A FISH CONSUMPTION SURVEY OF THE UMATILLA, NEZ PERCE, YAKAMA, AND WARM SPRINGS TRIBES OF THE COLUMBIA RIVER BASIN

Technical Report 94-3

October, 1994

Columbia River Inter-Tribal Fish Commission
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Columbia River Inter-Tribal Fish Commission (CRITFC)

CRITFC was created in 1977 by resolutions of the four Pacific Northwest Indian Tribes which participated in this survey: the Nez Perce Tribe; the Confederated Tribes of the Umatilla Indian Reservation in Oregon; the Confederated Tribes of the Warm Springs Indian Reservation in Oregon and; the Confederated Tribes and Bands of the Yakama Indian Nation in Washington (collectively referred to as CRITFC's member tribes).

CRITFC was formed to coordinate the management and protection of the tribes' treaty fishery resource and to implement the tribes' fishery policies and objectives in the Columbia Basin. The governing body of CRITFC, the Commission, consists of the Fish and Wildlife Committees of each tribe. These Commissioners establish CRITFC policy and direct staff. CRITFC staff consists primarily of biologists, attorneys and other professionals who provide legal and technical assistance to the tribes on issues relating to protection, enhancement and sustainable use of the fishery resources in the Columbia River Basin. CRITFC is accountable only to its member tribes and not to the states, the Bureau of Indian Affairs or any other entity.

This project was funded through a Cooperative Agreement between CRITFC and the Environmental Protection Agency's Office of Policy, Planning and Evaluation (USEPA, OPPE), Cooperative Agreement # CX818196-01.

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Proper citation for this report is:

CRITFC (Columbia River Inter-Tribal Fish Commission). 1994. A fish consumption survey of the Umatilla, Nez Perce, Yakama and Warm Springs Tribes of the Columbia River Basin. CRITFC Technical Report No. 94-3. Portland, Oregon.

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God created this Indian country... He put the Indians on it. They were created here in this country, truly and honestly, and that was the time this river started to run. Then God created fish in this river and put deer in these mountains and made laws through which has come the increase of fish and game... When we were created, we were given our ground to live on, and from that time these were our rights.

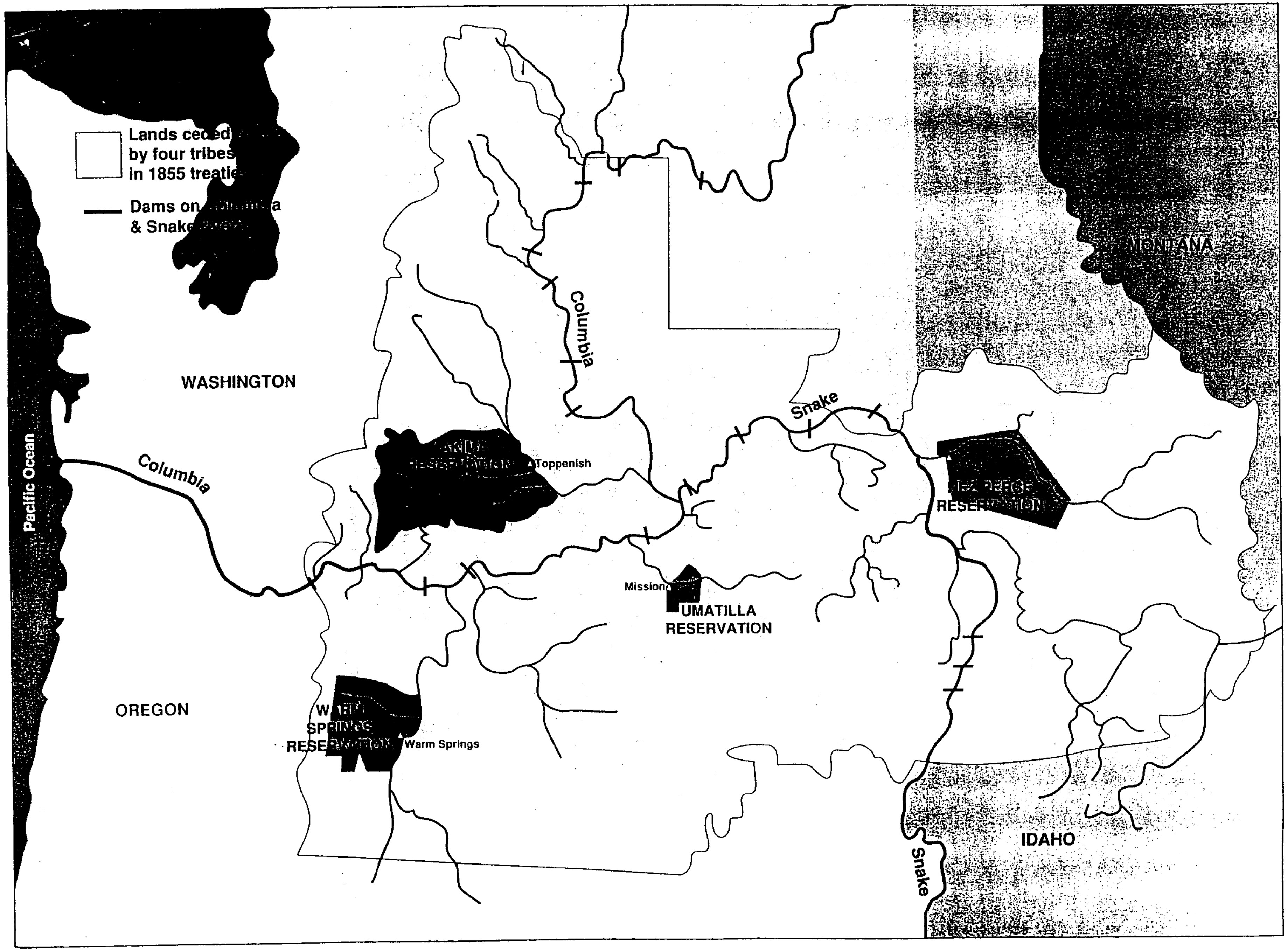
My strength is from the fish; my blood is from the fish, from the roots and berries. The fish and game are the essence of my life. I was not brought from a foreign country and did not come here. I was put here by the Creator.

Whenever the seasons open, I raise my heart in thanks to the Creator for his bounty that this food has come.

—Chief Meninock (Yakama Tribal Chief)

ABSTRACT

During the fall and winter of 1991-1992, a survey was conducted among Columbia River Basin Indian tribes to determine the level and nature of fish consumption among individual tribal members. The survey was initiated to test the hypotheses that Indians in that region consume more fish than non-Indians, that the national fish consumption rate of 6.5 grams per day (gpd) used by the United States Environmental Protection Agency (USEPA) to develop human health based water quality criteria might not be applicable to tribal members, and that a human health risk might exist among tribal members from exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin) and other waterborne toxic contaminants. We also wished to consider whether water quality standards based on the estimated national fish consumption rate and adopted for waters in the Columbia River Basin were appropriate with regard to the findings of the survey. The survey consisted of interviews made at four Columbia River Basin tribal reservations (Nez Perce, Warm Springs, Yakama and Umatilla) and was based on a stratified random sampling design. A total of 513 tribal members at least 18 years old were directly surveyed. These respondents also provided information for 204 children age 5 or younger. Information obtained included a breakdown of consumption by age group, season, species consumed, parts of the fish consumed, preparation methods, and changes in patterns of consumption over time and during ceremonies and festivals. Survey respondents aged 18 and older consumed an average of 58.7 gpd while children aged 5 and younger consumed an average of 19.6 gpd. These rates are respectively, approximately nine times and three times higher than the estimated national fish consumption rate and seriously call into question the applicability and adequacy of using a national fish consumption rate to protect tribal members' health. Both adults and children consumed salmon and resident trout more than any other fish species. The fish fillet and skin were, overall, the two most consumed fish parts but respondents also consumed the head, eggs, bones and organs of almost all fish species consumed. Although this consumption data signals a potential increased health risk to tribal members, consumption data alone does not tell us the extent to which tribal members are exposed to waterborne toxics. Consequently, as phase two of this project, information in this report will be combined with data on fish tissue contaminant levels in fish collected and consumed from Columbia River Basin tribal fisheries.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Warm Springs

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ACKNOWLEDGEMENTS

CRITFC would like to acknowledge all Technical Panel members for their invaluable assistance in producing this report. CRITFC is particularly grateful to the following people for dedicating their time and talents to this project: Harold Shepherd (formerly CRITFC); John Platt (CRITFC); Craig McCormack, Washington Department of Ecology (formerly U.S. EPA); Steve Helgerson, Health Care Finance Administration (formerly Indian Health Service); Gerald Filbin, U.S. EPA; Sarah Bermann, University of Pittsburgh Medical School (formerly Bruce Company); Danielle Dixon and Roxanne Bogart (formerly Bruce Company); Matthew Schwartzberg, CRITFC; Margaret McVey, ICF, Inc. and; Amin Abari, ICF, Inc.

CRITFC is especially grateful to the tribal governments and their staff for this survey could not have been completed without their devotion and commitment to this project. Finally, CRITFC wishes to thank all tribal members who contributed their time to participate in the survey.

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INTRODUCTION

In 1990, the Columbia River Inter-Tribal Fish Commission (CRITFC) entered into a Cooperative Agreement with the United States Environmental Protection Agency's Office of Policy, Planning and Evaluation (USEPA, OPPE) to formally conduct "A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama and Warm Springs Tribes of the Columbia River Basin," hereinafter referred to as the Columbia River Basin Fish Consumption Survey (CRBFCS). This survey is unique in that it is the only interview-based survey to date that examines fish consumption rates and patterns of Native Americans who reside in, catch and consume fish from the Columbia River Basin.

Survey Objective

The objective of the survey was to ascertain individual tribal members' consumption rates, patterns, habits and preparation methods of anadromous and resident fish species caught from the Columbia River Basin.

Background

Tribal interest in conducting such a survey of tribal members was in response to the United States Environmental Protection Agency's (USEPA) investigation of the human health risks from exposure to dioxin (tetrachlorodibenzo-p-dioxin or 2,3,7,8-TCDD) and other waterborne toxics through ingestion of contaminated fish. Because the four surveyed tribes fish for both ceremonial and subsistence purposes from the Columbia River Basin, they questioned the adequacy of USEPA's use of an estimated national per capita fish consumption rate of 6.5 grams per day (gpd) (USEPA, 1980) when developing human health based water quality criteria for toxics.

The Fishery Resource

The Umatilla, Nez Perce, Yakama and Warm Springs tribe (collectively referred to as CRITFC's member tribes) each possess fishing rights reserved by treaties signed in the 1850s with the United States government. Under the U.S. Constitution, these treaties are considered the "supreme Law of the Land." These treaties reserve to the tribes the right to take fish destined to pass their "usual and accustomed" fishing places (Treaty with the Umatilla Tribe, June 9, 1855, 12 stat. 945; Treaty with the Yakama Tribe, June 9, 1855, 12 Stat. 951; Treaty with the Nez Perce Tribe, June 11, 1855, 12 Stat. 957; Treaty with the Tribes of Middle Oregon, June 25, 1855, 12 Stat. 963). Among the fish that tribes have treaty rights to harvest are the salmonids and resident species originating in streams and lakes flowing throughout the Columbia River Basin as well as those anadromous species that return to their spawning grounds in the Columbia River Basin.

The importance of fish, especially salmon, to the tribes cannot be overstated for the fishery resource is not only a major food source for tribal members, it is also an integral part of the tribes' cultural, economic and spiritual well-being. The importance of the tribes' treaty fishing rights has received long-standing legal recognition. In a 1905 decision, the U.S. Supreme court stated: "The right to resort to the fishing places in controversy was a part of larger rights possessed by the Indians, upon the exercise of which there was not a shadow of impediment, and which were not much less necessary to the existence of the Indians than the atmosphere they breathed." United States v. Winans, 198 U.S. 371 (1905).

Thus, as ceremonial and subsistence fishers, CRITFC's member tribes rely on the protection and enhancement of water quality in the Columbia River Basin sufficient to protect treaty resources from harmful exposure to waterborne pollutants. The consistent decline of fish runs, the loss of adequate fish habitat, and the documented degradation of water quality in the Columbia River Basin have heightened the tribes' concern for the fishery resource and the health and livelihood of tribal members.

Degraded Water Quality

The Columbia River system is the fourth largest watershed in North America and drains over 250,000 square miles, with 85% of the watershed located in Oregon, Washington and Idaho, the three states where the surveyed tribes reside. Although the total amount of tribal reservation land for these four tribes is approximately 2.8 million acres, the tribes' aboriginal and ceded areas encompass 41 million acres and 31 Columbia River sub-basins, a majority of the Columbia River Basin.

Throughout the Columbia River Basin, certain resource uses such as hydroelectric dams, grazing, agriculture and forestry have contributed to the decline of the salmon runs. Numerous industrial sources (including eight U.S. pulp and paper mills, one Canadian pulp mill and ten aluminum plants), agricultural drainages carrying pesticides and insecticides, sewage treatment plants, combined sewer overflows, abandoned landfills, the Hanford Nuclear Reservation, and the Idaho National Engineering Laboratory continue to load toxic and radioactive wastes into the Columbia River system threatening both the health of tribal members and the fishery resource. Many federal and state sponsored investigations have revealed the prevalence of toxic chemicals in Columbia River fish and sediments.

For human health risk assessment purposes, USEPA has identified an individual's rate of fish and shellfish consumption as the key exposure variable (USEPA, 1989). Others have further identified ingestion of contaminated fish as the most significant pathway of human exposure to bioaccumulatable, persistent and toxic chemicals in aquatic environments (Rifkin and LaKind, 1991). Moreover, because waterborne toxics tend to bioaccumulate in aquatic organisms, the general human population is exposed to significantly greater doses of certain chemical contaminants from fish consumption than from water and atmospheric sources combined (Humphrey, 1983).

Consequently, noncommercial and subsistence fishers can be particularly susceptible to exposure to toxic pollutants (Institute of Medicine, 1991). Fish biomonitoring studies conducted outside the Columbia Basin have clearly demonstrated the persistence and bioaccumulation of certain chemical pollutants in aquatic environments and the potential for health problems due to consumption of contaminated fish (Fiore et al., 1989; Cordle et al., 1978; Cooper et al., 1991; and Tollefson and Cordle, 1986).

Within the Columbia River Basin, state and Federal agencies have consistently documented water quality problems, including toxic pollution. The major toxics of concern identified in the Columbia River Basin are organochlorine pesticides, dioxins and furans, polychlorinated biphenyls (PCB), heavy metals, and radionuclides (USEPA, 1992). Toxics have been identified at levels of concern in various parts of the basin, with the greatest concentrations measured in either sediments or fish tissue (USEPA, 1992). These pathogens and toxics in fish and sediment samples collected from the Columbia River Basin present the greatest threats to human health.

In 1986, USEPA initiated its National Study of Chemical Residues in Fish (NSCRF) (USEPA, 1992a) to monitor levels of toxic chemicals in fish tissue at numerous sites across the country, including the Columbia River Basin. The most toxic dioxin congener, 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), was found in samples from 70 percent of all the national sampling sites, including samples collected from the Columbia River Basin (USEPA, 1992a). Total PCBs and DDE (dichloro-diphenyldichloro-ethylene), a breakdown product of the insecticide DDT (dichloro-diphenyl-trichloroethane) were also found in Columbia River fish tissue. The State of Oregon has listed all of the Columbia River within the state's borders (river miles 0-309) as violating the water quality standard of .013 parts per quadrillion (ppq) adopted for 2,3,7,8-TCDD (Oregon Department of Environmental Quality, 1992). Washington State has specifically identified the Columbia River mainstem downstream of Priest Rapids Dam and the entirety of the Snake River within Washington State as violating Washington's dioxin water quality standard, which is also .013 ppq (Washington State Department of Ecology, 1992).

The Lower Columbia River Bi-State Program, initiated in 1990 by the Oregon and Washington State legislatures, conducted an extensive reconnaissance survey of water, sediment, and fish tissue samples collected from the Lower Columbia River (downstream of Bonneville Dam to the Pacific Ocean). Results of the Bi-State survey indicate a widespread occurrence of metals, pesticides, PCBs, and dioxin and furan compounds in fish tissue (Tetra Tech, 1993). These results are consistent with historical measurements of fish tissue concentrations of metal and organic compounds measured in national surveys conducted by USEPA and the United States Fish and Wildlife Service (USFWS) (Schmitt, C.J., et al., 1990).

From 1986 to 1991, the U.S. Geological Service (USGS) collected and analyzed soil, sediment, water, and fish tissue samples from the Yakima River basin as part of the USGS National Water Quality Assessment Program (NAWQA). Sixty-five of the ninety pesticides analyzed for were found in samples from this subbasin (USGS, 1993). Although the insecticide DDT has been banned for over 20 years (since 1972), high concentrations of DDT, DDE, and DDD (dichloro-diphenyl-dichloroethane) continue to occur in sediment and fish tissue samples (USGS, 1993). The USGS report concludes that fish in the Yakima River basin have among the highest concentrations of Total-DDT (T-DDT) which includes DDT, DDE and DDD, in the nation and that the Yakima River's 1990 level of T-DDT was 10 times higher than the chronic-toxicity criterion for the protection of freshwater aquatic life established by USEPA. Yakama tribal members consume both resident and anadromous fish caught from the Yakima river.

Statement of Significance of Data and Applications

Because ceremonial and subsistence fish consumption patterns are not currently accounted for in existing water quality criteria and standards for dioxin and other toxic pollutants in the Columbia River Basin, CRITFC and its member tribes expect federal, state and tribal regulatory agencies to incorporate information in this survey when developing and re-evaluating human health based water quality criteria and standards for toxics as well as in other regulatory and policy decisions relating to risk management, pollution prevention, remediation and environmental justice.

The consumption rates established in this report should be combined with site-specific fish tissue monitoring data to determine actual exposure and damage to Columbia River Basin Indians and their treaty protected resources resulting from toxic, heavy metal and nuclear waste contamination. CRITFC and its member tribes encourage other tribes and populations to utilize this survey's methodology in future fish consumption surveys.

METHODOLOGY

Sample Design

Sample Frame

Survey respondents were selected from patient registration files provided by four Indian Health Service (IHS) unit health centers located on the reservations of the participating Tribes. These files are open-ended and used for determining an individual's eligibility to receive health services from the Indian Health Service Center.

Sample Size and Tribal Representation

The population sizes of each of the four Tribes at the time of the sample selection ranged from 818 to 3872 individuals. Based in part on financial and logistical constraints, a total sample size of 500 interviews was chosen for the survey. Because the population sizes of the Tribes varied to such an extent, a self-weighting sample (i.e., a sample selected in proportion to the eligible population of each Tribe) would not have provided very useful results for the smaller reservations because of the small number of interviews that would have occurred there. Instead, the sample was selected so as to yield approximately equal numbers of interviews from each of the four Tribes. Thus, approximately 125 interviews per tribe were sought. Based on an expected overall response rate of 70 percent of individuals selected from IHS lists, 744 total individuals were randomly selected from the 4 lists, with roughly the same number chosen from each tribe: 182 from Yakama, 180 from Umatilla, 202 from Nez Perce[1], and 180 from Warm Springs.

Selection Procedure

Before the selection procedure occurred, the following individuals were eliminated from the IHS clinic lists: persons who were not at least 18 years of age, persons who were identified as not being members of the primary reservation Tribe, and persons who were identified as not living either on or near the reservation.

Names on the lists were selected by the Centers for Disease Control (CDC) using a systematic probability sampling method, in which a sampling interval was calculated by dividing the total number of names on each tribes' IHS patient registration list by the number of names desired from that Tribe. The names of persons to be contacted

[1] Note that the sample size for the Nez Perce Tribe was slightly larger than those for the other tribes. This was due to a request by the Tribe to increase the sample size by 20 persons because some difficulties were expected in locating enough persons to be interviewed.

were then identified by the sampling interval. The starting point was chosen using a random start method, which was a random number between 1 and the calculated interval number.

The IHS clinic lists for each Tribe were then cross-referenced with tribal enrollment lists to ensure their accuracy. Individuals were excluded from the sample if they were identified as deceased or unenrolled, if they had moved out of the area, or if they could not otherwise be interviewed. These individuals were replaced by eligible members using the same selection method as for the original names.

As tribal members were contacted to participate in the survey, it became evident that several persons identified in the final sample set had died, had moved out of the survey area, or could not be contacted. Several of these persons were then removed from the sample set and replaced with the names of other tribal members using the same selection procedure described above. In some cases, persons identified in the sample who were eligible respondents but who had moved out of the survey area (e.g., to Seattle) had returned to the reservation to visit and were surveyed.

Weighting Factors

Data were collected for the survey using stratified systematic sampling, with each of the four Tribes considered an independent stratum, or subpopulation. The final results presented in this text represent all four Tribes as a single population.

To obtain an unbiased estimate of the population mean of a set of pooled data, it was necessary either to utilize a self-weighting sample or to weight the collected data according to the proportion of each subpopulation sampled. The Survey design did not utilize a self-weighting sample because of the small number of interviews that would have occurred on the smaller reservations. Instead the samples for each of the four Tribes were selected to be essentially the same size. However, the population sizes of the four Tribes at the time of the sample selection ranged from 818 to 3872 individuals. Therefore, the data were weighted before they were pooled, using weighting factors based on the population sizes of each tribe. Since the percentage of individuals represented in the larger Tribes is smaller than the percentage of individuals represented in the smaller Tribes, it was necessary to give more weight to responses from individuals in the larger Tribes (Appendices 1-2 for weighting formulas).

Unweighted Data

The majority of the data presented in this report has been weighted to reflect the fish consumption habits and patterns for the overall tribal population. However, data concerning each individual Tribe (i.e., in the section concerning potential biases in the survey and the section concerning locations of fishing sites) were not weighted. In addition, data provided by survey respondents concerning the fish consumption habits and patterns of children living in their households were not weighted because of the low number of children represented in the survey.

Survey Methods

Target Population

The target population included all tribal members ages 18 and older who lived on or near the Yakama, Warm Springs, Umatilla or Nez Perce reservations. Respondents provided consumption information for themselves and one child five years of age or younger residing in the respondent's household. Respondents who consume fish are referred to as fish consumers and respondents who do not consume fish are referred to as non-fish-consumers.

Questionnaire Development

CRITFC and the USEPA Office of Policy, Planning and Evaluation established a technical panel to assist in the design and implementation of the survey. The panel consisted of representatives from CRITFC and toxicologists, epidemiologists, health scientists, and environmental scientists from the Indian Health Service (IHS), the Centers for Disease Control (CDC), Washington and Oregon State Health Departments, and the Region 10 and headquarters offices of USEPA (Appendix 3).

Members of the technical panel helped determine the following: the focus of the survey; the target population; questionnaire design and content; coordination and survey procedure and; the allocation of tasks necessary to complete the project. USEPA's Office of Policy, Planning, and Evaluation (OPPE) coordinated the development of the questionnaire. (Appendix 4 for CRTIFC and tribal coordination).

The Survey Questionnaire

The 17 page survey questionnaire (Appendix 5) included approximately 34 questions concerning demographics, 24 hour dietary recall, seasonal, annual and daily fish consumption rates, changes in fish consumption over the last 20 years, consumption of fish parts, fish preparation methods, breast feeding, location of Columbia River Basin fishing sites, sources of fish consumed and fish consumption as a result of cultural and other special events. Survey respondents were asked questions about their consumption of different species of fish as well as consumption of specific fish parts. Respondents were also asked to provide information about consumption of fish species and fish parts for one child five years of age or less residing in the respondent's household. A brief description of key questions and corresponding questionnaire numbers follows. Similar information is provided for those questions also pertaining to children's consumption.

24-Hour Recall (III-1)

The 24-hour dietary recall was asked of adult respondents for comparative analysis with overall individual fish consumption rates.

Seasonal Consumption (III-2,3,4,5)

To better understand seasonal variations and correlations in consumption, respondents were asked to estimate the two months of the year during which they consume the most fish (i.e., when their fish consumption rate is the highest) and the two months of the year during which they consume the "least" fish (i.e., when their fish consumption rate is the lowest). Note that although the terms "most" and "least" do not represent quantified amounts of fish, respondents were also asked to estimate the average number of fish meals per week they consumed during the two months identified as least and highest months of consumption.

Rate of Fish Consumption Throughout The Year (III-6,7; IV-5,7 for children)

Respondents were asked about the number of fish meals they consume over the year in general and during the seasons when they eat the most fish and the least fish. Fish meals included breakfast, lunch, dinner and snacks.

Since the term "fish meals" did not indicate a quantified amount of fish and may reflect different amounts in ounces depending on the respondent and on the meal, respondents were asked to estimate the average serving size in ounces of fish eaten during fish meals. To aid respondents in estimating amounts of fish consumed, foam sponge food models approximating four, eight, and twelve ounce fish fillets were provided.

Fish Species Consumed (III-9, IV-6 for children)

Ten Columbia River Basin fish species were specifically listed in the questionnaire for respondents to provide consumption information about. Because different fish species may be exposed to varying levels of toxic pollution depending on their life history, the ten species listed on the survey were separated into anadromous fish (those that are born and reside in a river system for one to three years, migrate to the ocean and remain there for up to several years, then return from the ocean to the river to spawn) and resident fish (those that remain in the river their entire lives).

The anadromous fish specified on the questionnaire were salmon/steelhead trout[2], lamprey, smelt, and shad. The resident fish specified on the questionnaire were trout, whitefish, sturgeon[3], walleye, squawfish, and sucker (Appendices 6-8 for species names). Respondents were also asked to provide information concerning their consumption of other fish species not identified in the questionnaire that may or may not originate in the Columbia River Basin.

Fish species were also separated into their appropriate trophic levels. Second trophic level fish, those that are mostly herbivorous, include shad, smelt, sturgeon, sucker, whitefish, and small trout. The carnivorous third trophic level fish include salmon, walleye, lamprey, squawfish, and large trout. Since trout are considered both second and third level fish, these species have been placed in a separate category: second/third level fish (CRITFC, 1993).

Change in Consumption Over the Last 20 Years (III-8)

To help characterize the historical pattern of tribal fish consumption and aid in determining the cultural and/or environmental causes for changes in tribal fish consumption over time, respondents 30 years old and older were asked if their or their family's current pattern of fish consumption differs from the pattern of consumption they experienced 20 years ago. These questions may also aid in predicting future increases or decreases in tribal fish consumption.

Fish Parts Consumed (III-9, IV-6 for children)

Respondents were asked to identify the fish parts they usually consume for each species. Fish parts listed on the survey were: fillet, skin, head, eggs, bones and other organs. Respondents were also asked to provide the same information for one child five years of age or younger residing in the respondent's household.

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[2] Salmon and steelhead trout were listed together on the survey questionnaire rather than as separate fish species. For the remainder of the report, references to salmon also include steelhead trout and references to trout will be for resident trout only.

[3] Although sturgeon below Bonneville Dam are considered anadromous, we have delineated this species as resident because the majority are located above Bonneville Dam and are now considered resident fish. Also, because the tribal commercial fishery begins above Bonneville dam, tribal members do not catch sturgeon below Bonneville dam.

Fish Preparation Methods (IV-1)

Because toxic chemicals may attenuate out of fish flesh when prepared by certain methods, respondents were asked about the different methods used to prepare fish in their homes and how often a particular method is used. The questionnaire specifically inquired about the use and frequency of the following preparation methods: pan frying, deep frying, poaching, boiling, baking, broiling, smoking, drying, eating raw, roasting, and canning. Respondents also were asked to provide information concerning how often they use each method, given the following three choices: at least once per week, at least once per month but less than once per week, or less than once per month.

Breastfeeding (IV-9,10,11,12,13)

Because certain toxic contaminants can be passed to newborn infants from mother's breast milk, female respondents were asked whether they have given birth, and if so, whether the child or children had been or are being breast fed. These respondents were also asked at what age their child ceased or will cease breastfeeding.

Source of Fish Consumed (V-1,4)

To verify where respondents were obtaining the fish they consume, respondents were asked to estimate what percent of the fish they consume is from the following sources: self-harvest or harvest by a family member; friends who fish; tribal ceremonies; tribal distributions; grocery stores or; "other." Respondents were asked to identify these "other" sources. Information on sources of fish are presented as the sum of individual responses as well as the weighted means for each source.

Fishing Site Locations (V-2)

In order to provide a more detailed account of the origin of fish obtained by tribal fishers, participants were asked to identify the specific locations within the Columbia River Basin where they fish for particular species. Those participants who indicated that they fish for themselves or the Tribe identified fishing sites on a map of the Columbia River Basin provided by the interviewer displaying numbered sites along the river's mainstem and tributaries (Appendix 9). Sites selected by survey respondents do not however, include all of the tribes' usual and accustomed fishing areas utilized by tribal members and do not reflect any one tribe's exclusive use of a fishing site.

Ceremonial Consumption of Fish (VI-1,2,3)

To substantiate the cultural importance and prevalence of fish to the four surveyed tribes, respondents were asked questions about their attendance at tribal ceremonies and their consumption of fish at these events.

Data Collection Procedure

An incentive method was used to limit the cost and duration of the project. Due to the large distances between residences and the frequent movement of individuals on reservations, interviewing door-to-door was considered unduly time consuming and expensive. Monetary incentives ($40/person) were used to encourage individuals to come to a central location on the reservation to be surveyed. Survey participants were notified of the time and location for interviews by letters signed by tribal government officials (Appendix 10).

After the initial invitation letter was sent to tribal members, interviewers were instructed to make at least four attempts to contact an individual by phone and finally, to make an attempt to conduct a door-to-door interview. The survey instrument was designed to allow interviewers up to four recorded attempts to interview an individual. Reasons were provided by the interviewer for why an individual could not be interviewed for each attempt made. In most cases, more than four attempts were made to contact an individual by phone. If these attempts were unsuccessful, the interviewer would then attempt a door-to-door interview. Of all the door-to-door attempts made by interviewers, only one individual was contacted and interviewed by this method. A total of 513 interviews were completed in a three week period.

Quality Assurance/Quality Control in Survey Implementation

Pretest

A survey pretest was conducted during October 1991. One Warm Springs tribal member and one Umatilla tribal member were hired to interview approximately 10 tribal members each from their respective reservations. The interviewers were informed as to the purpose of the survey and were instructed by phone on basic surveying procedure and techniques. The pretest lasted approximately one week and respondents were paid from 5 to 10 dollars for participating. The results of the pre-test were used to determine the time required to administer the survey and to identify potential problems with interpretation or delivery of survey questions. As a result of the pretest, some of the questions in the survey questionnaire were modified.

Interviewer Training

Nine tribal members (three from the Nez Perce, two from the Yakama, two from the Warm Springs, and two from the Umatilla Tribe) were hired to conduct interviews at locations on each of the tribal reservations. Interviewers surveyed only members of the Tribe to which the interviewer belonged.

A three-day training session for interviewers was conducted by a representative from CDC at CRITFC's office in Portland, Oregon in October 1991. During the training session, interviewers were instructed in surveying procedure and techniques, including locating interviewees, obtaining accurate data, prevention of bias in responses to questions, use of food models to assist respondents in determining amounts of food consumed, and quality control. In addition, the questionnaire was reviewed question-by-question to eliminate potential misunderstanding on the part of the interviewers and interviewees. The training included practice interviews in the presence of an instructor.

Lastly, interviewers were directed to make the following statement of purpose to each survey respondent before beginning the questionnaire:

> We are conducting a survey to understand fish eating patterns as well as other dietary patterns and health-related behaviors[4] of Native Americans in the Pacific 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.

Use of Food Models

Foam sponge food models approximating four, eight, and twelve ounce fish fillets were provided to aid respondents in estimating amounts of fish consumed.

Internal Technical Review

Final drafts of the report were submitted to several CRITFC and tribal staff for review and comment. Each tribes' governing body and the Columbia River Inter-Tribal Fish Commission were formally briefed on the report data for final approval. All submitted comments were addressed in subsequent edits.

Outside Technical Review

[4] In a separate effort to simultaneously obtain other non-dietary information from tribal respondents during the fish consumption survey interview, a separate behavioral risk questionnaire was developed. A policy decision was made by the Nez Perce tribe to ask these behavioral risk questions to Nez Perce tribal members participating in the fish consumption survey. Members of the other three participating tribes did not participate in the behavioral risk survey but were presented with the same introductory statement.

Several drafts of the report were submitted to members of the technical panel and to several USEPA staff for comment and review. All panel members and all USEPA staff submitted comments either in writing or verbally to CRITFC.

Independent Peer Review

A final draft of the report incorporated all prior solicited comments and was submitted to an independent peer review panel (Appendix 3). The peer review panel, selected by CRITFC, consisted of nine individuals from across the country esteemed in the fields of epidemiology, toxicology, survey methodology and statistics.

Procedures for Protecting Confidentiality

Information revealing participant identity was removed from survey questionnaires immediately after respondent names were verified with the master sample list. Thus, respondents cannot be identified from the individual questionnaires. Confidentiality agreements were signed between any contractors and CRITFC stating that none of the information provided in the database or the survey would be revealed before release of the final report. In addition, following completion of the report, all relevant information was returned to CRITFC. Lastly, general information and conclusions reached as a result of the survey were reviewed for confidentiality by the Commission and CRITFC's member Tribes before release to USEPA or the public.

Data Processing

Data Entry and Audit

Survey data were entered by computer into EPI Info Version 5.1, a Center for Disease Control statistical database package used for analysis of epidemiological data. Entered data were subsequently reviewed for missing answers or mistakes in data entry and corrections were made from the original questionnaires.

A second complete audit of the database was conducted by a private consulting firm with CRITFC's approval to ensure that the final survey results would reflect the high and low estimate ranges for the responses provided on the questionnaires. For example, respondents often would provide a range of responses regarding their estimated fish consumption. In these cases, the lowest number in the range was recorded in the database, even if that number were 0.00. In addition, data were consistently rounded down before being entered into the database. This second audit involved a question-by-question review of each survey with necessary changes made to the original database.

Data Analysis

To obtain the most accurate estimated mean rate of consumption for the entire set of respondents, the consumption rate for each respondent in grams per day was determined from the data on serving size and weekly fish consumption collected in the survey. For example, the fish consumption rate of an individual who consumes 2 fish meals per week and 8 ounces per fish meal is 64.8 gpd. The calculation is as follows:

- 8 ounces x 2 meals per week[5] = 16 ounces per week
- 16 ounces per week/7 days per week = 2.28 ounces per day
- 2.28 ounces per day x 28.35 grams per ounce = 64.8 gpd

Once the consumption rate for each respondent was calculated in grams per day (gpd), the average and distribution of these individual rates were calculated. Thus, the mean rate of consumption for adults throughout the year was calculated using this method, with the mean reported in gpd. The reported mean consumption rate estimate also includes those respondents that were not fish consumers and thus represents the estimated consumption rate of the entire tribal population sampled.

Responses to questions concerning the number of fish meals consumed by adults each month and the number of ounces consumed by adults at each meal were analyzed to determine if a correlation existed between these parameters, but no significant correlation was found. The remainder of this document will present the appropriate results in terms of the number of grams consumed per day (gpd). The mathematical conversion from ounces to grams resulted, in some cases, precision in the data to the 100th decimal point. In those cases, all data were rounded to the nearest tenth.

EPI was used to calculate weighted frequencies and proportions. Programs for calculating weighted means also were developed using EPI and results were verified using the automatic weighted mean option in SAS Version 6, produced by the SAS Institute. Some Chi-square analyses were performed using Lotus 1-2-3.

Statistical Tests

Analysis of the fish consumption rates indicated that the data were not normally or log-normally distributed, nor were any other standard data transforms likely to yield a normal distribution. The untransformed data and log-transformed data were tested

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[5] In cases where the response was given as meals/month, the calculation was as follows:
ounces x meals/month = ounces per month
ounces per month/30.4 days per month = ounces per day
ounces per day x 28.35 grams/ounce = grams per day

for normality using SAS' PROC UNIVARIATE option, which produces a test statistic for the null hypothesis that the input data values are a random sample from a normal distribution. If the sample size is less than 2000, the Shapiro-Wilk·statistic, W, is computed. The W statistic is the ratio of the best estimator of the variance (based on the square of a linear combination of the order statistics) to the usual corrected sum of squares estimator of the variance. W must be greater than zero and less than or equal to one, with small values of W leading to rejection of the null hypothesis. The Shapiro-Wilk statistic is very sensitive to any deviations from normality, and the test showed that the data was not normally distributed.

Outliers

Outliers, those data points that seemed unreasonably high due to discontinuity in distribution, were identified in responses to some survey questions. A total of five outliers were identified and these data points were ignored in all calculations. Of the five data outliers, one was for a child's estimated number of meals per week, two were adult mens' estimated meals per week and two were adult womens' estimated meals per week, including one woman who breastfed her child.

Individual Response Rate Calculations

Since some survey respondents opted to not answer certain questions, a response rate is provided in most tables representing summary results for each question. The response rate was calculated by dividing the number of responses by the total number of persons who should have answered the question. For example, the response rate for the question concerning women who have given birth is 98.9 percent because 285 females were surveyed and only 282 of these women answered this question. The response rate for questions is referred to in the report as RR. In those instances when outliers were identified and ignored in the final data calculations, the response rate was also modified to exclude those responses. Thus, the response rates provided in the report that omit outliers are referred in the report as RR*.

SURVEY RESULTS

Completed Surveys

An overall response rate (RR) of 69.0 percent of the sample was obtained and included 126 completed interviews from the Warm Springs Tribe (RR = 70.0%), 123 completed interviews from the Yakama Tribe (RR = 67.6%), 133 completed interviews from the Nez Perce Tribe (RR = 65.8%), and 131 completed interviews from the Umatilla Tribe (RR = 72.8%).

Approximately 43 percent of non-responses in the sample represent those individuals who could not be contacted by phone or other means or who had moved out of the survey area. For 25.2 percent of the non-surveyed group, interviewers provided no reason for lack of a tribal member's participation (Table 1).

Demographic Information

Location of Respondents

The Yakama, Nez Perce, Umatilla and Warm Springs reservations cover approximately 4445 square miles. Four hundred fifty-two respondents (88.1%) lived on one of these four reservations and 61 (11.9%) respondents lived off reservation (RR = 100%). Individuals close to the interview site were more likely to be surveyed than those further away ($P < 0.001$). Of the individuals living within 10 miles of the interview site, 74% were surveyed and 26% were not surveyed. The percent surveyed dropped off with increasing distance such that 67% of individuals between 31 and 70 miles of the survey site were surveyed (Table 2)(Appendix 12 for information on each tribe). Nine of the 14 individuals living beyond 70 miles from the interview site were surveyed.

Sex of Respondents

More females (57.9%) participated in the survey than males (42.1%) (RR = 100%). A significant difference exists between the number of males and females who were surveyed and those who were identified in the original sample but were not surveyed ($p < 0.05$) (Table 3).

Age of Respondents

The majority of survey respondents (58.7%) were between the ages of 18-39 years; 31.4 percent were between the ages of 40-59 years; and 9.9 percent were at least

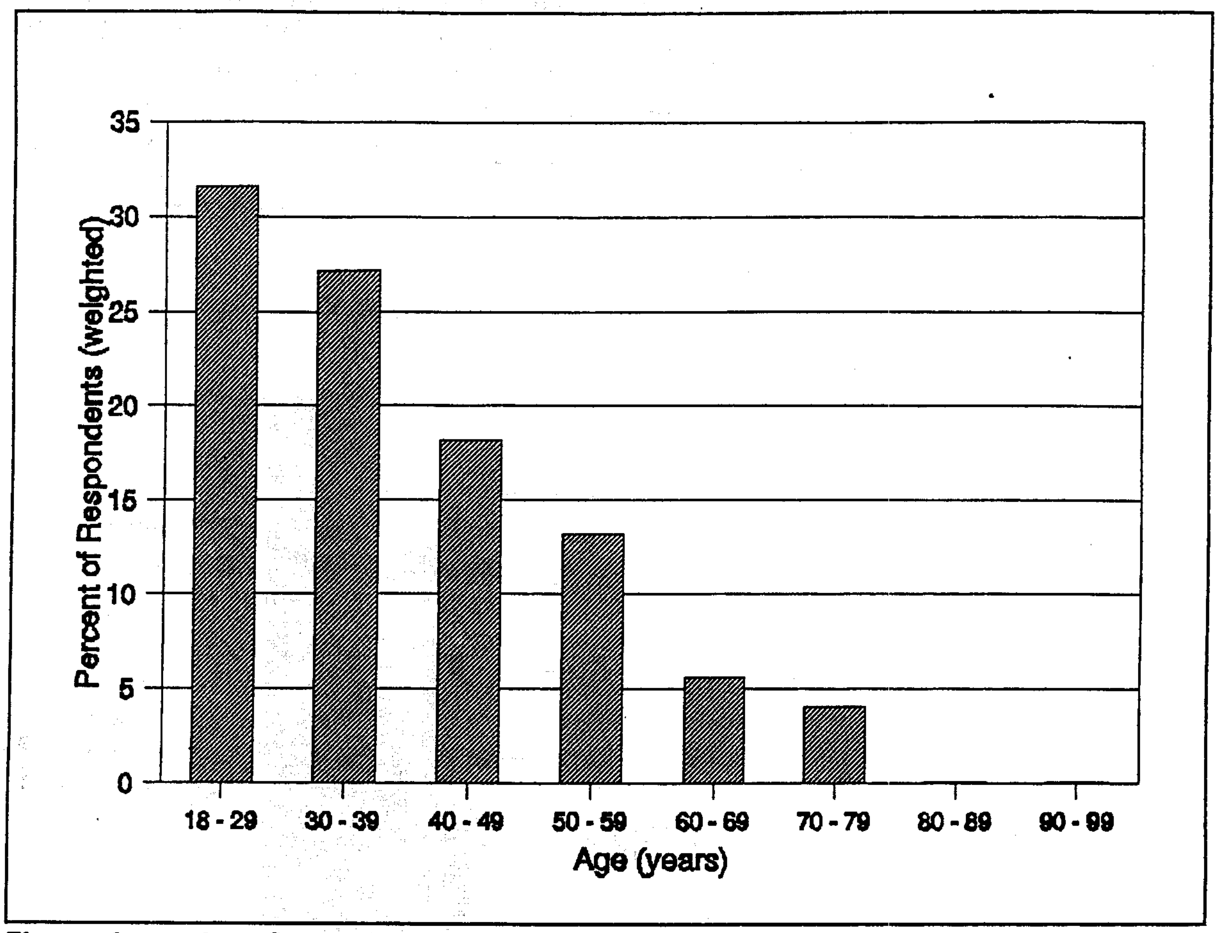

Figure 1 **Age Groups of Adult Respondents**

60 years old. The mean age of respondents was 38.9 (0.64 SE[6]) years (Table 4, Figure 1).

Rates of Adult Fish Consumption

Adult tribal members consumed an average of 1.71 (0.11 SE) fish meals per week throughout the entire year (RR = 97.5%) (Table 5). Approximately 75 percent of respondents indicated that they eat up to 8 ounces of fish per fish meal (Table 6). Approximately 17 percent of respondents eat 12 ounces at each serving, and 1.1 percent of respondents eat as much as 20 to 24 ounces. The mean of individual estimates of an average serving of fish is 7.83 (0.16 SE) ounces.

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6. SE = the standard error of the mean

The average rate of consumption by all surveyed adults throughout the year for all species from all sources was determined to be 58.7 (3.64 SE) gpd. The 90th percentile of consumption was between 97.2 and 130 gpd, the 95th percentile was at approximately 170 gpd, and the 99th percentile was 389 gpd (Figure 2, Table 7) (RR = 97.5%). These data include both fish consumers and non-fish-consumers.

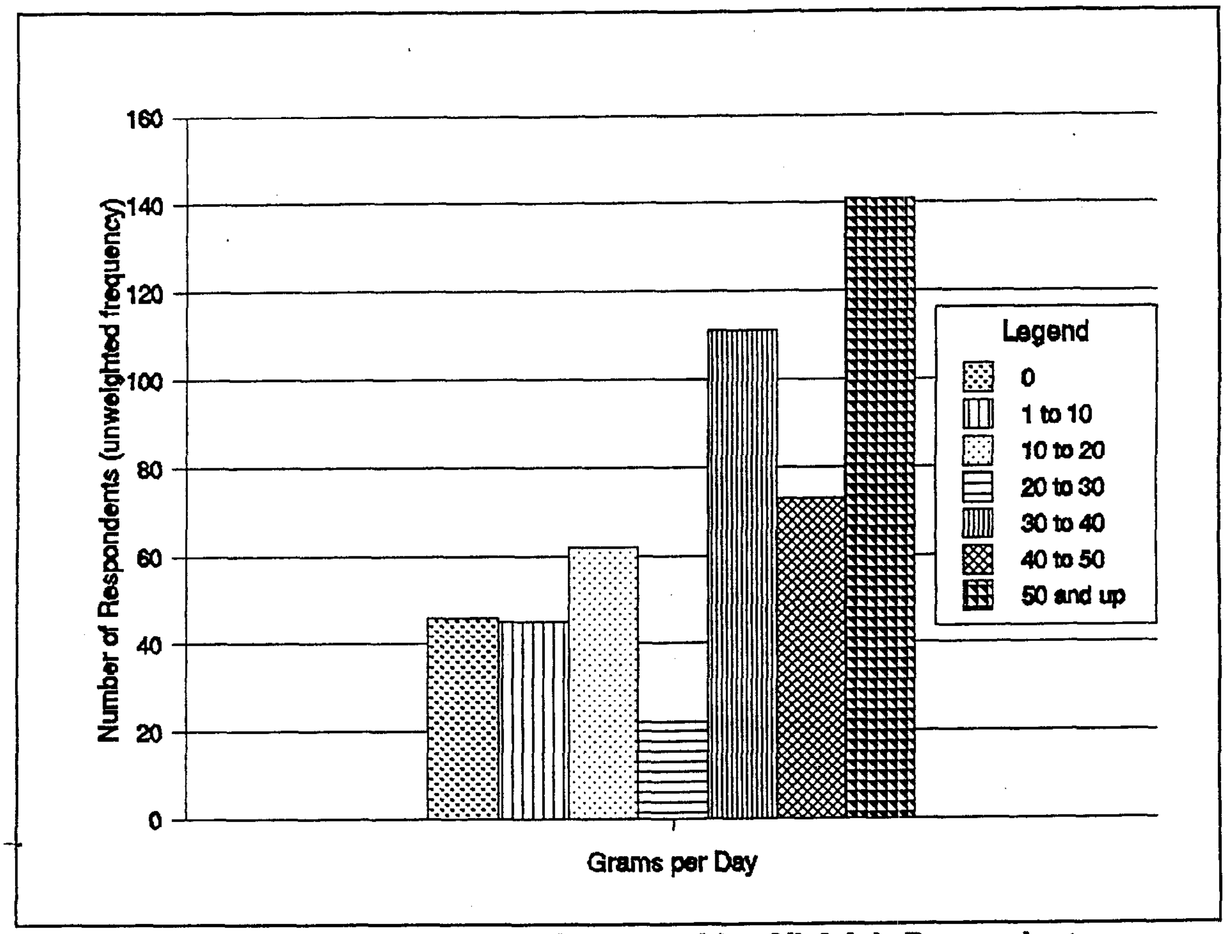

Figure 2 Grams per Day of Fish Consumed by All Adult Respondents

Fish-Consumers Only

Seven percent of respondents indicated that they were not fish consumers. Excluding these individuals, surveyed individuals composed solely of fish consumers consumed an average of 1.85 (0.11 SE) fish meals/week (Table 8) and 8.42 (0.13 SE) ounces/meal (Table 9). The mean rate of fish consumption for fish consumers only was 63.2 (3.84 SE) gpd (Table 10) (RR = 97.3).

Fishers

Almost half (48.7%) of the tribal members surveyed caught fish for personal consumption or for use by their Tribe (RR = 99.4%). Fish consumption rates for non-fishers and individuals who fish for themselves or for their Tribe are similar. However, the distributions, which are not normal, are significantly different ($p = .0001$) (Appendix 13). The variances of the means differ in three ways: 14 percent of non-fishers are also non-fish eaters while only 3 percent of fishers are non-fish eaters; fishers representing the high end of the consumption range tend to eat more gpd than non-fishers; and fishers representing the low end of the consumption range (above 0.0 gpd) tend to eat less gpd than non-fishers.

Rates of Consumption for Demographic Categories

Male tribal members consumed significantly more fish than female tribal members with males averaging approximately 63 gpd and females averaging approximately 56 gpd ($p = 0.0005$) (Table 11). Although the differences are not significant ($p > 0.05$), it is interesting to note that respondents ages 60 years and older consumed an average of 74.4 gpd of fish which is more than the average rate for persons age 18-39 years or persons age 40-59 years (Table 11a) and individuals living on-reservation consumed, on average, more grams of fish per day than those living off-reservation (Table 11b).

Seasonal Rate of Fish Consumption

Almost 42 percent of respondents indicated that most fish was consumed during the months of April through July (Figure 3, Table 12) (RR = 100%). Approximately 18 percent of the total number of respondents stated that they eat the same amount of fish each month of the year; 7.0 percent said they do not eat fish at all and; about 0.6 percent do not know in which months they consumed the most fish.

For all months identified as high fish consumption months by the entire population sampled (i.e., fish consumers and non-fish consumers combined) respondents consumed an average of 87.9 (4.80 SE) gpd of fish (Table 13) (RR= 99%). For approximately 26 percent of respondents, the two months of highest fish consumption were either May and June, June and July, or July and August. For the months of May and June, the two most frequently chosen high fish consumption months, survey respondents consumed an average of 2.93 (0.18 SE) meals/week or 108 (7.63 SE) gpd (Appendix 14) (RR = 99.6%).

When asked about the months of lowest fish consumption, 56.7 percent of respondents indicated that they eat the least fish during the months of November through February (Figure 4, Table 14) (RR = 96.9%). Approximately 28 percent of

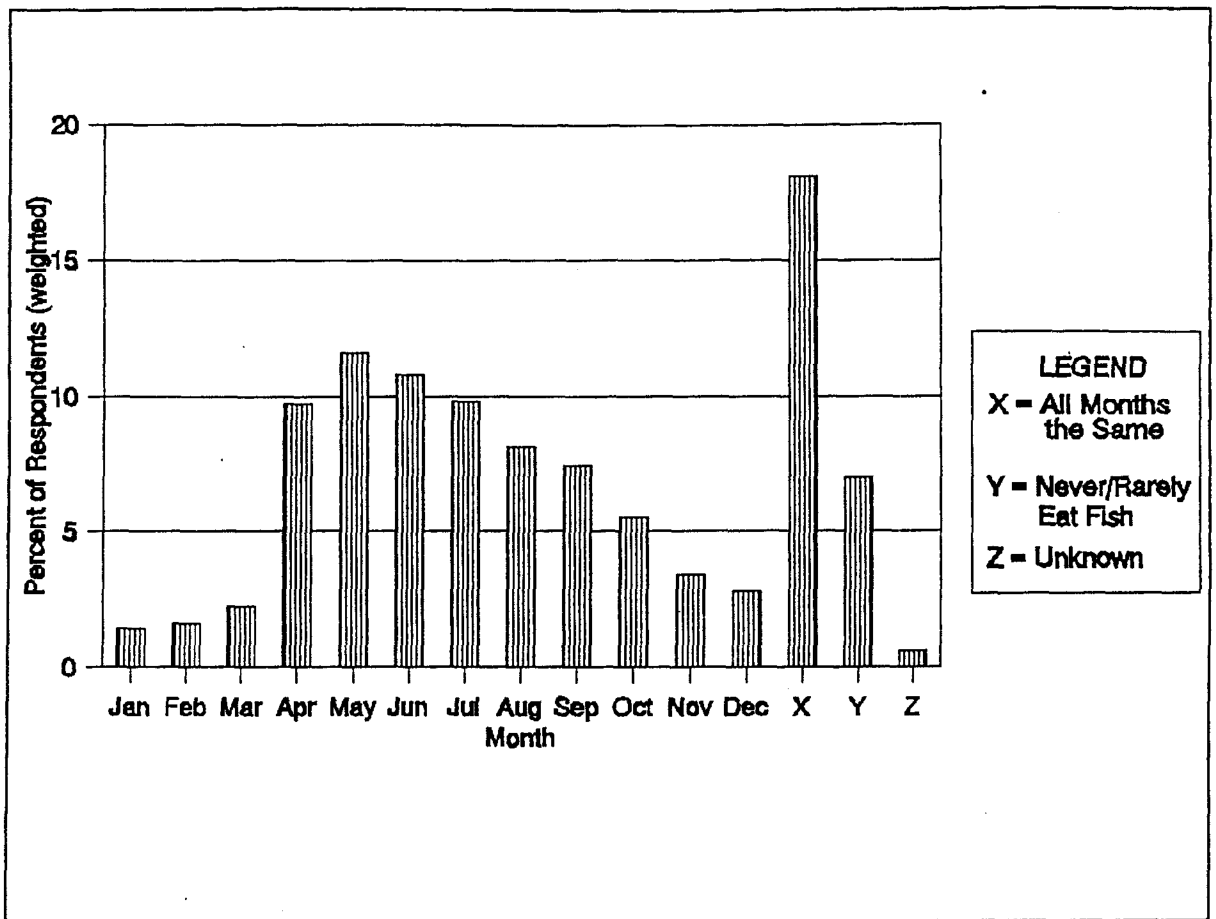

Figure 3 Months of High Fish Consumption

respondents estimated either January and February, January and November, or November and December as their two months of least fish consumption. Overall, the two most frequently estimated months of low consumption were December and January. In addition, 3.38 percent of the respondents indicated that fish consumption is equally low for all months except those during which they eat the most fish.

For all months identified as low fish consumption months by the entire population sampled, respondents consumed an average of 26.4 (1.39 SE) gpd (Table 13) (RR = 94.3%). In January and December, the two most frequently chosen months of low fish consumption, survey respondents consumed 0.86 (0.06 SE) meals/week or 30.7 (2.19 SE) gpd (Appendix 15) (RR = 97.6%).

Overall, the mean rate of consumption in high months (April-July) is over three times higher than the mean rate of consumption in low months (November-February) and the mean rate of consumption in May and June is over three times higher than the mean rate of consumption in December and January.

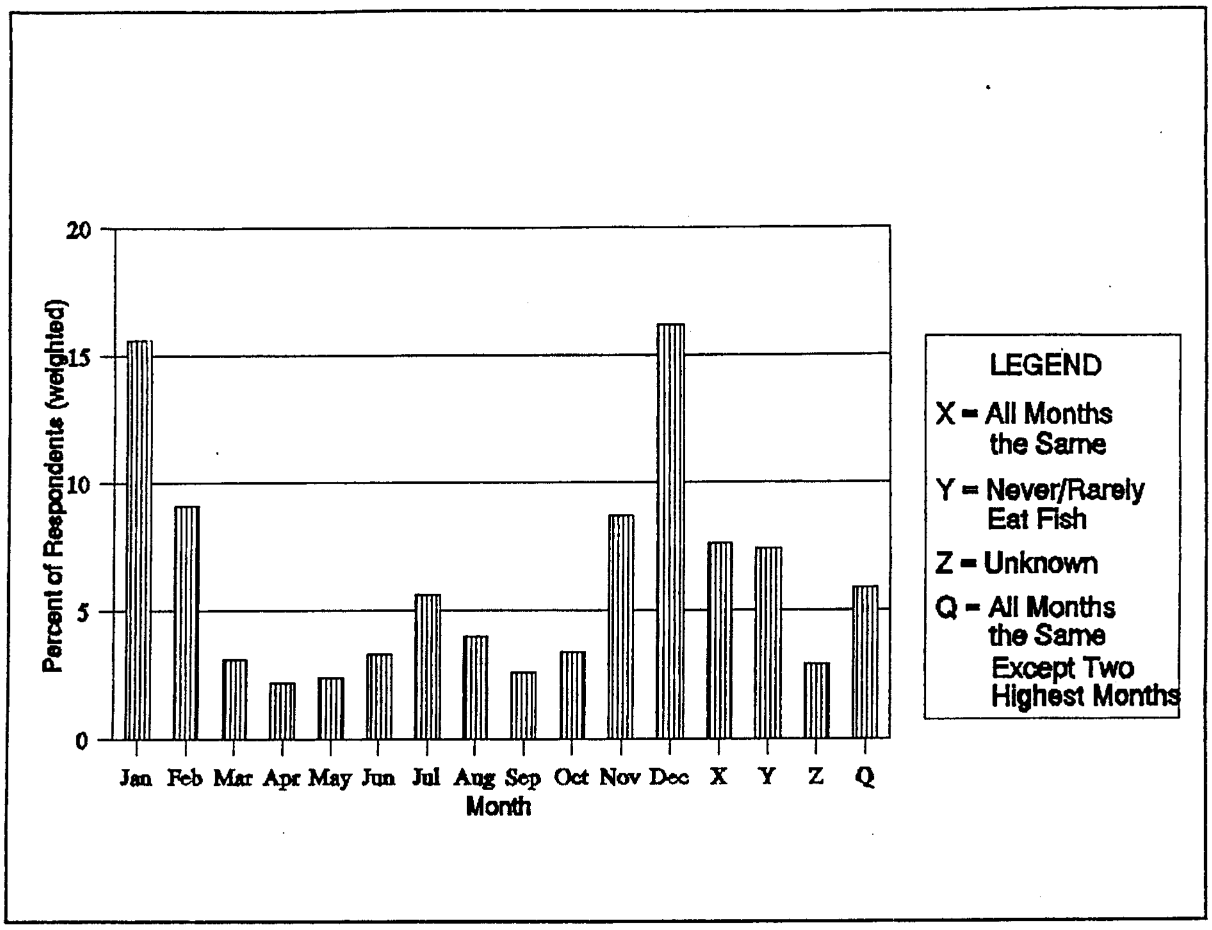

Figure 4 Months of Low Fish Consumption

Dietary Recall

Approximately 19 percent or 1 out of every 5 respondents, indicated that they had eaten fish within the 24 hours preceding the survey interview; 81.3 percent of respondents had not consumed fish during this period (RR = 100%). The overall rate of consumption reported by respondents who had consumed fish in the 24 hours preceding the survey was compared to the overall rate of consumption reported by respondents who had not consumed fish during that period (Appendix 16) (RR^* = 97.5%). Individuals who ate fish during that time period estimated significantly higher overall consumption rates (61.8 gpd)(6.03 SE) than those who did not eat fish during that period (57.9 gpd) (4.28 SE) (p = .0013).

Women Who Have Nursed or Currently Are Nursing Their Children

Of the 88 percent of women respondents who had given birth (RR = 98.9%), approximately 42 percent indicated that they currently are breast feeding or have breast fed their children (Appendix 17) (RR = 98.8%). These women consumed an average of 1.75 (SE 0.17) fish meals per week (Table 15) (RR* = 98.1%). Nursing mothers or mothers who have nursed ate an average of 59.1 (6.42 SE) grams of fish per day (Table 16). Therefore, on average, women who breast feed or had breastfed consumed nearly the same amount of fish as the tribal population in general.

The average rate of fish consumption for all women except those who are or have breastfed is 54.0 (6.60 SE) gpd and the average rate of fish consumption for women who have given birth but never breastfed is 57.1 (7.90 SE) gpd (Appendix 17). There is no significant difference between either of these rates and the average rate of fish consumption for women who are or have breastfed (for the first comparison, $p > 0.05$; for the second comparison, $p > 0.05$).

Consumption of Different Species by Adults

Salmon was consumed by the largest number of respondents (92%) (RR = 100%), followed by trout (70%) (RR = 100%), lamprey (54%) (RR = 100%) and smelt (52%) (RR = 99.2%) (Figures 5-6, Table 17). Some respondents also provided information concerning other fish species they consume, including bass, black cod, catfish, chiselmouth, crappie, halibut, Alaskan cod, blue gill, and red snapper.

The average rate of consumption of anadromous species for only those respondents who consume fish was 28.8 (1.45 SE) gpd and the average consumption rate of resident species was 10 (0.77 SE) gpd (Figures 7-8, Table 18). Table 19 illustrates overall consumption of individual fish species by both fish consumers and non-fish-consumers. These rates were determined by combining the average consumption rate for each individual who consumes a particular species with the average serving size in ounces for that individual and then calculating the mean of the individual consumption rates. Overall, all four Tribes consumed significantly more gpd of anadromous fish than resident fish ($p < 0.05$).

Data concerning frequency of overall (fish consumers and non-fish consumers) consumption are generally consistent with data concerning the rates of consumption of each species: 92.4 percent of tribal members consumed salmon, and these individuals ate on average 23.7 (1.16 SE) gpd. Approximately 70 percent of the tribal population consumed trout, and these individuals ate on average 6.62 (0.57 SE) gpd. Although only 22.8 percent of the tribal population consumed whitefish, these individuals ate on average 1.93 (0.36 SE) gpd (Tables 17, 19, Figures 7-8).
Overall, in order of the species listed in Table 19, more salmon is consumed than trout or any other species ($p < 0.0001$); more trout is consumed than lamprey or any other species listed after it ($p < 0.0001$); more whitefish is consumed than sturgeon or any other species listed after it ($p < 0.05$); and more sturgeon is consumed than walleye or any other species listed after it ($p < 0.0001$).

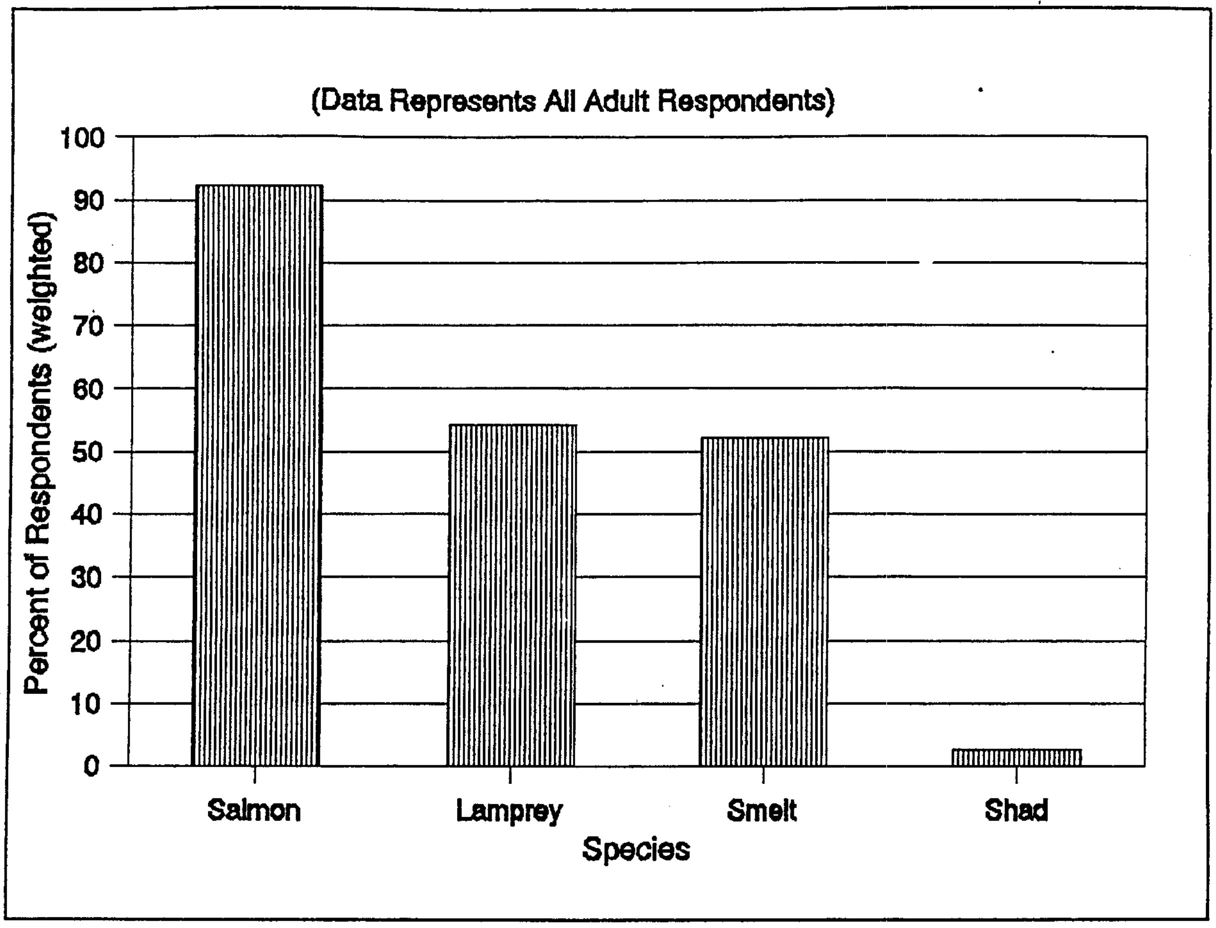

Figure 5 **Anadromous Fish Species Consumed by Adults**

Consumption by Fish Trophic Level

In terms of consumption of fish by trophic level, tribal members consumed an average of 5.31 (0.54 SE) gpd of second level fish (shad, smelt, sturgeon, sucker, whitefish and small trout), 6.62 (0.57 SE) gpd of trout, and 26.6 (1.32 SE) gpd of third level fish (salmon, walleye, lamprey, squawfish and large trout). Overall, tribal members consumed significantly more third-level fish than either trout ($p < 0.05$) or second-level fish ($p < 0.05$), but there is no significant difference in the rates of consumption of trout and second level fish ($p > 0.20$).

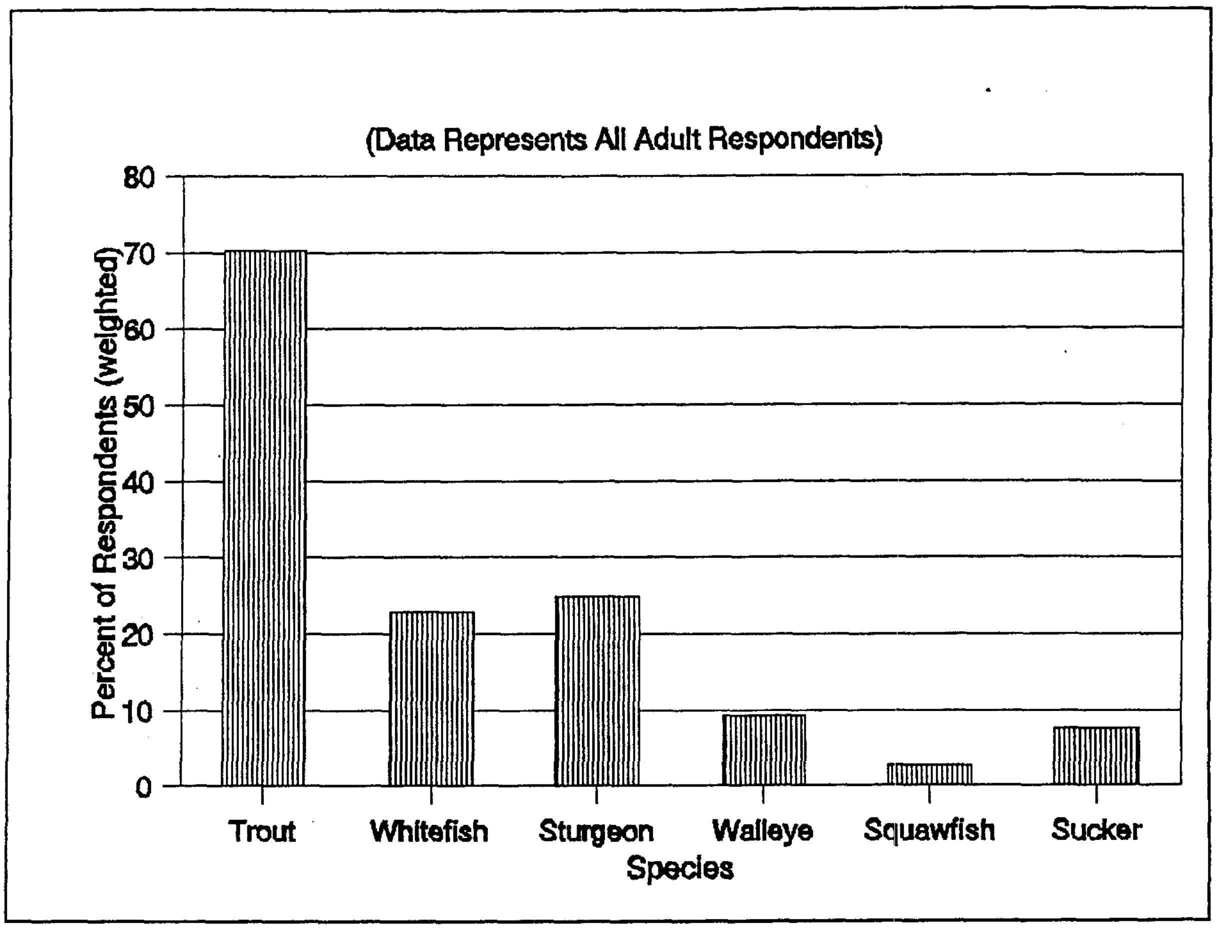

Figure 6 **Resident Fish Species Consumed by Adults**

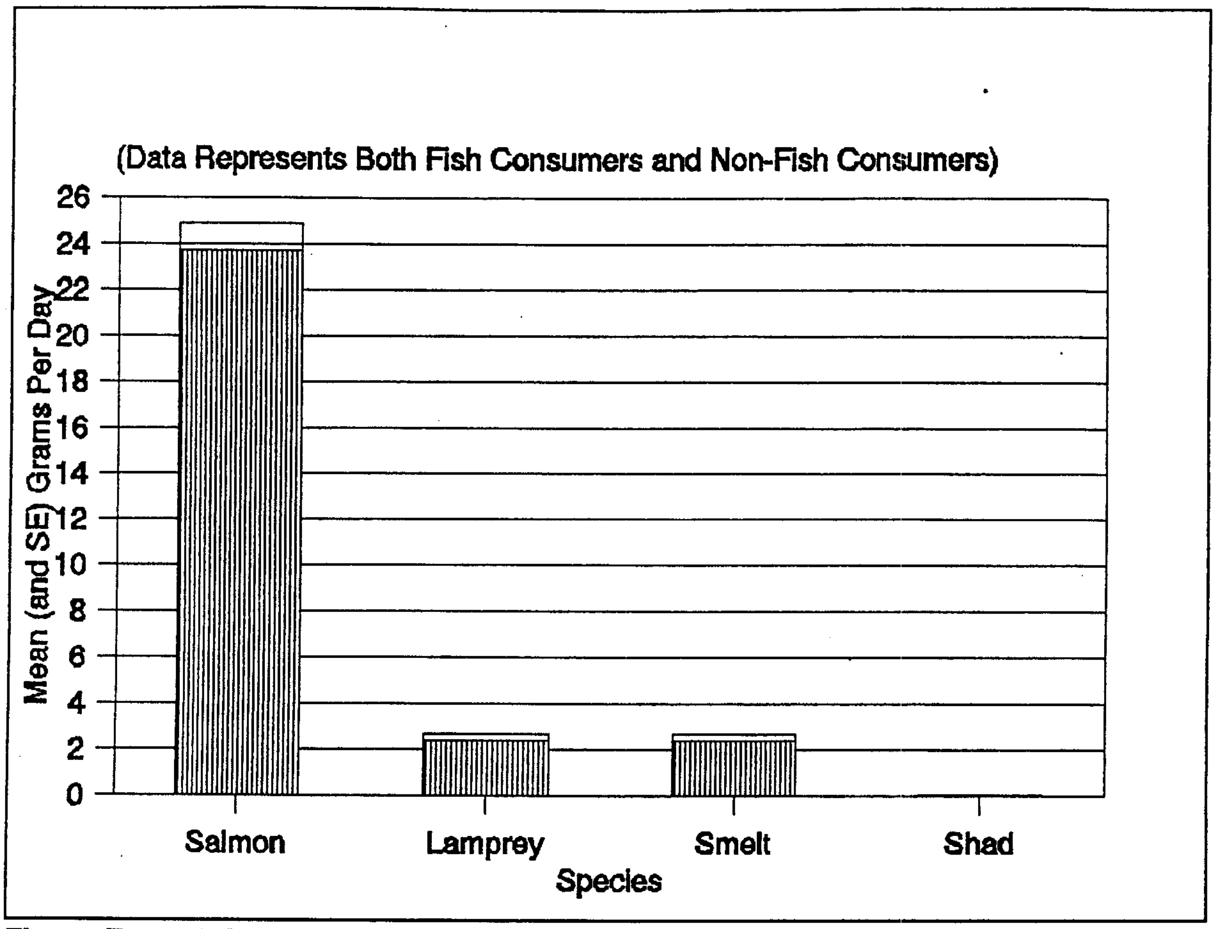

Figure 7 Adult Rate of Consumption of Anadromous Fish Species

Consumption of Specific Parts by Adults

Respondents indicated that the following fish parts were consumed: fillet, skin, head, eggs, bones, and other organs.

Overall, fillet and skin were the two most consumed fish parts for all ten species listed on the questionnaire with the fillet being the number one consumed fish part for all species except lamprey and smelt (Table 20). For lamprey and smelt, the skin was the most consumed fish part. In addition, more than 40 percent of respondents indicated that they consumed salmon head and/or eggs; 37.4 percent of respondents consumed smelt heads; 46.4 percent of respondents consumed smelt eggs; 27.9 percent of respondents consumed smelt organs and; approximately 12% consumed sturgeon eggs (Appendix 18 for Chi-square test comparisons).

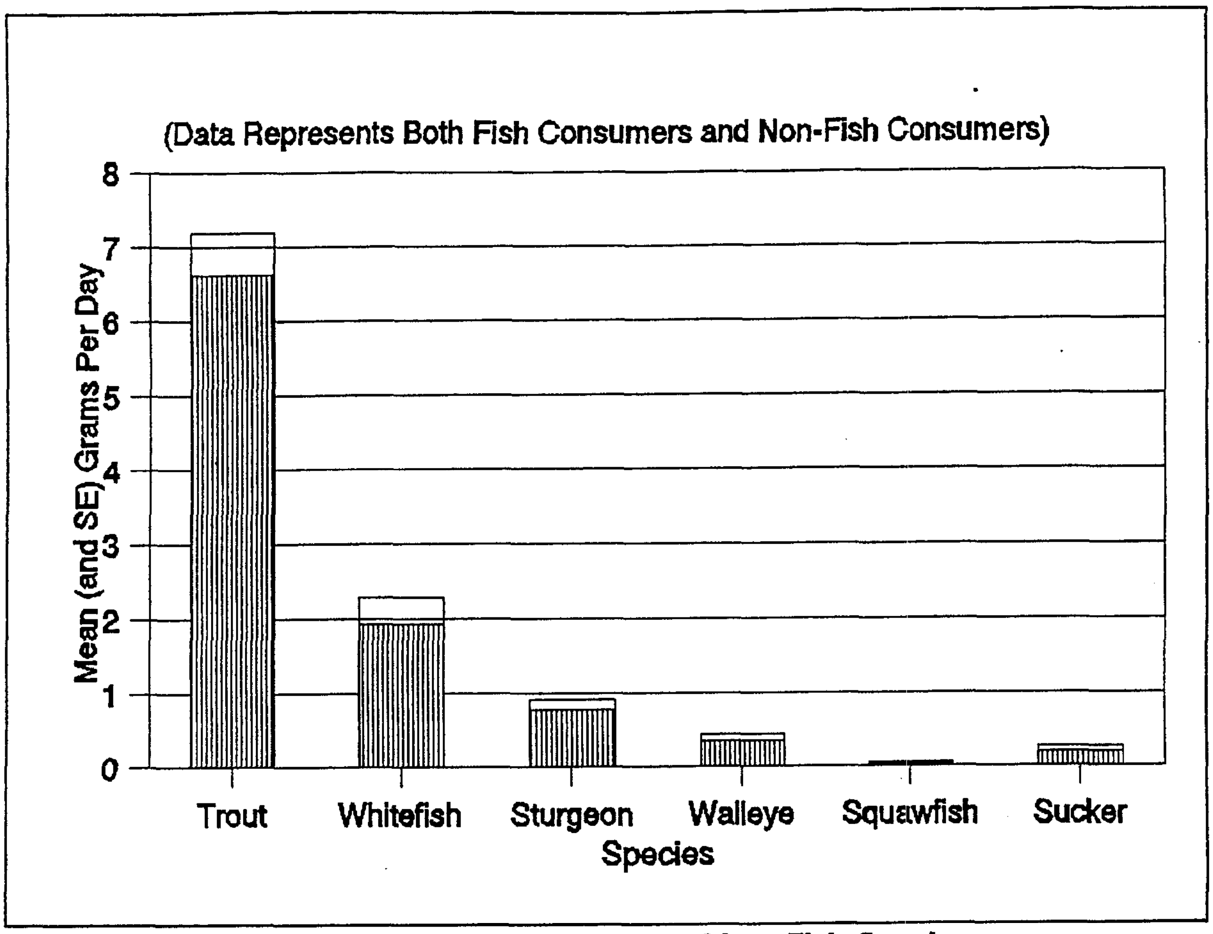

Figure 8 Adult Rate of Consumption of Resident Fish Species

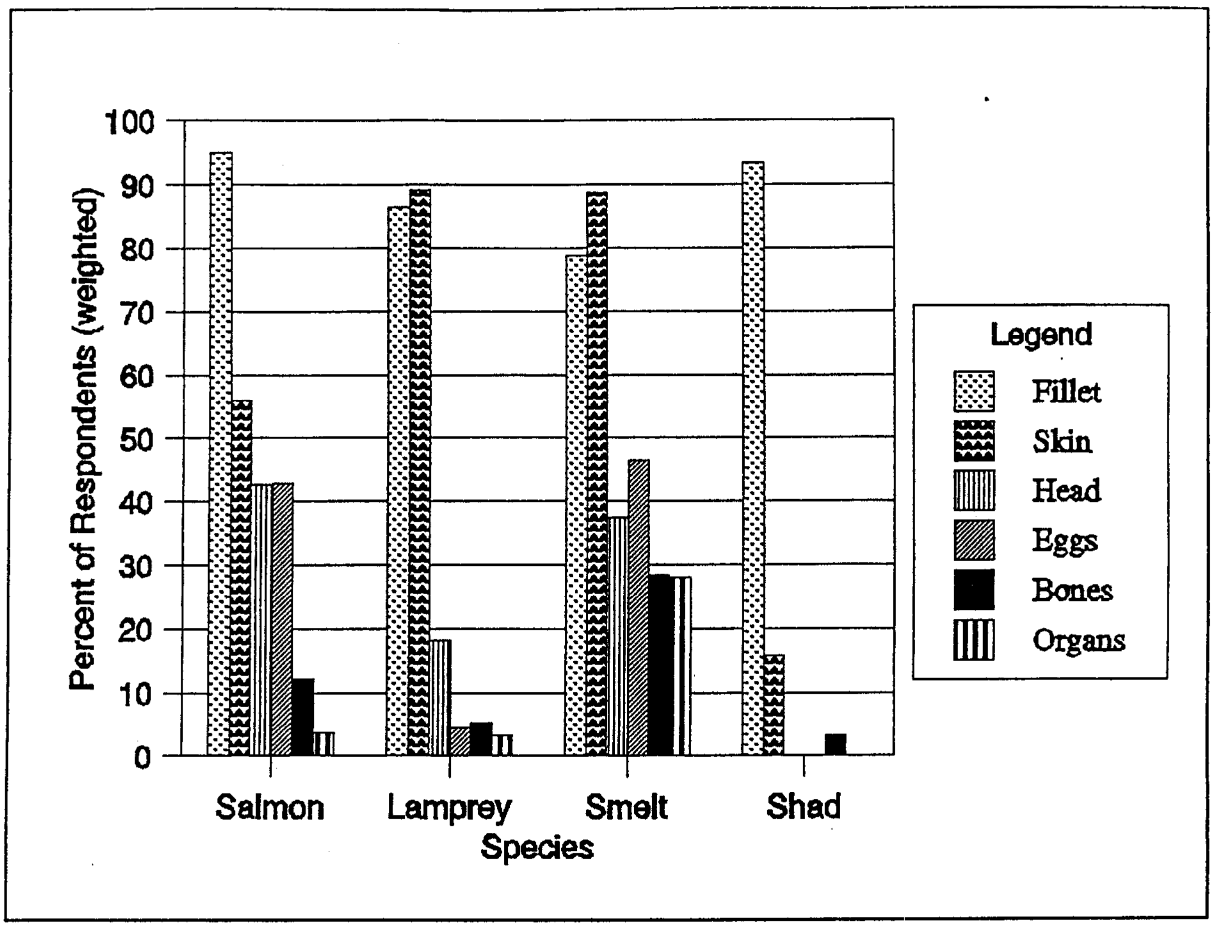

Figure 9 Adult Consumption of Anadromous Fish Parts

Respondents Whose Fish Consumption Has Changed Over the Last 20 Years

Approximately 70 percent of respondents who were older than 30 years believed they and/or their families currently consume a different amount of fish than they did 20 years ago (RR = 99.4%).

Type of Change

Of the 70 percent who indicated a change, 26.2 percent indicated an increase in fish consumption; 68.5 percent indicated a decrease in fish consumption; and 5.4 percent said they eat different species of fish now, but have not changed their overall fish consumption level. Some respondents indicated both a change in the level of their personal fish consumption and a change in the types of fish they eat. Data for these individuals were included in the above percentages reflecting increases or decreases in consumption (Figure 11). Overall, 4.2 percent of respondents said they now

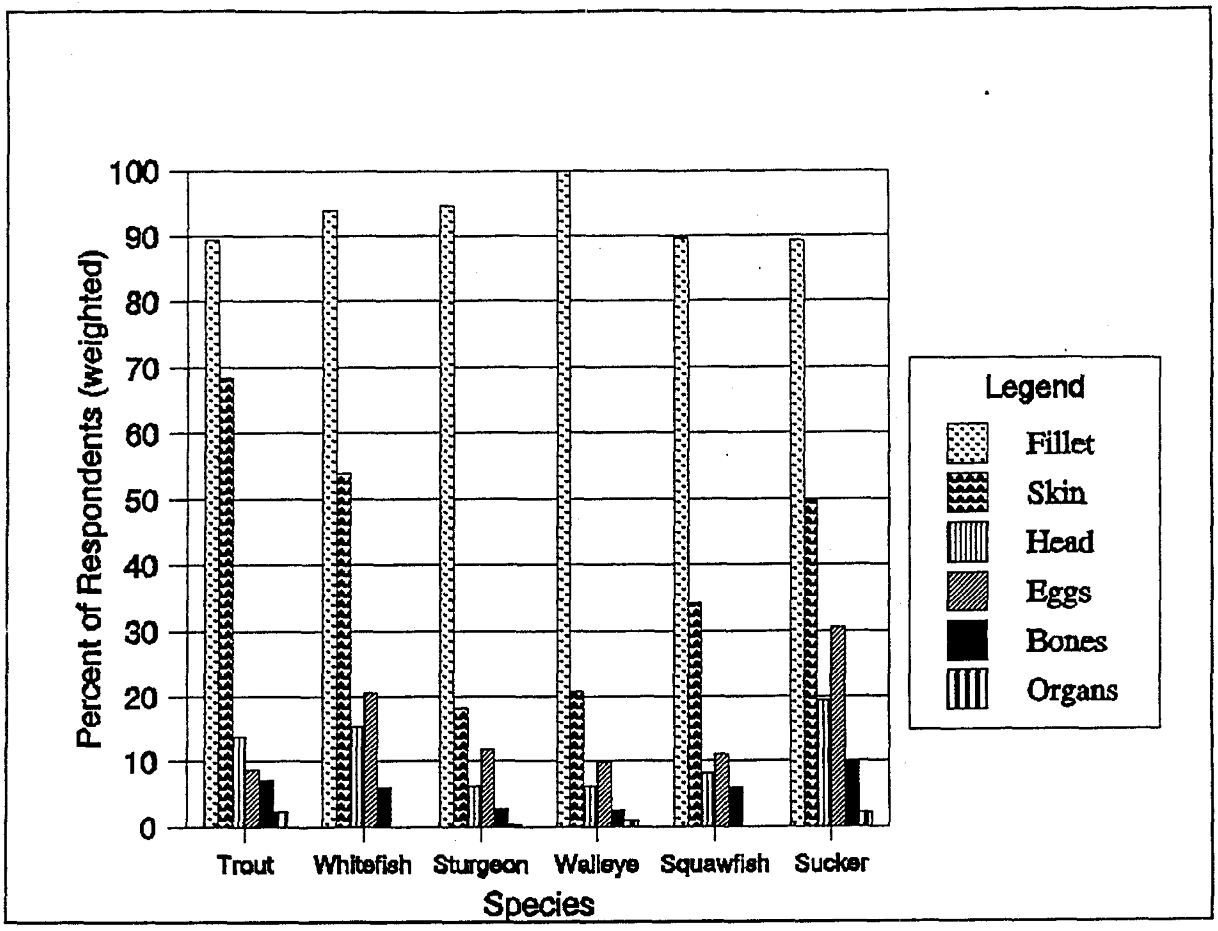

Figure 10 Adult Consumption of Resident Fish Parts

consume more and different types of fish, and 0.6 percent indicated they now consume less and different types of fish.

Quantifiable Change

For the 26.2 percent who indicated that they or their families eat more fish now than 20 years ago, the average increase in the number of fish meals consumed is 2.41 (0.37 SE) meals per week (Appendix 19) (RR = 100%). For the 68.5 percent who eat less fish per week now than 20 years ago, the average decrease in the number of fish meals consumed is 2.83 (0.28 SE) meals per week (Appendix 19) (RR = 100%). The change in the number of grams consumed per day over the last 20 years could not be calculated because the respondents only provided data concerning the current number of ounces consumed per fish meal by themselves, not their families.

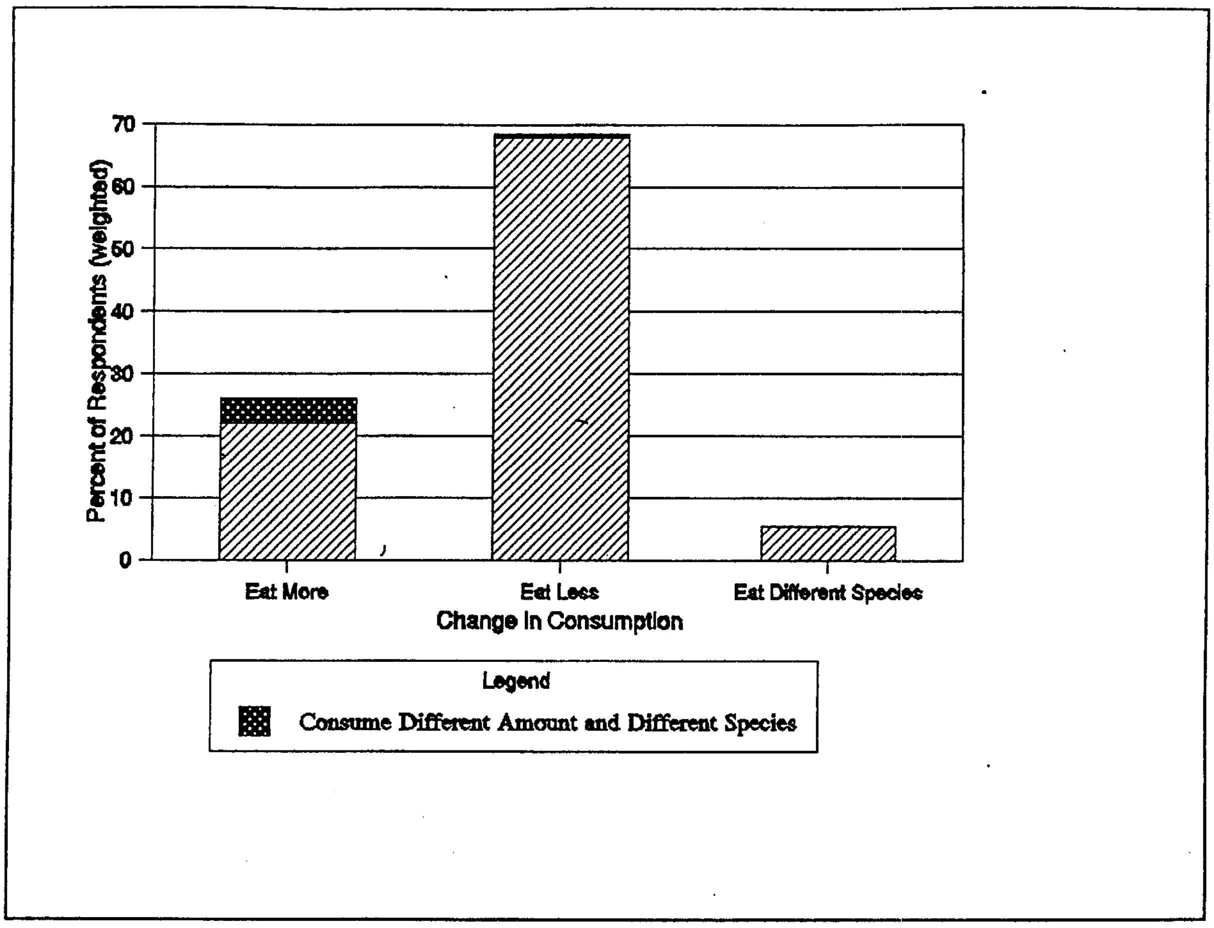

Figure 11 Change in Consumption Over the Last 20 Years

Children

Information on fish consumption was obtained for 204 children; 45.8 percent of these children were male (RR = 98.5%).

Age When Children Begin Eating Fish

The average age when children began eating meals that include fish was 13.1 (0.71 SE) months (Table 21). In addition, approximately 71 percent of these children started eating fish by the end of their first year. Approximately 26 percent of children started eating fish by the age of 6 months. However, the average age of infants when mothers ceased breast feeding was 7.64 (0.62 SE) months (Appendix 20).

Children's Consumption Rates

Approximately 83 percent of the 204 tribal children five years of age or younger about whom information was given ate fish. Children who consumed fish ate an average of 1.17 (0.11 SE) fish meals per week (Table 22), and 3.36 (0.18 SE) ounces per meal (Table 23). The average rate of fish consumption for these children is 19.6 (1.94 SE) gpd (Table 24) (RR = 95.1%).

Consumption of Different Species by Children

Respondents indicated that children, like adults, consumed more salmon and trout than any other species (Figures 14-15, Table 25). Frequency of consumption of the other eight species also closely follows the pattern of consumption among adults.

Children described by survey respondents tended to have higher rates of consumption of salmon (19.0 (1.47 SE) gpd) than any other fish species (Table 26, Figures 12-13). The large standard error of the mean consumption rate for whitefish reflects the fact that one respondent indicated that his/her child consumes 60 meals of whitefish per month; all other respondents who answered this question estimated 2 meals per month or less. Although 60 meals per month could be considered an unreasonable response when compared to other responses to this question, it is equivalent to 15 meals per week, which was not determined to be an unreasonable response when calculating the rate of children's fish consumption throughout the year. Some respondents also indicated that their children consumed other fish species, including bass, black cod, catfish, crappie, and blue gill.

Consumption of Specific Parts by Children

As in the case of adults, fillet and skin are consumed the most frequently by children. Respondents indicated that their children consumed fillet more frequently than any other fish part for all ten species (Figures 16-17, Table 27). Skin was the second most frequently consumed fish part for all ten species, with the skin of lamprey and smelt consumed the most.

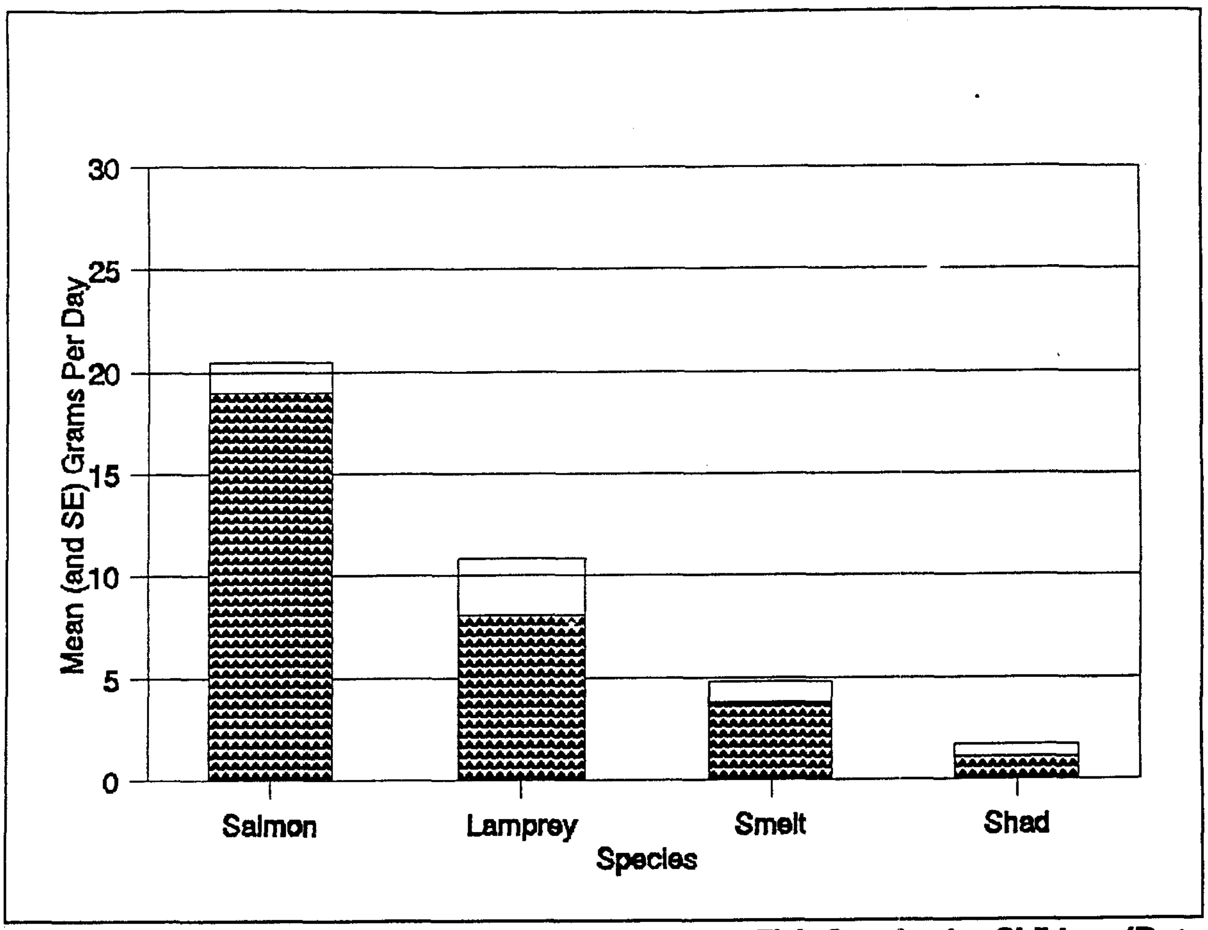

Figure 12 **Rate of Consumption of Anadromous Fish Species by Children (Data Represents Fish Consumers Only)**

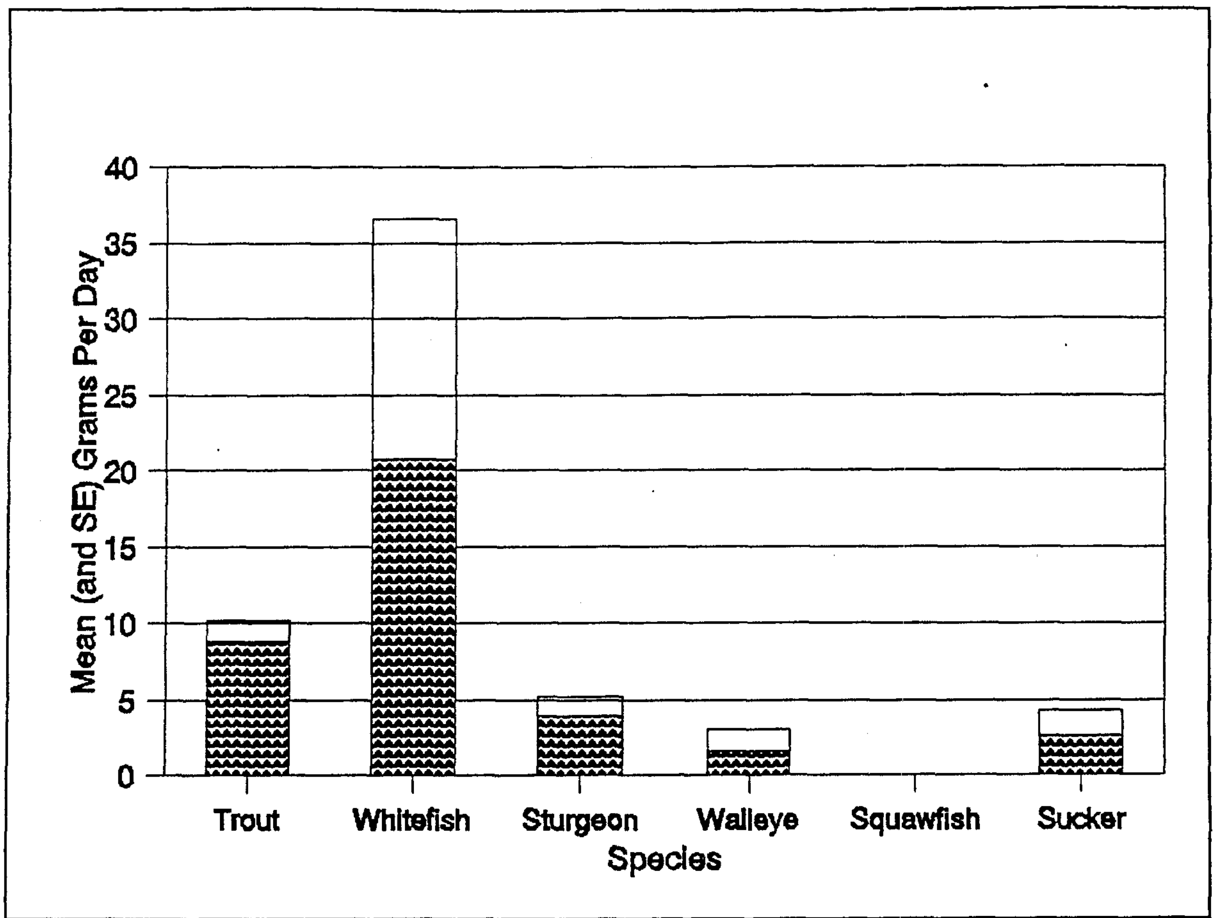

Figure 13 Rate of Consumption of Resident Fish Species by Children (Data Represents Fish Consumers Only)

Fish Preparation Methods

Of all surveyed respondents, 70.3 percent indicated that they regularly prepare the meals in their households (RR = 100%). The largest number of respondents (98.3%) indicated that they bake their fish, and the second largest number of respondents (79.5%) pan fry their fish (Figure 18, Table 28). These two methods were compared, and the frequencies of use were found to be significantly different ($p < 0.005$).

Baking, the method used by the largest percent of respondents, was used the most often, with 34.6 percent of respondents using this method at least once per week and 81.1 percent of respondents baking their fish at least once per month (Table 29). Approximately 75 percent of respondents indicated that they can their fish, and 64.9 percent of these persons do so at least once a month. Although only 39.3 percent of respondents broil their fish, 68.2 percent of these persons use this method at least once per month. In addition, the methods of smoking or roasting fish are used by

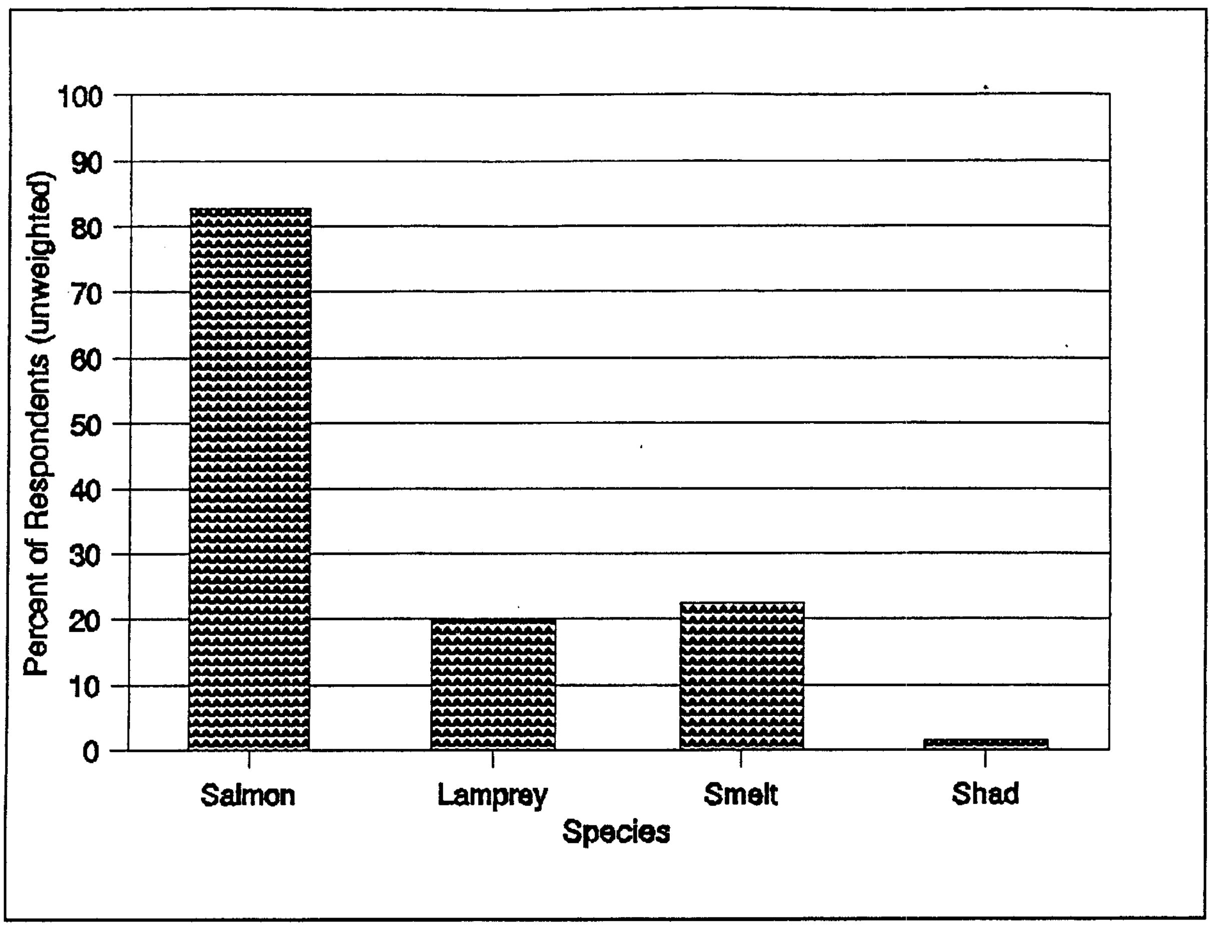

Figure 14 Anadromous Fish Species Consumed by Children

66.2 percent and 71.3 percent of respondents respectively, but only 41.0 percent of persons who roast their fish do so at least once per month and only 46.4 percent of individuals who smoke their fish do so at least once per month. Only 3.2 percent of respondents eat their fish raw, but 34.4 percent of these individuals do so at least once a month.

The Chi-square statistical test was used to compare the weighted frequencies of positive and negative responses to questions concerning the use of each preparation method. Each method was compared to the next most frequently used method (Appendix 21).

Origin of Fish Consumed

Overall, respondents obtained 87.6 (1.1 SE) percent of fish from the following sources combined: self-harvesting, harvesting by family members, friends, ceremonies, and tribal distributions. Survey respondents obtained the most fish on

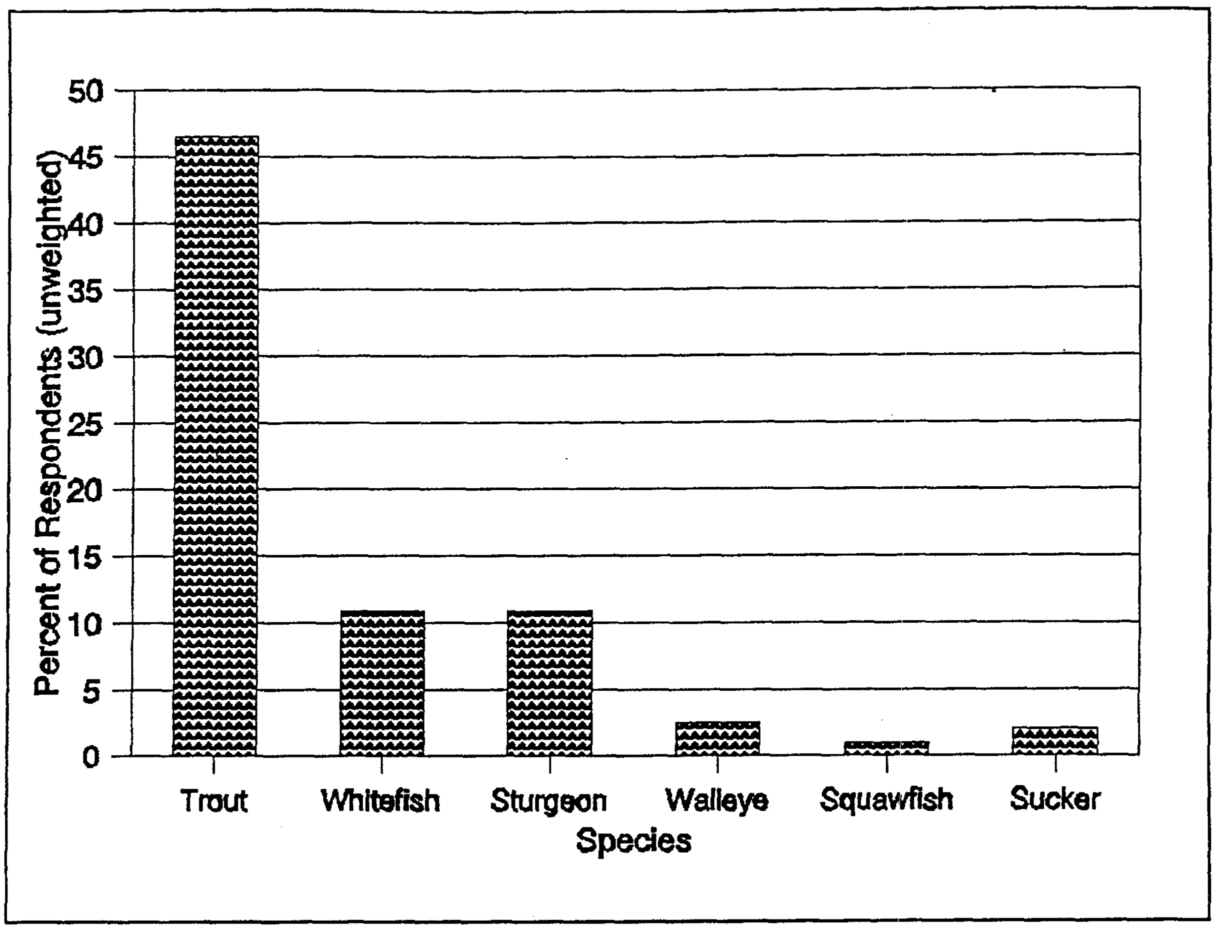

Figure 15 Resident Fish Species Consumed by Children

average through harvesting by themselves or their families (Appendix 22), and approximately 55 percent of surveyed individuals stated that at least 50 percent of the fish they eat is obtained from these sources (Figure 30). Thus, approximately 88 percent of the fish that tribal members consume originates from the Columbia River system.

In addition, 17.4 percent of tribal members obtain 50 percent or more of their fish from tribal distribution, 8.3 percent obtain a major portion of fish from ceremonies, and 11.2 percent from friends who fish. Approximately 7 percent of respondents obtain 50 percent or more of their fish from grocery stores and 2.9 percent from other sources, including restaurants, warehouses, or purchases from tribal fishers (Appendix 22). These fish may or may not have been harvested from the Columbia River basin. Appendix 22 provides information concerning other sources of fish indicated by survey respondents.

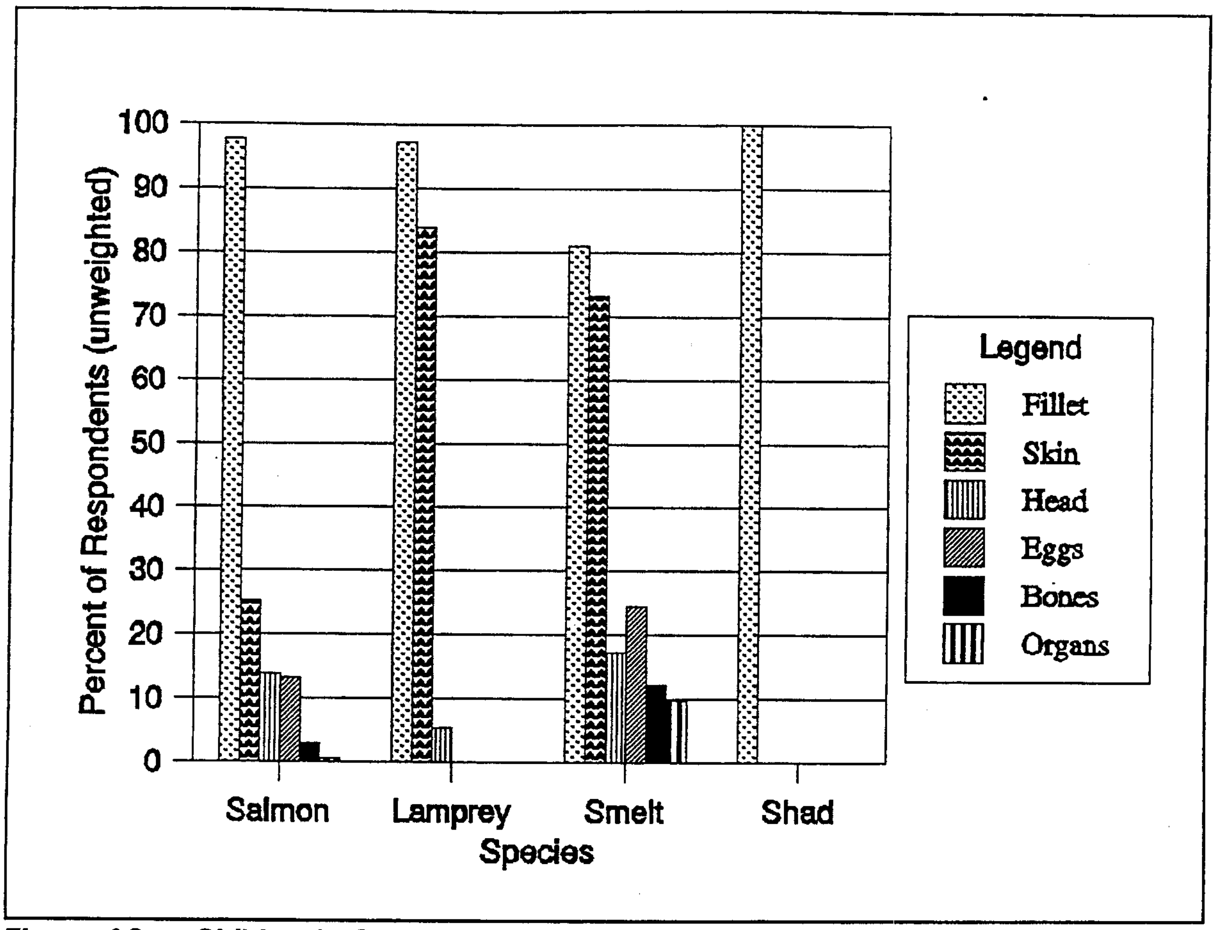

Figure 16 Children's Consumption of Anadromous Fish Parts

Fish Harvesting

Approximately 49 percent of respondents indicated that they harvest fish for personal or tribal consumption (RR = 99.4%). More than 57 percent of these persons travel more than 75 miles to harvest fish (Appendix 23).

Fishing sites used by the Tribes are located throughout the basin (Appendix 24). All sites displayed on the map of the river system (Appendix 9) were chosen at least once. In most cases, however, two or three sites were used by a majority of tribal members for obtaining either anadromous or resident fish.

For example, for catching resident species, 55.7 percent of Nez Perce respondents fish at the South, Middle and North forks of the Clearwater River (Figure 20); 98.4 percent of Warm Springs respondents fish the Deschutes River (Figure 22); 44.2 percent of Yakama respondents fish along the Columbia River mainstem between McNary Dam and the confluence with the Sandy River, while 25.2 percent fish the Klickitat River, and 22.8 percent fish the Yakima River (Figure 24); and finally, 66.1

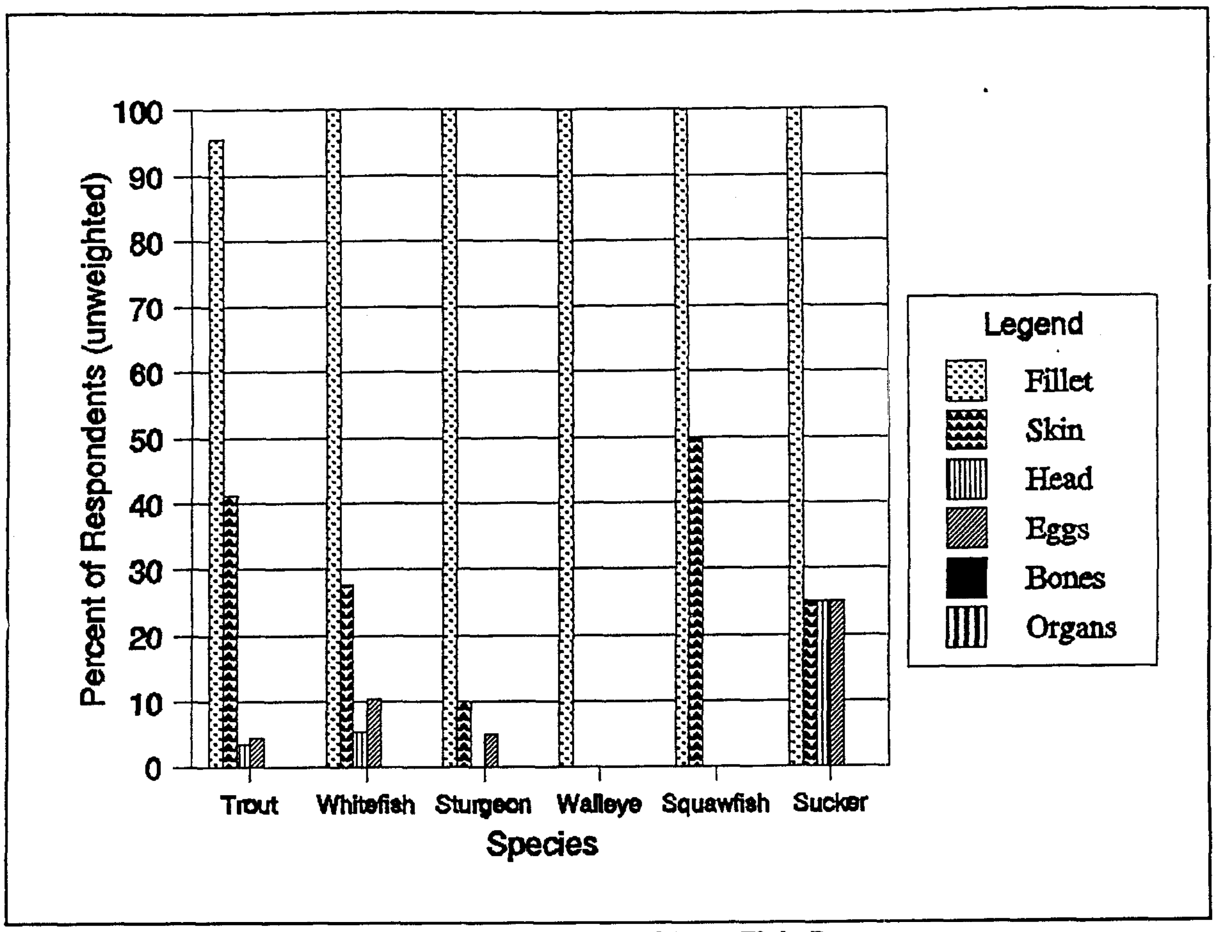

Figure 17 Children's Consumption of Resident Fish Parts

percent of the Umatilla respondents fish the Umatilla River (Figure 26).

For catching anadromous fish, 46 percent of Nez Perce respondents fish the Clearwater River and 24 percent fish the Salmon River Mainstem, Middle and South forks (Figure 19); 75.2 percent of Warm Springs respondents fish the Deschutes River (Figure 21); and 53.3 percent of Yakama respondents fish along the Columbia River mainstem from Chief Joseph's Dam to the Sandy River confluence (Figure 23); and 43.6 percent of Umatilla respondents fish the Umatilla River and 21.8 percent fish along the Columbia River mainstem between Priest Rapids Dam and the Sandy River confluence (Figure 25).

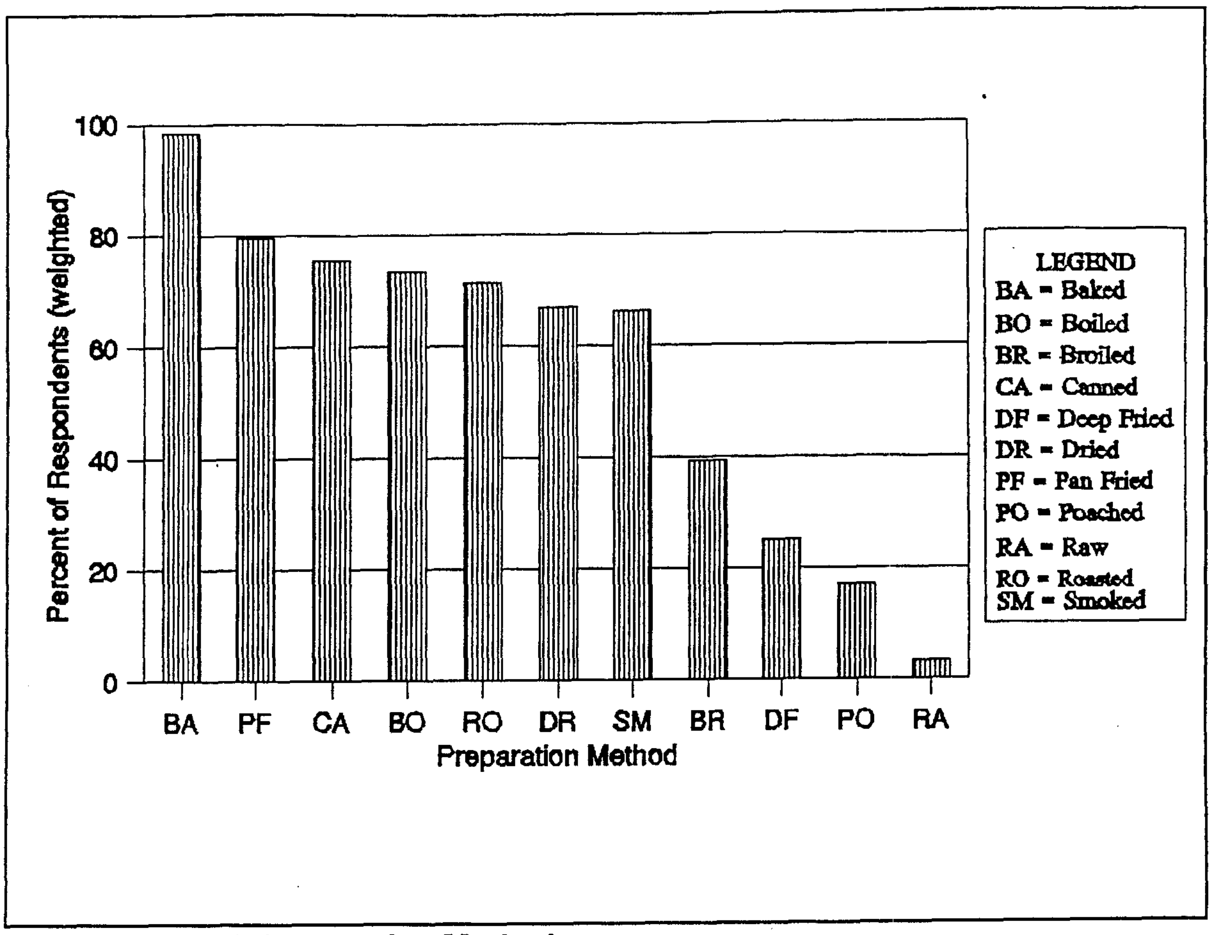

Figure 18 Fish Preparation Methods

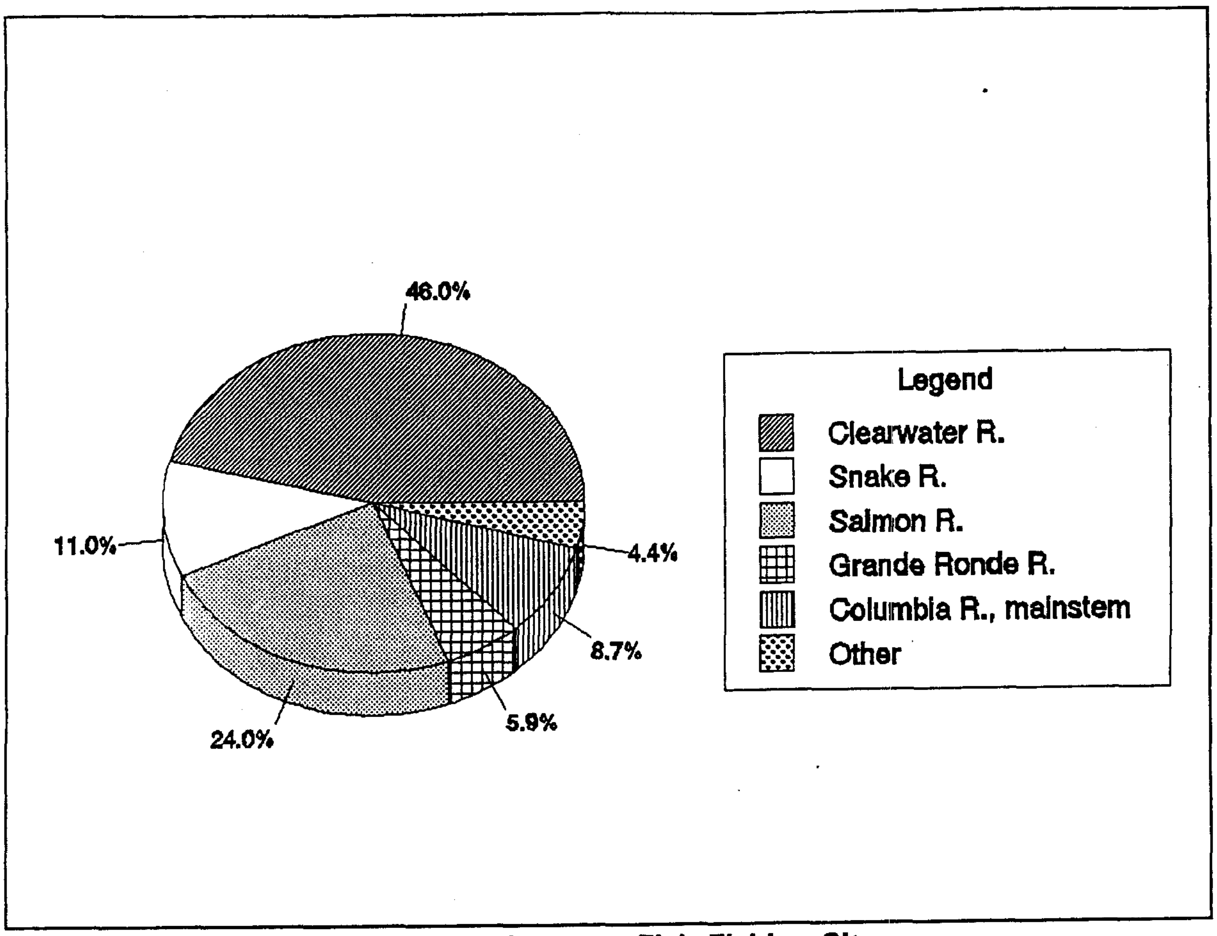

Figure 19 Nez Perce Tribe-Anadromous Fish Fishing Sites

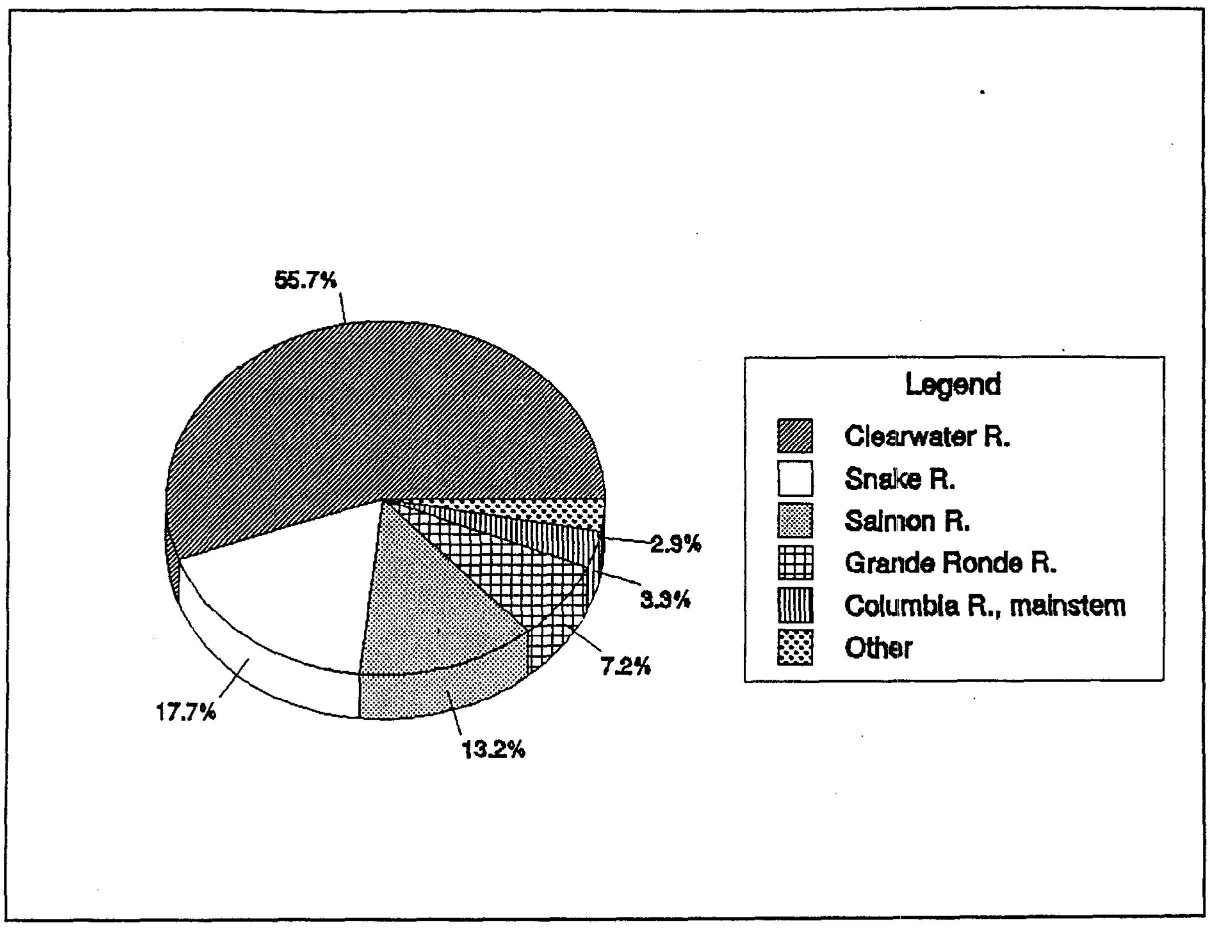

Figure 20 Nez Perce Tribe-Resident Fish Fishing Sites

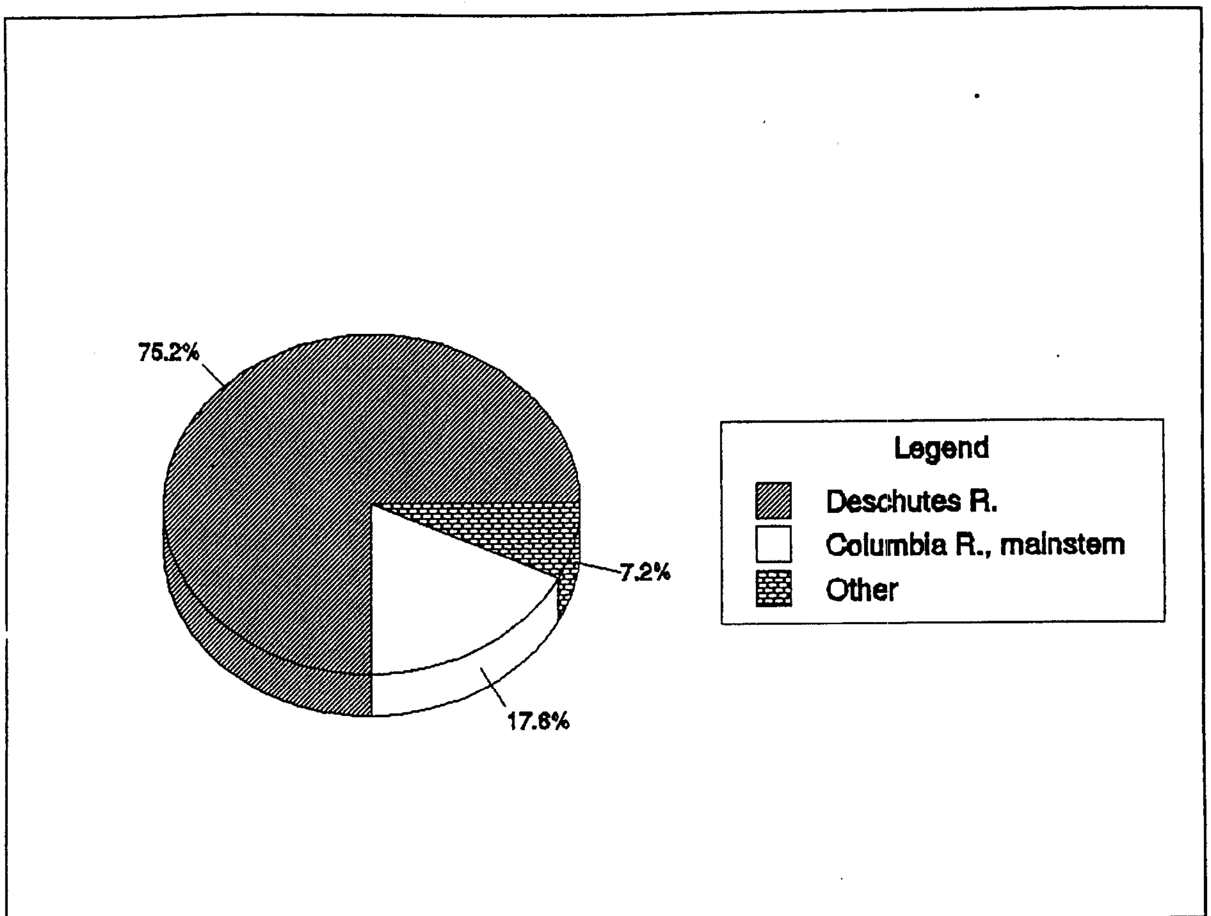

Figure 21 Warm Springs Tribe-Anadromous Fish Fishing Sites

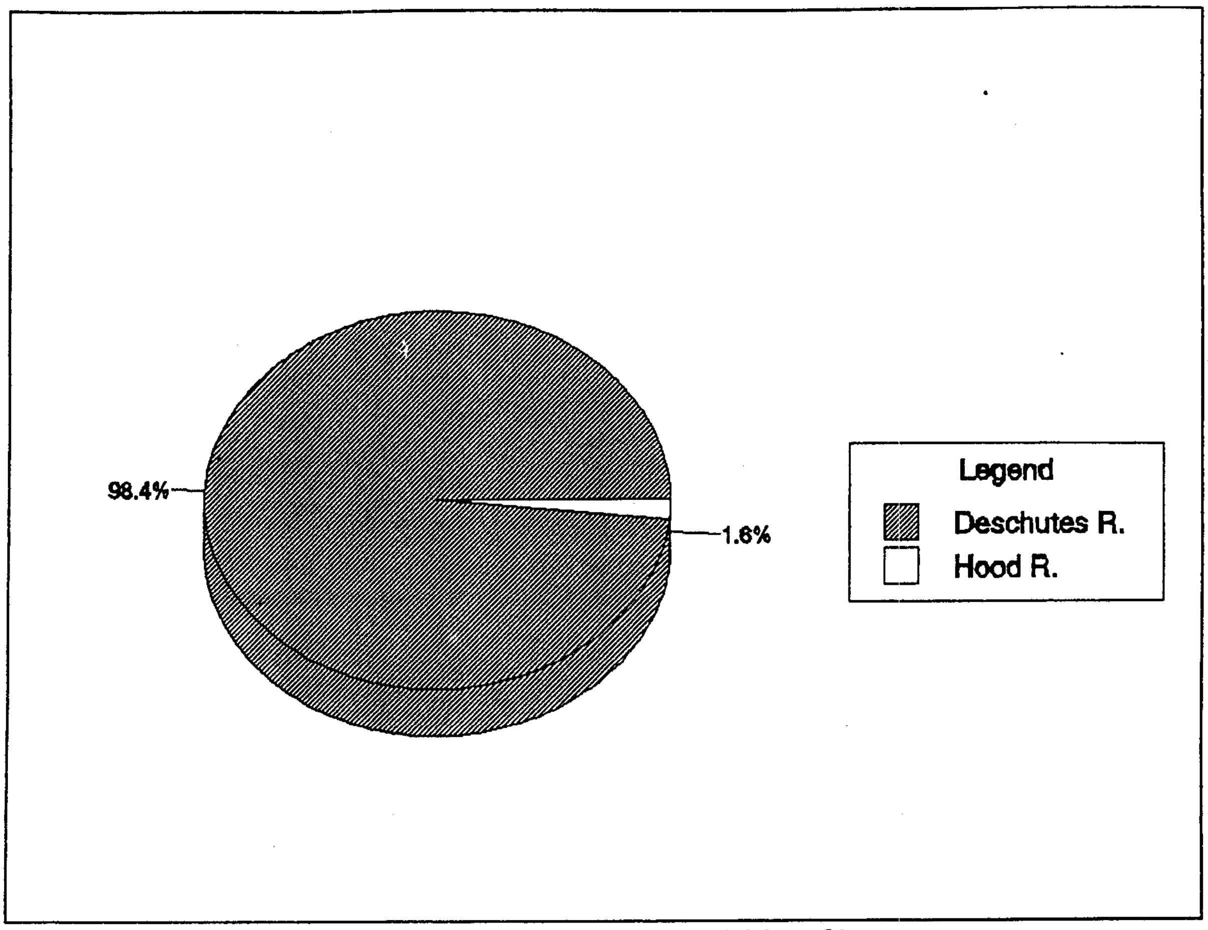

Figure 22 Warm Springs Tribe-Resident Fish Fishing Sites

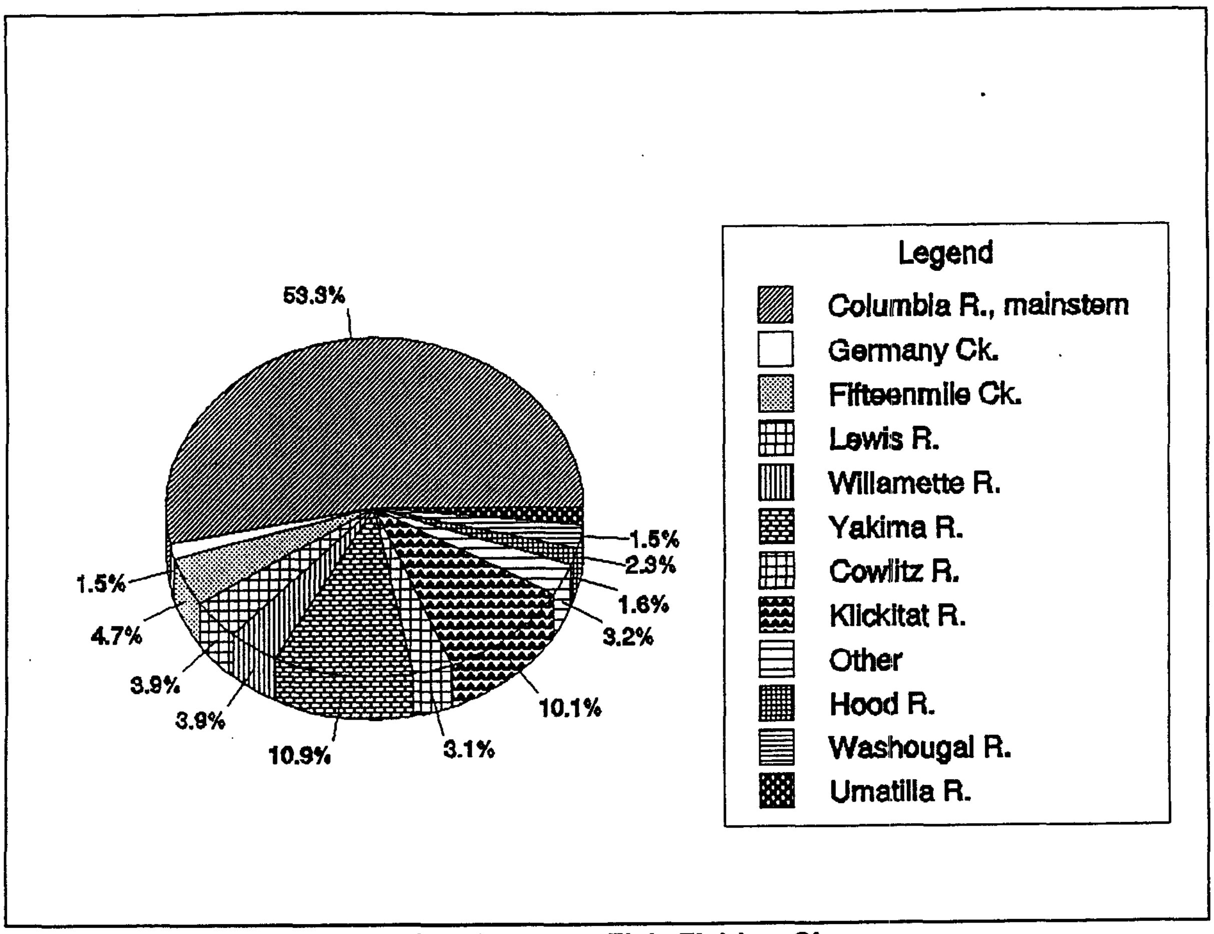

Figure 23 Yakama Tribe-Anadromous Fish Fishing Sites

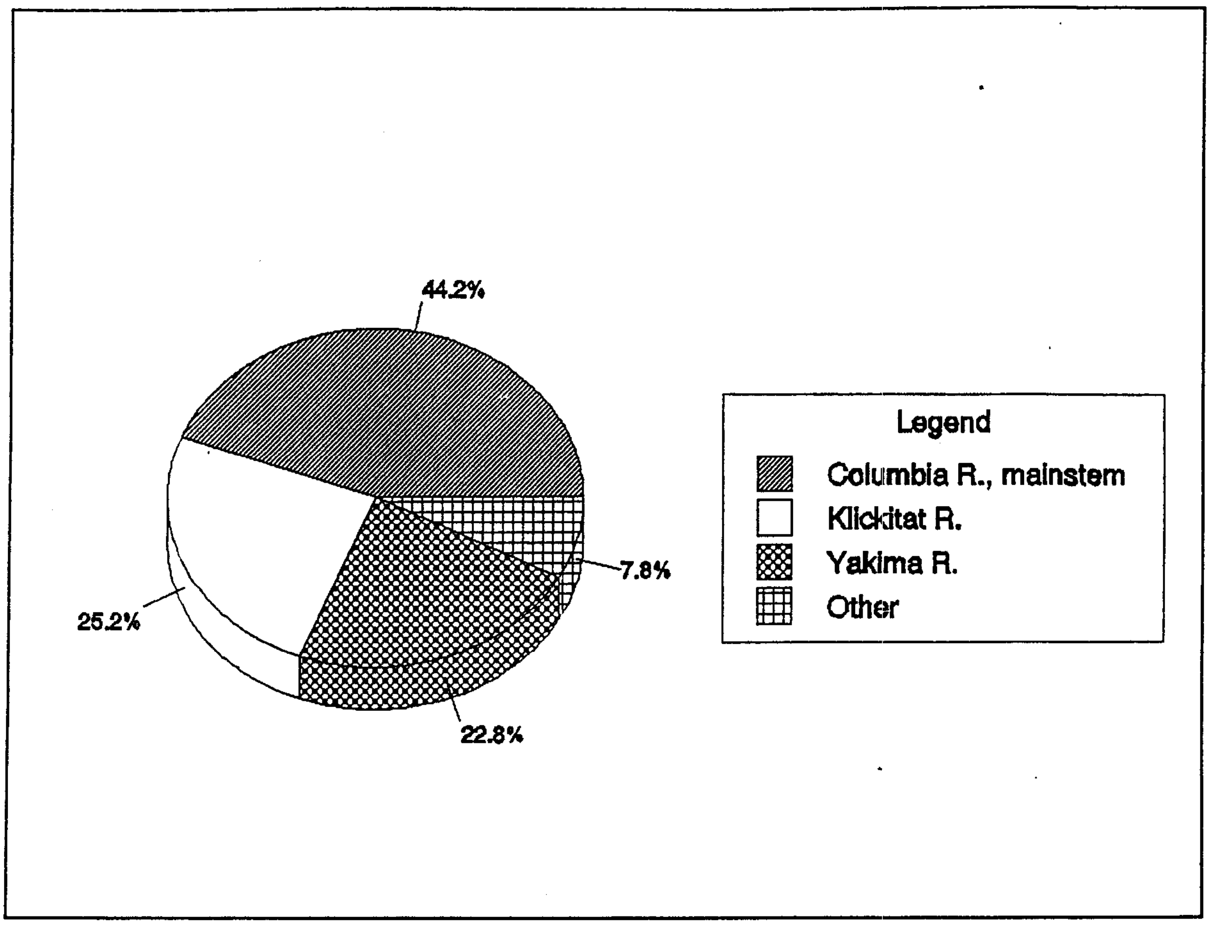

Figure 24 **Yakama Tribe-Resident Fish Fishing Sites**

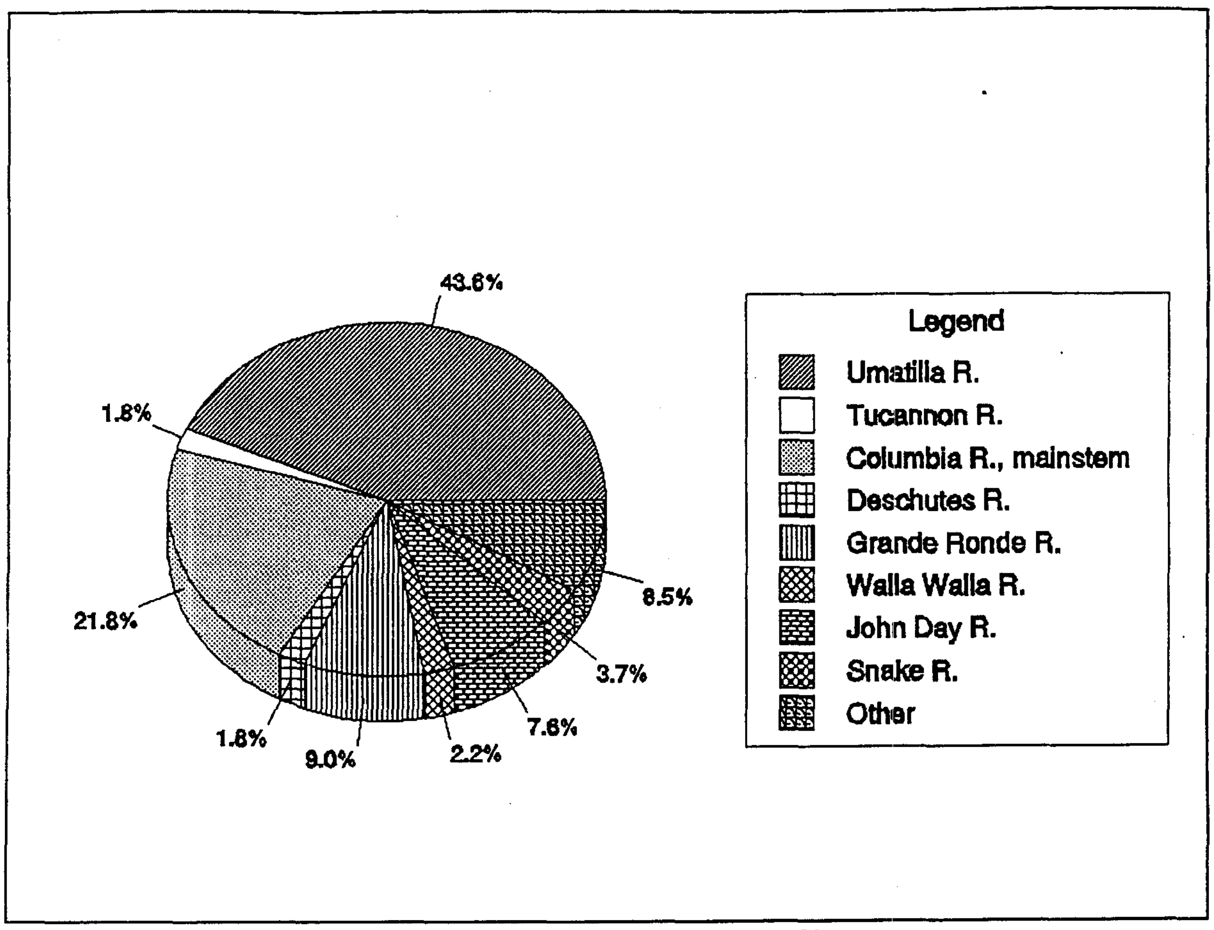

Figure 25 Umatilla Tribe-Anadromous Fish Fishing Sites

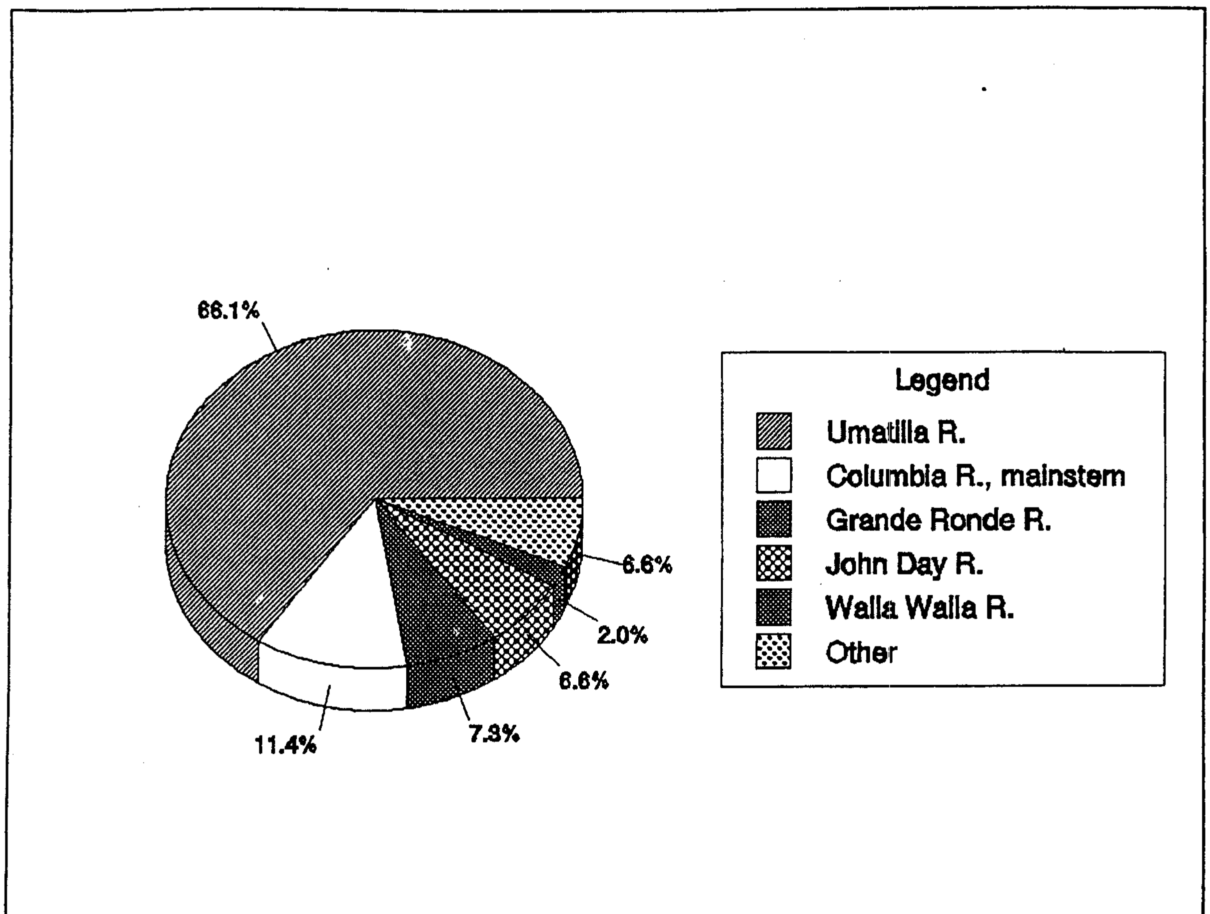

Figure 26 Umatilla Tribe-Resident Fish Fishing Sites

Ceremonial Consumption of Fish

Frequency of Ceremony Attendance

The survey data indicates that 93.3 percent of tribal members from the four Tribes have attended ceremonies or traditional events (Appendix 25). In addition, 52.4 percent of tribal members attend ceremonies at least one to three times per month, and approximately 15.3 percent of individuals attend ceremonies or events at least four to six times per month.

Frequency of Fish Consumption at Ceremonies

Of the 93.3 percent who do attend ceremonies, 72.6 percent of respondents eat fish at nearly every ceremony they attend and 83.7 percent of respondents eat fish during at least half of the ceremonies they attend (Figure 27) (RR = 100%).

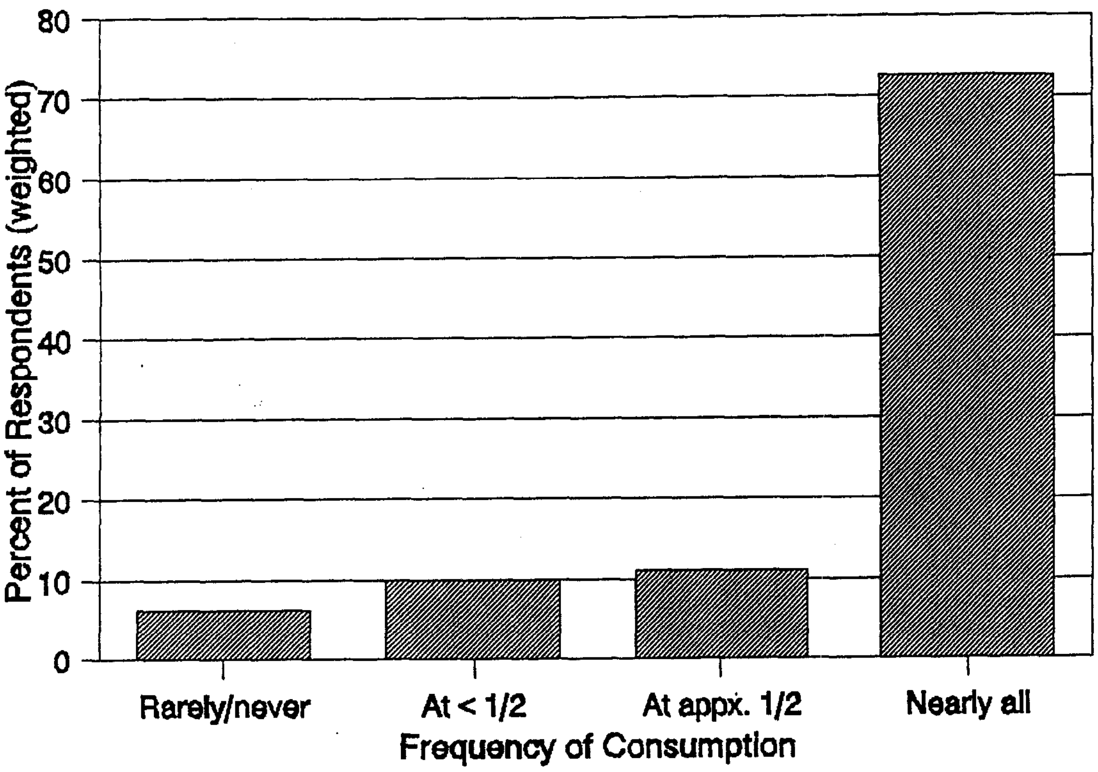

Figure 27 Frequency of Fish Consumption at Tribal Ceremonies

Amount of Fish Consumption During Tribal Ceremonies

The majority of respondents (59.8%) indicated that they eat approximately one to two 6-ounce servings at each ceremony Approximately 40.2 percent of respondents typically eat more than this amount during tribal ceremonies (Figure 28) (RR = 100%).

Finally, data concerning the amount of fish consumed at ceremonies based on the frequency of attendance at ceremonies indicated a relationship between frequency of ceremony attendance and fish consumption at ceremonies such that the more frequently an individual attended ceremonies, the more likely he/she was to consume fish at those ceremonies.

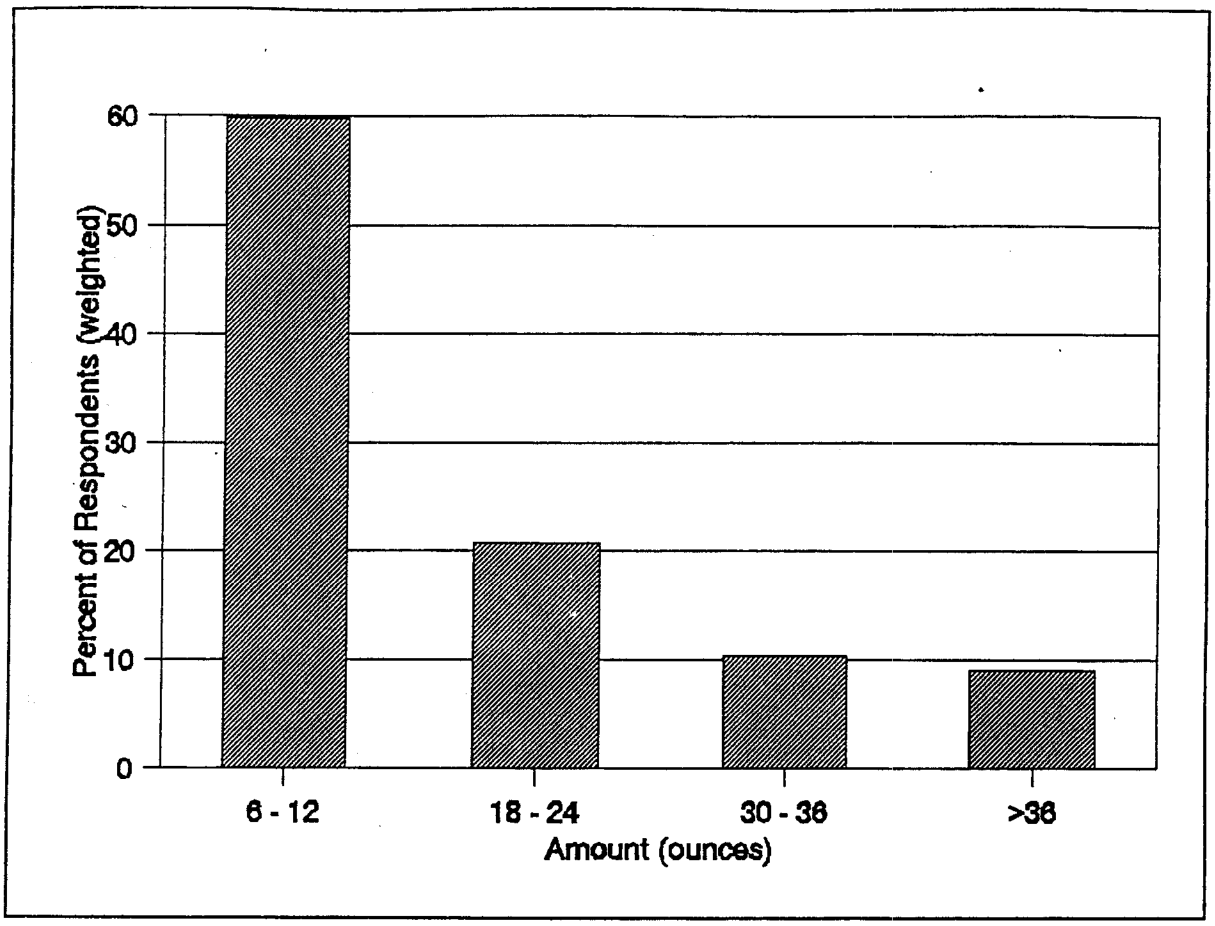

Figure 28 Amount of Fish Consumed at Tribal Ceremonies

DISCUSSION

Comparisons With the Estimated National Fish Consumption Rate for the U.S. Population

Numerous national and state surveys have been conducted over the past three decades to determine the fish consumption rates of the U.S. population and various subpopulations. However, none of these surveys have comprehensively studied the ceremonial and subsistence consumption habits of Columbia River Basin Indians.
In developing their Ambient Water Quality Criteria (AWQC) for various chemicals, USEPA estimates national per capita fish consumption at 6.5 gpd (USEPA, 1980). This value was derived from data obtained from the National Purchase Diary Survey conducted in 1973-1974 (SRI, 1980) and includes all commercially-harvested and recreationally-caught freshwater and estuarine fish and shellfish. According to results from CRITFC's survey, the average fish consumption rate of Umatilla, Yakama, Nez Perce, and Warm Springs tribal members is approximately nine times greater than the average consumption rate estimated for the general U.S. population.

The rates of tribal members' consumption across gender, age groups, persons who live on- vs. off-reservation, fish consumers only, seasons, nursing mothers, fishers, and non-fishers range from 6 to 11 times higher than the national estimate used by USEPA. The consistency of these results suggest that USEPA's AWQC and state adopted water quality standards for the Columbia River basin based on a consumption rate of 6.5 gpd may not be sufficient to protect the health of Native Americans living and consuming fish caught in the area (Figure 29 for some comparisons).

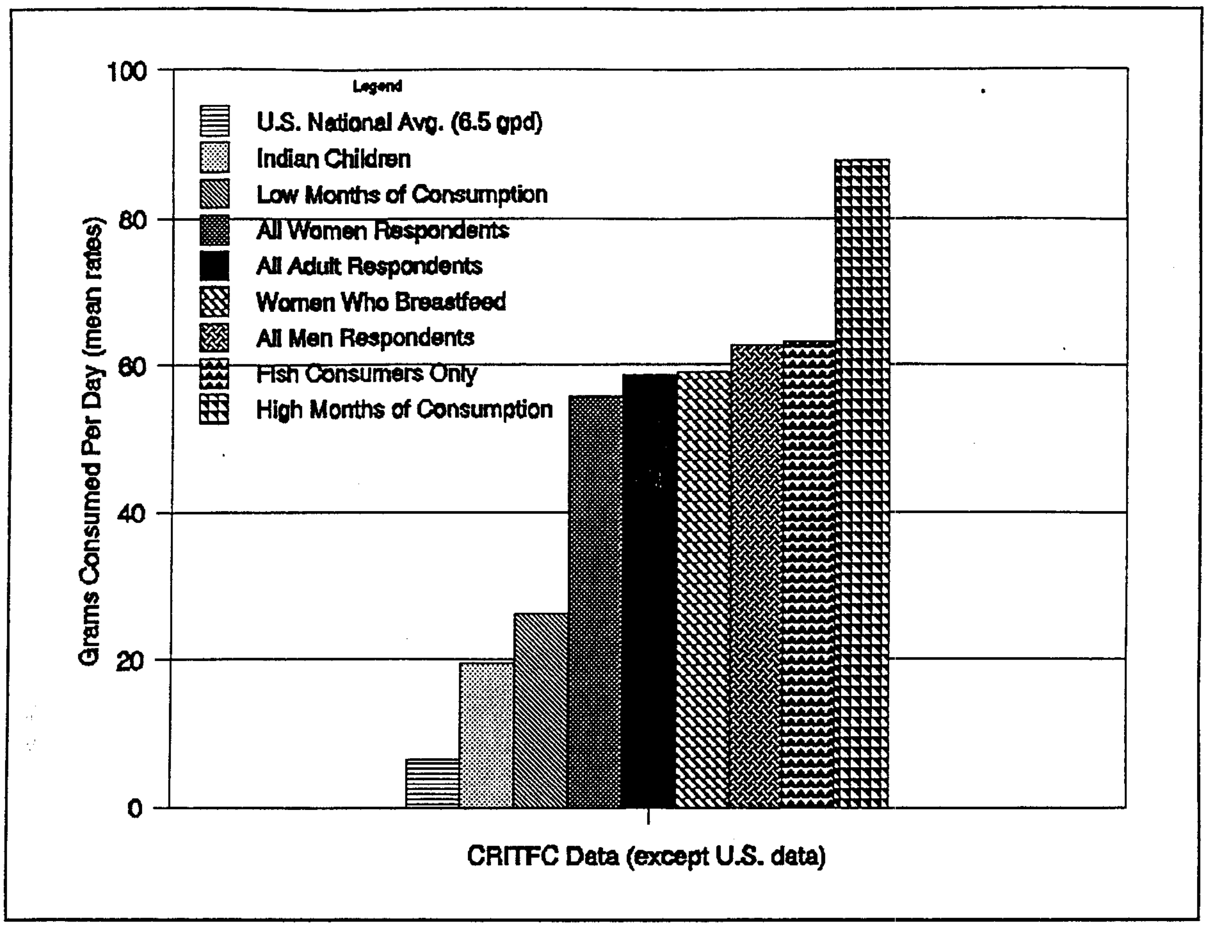

Figure 29 Comparisons of Consumption Rates-CRITFC Data vs. U.S. Average (6.5 gpd)

Comparison of Rates from Other Surveys

Although results from other surveys vary considerably, estimates of fish consumption rates provided by these surveys are consistently lower than estimates determined by the Columbia River Basin Fish Consumption Survey (CRBFCS), even those reporting estimates for tribal populations.

As detailed in the results section, tribal members represented by the CRBFCS consumed an average of 58.7 (3.64 SE) gpd of fish, and the top five percent consumers consumed more than 170 gpd. Because a qualitative comparison of other surveys reveals some interesting differences, a brief overview of fish consumption estimates from other selected national, state and local consumption surveys is provided in the following chart:

Chart 1: Fish Consumption Estimates Presented in Other Surveys

Survey with Reference	Estimate of fish consumption rate	Description
National Purchase Diary SRI (1980)	14.3 gpd	National estimates for consumption of all sources of fish.
U.S. Dept. of Agriculture U.S. Dept. of Agriculture (1986)	12 gpd	Mean estimate for women ages 19-50 years old
	5 gpd	Mean for children ages 1-5 years old.
Northwest Pulp and Paper Association Beak Consultants (1989)	7.91 gpd (1982) 14.59 gpd (1987)	Estimated consumption rates of *Columbia River basin sport fishers with families*. Includes consumption of all species caught, based on fishery landings and population census data.
	20.41 gpd (1982) 36.48 gpd (1987	Estimated consumption rate for Columbia River basin sport fishers only. Includes consumption of all species caught.
	.13 gpd (1982) 1.05 gpd (1988)	Estimated consumption rates for general population for fish caught in lower Columbia River Basin. Excludes sport fishermen and Native Americans.
	5.6 gpd (1982) 16.37 gpd (1988)	Estimated consumption rate of Native Americans (Warm Springs, Yakama, Nez Perce, Umatilla tribes) based on retained landings and tribal population.
Michigan Sport Anglers Survey (West, P., et al., 1989)	24.3 gpd	Native American anglers in survey area.
	23.1 gpd	Native Americans age 60 and older.
Penobscot River Users Survey Maine Dept. of Natural Resources (1991)	11 gpd	50th percentile
	48 gpd	90th percentile
Survey of Maine Anglers ChemRisk (1991)	5.0 gpd	All Maine anglers
	6.4 gpd	Maine fish consuming anglers

Adult Rates of Fish Consumption

CRITFC and the tribes have reported a mean consumption rate of 58.7 gpd which includes all respondents (fish consumers as well as non-fish-consumers) so that the mean rate would be most representative of the entire tribal population. However, it is important to note that for assessing human health damage from ingestion of contaminated fish, it may be more accurate to use estimates based on fish consumers only such that the population most affected will be adequately accounted for. The rate of consumption for fish consumers only was 63.2 gpd.

Children

Although further studies are needed to determine actual fish consumption rates of children, the survey data suggest that similarities exist between fish species and parts consumed by children living in the households of respondents and the respondents themselves. Adults indicated that children also consumed salmon and trout most frequently. Also like adults, children consumed the fillet and skin of all ten species more frequently than other fish parts. These similarities make sense since families who eat together tend to consume the same foods in general. In addition, the data show that children about whom information was given consumed approximately 3 times more fish than the average rate estimated for the general U.S. population. Although young children consumed less total amount of fish per day than adults, the data indicates that children's average consumption per body weight would actually exceed that of adults.

Sources of Fish

As Columbia River subsistence fishers, tribal members obtain on average approximately 88 percent of their fish from harvesting by themselves or their families, friends, ceremonies, or tribal distributions.

Almost half (48.7%) of survey respondents indicated that they fish for personal consumption or for use by their Tribe. However, approximately 77 percent of respondents stated that on average 41.3 (1.59 SE) percent of the fish they consume is obtained through fish-harvesting by themselves or their family members. Thus, fish-harvesting by both survey respondents and their family members appear to be major sources of fish.

Ceremonial Use of Fish

Cultural events, such as tribal ceremonies, are an integral part of tribal culture, and could influence the rate of fish consumption by Native Americans in the Columbia River basin. As survey data show, 93.3 percent of tribal members have attended ceremonies or traditional events and over half of these people attend ceremonies at least 1-3 times per month. Tribal distributions of fish (e.g., at feasts and celebrations) and ceremonies are important sources of fish. Respondents indicated that they obtain on average 23.2 (1.15 SE) percent of fish from tribal distributions and 11.3 (0.08 SE) percent from ceremonies. In general, there appears to be a positive relationship between attendance at ceremonies and fish consumption: the more often a person attends ceremonies, the more likely he/she is to consume fish at those ceremonies. In addition, almost 60 percent of persons who attend ceremonies eat at least 6 to 12 ounces of fish at the events, and about 9 percent consumed more than 36 ounces of fish at the events.

Although tribal meetings and ceremonies often occur on a weekly basis for events surrounding funerals, memorials, name-givings and medicine dances, specific tribal feasts and celebrations occur on an annual basis, as detailed in the following chart (1992 Annual Report, CRITFC).

Chart 2: Tribal Celebrations

Date	Celebration/Feast	Tribe
Feb.	•Lincoln's Day Pow-wow	Warm Springs
	•All-Indian Men's & Women's Basketball Tourney	Nez Perce
	•Washington Birthday Pow-wow	Yakama
Mar.	•E-peh-tes Pow-wow	Nez Perce
	•Speelyi-Mi Annual Indian Trade Fair	Yakama
	•All Indian Invitational Basketball Tournament	Yakama
Mar./Apr.	•Root and Salmon Feasts	Yakama
Apr.	•Wyam Pow-wow	Yakama
	•Rock Creek Longhouse Pow-wow	Yakama
Apr./May	•Root Feast	Warm Springs; Nez Perce; Umatilla
May	•Mat'Alyma Pow-wow & Root Feast	Nez Perce
	•National Indian Day	Nez Perce
	•Satus Longhouse Pow-wow	Yakama
Jun.	•Pi-Ume-Sha Treaty Days	Warm Springs
	•Chief Joseph Memorial	Nez Perce
	•Fathers' Day Fish Derby	Umatilla
	•Treaty Days-Tiinowit International Pow-wow	Yakama
	•Annual Treaty Day All-Indian Rodeo	Yakama
	•Annual Treaty Day All-Indian Golf Tournament	Yakama
	•Annual Yakama Indian Encampment	Yakama
	•Treaty Day Commemoration Pow-Wow	Yakama
	•Eagle Spirit Father's Day Celebration	Warm Springs
Jun./Jul.	•Talmaks Camp Meeting	Nez Perce
Jul.	•Pow-wow, Rodeo, Pioneer Fair/Indian Village	Yakama
Aug.	•Huckleberry Feast	Warm Springs; Yakama
	•Nez Perce War Memorial (Big Hole)	Nez Perce
	•Chief Looking Glass Pow-wow	Nez Perce
Sep.	•Pendleton Round-Up & Rodeo	Umatilla
	•National Indian Days Celebration	Yakama
Oct.	•Nez Perce War Memorial & Four Nations Pow-wow	Nez Perce
	•Kah-Hilt-Pah Pow-wow	Yakama
	•Mid-Columbia River Pow-wow	Yakama
Nov.	•Veterans' Day Pow-wow	Umatilla; Warm Springs; Yakama
	•Thanksgiving Pow-wow	Warm Springs
Dec.	•Christmas Pow-wow/Celebration	Umatilla; Yakama
	•Simnasho Traditional Pow-wow	Warm Springs
	•All-Indian Holiday Basketball Tournament	Warm Springs
	•New Year's Pow-wow	Warm Springs

As can be seen in the above chart, major annual tribal ceremonies occur during 11 months of the year, and several ceremonies occur each month. Approximately 58% of the ceremonies listed above occur during the period extending from April through September, which are the most frequently chosen months of high fish consumption by surveyed respondents. Approximately 28 to 33 percent of major celebrations occur in May and June, the two months of highest fish consumption, while 11 percent occur in January and December, the two months of least fish consumption. These results combined with data concerning the frequency and amount of fish eaten at ceremonies reinforce the theory that ceremonies play an important role in Native American fish consumption.

Seasonal Fish Consumption

Pacific salmon and steelhead migrate to and spawn in gravel beds in the tributaries of the Columbia River. The young fish that are born generally migrate to the ocean after spending a 1-3 years in the freshwater. After 1 or more years, depending on the species and stock, the fish return to the river system to spawn. The following chart illustrates the months during which Oregon and Washington State salmon and steelhead migrate from the ocean to the Columbia River system to spawn (Oregon Dept. of Fish & Wildlife, Washington Dept. of Fisheries, August 1993).

Chart 3: Salmon and Steelhead Seasonal Migrations

Species	Return to River System
Spring chinook salmon	Mar-May
Summer chinook salmon	Jun-Jul
Fall chinook salmon	Aug-Sep
Sockeye salmon	Mar-Jul
Coho salmon	Aug-Nov
Chum salmon	Sep-Mar
Pink salmon	Aug-Sep
Winter steelhead	Nov-Apr
Summer steelhead	Mar-Oct

Overall, salmon and steelhead migrations mostly occur during the months of March through October. These migration months coincide with months of high fish consumption as reported by survey respondents. In addition, the majority of annual tribal ceremonies occur during these months.

Historical Changes in Fish Consumption

Decrease in Fish Consumption

Respondents who indicated that their own and/or their family's fish consumption has changed over the last 20 years were also asked about the reason for this change. While the answers to this question varied, some consistency was apparent. For example, more than half (61%) of the 69 percent who eat less fish indicated that they eat less fish now because there are fewer fish in the Columbia River Basin, fishing seasons are more restricted than before, they are catching fewer fish than they did in previous years, Tribes are distributing less, or fish are "not available". Approximately 36 percent of individuals who eat less fish now indicated reasons related to changes in taste, family size, or their access to fish sources (e.g., fishing sites, distributions, family members who fish). The remaining 3 percent did not indicate a reason for their change in consumption.

Increase in Fish Consumption

On the other hand, approximately 26 percent of individuals indicated an increase in fish consumption over the past 20 years. Approximately 82 percent of these people indicated that they eat more fish now for dietary reasons, because he/she or family members have developed a taste for fish, their family size has increased, or he/she or a family member fishes more now. Eleven percent of respondents indicated that they consume more fish now because more fish is available. However, in some cases, it is unclear whether the increase in availability is due to an increase in the person's accessibility to the source of fish (e.g., change in fishing habits, or in closer proximity to streams or tribal distributions) or whether there exists a quantitative increase in the amount of fish available from the source. The remaining 7 percent did not indicate a reason for change.

Loss of Columbia River Basin Fish Runs

Fish count and harvest data collected in the basin support reasons for decreased consumption that relate to overall decreases in fish harvests and availability of fish. These data also contradict statements of increased consumption that relate to an increase in the amount of fish available in the basin. However, it is possible that certain sites currently have more fish available due to introduction of hatchery-raised fish. In-river run size of Columbia basin salmonid stocks, estimated by the Northwest Power Planning Council (NWPPC, 1985) to have been 10 million to 16 million adult fish before 1850, has declined to about 1.2 million adult fish in 1992 (Palmisano et al., 1993).

In general, as fish populations have been decreasing, ceremonial and subsistence catches have been sharply curtailed. The number of upriver (above Bonneville Dam) spring chinook entering the Columbia has dropped from over 130,000 in 1960 to approximately 110,000 in 1990 and Indian harvest has dropped from over 60,000 fish in 1960 to only 6,900 in 1990. Summer chinook numbers in the Columbia River have fallen from approximately 140,000 fish in 1960 to 28,000 in 1990 with Indian harvest declining from over 55,000 fish in 1960 to less than 100 in 1990. Finally, sockeye salmon numbers have decreased from 180,000 fish in 1960 to approximately 50,000 in 1990 and Indian harvest for sockeye has dropped from 120,000 in 1960 to only 2400 fish in 1990 (Oregon Dept. of Fish and Wildlife and Washington Dept. of Fisheries, 1991).

Since the start of this project in 1990, four stocks of salmon have been listed under the Endangered Species Act. Consequently, tribal harvest has been greatly reduced because of low returns of fish to the Columbia River Basin. In order to meet escapement goals for individual species of salmon, tribes have continued to curtail their harvest while efforts to increase fish runs through mitigation and fish production continue. Should such efforts succeed, it is likely that consumption of fish by tribal members will approach that of historical times and will thus be higher than it is today. Indeed, data from CRITFC's fish consumption survey illustrate that a significant portion of tribal members consume less fish today than they did twenty years ago mainly because fewer fish exist in the river system.

LIMITATIONS

Uncertainty

Although problems with data accuracy and bias appear to be minimal, there are some issues relating to the methodology and responses received that could potentially create a bias in the overall consumption data. However, any potential bias could, in actuality, bias the data in either direction such that estimated consumption rates of tribal members could be increased or decreased if critical elements creating potential bias were removed.

Sampling Bias

Because the sample population was selected from patient registration lists provided by the Indian Health Service (IHS), it is possible that the sample population had some health related biases affecting their diet. Although the IHS patient registration lists includes all tribal members who register for IHS services and is not necessarily exclusive of tribal members needing or receiving health care, no criteria were applied to the initial sample selection procedure to eliminate those tribal members with particular illnesses or health problems that could influence their dietary habits. Without further investigation of each person's health history, it is impossible to identify if a significant proportion of respondents have certain health conditions that require them to consume more or less fish.

Location Bias

A majority of the interviews (99.8%) were carried out at a central location on each reservation. Of all attempts made to contact interviewees on a door-to-door basis, only one participant was reached and interviewed at their home. During preliminary phases of the survey, concerns were raised that the use of monetary incentives to encourage interviewees to come to a central location may result in a higher response of those individuals living closer to the survey area, thus resulting in a bias in the sample.

It is plausible that individuals living closer to the interview site were more willing or able to travel the required distance. For reasons which outweighed the monetary or personal incentive to participate, those living farther away may have been unable or unwilling to travel and might have preferred to have the interview conducted at their home. Thus, only 8% of those surveyed lived beyond 30 miles from the interview site whereas 15% of the non-surveyed individuals lived beyond 30 miles from the interview site. However, 53% of surveyed individuals lived within 10 miles of the interview site and 41% of non-surveyed individuals lived within 10 miles of the survey site. Similarly, of the 14 individuals living beyond 70 miles of the survey site, 64% were surveyed and only 36% were not.

The top four reasons identified by interviewers for why an individual could not be interviewed were, respectively: 1) moved out of survey area; 2) no reason listed; 3) a total refusal to be interviewed and; 4) no phone or a disconnected phone. These four reasons accounted for 86% of the reasons listed by interviewers for unsuccessful interviews. Other reasons listed that may contribute in some way to location bias include: mental or physical disability; in prison; not at home when contact was attempted and; simply missing the scheduled appointment.

Gender Bias

Statistical analyses of the gender of individuals surveyed and not surveyed reveal that more females were surveyed than males and more males were not surveyed than females. Considering that males eat significantly more fish on average than females with males consuming about 13 more grams per day than females, a bias in favor of female individuals in the sample could create a lower estimate of overall tribal fish consumption. Also, males who ate more fish may have been more likely to participate in the survey than males who ate less fish and those males who ate less fish, may have been non-respondents.

Timing of Survey and Length of Survey Period

Conducting the survey during a period of high or low fish consumption could bias individuals' responses. It is plausible that people would tend to indicate higher or lower consumption rates in accordance with when they were questioned about their consumption such that an individual would estimate a lower rate if they were questioned during a month of low consumption and a higher rate if questioned during a period of high consumption. Since this survey was conducted during November, a month of low fish consumption as reported by survey respondents, consumption rates provided in this report could underestimate actual tribal consumption.

Also, respondents may be likely to under-report consumption of fish species not in season at the time the survey was conducted and may have over-reported consumption of fish species in season during the interview period. However, any possible bias resulting from the timing of the survey would be addressed if the survey were conducted over an annual cycle with re-surveys of initial respondents.

Response Rates on Individual Questions

The lack of a 100 percent overall survey response rate may present uncertainties that cannot be fully characterized. Although some individual questions had response rates as low as 75 and 80 percent, response rates for the key findings on adult fish consumption had response rates very close to or at 100 percent.

In general, when presented with uncertainties in individuals' responses, criteria were employed to produce a low-end estimate of fish consumption. For example, responses deemed unreasonably high (i.e., outliers) were not included in calculations of consumption rates. Outliers were removed from data sets of weekly consumption estimated by four adults and for one child. In addition, when respondents indicated ranges of ounces or meals, the lower end of the range was used to calculate rates even if the response was reduced to zero ounces or fish meals consumed.

Non-Fish-Consumers

Survey results indicate that only 7 percent of tribal members rarely or never ate fish. Because the percentage of non-fish-consumers was so low, the 90th, 95th and 99th percentiles of consumption for the entire population was the same as for those respondents who consumed the species. The uncertainty surrounding this low estimate of the number of Native American non-consumers could be produced in part by sampling bias. For example, individuals in the sample who were not surveyed were never questioned about their like or dislike of fish or their overall fish-consuming habits. It is possible that some of those non-surveyed individuals failed to participate because they thought that their contributions would be meaningless if they did not eat fish. Therefore, fish consumers may be slightly over-represented in the respondent pool thereby creating an overestimation of fish consumption rates.

Origin of Fish Consumed

Questions concerning weekly fish consumption, serving size, species and fish parts were directed at fish consumed from the Columbia River basin as well as "other" sources. Therefore, rates of consumption represent fish obtained from all sources. The question concerning sources of fish clarifies the percentages of fish consumed that originate from self/family member harvesting, ceremonies, and tribal distributions. Because the tribal commercial fishery is designated along the mainstem of the Columbia River from the McNary dam to Bonneville dam and throughout the many tributaries within the Columbia River basin it is assumed that fish obtained during these activities and events originate from the basin.

Children

Although a more detailed portrait than that presented in this report of children's fish consumption is required, it is worth noting that some respondents provided the same information for their child's consumption as they did for their own. Although it is not unreasonable for a child to consume similar amounts of fish as adults, the uncertainty surrounding responses to questions about children's consumption may have resulted from misinterpretation of the question or the convenience of indicating similar information. Any resulting bias in information provided for children's consumption is difficult to predict and analyze.

Fishing Sites

Survey questions concerning fishing sites were specifically requested for only the 10 species listed in the survey. Only six people from one Tribe identified "other species" that they consumed. Moreover, some individuals, instead of identifying a numbered site on the map provided, specified names of sites that could not be identified on the map (e.g., reservoirs, lakes, etc.) These sites were not included in the analysis of fishing site usage. Therefore, results describe fishing sites used by Native Americans for obtaining only the ten species listed on the questionnaire and may not describe the full extent of fishing sites used throughout the basin.

Dietary Recall

Respondents who consumed fish during the 24 hours preceding the survey interview estimated significantly higher overall consumption rates than those who did not eat fish during that period. This difference could be due to several factors. First, persons who had so recently consumed fish may have been more likely to overestimate the number of fish meals they eat each week than those who had not consumed fish for several days or several weeks. On the other hand, individuals who ate fish during this time period may be more accurate in the data they provide concerning the number of ounces they eat in each meal. It is also possible that persons who consume high amounts of fish throughout the year would have been more likely to have consumed fish during the 24 hours preceding the interview than individuals who consume less fish throughout the year. Thus, these persons would not necessarily be overestimating their yearly intake.

Regardless of the reason(s) for the difference in consumption rates, the overall rate of consumption for consumers and non-consumers is likely to be a low estimate since the survey was conducted during the season (October through February) identified by the majority (53.0%) of respondents as months of low fish consumption.

Additional Research

Although this report provides detailed information on the fish consumption rates, patterns and habits of tribal members, several issues require further investigation, especially if a complete health damage assessment is to be conducted. For example, while this report provides information for only one child in the household of respondents with children a more thorough investigation of fish consumption by Native American children as a clearly defined subpopulation may be useful to confirm the accuracy of these findings. In addition, this report does not provide estimates of consumption that take into account varying body weights. Given the differences in body weight and size between ethnic groups, fish consumption estimates in g/kg/day should be calculated.

The questionnaire also did not request information on trimming of fat, puncturing, and skin removal which in conjunction with certain cooking methods can greatly influence the contaminant loading in fish tissue and thus an individual's actual exposure to toxic pollutants from ingestion of fish tissue.

Also, consumption data alone do not define an individual's exposure to toxic pollutants. Indeed, this fish consumption survey report is not a health risk assessment of tribal members who consume fish. To conduct a health risk assessment of tribal members from consumption of fish, fish consumption data need to be applied with information identifying actual levels of toxics in the fish tissue individuals are consuming. Information from this survey, particularly the data which identify fish species most consumed, fish parts of each species most consumed and fishing site locations can be used to adequately design a fish tissue analysis sampling plan. By coordinating data in this way, a health damage assessment based on actual population-specific data can be conducted of tribal members.

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RECOMMENDATIONS AND DATA APPLICATIONS

Given the cultural, economic and dietary importance of fish to CRITFC's member tribes, results from Federal and State agency sponsored water quality and fish tissue studies have intensified tribal concern of increased human health risks from consumption of potentially contaminated fish. As is evident from the results obtained from this survey, the average fish consumption rate of Umatilla, Yakama, Nez Perce, and Warm Springs tribal members is approximately nine times greater than the national average consumption rate of 6.5 gpd used by the United States Environmental Protection Agency (USEPA) and the majority of states in calculating human health based ambient water quality criteria and standards for toxics.

As identified in this survey, the rates of consumption across gender, age groups, nursing mothers, fishers and non-fishers range from 6 to 11 times higher than the national estimate recommended by USEPA. Should the production and escapement numbers of salmon species increase, tribal harvest will be increased and tribal consumption will most likely increase from rates reported in this survey. The consistency of these results suggest that USEPA's and state adopted ambient water quality criteria and standards for toxic pollutants based on the national estimated fish consumption rate of 6.5 gpd may not be sufficient to protect Native Americans residing in the Columbia River Basin.

Because State and Federal monitoring studies of contaminant levels in Columbia River Basin fish tissue and river sediments suggest an increased risk to Columbia River Indians from consumption of potentially contaminated fish, CRITFC and its member tribes expect the information gathered from this survey to be used by federal, state and tribal regulatory agencies to more accurately estimate health damage from ingestion of fish contaminated by water borne toxic pollutants.

Such a human health damage assessment should include a re-evaluation of certain water quality criteria and standards currently deemed adequate to protect human health. The consumption rates established in this report should ideally be combined with site-specific fish tissue monitoring data to determine tribal members' actual exposure to toxic pollutants. CRITFC and its member tribes encourage other tribes and populations to utilize this survey's methodology in future fish consumption surveys.

TABLES

TABLE 1: Summary of Reasons Indicated by Interviewers for Why Tribal Members Did Not Participate

Reason (questionnaire code number)	Unweighted Frequency	Unweighted Percent
Moved out of survey area - M (6)	60	26.1%
No reason listed - NRL (12)*	58	25.2%
Total refusal - TR (9)*	48	20.9%
No phone or phone disconnected - NP (12)*	32	13.9%
Not enrolled - NE (12)	8	3.5%
Not at home; revisit necessary - NH (3 and 7)*	6	2.6%
Deceased - D (8)	5	2.2%
Mental/physical disability - MP (11)*	4	1.7%
Missed appointment - MA (4)*	3	1.3%
Wrong phone number - WP (12)*	2	0.9%
Prison - P (12)	1	0.4%
Member of another tribe - O (12)	1	0.4%
Refusal during interview - R (10)	1	0.4%
Removed from survey; unreliable (2)	1	0.4%
Total	230	100%
* Indicates that reason could be associated with a location bias		

TABLE 2: Summary of Locations of Surveyed and Non-Surveyed Individuals with Respect to the Interview Site

Miles From Interview Site	Unweighted Frequencies (Percentages)		
	Surveyed	Non-Surveyed	All
< = 10	268 (74)	94 (26)	362 (100)
11 - 30	203 (67)	100 (33)	303 (100)
31 - 70	32 (52)	30 (48)	62 (100)
> 70	9 (64)	5 (36)	14 (100)
Unknown	1 (33)	2 (67)	3 (100)
All	**513 (69)**	**231 (31)**	**744 (100)**

**All of the nine persons who lived greater than 70 miles from the interview site were surveyed.

TABLE 3: Sex of Surveyed and Non-Surveyed Individuals

Tribe	Population Size (percent male)	Unweighted Frequency (percent male) - Surveyed	Unweighted Frequency (percent male) - Non-Surveyed
Umatilla	818 (47.7%)	131 (52.0%)	49 (51.0%)
Nez Perce	1440 (42.5%)	133 (40.6%)	68 (56.0%)
Warm Springs	1531 (47.3%)	126 (46.0%)	54 (50.0%)
Yakama	3872 (46.5%)	123 (39.0%)	59 (57.6%)

TABLE 4: Age of Respondents

Age (years)	Unweighted Frequency	Weighted[7] Percent	Weighted Cumulative Percent
18-19	22	4.6%	4.6%
20-21	26	5.1%	9.7%
22-23	20	3.6%	13.3%
24-25	37	8.1%	21.5%
26-27	26	4.6%	26.0%
28-29	27	5.6%	31.6%
30-31	34	5.7%	37.3%
32-33	26	4.9%	42.2%
34-35	17	5.4%	47.5%
36-37	26	5.9%	53.4%
38-39	24	5.2%	58.7%
40-41	18	3.8%	62.5%
42-43	13	2.5%	65.0%
44-45	16	3.3%	68.3%
46-47	24	5.2%	73.5%
48-49	15	3.5%	76.9%
50-54	35	7.5%	84.4%
55-59	36	5.7%	90.1%
60-64	19	3.3%	93.4%
65-69	16	2.3%	95.7%
70-74	15	3.1%	98.8%
75-79	8	1.0%	99.8%
80-89	1	0.1%	99.9%
90-100	1	0.1%	100%
Total	512	100%	

N = 512
Weighted Mean = 38.9 years
Weighted SE = 0.64
RR = 99.8%

[7] The term "weighted" used throughout these tables means that the data were weighted by Tribe before they were combined.

TABLE 5: Number of Fish Meals Consumed by All Adult Respondents (Fish Consumers and Non-Fish Consumers) Per Week -Throughout the Year

Number of Meals	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
0.0	46	8.9%	8.9%
0.1	5	0.5%	9.4%
0.2	24	3.0%	12.4%
0.3	3	0.3%	12.7%
0.4	24	2.6%	15.3%
0.5	28	3.9%	19.2%
0.6	9	1.0%	20.2%
0.8	1	0.1%	20.3%
1.0	203	43.8%	64.1%
1.2	1	0.1%	64.2%
1.9	1	0.1%	64.3%
2.0	90	21.0%	85.4%
3.0	25	5.3%	90.7%
4.0	16	4.8%	95.5%
5.0	4	0.8%	96.2%
6.0	3	0.5%	96.7%
7.0	2	0.8%	97.6%
8.0	2	0.2%	97.8%
9.0	1	0.1%	97.9%
10.0	4	0.9%	98.8%
12.0	2	0.3%	99.1%
15.0	3	0.4%	99.6%
20.0	1	0.1%	99.7%
24.0	1	0.1%	99.9%
30.0	1	0.1%	100%
Total	500	100%	

N = 500 Weighted Mean = 1.71 meals Weighted SE = 0.11 Outliers = 4 RR = 98.2% total; 97.5% if outlier considered a nonresponse

TABLE 6: Average Serving Size (oz.) - Adult Fish Meals

Number of Ounces	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
0.0	37	7.2%	7.2%
1.0	1	0.4%	7.6%
4.0	60	10.7%	18.2%
5.0	2	0.8%	19.1%
6.0	41	7.8%	26.9%
8.0	247	48.5%	75.4%
10.0	28	4.8%	80.2%
12.0	84	17.4%	97.6%
15.0	1	0.1%	97.7%
16.0	6	1.3%	98.9%
20.0	4	0.8%	99.7%
24.0	2	0.3%	100%
Total	513	100%	

N = 513
Weighted Mean = 7.83 ounces
Weighted SE = 0.16
RR = 100%

TABLE 7: Number of Grams Per Day of Fish Consumed by All Adult Respondents (Fish Consumers and Non-Fish Consumers) Combined - Throughout the Year

Number of grams/day	Unweighted Frequency	Weighted Percent	Cumulative Percent
0.00	46	8.9%	8.9%
1.6	1	0.1%	9.0%
3.2	13	1.4%	10.4%
4.0	1	0.4%	10.8%
4.9	1	0.1%	10.9%
6.5	17	1.8%	12.8%
7.3	1	0.2%	12.9%
8.1	6	0.7%	13.7%
9.7	5	0.8%	14.4%
12.2	3	0.5%	14.9%
13.0	11	1.4%	16.3%
16.2	37	6.5%	22.8%
19.4	11	1.2%	24.0%
20.2	1	0.1%	24.1%
24.3	19	3.8%	27.9%
29.2	2	0.2%	28.1%
32.4	109	24.5%	52.5%
38.9	2	0.3%	52.9%
40.5	20	3.6%	56.5%
48.6	53	11.1%	67.6%
64.8	54	13.0%	80.6%
72.9	3	0.7%	81.2%
77.0	1	0.1%	81.4%
81.0	8	2.0%	83.3%
97.2	27	6.0%	89.3%
130	9	2.8%	92.2%
146	8	1.5%	93.7%
162	4	0.8%	94.4%
170	1	0.4%	94.8%

Number of grams/day	Unweighted Frequency	Weighted Percent	Cumulative Percent
194	10	2.4%	97.2%
243	1	0.1%	97.3%
259	1	0.1%	97.4%
292	1	0.1%	97.6%
324	3	0.7%	98.3%
340	1	0.4%	98.7%
389	2	0.2%	99.0%
486	4	0.6%	99.6%
648	1	0.1%	99.7%
778	1	0.1%	99.9%
972	1	0.1%	100%

N = 500
Weighted Mean = 58.7 gpd
Weighted SE = 3.64
90th percentile: 97.2 gpd < (90th) <<130 gpd
95th percentile ≈ 170 gpd
99th percentile = 389 gpd
Outliers = 4
RR = 98.2% total; 97.5% if outlier considered a nonresponse

TABLE 8: Number of Fish Meals per Week Consumed by Adult Fish Consumers Only - Throughout the Year

Number of meals	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
<0.1	10	1.8%	1.8%
0.1	5	0.5%	2.3%
0.2	24	3.3%	5.6%
0.3	3	0.4%	6.0%
0.4	24	2.8%	8.8%
0.5	28	4.2%	12.9%
0.6	9	1.0%	14.0%
0.8	1	0.2%	14.1%
1.0	203	47.2%	61.3%
1.2	1	0.1%	61.4%
1.9	1	0.2%	61.6%
2.0	90	22.7%	84.2%
3.0	25	5.7%	89.9%
4.0	16	5.2%	95.1%
5.0	4	0.8%	95.9%
6.0	3	0.5%	96.5%
7.0	2	0.9%	97.4%
8.0	2	0.2%	97.6%
9.0	1	0.2%	97.8%
10.0	4	0.9%	98.7%
12.0	2	0.4%	99.1%
15.0	3	0.5%	99.5%
20.0	1	0.2%	99.7%
24.0	1	0.2%	99.8%
30.0	1	0.2%	100%
Total	464	100%	

N = 464
Weighted Mean = 1.85 meals
Weighted SE = 0.11
Outliers = 4
RR = 98.1% total;
97.3% if outlier considered a nonresponse

TABLE 9: Average Serving Size (oz.) of Adult Fish Meals - Fish Consumers Only

Number of Ounces	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
<1.0	1	0.2%	0.2%
1.0	1	0.4%	0.6%
4.0	60	11.5%	12.1%
5.0	2	0.9%	13.0%
6.0	41	8.4%	21.3%
8.0	247	52.2%	73.5%
10.0	28	5.1%	78.7%
12.0	84	18.7%	97.4%
15.0	1	0.1%	97.5%
16.0	6	1.4%	98.9%
20.0	4	0.8%	99.7%
24.0	2	0.3%	100%
Total	477	100%	

N = 477
Weighted Mean = 8.42 ounces
Weighted SE = 0.13
RR = 100%

TABLE 10: Number of Grams per Day Consumed by Adult Fish Consumers Only

Number of grams/day	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
<1.0	10	1.8%	1.8%
1.6	1	0.1%	1.9%
3.2	13	1.5%	3.4%
4.1	1	0.5%	3.9%
4.9	1	0.1%	4.0%
6.5	17	2.0%	6.0%
7.3	1	0.2%	6.1%
8.1	6	0.8%	6.9%
9.8	5	0.8%	7.8%
12.2	3	0.5%	8.2%
13.0	11	1.5%	9.7%
16.2	37	7.0%	16.8%
19.4	11	1.3%	18.0%
20.2	1	0.2%	18.2%
24.3	19	4.1%	22.3%
29.2	2	0.2%	22.5%
32.4	109	26.4%	48.9%
38.9	2	0.3%	49.2%
40.5	20	3.9%	53.1%
48.6	53	12.0%	65.1%
64.8	54	14.0%	79.1%
72.9	3	0.7%	79.8%
77.0	1	0.2%	79.9%
81.0	8	2.1%	82.1%
97.2	27	6.5%	88.5%
130	9	3.1%	91.6%
146	8	1.6%	93.2%
162	4	0.8%	94.0%
170	1	0.5%	94.4%

Number of grams/day	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
194	10	2.6%	97.0%
243	1	0.1%	97.1%
259	1	0.2%	97.2%
292	1	0.2%	97.4%
324	3	0.8%	98.2%
340	1	0.5%	98.6%
389	2	0.3%	98.9%
486	4	0.6%	99.5%
648	1	0.2%	99.7%
778	1	0.2%	99.8%
972	1	0.2%	100%

N = 464
Weighted Mean = 63.2 gpd
Weighted SE = 3.84
90th percentile: 97 gpd < (90th) < 130 gpd
95th percentile: 170 gpd < (95th) < 194 gpd
99th percentile ≈ 389 gpd
Outliers = 4
RR = 98.1% total;
97.3% if outlier considered a nonresponse

TABLE 11: Fish Consumption Throughout the Year by Sex

Sex	N	Weighted Percent	Weighted Mean (gpd)	Weighted SE
Female	278	58.0	55.8	4.78
Male	222	42.0	62.6	5.60
Total	500	100	58.7	3.64

*4 outliers were excluded

TABLE 11a: Fish Consumption Throughout the Year by Age

Age (years)	N	Weighted Percent	Weighted Mean (gpd)	Weighted SE
18 - 39	287	58.8	57.6	4.87
40 - 59	155	31.6	55.8	4.88
60 & older	58	9.6	74.4	15.3
Total	500	100	58.7	3.64

*4 outliers were excluded

TABLE 11b: Fish Consumption Throughout the Year by Location

Location	N	Weighted Percent	Weighted Mean (gpd)	Weighted SE
On Reservation	440	88.1	60.2	3.98
Off Reservation	60	11.9	47.9	8.25
Total	500	100	58.7	3.64

*4 outliers were excluded

TABLE 12: Months of High Fish Consumption

Month	Unweighted Frequency	Weighted Percent
January	15	1.4%
February	17	1.6%
March	21	2.2%
April	103	9.7%
May	128	11.6%
June	123	10.8%
July	110	9.8%
August	85	8.1%
September	75	7.4%
October	53	5.5%
November	35	3.4%
December	27	2.8%
All months the same	152	18.1%
Never/ rarely eat fish	72	7.0%
Unknown	8	0.6%
Total	1026*	100%
40 persons answered both May and June RR = 100%		

*Each respondent was asked to identify two months of highest fish consumption; hence, there were 1026 total responses, and each person who answered that they rarely/never eat fish, that all the months are the same, or that the months are unknown were counted twice.

TABLE 13: Comparison of Grams of Fish Consumed by Tribal Members on a Daily Basis During Months of High Consumption vs. Months of Low Consumption

Seasonal Consumption	N	Weighted Mean (gpd)	Weighted SE	Response Rate
Months of High Consumption	508	87.9	4.80	99.0%
Months of Low Consumption	484	26.4	1.39	94.3%

TABLE 14: Months of Low Fish Consumption

Month	Unweighted Frequency	Weighted Percent
January	146	15.6%
February	91	9.1%
March	32	3.1%
April	22	2.2%
May	23	2.4%
June	40	3.3%
July	64	5.6%
August	40	4.0%
September	26	2.6%
October	37	3.4%
November	88	8.7%
December	151	16.2%
All months the same	102	7.6%
Never/ rarely eat fish	72	7.4%
Unknown	20	2.9%
All months the same except the 2 highest months	40	5.9%
Total	994*	100%
RR = 96.9%		

*Each respondent was asked to identify two months of highest fish consumption; since the response rate for this question was less than 100 percent, there were 994 total responses. As a result, it was necessary to double count the following responses: rarely/never eat fish, all months the same, unknown, and all months are the same except the two highest.

TABLE 15: Number of Weekly Fish Meals: Nursing Mothers or Mothers Who Have Nursed

Number of Meals	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
0.0	11	11.4%	11.4%
0.1	1	0.4%	11.8%
0.2	4	2.2%	14.0%
0.3	2	1.2%	15.2%
0.4	8	3.5%	18.7%
0.5	4	2.8%	21.4%
1.0	31	33.5%	54.9%
2.0	23	25.4%	80.3%
3.0	9	8.9%	89.2%
4.0	4	3.8%	93.0%
5.0	2	2.8%	95.8%
6.0	1	0.8%	96.6%
7.0	1	2.0%	98.6%
8.0	1	0.7%	99.3%
10.0	1	0.7%	100%
Total	103	100%	

N = 103
Weighted Mean = 1.75 meals
Weighted SE = 0.17
Outliers = 1
RR = 99.0% total;
98.1% if outlier considered a nonresponse

TABLE 16: Consumption by Women Who Have Breastfed Compared to All Other Female Respondents

Women	N	Weighted Percent	Weighted Mean (gpd)	Weighted SE
Women Who Have Breastfed	103	35.7%	59.1	6.42
All Other Female Respondents	175	64.3%	54.0	6.60
Total	278	100	55.8	4.78

**1 outlier not included

TABLE 17: Fish Species Consumed by All Adult Tribal Members

Species	N	Weighted Percent that consume the species	Response Rate
Salmon	513	92.4%	100%
Lamprey	513	54.2%	100%
Trout	513	70.2%	100%
Smelt	509	52.1%	99.2%
Whitefish	513	22.8%	100%
Sturgeon	513	24.8%	100%
Walleye	511	9.3%	99.6%
Squawfish	513	2.7%	100%
Sucker	513	7.7%	100%
Shad	512	2.6%	99.8%

TABLE 18: Consumption of Fish Species by Adults Who Eat the Particular Species

Species	Variables					
	N	Fish meals per month		Grams per day		Response Rate
		Weighted mean (meals)	Weighted SE	Weighted Mean (gpd)	Weighted SE	
Salmon	471	3.18	0.14	25.7	1.21	99.2%
Lamprey	228	0.57	0.06	4.7	0.55	88.7%
Trout	361	1.15	0.09	9.6	0.74	96.5%
Smelt	212	0.56	0.07	4.8	0.68	91.8%
Whitefish	120	1.17	0.19	8.9	1.37	94.5%
Sturgeon	116	0.43	0.06	3.3	0.50	92.8%
Walleye	43	0.49	0.10	3.8	0.90	93.5%
Squawfish	15	0.21	0.10	1.4	0.69	100%
Sucker	40	0.36	0.12	2.8	0.76	95.2%
Shad	16	0.23	0.08	2.0	0.77	94.1%

TABLE 19: Grams of Fish Species Consumed Each Day by Fish Consumers and Non-Fish Consumers

Species	N	Weighted Mean (gpd)	Weighted SE	Response Rate
Salmon	509	23.7 a[8]	1.16	99.2%
Trout	484	6.6 b	0.57	94.3%
Lamprey	500	2.4 c	0.28	97.5%
Smelt	494	2.4 c	0.31	96.3%
Whitefish	506	1.9 c	0.36	98.6%
Sturgeon	504	0.8 d	0.13	98.2%
Walleye	509	0.3 e	0.09	99.2%
Sucker	513	0.2 e	0.07	100%
Shad	511	0.05 e	0.03	99.6%
Squawfish	511	0.04 e	0.02	99.6%
Total Anadromous	--	28.8	1.45	--
Total Resident	--	10.0	.77	--

[8] Consumption rates for species designated by the same letter are not significantly different from one another.

TABLE 20: Adult Consumption of Fish Parts

Species	Parts											
	Fillet		Skin		Head		Eggs		Bones		Organs	
	N	Weighted percent that consume	N	Weighted percent that consume	N	Weighted percent that consume	N	Weighted percent that consume	N	Weighted percent that consume	N	Weighted percent that consume
Salmon	473	95.1%	473	55.8%	473	42.7%	473	42.8%	473	12.1%	470	3.7%
Lamprey	249	86.4%	251	89.3%	250	18.1%	250	4.6%	250	5.2%	250	3.2%
Trout	365	89.4%	365	68.5%	365	13.7%	364	8.7%	365	7.1%	362	2.3%
Smelt	209	78.8%	209	88.9%	210	37.4%	209	46.4%	210	28.4%	206	27.9 %
Whitefish	125	93.8%	124	53.8%	125	15.4%	125	20.6%	125	6.0%	124	0.0%
Sturgeon	121	94.6%	121	18.2%	121	6.2%	121	11.9%	121	2.6%	121	0.3%
Walleye	46	100%	46	20.7%	46	6.2%	46	9.8%	46	2.4%	46	0.9%
Squawfish	15	89.7%	15	34.1%	15	8.1%	15	11.1%	15	5.9%	15	0.0%
Sucker	42	89.3%	42	50.0%	42	19.4%	42	30.4%	42	9.8%	42	2.1%
Shad	16	93.5%	16	15.7%	16	0.0%	16	0.0%	16	3.3%	15	0.0%

TABLE 21: Age When Children Begin Eating Fish

Age (months)	Unweighted Frequency	Unweighted Percent	Unweighted Cumulative Percent
0.0	1	0.6%	0.6%
2.0	2	1.2%	1.8%
3.0	3	1.8%	3.6%
4.0	2	1.2%	4.8%
5.0	5	3.0%	7.8%
6.0	30	18.0%	25.7%
7.0	10	6.0%	31.7%
8.0	7	4.2%	35.9%
9.0	4	2.4%	38.3%
10.0	10	6.0%	44.3%
11.0	2	1.2%	45.5%
12.0	42	25.1%	70.7%
13.0	2	1.2%	71.9%
14.0	5	3.0%	74.9%
15.0	3	1.8%	76.6%
16.0	1	0.6%	77.2%
18.0	12	7.2%	84.4%
24.0	14	8.4%	92.8%
30.0	1	0.6%	93.4%
36.0	9	5.4%	98.8%
48.0	1	0.6%	99.4%
60.0	1	0.6%	100%
Total	167	100%	

N = 167
Unweighted Mean = 13.1 months
Unweighted SE = 0.71
Respondent Unsure = 3
Child has not started yet = 12
RR = 89.2% total; 81.9% of data were used

TABLE 22: Number of Fish Meals Consumed per Week by Children

Number of Meals	Unweighted Frequency	Unweighted Percent	Unweighted Cumulative Percent
0.0	42	21.5%	21.5%
0.1	3	1.5%	23.1%
0.2	7	3.6%	26.7%
0.3	2	1.0%	27.7%
0.4	8	4.1%	31.8%
0.5	6	3.1%	34.9%
0.6	3	1.5%	36.4%
1.0	83	42.6%	79.0%
2.0	24	12.3%	91.3%
3.0	7	3.6%	94.9%
4.0	3	1.5%	96.4%
5.0	2	1.0%	97.4%
6.0	2	1.0%	98.5%
10.0	2	1.0%	99.5%
12.0	1	0.5%	100%
Total	195	100%	

N = 195
Unweighted Mean = 1.17 meals
Unweighted SE = 0.11
Outliers = 1
RR = 96.1% total;
95.6% if outlier considered a nonresponse

TABLE 23: Serving Size (oz.) of Fish for Children Age Five or Under

Number of Ounces	Unweighted Frequency	Unweighted Percent	Unweighted Cumulative Percent
0.0	35	17.4%	17.4%
0.1	2	1.0%	18.4%
1.0	8	4.0%	22.4%
2.0	32	15.9%	38.3%
3.0	9	4.5%	42.8%
4.0	84	41.8%	84.6%
5.0	3	1.5%	86.1%
6.0	6	3.0%	89.0%
8.0	18	9.0%	98.0%
9.0	1	0.5%	98.5%
12.0	3	1.5%	100%
Total	201	100%	

N = 201
Unweighted Mean = 3.36 ounces
Unweighted SE = 0.18
RR = 98.5%

TABLE 24: Children's Fish Consumption Rates - Throughout Year

Number of grams/day	Unweighted Frequency	Unweighted Percent	Unweighted Cumulative Percent
0.0	41	21.1%	21.1%
0.4	1	0.5%	21.6%
0.8	1	0.5%	22.2%
1.6	5	2.6%	24.7%
2.4	1	0.5%	25.3%
3.2	6	3.1%	28.4%
4.1	7	3.6%	32.0%
4.9	3	1.5%	33.5%
6.5	4	2.1%	35.6%
8.1	23	11.9%	47.4%
9.7	2	1.0%	48.5%
12.2	5	2.6%	51.0%
13.0	1	0.5%	51.5%
16.2	41	21.1%	72.7%
19.4	1	0.5%	73.2%
20.3	2	1.0%	74.2%
24.3	4	2.1%	76.3%
32.4	21	10.8%	87.1%
48.6	8	4.1%	91.2%
64.8	6	3.1%	94.3%
72.9	4	2.1%	96.4%
81.0	2	1.0%	97.4%
97.2	2	1.0%	98.5%
162.0	3	1.5%	100%
Total	194	100%	

N = 194
Unweighted Mean = 19.6 gpd
Unweighted SE = 1.94
Outliers = 1
RR = 95.6% total; 95.1% if outlier considered a nonresponse

TABLE 25: Fish Species Consumed by Children

Species	N	Unweighted Percent of Children that Consume the Species	Response Rate
Salmon	202	82.7%	99.0%
Lamprey	201	19.9%	98.5%
Trout	202	46.5%	99.0%
Smelt	201	22.4%	98.5%
Whitefish	201	10.9%	98.5%
Sturgeon	201	10.9%	98.5%
Walleye	201	2.5%	98.5%
Squawfish	201	1.0%	98.5%
Sucker	201	2.0%	98.5%
Shad	197	1.5%	96.6%

TABLE 26: Consumption by Children Who Consume the Particular Species

Species	Variables					
	N	Fish meals per month		Grams per day		Response Rate
		Unweighted mean (meals)	Unweighted SE	Unweighted Mean (gpd)	Unweighted SE	
Salmon	164	2.32	0.16	19.0	1.47	98.2%
Lamprey	37	0.89	0.27	8.1	2.76	92.5%
Trout	89	0.96	0.12	8.8	1.42	94.7%
Smelt	39	0.40	0.09	3.8	0.99	86.7%
Whitefish	21	3.48	2.83	21.0	15.8	95.4%
Sturgeon	21	0.43	0.12	4.0	1.25	95.4%
Walleye	5	0.22	0.20	2.0	1.46	100%
Squawfish	2	0.0	--	0.0	--	100%
Sucker	4	0.35	0.22	2.6	1.68	100%
Shad	3	0.1	0.06	1.1	0.57	100%

TABLE 27: Children's Consumption of Fish Parts

Species	Parts											
	Fillet		Skin		Head		Eggs		Bones		Organs	
	N	Unweighted percent that consume	N	Unweighted percent that consume	N	Unweighted percent that consume	N	Unweighted percent that consume	N	Unweighted percent that consume	N	Unweighted percent that consume
Salmon	167	97.6%	167	25.1%	167	13.8%	167	13.2%	167	3.0%	167	0.6%
Lamprey	36	97.2%	37	83.8%	37	5.4%	37	0.0%	37	0.0%	37	0.0%
Trout	90	95.6%	90	41.1%	89	3.4%	89	4.5%	89	0.0%	88	0.0%
Smelt	42	81.0%	41	73.2%	41	17.1%	41	24.4%	41	12.2%	41	9.8%
Whitefish	20	100%	18	27.8%	19	5.3%	19	10.5%	19	0.0%	19	0.0%
Sturgeon	20	100%	20	10.0%	20	0.0%	20	5.0%	20	0.0%	20	0.0%
Walleye	4	100%	4	0.0%	4	0.0%	4	0.0%	4	0.0%	4	0.0%
Squawfish	2	100%	2	50.0%	2	0.0%	2	0.0%	2	0.0%	2	0.0%
Sucker	4	100%	4	25.0%	4	25.0%	4	25.0%	4	0.0%	4	0.0%
Shad	3	100%	3	0.0%	3	0.0%	3	0.0%	3	0.0%	3	0.0%

Table 28: Use of Fish Preparation Methods

Method	N	Weighted Percent Who Responded Yes	Response Rate
Panfried	477	79.5%	100%
Deepfried	475	25.1%	99.6%
Poached	476	16.9%	99.8%
Boiled	477	73.4%	100%
Baked	476	98.3%	99.8%
Broiled	477	39.3%	100%
Smoked	476	66.2%	99.8%
Dried	476	66.9%	99.8%
Raw	475	3.2%	99.6%
Roasted	477	71.3%	100%
Canned	477	75.3%	100%

Table 29: Frequency of Use of Fish Preparation Methods

Method	Use >/= 1/week (weighted percent)	Use at least 1/month but < 1/week (weighted percent)	Use < 1/month (weighted percent)	Response Rate
Panfried	21.9%	42.2%	35.9%	100%
Deepfried	10.2%	44.5%	45.3%	99.2%
Poached	28.2%	34.4%	37.4%	97.5%
Boiled	21.5%	41.6%	36.9%	99.4%
Baked	34.6%	46.5%	18.9%	99.4%
Broiled	25.0%	43.2%	31.8%	99.5%
Smoked	14.0%	32.4%	53.5%	99.7%
Dried	17.9%	32.3%	49.8%	99.4%
Raw	17.2%	17.2%	65.7%	84.6%
Roasted	9.4%	31.6%	59.0%	99.1%
Canned	25.7%	39.2%	35.1%	100%

APPENDICES

APPENDIX 1: Formulas for Calculating Weighting Factors

I. Calculation of Weighting Factors Using EPI

A. Formula: (Population Size of Tribe/Sample Size of Tribe); divide this number by the lowest of the four numbers

Tribe	Population/Sample	Final Weighting Factor
Umatilla	(818/131) = 6.246.	24/6.24 = 1.00
Nez Perce	(1440/133) = 10.8	10.8/6.24 = 1.73
Warm Spring	(1531/126) = 12.2	12.2/6.24 = 1.96
Yakama	(3872/123) = 31.5	31.5/6.24 = 5.05

APPENDIX 2: Weighting Formulas for Calculating Weighted Means

The following weighting factor formula, recommended by the Centers for Disease Control, was used to calculate the weighted mean of a set of data:

Weighting Factor: $w_i = N_h/n_h$ where observation i is from tribe h, N_h = the population size of the individual tribe and n_h = the sample size of the individual tribe.

The following formula was used to calculate the weighting factor for each Tribe:

Weighting Factor: $w_i = (N_h n)/(N n_h)$ where observation i is from tribe h, N = the population size of all four Tribes combined, N_h = the population size of an individual tribe, n = the sample size of all four Tribes combined, and n_h = the sample size of an individual tribe.

The weighting factors were then used in the weighting option in SAS for determining weighted means, frequency distributions, and percentiles. The weighted mean, variance and standard error are computed by SAS as follows:

Weighted Mean: $\bar{x}_w = \sum_{i=1}^{i=m} w_i x_i / \sum_{i=1}^{i=m} w_i$ where w_i = the weighting factor the individual tribe; x_i = the individual data point; and m = the number of data points, and the weighted mean = $\bar{X}_{w.}$

Weighted Variance: $S_w^2 = \sum_{i=1}^{m} w_i (x_i - \bar{x}_w)^2 / (n-1)$

Where w_i is the value of the weight of the ith observation and x_i is the value of the ith observation and m = number of data points = n = sample size of all four tribes combined.

Weighted Standard error of the mean = $s_w/n^{0.5}$

This formula is consistent with formulas for calculating weighting factors that are typically presented in statistical textbooks such as:

Cochran, William C., Sampling techniques (second edition), New York: John Wiley and Sons, Inc., 1963,; Dixon Wilfrid J. and Massey, Frank Jr., Introduction to Statistical Analysis (fourth edition), New York: McGraw-Hill Publishing Co.

SAS Institute, Inc. 1985. SAS User's Guide: Basics; Version 5 Edition. Cary, NC: SAS Institute.

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APPENDIX 4: CRITFC and Tribal Approval and Coordination

CRITFC's participation in the survey required approval from both the Commission and the independent tribal governments. CRITFC staff presented the survey protocol and copies of the draft questionnaire to the tribal governments during the spring and summer of 1991. Approval of the survey was first obtained by the Commission in April, followed by the Nez Perce Tribal Executive Committee in June 1991, the Board of Trustees of the Umatilla Tribes and the Warm Springs Tribal Council in July 1991, and the Yakama Tribal Council in August 1991.

Following tribal approval, CRITFC obtained the endorsement of and staff assistance from IHS. A letter was addressed to the Seattle IHS office, then circulated to the regional and national IHS Research Committees. The Portland area Research Committee approved the survey in July 1991, and approval from the National Research Committee was obtained in October. In addition, approval for the survey was obtained from the IHS Yakama Service Unit, the Warm Springs Service Unit, the Northern Idaho Service Unit (Nez Perce), and the Yellow Hawk Service Unit (Umatilla).

A project coordinator was retained by CRITFC's Portland office to coordinate the federal and tribal agencies involved in the survey, supervise interviewers, conduct the operations of the survey, and oversee data entry. The coordinator was also responsible for overseeing technical edits and statistical analyses prepared by a private environmental consulting firm contracted by CRITFC.

USEPA provided the grant to fund the project, provided technical consultation, and coordinated the development of the project protocol and questionnaire. Seattle-based IHS staff assisted in development of the questionnaire and provided technical consultation, a compilation of the Tribes' IHS clinic lists from which the sample was drawn, and a database program used to enter and analyze the collected data. CDC's Division of Reproductive Health in Atlanta, GA conducted the interviewer training sessions, provided technical consultation, and conducted the survey sample selection. Tribal officials from the Warm Springs, Yakama, Umatilla, and Nez Perce Tribes obtained office space that was used for conducting interviews and corresponding with survey respondents.

QUESTIONNAIRE NUMBER ____

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

I. Surveyor Activity Log

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: ____________________

ADDRESS: ____________________

____

____

PHONE: (___) - ___ - ____

SOCIAL SECURITY NUMBER: ___ __ ____

QUESTIONNAIRE NUMBER _ _ _ _

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

INTRODUCTION

Hi! My name is xxxxxxxxxxxxxxx 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.

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?

QUESTIONNAIRE NUMBER _ _ _ _

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]

QUESTIONNAIRE NUMBER ____

DIETARY INTAKE - 24 HOUR RECALL

Intake Day
Sunday 1
Monday 2
Tuesday 3
Wednesday 4
Thursday 5
Friday 6
Saturday 7

Interviewer's Opinion of Information
Reliable 1
Unable to recall one or more meals 2
Unreliable for other reasons 3

Intake Was
Typical 1
Considerably less than typical 2
Considerably more than typical 3

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

COMMENTS (Give line no. when appropriate):

QUESTIONNAIRE NUMBER _ _ _ _

DIETARY INTAKE, CONTINUATION PAGE

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

COMMENTS (Give line no. when appropriate):

QUESTIONNAIRE NUMBER _ _ _ _

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)

QUESTIONNAIRE NUMBER _ _ _ _

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]**

QUESTIONNAIRE NUMBER _ _ _ _

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 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Lamprey (Eel) Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Resident Trout Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Smelt Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Whitefish Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Sturgeon Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Walleye Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2

QUESTIONNAIRE NUMBER _ _ _ _

(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 No . . . 2	___	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Sucker Yes . . . 1 No . . . 2	___	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Shad Yes . . . 1 No . . . 2	___	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
OTHERS (list) 1. ____________	___	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
2. ____________	___	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
3. ____________	___	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2

QUESTIONNAIRE NUMBER _ _ _ _

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 j.	1	2	3
j. 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

QUESTIONNAIRE NUMBER _ _ _ _

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 <u>average</u> 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.)

QUESTIONNAIRE NUMBER _ _ _ _

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 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Lamprey (Eel) Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Resident Trout Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Smelt Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Whitefish Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Sturgeon Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Walleye Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2

QUESTIONNAIRE NUMBER _ _ _ _

(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 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Sucker Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
Shad Yes . . . 1 No . . . 2	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
OTHERS (list) 1. ____________	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
2. ____________	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2
3. ____________	____	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 No . . 2	Yes. . 1 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

QUESTIONNAIRE NUMBER ____

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	________	

QUESTIONNAIRE NUMBER _ _ _ _

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)
    ________ ____
    ________ ____

QUESTIONNAIRE NUMBER _ _ _ _

VI. Additional Questions

1) On average, throughout the year, how often do you attend ceremonies or other community events?

never (---> End of Interview)	0
less than 1 time per month	1
1-3 times per month	2
4-6 times per month	3
more than 6 times per month	4

2) How often do you eat fish at these ceremonies?

rarely/never (---> End of Interview)	0
less than 1/2 of the ceremonies or events	1
at about 1/2 of the ceremonies or events	2
at nearly all ceremonies or events	3

3) How much fish do you usually consume at each of these events?

none	0
1-2 6oz servings	1
3-4 6oz servings	2
5-6 6oz servings	3
more than 6 6oz servings	4

CONCLUSION

Again, thank you for your cooperation in participating in this survey. Your participation will significantly contribute to information needed to help protect your natural resources and provide guidance for public health programs for your tribe.

NOTE TIME INTERVIEW ENDS: _ _:_ _

APPENDIX 6: List of Resident Fish Species in the Columbia River Basin

Squawfish

Northern Squawfish - *Ptychocheilus oregonensis*

Sturgeon

White Sturgeon - *Acipenser transmontanus*
(populations above Bonneville Dam)

Suckermouth

Longnose suck - *Catostomus catostomus*
Bridgelip suckermouth - *Catostomus columbianus*
White suckermouths - *Catostomus commersoni*
Largescale suckers - *Catostomus macrocheilus*
Mountain Sucker - *Catostomus platyrhynchus*

Trout

Brown Trout - *Salmo trutta*
Bull Trout - *Salvelinus confluentus*
Brook Trout - *Salvelinus fontinalis*
Lake Trout - *Salvelinus namaycush*

Walleye

Stizostedion vitreum

Whitefish

Lake Whitefish - *Coregonus clupeaformis*
Mountain Whitefish - *Prosopium williamsoni*

APPENDIX 7: List of Anadromous Fish Species in the Columbia River Basin

Salmon

Sea-run cutthroat trout - *Oncorhyncus clarki*
Pink salmon - *Oncorhyncus gorbuscha*
Chum salmon - *Oncorhyncus keta*
Coho salmon - *Oncorhyncus kisutch*
Rainbow-Steelhead Trout - *Oncorhyncus mykiss*
Sockeye salmon - *Oncorhyncus nerka*
Chinook salmon - *Oncorhyncus tshawytscha*

Lamprey

Pacific Brook Lamprey - *Lampetra pacifica*
Western Brook Lamprey - *Lampetra richardsoni*
Pacific Lamprey - *Lampetra tridentata*

Shad

American Shad - *Alosasapid issima*

Smelt

Longfin Smelt - *Spirinchus thaleichthys*
Eulachon - *Thaleichthys pacificus*

Sturgeon

White Sturgeon - *Acipenser transmontanus*
(populations below Bonneville Dam)

APPENDIX 8: List of Other Fish Species in the Columbia River Basin

Bass
Micropterus spp.
Largemouth Bass - *Micropterus salmoides*

Bluegill
Lepomis macrochinus

Cod
Gadus spp:

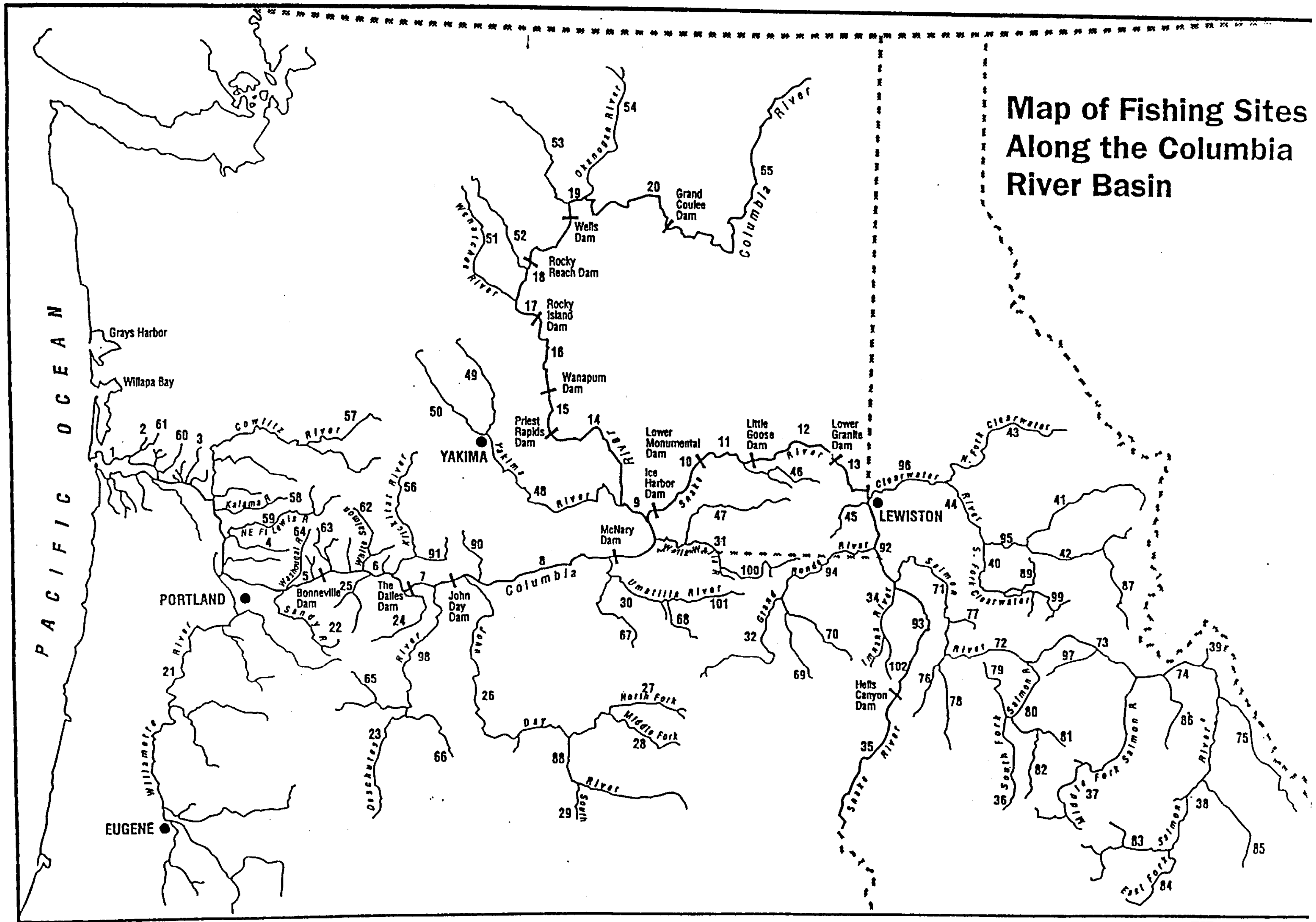
Crappie
Black crappie - *Pomoxis nigromaculatus*

Catfish
Channel catfish - *Ictalurus punctatus*
Halibut
Hippoglossus spp.

Perch
Perca spp.
Yellow Perch
Perca flavescens

Red Snapper
– *Sebastodes ruberrimus*

Map of Fishing Sites Along the Columbia River Basin



APPENDIX 10: Sample Letter from Tribal Government Requesting Participation in the Survey

Dear --,

I am pleased to inform you that you have been selected to take part in the Columbia River Basin Fish Consumption Survey sponsored by the -- Tribes. Approximately 125 tribal members will be surveyed to obtain information about fish consumption. The information collected will be used to ensure that state and federal governments are adequately protecting the water resources upon which our fisheries and our tribal members depend.

Please sign up for an interview by calling (###) any time of the day or night beginning on October 21st. Interviews will be held Monday through Friday, October 31 - November 20 at the Community Counselling Center (phone: ###). See the enclosed schedule for interview time.

The information which you provide during the interview and your identity will be kept completely confidential. In addition, you will receive a $40 after the questionnaire is completed and verified to cover time and transportation expenses to the Counselling Center office.

If you are unable to attend an interview, please call the above number anyway to verify your address.

The information that you provide is extremely important to the welfare of the Tribe. Your assistance is appreciated.

Sincerely,

Chairman,
Off-Reservation Fish and Wildlife Committee

APPENDIX 11: Job Announcements for Survey Coordinators and Interviewers

Job Announcement

POSITION: Survey Interviewer
PROGRAM: Columbia River Basin Fish Consumption Survey
DUTIES: 1. Participates in ___________ tribe survey to obtain information about fish consumption of tribal members in an effort to better protect tribal fishing rights.

2. Participates in training session from September ____ - ____ in "The Dalles" Oregon.

3. Assists in scheduling of interviews as needed.

4. Conducts prescheduled interviews of respondents at designated locations and house-to-house and records responses on survey questionnaire. Keeps complete records of respondents and surveys conducted. Reviews completed questionnaires to assure all required data is present. Must assure strict confidentiality of participants and information obtained.

5. Provides survey participants with incentive payment checks.

6. Meets regularly with local coordinator to turn in and review completed work.

QUALIFICATIONS:

1. Knowledge and/or experience in conducting personal interviews.

2. Ability and skill in effectively communicating and interacting with individuals and groups of a variety of age, economic, and educational ranges.

3. Must be member of the ____________ tribe and be able to understand and speak the native dialect.

4. Graduation from high school required. College experience preferred.

5. Experience in conducting surveys preferred.

6. Required to provide own means of transportation to conduct interviews.

7. Ability to maintain confidentiality of participants and information.

8. Dependability in areas of promptness, timeliness, and accomplishing assignments.

9. Ability to exercise self-initiative in performing the work at an acceptable level with little supervision.

SALARY: (_____ positions)
$6/hour

These are temporary positions that will be expected to last approximately 15 days but may last longer or shorter depending on the length of the project, Interviewers will be compensated for any travel which is necessary after completion of the project. At least one interviewer must be female as female participants may not be willing to provide certain information of a personal nature to members of the opposite sex.

Please send Cover letter and Resume to:

Harold Shepherd
Survey Coordinator
Columbia River Inter-Tribal Fish Commission
975 S.E. Sandy Blvd., Suite 202
Portland, Oregon 97214

APPENDIX 11 (cont'd)

Job Announcement

POSITION: Local Coordinator
PROGRAM: Columbia River Basin Fish Consumption Survey
DUTIES:
1. Participates in __________ tribe survey to obtain information about fish consumption of tribal members in an effort to better protect tribal fishing rights.
2. Participates in training session from September ____ - ____ in "The Dalles" Oregon.
3. Supervising, training, observing, evaluating, and retraining interviewers and assisting interviewers with difficult cases.
4. Maintenance of production standards, reviewing work for completeness and accuracy; reassigning for further work when necessary. Transmitting completed materials to Survey Coordinator.
5. Assists in scheduling of interviews as needed.
6. Conducts prescheduled interviews of respondents at designated locations and house-to-house and records responses on survey questionnaire. Keeps complete records of respondents and surveys conducted. Reviews completed questionnaires to assure all required data is present. Must assure strict confidentiality of participants and information obtained.
7. Provides survey participants with incentive payment checks.
8. Meets regularly with Survey Coordinator to review completed questionnaires and discuss progress, problems, etc.

QUALIFICATIONS:
1. Experience and/or knowledge in conducting personal interviews.
2. Ability and skill in effectively communicating and interacting with individuals and groups in a variety of age, economic, and educational ranges. Ability to train others to use these techniques.
3. Must be member of the __________ tribe and be able to understand and speak the native dialect.
4. Graduation from high school required. College experience preferred.
5. Experience in conducting surveys preferred.
6. Required to provide own means of transportation to conduct interviews.
7. Ability to maintain confidentiality of participants and information.
8. Dependability in areas of promptness, timeliness, and accomplishing assignments.
9. Ability to exercise self-initiative in performing work and ensuring that interviewers perform work at an acceptable level.

SALARY: $8/hour.

This is a temporary position that will be expected to last approximately 15 days but may last longer or shorter depending on the length of the project. The Coordinator will be compensated for any travel which is necessary after completion of the project. Please send Cover letter and Resume to:

Harold Shepherd
Survey Coordinator
Columbia River Inter-Tribal Fish Commission
975 S.E. Sandy Blvd., Suite 202
Portland, Oregon 97214

APPENDIX 12: Locations of Tribal Members from Interview Site and Reasons for Not Participating

Locations of Yakama Surveyed Individuals
Interview Site: Toppenish, WA Administrative Building

City/Town	Unweighted Frequency	Unweighted Percent	Miles from Interview Site
Wapato, WA	42	34.2%	8
Toppenish, WA	30	24.5%	<5
White Swan, WA	20	16.3%	21
Brownstown, WA	6	5.0%	18
Goldendale, WA	3	2.4%	48
Granger, WA	3	2.4%	12
Harrah, WA	3	2.4%	15
Seattle, WA	3	2.4%	158
Zillah, WA	2	1.6%	6
Parker, WA	2	1.6%	12
Yakama, WA	2	1.6%	23
Dallesport, WA	2	1.6%	80
Lyle, WA	1	0.8%	86
Pendleton, OR	1	0.8%	118
Juliaetta	1	0.8%	206
Klickitat	1	0.8%	70
Unknown	1	0.8%	-
Total	123	100%	

APPENDIX 12 (cont'd)

Locations of Yakama Non-Surveyed Individuals and Reasons Given for Not Participating

City/Town	Unweighted Frequency	Unweighted Percent	Miles from Interview Site	Reasons (unweighted frequency)
Toppenish, WA	20	34.0%	<5	NP(9);NRL(11)
Wapato, WA	11	18.6%	8	NP(6);NRL(5)
White Swan, WA	13	22%	21	NP(7);NRL(6)
Yakima, WA	6	10.2%	23	NP(3);NRL(3)
Brownstown, WA	2	3.5%	18	NP(1)
Unknown	2	3.5%	-	NRL(2)
Zillah, WA	1	1.7%	6	NRL(1)
The Dalles, OR	1	1.7%	79	NRL(1)
Goldendale, WA	1	1.7%	48	NP(1)
Harrah, WA	1	1.7%	15	NRL(1)
Parker, WA	1	1.7%	12	NP(1)
Total	59	100%		

Legend for Reasons: NP = No Phone; NRL = No Reason Listed

APPENDIX 12 (cont'd)

Locations of Warm Springs Surveyed Individuals
Interview Site: Warm Springs, OR Community Center

City/Town	Unweighted Frequency	Unweighted Percent	Miles from Interview Site
Warm Springs, OR	124	98.4%	<25
Madras, OR	2	1.6%	15
Total	126	100%	

Locations of Warm Springs Non-Surveyed Individuals and Reasons Given for Not Participating

City/Town	Unweighted Frequency	Unweighted Percent	Miles from Interview Site	Reason (unweighted frequency)
Madras, OR	2	3%	15	M(2)
Portland, OR	1	2%	100	M(1)
Parker, WA	1	2%	185	M(1)
Salem, OR	1	2%	165	M(1)
Warm Springs, OR	49	90%	<25	NRL(21);M(12);TR(4);NP(4);MA(3);WP(2);MP(1);D(1);RI(1)
Total	54	100%		

Legend for Reasons: M = moved out of survey area; NRL=no reason listed; TR=total refusal; NP=no phone or disconnected; MA=missed appointment; WP=wrong phone number; MP=mental/physical disability; D=deceased; RI=refusal during interview

APPENDIX 12 (cont'd)

Location of Umatilla Surveyed Individuals
Interview Site: Mission, OR Tribal Council Chambers, Board of Trustees, Tribal Headquarters

City/Town	Unweighted Frequency	Unweighted Percent	Miles from Interview Site
Pendleton, OR	102	77.8%	5
Adams, OR	15	11.4%	19
Pilot Rock, OR	6	4.6%	20
Weston, OR	3	2.3%	27
Cayuse, OR	2	1.5%	6
Irrigon, OR	1	0.8%	60
Athea, OR	1	0.8%	25
La Grande, OR	1	0.8%	55
Total	131	100%	

APPENDIX 12 (cont'd')

Location of Umatilla Non-Surveyed Individuals and Reasons Given for Not Participating

City/Town	Unweighted Frequency	Unweighted Percent	Miles from Interview Site	Reason (unweighted frequency)
Pendleton, OR	31	63.3%	5	M(16);NP(4);MP(3);TR(3) NH(3);R(1);D(1)
Adams, OR	6	12.2%	19	M(4);NH(1);D(1)
Cayuse, OR	4	8.2%	6	TR(2);NH(1);D(1)
Milton Freewater	3	6.1%	34	NP(3)
Pilot Rock, OR	2	4.1%	20	NP(1);M(1)
Hermiston, OR	2	4.1%	36	NP(1);M(1)
La Grande, OR	1	2.0%	55	M(1)
Total	49	100%		

Legend for Reasons: R = *removed from survey, unreliable*; NH = *not at home*; M = *moved out of survey area*; D = deceased; TR = total refusal; M = mental/physical disability; NP = no phone or phone disconnected

APPENDIX 12 (cont'd)

Location of Nez Perce Surveyed Individuals
Interview Site: Lapwai, ID at Northern Idaho Public Health Service

City/Town	Unweighted Frequency	Unweighted Percent	Miles from Interview Site
Lapwai, ID	83	62.2%	<10
Kamiah, ID	19	14.3%	60
Clarkston, WA	5	3.8%	14
Culdesac, ID	4	3.0%	9
Kooskia, ID	4	3.0%	68
Lewiston, ID	7	5.3%	13
Spaulding, ID	3	2.3%	4
Juliaetta, ID	3	2.3%	16
Moscow, ID	2	1.5%	36
Asotin, ID	1	0.8%	18
Spokane, WA	1	0.8%	123
Orofino, ID	1	0.8%	35
Total	133	100%	

APPENDIX 12 (cont'd)

Location of Nez Perce Non-Surveyed Individuals and Reasons Given for Not Participating

City/Town	Unweighted Frequency	Unweighted Percent	Miles from Interview Site	Reason (Unweighted frequency)
Lapwai, ID	24	34.8%	<10	M(12);TR(5);NH(1); D(1);NRL(4)
Kamiah, ID	12	17.4%	60	TR(9);M(1);NRL(2)
Lewiston, ID	8	11.6%	13	TR(6);M(2)
Moscow, ID	5	7.3%	36	TR(5)
Clarkston, WA	5	7.3%	14	TR(3);M(2)
Winchester, ID	2	2.9%	23	TR(2)
Culdesac, ID	2	2.9%	9	TR(1);M(1)
Kooskia, ID	3	4.4%	68	TR(2);M(1)
Lenore, ID	1	1.4%	17	TR(1)
Pullman, WA	1	1.4%	36	TR(1)
Spaulding, ID	1	1.4%	4	M(1)
Asotin, ID	1	1.4%	18	TR(1)
Madras, OR	1	1.4%	355	O(1) not member
Grangeville, ID	1	1.4%	61	TR(1)
Juliaetta, ID	1	1.4%	16	TR(1)
Peck, ID	1	1.4%	38	TR(1)
Total	69	100%		

Legend for Reasons: M = moved out of survey area; NH = not at home; revisit necessary; D = deceased; TR = total refusal; O = other

APPENDIX 13: Fish Consumption of Persons Who Fish for Personal Consumption or for Use by Their Tribe

Harvest Fish	N	Weighted Percent	Weighted Mean (gpd)	Weighted SE
No	245	51.7	57.8	5.70
Yes	253	48.3	59.9	4.61
Total	498	100	58.8	3.65

**4 outliers not included

APPENDIX 14: Consumption Data for Months of Highest Fish Consumption (May and June)

Number of Fish Meals Consumed by Adults per Week - High Months (May and June)

Number of meals	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
0.0	1	0.4%	0.4%
0.2	1	0.4%	0.8%
0.4	7	1.7%	2.5%
0.5	3	1.1%	3.6%
1.0	62	26.5%	30.2%
2.0	53	25.4%	55.6%
3.0	36	19.2%	74.8%
4.0	25	12.8%	87.5%
5.0	7	3.3%	90.9%
6.0	3	2.6%	93.4%
7.0	5	1.9%	95.3%
10.0	2	0.6%	95.9%
12.0	2	2.2%	98.1%
14.0	1	0.4%	98.5%
15.0	2	1.5%	100%
Total	210	100%	

N = 210
Weighted Mean = 2.93 meals
Weighted SE = 0.18
RR = 99.6%

APPENDIX 14 (cont'd)

Fish Consumption for May and June by Age

Age (years)	Unweighted Frequency	Weighted Percent	Weighted Mean (gpd)	Weighted SE
18 - 39	114	55.4%	130	12.8
40 - 59	65	31.4%	78.6	6.7
60 & older	31	13.2%	82.9	11.5
Total	210	100%	108	7.63

Fish Consumption for May and June by Sex

Sex	Unweighted Frequency	Weighted Percent	Weighted Mean (gpd)	Weighted SE
Female	119	58.3 %	97.3	9.4
Male	91	41.7%	122.1	12.6
Total	210	100%	107.8	7.63

Summary of Consumption Rates During May and June

Rate of consumption	N	Weighted Mean (gpd)	Weighted SE
grams/day	210	108	7.63
meals/week	210	2.93	0.18

APPENDIX 15: Consumption Data for Months of Lowest Fish Consumption (January and December)

Number of Fish Meals Consumed by Adults per Week - Low Months (January and December)

Number of meals	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
0.0	64	25.9%	25.9%
0.1	1	0.3%	26.2%
0.2	26	7.1%	33.3%
0.4	7	1.7%	35.0%
0.5	5	1.5%	36.5%
0.6	1	0.3%	36.8%
1.0	94	50.7%	87.5%
2.0	14	7.9%	95.4%
3.0	5	2.7%	98.1%
4.0	3	1.6%	99.6%
5.0	1	0.4%	100%
Total	221	100%	

N = 221
Weighted Mean = 0.86 meals
Weighted SE = 0.06
RR = 97.6%

APPENDIX 15 (cont'd)

Fish Consumption for January and December by Age

Age (years)	Unweighted Frequency	Weighted Percent	Weighted Mean (gpd)	Weighted SE
18 - 39	131	58.1	27.1	2.8
40 - 59	72	33.2	31.6	3.1
60 & older	18	8.62	50.9	11.8
Total	221	100	30.7	2.2

Fish Consumption for January and December by Sex

Sex	Unweighted Frequency	Weighted Percent	Weighted Mean (gpd)	Weighted SE
Female	128	58.3	32.9	3.2
Male	93	41.7	27.5	2.7
Total	221	100	30.7	2.2

Summary of Consumption Rates for January and December

Rate of consumption	N	Weighted Mean (gpd)	Weighted SE
Grams/day	221	30.7	2.19
Meals/week	221	0.86	0.06

APPENDIX 16: Comparison of Fish Consumption (gpd) Throughout the Year of Persons Who Ate Fish in the 24 Hours Preceding the Survey vs. Persons Who Did Not Eat Fish in That Time Period

Ate Fish	N	Weighted Mean	Weighted SE	Response Rate
No	402	57.9	4.28	97.5%
Yes	98	61.8	6.03	

**4 outliers not included

APPENDIX 17: Consumption Rates of Women Who Have Given Birth and Who Breastfeed

Consumption by Women Who Have Given Birth Compared to Those Who Have Not Given Birth

Women	N	Weighted Percent	Weighted Mean (gpd)	Weighted SE
Have Not Given Birth	33	11.9	40.9	12.7
Have Given Birth	242	88.1	57.7	5.21
Total	275	100	55.9	4.83

**1 outlier not included

Consumption by Women Who Have Breastfed Compared to Those Who Have Had Children But Do Not Breastfeed

Women Who Have Given Birth	N	Weighted Percent	Weighted Mean (gpd)	Weighted SE
Did Not Breastfeed the Child	136	58.2	57.1	7.90
Breastfed the Child	103	41.8	59.1	6.42
Total	239	100	58.0	5.27

**1 outlier not included

APPENDIX 18: Chi-Square Test Comparisons of Fish Parts Consumed

The Chi-square test was used to compare the frequencies of consumption of each fish part among the four anadromous species and among the six resident species, with the following results (** indicates significant differences among species):

Anadromous Species

Fish Part	Chi-square value	p-value	Significance
fillet	44.8	$p < 0.005$	**
skin	157.2	$p < 0.005$	**
head	53.7	$p < 0.005$	**
eggs	144.9	$p < 0.005$	**
bones	61.4	$p < 0.005$	**
organs	115.1	$p < 0.005$	**

Resident Species

Fish Part	Chi-square value	p-value	Significance
fillet	7.92	$p > 0.10$	
skin	115.0	$p < 0.005$	**
head	9.65	$p > 0.05$	
eggs	23.29	$p < 0.005$	**
bones	5.33	$p > 0.05$	
organs	5.04	$p > 0.05$	

APPENDIX 19: Increase and Decrease in Weekly Fish Meals Over the Last 20 Years

Increase in Meals	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
0.0	2	4.4%	4.4%
0.1	1	0.7%	5.2%
0.2	1	0.7%	5.9%
0.3	3	2.2%	8.1%
0.4	5	4.2%	12.4%
0.5	1	1.3%	13.6%
0.6	1	0.7%	14.4%
1.0	30	39.8%	54.1%
2.0	15	26.9%	81.0%
3.0	8	8.9%	89.9%
6.0	1	3.7%	93.6%
12.0	1	1.4%	95.0%
14.0	1	3.7%	98.7%
20.0	1	1.3%	100%
Total	72	100%	

N = 72
Weighted Mean = 2.41 meals
Weighted SE = 0.37
RR = 100%

APPENDIX 19 (cont'd):

Decrease in Weekly Fish Meals Over the Last 20 Years

Decrease in Meals	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
0.0	4	4.9%	4.9%
0.1	1	0.3%	5.2%
0.2	3	1.3%	6.5%
0.3	2	1.0%	7.5%
0.4	2	0.6%	8.1%
0.5	4	3.1%	11.2%
0.6	1	0.3%	11.5%
0.8	1	0.5%	12.0%
0.9	1	0.3%	12.3%
1.0	38	28.2%	40.5%
1.3	1	0.3%	40.8%
1.5	1	1.5%	42.2%
1.9	1	0.5%	42.7%
2.0	29	17.0%	59.8%
3.0	25	18.9%	78.7%
4.0	7	7.2%	85.9%
5.0	4	3.7%	89.6%
6.0	9	4.5%	94.1%
7.0	1	0.6%	94.7%
8.0	1	0.3%	94.9%
9.0	1	0.6%	95.5%
12.0	1	0.6%	96.1%
14.0	2	0.8%	96.9%
15.0	1	0.5%	97.4%
16.0	1	1.5%	98.9%
17.0	1	0.3%	99.2%
20.0	2	0.8%	100%
Total	145	100%	

Decrease in Meals	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
N = 145 Weighted Mean = 2.83 meals Weighted SE = 0.28 RR = 100%			

APPENDIX 20: Age of Infant When Breast Feeding Ceased or Will Cease

Age (months)	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
0.0	1	0.4%	0.4%
1.0	7	9.4%	9.8%
2.0	10	8.5%	18.3%
3.0	10	8.3%	26.7%
4.0	9	10.5%	37.1%
5.0	9	8.1%	45.2%
6.0	17	15.8%	61.0%
7.0	4	2.5%	63.5%
8.0	6	8.8%	72.3%
10.0	3	1.9%	74.2%
11.0	1	0.8%	75.0%
12.0	9	9.7%	84.8%
13.0	2	1.3%	86.0%
15.0	1	0.7%	86.8%
18.0	6	7.3%	94.1%
24.0	3	5.2%	99.3%
26.0	1	0.7%	100%
Total	99	100%	

N = 99
Weighted Mean = 7.64 months
Weighted SE = 0.62
RR = 94.3%

Appendix 21: Chi-Square Analysis of Food Preparation Methods-Use and Frequencies

Pan frying is used by significantly more individuals than boiling (Chi-square = 4.99; $0.025 < p < 0.05$), and thus significantly more often than all of the other less frequently used methods except for canning;

Canning and boiling are used by significantly more individuals than drying (Chi-square = 8.26 for the former and 4.28 for the latter; $p < 0.005$ for the former and $p < 0.05$ for the latter);

Roasting, drying, and smoking are used by significantly more individuals than broiling (Chi-square = 69.14 to 98.68; $p < 0.005$);

Broiling is used by significantly more individuals than deep frying (Chi-square = 21.96; $p < 0.005$);

Deep frying is used by significantly more individuals than poaching (Chi-square = 9.56; $p < 0.005$); and

Poaching is used by significantly more individuals than eating raw (Chi-square = 49.42; $p < 0.005$).

APPENDIX 22: Percent of Fish Obtained From Various Sources

Percent of Fish	SOURCES											
	Yourself/ Family		Stores		Friends		Ceremonies		Tribal Distribution		Other	
	Unwtd Freq.	Wtd. Percent	Unwtd Freq.	Wtd. Percent	Unwtd Freq.	Wtd. Percent	Unwtd Freq.	Wtd. Percent	Unwtd Freq.	Wtd. Percent	Unwtd Freq.	Wtd. Percent
0.0%	112	23.3%	309	70.2%	291	52.1%	252	51.2%	185	44.4%	403	84.2%
1.0-5.0%	15	1.8%	43	6.4%	37	6.5%	60	11.1%	30	7.3%	34	5.9%
6.0-10.0%	35	5.1%	56	7.9%	52	9.5%	62	11.8%	45	10.9%	26	2.5%
11.0-15.0%	7	1.0%	9	1.5%	10	2.2%	18	4.1%	21	3.4%	9	1.1%
16.0-20.0%	31	4.0%	28	3.9%	28	7.3%	28	5.0%	34	5.0%	10	1.0%
21.0-25.0%	22	4.3%	9	1.2%	19	4.7%	16	3.7%	31	5.8%	7	1.0%
26.0-30.0%	8	0.9%	9	0.9%	12	3.2%	9	1.3%	21	3.2%	4	0.7%
31.0-35.0%	5	1.5%	0	0.0%	3	1.0%	4	1.0%	3	0.7%	1	0.1%
36.0-40.0%	15	1.9%	7	0.9%	11	2.3%	12	2.3%	13	1.8%	1	0.1%
41.0-45.0%	2	0.5%	1	0.4%	0	0.0%	1	0.1%	0	0.0%	1	0.4%
46.0-50.0%	94	17.9%	17	3.6%	27	7.1%	29	5.4%	56	8.0%	2	0.5%
51.0-55.0%	1	0.1%	0	0.0%	0	0.0%	1	0.4%	2	0.2%	0	0.0%
56.0-60.0%	13	2.8%	1	0.1%	4	0.5%	3	0.6%	11	1.3%	0	0.0%
61.0-65.0%	1	0.1%	0	0.0%	0	0.0%	0	0.0%	2	0.2%	0	0.0%
66.0-70.0%	9	2.3%	3	0.6%	1	0.4%	0	0.0%	9	1.1%	1	0.1%
71.0-75.0%	36	7.6%	0	0.0%	1	0.4%	2	0.6%	11	1.3%	0	0.0%
76.0-80.0%	27	6.5%	5	0.7%	3	0.9%	4	0.5%	8	1.3%	0	0.0%

Percent of Fish	SOURCES											
	Yourself/ Family		Stores		Friends		Ceremonies		Tribal Distribution		Other	
	Unwtd Freq.	Wtd. Percent	Unwtd Freq.	Wtd. Percent	Unwtd Freq.	Wtd. Percent	Unwtd Freq.	Wtd. Percent	Unwtd Freq.	Wtd. Percent	Unwtd Freq.	Wtd. Percent
81.0-85.0%	2	0.2%	0	0.0%	1	0.4%	0	0.0%	1	0.1%	0	0.0%
86.0-90.0%	21	5.2%	3	0.5%	3	1.0%	0	0.0%	4	0.5%	1	0.1%
91.0-95.0%	5	0.6%	3	0.4%	1	0.4%	0	0.0%	1	0.4%	0	0.0%
96.0-100%	45	11.9%	3	1.0%	2	0.3%	5	0.8%	18	3.0%	6	2.2%
Total	506	100%	506	100%	506	100%	506	100%	506	100%	506	100%
Weighted Mean (%)	41.3%		9.14%		10.7%		11.3%		23.2%		4.25%	
Weighted SE	1.59		0.82		0.94		0.80		1.15		0.73	
R.R.	98.6%		98.6%		98.6%		98.6%		98.6%		98.6%	

APPENDIX 22 (cont'd):

Percent of Fish Obtained from "Other" Sources

Source = Other	Percent Obtained from Source					
Weighted Frequency Weighted Percent	0-20%	21-40%	41-60%	61-80%	81-100%	Total
Buy (various sources)	2.11 2.82%	0 0.00%	2.11 2.82%	0 0.00%	2.11 2.82%	6.33 8.46%
Buy from fishers, Indians, or Tribe	0.81 1.09%	0 0.00%	2.11 2.82%	0 0.00%	0.81 1.09%	3.73 5.00%
Canned salmon from Tribe or warehouse	1.62 1.18%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	1.62 1.18%
Commodities	0.73 0.97%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0.73 0.97%
Holiday Dinners	0 0.00%	0 0.00%	0 0.00%	0 0.00%	2.11 2.82%	2.11 2.82%
Restaurants	40.4 54.0%	9.82 13.2%	0.42 0.56%	0.42 0.56%	7.04 9.44%	58.0 77.7%
Trades	2.11 2.82%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	2.11 2.82%

APPENDIX 23: Travel Distance from Home to Fishing Sites

Distance (miles)	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
0-5	8	2.8%	2.8%
6-10	12	4.7%	7.5%
11-15	6	1.6%	9.1%
16-20	18	4.6%	13.7%
21-25	11	5.3%	19.0%
26-50	37	13.7%	32.7%
51-75	23	9.5%	42.2%
76-100	44	24.6%	66.8%
More than 100	100	33.2%	100%
Total	259	100%	
RR = 100%			

APPENDIX 24: Tribal Fishing Sites for Resident and Anadromous Fish Species - By Tribe

Nez Perce Use of Fishing Sites for Resident Fish

Location	Unweighted Percent	Map Sites
Clearwater River East of Lewiston, North, South, and Middle Forks	55.7%	40-44, 87, 89, 95, 96, 99
Snake River, including Imnaha River and Tucannon River	17.7%	12, 34, 35, 45, 46, 92, 93
Salmon River, North, South, and Middle Forks	13.2%	36, 37, 39, 71-74, 76-80
Grande Ronde	7.2%	32, 69, 70, 94
Columbia Mainstem from Sandy River confluence to John Day Dam	3.3%	5-7, 9
Individual sites along Hood, Yakima, Wenatchee, Okanogan, Klickitat, South Fork of the John Day, Squaw Creek, and Deschutes Rivers	2.9%	25, 49, 51, 54, 56, 88, 90, 98
Total = 100%		

APPENDIX 24 (cont'd)

Warm Springs Use of Fishing Sites for Resident Fish

Location	Unweighted Percent	Map Sites
Deschutes River	98.4%	23, 65, 66, 98
Hood River	1.6%	25
Total = 100%		

Yakama Use of Fishing Sites for Resident Fish

Location	Unweighted Percent	Map Sites
Columbia River Mainstem between Sandy River confluence and McNary Dam	44.2%	5-8
Klickitat River	25.2%	56
Yakima River	22.8%	48-50
Individual sites along Germany Creek, Deschutes, Fifteenmile Creek, Umatilla, North Fork Clearwater, and N.E. Lewis River	7.8%	3, 23, 24, 30, 43, 63
Total = 100%		

APPENDIX 24 (cont'd)

Umatilla Use of Fishing Sites for Resident Fish

Location	Unweighted Percent	Map Sites
Umatilla River	66.1%	30, 67, 68, 101
Columbia River mainstem between Bonneville and Priest Rapids Dams	11.4%	5-9
Grande Ronde River	7.3%	32, 69, 70, 94
John Day mainstem, North and Middle Forks	6.6%	26-28
Walla Walla River	2.0%	31,100
Individual sites along Deschutes, Hood, Fifteenmile, Imnaha, Lower Snake, North Fork and South Fork Clearwater, Tucannon, and Klickitat	6.6%	23-25, 34, 35, 43, 46, 56, 93, 98, 99
Total = 100%		

APPENDIX 24 (cont'd)

Nez Perce Use of Fishing Sites for Anadromous Fish

Location	Unweighted Percent	Map Sites
Clearwater River	46.0%	40-44, 87, 89, 95, 96, 99
Salmon River mainstem, South and Middle Forks	24.0%	36, 37, 71-73, 76-80
Snake River, including Tucannon and Imnaha River tributaries	11.0%	11-13, 34, 35, 45, 46, 92, 93
Columbia River mainstem between Bonneville and McNary Dams and near Grande Coulee Dam	8.7%	5-8
Grande Ronde River	5.9%	32, 94
Individual sites along Gray's, Fifteenmile Creek, Yakima, Klickitat, Umatilla, and Walla Walla Rivers	4.4%	2, 20, 24, 49, 56, 68, 100
Total = 100%		

APPENDIX 24 (cont'd)

Warm Springs Use of Fishing Sites for Anadromous Fish

Location	Unweighted Percent	Map Sites
Deschutes River	75.2%	23, 65, 66, 98
Columbia River mainstem between Sandy River confluence and McNary Dam	17.6%	5, 8
Individual sites at Columbia River mouth and along Willamette, Sandy, Fifteenmile, Hood, Klickitat, Kalama, N.E. Lewis Rivers	7.2%	1, 21, 22, 24, 25, 56, 58, 63
Total = 100%		

APPENDIX 24 (cont'd)

Yakama Use of Fishing Sites for Anadromous Fish

Location	Unweighted Percent	Map Sites
Mainstem from confluence with Sandy River to Chief Joseph's Dam	53.3%	5-9, 15, 16, 18
Yakima River	10.9%	48, 50
Klickitat River	10.1%	56, 91
Fifteenmile Creek	4.7%	24
Willamette River	3.9%	21
Lewis River	3.9%	4, 63
Cowlitz River	3.1%	57
Washougal River	2.3%	64
Hood River	1.6%	25
Umatilla River	1.5%	30
Germany Creek	1.5%	3
Individual sites along Sandy, Wenatchee, Kalama, and Deschutes Rivers	3.2%	22, 51, 58, 98
Total = 100%		

APPENDIX 24 (cont'd)

Umatilla Use of Fishing Sites for Anadromous Fish

Location	Unweighted Percent	Map Sites
Umatilla River	43.6%	30, 67, 68, 101
Columbia River mainstem between Sandy River confluence and Priest Rapids Dam	21.8%	5-9
Grande Ronde	9.0%	32, 69, 70, 94
John Day mainstem, North and Middle forks	7.6%	26-28
Snake River including Imnaha tributary	3.7%	34, 35, 93
Walla Walla River	2.2%	31
Deschutes River	1.8%	23, 98
Tucannon River	1.8%	46
Individual sites at Columbia River mouth, and along Willamette, Sandy, Fifteenmile Creek, Hood, Clearwater, Klickitat, N.E. Lewis, Washougal, Salmon, and Squaw Creek	8.5%	1, 21, 22, 24, 25, 43, 56, 63, 64, 71, 90, 96
Total = 100%		

APPENDIX 25: Attendance and Fish Consumption at Tribal Ceremonies

Attendance at Ceremonies or Events

Ceremony Attendance	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
Never	32	6.7%	6.7%
Less Than 1 Time per Month	221	40.9%	47.6%
1-3 Times per Month	187	37.1%	84.7%
4-6 Times per Month	48	10.6%	95.3%
More Than 6 Times per Month	24	4.7%	100%
Total	512	100%	
RR = 99.8%			

Fish Consumption at Ceremonies or Events

Fish Consumption at Ceremonies	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
Rarely/Never	38	6.3%	6.3%
At Less Than 1/2 of Events	41	10.0%	16.3%
At About 1/2 of Events	57	11.1%	27.4%
At Nearly All Events	344	72.6%	100%
Total	480	100%	
RR = 100%			

APPENDIX 25 (cont'd)

Amount of Fish Consumed at Ceremonies or Events

Amount of Fish Consumed at Ceremonies	Unweighted Frequency	Weighted Percent	Weighted Cumulative Percent
None	0	0.0%	0.0%
1-2 6 oz. servings	293	59.8%	59.8%
3-4 6 oz. servings	89	20.7%	80.4%
5-6 6 oz. servings	34	10.4%	90.9%
>6 6 oz. servings	26	9.1%	100%
Total	442	100%	
RR = 100%			

APPENDIX 25 (cont'd)

Cross-Frequency Table: Attendance at vs. Consumption of Fish at Ceremonies or Events

Weighted Frequency (weighted percent)	Amount of Fish Consumed at Ceremonies				
Attendance at Ceremonies	Rarely/never consume fish at ceremonies	Consume fish at <1/2 of ceremonies	Consume fish at approximately 1/2 of ceremonies	Consume fish at nearly all ceremonies	Total
<1 time per month	19.6 (4.16%)	27.0 (5.73%)	20.3 (4.30%)	142 (30.0%)	209 (44.2%)
1-3 times per month	8.79 (1.86%)	20.9 (4.42%)	23.0 (4.88%)	135 (28.6%)	188 (39.8%)
4-6 times per month	0.81 (0.17%)	0 (0.00%)	7.32 (1.55%)	43.5 (9.22%)	51.6 (10.9%)
more than 6 times per month	0.81 (0.17%)	0 (0.00%)	1.54 (0.33%)	21.6 (4.57%)	23.9 (5.07%)
Total Weighted Frequency Total Weighted Percent	30.0 6.36%	47.9 10.2%	52.2 11.1%	342 72.4%	472 100%

APPENDIX 26:

List of Acronyms

ACOE	Army Corps of Engineers
BIA	Bureau of Indian Affairs
BPA	Bonneville Power Administration
CDC	Center for Disease Control
CRBFCS	Columbia River Basin Fish Consumption Survey (i.e., the survey upon which this report is based)
CRITFC	Columbia River Inter-Tribal Fish Commission
CSFII	Continuing Survey of Food Intake by Individuals
DDD	dichloro-diphenyl-dichloro-ethane
DDE	dichloro-diphenyl-ethane
DDT	dichloro-diphenyl-trichloro-ethane
FDA	Food and Drug Administration
gpd	grams per day
IHS	Indian Health Service
mths	Months
NAWQA	National Water Quality Assessment
NMFS	National Marine Fisheries Service
NSCRF	National Study of Chemical Residues in Fish
NWPPC	Northwest Power Planning Council
OPPE	Office of Policy, Planning and Evaluation in EPA
ORD	Office of Research and Development
PCB	polychlorinated biphenyl
perc	percent
RR	response rate with outliers included
RR^*	response rate with outliers excluded
SCS	Soil Conservation Service
SE	standard error of the mean
2,3,7,8-TCDD	Tetra-chloro-dibenzo-p-dioxin
unwtd	unweighted
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Service
wtd	weighted

REFERENCES

Beak Consultants. 1989. *Human Consumption Rates of Fish from the Columbia River*, Project #73296. Northwest Pulp and Paper Association, Bellevue, WA.

ChemRisk. (1991). *Consumption of Freshwater Fish by Maine Anglers*. ChemRisk, Portland, Maine; HBRS, Inc. Madison, Wisconsin, March/July, 1991.

Columbia River Inter-Tribal Fish Commission. (1993), Personal Communication with Doug Hatch, Portland, OR, March 3, 1993.

Columbia River Inter-Tribal Fish Commission. *Annual Report, 1992*. CRITFC, Portland, Oregon.

Cooper, C.B., Doyle, M.E., Kipp, K. 1991. "Risks of Consumption of Contaminated Seafood: The Quincy Bay Case Study." *Environ Health Perspectives* 90:133-140.

Cordle, F., Corneliussen, P., Jelinek, C., Hackley, B., Lehman, R., McLaughlin, J., Rhoden, R., Shapiro, R. 1978. "Human Exposure to Polychlorinated Biphenyls and Polybrominated Biphenyls." *Environ Health Perspectives* 24:157-172.

Fiore, B.J., Anderson, H.A., Hanrahan, L.P., Olson, L.J., Sonzogni, W.C. 1989. "Sport Fish Consumption and Body Burden Levels of Chlorinated Hydrocarbons: A Study of Wisconsin Anglers." *Arch Environ Health* 44(2):82-88.

Humphrey, H.E.B. 1983. "Populations Studies of PCBs in Michigan Residents." In: PCBs: *Human and Environmental Hazards*, Ann Arbor, MI: Ann Arbor Science Publications, 299-310.

Institute of Medicine, Food and Nutrition Board. 1991. "Exposures from Sport, Subsistence, and Tribal Fishing." In: *Seafood Safety*. Committee on Evaluation of the Safety of Fishery Products (ed. Farid E. Ahmed). National Academy Press, Washington, D.C. Pp. 245-251.

Maine Department of Natural Resources. 1991. "Penobscot River Users Survey."
National Marine Fisheries Services. 1985. *Analysis of Seafood Consumption in U.S.: 1970, 1974, 1978, 1981*. Silver Spring, Maryland.

Northwest Power Planning Council, *Compilation of Information on Salmon and Steelhead Losses in the Columbia River Basin*, 45-51, September, 1985.

Oregon Department of Environmental Quality. 1992. Oregon's 1992 Water Quality Status Assessment Report, 305(b) Report. Portland, Oregon, April 1992.

Oregon Department of Fish & Wildlife and Washington Department of Fisheries, *Status Report, Columbia River Fish Runs & Fisheries, 1938-1992*, pp. 23-30, August 1993.

Oregon Department of Fish and Wildlife and Washington Department of Fisheries. 1991. *Status Report Columbia River Fish Runs and Fisheries 1960-90*, pp. 27-32 & 38-40, July 1991.

Palmisano, J.F., Ellis, R.H., Kaczynski, V.W. 1993. *The Impact of Environmental and Management Factors on Washington's Wild Anadromous Salmon and Trout*. Prepared for Washington Forest Protection Association, The State of Washington Department of Natural Resources, Olympia, Washington, January, 1993.

Rifkin, E. and LaKind, J. 1991. "Dioxin Bioaccumulation: Key to a Sound Risk Assessment Methodology." J. toxicol Environ., Health 33:103-112.

SRI, Inc., 1980. *Seafood Consumption Data Analysis, Final Report (National Purchase Diary (NPD) Survey)*. Menlo Park, California.

Schmitt, C.J., J.L. Zajicek, and P.H. Peterman. 1990. "National Contaminant Biomonitoring Program: Residues of Organochlorine Chemicals in U.S. Freshwater Fish, 1976-1984. Arch. *Environ. Contam. Toxicol.* 19:748-781.

TetraTech. 1993. *Reconnaissance Survey of the Lower Columbia River. Task 6: Reconnaissance Report, Vol. I.*

Tollefson, L. and Cordle, F. 1986. "Methylmercury in Fish: A Review of Residue Levels, Fish Consumption and Regulatory Action in the United States." *Environ Health Perspectives* 68:203-208.

U.S. Constitution, Art. VI., cl. 2.

U.S. Department of Agriculture. 1986. *Nationwide Food Consumption Survey Continuing Survey of Food Intakes by Individuals, Women 19-50 Years and Their Children 1-5 Years, 4 Days, 1986.* Human Nutrition Information Service, Nutrition Monitoring Division. NFCS, CSFII. Report No. 86-3. 1986.

U.S. Environmental Protection Agency. 1980. "Water Quality Criteria Documents: Availability." USEPA, Washington, D.C., Federal Register, Vol. 45, No. 231, Part V, pp.79318-79379.

U.S. Environmental Protection Agency, (1989). *Assessing Human Health Risks from Chemically Contaminated Fish and Shellfish: A Guidance Manual.* USEPA-503/8-89-002. Office of Water Regulations and Standards (WH-552), USEPA, September 1989.

U.S. Environmental Protection Agency, Region 10. (1992). *Columbia River Basin Water Quality Summary Report*. Portland, Oregon, June 26, 1992.

U.S. Environmental Protection Agency. (1992a). *National Study of Chemical Residues in Fish*, Volumes 1 and 2. USEPA 823-R-92-008. Office of Science and Technology, USEPA, Washington, D.C., September, 1992.

U.S. Geological Service. 1993. *Persistence of the DDT Pesticide in the Yakima River Basin, Washington - National Water Quality Assessment*. U.S. Government Printing Office, Washington, D.C.

Washington State Department of Ecology. 1992. 1992 Statewide Water Quality Assessment, 305(b) Report. Publication #92-04.

West, P.C., Fly, J.M., Marans, R., Larkin, F. 1989. *Michigan Sport Anglers Fish Consumption Survey: A Report to the Michigan Toxic Substance Control Commission*. Natural Resources Sociology Research Lab Technical Report #1. School of Natural Resources, University of Michigan, Ann Arbor, Michigan, May, 1989.