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Survey of Fish and Shellfish Consumption by Residents of the Greater New Orleans Area

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Consumption of contaminated fish/shellfish products may pose a substantial risk to human health. The risk may be further exacerbated by an increasing rate of fish consumption in the U.S.; an estimated increase from an average of 13 g/day per capita in 1960 to 21 g/day in 1986 (USDA 1985; USDA 1986). These concerns have prompted several studies of fish consumption patterns on a local or regional basis. In addition, the EPA has recently issued a guidance manual for assessing human health risks associated with contaminated fish/shellfish products (EPA 1989).

A recent survey of the states revealed that 30 states use risk assessment to advise the public of potential health risks associated with consumption of contaminated fish (Cunningham et al. 1990). However, there is considerable variation in the fish consumption values used to calculate the risk. For example, the most frequently used rates were: 6.5 g/day (national average), 20 g/day (coastal states), 165 g/day (99th percentile) or a "population specific" consumption value (Cunningham et al. 1990). EPA (1989) recommends that "local or regional assessments of fish/shellfish consumption be performed whenever possible to avoid possible errors inherent in extrapolating standard values for the U.S. population to distinct subpopulations."

This is particularly true for Louisiana since this state is second only to Alaska in total fisheries products with annual total commercial landings of over 1 billion pounds. Since seafood is such an integral part of life in Louisiana, it is particularly important to assess local fish/shellfish consumption patterns so that appropriate seafood consumption criteria and risk assessment guidelines can be established for Louisiana residents. The purpose of this project, therefore, was to begin this process by determining fish and shellfish consumption

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patterns by person living in the greater New Orleans area.

MATERIALS AND METHODS

A telephone 7-day recall survey was selected to survey a random sample of the general population. Among the parameters addressed in the survey were: standard demographics, economic/educational background, religion, seafood consumption patterns (species eaten, form of species consumed, cooking method, fish consumption rate - grams/day, store bought or sport caught, geographic location of catch) and fishing practices. For the purposes of this article, the term "seafood" is used generically to include both fresh water and salt water finfish as well as shrimp, crab, crawfish and oysters.

The survey instrument was validated in a field trial. Ten individuals were interviewed by telephone and refinements to the survey form were made to clarify ambiguous questions and to include additional pertinent questions.

The survey sample was derived and interviews conducted by a market research and opinion poll consulting firm located in the greater New Orleans area. The survey sample was derived randomly from parish area homes. Interviews were held daily with approximately 1/3 of the interviewing time during the day and 2/3 during evening hours. The sampling procedure was rigidly controlled with up to 4 attempts made to a household before alternative numbers to the same exchange were selected. Ten percent of each interviewer's work was validated by call back of respondents. All of the work was done from a central telephone location which provided for continuous monitoring of interviewer progress, efficiency, verbalization and validity.

RESULTS AND DISCUSSION

The full survey was conducted in the summer of 1991 in the greater New Orleans area. A total of 587 interviews were attempted to complete 405 interviews, providing a cooperation rate of 69%. Interviews lasted up to 20 minutes, depending on the number of fish meals reported by respondents.

Among the 405 respondents, 20 individuals (5%) reported never eating fish or seafood. Major reasons for not eating fish included allergies (45%) and taste (30%). Five percent each reported odor, preference for other foods, medical reasons, fear of contamination or personal beliefs as reasons for not eating seafood. This differs from a survey done in Oregon that found that non fish eaters cited cost (41%), local availability (24%) and quality (22%) as the main reasons for not eating fresh

fish (Hadlett and Raab 1990).

Among the 405 individuals surveyed, an additional 137 respondents (34%) reported eating fish or shellfish, although not in the last week, and 248 individuals (61%) reported eating fish or shellfish in the last week.

The survey sample was predominantly female (59.8%), white (74.1%) and Catholic (57.6%). There was a broad age distribution in the sample. There was also a broad spectrum of income levels and occupations represented. It is interesting to note that 77.4% of those surveyed reported living in Louisiana for over 20 years. This has implications for risk assessment when length of exposure and frequency of exposure variables are considered. Over 95% of those surveyed reported living in an urban area, as indicated by connection to a community sewerage system.

Two hundred forty eight (248) respondents reported eating fish or shellfish during the preceding week. The majority of individuals (60.5%) reporting 1 seafood meal during the week; 25% ate 2 seafood meals; 10% had 3 seafood meals and 3% reported 4 or more seafood meals. The total number of seafood meals reported was 400.

Eighty (32.3%) of the 248 seafood eaters ate one shrimp meal and 14 (5.6%) ate 2 or more shrimp meals, making shrimp the most preferred species. Sixty nine (25.8%) ate at least one cat fish meal. This agrees with a survey of preferred seafood species in 3 south central U.S. cities (Dellenbarger et al. 1991). Additional popular species were speckled trout (15.7%) and crab (12.5%).

The survey showed that among the 400 meals, restaurants accounted for the largest percent of shrimp and catfish meals, 43.4% and 45.8%, respectively. Except for catfish and tuna, other finfish were most often caught by the consumer or a friend: speckled trout, 57.1%; other salt water fish, 57.1%; fresh water fish, 61.6%. Crabs (40%) and crawfish (64.3%) were most often purchased at a fish market. Tuna (72.4%) was most often purchased at a grocery store.

Data for the 400 meals indicate that shrimp were most often fried (49.1%) or boiled (40.7%); catfish (81.1%), fresh water fish (53.8%) and speckled trout (60%) were most often fried, while other salt water fish (45.7%) were most often broiled. Crabs (84%) and crawfish (100%) were usually boiled.

There were 191 responses to questions concerning consumption of fish skin and internal organs. Respondents reported eating the skin in 24.7% of these. Respondents ate the skin in only 18.9% of 74 catfish meals, but in

38% of the 50 speckled or white trout meals. The respondents ate the livers or other internal organs in only 2 of the 191 fish meals. In 156 (83%) of the 189 meals for which information was available, the fish was a steak or fillet.

There were 15 crawfish meals reported. This value is probably low since this survey was conducted at the end of the crawfish season. In 79% of these meals, the respondents ate the hepatopancreas (the "fat"), which indicates that there may be increased potential for exposure to lipophilic contaminants found in crawfish.

The quantities of shellfish that respondents estimated were eaten varied considerably. For shrimp, the median and modal response were both 0.25 - 0.50 lb (114 - 228 g). For numbers of crabs consumed, the modal response was 6 crabs; the median response was 5 crabs. For those consuming crabmeat, the quantity varied from less than 0.25 lb to 1 lb. For crawfish, both modal and median responses were 2 to 3 lb (914 - 1371 g). The median and modal response of those eating fresh tuna were between 0.25 and 0.50 lb (114 - 228 g). The median response for those eating canned tuna was 3 oz; the modal response was 6 oz (171 g).

Some respondents indicated the amount of fish eaten in terms of dimensions of the fish fillet. The dimensions were converted to a volume (length x width x height). Based on the volume, weights of the fish were then calculated by using the conversion factor, 1 cu cm = 1 g. The calculated weights were compared to the actual weight of each of several "control" portions of fish; the estimated weights were twice as large as they should have been, probably because dimensions were given based on the largest (thickest) portion of the fish fillet. When the original estimated volumes were converted to grams using an adjustment factor of 0.5, it was found that 1 cu in = 8.5 g. The numbers of grams of finfish were estimated in this manner.

The estimated quantities of various finfish species consumed by respondents in the survey were as follows: catfish, median response, 159.1 g; speckled trout, median response, 215.3 g and modal response, between 246 and 410 g. The median response for "other salt water fish" was 203.0 g consumed. For "other fresh water fish" meals, 15 of 17 respondents provided dimensions of the fish. The median response was 73.0 g consumed.

The average daily consumption of various seafoods was next calculated. Average daily consumption depends on the number of meals consumed per week as well as the quantity eaten at a given meal. The survey found that 60% of respondents ate seafood once during the previous

week and 25% ate seafood twice. Data are given, therefore, based on one seafood meal per week and two seafood meals per week. The resulting amounts are given in Table 1 for the most commonly eaten foods based upon the median response. The form of the estimate varies with species since information was not obtained in the same way for all species.

Table 1. Estimated daily consumption (in grams) of fish/shellfish by residents of the greater New Orleans area.

food	one meal/week	two meals/week
Shrimp	16.3-32.6 g	32.6-65.1 g
Catfish	22.7 g	49.5 g
Speckled trout	30.8 g	61.5 g
Other salt water fish	29.0 g	58.0 g
Tuna (fresh)	16.3-32.6 g	32.6-65.1 g
Other fresh water fish	10.4 g	20.9 g
Crawfish	13.0-19.5 g	26.0-39.0 g
Crab	26.0 g	52.0 g

For finfish, the average consumption was estimated by multiplying the quantities given in Table 1 above by 1/7 (once per week) and by 2/7 (twice per week). For example, Table 1 indicates the daily consumption of catfish to be 22.7 g based on one catfish meal per week and 49.5 g based on two catfish meals per week.

For crabs, the average consumption was based on a modal consumption of 6 boiled crabs. Several seafood processors gave an estimate of 15 boiled crabs = 1 lb, or 456 g of meat. The calculation, therefore, based on one crab meal per week, as shown in Table 1, is: 6/15 X 456 g = 182 g / 7 days = 26 g.

For crawfish, the average consumption was based on a median consumption of 2 to 3 lb. Several seafood processors estimated that 10 lb of boiled crawfish = 1 lb of meat. The calculation, therefore, based on one crawfish meal per week is: (for 2 lb) 914 g X 0.1 / 7 = 13.0 g and (for 3 lb) 1371 g X 0.1 / 7 = 19.5 g.

For shrimp, the median response was 0.25 to 0.5 lb of shrimp consumed. The calculation for shrimp, based on one shrimp meal per week is: (for 0.25 lb) 0.25 X 456 g = 114 g / 7 =16.3 g and (for 0.5 lb) 0.5 X 456 g = 228 g / 7 = 32.6 g.

The relationships between eating seafood in the last week and the demographic variables were explored statistically with the chi square test of independence. Analysis of the data indicates that consumption of fish or shellfish during the 7-day recall period was not associated with gender (chi square=1.37, df=1, p=0.24), race (chi square=0.82, df=1, p=0.37), religion (chi square=0.06, df=1, p=0.81) or income (chi square=7.25, df=5, p=0.12). Seafood consumption was associated with age (chi square=7.99, df=2, p=0.019) and whether consumers resided in an urban or rural area as indicated by access to a community sewerage system (chi square=4.06, df=1, p=0.044). Note, however, that there were very few rural respondents (4% of the total) which may impact the survey results. Seafood consumption was marginally associated with occupation (chi square=10.17, df=5, p=0.071).

It is particularly relevant to note that no differences in fish and seafood consumption were found with differences in race or income. A similar survey of minority populations in Michigan showed that the associations between fish consumption and race or income to be "marginally non significant" (West et al. in preparation). This study indicates that low income individuals or minorities in the greater New Orleans area would not be considered at additional risk when assessments associated with fish consumption are calculated.

A series of questions was asked to determine fishing practices of respondents. This was done in an attempt to identify sport and subsistence fishermen and to determine if fishing influenced fish consumption. The survey indicated that 31.4% (130 individuals) fish for recreation. Subsistence fishermen accounted for less than 1% of the sample. Those who fish were more likely to have eaten fish in the previous week than those who do not fish (chi square=14.46, df=1, p<0.001). While only 130 of 405 respondents reported that they fish for fun or for necessity, it is interesting to note that the sources of 62% of the fresh water finfish and over 50% of trout and other salt water finfish in this survey were either self caught or gifts from anglers.

While this survey targeted the general population, the survey also identified a large population that is affected by recreational fishing as noted above. This population is significantly larger than that reported for Wisconsin and Michigan in a recent EPA workshop (EPA 1991). In those states, surveys are based on the assumption that anglers consume the most fish, and are, therefore, at highest risk. In Wisconsin, for example, only 6.7 % of anglers consume 1 or more fish meals per week (EPA 1991). In the New Orleans area, the amount of fishing and the generous distribution of fish to friends

has a bearing on the interpretation of exposure data in assessment of risk from contaminated fish.

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