



Guidance for Conducting Fish and Wildlife Consumption Surveys



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CONTENTS

TABLES	vi
GLOSSARY AND ABBREVIATIONS	vii
ACKNOWLEDGMENTS	x
EXECUTIVE SUMMARY	ES-1
SECTION 1: INTRODUCTION	1-1
1.1 Historical Perspective	1-1
1.2 Purpose	1-2
1.3 Objectives	1-3
1.4 Relationship of Manual to Other Guidance Documents	1-3
1.5 Organization of This Manual	1-3
SECTION 2: SURVEY OBJECTIVES AND INFORMATION NEEDS	2-1
2.1 Overview	2-1
2.2 Definition of Survey Objectives	2-1
2.3 Information Needs	2-5
2.4 Summary	2-8
SECTION 3: SURVEY APPROACHES AND SELECTION CRITERIA	3-1
3.1 Overview	3-1
3.2 Types of Surveys	3-1
3.2.1 Telephone Survey	3-1
3.2.2 Mail Survey	3-1
3.2.3 Diary	3-2
3.2.4 Personal Interview	3-2
3.2.5 Creel Survey	3-2
3.3 Selection Criteria	3-2
3.3.1 Target Population of Concern	3-4
3.3.2 Accuracy	3-5
3.3.3 Time Frame	3-6
3.3.4 Resource Considerations	3-7
3.3.5 Characteristics of the Source of the Fish or Wildlife	3-7
3.4 Summary	3-7
SECTION 4: INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION	4-1
4.1 Overview	4-1
4.2 General Instrument and Study Design Issues	4-1
4.3 General Statistical Analysis and Data Interpretation Considerations	4-5
4.4 General QA/QC Considerations	4-10
4.5 Telephone Survey	4-10
4.5.1 Advantages	4-10
4.5.2 Disadvantages	4-11

4.5.3	Specific Issues for Instrument and Study Design: Telephone Survey	4-11
4.5.4	Specific Issues for Statistical Sampling and Analysis: Telephone Survey	4-12
4.5.5	Specific Issues for QA/QC: Telephone Survey	4-13
4.6	Mail Survey	4-13
4.6.1	Advantages	4-13
4.6.2	Disadvantages	4-14
4.6.3	Specific Issues for Instrument and Study Design: Mail Survey	4-14
4.6.4	Specific Issues for Statistical Sampling and Analysis: Mail Survey	4-16
4.6.5	Specific Issues for QA/QC: Mail Survey	4-16
4.7	Diary	4-16
4.7.1	Advantages	4-16
4.7.2	Disadvantages	4-17
4.7.3	Specific Issues for Instrument and Study Design: Diary	4-17
4.7.4	Specific Issues for Statistical Sampling and Analysis: Diary	4-18
4.7.5	Specific Issues for QA/QC: Diary	4-18
4.8	Personal Interview	4-19
4.8.1	Advantages	4-19
4.8.2	Disadvantages	4-19
4.8.3	Specific Issues for Instrument and Study Design: Personal Interview	4-20
4.8.4	Specific Issues for Statistical Sampling and Analysis: Personal Interview	4-21
4.8.5	Specific Issues for QA/QC: Personal Interview	4-21
4.9	Creel Survey	4-21
4.9.1	Advantages	4-21
4.9.2	Disadvantages	4-22
4.9.3	Specific Issues for Instrument and Study Design: Creel Survey	4-22
4.9.4	Specific Issues for Statistical Sampling and Analysis: Creel Survey	4-24
4.9.5	Specific Issues for QA/QC: Creel Survey	4-24
SECTION 5: SUMMARY		5-1
REFERENCES		Ref-1

APPENDIX A: SUMMARY OF SURVEY METHODS

APPENDIX B: EXAMPLES OF SURVEY QUESTIONNAIRES

- Telephone Survey: EPA/Delaware Consumption Survey Phone Questionnaire
- Mail Survey: 1991/92 Michigan Fish Eaters Survey
- Mail Survey: Your Family and Fishing: A Questionnaire for the Children’s Fishing Project
- Mail Survey: New York State Fisher Cohort Study
- Diary: Fishing Trips and Fish Meals

Diary: Fishing Trips and Fish Consumption

Personal Interview: 1991 Columbia River InterTribal Fish Commission Survey

Creel Survey: San Diego Bay Fisher Survey Questionnaire

Creel Survey: Alabama State-wide Freshwater Fish Consumption Survey

Creel Survey: Hudson River Fisher Survey

TABLES

Table 1 Potential Information Requirements for Fish and Wildlife
Consumption Surveys 2-6

Table 2 Example Development of a Survey 2-9

Table 3 Comparison of Five Fish and Wildlife Consumption Survey Approaches
Using Various Selection Criteria 3-3

Table 4 Characteristics of Creel Survey Methods 4-23

GLOSSARY AND ABBREVIATIONS

Access Point Survey	A survey that is administered at locations where fishers or hunters gain entry to fishing or hunting areas. Examples include boat ramps, docks, and wildlife refuge check stations.
Accuracy	A measure of agreement, expressed numerically as a percentage, between a measured value and an accepted or true value.
Aerial Survey	Flying over a fishing or hunting area to obtain an estimate of the total population participating in the activity during the period of time in which a creel survey or personal interviews are conducted. This procedure is used to estimate the percentage of the population interviewed when other sampling strategies (e.g., probability sampling) cannot be used.
Bias	Property of a statistical estimator that consistently overestimates or underestimates a population parameter. The discrepancy between the expected value of an estimator and the population parameter being estimated.
Bioaccumulative Chemical	A chemical that is accumulated in the tissue of organisms through any route, including respiration, ingestion, or direct contact with air, water, or sediment.
Bivariate Analysis	Statistical analysis that involves two variables.
Bus Route Method	A method for conducting a creel survey that involves visiting predetermined fishing sites at predetermined times to interview fishers.
CATI	Computer-assisted telephone interviewing, a method of telephone interviewing in which a structured questionnaire is programmed into a computer. The interviewer enters the respondent's replies directly into the computer program.
Census	A complete enumeration a population.
Confidence Interval	The range of values within which it is estimated a population parameter lies with a defined level of confidence based on sample data.
Confidence Level	The probability that a population parameter lies within a given range.
Descriptive Statistics	The branch of statistics that involves summarizing, tabulating, organizing, and graphing data for the purpose of describing a

	sample of objects or individuals that have been measured or observed.
Frequency Distribution	A tabular or graphical presentation of the number of times each value occurs in the data set.
Inferential Statistics	The branch of statistics that involves making inferences about the value of one or more population parameters, on the basis of sample statistics. The most common applications of inferential statistical procedures are estimation and hypothesis testing.
Measures of Central Tendency	Descriptive statistics that identify the center or middle of a distribution. Common measures are the mode, mean, and median.
Measures of Dispersion	Descriptive statistics that identify the spread of values of numerical data. Common measures are the range, standard deviation, and variance.
Multivariate Analysis	The analysis of data consisting of multiple variables and examination associations among variables. (e.g., regression and correlation analysis, analyses of variance and covariance.)
Nonparametric Test	A statistical test of a hypothesis that is not a statement about population parameters and makes no assumptions about the distribution of the data.
Parametric Test	A statistical test of a hypothesis about one or more population parameters. Parametric tests require a knowledge of the functional form of the population from which the samples are drawn.
Probability	The chance that a given event or result will occur.
QA	Quality assurance; the steps and procedures used to review data and determine whether the data quality objectives of a study have been met.
QC	Quality control; the procedures and practices implemented as part of a study to minimize errors and ensure the accuracy of data.
RDD	Random digit dialing; a method used to select samples for telephone surveys by random selection of telephone numbers within working exchanges. This method permits coverage of both listed and unlisted telephone numbers.
Recall Error	A response error resulting from a subject's inaccurate recollection of particular events.

Rolling Cohort Method	A survey method that involves randomly placing survey participants into groups (cohorts), which are then sequentially surveyed over equally spaced intervals, for example, intervals of two or more weeks. Each cohort is asked to provide recall data for a period of time equal to the interval spacing between cohort surveys. This method is typically used to provide coverage over an entire year while avoiding the problems associated with long recall periods.
Roving Creel Survey	A creel survey that is conducted by having the interviewer move through the survey area in a random or defined pattern to contact fishers.
Stratified Sample Design	Sampling design that separates population elements into non-overlapping groups (strata) from which samples are to be selected. The establishment of strata occurs prior to sampling.
Univariate Analysis	Statistical analysis involving a single variable.
Weights	Weights are needed when sampled units are selected by unequal probability sampling. Weights are used to assign greater relative importance to some sampled elements than to others. Weights are calculated as the inverse of the probability of selection.

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EXECUTIVE SUMMARY

Concern over potential human health risks associated with chemically contaminated fish and wildlife has led many states to issue consumption advisories and bans in an effort to limit exposures to certain organic compounds and metals that can become concentrated in the tissues of these organisms. However, the processes and procedures by which states issue consumption advisories and bans have varied. The U.S. Environmental Protection Agency (EPA) has developed a series of four documents designed to provide guidance to state, local, regional, and tribal environmental health officials who are responsible for issuing consumption advisories for noncommercially caught fish and shellfish. The documents are meant only to provide guidance and do not constitute a regulatory requirement. The documents are *Guidance for Assessing Chemical Contamination Data for Use in Fish Advisories, Volume 1: Fish Sampling and Analysis* (released in 1993 and revised in 1995), *Volume 2: Risk Assessment and Fish Consumption Limits* (released in 1994 and revised in 1997), *Volume 3: Risk Management* (released in 1996), and *Volume 4: Risk Communication* (released in 1995). The current document provides additional guidance on methods for obtaining consumption rate data for use in characterizing exposure in a population when estimating potential risks and determining whether a consumption advisory is warranted to limit exposure to contaminants in fish (a term that includes shellfish for the purposes of this document) and wildlife. Consumption rate data are also useful to states that are in the process of developing or modifying water quality standards.

The purpose of this document is to provide explicit instructions for selecting a survey approach and designing a survey to obtain consumption rate information. A statistician should also be consulted to provide advice on the specific sampling and statistical analysis considerations for each fish consumption rate assessment project. The survey methods presented in this document may be used by regional, state, tribal, or local agencies to obtain information on the consumption of noncommercially obtained fish and wildlife. This information can then be used to estimate risks to persons who could consume organisms that might contain bioaccumulative and potentially dangerous levels of toxicants, and to develop consumption advisories and water quality standards to protect human health. Such surveys can also provide demographic information about a population for which advisories are issued, which might assist in the communication of risks and advisory recommendations.

The primary objectives of this document are as follows:

- Emphasize the importance of survey objectives in selecting a survey approach and designing the survey.
- Provide selection criteria for choosing among the various survey approaches.
- Critically evaluate key components in survey design and methods, including question development, statistical analysis, quality assurance/quality control, and data interpretation.

Section 1 provides an overview on the history of consumption advisories, the purpose and objectives of this document, the relationship of this document to other guidance documents, and the organization of this document. Section 2 presents a discussion of the development of the underlying objectives for conducting a survey and summarizes the factors that should be considered when articulating

survey objectives. Survey objectives should reflect the purpose for which the data will be used. Because each survey method has unique biases, the specific survey objectives will dictate how the survey is conducted. For example, if the target population and/or waterbody is relatively small, surveys will most likely be conducted at access sites rather than by means of mail or telephone surveys because the latter type of survey is unlikely to capture enough respondents in the target population for a statistically valid estimate unless they have been specifically identified and their addresses or telephone numbers are known. Several key factors or variables can influence the choice or articulation of an objective. These factors include, but are not limited to, types of fish or wildlife being consumed, geographic location, population of concern, associated behavior, timing, accuracy/uncertainty, type of decision to be made, and adherence to advisories.

The survey objectives will also help in designing the survey instrument, commonly called a questionnaire. Information collected in the survey can be placed in one of four categories: (1) physical and sociodemographic characteristics of fishers and hunters, (2) fishing and hunting activities and behavior, (3) preparation and consumption patterns, and (4) consumption advisory awareness, knowledge, attitudes, and beliefs. Each question in the survey instrument should be designed so that it addresses one information need.

Section 3 reviews the various consumption assessment approaches included in this document and presents selection criteria to be used in choosing from among the different approaches (i.e., telephone survey, mail survey, diary, personal interview, and creel survey). The selection of a consumption survey approach or approaches should be based on carefully assessing each approach in light of the stated objectives for conducting the survey. Key considerations include the target population or subpopulations of concern, the degree of accuracy required from the survey results, the time frame in which the survey information is needed, human and financial resources available to conduct the survey and analyze the data, and the characteristics of the fish or wildlife populations being evaluated and their harvesting.

In Section 4, instrument and study design considerations for each of the survey approaches are discussed. Many issues are common to all five survey approaches, including issues pertaining to questionnaire design (question structure, wording, and order), statistical analysis, data interpretation, and quality control. The selection criteria that can be used to differentiate the survey approaches can be divided into the following five categories:

- Target population/subpopulation
- Accuracy
- Time frame
- Resources
- Harvest characteristics

This document compares the five survey approaches based on criteria within the five categories listed above. Often more than one survey approach may provide the required information. In such cases, the selection of an approach should be based on other considerations such as personal preference, past experience, available resources (funds and personnel), or consistency with other local, regional, or national surveys. This last factor is particularly important if the purpose of the survey is to provide data for comparison with the results of another survey.

EPA welcomes your suggestions and comments. A major goal of this guidance document series is to provide a clear and usable summary of critical information necessary to make informed decisions regarding the development of consumption advisories and water quality standards. EPA hopes this document will be a useful adjunct to the resources used by the states, local governments, and tribal bodies in making decisions regarding the development of consumption advisories and water quality standards in their jurisdictions.

SECTION 1

INTRODUCTION

1.1 Historical Perspective

Concern over potential human health risks associated with chemically contaminated fish, shellfish, and other organisms that feed on fish and shellfish has led many states to issue consumption advisories and bans in an effort to limit exposures to certain organic compounds and metals that may become concentrated in the tissues of these organisms. However, the processes and procedures by which states develop consumption surveys and use the survey results as a basis for issuing advisories or bans and water quality standards have varied. In an effort to evaluate the fish consumption advisory process in the states, the U.S. Environmental Protection Agency (EPA) provided a grant for the American Fisheries Society (AFS) to conduct a survey of state fish consumption advisory practices (Cunningham et al., 1990). In the survey, state representatives were asked to describe their fish consumption advisory process and procedures, to identify state concerns related to the advisory process, and to recommend actions that could be undertaken by the federal government to improve the effectiveness of the consumption advisories.

To follow up on the state recommendations for federal action, EPA invited officials from state agencies to attend a Federal-State Forum on August 30, 1990, in Pittsburgh, Pennsylvania. Representatives of agencies from 27 states and the District of Columbia, as well as several federal agencies, including EPA, the Food and Drug Administration (FDA), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service (FWS), the Tennessee Valley Authority (TVA), and the Agency for Toxic Substances and Disease Registry (ATSDR) were present. The agenda for the forum contained a list of the federal action items identified in the AFS survey. Participants were asked to rank proposed federal action items as short- or long-term priorities and to recommend other action items not previously identified in the survey. Each participant was also asked to submit the three action items most important to his or her program. The second most frequently requested short-term action item contributed by forum participants was to conduct surveys or studies to assess the fish consumption rates of various subpopulations in different regions of the country (Southerland, 1991). Fish consumption rate data are essential in developing water quality standards, and they also play an integral role in developing advisories and bans.

EPA recognized that studies of fish consumption patterns should be conducted to update available information and to focus on geographical or cultural populations potentially at a high risk. For humans, a technique that has often been used to obtain consumption pattern data is to conduct a survey in which respondents are asked to estimate how much fish tissue they consume and the frequency at which it is consumed or to record actual consumption information on a daily basis. To address this need, EPA implemented a three-phase approach for assisting the states in estimating fish tissue consumption rates in potential high-risk populations. This approach included the following steps:

- Review and critically evaluate existing fish tissue consumption rate survey methods and determine their applicability for estimating consumption rates in recreational and subsistence fishing populations.

- Conduct a workshop for the states presenting the results of the review and critical evaluation of fish tissue consumption survey methods.
- Provide direct support to the states in conducting fish tissue consumption surveys targeting recreational and subsistence fishers.

A 1992 document was prepared to meet the first step in this process (U.S. EPA, 1992). Existing literature concerning fish tissue consumption was reviewed, and selected surveys were evaluated to identify approaches (recall vs. diary vs. creel) and methods for survey design and analysis. The purpose of the document was to assess the attributes and shortcomings of these approaches and to explore the underlying methods involved in designing and conducting fish consumption surveys. The report also discussed the types of questions that need to be answered in order to understand fish consumption patterns in high-risk populations. It did not, however, recommend a specific protocol for use by the states, nor did it provide selection criteria for states to use to develop surveys.

1.2 Purpose

The purpose of this document is to provide more explicit instructions than those provided in the 1992 EPA document for selecting a survey method and designing a survey to obtain consumption rate information. Data on exposure and determination of the average daily intake are necessary to assess risks posed to consumers of fish and shellfish (U.S. EPA, 1997a). Shellfish, including crabs, lobsters, shrimp, crayfish, mussels, and oysters, have also been included in surveys examining consumption rates, and consumption advisories and bans have been developed for these organisms in some localities. In addition to concerns about consumption of contaminated fish and shellfish, recent studies have indicated that persons who eat wildlife (e.g., frogs, turtles, and waterfowl) that live in polluted areas and/or consume contaminated fish and shellfish might also be exposed to potentially toxic levels of bioaccumulative chemical contaminants. For example, consumption advisories have been issued for snapping turtles and other turtles in New York, Arizona, Massachusetts, and Minnesota; New York has issued consumption advisories for mergansers because of high levels of chlordane, DDT, mirex, and polychlorinated biphenyls found in the tissues of these ducks (U.S. EPA, 1996b).

Consumption patterns, including the types and amounts of fish and wildlife and frequencies of meals eaten from these organisms and the preparation methods used, can also vary greatly within populations because of differences in age or gender. They can differ between populations because of differences in cultural practices and/or socioeconomic status. The survey methods presented in this document may be used by regional, state, tribal, or local agencies to obtain information on the consumption of noncommercially obtained fish (a term that includes shellfish for the purposes of this document) and wildlife (a term that includes other aquatic and terrestrial animals and birds for the purposes of this document). This information can then be used to determine whether the amounts of fish and wildlife being eaten are safe in relation to possible chemical contamination, to estimate risks to persons who could consume fish and wildlife that might contain bioaccumulative and potentially dangerous levels of toxicants, and to develop consumption advisories and water quality standards to protect human health. Information presented in this document should also prove valuable in evaluating the type and quality of data obtained in surveys conducted by others to determine whether they are suitable for use in planned risk assessments.

1.3 Objectives

The primary objectives of this document are as follows:

- Emphasize the importance of survey objectives in selecting a survey approach and designing the survey.
- Provide selection criteria for choosing among the various survey approaches.
- Critically evaluate key components in survey design and methods, including question development, statistical analysis, quality assurance and quality control, and data interpretation.

1.4 Relationship of Manual to Other Guidance Documents

To address concerns raised by the survey of state fish advisory practices (Cunningham et al., 1990), EPA developed a series of four documents designed to provide guidance to state, local, regional, and tribal environmental health officials who are responsible for issuing consumption advisories for noncommercially caught fish and shellfish. The documents are meant only to provide guidance and do not constitute a regulatory requirement. The documents are *Guidance for Assessing Chemical Contamination Data for Use in Fish Advisories, Volume 1: Fish Sampling and Analysis* (released in 1993 and revised in 1995), *Volume 2: Risk Assessment and Fish Consumption Limits* (released in 1994 and revised in 1997), *Volume 3: Risk Management* (released in 1996), and *Volume 4: Risk Communication* (released in 1995). EPA recommends that the four volumes of this guidance series be used together since no one volume provides all the necessary information to make decisions regarding the issuance of consumption advisories. The current volume provides additional guidance on methods for obtaining consumption rate data for use in developing the exposure assessment to estimate potential risks and to determine whether a consumption advisory is warranted to limit exposure to contaminants in fish and wildlife. The reader is directed to consult additional references provided in this document for more detailed information on designing, conducting, and analyzing consumption surveys. In addition, reviews of consumption surveys, compilations of fish and shellfish consumption rate data, and detailed discussions of issues pertaining to consumption surveys and the use of these data in risk assessments are available in Gassel (1997) and U.S. EPA (1997a).

1.5 Organization of This Manual

Following this introduction, Section 2 presents a discussion of potential survey objectives and summarizes the factors that should be considered when articulating survey objectives. Section 3 reviews the various consumption assessment approaches included in this document and presents selection criteria to be used in choosing between the different approaches. In Section 4, instrument and study design considerations for each of the survey approaches are discussed. The document is summarized in Section 5, and the literature cited is given in the references section. Appendix A provides a summary in table form of previous consumption surveys. Appendix B presents example survey instruments for the five survey approaches discussed in this document. The reader should note that these survey instruments are provided as examples only and their inclusion in this document does not imply endorsement by EPA.

SECTION 2

SURVEY OBJECTIVES AND INFORMATION NEEDS

2.1 Overview

Consumption rates for fish and wildlife differ throughout the country and for specific subpopulations (see, for instance, Hu, 1985; Allen et al., 1996; U.S. EPA, 1996a; Gassel, 1997; U.S. EPA, 1997a). Several recent studies have attempted to develop consumption rate estimates for high-risk populations.

The four steps in the design and development of a consumption survey are as follows:

1. Identification of the survey objectives.
2. Preparation of a sample design and analysis plan, which includes
 - identification of the target population(s) and selection of the sampling strategy for the survey population(s)
 - identification of the specific data to be gained from the survey
 - the analytical/statistical methods to be used once the data are collected
3. Selection of the survey approach to be used to obtain the data.
4. Design of the survey instrument(s).

This section describes the objectives and information needs of surveys or censuses targeting populations of concern.

2.2 Definition of Survey Objectives

Developing the consumption survey objectives is a critical step in designing the survey. An objective is “something toward which effort is directed” (Merriam-Webster, 1993). Objectives can flow from a problem that has been identified (high levels of polychlorinated biphenyls [PCBs] in sport fish) or a question that has been posed (Will eating the fish in this river, or wildlife in this area, make people sick?). The reasons for conducting the survey (e.g., the need to know whether fishers at Lake X eat catfish and how much is consumed) should suggest some or all of the appropriate objectives. For example, if there is a need for fish consumption data for recreational fishers at a contaminated waterbody, three specific objectives would be the following:

1. Identify the population of fishers who catch and eat fish from the waterbody.
2. Obtain information regarding fishing activities at the waterbody for the target population.
3. Determine the fish consumption practices for the target population.

2. SURVEY OBJECTIVES AND INFORMATION NEEDS

If the target population is relatively small and it is desirable and feasible to survey the entire population (i.e., take a census), then the results obtained will be observations of the population parameters. The more typical situation, however, is when a subset of the target population is sampled at random; the results obtained are sample statistics which, if obtained correctly, are expected to be good approximations of the population parameters. Census estimates have less error than sample estimates because they are subject only to the reliability, validity, and measurement error involved in the survey response (see discussion of Accuracy in Section 3.3.2). The sample estimates are subject to the same types of error as censuses, but also to sample selection bias and sampling error.

Survey objectives should reflect the purpose for which the data will be used, one of the reasons for conducting the survey. For example, in cases where health effects from fish or wildlife consumption are suspected, an advisory might be implemented to reduce adverse effects or water quality standards might be established and enforced. Development of an advisory may proceed without site-specific consumption information (see procedures in U.S. EPA, 1997a) based on contaminant levels in tissue and a valid EPA risk value (reference dose or cancer slope factor), chronic no-observed-adverse-effect level (NOAEL), or lowest-observed-adverse-effect level (LOAEL) and an estimated overall average consumption rate to characterize risk. However, determination of actual consumption levels can improve the accuracy of the risk estimate. Subsistence fishers or hunters, who rely on noncommercially obtained fish or wildlife for a major portion of the protein in their diets, might be more at risk than those who fish or hunt primarily for recreation or sport and thus eat less fish and wildlife. Those who fish or hunt less frequently but rely on potentially contaminated sources of fish and wildlife from friends or neighbors for most of their protein needs might be more at risk. Children, women of child-bearing age, and older persons might be more at risk from exposure to certain contaminants than adult middle-aged males. Another potential use for fish consumption data is in state ambient water quality standards programs. For these programs, local fish consumption data are preferred over national default rates.

Consumption rate information is also used in risk management decisions regarding the allocation of resources and implementation of various public health protection strategies related to consumption of contaminated fish and wildlife (U.S. EPA, 1997a). Information on methods used by fishers or hunters to prepare their catch and the extent to which a particular contaminant concentration is likely to be decreased by trimming and skinning or broiling and frying, for example, are needed to develop dose modification factors to change the contaminant concentration and the resulting exposure estimate used as a parameter in the risk equations, for the development of fish advisories, and for risk communication activities (U.S. EPA, 1997a). Thus, different final uses of the data, in addition to the underlying research objectives, will also influence the development of the survey objectives and the design and implementation of the survey.

The objectives for the process of obtaining consumption rate data might be expressed as follows:

- Determine the amount and frequency of noncommercially caught fish consumed by individual members of households in a target population.
- Determine the amount and frequency of consumption of fish from River X for children.
- Determine the amount and frequency of consumption of frogs caught at Lake Y during the summer.

2. SURVEY OBJECTIVES AND INFORMATION NEEDS

- Determine the amount and frequency of consumption of shark, tuna, and swordfish either caught by the fisher or obtained from other sources.
- Determine the amount and frequency of consumption of whole fish versus fish muscle for members of different ethnic populations and socioeconomic sub-populations.
- Determine the amount and frequency of consumption of ducks from regions with several waterbodies containing similar known toxicants.

Different survey objectives will be needed to address different information needs. Consumption rate data might be required for developing an advisory at a waterbody based on contaminants in all fish, or just in certain species of fish. Alternatively, data might be used to develop an advisory to protect human health from exposure to a specific contaminant from a variety of noncommercially caught fish and wildlife, and other sources. An advisory might also be developed to guide people in preparing fish in a manner that removes contaminants and thus reduces exposure.

Because each survey approach has unique biases, the specific survey objectives will dictate how the survey is conducted. For example, if the target population and/or waterbody is relatively small, surveys will most likely be conducted at access sites rather than through mail or telephone surveys because the latter type of survey is unlikely to capture enough respondents in a given population for a statistically valid estimate unless the target population has been previously identified so that their addresses or telephone numbers are known. A large number of data points might be needed to minimize the uncertainty of the fish consumption estimates so as to improve the estimate of risks to the targeted population.

The survey objectives will also help in designing the survey instrument (commonly called a questionnaire). The information to be collected is targeted to address the objectives. One question might provide data needed for one or more objectives; one objective might require several questions to collect the data. The survey objectives can also guide the development of the types of questions to be asked and analyses of the data that might be performed to obtain specific results (e.g., estimated age distribution of consumers, estimated number of fish dishes [or fish meals] consumed per person per week [or per month], and estimated age distribution of persons eating more than 10 g per day). The survey objectives thus serve as a planning tool to ensure that the required information is collected.

Several key factors or variables can influence the choice or articulation of an objective. These factors include, but are not limited to, type of consumption, geographic location, population of concern, associated behavior, timing, accuracy/uncertainty, type of decision to be made, adherence to advisories, and type of adverse health outcomes associated with the contaminants at a site.

The type of consumption that might be targeted in a particular survey could be total (all fish consumed from all sources, caught or bought, noncommercial or commercial), recreational only (fish consumed only when caught for sport), recreational as a percent of total fish consumption, subsistence only (fish consumed year-round as the primary protein source), or species-specific fish consumption (largemouth bass only, sharks only, snapping turtles only, all bottom-feeding species only), for example.

The geographic location to be investigated is also important, both for fishing and hunting activity and for consumers of the fish and wildlife caught. Determining the consumption of bluefish (a saltwater fish) among fishers in the Great Lakes region might be technically feasible, but it would not provide

2. SURVEY OBJECTIVES AND INFORMATION NEEDS

information useful in developing an advisory for Lake Michigan, which would need to be based on the consumption of contaminated lake trout, for instance.

Identification of the population of concern is an important objective that should be articulated during the early stages of the survey design. Surveys can be designed to identify groups that might be at greater risk of exposure to contaminants in fish and wildlife due to higher consumption rates. For example, West et al. (1989) described variations in fish consumption in communities in Michigan by ethnicity, income, and length of residence. This survey determined that, in general, African Americans and Native Americans ate more fish than Caucasians; individuals with lower incomes ate more fish than individuals with higher incomes; and older individuals ate more fish than younger individuals. Surveys also can be designed to target especially susceptible subpopulations. For pregnant and nursing women, women planning to have children, small children, people with preexisting health problems, and older persons, the risk from consuming contaminated fish might be greater than for healthy men and healthy non-reproducing women (U. S. EPA, 1997a). Exposure to some contaminants is of particular concern during prenatal or postnatal development because of the rapid tissue growth and development that infants and children undergo during those periods (NAS, 1993). Persons with preexisting health problems might be particularly susceptible to contaminants that interact with their medications or are toxic to organs already affected by disease (U.S. EPA, 1997a). Older persons might be at greater risk to contaminants because the aging process can increase the retention of toxic chemicals through a variety of morphological, organ, and cellular changes (e.g., West et al., 1997). Additional information on the identification and selection of populations of concern is provided in U.S. EPA (1997a).

Timing is an essential consideration for obtaining consumption rate data. How soon will information from the study be needed? Over what seasons are the data needed, or is the entire year being considered? Fishing activity might be undertaken by the majority of fishers only during the summer, and duck hunting is usually limited to specific time periods; however, the popularity of ice fishing has grown in some areas of the northern United States. In addition, fish or wildlife caught in one season might be preserved (e.g., smoked or frozen) and consumed later, indicating that exposure to tissue contaminants might be equally important year-round.

Another important concept that can influence the development of the objectives is the required accuracy. If only a “ballpark” figure is needed for issuing advice, identification of consumption rates for specific populations or sites might be unnecessary. However, if regulatory or legal challenges to issuance of an advisory, closure, or water quality standards are anticipated, a highly accurate, legally defensible consumption rate might be required, indicating a need to address more objectives or very detailed objectives in the survey.

The type of decision to be made based on the consumption data can drive the survey process; for example, risk assessment (predictive/protective) versus diet/health relationships (empirical). Will data on actual consumption be used in relation to observed health effects, or is potential consumption information (e.g., in the absence of contaminants) desired to assist in cleaning up a contaminated site so that fishing or hunting activity can be restored? For whom will the advice be constructed—the general public or a specific population?

In some cases, consumption data are desired to evaluate adherence to advisories, i.e., the success of existing advisory messages recommending certain consumption behavior. The objective of determining consumption advisory effectiveness should then be included in the list of survey objectives.

2. SURVEY OBJECTIVES AND INFORMATION NEEDS

The responsibilities and the ethics of conducting the survey should also be considered. Of particular importance are the requirements for reporting back to the population surveyed so that respondents can learn the results. In most instances, approval by a human subjects research review board is needed prior to implementing the survey even when the person to be interviewed is clearly anonymous. Confidentiality and informed consent are important in any survey process where personal data are collected and the participant can be identified, as in a personal interview, a listed telephone sample, or a list of license holders.

2.3 Information Needs

In addition to the overall purpose and objectives of a consumption study, the need for information about specific aspects of consumption or characteristics of fish and wildlife consumers should be considered. The extent to which these factors are important or to which information is needed to meet the objectives of the study will influence what survey approach is selected. These factors include:

- Physical and sociodemographic characteristics of fishers and hunters and/or fish and wildlife consumers.
- Fishing and hunting activities and behavior.
- Preparation and consumption patterns.
- Consumption advisory awareness, knowledge, attitudes, and beliefs.

Specific information needs within these general categories are given in Table 1. The list was compiled from recent fishing/shellfishing surveys and comments from representatives of federal and state agencies and other organizations.

The most important data needed to develop an exposure assessment are the characteristics of the population that might be exposed and the exposure or consumption rate, usually expressed in grams per individual per day (g/day) or grams per kilogram of body weight per day (g/kg/day). These information needs are marked with a diamond in Table 1. Certain population subgroups are known to be more susceptible to toxic effects from chemical contaminants (U.S. EPA, 1997a). Of particular concern are children, women of childbearing age, and elderly persons.

The survey objectives might focus on one or more subgroups for which development of a fish consumption advisory might be warranted, depending on the possible chemical contaminants to which consumers might be exposed. The information might be obtained by surveying members of that subgroup only, or by surveying whole households as sample units and later selecting subgroup data for separate analysis. The subgroups might be identified by asking whether the respondent (or each household member) is male or female, his or her actual age or age category, or other designation. The exposure assessment will also require data on the amount of contaminant found in the fish, shellfish, or wildlife tissue of concern. The reader is referred to U.S. EPA (1995, 1997a) for further guidance in obtaining such data.

2. SURVEY OBJECTIVES AND INFORMATION NEEDS

Table 1. Potential Information Requirements for Fish and Wildlife Consumption Surveys^a
Physical and Sociodemographic Characteristics of Fishers/Hunters and/or Consumers: <ul style="list-style-type: none">◆ Characteristics of fisher or hunter and each household member (ethnicity, gender, date of birth, height, weight)◆ Pregnancy/lactation status of women in the household◆ Physical disabilities or medical conditions of each household member◆ Number and type of permanent and temporary household members (e.g., child or adult, fish/wildlife consumer or nonconsumer, resident or migrant)• Occupation/employment status• Income level• Education level• Language spoken at home• City of residence
Fishing and Hunting Activities and Behavior: <ul style="list-style-type: none">• Location(s) of fishing or hunting activities (specific sites, type of waterbody)• Distance(s) of fishing or hunting activities from principal residence• Seasonal and temporal distribution of fishing or hunting activities (total number of days per season, which months of the year, for each location)• Fishing or hunting effort (hours/outing, hours/day, outings/month, days/month)• Purpose for fishing or hunting (consumption, sport only: catch and release, etc.)• Mode of fishing or hunting (e.g., nets, traps, hook and line; pier, shore, private boat, charter boat, scuba)• Type of animal caught (general category such as bottomfish, flatfish, turtle; or identified to species or group of species)• Numbers of animals by species caught per outing• Size ranges of animals caught (minimum and maximum weights and lengths by species)• How the animals were disposed of (released, consumed by household, sold, given away)• How long involved in fishing or hunting activities and consuming self-caught animals (new to sport or years)
Preparation and Consumption Patterns: <ul style="list-style-type: none">◆ Amounts (raw wet weight or cooked weight) of wild-caught fish or wildlife tissue eaten per meal/day/week/month for each person in household (visual cues are helpful to improve the accuracy of portion size estimates)◆ Quantity of fish, or other aquatic organisms, waterfowl, or wildlife that might have eaten fish from the same sites, consumed during a specified time period◆ Geographic and seasonal variations in consumption◆ Parts of animal consumed (may vary with the species)• Parts of animal used for cooking but not ingested (e.g., boiling of bones or fish heads)◆ How the animals were prepared for eating (e.g., skinned, fillet, steak, shucked)◆ How the animals were cooked (e.g., baked, fried, steamed)◆ Special cultural/ethnic practices in fish or wildlife consumption and preservation• Consumption of fish or wildlife purchased in supermarkets, fish markets, or roadside stands; purchased at the dock; or obtained by bartering (amounts, number of meals, frequency)• Whether fish or wildlife were frozen or preserved and eaten throughout the year, or eaten only when fresh

2. SURVEY OBJECTIVES AND INFORMATION NEEDS

Table 1. (continued)

Preparation and Consumption Patterns (continued):

- Participation in food assistance program
- Source of home water supply
- Risk behaviors (smoking, drinking)
- The level of consumption that would be desired in the absence of contaminants
- If advisory has resulted in reduced consumption of fish or wildlife, what has replaced that protein/food source in the diet?

Consumption Advisory Awareness, Knowledge, Attitudes, and Beliefs:

- Has the fisher or hunter heard or read from any source (including interpersonal communication or mass media sources such as announced fishing bans or posted notices) of the possible contamination of fish or wildlife by chemical or biologic agents in areas where currently fishing/hunting or where planning to fish/hunt?
- If yes, how has it affected his/her fishing or hunting activities, meat preparation methods, or consumption patterns?
- What, if anything, would stop the fisher or hunter from eating the animal that he or she has caught? Is the fisher or hunter in a situation that precludes him or her from finding other food sources (i.e., is he or she subsistence fishing and hunting?)
- Did the fisher or hunter ever get sick from eating self-caught/self-prepared fish or wildlife?
- Did the fisher or hunter ever observe any abnormalities, internal or external, in captured animals? If so, were the animals consumed, thrown out, or given away?
- If aware of the advisory, does the fisher or hunter inform the recipient of the gift meat about the advisory?
- Does the fisher or hunter feel that the health risks indicated in the advisory are relevant to him or her? If no, why not? If so, why does he or she continue to consume the fish or wildlife?
- Does the respondent know the correct advisory content?
- To what extent does the respondent believe the advisory content?
- How important does the respondent feel the advisory is to him or her or other members of the household?

^a Information requirements marked with a diamond are of primary importance in determining risk.

One of the fundamental issues surrounding the collection of information is identifying the sampling unit and the methods by which that sampling unit will be surveyed. In fish consumption surveys, the sampling unit is typically the individual consumer. When sampling (rather than taking a census of) the population, it would be inappropriate to consider all members of a household in a particular subgroup (e.g., children) as independent observations of the population because of obvious “household effects.” If each individual in every household were considered an independent case, the consumption estimates for the population would be skewed toward those of larger families. If the individual is the sampling unit, the appropriate design might be to randomly select a household and then randomly select a household member within the target population. The resulting estimate would represent the average consumption rate for the target population. Alternatively, if the sampling unit is the household, all members of the household should be questioned, either individually or perhaps by proxy with the primary food preparer as the single respondent speaking for all members of the household. The complete information for a household could then be summarized to produce a single estimate for each subgroup within the selected household. For example, this single estimate might be the mean or the maximum consumption for household members in the target population. This household estimate would represent the average or maximum *household* consumption rate for the target population. Proxy respondents may be necessary when the target population is an older person or a child; in these situations, proxy

2. SURVEY OBJECTIVES AND INFORMATION NEEDS

respondents may actually provide more accurate responses to survey questions regarding fish consumption and preparation information. When using proxy respondents, the primary concern is to ensure that the target sampling unit is sampled only once and that all sampling units in the population have an equal probability of being sampled.

U.S. EPA (1992) noted that fish consumption rates can vary widely in the human population. Different rates might be obtained for infrequent fish consumers, sport fishers, subsistence fishers, and others who eat fish frequently or for those who eat wildlife. Also, the rate itself might represent one of several different possible summary statistics (e.g., mean, median, 95 percent upper confidence limit) of the entire distribution. Several authors (e.g., West et al., 1993; Gassel, 1997) have noted that a single point estimate is inadequate to represent consumption rates for a population because of the inherent variability in the consuming populations; thus the entire distribution or several points in the distribution could be used to describe the consumption rate or to protect a larger percentage of the overall consuming population. Various subgroups within these categories might also have different consumption rates (adults vs. children, children of different ages or sizes, elderly versus middle-aged). Since consumption rates will “have a significant impact on the risk estimations and on the selection of fish consumption limits” (U.S. EPA, 1992), it is important to consider carefully how the consumption rate will be determined from the questions asked. For example, consumption rates will be calculated from species-specific estimates of the frequency of fish consumption (“1 meal per week from May through July”), portion size, and preparation techniques (“approximately half-pound fillet, generally broiled”). These responses could result in a consumption rate estimate of 225 grams per week for 3 months. Insufficient delineation on the timing or details of consumption patterns will result in poor estimates of the consumption rate and consequently inaccurate estimates of risk. The method to be used will also depend on the survey method selected (see Section 3). See Section 4 for more details on how these estimates can be obtained for the different survey methods, as well as a discussion of the uncertainties associated with consumption estimates.

The type and level of detail for the data to be collected will depend on the stated objectives for the survey and the statistical methods that will be used to meet those objectives. Data (e.g., consumption information and fishing effort) may be collected as continuous or categorical data types. A survey question may be constructed to provide categorical answers from which the respondent must choose (e.g., “none,” “a few meals,” “some meals,” “most meals,” or “all meals” in response to the question “How many meals are prepared using method X?”); alternatively, the question may be phrased to force the respondent to come up with his or her own estimate (“How many meals per month are prepared using method X?”). The analytical implications associated with these two approaches should be discussed with an experienced survey researcher and/or statistician before constructing the survey questions. It should be noted that since the use of categorical response choices can affect the outcome by suggesting responses or altering memories, the use of categories should be employed judiciously (Wentland and Smith, 1993).

2.4 Summary

Reasons for conducting a consumption survey can be varied, but it is important to clearly define why the survey is being conducted and what information can be derived from the survey. This is important so that those who are using a survey instrument, as well as those participating in the survey, understand what can and will be done with the information obtained. Consumption survey objectives should be developed very early in the planning process. The nature of the objectives will dictate what survey method(s) can be used effectively. Information collected in the survey can be placed in one of four categories (Table

2. SURVEY OBJECTIVES AND INFORMATION NEEDS

1): (1) physical and sociodemographic characteristics of fishers/hunters and/or consumers, (2) fishing and hunting activities and behavior, (3) preparation and consumption patterns, and (4) consumption advisory awareness, knowledge, attitudes, and beliefs. Table 2 presents an example of the development of a survey from an examination of the problem and selection of an approach to production and analysis of the results.

Table 2. Example Development of a Survey	
Problem:	Catfish in Lake A contain high levels of chemical X, a known carcinogen.
Purpose:	Determine whether children would be at increased risk of developing cancer as a result of eating catfish from Lake A.
Objectives:	Determine whether children are eating catfish caught in Lake A. Determine how much catfish tissue from Lake A children eat.
Survey Method:	Personal interviews at Lake A. ^a
Instrument Questions:	<p>Do you catch catfish from Lake A?</p> <p>(IF YES) Do you release the catfish or keep them? (KEEP) How many catfish do you keep per year? (NUMBER)</p> <p>How many children do you have in your household, if any? (NUMBER) (IF > 0) Do any of the children eat catfish? (IF YES)</p> <p>(List each child who eats catfish by age and gender.) What is the age of each child who eats catfish? What is the gender of each child who eats catfish?</p> <p>(For each child listed) (LIST) How often does (_____) eat catfish, if at all? (per week, month, etc.) (IF > 0) How much catfish does (_____) eat per meal? (visual cues)</p> <p>How is the catfish prepared?</p>
Analysis and Results:	<p>Percent of population surveyed that have children in household.</p> <p>Percent of children in household who eat catfish.</p> <p>Frequency and amount of catfish consumption by children.</p>

^aAs with all survey instruments, the researcher should be concerned about sampling, recall period, and accuracy, and whether the respondent on site at the lake can best answer questions about preparation and portion sizes. This instrument is subject to the weaknesses described in this document; it should be refined whenever possible to ensure that its design supports the study objectives and that it maximizes the use of available resources.

SECTION 3

SURVEY APPROACHES AND SELECTION CRITERIA

3.1 Overview

Currently, most states do not have sufficient data available to calculate local consumption rates or to identify special populations at risk. As a result, a variety of methods are used for estimating consumption rates when calculating risk associated with the consumption of chemically contaminated fish tissue (U.S. EPA, 1989). As states increase their focus on this type of risk assessment, the need for site-specific fish—and now wildlife—consumption surveys has become more apparent. This section briefly summarizes some of the available approaches and provides selection criteria that can be used to choose among the approaches. The discussion of survey approaches applies to both population censuses and the surveying of a population sample (e.g., a telephone survey could be applied to both a census and a sample survey).

3.2 Types of Surveys

EPA (U.S. EPA, 1992) has identified five different approaches to conducting surveys of subsistence and recreational fishers and hunters—telephone survey, mail survey, diary, personal interview, and creel survey. Some differences among these approaches include whether respondents must rely on the recall of past or recent activities or behavior (telephone survey, mail survey, and personal interview) versus a description of current or recent activities (creel survey, personal interview, and diary) and whether the survey information is collected away from fishing or hunting locations (telephone survey, mail survey, diary, and personal interview) or at the site of fishing and hunting activity (creel survey, personal interview, and diary). These approaches are either self administered (mail survey or diary) or administered by an interviewer. A self-administered questionnaire is one in which the respondent marks or writes answers on a paper questionnaire from which answers are later transferred to a database. Recent developments in software and use of the World Wide Web can permit respondents to enter information directly into an Internet interface that permits transfer of electronic data to a database. Those approaches administered by an interviewer can be either computer-assisted or recorded on paper and later entered into a database. Each of the five survey approaches is briefly summarized below. A more detailed discussion of each approach is presented in Section 4. The reader should also consult the detailed information on surveys provided in books and reports such as Salant and Dillman (1994) and Armstrong et al. (1994).

3.2.1 Telephone Survey

The telephone survey consists of telephoning selected respondents and asking them about current or recent fishing or hunting trips and fish or wildlife consumption. The answers are recorded on preprinted questionnaires or entered directly into a computer database, usually by interviewers working from one central location under supervision.

3.2.2 Mail Survey

For a mail survey, a self-administered questionnaire regarding the recent or past fishing or hunting activities and consumption of selected individuals is mailed to them.

3. SURVEY APPROACHES AND SELECTION CRITERIA

3.2.3 Diary

The diary approach involves the use of diaries, logbooks, or catch cards, which are completed by fishers or hunters, preferably at the end of a day's fishing or hunting or at the time of consumption of fish or wildlife. This approach differs from the questionnaire approaches in that there are typically multiple entries, each of which consists of a smaller amount of information than is typically requested in a mail or telephone questionnaire. Types of information recorded typically include number and size of animals caught and by whom, fishing or hunting location, type of fish or wildlife eaten, size of serving, preparation method (how it was cleaned and cooked), and who ate the fish or wildlife.

3.2.4 Personal Interview

Personal interviews can be conducted at known fishing or hunting sites, at the fisher's or hunter's home, or at a centralized location (see, for example, CRITFC, 1994). In-home interviews ask about recent fishing or hunting trips and fish or wildlife consumption. On-site interviews have the flexibility to include questions about the current trip, as well as the respondent's usual fish or wildlife consumption. Respondents are asked a fixed set of questions, and the answers are recorded on questionnaires or entered directly into a computer database.

3.2.5 Creel Survey

The creel survey is a specialized form of personal interview that takes place only at or near the fishing site during or immediately after the fisher's fishing trip. In addition to asking a specific set of questions about fishing activity and fish consumption behavior, an attempt is usually made to identify and/or measure fish in the fisher's possession (the "creel"). The creel survey can be conducted at access points (e.g., boat ramps, docks), along the shoreline, or on the water from a boat. Fish consumption information obtained from the fishers is hypothetical in the sense that consumption has not yet occurred.

3.3 Selection Criteria

The selection of which survey approach or approaches to use to gather information from fish and wildlife consumers should be determined by carefully assessing each approach in light of the stated objectives for conducting the survey. Key considerations include the target population or subpopulation of concern, the degree of accuracy required from the survey results, the time frame in which the survey information is needed, the human and financial resources available to conduct the survey and analyze the survey data, and the characteristics of the fish or wildlife populations and their harvest being evaluated.

Table 3 shows these five key considerations that influence the selection of an appropriate survey approach, with specific selection criteria for each consideration that can be used to discriminate among the survey approaches. In some cases, more than one survey approach might provide the required information. In these cases, the selection of an approach should be based on other considerations such as personal preference, past experience, or consistency with other local, regional, or national surveys. The key considerations are discussed below separately.

3. SURVEY APPROACHES AND SELECTION CRITERIA

Table 3. Comparison of Five Fish and Wildlife Consumption Survey Approaches Using Various Selection Criteria					
Selection Criterion	Telephone Survey	Mail Survey	Diary	Personal Interview	Creel Survey
I. Target Population/Subpopulation					
Survey sample known prior to conducting survey	yes/no ^a	yes	yes	yes/no ^b	yes/no ^c
Can be used where low literacy rates might be encountered	yes	no	no	yes	yes
II. Accuracy^d					
Reliability					
Potential for response reliability	moderate/high	low/moderate	low/moderate	moderate/high	moderate/high
Validity					
Validity of consumption estimates	low	low/high ^e	moderate	low/moderate ^f	moderate ^f
Validity of species identification	low	moderate	moderate	moderate/high ^g	high
Bias					
Potential to minimize recall bias	moderate	low/high ^e	moderate	moderate/high ^g	not applicable
Potential to minimize prestige bias	moderate	low	low	moderate	moderate
Measurement error					
Opportunity for respondent to ask for clarification	moderate/high	low	low	high	high
Potential for respondent participation	moderate	moderate	low	high	high
III. Time Frame					
Immediate data from respondent	yes	no	no	yes	yes
IV. Resources					
Interviewer burden	moderate	low	low	high	high
Respondent burden	low	moderate	high	low	low
Relative cost	moderate	low/moderate	low	high	high
V. Harvest Characteristics					
Many access points	yes	yes	yes	yes/no ^b	yes/no ^h
High fishing or hunting pressure	yes/no ⁱ	yes	no	yes	yes/no ^j
Large geographic area	yes	yes	yes	no	no

^aYes if phone numbers are obtained after the sample population has been preselected, no if random-digit dialing (RDD) or general directory frames are used, unless geographically delimited using 3-digit prefix.

^bNo for interviews conducted at fishing or hunting access points, yes for off-site interviews.

3. SURVEY APPROACHES AND SELECTION CRITERIA

^cDepends on ability to estimate total site usage using random sampling of all access points (e.g., using “bus route method,” aerial survey, or other methods; see Section 4.9.4, or Pollock et al., 1994 for more information on these methods).

^dGiven sufficient resources, all five survey approaches can generate accurate data. The descriptions given here are relative to each other and reflect the typical implementation of each approach.

^eDepends on recall method used -- six-month recall periods will have lower validity and higher recall bias than a 14-day rolling cohort approach (e.g., West et al., 1989; 1993).

^fOn-site interviews result in valid catch estimates, but consumption estimates are hypothetical because they measure only *the intent* to consume (see Section 4.9.2). Off-site interviews result in catch and consumption estimates with potentially low validity depending on the period of recall (see also footnote d).

^gModerate for off-site interviews, high for on-site interviews.

^hYes for roving creel survey, no for access point survey.

ⁱYes for random telephone numbers, no for known telephone numbers.

^jYes for access point survey, no for roving creel survey.

3.3.1 Target Population of Concern

The five survey approaches can be used to provide consumption information on the general population or specific subpopulations of concern. However, the survey approaches differ in the degree to which the target population must be determined prior to conducting the survey. For telephone and mail surveys, the diary approach, and personal interviews conducted away from fishing or hunting areas, the survey sample is typically identified before the consumption survey is conducted. These survey approaches might be preferable when the objective is to characterize consumption for an identified population or subpopulation of concern and there is a lack of specific information on fishing locations. However, when a subpopulation is difficult to reach (e.g., low-income families with no permanent address or phone number), combining these survey methods with on-site interviews may be necessary to account for selection biases. Creel surveys, on-site personal interviews, and random-digit dialing telephone surveys do not necessarily require identification of a target population of concern, although these approaches do require that a geographic area of concern be identified. Creel surveys and on-site personal interviews might be preferable when there are concerns about contaminant levels in a specific waterbody, but little information is available on consumption of fish or wildlife from the waterbody.

Another criterion that can influence the selection of the survey approach is the likelihood that the target population of concern will have a low literacy rate or respondents will have difficulty interpreting or providing responses to written questionnaires because of language or cultural barriers. Survey approaches that involve direct interaction with respondents (telephone survey, personal interview, and creel survey) might be more effective when it is suspected that the target populations could have a low response rate or difficulties with written questionnaires. In some cases, the use of multilingual questionnaires can assist the target population in providing responses to written questionnaires. The same question, however, might mean different things to different groups of people; thus, careful attention must be paid to ensure that responses to questions provide the same information for all groups. It may be necessary to conduct an initial study of community characteristics, including preliminary testing of a survey approach on focus groups and individual cognitive interviews (Biemer et al., 1991). The information obtained can be used to develop effective survey approaches tailored to the population of concern.

Because it can be difficult to identify subsistence fisher or hunter populations solely through traditional approaches such as mail or phone surveys, it may be necessary for researchers to use other methods to target these populations. A couple of methods might be of use. One method involves

3. SURVEY APPROACHES AND SELECTION CRITERIA

contact with community organizations that represent these populations (e.g., Indian tribal organizations) and have already established a relationship with community members (see, for example, CRITFC, 1994). In addition, creel clerks (those who interview fishers at specific fishing locations) might be good sources of information on fisher demographics because they have direct contact with people at fishing sites (Shubat, 1993, cited in U.S. EPA, 1997b).

It is important to anticipate cultural and language requirements of each ethnic group in following the community-based approach indicated above, as well as in other situations when conducting surveys. Language barriers and literacy rates are important issues that must be addressed. Who is permitted to ask questions and how the questions are asked can vary within different societies and can affect the willingness and forthrightness of respondents. Cultural and religious sensitivity on the part of the interviewer is important to maximize respondent participation and minimize errors or bias in the consumption estimates of fish and wildlife. For example, Asians and Pacific Islanders are currently the fastest growing minority population in the United States. For many first- and second-generation immigrants and refugees, surveys that use creel, mail-in, telephone, or door-to-door approaches are ineffective in obtaining reliable data characterizing fish and seafood consumption patterns (Nakano, 1996, cited in U.S. EPA, 1997b). Cultural patterns in species preference, preparation techniques, and parts of the fish that are eaten or used in the cooking process should be understood when developing the survey questions. Informal studies indicate a preference for bottom-dwelling fish, so Asian and Pacific Islander surveys should include an appropriate species list (Soukhaphonh et al., 1996, cited in U.S. EPA, 1997b). Pictures that help persons to identify what species they are catching would also increase the understandability of the survey instrument. Socioeconomic issues and fear of authority, particularly among subsistence fishers and hunters, can also adversely affect survey results if these are not taken into consideration early in the planning process. In these situations, it may be useful to consult and ask for assistance from community organizations such as churches or tribal organizations in developing and conducting surveys.

3.3.2 Accuracy

The required accuracy of consumption rates is an important topic to be considered when establishing the objectives for the survey. The survey study design has the greatest impact on the overall accuracy with which consumption rates can be estimated. Thus, all five survey approaches can provide estimates of high accuracy provided resources are sufficient, statistically valid survey designs that include provisions for surveying an adequate number of respondents are used, and the design is sensitive to the characteristics of the subject matter and the target population.

There are several different components to accuracy, including reliability (the variability or repeatability of the response); validity (the ability of the respondent to provide the correct answer, e.g., the number of fish consumed in the past month); measurement errors (which are associated with the interviewer, the respondent, the questionnaire, and the mode of data collection); bias (the consistent overestimation or underestimation due to survey design and sample selection); and random errors. The measurement errors can be minimized by careful consideration of the target population to ensure that the survey questions are not phrased in a way that is leading or unclear. Research has shown that minor changes in a question's wording can lead to large changes in respondent answers (Biemer et al. (eds), 1991). Some level of respondent error is unavoidable since such error is a function of differences in cognitive abilities or differential motivation to answer the questions. However, sensitivity to these population differences in survey design and question construction can

3. SURVEY APPROACHES AND SELECTION CRITERIA

help ensure that accurate information is obtained from as many respondents as possible. Interviewer errors can be minimized using training and quality assurance/quality control (QA/QC) to standardize interviewing procedures. Some respondent errors are inherent to the mode of data collection. For example, it has been found that telephone interviews tend to result in shorter answers than do face-to-face interviews (Biemer et al. (eds), 1991).

Other factors influencing the accuracy of the survey responses include whether the respondent views the subject as nonthreatening or sensitive; whether respondents remain anonymous; the length of the recall period (recall bias); the tendency for respondents to provide responses that conform to ideal norms or enhance their self-image (prestige bias); the clarity of questions (question misinterpretation); the familiarity of the respondent with the subject matter; the interest level of the respondent in the subject matter; and the amount of specificity in the question (e.g., requests for exact numbers versus approximations or ranges) (Wentland and Smith, 1993).

Selection criteria that can be used to discriminate among survey approaches with regard to accuracy include the potential for recall bias, prestige bias, question misinterpretation, species misidentification, and survey participation. Table 3 compares these criteria for the five survey approaches. Survey approaches having a criterion listed as high have the least potential for inaccurate survey responses and hence might result in a more accurate survey. Survey approaches based on on-site interviews and creel surveys, if well designed, might not be affected by recall bias because the fish caught will not have been consumed yet. Prestige bias is inherent in all survey approaches but might have the least impact on creel surveys, which directly observe and record fish catch. The potential for question misinterpretation is lowest for survey approaches that use direct interaction with respondents (telephone survey, personal interview, creel survey) since the interviewer can clarify topics that are unclear to the respondents, as well as showing models, photographs, or other visual aids to increase accuracy of responses.

The potential for misidentification of fish or other species consumed is affected by recall bias, prestige bias, and the familiarity of the respondent with the subject matter. The potential for fish misidentification is lowest for creel surveys and on-site personal interviews because the interviewer can both directly observe fish catch and allow respondents to visually select the species consumed from displays of fish species. Survey participation affects the accuracy of consumption estimates by affecting the number and characteristics of respondents that are evaluated in the survey. In general, surveys that include a larger number of respondents and a low refusal rate provide a more accurate representative estimate of consumption in the target population. Nonresponse bias resulting from low respondent participation can be adjusted using various follow-up techniques. Survey approaches using on-site interviews and creel surveys have the highest potential for survey participation since the interviewer can directly engage respondents and motivate them to participate. An understanding of and sensitivity to the characteristics of the target population of concern, as discussed in Section 3.3.1, can help minimize nonresponse bias due to culture, religion, language, and attitudes toward government and authority. Experts in the field have developed specific strategies to counter these problems. The reader is directed to Tarrant and Manfredi (1993) and Vaske et al. (1996) for additional information.

3. SURVEY APPROACHES AND SELECTION CRITERIA

3.3.3 Time Frame

The allotted time frame for the study, including survey development, implementation, analysis, and reporting, might be driven by the need or needs the survey is designed to fulfill, for instance, making management decisions. The fish consumption surveys listed in Appendix A required lengths of time ranging from 4 months to 2 years to complete. It is difficult to discriminate among different survey approaches based on study durations because the length of time to collect and process consumption survey data depends on the resources available to conduct the study and the study design.

The survey approaches do differ on whether the responses to survey questions are obtained in real time (telephone survey, personal interview, and creel survey) or over a longer time frame (mail survey and diary approach). The mail survey and diary approaches might take longer to complete than other approaches because respondents might not provide timely responses to the questionnaires.

3.3.4 Resource Considerations

The survey approach selected affects the resources (labor and cost) required to complete the survey. As a general guideline, personal interviews cost at least twice as much as telephone surveys. Both of these approaches are more costly than mail surveys (U.S. EPA, 1983). Few of the fish consumption surveys listed in Appendix A include information on the level of effort and costs expended to complete the survey. Cost and level of effort vary widely depending on the type of survey and its geographical extent. Personal interviews and creel surveys will in most cases be more expensive to implement than the other approaches because of the high personnel costs of one-on-one contacts with respondents. Other costs can be incurred when survey planners consider offering respondents some type of incentive (monetary or otherwise) for completing and returning the survey instrument or participating in interviews. Examples of such incentives include reports of the survey results, cash payments, food vouchers, recipes, or items such as baseball caps. Although some survey approaches can be implemented for a lower financial cost, there may be an associated loss of data quality and/or accuracy that can have serious management implications depending on the research objectives.

3.3.5 Characteristics of the Source of the Fish or Wildlife

The decision about which survey approach to use can depend on the characteristics of the fish or wildlife populations being evaluated and how the animals are harvested. Three important characteristics are (1) the number of access points, (2) the fishing or hunting pressure, and (3) the geographic area. Access points refer to fishing or hunting locations for shore fishers or hunters (e.g., beach, river bank, boat dock, fishing pier) and boat ramps for offshore fishers or hunters, as well as parking lots or preserve entrances where fishers or hunters might begin their activities. In situations with many different access points, off-site approaches like telephone surveys, mail surveys, and diaries are preferred. One exception to this trend is the roving creel survey, an on-site approach that can also yield good results in fisheries with many access points. In fisheries with high fishing pressure, mail surveys, personal interviews, and access-point creel surveys may be effective because fishers are concentrated in relatively small areas. Roving creel surveys, in which the interviewer moves from fisher to fisher and sometimes from site to site, are more applicable to fisheries with low fishing pressure, where ample time is available for instantaneous counts and for interviewing all fishers. For fisheries covering a large geographic area, approaches not requiring face-to-face contact

3. SURVEY APPROACHES AND SELECTION CRITERIA

(e.g., phone and mail surveys, diaries) could be more appropriate. In any case, available personnel and time resources are also important considerations in selecting the survey approach since, for example, multiple interviewers can cover larger geographic areas simultaneously.

3.4 Summary

This chapter introduced the five consumption survey approaches covered in this document and presented selection criteria states and tribes can use to choose the appropriate method for the objectives of their project. Due to the complexity of estimating consumption in specific subpopulations, no single method can be recommended in all cases. In fact, a combination of approaches may be most appropriate in many cases. For example, a mail survey for which the sample population is taken from fishing license records might not accurately assess consumption for a group that does not always hold licenses (e.g., subsistence fishers). Thus, a combination of mail surveys with on-site interviews might provide a more representative picture of consumption. Key considerations that should be carefully evaluated in selecting a survey approach include the target population or subpopulations of concern, the level of accuracy required in the survey results, the time frame in which the survey information is needed, the staff and financial resources available to conduct the survey and analyze the survey data, and the characteristics of the fishery being evaluated.

SECTION 4

INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

4.1 Overview

This chapter provides specific guidance on designing and implementing consumption surveys using one of the five approaches introduced in Chapter 3. For the sake of brevity, the reader is referred to other texts where appropriate for detailed guidance and examples. Because all of the approaches are aimed at obtaining consumption rate estimates, there are similarities in study design and implementation. Issues common to all approaches are discussed in Sections 4.2 through 4.4; Sections 4.5 through 4.9 present method-specific issues.

4.2 General Instrument and Study Design Issues

The four steps in the design and development of a consumption survey are as follows:

1. Identification of the survey objectives.
2. Preparation of a sample design and analysis plan, which includes
 - identification of the target population(s) and selection of the sampling strategy for the survey population(s)
 - identification of the specific data to be gained from the survey
 - the analytical/statistical methods to be used once the data are collected
3. Selection of the survey approach to be used to obtain the data.
4. Design of the survey instrument.

Study objectives and data needs were discussed in Chapter 2. The issues surrounding the selection of a particular survey approach were discussed in Chapter 3. This chapter addresses the remainder of the issues involved in questionnaire design and the preparation of the analysis plan.

Population selection cannot be separated from how the consumption data will be used. If the consumption data will be used for the assessment of human health risk, surveying the population that consumes fish or wildlife from a specific region or contaminated waterbody is appropriate. This population will typically consist of fishers or hunters and perhaps their families if the sample unit is the entire household. Additional considerations in selecting populations are described under the specific survey approaches. The reader is advised to consult a statistician at this stage in the process to ensure a good study design, appropriate selection of the survey population, and confidence that the research questions can be answered by the survey results.

Each of the five approaches described in Section 3 requires that questions be answered, verbally or in writing, by potential consumers of fish or wildlife. The specific questions to be asked in a consumption survey are dependent on (1) the objectives of the survey, (2) the population being

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

surveyed, and (3) the available resources of the interviewer. For most surveys, the questions can be developed from the list of information requirements given in Table 1.

Each question in the questionnaire should make a contribution to answering a specific information need. Pollock et al. (1994) suggest creating a data requirement-by-question matrix for the questionnaire to confirm that each question is relevant to the study objectives. This matrix should specify all information requirements necessary to adequately describe the consumption patterns for the target population (Table 1). This matrix will help facilitate the iterative process of constructing effective questions for the questionnaire.

Of the four issue categories given in Table 1 (personal and demographic characteristics, fishing and hunting activities and behavior, preparation and consumption patterns, and consumption advisory awareness, knowledge, attitudes, and beliefs), only questions on demographic characteristics and consumption patterns are strictly necessary to derive rough consumption estimates. Questions on fishing and hunting activities and behavior would be asked only of respondents who indicated they fished or hunted. Advisory awareness questions would be relevant only in areas where there are advisories; these questions can be especially relevant if epidemiological data will be used to supplement a risk assessment.

Personal and demographic questions are asked to identify the respondent's membership in a particular population group and to allow the researcher to test for correlations between consumption and various population parameters (see Table 1 for examples). Sociodemographic variables such as age, gender, community type, educational level of head of household or respondent, ethnic origin or race, family size and composition, geographic region, income, occupation of head of household, and religion can influence patterns of intake. Current employment status might affect the amount of time spent fishing or hunting and the amount of fish or wildlife consumed. Without an adequate demographic base, the interpretation of the results can be biased in unforeseen ways.

Before specific questions regarding fishing and hunting and consumption can be developed, the researcher must choose a time period for which respondents will be asked to recall consumption. One of the most important methodological issues in regional fish consumption surveys is to adequately address the dual objectives of obtaining accurate recall of consumption estimates and capturing variation over time (usually a full year cycle). The accuracy of recall is inversely proportional to the length of the recall period. Recall periods typically range from 7 days to 1 year. One method developed to meet these dual objectives is the "rolling cohort" method, which minimizes an individual's required recall time but maximizes the length of the study. The rolling cohort method uses statistical random selection techniques to place sample cases into random cohorts and then surveys the cohorts in waves spaced two or more weeks apart. The results obtained are treated with standard statistical weighting techniques to represent an even flow of data across the year cycle (West et al. 1993). Using this method, different groups of people are sampled for portions of a relatively long study period; for more information on this approach see West et al. (1989, 1993). Alternatively, using a single cohort approach, the estimation of consumption over an entire year is a relatively difficult matter. The respondent's recall over that period of time is likely to be incomplete. Recall error can occur in any one of the four steps involved in answering a question: (1) comprehension, (2) retrieval of information, (3) judgment, and (4) response (Eisenhower et al., 1991). The rolling cohort method is an important surveying method that can be used to reduce recall error based on inaccurate retrieval of information. Additional ways in which recall error in each of these four areas can be

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

reduced are discussed by Eisenhower et al. (1991). Some examples include designing questions that are easy to comprehend and do not require complicated judgments about whether the response is representative of others' responses, and providing visual cues to aid recall and estimation. For some survey methods (e.g., diary and creel survey), recall period is not an issue.

Questions on consumption are obviously central to the questionnaire, but are often the most difficult to design in an unambiguous manner. Estimates of meal size are subject to considerable error. This type of question is more difficult to ask and answer in surveys without personal contact (e.g., telephone and mail surveys) because questioning must be done without the help of the models of portion sizes often used in personal interviews. The use of photos of different-sized fish or other meat portions in mail surveys (with ruler bars for scale) and reference to familiar objects (e.g., a deck of cards as approximately the size of a 3-ounce [oz] portion) in telephone surveys can assist participants in providing accurate responses to inquiries about meal size. A typical fish or wildlife consumer might have difficulty quantifying the weight of tissue eaten over a specified interval, but might be able to recall the number of meals eaten over the time period in question. During the analysis of data, the number of meals can be converted into weights by multiplying the number of meals by the participant's estimate of the meal size typically consumed. EPA (1997a) has identified a value of 8 oz (227 g) of cooked fish fillet per 70-kg consumer body weight as an average meal size for the general adult noncommercial-fish-consuming population and for women of reproductive age. This meal size, however, does not represent higher-end exposures where persons consume more than the average amount in a given meal, and it might not reflect meal sizes consumed by children or those adults who eat smaller portions. For this reason, it is recommended that participants be asked to estimate meal size instead of assuming default values.

Studies show that the typical weight loss in cooking a fillet or steak of fish is about 20 percent (Jacobs et al., 1998). Thus, using cooked weights results in a slightly lower intake rate. In researching consumption surveys, EPA has found that some surveys have reported rates for cooked fish, others have reported rates for uncooked fish, and many more are unclear as to whether rates for cooked or uncooked fish were used. For the purpose of developing ambient water quality standards, EPA intends to use cooked weight assumptions because, by and large, cooked fish is what people consume. EPA believes, therefore, that these values appropriately reflect the potential exposure from fish consumption better than uncooked weights. Pictures of cooked fish on a plate in relative size comparison to other food on the plate, the plate itself, silverware, and napkin help respondents visualize portion size and lead to enhanced accuracy (Humphrey, 1976, 1983; West, 1989, 1993). However, EPA's fish advisory program recommends that intake rates in developing risk analyses for advisories be based on uncooked weights because chemical analysis to determine concentrations of pollutants in tissue is almost always based on analysis of uncooked portions of fish. Uncooked fish portions can similarly be compared to a common object, such as a deck of cards, to better estimate weight. Questions included in the surveys should clearly identify whether weights represent cooked or uncooked fish.

For a question to be readily understood, it must be simple and straightforward. The design of each specific question must consider both question structure and question wording. The position of each question in the overall survey is also important. Each of these topics is discussed below. The reader is referred to Biemer et al. (1991), Wentland and Smith (1993), Pollock et al. (1994), and the references cited therein for more information.

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

Question structure. Four general types of question structures are available (Pollock et al., 1994): (1) open-end questions, (2) closed-end questions with ordered response choices, (3) closed-end questions with unordered response choices, and (4) partially closed-end questions. Open-end questions have no categories from which the respondent can choose; however, interpretation of all but the simplest open-end questions can be quite difficult. Closed-end questions provide several answer categories, which can be ordered sequentially (e.g., numerically) or unordered. The answers to closed-end questions are easy to summarize quantitatively. Response options must be selected carefully so that the choices are mutually exclusive, inclusive of all reasonable choices, and easy to understand. Categories also may provide cues to aid respondents' recall (Bradburn and Sudman, 1991). Partially closed-end questions allow an open-ended option such as "other." This option represents a good compromise between open-ended and closed-end structures (Pollock et al., 1994), but some research suggests that the "other" category is rarely selected (Bradburn and Sudman, 1991).

For closed-end questions, the specific ranges for each response alternative can affect the way in which the question is answered. Values in the middle range of the scale selected are often assumed by respondents to reflect the "average" or "typical" behavior, whereas the extremes of the scale are assumed to represent the extremes of the distribution (Schwarz and Hippler, 1991). Thus respondents will choose a given value more frequently if it is not at either extreme of the range in which it is placed, and they will select a given range more frequently if it lies closer to the middle of the overall range.

Question wording. The specific wording of questionnaires on fish consumption must be developed very carefully to elicit nonbiased responses. Some recommended guidelines for question wording are listed below (Pollock et al., 1994):

- All alternatives of a multiple-choice question should be given.
- As few words as necessary should be used.
- The units that apply to each response should be given.
- The time frame covered by the survey should be clear.
- Only one concept or issue should be addressed by each question.

Draft questions should be reviewed carefully for ambiguity. In survey approaches that include personal contact (e.g., telephone surveys and personal interviews), ambiguity can be corrected through interaction between the interviewer and respondent. It is preferable to minimize ambiguity by testing the questionnaire on a focus group. Salant and Dillman (1994) also provide a good discussion of many of the issues surrounding good question wording, such as content, sentence structure, and the order of response choices. Appendix 6.A of that book provides samples of wording problems and possible solutions.

Question order. Topic sections should be arranged for the convenience of the respondent, not that of the researcher. There is likely a logical order to grouping questions which will aid in respondent recall. The questions should build on each other. For example, rather than asking "Did you wear your seatbelt the last time you were a passenger in a car?" the following series of questions may be more effective: "When was the last time you rode in a car as a passenger? (Today, yesterday, 2 days ago)" "How long was the trip? (Less than a mile, 1-2 miles, more than 2 miles)" "Did you wear your seatbelt? (The entire time the car was moving, part of the time, or not at all)" This kind of cognitive design can be very effective in minimizing respondent error and should be used for important

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

questions (Salant and Dillman, 1994). In addition, it might be useful to phrase important questions a couple of different ways and ask them at different points in the survey to measure respondent accuracy. In a personal interview, these answers can be compared and if needed, the respondent can be asked additional questions to help clarify the most accurate response.

The first one or two questions might be the most critical, particularly for mail surveys, since these might determine whether the respondent chooses to complete the questionnaire. Sensitive questions or questions that are difficult to answer should be asked near the end of the interview so as not to threaten the respondent and compromise the rapport between interviewer and respondent. Sensitive questions include demographic questions such as age, income, and education and questions about whether the fisher has an applicable fishing or hunting license or is familiar with a particular advisory or regulation (Pollock et al., 1994).

4.3 General Statistical Analysis and Data Interpretation Considerations

A typical survey will generate a considerable amount of data from each respondent. Although the use to which the data will be put is established before the survey begins, the same is not always true of the manner in which the data will be analyzed and interpreted. To the extent possible, however, the researcher should specify the details of analysis and interpretation methods as early as possible in the survey design process because they might have a significant bearing on the form and content of the questions asked. Addressing these issues during questionnaire design minimizes difficulties that arise during data analysis and interpretation.

Statistical considerations play an important role at both the survey design and results analysis levels. At the survey design level, statistical methods are used to determine the appropriate number of sampling units (potential fish consumers) and how those sampling units are to be selected from the target population. Final sample size will depend on the level of precision required for the estimates. In some cases, the statistical design might need to be modified based on the resources available to conduct the survey. The Bureau of the Census may be consulted to obtain information about total population and/or subpopulation numbers present in a particular area. The Bureau can provide data files listing demographic information of age, gender, and/or ethnicity by census tract, for a cost.

The probability technique can be used to select subsamples of licensees or other designated groups. For example, if existing survey data indicate that 20 percent of the general population 16 years of age and older in a state fish, a researcher could have to contact 5,000 people to have a sample size of 1,000 fishers. If the response rate is 50 percent, however, a researcher could collect data from only 500 fishers. To adjust for nonresponse, the researcher would need to attempt to contact 10,000 people to collect data on 1,000 fishers. Obviously, this process would be more efficient if the sample were from a list of fish license holders. This is a process known as stratified sampling, where a target population is subdivided into subgroups prior to sample selection. With a license holder list, however, the researcher would not obtain consumption data from those people who fish without a license, who can account for as much as 25 percent of fishers. This and other issues relating to sample representativeness are discussed in Pollock et al. (1994), U.S. EPA (1997a), Scheaffer et al., (1990), and other references cited in this chapter.

An appropriate sampling design is imperative to ensure statistical rigor and minimize bias and sampling error in the study; the reader is therefore advised to consult an experienced survey researcher

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

and/or statistician during the sample selection stage to achieve adequate representation of the survey population.

Additional problems in sample size selection might be encountered when attempting to look at special populations, such as those who eat fish or wildlife frequently. The design of population surveys and sampling techniques for events and populations that are nonuniform or infrequent presents additional statistical constraints (Kalton and Anderson, 1986; Sudman et al., 1988). A common solution to determining sample size in these cases is to predict the response frequency of the most constraining (i.e., rarest) piece of data among the questions to be answered and then calculate the sample size required to ensure that the minimum number of replies needed for statistically valid results for the group described by that constraining datum would be received. If fish consumption by pregnant women (3 percent of the population) represents the rarest piece of data desired and one wanted a sampling error of plus or minus 5 percent, assuming a conservative 50/50 distribution, a survey of 400 pregnant women would be needed. To reach 400 pregnant women, one would need to contact 53,332 people in the general population: $53,332 \text{ people} \times 0.50 \text{ (response rate)} \times 0.50 \text{ (\% female)} \times 0.03 \text{ (\% pregnant)} = 400 \text{ pregnant women}$. If the percentage of pregnant women in the target population differs from 3 percent, this calculation would need to be adjusted accordingly. Obviously, this method would be very inefficient and costly, so alternative methods for contacting pregnant women would likely be considered, such as working through medical doctors, clinics, or hospitals.

Once data are gathered and prepared for analysis (coded, entered into a database, and checked for errors), they must be statistically analyzed. Three basic methods of statistical analysis are used with survey data—univariate, bivariate, and multivariate analysis. Univariate analysis examines one variable at a time for the purpose of describing a survey sample and is usually presented as frequency distributions (percentages), measures of central tendency (mean, median, or mode), and measures of dispersion (range, standard deviation). Measures of central tendency and dispersion are applicable only to interval or ratio data. Frequency distributions can be used for nominal, ordinal, or interval and ratio data, although for interpretation and presentation purposes, interval data are often collapsed into categories, such as age ranges. Subgroups within a sample can be described using univariate analysis as well. For example, if females were selected in the analysis, this subsample would become the new “sample” and could be described using univariate analysis on other variables, such as income.

Bivariate and multivariate analyses are used to examine associations among variables. In bivariate analysis one variable is used to explain the distribution of another variable; for instance, the relationship between income and subsistence fishing or hunting could be investigated using regression analysis. In multivariate analysis two or more variables, such as income and education, are used in combination to attempt to explain the distribution of another variable, such as subsistence fishing or hunting.

The term *descriptive statistics* refers to data reduction techniques used to present results in a usable and comprehensible form. The most common descriptive statistical methods are the estimation of population parameters such as percentages, means, standard deviations, and correlation coefficients, all of which are used to summarize data. Care must be taken when summarizing the data because the statistical methods appropriate for calculating unbiased estimates of the population parameters will depend on the sampling method (e.g., simple random sampling, stratified sampling, proportional stratified sampling). There are important statistical issues to consider when making adjustments for the various types of sampling inaccuracies (see Section 3.3.2). Weights might need to be applied

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

during the estimation of population parameters where the weights account for different sizes of subpopulations, for differential nonresponse rates, or for disproportionate sample selection probabilities. For example, there might be cases where probabilities of respondent selection become disproportionate in field implementation such that the sample population disproportionately represents different demographic groups. In those cases where probabilities change between the design and implementation stages, post-stratified weights are used to estimate population parameters that are derived from a sample distribution that does not correspond to the known population distribution. An experienced survey statistician should be consulted to facilitate the appropriate summary of your data. The term *descriptive statistics* also includes methods of displaying data graphically. Numerical and graphical exploratory data analysis techniques (Tukey, 1977) can be used to investigate the data for trends or patterns that might not be immediately obvious. Interactions between factors such as class, income, and race can be significant and extremely important in a fish consumption evaluation (West et al., 1995). Interactions between such factors can mask important characteristics of the data set unless thorough exploratory techniques are used.

Inferential statistics can be divided into estimation and hypothesis testing. Estimation is probably the most useful statistical method for analyzing consumption data. The process of estimation entails calculating, from the data of a sample, some statistic (e.g., the sample mean) that is offered as an approximation of the corresponding parameter of the population (e.g., the population mean) from which the sample is drawn. Interval estimates such as a 95 percent confidence interval for the mean can be constructed. The interpretation is that the probability is 95 chances in 100 that the interval contains the true but unknown mean. Estimation methods can be helpful in analyzing the relationship between two or more variables (measures of association). Different statistical tests of association are used for different types of data, such as nominal and ordinal data (*F*-test), and interval or ratio variables (*t*-test, Pearson's product-moment correlation, regression, path and factor analysis, analysis of variance, discriminant analysis, and log-linear models).

Hypothesis testing employs tests of statistical significance that measure the probability that a parameter falls within a certain range. The most common acceptable level of significance is 0.05 ($p < 0.05$), which means "the probability of a relationship as strong as the one observed being attributable to sampling error alone is no more than 5 in 100" (Babbie, 1990). It is important to note that although there could be a statistically significant difference in a measure of association between two groups, the actual difference might be so small as to be irrelevant in the study. Conversely, large differences in consumption rates might not be statistically significant. When sample sizes are large, it is particularly important to pay attention to this phenomenon since small differences might appear to be statistically different. For example, fish consumption (mean g/person/day) might be 17.5 g for Group A and 18.5 g for Group B and might be significantly different at the 0.05 level. For policy development and decision-making processes in risk assessment, a difference of 1 g might not be important. Common tests of significance are chi square for nominal/ordinal data and *t*-tests and analysis of variance (ANOVA) for interval data. Note that stated hypotheses (null and alternative) are required for tests of association. Large differences in consumption rates that are not statistically different are related to small sample sizes or large variances. If variances are high, it is appropriate to examine the data for outliers and apply the appropriate nonparametric test.

For parametric tests, however, the underlying assumptions of independent samples, normality, and equal variances should hold true. If the assumptions of normality and equal variances do not hold,

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

nonparametric tests should be used. Nonparametric statistics consist of counting or ranking of data or examination of the sign differences of paired data (Steel et al., 1997).

EPA (1997a) has provided guidance on using fish consumption data to develop estimates of population exposure to contaminants for human health risk assessments. The document includes guidance on deriving fish consumption estimates and provides summary results and methods for many of the fish consumption surveys performed in recent years. The information in the document is summarized briefly below; the reader is referred to the source for a more complete discussion.

If consumption rates are to be used in a risk assessment, which typically evaluates chronic exposure, an estimate of average daily consumption for a relatively long period of time (e.g., weeks to a year) is appropriate. For some chemicals of concern, acute toxicity or developmental toxicity might also be of concern. In these cases, estimates of maximum individual daily consumption over a shorter period of time (e.g., 1 week or less) might also be warranted. The most basic equation for estimating individual consumption rates is as follows:

$$\text{average daily consumption} = \frac{\text{grams (uncooked) tissue consumed}}{\text{averaging time (days)}}$$

The averaging period must be carefully selected, keeping its intended use in mind. Consumption estimates to be used to evaluate acute exposure should be the maximum of the daily consumption rates calculated, assuming an averaging time of 1 day. The reader should consult U.S. EPA (1997a) for more information on the calculation and application of averaging periods.

Per capita consumption rate estimates require that days in which fish or other organisms of concern are not consumed be factored into the calculation. For estimates of daily consumption over a 1-year period, surveys that include less than a 1-year recall period must include some method of extrapolation to time periods for which consumption estimates are not available. For example, if a respondent indicates he eats four fish meals per month from the waterbody in question during the 3-month fishing season and none during the remaining 9 months, the consumption rate would be one meal per month for the entire year (4 meals/month x 3 months/12 months). This information could also be translated into consumption per day if the meal size were known.

Another issue that must be addressed is the treatment of respondents who do not eat fish or wildlife from the waterbody in question, or do not eat fish or wildlife at all. In a telephone survey, for example, the number of nonconsumers of fish might outnumber the consumers. The decision on whether to include these respondents in the consumption estimate or exclude them is dependent on the specific goal of the risk assessment. Per capita consumption rates by definition would include nonconsumers and consumers of fish. Including the zero-consumption respondents is a more accurate representation of the overall fish consumption rate for a population, but it also underestimates the mean consumption rate of those who eat fish from the target site by diluting the estimated mean consumption with nonconsumer zeros. Thus using the estimated mean per capita fish consumption could seriously underestimate the risk to regular consumers of fish. An alternative approach, which is more conservative with regard to risk, is to use an upper percentile of the per capita fish consumption distribution, such as the 90th, 95th, or 99th percentile, for risk assessment purposes. If,

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

on the other hand, the decision is made to exclude nonconsumers of fish from the analysis of the survey results, the researcher must be able to distinguish between the respondents who never eat fish and the respondents who eat fish but did not eat fish during the recall period. The latter should be included in consumption rate calculations. Many of the fish consumption rate estimates provided by EPA (U.S. EPA, 1997a) are based on fish consumers only, resulting in higher consumption rates, which would be more conservative or protective of those persons when estimating risk (see also Gassel, 1997). Thus, it is important to state explicitly whether the consumption rate derived from the survey data includes consumers only or both consumers and nonconsumers.

Some of the questions that might be asked in the interview (e.g., preparation methods, tissues consumed, species, size) do not relate directly to overall consumption estimates but may be used to modify the dose calculations in a risk assessment. For example, cooking fish almost always reduces contaminant levels, so reducing the dose by an appropriate correction factor depending on the cooking method might be appropriate. A detailed discussion of the way in which this ancillary information on fish consumption can be used is given in U.S. EPA (1997a).

Consumption data can be presented in a variety of ways. Consumption estimates can be given as point estimates or as distributions illustrating the variability in the population. A point estimate is a single value such as 50 g/day, whereas a distribution can be summarized by a measure of central tendency (e.g., mean, median), a standard deviation, and a shape of the distribution curve (e.g., lognormal). For many risk assessments, risk estimates for individuals at both the central tendency and high-end portions of the exposure distribution are made. To preserve the maximum amount of flexibility for future uses of the data, researchers should present consumption data as a distribution. Point estimates from within the distribution can be used in deterministic risk assessments, and a discussion of the distribution can be used in probabilistic risk assessments. The lognormal distribution has been shown to provide a good fit to consumption data (Murray and Burmaster, 1994; Ruffle et al., 1994). The choice of a distribution for use in a probabilistic risk analysis should be based on a thorough evaluation of the data, however, since the lognormal distribution might not always provide a good fit to food consumption data (Driver et al., 1996). Ideally, the response for each sampling unit should be retained, thereby providing an accurate description of the observed distribution of responses without relying on assumptions about the theoretical distribution. It is highly recommended that consumption data be collected and presented as a distribution, rather than as point estimates, to provide sufficient information for the decision-making process.

Demographic data collected in the questionnaire can be used in conjunction with the consumption data in several ways. For diet/health surveys that could result in consumption advisories, consumption data for various ethnic groups can suggest the form (e.g., languages) in which the advisory should be available (Allen et al., 1996). Data on age and residence time can be used in risk assessments to evaluate whether additional subpopulations (e.g., children, older persons, and pregnant and lactating women) should be evaluated based on their different rates of consumption. In all cases where demographic data are used in this manner, statistical tests of significance should be employed to determine whether specific subpopulations have consumption rates significantly different from those of the rest of the sample population.

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

4.4 General QA/QC Considerations

Establishing adequate quality assurance (QA) and quality control (QC) procedures during all stages of a survey is critical for collecting valid data. Both QA and QC procedures are incorporated as part of the study design and are intended to minimize measurement errors or other biases. QA procedures are put in place before data collection begins; QC procedures are followed during or after data collection. Thorough training of the interviewers in fish identification would be considered a QA activity, while random spot checks of interviewers by a supervisor during data collection would be a QC activity. QA and QC procedures for reducing interviewer-related errors are discussed by Fowler (1991).

At the heart of nearly all QC procedures is the simple concept of double checking, for example, of data collected, data entered into a database, or calculations. Field and/or office audits to ensure that planned procedures are being followed might be appropriate depending on the survey approach.

For some survey approaches, direct entry into computers might not be practical. In these cases, secondary entry into some sort of data processing software is typically necessary. The data entry step has a high potential for errors, but several QC procedures can be implemented to minimize or eliminate errors of this type. The two most common procedures are (1) proofreading of some or all the data entered and (2) entry of all data twice into separate files and subsequent comparison of the two files. Data entry errors can be minimized by designing the survey forms in such a way that they can be easily read by Optical Character Recognition (OCR) software (Heineman, 1991). Survey forms that require a considerable amount of hand entry by the interviewer might not lend themselves readily to this type of scanning. Once the data have been entered into a computer, checks can be performed to detect inadmissible and out-of-range values.

QC procedures can be implemented to check the internal consistency of the questionnaire responses. Responses given in one category can be used to check those in another. For a target waterbody, information on catch rates and locations should be consistent with information on amounts and species of fish or wildlife consumed. If data from a respondent are not consistent, the researcher may consider deleting that respondent from the database. A list of specific information needs and cross-checks should be prepared prior to checking the data to ensure that respondents are objectively and consistently deleted from the database when information is missing or not consistent.

4.5 Telephone Survey

4.5.1 Advantages

- The telephone survey can assess region-specific consumption rates, depending on how the respondents are selected (for instance, by proximity to a particular waterbody).
- This approach can target specific subpopulations of concern when these populations can be preselected on some basis or when specific limiting questions are included on the surveys.
- This approach is generally about half as expensive and less time-consuming than the personal interview because less training of interviewers is required and travel costs are

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

not necessary. Larger numbers of respondents can thus be contacted (see U.S. EPA, 1984).

- A high rate of success for completing interviews is likely for known phone numbers, although the success rate is 5 percent lower than that for personal interviews (U.S. EPA, 1984) because of lack of personal contact. Success rates are lower for random phone numbers (random-digit dialing) because of the prevalence of unsolicited phone calls from telemarketers and solicitors.
- Sensitive information can be obtained more easily than with other approaches, particularly if the respondent remains anonymous.
- Since this approach provides immediate responses to questions, analyses can be completed more quickly.

4.5.2 Disadvantages

- Interviewers cannot reach people who do not have phones or those with unlisted numbers. (Only random-digit dialing includes unlisted numbers.)
- Interviews might need to be limited in scope and length, so the number of questions must be carefully chosen.
- Language and cultural barriers that might be encountered are difficult to compensate for in telephone surveys.
- It is difficult to verify information given.
- Telephone surveys do not have the ability to show visual aids, which can help in locating study site boundaries and in standardizing meal sizes; however, a common size reference such as a deck of cards can still be used.

4.5.3 Specific Issues for Instrument and Study Design: Telephone Survey

Telephone surveys have not been widely used in fisheries, but they might become more common in the future (Pollock et al., 1994). Selecting the numbers to be dialed is a critical first step that must be addressed before any other details of the survey. If the sample group includes people who do not eat fish or wildlife, additional questions will have to be asked to separate this population from the fish/wildlife-consuming population.

Various methods have been used to select the individuals to be interviewed. Pollock et al. (1994) divide the methods into (1) random-digit dialing, (2) directory frames, and (3) special frames. Random-digit dialing is easy to do, but may be costly and inefficient if done manually because of the additional effort required to eliminate nonworking or nonresidential numbers. A computer-assisted telephone interviewing (CATI) system can make random-digit dialing very efficient, particularly if numbers are purchased from a survey sampling company and are prescreened. Computer dialing eliminates nonworking and nonresidential numbers quickly.

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

Directory frames can be constructed from telephone directories. However, they do not include unlisted numbers and quickly become out-of-date. Both random-digit dialing and directory frame methods will include a large proportion of people who do not consume fish or wildlife. Special frames can be constructed from boat registration lists, angling or hunting club membership lists, and fishing and hunting license files, for example (Pollock et al., 1994). Such special frames have the effect of selecting a subpopulation likely to have a consumption profile that differs from that of the general population. This should be noted in interpreting these results, and care should be taken not to generalize from such a group to the greater population.

Telephone surveys are often conducted from a single location with the help of several different interviewers. Interviewers should be told how many callbacks to make and at what times of day before they abandon a sample unit. With a CATI system, the number of callbacks can be preset for the whole sample in the supervisor's computer. Generally, telephone methods are least efficient during holidays and summer, when people are away from home and more redialing is necessary to obtain an interview (Pollock et al., 1994). To maximize the cooperativeness of respondents, telephone surveys should last no longer than 10 minutes.

Estimating consumption over a long time period can be difficult. Ideally, respondents would be interviewed using the rolling cohort method described in Section 4.2: cohorts would be selected randomly, and calls and callbacks would be spaced out over the study period to give fairly even time period coverage. This approach is also effective at minimizing necessary recall time so recall accuracy is improved.

For a question to be understood verbally, it must be simple and straightforward. For questions that have a definite number of responses, the possible responses should not be so numerous that they must be repeated.

4.5.4 Specific Issues for Statistical Sampling and Analysis: Telephone Survey

In addition to determining the number of respondents required, statistical methods should also be used to select the respondents from the target population. For random-digit dialing, several methods can be used to select numbers. Phone numbers can be purchased from companies that specialize in the scientific development of random telephone number lists by geographic area. An alternative two-stage sampling method, known as the Mitofsky-Waksberg method, requires that the first six digits (area code and prefix) be preselected and the last four digits be selected randomly. Multistage methods are designed to improve the frequency of residential number hits. For example, a two-stage cluster method treats the sampling frame of telephone numbers as a set of banks of 100 numbers each. A bank is defined by an area code, a prefix, and the first two digits of the suffix. Within a bank, numbers are selected randomly. If the first number selected is not a residential number, the entire bank is rejected because banks usually have no or many residential numbers. If the first selected number is a residential number, additional numbers are selected until the specified number of households has been drawn (Pollock et al., 1994).

Directory frames can be created by simple random sampling, stratified random sampling, systematic random sampling, and add-a-digit sampling. The last method involves adding a number from 1 to 9 to a selected telephone number. This method can select people with unlisted numbers or people

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

with numbers put in service after the directory was published. Sampling methods for creating directory frames are discussed in Pollock et al. (1994) and Salant and Dillman (1994).

Bias can be associated with telephone surveys due to the presence of multiple phone lines in a household (including cellular phones), households without any phones, or a large number of no answers due to the prevalence of answering machines. It might not be appropriate to assume that the results for the responding group are representative of the nonresponding group. This is especially true in fish consumption surveys, where the lower income, non-telephone households might have a higher consumption rate than that of other households. In this situation, an alternative mode of administration would be more appropriate to effectively reach the target population or sub-population. For more information regarding the analytical treatment of bias, the reader is referred to texts such as Scheaffer et al. (1990) and Biemer et al. (1991), or a statistician.

4.5.5 Specific Issues for QA/QC: Telephone Survey

If the telephone interviews are conducted from a central location, the supervisor can listen to a portion of the interviews to ensure that the survey is being completed in accordance with the design quality control procedure. During these audits, the supervisor should also check the data entry forms that the interviewer completes for transcription or other errors. The interviewer can also conduct a brief self-review after each interview or at the end of the day. Data entry errors can be corrected more easily if they are caught while the events of the interview are still fresh in the interviewer's memory.

Many telephone surveys incorporate a CATI system, whereby the interviewer keys responses directly into the computer. This eliminates the error-prone transfer of data from paper to computer. A typical system is programmed with editing instructions to ensure that only valid responses that are consistent with the question may be entered. The computer automatically follows complex skip patterns (e.g., if answer to number 4 is no, go to question number 9) which reduces both confusion during the interview and training time for the interviewers.

4.6 Mail Survey

4.6.1 Advantages

- Mail surveys can assess region-specific consumption rates, depending on how the respondents are selected (obtaining addresses from license applications, fishing tournament entries, etc.).
- This approach can target specific subpopulations of concern when these populations can be preselected on some basis or when specific limiting questions are included on the surveys.
- This approach is the least costly since interviewers are required only for obtaining follow-up information. Large numbers of respondents can be contacted over a broad area (see U.S. EPA, 1984).
- Respondents are most likely to provide honest answers and fewer “socially desirable” responses (U.S. EPA, 1984).

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

- More complex data can be obtained because the respondent can take time to consider the questions asked and consult other sources if necessary.
- The survey can cover more types of questions, so multiple objectives can be evaluated.
- Visual aids (geographic, meal size) can be added to improve accuracy.

4.6.2 Disadvantages

- Mail surveys cannot reach people who lack mailing addresses, such as migrant workers, homeless people, and other people who move frequently or have informal living arrangements. These groups might contain a disproportionately high number of subsistence fishers and thus might be groups at higher risk overall.
- If addresses are obtained from specific sources, such as lists of licensed fishers or hunters, the survey will miss unlicensed fishers or hunters and others possibly at high risk from fish or wildlife consumption.
- Questions must be carefully designed to compensate for the lack of social interaction provided by telephone or personal interviews and must provide adequate instructions to elicit satisfactory responses and motivate the respondents to cooperate (U.S. EPA, 1984).
- Questions need to be limited in scope and complexity, preferably requiring only short answers or checking off multiple choices, to maintain cooperation by the respondent.
- Voluntary mail surveys require substantial follow-up efforts or incentives to achieve reasonable response rates (either by conducting telephone interviews or by offering the respondents the choice of phoning in their answers).
- Skewed or biased response is possible because there is no opportunity for clarification through personal interaction.
- A mail survey is likely to produce a higher number of inaccurate and incomplete responses because it lacks the opportunity to instruct and motivate provided by personal interview approaches (U.S. EPA, 1984).
- This type of survey may undersample groups with low literacy rates and respondents who have difficulty understanding the questions or cannot read the language in which the questions are written.

4.6.3 Specific Issues for Instrument and Study Design: Mail Survey

Mail surveys have often been the preferred off-site approach for collecting fish and wildlife consumption information because they can be relatively simple to conduct and cost-effective. If the consumption data will be used for the assessment of human health risk, surveying subpopulations that consume fish or wildlife from a specific region or waterbody that might be contaminated is

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

appropriate. This can be done by selecting addresses within a specified distance from the waterbody in question.

The population to be interviewed is often selected with the help of fishing or hunting license files. This method might exclude on-reservation Native American subsistence fishers, who do not need licenses to fish on tribal waters; however, off-reservation Native Americans would not be excluded in states where they are required to have state fishing licenses. Also excluded would be those who fish or hunt illegally and those who do not require a license, such as children and seniors. The sample population drawn from license files will consist of fishers or hunters and perhaps their families and friends, but there is no way to preselect respondents who consume fish from a particular waterbody.

A typical mail survey includes an initial mailing to all respondents, followed by one or more follow-up mailings to nonrespondents after a specified interval. The first mailing should consist of a cover letter, a questionnaire with a unique respondent number, a postage-paid return envelope, and perhaps an inducement to participate in the survey. The cover letter should begin with a brief explanation of the purpose of the survey. The letter should also stress the confidentiality of the response. The respondent number on every questionnaire should be used to check off the name from the mailing list so that nonrespondents can be identified for future mailings; for confidentiality purposes, the names should not be included on the questionnaire itself. In the most common sequence for addressing nonrespondents, the four-wave Dillman Method, the initial survey is followed by a postcard reminder, then a second survey with a new cover letter reiterating the purpose of the survey and indicating that no response was received from the first mailing (Dillman, 1978; Salant and Dillman, 1994). A final postcard is sent if no response is received. Another approach is to send out a second survey with a new cover letter to nonrespondents approximately 3 weeks after the first mailing. A third mailing, which Pollock et al. (1994) recommend be by certified mail, may be sent out 4 weeks after the second mailing, again only to nonrespondents. Multiple mailings are important for reducing the nonresponse rate and its associated bias. Shorter time periods than those described above might be desirable (Knuth and McMullin, 1996).

Nonresponse bias can be checked by using the telephone or by sending a very brief survey on a postcard with prepaid postage. Another method of evaluating nonresponse bias is to compare data from surveys returned early with data from surveys returned much later. Greater bias in the respondents' profile can result because effort is involved in completing the survey. This means that respondents can be either more highly motivated for some personal reason, incentive, or interest in health and contamination issues and more likely to return the completed survey or, conversely, less motivated because of indifference or mistrust of those conducting the survey, leading to a low response rate.

Estimating consumption over an entire year by using mail surveys is a relatively difficult matter. The respondent's recall over that period of time is likely to be incomplete. Ideally, respondents would be surveyed during different times of the year to minimize the recall period. This approach might work relatively well for the mail survey method, particularly if respondents are screened in the first mailing for their degree of cooperativeness. Alternatively, the rolling cohort approach described in Section 4.2 can be used.

Questions in a mail survey can be more complex and technical than those in interviews because the answer period is not time-constrained and the respondent can seek answers from other sources. Draft

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

questions should be reviewed carefully for ambiguity because of the lack of direct personal interaction (see Section 4.2 for discussion and references).

4.6.4 Specific Issues for Statistical Sampling and Analysis: Mail Survey

Nonresponse bias in mail surveys can frequently be large according to Brown (1991). However, West (1989) found that nonrespondents ate nearly as much fish as respondents; when the consumption rate was adjusted for nonrespondents, it was almost equal to the regional average found in numerous other studies. The magnitude of this bias can be analyzed statistically if information about the nonrespondents can be obtained. Such a followup survey is commonly conducted by telephone, but other methods are possible (Fisher, 1996). Nonresponse bias (B) is represented by the following equation:

$$B = (W_2)(Y_1 - Y_2)$$

where W_2 is the fraction of nonrespondents and Y_1 and Y_2 are the population means for respondents and nonrespondents, respectively. An estimate of Y_1 comes from the mail survey. If an estimate of Y_2 can be obtained through a telephone survey, the results of the mail survey can be corrected for nonresponse bias (Pollock et al., 1994). For information regarding the analytical treatment of bias, the reader is referred to texts such as Biemer et al. (1991), Scheaffer et al., (1990), or a statistician. Other types of bias can be associated with poor selection of the survey sample and poor questionnaire design. The importance of understanding the characteristics of the target population and how this can affect the survey results is described in Section 3.3.1.

4.6.5 Specific Issues for QA/QC: Mail Survey

An efficient means of tracking the status of all questionnaires and respondents is an important QA mechanism for mail surveys. Software programs for administering mail surveys are reviewed by Larson and Jester (1991). QC procedures used during personal contact survey methods, such as field audits, cannot be used for mail surveys because the respondents “collect” the data themselves by completing the questionnaire. After the questionnaires are returned, entry into some sort of data processing software is typically necessary. QC procedures for data entry are described in Section 4.4.

4.7 Diary

4.7.1 Advantages

- The diary approach can assess region-specific consumption rates if respondents are selected appropriately.
- Diaries can provide data over long periods of time for particular subpopulations of concern if such subpopulations have been appropriately preselected.
- This approach is less expensive than personal interviews.
- The diary approach can be used for respondents inaccessible by telephone.

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

- Large numbers of respondents may be included.
- This approach results in minimal recall bias, although other potential sources of error or alterations in record keeping can occur.
- Visual aids (geographic, meal size) can be added to improve accuracy.

4.7.2 Disadvantages

- Interviewers must be trained to teach the respondents how to complete the diary.
- Using the diary approach requires respondent literacy, a high degree of motivation, and constant monitoring to maintain consistency in the data collected.
- The act of keeping records can affect dietary practices.
- Depending on respondent involvement, there can be a high degree of failure in daily recordkeeping.
- There can be language barriers both in setting up respondents and in interpreting their responses.

4.7.3 Specific Issues for Instrument and Study Design: Diary

The diary approach for measuring fisher participation has been infrequently reported in the literature. Recently, however, there has been a trend to use the method to measure both fishing participation and fish consumption (Connelly and Brown, 1996). Various methods have been used to select the fishers to be surveyed by the diary approach. Fishers can be contacted by mail, by telephone, or at the fishing site. Even if material is distributed at the fishing site, the diary approach is considered “off site” because it uses self-reporting of data. Diaries are also used for hunting participation and could be used for wildlife consumption as well.

The diary approach can be used to collect either single-trip or multi-trip records. Diaries are normally used when information about more than one trip is needed. Fishers and hunters may be issued diaries to record their catch and consumption practices over a specified period of time. Diaries are usually returned by mail at the end of the study period. For single trips, catch cards may be issued to persons at the fishing or hunting site to record their catch and estimate their consumption based on a single day of fishing or hunting. They are handed out to fishers or hunters at the beginning of their fishing or hunting trip and either collected at the end of the day or mailed in later (Pollock et al., 1994).

Because participants are not required to recall fishing or hunting and fish or wildlife consumption but can record it directly, recall errors are minimized, assuming that diaries are completed on a regular basis. Some recall period is inevitable, however, because some people will forget to record their data until reminded. Typically, the diary method yields much lower estimates of fishing and fish consumption than either mail or telephone surveys (Thompson and Hubert, 1990; Connelly and Brown, 1995).

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

The structure of the diary is slightly different from the structure of the questionnaires developed for other survey approaches. Because entries are usually repeated over time, not all questions need to be answered for each entry. Demographic questions are asked only once. Charts or tables can be used to report catch rates and consumption patterns. Because of higher levels of complexity, diary instructions are more thorough than typical questionnaire instructions.

The study period must be long enough to provide the data necessary for consumption estimates, but not so long as to burden respondents. Estimating consumption over a entire year by using a diary is a relatively simple matter if participants are willing to participate for that long. The degree of cooperativeness can be gauged during initial contact. An alternative to keeping the same participants for the entire study would be to use the rolling cohort method (Section 4.2) to reduce the time individuals are asked to keep diaries and eliminate participant burnout.

Questions in a diary can be more complex and technical than those in interviews because the answer period is not time-constrained and the respondent can seek answers from other sources. However, the questions should not be so complex that the participant does not want to complete the diary on multiple occasions. Draft questions should be reviewed carefully for ambiguity because of the lack of direct personal interaction.

4.7.4 Specific Issues for Statistical Sampling and Analysis: Diary

If catch cards or diaries are handed out at a target waterbody, planning for sampling consists of determining specific sites and times to hand them out. If the survey instruments are mailed out, living close to the waterbody could be a criterion for selecting respondents. Sampling frames may be constructed using a variety of probability sampling methods, including (1) simple random sampling without replacement, (2) stratified random sampling, (3) systematic random sampling, (4) two-stage (cluster) sampling, and (5) nonuniform probability sampling. These methods as applied to fisher surveys are discussed in Pollock et al. (1994). Bias in the diary survey approach can be associated with poor selection of the survey sample and poor questionnaire design. The importance of understanding the characteristics of the target population and how they can affect the survey results is described in Section 3.3.1. For information regarding the analytical treatment of bias, the reader is referred to texts such as Scheaffer et al. (1990) and Biemer et al. (1991) or a statistician.

4.7.5 Specific Issues for QA/QC: Diary

Field audits and other QC procedures used in personal contact survey approaches cannot be used for diaries and catch cards because data are self-reported by the respondents. Periodic phone contacts might be useful to provide oversight and motivation to complete the diaries (Connelly and Brown, 1995). Data obtained on the phone can later be compared with data in the diaries.

Once the diaries are returned, entry into some sort of data processing software will typically be necessary. QC procedures for data entry are described in Section 4.4.

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

4.8 Personal Interview

4.8.1 Advantages

- Personal interviews can assess region-specific consumption rates by targeting the waterbody or residence of the respondent.
- This approach can also identify specific subpopulations of concern by obtaining data from known contaminated fishing/shellfishing sites or working with community agencies to identify potential respondents.
- Interviewees' responses can be augmented with first-hand observations of the respondents and the interview sites.
- Literacy and language barriers might be more easily overcome using this approach.
- Recall bias can be minimized by providing appropriate visual aids (for species and portion or meal size) or by basing the survey on the fish or wildlife caught at the time of the interview.
- This approach has a high rate of success for completing interviews because of personal contact. Interviewers can be trained to clarify confusing questions or neutrally probe for answers.
- Verification of information is comparatively easy, especially if data collected are based on the actual catch of the day. It is also relatively easy to use special techniques such as visual aids and probing.

4.8.2 Disadvantages

- The number and complexity of survey questions might need to be limited so that surveys can be performed quickly, depending on the respondent's availability and interest.
- Personal interviews are the most costly approach, requiring the coordination, hiring, training, and close supervision of interviewers and field staff at more than one location, as well as additional paperwork to control the fieldwork and processing operations (U.S. EPA, 1984).
- For on-site personal interviews, responses to questions about consumption are hypothetical because consumption of the catch has not yet occurred and it is unknown how many fish will be given away and consumed by the friends or family of the fisher. In addition, these responses measure only the *intent* to consume, which might not be an accurate representation of the true consumption rate. Follow-up studies might be needed to understand the relationship between the intent to consume and actual consumption. As preliminary estimates, the consumption estimates from creel surveys are conservative (potentially overestimating consumption for the angling population).

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

4.8.3 Specific Issues for Instrument and Study Design: Personal Interview

Various methods have been used to select the fishers or hunters to be interviewed. The sample may consist only of fishers or hunters or may include members of their households who could later be separated into subgroups of the sample unit (U.S. EPA, 1983). On the regional or local level, lists of fishing or hunting license holders might be used to obtain stratified samples based on a particular type of license or geographic reference, such as counties located close to the waterbody in question. This method might exclude on-reservation Native American subsistence fishers, who do not need licenses to fish on tribal waters, or urban subsistence fishers, who might not have obtained licenses. Intercept or on-site interview approaches may attempt to question everyone, interview only those who have caught fish or wildlife at the time (nonuniform sampling), or randomly select fishers or hunters to be questioned. Depending on the objectives of the survey, other strategies might be required to obtain samples of recreational and subsistence fishers or hunters.

Once the population has been identified, the location of the interviews should be selected. Locations can be off site or on site, where “site” refers to the waterbody in question (Pollock et al., 1994). Off-site personal interviews are usually based on sampling from a list of fishers or hunters (e.g., license holders), and such an interview usually takes place in the respondent’s home. Clustering methods can be employed for off-site surveys to interview a number of respondents in one location. This technique can lower the costs of the interview survey and may be particularly effective if incentives are offered to respondents to meet at a central location. On-site approaches are based on sampling from a list of fishing or hunting places and times. Fishers are interviewed while in the act of fishing or just as they come off the water. On-site approaches allow more information to be verified by the researcher. For example, researchers in the field are less likely than fishers to make mistakes about the identification of fish species. A specialized form of on-site interview, the creel survey, is discussed in Section 4.9.

The accuracy of recall is inversely proportional to the amount of time for which recall is required. Off-site interviews often include longer recall periods than on-site interviews. For example, fishers found at fishing sites may, on the average, fish more frequently than fishers contacted off site and should be able to provide estimates of fish consumption more readily over a shorter period of time (including the interview day). Ideally, the same respondents would be interviewed during different times of the year to minimize the recall period. This approach is often not financially practical. Alternatively, the rolling cohort method (Section 4.2) may be used to interview different respondents over the course of the year. This method could be financially practical if only a small group of interviewers were trained and employed over the period of the study, though it might be financially impractical if trying to cover a large study area. Although the results might be equally reliable, the consumption rates obtained could differ. Each of these methods presents different problems and introduces different biases. For example, interviewing the same respondents during a long period might unconsciously affect their consumption since they know they are participating in a consumption survey. Again, the reasons for conducting the survey and the survey objectives are important in determining which approach might be used.

As with all approaches, meal size estimates are subject to considerable error. Questions on meal size are often accompanied in a personal interview by models of a typical fillet meal (e.g., 3 oz, 5 oz, or 8 oz). These visual cues are very helpful in triggering a more accurate response from the respondent. It is important to note that the most helpful visual aids represent the species that are being caught or are being asked about in the questions and the size and shape of the portions being eaten (Save San

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

Francisco Bay Association, 1995). For example, commonly eaten portions of eel, shark, and bass vary greatly in shape, size, and weight. Since fish caught in small or constricted waterbodies do not grow as large as fish caught in bays and oceans, showing an 8-oz fillet model or picture might not be appropriate for waterbodies where fish of that size are not routinely caught. An fisher could also be asked to describe the species and size of fish routinely caught and eaten and approximately how much of the fish each household member eats (e.g., one-half of the white meat from a 12-inch perch, both fillets of an 8-inch catfish). For on-site interviews in which the fish can be identified and measured (length and breadth at belly), it is possible to relate meal size to the size of the fish if it is to be consumed (Allen et al., 1996). The question wording and responses should be limited so that reporting of ranges (e.g., 2 to 4 meals per week, 6 to 8 oz per meal), which would be difficult to deal with in the analyses, is eliminated. The respondent should be asked to provide a best estimate of the average meal size consumed and frequency for the recall period needed.

4.8.4 Specific Issues for Statistical Sampling and Analysis: Personal Interview

For on-site interviews, sampling consists of determining specific sites and times for interviewing, and methods for selecting interviewees. For off-site interviews, living close to the waterbody could be a selection criterion. Sampling frames may be constructed using a variety of probability sampling methods, including (1) simple random sampling without replacement, (2) stratified random sampling, (3) systematic random sampling, (4) two-stage (cluster) sampling, and (5) nonuniform probability sampling. Sampling frames that consist only of sites or times are also possible. These methods as applied to fisher surveys are discussed in Pollock et al. (1994). Bias in the personal interview approach can be associated with poor selection of the sample and poor questionnaire design. The importance of understanding the characteristics of the target population and how these characteristics can affect the survey results are described in Section 3.3.1. For information regarding the analytical treatment of bias, the reader is referred to texts such as Scheaffer et al. (1990), Biemer et al. (1991), or a statistician.

4.8.5 Specific Issues for QA/QC: Personal Interview

For both on-site and off-site interviews, the supervisor can be present with the interviewer for some of the interviews to ensure that the questionnaire is being completed in accordance with the survey design. During these field audits, the supervisor should also check the data entry forms that the interviewer completes for transcription or other errors. The interviewer can conduct a brief self-review after each interview or at the end of the day. Data entry errors can be corrected more easily if they are caught while the events of the interview are still fresh in the interviewer's memory. Data from personal interviews are typically entered into a computer database. QC procedures for data entry are described in Section 4.4.

4.9 Creel Survey

4.9.1 Advantages

- Creel surveys, as a personal interview approach, can assess region-specific consumption rates by targeting specific waterbodies.

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

- This approach can also identify specific subpopulations at high risk by obtaining data from actual fishers at known contaminated fishing/shellfishing sites.
- Creel surveys can provide first-hand observations of the respondents, their fishing activities and behavior, their catch, and the interview sites.
- Recall bias can be minimized by providing appropriate visual aids (for species and portion or meal size) and by basing the survey on the fish caught at the time of the interview.
- The rate of success for completing interviews is high because of personal contact.
- Verification of information is comparatively easy, especially if data collected are based on the actual catch of the day. It is also relatively easy to obtain sensitive information and to use special techniques such as visual aids and probing.
- Because creel surveys are often regularly conducted by state and tribal agencies for fishery management purposes, questions on fish consumption can be added at relatively little additional cost.

4.9.2 Disadvantages

- The number and complexity of survey questions must be limited so that surveys can be performed quickly.
- Interviewers might encounter language barriers.
- Creel surveys are costly because they require the coordination, hiring, training, and close supervision of interviewers and field staff for quality control, as well as additional paperwork to control the fieldwork and processing operations. Creel surveys consisting of questions added to ongoing creel survey activities are less expensive.
- Responses to questions about consumption are hypothetical because consumption of the catch has not yet occurred and it is unknown how many fish will be given away and consumed by the friends or family of the fisher. In addition, these responses measure only the *intent* to consume, which might not be an accurate representation of the true consumption rate. Follow-up studies might be needed to understand the relationship between the intent to consume and actual consumption. As preliminary estimates, the consumption estimates from creel surveys are conservative, potentially overestimating consumption for the fishing population.

4.9.3 Specific Issues for Instrument and Study Design: Creel Survey

The creel survey approach is used by fishery managers to obtain harvest data collected on site, from single fishers (hook and line, castnet, clam rake, etc.) or from larger-scale commercial-type operations (trawl, gill nets, etc.) that obtain fish for a specific community (see Gutherie et al., 1990). Although questions on fish consumption practices are not normally included in a creel survey, this information

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

can be readily obtained if desired. If surveys are regularly conducted as part of agency management programs, questions on fish consumption may be added for relatively little additional cost.

Two types of creel survey methods can be distinguished—access point surveys and roving creel surveys. The characteristics of the two types of surveys are given in Table 4. The access point survey is preferred when entry points into the fishery are relatively few and well defined. When access to the fishery occurs at too many points to be accommodated in a traditional access point design, the roving method might be preferred.

Questions on meal size are often accompanied in a personal interview by models of a typical fillet meal (e.g., 5 oz or 8 oz). These visual cues are very helpful in triggering a more accurate response from the respondent. It is important to note that the most helpful visual aids represent the species that are being caught or are being asked about in the questions and the size and shape of the portions being eaten. For example, commonly eaten portions of eel, shark, and bass vary greatly in shape, size, and weight. Since fish caught in small or constricted waterbodies do not grow as large as fish caught in bays and oceans, showing an 8-oz fillet model or picture might not be appropriate for waterbodies where fish of that size are not routinely caught. An fisher could also be asked to describe the species and size of fish routinely caught and approximately how much of the fish each household member eats (e.g., one-half of the white meat from a 12-inch perch, both fillets of an 8-inch catfish). For on-site interviews in which the fish can be identified and measured (length and breadth at belly), it is possible to relate meal size to the size of the fish if it is to be consumed (Allen et al., 1996). The question wording and responses should be limited so that reporting of ranges (e.g., 2 to 4 meals per week, 6 to 8 oz per meal), which would be difficult to deal with in the analyses, is eliminated. The respondent should be asked to provide a best estimate of the average meal size consumed and frequency for the recall period needed.

Characteristic	Access Point Survey	Roving Creel Survey
Takes place on site, physically on shore or water	yes	yes
Fishery has countable number of access sites	yes	no
Specific locations on waterbodies can be targeted	no	yes
Sampling events are chosen with probability methods	yes	yes
Fishers using sites are representative of all fishers using the fishery	yes	no
Fishers fishing longer are sampled disproportionately more than short-term fishers	no	yes
Fishers are interviewed as they leave the fishery	yes	no
Fishers are counted while they are still fishing	no	yes
Information gathered on effort and harvest is unbiased	yes	no
Harvest can be examined by the creel clerk	yes	yes

Source: Pollock et al. (1994).

4. INSTRUMENT AND STUDY DESIGN AND IMPLEMENTATION

4.9.4 Specific Issues for Statistical Sampling and Analysis: Creel Survey

Access sites must be selected in a statistically sound manner. Statistical considerations are perhaps more profound for surveys in which fishing effort is calculated, but fish consumption might also vary with the characteristics of the access site. For waterbodies with a small number of sites, the traditional one-site-per-day approach might be suitable. For waterbodies with many access sites, the bus route method might be more appropriate. This method entails numerous access sites being treated as a group that is sampled during one or more days. The survey route is analogous to a bus route with stops at designated places (access sites) on a predetermined time schedule. Examples of scheduling both traditional and bus route access surveys are provided in Pollock et al. (1994).

It should be noted that creel surveys are likely to target persons who consume more fish than the general population and therefore estimates of fish consumption by fishers obtained from creel surveys should not be applied to the general population. A number of statistical concerns are peculiar to creel survey data. The reader is advised to consult Lester et al. (1991) and Pollock et al. (1994) for more information on this topic.

Bias in creel surveys can be associated with the time of year, time of day, and length of the interview (affecting the proportion of the angling population that could actually be sampled for a fixed level of effort). These sources of bias are associated with poor sample selection and poor questionnaire design. The importance of understanding the characteristics of the target population and how this can affect the survey results is described in Section 3.3.1. For information regarding the analytical treatment of bias, the reader is referred to texts such as Biemer et al. (1991), Scheaffer et al. (1990), or a statistician.

4.9.5 Specific Issues for QA/QC: Creel Survey

For both on-site and off-site interviews, the supervisor can be present with the interviewer for some of the interviews to ensure that the questionnaire is being completed in accordance with the survey design. During these field audits, the supervisor should also check the data entry forms that the interviewer completes for transcription or other errors. The interviewer can also conduct a brief self-review after each interview or at the end of the day. Data entry errors can be corrected more easily if they are caught while the events of the interview are still fresh in the interviewer's memory. Data from creel surveys are typically entered into a computer database. QC procedures for data entry are described in Section 4.4.

SECTION 5

SUMMARY

Fish consumption surveys are typically conducted using one or more of the approaches described in this document. Each approach has strengths and weaknesses, as described in Tables 2 and 3 and Section 4. Which survey approach is appropriate depends on (1) the objectives of the survey, (2) the population being surveyed, and (3) the resources available for the survey. During the planning of the survey, the trade-offs between data desires, data needs, data quality, survey length, representativeness, survey cost, and other factors must be taken into consideration. Usually, one or more of these factors will limit what the survey can expect to accomplish. Understanding these problems early in the planning process can lead to the development of the most appropriate survey for the problems presented and the information needed.

A common objective of recent surveys is to characterize subpopulations at the higher end of the consumption scale. Persons in these groups might be at greater health risk if the fish or wildlife they consume are from contaminated waterbodies. Ease of access to persons in certain subpopulations differs in the various methods. On-site interviews are more likely to reach subsistence/recreational fishers or hunters, who might not be licensed, but more detailed data might be obtained by diaries and written questionnaires. Pilot studies might be necessary to determine whether the proposed study design can reach a statistically valid number of respondents in the target population.

The process of developing a consumption survey is time-consuming and might require the help of various professionals, including fisheries biologists, risk assessors, epidemiologists, statisticians, and survey and human dimensions specialists. Essig and Holliday (1991) present a case study describing how the National Marine Fisheries Service developed one survey. States, tribes, and others who are planning to conduct consumption surveys are urged to solicit help from persons who have previously performed surveys so that costly pitfalls can be avoided.

Appendix A contains information on a number of consumption surveys (primarily for fish). Several examples of recent survey instruments are presented in Appendix B. The reader should note that these are *examples only* and no endorsement by U.S. EPA is implied. They are provided to illustrate the diversity in survey approaches, instruments, and information needs that have been addressed in various consumption surveys. The reader should consult the report cited for each survey to understand the underlying hypotheses and objectives that survey instrument was developed to meet. Contact information for obtaining copies of these survey reports is provided in Appendix A.

The reader is again advised that this document and the documents *Guidance for Assessing Chemical Contamination Data for Use in Fish Advisories, Volume 1: Fish Sampling and Analysis* (released in 1993 and revised in 1995), *Volume 2: Risk Assessment and Fish Consumption Limits* (released in 1994 and revised in 1997), *Volume 3: Risk Management* (released in 1996), and *Volume 4: Risk Communication* (released in 1995) are offered as guidance only and are not regulatory requirements. EPA recommends that these guidance documents be used together since no one volume provides all the necessary information to make decisions regarding the issuance of consumption advisories.

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APPENDIX A
SUMMARY OF SURVEY METHODS

SUMMARY OF SURVEY METHODS INFORMATION (Page of 7)

Title of Survey	Type of Survey	Contact Address/ Phone No.	Level of Effort	Time	Cost	Comments
A Pretest of an Approach to Collection of Marine Recreational Fishing Data on the East and Gulf Coasts 1977	Creel census and telephone survey	The following information was given in K.A. Chandler and G.L. Brown, HSR-PR-78/1-C1, 25 January 1978, prepared for NMFS	6,077 telephone surveys, 1,644 fishermen interviewed at 3 locations to estimate sample sizes required and number of days	For a total of 18,800 fish to provide estimates of the proportional distribution of fish caught for an area (not to determine fish consumption rates), estimated 132 days to interview 3,003 fishermen in Rhode Island, 120 days for 3,087 interviews in South Carolina, 282 days to interview 6,373 in Texas	Telephone interviews: RI \$1.50; SC \$1.73; TX \$1.68; cost for intercept interviews not given but average number of interviews per hr: RI 2.59; SC 2.29; TX 2.26; assumed 10 hours of interviewing per day Cost for surveys in these 3 states estimated to be \$333,236 (1979)	Noted cost per interview for surf fishermen may be higher
Fishing Effort and Harvest by Arizona's Licensed Resident Anglers 1980	Mail survey and creel census	Eric Swanson Arizona Game and Fish Department Phoenix, AZ (602) 942-3000 Ext. 608	Sent out 18,000 surveys (10% of registered fishermen); 33% response	About 9 months including setup, data gathering and analysis	Funded through federal aid	Ballpark estimates Have done subsequent surveys
Commencement Bay Seafood Consumption Study 1981	Creel census	Doug Pierce Tacoma-Pierce County Health Department Tacoma, WA (206) 591-5543	5 months in the field collecting data; 7 months writing report	1 year	\$25,000 primarily to pay contract staff	Cost does not include tissue analysis done by EPA
Fisheries Surveys: Altamaha River St. Mary's River 1982 1986	Creel census	Dan Holder Georgia Dept. Nat. Resources, Game & Fish Div. Atlanta, GA (912) 285-6094	10-month creel survey using college students, random samples	10 months of 12-month creel survey	\$9,077 (based on \$5.50/hour wage for surveys)	Ballpark estimates Have done subsequent surveys
A Study of Toxic Hazards to Urban Recreational Fishermen and Crabbers 1983	Personal interview and creel census	Bruce Ruppel NJ Dept. Environ. Protection Trenton, NJ (609) 984-6548	87 interviews on-site	2 years for entire study	Estimate: \$50,000 Funded by the State	Also funds from Hudson River Foundation

SUMMARY OF SURVEY METHODS INFORMATION (Page of 7)

Title of Survey	Type of Survey	Contact Address/ Phone No.	Level of Effort	Time	Cost	Comments
Evaluation of Methods Used to Determine Potential Health Risks Associated with Organic Contaminants in the Great Lakes Basin 1983	Telephone and mail surveys	Given in report: EPA Environmental Research Laboratory Duluth, MN	Collected data by 3 different protocols, 587 respondents	About 2 years	About \$21 per participant for each protocol, excluding data analysis	
Recreational and Subsistence Catch and Consumption of Seafood from Three Urban Industrial Bays of Puget Sound 1983-1984	Personal interview and creel census	Mary McCallum Washington State Division of Health, Epidemiology Section Seattle, WA (206) 753-5964	1,643 interviews on site	Data collection over a 12-month period, 2 years total	Grant - \$100,000 for salary of supervisor	
Low Income Families' Consumption of Freshwater Fish Caught from New York State Waters 1985	Personal interview	Marie Wendt KVRHA 122 State Street Augusta, ME 04330	40 personal interviews over a 2-week time-frame	Data collection and analysis - 1 year	Graduate student thesis funded through Sea Grant	
Potential Toxicant Exposure Among Consumers of Recreationally Caught Fish from Urban Embayments of Puget Sound 1983-1987	Personal interview and creel census	Dr. Marsha Landolt University of Wash. School of Fisheries Seattle, WA (206) 543-7468	1st year - 4,181 angler interviews; 2nd year - 437 interviews on site at boat ramps	2 years	\$207,000 (excluding indirect costs)	Significant portion of funds were for analytical chemistry; rest for data entry and analysis, salaries of interviewers, etc.

SUMMARY OF SURVEY METHODS INFORMATION (Page of 7)

Title of Survey	Type of Survey	Contact Address/ Phone No.	Level of Effort	Time	Cost	Comments
Study of Sport Fishing and Fish Consumption Habits and Body Burden Levels of PCBs, DDE, and Mercury of Wisconsin Anglers 1985	Mail survey	Beth Fiore Wisconsin Division of health Madison, WI (608) 266-6914	1,600 surveys mailed 801 returned	About 1 year	Estimate of \$27,250	Phone follow-up to mail out; 50% responded Cost does not include blood analyses for contaminants Would use two-tiered approach next time: 1) Great Lakes 2) General
Marine Recreational Fishery Statistics Survey Atlantic and Gulf Coasts 1986 1987-1989	Creel census	Mark Holliday National Marine Fisheries Service, NOAA, Washington, DC (301) 427-2328	46,000 intercept interviews and 74,000 telephone interviews (1986)	Data collection 1 year - data ready for distribution within 4 months	Collaboration with 5 state agencies - \$2,000,000	The 1987-1989 survey is now available Have done similar surveys for the Pacific Coast
Relationship of Human Levels of Lead and Cadmium to the Consumption of Fish Caught On and Around Lake Coeur d'Alene, Idaho 1986-1987	Personal interview or telephone survey	Mike Greenwell Agency for Toxic Substances and Disease Registry Public Health Service U.S. Dept. of Health & Human Service Atlanta, GA (404) 639-0700	299 households, follow-up study on 33 individuals	About 2 years	Done in-house	Done by Division of Health Studies, Sharon Campolui
A Survey of Attitudes and Fish Consumption of Anglers on the Lower Tittabawassee River, Michigan 1987	Creel census	John Hesse Michigan Department of Public Health Lansing, MI (517) 335-8353 (8350)	5 interviewers conducted 703 interviews	4 months for surveys (1 May to 31 Aug)	\$6,500	Follow-up telephone survey done by Michigan State University as part of a survey class
Angler Use and Harvest on Fox Lake, Wisconsin 1987	Creel census	James C. Congdon DNR Madison Wisconsin Bureau of Fisheries Mgmt. Horicon County (414) 485-3003	½ FTE doing creel survey for entire fishing season (1 May-15 March, 11.5 months)	11.5 months	Funded with state funds	

SUMMARY OF SURVEY METHODS INFORMATION (Page of 7)

Title of Survey	Type of Survey	Contact Address/ Phone No.	Level of Effort	Time	Cost	Comments
Michigan Sport Anglers Fish Consumption Survey 1988	Mail survey and telephone survey	Dr. Patrick West Univ. of Michigan School of Natural Resources (313) 764-7206 (313) 763-2200	2,600 surveys mailed out 4 waves of mailings and follow-up phone calls for nonresponse bias	1 year	\$30,000	
New York Statewide Angler Survey 1988	Mail survey	Nancy Connelly Cornell University NY State College of Agriculture and Life Sciences, Fernow Hall Ithaca, NY (607) 255-2830	17,000 mailed out 3 follow-up mailings 200 telephone follow-ups for nonresponse bias 10,314 quest. returned	10 months, total time about 18 months	Funded by Dept. Environ. Conserv., Bureau of Fisheries, State of New York	
Risk Perception and Communication Regarding Chemically Contaminated Fish in Lake Ontario Fisheries 1988-1989	Mail surveys and personal interviews	Dr. Barbara Knuth Cornell University Department of Natural Resources, Fernow Hall Ithaca, NY (607) 255-0349	Sample of 188 opinion leaders, 120 adult and teenage farm workers, 32 low-income residents, 70 fishery professionals.		\$38,000	Fish consumption assessment was part of overall study focused on risk management and communication.
A Study of the Consumption Patterns of Great Lakes Salmon and Trout Anglers 1989	Mail survey	Chuck Cox Ministry of the Environment Water Res. Branch Toronto, CANADA	2,100 surveys mailed out, 1,427 returned (68% response)	4 months for data collection and analysis	\$1,500 mailing costs, plus staff time for processing results	Very effective with proper cover letter, stamped return envelope, and multiple choice questionnaire; also provide space for comments, so anglers may voice concerns
Consumption of Freshwater Fish by Maine Anglers 1990	Mail survey	Ellen Elbert ChemRisk 1685 Congress St. Portland, ME (207) 744-0012	2,500 mailed out 1,612 returned	9 months	Client confidential	Revised draft report available

SUMMARY OF SURVEY METHODS INFORMATION (Page of 7)

Title of Survey	Type of Survey	Contact Address/ Phone No.	Level of Effort	Time	Cost	Comments
Risk Perception, Reproductive Health Risk, and Consumption of Contaminated Fish in a Cohort of New York State Anglers 1990-1992	Mail survey	Dr. John Vena State University of New York, Buffalo, NY (716) 829-2975	30,000 licensed anglers contacted	2 years	\$157,220	
Great Lakes Fish Consumption Advisories: Angler response to advisories and evaluation of communication techniques 1990-1992	Mail survey	Dr. Barbara Knuth Cornell University Department of Natural Resources, Fernow Hall Ithaca, NY (607) 255-0349	8,000 licensed anglers	2 years; mail survey conducted over 3 months	\$111,280	
A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin 1991	Personal Interview	Mary Lou Soscia Columbia River Inter-tribal Fish Commission (CRITFC) 729 NE Oregon St. Portland, OR 97232 (503) 238-0667	513 off-site interviews in fall and winter 1991-1992	All surveys conducted in November at central locations on each reservation; final report produced in October 1994	<i>Not available</i>	Extensive oversight provided by state and federal agencies
Effects of the Health Advisory and Advisory Changes on Fishing Habits and Fish Consumption in New York State Sport Fisheries 1991-1992	Mail survey	Dr. Barbara Knuth Cornell University Department of Natural Resources, Fernow Hall Ithaca, NY (607) 255-0349	Sample of 2,000 licensed anglers.	2 years; mail survey conducted over 3 months	\$41,772	Fish consumption assessment was part of overall evaluation of health advisory impacts.
Michigan Sport Anglers Fish Consumption Survey 1991-1992	Mail survey and telephone survey	Dr. Patrick West Univ. of Michigan School of Natural Resources (313) 764-7206 (313) 763-2200	2,450 surveys mailed out 4 waves of mailings and follow-up phone calls for nonresponse bias	18 months	\$50,000	

A-5

SUMMARY OF SURVEY METHODS INFORMATION (Page of 7)

Title of Survey	Type of Survey	Contact Address/ Phone No.	Level of Effort	Time	Cost	Comments
Estimating the Sportfishing Participating and Consumption of Lake Ontario Fish 1991-1993	Diary survey and mail survey	Nancy Connelly Cornell University Department of Natural Resources, Fernow Hall Ithaca, NY (607) 255-2830	516 diary participants, 2,500 licensed anglers for mail survey	2 years	\$83,085	Compared results of diary and mail approaches. Mail surveys produced higher estimates of angler-days and fish consumption.
Demographic Variability in Seafood Consumption Rates Among Recreational Anglers of Santa Monica Bay 1991-1992	Creel census	Jim Allen Southern California Coastal Water Research Project 7171 Fenwick Lane Westminster, CA 92683 (714) 894-2222	1,244 anglers interviewed at access points; 113 field survey trips taken	Surveys took place over one year	\$138,000	Non-English speakers were also interviewed
A Survey of Fish and Shellfish Consumption by Residents of the Greater New Orleans Area 1992	Telephone survey	Ann Anderson Tulane University School of Public Health and Tropical Medicine 1501 Canal St. New Orleans, LA 70112 (504) 588-5397 acanders@mailhost.tcs.tulane.edu	405 interviews completed out of 587 attempted; up to 4 callbacks before moving abandoning number; 10% of each interviewer's work verified by callback	Interviews conducted in summer; about one year for entire study	\$25,000	Consumption estimates did not vary with race, gender, income, or religion
Angler Attitudes and Behavior Associated with Ohio River Advisories 1992-1993	Mail survey	Dr. Barbara Knuth Cornell University Department of Natural Resources, Fernow Hall Ithaca, NY (607) 255-0349	5,000 licensed anglers	2 years	\$130,276	
Results of a Survey of Recreational Marine Fishermen to Evaluate an Approach to Collect Per Person Fish Consumption 1992	Personal interviews, followed by telephone contact	Robert L. Hiatt QuanTech	1959 anglers screened, 1339 interviewed (Delaware); 3066 anglers screened, 260 interviewed (Alabama/Mississippi)	Data collected over 6 months;	<i>Not available</i>	Telephone followup to obtain consumption estimates for fish in angler's possession during field interviews

A-6

SUMMARY OF SURVEY METHODS INFORMATION (Page of 7)

Title of Survey	Type of Survey	Contact Address/ Phone No.	Level of Effort	Time	Cost	Comments
Fishing for Food in San Francisco Bay 1993	Personal interviews	Keith Nakatani Save San Francisco Bay Association 1736 Franklin St. Oakland, CA 94612 (510) 452-9261	Pilot study included 69 initial interviews supplemented by 3 in-depth interviews with ethnic fishers	<i>Not available</i>	<i>Not available</i>	
Estimation of Daily Per Capita Freshwater Fish Consumption of Alabama Anglers 1993	Personal interviews and logs	Lynn Sisk Alabama Department of Environmental Management (334) 271-7700	1,586 interviews	12 months	\$110,000	Anglers were asked to keep logs of catch
Seafood Consumption in Coastal Louisiana 1993	Telephone survey	Lynn Dellenberger Louisiana State University (504) 388-2751	1,100 interviews	1 month	<i>Not available</i>	A "stratified random" approach was used to obtain information with adequate representation of the population of interest
Hudson River Angler Survey 1993	Personal Interview	Hudson River Sloop Clearwater 112 Market St. Poughkeepsie, NY 12601 office@clearwater.org (914) 454-7673	336 interviews	4 months	\$22,619	
Patterns of Harvest and Consumption of Lake Champlain Fish 1993-1994	Mail survey	Dr. Barbara Knuth Cornell University Department of Natural Resources, Fernow Hall Ithaca, NY (607) 255-0349	2,000 licensed anglers	1 year	\$25,000	
Fish Consumption and Risk Perception in the New York/New Jersey estuary 1994	Personal interview	Joanna Burger Rutgers University P.O. Box 1059 Piscataway, NJ 08855 (908) 445-4318 burger@biology.rutgers.edu	318 interviews conducted at access points	7 months	\$35,000	Most respondents ignored fish advisories in the area

SUMMARY OF SURVEY METHODS INFORMATION (Page of 7)

Title of Survey	Type of Survey	Contact Address/ Phone No.	Level of Effort	Time	Cost	Comments
Fishing for Food in San Francisco Bay 1997	Creel Survey	Andrew N. Cohen Lori Lee Save San Francisco Bay Association 1736 Franklin Street, 4th Floor Oakland, CA 94612 (510) 452-9261 74212.145@compuserve.com	69 interviews completed, 65 declined to participate; conducted at fishing piers	12 months	<i>Not available</i>	
Children's Fishing and Fish Consumption Patterns 1995-1997	Mail survey and diary	Dr. Barbara Knuth Cornell University Department of Natural Resources, Fernow Hall Ithaca, NY (607) 255-0349	123 families; diary participation by 53 children	2 years	\$31,107	

APPENDIX B

EXAMPLES OF SURVEY QUESTIONNAIRES

Telephone Survey

KCA Research, Inc. 1993. *Results of a survey of recreational marine fishermen to evaluate an approach to collect per person fish consumption.* Alexandria, Virginia. Prepared for the U.S. Environmental Protection Agency, Office of Science and Technology, Standards and Applied Science Division, Washington, DC, under subcontract to Tetra Tech, Inc., Fairfax, Virginia.

EPA/DELAWARE CONSUMPTION SURVEY PHONE QUESTIONNAIRE (9/30/92)

PRIOR TO BEGINNING OF INTERVIEW, RECORD AGE AND SEX OF EACH HOUSEHOLD MEMBER

Introduction

Hello. My name is _____. One of our field staff members interviewed you on (date of interview) about your (fishing and/or crabbing). We are working on a special study for the (Environmental Protection Agency/State of Delaware) to learn more about what people do with the fish that they catch.

1. Do you recall speaking with our field staff member on (date of field interview)?

Yes
No--TERMINATE

2. Our records indicate that there are (number) persons currently residing in your household. Is this information correct?

IF NOT, OBTAIN CORRECTED LIST OF HOUSEHOLD MEMBERS' SEX AND AGES
IF PERSON CAUGHT ONLY CRABS, GO TO QUESTION 12

3. Our records also indicate that you (or members of your fishing party) caught and kept the following fish on that fishing trip.

READ NAMES OF SPECIES AND NUMBERS CAUGHT

Is this information correct?

IF NOT, OBTAIN CORRECTED LIST OF NUMBER AND SPECIES OF FISH

I am going to ask a series of questions to determine the amount, if any, of the fish you caught on (date of trip) which have been eaten or which will be eaten by you or other members of your current household.

4. For how many different meals have you or someone in your household already eaten one or more of the fish which you caught on (date of trip)?

IF NO HOUSEHOLD MEMBERS HAVE EATEN ONE OR MORE OF THE FISH,
GO TO QUESTION 10

5. For the (first, second, etc.) meal, did you or someone in your household eat some of the (first, second, etc. species)?

Yes 1
No 2 REPEAT QUESTION 5 FOR NEXT SPECIES;
IF LAST SPECIES OF A MEAL, REPEAT QUESTION 5
FOR FIRST SPECIES OF NEXT MEAL;
IF LAST SPECIES OF LAST MEAL,
GO TO QUESTION 10

6. For the (first, second, etc.) meal, was the skin of the (first, second, etc. species) removed in preparation for the meal?

Yes	1
No	2
Don't know	3
Refused	4

7. How was the (first, second, etc. species) prepared for that meal? Was it prepared whole, as in soup; filleted; headed, tailed, and gutted; gutted only; headed and gutted; or was it prepared in some other way?

Prepared whole	1
Filleted	2
Headed, tailed, gutted	3
Gutted only	4
Headed and gutted	5
Other	6 SPECIFY
Don't know	7
Refused	8

8. For this (first, second, etc.) meal, was the (first, second, etc. species) fried, baked, broiled, smoked, boiled or stewed, grilled, or prepared in some other manner?

Fried	1
Baked	2
Broiled	3
Smoked	4
Boiled/Stewed	5
Other	6 SPECIFY
Don't know	7
Refused	8
GRILLED/BBQ	9

9. The average (first, second, etc. species) in your catch would produce about (number of ounces based on weight table) of edible meat. How many total ounces of (first, second, etc. species) would you estimate you ate at the (first, second, etc.) meal? Please be careful to exclude any fish that were given away or kept by other members of your fishing party.

REPEAT QUESTION 9 FOR EACH HOUSEHOLD MEMBER

REPEAT QUESTION 5 FOR EACH SPECIES

REPEAT QUESTION 5 FOR EACH MEAL

10. Between now and (date of fishing trip + one month), how many additional meals do you anticipate you or members of your household will eat of the (name of first, second, etc. species)?

IF NO MORE MEALS OF SPECIES WILL BE EATEN, REPEAT QUESTION 10 FOR NEXT SPECIES;

IF NO MORE MEALS OF LAST SPECIES WILL BE EATEN, AND NO CRABS WERE CAUGHT, TERMINATE;

IF NO MORE MEALS OF LAST SPECIES WILL BE EATEN, AND CRABS WERE CAUGHT, GO TO QUESTION 12

IF MORE MEALS OF ANY SPECIES WILL BE EATEN, GO TO QUESTION 11

11. Assuming the total edible portion of a (first, second, etc. species) of the size you caught would be about (number of ounces), how many additional ounces would you estimate will be eaten by you between now and (date of fishing trip + one month)?

REPEAT QUESTION 11 FOR EACH HOUSEHOLD MEMBER

REPEAT QUESTION 10 FOR EACH SPECIES

IF LAST SPECIES AND BLUECRABS WERE NOT CAUGHT, TERMINATE;
IF LAST SPECIES AND BLUECRABS WERE CAUGHT THEN ASK:

12. Our records indicate that you (or members of your party) caught and kept the following bluecrabs on your trip.

READ TYPES OF CRABS AND NUMBER CAUGHT

Is this information correct?

IF NOT, OBTAIN CORRECTED LIST OF NUMBER AND TYPES OF BLUECRABS

13. For how many different meals have you or someone in your household already eaten one or more of the crabs which you caught on (date of trip)?

IF NO HOUSEHOLD MEMBERS HAVE EATEN ONE OR MORE OF THE CRABS,
GO TO QUESTION 18

14. For the (first, second, etc.) meal, did you or someone in your household eat any (first, second, etc. type of crab)?

Yes	1
No	2

REPEAT QUESTION 14 FOR NEXT TYPE OF CRAB;
IF LAST CRAB TYPE OF A MEAL, REPEAT QUESTION
14 FOR FIRST CRAB TYPE OF NEXT MEAL;
IF LAST CRAB TYPE OF LAST MEAL, GO TO
QUESTION 18

15. How were the crabs prepared for the (first, second, etc.) meal? Were they steamed, boiled, or prepared in some other fashion?

Steamed	1
Boiled	2
Other	3 SPECIFY
Don't Know	4
Refused	5

16. IF SOFTSHELL CRABS, CODE QUESTION 16 AS '1'; GO TO QUESTION 17

Did you eat the 'mustard' of the crab(s)?

Yes	1
No	2
Don't Know	3
Refused	4

17. How many of the (first, second, etc. type crab) would you estimate you ate at the first meal? Please be careful to exclude any crabs that were given away or kept by other members of your crabbing party.

REPEAT QUESTION 17 FOR EACH HOUSEHOLD MEMBER

REPEAT QUESTION 14 FOR EACH CRAB TYPE

REPEAT QUESTION 14 FOR EACH MEAL

18. Between now and (date of trip + one month), how many additional meals do you anticipate you or members of your household will eat of the (first, second, etc. type of crab)?

IF NO MORE MEALS OF FIRST TYPE OF CRAB WILL BE EATEN, REPEAT QUESTION 18 FOR NEXT TYPE OF CRAB;

IF NO MORE MEALS OF LAST TYPE OF CRAB WILL BE EATEN, TERMINATE

IF MORE CRAB MEALS WILL BE EATEN, GO TO QUESTION 19

19. How many additional crabs from the catch would you estimate you will eat between now and (date of trip + one month)?

REPEAT QUESTION 19 FOR EACH HOUSEHOLD MEMBER

REPEAT QUESTION 18 FOR EACH TYPE OF CRAB

Mail Survey

P.C. West, J.M. Fly, R. Marans, F. Larkin, and D. Rosenblatt. 1993. *1991-1992 Michigan sport anglers fish consumption study*. Final report to the Michigan Great Lakes Protection Fund and Michigan Department of Natural Resources. Technical Report No. 6, University of Michigan, School of Natural Resources Sociology Research Lab, Ann Arbor, MI.



1991/92 MICHIGAN FISH EATERS SURVEY

IMPORTANCE:

The information you provide on fish eating habits will be used to revise the fish consumption assumptions contained in public health formulas for setting water pollution standards for toxic chemicals.

DIRECTIONS: PLEASE READ CAREFULLY

We would like to ask that you, the FISH LICENCE HOLDER, be the primary person to fill out the questionnaire. A map of Michigan showing major rivers and tributaries is enclosed to help you remember where you caught or bought particular fish you ate this past week. The map also shows 12 zones in the State of Michigan that you are asked to use in locating where you caught or bought fish. Also enclosed are pictures of fish meals (about 1/2 pound) to help you estimate meal portion sizes. Pictures of commonly caught fish are included in the survey cover page (back and front) to help you identify major species (trout, catfish ect.). A list of common Michigan game fish is also included in the last pages of the survey booklet. Your responses to the survey will be kept strictly confidential. Thank you for your participation.



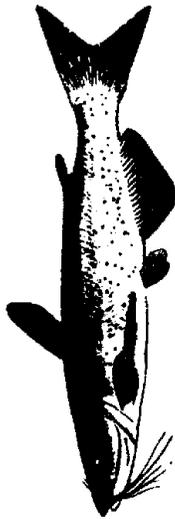
LAKE TROUT

This study is being conducted by the University of Michigan,
School of Natural Resources under funding from the Michigan
Great Lakes Protection Fund.

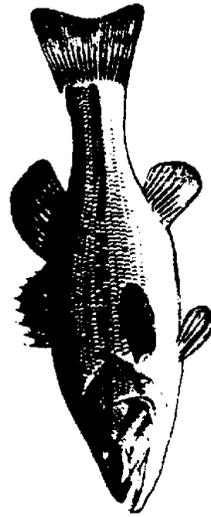
ONLY THE SPORT FISH LICENSE
HOLDER SHOULD FILL OUT THIS
SURVEY FOR HIM/HERSELF.



WALLEYE



CHANNEL CATFISH



LARGEMOUTH BASS

1. Do you currently eat fish (of any kind) ?

YES
 NO

1a. If NO, have you ever eaten fish?

YES
 NO

Go to
Question
* 4

If yes

2. About how many years have you been eating fish? _____

3. About how many years have you been eating Michigan sport caught fish? _____

4. About how many Years have you been living in Michigan? _____

5. Prior to this survey, were you aware of fish consumption advisory warnings issued by the Michigan Department of Public Health?

(1) YES, aware of specific species and/or regions
 (2) YES, generally or vaguely aware
 (3) NO
 (4) DON'T KNOW / CAN'T REMEMBER

Go to Question 6 on page 3.

5b. If yes, have you fished in any waters covered by Michigan sport fish consumption advisories?

YES
 NO
 DON'T KNOW

Go to Question 6 on page 3.

5c. In response to these warnings, for these waters, have you done any of the following? (Check Yes or No)

	NO	YES	Great Lakes	Inland Lakes	Rivers	River Mouth	Don't Know
Eaten less fish							
Trimmed fish Differently							
Cooked Fish Differently							
Changed Species Fished/eaten							
Changed location you catch fish to eat							
Changed location you bought fish							

5d. For any items checked yes in 5c, from what waters did this occur? (check all that apply)

	1	2	3	4	5
Great Lakes					
Inland Lakes					
Rivers					
River Mouth					
Don't Know					

6a. Did you eat fish in the PAST SEVEN DAYS?

(1) YES
 (2) NO

(If NO, go to QUESTION 6 PAGE 7)

If yes, please put an "x" in each box for the days and meals in which you ate fish in the last 7 days.

	7 days ago										Yesterday	Not Today
Breakfast												
Lunch												
Dinner												

p.8

Do you have any further comments?

If you would like a summary of the survey results, simply fill out this form.

Please send me a copy of the results when they become available in the fall of 1992.

Name _____

Address _____

This form will be separated from the rest of the survey when we receive it.

THANK YOU FOR YOUR PARTICIPATION
IN THIS SURVEY.

Mail Survey

B.A. Knuth. 1995-1997. *Children's fishing and fish consumption patterns*. (Mail survey of children's guardians.) Cornell University, Ithaca, New York. Prepared for New York Great Lakes Protection Fund.

YOUR FAMILY AND FISHING

A QUESTIONNAIRE FOR THE
CHILDREN'S FISHING PROJECT



Human Dimensions Research Unit
Department of Natural Resources
New York State College of Agriculture and Life Sciences
A Statutory College of the State University
Farrow Hall, Cornell University, Ithaca, N.Y. 14853



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YOUR FAMILY AND FISHING

A Questionnaire For The Children's Fishing Project

Research conducted by the
Human Dimensions Research Unit
in the Department of Natural Resources
College of Agriculture and Life Sciences
Cornell University

In cooperation with the
Sportfishing and Aquatic Resources Education Program (SAREP)

and
Sponsored by the
New York State Great Lakes Protection Fund

The purpose of this study is to learn more about children's fish consumption and how families are responding to the state's health advice about fish consumption. This study is being done in conjunction with the SAREP program. Your children may be in a special SAREP club or do SAREP activities as part of another youth organization they belong to such as 4-H or Scouts. Your name was obtained from your children's SAREP instructor. Your participation and that of your children in this study is completely voluntary, but obtaining information from families such as yours is very important for the success of the study.

Please take a few minutes now to complete this questionnaire about your family's fishing experiences and fish consumption habits. In the later part of the questionnaire we ask for your permission to have your children participate in the next phase of the study, keeping a diary about their fishing trips. If you give your permission and your children are selected for the next phase, we will let their SAREP instructor know they will be participants. All other information you provide on this questionnaire will remain strictly confidential and never be associated with your name.

To return the questionnaire, simply seal it, and drop it in any mailbox (no envelope is needed); return postage has been provided.

THANK YOU FOR YOUR ASSISTANCE!

HOUSEHOLD INFORMATION

1. First, we would like to know a little about the members of your household. Please provide the following information about each member of your household, including yourself.

Household Members	Sex	Age	Race	Relationship to Respondent
Yourself				
2				
3				
4				
5				
6				
7				
8				

FISHING EXPERIENCES

2. Now, please think back over the past 12 months. Referring to the household chart in Question 1, for each household member please estimate:

- (1) the number of days he or she spent fishing in New York State;
- (2) the number of days he or she spent fishing Lake Ontario or one of its tributaries, such as the Salmon River or Lower Niagara River;
- (3) the number of sport-caught fish meals eaten; and
- (4) the number of fish meals from all other sources, including fish purchased fresh, canned, or frozen at a store or restaurant.

Household Members	In the Past 12 Months			
	Days Fished in New York State	Days Fished Lake Ontario or its Tributaries	Approximate Number of Sport-Caught Fish Meals Eaten	Approximate Number of Fish Meals from Other Sources
Yourself				
2				
3				
4				
5				
6				
7				
8				

5. Which of the following information sources made you aware of the health advisories? (Please check all that apply.)
- ___ Newspaper article or editorial
 - ___ Magazine article
 - ___ Fishing Regulations Guide
 - ___ Talking with my child
 - ___ Information brought home from my children's SAREP/youth activities
 - ___ Warnings posted on waters that I fish
 - ___ Friends
 - ___ Television or radio
 - ___ Guides or charterboat operators

6. Are you aware of the health advisory for Lake Ontario and its tributaries up to the first barrier impassable to fish? (Check one.)
- ___ Yes, I've heard or read about it generally.
 - ___ Yes, I know specifically what the advisory recommends.
 - ___ No

7. What do you think the State recommends as the maximum number of meals of fish that a person should eat from any water in New York State? (Check one.)
- ___ None
 - ___ 1 per week
 - ___ 1 or less per mo.
 - ___ 2 per week
 - ___ 2-3 per mo.
 - ___ 3-4 per week
 - ___ 5-6 per week
 - ___ 1 per day
 - ___ Don't know

8. What do you think the State recommends as the maximum number of meals of fish that women of childbearing age and children under 15 should eat if the fish come from waterbodies listed in the health advisory? (Check one.)
- ___ None
 - ___ 1 per week
 - ___ 1 or less per mo.
 - ___ 2 per week
 - ___ 2-3 per mo.
 - ___ 3-4 per week
 - ___ 5-6 per week
 - ___ 1 per day
 - ___ Don't know

3. How often are your household's sport-caught fish meals prepared or cooked in the following ways? Circle one number for each item. SKIP TO QUESTION 4 if your household does not eat sport-caught fish.

	No meals	All meals
a. Remove the strip of fat along the back of the fish	1 2 3 4 5	1 2 3 4 5
b. Remove belly fat	1 2 3 4 5	1 2 3 4 5
c. Remove the skin	1 2 3 4 5	1 2 3 4 5
d. Eat whole, gutted fish	1 2 3 4 5	1 2 3 4 5
e. Fillet the fish	1 2 3 4 5	1 2 3 4 5
f. Pan fry	1 2 3 4 5	1 2 3 4 5
g. Deep fry	1 2 3 4 5	1 2 3 4 5
h. Make fish soups or chowders	1 2 3 4 5	1 2 3 4 5
i. Bake, roast, broil, or grill fish	1 2 3 4 5	1 2 3 4 5
j. Microwave fish	1 2 3 4 5	1 2 3 4 5
k. Reuse oil or fat from cooking fish	1 2 3 4 5	1 2 3 4 5
l. Eat frozen or canned fish caught at an earlier time	1 2 3 4 5	1 2 3 4 5
m. Smoke fish	1 2 3 4 5	1 2 3 4 5

4. Sportfish in a number of New York waterways have been found to contain levels of chemical contaminants which may pose health risks to fish consumers. The New York Department of Environmental Conservation distributes health advisories written by the Department of Health which give advice about limiting consumption of fish from certain waters of the State.

Prior to this survey were you aware of these health advisories?

- ___ Yes
- ___ No (SKIP TO THE SECTION TITLED "IF YOU HAVE CHILDREN AGES 8 TO 14 ..." on page 5)

IF YOU HAVE CHILDREN AGES 8 TO 14 PLEASE READ THIS SECTION. IF NOT, SKIP TO THE NEXT SECTION THAT STARTS WITH QUESTION 9.

The next phase of this study involves having children ages 8 to 14 (as of July 1, 1998) keep a diary about their fishing trips and fish meals over the summer and early fall. We will provide each child with a special diary in which they can mark off each fishing trip and each fish meal they eat between July 1 and Oct. 15. A Cornell staff member will call the child every 2 to 3 weeks to see how they are doing and gather the information that has been recorded so far in the diary.

When the diaries are mailed out to the children in late June, they will receive an iron-on patch to recognize their participation in the project. Their SAFEIP instructor will also be contacted to let him or her know of the child's participation in the project. At the end of the diary period we will collect the diaries and send each child a small thank you gift for their participation.

In order for your children to participate in this phase of the project, we need your written consent. If you are willing to let your child participate in this important study, please sign the consent form below and write in the names of the children who are willing to participate. If you have any questions or concerns before signing the consent form, please call Nancy Connelly (Project Manager for the study) collect at (607) 255-2830.

Not all children who have their parent's consent may be selected to participate in the diary portion of the study. If your children are selected to participate we will send them the special diary and patch in mid-June.

I give my permission for _____
(Children's Names)

to participate in the diary portion of this study as described above.

(Parent or Guardian's Signature)

9. Which of the following best describes the area where you currently live? (Check one.)

- _____ Rural, hamlet, or village (under 5,000 population)
- _____ Small city of 5,000 to 24,999 population
- _____ City of 25,000 to 99,999 population
- _____ Large city of 100,000 population or over

10. How many years of school did you complete, counting 12 years for high school graduation, and 1 year for each additional year of college, technical, or vocational training?

_____ years

11. Please circle your approximate 1995 TOTAL HOUSEHOLD INCOME before taxes, in thousands of dollars:

- Less than 10 10 12 14 16 18 20 22 24 26 28
- 30 32 34 36 38 40 45 50 55 60 65 70
- 75 80 85 90 95 More than 95

Please use the space below for any additional comments you may wish to make.

Thank You For Your Time and Effort!

To return this questionnaire, simply seal it (postage has been provided) and drop it in the nearest mailbox.



Printed on recycled paper

Mail Survey

J. Vena. 1992. Preliminary findings from the New York State Angler Cohort Study.
Perspectives Great Lakes Program 6:1-5.



UNIVERSITY AT BUFFALO

STATE UNIVERSITY OF NEW YORK

Department of Social and Preventive Medicine
 2211 Main Street, Building A
 Buffalo, New York 14214

Please fill in the blanks, check a column (✓) or circle numbers to indicate your answer to each question. Please answer all questions. Even if you are unsure of the exact answer, please give your best answer.

1 How many years have you fished in New York State? Number of years _____

2 During the past year (June 1, 1990 to June 1, 1991) how many days did you go fishing in New York State waters? Number of Days _____
 Check here if you haven't fished since June 1, 1990 and skip to Question 5 _____

3 From June 1, 1990 to June 1, 1991, how many days did you go fishing on each of the following bodies of water in New York State (for those waters you did not fish in, enter 0.)

	No. of days fishing		No. of days fishing		No. of days fishing
a. Lake Erie & all tributaries (excluding Buffalo River)	_____	e. Lake Ontario and all tributaries	_____	j. Indian Lake, New York	_____
b. Buffalo River in Erie County	_____	f. Cayuga Creek	_____	k. Long Pond, New York	_____
c. Upper Niagara River (above the falls)	_____	g. Canadice Lake	_____	l. Onondaga Lake	_____
d. Lower Niagara River (below the falls)	_____	h. Canandaigua Lake	_____	m. Inland trout streams	_____
		i. Keuka Lake	_____	n. Other lakes	_____

4 Counting only the legal size edible fish you caught in New York waters between June 1, 1990 and June 1, 1991, about what percentage were:

- A. Released %
- B. Eaten by you or your household %
- C. Given away (either fresh or processed) %
- D. Thrown away or otherwise disposed of %

Total = 100%

The next several questions ask about eating sport fish or game.

A few questions ask about eating sport fish taken from certain waters.

5 Please check (✓) the column that best describes your usual habits of **eating sport fish** during each of the four seasons of the past year (June 1, 1990 to June 1, 1991). Only consider fish that were caught in New York waters that you personally ate.

**Average Number of Fish Meals You Ate from Fish
 Caught in New York Waters, 1990-91 Seasons**

Seasons	None	1 or less per mo.	2 per mo.	3 per mo.	1 per week	2 per week	3-4 per week	5 or more/week
June, July, Aug., 1990								
Sept., Oct., Nov., 1990								
Dec, Jan, Feb, 1991								
Mar., Apr. May 1991								

6 Please check (✓) the column that best describes your usual frequency of eating game or fowl over the past year (June 1, 1990 to June 1, 1991)

Seasons	None	1 or less per mo.	2 per mo.	3 per mo.	1 per week	2 per week	3-4 per week	5 or more/week
Wild fish-eating duck								
Wild dabbling or diving duck								
Other wild game birds								
Turtle (any species)								
Rabbit								
Deer								

7a During which of the past years have you eaten any type of fish caught from **Lake Ontario and its tributaries, the Lower Niagara River, Cayuga Creek, or the St. Lawrence River?** (Check each year when you ate fish from any of these waters)

1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1985	1986	1987	1988	1989	1990	1991			

7b Please check (✓) each column that best describes your usual frequency of eating each of the kinds of fish caught from **Lake Ontario and its tributaries, the Lower Niagara River, Cayuga Creek, or the St. Lawrence River in the past year.**

Average Number of Fish Meals You Ate, June 1990 to June 1991

	None	1 or less per mo.	2 per mo.	3 per mo.	1 per week	2 per week	3-4 per week	5 or more/week
Channel Catfish								
Lake Trout								
Chinook Salmon								
Coho Salmon over 21 inches								
Coho Salmon under 21 inches								
Rainbow Trout over 25 inches								
Rainbow Trout under 25 inches								
Brown Trout over 20 inches								
Brown Trout under 20 inches								
Carp								
White Perch								
Yellow Perch								

7c How do these usual amounts of fish eaten compare to the amounts you ate in previous years from these waters?

- About the same
 This past year I ate **more** than usual
 This past year I ate **less** than usual

8a During which of the past years have you eaten any type of fish caught from **Lake Erie and its tributaries, the Buffalo River, the Upper Niagara River, Canadice Lake, Canandaigua Lake, Keuka Lake, Indian Lake, or Long Pond?**(Check each year when you ate fish from any of these waters)

<input type="radio"/> 1955	<input type="radio"/> 1956	<input type="radio"/> 1957	<input type="radio"/> 1958	<input type="radio"/> 1959	<input type="radio"/> 1960	<input type="radio"/> 1961	<input type="radio"/> 1962	<input type="radio"/> 1963	<input type="radio"/> 1964
<input type="radio"/> 1965	<input type="radio"/> 1966	<input type="radio"/> 1967	<input type="radio"/> 1968	<input type="radio"/> 1969	<input type="radio"/> 1970	<input type="radio"/> 1971	<input type="radio"/> 1972	<input type="radio"/> 1973	<input type="radio"/> 1974
<input type="radio"/> 1975	<input type="radio"/> 1976	<input type="radio"/> 1977	<input type="radio"/> 1978	<input type="radio"/> 1979	<input type="radio"/> 1980	<input type="radio"/> 1981	<input type="radio"/> 1982	<input type="radio"/> 1983	<input type="radio"/> 1984
<input type="radio"/> 1985	<input type="radio"/> 1986	<input type="radio"/> 1987	<input type="radio"/> 1988	<input type="radio"/> 1989	<input type="radio"/> 1990	<input type="radio"/> 1991			

8b Please check (✓) each column that best describes your usual frequency of eating each of the kinds of fish caught from **Lake Erie and its tributaries, the Buffalo River, the Upper Niagara River, Canadice Lake, Canandaigua Lake, Keuka Lake, Indian Lake, or Long Pond in the past year.**

Average Number of Fish Meals You Ate, June 1990 to June 1991

	None	1 or less per mo.	2 per mo.	3 per mo.	1 per week	2 per week	3-4 per week	5 or more/week
Channel Catfish								
Lake Trout								
Chinook Salmon								
Coho Salmon over 21 inches								
Coho Salmon under 21 inches								
Rainbow Trout over 25 inches								
Rainbow Trout under 25 inches								
Brown Trout over 20 inches								
Brown Trout under 20 inches								
Carp								
White Perch								
Yellow Perch								
Walleye or Pickerel								

8c How do these usual amounts of fish eaten compare to the amounts you ate in previous years from these waters?

- About the same
 This past year I ate **more** than usual
 This past year I ate **less** than usual

- 9** When you eat sport-caught fish, about what amount do you usually eat at one meal? (check one usual serving size)
 1. 1/4 pound (4 oz.) 2. 1/2 pound (8 oz.) 3. 3/4 pound (12 oz.) 4. 1 pound (16 oz.)

- 10** Please indicate how often the following methods are used in your household to prepare and eat any sport-caught fish. (check the column for each item that best describes your actions)

	Always	Usually	Sometimes	Rarely	Never
a. Trim belly meat					
b. Trim the fat along the back of the fish					
c. Trim the fat from the sides of the fish					
d. Puncture or remove the skin					
e. Eat the skin of the fish					
f. Eat whole fish					
g. Cut a steak from the fish					
h. Fillet the fish					
i. Pan fry					
j. Deep fry					
k. Make fish soups or chowders					
l. Can the fish					
m. Smoke the fish					
n. Pickle the fish					
o. Bake or broil the fish					
p. Poach or boil the fish					
q. Reuse oil or fat from cooking fish					

- 11** Sport fish in several New York waterways have been found to contain levels of contaminants which may pose health risks to people who eat fish. The New York Department of Environmental Conservation distributes a health advisory written by the Department of Health which gives advice about limiting consumption of fish from certain waters of the State.

- 11a** Were you aware of the health advisory before receiving this survey? (check one)
 Yes ① No ② (if no, please go to question 15)

- 11b** Did the following information sources make you aware of the health advisory? (check yes ① or no ②)

	Yes	No		Yes	No
Newspaper	①	②	New York State fisheries agency personnel	①	②
Magazine article	①	②	Warnings posted on waters that I fish	①	②
Fishing Regulations Guide	①	②	Friends	①	②
Newsletter from fishing club	①	②	Television or radio	①	②
Cooperative Extension information	①	②	Guides or charter boat operators	①	②
New York Sea Grant information	①	②	Other (please specify)	①	②

- 12** Have you ever referred back to the advisory in the Fishing Regulations Guide to make decisions about catching or eating fish? (check yes or no)
 Yes ① No ②

- 13** Since you learned about the health advisories, have you made any changes in either your fishing habits or the way you eat the fish you catch? (check no or yes)

① No. I made no changes as a result of the advisories (Go to question 15)

② Yes. What changes have you made? (check all that apply)

- ① I no longer eat any sport-caught fish
- ② I eat less fish now than before the advisories
- ③ I eat more fish now because I can choose to keep fish from waters where there are less serious advisories
- ④ I have changed the ways I clean and/or prepare sport-caught fish before eating them.
- ⑤ I have changed fishing locations because of the advisories.
- ⑥ I take fewer fishing trips now because I can choose waters with less serious contaminant problems.
- ⑦ I have changed the species I fish for, because of the advisories

14 For each type of fish, please check the one circle that describes the change you made in your eating habits because of the advisory.
(check one circle for each type of fish)

	Stopped Eating	Decreased Amount	Increased Amount	No Change	Never Ate
Walleye or Pickerel	①	②	③	④	⑤
Channel Catfish	①	②	③	④	⑤
Lake Trout	①	②	③	④	⑤
Chinook Salmon	①	②	③	④	⑤
Coho Salmon over 21 inches	①	②	③	④	⑤
Rainbow Trout over 25 inches	①	②	③	④	⑤
Brown Trout over 20 inches	①	②	③	④	⑤
Carp	①	②	③	④	⑤
White Perch	①	②	③	④	⑤
Yellow Perch	①	②	③	④	⑤

15 What do you think the State recommends as the maximum number of meals of fish that a person should eat from any water in New York State?
(check one)

Eat no more fish meals than:

None 1 or less/mo. 2-3 /mo. 1/week 2 /week 3-4 /week 5-6/week 1 per day Don't Know

○ ○ ○ ○ ○ ○ ○ ○

16 What do you think the State recommends as the maximum number of meals of fish that women of childbearing age and children under 15 should eat if the fish have contaminants? (check one)

Eat no more fish meals than:

None 1 or less/mo. 2-3 /mo. 1/week 2 /week 3-4 /week 5-6/week 1 per day Don't Know

○ ○ ○ ○ ○ ○ ○ ○

17 Please check the number that corresponds to your agreement or disagreement with each of the following statements:

	Strongly Agree	Moderately Agree	Slightly Agree	Slightly Disagree	Moderately Disagree	Strongly Disagree	Don't Know
Eating fish caught from Lake Erie:							
-is completely safe for me	①	②	③	④	⑤	⑥	⑦
-is completely safe for children under 15	①	②	③	④	⑤	⑥	⑦
-is completely safe for all women of childbearing age	①	②	③	④	⑤	⑥	⑦
Eating fish caught from Lake Ontario:							
-is completely safe for me	①	②	③	④	⑤	⑥	⑦
-is completely safe for children under 15	①	②	③	④	⑤	⑥	⑦
-is completely safe for all women of childbearing age	①	②	③	④	⑤	⑥	⑦
Eating fish caught from the Buffalo River:							
-is completely safe for me	①	②	③	④	⑤	⑥	⑦
-is completely safe for children under 15	①	②	③	④	⑤	⑥	⑦
-is completely safe for all women of childbearing age	①	②	③	④	⑤	⑥	⑦
Eating fish caught from the Lower Niagara River:							
-is completely safe for me	①	②	③	④	⑤	⑥	⑦
-is completely safe for children under 15	①	②	③	④	⑤	⑥	⑦
-is completely safe for all women of childbearing age	①	②	③	④	⑤	⑥	⑦
The health benefits of eating sport-caught fish are greater than the health risks	①	②	③	④	⑤	⑥	⑦

18 Please check yes, no or not sure for each statement below:

	Yes	No	Not Sure
I believe eating fish containing chemical contaminants poses some danger to me	①	②	③
I believe eating fish containing chemical contaminants poses some danger to my children	①	②	③
Eating contaminated fish can result in accumulation of chemicals in my body	①	②	③
Eating contaminated fish over many years increases my health risks	①	②	③

19 In your opinion, how do each of the following activities or substances rate as risks to health?
Please rate each on a scale of one to eight ranging from very safe (1) to very risky (8) (check a rating for each risk factor)

	1	2	3	4	5	6	7	8
	Very Safe				Very Risky			
Work conditions	1	2	3	4	5	6	7	8
Driving a car	①	②	③	④	⑤	⑥	⑦	⑧
Cigarette smoking	1	2	3	4	5	6	7	8
Beer	①	②	③	④	⑤	⑥	⑦	⑧
Food additives	1	2	3	4	5	6	7	8
Prescription medicines	①	②	③	④	⑤	⑥	⑦	⑧
Air pollution	1	2	3	4	5	6	7	8
Tap water	①	②	③	④	⑤	⑥	⑦	⑧
Pesticides	1	2	3	4	5	6	7	8
Home activities	①	②	③	④	⑤	⑥	⑦	⑧
Eating New York sport-caught fish	1	2	3	4	5	6	7	8

20 Have you ever been told by a doctor that you had any of the following: (check yes or no and if yes, please give age when diagnosed)

	Yes	No	Age Diagnosed		Yes	No	Age Diagnosed
Heart attack (myocardial infarction)	①	②	_____	Colon polyps	1	②	_____
Coronary artery bypass or angioplasty	①	②	_____	Ulcerative colitis	1	②	_____
High cholesterol (more than 240mg/dl)	①	②	_____	Stomach ulcers	1	②	_____
Chronic bronchitis	①	②	_____	Kidney or bladder disease	1	②	_____
Asthma	①	②	_____	Liver cirrhosis or hepatitis	1	②	_____
Hay fever or other allergies	①	②	_____	Arthritis or Rheumatism	①	②	_____
Infertility	①	②	_____	Vasectomy (male)	①	②	_____
High blood pressure (hypertension)	①	②	_____	Tubal ligation (tubes tied) (female)	①	②	_____
Stroke (CVA)	①	②	_____	Parkinson's Disease	1	②	_____
Goiter or thyroid condition	①	②	_____	Skin cancer	①	②	_____
Diabetes	①	②	_____	Any other cancer	①	②	_____

If yes, what kind? _____

21a Have you ever smoked cigarettes? Yes ① No ② (if no, go to question 22)

21b If yes, for how many years? _____

21c Usually, how many cigarettes do/did you smoke per day? _____

22 What is your race/ethnic group? (check one)

- ① White
② African-American
③ Native-American
④ Hispanic
⑤ Asian-American or Asian
⑥ Other

23 What is your current marital status? (check one)

- ① Never married
② Married
③ Divorced/Separated
④ Widowed

24 Please Circle the highest grade of school you have completed.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17+

25 Please check your approximate total household income before taxes, in dollars:

- ① less than \$15,000
② \$15,000 to \$24,999
③ \$25,000 to \$39,999
④ \$40,000 or more

26 If your address on the envelope is not correct, please update it here for us.

Name _____
Address _____
City/Town _____ Zip code _____

27 How many years at your current address? _____

28 Your Social Security Number (confidential, for study purposes only) _____

The last section of the survey asks questions about pregnancy, births and diet during pregnancy

IF FEMALE, skip to question 32. complete shaded questions 32-38

IF MALE AND MARRIED, or living with a female partner, it is important to please ask your wife or partner to complete shaded questions 29-38

IF MALE AND UNMARRIED (or divorced, separated or widowed) you are finished. Thank you for your cooperation. To return the questionnaire, mail it back to us using the postage paid envelope.

WIFE OR PARTNER: please fill in the blanks, check a circle or circle numbers to indicate your answer to each question. Please answer all questions (numbers 29 to 38). Even if you are unsure of the exact answer, please give your best answer.

29a During which of the past years have you eaten any type of fish caught from **Lake Ontario and its tributaries, the Lower Niagara River, Cayuga Creek or the St. Lawrence River?** (Check each year when you ate fish from any of these waters)

1955	<input type="checkbox"/>	1956	<input type="checkbox"/>	1957	<input type="checkbox"/>	1958	<input type="checkbox"/>	1959	<input type="checkbox"/>	1960	<input type="checkbox"/>	1961	<input type="checkbox"/>	1962	<input type="checkbox"/>	1963	<input type="checkbox"/>	1964	<input type="checkbox"/>
1965	<input type="checkbox"/>	1966	<input type="checkbox"/>	1967	<input type="checkbox"/>	1968	<input type="checkbox"/>	1969	<input type="checkbox"/>	1970	<input type="checkbox"/>	1971	<input type="checkbox"/>	1972	<input type="checkbox"/>	1973	<input type="checkbox"/>	1974	<input type="checkbox"/>
1975	<input type="checkbox"/>	1976	<input type="checkbox"/>	1977	<input type="checkbox"/>	1978	<input type="checkbox"/>	1979	<input type="checkbox"/>	1980	<input type="checkbox"/>	1981	<input type="checkbox"/>	1982	<input type="checkbox"/>	1983	<input type="checkbox"/>	1984	<input type="checkbox"/>
1985	<input type="checkbox"/>	1986	<input type="checkbox"/>	1987	<input type="checkbox"/>	1988	<input type="checkbox"/>	1989	<input type="checkbox"/>	1990	<input type="checkbox"/>	1991	<input type="checkbox"/>						

29b Please check (✓) the column that best describes your usual frequency of eating each of the kinds of fish caught from **Lake Ontario and its tributaries, the Lower Niagara River, Cayuga Creek, or the St. Lawrence River in the past year.**

Average Number of Fish Meals You Ate, June 1990 to June 1991

	None	1 or less per mo.	2 per mo.	3 per mo.	1 per week	2 per week	3-4 per week	5 or more/week
Channel Catfish								
Lake Trout								
Chinook Salmon								
Coho Salmon over 21 inches								
Coho Salmon under 21 inches								
Rainbow Trout over 25 inches								
Rainbow Trout under 25 inches								
Brown Trout over 20 inches								
Brown Trout under 20 inches								
Carp								
White Perch								
Yellow Perch								

29c How do these usual amounts of fish eaten compare to the amounts you ate in previous years from these waters? (check one)

- ① About the same ② This past year I ate **more** than usual ③ This past year I ate **less** than usual

29d When you eat sport-caught fish, about what amount do you usually eat at one meal? (check one usual serving size)

- ① 1/4 pound (4 oz.) ② 1/2 pound (8 oz.) ③ 3/4 pound (12 oz.) ④ 1 pound (16 oz.)

30 Have you ever been told by a **doctor** that you had any of the following: (check yes or no and if yes, please give age when diagnosed)

	Yes	No	Age Diagnosed		Yes	No	Age Diagnosed
Heart attack (myocardial infarction)	①	②	_____	Colon polyps	①	②	_____
Coronary artery bypass or angioplasty	①	②	_____	Ulcerative colitis	①	②	_____
High cholesterol (more than 240mg/dl)	①	②	_____	Stomach ulcers	①	②	_____
Chronic bronchitis	①	②	_____	Kidney or bladder disease	①	②	_____
Asthma	①	②	_____	Liver cirrhosis or hepatitis	①	②	_____
Hay fever or other allergies	①	②	_____	Arthritis or Rheumatism	①	②	_____
Infertility	①	②	_____	Tubal ligation (tubes tied)	①	②	_____
High blood pressure (hypertension)	①	②	_____	Parkinson's Disease	①	②	_____
Stroke (CVA)	①	②	_____	Skin cancer	①	②	_____
Goiter or thyroid condition	①	②	_____	Any other cancer	①	②	_____
Diabetes	①	②	_____	If yes, what kind? _____			

31a Have you ever smoked cigarettes? Yes No (if no, go to question 32)

31b If yes, for how many years? _____

31c Usually, how many cigarettes do/did you smoke per day? _____

32a Have you ever been pregnant (include live birth, still birth, miscarriage, etc.)? (check yes or no)
 Yes No If yes, what is the number of pregnancies _____

32b Do you plan on having children in the next 3 years? (check one) Yes No Undecided

32c Did you have any children born alive in the past five years? (since June 1, 1986) Yes No (if no, go to question 38)

For each child born alive anytime since June 1, 1986, please provide the following information. Start with your youngest child.

	Child's Name			Sex (Circle one)	Date of Birth mo. day yr.	Birth Weight lbs oz.	Hospital of Birth	City/State
	First	MI	Last					
1.	_____	_____	_____	M F _____	_____	_____	_____	_____
2.	_____	_____	_____	M F _____	_____	_____	_____	_____
3.	_____	_____	_____	M F _____	_____	_____	_____	_____
4.	_____	_____	_____	M F _____	_____	_____	_____	_____
5.	_____	_____	_____	M F _____	_____	_____	_____	_____

Your name _____

Your maiden name _____

Your Social Security Number _____
 (confidential, for study purposes only)

33 Please indicate the frequency with which you ate sport-caught fish from New York waters when you were pregnant anytime since June 1, 1986.

Your Average Number of Sport-Caught Fish Meals Eaten During Pregnancy

	None	1 or less per mo.	2 per mo.	3 per mo.	1 per week	2 per week	3-4 per week	5 or more/week
During pregnancy of child 1 (youngest)								
During pregnancy of child 2 (next oldest)								
During pregnancy of child 3 (next oldest)								
During pregnancy of child 4 (next oldest)								
During pregnancy of child 5								

34 What were your smoking habits while you were pregnant with your youngest child? (check one)

- I smoked more than usual I smoked the same amount as usual
 I smoked less than usual I stopped smoking I never smoked cigarettes

35 What was your usual intake of the following beverages over the past year (June 1, 1990 to June 1, 1991)

	Check the column that gives your usual frequency of consumption							
	Never or less than once/month	1 - 3 per mo.	2 - 4 per week	5 - 6 per week	1 per day	2 - 3 per day	4 - 5 per day	6+ per day
Caffeinated beverages (such as coffee, tea, soft drinks)								
Beer								
Wine								
Hard liquor (such as gin, vodka)								

36 About how much alcohol did you drink while you were pregnant with your youngest child? (check one)

- 1 I drank more alcohol than usual 2 I drank the same amount as usual
 3 I drank less alcohol than usual 4 I stopped drinking alcohol 5 I never drink alcohol

37 Please indicate how frequently you ate the following foods while you were pregnant with your youngest child.

Your Average Number of Meals Eaten During Pregnancy

	None	1 or less per mo.	2 per mo.	3 per mo.	1 per week	2 per week	3-4 per week	5 or more/week
Store bought fish (fresh or froz.)								
Tuna or other canned fish								
Fish from restaurant								
Sport fish not caught in N.Y.								
Wild duck								
Turtle (any species)								

38 Please check the circle that best describes your husband's or partner's usual frequency of eating fish over the past year (June 1, 1990 to June 1, 1991) that were caught for sport in New York waters.

Average Number of Sport-caught Fish Meals Eaten June 1990 to June 1991

	None	1 or less per mo.	2 per mo.	3 per mo.	1 per week	2 per week	3-4 per week	5 or more/week
Your husband's or partner's frequency	①	②	③	④	⑤	⑥	⑦	⑧

Thank you for your cooperation. Your contribution will be important to the success of this study.

To return the questionnaire, mail it back to us using the postage paid envelope (provided).

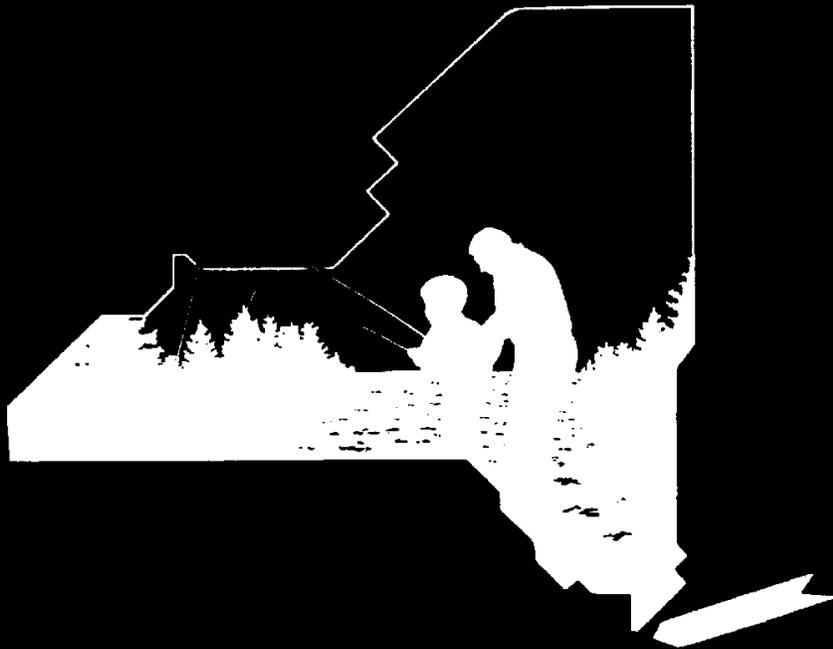


UNIVERSITY AT BUFFALO
 STATE UNIVERSITY OF NEW YORK
 Department of Social and Preventive Medicine
 2211 Main Street, Building A
 Buffalo, New York 14214

Diary

B.A. Knuth. 1995-1997. *Children's fishing and fish consumption patterns*. (Diary for children.) Cornell University, Ithaca, New York. Prepared for New York Great Lakes Protection Fund.

1996
FISHING TRIPS
AND
FISH MEALS



Human Dimensions Research Unit
Department of Natural Resources
New York State College of Agriculture and Life Sciences
A Statutory College of the State University
Ferry Hall, Cornell University, Ithaca, N.Y. 14853



Dear Diary Keeper:

Thanks for keeping this diary of the days you go fishing and the fish meals you eat. Please start keeping your diary on July 1. The first half of the diary has pages for your fishing trips. The second half begins with a yellow page and has charts for recording your fish meals. Directions are at the beginning of each section.

Remember we will be calling you on the telephone every few weeks to see how you are doing.

Thanks for helping with this important project!



**Barbara A. Knuth
Associate Professor**



Printed on recycled paper

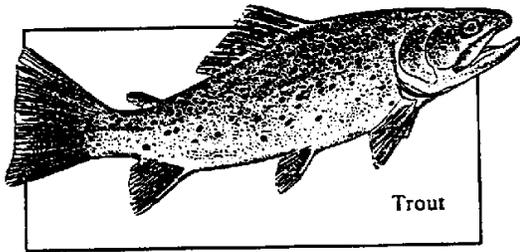
FISHING DAYS

Directions:

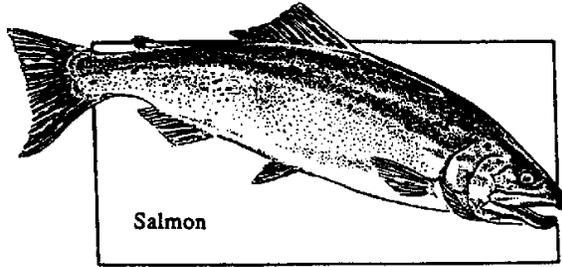
1. Fill out one chart for each day you go fishing.
2. Write down the date and the name of the lake, pond, stream, or river where you went fishing. Also write down the closest city or town to where you went fishing. See the example at the bottom of this page.
3. Circle all the types of people you went fishing with. A youth group might be a SAREP club, a 4-H club, Scouts, or a church group.
4. If you caught fish that day, write down what kind of fish you caught and how many of each kind. Use 1 line for each kind of fish. Some kinds of fish you might catch would be sunfish, bass, yellow perch, or trout. Look at the pictures on the next page to help you decide what kind of fish you have. If you don't know what kind of fish it was, just write DON'T KNOW. In the Box under the question "Did you eat any of these fish?", write "yes" if you ate any of these fish, and "no" if you didn't. Then in the last space write the names of anyone else in your family who ate these fish.
5. In the example below, the diary keeper went fishing on July 10 to Lake Ontario near Rochester with his family. He caught one trout but did not eat it. He also caught 2 yellow perch. He and his mom ate the yellow perch.

Date: <u>July 10</u>		What lake or stream did you fish? <u>Lake Ontario</u>	
Nearest City or Town: <u>Rochester</u>			
Who did you go fishing with? (Circle the right people.)			
<input checked="" type="checkbox"/> FAMILY		<input type="checkbox"/> FRIENDS	<input type="checkbox"/> SAREP OR OTHER YOUTH GROUP
			<input type="checkbox"/> BY MYSELF
Kind of Fish Caught (Species)	How many did you catch?	Did you eat any of these fish? (yes or no)	Write the names of anyone else <u>in your family</u> who ate these fish
Trout	1	no	
Yellow Perch	2	yes	Mom

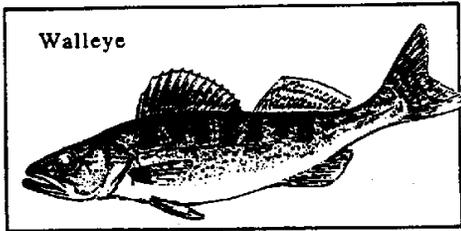
COMMON FISH OF NEW YORK STATE



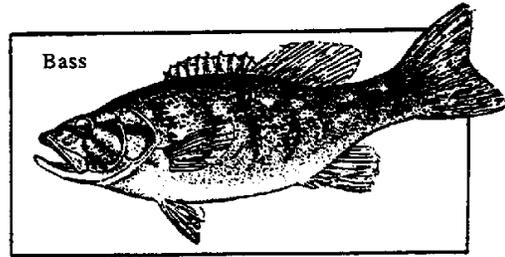
Trout



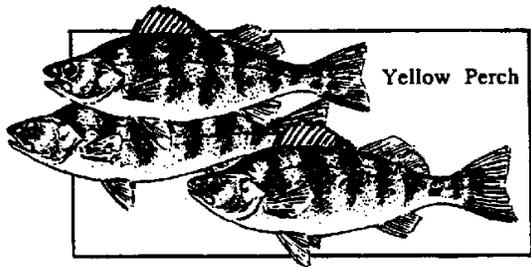
Salmon



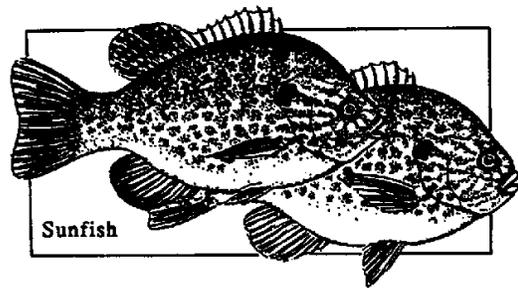
Walleye



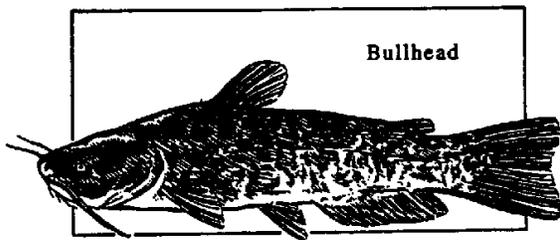
Bass



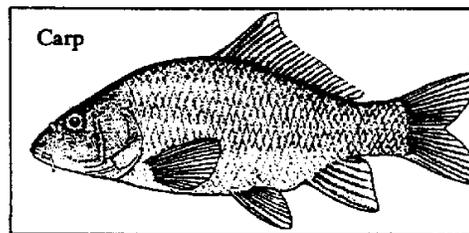
Yellow Perch



Sunfish



Bullhead



Carp

[NOTE: Multiple pages included in survey booklet to provide space for 26 fishing days]

FISHING DAYS

Date: _____		What lake or stream did you fish? _____	
Nearest City or Town: _____			
Who did you go fishing with? <i>(Circle the right people.)</i>			
FAMILY	FRIENDS	SAREP OR OTHER YOUTH GROUP	BY MYSELF
Kind of Fish Caught (Species)	How many did you catch?	Did you eat any of these fish? (yes or no)	Write the names of anyone else in your family who ate these fish

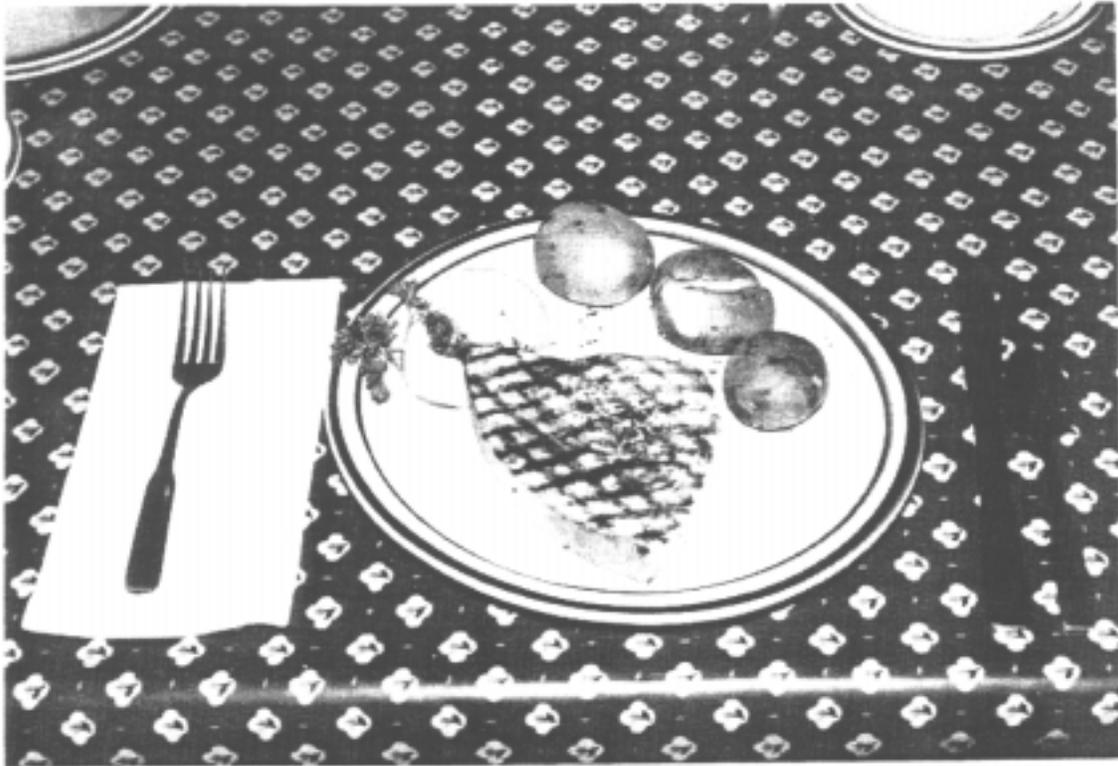
Date: _____		What lake or stream did you fish? _____	
Nearest City or Town: _____			
Who did you go fishing with? <i>(Circle the right people.)</i>			
FAMILY	FRIENDS	SAREP OR OTHER YOUTH GROUP	BY MYSELF
Kind of Fish Caught (Species)	How many did you catch?	Did you eat any of these fish? (yes or no)	Write the names of anyone else in your family who ate these fish

FISH MEALS

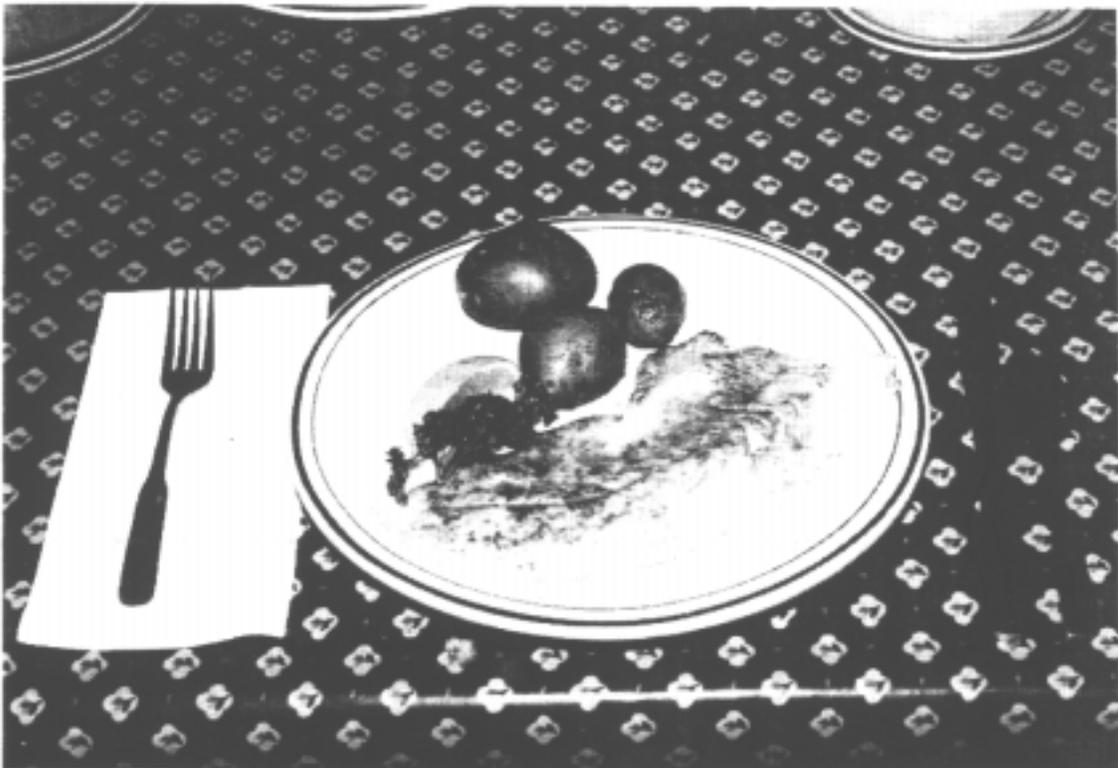
Directions:

1. Fill out one chart for each fish meal you eat. Fish meals include any fish you eat at home, in restaurants, out camping or on picnics, or at a friend's house. It does not include meals of shellfish, like lobster, shrimp, or clams.
2. For each meal, write down the date and the kind of fish you ate. Some kinds of fish might be: tunafish, trout, or perch. Sometimes you might not know what kind of fish it is, like in fish sticks or fish sandwiches from Burger King, so you can write "fish sticks" or "fish from Burger King."
3. Answer all the questions about the fish meal by circling your answer. Look at the picture on the other page to see if you ate more, less, or the same amount of fish as is in the picture. If the fish was caught on a fishing trip, circle "FISHING TRIP" and write down the name of the lake or stream where the fish was caught.
4. Circle your answers to the questions about how the fish was prepared and cooked.
5. In the example below, the diary keeper ate fish sticks for dinner on July 9. Her meal size was smaller than the meal in the picture. The fish sticks came from the grocery store. The fish sticks were baked in the oven and there was no skin on the fish when it was cooked.

Date: <u>July 9</u>		Kind of Fish Eaten (Species): <u>Fish Sticks</u>	
Did you eat (circle one): <u>LESS</u> SAME MORE fish than in the picture?	Where did the fish come from: <u>GROCERY STORE</u> RESTAURANT FISHING TRIP → What lake or stream? _____		
Was the fish cooked with the skin on? YES <u>NO</u> DON'T KNOW	How was the fish cooked? PAN FRIED DEEP FRIED <u>GRILLED, BROILED, OR BAKED</u> CAME IN A CAN SOME OTHER WAY DON'T KNOW		



About 1/2 Pound Fish Steak



About 1/2 Pound Fish Fillet

[NOTE: Multiple pages included in survey booklet to provide space for 48 fish meals]

FISH MEALS

Date: _____		Kind of Fish Eaten (Species): _____			
Did you eat (<i>circle one</i>): LESS SAME MORE fish than in the picture?	Where did the fish come from:				
	GROCERY STORE	RESTAURANT	FISHING TRIP → What lake or stream? _____		
Was the fish cooked with the skin on? YES NO DON'T KNOW	How was the fish cooked?				
	PAN FRIED	DEEP FRIED	GRILLED, BROILED, OR BAKED	CAME IN A CAN	SOME OTHER WAY	DON'T KNOW

Date: _____		Kind of Fish Eaten (Species): _____			
Did you eat (<i>circle one</i>): LESS SAME MORE fish than in the picture?	Where did the fish come from:				
	GROCERY STORE	RESTAURANT	FISHING TRIP → What lake or stream? _____		
Was the fish cooked with the skin on? YES NO DON'T KNOW	How was the fish cooked?				
	PAN FRIED	DEEP FRIED	GRILLED, BROILED, OR BAKED	CAME IN A CAN	SOME OTHER WAY	DON'T KNOW

Date: _____		Kind of Fish Eaten (Species): _____			
Did you eat (<i>circle one</i>): LESS SAME MORE fish than in the picture?	Where did the fish come from:				
	GROCERY STORE	RESTAURANT	FISHING TRIP → What lake or stream? _____		
Was the fish cooked with the skin on? YES NO DON'T KNOW	How was the fish cooked?				
	PAN FRIED	DEEP FRIED	GRILLED, BROILED, OR BAKED	CAME IN A CAN	SOME OTHER WAY	DON'T KNOW

Diary

T.L. Brown and N.A. Connelly. 1991-1993. *Estimating the sportfishing participation and consumption of Lake Ontario fish*. Cornell University, Ithaca, New York.

1992
FISHING TRIPS
AND
FISH CONSUMPTION



Human Dimensions Research Unit
Department of Natural Resources
New York State College of Agriculture and Life Sciences
A Statutory College of the State University
Cornell University, Ithaca, N. Y.



Dear Angler:

Thank you for volunteering to keep this diary of your fishing trips and fish consumption in 1992. The diary is divided into 3 sections for:

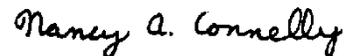
- 1) any fishing trips you take to Lake Ontario and its tributaries up to the first barrier impassable to fish,
- 2) any fishing trips you take to other New York State waters, and
- 3) any type of fish that you eat from any source.

Directions for filling out each section are given at the beginning of each section. If you have any questions don't hesitate to write us a note or give us a call (call collect if you wish); our address and telephone numbers are listed below. Remember we will be contacting you by telephone several times during the year to collect information you have recorded in the diary and at the end of the year we will send you an envelope so that you can return the diary to us.

Thanks again and get started right away recording your activities. (Don't forget to write in fish meals you may have eaten between Jan. 1 and now.)



Tommy V. Brown
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(607) 255-7695



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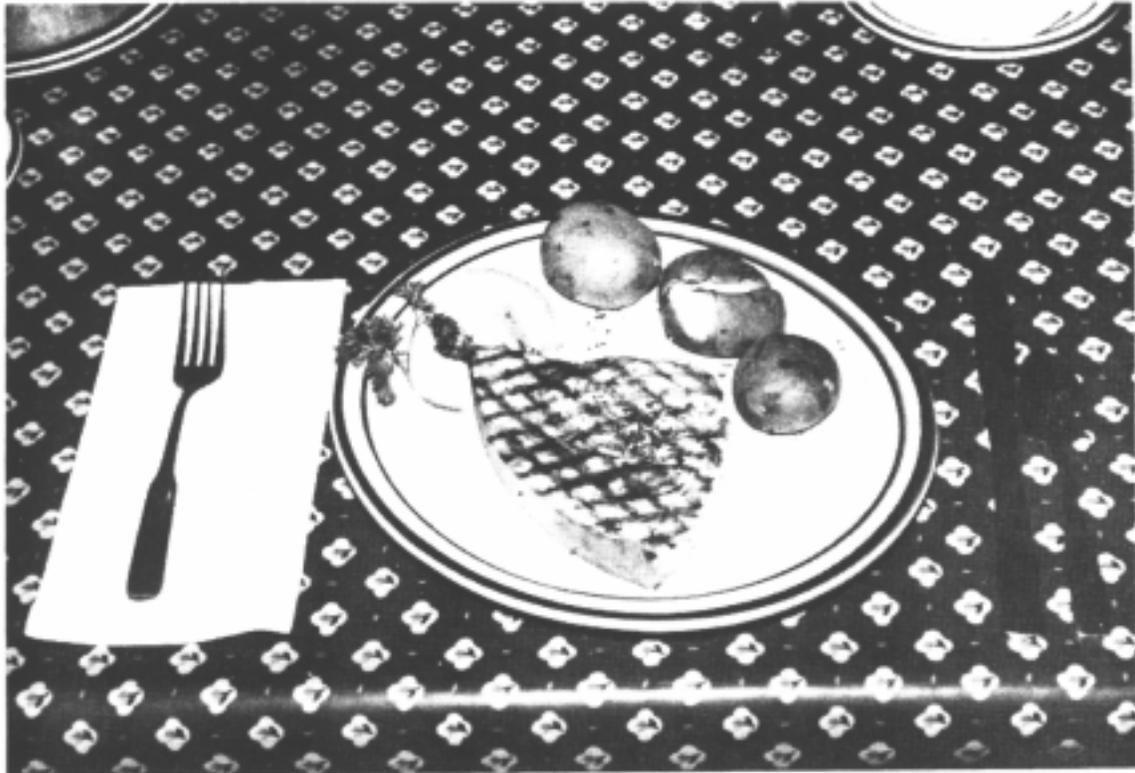
Printed on recycled paper

FISHING TRIPS TO LAKE ONTARIO OR ITS TRIBUTARIES

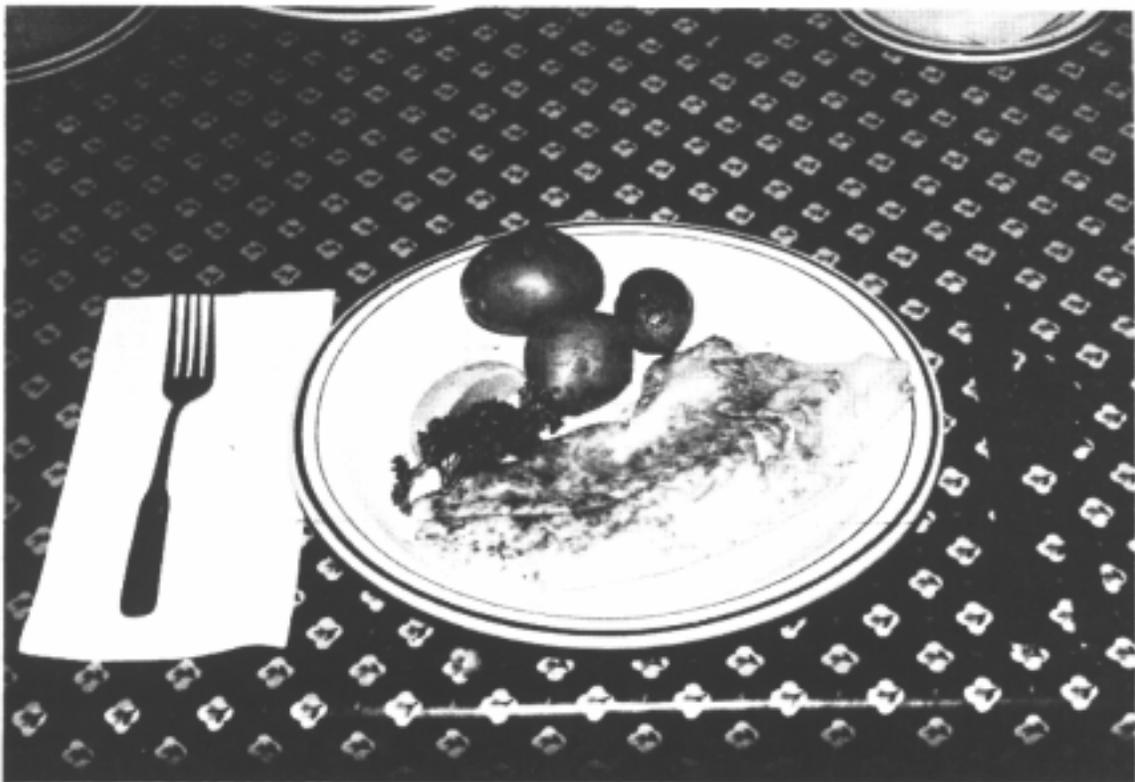
1. Trips that should be recorded in this section include trips to Lake Ontario or any of its tributaries up to the first barrier impassable to fish (e.g., dams or high waterfalls). Some major tributaries are the Salmon River, the Black River, and the Lower Niagara River.
2. Fill out a separate entry for each day that you fish.
3. Record information on your share of the expenditures for that day. Likely expenditures might include bait, tackle, food, lodging, gas and oil, boat rental, charter fees, etc. Divide your share of expenditures into those made en-route to the fishing site and those made at the fishing location.
4. Record each fish that you personally caught. Do not record information about fish caught by other members of your party. Record the species and approximate length of the fish caught, then mark the box that best describes what you did with the fish. "Kept, eaten" refers to fish you caught that were eaten either by you or members of your household. A fish that was kept but not eaten might have been mounted, used for fertilizer or otherwise disposed of on land. Released fish were put back into the water. Fish "given away" includes any fish you gave to another person not in your household, no matter what they did with it. If you caught more than 10 fish in one day, continue recording the day's catch on the next entry.
5. See the example entry below if you have any further questions.

Example:

Date: <u>1/15/92</u>		Water Body: <u>Salmon River</u>		County: <u>Oswego</u>	
En-route Expenditures: \$ <u>10</u>			At-site Expenditures: \$ <u>30</u>		
Species Caught	Length In Inches	Dispensation (check one)			
		Kept, Eaten	Kept, Not Eaten	Released	Given Away
<u>Coho Salmon</u>	<u>25</u>	<input checked="" type="checkbox"/>			
<u>Steelhead</u>	<u>10</u>			<input checked="" type="checkbox"/>	



About 1/2 Pound Fish Steak



About 1/2 Pound Fish Fillet

FISH CONSUMPTION

1. Fish meals include meals of sport-caught fish (regardless of who caught the fish), fish bought in restaurants or stores, fish eaten at friend's houses or at work. It does not include meals of shellfish, such as lobster, shrimp, scallops, or clams.
2. Record information for every fish meal that you eat. Do not record information for fish meals that other members of your household ate, but that you did not eat. (For example, do not record Sally's school lunch of fish sticks.)
3. Record each meal on a separate line. If you don't know the answer to one of the questions asked, write "DK" in the answer space.
4. Record the species of fish eaten and the approximate size of the meal you ate. Refer to the portion sizes (about 1/2 pound) pictured on the opposite page. Was your portion size less, more, or about the same as the portions shown?
5. Record if the fish was sport-caught or if it came from another source, such as canned, frozen from the store, or from a restaurant.
6. Indicate how many other household members ate the meal with you. Their portion size is not important. It may have been more or less than yours.
7. Record if the skin was removed from the fish before cooking, if the fat was trimmed before cooking, and how the meal was cooked.
8. See the example entries below if you have any further questions.

Examples:

Date	Species Eaten	Your Meal Size			Method		Number of Other Household Members Eating Fish Meal	Preparation				Cooking Method					
		Less	Same	More	Sport-caught	Other		Skin On?		Fat Trimmed?		Pan Fried	Deep Fried	Boil	Grill or Broil	Bake	
								Yes	No	Yes	No						
1/10	Haddock		X			X	3		X	DK							X
1/12	Rainbow Trout			X	X		1	X		X		X					
1/15	DK		X			X	0		X	DK		X					

Personal Interview

CRITFC. 1994. *A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin*. Technical Report 94-3. Columbia River Inter-Tribal Fish Commission, Portland, OR.

QUESTIONNAIRE NUMBER _____

1991 Columbia River InterTribal Fish Commission Survey of Fish Consumption and Related Issues



INTERVIEWER VISIT	1 Month Day	2 Month Day	3 Month Day	4 Month Day
DATE	--/--	--/--	--/--	--/--
TIME	--:--	--:--	--:--	--:--
RESULT*	_____	_____	_____	_____
NUMBER OF INTERVIEWER	_____	_____	_____	_____
NUMBER OF SUPERVISOR	_____	_____	_____	_____

* RESULT CODES:

- 1 Completed interview at home
- 2 Completed interview at central location
- 3 Not at home at time of visit; re-visit necessary
- 4 Missed appointment at central location; need to reschedule
- 5 Moved within survey area
- 6 Moved out of survey area

- 7 Temporarily not at home; re-visit necessary
- 8 Permanently absent, Deceased
- 9 Total refusal
- 10 Refusal during the interview by the respondent or other family member
- 11 Respondent mentally or physically disabled
- 12 Other (Specify) _____ Entry code: _____

NAME: _____ PHONE: (____) - ____ - ____

ADDRESS: _____

SOCIAL SECURITY NUMBER: _____

1991 Columbia River InterTribal Fish Commission Survey
of Fish Consumption and Related Issues

INTRODUCTION

Hi! My name is xxxxxxxxxxxxxx and I represent the (name of tribe of person being interviewed). We are conducting a survey to understand fish eating patterns as well as other dietary patterns and health-related behaviors of Native Americans in the Northwest. The information given in this survey will assist the (name of tribe) in documenting actual rates of dietary fish consumption, ways in which fish meals are cooked and prepared, the types of fish species regularly consumed, and locations where fish are caught or obtained.

B-58

II General Background

NOTE TIME INTERVIEW BEGINS: ___:___ AM/PM

II-1 What was the month and year of your birth?

MONTH _____ YEAR _____

(INTERVIEWER: CALCULATE AND REMEMBER AGE FOR LATER USE)

II-2 So you are now _____ years old?

II-3 Are you an enrolled member of the [name of tribe]?

Yes 1
No 2

*** IF NO, TERMINATE INTERVIEW ***

II-4 SEX OF RESPONDENT

MALE 1
FEMALE 2

II-5 Do you live on the [name of tribe] reservation or off-reservation?

ON THE RESERVATION 1
OFF-RESERVATION 2

III: Fish Consumption and Dietary Information

III-1 I am now going to ask you to remember all of the food and drinks that you ate yesterday, from the time you woke up in the morning until the time you went to sleep for the night. In addition to asking you about the type of food, I'll show you some examples of serving sizes in order to determine the amount you actually ate.

[See 24 hour recall dietary intake form]

DIETARY INTAKE - 24 HOUR RECALL

- | | | |
|-------------------|---|--|
| Intake Day | Interviewer's Opinion of Information | Intake Was |
| Sunday 1 | Reliable 1 | Typical 1 |
| Monday 2 | Unable to recall one or more meals 2 | Considerably less than typical 2 |
| Tuesday 3 | Unreliable for other reasons 3 | Considerably more than typical 3 |
| Wednesday 4 | | |
| Thursday 5 | | |
| Friday 6 | | |
| Saturday 7 | | |

Where Prepared
 1 = Home
 2 = Restaurant

Line No.	Time Eaten		Food and Beverages	Amount (ozs.)	Complete Description
	A = AM	P = PM			
	Hour	Min			
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

COMMENTS (Give line no. when appropriate):

DIETARY INTAKE, CONTINUATION PAGE

Line No.	Where Prepared 1 = Home 2 = Restaurant		Time Eaten A = AM P = PM		Food and Beverages	Amount (ozs.)	Complete Description
	Hour	Min	A	P			
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							

COMMENTS (Give line no. when appropriate):

III-2 During which two months of the year would you say you eat the most fish?

January	.....	1	September	.....	9
February	.....	2	October	.....	10
March	.....	3	November	.....	11
April	.....	4	December	.....	12
May	.....	5	All months the same	.....	66
June	.....	6	Never/rarely eat fish [Skip to Q. IV-2]	.....	77
July	.....	7	Unknown	.....	88
August	.....	8			

III-3 During the months you indicated you eat the most fish, about how many meals of fish do you eat on a weekly basis?
(Remember to include fish consumed for breakfast, lunch, dinner, and snacks).

Avg. # of fish meals weekly: _____ (two highest months)

III-4 During which two months would you say you usually eat the least fish?

January	.....	1	September	.....	9
February	.....	2	October	.....	10
March	.....	3	November	.....	11
April	.....	4	December	.....	12
May	.....	5	All months the same	.....	66
June	.....	6	Never/rarely eat fish [Skip to Q. IV-1]	.....	77
July	.....	7	Unknown	.....	88
August	.....	8	All months except 2 marked		
			In question III-2 are equally low	.....	99

III-5 During the months you indicated you eat the least fish, about how many meals of fish do you eat on a weekly basis?

Avg. # of fish meals weekly: _____ (two lowest months)

III-6 On average, throughout the year, about how many fish meals weekly do you eat?
average # of fish meals weekly: _____ (throughout year)

III-7 What is the average portion size of fish you eat in a meal that includes fish?
[SHOW THE RESPONDENT FOOD MODELS, AND ENTER THE AVERAGE SERVING SIZE IN OUNCES]

Average serving size (ounces): _____

III-8 IF RESPONDENT IS YOUNGER THAN 30 YEARS OF AGE, SKIP TO QUESTION III-9
a) Has the number (amount) of fish consumed by you or your family changed over the last 20 years?

Yes . . . 1 No . . . 2 *** IF NO, GO TO QUESTION III-9 ***

- If yes, what has the change been?
 - eat more fish now 1
 - eat less fish now 2
 - eat different types of fish now 3

Why? _____

b) Can you estimate how many more fish meals weekly, or how many less fish meals weekly, you or your family eat now as compared to the time before your fish consumption changed?
now eat _____ fish meals more per week than before
now eat _____ fish meals less per week than before

III-9 I am now going to ask you some questions on specific types of fish that can be obtained from the Columbia River Basin. For each type of fish I mention, I am going to ask you several questions concerning how often you eat it and which parts of the fish are usually eaten. [See TABLE 1]

TABLE 1. Types of Fish and Parts Consumed (Respondent)

Type of Fish (circle Yes if commonly eaten)	Average number of meals per month	Parts Usually Consumed For Each Species (Circle answer)						
		Fillet	Skin	Head	Eggs	Bones	Other Organs	
Salmon and Steelhead Yes... 1 No... 2 (If YES, go to next columns)	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Lamprey (Eel)	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Resident Trout	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Smelt	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Whitefish	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Sturgeon	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Walleye	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1

(CONTINUED) Type of Fish	Average number of meals per month	Parts Usually Consumed For Each Species (Circle answer)						
		Fillet	Skin	Head	Eggs	Bones	Other Organs	
Squawfish	_____	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Yes... 1 No... 2		No.. 2	No.. 2	No.. 2	No.. 2	No.. 2	No.. 2	No.. 2
Sucker	_____	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Yes... 1 No... 2		No.. 2	No.. 2	No.. 2	No.. 2	No.. 2	No.. 2	No.. 2
Shad	_____	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Yes... 1 No... 2		No.. 2	No.. 2	No.. 2	No.. 2	No.. 2	No.. 2	No.. 2
OTHERS (list)								
1. _____	_____	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
		No.. 2	No.. 2	No.. 2	No.. 2	No.. 2	No.. 2	No.. 2
2. _____	_____	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
		No.. 2	No.. 2	No.. 2	No.. 2	No.. 2	No.. 2	No.. 2
3. _____	_____	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
		No.. 2	No.. 2	No.. 2	No.. 2	No.. 2	No.. 2	No.. 2

IV. Food Preparation Questions

IV-1 Please tell me about how fish is usually (throughout the year) prepared or cooked in your home (more than 1 selection from the following may be given). Please also indicate how often fish is prepared/cooked in that particular manner.

Table 2

Is the fish ever...	HOW OFTEN?		
	Once a week or more	Less than once a week, but more than or equal to once a month	Less than once a month
a. pan-fried? Yes ... 1 -----> No ... 2 go to b.	1	2	3
b. deep fried? Yes ... 1 -----> No ... 2 go to c.	1	2	3
c. poached in water? Yes ... 1 -----> No ... 2 go to d.	1	2	3
d. boiled as soup or stew? Yes ... 1 -----> No ... 2 go to e.	1	2	3
e. baked? Yes ... 1 -----> No ... 2 go to f.	1	2	3
f. broiled? Yes ... 1 -----> No ... 2 go to g.	1	2	3
g. smoked? Yes ... 1 -----> No ... 2 go to h.	1	2	3
h. dried or dried into a powder? Yes ... 1 -----> No ... 2 go to i.	1	2	3
i. eaten raw? Yes ... 1 -----> No ... 2 go to l.	1	2	3
l. roasted over an open fire or barbecued? Yes ... 1 -----> No ... 2 go to k.	1	2	3
k. canned? Yes ... 1 -----> No ... 2 go to l.	1	2	3

IV-2 Do you regularly prepare the meals in your household?
Yes . . . 1 No . . . 2

IV-3 Are there any children 5 years or younger living in this household?
Yes . . . 1 No . . . 2

IF NO, GO TO QUESTION IV-9

IV-4 Please provide the following information for the youngest person in your household who is 5 years of age or less:

First Name _____

Sex Male 1
 Female 2

Weight -- pounds

Height _ feet, _ inches

IV-5 Throughout the year, what is the average portion size of fish this child eats in a meal that includes fish?
[SHOW THE RESPONDENT FOOD MODELS, AND ENTER THE AVERAGE SERVING SIZE IN OUNCES]

Average serving size (ounces): -- ounces 77 = Eats no fish

IV-6 A few minutes ago you described which types of fish you eat and which parts are normally consumed. This information was put into Table 1 (SHOW TABLE). For the child listed in question 4, please provide the same information on the separate Table 3 (DURING THE INTERVIEW, THE INTERVIEWER SHOULD SHOW THE PREVIOUSLY COMPLETED TABLE 1 AND ASK THE RESPONDENT TO CONCENTRATE ON THE DIFFERENCES BETWEEN WHAT THEY EAT AND WHAT THE CHILD EATS.)

TABLE 3. FOR CHILD UNDER FIVE: Types of Fish and Parts Consumed

Type of Fish (circle Yes if commonly eaten)	Average number of meals per month	Parts Usually Consumed For Each Species (Circle answer)							
		Fillet	Skin	Head	Eggs	Bones	Other Organs		
Salmon and Steelhead Yes... 1 No... 2 (If YES, go to next columns)	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Lamprey (Eel) Yes... 1 No... 2	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Resident Trout Yes... 1 No... 2	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Smelt Yes... 1 No... 2	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Whitefish Yes... 1 No... 2	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Sturgeon Yes... 1 No... 2	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Walleye Yes... 1 No... 2	—	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1

(CONTINUED) Type of Fish	Average number of meals per month	Parts Usually Consumed For Each Species (Circle answer)						
		Fillet	Skin	Head	Eggs	Bones	Other Organs	
Squawfish	_____	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Yes... 1 No... 2		No... 2	No... 2	No... 2	No... 2	No... 2	No... 2	No... 2
Sucker	_____	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Yes... 1 No... 2		No... 2	No... 2	No... 2	No... 2	No... 2	No... 2	No... 2
Shad	_____	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
Yes... 1 No... 2		No... 2	No... 2	No... 2	No... 2	No... 2	No... 2	No... 2
OTHERS (list)								
1. _____	_____	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
		No... 2	No... 2	No... 2	No... 2	No... 2	No... 2	No... 2
2. _____	_____	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
		No... 2	No... 2	No... 2	No... 2	No... 2	No... 2	No... 2
3. _____	_____	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1	Yes.. 1
		No... 2	No... 2	No... 2	No... 2	No... 2	No... 2	No... 2

IV-7 On average, throughout the entire year, about how many fish meals weekly does the child eat?
Average number of fish meals weekly _____

IV-8 At what age (in months) did the child begin eating meals that include fish?

__ months

7 7 = not yet

8 8 = unknown

IV-9 IF RESPONDENT IS MALE, SKIP TO NEXT SECTION

The next few questions are being asked to get better information on the diet of very young children.

Have you ever given birth? Yes . . . 1 No . . . 2

IF NO, SKIP TO NEXT SECTION

IV-10 In what month and year was your last child born? __ month 19 __ year

IV-11 Was this baby breast fed? Yes . . . 1 No . . . 2

IF NO, SKIP TO NEXT SECTION

IV-12 At what age (in months) did you stop breast feeding this child?

__ months ----> **SKIP TO NEXT SECTION**

7 7 = still breast feeding ----> **CONTINUE TO QUESTION IV-13**

IV-13 At what age (in months) do you plan to stop breast feeding your child? __ months

V. Origin of Fish Consumed by Respondent

V-1 Do you catch fish for either personal consumption or for use by your Tribe in some way?
Yes . . . 1 No . . . 2

IF NO, SKIP TO QUESTION V-4

V-2 Please indicate on this map (show map) where you usually catch the following fish species.

REFER TO MAP TO HIGHLIGHT (numbered) POINTS ON THE RIVER

(list numbers of sites) 0 = Doesn't catch this type of fish

- Salmon & Steelhead _____
- Lamprey (eel) _____
- Resident Trout _____
- Smelt _____
- Whitefish _____
- Sturgeon _____
- Walleye _____
- Squawfish _____
- Sucker _____
- Shad _____

V-3 About how far from home do you usually travel to fish?

- 0-5 miles 1
- 6-10 miles 2
- 11-15 miles 3
- 16-20 miles 4
- 21-25 miles 5
- 26-50 miles 6
- 51-75 miles 7
- 76-100 miles 8
- more than 100 miles 9

V-4 Of all the fish you eat, approximately what percent do you get from: (INTERVIEWER: READ OPTIONS)

- Fish caught by yourself or family members _____
- Grocery stores _____
- Other sources:
 - Friends who fish _____
 - Ceremonies _____
 - Distribution by the tribe _____
 - Other (list) _____

Creel Survey

San Diego County Department of Health Services. 1990. *San Diego Bay Health Risk Study: An evaluation of the potential risk to human health from fish caught and consumed in San Diego Bay*. Prepared for The Port of San Diego, San Diego, CA.

ANGLER SURVEY QUESTIONNAIRE

Time _____
Date _____
Day M T W Th F Sa Su
Site Glorietta Bay Coronado Ferry Landing Shelter Is.
Harbor Is. Spanish Landing Embarcadero Park Sweetwater Port Dist
Chula Vista Bayside Park G Street Pier
Location Center East West North South End Front
Mode Pier Shore Boat Other
Interview? Y N Language barrier
Planning District 1 2 3 4 5 6 7 8 9
Previous Interview? Y N
May I ask your ethnicity? Caucasian Negro Filipino Vietnamese
Am. Indian Hispanic Chinese _____
May I ask you age? _____
Sex M F
What country were you born in? US Philippines Vietnam China
Mexico
What city do you live in? San Diego National City Chula Vista
Coronado Spring Valley Imperial Bch.
La Mesa Lemon Grove El Cajon _____
Zip Code _____
Are currently employed? Y N
What is your occupation? _____
How many years did you go to school? 8 9 10 11 12 13 14 15 16 17+
To the nearest half hour, what time did you arrive? _____
How many people did you come here with today? _____
How many are fishing? _____
May I measure your fish? Y N Nothing caught Not available
What will you do with these fish? Eat Throw back Use for bait
Give away Undecided
How many adults will eat these fish? _____

ANGLER SURVEY QUESTIONNAIRE

How many children less than 1 yr. old will eat these fish? ___
How many children between the ages 1 & 5 will eat these fish? ___
How many children between the ages 5 & 10 will eat these fish? ___
How many pregnant/lactating women will eat these fish? ___
Is this your 1st or 2nd time fishing here? 3rd 4th N
How many times a month do you fish here? ___
How many times a year do you fish here? ___

Do you remember the last time you fished here?
How many days ago was that? ___
To the nearest half hour, how many hours did you fish then? _____

Do you remember the last time you fished here, caught something,
and ate it?
How many days ago was that? _____ Do not eat fish
What kind of fish was it? _____

Do you fish year-round? Y N
Were you fishing for any particular kind of fish today? Y N

What kind of fish do you generally fish for? _____ none

Have you ever bought fish at the market? Y N
How many times a month do you buy fish? ___
Is there a particular kind of fish that you buy? Y N _____

Creel Survey

Fishery Information Management Systems, Inc., and Department of Fisheries and Allied Aquacultures, Auburn University. 1994. *Estimation of daily per capita freshwater fish consumption of Alabama anglers*. Prepared for Alabama Department of Environmental Management, Montgomery, Alabama.

**Alabama State-Wide Freshwater
Fish Consumption Survey (Interview Schedule)**

I am conducting a fresh water fish consumption survey in the State of Alabama. May I take a few minutes of your time to ask some questions about your fishing trip and measure the fish that you have kept?

Date and Location

Month ___ Day ___ Year _____ System _____ Interview # ___ Time: _____

Fish Consumption Related Questions

1. Have you kept any fish that you have caught today?

(Circle response)

Yes

No

2A. Do you eat fish that you catch from this location?

(Circle response)

Yes

No : then

IF NO TO #1

2B. why? _____ (Code: _____),

&

YES TO #2

2C. and what do you do with them?
_____ (Code: _____)

GO TO QUESTION NUMBER

5A.

5B.

3A. Have you caught enough fish today for a family meal?

(Circle response)

Yes

No : then

3B. How many more fish like the ones you've caught do you need to make a meal?

_____ (enter a number of additional fish needed) .

3C. Will you freeze these fish until you have caught enough to make a meal?

Yes No
GO TO QUESTION NUMBER 3E

3D. Will you eat these fish today?

(Circle response)

Yes

No

3E. When do you think that you will eat these fish?

_____ (Code: _____)
GO TO NEXT QUESTION

4A. How many other people will eat these fish with you?

_____ (enter number of people that will consume these fish)

4B. How will these fish be cooked? _____ (Code: _____)

5A. How many meals have you eaten over the past month with fish you've caught here? _____

5B. How many meals have you eaten over the past month with fish you've caught in other lakes or rivers in Alabama? _____

5C. How many meals have you eaten over the past month with fish you've caught in farm ponds in Alabama? _____

These next few questions are about the way you prepare and cook your fish and how important they are to you.

6A. Do you clean your own fish? (Circle response)

Yes

No

6B. Who does? _____ (Code: ____)

7. A serving of fish consists of approximately 4 ounces. This would be about the size of the palm of your hand. How many servings of fish do you usually eat per meal? _____

Short Form Ends Here (with species information)

8. How important to your family meals are the fish that you catch here or in other Alabama lakes and rivers? Are they:

(1)not important (2)somewhat important (3)important (4)very important ?

9. Are the fish you catch here or in other Alabama Lakes and Rivers important in reducing your family food expenses? Are they:

(1)not important (2)somewhat important (3)important (4)very important ?

10. What will you eat today for your next family meal (main course) if you don't eat fish caught here?

_____ (Code: ____)

11. Have you ever heard of a health advisory warning against consuming fish caught here? Yes _____ No _____

12. Do you know of any place in Alabama where a health advisory warning against consuming fish has been issued? Yes _____ No _____

If yes, where _____

(Code: ____)

13. Would you eat fish from this location if there was a health advisory warning against consuming fish caught here? Yes _____ No _____

14. Who do you feel should be responsible for the protection of Alabama's water resources? _____

(Code: ____)

There are many hazards or risks in our daily lives. These next few questions will help us determine the angling public's views concerning the risks associated with the fish that you catch and eat for your family meals.

Out of all your daily activities, what is most dangerous to you? _____
(Code: _____)

Please respond to the following statements, on a scale of 1 to 5, 1 meaning that you strongly disagree, 3 meaning undecided and 5 meaning that you strongly agree.

- | | | | | | |
|--|----|---|---|---|----|
| 15. Public agencies have exaggerated the risk of eating fish caught in Alabama lakes & rivers. | SD | D | U | A | SA |
| | 1 | 2 | 3 | 4 | 5 |
| 16. Adequate information is available about the safety of eating fish from Alabama lakes & rivers. | 1 | 2 | 3 | 4 | 5 |
| 17. People need to worry about chemicals in the fish they eat from Alabama lakes and rivers. | 1 | 2 | 3 | 4 | 5 |
| 18. Larger fish are more hazardous to eat than small ones. | 1 | 2 | 3 | 4 | 5 |
| 19. Bottom-feeding fish like Catfish and Bullheads are more hazardous to eat than other fish like Crappie & Bream. | 1 | 2 | 3 | 4 | 5 |
| 20. Most of Alabama's Lakes and Rivers are free of pollution. | 1 | 2 | 3 | 4 | 5 |
| 21. State agencies need to take a more aggressive approach to protect Alabama's lakes and rivers. | 1 | 2 | 3 | 4 | 5 |

Demographics

22. What time did you begin fishing today _____?

23. How many other people are fishing with you today?
_____ (enter the total number of anglers in party, including yourself)

24. RACE: (enter number of anglers in party that are in each race)
 ____ (B) Afro-American ____ (H) Hispanic-American
 ____ (A) Asian-American ____ (N) Native-American
 ____ (C) Euro-American

25. Ages and Body weight of Anglers: (enter number of anglers in party that are within each age category)
 Ages
 ____ < 20 ____ 20-29 ____ 30-39 ____ 40-49 ____ 50-59 ____ ≥ 60

Do you mind if I ask you how much you and your fishing companions weigh? (circle the anglers gender)

____ M F ____ M F
 ____ M F ____ M F ____ M F ____ M F ____ M F ____ M F

26. What State _____, County _____, and Town _____ do you live in?

27. How much money did you spend on today's fishing trip on:

Gas: \$ _____ Food & Drinks: \$ _____ Bait: \$ _____

28. Would you please tell me which one of these categories your yearly family income falls in. _____

Creel Survey

B. Barclay. 1993. *Hudson River angler survey: A report on the adherence to fish consumption health advisories among Hudson River anglers*. Hudson River Sloop Clearwater, Inc., Poughkeepsie, New York.

QUESTIONNAIRE - HUDSON RIVER ANGLER SURVEY

Interviewer: _____

Date: _____/_____/_____ Day of week: _____
 mo. day yr.

Time Started: _____ Time Ended: _____

Site: _____

Sex of person being interviewed: M F

1) I am taking a survey of fishing activity along the Hudson River and New York Harbor, sponsored by the Clearwater Foundation. Could I ask you some questions?

- Yes
- No - (THANK PERSON AND TERMINATE INTERVIEW)

2) Have you already been interviewed by Clearwater about recreational fishing?

- Yes (END INTERVIEW)
- No

3) What types of fish are you trying to catch here today?

4) What fishing or crabbing equipment are you using today?
(READ ALL CHOICES)

- hook and line
- trap
- net
- other; _____

5) Have you caught anything here today, and if so, what?

Type of fish Number caught

- 6) How many times have you fished or crabbed on the Hudson River in the last seven days (that is from _____ until today)?
- 7) How many times have you fished or crabbed on the Hudson River in the last month (that is from _____ until today)?
- 8) What is the main reason you fish or crab?
- 9) What other reasons do you fish or crab?
(RECORD IN ORDER GIVEN)

- 10) We would like to know what you do with the fish or crabs that you catch. Do you do any of the following with your catch often, sometimes, rarely or never?

(READ FROM LIST BELOW, CHECK EACH APPLICABLE ANSWER)

	<u>Often</u>	<u>Sometimes</u>	<u>Rarely</u>	<u>Never</u>
Eat;				
Toss back;				
Use for fertilizer;				
Use for bait;				
Throw in trash;				
Give away;				

If you ever give them away, what do the people you give them to do with them?

Eat; _____
 Fertilizer; _____
 Bait; _____
 Other; _____ (what)
 Don't know; _____

Sell; Often Sometimes Rarely Never

If you ever do sell them, what do the people you sell them to do with them?

Eat; _____
 Fertilize _____
 Bait; _____
 Other; _____ (what)
 Don't know; _____

Anything else; _____ (what)

- 11) What do you think most people here do with their catch?
 (RECORD IN ORDER GIVEN)

(IF RESPONDENT DOES NOT EAT CATCH, CONTINUE. IF THEY DO EAT CATCH, SKIP TO QUESTION 17)

- 12) Have you ever eaten fish or crabs from here in the past?

yes _____ (SKIP TO QUESTION 14)
 no _____

- 13) Why don't you eat your catch?

(SKIP TO QUESTION 21)

14) What kind of fish or crab did you eat?
(RECORD ALL ANSWERS GIVEN)

15) How often during the fishing season did you used to eat these fish or crabs? (READ ALL CHOICES)

- 4 or more times a week _____
- 2 or 3 times a week _____
- once a week _____
- 2 to 3 times a month _____
- once a month _____
- less than once a month _____

16) Why did you stop eating them?

(SKIP TO QUESTION 21)

(RESUME QUESTIONS HERE IF RESPONDENT DOES EAT THEIR CATCH)

17) How many times in the last week (that is from _____ until today) did you eat fish or crab from the Hudson River?

_____ No. of meals (EMPHASIZE NO. OF MEALS, NOT FISH)

18) How many times in the last month (that is from _____ until today) did you eat fish or crabs from the Hudson River?

_____ No. of meals (EMPHASIZE # OF MEALS, NOT FISH)

19) Who besides yourself eats the fish or crabs you catch from this area? (FOR EACH PERSON LISTED, RECORD THE FOLLOWING)

- Relation to respondent,
- Age,
- What kind of fish or crab they eat?
- Whether they eat more, the same, or less fish or crab than respondent.

Relation Age type of fish/crab amount (more, same, less)

20) I am going to read you a series of cleaning and cooking methods for fish and crabs. Could you please respond if you Always, Sometimes or Never use each of these methods:
(READ EACH, RECORD APPROPRIATE RESPONSE)

<u>Method</u>	<u>Always</u>	<u>Sometimes</u>	<u>Never</u>
Eat whole fish or crab			
Puncture or remove skin			
Fillet the fish			
Trim off belly meat			
Trim off the strip of fat along the back of fish			
Pan fry or deep fry			
Make soup or chowder			
Bake, barbecue or poach			
Reuse oil or fat from cooking			

(RESUME QUESTIONING HERE WITH ALL RESPONDENTS)

21) Are there any fish or crab that people catch here, that are not safe to eat?

yes _____

no _____ (SKIP TO QUESTION 27)

no opinion/don't know _____ (SKIP TO QUESTION 27)

22) What fish or crabs that people catch here are not safe to eat?

23) Is it the whole fish or crab that is not safe to eat, or just parts of them?

24) Why are they not safe to eat?

25) What would happen if you ate them?

26) If you ate these fish or crabs and had no reaction within a day or two, would that mean the fish or crab are safe to eat?

yes _____

no _____

don't know _____

27) How can you tell if the fish or crabs caught here, or their parts, are safe to eat?

28) Is there any way to make the fish or crab that are caught here safer to eat after they have been caught?

no _____
If yes, what are they;

29) For the fish or crab you catch here, would you say that eating them;
(READ ALL CHOICES)

poses no risk at all _____
poses a slight risk _____
poses a serious risk _____

30) Would you say the water here is: (READ ALL CHOICES)

not at all polluted _____
slightly polluted _____
quite polluted _____

31) (IF RESPONDENT BELIEVES WATER IS MORE POLLUTED THAN FISH) If the water is slightly/quite polluted, why does eating the fish pose no risk/a slight risk?

32) Please answer yes, no or don't know for each of the following questions;

yes no don't know

Do you think that the fish you catch here are contaminated?

Do you believe that eating fish caught at this site would pose a risk to your health?

Would you like more information about the potential risks from eating fish that are contaminated?

Would you like more information about how you can control the risks from eating contaminated fish?

33) Do you happen to know if there are any official health warnings about eating fish that are caught here?

yes _____
no _____ (SKIP TO QUESTION 40)
don't know _____ (SKIP TO QUESTION 40)

34) What warnings are you aware of?

35) How did you originally learn about them?

40) What age group are you in? (READ)

- | | | | |
|----------|-------|----------|-------|
| under 10 | _____ | 40 - 44 | _____ |
| 10 - 14 | _____ | 45 - 49 | _____ |
| 15 - 19 | _____ | 50 - 54 | _____ |
| 20 - 24 | _____ | 55 - 59 | _____ |
| 25 - 29 | _____ | 60 or up | _____ |
| 30 - 34 | _____ | | |
| 35 - 39 | _____ | | |

41) What is your race or ethnic background?

42) In what range is your total yearly household income, before taxes? (READ CHOICES)

- | | |
|---------------------|-------|
| less than \$10,000 | _____ |
| \$10,000 - \$29,999 | _____ |
| \$30,000 - \$49,999 | _____ |
| \$50,000 - \$69,999 | _____ |
| \$70,000 - \$89,999 | _____ |
| \$90,000 or over | _____ |

43) What is the number of people in your household?

Thank you very much for your time and cooperation.