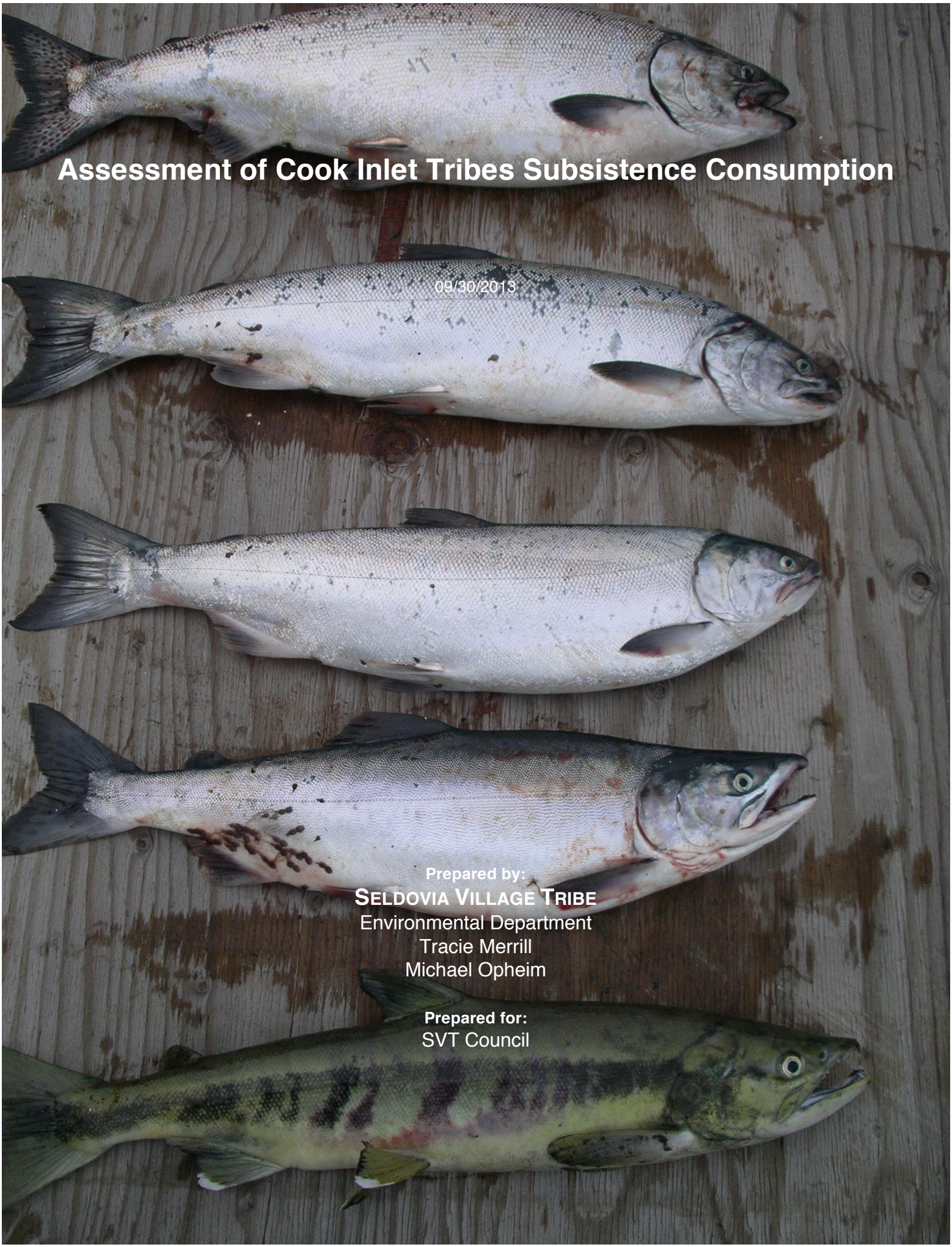

Assessment of Cook Inlet Tribes Subsistence Consumption

09/30/2013

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4. ABSTRACT

The Seldovia Village Tribe (SVT) participated in the Indian General Assistance Program (IGAP) under assistance agreement GA-96080301-4 during FY11-FY12. This report meets the requirements of the workplan under this agreement. This program gave us the opportunity to answer long standing questions and build capacity in our environmental department by conducting a comprehensive assessment/survey in 2012 of the consumption of fish, invertebrates, and marine mammals in the Cook Inlet by Alaska Natives (tribal members) of Seldovia, Port Graham, Nanwalek, and Tyonek. SVT undertook this project because little information exists regarding consumption rates of subsistence foods by Cook Inlet tribal members and the daily rate of fish consumption for Cook Inlet tribal members is believed to be dramatically higher than the rates currently recommended by the Environmental Protection Agency (EPA) and utilized by the Alaska Department of Environmental Conservation (ADEC) in Alaska to establish water quality standards based on human health criteria.

Results revealed that the average daily fish consumption rate for Cook Inlet tribal members was 94.8 (± 23.5 SE) grams per day (g/d). Overall, tribal members within their mid to late thirties through early to mid-sixties consumed the most fish, males consumed more fish than females, fishers consumed more fish than non-fishers, and salmon was one of, if not the, top consumed fish. The average daily rate of fish consumption for children 5 years old and younger in this assessment was 34.9 (± 17.4 SE) g/d. The average daily consumption rate of shellfish for adults was 12.0 (± 3.4 SE) g/d. The results obtained from this assessment indicate that the average daily fish consumption rate of Cook Inlet tribal members is approximately five times greater than the consumption rate recommended by EPA (17.5 g/d) and 15 times greater than the rate used by ADEC (6.5 g/d) in determining human health based ambient water quality criteria and standards for toxins. Current rates clearly underestimate tribal fish consumption, suggesting water quality criteria based on these rates could endanger Native Alaskan health in Cook Inlet. Based on the 95 percentile fish consumption rate value obtained for all respondents of this assessment, we would suggest the use of 247 g/d.

5. ACKNOWLEDGEMENTS

Seldovia Village Tribe would like to thank the United States Environmental Protection Agency for funding this assessment through the Indian General Assistance Program. We would further like to thank the Columbia River Inter-Tribal Fish Commission (CRITFC). Their 1994 fish consumption survey technical report of the Umatilla, Nez Perce, Yakama, and Warm Spring tribes provided the template, and framework, for the methodology and design of the questionnaire used in our assessment. Portions of our Quality Assurance Project Plan (QAPP) were also modeled after a similar plan developed by the Wampanoag Tribe of Gay Head. We wish to acknowledge the Alaska Native Tribal Health Consortium (ANTHC) for their assistance with statistics, as well as data analysis and verification. We are also especially grateful to tribal members living in Port Graham, Nanwalek, Tyonek, and Seldovia who contributed their time to participate in the assessment. This assessment would not have been completed without their support and participation.

6. INTRODUCTION

Between November 2011 and September 2012, Seldovia Village Tribe staff undertook a subsistence consumption assessment (i.e. survey) of Cook Inlet tribal members through EPA IGAP special project funding. This assessment involved an interview-based survey that examined subsistence food consumption rates, and patterns, of Alaska Natives residing in Seldovia, Port Graham, Nanwalek, and Tyonek. Community members of these villages frequently consume and harvest traditional foods from the waters of Cook Inlet. This is the first assessment to collect fish consumption rates and patterns of Alaska Natives living in Cook Inlet in regards to fish preparation methods, cooking methods, breast-feeding, and elementary age children.

6.1 Assessment objective

The objective of this assessment was to ascertain individual tribal members' consumption rates, patterns, habits, and preparation methods of anadromous and resident fish species caught within Cook Inlet waters as well as other marine species (non-fish species) harvested traditionally by tribal members as food sources. This assessment was undertaken due to concerns of contaminants in

Cook Inlet waters and that current fish consumption rates used by agencies, such as the US Environmental Protection Agency (EPA) and Alaska Department of Environmental Conservation (ADEC), for developing human health based water quality criteria in Alaska may greatly be underestimating the amount of fish eaten, on a daily basis, by Cook Inlet tribal members. If Cook Inlet tribal members do have significantly higher fish consumption rates than those currently being recommended and/or used by EPA and ADEC for establishing human health criteria, then current water quality criteria may not be adequately protecting the health of tribal members from exposure to toxins.

6.2 Background

6.2.1 Inaccurate estimates of per capita fish consumption in the United States

Located on the Kenai Peninsula of south-central Alaska, Seldovia, Port Graham, and Nanwalek have been home to Native people for thousands of years (Figure 1). Tyonek is a Native village located in the upper Cook Inlet area, about 40 air miles south of Alaska's largest city, Anchorage. All these villages are only accessible by boat or by plane. Native people have resided in Tyonek, as well, for thousands of years. For as long as the people of Cook Inlet have resided here, they have depended upon and harvested the rich marine resources of Cook Inlet. Alaska Natives were historically nomadic and "followed" food sources so it is not surprising that multiple tribes settled in the Cook Inlet area because of its rich abundance and access to resources.

Fish, especially salmon, are extremely important to tribal members. Fish have traditionally sustained Native people and communities within Cook Inlet for many thousands of years. Salmon is a major food source as well as part of the cultural and economic well being of the tribes. Traditional foods vary seasonally, but are harvested year round, and are essential to culturally important activities. Estimated Subsistence Harvest in the Lower Cook Inlet is estimated to be in the many hundreds of pounds per person annually. The historical and current methods of catching fish range widely: building a temporary dam that as the tide came in the fish could swim over but on the outgoing tide the fish would get trapped, snagging fish using a single 3 barbed hook on twine tied to a stick, working a fish trap, gillnet, and/or beach seine. Some people now rely on a rod and reel to catch their fish from shore or from a boat. Elders speak of nets used to fish made from cotton twine which often lasted two seasons. Next came nylon fish nets which can be used for many years. The first skiffs and dories were only two-three planks high on the sides and about 10-12 feet long that have now been replaced by fiberglass and aluminum skiffs that are well over 27 feet in length with 2 and 3 feet tall sides.

This history of the techniques used to gather fish is important because as times have changed so have fishing techniques. Fish is still preserved in almost the same ways as ancestors taught but with some new technologies like freezing in vacuum seal bags instead of coffee cans with water in them. Fish were traditionally salted, smoked, and dried and still are today. Canning fish became a popular method to preserve fish so that more fish would be available during the winters.

Interest in conducting an assessment of tribal members' consumption of subsistence foods came from the US Environmental Protection Agency (EPA) investigations of human health risks posed from

exposure to chlorinated dioxins, mercury, and other toxins through ingestion of contaminated fish and other marine foods (ATSDR 2009). EPA issued a recommendation in 2000 that states consider adoption of a fish consumption rate of 17.5 g/day to calculate human health criteria. Alaska currently uses the previously recommended rate of 6.5 g/day. A fish consumption rate of 17.5 g/d equals about 0.6 ounces per day or three 6-ounce meals per month (Powell 2011). In Alaska, the Department of Environmental Conservation (ADEC) uses a fish consumption rate of only 6.5 g/d to calculate human health based water quality criteria (Powell 2011). These estimates are questioned as being too low for Alaska Natives. A more recent study conducted by the Agency for Toxic Substances and Disease Registry (ATSDR) indicated Alaska Natives living in Cook Inlet may consume up to 7 oz., or 198.5 grams, of fish per day (ATSDR 2009). Studies of tribes in Oregon and Washington who have similar diets to Alaska Natives indicated they consume, on average, between 48.8 and 81.1g/d (Suquamish 2000, Toy et al. 1996, CRITFC 1994). Cook Inlet tribes and these other tribes share concerns of exposure to similar contaminants (ATSDR 2009, EPA 2002).

6.2.2 Degraded water quality

The health of Cook Inlet has long been a priority to tribal members. Within Cook Inlet, there exist many sources of pollution. On and offshore oil and gas activities occur within the upper portions of Cook Inlet. Since drilling operations began in the 1960s, offshore drilling for oil and gas in Cook Inlet has generated more than 978 million barrels of treated wastewater (ATSDR 2009). While some of the Cook Inlet platforms separate and treat production fluids (oil, gas, and water) right at the platforms and directly discharge the production water into Cook Inlet, others pipe production fluids to three shore-based facilities (Granite Point, Trading Bay, and East Foreland) for separation and treatment. Production water from these shore-based facilities is discharged to Cook Inlet following treatment (either directly from the on-shore facilities or from platforms). Contaminants generated from these operations enter Cook Inlet through the treated wastewaters and drilling mud (ATSDR 2009). Chemicals found in treated wastewater and drilling mud include oil, grease, mercury, cadmium, barium sulfite, and chemical additives such as flocculants, oxygen scavengers, biocides, cleansers, and scale corrosion inhibitors. It is estimated that 253 tons of oil are discharged into Cook Inlet, alone, from treated wastewaters each year (MMS 2003). Additionally, Cook Inlet receives about an average of 182.4 thousand cubic meters per day of wastewater from 10 municipalities (MMS 2003). While Tyonek is within 10 miles of the nearest oil and gas operations in Cook Inlet, Seldovia is approximately 117 miles away from the closest platform, and Port Graham and Nanwalek are approximately 128 miles away from the nearest platforms (USEPA 2000, 2003).

For human health risk assessment purposes, an individual's rate of fish and shellfish consumption is a key exposure variable. Ingestion of contaminated fish is one of the most significant pathways of human exposure to toxic chemicals in aquatic environments (ATSDR 2009). Moreover, because waterborne toxins tend to bioaccumulate in aquatic organisms, those who consume fish can be exposed to significantly higher doses of certain chemical contaminants than from water and atmospheric sources combined (ATSDR 2009). Traditional foods comprise 40 percent to 90 percent of rural Alaskan diets and, therefore, high levels of contaminants in fish, as well as other resources, can be especially dangerous to Alaska Natives (ATSDR 2009). A survey of chemical contaminants of fish, invertebrates, and plants collected in the vicinity of Seldovia, Tyonek, Port Graham, and Nanwalek in 1997 detected global contaminants (mercury, organochlorine pesticides, and PCB congeners) as well as several individual PAH compounds and one type of dioxin (EPA 2003).

6.2.3 Background of villages

Seldovia Village Tribe is one of 229 federally recognized tribes/native villages in Alaska. The name “Seldovia” is derived from "Zaliv Seldevoy," a Russian word meaning "herring bay.” Seldovia is located very close to Port Graham and Nanwalek and is located on the Kenai Peninsula on the south shore of Kachemak Bay opposite Homer. Seldovia is a community of approximately 420 people of which 28.8% is American Indian and/or Alaska Native (US Census 2010). Historically, the Seldovia area was a meeting and trading place for the Kodiak Koniaqs, the Aleuts from the Aleutians, the Chugach people from Prince William Sound, and the Tanaina Kenaitze people of the Cook Inlet. They traveled over land and across the sea to make their home in Kachemak Bay. Speaking Sugpiaq, Aleut, and Dena’ina, they traded goods, ideas, and regional traditions. This confluence of cultures gave rise to a tradition of subsistence from the sea and land that continues to this day. Mining, fox farming, logging, and fishing were major industries conducted in Seldovia between the 1700s and early to mid-1900s. Salmon has played a huge role in the survival of the Seldovia people for many generations. There is a tradition of fishing for family members and friends because of being taught to take care of neighbors. During the months the salmon are running, fish are eaten three times a day and in between that tribal members are busy catching fish.

Port Graham, a sovereign federally-recognized tribe, is a rural predominately Native village. Located 225 miles southwest of Anchorage, the village is located close to the southern tip of the Kenai Peninsula, nestled off the Cook Inlet. The population is approximately 177 of which 90.4% are American Indian and/or Alaska Native (US Census 2010). Most of these “Sugpiat” or “real people” of the Chugach region trace their roots and heritage to the Prince William Sound and Gulf of Alaska. Port Graham, as many rural villages in Alaska, is heavily dependent on traditional ways of life, which have always been an integral part of their heritage. This vast knowledge of natural resources and the environment has been passed from generation to generation and is a major component of the Native culture. Traditional ways of life are ingrained in their very existence; their lives and culture literally depend on the health of traditional resources.

Nanwalek aka (English Bay) is a small native village on the southern tip of the Kenai Peninsula, about 28 miles southwest of Homer, 10 miles southwest of Seldovia and around 4 miles east of Port Graham. Nanwalek is governed by the federally-recognized Nanwalek IRA Council. The word Nanwalek means a place with a lagoon. Approximately 254 people live there of which 89.4% are American Indian and/or Alaska Native (US Census 2010). The beautiful village sits in an area surrounded by Mount St. John and Mount Bede, with an airstrip, and overlooks the Lower Cook Inlet with a reef that you can walk out on during low tide. This bountiful environment offers the people who live there a non-ending resource of food. Almost everything is edible from the ocean. The people of Nanwalek have survived on such foods as seaweed, five species of salmon, butter clams, cockles, lady slippers, bidarkis, snails, China caps, mussels, steamer clams, sea cucumber, tomcod, octopus, halibut, seal, sea lion, bass, cod, fish eggs, and waterfowl. The Native people of this village have used these food sources for centuries and they still depend heavily on them. Ancestors lived off of the land and passed their knowledge down through generations on how to prepare and preserve foods using only the environment. Without any kind of handwritten or recorded recipes, their knowledge was passed down verbally and visually. Nanwalek is fortunate to have the traditions of food, culture, and people that have this knowledge still alive today. The people of Nanwalek, as in many other

communities that live and depend on the ocean for food, find it very important to keep the ocean, air, and land as clean as possible for their livelihood.

Tyonek lies on a bluff on the northwest shore of Cook Inlet, 43 miles southwest of Anchorage. Approximately 171 people reside there of which 94.7% are American Indian and/or Alaska Native (2010 US Census). A federally-recognized tribe is located in the community -- the Native Village of Tyonek. Tyonek is a Dena'ina Athabascan Indian village first reported in 1880 as "Toyonok," which means "little chief." A subsistence lifestyle is practiced in Tyonek. Subsistence activities provide salmon, moose, beluga whale, and waterfowl. Their tribe has been taught for generations to respect and protect their lands and resources, because the land and animals are the ones that feed and help them survive. Tyonek is a fishing community. Net fishing in the Cook Inlet has been the way of life for thousands of years. Salmon is an important ingredient in their community potlatches, holiday feasts, and activities. Salmon is the first solid food for their babies and parents let them gnaw on smoked fish (biliek) when they start teething or just as something to chew on. Fish is always kept in their freezers for wintertime when the times become difficult.

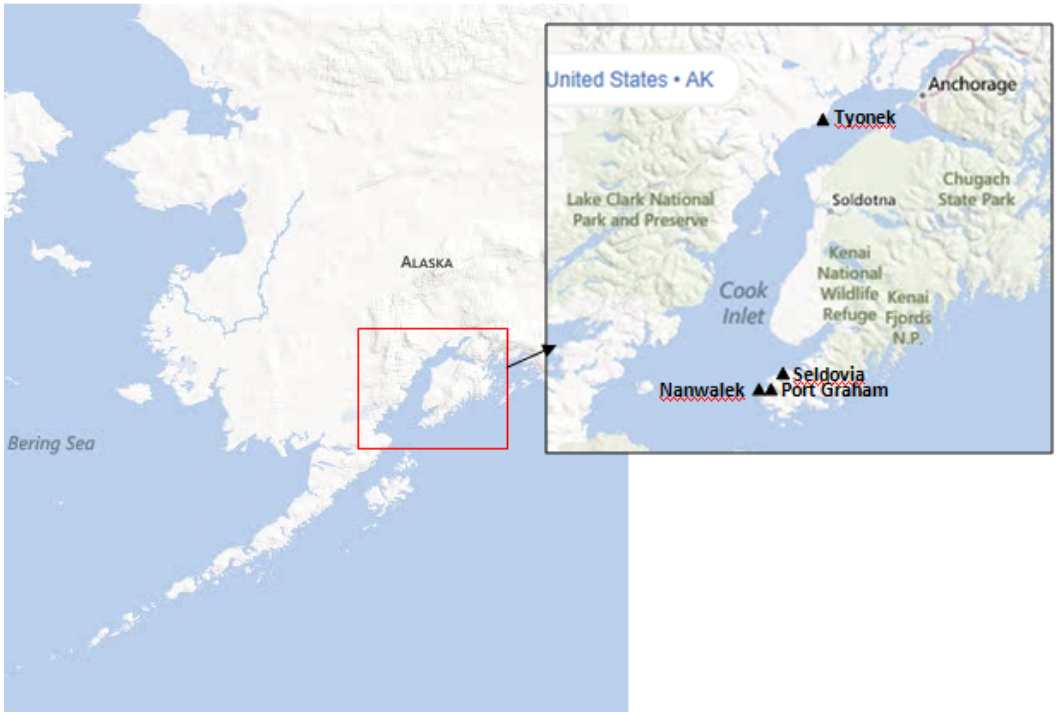

Figure 1. Map of Cook Inlet

7. METHODOLOGY

7.1 Quality Assurance Project Plan

A 44-page Quality Assurance Project Plan (QAPP) was developed for this assessment and approved by EPA in 2012. It outlined: 1) background and need for assessment, 2) primary study goal, 3) objectives, 4) project organization, 5) project schedule, 6) target population, 7) statistical analysis, 8) quality control for interviewing, 9) quality control for data entry, management, storage, and analysis, 10) quality control for confidentiality, and 11) final report as well as including a reference page and

appendices (copies of all the documents developed for the assessment). SVT staff and village interviewers conducted the assessment following the methods and procedures outlined in the QAPP.

7.2 Sample design

7.2.1 Sample frame

Announcements were posted in each participating village about the assessment and descriptions for interviewer positions. Two interviewers were selected from each participating village and contracted by SVT to conduct the preliminary work, as well as carry out, the assessment following the approved documents and methods outlined in the QAPP SVT provided. Selection of tribal members participating in the assessment was random thus eliminating any potential bias from interviewers. Respondents were randomly selected from tribal member registry lists. These lists are updated continuously by tribal staff and used to determine an individual's eligibility to receive services and benefits from tribal programs.

7.2.2 Sample size and tribal representation

At the time of this assessment, based upon tribal registry lists, there were 42 adult (18 years of age or older) tribal members living in Seldovia, 90 in Port Graham, 250 in Nanwalek, and 104 in Tyonek (representing 34, 54, 65, and 77 tribal households, respectively). Based upon the resident tribal household population (34) of Seldovia, a sample size of 19 completed interviews was sought (each from a different household) from each village. "Resident" was defined as living the majority of time in each village. Because tribal populations varied for each village, a consistent sample size (19) was obtained for each village (Figure 2). In addition to maintaining consistency, 19 interviews were sought from each village because that was a realistic number of interviews to obtain within two days at each village due to budget and time restrictions. Data from each individual village were not weighted. However, whenever the data were compiled, the data were weighted based upon the number of tribal households in each village.

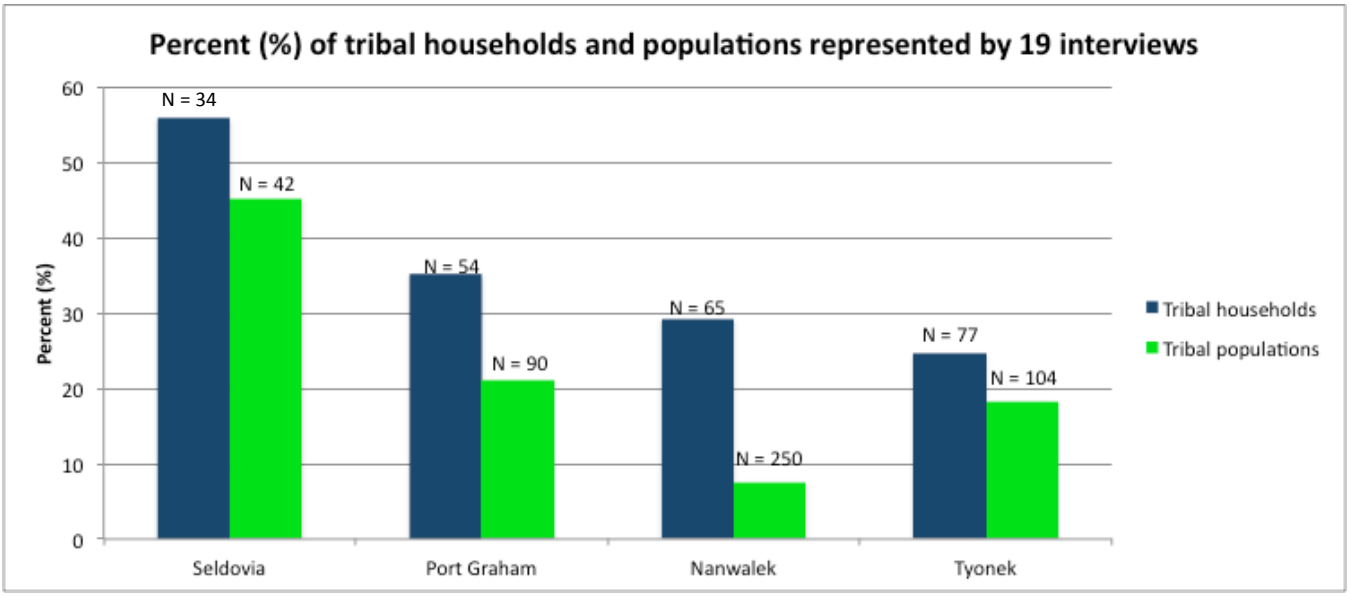

Figure 2. Percent (%) of tribal households and populations represented by 19 interviews.

The required sample sizes for this assessment were determined by the below calculations. Confidence intervals were not calculated for each individual village although the overall sample size needed was calculated (based upon the total number of tribal households), to insure that 76 completed questionnaires would be sufficient for the level of confidence we were seeking.

Estimation of the standard deviation for sample size calculations:

A standard deviation of 30 grams was based on the approximation that 95% of observations fall within 2 standard deviations of the mean. In Appendix B of Volume 2: Risk Assessment and Fish Consumption Limits – Third Edition, available at http://water.epa.gov/scitech/swguidance/fishshellfish/techguidance/risk/upload/2009_04_23_fish_advice_volume2_v2cover.pdf, Table B-3 contains mean and 95% consumption rates from several studies. In this table (Figure 3), the 95th percentile ranges from 2 grams to 75 grams above the mean.

Table B-3. Sport Fishers[a] Consumption Data

Fisher Group	Consumption Rates (g/d) Mean	Median	80th Percentile	90th Percentile	95th Percentile	Fish Type
Alabama fishers[1]	45.8				50.7	F+S, F+C
Louisiana (coastal) fishers[2]		65				F+S, F+C
New York fishers[3]	28.1					F+S, R+C
New York (Hudson River) fishers[4]	40.9					F+S, R
Michigan fishers[5]	14.5		30	62	80	F+S, R
Michigan fishers[6]	18.3			≈50		F+S, R+C
Michigan fishers[7]	44.7					F, R
Wisconsin fishers (10 counties)[8]	12.3				37.3	F, R
Wisconsin fishers (10 counties)[8]	26.1				63.4	F, R+C
Ontario fishers[9]	22.5					F, R
Los Angeles Harbor fishers[10]		37		225		S, R
Washington State (Commencement Bay) fishers[11]		23		54		S, R
Washington State (Columbia River) fishers[12]	7.7					F+S, R+C
Maine fishers (inland waters)[13]	6.4	2.0		13	26	F, R

F = freshwater, S = saltwater, R = recreationally caught, C = commercially caught.
[a] Sport fishers may include individuals who eat sport-caught fish as a large portion of their diets.

SOURCES:
1 ALDEM (1993).
2 Dellenbarger et al. (1993).
3 Connelly et al. (1990).
4 Barclay (1993).
5 West et al. (1993).
6 West et al. (1989).
7 Humphrey (1976).
8 Fiore et al. (1989).
9 Cox et al. (1993).
10 Puffer et al. (1982).
11 Pierce et al. (1981).
12 Honstead et al. (1971).
13 Ebert et al. (1993).

Figure 3. Sport Fishers' consumption data.

For a conservative estimate, we set the standard deviation to 30 grams.

For Seldovia:

Sample size necessary to be 95% confident of the mean consumption to within a bound of 9 grams, assuming a standard deviation of 30 grams/day:

POPULATION SIZE:

34 enrolled tribal households in Seldovia

$$n = \frac{\sigma^2}{\frac{B^2}{Z^2} + \frac{\sigma^2}{N}}$$

n = 18.93

Where: n= required sample size
N= population (34 used for sample size needed)
σ = standard deviation (used 30 grams/day for sample size needed)
B = bound that is being estimated within (used 9 for sample size needed)

Z = z-score for (1- α)% confidence (used 1.96 for 95% Confidence level); α = level of significance = 0.05 for 95% confidence

For all four Cook Inlet villages:

Sample size necessary to be 95% confident of the mean consumption to within a bound of 9 grams for total population of all 4 villages (230 tribal households), assuming a standard deviation of 30 grams/day:

$$n = \frac{\sigma^2}{\frac{B^2}{Z^2} + \frac{\sigma^2}{N}}$$

n = 36.00

Where: n= required sample size

N= population (230 used for sample size needed)

σ = standard deviation (used 30 grams/day for sample size needed)

B = bound that is being estimated within (used 9 for sample size needed)

Z = z-score for (1- **α**) % confidence (used 1.96 for 95% Confidence level); α = level of significance = 0.05 for 95% confidence

7.2.3 Selection procedure

For each village, before any selection process took place, tribal members under the age of 18 were removed from the registry lists as well as known non-resident tribal members. Remaining names on the lists were each assigned a number in sequential order. Using a random number generator, a hundred numbers were generated. All numbers were between the values of one and the largest number assigned to tribal members on each list. Tribal members assigned to the first 19 numbers appearing in the generated random number table were then selected and attempts were made to contact them for interviews. Tribal members who could not be contacted after a minimum of four attempts, or refused to participate, were removed from the sample set and were replaced by the next eligible members on the list following the same selection method as above. Attempts were made to contact selected tribal members who had no valid phone number. They were contacted in-person or were sent a letter informing them of the assessment and asking them to contact tribal staff to arrange an appointment. Tribal members were given a month to respond, and after a month they were removed from the sample pool. The tribal members residing in the same households as interviewed members were also removed from the sample set upon completion of those interviews.

7.2.4 Weighting data

Data presented in this report from individual villages were unweighted. However, whenever data were compiled, the data were weighted using the following formulas as described in the CRITFC survey and consistent with those found in the following statistical reference (Stanley 2008):

Weighting factor of each tribe:

W_{bhi} or base weight = (N_h/n_h) where: N_h = the population size (# of tribal households) of each individual tribe
n_h = sample size of the individual tribe (n_h = 19 for each tribe)

*wi = Final weighting factor for each tribe = calculate base weight for each tribe and then divide each of these by the lowest base weight value

For the weighted mean:

$$\bar{X}_w = \sum_{i=1}^{i=m} w_i x_i \Big/ \sum_{i=1}^{i=m} w_i$$

where: w_i = weighting factor for individual tribe
x_i = the individual data point
m = the number of data points

This can also be written as: $x'_w = \sum_{i=1}^{n} w_i x_i$ and $X_{rw} = x'_w/w'$ and $w' = \sum_{i=1}^{n} w_i$

For the weighted variance:

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

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

7.3 Assessment methods

7.3.1 Target population

The target population included all tribal members 18 years and older who lived in Seldovia, Port Graham, Nanwalek, and Tyonek at the time the assessment was being conducted. Interviews were sought with 19 tribal members (each representing a different household) from each village. Respondents provided consumption information for themselves and the youngest child (17 years old or younger) residing in the respondent's household. Data for these children is summarized in section 8.7 of this report. Respondents who stated they consume fish were referred to as "fish consumers" and respondents who stated they did not consume fish were referred as "non-fish consumers." Since the purpose of the assessment was to determine current consumption rates, respondents who had not eaten a species within the last year (from the date of the interview), were not considered to be eating that species.

7.3.2 Questionnaire development

The questionnaire design and content used during interviews was modeled after the survey developed by the Columbia River Inter-Tribal Fish Commission for their fish consumption survey of the Umatilla, Nez Perce, Yakama, and Warm Spring tribes of the Columbia River Basin. The

questionnaire was included as an appendix with the QAPP developed for this project and subsequently approved by EPA in 2012 and is attached as Appendix A in this report.

Under the guidance of the Tribal Council, SVT environmental department staff determined the focus of the assessment, the target population, questionnaire design and content, interview procedure and methodology, and tasks necessary to complete the assessment. All of the above were referenced in the QAPP developed for the project and subsequently approved by EPA.

7.4 The assessment questionnaire

The 18-page questionnaire (in addition to several pages of maps marked by respondents) included 36 questions within five sections (Memory recall, Adult consumption of fish, Child consumption of fish, Adult consumption of non-fish subsistence foods, and Obtaining fish). Respondents were asked questions about their consumption of different fish species and fish parts as well as consumption of several non-fish marine foods. Questions included: demography, 24 hour dietary recall, seasonal, annual, and daily fish consumption rates, consumption of fish parts, fish preparation methods, breast-feeding, Cook Inlet fishing sites, sources of fish consumed, and fish consumed as a result of cultural and social events. In addition, questions concerning the consumption of several non-fish marine species (invertebrates, harbor seal, beluga, and sea birds/ducks) were included. If children (17 years old or younger) resided in the same household as a respondent, the respondent was also asked to provide information about the consumption of fish species and fish parts for the youngest child in the household. In order to be considered an adult, the respondent must have already reached their 18th birthday.

7.4.1 24-Hour Recall

The 24-hour dietary recall was asked of adult respondents for comparative analysis with overall individual fish consumption rates. Respondents were asked to list everything they had eaten or drank within the past 24 hours prior to the starting time of their interviews along with amounts. Fish fillet (three ounce and five ounce) models were shown to respondents to help them determine accurate amounts.

7.4.2 Fish

7.4.2.1 Seasonal Consumption

To better understand seasonal variation and correlations in consumption, respondents were asked to identify the two months of the year they consume the most fish and the two months they consume the least fish. Respondents were then asked to estimate the average number of fish meals per week they consumed during the two months they identified as highest and least months of consumption.

7.4.2.2 Rate of fish consumption throughout year

Respondents were asked about the number of fish meals they consume on a weekly basis, on average, throughout the year.

7.4.2.3 Defining and quantifying “fish meals”

“Fish meals” included breakfast, lunch, dinner, and snacks. Snacks included food items such as crackers with fish spread and dried fish. Fish meals were not defined by any quantified amount. Since the term “fish meals” did not indicate a quantified amount of fish and may have reflected different amounts in ounces depending on the respondent and 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, plastic models approximating three-ounce and five-ounce fish fillets were provided.

7.4.2.4 Fish species consumed

The questionnaire asked for consumption information on 29 species of Cook Inlet fish. These species were chosen because they are known to be traditionally harvested by tribal members and because they all can be found locally at least for part of the year. Smelt, pike, whitefish, needlefish, and bullhead were not on the earlier version of the questionnaire form provided to Seldovia tribal members but were on the later version provided to Port Graham, Nanwalek, and Tyonek. This assessment had already been undertaken for tribal members in Seldovia before funding was approved for this assessment to be done in the other three villages.

7.4.2.5 Fish parts consumed

Respondents were asked to identify the parts they usually consume for each fish species they identified as being “commonly eaten.” Fish parts listed on the survey were: fillet, skin, head, eggs, bones, belly fat/flaps/meat, and other organs. Respondents were also asked to provide the same information for one child 17 years of age or younger residing in the respondent’s household (if applicable). Belly fat/flaps/meat was not on the earlier version of the questionnaire form provided to Seldovia tribal members but was on the later version provided to Port Graham, Nanwalek, and Tyonek.

7.4.2.6 Fish preparation methods

Because toxic chemicals may attenuate out of fish flesh when prepared by certain methods (DEC 2012), 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, canning, and salting. Pickled fish was included under the “raw” category. Although a separate category was created for salted fish on the questionnaire form, for analysis, salted fish was considered “raw” fish. 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. “Salted” was not given as an option on the original questionnaire form Seldovia tribal members responded to.

7.4.2.7 Breast-feeding

Because certain toxic contaminants can be passed to newborn infants from mother’s breast milk (Nickerson 2006, Ramirez et al. 2000), all female respondents were asked whether they have given birth, and if so, the month/year of their youngest child’s birth, whether that child has been, or is currently, being breast-fed. Female respondents were also asked at what age their child ceased or will cease breast-feeding.

7.4.2.8 Source of fish consumed

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:

1) Self-harvest or harvest by family
2) Grocery stores
3) Other
    - Friends who fish
    - Ceremonies
    - Distribution by the tribe
    - Other (list)

The “ceremonies” category included potlucks and the “other (list)” category included restaurants and any other sources respondents mentioned that were not already specifically listed. Information on sources of fish is presented as the sum of individual responses as well as the means for each source.

7.4.2.9 Fishing site locations

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 Cook Inlet where they fish for particular species. Those participants who indicated that they fish for themselves or the tribe identified fishing sites on several maps provided to them by the interviewer. In addition, they listed the names and/or descriptions of these sites next to each fish species caught. However, the maps did not encompass all of the usual and accustomed fishing areas utilized by tribal members and some tribal members did not wish to disclose their fishing sites. The maps were not mandatory for the survey but an option if participants wanted to share those locations.

7.4.2.10 Ceremonial consumption of fish

To substantiate the cultural importance and prevalence of fish to tribal members, respondents were asked questions about their attendance at ceremonies (including tribal and non-tribal community

events) and their consumption of fish at these events.

7.4.3 Non-fish subsistence foods

7.4.3.1 Non-fish species consumed

Respondents were asked consumption questions regarding eleven non-fish species: harbor seal, beluga whale, bidarkis (black leather chitons), limpets (China caps), mussels, butter clams, little neck clams (steamers), snails (periwinkles, hairy tritons), octopus, and sea birds. “Sea birds” included birds considered to be “sea ducks” such as eiders, scoters, golden eyes, etc. These species were chosen because they are some of the most important non-fish marine resources traditionally harvested by tribal members. Questions regarding beluga and snails were not asked in the earlier version of the questionnaire used for Seldovia tribal members. Although octopus was listed, consumption of octopus was not included in shellfish consumption rates for any of the villages because quantities consumed could not be accurately determined based upon respondents’ answers. It should also be noted that crab was once a very important local food source for tribal members, as well, but due to large declines in their local population, they are no longer commonly harvested in the area.

7.4.3.2 Consumption throughout year

For each non-fish marine species listed above, respondents were asked how often they consume each species in a year. For each species, they were also asked either how many they consumed in a meal or in a year. Questions were phrased this way because many of these species are only eaten a very limited number of times in a year by tribal members. There were several additional questions asked regarding harbor seal and beluga whale consumption. Respondents were asked what harbor seal/beluga whale parts they commonly eat (meat, ribs, intestines, liver, flippers, other) and how they are typically prepared (boiled, fried, other). Additionally, they were asked how much harbor seal and/or beluga meat (or parts) they ate per meal. There were several choices they could pick from to answer this question: less than half a plate, half a plate, a full plate, or more than one full plate. A “plate” was stated as being about the size of a regular dinner plate. Since “blubber/fat” was not listed in the earlier version of the questionnaire given to Seldovia tribal members for harbor seal, for analysis purposes, when respondents listed “oil” under “other parts,” they were considered to have eaten blubber/fat (since these parts are rendered into oil).

7.5 Development of additional forms

In addition to the QAPP and the interview questionnaire, SVT developed several other documents for this assessment. These other documents included: a contact activity log sheet, an interviewer check list, a confidentiality statement, and a consent form for respondents to sign prior to participating in the interviews. All these forms were attached as appendices to the QAPP and approved by EPA. The purpose of these forms was to insure quality control and to fully inform and clarify to respondents about the purpose of the assessment, expectations, how the data they provided would be protected and used, and how confidentiality would be maintained.

7.6 Data collection procedure

Interviewers were instructed to make at least four attempts to contact an individual by phone to schedule an interview. For those tribal members who did not have phones, interviewers were encouraged to try to reach these tribal members either by letter or in-person. The interviewer logged his/her attempts to contact a tribal member on contact activity log sheets. Additionally, these sheets were designed to allow the interviewer to make two changes to the original appointment in case rescheduling was necessary. Reasons were documented by the interviewer as to why an individual could not be interviewed (refused to participate, could not be contacted, etc.). A total of 76 interviews were completed between November 2011 and September 2012. Interviews were conducted either within central locations or at the homes of tribal members in each village.

7.7 Quality control in assessment implementation

7.7.1 Pretest

Amongst the four villages, at least three interview pretests were conducted prior to the interviews actually being conducted. For each interview pretest, a tribal staff member was chosen and interviewed to determine the time required to administer the questionnaires and to identify potential problems with interpretation or delivery of questions.

7.7.2 Interviewer training

Before conducting interviews, key project staff reviewed EPA's Guidance for conducting fish and wildlife consumption surveys and Survey Management Handbook as well as several documents that discuss proper interviewing techniques. A training session for interviewers was hosted by SVT personnel through a teleconference call and webinar (a *join.me* session). Through these resources, project staff learned about obtaining accurate survey data, prevention of bias in responses to questions, use of food models to assist respondents in determining amounts of food consumed, and quality control.

7.7.3 Activities and efforts to maintain and improve accuracy of data

7.7.3.1 Presence of a monitor

In addition to the respondent and the interviewer, a designated quality control monitor was present during all interviews to observe and monitor the interviews and to examine questionnaires for completeness. At the conclusion of an interview, if appropriate, the quality control monitor would suggest improvements to the interviewer. Additionally, if needed, the quality control monitor would assist with rephrasing or clarifying questions to respondents. The quality control monitor would then initial each questionnaire form after looking it over and being sure all questions were answered.

7.7.3.2 Use of digital voice recorders

After being read a confidentiality statement at the beginning of the interview, respondents were asked to sign a consent form agreeing to participate in the interview. Additionally, respondents checked a box on the consent form indicating whether they agreed, or did not agree, to have the interview recorded. For those respondents who agreed to have their interviews recorded, the interviews were recorded using digital voice recorders (ZOOM H2 Handy Recorder). The interviews were recorded so that responses to questions could be verified and clarified.

7.7.3.3 Use of food models

Plastic food models (fakefoodonline.com) approximating three and five ounce fish fillets were provided to aid respondents in estimating amounts of fish consumed. Actual fillets of halibut and salmon of similar size to the fake foods models were weighed to get these weights.

7.7.3.4 Use of fish ID books

A fish identification book, A field guide to common marine fishes and invertebrates of Alaska by Susan C. Byersdorfer and Leslie J. Watson (2010), was made available to respondents during the interviews if they were unfamiliar with the name of a fish species. The identification book contained color photographs of fish species along with physical and life history descriptions. Often local names are used for fish species in the Cook Inlet Villages. For instance, “humpies” are pink salmon, “reds” are sockeye salmon, “kings” are chinook salmon, “dogs” are chum salmon, “silvers” are coho salmon, “black cod” is sablefish, “pogies” are greenlings, “black bass or sea bass” is the black rockfish, and “hooligan” is eulachon. For this reason, respondents would sometimes not be able to recognize a fish species based on the name on the questionnaire form but would when shown a picture of it or the quality control monitor used the more common name known in the villages.

7.7.3.5 Reading questions and documents as written

A confidentiality statement, a consent form, and questions on the questionnaire were read “as written” to respondents by the interviewer. After being read a question, if the respondent was unclear about what was being asked, the question was then rephrased or clarified to them.

7.8 Procedures for protecting confidentiality

A confidentiality statement was read (as written) to respondents at the beginning of interviews explaining to them how the data would be used and how their identities would be protected. Participants were only identified by a number system on the contact activity log sheets and in the spreadsheet where their information was entered. No personal statements made by respondents that could identify them were entered into the spreadsheet. On the interviewer check list form, the associated interview/questionnaire was only referenced by a number system. Completed questionnaires and the digital tape recorders were kept in secured offices.

7.9 Data processing

7.9.1 Data entry

Assessment data was entered into a Microsoft Excel spreadsheet maintained by SVT environmental department staff. If the respondent provided a range regarding their estimated fish consumption, the average of the high and low values was entered into the spreadsheet. Participants, and data subsequently referenced to them, were only identified by numbers in the spreadsheet.

7.9.2 Data analysis

Mean, median, and 95 percentile fish, shellfish, and seafood daily consumption rate values for adult respondents were determined for each village and for all four Cook Inlet villages combined. Standard errors were included with mean values. Consumption rate estimates were calculated for all respondents (thus representing consumption rates of the entire tribal population sampled), fish consumers only, males, females, fishers, and non-fishers. Because differences in consumption rates were very small between all respondents and fish consumers only, consumption rate values for all respondents (both fish consumers and non-fish consumers combined) are reported in the text of this report unless otherwise stated. Consumption rate estimates are available for fish consumers only in Appendices B, C, D, and E.

Adult consumption rate values for all fish consumed (both listed and non-listed species on survey) were based on the consumption rates of individual respondents in grams per day (g/d) as determined from the data on average serving size and number of weekly fish meals eaten, on average, throughout the year. This calculation was as follows:

Ounces eaten per meal x number of meals per week = ounces per week
Ounces per week/7 days per week = ounces per day
Ounces per day x 28.35 grams per ounce = grams per day

Adult consumption rate values were obtained for anadromous fish species (sockeye salmon, chinook salmon, coho salmon, pink salmon, chum salmon, rainbow trout, dolly varden trout, steelhead, lake trout, eulachon, and smelt), non-anadromous fish species (halibut, lingcod, grey cod, black rockfish, black cod, pollock, flounder, tomcod, red rockfish, greenling, herring, sculpin, dogfish shark, salmon shark, pike, whitefish, needlefish, and bullhead), and for all the above listed fish species based on meals per month of each species and the average fish portion size reported by respondents. These consumption rate values included only listed fish species.

This calculation was as follows:
Ounces eaten per meal 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

Adult consumption rates for all fish consumed (both listed and non-listed fish species) during months identified as high and low fish consumption months by respondents were calculated as follows:

Ounces eaten per meal x number of meals per week during two months identified as either low or high fish consumption months = ounces per week
Ounces per week/7 days per week = ounces per day
Ounces per day x 28.35 grams per ounce = grams per day

Shellfish (blue mussels, snails, clams, bidarkis, limpets) consumption rates were based on the number of times they were eaten in a year and the average number eaten in a meal as reported by adult respondents. For each species, the total number eaten in a year was then multiplied by an average wet tissue weight (biomass) value as established by actual weighing or through calculated wet tissue weights obtained through length/weight formulas.

This calculation was as follows:
Number of times eaten in year x how many consumed per meal = number consumed per year
Number consumed in a year x wet tissue weight (grams) = grams per year
Grams per year/365 days in year = grams per day

Wet tissue weight values were found in primary literature published about research in Alaska (Table 1). For conservative estimates of each shellfish species, weights were used that either were associated with lengths of organisms typically harvested for consumption or lengths at, or just above, the minimum legally harvestable sizes.

Table 1. Wet tissue weight calculations for shellfish.

Species	Length (mm)	Average wet tissue weight (grams ± standard deviation) or calculated wet tissue weight (grams) based on length	Source
Blue mussels	40 to 54	4.5 ± 2.0	Burger and Gochfeld 2006
Littorina snail	8-19	0.3 ± 0.0	McKinney et al. 2004
Butter clams	67	25.0	Nickerson 1977
Littleneck clams	42 to 45	7.5	Brooks 2001
Shield limpet	33	7.9	Andres 1994
Bidarki (black leather chiton)	90	40.0	Andres 1994

Consumption rates for seafood were calculated in two different ways 1) by combining consumption data for all fish (both listed and non-listed species) and for shellfish species listed in the questionnaire and 2) by combining consumption data for all fish species and shellfish species listed in the questionnaire (so this rate would solely be for listed species).

Mean, median, and 95 percentile fish daily consumption rate values for children (17 years old and younger) were determined for each village and for all four Cook Inlet villages combined. Standard errors were included with mean values. Consumption rate estimates were calculated for all children

(those who ate fish and those who did not), for only children who ate fish, for children 5 years old or younger, and for children between the ages of 6 and 17 years old. Children consumption rates reported in text are for all children (for both children who eat fish and those who don't) unless otherwise stated. Consumption rates for only those children who eat fish are reported in Appendix F.

Average fish consumption rates and patterns for adults and children were compared with data collected from the Columbia River Basin tribes during their fish consumption survey (Columbia River Inter-Tribal Fish Commission 1994) as well as results from the Suquamish Indian Tribe (*Suquamish 2000*), Tulalip and Squaxin Island tribes (*Toy et al. 1996*), and previous fish consumption data obtained for Alaska Natives (*ATSDR 2009, Nobmann et al. 1992)* to determine if, and what, differences existed between the data obtained in this assessment and data collected from other Northwest/Alaskan studies focusing on American Indians/Alaskan Natives.

7.9.3 Statistical tests

Since the sample size was less than 2000, a Shapiro-Wilk test was used to evaluate the normality of both untransformed, weighted data (grams/day for all respondents (fish consumers and non-fish consumers combined)) and log-transformed (log(x+1)), weighted data using the statistical software program, *R*. The resulting 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 (CRITFC 1994). 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 deviations from normality (CRITFC 1994). Since the grams/day data, overall, was not normally distributed, even after being log-transformed, and because of small sample sizes, non-parametric tests were used to compare data between groups (fishers vs. non-fishers, males vs. females, etc.). Two-tailed Mann-Whitney U tests were used to compare the medians/distributions between two groups since approximation is good for sample sizes above 20, sample sizes do not need to be equal, and no assumptions are made regarding normality of data (Choudhury 2009). Mann-Whitney U tests were performed using the online calculation available at http://elegans.som.vcu.edu/~leon/stats/utest.html. Using the statistical software program, *R*, a Kruskal-Wallis test was used to compare among groups of 3 or more. For all statistical analyses, the alpha level was 0.05. For means, standard errors (SE) were calculated.

7.9.4 Outliers

One outlier from Port Graham's adult data set was excluded in analysis of fish consumption rates for anadromous, non-anadromous, and all listed fish species because the accuracy of that data was questioned. One outlier from Nanwalek's children data was also excluded for this same reason. All other outliers were included despite being high compared to other values given by respondents because they were believed to realistically reflect consumption rates.

8. ASSESSMENT RESULTS

8.1 Demographic information

8.1.1 Non-response rates

Non-response rates (or percentage of tribal members who were contacted and refused to participate, were not successfully contacted although multiple attempts were made, or could not participate because they were not present in the village at the time) were as follows for each village:

Seldovia = 14/33 = 42.4%

Port Graham = unavailable = data not reported

Nanwalek = 19/19 = 0%

Tyonek = 11/30 = 37.7%

8.1.2 Sex of respondents

Overall, an equal number of females and males participated in the assessment (n_1 = 38 females, n_2 = 38 males; Table 2). In Seldovia and Nanwalek, a larger number of females participated than males in the interviews while more males participated in Port Graham and Tyonek (Table 2). The largest difference between the number of participating males and females occurred in Port Graham, with a difference of 5.

Table 2. Number of female and male respondents per village. Unweighted data.

Village	# of females	# of males
Seldovia	11	8
Port Graham	7	12
Nanwalek	11	8
Tyonek	9	10
Cook Inlet (combined)	38	38

8.1.3 Age of respondents

The average age of all respondents (n=76) was 46.8 (± 2.3 SE) years. The average ages of respondents were 58.5 (± 2.9 SE), 52.8 (± 4.1 SE), 41.9 (± 2.9 SE), and 41.4 (± 3.1 SE), respectively, for Seldovia, Port Graham, Tyonek, and Nanwalek (n=19 for each village). The majority of respondents (n=30) were between the ages of 40-59 years (Appendix B). A Kruskal Wallis test revealed there were significant differences (H=16.8, p = 0.001, df=3, n=19 for each village) in the age distributions of respondents among villages. Nanwalek and Tyonek had a larger number of respondents between the ages of 18-39 (52.6% or 10/19 for Nanwalek and 42.1% or 8/19 for Tyonek) compared to Seldovia (5.3% or 1/19) and Port Graham (26.3% or 5/19) (Appendix B).

8.2 Rates of adult fish consumption

The average rate of consumption by all interviewed adults (n=76) throughout the year for all fish (both listed and unlisted species) from all sources was determined to be 94.8 (± 23.5 SE) grams per day (g/d) with a median of 46.5 g/d and a 95 percentile value of 247.1 g/d. A Shapiro-Wilk normality test revealed that these data (g/d) were not normally distributed ($W = 0.482$, p-value < .0001) even after being log-transformed (log (x+1)) ($W = 0.9207$, p-value < 0.001). The majority of respondents indicated they ate up to 10 ounces of fish per fish meal (69/76 or 91.0%). The remaining percent (9.0% or 7/76) of respondents indicated they ate more than 10 ounces. The mean of individual estimates of an average serving of fish was 7.1 (± 0.5 SE) ounces. Surprisingly, the standard deviation calculated from the g/d data was higher than what we originally anticipated when calculating the sample size needed for the assessment.

8.2.1 Rates of consumption for demographic categories

8.2.1.1 Fish-consumers vs. non-fish consumers

Four of 76 respondents indicated they rarely/never eat fish. However, in three of the four cases, the respondents indicated they ate fish at least once or twice a year and so the average number of fish meals eaten by them weekly throughout the year was calculated by dividing the number of fish meals they ate in a year by the number of weeks in a year (52.14 weeks). Reasons given that they no longer ate fish frequently included that they were no longer physically able to fish for themselves and that they had developed allergies to fish and other seafood. Several tribal members also stated that they would eat certain species but that these species are no longer plentiful or as easily accessible in their harvesting areas. Excluding the individual that indicated he was not a fish consumer at all, interviewed fish consumers (n=75) consumed an average of 95.5 (± 23.8 SE) g/d of fish (Appendix B).

8.2.1.2 Fishers vs. non-fishers

Approximately 92% (92.1% or 68/76) of tribal members interviewed caught fish for personal consumption. Interestingly, the mean fish consumption rate for non-fishers (n=8) at 45.8 (± 19.4 SE) g/d was much lower than the mean consumption rate for fishers (n=68) at 99.0 (± 26.1 SE) g/d (Appendix B). A two-tailed Mann-Whitney U test revealed significant differences in the median g/d values between the two groups ($U = 421.5$, $p = 0.010$, $n_1 = 68$, $n_2 = 8$). A discussion of these results can be found in section 9.

8.2.1.3 Gender and age

Males consumed more fish than females (with males averaging 109.5 (± 39.2 SE) g/d and females averaging 79.8 (± 26.3 SE) g/d (Appendix B). However, a two-tailed Mann-Whitney U test revealed no significant differences between the median g/d values between males and females ($U = 816.5$, $p \geq 0.05$, $n_1 = 38$, $n_2 = 38$). Respondents between the ages of 40 and 59 years consumed, on average, 109.6 (± 48.9 SE) g/d of fish, which was more fish than any other age group (18-39, 60+). Interestingly, the age group having the second largest fish consumption rate was respondents

between the ages of 18-39 years with an average rate of 99.4 (± 41.6 SE) g/d (Appendix B). No significant differences in fish consumption values between age groups (statistic H = 2.79, df = 2, p = 0.248, n_1 = 24, n_2 = 30, n_3 = 22) were detected with a Kruskal-Wallis test.

8.2.2 Seasonal rate of fish consumption

For approximately 52 percent (51.9% or 40/76) of respondents, the two months of highest fish consumption were June and July or July and August (Figure 4). For all months identified as high fish consumption months (i.e. months identified by each respondent as their two months of highest fish consumption) by the entire population sampled, respondents consumed an average of 116.4 (± 19.3 SE) g/d of fish (n=75) (Appendix C). Additionally, out of the four villages, tribal members of Nanwalek consumed the most fish (189.6 (± 37.6 SE) g/d), on average, during high fish consumption months.

When asked about the months of lowest fish consumption, approximately 63 percent (63.2% or 47/76) of respondents indicated that they ate the least fish during the months of November through May with January being cited the most frequently as a month of least fish consumption (16/76 or 20.8%) (Figure 4). During all low-fish consumption months as identified by the entire population sampled (i.e. months identified by each respondent as their two months of lowest fish consumption), respondents consumed an average of 41.0 g/d (± 6.4 SE)(Appendix D). Tribal members of Tyonek and Seldovia (n=19 for both villages) consumed the least amount of fish during these months. In fact, respondents from both villages, on average, consumed an equally low amount of fish during this time period at 33.6 g/d (± 12.8 and ± 6.9 SE for Seldovia and Tyonek, respectively). Overall, the mean rate of consumption in high fish consumption months was nearly 3 times higher than the mean rate of consumption in low fish consumption months.

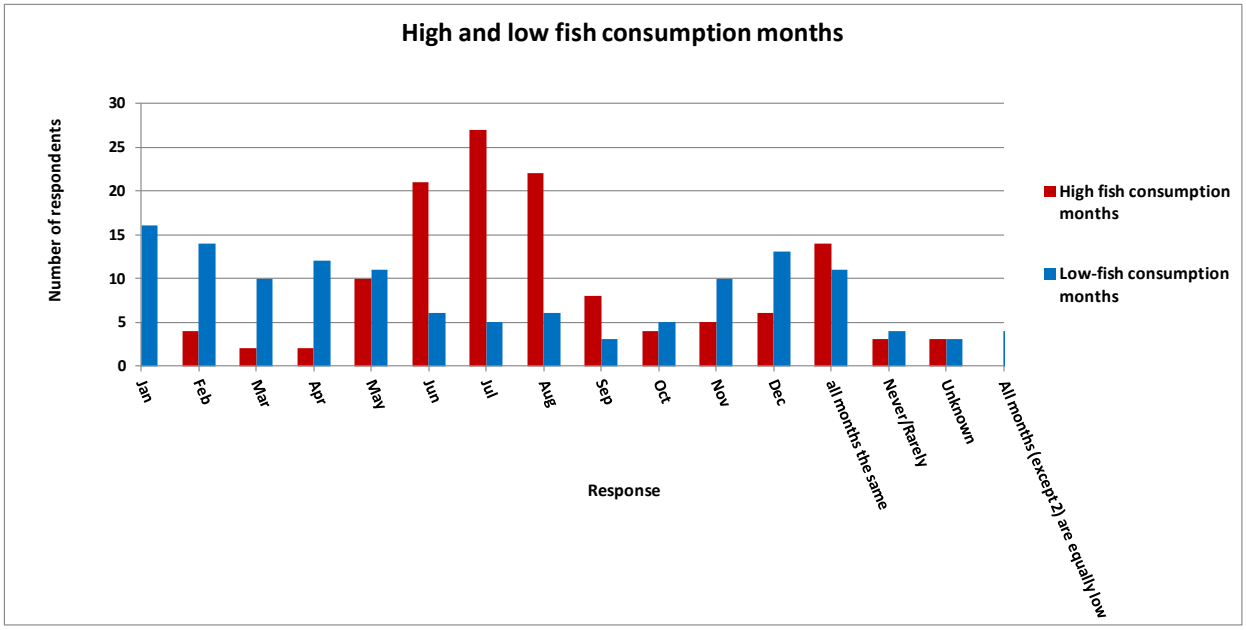

Figure 4. High and low fish consumption months. Unweighted data.

8.2.3 Dietary recall

Approximately 44 percent (43.5% or 34/76) of respondents indicated they had eaten fish within the 24 hours preceding the starting time of their interviews; 56.5 percent or 42/76 of respondents had not consumed fish during this period. The overall rate of consumption reported by respondents who had consumed fish in the 24 hours preceding the interview was compared to the overall rate of consumption reported by respondents who had not consumed fish during that period. A two-tailed Mann-Whitney U test ($U = 1018.5$, $p = 0.001$, $n_1 = 42$, $n_2 = 34$) revealed that respondents who had eaten fish within this time frame, on average, had significantly different median fish consumption rates (g/d) than those who had not eaten fish. The average fish consumption rate for respondents who had eaten fish (110.0 (± 29.1 SE) g/d) within the 24 hours prior to their interviews (n=34) was higher than for those who had not (83.1 (± 35.6 SE) g/d, n=42).

8.2.4 Women who have nursed or currently are nursing

Of the 37 women who responded to the question regarding whether they had ever give birth, 96.3% or 36/37 said they had given birth. Out of those women who had given birth, approximately 68 percent (68.0% or 25/35) said they had breast-fed their youngest child. No interviewed female was currently breast-feeding. Of those children who were breast-fed (n=25), the average age that the children stopped breast-feeding was 11.5 (± 2.3 SE) months. Women who breast-fed, consumed on average, 100.1 (± 38.5 SE) g/d which is higher than the mean fish consumption rate found, in general, for women (79.8 (± 26.3 SE) g/d) within the tribal population. A two-tailed Mann-Whitney U test ($U = 158.5$, $p = 0.477$, $n_1 = 25$, $n_2 = 11$) revealed no significant differences in median g/d between women who breast-fed and women who did not.

8.2.5 Consumption of different species by adults

Overall, coho salmon was the fish species eaten by the most respondents (89.5% or 66/75 of respondents), followed by halibut (83.9% or 64/75 of respondents), chinook salmon (79.0% or 59/75 respondents), sockeye salmon (75.4% or 59/75 of respondents), and pink salmon (63.8% or 50/75 of respondents) (Figure 5). In terms of quantity (g/d), though, coho salmon had the highest average daily consumption rate by respondents at 31.2 (± 9.7 SE) g/d followed by sockeye salmon at 22.8 (± 5.5 SE) g/d then pink salmon at 17.1 (± 4.6 SE). It should be also noted that among villages, there was considerable variation in which species contributed to the highest percentages (based on total grams consumed by respondents per month) of fish consumption (Tables 3 and 4). For instance, in Seldovia, sockeye salmon and halibut made up the majority of fish consumed while in Port Graham, it was sockeye and coho salmon. In Nanwalek, the highest percentages of fish consumed were coho and pink salmon, while it was chinook and coho salmon in Tyonek (Tables 3 and 4).

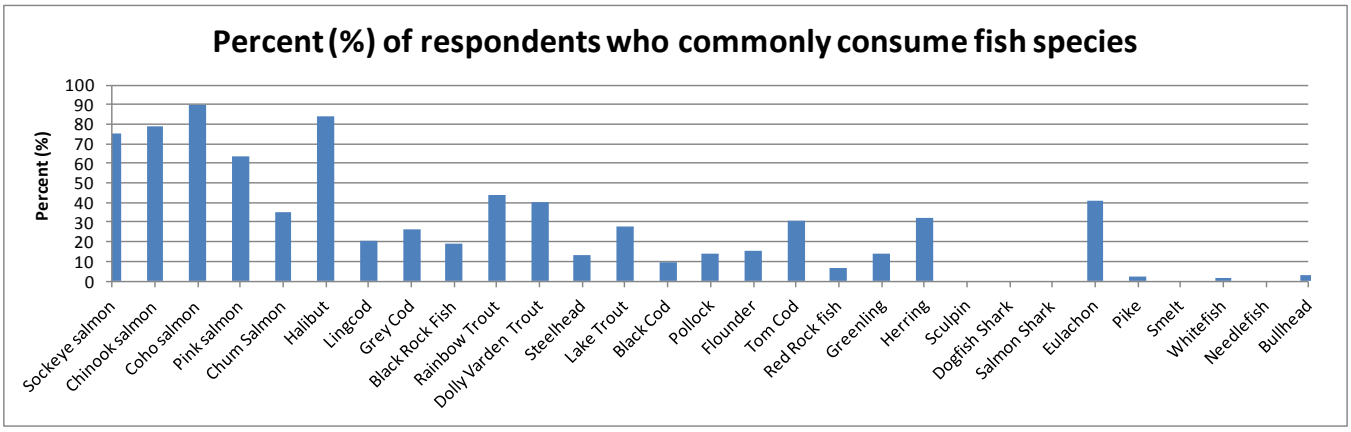

Figure 5. Percent (%) of respondents (n=75) who commonly consume fish species. Weighted data. Seldovia data not included in this graph for the following species: pike, smelt, whitefish, needlefish, and bullhead since they were not included in original questionnaire.

Table 3. Consumption of anadromous fish species by percent of total fish consumption per month. Percents are based on consumption of only listed fish species identified in questionnaire (based upon number of times fish species are eaten in a month and average fish portion sizes as indicated by respondents). Unweighted data. One outlier excluded from Port Graham's data.

Village	Fish Species										
	Sockeye salmon	Chinook salmon	Coho salmon	Pink salmon	Chum salmon	Dolly varden trout	Steelhead	Eulachon	Rainbow trout	Lake trout	Smelt
Seldovia (n=19)	24.7	10.3	14.0	8.8	4.1	0.6	0.0	1.4	0.7	0.4	N/A
Port Graham (n=18)	17.7	9.4	17.9	7.6	6.8	3.0	1.2	2.2	3.1	1.0	0.0
Nanwalek (n=19)	14.2	1.8	20.7	16.5	2.5	6.3	0.4	5.2	4.2	2.6	0.0
Tyonek (n=18)	9.2	40.6	24.2	0.9	0.9	1.3	2.3	9.2	2.7	1.6	0.0

Table 4. Consumption of non-anadromous fish species by percent of total fish consumption per month. Percents are based on consumption of only listed fish species identified in questionnaire (based upon number of times fish species are eaten in a month and average fish portion sizes as indicated by respondents). Unweighted data. One outlier excluded from Port Graham's data.

Village	Fish Species										
	Halibut	Lingcod	Grey cod	Black rockfish	Black cod	Pollock	Flounder	Tomcod	Red rockfish	Greenling	Herring
Seldovia (n=19)	19.8	1.9	4.6	0.7	1.0	2.9	0.0	1.0	0.7	0.8	1.7
Port Graham (n=18)	10.1	1.9	1.3	1.5	1.4	6.6	2.0	1.3	0.9	0.9	1.3
Nanwalek (n=19)	11.3	0.5	1.0	1.4	0.1	1.7	0.6	4.2	0.0	1.6	2.8
Tyonek (n=18)	5.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	1.1

Table 4 cont'd. Consumption of non-anadromous fish species by percent of total fish consumption per month. Percents are based on consumption of only listed fish species identified in questionnaire (based upon number of times fish species

are eaten in a month and average fish portion sizes as indicated by respondents). Unweighted data. One outlier excluded from Port Graham's data.

Village	Fish Species						
	Sculpin	Dogfish shark	Salmon shark	Pike	Whitefish	Needlefish	Bullhead
Seldovia (n=19)	0.0	0.0	0.0	N/A	N/A	N/A	N/A
Port Graham (n=18)	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Nanwalek (n=19)	0.0	0.0	0.0	0.0	0.5	0.0	0.1
Tyonek (n=18)	0.0	0.0	0.0	0.5	0.0	0.0	0.0

Average daily consumption rates for all respondents (n=74) based on total fish consumption per month for all anadromous fish species listed in the questionnaire was 115.3 (± 20.2 SE) g/d with a median value of 62.5 g/d and a 95 percentile value of 343.4 g/d (Appendix E). Average daily consumption rates for all respondents (n=74) for all non-anadromous fish species listed in the questionnaire was 37.9 (± 8.9 SE) g/d with a median value of 12.1 g/d and a 95 percentile value of 152.2 g/d (Appendix E). Average daily consumption rates for all respondents (n=74) for all fish species listed in the questionnaire was 153.2 (± 25.8 SE) with a median value of 78.5 g/d and a 95 percentile value of 513.6 g/d which is considerably higher than the 94.8 (± 23.5 SE) g/d rate and corresponding median and 95 percentile values based on weekly fish meals (includes listed and non-listed fish species) (Appendices B and E).

8.2.6 Consumption of specific parts by adults

Respondents indicated that they consumed the following fish parts: fillet, skin, head, eggs, bones, belly flaps/meat, and other organs. For each village, fillets were the most popular fish part eaten by respondents (Tables 5-7). Skin, eggs, and belly flaps/meat were also consumed frequently. For instance, for two of the most consumed fish species:

Table 5. Percentage (%) of coho salmon consumers (n=66) who eat specific parts from species. Belly flaps/meat not included for Seldovia tribal members. Weighted data.

Part	**Percent of coho salmon consumers (n=66) who eat part from this species**
Fillet	100
Skin	72.5
Head	56.2
Eggs	73.1
Bones	42.8
Belly flaps/meat	62.8
Other organs	27.6

Table 6. Percentage (%) of sockeye salmon consumers (n=59) who eat specific parts from species. Belly flaps/meat not included for Seldovia tribal members. Weighted data.

Part	Percent of sockeye salmon consumers (n=59) who eat part from this species
Fillet	100
Skin	72.2
Head	59.7
Eggs	79.0
Bones	45.3
Belly flaps/meat	68.1
Other organs	33.8

Table 7. Fish consumption (percentage) by parts (across all fish species). Unweighted data. Percentages based on total counts of responses, across all fish species, indicating parts are eaten.

Village	Parts						
	Fillet	Skin	Head	Eggs	Bones	Belly flaps/meat	Other
Seldovia (n=19)	42.7	14.6	10.4	16.5	10.1	N/A	5.8
Port Graham (n=19)	25.0	20.8	14.6	16.4	5.5	14.4	3.2
Nanwalek (n=19)	24.4	16.6	9.8	14.6	8.9	17.3	8.4
Tyonek (n=18)	24.5	15.1	12.3	14.8	10.8	14.5	8.0

8.3 Fish preparation methods

Of all respondents, 73.6% (58/76) regularly prepare the meals in their households. The most popular cooking/preparation methods for fish meals (in order of popularity) were smoked, canned, pan-fried, baked, and boiled. For each of these top cooking methods, the highest proportion of respondents indicated they cooked/ate fish these ways once a week or more: smoked (58.2% or 40/76), canned (47.4% or 35/76), pan-fried (44.6% or 30/76), baked (44.3% or 31/76), and boiled (35.3% or 26/76).

8.4 Origin of fish consumed

On average, 80.8% (± 3.5 SE) of all respondents (n=76) obtained their fish by personally harvesting the fish themselves and/or through family members, 9.7% (± 2.7 SE) from friends, 4.8% (± 1.2 SE) from ceremonies, 2.0% (± 0.8 SE) from grocery stores, 0.9% (± 0.7 SE) through distribution from the tribe, and 1.0% (± 0.9 SE) from other sources such as restaurants.

8.5 Fish harvesting

Approximately 92% percent (92.1% or 68/76) of respondents indicated they catch fish for personal consumption. All five salmon species, plus halibut, were the most common fish species harvested. For Seldovia, the most popular local fishing spots were Tutka Bay, Hoen's Lagoon, the slough, off Barabara Point, off Point Pogibshi, Jakolof Bay, and Outside Beach. For Port Graham, the most popular fishing locations were Port Graham Bay, outside "the island" or Passage Island, Nanwalek,

Windy Bay, off Point Pogibshi, and at the floats. Favorite fishing spots of respondents from Nanwalek were at the end of the air strip, Nanwalek Bay, 1st lake/1st hole, Dogfish Bay, by the Yum Yum tree, Humpy Creek, and Nanwalek Lagoon. Popular fishing locations indicated by respondents from Tyonek were Tyonek Beach, Old Tyonek Beach, Tyonek Village, Beshta Bay, Homer, the Chuitt River, and Nicolai River. Additionally, Flat Island was commonly cited by Seldovia and Port Graham respondents (Figures 6-9). Of respondents who fish, 61.8% (45/68) indicated that they usually travel to fish between 0-5 miles, 12.6% (9/68) between 6-10 miles, 10.7% (10/68 between 11-15 miles, 12.0% (9/68) between 16 and 20 miles, and 2.9% (2/68) greater than 20 miles. For the question regarding traveling distance, although respondents were asked to select one choice, some respondents chose two answers and both responses were counted in those cases.

Figure 6. Map of fishing locations in and around Seldovia.

Figure 7. Map of fishing locations in and around Port Graham.

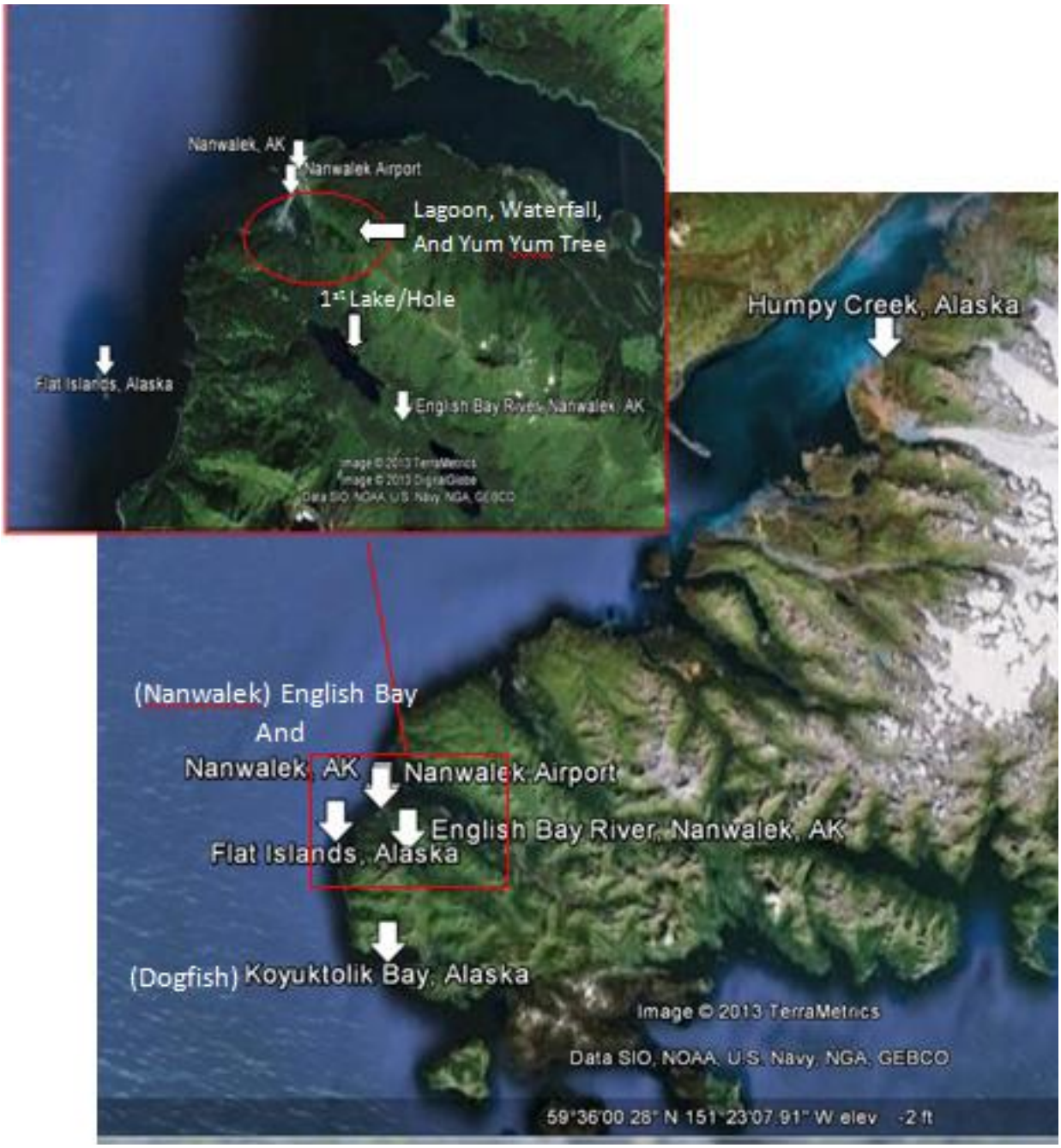

Figure 8. Map of fishing locations in and around Nanwalek.

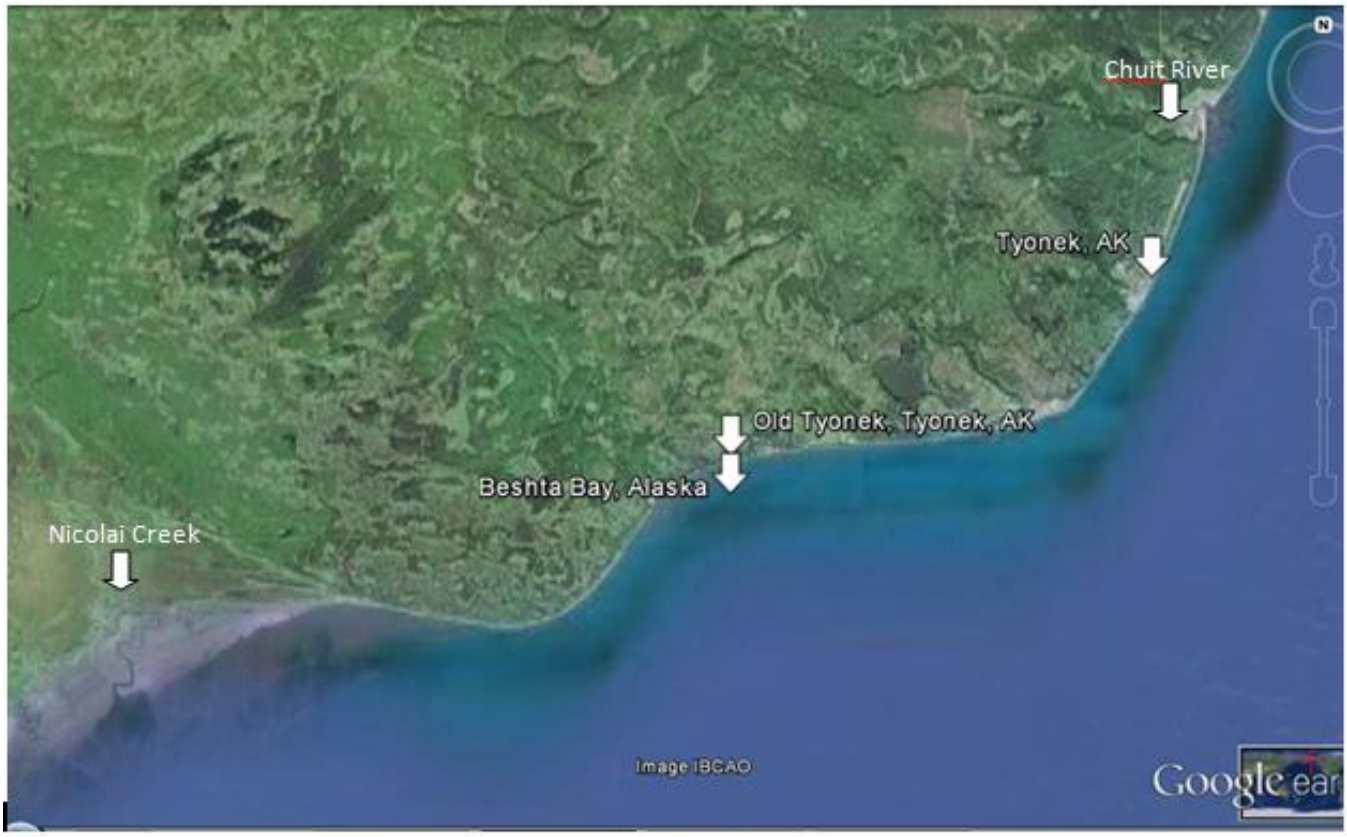

Figure 9. Map of fishing locations in, and around, Tyonek.

8.6 Ceremonial consumption of fish

8.6.1 Frequency of ceremony attendance

Roughly 90% (90.1% or 67/76) of respondents indicated they attend ceremonies or community events. While 45.2% (35/76) of tribal members indicated they attend ceremonies/community events less than once a month, 30.9% (22/76) indicated one to three times a month, 11.0%(8/76) four to six times a month, and 3.0% (2/76) greater than six times a month.

8.6.2 Frequency of fish consumed at ceremonies

Of respondents who indicated they attend ceremonies/community events, nearly 87% (86.9% or 58/67) consume fish at these occasions. Approximately 67% (66.6% or 38/67) of these respondents indicated they eat fish at nearly all these events, 16.1% (10/67) about half of the time, and 17.3% (10/67) eat fish less than half the time at these events.

8.6.3 Amount of fish consumption during tribal ceremonies

Of respondents who attend ceremonies/community events and eat fish at these events, approximately 71% (70.9% or 42/58) eat one to two 6-ounce servings at each ceremony. Nearly 24%

(23.9% or 13/58) of these respondents indicated they eat three to four 6-ounce servings at such events, and five to six 6-ounce servings or more were eaten by 5.1% (3/58) of respondents.

8.7 Children

Information on fish consumption was obtained for 35 children (17 years of age or younger) (Appendix F). A large proportion of these children (65.6% or 23/34) were male (Table 8). The average age of these children was 6.2 (± 1.2 SE) years old. One outlier was excluded, in regards to daily fish consumption rate calculations, from Nanwalek because the child's g/d rate was deemed unrealistic.

Table 8. Ages and gender of children (n=35).

	5 years old or younger			**6 to 17 years old**	
Village	*boys*	*girls*	*Gender not recorded*	*boys*	*girls*
Seldovia (n=4)	0	0	0	3	1
Port Graham (n=8)	5	0	0	3	0
Nanwalek (n=15)	3	5	1	5	1
Tyonek (n=8)	3	1	0	2	2

8.7.1 Age when children begin eating fish

Of children who consumed fish (n=31), the average age they began eating meals that included fish was 11.8 (± 2.6 SE) months (n=30). The most commonly cited reason for a child not eating fish was that they were too young.

8.7.2 Children's consumption rates

Approximately 87 percent (86.9% or 31/35) of the children for whom information was given, ate fish (Appendix F). The average daily rate of fish consumption (for both listed and non-listed fish species) for all children (including those who ate fish and those who didn't) was 58.0 (± 16.3 SE) g/d with a median of 40.5 g/d and a 95 percentile value of 177.8 g/d (n=34). Four children did not eat any fish. The average daily rate of fish consumption for only those children who ate fish (n=30) was 67.0 (± 17.5 SE) g/d with a median of 40.5 g/d and a 95 percentile value of 186.6 g/d. The average daily rate of fish consumption for all children 5 years old and younger (n=17) was 34.9 (± 17.4 SE) g/d, with a median of 12.8 g/d and a 95 percentile value of 134.1 g/d. The average daily rate of fish consumption for only children 5 years old and younger (n=13) who ate fish was 47.1(± 20.9 SE) g/d with a median of 31.8 g/d and a 95 percentile value of 151.8 g/d. For children 6 to 17 years of age, the average daily fish consumption rate was 83.3 (± 25.8 SE) g/d with a median value of 67.3 g/d and a 95 percentile value of 203.7 g/d. All children 6 years of age or older whom information was obtained for ate fish.

8.7.3 Consumption of different species by children

Not surprisingly, consumption patterns of children (for whom information was given) were similar to adults (Figure 10, Tables 9 and 10). Coho salmon was the most popular fish species eaten by children (eaten by 81.4% or 28/35 of children) followed by sockeye salmon (eaten by 77.4% or 26/35 of children), halibut (eaten by 76.8% or 27/33 of respondents), pink salmon (eaten by 63.7% or 21/33 of children), and chinook salmon (eaten by 57.8% or 21/33 of children) (Figure 10).

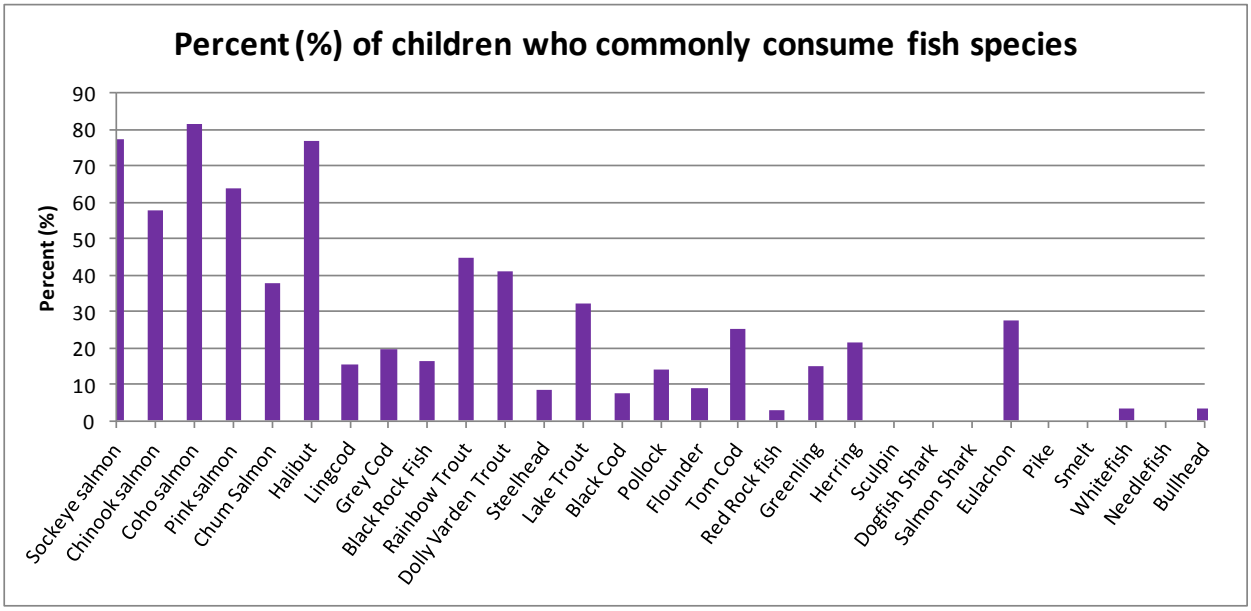

Figure 10. Percent (%) of children (n=35) who commonly consume fish species. Weighted data. Seldovia data not included in this graph for the following species: pike, smelt, whitefish, needlefish, and bullhead since they were not included in original questionnaire.

Table 9. Children's consumption of anadromous fish species by percent of total fish consumption per month. Percents are based on consumption of only listed fish species identified in questionnaire (based upon number of times fish species are eaten in a month by children and average fish portion sizes for children as indicated by adult respondents). Unweighted data. One outlier excluded from Nanwalek's data.

Village	Fish Species										
	Sockeye salmon	Chinook salmon	Coho salmon	Pink salmon	Chum salmon	Dolly varden trout	Steelhead	Eulachon	Rainbow trout	Lake trout	Smelt
Seldovia (n=4)	29.0	6.4	6.2	11.6	9.3	5.9	0.0	4.2	1.4	1.4	N/A
Port Graham (n=8)	24.8	12.6	21.1	15.1	5.4	2.6	0.0	0.0	2.5	2.5	0.0
Nanwalek (n=14)	14.4	1.3	10.2	15.3	3.0	9.1	0.7	9.8	3.2	1.9	0.0
Tyonek (n=8)	1.3	48.1	39.4	0.3	0.0	0.0	0.3	0.3	0.5	0.5	0.0

Table 10. Children's consumption of non-anadromous fish species by percent of total fish consumption per month. Percents are based on consumption of only listed fish species identified in questionnaire (based upon number of times fish species are eaten in a month by children and average fish portion sizes for children as indicated by adult respondents). Unweighted data. One outlier excluded from Nanwalek's data.

Village	Fish Species										
	Halibut	Lingcod	Grey cod	Black rockfish	Black cod	Pollock	Flounder	Tomcod	Red rockfish	Greenling	Herring
Seldovia (n=4)	14.6	1.5	2.9	0.1	2.9	1.1	0.0	1.4	0.0	0.0	0.0
Port Graham (n=8)	10.7	0.1	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0
Nanwalek (n=14)	9.9	0.1	0.8	0.7	0.2	3.0	0.6	7.8	0.0	2.7	4.4
Tyonek (n=8)	9.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0

Table 10 cont'd. Children's consumption of non-anadromous fish species by percent of total fish consumption per month. Percents are based on consumption of only listed fish species identified in questionnaire (based upon number of times fish species are eaten in a month by children and average fish portion sizes for children as indicated by adult respondents). Unweighted data. One outlier excluded from Nanwalek's data.

Village	Fish Species						
	Sculpin	Dogfish shark	Salmon shark	Pike	Whitefish	Needlefish	Bullhead
Seldovia (n=4)	0.0	0.0	0.0	N/A	N/A	N/A	N/A
Port Graham (n=8)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nanwalek (n=14)	0.0	0.0	0.0	0.0	0.6	0.0	0.2
Tyonek (n=8)	0.0	0.0	0.0	0.0	0.0	0.0	0.0

8.7.4 Consumption of specific parts by children

As in the case of adults, fillets, eggs, and skin were consumed the most frequently by children (Tables 11-13). Respondents indicated that their children consumed fillet more frequently than any other fish part for all species.

Table 11. Percentage (%) of children who eat coho salmon (n=27) who eat specific fish parts from species. Belly flaps/meat not included for Seldovia data. Weighted data.

Part	**Percent of children who eat coho salmon (n=27) who eat part from this species**
Fillet	100
Skin	58.2
Head	33.1
Eggs	54.9
Bones	33.8
Belly flaps/meat	50.8
Other organs	11.8

Table 12. Percentage (%) of children who eat sockeye salmon (n=25) who eat specific fish parts from species. Belly flaps/meat not included for Seldovia data. Weighted data.

Part	Percent of children who eat sockeye salmon (n=25) who eat part from this species
Fillet	96.3
Skin	54.0
Head	27.5
Eggs	66.0
Bones	32.6
Belly flaps/meat	63.5
Other organs	12.5

Table 13. Consumption of fish parts (percentage) by children (n=35). Percentages based on total number of responses, across all fish species, indicating the parts that are eaten. Unweighted data.

Village	Parts						
	Fillet	Skin	Head	Eggs	Bones	Belly flaps/meat	Other
Seldovia (n=4)	50.0	11.8	8.8	19.1	10.3	N/A	0.0
Port Graham (n=8)	33.3	16.3	10.4	15.6	8.9	14.1	1.5
Nanwalek (n=15)	32.8	17.4	4.2	17.6	7.0	16.8	4.2
Tyonek (n=8)	36.5	20.3	6.8	14.9	8.1	10.8	2.7

8.8 Adult consumption of non-fish subsistence foods

Although respondents indicated that fish was by far the most consumed subsistence resource (being consumed by 99.2% or 75/76), other marine taxa/species were identified as being important food sources to adult tribal members through this assessment, especially clams, black leather chitons (bidarkis), octopus, and harbor seal (Figure 11). The average daily consumption rate for all listed shellfish species (excluding octopus) for all respondents (fish and non-fish consumers combined) was 12.0 (± 3.4 SE) with a median value of 3.3 g/d and a 95 percentile value of 36.7 g/d (Appendix B). This rate is an underestimation of shellfish rate consumption (particularly for Port Graham) since octopus was not included, Seldovia tribal members were not asked about snails, and this rate does not account for all shellfish (only listed species). Approximately 60% (60.2% or 47/76) of respondents eat butter clams, 57.4% (47/76) eat bidarkis, 56.1% (45/76) eat octopus and 41.8% (34/76) consume little neck clams from harvested sources (not obtained from stores or restaurants). In addition, 47.8% (36/76) of respondents eat harbor seal. The meat, ribs, and blubber/fat were the most popular parts eaten from seals by those respondents who ate seal, (92.6% or 34/35, 83.1% or 30/35, and 76.5% or 27/35 respectively) (Table 14). Of those who ate harbor seal, the most common ways to cook seal parts were boiling (which includes rendering it for oil, soup, gravy, etc.) and baking (baking made up the overwhelmingly majority of “other cooking methods” although roasting/singeing over open fire, fermenting, and pickling were also mentioned) (Table 15). The majority (25.2% or 10/35) of respondents who eat harbor seal consume the equivalent of half a dinner plate full per meal while 23.4% (9/35) eat less than half a dinner plate full, 20.7% (10/35) eat a full dinner plate full, and 15.5% (6/35) eat more than one full dinner plate full.

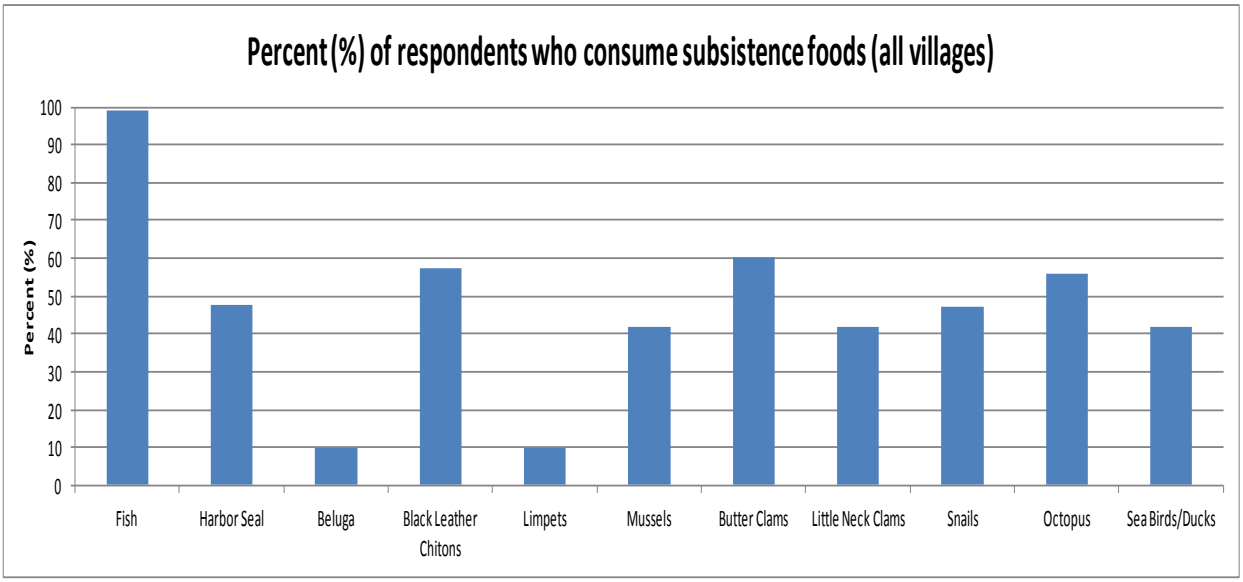

Figure 11. Percent (%) of respondents (n=76) who consume subsistence foods. Weighted data. Seldovia data not included for beluga (n=57) or snails (n=57) since they were not included in original questionnaire.

Table 14. Percent of respondents who eat seal (n=35) who eat this part from the seal. Weighted data.

Part	Percent of respondents who eat seal (n=35) who eat this part from seal
Meat	92.6
Ribs	83.1
Intestines	32.8
Liver	15.6
Blubber/Fat	76.5
Flippers	34.5
Other parts	7.8

Table 15. Cooking (percentage) of seal parts by respondents who eat seal (n=35). Percentages based on total responses, across all seal parts, indicating parts are cooked that way. Weighted data.

Cooking method	Percent of respondents who cook seal this way
Boiling	47.4
Frying	13.3
Other	39.3

For the villages of Port Graham, Nanwalek, and Tyonek, respondents were also asked questions regarding their consumption of beluga whales and snails. While only a small percentage of these respondents ate beluga whale (9.7% or 5/57), a fairly large proportion did eat snails (47.1% or 12/57) (Figure 11).

Unsurprisingly, those non-fish subsistence foods identified as being eaten by more respondents (more popular) (n=76) were eaten more often, on average, per month than less popular non-fish

foods (Figure 12). Black leather chitons were eaten, on average, the most frequently per month at 0.9 (± 0.2 SE) times/month followed by butter clams at 0.3 (± 0.1 SE), harbor seal at 0.3 (± 0.1), then octopus at 0.3 (± 0.1 SE).

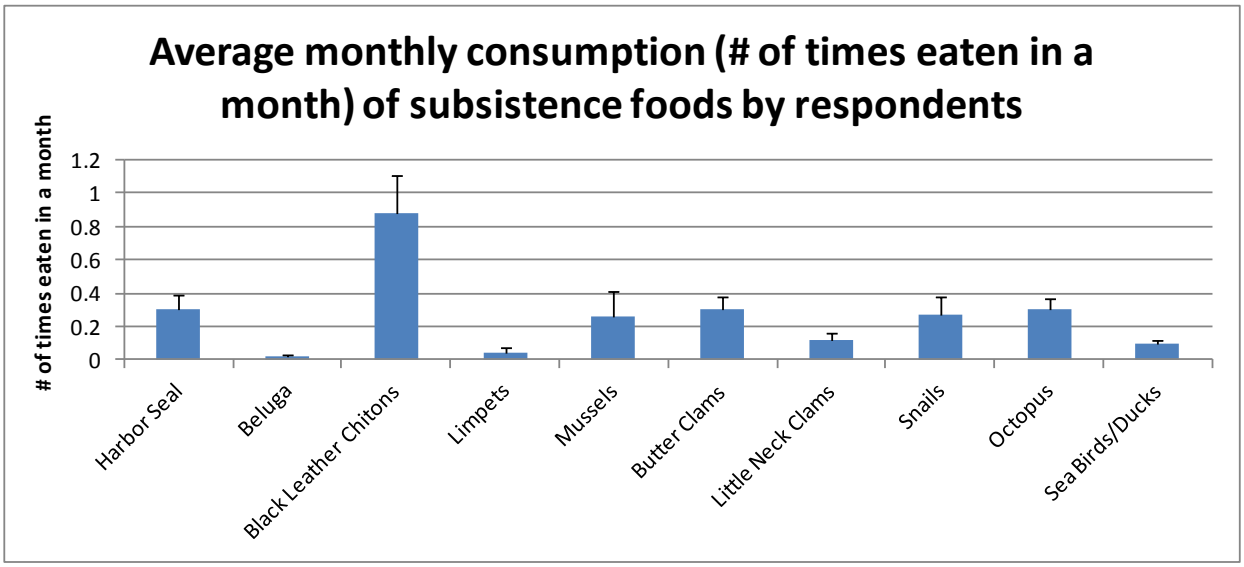

Figure 12. Average monthly consumption of subsistence foods ± SE by respondents (n=76). Weighted data. Seldovia data not included for snails (n=57) or beluga (n=57) since they were not included in original questionnaire.

8.9 Adult consumption of seafood (shellfish and fish combined)

The average daily seafood consumption rate (shellfish and fish combined) for all respondents (fish consumers and non-fish consumers combined) was 106.8 (± 23.9 SE) g/d with a median value of 55.3 g/d and a 95 percentile value of 267.1 g/d (Appendix B). This rate is an underestimation of seafood consumption for tribal members because shellfish rates did not include octopus for any of the villages (frequently eaten by Port Graham tribal members), did not include snails for Seldovia tribal members, and was based only on listed shellfish species in the questionnaire form.

9. DISCUSSION

9.1 Limitations of assessment

9.1.1 Categorization and classification of subsistence food items

Although the survey indicates highest and lowest consumption rates it does not establish a classification of subsistence food considered the highest and lowest sought after species or amounts that are used consistently by Alaska Natives in general within the community and amongst tribes for consumption and sharing; meaning that all customary and traditional native food items are equally important.

9.1.2 Low sample size and high variability

Seventy-six questionnaire forms, 19 from each village, was a small sample size and therefore when the data were analyzed into demographic groups or sub-categories (such as age categories, gender, etc.), sample sizes become very small with high variability (i.e. large standard errors). Consequently, it was difficult to determine statistically significant differences between results. A sample size of 19 was based on a population size of 34 households in Seldovia. This sample size was chosen not only because it was a realistic goal for Seldovia but also because it was calculated that the mean consumption for Seldovia's adult tribal members would be within a bound of 9 grams from the "true" mean with 95% confidence. However, there ended up being a standard error of approximately 14 grams for Seldovia. This may be due to larger variation in individual g/d rates for tribal members than the standard deviation of 30 g/d used initially in the sample size calculations based upon previous fish consumption surveys/studies. Sample sizes of 19 were used in each participating village to be consistent and because 19 was an obtainable goal for each village given the time constraints of the assessment.

9.1.3 Sampling bias

Although an equal number of adult males and females participated in this assessment, a much larger proportion of male, compared to female, children were represented in the dietary information collected. This may have influenced the overall fish consumption rate found for children since it would be expected that boys would consume larger amounts of food than girls.

9.1.4 Timing of survey and length of survey period

Conducting the assessment during periods of high or low fish consumption could have biased individuals' responses. It is possible that respondents indicated higher or lower consumption rates in accordance with when they were questioned about their consumption. Since this assessment was conducted between November 2011 and September 2012 (most surveys conducted in May 2012), consumption as reported by tribal members could be overestimated. Also, respondents may have under-reported consumption of fish species not in season at the time the assessment was conducted or over-reported fish species in season during the interview period.

9.1.5 Reliability of total fish consumption rates

Differences were apparent in daily fish consumption rates calculated based on average number of weekly fish meals (so this would be for all fish (both listed and non-listed species on questionnaire form) reported by respondents and rates calculated based on the average number of monthly meals eaten of individual fish species by respondents (so only listed fish species would be included in these rates). It would be expected that daily fish consumption rates based on the number of weekly fish meals eaten (for all fish species) would be higher than daily fish consumption rates based on the number of monthly meals eaten for only listed fish species. However, this was not always the case in this report. Sometimes daily fish consumption rates based only on listed fish species was higher.

There may be several reasons for this:

1) Memory recall may have differed among respondents in terms of whether they more easily and accurately remembered their consumption of weekly fish meals (for all fish in general), vs. their consumption of individual fish species on a monthly basis.

2) When calculating daily fish consumption rates of individual fish species, average fish portion sizes stated by the respondents were used. However, portion sizes may differ for respondents depending upon the fish species. Therefore, some daily fish consumption rates reported for individual species may have been underestimated or overestimated as a result.

3) Determining consumption rates for anadromous and non-anadromous fish species was not originally intended, only consumption rates of fish (in general). At the request of EPA, data were analyzed this way. Therefore, consumption questions regarding anadromous and non-anadromous fish species were not specifically phrased or elaborated upon to help synchronize the information with the initial questions asked of respondents regarding weekly fish consumption (for fish in general). This most likely contributed to variability in responses.

It would be difficult to determine which calculations of daily fish consumption rates are more reliable although we feel all consumption rates obtained in this assessment are as accurate as they can be given the limitations of this assessment. For all these reasons, listed separately in the appendices of this report, are daily fish consumption rates based on the number of weekly fish meals respondents reported they ate as well as fish consumption rates calculated based on the number of monthly meals respondents ate of particular fish species.

9.1.6 Non-fish consumers

It is possible that some tribal members did not return phone calls or respond when contacted about the assessment 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.

9.1.7 Nursing/breast-feeding women

As mentioned previously, all female respondents who had given birth were asked how long they had breast-fed their youngest child for, regardless of when they had given birth. Therefore, there may be considerable memory recall error if a long time has passed since a respondent had given birth. This is particularly true for community members whose youngest “children” are now grown adults. Over long time frames, changing historical, economic, scientific, and cultural factors could have influenced the breast-feeding time periods reported as well.

9.1.8 Children

Often respondents provided similar information for a child's consumption as they did for their own. Although it is certainly not unreasonable for a child to consume similar amounts of fish or to follow similar patterns of fish consumption as adults within the same household, it is possible these responses were influenced by the convenience of indicating similar information. Any resulting bias in dietary information reported for children from this factor, though, would be difficult to determine in regards to overestimation or underestimation of fish consumption.

9.1.9 Dietary recall

Respondents who consumed fish during the 24 hours preceding the interviews had 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 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. However, on the other hand, individuals who ate fish recently may be more accurate in the data they provide concerning the number of ounces they eat in each meal. It is also possible that individuals 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 individuals would not necessarily be overestimating their fish consumption.

9.1.10 Non-fish subsistence foods

Consumption of invertebrate species and other non-fish animals, in general, is difficult to quantify for tribal members. Often tribal members collect clams, bidarkis, and mussels in buckets when they harvest them but do not count or weigh them. Although it may be relatively easy for them to recall how many times they have eaten species, like octopus, within the past year, trying to quantify that in terms of ounces or pounds is much more difficult especially when they may be only eating a portion of the animal (such as the arms of the octopus) or the animal minced in a dish.

For this assessment, tribal members were asked about the number of times they ate these species in a year and about the number of individuals they typically ate in a meal or within a year since it was thought this might be easier for them to visualize than weights and subsequently be more accurate (this is especially true for bivalves). However, quantifying amounts eaten by respondents still proved a challenge. Answers were not given in consistent forms (sometimes quantities would be given as whole numbers, other times in "cups", "pints", "bucket fulls," or "portions" of a whole animal). Collecting consumption data on these food sources is very difficult because these are not food sources typically thought of in quantity terms when being harvested and they are not consumed as frequently as fish.

It should be noted that several respondents, especially from Nanwalek and Port Graham, remarked that they commonly eat sea lion, razor clams, and gumboot chitons as well. These were not on the questionnaire. The percent of respondents who eat snails and beluga (as well as how frequently they

are eaten per month) may have been higher if those questions had been asked of Seldovia tribal members as well. Shellfish consumption rates, and subsequent seafood consumption rates, obtained in this assessment are underestimations because octopus was not included in the calculations (since it was too difficult to accurately quantify amounts eaten by respondents), snail consumption was not asked of Seldovia tribal members, and shellfish consumption rates were based on only shellfish species listed in the questionnaire forms.

9.1.11 Two versions of questionnaire form

At the time SVT was planning and organizing the assessment for Seldovia, it was not known whether this assessment would be conducted in other Cook Inlet Villages. Unfortunately, the assessment had already been conducted in Seldovia by the time it was known that other villages would be participating. Although minor, a few additional fish and invertebrate species as well as parts and cooking methods were added to the questionnaire form (used by Port Graham, Nanwalek, and Tyonek), that were not on the questionnaire form originally used in Seldovia. These were added at the request of the other partner tribes and EPA. Species were: beluga, snails, pike, smelt, whitefish, needlefish, and bullhead. Parts were: belly flaps/meat for fish and blubber/fat for harbor seals. The cooking method added was salted. We do not feel these had significant impacts on the overall results because it is known that the additional fish species and non-fish species added are rarely, if at all, consumed by SVT members. It is also known that salted fish is only consumed by a few SVT members. When SVT members were asked how they prepared harbor seal parts, many specified “oil” in the “other” parts consumed category so it was easy to distinguish that they did in fact eat blubber/fat from the seal since these are the parts rendered into oil. Tables and figures that reported on fish parts consumed were analyzed separately for Seldovia and the other villages or acknowledged in the descriptions that belly flaps/meat was not included for Seldovia to avoid confusion. It is possible that “belly flaps/meat” would have been a popular part consumed by Seldovia tribal members if it had been presented to them as an option.

Consumption rates obtained for anadromous and non-anadromous fish species in this assessment are underestimations, as well, since they were based only on fish species listed in the questionnaire and not all species were asked of Seldovia tribal members.

9.2 Comparisons

9.2.1 Comparisons with the estimated national fish consumption rate for the U.S. population

Currently, in Alaska, the Alaska Department of Environmental Conservation (ADEC) uses a 6.5 g/day fish consumption rate to calculate human health criteria (Powell 2011). The Environmental Protection Agency (EPA) recommends a fish consumption rate of 17.5 g/d to establish water quality criteria (Powell 2011). According to results from this assessment, the average fish consumption rate of Cook Inlet village tribal members is approximately 5 times greater than the consumption rate recommended by EPA and 15 times greater than the rate used by ADEC. The rates of tribal members’ consumption across gender, age groups, fish consumers only, seasons, mothers who are nursing or have nursed are all above these rates. Not only is the average daily fish consumption rates of tribal members

found in this assessment higher than these current rates, but the 95 percentile values obtained in this assessment are much higher. These results suggest the EPA and ADEC's adopted water quality standards based on the present consumption rates may not be sufficient to protect the health of tribal members who catch and consume fish caught in the Cook Inlet area.

9.2.2 Comparison of rates from other Northwest Native American/Alaska Native surveys/studies

Brief background of surveys/studies. Adult fish consumption rate estimates from these studies follow below in Table 16:.

1) Alaska

Port Graham conducted a dietary survey of tribal members in 2004. Respondents were asked to estimate the amount of fish and other subsistence foods they ate in a year (in pounds). Port Graham then provided this information to the Agency for Toxic Substances and Disease Registry (ATSDR) as part of the contaminant study they conducted (ATSDR 2009). Information regarding Port Graham's survey data can be found in the ATSDR report (ATSDR 2009). In summary, dietary information was collected in this survey from 44 participants (12 elders (65+ years of age), 28 adults (20 to 64 years of age), and 4 teenagers (15 to 19 years of age). Data included consumption rates for fish and non-fish subsistence foods.

Between 1987-1988, 351 Alaska Native adults (21 to 60 years of age) were interviewed regarding their food and beverage consumption (Nobmann et al. 1992). Participants were from eleven different Alaska communities (Kotzebue, Selawik, Mountain Village, Bethel, Kwigillingok, Anchorage, Pedro Bay, Dillingham, Pilot Point, Sitka, and Kake). A total of 995 24-hour memory recalls were collected from these participants. A mean daily consumption rate of seafood (includes fish and shellfish) was calculated from data collected from these participants.

Between 1984 and 1985, the Alaska Department of Fish and Game surveyed respondents from 38 households in Angoon, Alaska, and collected household information regarding harvesting, consumption, and use of fish and other non-fish subsistence foods (George and Bosworth 1988). The majority of respondents (87.6%) were Alaska Native, predominately Tlingit.

2) Washington and Oregon

a. Columbia River Basin region

The Columbia River Basin tribes (Umatilla, Nez Perce, Yakama, and Warm Springs) conducted a fish consumption survey of their tribal members (which the methodology and questionnaire in this assessment followed) in 1991-1992. In total, they surveyed 513 adult tribal members (18 years old or older) and obtained dietary information for 204 children (ages 5 years old or younger). Their survey included only fish.

b. Puget Sound region

The Suquamish Indian Tribe of the Port Madison Indian Reservation conducted a fish consumption survey of their tribal members in 1997 (Suquamish 2000). Their survey included 92 adults (16+ years of age) and 31 children (5 years of age or younger). This survey encompassed both fish and shellfish.

In 1994, the Tulalip and Squaxin Island tribes conducted a fish consumption survey of 190 adult tribal members (18+ years of age) and 69 children (5 years of age or younger) (Toy et al. 1996). Their survey encompassed fish and non-fish subsistence foods.

Whenever SVT could make comparisons amongst the data collected in this assessment and these other cited surveys, this was done below. However, information regarding seasonality, ceremonies, breast-feeding, fish preparation/cooking methods, consumption of non-fish subsistence foods, and children's consumption rates were not always collected. Additionally, data were compiled and analyzed differently among these surveys, sometimes making direct comparisons difficult.

9.2.2.1 Adult rates of fish consumption

Table 16. Estimates of average daily fish consumption for adults (grams/day or g/d).

Tribe(s) and geographic areas		Average rates	Reference
Alaska	Cook Inlet Tribes	Adults: 94.8 g/d	*This current assessment*
	Port Graham	Elders: 256 g/d Adults: 199 g/d	*ATSDR (2009)*
	Kotzebue, Selawik, Mountain Village, Bethel, Kwigillingok, Anchorage, Pedro Bay, Dillingham, Pilot Point, Sitka, and Kake	Adults: 109 g/d	*Nobmann et al. 1992 *rate includes fish and shellfish*
	Angoon	Adults: 46.0 g/d	*George and Bosworth 1988*
Washington and Oregon	Suquamish Indian Tribe	Adults: 81.1 g/d	*Suquamish (2000)*
	Tulalip and Squaxin Island Tribes	Adults: 48.8 g/d	*Toy et al. 1996*
	Columbia River Basin Tribes	Adults: 58.7 g/d	*CRITFC (1994)*

Comparison with current assessment

Based upon this assessment, adult tribal members of Cook Inlet were estimated to consume 94.8 (± 23.5 SE) g/d of fish, a higher rate than the Columbia River Basin tribes or Puget Sound tribes. They

were also found to have overall higher seafood consumption rates. Several factors may account for this. Native Alaskans living in Cook Inlet may rely more heavily on subsistence foods (in general) than tribal members from Washington or Oregon due to stronger cultural or income influences and/or more limited accessibility to grocery stores (due to both transportation and income factors). The role that terrestrial-based subsistence foods have on diet, compared to marine subsistence foods, may also differ between tribes in Washington or Oregon and Cook Inlet tribes due to availability and accessibility. The average rate of fish consumption, overall, for Cook Inlet members was lower than what was found in previous studies involving Native Alaskans with the exception of Angoon. However, it should be noted that the average rate of fish consumption found for Port Graham tribal members between the ages of 40-59 (281.1 (± 213.7 SE) g/d) (n=5) in this assessment supported the rates found in their earlier survey. Overall, fish consumption rates found in this assessment supported the rate found in the *Nobmann et al. 1992* study. Differences in survey results may be due to differences in methodology. For instance, some of the surveys required tribal members to recall fish consumption patterns on an annual (yearly) basis, and in pounds, instead of on a weekly or monthly basis and in ounces (ATSDR 2009, George and Bosworth 1988). Food models were not always used nor were surveys always conducted in-person but rather sometimes filled out by respondents and mailed in. A lot of variation in fish consumption patterns existed among Cook Inlet villages, as well, which would have greatly influenced the overall average rate of fish consumption. Fish consumption rates and patterns can vary widely between individual tribes, even within the same geographic area (*Toy et al*, 1996).

Differences in the demographics of respondents were apparent between Cook Inlet and Columbia River Basin tribal members. In the Columbia River Intertribal Fish Commission survey, the largest number of respondents fell within the age category between 18-29 years old whereas the majority of respondents in this assessment were between the ages of 40-59 years old (n=30). Overall, the demographic statistics of this assessment were similar to that of other fish consumption surveys conducted for northwest tribes. For example, most respondents were within the age category of 35-64 years old (n=99) in the fish consumption survey of Tulalip and Squaxin Island tribal members and within the ages of 16 and 42 years old (n=58) for the Suquamish Indian Tribe's survey. The majority of participants in Port Graham's 2004 survey were between the ages of 20 to 64 years old (n=28) and between 30 and 49 years old in the *Nobmann et al.* 1992 study (n=192). While an equal number of males and females participated in this assessment (n=38 for each gender) and in the Suquamish Indian Tribe's survey (n=46 for each gender), more females participated in the surveys conducted by the Columbia River Basin tribes (n=278 for females and n=222 for males) and by *Nobmann et al.* 1992 (n=186 for females and n=165 for men). While elders, on average, were found to consume more fish (g/d) than other age groups in the *CRITFC* and in the ATSDR surveys, this was not true for Cook Inlet tribes (overall) in this assessment, nor for the Tulalip and Squaxin Island tribes or the Suquamish Indian Tribe. The general trend was that respondents within their mid to late thirties through early to mid-sixties consumed the most fish. Similarities in results between this assessment and these other surveys (Suquamish 2000, Toy et al. 1996, CRITFC 1994, George and Bosworth 1988), were that males, on average, consumed more fish (g/d) than females (Appendices B-E), tribal members who fished consumed more fish than non-fishers (Appendices B-E), and salmon was one of, if not the, top consumed fish by tribal members (see Figure 5 and Tables 3 and 4).

9.2.2.2 Seasonal fish consumption

Columbia River Basin Tribes

Almost 42 percent (*weighted*) of respondents indicated that the most fish was consumed during the months of April through July. For all months identified as high fish consumption months by the entire population sampled (i.e., fish consumers and non-fish consumers combined) respondents (n=508) consumed an average of 87.9 (± 4.8 SE) g/d (*weighted*) of fish. 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 and the months of May and June were the most frequently chosen high fish consumption months.

When asked about the months of lowest fish consumption, 56.7% (*weighted*) of respondents indicated that they eat the least fish during the months of November through February. Approximately 28% (*weighted*) of 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 cited months of low consumption were December and January. For all months identified as low fish consumption months by the entire population sampled, respondents (n=484) consumed an average of 26.4 (± 1.4 SE) g/d (*weighted*).

Fish consumption rates in regards to seasonality were not available from the other surveys cited above.

Comparison with current assessment

For Cook Inlet tribes, approximately 52 percent (51.9% or 40/76) of respondents indicated the two months of highest fish consumption as either June and July or July and August. For both Cook Inlet and the Columbia River Basin tribes, the migration months of salmon within local areas coincides with months of high fish consumption as well as an increase in tribal/community events. Approximate timing of salmon runs for both the Columbia River and the Kenai Peninsula are provided below (Table 17):

Table 17. Salmon species and migration times for Columbia River, Puget Sound Rivers, and Kenai Peninsula. Data provided by Columbia River Inter-Tribal Fish Commission 1994 report and the websites, http://www.piscatorialpursuits.com/akfishruns.htm, http://www.piscatorialpursuits.com/akfishruns.htm, and http://wdfw.wa.gov/fishing/salmon/whenwhere/area_pugetsound.pdf

Salmon Species	Columbia River	Puget Sound Rivers	Kenai Peninsula
Chinook	March-November	June-October	June-July
Sockeye	May-August	July	June-August
Coho	August-November	September-November	August-October

Since runs of salmon on the Kenai Peninsula of Alaska occur later than in the Columbia River, it is not surprising that high fish consumption months in Cook Inlet would follow slightly behind that of the Columbia River Basin.

When asked about the months of lowest fish consumption, approximately 63 percent (63.2% or 47/76) of respondents indicated that they eat the least fish during the months of November through May with January being cited the most frequently as a month of least fish consumption. While this result is very similar to the results obtained by the Columbia River Intertribal Fish Commission survey, Cook Inlet tribal members consume more fish (g/d), on average, during both high and low fish consumption months than Columbia River Basin tribal members (see Appendices C and D).

9.2.2.3 Sources of fish

Angoon

Approximately seventy-one percent (71.1%) of surveyed households in Angoon have household members who harvest salmon and eighty-four percent (84.2 %) of surveyed households have household members who harvest other fish.

Port Graham

Approximately seventy percent (69.8 %) of the total amount of subsistence foods (i.e. foods not purchased at grocery stores/restaurants) consumed in a year (measured in pounds) by surveyed tribal members is fish (unpublished data from Port Graham 2004 survey, ATSDR 2009 report). Approximately fifty-seven percent (57.3 %) of the total amount of subsistence foods consumed in a year (measured in pounds) by surveyed tribal members is salmon.

Columbia River Basin Tribes

About half of the Columbia River Basin tribes (48.7% or 253/498; *weighted*) survey respondents indicated they fish for personal consumption or for use by their tribe and on average, 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 through self-harvesting or family.

Puget Sound Tribes

For the Tulalip and Squaxin Island tribes, a mean percentage of approximately one-third to half of consumed fish are caught while the rest are mainly obtained through grocery stores or restaurants. Harvesting supplied a mean of 72-80% of the anadromous fish (i.e. salmon) consumed by each tribe.

Ninety-two percent of respondents of the Suquamish Indian Tribe's survey indicated they consume salmon at ceremonies, gatherings, and community events. On average, 90.0 (± 6.0 SE) percent of the Suquamish Tribe's survey respondents who eat salmon obtain their salmon through harvesting, 8 (± 2.0 SE) percent from grocery stores, and 3 (± 1.0 SE) percent from restaurants.

Comparison with current assessment

For tribal members in Cook Inlet, the percentage of respondents who fish (92.1% or 68/76) was much higher than Columbia River Basin tribal members and on average, tribal members obtained 96.2 (± 1.8 SE) percent (n=76) of their fish from the combined sources of harvesting by themselves or their families, friends, ceremonies, and tribal distribution. However, the mean percentage of fish obtained through harvesting reported by tribal members in this assessment (80.8% (± 3.5 SE)) is similar to those values obtained for Puget Sound tribes and other Alaska tribes (George and Bosworth 1988). Like these other tribes, Cook Inlet tribal members obtain the largest percentage of their fish through harvesting, either by self-harvesting or by the harvesting of others (family, friends, community members). It is very apparent from this assessment, as well as from these other surveys, that harvesting is a critical way that fish are obtained by tribal members. A larger proportion of Cook Inlet tribal members may fish than tribal members of some of these other tribes due to: easy access to the ocean; cultural values; more limited access to grocery stores, restaurants, and other food sources; and higher grocery costs.

9.2.2.4 Ceremonial use of fish

Angoon

Sharing of foods in the fall time at “Indian parties” involves nearly all Angoon households as well as members of other communities.

Columbia River Basin Tribes

A large percentage (93.3% or 480/512; *weighted*) of Columbia River Basin tribal members indicated they attend ceremonies or traditional events and over half of these individuals (52.4% or 187/512; *weighted*) attend ceremonies at least 1-3 times per month. Of the tribal members who do attend ceremonies/events, 72.6% (344/480; *weighted*) consume fish during these occasions.

Puget Sound Tribes

Adult men and women of the Suquamish Indian Tribe were found to attend a large number of social gatherings each year. The frequency of attendance was very similar between men and women, with a mean of 12.3 gatherings per year for men and 12.5 for women (n=46 for each gender). Consumption at these gatherings of salmon, oysters, clams, and crab accounted for about 6% of the total seafood consumption rate. Ninety-two percent of respondents of the Suquamish Indian Tribe’s survey indicated they consume salmon at ceremonies, gatherings, and community events.

Comparison with current assessment

Cultural events, such as tribal ceremonies and potlatches, are an integral part of tribal culture and can influence the rate of fish consumption. Although quotas of fish (in terms of fish provided by a tribe to members) are often not given to tribal members by the participating Cook Inlet tribes in this assessment, tribal members frequently receive fish from their tribes through meal programs and

sponsored community events (like potlatches, holiday celebrations). At 90.1% (67/76), the proportion of respondents who attend ceremonies and/ or community events is very similar to that of tribal members of the Columbia River Basin tribes. While Cook Inlet tribal members do not attend events/ceremonies as frequently as Columbia River Basin tribal members (the majority (45.2% or 35/76) attending such events less than once a month), a greater proportion of them do eat fish (86.9% or 58/67) while in attendance. The frequency in which Cook Inlet tribal members attend ceremonies/social events and the proportion of tribal members who eat fish at these events appear to be akin to that of Suquamish Indian tribal members.

9.2.2.5 Children

Port Graham

Teenagers (15 to 19 years of age) were estimated to consume approximately 142 g/d (n=4).

Columbia River Basin Tribes

Children (5 years old or younger) were found to eat about 19.6 (± 1.9 SE) g/d (n=194).

Puget Sound Tribes

The total seafood consumption rate (includes fish and shellfish) for children (5 years old or younger) of Suquamish Indian tribal members was found to be 24.8 g/d (n=31).

Children (5 years old or younger) of the Tulalip and Squaxin Island tribes were found to consume fish, on average, at a rate of 2.7 g/d (n=69).

Comparison with current assessment

Children (17 years old and younger) of Cook Inlet tribal households were found, on average, to consume about 58.0 (± 16.3 SE) g/d (n=34) of fish (Appendix F). Children five years old and younger consumed, on average, 34.9 (± 17.4 SE) g/d (n=17) of fish which is higher than consumption rates found among children within this age group in all the other tribes. The same factors/influences driving fish/seafood consumption rates among adults would most likely be affecting consumption rates among children as well. Similar to the dietary information collected for children in the CRITFC and Suquamish Indian Tribe surveys, dietary patterns of children in Cook Inlet tribal households tend to be similar with other members of their households (in the case of this assessment, the adults interviewed). Salmon was also the most consumed fish species by children. Interestingly, though, children in Cook Inlet tribal households appear to begin consuming fish at an earlier age than children in most of these other tribes. The average age that children of Columbia River Basin tribal members began eating fish was 13.1 (± 0.7 SE) months (n=167), 39 months for the Tulalip and Squaxin Island tribes (n=69), and 12 months for the Suquamish Indian tribe vs. 11.8 (± 2.6 SE) months (n=30) for those residing in Cook Inlet.

Children in Cook Inlet tribal households are breast-fed for a longer time than children in tribal households reported in these other surveys. The average age children stopped being breast-fed in Columbia River Basin tribal households was 7.6 (± 0.6 SE) months (n=99) and 8-9 months for the Tulalip and Squaxin Island tribes vs. 11.5 (± 2.3 SE) months (n=25) for Cook Inlet tribal households.

It is important to note that for both Cook Inlet tribal members and Columbia River Basin tribal members, the breast-feeding questions were asked of all female respondents who had given birth, regardless of when they had given birth. Therefore, there may be considerable memory recall error if a long time has passed since a respondent had given birth.

As apparent from the assessment results, breast-feeding is a method that a majority of Tribal mothers use to feed their babies. It has long been established as a culturally and traditionally acceptable method. Interestingly, the proportion of female respondents in this assessment who breast-fed was higher than in the Columbia River and Puget Sound tribes. In the Columbia River Intertribal Fish Commission survey, of the 88% (242/275; *weighted*) of female respondents who had given birth, approximately 42% (103/239; *weighted*) indicated that they were currently breast-feeding or have breast-fed their children. Forty-three% of the Tulalip and seventy-five percent of the Squaxin Island children under age five had been breast-fed. For Cook Inlet female respondents, 96.3% or 36/37 said they had given birth. Out of those women, approximately 68% (25/35) said they had breast-fed their youngest child.

Cultural values, education, expense, and access to baby formula may all be contributing to long breast-feeding periods and to the popularity of breast-feeding among female tribal members.

9.2.2.6 Adult consumption of shellfish

Port Graham

Average individual consumption of clams/mussels was estimated at about 2.8 g/d and 25.5 g/d for other invertebrates (chiton, snails, octopus) for adults. Children were assumed to eat about half to one-third as much as adults.

Comparison with current assessment

In this assessment, the average daily consumption rate for shellfish for all adult tribal members came to 12.0 (± 3.4 SE) g/d. However, the daily shellfish consumption rates obtained in this assessment are an underestimation for the reasons already stated above in this report. The shellfish consumption rates came in rather low for Port Graham members, especially, compared to Seldovia and Nanwalek tribal members. Two possible reasons for this could be that their tribal members eat a lot of octopus (which was excluded in the calculations) and shellfish may not be eaten as frequently by their tribal members as they once were because their tribal members are having to travel further distances to collect shellfish since many of these species are no longer plentiful in nearby harvesting areas. Based upon the proportion of respondents who eat the above mentioned subsistence foods, as well as how frequently they do so, the results of this assessment support that chitons, clams, octopus, and snails are priority non-fish subsistence foods for Cook Inlet tribes.

9.3 Recommendations and future studies

As is evident from the results obtained from this assessment, the average fish consumption rate of Seldovia, Port Graham, Nanwalek, and Tyonek surveyed tribal members is approximately 5 times greater than the average consumption rate recommended by EPA and 15 times greater than the rate used by ADEC in calculating human health based ambient water quality criteria and standards for toxins. These results suggest that EPA's and State of Alaska adopted ambient water quality criteria and standards for toxic pollutants based on their current fish consumption rates may not be sufficient to protect Native Alaskans residing in Cook Inlet. Based on the 95 percentile fish consumption rate value obtained for all respondents of this assessment, we would suggest the use of 247 g/d.

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. SVT hopes to undertake such a project in the near future.

Based on this assessment, we would suggest that future Cook Inlet village dietary surveys include sea lion, razor clams, and gumboot chitons as subsistence foods since they were reported as being commonly eaten during this assessment. We would also suggest that non-fish subsistence species be quantified in terms of pounds for consistency and simplicity.

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11. APPENDICES

Appendix A. Questionnaire Form

QUESTIONNAIRE NUMBER_____

2012 Subsistence Food Dietary Assessment of Seldovia, Port Graham, Nanwalek, and Tyonek Tribes of Cook Inlet, AK

IMPORTANT: READ CONFIDENTIALITY STATEMENT TO RESPONDENT BEFORE BEGINNING INTERVIEW AND HAVE RESPONDENT SIGN CONSENT FORM

BACKGROUND INFORMATION TO ASK PERSON BEING INTERVIEWED:

Interviewer fills out this section:

Month/Day

Date __/__

Village _____

Sex of person being interviewed: (*Circle Male or Female*)

Male Female

Time Interview Begins: __:__ AM/PM [*Circle AM or PM*]

1) Name:_____

2) Phone: ( )-_____-_____

3) What was the month and year of your birth?

Month_____ Year_____

1

QUESTIONNAIRE NUMBER _____

SECTION 1 – *MEMORY RECALL*

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.

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 Hour	Min	Where Prepared 1 = Home 2 = Restaurant		Food and Beverages	Amount (ozs.)	Complete Description
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

COMMENTS (Give line no. when appropriate):

Interviewer fills out this section:

Intake day ___(1-7)

Opinion of Information ___(1-3)

Intake was____(1-3)

2

QUESTIONNAIRE NUMBER _____

DIETARY INTAKE CONTINUATION PAGE

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 Hour	Min	Where Prepared 1 = Home 2 = Restaurant	Food and Beverages	Amount (ozs.)	Complete Description
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						

COMMENTS (Give line no. when appropriate):

Interviewer fills out this section:

Intake day ___(1-7)

Opinion of Information ___(1-3)

Intake was____(1-3)

3

QUESTIONNAIRE NUMBER_____

SECTION 2 – *ADULT CONSUMPTION OF FISH*

1) During which two months of the year would you say you eat the most fish? [*Circle response(s)*]

January	September
February	October
March	November
April	December
May	All months the same
June	Never/rarely eat fish (*skip to Question #7*)
July	Unknown
August	

2) 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)

3) During which two months would you say you usually eat the least fish? [*Circle response(s)*]

January	September
February	October
March	November
April	December
May	All months the same
June	Never/rarely eat fish (*skip to TABLE 2*)
July	Unknown
August	All months except 2 (marked in question 1) are equally low

4) 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)

5) On average, throughout the year, about how many fish meals weekly do you eat?

Avg. # of fish meals weekly:_____ (throughout year)

6) 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):_____

QUESTIONNAIRE NUMBER_____

I am now going to ask you some questions on specific types of fish that can be obtained from Cook Inlet. For each type of fish I mention, I am going to ask you several questions concerning how often you eat it and which parts of the fish are usually eaten. (*See Table 1*)

Table 1.

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	Belly fat/flaps/meat	Other Organs
Sockeye Salmon Yes No (*if Yes, go to next columns*)		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Chinook Salmon Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Coho Salmon Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Pink Salmon Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Chum Salmon Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Halibut Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Lingcod Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Grey Cod Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Black Rockfish Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Rainbow Trout Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Dolly Varden Trout Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Steelhead Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Lake Trout Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No

QUESTIONNAIRE NUMBER _____

Table 1 Continued

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	Belly fat/flaps/meat	Other Organs
Black Cod Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Pollock Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Flounder Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Tom Cod Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Red Rockfish Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Greenling Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Herring Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Sculpin Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Dogfish Shark Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Salmon Shark Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Eulachon or Hooligan Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Pike Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Smelt Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Whitefish Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Needlefish Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Bullhead Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No

QUESTIONNAIRE NUMBER _____

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. (*See Table 2*)

Table 2.

Is the fish ever... (Circle Yes if cooked that way)		HOW OFTEN? (Circle 1,2, or 3)		
		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? *(Includes fish pie or Perak)*	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? *(Includes pickled)*	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? *(Includes jarred and kippered)*	Yes...1 → No ...2 go to l	1	2	3
l. salted?	Yes...1 → No ...2	1	2	3

QUESTIONNAIRE NUMBER _____

SECTION 3 – *CHILD CONSUMPTION OF FISH*

7) Do you regularly prepare the meals in your household? (*Circle Yes or No*)

Yes No

8) Are there any children 17 years or younger living in your household? (*Circle Yes or No*)

Yes No

IF NO, GO TO QUESTION 9

If YES, CONTINUE WITH REST OF QUESTION 8

8A. Please provide the following information for the youngest person in your household who is 17 years of age or less:

First Name_____

Male or Female (*Circle Male or Female*)

In what month and year was this child born:

__/____

Your relationship to child (*Enter mother, father, aunt, uncle, etc.*)

_____

8B. Throughout the year, what is the average portion size of fish this child eats in a meal that includes fish? [*SHOW THE RESPONDENT FOOD MODELS, AND ENTER THE AVERAGE SERVING SIZE IN OUNCES OR CIRCLE "EATS NO FISH"*]

Average serving size (ounces):__ __ ounces

Eats no fish

IF THEY ANSWERED 'EATS NO FISH," SKIP TO QUESTION #9

8C. 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, please provide the same information on a separate table (*Table 3*).

QUESTIONNAIRE NUMBER _____

Table 3.

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	Belly fat/flaps/meat	Other Organs
Sockeye Salmon Yes No (*if Yes, go to next columns*)		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Chinook Salmon Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Coho Salmon Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Pink Salmon Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Chum Salmon Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Halibut Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Lingcod Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Grey Cod Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Black Rockfish Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Rainbow Trout Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Dolly Varden Trout Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Steelhead Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Lake Trout Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No

QUESTIONNAIRE NUMBER _____

Table 3 Continued

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	Belly fat/flaps/meat	Other Organs
Black Cod Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Pollock Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Flounder Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Tom Cod Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Red Rockfish Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Greenling Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Herring Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Sculpin Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Dogfish Shark Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Salmon Shark Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Eulachon or Hooligan Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Pike Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Smelt Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Whitefish Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Needlefish Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Bullhead Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No

QUESTIONNAIRE NUMBER _____

8D. On average, throughout the entire year, about how many fish meals weekly does the child eat?

Avg. # of fish meals weekly:_____

8E. At what age (in months) did the child begin eating meals that include fish? [*ENTER NUMBER OF MONTHS OR CIRCLE EITHER "NOT YET" OR "UNKNOWN"*]

_____ Months (*ONLY FILL IN MONTHS OR YEARS, NOT BOTH*)

_____ Years (*ONLY FILL IN MONTHS OR YEARS, NOT BOTH*)

Not Yet

Unknown

9) *IF RESPONDENT IS MALE, SKIP TO QUESTION #10*

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

SKIP TO QUESTION 9C, IF THEY ANSWERED "MOTHER" IN QUESTION 8A

SKIP TO QUESTION 9B, IF THEY ANSWERED "GRANDMOTHER OR GREAT GRANDMOTHER" IN QUESTION 8A

9A. Have you ever given birth? (*Circle Yes or No*)

Yes No

IF NO, SKIP TO QUESTON #10

9B. In what month and year was your last child born:

_ _/_ _ _ _

9C. Was this baby breast fed? (*Circle Yes, No, Unknown*)

Yes No Unknown

IF NO, SKIP TO QUESTON #10

9D. At what age (in months) did the child stop breast feeding? (*ENTER NUMBER IN MONTHS OR CIRCLE "STILL BREAST FEEDING"*)

_ _ months ➔ *SKIP TO QUESTION #10*

Still breast feeding

QUESTIONNAIRE NUMBER _____

9E. At what age (in months) do you plan to stop breast feeding your child?

__ months

SECTION 4 – *OTHER SUBSISTENCE FOODS*

10) I'm now going to ask you some questions about your consumption of marine mammals and other non-fish subsistence foods.

Table 4

Type of marine mammal (*Circle yes if commonly eaten*)	Average number of meals in a year	Parts usually consumed for each species (*circle answer*)						
		Meat	Ribs	Intestines	Liver	Blubber/Fat	Flippers	Other organs/Parts (example: oil)
Harbor Seal Yes No (*if Yes, go to next columns*)		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Beluga Whale Yes No		Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No

Answer Questions 11 through 14 only if respondent answers "yes" in Table 4 for consuming marine mammals – if not, skip to question #15.

11) How do you typically prepare harbor seal? *If part is typically prepared this way, please put "X" under the cooking/preparation method*

Part	Boiled	Fried	Other cooking method
Meat			
Ribs			
Intestines			
Liver			
Skin/Blubber or Fat			
Flippers			
Other (please specify)			

Please explain if "other" is filled in for seal part or for cooking method:

QUESTIONNAIRE NUMBER_____

12) How much harbor seal meat (or parts) do you typically eat in a meal?

Less than half a plate (regular dinner size plate)
Half a plate (regular dinner size plate)
A full plate (regular dinner size plate)
More than one full plate (regular dinner size plate)

13) How do you typically prepare beluga whale? *If part is typically prepared this way, please put "X" under the cooking/preparation method*

Part	Boiled	Fried	Other cooking method
Meat			
Ribs			
Intestines			
Liver			
Skin/Blubber or Fat			
Flippers			
Other (please specify)			

Please explain if "other" is filled in for beluga part or for cooking method:

14) How much beluga meat (or parts) do you typically eat in a meal?

Less than half a plate (regular dinner size plate)
Half a plate (regular dinner size plate)
A full plate (regular dinner size plate)
More than one full plate (regular dinner size plate)

15) How often do you eat bidarkis (black leather chitons) in a year?
[*ENTER NUMBER OF TIMES A YEAR OR CIRCLE NEVER*]

_____ times a year

Never ➔ *SKIP TO 17*

QUESTIONNAIRE NUMBER_____

16) How many bidarkis do you generally eat in a meal?

17) How often do you eat limpets (china caps) in a year?
[*ENTER NUMBER OF TIMES A YEAR OR CIRCLE NEVER*]

_____ times a year

Never - *SKIP TO 19*

18) How many limpets (china caps) do you generally eat in a meal?

19) How often do you eat mussels harvested from local beaches?
[*ENTER NUMBER OF TIMES A YEAR OR CIRCLE NEVER*]

_____ times a year

Never - *SKIP TO 21*

20) How many mussels do you generally eat in a meal?

21) How often do you eat butter clams harvested from local beaches?
[*ENTER NUMBER OF TIMES A YEAR OR CIRCLE NEVER*]

_____ times a year

Never - *SKIP TO 23*

22) How many butter clams do you generally eat in a meal?

If respondent eats butter clams but gets them from other sources (like grocery stores):

Source(s): (please list)	# of clams (in a year) from source
_____	_____
_____	_____
_____	_____

23) How often do you eat steamers (or little neck) clams from local beaches?
[*ENTER NUMBER OF TIMES A YEAR OR CIRCLE NEVER*]

_____ times a year

Never - *SKIP TO 25*

24) How many little neck clams do you generally eat in a meal?

If respondent eats steamers but gets them from other sources (like grocery stores):

Source(s): (please list)	# of clams (in a year) from source
_____	_____
_____	_____
_____	_____

QUESTIONNAIRE NUMBER _____

25) How often do you eat snails in a year?
[*FOR EACH SNAIL SPECIES, ENTER NUMBER OF TIMES A YEAR OR CIRCLE NEVER*]

Hairy tritons (large snails)

_____ times a year

Never - *SKIP TO 27*

Periwinkles (very small snails)

_____ times a year

Never - *SKIP TO 27*

26) How many snails do you generally eat in a meal? (*Enter number for each snail species*)

_____ **Hairy tritons** _____ **Periwinkles**

27) How often do you eat octopus harvested from local beaches?
[*ENTER NUMBER OF TIMES A YEAR OR CIRCLE NEVER*]

_____ times a year

Never - *SKIP TO 29*

28) How many octopus do you generally eat in a year?

29) How often do you eat sea birds (including ducks)?
[*ENTER NUMBER OF TIMES A YEAR OR CIRCLE NEVER*]

_____ times a year

Never ➔ *SKIP TO 31*

30) How many sea birds (including ducks) do you generally eat in a year?

SECTION 5 – *OBTAINING FISH*

31) These next questions deal with where and how you obtain fish and other species.

31A. Do you catch fish for either personal consumption or for use by your Tribe in some way?

Yes No

IF NO, SKIP TO QUESTON #33

QUESTIONNAIRE NUMBER_____

31B. Please indicate on the map(s) (*show map(s)*) where you usually catch the following species:

REFER TO MAPS – please write in locations as well next to species

Fish

Sockeye Salmon _____
Chinook Salmon _____
Coho Salmon _____
Pink Salmon _____
Chum Salmon _____
Halibut _____
Lingcod _____
Grey Cod _____
Black Rockfish _____
Rainbow Trout _____
Dolly Varden Trout _____
Steelhead _____
Lake Trout _____
Black Cod _____
Pollock _____
Flounder _____
Tom Cod _____
Red Rockfish _____
Greenling _____
Herring _____
Sculpin _____
Dogfish Shark _____
Salmon Shark _____
Eulachon _____
Pike _____
Smelt _____
Whitefish _____
Needlefish _____
Bullhead _____

Marine Mammals

Harbor Seal _____
Beluga Whale _____

QUESTIONNAIRE NUMBER_____

32) About how far from home do you usually travel to fish? (*Circle response*)

0-5 miles	21-25 miles
6-10 miles	26-50 miles
11-15 miles	51-75 miles
16-20 miles	76-100 miles
	more than 100 miles

33) Of all the fish you eat in a year, approximately how many do you get from:

This column filled in by SVT staff ⬇

	Total	Percent
Fish caught by yourself or family members	_____	_____
Grocery stores	_____	_____
Other sources:		
Friends who fish	_____	_____
Ceremonies (example: potlucks)	_____	_____
Distribution by the tribe	_____	_____
Other (list) (example: restaurants)		
_____	_____	_____
_____	_____	_____

34) On average, throughout the year, how often do you attend ceremonies or other community events (examples: potlucks, weddings, etc.)? (*Circle response*)

never ➔ *END OF INTERVIEW*
less than 1 time per month
1-3 times per month
4-6 times per month
more than 6 times per month

35) How often do you eat fish at these ceremonies? (*Circle response*)

rarely/never ➔ *END OF INTERVIEW*
less than ½ of the ceremonies or events
at about ½ of the ceremonies or events
at nearly all ceremonies or events

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

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

QUESTIONNAIRE NUMBER _____

CONCLUSION:

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.

Time Interview Ends: _ _:_ _ AM/PM [*Circle AM or PM*]

Section filled out by interviewer

Number assigned to adult interviewed: _____

Number assigned to child in household: _____

Survey received on _ _/_ _/_ _ _ _

Section filled out by Quality Assurance Monitor

I have examined this questionnaire form and to my knowledge, the data has been recorded accurately and there is no missing data or incompleteness.

Print name _____

Initials _____ Date_____

Appendix B. Adult Consumption Of All Fish (Both Listed And Non-Listed Species) And Shellfish (Listed Species)

Average, median, and 95 percentile consumption rates (grams per day (g/d)). Total fish consumption rates based on average number of weekly fish meals throughout the year and average fish meal portion size as indicated by respondents (includes both listed and non-listed fish species). Shellfish consumption rates are for listed species only and do not include octopus. Shellfish consumption rates were based on the average number of times a species was eaten in a year and how many individuals of that species were eaten, on average, in a meal, as indicated by respondents. The total number of individuals eaten of a species in a year by a respondent was then multiplied by the average, or calculated, wet tissue weight (grams) found in primary literature for that species of harvestable size.

Seldovia (values for fish and non-fish consumers combined). Unweighted.

Total Fish			
	Average ± SE	Median	95%
All respondents (n=19)	53.3 ± 14.0	40.5	171.3
Males (n=8)	70.0 ± 32.1	32.7	222.5
Females (n=11)	41.1 ± 6.9	40.5	74.9
Fishers (n=14)	66.5 ± 17.5	48.6	194.6
Non-Fishers (n=5)	16.4 ± 9.8	0.8	40.5
18-39 years old (n=1)	18.2	18.2	18.2
40-59 years old (n=8)	43.8 ± 7.0	44.6	72.3
60+years old (n=10)	64.3 ± 26.0	37.7	213.2
Shellfish (snails not included)			
	Average ± SE	Median	95%
All respondents (n=19)	16.0 ± 6.3	4.9	75.1
Males (n=8)	5.9 ± 3.0	1.6	19.3
Females (n=11)	23.3 ± 10.4	5.1	88.4
Fishers (n=14)	14.3 ± 7.3	5.0	53.4
Non-Fishers (n=5)	20.6 ± 13.9	2.4	63.2
18-39 years old (n=1)	5.1	5.1	5.1
40-59 years old (n=8)	19.0 ± 12.8	3.2	78.4
60+years old (n=10)	14.6 ± 7.0	5.8	51.0
Total Seafood (snails not included)			
	Average ± SE	Median	95%
All respondents (n=19)	69.3 ± 14.4	49.7	173.6
Males (n=8)	75.9 ± 31.8	42.7	223.6
Females (n=11)	64.4 ± 11.0	50.1	122.0
Fishers (n=14)	80.8 ± 17.9	49.9	196.3
Non-Fishers (n=5)	37.0 ± 15.8	42.9	71.4
18-39 years old (n=1)	23.4	23.4	23.4
40-59 years old (n=8)	62.8 ± 14.8	49.9	129.7
60+years old (n=10)	79.0 ± 24.7	58.0	214.5

Seldovia (fish consumers only). Unweighted.

Total Fish			
	Average ± SE	Median	95%
All respondents (n=18)	56.2 ± 14.4	40.5	176.0
Males (n=7)	80.0 ± 35.2	35.0	227.2
Females (n=11)	41.1 ± 6.9	40.5	74.9
Fishers (n=14)	66.5 ± 17.5	48.6	194.6
Non-Fishers (n=4)	20.5 ± 11.6	20.6	40.5

18-39 years old (n=1)	18.2	18.2	18.2
40-59 years old (n=8)	43.8 ± 7.0	44.6	72.3
60+years old (n=9)	71.5 ± 28.0	40.5	217.9
Shellfish (snails not included)			
	Average ± SE	Median	95%
All respondents (n=18)	16.9 ± 6.6	5.0	76.8
Males (n=7)	6.7 ± 3.3	2.5	19.9
Females (n=11)	23.3 ± 10.4	5.1	88.4
Fishers (n=14)	14.3 ± 7.3	5.0	53.4
Non-Fishers (n=4)	25.8 ± 16.7	15.7	65.4
18-39 years old (n=1)	5.1	5.1	5.1
40-59 years old (n=8)	19.0 ± 12.8	3.2	78.4
60+years old (n=9)	16.3 ± 7.6	9.0	53.3
Total Seafood (snails not included)			
	Average ± SE	Median	95%
All respondents (n=18)	73.1 ± 14.6	49.9	178.1
Males (n=7)	86.8 ± 34.5	44.0	228.2
Females (n=11)	64.4 ± 11.0	50.1	122.0
Fishers (n=14)	80.8 ± 17.9	49.9	196.3
Non-Fishers (n=4)	46.3 ± 16.5	56.2	71.6
18-39 years old (n=1)	23.4	23.4	23.4
40-59 years old (n=8)	62.8 ± 14.8	49.9	129.7
60+years old (n=9)	87.7 ± 25.8	71.9	219.1

Port Graham. Unweighted.

Total Fish			
	Average ± SE	Median	95%
All respondents (n=19)	116.4 ± 57.8	42.5	332.1
Males (n=12)	159.0 ± 90.2	51.6	644.0
Females (n=7)	43.3 ± 14.4	32.4	100.8
Fishers (n=17)	124.6 ± 64.4	42.5	421.2
Non-Fishers (n=2)	46.6 ± 34.4	46.6	77.6
18-39 years old (n=5)	70.5 ± 43.8	40.5	204.1
40-59 years old (n=5)	281.1 ± 213.7	89.1	929.1
60+years old (n=9)	50.4 ± 8.7	42.5	81.0
Shellfish			
	Average ± SE	Median	95%
All respondents (n=19)	8.1 ± 1.9	4.8	23.8
Males (n=12)	8.2 ± 2.4	5.6	22.9
Females (n=7)	8.0 ± 3.3	4.5	21.5
Fishers (n=17)	8.2 ± 2.1	4.6	24.7
Non-Fishers (n=2)	7.6 ± 4.8	7.6	11.9
18-39 years old (n=5)	7.0 ± 4.2	3.7	19.8
40-59 years old (n=5)	5.6 ± 2.9	3.9	14.4
60+years old (n=9)	10.2 ± 3.0	9.2	24.8
Total Seafood			
	Average ± SE	Median	95%
All respondents (n=19)	124.5 ± 57.5	60.9	336.9
Males (n=12)	167.2 ± 89.7	66.6	647.7
Females (n=7)	51.3 ± 14.7	49.3	105.4

Fishers (n=17)	132.8 ± 64.1	60.9	425.7
Non-Fishers (n=2)	54.2 ± 39.2	54.2	89.5
18-39 years old (n=5)	77.4 ± 43.8	49.4	211.2
40-59 years old (n=5)	286.7 ± 212.8	93.0	931.7
60+years old (n=9)	60.6 ± 10.0	60.9	96.4

Nanwalek. Unweighted.

Total Fish			
	Average ± SE	Median	95%
All respondents (n=19)	136.1 ± 35.6	91.1	277.0
Males (n=8)	97.7 ± 25.1	88.1	204.8
Females (n=11)	164.1 ± 58.5	121.5	465.8
Fishers (n=18)	137.0 ± 37.6	91.1	302.1
Non-Fishers (n=1)	121.5	121.5	121.5
18-39 years old (n=10)	164.7 ± 65.3	121.5	492.1
40-59 years old (n=7)	101.8 ± 26.5	91.1	207.4
60+years old (n=2)	113.4 ± 28.4	113.4	138.9
Shellfish			
	Average ± SE	Median	95%
All respondents (n=19)	26.7 ± 7.4	19.0	92.5
Males (n=8)	25.0 ± 9.9	22.2	67.7
Females (n=11)	27.9 ± 10.9	16.9	85.4
Fishers (n=18)	27.9 ± 7.7	19.0	94.6
Non-Fishers (n=1)	5.7	5.7	5.7
18-39 years old (n=10)	16.1 ± 3.6	15.2	30.4
40-59 years old (n=7)	29.9 ± 10.6	19.0	73.5
60+years old (n=2)	68.8 ± 62.8	68.8	125.3
Total Seafood			
	Average ± SE	Median	95%
All respondents (n=19)	162.8 ± 36.5	127.2	320.4
Males (n=8)	122.7 ± 29.2	121.1	231.2
Females (n=11)	192.0 ± 59.2	127.2	508.6
Fishers (n=18)	164.8 ± 38.5	129.6	343.9
Non-Fishers (n=1)	127.2	127.2	127.2
18-39 years old (n=10)	180.8 ± 65.8	139.2	510.2
40-59 years old (n=7)	131.6 ± 30.3	108.1	236.9
60+years old (n=2)	182.2 ± 91.1	182.2	264.2

Tyonek. Unweighted.

Total Fish			
	Average ± SE	Median	95%
All respondents (n=19)	63.0 ± 19.6	35.0	148.2
Males (n=10)	89.6 ± 35.3	48.6	268.5
Females (n=9)	33.5 ± 8.2	24.3	73.5
Fishers (n=19)	63.0 ± 19.6	35.0	148.2
Non-Fishers (n=0)	N/A		
18-39 years old (n=8)	47.6 ± 12.0	34.4	100.2
40-59 years old (n=10)	77.1 ± 36.5	33.7	268.5
60+years old (n=1)	45.6	45.6	45.6
Shellfish			
	Average ± SE	Median	95%

All respondents (n=19)	0.7 ± 0.4	0.2	2.1
Males (n=10)	1.2 ± 0.7	0.4	4.8
Females (n=9)	0.1 ± 0.0	0.0	0.2
Fishers (n=19)	0.7 ± 0.4	0.2	2.1
Non-Fishers (n=0)	N/A		
18-39 years old (n=8)	1.0 ± 0.9	0.0	5.1
40-59 years old (n=10)	0.4 ± 0.1	0.2	1.2
60+years old (n=1)	0.3	0.3	0.3
Total Seafood			
	Average ± SE	Median	95%
All respondents (n=19)	63.7 ± 19.7	35.6	149.6
Males (n=10)	90.8 ± 35.2	48.9	269.2
Females (n=9)	33.6 ± 8.2	24.3	73.6
Fishers (n=19)	63.7 ± 19.7	35.6	149.6
Non-Fishers (n=0)	N/A		
18-39 years old (n=8)	48.6 ± 12.3	34.4	103.2
40-59 years old (n=10)	77.5 ± 36.5	34.4	269.2
60+years old (n=1)	45.8	45.8	45.8

Cook Inlet Tribes (values for fish and non-fish consumers combined). Weighted.

Total Fish			
	Average ± SE	Median	95%
All respondents (n=76)	94.8 ± 23.5	46.5	247.1
Males (n=38)	109.5 ± 39.2	54.1	290.8
Females (n=38)	79.8 ± 26.3	42.6	175.7
Fishers (n=68)	99.0 ± 26.1	48.6	253.2
Non-Fishers (n=8)	45.8 ± 19.4	25.0	110.8
18-39 years old (n=24)	99.4 ± 41.6	43.5	232.9
40-59 years old (n=30)	109.6 ± 48.9	48.6	316.7
60+years old (n=22)	62.5 ± 13.6	44.2	151.5
Shellfish (snails not included for Seldovia)			
	Average ± SE	Median	95%
All respondents (n=76)	12.0 ± 3.4	3.3	36.7
Males (n=38)	9.4 ± 3.5	2.1	29.7
Females (n=38)	14.7 ± 5.8	4.1	63.2
Fishers (n=68)	11.9 ± 3.6	2.9	34.5
Non-Fishers (n=8)	13.7 ± 8.9	3.5	50.2
18-39 years old (n=24)	8.4 ± 3.0	3.6	29.3
40-59 years old (n=30)	11.7 ± 4.5	1.2	47.3
60+years old (n=22)	18.3 ± 8.3	6.1	84.0
Total Seafood (snails not included for Seldovia)			
	Average ± SE	Median	95%
All respondents (n=76)	106.8 ± 23.9	55.3	267.1
Males (n=38)	118.9 ± 39.3	61.0	291.0
Females (n=38)	94.5 ± 27.7	50.2	241.1
Fishers (n=68)	110.9 ± 26.6	54.1	271.8
Non-Fishers (n=8)	59.5 ± 19.5	55.0	118.3
18-39 years old (n=24)	107.8 ± 42.7	51.5	242.2
40-59 years old (n=30)	121.2 ± 49.0	50.3	328.0

60+years old (n=22)	80.8 ± 17.8	60.8	259.1

Cook Inlet Tribes (fish consumers only). Weighted.

Total Fish			
	Average ± SE	Median	95%
All respondents (n=75)	95.5 ± 23.8	48.0	247.7
Males (n=37)	111.2 ± 31.6	54.7	293.7
Females (n=38)	79.8 ± 26.3	42.6	175.7
Fishers (n=68)	99.0 ± 26.1	48.6	253.2
Non-Fishers (n=7)	50.8 ± 20.0	39.2	111.9
18-39 years old (n=24)	99.4 ± 41.6	43.5	232.9
40-59 years old (n=30)	109.6 ± 48.9	48.6	316.7
60+years old (n=21)	64.7 ± 13.9	44.9	152.5
Shellfish (snails not included for Seldovia)			
	Average ± SE	Median	95%
All respondents (n=75)	12.1 ± 3.4	3.5	36.9
Males (n=37)	9.6 ± 3.6	2.3	29.7
Females (n=38)	14.7 ± 5.8	4.1	63.2
Fishers (n=68)	11.9 ± 3.6	2.9	34.5
Non-Fishers (n=7)	15.2 ± 9.5	4.3	52.3
18-39 years old (n=24)	8.4 ± 3.0	3.6	29.3
40-59 years old (n=30)	11.7 ± 4.5	1.2	47.3
60+years old (n=21)	18.9 ± 8.7	6.7	85.6
Total Seafood (snails not included for Seldovia)			
	Average ± SE	Median	95%
All respondents (n=75)	107.7 ± 24.2	57.0	267.6
Males (n=37)	120.8 ± 40.2	61.0	293.9
Females (n=38)	94.5 ± 27.7	50.2	241.1
Fishers (n=68)	110.9 ± 26.6	54.1	271.8
Non-Fishers (n=7)	66.0 ± 20.3	68.3	119.2
18-39 years old (n=24)	107.8 ± 42.7	51.5	242.2
40-59 years old (n=30)	121.2 ± 49.0	50.3	328.0
60+years old (n=21)	83.6 ± 18.2	66.2	259.6

Appendix C. Adult Consumption Of Fish During High Fish Consumption Months

Average, median, and 95 percentile consumption rates (grams per day (g/d)). Total fish consumption rates based on average number of weekly fish meals eaten by respondents during the two months they indicated they ate the most fish and their average fish meal portion size. Fish consumption rates include both listed and non-listed fish species.

Seldovia (values for fish and non-fish consumers combined). Unweighted.

	Average ± SE	Median	95%
All respondents (n=19)	78.9 ± 15.3	72.9	211.4
Males (n=8)	84.5 ± 30.4	66.8	222.5
Females (n=11)	74.7 ± 15.9	72.9	151.9
Fishers (n=14)	98.4 ± 17.3	77.0	223.6
Non-Fishers (n=5)	24.3 ± 16.2	0.0	72.9
18-39 years old (n=1)	36.5	36.5	36.5
40-59 years old (n=8)	86.6 ± 18.3	77.0	168.3
60+years old (n=10)	77.0 ± 25.6	66.8	213.2

Seldovia (fish consumers only). Unweighted.

	Average ± SE	Median	95%
All respondents (n=18)	83.3 ± 15.5	72.9	213.8
Males (n=7)	96.6 ± 32.2	72.9	227.2
Females (n=11)	74.7 ± 15.9	72.9	151.9
Fishers (n=14)	98.4 ± 17.3	77.0	223.6
Non-Fishers (n=4)	30.4 ± 19.4	20.3	74.9
18-39 years old (n=1)	36.5	36.5	36.5
40-59 years old (n=8)	86.6 ± 18.3	77.0	168.3
60+years old (n=9)	85.5 ± 26.9	72.9	217.9

Port Graham. Unweighted.

	Average ± SE	Median	95%
All respondents (n=19)	124.1 ± 37.1	81.0	567
Males (n=12)	158.1± 56.2	81.0	567
Females (n=7)	65.7 ± 18.7	64.8	129.0
Fishers (n=17)	132.9 ± 40.9	81.0	567
Non-Fishers (n=2)	48.6 ± 32.4	48.6	77.8
18-39 years old (n=5)	175.0 ± 99.6	64.8	129.0
40-59 years old (n=5)	200.1 ± 94.6	129.6	484.8
60+years old (n=9)	53.4 ± 9.1	54.7	81.0

Nanwalek. Unweighted.

	Average ± SE	Median	95%
All respondents (n=18)	189.6 ± 37.6	141.8	372.7
Males (n=7)	147.3 ± 36.7	121.5	284.9
Females (n=11)	216.5 ± 56.8	141.8	506.3
Fishers (n=17)	198.9 ± 38.6	141.8	506.3
Non-Fishers (n=1)	30.4	30.4	30.4
18-39 years old (n=9)	232.4 ± 71.7	212.6	561.3
40-59 years old (n=7)	156.2 ± 24.0	141.8	226.8

60+years old (n=2)	113.4 ± 28.4	113.4	138.9

Tyonek. Unweighted.

	Average ± SE	Median	95%
All respondents (n=19)	69.1 ± 12.2	52.7	164.2
Males (n=10)	81.2 ± 17.5	62.8	162.0
Females (n=9)	55.7 ± 16.7	40.5	134.9
Fishers (n=19)	69.1 ± 12.2	52.7	164.2
Non-Fishers (n=0)	N/A		
18-39 years old (n=8)	74.2 ± 18.6	54.7	154.9
40-59 years old (n=10)	67.4 ± 18.4	50.6	174.3
60+years old (n=1)	45.6	45.6	45.6

Cook Inlet Tribes (values for fish and non-fish consumers combined). Weighted.

	Average ± SE	Median	95%
All respondents (n=75)	116.4 ± 19.3	72.9	292.8
Males (n=37)	118.9 ± 26.9	81.0	314.3
Females (n=38)	114.0 ± 28.1	60.9	283.5
Fishers (n=67)	123.7 ± 21.2	81.0	299.7
Non-Fishers (n=8)	33.1 ± 13.2	19.6	81.0
18-39 years old (n=23)	153.0 ± 50.8	77.5	518.3
40-59 years old (n=30)	113.6 ± 25.3	76.0	226.8
60+years old (n=22)	68.2 ± 13.4	60.7	151.5

Cook Inlet Tribes (fish consumers only). Weighted.

	Average ± SE	Median	95%
All respondents (n=74)	117.4 ± 19.5	72.9	293.5
Males (n=36)	120.8 ± 27.5	81.0	322.4
Females (n=38)	114.0 ± 28.1	60.9	283.5
Fishers (n=67)	123.7 ± 21.2	81.0	299.7
Non-Fishers (n=7)	36.8 ± 14.3	23.3	81.0
18-39 years old (n=23)	153.0 ± 50.8	77.5	518.3
40-59 years old (n=30)	113.6 ± 25.3	76.0	226.8
60+years old (n=21)	70.5 ± 13.6	62.0	152.5

Appendix D. Adult Consumption Of Fish During Low Fish Consumption Months

Average, median, and 95 percentile consumption rates (grams per day (g/d)). Total fish consumption rates based on average number of weekly fish meals eaten by respondents during the two months they indicated they ate the least amount of fish and their average fish meal portion size. Fish consumption rates include both listed and non-listed fish species.

Seldovia (values for fish and non-fish consumers combined). Unweighted.

	Average ± SE	Median	95%
All respondents (n=19)	33.6 ± 12.8	18.6	69.3
Males (n=8)	42.2 ± 30.6	16.7	172.9
Females (n=11)	27.4 ± 4.5	32.4	45.6
Fishers (n=14)	41.4 ± 16.7	22.3	120.9
Non-Fishers (n=5)	11.8 ± 8.0	0.0	36.1
18-39 years old (n=1)	9.1	9.1	9.1
40-59 years old (n=8)	28.7 ± 4.8	28.4	46.5
60+years old (n=10)	40.0 ± 24.3	18.4	158.6

Seldovia (only fish consumers). Unweighted.

	Average ± SE	Median	95%
All respondents (n=18)	35.5 ± 13.3	19.4	79.6
Males (n=7)	48.2 ± 34.6	18.2	184.7
Females (n=11)	27.4 ± 4.5	32.4	45.6
Fishers (n=14)	41.4 ± 16.7	22.3	120.9
Non-Fishers (n=4)	14.8 ± 9.6	9.3	37.2
18-39 years old (n=1)	9.1	9.1	9.1
40-59 years old (n=8)	28.7 ± 4.8	28.4	46.5
60+years old (n=9)	44.5 ± 26.7	18.6	169.3

Port Graham. Unweighted.

	Average ± SE	Median	95%
All respondents (n=19)	36.4 ± 6.6	32.4	81.4
Males (n=12)	46.8 ± 8.7	42.5	82.8
Females (n=7)	18.6 ± 5.4	16.2	38.1
Fishers (n=17)	35.0 ± 6.7	32.4	81.8
Non-Fishers (n=2)	48.6 ± 32.4	48.6	77.8
18-39 years old (n=5)	31.8 ± 13.9	24.3	72.9
40-59 years old (n=5)	16.2 ± 8.2	16.2	39.7
60+years old (n=9)	50.2 ± 8.9	40.5	83.4

Nanwalek. Unweighted.

	Average ± SE	Median	95%
All respondents (n=18)	58.2 ± 13.1	48.6	154.5
Males (n=7)	68.6 ± 28.3	36.5	184.3
Females (n=11)	51.6 ± 12.7	60.8	121.5
Fishers (n=17)	61.4 ± 13.5	60.8	158.8
Non-Fishers (n=1)	5.1	5.1	5.1
18-39 years old (n=9)	47.4 ± 10.6	60.8	89.1

40-59 years old (n=7)	56.4 ± 29.1	20.5	178.2
60+years old (n=2)	113.4 ± 28.4	113.4	138.9

Tyonek. Unweighted.

	Average ± SE	Median	95%
All respondents (n=19)	33.6 ± 6.9	24.3	83.0
Males (n=10)	37.5 ± 11.3	31.4	92.1
Females (n=9)	29.3 ± 8.0	20.3	70.1
Fishers (n=19)	33.6 ± 6.9	24.3	83.0
Non-Fishers (n=0)	N/A		
18-39 years old (n=8)	30.6 ± 12.0	22.3	85.7
40-59 years old (n=10)	36.3 ± 9.6	26.3	80.1
60+years old (n=1)	30.4	30.4	30.4

Cook Inlet Tribes (values for fish and non-fish consumers combined). Weighted.

	Average ± SE	Median	95%
All respondents (n=75)	41.0 ± 6.4	27.4	101.3
Males (n=37)	47.5 ± 11.2	31.4	99.5
Females (n=38)	34.5 ± 6.5	20.3	86.5
Fishers (n=67)	42.6 ± 7.0	30.4	101.3
Non-Fishers (n=8)	22.1 ± 11.9	6.0	68.1
18-39 years old (n=23)	36.9 ± 9.2	24.3	101.3
40-59 years old (n=30)	37.2 ± 10.7	20.3	80.4
60+years old (n=22)	53.3 ± 13.3	33.2	126.3

Cook Inlet Tribes (only fish consumers). Weighted.

	Average ± SE	Median	95%
All respondents (n=74)	41.3 ± 6.5	29.0	101.3
Males (n=36)	48.3 ± 11.4	31.8	99.9
Females (n=38)	34.5 ± 6.5	20.3	86.5
Fishers (n=67)	42.6 ± 7.0	30.4	101.3
Non-Fishers (n=7)	24.6 ± 13.3	9.5	69.4
18-39 years old (n=23)	36.9 ± 9.2	24.3	101.3
40-59 years old (n=30)	37.2 ± 10.7	20.3	80.4
60+years old (n=21)	55.1 ± 13.7	35.8	127.8

Appendix E. Adult Consumption of all listed fish and shellfish species

Average, median, and 95 percentile consumption rates (grams per day (g/d)) based on average fish meal portion size and average monthly number of meals of individual fish species as indicated by respondents. Total seafood consumption rates incorporate shellfish consumption as recorded in Appendix B.

Seldovia (values for fish and non-fish consumers combined). Unweighted.

Anadromous Fish (does not include smelt)			
	Average ± SE	Median	95%
All respondents (n=19)	50.9 ± 9.4	52.2	141.0
Males (n=8)	50.4 ± 17.4	51.1	124.0
Females (n=11)	51.4 ± 10.9	52.2	103.5
Fishers (n=14)	65.1 ± 9.8	56.0	143.8
Non-Fishers (n=5)	11.3 ± 9.5	0.8	40.6
18-39 years old (n=1)	40.2	40.2	40.2
40-59 years old (n=8)	63.7 ± 11.3	54.1	114.4
60+years old (n=10)	41.8 ± 15.1	35.7	116.2
Non-anadromous Fish (does not include pike, whitefish, needlefish, or bullhead)			
	Average ± SE	Median	95%
All respondents (n=19)	27.5 ± 5.8	22.4	60.0
Males (n=8)	31.8 ± 11.9	23.5	81.5
Females (n=11)	24.3 ± 5.4	22.4	48.7
Fishers (n=14)	36.4 ± 6.2	32.4	69.8
Non-Fishers (n=5)	2.5 ± 2.1	0.2	9.0
18-39 years old (n=1)	44.1	44.1	44.1
40-59 years old (n=8)	27.6 ± 5.4	22.9	48.6
60+years old (n=10)	25.7 ± 10.2	13.6	77.6
Total Fish (does not include smelt, pike, whitefish, needlefish, or bullhead)			
	Average ± SE	Median	95%
All respondents (n=19)	78.4 ± 13.5	67.5	181.4
Males (n=8)	82.2 ± 26.2	65.6	190.6
Females (n=11)	75.7 ± 14.6	77.1	146.1
Fishers (n=14)	101.5 ± 13.0	86.9	187.2
Non-Fishers (n=5)	13.8 ± 11.6	0.8	49.5
18-39 years old (n=1)	84.3	84.3	84.3
40-59 years old (n=8)	91.3 ± 14.1	78.5	156.0
60+years old (n=10)	67.6 ± 23.2	52.9	187.2
Total Seafood (snails not included; does not include smelt, pike, whitefish, needlefish, or bullhead)			
	Average ± SE	Median	95%
All respondents (n=19)	94.4 ± 15.8	88.8	212.8
Males (n=8)	88.1 ± 26.5	77.8	195.4
Females (n=11)	99.0 ± 20.4	89.4	203.7
Fishers (n=14)	115.8 ± 17.3	93.9	232.7
Non-Fishers (n=5)	34.4 ± 19.0	10.7	85.4
18-39 years old (n=1)	89.4	89.4	89.4
40-59 years old (n=8)	110.3 ± 25.8	89.7	227.8
60+years old (n=10)	82.2 ± 22.4	79.7	192.7

Seldovia (fish consumers only). Unweighted.

Anadromous Fish (does not include smelt)			
	Average ± SE	Median	95%
All respondents (n=18)	53.8 ± 9.4	53.5	141.6
Males (n=7)	57.6 ± 18.3	56.0	127.8
Females (n=11)	51.4 ± 10.9	52.2	103.5
Fishers (n=14)	65.1 ± 9.8	56.0	143.8
Non-Fishers (n=4)	14.2 ± 11.7	3.9	42.7
18-39 years old (n=1)	40.2	40.2	40.2
40-59 years old (n=8)	63.7 ± 11.3	54.1	114.4
60+years old (n=9)	46.5 ± 16.1	54.7	120.1
Non-anadromous Fish (does not include pike, whitefish, needlefish, or bullhead)			
	Average ± SE	Median	95%
All respondents (n=18)	29.0 ± 5.9	22.9	62.0
Males (n=7)	36.4 ± 12.7	25.7	83.5
Females (n=11)	24.3 ± 5.4	22.4	48.7
Fishers (n=14)	36.4 ± 6.2	32.4	69.8
Non-Fishers (n=4)	3.1 ± 2.6	0.8	9.5
18-39 years old (n=1)	44.1	44.1	44.1
40-59 years old (n=8)	27.6 ± 5.4	22.9	48.6
60+years old (n=9)	28.6 ± 11.0	22.4	79.6
Total Fish (does not include smelt, pike, whitefish, needlefish, or bullhead)			
	Average ± SE	Median	95%
All respondents (n=18)	82.8 ± 13.5	72.3	182.6
Males (n=7)	93.9 ± 27.0	67.5	192.3
Females (n=11)	75.7 ± 14.6	77.1	146.1
Fishers (n=14)	101.5 ± 13.0	86.9	187.2
Non-Fishers (n=4)	17.3 ± 14.3	4.6	52.1
18-39 years old (n=1)	84.3	84.3	84.3
40-59 years old (n=8)	91.3 ± 14.1	78.5	156.0
60+years old (n=9)	75.1 ± 24.5	63.6	188.9
Total Seafood (snails not included; does not include smelt, pike, whitefish, needlefish, or bullhead)			
	Average ± SE	Median	95%
All respondents (n=18)	99.6 ± 15.8	89.1	216.8
Males (n=7)	100.7 ± 26.9	87.4	196.8
Females (n=11)	99.0 ± 20.4	89.4	203.7
Fishers (n=14)	115.8 ± 17.3	93.9	232.7
Non-Fishers (n=4)	43.1 ± 21.9	41.3	86.3
18-39 years old (n=1)	89.4	89.4	89.4
40-59 years old (n=8)	110.3 ± 25.8	89.7	227.8
60+years old (n=9)	91.3 ± 22.8	87.4	194.0

Port Graham. Unweighted.

Anadromous Fish (*one outlier excluded)			
	Average ± SE	Median	95%
All respondents (n=18)	123.3 ± 30.2	71.1	315.3
Males (n=11)	111.8 ± 28.9	53.2	248.7
Females (n=7)	141.4 ± 66.1	89.0	408.1
Fishers (n=16)	126.5 ± 33.3	71.1	339.0
Non-Fishers (n=2)	97.9 ± 73.0	97.9	163.6
18-39 years old (n=4)	72.2 ± 26.0	52.1	134.80

40-59 years old (n=5)	186.5 ± 91.6	163.3	457.0
60+years old (n=9)	111.0 ± 31.4	89.0	247.1
Non-anadromous Fish (*one outlier excluded)			
	Average ± SE	Median	95%
All respondents (n=18)	53.0 ± 20.7	15.6	227.3
Males (n=11)	75.1 ± 32.0	22.4	271.9
Females (n=7)	18.4 ± 11.0	3.5	63.8
Fishers (n=16)	54.0 ± 23.0	15.6	240.0
Non-Fishers (n=2)	45.6 ± 44.6	45.6	85.7
18-39 years old (n=4)	33.6 ± 15.9	20.5	72.1
40-59 years old (n=5)	54.3 ± 39.5	9.3	176.6
60+years old (n=9)	61.0 ± 36.4	16.8	249.8
Total fish (*one outlier excluded)			
	Average ± SE	Median	95%
All respondents (n=18)	176.4 ± 42.8	102.9	534.6
Males (n=11)	186.9 ± 59.1	75.5	520.7
Females (n=7)	159.9 ± 64.5	116.0	417.8
Fishers (n=16)	180.5 ± 47.0	102.9	544.1
Non-Fishers (n=2)	143.5 ± 117.7	143.5	249.4
18-39 years old (n=4)	105.8 ± 23.5	95.8	160.1
40-59 years old (n=5)	240.8 ± 102.2	213.7	501.5
60+years old (n=9)	172.0 ± 65.1	89.8	482.5
Total Seafood (*one outlier excluded)			
	Average ± SE	Median	95%
All respondents (n=18)	184.7 ± 43.4	104.7	541.1
Males (n=11)	195.4 ± 60.3	76.3	530.4
Females (n=7)	167.9 ± 64.2	119.7	424.8
Fishers (n=16)	188.9 ± 47.6	104.7	551.9
Non-Fishers (n=2)	151.1 ± 122.4	151.1	261.3
18-39 years old (n=4)	113.2 ± 28.6	98.0	180.6
40-59 years old (n=5)	246.4 ± 101.1	217.7	505.5
60+years old (n=9)	182.1 ± 66.9	89.8	504.8

Nanwalek. Unweighted.

Anadromous Fish			
	Average ± SE	Median	95%
All respondents (n=19)	197.2 ± 42.5	153.9	541.7
Males (n=8)	97.1 ± 20.5	80.7	181.1
Females (n=11)	270.0 ± 64.3	228.5	624.2
Fishers (n=18)	206.2 ± 43.9	165.5	552.0
Non-Fishers (n=1)	35.0	35.0	35.0
18-39 years old (n=10)	227.2 ± 74.0	163.0	634.6
40-59 years old (n=7)	173.0 ± 48.4	153.9	342.1
60+years old (n=2)	132.0 ± 45.2	132.0	172.7
Non-anadromous fish			
	Average ± SE	Median	95%
All respondents (n=19)	68.3 ± 13.4	56.0	159.0
Males (n=8)	36.9 ± 13.9	20.1	100.7
Females (n=11)	91.2 ± 18.4	97.9	179.5
Fishers (n=18)	70.3 ± 14.1	56.1	161.6
Non-Fishers (n=1)	32.6	32.6	32.6
18-39 years old (n=10)	53.3 ± 15.7	37.3	130.9

40-59 years old (n=7)	92.2 ± 26.9	96.8	188.9
60+years old (n=2)	60.2 ± 37.8	60.2	94.1
Total Fish			
	Average ± SE	Median	95%
All respondents (n=19)	265.6 ± 50.5	192.7	685.8
Males (n=8)	134.0 ± 32.6	101.2	281.8
Females (n=11)	361.2 ± 72.2	417.8	729.2
Fishers (n=18)	276.5 ± 52.1	221.7	691.2
Non-Fishers (n=1)	67.6	67.6	67.6
18-39 years old (n=10)	280.5 ± 83.7	167.1	734.6
40-59 years old (n=7)	265.2 ± 71.5	250.6	485.2
60+years old (n=2)	192.1 ± 83.0	192.1	266.8
Total Seafood			
	Average ± SE	Median	95%
All respondents (n=19)	292.2 ± 51.2	202.5	701.4
Males (n=8)	159.0 ± 39.6	104.3	334.5
Females (n=11)	389.1 ± 71.6	436.8	744.4
Fishers (n=18)	304.4 ± 52.6	264.6	706.8
Non-Fishers (n=1)	73.3	73.3	73.3
18-39 years old (n=10)	296.5 ± 84.3	186.9	749.8
40-59 years old (n=7)	295.0 ± 71.3	338.7	497.9
60+years old (n=2)	260.9 ± 145.8	260.9	392.1

Tyonek. Unweighted.

Anadromous Fish			
	Average ± SE	Median	95%
All respondents (n=18)	66.6 ± 13.1	58.7	161.7
Males (n=10)	73.2 ± 18.3	68.6	167.7
Females (n=8)	58.4 ± 19.4	39.9	145.0
Fishers (n=18)	66.6 ± 13.1	58.7	161.7
Non-Fishers (n=0)	N/A		
18-39 years old (n=7)	50.3 ± 20.1	23.8	125.9
40-59 years old (n=10)	72.3 ± 18.2	58.7	175.2
60+years old (n=1)	123.6	123.6	123.6
Non-Anadromous Fish			
	Average ± SE	Median	95%
All respondents (n=18)	5.0 ± 1.4	1.8	14.7
Males (n=10)	5.5 ± 2.1	3.3	15.3
Females (n=8)	4.3 ± 2.0	1.8	13.2
Fishers (n=18)	5.0 ± 1.4	1.8	14.7
Non-Fishers (n=0)	N/A		
18-39 years old (n=7)	3.9 ± 1.9	0.2	11.0
40-59 years old (n=10)	4.9 ± 2.0	1.8	15.3
60+years old (n=1)	14.0	14.0	14.0
Total Fish			
	Average ± SE	Median	95%
All respondents (n=18)	71.6 ± 13.2	64.9	162.1
Males (n=10)	78.7 ± 18.2	75.5	171.9
Females (n=8)	62.7 ± 19.8	47.1	150.3
Fishers (n=18)	71.6 ± 13.2	64.9	162.1
Non-Fishers (n=0)	N/A		
18-39 years old (n=7)	54.2 ± 20.9	35.4	132.4

40-59 years old (n=10)	77.2 ± 17.6	64.9	175.5
60+years old (n=1)	137.6	137.6	137.6
Total Seafood			
All respondents (n=18)	72.3 ± 13.0	62.3	160.5
Males (n=10)	78.7 ± 18.2	75.5	171.9
Females (n=8)	62.7 ± 19.8	47.1	150.3
Fishers (n=18)	72.3 ± 13.0	62.3	160.5
Non-Fishers (n=0)	N/A		
18-39 years old (n=7)	55.4 ± 20.5	29.0	130.0
40-59 years old (n=10)	77.6 ± 17.6	65.2	175.6
60+years old (n=1)	137.8	137.8	137.8

Cook Inlet Tribes (values for fish and non-fish consumers combined). Weighted.

Anadromous Fish (data does not include smelt for Seldovia; one outlier excluded).			
	Average ± SE	Median	95%
All respondents (n=74)	115.3 ± 20.2	62.5	343.4
Males (n=37)	86.7 ± 15.1	62.3	198.2
Females (n=37)	144.9 ± 36.6	61.0	518.5
Fishers (n=66)	121.7 ± 22.1	69.7	351.3
Non-Fishers (n=8)	43.1 ± 24.5	18.7	132.2
18-39 years old (n=22)	133.2 ± 53.1	58.4	500.3
40-59 years old (n=30)	114.4 ± 27.9	61.0	331.4
60+years old (n=22)	91.8 ± 19.7	71.0	201.7
Non-anadromous Fish (data does not include pike, whitefish, needlefish, or bullhead for Seldovia; one outlier excluded)			
	Average ± SE	Median	95%
All respondents (n=74)	37.9 ± 8.9	12.1	152.2
Males (n=37)	35.6 ± 13.9	9.7	103.6
Females (n=37)	40.3 ± 11.3	14.8	152.2
Fishers (n=66)	39.3 ± 9.8	13.0	152.9
Non-Fishers (n=8)	21.8 ± 13.6	1.1	71.9
18-39 years old (n=22)	31.6 ± 12.2	12.5	102.3
40-59 years old (n=30)	38.4 ± 14.3	10.4	176.7
60+years old (n=22)	45.8 ± 19.6	14.0	108.5
Total Fish (data does not include smelt, pike, whitefish, needlefish, or bullhead for Seldovia; one outlier excluded)			
	Average ± SE	Median	95%
All respondents (n=74)	153.2 ± 25.8	78.5	513.6
Males (n=37)	122.3 ± 26.9	75.6	299.6
Females (n=37)	185.1 ± 43.4	90.9	581.8
Fishers (n=66)	161.0 ± 28.3	89.7	517.8
Non-Fishers (n=8)	64.9 ± 37.7	19.8	199.7
18-39 years old (n=22)	164.9 ± 61.3	83.9	648.2
40-59 years old (n=30)	152.8 ± 37.2	71.5	468.5
60+years old (n=22)	137.6 ± 37.1	92.2	297.7
Total Seafood (one outlier excluded; snails, smelt, pike, whitefish, needlefish, and bullhead not included for Seldovia)			
	Average ± SE	Median	95%
All respondents (n=74)	165.0 ± 26.8	90.3	515.8
Males (n=37)	131.5 ± 28.4	77.7	339.4
Females (n=37)	200.4 ± 44.7	99.6	590.8

Fishers (n=66)	173.2 ± 29.4	93.5	521.7
Non-Fishers (n=8)	78.6 ± 38.1	48.4	214.9
18-39 years old (n=22)	173.8 ± 62.7	93.3	664.6
40-59 years old (n=30)	164.5 ± 38.8	77.0	489.8
60+years old (n=22)	155.8 ± 40.2	105.0	416.7

Cook Inlet Tribes (fish consumers only). Weighted.

Anadromous Fish (one outlier excluded; smelt not included for Seldovia)			
	Average ± SE	Median	95%
All respondents (n=73)	116.2 ± 16.9	63.2	344.2
Males (n=36)	88.1 ± 15.3	63.5	198.8
Females (n=37)	144.9 ± 36.6	61.0	518.5
Fishers (n=66)	121.7 ± 22.1	69.7	351.3
Non-Fishers (n=7)	47.8 ± 27.4	24.4	136.1
18-39 years old (n=22)	133.2 ± 53.1	58.4	500.3
40-59 years old (n=30)	114.4 ± 27.9	61.0	331.4
60+years old (n=21)	94.9 ± 20.2	75.8	204.3
Non-anadromous fish (data does not include pike, whitefish, needlefish, or bullhead for Seldovia; one outlier excluded)			
	Average ± SE	Median	95%
All respondents (n=73)	38.2 ± 9.0	12.4	152.3
Males (n=36)	36.2 ± 14.2	10.1	106.9
Females (n=37)	40.3 ± 11.3	14.8	152.2
Fishers (n=66)	39.3 ± 9.8	13.0	152.9
Non-Fishers (n=7)	24.2 ± 15.3	1.3	73.7
18-39 years old (n=22)	31.6 ± 12.2	12.5	102.3
40-59 years old (n=30)	38.4 ± 14.3	10.4	176.7
60+years old (n=21)	47.3 ± 20.4	18.1	115.9
Total fish (data does not include smelt, pike, whitefish, needlefish, or bullhead for Seldovia; one outlier excluded)			
	Average ± SE	Median	95%
All respondents (n=73)	154.4 ± 26.0	79.6	514.0
Males (n=36)	124.3 ± 27.4	76.0	303.6
Females (n=37)	185.1 ± 43.4	90.9	581.8
Fishers (n=66)	161.0 ± 28.3	89.7	517.8
Non-Fishers (n=7)	72.0 ± 42.2	25.3	205.8
18-39 years old (n=22)	164.9 ± 61.3	83.9	648.2
40-59 years old (n=30)	152.8 ± 37.2	71.5	468.5
60+years old (n=21)	142.3 ± 38.3	97.3	308.1
Total Seafood (one outlier excluded; snails, smelt, pike, whitefish, needlefish, bullhead, and octopus excluded for Seldovia)			
	Average ± SE	Median	95%
All respondents (n=73)	166.3 ± 27.1	90.8	516.4
Males (n=36)	133.6 ± 28.9	78.0	342.2
Females (n=37)	200.4 ± 44.7	99.6	590.8
Fishers (n=66)	173.2 ± 29.4	93.5	521.7
Non-Fishers (n=7)	87.2 ± 42.1	70.0	220.7
18-39 years old (n=22)	173.8 ± 62.7	93.3	664.6
40-59 years old (n=30)	164.5 ± 38.8	77.0	489.8
60+years old (n=21)	161.1 ± 41.4	109.9	423.8

Appendix F. Child Consumption Of Fish (Both Listed And Non-Listed Species)

Average, median, and 95 percentile consumption rates (grams per day (g/d)). Total fish consumption rates based on average number of weekly fish meals throughout the year and average fish meal portion size as indicated by adult respondents for the children (includes both listed and non-listed fish species).

Seldovia. Unweighted.

	Average ± SE	Median	95%
All children (n=4)	29.7 ± 13.1	22.3	94.2
5 yrs old and younger (n=0)	N/A		
6 to 17 yrs old (n=4)	29.7 ± 13.1	22.3	94.2

Port Graham. Unweighted.

	Average ± SE	Median	95%
All children (n=8)	55.2 ± 14.1	41.5	117.2
5 yrs old and younger (n=5)	49.4 ± 18.8	40.5	105.7
6 to 17 yrs old (n=3)	64.8 ± 24.6	60.8	104.5

Nanwalek (all children). One outlier excluded. Unweighted.

	Average ± SE	Median	95%
All (n=14)	79.7 ± 25.7	46.1	250.7
5 yrs old and younger (n=8)	43.9 ± 23.7	24.3	149.7
6 to 17 yrs old (n=6)	127.6 ± 46.4	85.1	295.7

Nanwalek (only children who eat fish). One outlier excluded. Unweighted.

	Average ± SE	Median	95%
All (n=12)	93.0 ± 28.2	62.3	264.5
5 yrs old and younger (n=6)	58.5 ± 29.6	38.5	164.8
6 to 17 yrs old (n=6)	127.6 ± 46.4	85.1	295.7

Tyonek (all children). Unweighted.

	Average ± SE	Median	95%
All (n=8)	33.9 ± 13.5	22.3	94.2
5 yrs old and younger (n=4)	7.1 ± 5.8	2.0	21.3
6 to 17 yrs old (n=4)	60.8 ± 18.5	60.8	98.2

Tyonek (only children who eat fish). Unweighted.

	Average ± SE	Median	95%
All (n=6)	45.2 ± 15.5	32.4	96.2
5 yrs old and younger (n=2)	14.2 ± 10.1	14.2	23.3
6 to 17 yrs old (n=4)	60.8 ± 18.5	60.8	98.2

Cook Inlet Tribes (all children). One outlier excluded. Weighted.

	Average ± SE	Median	95%
All (n=34)	58.0 ± 16.3	40.5	177.8
5 yrs old and younger (n=17)	34.9 ± 17.4	12.8	134.1
6 to 17 yrs old (n=17)	83.3 ± 25.8	67.3	203.7

Cook Inlet Tribes (only children who eat fish). One outlier excluded. Weighted.

	Average ± SE	Median	95%
All (n=30)	67.0 ± 17.5	40.5	186.6
5 yrs old and younger (n=13)	47.1 ± 20.9	31.8	151.8
6 to 17 yrs old (n=17)	83.3 ± 25.8	67.3	203.7