



December 2010

Gulf Coast Seafood Consumption Survey

After the BP *Deepwater Horizon* oil spill in the Gulf of Mexico, up to 36 percent of Gulf fisheries were temporarily closed to fishing and shrimping. In June 2010, the Food and Drug Administration (FDA) released a protocol for determining seafood safety.¹ The protocol has guided the reopening of tens of thousands of square miles of federal and state fisheries in the Gulf, and now more than 99 percent of Gulf waters have reopened to fishing. The federal protocol included several assumptions that were questioned by scientists and Gulf Coast residents. Among the major issues that raised questions were the seafood consumption rates, which the FDA derived from national rather than local data; the FDA assumed that people eat two meals of fish and one meal of shrimp per week, with no more than 3 ounces of shrimp per meal (approximately four jumbo shrimp). Nearly two dozen Gulf Coast groups commented on these assumptions in a formal letter to the FDA on August 17, 2010, saying that, in their judgment, these numbers significantly underestimate local seafood consumption. After the *Exxon Valdez* oil spill, FDA used local seafood consumption data for their seafood safety assessment, so it was unclear to many observers why local data were not collected for the Gulf. NRDC therefore partnered with local organizations to gather data on seafood consumption patterns among local residents, with a focus on validating the national seafood survey numbers used by the FDA. If the FDA estimates truly reflect high-end seafood consumption rates, as the Agency claims, our seafood survey would fail to identify significant numbers of people in the Gulf Coast who eat seafood at much higher rates.

Methods

We conducted a survey of 547 Gulf Coast residents in Louisiana, Mississippi, Alabama, and Florida. The survey was administered via an online survey instrument and paper copies were administered by community representatives in English and Vietnamese. Gulf Coast residents were defined as those living in counties which border the Gulf of Mexico or an associated water body. To ensure adequate representation of high-end seafood consumers, we partnered with local community organizations to administer the survey to rural coastal communities in Louisiana, and Vietnamese Americans in Louisiana and Mississippi. The survey was advertised

through partnerships with local organizations and publication in local newsletters and media. Participation in the survey was voluntary, not contingent on consuming any Gulf seafood, and open to all residents of Gulf Coast counties.

The survey collected information on consumption frequency and meal size for fish, shrimp, crab, and oysters. In addition, we collected demographic information including sex, ethnicity, state and county of residence, the presence of children in the house, weight, and pregnancy status. Survey responses were collected from August 2010 through October 2010 and non-Gulf Coast residents were removed from the data file. Surveys were included in the analysis if responses were present for the majority of questions. We aggregated responses according to various demographic groupings and summarized the results using counts, percentages, mean, median, and 90th percentile.

Shrimp consumption rates were calculated according to the formula used by FDA in their risk assessment to determine Levels of Concern for Polycyclic Aromatic Hydrocarbons (PAHs) in shrimp:²

$[(\text{meal frequency (meals/month)}/30 \text{ (days/month)}) \times \text{meal size (g)}] = \text{grams of shrimp per day}$

We used median and 90th percentile values for meal frequency and number of shrimp eaten per meal collected in our survey. We assumed a jumbo shrimp size category which is classified as 23 shrimp per pound as per industry guidance documents.³

Results

Study Population

Our study population consisted of 547 Gulf Coast residents with approximately 60% female and 40% male respondents. About half of the survey respondents live in Louisiana with 21% from Mississippi, 14% from Alabama, and 15% from Florida. The majority of respondents identified themselves as White (65%) followed by Asian/Pacific Islander (16%), African American (7%), and Other/Unknown (5%) (See Table 1). We identified two subgroups of respondents that reflected populations suspected to be high-end seafood consumers: rural Louisiana fishing communities (133 survey respondents), and Vietnamese-American fishing communities (89 respondents).

Table 1: Survey Respondent Demographics

	African American/Black	Asian/Pacific Islander	Native American/ Alaska Native	White	Other/ Unknown	Total	Percentage
Louisiana	14	47	36	170	6	273	50%
Mississippi	20	36	1	42	18	117	21%
Alabama	0	1	0	70	3	74	14%
Florida	2	1	4	74	2	83	15%
Total	36	85	41	356	29	547	100%
Percentage	7%	16%	7%	65%	5%	100%	

Survey respondents’ self-reported weight ranged from 95 pounds to 515 pounds, with a mean of 165 and a median of 160. Forty-four percent—or 243 respondents—had children in their household under 16 years of age and nine people (1.6%) were pregnant or nursing.

Seafood Consumption Frequency

Fish

Overall in our study population, the average, median, and 90th percentile consumption frequency for fish was 3, 2, and 5 times per week, respectively. Some subpopulations had significantly higher consumption rates (see Table 2). The Asian/Pacific Islander ethnic group had a median fish consumption frequency of 5 times per week and a 90th percentile of 8 times per week. For comparison, the FDA assumption was 2 times per week.

Shrimp

In our study population, the average, median, and 90th percentile consumption frequency for shrimp was 2, 2, and 5 times per week, respectively. Some subpopulations had significantly higher consumption rates (see Table 2). The Asian/Pacific Islander ethnic group had a median shrimp consumption frequency of 4 times per week and a 90th percentile of 6 times per week. For comparison, the FDA assumption was 1 meal per week.

Table 2: Seafood Consumption Frequency by Ethnicity

Meals/week	Fish		Shrimp		Oyster		Crab	
	Median	90th Percentile						
Total	2	5	2	5	<1	3	1	4
African American/Black	3	6	2	5	<1	2	1	3
Asian/Pacific Islander	5	8	4	6	2	5	2	4
Native American/ Alaska Native	1	3	2	8	1	2	1	7
Unknown	2	5	2	4	1	3	1	4
White	2	4	1	4	<1	2	1	4

Oyster

In our study population, the average, median, and 90th percentile consumption frequency for oyster was 1, less than 1, and 3 times per week respectively. Some subpopulations such as Native Americans and Asian/Pacific Islanders consumed oysters more frequently (see Table 2). The Asian/Pacific Islander ethnic group had a median oyster consumption frequency of 2 times per week and a 90th percentile of 5 times per week. For comparison, the FDA assumption was 1 meal per week.

Crab

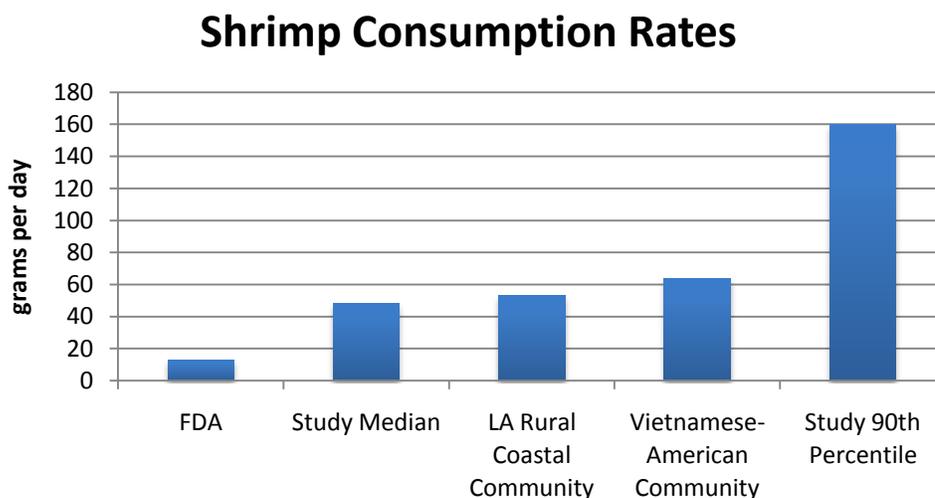
In our study population, the average, median, and 90th percentile consumption frequency for crab was 1, 1, and 4 times per week respectively. Some subpopulations, such as Asian/Pacific Islanders, consumed crab more frequently (see Table 2). The Asian/Pacific Islander ethnic group had a median crab consumption frequency of 2 times per week and a 90th percentile of 4 times per week. For comparison, the FDA assumption was 1 meal per week.

Shrimp Consumption Rates

Using the results of our survey, we calculated the total daily consumption rate (grams/day) for all respondents and for sub-categories known to be high-end consumers. The consumption rate is the number of shrimp meals per week multiplied by the average number of grams of shrimp consumed at each meal, and divided by the number of days per week. We compared the median daily consumption rate for the study as whole (48 g/day), respondents from Louisiana (LA) rural coastal communities (53.3 g/day), and respondents from Vietnamese-American communities in Louisiana and Mississippi (64 g/day), and the 90th percentile of the whole

survey (160 g/day) to the estimate used by FDA (13 g/day). The consumption rates all exceed FDA estimates by 3.6, 4.0, 4.8, and 12.1 times respectively (See Figure 1).

Figure 1: Shrimp Consumption Rates FDA and Study Populations



Shrimp are a particular concern for three reasons: (1) based on our survey results, the FDA seafood consumption estimates for shrimp represent the most significant underestimate of seafood consumption for Gulf Coast residents; (2) shrimp are expected to accumulate higher concentrations of PAHs compared to fish, since invertebrates are less able to efficiently excrete these chemicals than are vertebrate fish;⁴ and (3) the FDA testing protocols include the fewest samples for shrimp, and may underestimate contamination further by shelling and removing the head before testing, whereas many Gulf Coast recipes involve cooking shrimp in the shells and eating them whole.

Vulnerable populations

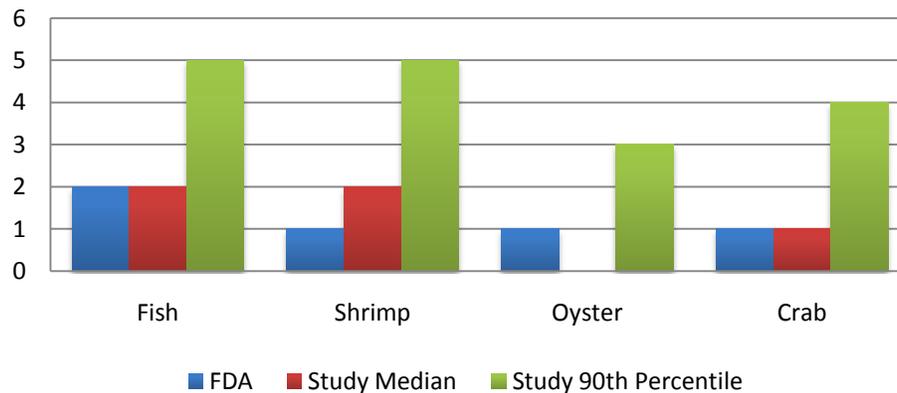
Previous studies have identified that pregnant women, young children, and high-end seafood consumers are vulnerable to contaminants in seafood due to increased levels of exposure, lower body weights and the physiological vulnerabilities of the developing fetus and child. In particular, researchers have identified statistically significant associations between prenatal exposure to PAHs and low birthweight, decreased infant head circumference, and persistent deficits in child IQ at age 5 years.^{5,6,7} Furthermore, the levels of genetic abnormalities (PAH-DNA adducts) were significantly higher in infant cord blood than in matched maternal blood in two separate study populations, indicating that the fetus is likely to be significantly more susceptible to genetic damage from PAHs compared to the mother.⁸ Unfortunately, the FDA did not consider the special vulnerability of the fetus and infant in their calculation.

A woman from a coastal county in Alabama responded to our survey and indicated that she weighs 120 pounds and is pregnant or nursing. She estimated that she eats shrimp 3 times per week and between 8 and 11 shrimp per meal. If we use the FDA’s own calculation to set a level of PAH contaminants in shrimp that would be safe for this woman’s bodyweight and shrimp consumption, it would be 15.3 ppb, or 8.6 times less than 131.5 ppb which is the current FDA allowable level of the PAH contaminant benzo(a)pyrene in Gulf shrimp. Unfortunately there has not been enough shrimp testing to assure that there are no significant areas of contamination above this level. In addition, this calculation does not take into consideration the special vulnerability of the developing fetus to oil spill chemicals.

Among our survey respondents, 43 percent responded that they eat fish more frequently than the FDA estimates and 54 percent responded that they eat shrimp more frequently than the FDA estimates. Sixty percent reported that they weigh less than the 176 lb FDA estimate and 44 percent have children who eat seafood. Although the majority of the survey respondents reported oyster and crab consumption frequencies similar to FDA estimates, high-end consumers (represented in our survey by the 90th percentile) reported significantly higher consumption frequencies—three and four times per week respectively (See Figure 2).

Figure 2: Seafood Consumption Frequency FDA and Study Population

Seafood Consumption Frequency (meals /week)



Conclusions

Our survey found elevated rates of seafood consumption among the Gulf Coast residents we surveyed. Rates of shrimp consumption significantly exceeded the estimate used by the FDA to calculate a safe level of exposure to oil spill-related contaminants—ranging from 3.6 to 12.1 times higher. Some subpopulations, particularly Vietnamese-Americans, reported significantly higher seafood consumption rates than other survey respondents and the FDA estimates. In addition, many of our survey respondents are also more vulnerable to contaminants in seafood than FDA accounted for due to smaller body weight. When coupled with increased consumption rates, this can result in a significantly increased dose of contaminants. Our survey also found that many Gulf Coast households include children (44%) who the US EPA recommends should be considered vulnerable to contaminants like the oil-spill related contaminant PAHs and for whom separate risk levels should be set.⁹

¹ FDA. 2010. Protocol for Interpretation and Use of Sensory Testing and Analytical Chemistry Results for Re-Opening Oil-Impacted Areas Closed to Seafood Harvesting. June 18, 2010.

² *ibid*

³ Standards Usage Of Packing And Counts For Shrimp
http://www.khalsan.com/foodstuff/shrimplibrary/size_%20descriptions.htm

⁴ Law RJ, Hellou J. Contamination of Fish and Shellfish following Oil Spill Incidents. 1999. *Environ Geosci.*;6(2): 90-98.

⁵ Choi H, et al. 2006. International Studies of Prenatal Exposure to Polycyclic Aromatic Hydrocarbons and Fetal Growth. *Environ Health Perspect* 1744-1750

⁶ Perera F, et al. 2003. Effects of transplacental exposure to environmental pollutants on birth outcomes in a multiethnic population. *Environ Health Perspect* 111:201–205

⁷ Perera F, et al. 2009. Prenatal Airborne Polycyclic Aromatic Hydrocarbon Exposure and Child IQ at Age 5 Years. *Pediatrics* 124(2):e195-202

⁸ Perera F., et al. 2004. Biomarkers in Maternal and Newborn Blood Indicate Heightened Fetal Susceptibility to Procarcinogenic DNA Damage. *Environ Health Perspect* 112:1133–1136

⁹ USEPA. 2005. Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens Risk