

Consultations

## HEALTH CONSULTATION

REVIEW OF MERCURY HEALTH SERVICES' BLOOD MERCURY DATA FOR SELECTED  
PARISHES IN LOUISIANA  
VARIOUS PARISHES, LOUISIANA

**I. BACKGROUND AND STATEMENT OF ISSUES****A. Introduction**

The purpose of this health consultation is to screen for elevated blood mercury levels in the areas of Louisiana for which fish consumption advisories have been issued. The 1997 Louisiana legislature provided funding to screen for the presence of mercury in blood in residents living near selected advisory areas. This screening is cross-sectional in design and can be used to evaluate associations between mercury levels and potential risk factors for disease development, but cannot establish a direct cause for disease development.

A large-scale Louisiana Department of Environmental Quality testing program monitors fish tissue for mercury across Louisiana. Annual fish testing has been conducted since 1994. To date, fish in more than 100 water bodies have been evaluated. Mercury is present in the edible portions of some fish, in all water bodies tested. Based on environmental data from fish/shellfish tissue, water, and bottom sediments which show the presence of mercury at levels which may potentially cause adverse human health effects, fish consumption and health advisories are issued by Louisiana Department of Health and Hospitals, Louisiana Department of Environmental Quality, and Louisiana Department of Wildlife and Fisheries. As of September 23, 1998, sixteen mercury contaminant fish consumption advisories have been issued throughout Louisiana (see Appendix A). Fish consumption advisories are issued based on levels of contaminants in specific species of fish or shellfish and provide guidance to residents on the amount of the edible portion of that fish species from a specific water body which may be eaten without risking adverse health effects.

The primary source of environmental exposure to mercury in the general population is through the consumption of contaminated fish.<sup>1</sup> Therefore, identification of mercury in fish and the issuing of fish consumption advisories is a first step in preventing exposure. For those persons who consume more fish than recommended in the advisories, the elevated mercury concentrations may pose a public health hazard. The monitoring of mercury in blood furnishes a means to assess the total exposure of individuals who eat fish from these waters.

The State of Arkansas also issues fish consumption advisories because of mercury contamination in waterways. The greatest concentrations and most extensive occurrence of elevated mercury levels are found in largemouth bass and flathead catfish in the lower Saline and Ouachita Rivers, Gulf Coastal Plains region of south Arkansas, that are adjacent to Louisiana. In 1992, fish testing in Arkansas revealed mercury levels in fish exceeding FDA tolerance limits. Public concerns were heightened. Funds from the Governor's Emergency Fund provided

baseline blood mercury screening for volunteers who lived in eight affected counties (Bradley, Calhoun, Cleveland, Dallas, Ouachita, Union, Ashley, and Drew).<sup>2,3</sup>

The Arkansas Department of Health provided blood mercury screening to 236 participants in a previous study.<sup>2</sup> These individuals were required to confirm that their consumption rate was a minimum of two meals per month of fish taken from impacted waters of the lower Saline and/or Ouachita Rivers in order to be eligible. A meal was considered to be eight ounces of edible portions of fish prior to cooking. Blood mercury levels in 36 participants were in the range of 20-75 ppb (15%). No mercury was detected in 25% of participants tested. The limit of detection was 2 ppb of mercury in blood. The range of blood mercury concentrations for all participants was 0-75 ppb.<sup>2</sup>

In Louisiana, the State Office of Public Health offered free blood mercury screening services to state residents through the local Parish Health Units in thirteen parishes. These parishes are located in areas of the state where there are mercury contaminant fishing advisories. Screening residents for blood mercury provides data to ascertain patterns of mercury distribution among high risk populations in parishes with mercury fish advisories (See [Appendix B](#)) and to determine baseline blood mercury in residents. The state analyzed the blood samples from high risk populations to include the blood mercury levels of pregnant women, children younger than seven years of age, and people who eat large amounts of fish from water bodies (such as commercial fishermen) currently under a mercury advisory.

## **B. Protocol**

Blood samples were collected from February 28 - March 7, 1998, in Acadia, Caldwell, Evangeline, Iberia, Jefferson Davis, Lafayette, Morehouse, Ouachita, St. Landry, St. Martin, St. Tammany, Vermilion, and Washington Parishes (see [Appendix C](#)). Simultaneous with the collection of the blood sample, the Section of Environmental Epidemiology and Toxicology within the Office of Public Health, conducted a written risk factor survey.

### *Sample Collection*

Whole blood samples were collected by venipuncture. The samples were analyzed by cold vapor atomic absorption in the Office of Public Health Central Laboratory, New Orleans Chemistry Section.

### *Data Review*

The sample results were reviewed to determine if individuals had elevated mercury levels and to describe the relative distribution of mercury in blood among those who participated in the screening. The International Commission of Occupational Health and the International Union of Pure and Applied Chemistry, Commission on Toxicology determined that the mean background whole blood level for total mercury in people who do not eat fish is approximately two parts per billion. Normal total mercury blood levels in those who eat fish range from 2 to 20 ppb.<sup>1</sup> If an individual's blood mercury level is above 20 ppb, it is considered elevated.

It is recommended that people who are found to have those blood mercury levels decrease their fish intake. If blood mercury levels reach 80 ppb<sup>4</sup> in the general population or 40 ppb<sup>5</sup> in pregnant women or children, medical evaluation by a physician is advised in addition to decreasing fish consumption (see [Appendix D](#)). Individuals with elevated blood mercury are retested after three months. Blood levels reflect recent exposure and do not indicate the total body burden of mercury. [Appendices E - G](#) demonstrate protocol development, times

and locations of blood mercury testing, and the participant questionnaire used in this review.

### C. Special Populations of Concern

Infants, young children and pregnant or breast-feeding women are groups of concern within the general population because of the impact that mercury has on developing neurological systems. Groups that depend upon fishing for a large portion of their food (subsistence) are of concern because of the greater amounts of potentially contaminated fish they may eat. Because low income people may rely on catching fish to increase their sources of protein, program participants were specifically recruited through the Women, Infants, and Children (WIC) federal assistance program. Commercial fishers, charter boat captains and their families also have easy access to large amounts of fish and may derive a larger portion of their diet from fish. In order to inform this group of the blood mercury service, a mailing was sent to all commercial fishers in the state.

### D. Quality Control

The Office of Public Health laboratory employs quality control procedures recommended by the Centers for Disease Control and Prevention for spectrophotometry of mercury in whole blood by cold vapor atomic absorption to prepare and analyze the blood mercury samples. The range of the percent recoveries for the material received and analyzed was between 91 and 106%. Quality control procedures for sampling, chain of custody, laboratory procedures and methodology and data analyses are conducted. The limit of detection for blood mercury level was 0.30 ppb.

## II. RESULTS

Population data by parishes represented in the screening are listed in Table 1. There were 313 participants in all: 187 participants were females and 126 participants were males. The yearly income range of the volunteers was widely dispersed. Those who earned less than \$10,000 made up 27% of all individuals screened. Eighty participants (25.6%) earned between \$20,000 and \$50,000 per year. Those who earned between \$10,000 and \$19,999 constituted 21.4% of all participants. There were 32 individuals (10.2%) who earned more than \$50,000 yearly. Forty-eight participants (15.3%) refused to answer a question pertaining to income description.

The ethnic composition of the participants is as follows: 65.5% are white, 29.7% are black, and 4.8% consider themselves some other race or ethnicity. Analysis of data by educational level of participants indicated the following: 34.2% of volunteers did not graduate from high school, 30.1% graduated from high school or received a General Equivalency Diploma, and 29.7% attended some college, graduated college or undertook higher educational pursuits.

**Table 1.**

**Summary of Participants And Parishes Population Data**

PARISH	NUMBER OF PARTICIPANTS		PARISH POPULATION *
	MALE	FEMALE	
ACADIA	3	5	56,855
BRADLEY** (ARKANSAS)	1	0	N/A
CALDWELL	6	15	10,334

EVANGELINE	1	2	33,967
JACKSON**	0	1	15,683
JEFFERSON DAVIS	1	3	31,380
LA SALLE**	1	1	13,795
LAFAYETTE	1	5	176,592
MOREHOUSE	22	70	32,062
ORLEANS**	1	1	484,194
OUACHITA	43	48	146,449
ST. LANDRY	2	1	82,156
ST. MARTIN	1	0	45,741
ST. TAMMANY	19	16	167,242
UNION**	1	4	21,475
VERMILION	1	0	50,794
WASHINGTON	22	15	42,899
<b>TOTAL</b>	<b>126</b>	<b>187</b>	

\* Wessex, Incorporated. 1994 Population Estimates

\*\* These individuals presented at the clinic and were tested. Their parish/county of residence was not targeted in this screening.

N/A - not available.

Of the 313 samples individuals tested, five individuals had blood mercury levels above 20 ppb. One individual had a blood mercury level of 20 ppb. Of these six individuals (1.9%) with elevated or borderline blood mercury, there was no relationship observed in the fish species consumed and the resultant blood mercury level. However, these 6 participants all ate bluecatfish, channel catfish, largemouth bass or white crappie.

The remaining 307 (98.1%) individuals exhibited blood mercury concentrations which were below 20 ppb. The range for all individuals with detectable blood mercury levels was 0.5 to 35.1 ppb. In 48 (15.3%) of these individuals, blood mercury levels were nondetect.

### Statistical Analysis

Means and medians were calculated for mercury concentrations by age, occupation, racial/ethnic group, education, local fish consumption, recent fish consumption, frequency of fish consumption in the past year, pregnancy and recent fish consumption in pregnant women. Statistical analysis was performed to determine whether the means and medians were different. Because these data were not normally distributed, nonparametric statistical methods were used. A sign test ( $p=0.05$ ) was performed to test for significance.<sup>6</sup>

Tables 2-10 display the blood mercury concentrations by age, occupation, racial/ethnic group, education, local fish consumption, recent fish consumption, frequency of fish consumption, pregnancy and recent fish consumption in pregnant women.

The mean blood mercury concentrations were tabulated by age group. For participants less than 7 years, the mean blood mercury concentration was 2.15 ppb. For participants ages 7-19 years, the mean blood mercury concentration was 1.39 ppb. For participants ages 20-39 years, the mean mercury concentration was 2.63 ppb. For participants ages 40-59 the mean mercury concentration was 4.45 ppb. For participants, ages 60 years and older, the mean mercury concentrations was 4.30 ppb (Table 2). Mean mercury concentrations were significantly lower in the <7 age group as compared to all age groups as a whole. Mean and median mercury concentrations were significantly lower in the 7-19 age group as compared to screening participants as a whole.

**Table 2.**  
**Mercury Concentration (ppb) by Age**

Age	<7 (n=22)	7 - 19 (n=32)	20-39 (n=89)	40-59 (n=75)	60+ (n=93)
Mean *	2.15	1.39	2.63	4.45	4.30
Median*	1.75	0.75	2.1	2.8	3.0
Range of Concentrations	ND - 8.70	ND - 8.70	ND - 30.7	ND - 35.1	ND - 22.9

\* Calculations of mean mercury concentration and median include ♦ method detection limit (0.15) for samples which are non-detect.  
ND- not detected

Occupation was an indicator of higher blood mercury concentrations in this sample as shown in Table 3: the mean blood mercury concentration for commercial fishers and their household members is 6.65 ppb as compared to 3.21 ppb in all others tested. Mean and median mercury concentrations were significantly higher in commercial fishermen and their household member than those in other occupations.

**Table 3.**  
**Mercury Concentration (ppb) by Occupation**

Occupation	Commercial Fishers and Household Members (n=18 )	Other (n=295)
Mean*	6.65	3.21
Median*	4.95	2.20
Range of Concentrations	ND - 35.1	ND - 30.7

\* Calculations of mean mercury concentration and median include ♦ method detection limit (0.15) for samples which are non-detect.  
ND- not detected.

Analysis of the data by race in Table 4 indicates that the mean level in African-Americans (2.43ppb) is approximately 40% lower than in whites (3.84 ppb) and others (3.67 ppb) in this sample. This lower mean blood mercury level in blacks is statistically significant when compared to the level in whites. Also, other racial/ethnic groups had significantly lower blood mercury concentrations as compared to whites.

**Table 4.**  
**Mercury Concentration (ppb) by Race/Ethnic Group**

Race/Ethnicity	White (n=205 )	Black (n= 93)	Other (n=15)
Mean*	3.84	<b>2.43</b>	<b>3.67</b>
Median*	2.30	1.70	<b>2.20</b>
Range of Concentrations	ND - 35.10	ND - 30.7	ND - 20.60

\* Calculations of mean mercury concentration and median include ♦ method detection limit (0.15) for samples which are non-detect.  
ND- not detected

Table 5 demonstrates that as educational levels of participants increased, mean blood mercury concentrations decreased. In individuals who did not graduate high school, the average blood mercury level was 3.67 ppb; high school graduates and GED holders had average blood mercury levels of 3.43 ppb; college graduates and those with higher education had average blood mercury levels of 2.96 ppb. None of the mean or median blood levels by educational status were significantly different.

**Table 5.**  
**Mercury Concentration (ppb) by Education**

Education	< High School (n=107 )	High School/GED (n=93 )	Some College + (n=97)
Mean*	3.67	3.43	2.96
Median*	2.20	2.20	2.20
Range of Concentrations	ND - 35.10	ND - 26.70	ND - 18.10

\* Calculations of mean mercury concentration and median include ♦ method detection limit (0.15) for samples which are non-detect.  
ND- not detected

Table 6 presents blood mercury results from participants who indicated they ate fish caught within 40 miles of their homes. These data show that this population had more than double the mean concentration of blood mercury (4.34 ppb) than those who did not eat local fish (1.76 ppb). Mean blood mercury concentrations were significantly lower in participants who did not eat local fish as compared to those who ate fish caught within 40 miles of their homes.

**Table 6.**  
**Mercury Concentration (ppb) by Local Fish Consumption**

Local Fish Consumption	Eat fish caught within 40 miles of home (n=186)	Do not eat local fish or don't know (n=108)
Mean*	<b>4.34</b>	<b>1.76</b>
Median*	2.80	1.50
Range of Concentrations	ND - 35.1	ND - 7.60

\* Calculation of mean mercury concentration and median include ♦ method detection limit (0.15) for samples which are non-detect.

ND- not detected

Table 7 indicates that those who had eaten fish in the previous three days prior to the time that the blood sample was taken had greater blood levels (4.55 ppb) than those who had not eaten fish in the previous three days (2.59 ppb). However, this increase was not statistically significant.

**Table 7.**  
**Mercury Concentration (ppb) by Recent Fish Consumption**

Recent Fish Consumption	Ate fish in last three days (n =120)	Did not eat fish in past three days or don't know (n=175)
Mean*	4.55	2.59
Median*	3.00	1.90
Range of Concentrations	ND - 35.10	ND - 20.6

\* Calculations of mean mercury concentration and median include  $\diamond$  method detection limit (0.15) for samples which are non-detect.

ND- not detected

There was also a trend among those who reported a greater frequency of fish consumption during the last year. The highest mean concentration of blood mercury (5.10 ppb) was found in participants who reported eating fish more than once per week. The next highest level (3.56ppb) was found in those who ate fish once per week. When fish consumption decreased to two meals per month or less, the levels were consistent with background levels of those who do not eat fish.

For the purpose of analyzing the data, the frequency of consumption was grouped into three categories (Table 8). Those who ate fish once a week or more had a statistically significant higher blood mercury mean concentration (4.32 ppb) as compared to those with less frequent consumption. Those with elevated blood mercury concentrations (>20 ppb) in this screening reported that they consumed fish at least once a week.

**Table 8.**  
**Mercury Concentration (ppb) by Frequency of Fish Consumption (Past Year)**

Frequency of Fish Consumption	$\geq$ Once /wk (n=181)	1-2/month (n=85)	<6 times/yr (n=26)
Mean*	4.32	1.82	2.08
Median*	2.80	1.50	1.50
Range of Concentrations	ND - 35.10	ND - 5.50	ND - 8.70

\* Calculations of mean mercury concentration and median include  $\diamond$  method detection limit (0.15) for samples which are non-detect.

ND- not detected

There were no elevated blood mercury levels detected in two sensitive populations - pregnant women or in any child less than seven years of age (Table 9 and Table 2). The mean blood mercury concentration among pregnant women was 2.03 ppb. The mean mercury concentration in children less than seven years of age was 2.15 ppb. No statistically significant differences in blood mercury by pregnancy status were observed in this screening. The third population of concern, commercial fishers and their families, contained an individual who had an

elevated blood mercury level of 35.1 ppb (Table 3).

**Table 9.**

**Mercury Concentration (ppb) by Pregnancy Status**

Pregnancy Status	Pregnant at the time of screening (n=52)	Not Pregnant at screening or don't know (n =120)
Mean*	2.03	2.55
Median*	1.65	2.05
Range of Concentrations	ND - 8.70	ND - 22.90

\* Calculations of mean mercury concentration and median include ♦ method detection limit (0.15) for samples which are non-detect.  
 ND- not detected

Table 10 indicates that the blood mercury concentrations among pregnant women with recent fish consumption were not elevated when compared with pregnant women who did not eat fish in the recent past. The mean blood mercury concentration was 1.77 ppb in pregnant women who ate fish in the last three days compared to 2.13 ppb in pregnant women who did not eat fish in the last three days. The reason for this difference is unclear and caution should be used in interpreting these data and drawing conclusions. There are several factors to consider which might influence this result. First, the numbers of pregnant women were very small, making any results less stable. Second, though the women reported having eaten fish, the type and source of the fish eaten recently is unknown. Not all fish contain mercury. Third, since health educational materials regarding fish advisories have targeted pregnant women, it is possible that women who do consume fish are more careful about the type of fish and portion size which they consume. Finally, there are issues of recall errors which would lead to misclassification: a woman may report having eaten fish in the last three days, when she actually ate it more than three days ago, and the reverse, indicating eating fish more than three days ago when it was less than that.

**Table 10.**

**Mercury Concentration (ppb) by Recent Fish Consumption in Pregnant Women**

Recent Fish Consumption	Ate fish in last three days (n=14)	Did not eat fish in past three days or don't know (n =38)
Mean*	1.77	2.13
Median*	1.15	1.75
Range of Concentrations	ND - 4.10	ND - 8.70

\* Calculations of mean mercury concentration and median include ♦ method detection limit (0.15) for samples which are non-detect.  
 ND- not detected

Table 11 exhibits a summary of the six participants (five men and one female) who meet the screening criteria for elevated blood mercury concentrations. Each of these individuals resided in either Morehouse or Ouachita parish. The range of blood mercury concentrations for these participants was 19.6-35.1 ppb. The median blood mercury concentration for these individuals was 24.8 ppb.



**Table 11.**  
**Summary of Participants with Elevated Blood Mercury Concentrations**

Mean: 25.93 ppb Median: 24.8 ppb Range: 19.6 - 35.1 ppb		
Sex	Parish of Residence	Concentration (ppb)
Male	Ouachita	19.6
Male	Morehouse	20.6
Female	Ouachita	22.9
Male	Ouachita	26.7
Male	Morehouse	30.7
Male	Ouachita	35.1

**III. DISCUSSION**

The monitoring of mercury concentrations in blood indicated that the majority of participants in the screening services, including those in high risk groups, did not have elevated blood mercury concentrations. Six individuals however had levels greater than or equal to 20 ppb and were advised by the Louisiana Office of Public Health to decrease the consumption of fish caught from the areas covered by the advisories. The six individuals with elevated blood mercury concentrations reside in parishes (Ouachita and Morehouse), which had the most participants in the screening and that are adjacent to areas in Southern Arkansas that are also under health advisories for mercury contamination in fish.

Mercury is a ubiquitous contaminant which occurs throughout the world. Possible sources of mercury to Louisiana's waters include atmospheric deposition, the alkali industry, natural geologic deposits and agricultural use as seed dressings. The most common form of organic mercury is methylmercury. It is produced by microscopic organisms in the soil and water interacting with metallic mercury; the more mercury present in the environment can increase the amount of methylmercury produced by these organisms. Humans may be exposed to mercury by eating fish contaminated with methyl mercury.

No pregnant women or children were found to have elevated levels. Their mean blood mercury concentration is comparable to the national background levels for those who do not eat fish. No data was collected to indicate the impact of the educational information previously distributed in association with the existing fish consumption advisories. The advisories and any related news release generally emphasized the risk to target populations of pregnant women, children, and those who consume large quantities of local fish.

Commercial fishermen and their households had the highest mean concentration of mercury in this screening. Their blood mercury mean and median levels were significantly higher than those in other occupations. All the commercial fishermen and their household members who participated in this screening are white. Efforts to provide additional educational information to commercial fishermen and their household members should be increased.

Blood mercury concentrations tended to increase with age with those over 40 years old having the

highest levels. Mean mercury concentrations were significantly lower in the 0-6 and 7-19 age groups. Median mercury concentrations were also significantly lower in the 7-19 age group.

The survey questions that dealt with the frequency, location, and time of fish consumption demonstrate that blood mercury concentrations increased with fish consumption; however, not all the trends were statistically significant. Those who ate fish once a week or more had a statistically significant higher blood mercury mean concentration as compared to those with less frequent fish consumption. Mean blood mercury concentrations were significantly higher for those who ate fish caught within 40 miles of their homes. Higher mean concentrations of blood mercury were found in those who have eaten fish recently (within the last three days), although this trend is not significant.

In addition, in this screening, blacks had a significantly lower mean concentration than whites. The mean blood mercury concentration increased as the educational level of participants decreased, although not significantly. Pregnant women who consumed fish in the past three days had significantly lower mean and median blood mercury concentrations than pregnant women who did not eat fish recently. No statistically significant differences in the blood mercury of pregnant women and other women were observed in this screening.

Although the overall levels of mercury in blood remain relatively low in this screening group, the data tend to indicate that eating fish contributes to the mercury concentration in blood. This cross-sectional survey may or may not be generalized to other groups, because volunteers were self-selected and information obtained was self-reported.

#### **IV. CONCLUSIONS**

Based on the blood screening data and information reviewed, LOPH concludes that:

1. The overall blood mercury levels in participants are relatively low. Ninety-eight percent of the participants exhibited blood mercury concentrations within the normal levels for people who eat fish. Individuals with high fish consumption have blood mercury concentrations greater than those who do not eat fish.
2. The blood mercury levels in participants do not indicate a public health hazard for these individuals. The six individuals whose blood mercury levels were above normal were advised to decrease fish consumption. A public health hazard may exist for any individual who eats more fish than recommended in advisory areas.
3. Pregnant women and children in this sample population have blood mercury concentrations comparable to national background levels. They also were found to have lower blood mercury concentrations than others who participated in the monitoring.
4. Commercial fishermen and their household members demonstrated the highest blood mercury levels.
5. Blood mercury levels tended to increase with age of the participant.
6. The findings of this mercury screen may or may not be generalized to other individuals because the selection of the participants was not random.

## V. RECOMMENDATIONS

1. Continue the fish consumption advisories.
2. Place additional emphasis on reaching higher risk groups with health education activities and the production of materials aimed at limiting fish consumption from waters where advisories are in place. The higher risk groups identified in this screening include commercial fishers and their families and older populations. This does not exclude previously identified sensitive populations, which include pregnant women and children.
3. Disseminate the results of this health consultation with corresponding health educational materials in areas with fish advisories.

## VI. REFERENCES

1. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Mercury. Atlanta: ATSDR, August 1997.
2. Armstrong, M., Burge P, Evans, S, Giese, J, McChesney T, Nix J, Price A, Thornton K, and Thurman D. Mercury in Arkansas: 1993-1994 Biennium Report, Chapter 2, June 1995.
3. Burge, P, Evans, S. Mercury Contamination in Arkansas Gamefish: A Public Health Perspective. Journal of the Arkansas Medical Society, Volume 90, Number 11, 542-544, April 1994.
4. Ellenhorn, Matthew J. *Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning*, (2<sup>nd</sup> Ed.). Baltimore: Williams and Wilkins, A Waverly Company, 1997.
5. WHO. Environmental Health Criteria 101: Methylmercury, Geneva, World Health Organization, 106pp, 1990.
6. Cochran, William G., Snedecor, GW. *Statistical Methods*, (8<sup>th</sup> Edition), Ames: Iowa State University Press, 1989.

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**CERTIFICATION**

The Review of Blood Mercury Data for Selected Parishes in Louisiana Health Consultation was prepared by the Louisiana Office of Public Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this health consultation and concurs with its findings.

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**VIII. APPENDICES**

**APPENDIX A:**

**LOUISIANA MERCURY CONTAMINANT FISHING ADVISORIES**

FISH AND SHELLFISH CONSUMPTION HEALTH ADVISORIES		PARISH	LOCATION	ISSUE DATE	AREA
Pregnant women, breastfeeding women and children less than 7 years of age	Other adults and children				

<b>No bowfin consumption.</b> <b>Limit bass, bigmouth buffalo or freshwater drum to no more than 1 meal a month.</b>	No bowfin consumption.  No consumption limits on other species.	St. Tammany, Washington	Pearl River	Issued 1/97	57 miles
<b>Limit bowfin (choupique), flathead catfish, white crappie (sac-a-lait) or freshwater drum to no more than 1 meal a month.</b>	No consumption limits.	Vermillion	Seventh Ward Canal	Issued 7/97	11.5 mi.
<b>Limit bowfin, white crappie or largemouth bass to no more than 1 meal a month.</b>	No consumption limits.	Desoto	Toledo Bend Reservoir, north of Pine Island and south of Grand Cane Bayou	Issued 11/17/97	not available
<b>No bowfin consumption.</b> <b>Limit crappie or largemouth bass to no more than 1 meal a month.</b>	Limit bowfin to 2 meals a month. No consumption limits on other species.	Sabine	Toledo Bend Reservoir, San Patricio arm of the lake	Issued 11/17/97	not available
<b>Limit largemouth bass, flathead catfish, redear or bluegill sunfish (bream) to no more than 1 meal a month.</b>	No consumption limits.	Vernon	Lake Vernon	Issued 8/97	6.6 sq. miles
<b>King mackerel - 39 inches or less in total length</b>	Limit consumption to four meals per month	Gulf of Mexico waters off of all costal parishes	Gulf of Mexico	Issued 9/4/97	
<b>Limit consumption to one meal per month</b>					
<b>King mackerel - greater than 39 inches in total length</b>	NO consumption	Gulf of Mexico waters off of all costal parishes	Gulf of Mexico	Issued 9/4/97	
<b>NO consumption</b>					
<b>Limit bowfin (choupique) consumption to no more than one meal per month</b>	No consumption limits	St. James, Ascension, Livingston, St. John the Baptist	Blind River	Issued 4/23/98	
<b>Limit bowfin (choupique), black crappie or freshwater drum to no more than 1 meal a month</b>	No consumption limits.	Acadia, Evangeline, St. Landry	Bayou des Cannes	Issued 10/97	54 mi.
<b>No bowfin (choupique) consumption.</b> <b>Limit largemouth bass, crappie (sac-a-lait) or freshwater drum (gaspergou) to no more than 1 meal a month.</b>	Limit bowfin to 2 meals per month; no consumption limit on other species.	Acadia, St. Landry	Bayou Plaquemine Brule	Issued 10/96	40 mi.

<b>No bowfin (choupique) consumption.</b> <b>Limit largemouth bass to no more than 1 meal a month.</b>	Limit bowfin to 2 meals per month; no consumption limit on other species.	Evangeline	Chicot Lake	Issued 5/97	3.1 sq. mi.
<b>No bowfin (choupique) consumption.</b> <b>Limit bass or crappie (sac-a-lait) to no more than 1 meal a month.</b>	Limit bowfin to 2 meals per month; no consumption limit on other species.	Natchitoches	Black Lake	Issued 10/96	7.6 sq. mi.
<b>No bass consumption.</b> <b>Limit other fish species to no more than 2 meals a month.</b>	Limit bass to 2 meals per month; no consumption limit on other species.	Ouachita, Union, Morehouse, Caldwell	Ouachita River: LA/ARK border to lock at Columbia	Issued 7/92; reviewed 8/94	102 miles
<b>Limit largemouth bass, crappie (sac-a-lait) or freshwater drum (gaspergou) to no more than 1 meal per month.</b>	No consumption limits.	St. Martin	Henderson Lake	Issued 1/96	37.8 sq. mi.
<b>Limit all bass species or bowfin (choupique) to no more than 1 meal per month.</b>	No consumption limits.	St. Tammany, Washington	Bogue Chitto River	Issued 8/96	35 miles
<b>Limit largemouth bass, white crappie, black crapple, freshwater drum, redear sunfish to no more than 1 meal a month.</b>	No consumption limits.	St. Tammany	Bayou Liberty	Issued 1/97	10 miles

Note: A meal is considered to be 1/2 pound in size.

Date issued - June 1998

**APPENDIX B: LOCATIONS OF LOUISIANA PARISHES SELECTED FOR BLOOD MERCURY SCREENING**



**APPENDIX C: LOCATIONS OF LOUISIANA PARISHES WITH MERCURY CONTAMINANT FISHING ADVISORIES**



## **APPENDIX D: LETTER FROM WILLIAM HARTLEY, SC.D. TO DIANNE DUGAS**

**Tulane University Medical Center  
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Date: October 24, 1997

From: William Hartley, Sc.D.

To: Dianna Dugas, MSW, MPH  
Assistant Chief Epidemiologist  
Louisiana Office of Public Health  
Section of Environmental Epidemiology and Toxicology

Re: Blood Mercury

Mercury is a naturally occurring element. However, the greatest exposure to mercury comes from dietary intake, including consumption of contaminated fish. Most individuals will have some degree of mercury in their body regardless of personal fish consumption patterns. Recently, the International Commission on Occupational Health (ICOH) and International Union of Pure and Applied Chemistry (IUPAC) Commission on Toxicology determined that the mean background whole blood level for total mercury in people who do not eat fish is approximately 2 to 20 ppb (ATSDR 1994).

According to Ellenhorn's Medical Toxicology and Lexi-Comp's Clinical Reference, approximately 80 ppb total mercury in whole blood is considered to be the threshold limit for toxicity in adult males and adult non-pregnant females (Ellenhorn 1997 and Leiken 1995). For fetuses, 10-20 ppm of methylmercury in maternal hair, which corresponds to approximately 40 to 80 ppb methylmercury in the mother's blood, may result in a 5% risk of neurological and developmental abnormalities (WHO 1990). Therefore, mercury blood levels for pregnant women and children under seven years of age should be below 40 ppb.

Because the primary general population exposure to mercury is through consumption of fish, decreasing one's fish intake will decrease one's blood mercury concentration. Therefore, those individuals whose whole blood mercury levels are above the normal level of 20 ppb should decrease their consumption of fish until their blood mercury levels return to normal. Adults and children 7 years and older should seek medical evaluation if their blood mercury is greater than or equal to 80 ppb. Pregnant women and children less than 7 years should consult their physician if they have blood levels 40 ppb or higher. This level for pregnant women and children is based on the more toxic methylmercury and the screening levels are for total (all forms) mercury. Consequently, there is some additional safety in using  $\geq 40$  ppb as a screening level for total mercury.

The following table summarizes the recommended screening levels and public health actions for whole blood total mercury:

	Adults	Pregnant Women and Children < 7yrs
<b>Normal range</b>	2-20 ppb	2-20 ppb
<b>Recommend decrease fish intake</b>	> 20 ppb	> 20 ppb
<b>Advise medical evaluation by physician</b>	≥ 80 ppb	≥ 40 ppb

**References:**

ATSDR, 1994. Toxicological Profile for Mercury. Agency for Toxic Substance and Disease Registry, U.S. Public Health Service. ATSDR/TP-93/10.

Ellenhorn, Matthew J. *Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning, (2<sup>nd</sup> Ed.)*. Baltimore: Williams and Wilkens, A Waverly Company, 1997.

Leiken, Jerrold B. *Lexi-Comp's Clinical Reference Library Poisoning and Toxicology Handbook (2<sup>nd</sup> Ed.)*. 1996-1997. Frank P. Paloured, Pharm D., 1995.

WHO, 1990. Environmental Health Criteria 101: Methylmercury, Geneva, World Health Organization, 106pp.

**APPENDIX E: PROTOCOL**

**DRAFT**

December 17, 1997

**Tentative Protocol to determine mercury concentrations in the blood of Louisiana citizens**

**I. Introduction**

Testing of fish tissue from approximately 100 water bodies in Louisiana has indicated levels of mercury in the edible portions of fish sufficient to raise public health concerns. At this time fish consumption advisories for 12 water bodies across the state have been issued. Many other locations are scheduled for resampling due to the mercury levels found in initial sampling results. Although the levels of mercury in fish are gradually being documented, there has been no effort to determine if people who eat the fish are ingesting quantities of mercury which could cause adverse health effects. To date, the presence of advisories on the water bodies which contain the fish with the highest mercury concentrations has been presumed to enable residents to regulate their mercury intake. The best determination of levels of mercury in the citizens is to measure the amount of the metal in the body. Blood concentration is the superior biological media for the measurement of mercury ingested via fish tissue (ATSDR, 1994).

**II. Proposal**

The 1997 Louisiana legislature provided funding for the determination of levels of mercury in the blood of Louisiana citizens. The Louisiana Office of Public Health (LOPH) proposes to use the funding to offer, as a public service, free blood testing to state residents in three areas of the state where there are mercury advisories, the parishes around the Ouachita River, the Pearl River and Henderson Lake. The service will be provided throught the local Parish Health Units (PHUs). If



anyone has an elevated blood mercury level, they will be advised to consult with their physician. Follow-up blood testing will be available.

### A. Sub-populations

Infants, young children and pregnant or breast-feeding women are the groups within the general population most at risk due to the impact of mercury on the developing neurological system. Low income families possibly are more likely than others to use subsistence fishing to supplement diet. Anecdotal information indicates that residents of some riverbank communities are consuming fish from advisory areas in excess of advised amounts. Therefore testing will be targeted to mothers and children 7 years and younger who live near three water bodies with advisories. These participants will be identified through their participation in the Women Infant and Children (WIC) federal assistance program. This program is directed at low income families. Participants will be offered this service in each of the 3 targeted areas. They will be asked to answer a questionnaire and have a blood sample taken.

Commercial fisherman, charter boat captains and their families have easy access to large amounts of fish and are likely to incorporate more into their diet than the general population. Therefore testing will be targeted at commercial fisherman and charter boat captains and their families in the three targeted areas in the state. Recruitment of this sub-population may be more difficult because commercial fisherman may not live in the same place that they work, they work variable hours and they do not frequent any central location where they can be interviewed and their blood sampled easily. The availability of this service i.e. location, times and dates that the service will be advertised through local press releases using T.V., radio and newspapers. LOPH is seeking to obtain the addresses of commercial fisherman and charter boat captains from LDWF so that letters can be sent to this population informing them of the service which is to be offered to them.

The service will also be available to the general public. This service will be offered at a minimum of 3 PHU in the targeted areas for a limited time. Depending on the amount of community response, the service will be offered at other PHUs within the same or additional advisory areas until the funding is exhausted. The service will be publicized and offered at one site at a time based on site prioritization and as money permits.

### B. Notification of Results

The International Commission on Occupational Health and International Union of Pure and Applied Chemistry, Commission on Toxicology determined that the mean background whole blood level for total mercury in people who do not eat fish is approximately 2 ppb. Normal total mercury blood levels range from 2 to 20 ppb (ATSDR, 1994).

**The following table summarizes the recommended screening levels and public health actions for whole blood total mercury.**

	Adults	Pregnant Women and Children less than 7 years of age
<b>Normal range</b>	2-20 ppb	2-20 ppb
<b>Recommend decreased fish intake</b>	>20 ppb	>20 ppb
<b>Advise medical evaluation by physician</b>	≥ 80 ppb	≥ 40 ppb

Each client who gets a blood test will receive a letter with their blood mercury concentration. In

the event that a person's blood mercury concentration is determined to be mildly elevated, (greater than 20 ppb and less than 80 ppb), or, for pregnant women and children less than 7 years of age, (greater than 20 ppb and less than 40 ppb), LOPH will notify the client through the mail and offer recommendations on how the level could be reduced by decreased fish intake. Persons whose blood has a mercury concentration of 80 ppb or greater and pregnant women and children whose blood has a mercury concentration of 40 ppb or greater will be advised to decrease fish intake and seek the advice of a physician. A retest after 3 months will be available to those with elevated blood mercury levels.

### C. Site selection for site specific portion of testing

Identification of blood mercury levels in persons at high risk, those who consume the most fish or are within the most susceptible sub-population (pregnant and breast-feeding women, fetuses, young children), is the goal of the blood testing service. Therefore, the selection of sites for offering this service is an important factor.

The occurrence of mercury in fish and fish consumption advisories is not restricted to any one area of the state but is distributed across the state including rivers, bayous, inland reservoirs and coastal lakes. Blood testing will be offered in a minimum of three locations within the State. Depending upon the level of participation, additional locations will be added until the funds are exhausted.

The following criteria are used to identify three locations where the blood mercury service is to be offered.

1. Nearby water body under an LOPH fish consumption advisory.
2. High mercury concentration in fish in comparison to other locations under advisement.
3. Low median annual income in comparison to the State average.

The first location which has met the above criteria is in the vicinity of the Ouachita River, in the northeast portion of the state in Morehouse, Union, Caldwell and Ouachita parishes. The first mercury advisory released in the state was for the Ouachita River in 1992. Some of the highest mercury concentrations have been found at this location. The second location will be in Region IV in St. Martin, Acadia, Lafayette, St. Landrey and Evangeline parish. This area has 4 advisories. The third location will be Washington and St. Tammany parishes where the Pearl River serves as the eastern state border. There are two additional consumption advisories in this portion of the state so individuals could be getting mercury from more than one water body. The specifics of the advisories are as follows.

LOCATION	PARISH	Advice for women planning to become pregnant, pregnant women, breast-feeding women, and children less than 7 years of age	Advice for other adults and children	AREA
<b>Ouachita River: LA/ARK Border to lock at Columbia</b>	Ouachita, Union, Morehouse, Caldwell	No bass consumption. Limit other fish species to no more than 2 meals a month.	Limit bass to 2 meals per month; no consumption limit on other species.	102 miles
<b>Bayou Plaquemine Brule</b>	Acadia, St. Landry	No bowfin (choupique) consumption.	Limit bowfin to 2 meals per month; no	40 mi.

		Limit largemouth bass, crappie (sac-a-lait) or fresh water drum (gaspergou) no more than 1 meal a month	consumption limit on other species.	
<b>Chicot Lake</b>	Evangeline	No bowfin (choupique) consumption.  Limit largemouth bass to no more than 1 meal a month	Limit bowfin to 2 meals per month; no consumption limit on other species.	3.1 sq. miles
<b>Bayou des Cannes</b>	Acadia, Evangeline, St. Landry	Limit bowfin, black crappie or freshwater drum to no more than 1 meal a month	No consumption limits	54 mi.
<b>Henderson Lake</b>	St. Martin	Limit largemouth bass, crappie (sac-a-lait) or freshwater drum (gaspergou) to no more than 1 meal per month.	No consumption limits.	37.8 sq. mi.
<b>Bogue Chitto River</b>	St. Tammany, Washington	Limit all bass species or bowfin (choupique) to no more than 1 meal per month.	No consumption limits.	35 mi
<b>Bayou Liberty</b>	St. Tammany	Limit largemouth bass, white crappie, black crappie, freshwater drum or redear sunfish to no more than 1 meal a month.	No consumption limits.	10 mi.
<b>Pearl River</b>	St. Tammany, Washington	No bowfin consumption.  Limit bass, bigmouth buffalo or freshwater drum to no more than 1 meal a month.	No bowfin consumption.  No consumption limits on other species.	57 miles

### D. Questionnaire Administration

Upon arrival at the test location, each client will be read a consent form which they must sign. The client will then be read a questionnaire by a nurse. The questionnaire will contain questions designed to gather information about their mercury exposure as it relates to fish consumption practices. Although this questionnaire will provide some background information on fish consumption in Louisiana, the data will not be sufficient to completely characterize the issue nor draw definitive conclusions. Information on the geographic source, species, amount and frequency of fish meals will be gathered. Sources of other mercury exposure such as through occupational exposure, pharmacological use or personal hobby possibly may be identified through the questionnaire. Approval of the questionnaire and corresponding instructions (found in the attachments) from the LOPH Forms Committee is likely to be the task requiring the most time before the service can be offered. A tele-conference will be scheduled to train the nurses about the questionnaire.

No one who requests a blood test will be denied, even if the questionnaire response indicates low fish consumption rates.

### E. Specimen collection, transport and analysis

After the nurse has completed the questionnaire on the client, a phlebotomist or nurse at the PHU or other location will take the blood sample. A 2.5 ml sample of venous blood will be submitted in a lavender top tube. The specimens should be labeled, preserved, and transported following the same procedures used for blood lead samples which are collected at the PHUs. Refer to the Louisiana Public Health Laboratories Specimen Submission Manual (page 12). The specimens will be shipped to the Central Laboratory in New Orleans for analysis. Samples of other media used to indicate mercury exposure such as hair, fingernails, urine or breast milk will not be accepted at this time.

The blood specimens will be analyzed in batches by cold vapor atomic absorption spectrometry. In this method the mercury is reduced to elemental state. Therefore total mercury concentration rather than speciated mercury will be provided.

**III. Limitations**

Participation is to be voluntary. Therefore, the sample population will be self-selected and may not represent the general population in the areas where fish advisories exist. The WIC women and children population sampled is limited to WIC participants. Other pregnant women, infants and young children who are not on WIC will only be captured if they select to come to a PHU or go to the Mall during the Health Fair. Likewise, the subsistence or recreational fisherman are self selected and are more likely to be those who are well informed, educated about health effects of mercury and have the free time and transportation to get to the PHU.

Ingestion of commercial fish meals such as canned tuna will contribute as will certain occupational exposures to blood mercury levels. The questionnaire will include brief questions on these two sources of exposure.

The interpretation of the blood results is completely dependent upon the clients accurate response to the questionnaire. The reliability of the information gathered by the questionnaire will depend upon an individual's ability to recall past meals. Information on both the source of the fish and the species is needed.

Following ingestion, mercury levels in the blood peak at approximately 30 hours. Mercury in the body has a half life of 60-70 days. A high level could be the result of a recent meal, not a chronically high blood level. Likewise a low level could be the result of a temporary cessation of fish consumption. In some cases, a fraction of the ingested mercury can be stored in the brain for a long time. This cross-sectional survey functions as a community service and the results may serve to indicate a need for additional surveillance.

**IV. Findings of Expected (Outcome) Conclusions:**

This community service is being provided to citizens in areas where LOPH fish advisories exist to ensure that concerned people who feel they are at risk for mercury exposure have a resource to get tested. It is not intended to provide a complete description of the problem nor the actual level of mercury exposure in these communities.

**APPENDIX F:**

**LOUISIANA MERCURY IN FISH BLOOD SCREENING PROGRAM TIMES AND LOCATIONS**

Location	Weekdays	Saturday	Address/Phone
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<b>Acadia Parish Health Unit</b>	Call unit for information.		530 E. Mill St. Crowley 318-788-7507
<b>Caldwell Parish Health Unit</b>	March 3-6, 8 a.m.-3:30 p.m.	March 7, 8 a.m.-2 p.m.	200 Collins Rd., Columbia 318-649-2393
<b>Evangeline Parish Health Unit</b>	Call unit for information.		415 W. Cotton St. Ville Platte 318-363-1135
<b>Iberia Parish Health Unit</b>	Call unit for information.		121 W. Pershing St. New Iberia 318-373-0021
<b>Jefferson Davis Parish Health Unit</b>	March 4, Mar 5, March 6, 1:30-3:30 p.m.		403 Baker St. Jennings 318-824-2193
<b>Lafayette Parish Health Unit</b>	Call unit for information.		2100 Jefferson St. Lafayette 318-262-5616
<b>Morehouse Parish Health Unit</b>	March 3-6, 8 a.m.-4:30 p.m.	March 7, 8 a.m.-2 p.m.	650 School Rd., Bastrop 318-283-0806
<b>Ouachita Parish Health Unit (Monroe)</b>	March 3-6, 8 a.m.-4 p.m.	Feb. 28 and March 7, 8 a.m.-2 p.m.	2913 Desiard St., Monroe 318-362-3400
<b>Ouachita Parish (West Monroe)</b>	March 3-6, 8 a.m.-4 p.m.	Feb. 28 and March 7, 8 a.m.-2 p.m.	1416 Natchitoches St., West Monroe 318-362-3428
<b>Ouachita Parish Sterlington Hospital Emergency Room</b>	March 2-3, 8 a.m.-2 p.m.		Sterlington 318-665-2771
<b>St. Landry Parish Health Unit</b>	Call unit for information.		308 W. Bloch St. Opelousas 318-948-0220
<b>St. Martin Parish Health Unit</b>	Call unit for information.		415 St. Martin St. St. Martinville 318-394-3097
<b>St. Tammany Parish Health Unit</b>	March 2-6, 8-10 a.m.	Feb. 28 and March 7 9-11 a.m.	520 Old Spanish Trail Slidell 504-646-6446
<b>Vermillion Parish Health Unit</b>	Call unit for information.		401 S. St. Charles St. Abbeville 318-893-1443
<b>Washington Parish Health Unit (Franklinton)</b>	March 2-6, 8-10 a.m.	Feb 28, 9-11 a.m.	1104 Bene St., Franklinton 504-839-5646
<b>Washington Parish Health Unit (Bogalusa)</b>	March 2-6, 8-10 a.m.	March 7, 9-11 a.m.	626 Carolina Ave. Bogalusa

504-732-6615

APPENDIX G: PARTICIPANT QUESTIONNAIRE

Blood sample I.D. \_\_\_\_\_  
(Nurse will apply adhesive label above and to the lavender top sample tube)

Louisiana Department of Health and Hospitals  
Office of Public Health

BLOOD TESTING FOR MERCURY, QUESTIONNAIRE TO ACCOMPANY BLOOD SAMPLE

1. Current date      /      /       
Mo/day /yr
2. Name \_\_\_\_\_
3. Age \_\_\_\_\_
4. Sex (check one)  Male/  Female, If female, are you pregnant  Yes /  No  Don't know
5. How would you best describe your race or ethnic background?  
(1) Cajun (2) Hispanic (3) White (4) Black (5) Asian American  
(6) Native American (7) Other \_\_\_\_\_
6. Mailing Address \_\_\_\_\_  
(street)  
\_\_\_\_\_  
(city, state, zip code) (Parish)
7. Telephone number (\_\_\_\_\_) \_\_\_\_\_
8. How did you learn about this blood testing service?  Received a letter in the mail  My physician  
 Public Health Unit  Radio/TV  Newspaper  Family/ Friend  Other \_\_\_\_\_
9. Occupation  Commerical fisherman  Professional/technical  Laborer skilled/unskilled  
 Homemaker  Student  Retired  Other \_\_\_\_\_  Refused to answer
10. If you answered Homemaker, Student or Other to the previous question, what is the occupation of the head of the household? \_\_\_\_\_ (select from the available responses in Question 9.)
11. Pick the educational level which best describes you?  
 Did not graduate high school  Graduated high school/GED  
 Attended some college or graduated college or higher
12. Which family income best describes your family?  
 Less than \$10,000  \$10,000 - \$19,999  \$20,000 - \$50,000  greater than \$50,000  refused
13. How many people live in your house?  2 or less  3-5  6 or more

14. In the past year, how often did you usually eat fish?

- One or more meals a day    2-6 meals a week    1 meal a week    2 meals a month  
 1 meal a month    1 meal every two months    less than 6 meals/year    no meals

15. What kinds of fish do you generally eat ? (Check all the applicable fish)

**Freshwater fish -**

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> bowfin (choupique, grinnel) | <input type="checkbox"/> black crappie                           | <input type="checkbox"/> striped bass (white bass) |
| <input type="checkbox"/> garfish                     | <input type="checkbox"/> bluegill sunfish (perch, bream)         | <input type="checkbox"/> bigmouth buffalo          |
| <input type="checkbox"/> channel catfish             | <input type="checkbox"/> white crappie (sac-a-lait, white perch) | <input type="checkbox"/> red ear sunfish           |
| <input type="checkbox"/> flathead catfish            | <input type="checkbox"/> largemouth bass                         | <input type="checkbox"/> warmouth (goggle-eye)     |
| <input type="checkbox"/> blue catfish                | <input type="checkbox"/> spotted bass (red eye, Kentucky bass)   | <input type="checkbox"/> other _____               |
| <input type="checkbox"/> farm raised catfish         |  | _____  |
| <input type="checkbox"/> freshwater drum (gaspergou) |  | _____  |

**Marine and estuarine species -**

- |   |  |  |
|---|--|--|
| <input type="checkbox"/> sheepshead     | <input type="checkbox"/> white trout   | <input type="checkbox"/> other (for example, fish patty from frozen food section of grocery or a fast food restaurant or restaurant prepared fish like chowder made of unknown fish) |
| <input type="checkbox"/> king mackerel  | <input type="checkbox"/> fresh tuna    | _____  |
| <input type="checkbox"/> redfish        | <input type="checkbox"/> canned tuna   | _____  |
| <input type="checkbox"/> black drum     | <input type="checkbox"/> fresh salmon  |  |
| <input type="checkbox"/> speckled trout | <input type="checkbox"/> canned salmon |  |
| <input type="checkbox"/> flounder       | <input type="checkbox"/> cod           |  |
| <input type="checkbox"/> mullet         | <input type="checkbox"/> shark         |  |
| <input type="checkbox"/> red snapper    |  |  |

16. Did you eat fish within the last three days?  Yes  No  Don't know.

If yes: What fish species or type did you eat the last time you ate fish? (Select up to 3 fish from the above list) \_\_\_\_\_

17. Do you eat fish caught within 40 miles of your home?  Yes  No  Don't know.

If yes:

What percent of the fish you eat is caught within 40 miles of your home?

- less than 50%    more than 50%    Don't know

Do you know where the fish was caught?  Yes    No    Don't know    Other

Name(s) of where the fish is usually caught \_\_\_\_\_

18. Do you work with mercury or mercury products in your job? (Example: mercury cell batteries, mercury vapor lamps thermostats, switches etc)  Yes  No  Don't know  Other \_\_\_\_\_

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