recreational anglers and their families typically eat more seafood than average, they may be more at risk from mercury exposure – depending on the mercury levels in the fish they consume. For this reason, we were interested in finding out which fish were most popular, and how much seafood anglers and other Gulf residents consumed. Together with our mercury testing, this information has helped to identify those species of greatest concern – those that are both higher in mercury and eaten frequently.

Because our survey was administered during the three-day Rodeo, most respondents were not participating Rodeo anglers (see side bar). Two-thirds of our 63 respondents were anglers, however, and all respondents ate some seafood.

Who were the respondents?

67.6% Anglers
9.5% Rodeo participants
52.6% Male
47.4% Female
82.8% from Alabama
8.6% from other Gulf states
8.6% from non-Gulf states

Most participants were age 18-30 (34.9%) or 41-50 (30.2%)

Note: All survey respondents eat seafood.
Sixty-one percent of respondents buy half or more of seafood consumed

HOW MUCH SEAFOOD DO GULF RESIDENTS EAT?

When asked how much total fish and shellfish (sport caught and purchased) survey respondents ate, most people said they eat either 1-2 meals per week or 1-3 meals per month (Figure 1). The average consumption rate was slightly higher than one six ounce meal per week or 30 grams per day. This means the estimated seafood consumption rate for these Gulf coast residents is nearly twice as high as those seen in some national surveys, as we might have anticipated.[10] These rates, however, are consistent with those found in another survey of Alabama anglers[11] used by the state. About ten percent of those surveyed ate seafood more than three times per week, and roughly two percent consumed fish five or more times per week. This group with higher consumption rates may be at greater risk for mercury exposure, depending on which species they consume most. Despite the high proportion of recreational anglers in the survey, less than 40 percent ate mostly sport-caught fish.

Most people surveyed eat a wide variety of seafood, averaging 12 different types of fish and shellfish (with a range of 2-29 types). Shrimp and crab, usually low in mercury, were the most popular seafood consumed outside of Rodeo landed fish.

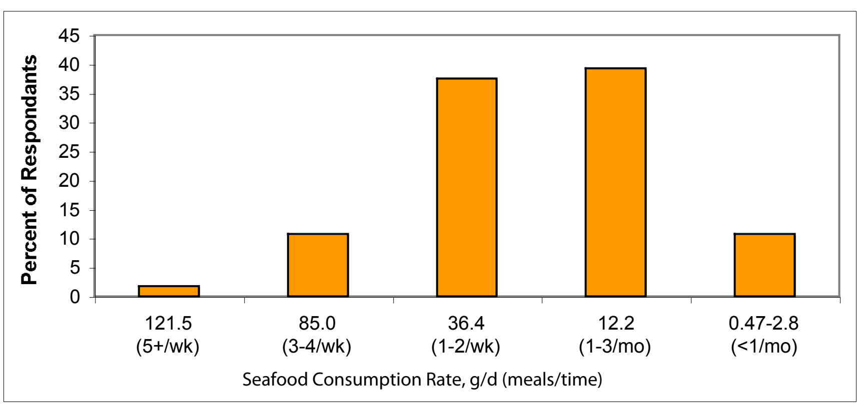

Figure 1. Overall seafood consumption rate distribution

The consumption rank of Rodeo landed fish from our survey respondents is shown in Figure 2. The two most consumed fish of those surveyed were red snapper and yellowfin tuna. Those responding to the survey ate far greater amounts of these fish than most other types. The next two most popular fish were flounder and grouper, also consumed at higher rates than most other fish on the survey.

RED SNAPPER AND YELLOWFIN ARE MOST CONSUMED FISH

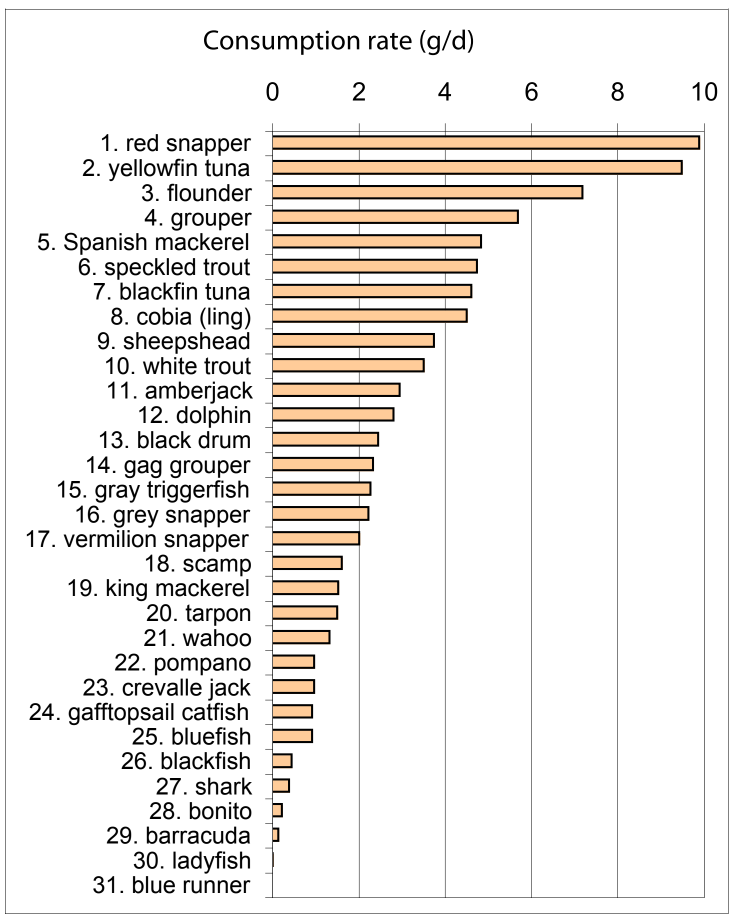

Figure 2. Reported consumption rates of Rodeo landed fish

Four species with higher mercury levels rank as either highly or moderately consumed in our survey: Spanish mackerel (5th); blackfin tuna (7th); cobia (ling) (8th), and amberjack (11th).

FISH CONSUMPTION AND MERCURY LEVELS

Table 2 shows fish consumption levels in relation to relative mercury levels in those fish, based on our Rodeo survey and testing results. Many fish with moderate to high consumption levels were relatively low in mercury, including the popular yellowfin tuna, flounder, and speckled trout. Of most concern are four fish species with higher mercury levels that rank as either highly or moderately consumed in our survey: Spanish mackerel (5th); blackfin tuna (7th); cobia (ling) (8th), and amberjack (11th). Black drum may also be of concern, but more data are needed on this species. Other fish with higher mercury levels do not appear to be eaten as frequently.

Some fish that are both moderately contaminated with mercury and moderately to frequently consumed may also present some concern for sensitive groups. For example, grouper is a fish whose average mercury levels are close to those for albacore tuna, which is currently under an FDA/EPA consumption advisory due to its popularity – despite its moderate mercury levels. The same reasoning could apply in the Gulf, where grouper is very popular in markets and on restaurant menus. Although consumers frequently do not know what type of grouper they are eating, some species seem to have higher levels than others. For example, gag grouper mercury levels were roughly twice those for scamp and Warsaw groupers in our study (Table 1).

Given that red snapper and yellowfin tuna are the top consumed fish, the dearth of recent, reliable Gulf data on their mercury levels is surprising. There is some debate over mercury levels in red snapper, due to a few reported high values in some Atlantic and Gulf fish.[12] We sampled a broad size range and obtained a relatively low average level for mercury. We did not, however, sample any tournament winners, which might have had higher levels.

It is important to keep in mind that minimizing mercury exposure depends not only on the amount of mercury in the fish, but also on how much one consumes, and the body weight of the individual. For example, given the average weight of our survey respondents (74 kg), and their average fish consumption level (30 grams per day), they could safely consume fish with an average mercury level of 0.25 ppm (most of the fish in the green zone on Table 1) and not exceed the EPA "safety dose" for methylmercury. Women of childbearing age, children, and other sensitive groups may wish to consult the EPA risk-based consumption limit guidelines (Table A3), which lists the amount of fish which may be safely consumed in one month, based on mercury levels in the fish of interest.

SOME POPULAR FISH ARE HIGH IN MERCURY

	Consumption Rates		
	High	Medium	Low
Mercury levels ↓	Yellowfin Tuna Flounder Speckled Trout (Spotted Seatrout)	White Trout (Sand Seatrout) Dolphin Gray Triggerfish Vermilion Snapper Sheepshead	Scamp grouper Blackfish (Tripletail)
	Red Snapper Grouper (all)	Gray Snapper Gag grouper	Hardtail (Blue Runner)
	Spanish Mackerel Blackfin Tuna	Amberjack Black Drum	Wahoo Gafftopsail catfish Bluefish Ladyfish
	Cobia (Ling)		King Mackerel Barracuda Bonito (Little tunny) Crevalle jack

Table 2. Reported Consumption Rates of Rodeo Fish and their Relative Mercury Levels

Colors show relative mercury levels.
In general:
red (>1 ppm), orange (>0.5 ppm), gold (>0.3 ppm),
and green (<0.3 ppm).

RECOMMENDATIONS:

- Rodeo and other available Gulf data suggest that cobia (ling), blackfin tuna, barracuda, amberjack, bluefish, large Spanish mackerel, gafftopsail catfish, and crevalle jack would warrant consumption advisories in the Northern Gulf.

- Due to its popularity and high rate of consumption in the Gulf region, grouper may also warrant consumption advisories.

- Women of childbearing age and children should not eat Gulf king mackerel, tilefish, and shark, as recommended by the FDA and EPA.

- States and the EPA should aggressively work to reduce mercury emissions and releases from sources such as chlor-alkali plants and coal-fired power plants, and to clean up mercury from hazardous waste sites.

- Alabama, Mississippi, Louisiana, and the Northern Florida Gulf should share monitoring data for under-sampled, popular northern Gulf fish common to non-state waters and coordinate fish advisory information for recreational anglers.

- Government agencies should develop and fund a systematic research and testing program that would:

    - Determine whether there are certain sizes of higher mercury fish that may be safer to consume.

    - Increase monitoring for fish that are higher in mercury and/or are popularly consumed, but for which there is a paucity of data, such as red snapper and yellowfin tuna.

    - Refine understanding of Gulf fish consumption levels and identify at-risk groups.

    - Fill data gaps in our understanding of mercury in the Gulf of Mexico, such as those identified by the Federal Interagency Working Group on Methylmercury.[13]

METHODS:

Study Area: Fish were landed at the 73rd Annual ADSFR at Dauphin Island, Alabama. Coordinates of the area fished over three days are: East: Longitude 85; West: Longitude 91; South: Latitude 28; North: All Gulf coast, including bays and inlets.

Fish Sampling Protocols and Analysis: Fish weight, fork length, species ID, and date of collection were recorded on samples selected for mercury analyses. Fish weights recorded in Table A1 are either official Rodeo weights or weights taken at the science station. An approximately one inch square plug of skinless, boneless left dorsal fish tissue above the lateral line was obtained with acid-washed, stainless steel knives and scalpels, placed in 4 mm zipper lock bags, labeled, and held on ice throughout each sampling day. Samples were then held frozen (-10°C) until shipped on ice to laboratories for total mercury analyses. Samples were shipped to an EPA-certified commercial lab and one federal government lab. At the commercial lab, fish tissue was homogenized according to method EPA 600/4-81-055 and analyzed for total mercury with cold vapor atomic adsorption using EPA method M7471A CVAA. Detection limits for this method were 0.04 ppm. One-half the detection limit (0.02) was used for those samples below detection when averaging values for a species. The government lab used EPA Method 7473, thermal decomposition, amalgamation, and atomic absorption spectrophotometry (TDAAAS). Detection limits for this method were < 0.01. Analytical QA/QC consisted of sample duplicate analyses, reagent blanks, spike sample recovery, and analysis of certified reference material. In addition, fish tissue from six fish was sent to both labs for analyses and inter-laboratory comparison. The government lab, using EPA method 7473, gave results that were, on average, 18 percent higher than those at the commercial lab. At this time, it is not entirely clear why these two EPA certified methods yielded different results. The results presented in this report were not adjusted in any way, but the method of analysis for each fish is noted in Table A1. All fish data are presented in parts per million (ppm) or milligrams of mercury per kilogram of wet fish tissue.

Fish Consumption Survey Methods: Attendees of the 2005 Alabama Deep Sea Fishing Rodeo were surveyed on July 15-17. Oceana, as a sponsor of the 2005 Rodeo, was provided an informational booth in a large tent through which attendees entered the Rodeo site. Interested attendees were asked to fill out the survey and offered help, if needed. The fish consumption survey was designed as a two-page assisted, self-administered, recall information questionnaire. No effort was made to control for recall bias. The survey had 16 questions in three sections: fish consumption and preferences, advisory awareness, and demographics. Sixty-three surveys were taken, though not all questions were answered on all surveys. The response rate for each question ranged from 51-100% with an average response rate of 79%.

Other data consulted: For comparisons presented in Table A2, other data on mercury levels in fish collected from bays, estuaries, and the Gulf were obtained from the Alabama Department of Environmental Management, the Louisiana Department of Environmental Quality,[14] the Florida Fish and Wildlife Conservation Commission,[15] and the Gulf of Mexico Program Gulfwide Mercury in Tissue Database.[16] The mercury averages from surrounding states presented in Table A2 are the mean of site averages in many cases.

APPENDICES:

ADSFR groups	Species	Date	Weight (lb)	Length (in)	Hg (ppm)	Method of analysis[a]
Amberjack	*Seriola dumerili*					
		7/15/05	26.31	38.0	0.53	1
		7/15/05	32.33	39.5	0.77	1
		7/15/05	53.06*	48.8	1.57	1
		7/16/05	34.00	39.8	0.64	1
		7/16/05	32.95	40.5	0.62	2
		7/16/05	22.58	35.5	0.89	2
		7/16/05	14.67	32.0	0.44	1
		7/16/05	28.00	39.0	0.93	2
		7/16/05	34.00	38.0	0.70	2
		7/16/05	27.50	38.5	0.86	2
		7/15/05			0.59	2
		7/15/05			0.69	2
		7/15/05			0.51	2
Barracuda (Great)	*Sphyraena barracuda*					
		7/15/05	24.75	47.3	1.67	3
		7/15/05	27.24	48.0	1.90	2
		7/15/05	17.20	46.8	1.40	2
Black Drum	*Pogonias cromis*					
		7/16/05	49.19*	43.3	0.89	1
		7/17/05	41.66	40.0	0.19	1
Blackfin Tuna	*Thunnus atlanticus*					
		7/15/05	13.41	27.8	0.31	1
		7/15/05	25.25	32.0	1.08	1
		7/16/05	28.96*	33.8	1.20	1
		7/16/05	22.40	31.5	0.98	1
		7/17/05	26.13*	33.5	1.04	2
		7/17/05	21.15	30.3	0.81	1

Table A1. Raw mercury data

NOTES:
*Tournament unofficial winning weight
a Method of mercury analysis (see report methods for details)
1: CVAA,
2: TDAAAS
3: Split sample, both methods used

ADSFR groups	Species	Date	Weight (lb)	Length (in)	Hg (ppm)	Method of analysis[a]
Blackfish: tripletail	*Lobotes surinamensis*					
		7/15/05	8.70	21.7	< 0.04	1
		7/15/05	9.60	22.3	< 0.04	1
		7/15/05	9.95	22.8	< 0.04	1
		7/16/05	15.97*	25.3	< 0.04	1
		7/16/05	9.53	21.5	0.09	2
		7/16/05	10.26	22.0	0.07	2
		7/16/05	6.11	20.0	< 0.04	1
		7/16/05	7.19	22.0	0.05	2
		7/17/05	11.00	24.8	0.22	2
		7/17/05	7.80	22.8	0.11	2
Blue Runner: Hardtail	*Caranx crysos*					
		7/16/05	1.31	14.0	0.19	1
		7/16/05	2.96	17.5	0.10	1
		7/16/05	6.8*	22.5	0.43	1
		7/16/05	4.5*	19.8	0.83	1
		7/17/05	3.69	18.8	0.81	3
Bluefish	*Pomatomus saltatrix*					
		7/15/05	4.00	19.9	0.57	2
		7/15/05	3.67	20.0	0.68	2
		7/15/05	2.32	17.0	0.65	2
		7/15/05	5.67*	22.8	0.80	2
		7/15/05	4.07	21.5	0.83	2
		7/16/05	5.25*	21.8	0.55	2
		7/17/05	4.55	20.3	0.51	2
Bonito: little tunny	*Euthynnus alletteratus*					
		7/15/05	7.72	25.0	1.20	2
		7/15/05	8.10	24.8	1.60	2
		7/16/05	9.00	27.3	1.50	2
		7/16/05	10.80	28.0	1.55	2
		7/17/05	8.90	26.3	1.35	2

ADSFR groups	Species	Date	Weight (lb)	Length (in)	Hg (ppm)	Method of analysis[a]
Gafftopsail catfish	*Bagre marinus*					
		7/15/05	4.50	20.8	0.70	2
		7/15/05	5.51	20.0	0.58	2
		7/16/05	6.12	22.5	0.60	2
		7/16/05	5.63	21.5	0.61	2
		7/16/05	5.35	21.8	0.49	2
Gray snapper	*Lutjanus griseus*					
		7/15/05	10.05	26.0	0.48	3
		7/15/05	7.42	23.5	0.52	1
		7/16/05	7.59	24.5	0.33	2
		7/16/05	9.42	26.5	0.42	2
		7/16/05	8.80	23.5	0.56	1
		7/17/05	10.42*	25.9	0.36	1
		7/17/05	7.90	24.5	0.35	1
		7/17/05	10.53*	25.8	0.55	2
Gag grouper	*Mycteroperca microlepis*					
		7/15/05	15.50	32.0	0.28	1
		7/15/05	33.67*	42.0	0.48	1
		7/15/05	14.37	33.3	0.47	1
		7/15/05	39*	45.0	0.57	1
		7/16/05	27.05*	39.3	0.37	1
		7/16/05	21.61	36.0	0.71	2
		7/16/05	21.90	38.3	0.62	2
		7/16/05	16.30	32.0	0.36	2
		7/16/05	20.37	35.0	0.52	2
		7/16/05	20.32	36.5	0.69	2
Scamp grouper	*Mycteroperca phenax*					
		7/16/05	17.06*	30.6	0.22	1
		7/16/05	10.09	27.8	0.19	1
		7/16/05	5.04	22.5	0.09	1
		7/16/05	12.24	29.3	0.42	1
		7/16/05	5.50	22.5	0.13	1
		7/16/05	10.00	28.5	0.33	1
		7/17/05	19.34*	32.8	0.40	1
		7/17/05	11.60	26.8	0.12	1

Table A1. Continued

ADSFR groups	Species	Date	Weight (lb)	Length (in)	Hg (ppm)	Method of analysis[a]
Jack Crevalle: Cavalla	*Caranx hippos*					
		7/15/05	19.35	33.5	1.01	2
King Mackerel	*Scomberomorous cavalla*					
		7/15/05	60.50*	60.4	3.97	3
		7/15/05	54.17*	57.8	3.56	2
Ladyfish	*Elops saurus*					
		7/15/05	2.42	19.5	1.08	2
		7/15/05	2.24	19.3	0.81	2
		7/15/05	2.05	19.1	0.67	2
		7/15/05	1.46	17.0	0.72	2
		7/15/05	1.50	18.0	0.67	2
Red snapper	*Lutjanus campechanus*					
		7/15/05	11.81	26.8	0.13	1
		7/15/05	2.75	16.6	0.10	1
		7/15/05	4.82	19.5	0.09	1
		7/15/05	8.10	23.4	0.23	2
		7/15/05	20.44	31.3	0.69	1
		7/16/05	21.55	33.3	0.81	2
		7/16/05	14.38	27.3	0.32	2
		7/16/05	16.78	30.0	0.63	3
		7/16/05	13.40	29.0	0.23	2
		7/16/05	20.26	32.3	0.67	2
Sheepshead	*Archosargus probatocephalus*					
		7/15/05	7.44*	22.8	0.09	1
		7/16/05	7.23	19.5	0.62	1
		7/17/05	5.50	18.8	0.28	2
		7/17/05	7.20	21.8	0.25	2
		7/17/05	5.30	19.8	0.21	2

ADSFR groups	Species	Date	Weight (lb)	Length (in)	Hg (ppm)	Method of analysis*
Vermillian snapper	*Rhomboplites aurorubens*					
(Beeliner)		7/15/05	3.30	18.3	< 0.04	1
		7/16/05	2.96	18.3	< 0.04	1
		7/16/05	3.75*	19.3	< 0.04	1
		7/16/05	4.31*	20.0	< 0.04	1
		7/17/05	2.50	16.8	< 0.04	1
		7/17/05	2.10	15.5	< 0.04	1
		7/17/05	2.30	16.5	< 0.04	1
		7/17/05	2.50	17.0	< 0.04	1
Wahoo	*Acanthocybiumsolandri*					
		7/15/05	56.59*	55.7	1.29	1
		7/16/05	22.79	44.3	0.27	1
		7/16/05	40.00	54.6	0.52	1
		7/16/05	41.00	56.8	0.77	1
		7/16/05	30.00	50.0	1.25	1
White trout: sand weakfi	*Cynoscion arenarius*					
		7/17/05	3.00*	19.5	0.22	1
Yellowfin Tuna	*Thunnus albacares*					
		7/15/05	57.17	45.5	0.36	2
		7/15/05	60.04	44.5	0.16	2
		7/16/05	93.40*	53.8	0.60	1
		7/16/05	53.06	45.5	0.21	2
		7/16/05	69.84*	45.0	0.18	2
		7/16/05	56.02	43.0	0.16	2
		7/16/05	52.00	42.8	0.06	1
		7/17/05	59.30	46.3	0.18	1
		7/17/05	96.63*	52.5	0.20	1
		7/17/05	51.57	43.5	0.09	1
red grouper	*Epinephelus morio*					
		7/16/2005	6.59	20.5	0.18	1
		7/16/2005	8.56	25.0	0.19	1
		7/16/2005	10.60	26.5	0.24	1
		7/17/2005	8.52	23.4	0.40	1
		7/17/2005	7.72	23.1	0.19	1
		7/17/2005	7.25	24.0	0.51	2
		7/17/2005	5.25	22.2	0.56	2
Warsaw grouper	*Epinephelus nigritis*					
		7/17/2005	25.00	34.5	0.20	1
		7/17/2005	38.75		0.20	1
Bigeye Tuna	*Thunnus obesus*					
		7/16/2005	32.70	36.0	0.30	1
		7/17/2005	39.25	38.5	0.05	1

ADSFR groups	species	Date	Wt. lb	Length inches	Hg ppm	Method of analysis*
Dolphin: Mahi Mahi	*Coryphaena hippurus*					
		7/15/05	19.95	37.3	0.09	1
		7/15/05	16.59	41.3	0.23	1
		7/15/05	15.38	40.0	0.25	2
		7/15/05	30.30	44.5	0.17	2
		7/16/05	4.25	24.0	< 0.04	1
		7/16/05	22.90	39.8	0.10	1
		7/16/05	38.47*	49.3	0.13	1
		7/16/05	18.37	40.5	0.21	2
		7/16/05	25.40	42.3	0.11	2
		7/17/05	28.60	44.5	0.15	2
Southern Flounder	*Paralichthys lethostigma*					
		7/15/05	1.90	16.5	0.09	2
		7/15/05	2.25	17.5	0.11	2
		7/16/05	2.50	17.8	0.10	2
		7/16/05	2.00	17.3	0.06	1
		7/17/05	1.86	16.5	0.02	1
		7/17/05	1.90	16.5	0.05	1
		7/17/05	4.04*	20.0	0.17	1
		7/17/05	2.80	19.3	0.12	1
Spanish Mackerel	*Scomberomorous maculatus*					
		7/15/05	4.27*	24.3	1.23	1
		7/15/05	3.57	23.0	0.76	1
		7/15/05	3.25	22.5	0.66	2
		7/17/05	3.02	22.5	0.22	2
		7/17/05	3.25	22.8	0.21	2
		7/17/05	3.67	22.5	0.77	3
Speckled trout: spotted wea	*Cynoscion nebulosus*					
		7/16/05	2.60	20.3	0.21	1
		7/16/05	4.30	23.5	0.27	1
		7/16/05	3.25	19.8	0.16	1
		7/16/05	2.60	20.0	0.16	2
		7/16/05	4.00	22.8	0.20	2
		7/16/05	4.75	24.8	0.70	2
		7/16/05	5.25	23.8	0.09	1
		7/16/05	4.50	23.5	0.33	2
		7/16/05	5.00	25.0	0.47	2
		7/17/05	6.42*	26.0	0.55	1
Trigger fish (gray)	*Balistes capriscus*					
		7/15/05	2.82	15.3	0.26	1
		7/16/05	4.10	18.0	0.07	1
		7/16/05	5.19	19.0	< 0.04	1
		7/16/05	5.00	19.5	0.23	1
		7/15/05	3.84	17.3	0.05	1
		7/16/05	3.07	16.3	0.02	1
		7/16/05	3.37	16.8	0.59	1
		7/17/05	3.25	16.5	0.19	1

Species	Mercury (ppm)					Length (in)			
	avg	min	max	# samples	source*	avg	min	max	# samples
Coastal Pelagics									
Cobia (Ling)	1.64	0.70	3.24	8	R	48.1	42.0	56.5	8
Cobia	0.95	0.10	3.03	39	L	46.1	34.8	60.4	39
Cobia	0.83	0.13	1.70	17	F	29.3	14.3	39.4	17
Cobia	0.51	0.32	0.84	3	M	15.2	13.9	16.7	3
Spanish Mackerel	0.64	0.21	1.23	6	R	22.9	22.5	24.3	6
Spanish Mackerel	0.32	0.18	0.52	18	L	20.8	11.1	26.7	18
Spanish Mackerel	0.46	0.10	3.00	268	F	13.2	6.2	25.2	268
King Mackerel	3.76	3.56	3.97	2	R	59.1	57.8	60.4	2
King Mackerel	1.26	0.13	5.90	88	L	41.3	13.0	70.4	88
King Mackerel	1.78	0.25	4.00	119	F	45.7	24.4	54.3	119
King Mackerel	1.57	0.88	2.66	120	A	39.3	0.0	0.0	120
King Mackerel	0.70	0.15	2.00	187	T	36.0	23.5	50.5	187
Offshore pelagics									
Wahoo	0.82	0.27	1.29	5	R	52.2	44.3	56.7	5
Wahoo	0.47			1	L	54.0			1
Wahoo	0.47	0.06	1.40	23	F	42.8	36.7	50.8	23
Barracuda	1.66	1.40	1.90	3	R	47.3	46.8	48.0	3
Barracuda	0.62	0.08	3.10	63	F	17.0	4.7	43.1	63
Dolphin (Mahi Mahi)	0.15	<0.04	0.25	10	R	40.3	24.0	49.3	10
Dolphin	0.15	0.00	0.41	33	L	40.5	17.0	60.2	32
Dolphin	0.11	0.04	0.49	33	F	31.7	16.1	51.4	33
Highly Migratory									
Blackfin Tuna	0.90	0.31	1.20	6	R	31.5	27.8	33.8	6
Blackfin Tuna	0.87	0.10	1.89	25	L	33.4	25.9	38.5	25
Yellowfin Tuna	0.22	0.06	0.60	10	R	46.2	42.8	53.8	10
Yellowfin Tuna	0.16	0.06	0.27	8	L	45.6	38.2	58.3	8
Bigeye Tuna	0.17	0.05	0.30	2	R	37.2	36.0	38.5	2
Bonito	1.44	1.20	1.60	5	R	26.3	24.8	28.0	5
Bonito	1.28			1	L	29.3			1
Bonito	0.40	0.16	0.69	9	F	20.7	18.0	22.9	9

Table A2. Gulf comparison

SOURCE
R: Rodeo data;
A: Alabama data from Alabama Department of Enviornonmental Management;
L: Louisiana data from Louisiana Department of Enviornmental Qualitiy;
F: Florida Gulf data from Florida Fish and Wildlife Conservation Commission;
T: (Texas) and M: (Mississippi) G: (Gulf Wide) data from USEPA Gulf of Mexico Program Gulfwide Mercury in Tissue Database

Species	Mercury (ppm)					Length (in)			
	avg	min	max	# samples	source*	avg	min	max	# samples
Reef fish									
Amberjack	0.77	0.44	1.57	13	R	39.6	32.0	48.8	10
Amberjack	0.54	0.19	1.08	36	L	40.9	32.4	53.2	36
Amberjack	0.69	0.34	0.99	11	F	32.5	23.4	38.9	10
Triggerfish	0.18	<0.04	0.59	8	R	17.3	15.2	19.5	8
Snappers									
Red	0.39	0.09	0.81	10	R	26.9	16.6	33.3	10
Red	0.30	0.02	1.18	47	L	27.7	16.7	65.9	47
Gray(inshore)	0.45	0.33	0.56	8	R	25.0	23.5	26.5	8
Gray(inshore)	0.19	0.03	0.62	209	F	9.6	5.2	17.2	209
Gray(inshore)	0.11			1	T	12.4			1
Vermilion	<0.04	<0.04	<0.04	8	R	17.7	15.5	20.0	8
Vermilion	0.09	0.04	0.25	11	F	11.5	10.0	14.0	11
Groupers									
Gag	0.51	0.28	0.71	10	R	36.9	32.0	45.0	10
Gag	0.31	0.08	0.79	8	L	26.2	6.8	39.1	8
Gag	0.35	0.04	1.06	78	F	17.2	5.4	28.5	78
Scamp	0.24	0.09	0.42	8	R	27.6	22.5	32.8	8
Scamp	0.37	0.10	0.66	10	L	28.5	23.8	33.6	10
Scamp	0.36	0.07	0.59	24	F	18.1	12.0	22.0	24
Red	0.32	0.18	0.56	7	R	23.5	20.5	26.5	7
Red	0.30	0.11	0.66	43	F	17.0	15.2	21.0	43
Warsaw	0.20	0.20	0.20	2	R	34.5			1
Warsaw	0.37	0.12	0.59	11	L	36.4	24.9	72.6	11

Species	Mercury (ppm)					Length (in)			
	avg	min	max	# samples	source^	avg	min	max	# samples
Inshore									
Blackfish (Tripletail)	0.06	<0.04	0.22	10	R	22.4	20.0	25.3	10
Blackfish (Tripletail)	0.05	0.04	0.10	4	L	17.8	16.6	19.1	8
Blackfish (Tripletail)	0.27	0.02	0.76	40	F	12.8	11.4	19.4	40
Blackfish (Tripletail)	0.60	0.27	1.28	4	T				
Hardtail (Blue Runner	0.45	0.10	0.83	5	R	18.5	14.0	22.5	5
Hardtail	0.18			1	F	8.1			1
Bluefish	0.68	0.51	0.83	7	R	20.4	17.0	22.8	7
Bluefish	0.87	0.26	1.60	63	F	14.4	9.3	18.5	63
Jack Crevalle	1.01			1	R	33.5			1
Jack Crevalle	0.59	0.30	3.90	114	F	12.4	6.0	22.6	114
Jack Crevalle	0.64	0.20	1.24	3	L	33.5	27.4	39.1	3
Black Drum	0.54	0.19	0.89	2	R	41.6	40.0	43.3	2
Black Drum	0.15	0.01	0.49	35	F	15.5	7.6	33.5	35
Black Drum	0.14	0.00	0.49	19	L	21.1	9.4	39.4	19
Black Drum	0.53	0.04	6.62	100	T	19.4	11.8	26.8	146
Ladyfish	0.79	0.67	1.08	5	R	18.6	17.0	19.5	5
Ladyfish	0.33	0.02	1.90	188	F	12.8	8.5	13.2	188
Ladyfish	0.52	0.22	1.01	13	A	19.6	14.5	20.9	13
Sheepshead	0.29	0.09	0.62	5	R	20.5	18.8	22.8	5
Sheepshead	0.18	0.06	1.10	163	F	11.5	5.2	18.5	163
Sheepshead	0.14	0.00	0.96	64	L	17.8	9.3	41.4	64
Sheepshead	0.20	0.05	1.73	84	T	17.1	11.4	22.8	79
Gafftopsail catfish	0.60	0.49	0.70	5.00	R	21.3	20.0	22.5	5.0
Gafftopsail catfish	0.74	0.02	1.80	67	F	16.2	8.3	19.7	67
Gafftopsail catfish	0.34	0.00	1.40	121	G				

Table A2. Continued

Species	Mercury (ppm)					Length (in)			
	avg	min	max	# samples	source*	avg	min	max	# samples
Southern Flounder	0.09	<0.04	0.17	8	R	17.7	16.5	20.0	8
Southern Flounder	0.16	0.07	0.30	9	F	13.5	10.8	16.7	9
Southern Flounder	0.15	0.10	0.22	7	A	12.8	11.0	14.8	7
Southern Flounder	0.17	0.00	1.00	20	L	18.3	9.2	16.7	20
Southern Flounder	0.17	0.03	1.70	87	T	16.7	12.8	20.5	77
Speckled Trout	0.31	0.09	0.70	10	R	22.9	19.8	26.0	10
Speckled Trout	0.44	0.02	2.50	566	F	14.3	6.0	24.6	566
Speckled Trout	0.18	0.10	0.38	62	A	15.7	12.6	19.0	62
Speckled Trout	0.16	0.02	0.46	74	L	17.2	10.7	23.4	74
Speckled Trout	0.14	0.07	0.60	51	T	17.1	13.8	23.6	51
White Trout	0.22			1	R	19.5			1
White Trout	0.53	0.11	1.20	104	F	10.2	5.7	13.3	104
White Trout	0.15	0.02	0.20	45	A	12.9	11.4	15.9	45
White Trout	0.09	0.05	0.10	7	T	14.1	12.0	16.9	7
Florida pompano	0.15			1	L	17.0			1
Florida pompano	0.19	0.03	0.49	27	F	11.4	7.6	15.6	27
Tarpon	0.40	0.26	0.69	4	F	20.9	18.9	23.0	4

SOURCE

R: Rodeo data;
A: Alabama data from Alabama Department of Enviornonmental Management;
L: Louisiana data from Louisiana Department of Enviornmental Qualitiy;
F: Florida Gulf data from Florida Fish and Wildlife Conservation Commission;
T: (Texas) and M: (Mississippi) G: (Gulf Wide) data from USEPA Gulf of Mexico Program Gulfwide Mercury in Tissue Database

Fish Meals/Month	Fish Tissue Hg Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.029
16	>0.029 - 0.059
12	>0.059 -0.078
8	>0.078 - 0.12
4	>0.12 - 0.23
3	>0.23 - 0.031
2	>0.31 - 0.47
1	>0.47 - 0.94
0.5	>0.94 - 1.9
None (<0.5)	>1.9

Table A3. EPA risk-based monthly fish consumption limit table

Assumed meal size is 8 oz (0.227 kg). Consumption limits based on adult body weight of 70 Kg and Methylmercury RfD of $1*10^{-4}$ mg/kg/d

END NOTES:

[1]Analysis by K.R. Mahaffey, USEPA, presented at the 2005 Fish Forum, September 19, 2005; available at http://epa.gov/waterscience/fish/forum/2005/presentations/Monday%20Slides%200919/afternoon/Mahaffey_Fish%20Forum%202005%20-%20Mahaffey%20Final.ppt

[2]"Methylmercury in the Gulf of Mexico: State of knowledge and research needs" Report of the National Science and Technology Council, Committee on the Environment and Natural Resources, Interagency Working Group on Methylmercury. June 2004. Available at : http://www.masgc.org/mercury/051004.pdf

[3]Mason, R.P., W.F. Fitzgerald, and F.M.M. Morel, 1994. The biogeochemical cycling of elemental mercury: Anthropogenic influences. Geochimica et Cosmochimica Acta 58: 3190-3198

[4]National Atmospheric Deposition Program / Mercury Deposition Network 2004 wet deposition map accessed 12/11/2005 at http://nadp.sws.uiuc.edu/mdn/maps/map.asp?imgFile=2004/04MDNdepo.gif

[5]See note 2.

[6]See Raines, B. "Seafood riddled with mercury," Mobile Register, July 22, 2001; Raines, B. "Hair tests indicate high mercury levels," Mobile Register, September 30, 2001 and other articles at: http://www.al.com/specialreport/?mobileregister/mercuryinthewater.html

[7]See Mahaffey, Note 1 above.

[8]Florida 2005 Fish Consumption Guide. Available at: http://www.doh.state.fl.us/environment/community/fishconsumptionadvisories/Fish_consumption_guide.pdf

[9]Raines, B. "State will tighten mercury standards for fish advisories," Mobile Register, November 16, 2005.

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[11]Meredith, E.K. and S.P. Malvesuto. 1996. Evaluation of two on-site survey methods for determining daily per capita fish freshwater consumption by anglers. American Fisheries Society Symposium 16:271-278.

[12]See note 5 above.

[13]"Methylmercury in the Gulf of Mexico: State of knowledge and research needs" Report of the National Science and Technology Council, Committee on the Environment and Natural Resources, Interagency Working Group on Methylmercury. June 2004. Available at : http://www.masgc.org/mercury/051004.pdf

[14]Louisiana data publicly available at: http://www.deq.louisiana.gov/portal/default.aspx?tabid=1635

[15]Adams, D.H., R.H. McMichael,, Jr., and G.E. Henderson. 2003. Mercury levels in marine and estuarine fishes of Florida 1989-2001. Florida Marine Institute Technical Report TR-9. 2nd ed, rev. 57 pp.

[16]U.S. EPA Gulf of Mexico Program. Data available at: http://www.duxbury.battelle.org/gmp/hg.cfm

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