Traditional Ecological Knowledge and Contemporary Subsistence Harvest of Non-Salmon Fish in the Koyukuk River Drainage, Alaska

by
David B. Andersen[1], Caroline L. Brown[2],
Robert J. Walker[2] and Kimberly Elkin[3]

Technical Paper No. 282

[1]Research North°
Fairbanks, Alaska

[2]Alaska Department of Fish and Game
Division of Subsistence

[3]Tanana Chiefs Conference
Fairbanks, Alaska

May 2004

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

LIST OF APPENDICES

ABSTRACT

It would be difficult to overstate the importance of the non-salmon fish resources to the past and present human population of the Koyukuk River region. Moose were not present in the drainage until the mid-1930s and the area has limited access to other subsistence mainstays such as salmon and caribou. In order to feed themselves and their dog-teams, residents of the Koyukuk drainage developed a particularly rich body of traditional ecological knowledge (TEK) pertaining to the habits, seasonal movements, and availability of resident fish species. The primary purpose of this project was to begin the process of collecting and documenting this traditional knowledge through interviews with local experts. TEK interviews were conducted with a total of 29 individuals from throughout the Koyukuk drainage. The wealth of information they provided on the behavior, harvest, and use of fish is summarized by species. In addition to this largely historical perspective, a door to door harvest survey was conducted to provide estimates of the contemporary (2002) annual harvest of non-salmon fish in Koyukuk River communities. These data show that fish continue to be harvested and used in significant quantities by a high percentage of area households.

Key Words: Alaska blackfish (*Dallia pectoralis*), Alatna River, Arctic grayling (*Thymallus arcticus*), Burbot (*Lota lota*), harvest survey, Koyukuk River, Longnose sucker (*Catostomus catostomus*), Northern pike (*Esox lucius*), Sheefish (*Stenodus leucichthys*), Traditional Ecological Knowledge, and whitefish (*Coregonus sp. & Prosopium cylindraceum*).

Citation: Andersen, D. B., C.L. Brown, R.J. Walker, and K. Elkin. Traditional ecological knowledge and contemporary subsistence harvest of non-salmon fish in the Koyukuk River drainage, Alaska. Federal Subsistence Fishery Monitoring Program, Final Project Report No. FIS 01-100. U. S. Fish and Wildlife Service, Office of Subsistence Management, Fisheries Resource Monitoring Program, Fishery Information Service, Anchorage, Alaska.

Andersen, D.B., C.L. Brown, R.J. Walker, and K. Elkin. 2004. Traditional Ecological Knowledge and Contemporary Subsistence Harvest of Non-Salmon Fish in the Koyukuk River Drainage, Alaska. Division of Subsistence, Alaska Department of Fish and Game, Technical Paper No. 282.

INTRODUCTION

The Koyukuk River is a major tributary of the Yukon River entering from the north and draining much of north-central Alaska. From its headwaters in the Brooks Range, to its confluence with the Yukon River, the Koyukuk runs some 700 miles through a land traditionally occupied by inland Eskimo bands and the Koyukon Athabascan people. The once scattered human population of the region now resides in seven remote villages: Alatna, Allakaket, Bettles/Evansville, Hughes, Huslia, Koyukuk, and Wiseman. Major geographic features of the region, including significant tributaries, and the locations of these present-day communities, are shown in Fig. 1.

For the people inhabiting the Koyukuk River, fish have been among the more available and reliable food resources. In contrast to arctic areas farther north, where caribou are a mainstay of the subsistence economy, migratory caribou are only rarely and sporadically available in the Koyukuk drainage. Today, moose are one of the region's primary subsistence resources, but according to numerous respondents interviewed over the course of this project they are a relatively recent arrival, becoming established in the Koyukuk area in the 1930s. Many Koyukuk River elders recall times prior to about 1935 when moose were virtually absent from the Koyukuk River valley. The thin resources of the Koyukuk region also stood in contrast to coastal areas to west, where a host of marine resources were both abundant and relatively predictable. For much of the first half of the twentieth century and before, the major subsistence resources of the Koyukuk drainage consisted mostly of small game and a wide variety of fish:

> "There was no moose long time ago. [Husband] was six years old when he saw first bull moose on Alatna (1932). They know what it was because people down there on Yukon hunt them and talk about it. And South Fork people go down there some place for moose hides….maybe Stevens Village….I don't know. That's why Eskimo and Athabascan call moose same word……deneege….so because they call it that the Eskimo call it that too. Before moose it was tough. If there was no rabbits and grouse and those ptarmigan, I don't know how they would survive. Rabbit was one that really help….dogs and everybody. And you have to move lots. And if there was no porcupine that time too they wouldn't have survived, 'cause porcupine…..there were plenty of those around and they have to live off it. [R051203, Evansville]

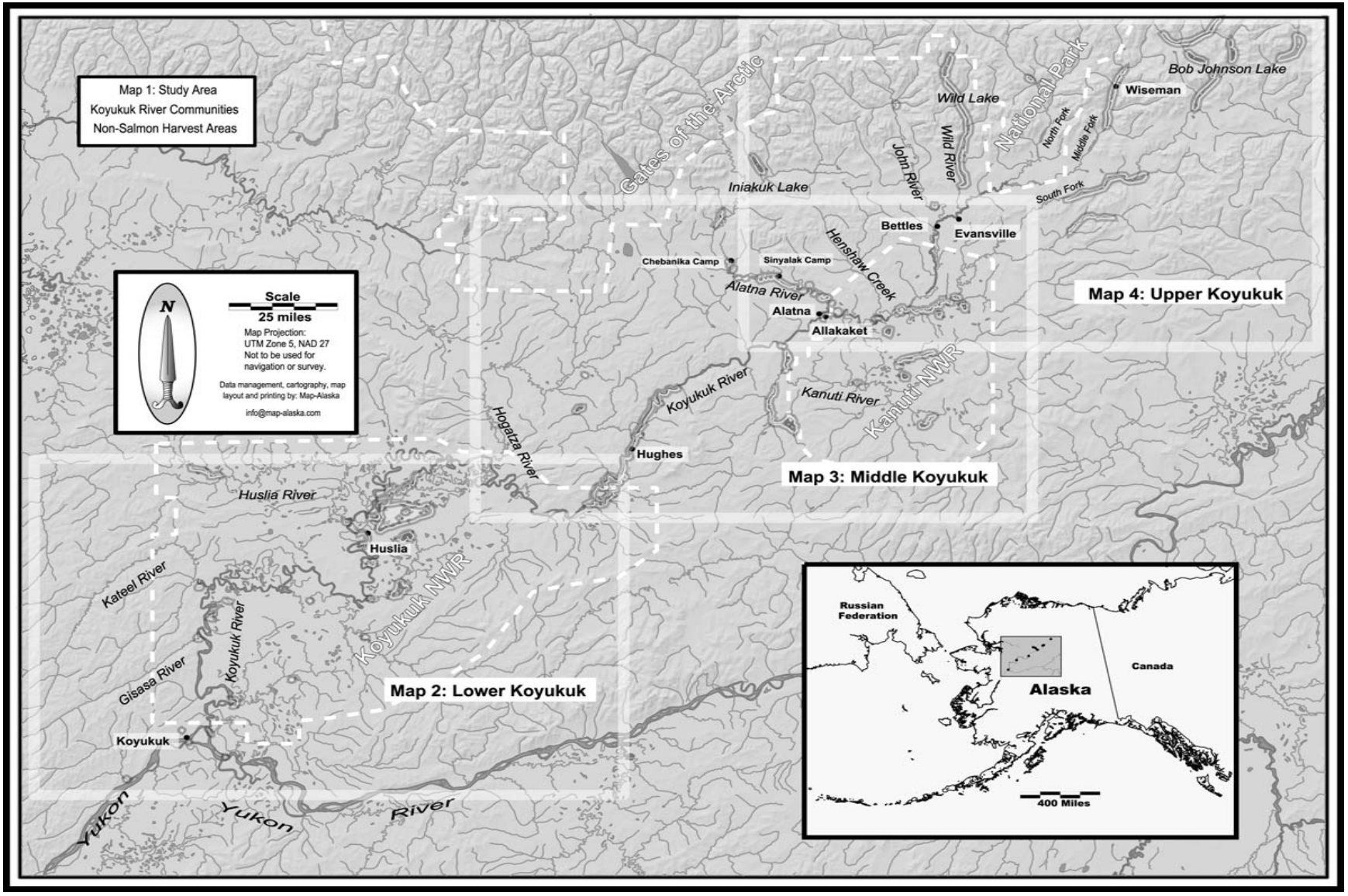


Figure 1. Map of the Koyukuk River Drainage

> "Long time ago those fish was important!--no caribou, no moose--just rabbit, ptarmigan, spruce hen, willow grouse, duck, geese—that's all, and fish, lucky there was lot of fish those days." [J110101, Huslia]

Much has been made of the seasonal abundance of salmon and their importance in feeding people and dog teams throughout the Yukon River drainage. The Koyukuk River is no exception, and summer runs of chinook or king salmon (*Oncorhynchus tshawytscha*) and chum salmon (*Oncorhynchus keta*) are harvested by Koyukuk River residents, particularly in the lower reaches of the drainage. In general, salmon decline in both quantity and quality in the middle and upper reaches of the drainage. As a result, residents in these areas tend to place greater emphasis on the harvest and use of non-salmon fish species to meet their subsistence needs. One Allakaket resident summarized the unreliability of the salmon resource in the upper Koyukuk this way:

> "If there is salmon in the Koyukuk we don't go back there [in the creeks]. But when there's no salmon in the Koyukuk River….around here, you know…..downriver its different I guess, but up here, far as I know, it was nothing….good enough to feed dogs all summer long. We had to do everything we could to make a living, you know." [F080901 Allakaket]

The dramatic difference in the availability of fish along the salmon-rich Yukon River and the availability of fish in tributary drainages such as the Koyukuk is summarized by the comments of one Huslia resident:

> "Them Yukon River…….they are millionaire people with their fish. They got rich river…..yeah, that's millionaire people that's livin' down there." [X070503, Huslia]

The critical role fish have played, and continue to play, in feeding the dog teams of Interior Alaska is something that will be referred to throughout this report and is key to understanding the importance of fish within an historical context. Before the availability of practical, reliable, and affordable snowmobiles in the late 1960s, supplying food to feed family dog teams was a year round task faced by virtually every household in rural Alaska (Andersen 1992). Dogs were not only used as a mainstay for winter transportation, but also as pack dogs during fall hunting trips. Prior to the availability of affordable boat motors in the 1930s, dogs in harness were also used to pull or "line" small boats up-stream. The process of using dogs to pull boats was described by one respondent:

> "Before outboard we line with dogs in summer time to go upriver. Thirty two foot long row boats, you know. They didn't have small ones, they have big long boats. When we get to

> end of gravel bar we put the dogs in boat and row across….take them off on the other side and line the whole gravel bar again. Back and forth. It was nothing for us….fast for us. You know we have to run sometimes with dogs. We have to tie the rope….dogs got rope back there, we have to move it back probably to here….and this guy back here who's steering the boat with little paddle, you know…you gotta have 'em just right. If we tie 'em way up here he go back to the shore. We have to tie back here some place to keep like this [boat angled outward]. And dogs used to know when there is snag. Snag on the river bar right there in the water and they're coming up. The leader know he's gonna get in trouble right there….big snag like this. The leader know he's gonna get in trouble. Before we say anything he jump in water and go around the snag. Because if he go behind there he's gonna get whipping for doing that. So they see snag, they go around it by themselves. We were the one last had outboard motor back in….I forgot what year. We had lotta kids so we couldn't afford outboard motor." [T061603, Allakaket]

Family dog teams tended to be small, averaging perhaps seven large dogs, but the quantity of food required to keep even a small dog team in working condition year-round required constant effort on the part of dog owners. Where chum salmon could be caught in abundance, such as along the Yukon mainstem, they became the dog food-of-choice. Dried chum salmon for use as dog food became a form of currency in the late nineteenth and early twentieth century, and were traded in bundles at Yukon River trading posts and stores (Andersen 1992). But in areas such as the Koyukuk River, where local supplies of salmon were less abundant and less reliable, local residents turned to non-salmon fish as a primary source of dog food. The availability of fish to feed dogs often dictated the number of dogs that could be kept in a given year:

> "Sometimes when it's poor fishing in the summer for salmon you use any kind of fish you get for dogs. Long ago they used to put up quite a bit of dog feed for dogs…..dry them…..dog salmon. And if you don't get enough of that in the summer you use anything you catch. My average number of dogs I use was seven…..me alone, before I got married. Some people used, if they had enough dog feed, they used up to eleven or thirteen dogs in a team. But you have to go by the dog feed. If there ain't enough they don't use too many dogs." [N050503, Koyukuk]

While there was a concentration on fall fishing activities to obtain their winter supply of fish, Koyukuk River residents did not always have the luxury of being able to put up a winter's worth of dog food in a short period of time, and fishing to feed both people and dogs was an activity that was actively pursued year-round. Elders noted that early spring was often the leanest time of the year, after winter supplies of fish had run out and before breakup allowed fresh "spring fish" to be caught. One respondent remembered feeding their dogs fireweed shoots mixed with grease in the spring to hold them over until fresh fish could be caught.

Fishing techniques were perfected that allowed fish to be harvested in virtually every calendar month if food was needed. Some non-salmon species such as Alaska blackfish and longnose suckers were primarily regarded as feed for dogs along the Koyukuk, but readers will note in the species summaries of each fish, that for those attempting to feed sled dogs, virtually every kind of non-salmon fish had a use as dog food.

While fishing was a central activity, and often one of the main reasons family groups relocated to certain seasonal camps, it was just one of a variety of activities that were occurring simultaneously as family groups attempted to stockpile food for the winter months. In describing the traditional seasonal round of subsistence activities practiced by the Koyukuk River Koyukon, Clark (1981) includes this description:

> "In years when the salmon run was small, some families left the rivers and installed traps in tributaries to catch whitefish and suckers. Later, with the introduction of commercial twine, nets almost completely supplanted the use of traps on the Koyukuk; and with the introduction of the fish wheel about 1910 the Yukon people began to use it almost exclusively. On the Koyukuk the net fishery resulted in a proliferation of smaller fish camps, while the introduction of the fish wheel created large camps on the Yukon. Concomitant with fishing, hunting continued but it usually was limited to the vicinity of the fish camp.
>
> The men returned from their hunting forays as the days began to get cooler and darker and together with their families went to fall camps on outlet streams adjacent to larger lakes. Men set grayling and whitefish traps in the streams and continued to hunt locally while women and children dried fish and snared small game." [Clark, 1981 pg. 588]

As a food resource that could be harvested during almost any month of the year using a variety of methods, it would be difficult to overstate the importance of fishing to the people of the Koyukuk River. Because of this importance, residents of the Koyukuk River drainage developed a particularly rich body of knowledge pertaining to the habits, seasonal movements, and availability of the various fish species. Regional methods and technologies evolved for harvesting, preserving, and preparing each fish species. In addition, fish figured prominently in local place-names, traditional stories, legends, and beliefs that still have meaning and significance today. The purpose of this project was to begin the process of collecting and documenting traditional ecological knowledge pertaining to non-salmon fish species in this region through interviews with key individuals identified as local experts on this topic. Previous

work by Clark (1981), Nelson et. al. (1982), Nelson (1983), Marcotte and Haynes (1985), and Marcotte (1986) provided important background for this study, although their primary focus was not on fish.

Because of the nature of the information presented, and the way it was collected, these data fall into the broad category of what is now commonly referred to as traditional ecological knowledge, or TEK. A series of published biographies with Koyukuk River elders in the early 1980s (Beetus 1980, Nictune 1980, Beatus 1981, Simon 1981, Solomon, 1981) were done before the term TEK was coined, but fall squarely in this genre. In recent decades, a growing body of literature grounded in TEK research has emerged (Freeman 1992, Hunn 1988). While definitions vary, TEK can be most simply described as "a system of knowledge developed by a given culture to classify the objects, activities, and events of its universe" (Hardesty 1977:291). Indigenous populations have been keen observers of their environment for thousands of years. But only relatively recently have these observations begun to be systematically combined or juxtaposed with western science. In a northern context, Wenzel (1999:114) commented that "Traditional ecological knowledge, as a conceptualization and expression of what Inuit know about their environment and its processes, has formed an important aspect of scientific inquiry among Inuit far longer than TEK, as a "research type" has had "intellectual currency." While TEK has been more widely embraced by western science in recent years, the relationship between these two "systems of knowing" is still developing. This report works from the premise that questions about the natural world can best be addressed by using both systems to compliment one another, and the information compiled in this report is offered in that spirit.

OBJECTIVES

Three objectives were outlined for this project:

1) Collection of Traditional Ecological Knowledge
   a. TEK interviews with local experts on the ecology, harvest, and use of non-salmon fish species.
   b. Mapping sessions with TEK key respondents to identify important fishing sites, fishing areas, and fish habitats.
   c. Compile collected TEK information into a searchable askSam computer database.

2) Harvest Assessment
   a. Conduct household harvest surveys to estimate the annual harvests of non-salmon fish species in seven Koyukuk River communities by community and season of harvest for calendar year 2002.
   b. Provide estimates of the percentage of households using, harvesting receiving, and giving away non-salmon fish species.
   c. Provide basic demographic statistics for surveyed communities including population and ethnicity.
   d. Collect household (user) comments on how 2002 harvest and use levels compare to other recent years.

3) Capacity Building
   a. Consult local tribal organizations on defining research questions, collecting, reviewing and analyzing data, and reporting study findings.
   b. Train tribal organization (Tanana Chiefs Conference) staff in the use of the askSam database

All of these research objectives were accomplished. Due to project delays brought about by personnel turnover discussed below, the harvest assessment component was changed to address calendar year 2002 instead of 2001 as originally planned. This is the only deviation from the objectives identified in the original research design.

METHODS

Collection of TEK

This was originally conceived as a cooperative project between the Alaska Department of Fish and Game (ADF&G), Division of Subsistence, and Tanana Chiefs Conference (TCC), Department of Wildlife and Parks. An unprecedented sequence of staffing changes during the first year of the research effort resulted in a complete turn-over of principle investigators and supervisory staff at both agencies and a delay in project progress. To provide continuity during this transition with work already accomplished, ADF&G sub-contracted with the former lead researcher, now with Research North, to complete portions of the second year of research. Project funding was provided by the U.S. Fish and Wildlife Service (USFWS) under cooperative agreement number 701811J335, with oversight by the Office of Subsistence Management, Fisheries Information Service, project number FIS01-100.

The local or traditional knowledge documented and summarized here was collected through key respondent interviews with life-long local residents identified as experts on fish and fishing in the communities of Alatna, Allakaket, Bettles/Evansville, Hughes, Huslia, Koyukuk, and Wiseman. Between August 2001 and July 2003 a total of 23 interview sessions were held involving 29 individuals. Several interviews took place with elderly couples where both contributed significantly to the interview session. Table 1 lists the names and ages of the 29 respondents by home community.

Of the 29 respondents interviewed, 25 were of Koyukon Athabascan descent, three were of Inupiat (Kobuk River) Eskimo descent, and one was non-Native. The list of respondents included 14 women and 15 men ranging in age from 46 to 87 years old. Only two respondents were under sixty-five years of age, and 12 of the respondents were 75 years old or older. The average age of respondents was 74 years. Their expertise with regard to fish had been gained from decades of observing, fishing for, harvesting, and processing the fish species discussed.

Table 1. Name and Age of Respondents by Community

Respondent's Name	Year Born	Age at Time of Interview
Alatna / Allakaket		
Lindberg Bergman	1929	72
David David	1932	69
Ann Edwards	1928	73
Moses Henzie	1930	71
Johnson Moses	1924	79
Bertha Moses	1930	73
Andrew Simon	1937	64
Effie Williams	1919	82
Bettles / Evansville		
Florence Nictune	1930	73
Jean Stevens	1929	74
Hughes		
Celia Beetus	1922	80
Henry Beatus	1932	70
Joe Beetus	1915	87
Rita Koyukuk	1929	73
Huslia		
Harry Ambrose	1918	85
Rose Ambrose	1928	75
Catherine Attla	1926	75
Steven Attla	1924	77
Edith Bifelt	1928	73
Emily Sam	1929	72
Tony Sam	1929	72
Bobby Vent	1913	88
Mary Vent	1913	88
Koyukuk		
Roger Dayton	1921	82
Andrew Edwin	1922	81
Marion Huntington	1938	65
Benedict Jones	1933	70
Eliza Jones	1938	65
Wiseman		
Jack Reakoff	1957	46
Average age of all respondents		**74**

While all of the respondents reside in the present-day communities mentioned above, many elderly respondents talked about having been raised "out on the land" in seasonal camps that served as the focal point for specific subsistence activities. Family ties to certain geographic areas are still widely recognized among those now living in villages. For example, residents may refer to others, or self-identify, as being "one of the South Fork people," or "from the Alatna River," or as having grown up "in the Kanuti River country." These subregional associations were taken into consideration in identifying respondents so that representatives from most regional bands or major geographic areas were included. As a result, the collective information offered by respondents should be viewed as having a relatively broad perspective from all parts of the Koyukuk River drainage.

In formulating interview questions and the harvest survey form, previous subsistence baseline studies by Marcotte and Haynes (1985) and Marcotte (1986) were used to provide an initial list of the non-salmon species commonly used for subsistence in the Koyukuk River region. This list included: Alaska blackfish (*Dallia pectoralis*), arctic grayling (*Thymallus arcticus*), burbot (*Lota lota*), longnose sucker (*Catostomus catostomus*), northern pike (*Esox lucius*), sheefish (*Stenodus leucichthys*), and several species of whitefish (*Coregonus sp.* and *Prosopium cylindraceum*). The arctic lamprey (*Lampetra japonica*) was added to the list of potential species with the thought that they might be occasionally taken by fishermen in the community of Koyukuk. TEK interview discussions focused on these species.

An interview protocol (Appendix A) served to direct the interview discussions toward specific topics so that similar lines of questioning were used for all respondents. Photographs of the fish species being discussed were shown to respondents and proved to be an effective visual prompt, both for framing questions to the informants and for eliciting their responses. The result was a semi-structured interview format. Discussions frequently took unexpected detours from the interview guide; these often-interesting and informative detours were not discouraged.

With the exception of one interview conducted in a Fairbanks meeting hall, all interviews took place in respondents' homes. All interviews were conducted by a research team of two individuals, one of whom was a speaker of the Koyukon language and could offer translation

with Koyukon respondents if needed. While most respondents were speakers of their Native language, all were conversant in English. Some interview questions or key concepts had to be explained to respondents through translation, which they then answered in English. With the knowledge and permission of the respondents, interviews were recorded using an audiocassette tape recorder. Interviews ranged in length from 25 minutes to more than two hours. The average interview lasted approximately one hour. In recognition of their contribution to the research effort, respondents were paid an honorarium of $50 to $100 depending on the length of the interview.

Plate 1. Koyukuk fisherman Benedict Jones (center) maps fishing areas with researchers Dave Andersen (left) and Stanley Ned (right). Photo by Caroline Brown

In addition to taped interviews, mapping sessions were conducted with about one-half of the respondents. The mapping component typically came at the end of the interview sessions. Several of the very elderly respondents declined participation in the mapping portion of the interview because they were tired or because poor vision made it difficult to view the maps. Others were simply pressed for time or expressed some reluctance in making the exact location

of prime fishing spots known to the general public. For those willing to provide mapped information, clear acetate sheets were placed over USGS topographic maps (1:250,000 scale) and colored markers were used to identify features referred to during the interviews such as specific fishing locations, fish camps, fish trap locations, fish concentration areas, and important fish habitats such as spawning areas. Mapped data resulting from the interviews have been compiled and are presented as Appendix C.

Additionally, information was gathered through participant observation, with researchers taking every opportunity to accompany local residents on fishing trips to observe harvest activities first-hand. These observations provided insights into the deployment and use of gear, the handling and transport of the catch, and methods of processing, preserving, and preparing fish and fish products that might have been difficult to describe or fully appreciate through any other means.

It would be ideal if all readers could have the luxury of sitting down and listening to the more than 23 hours of audio tape resulting from the interviews with these remarkable people. There is a richness in hearing their stories first-hand that is diluted when summarized and transferred to the printed page. Printed summaries lack important qualities that are attached to spoken words; the inflections of the human voice, the emphasis added to a word or phrase, the passionate and colorful retelling of a story from the distant past. In an attempt to minimize this loss, the narrative that follows makes extensive use of verbatim interview excerpts to support statements, illustrate key points, and to let the respondents' own words come through as a clear and significant voice in the story that unfolds.

Readers may note that a particular interview quotation may have been used in multiple sections of the report. It is sometimes difficult to isolate specific pieces of information and maintain the context in which the information was offered. A quotation, for example, may describe the use of a fishing method that is used to harvest several species of fish. That quote might be used to support the narrative discussion of gear types as well as the species accounts of each fish that was mentioned. For this reason, certain quotations have been repeated. This allows readers interested in specific topics to tailor their reading of this text without missing pertinent information.

While Table 1 (above) contains the names of all the respondents contributing to this project, individual statements have been coded to provide at least some level of anonymity, rather than being attributed to specific individuals. This is in keeping with Division of Subsistence protocols and research ethics agreed upon with respondents.

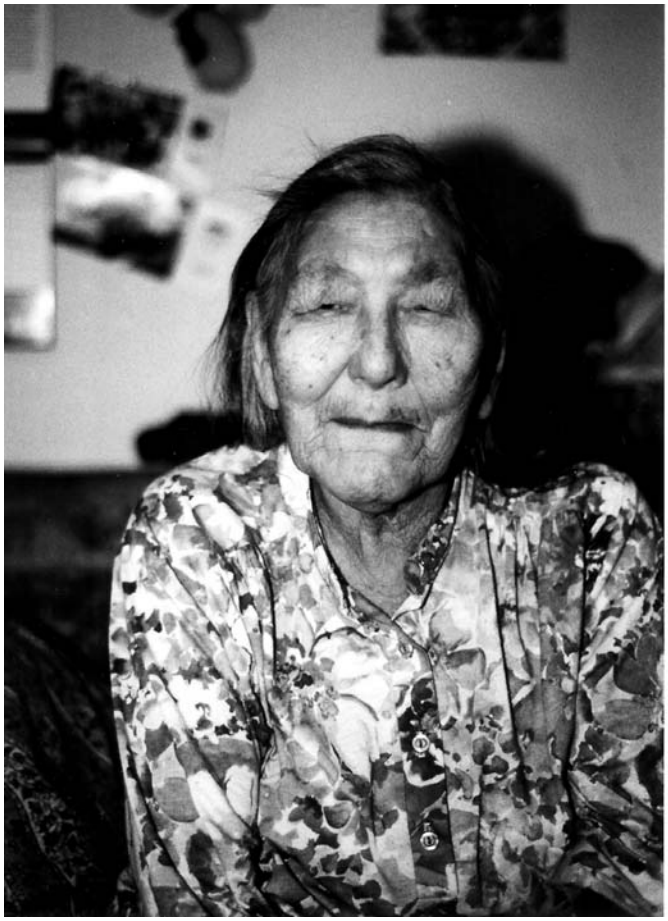


Plate 2. Koyukuk River elder Celia Beetus, interviewed at her home in Hughes, January 2002. Photo by Dave Andersen

Collection of Harvest Data

The primary harvest data collection method for this project was a door-to-door household survey. Based on retrospective recall, respondents were asked to provide specific information on the number and species of fish harvested during calendar year 2002. In addition to harvest numbers, information was also collected on the sharing and use of fish by each household and the timing

(month) of harvest activities. Basic demographic information was also obtained from each household to support analysis of the survey data.

The survey was conducted consistent with the ADF&G, Division of Subsistence policy on research ethics. With the aid of the tribal councils in each community, TCC identified local research assistants to administer the surveys. Survey households were provided a one-page project description which also included information about the voluntary and confidential nature of their participation. Agency contact numbers at both ADF&G and TCC were provided in case participants had further questions about the project following the survey.

Sampling Goals

A total of 253 households were identified in the six Koyukuk River communities participating in the survey. A complete census of all 253 households was attempted and the relatively small size of the communities facilitated very high rates of contact and survey completion. Table 2 shows the number of households contacted and surveyed in each community. Surveys were completed with 242 or 96% of all households in the six communities. Although the headwater community of Wiseman was included in the collection of TEK, current fishing regulations for the Dalton Highway corridor generally restrict fishing in the vicinity of Wiseman to methods and bag limits associated with sport fishing. For this reason, Wiseman was not included in this survey which was designed to quantify subsistence harvests.

Table 2. Community Sampling and Participation Rates

Community	Survey Design	Number of Households	Number of Surveyed Households	Percentage of Surveyed Households	Unable to Contact	Declined Survey	Community Population (US Census, 2000)
Koyukuk	census	43	42	97.67%	1	0	111
Huslia	census	88	86	97.73%	2	0	291
Hughes	census	26	23	88.46%	3	0	65
Allakaket	census	55	55	100%	0	0	102
Alatna	census	12	12	100%	0	0	21
Bettles/ Evansville	census	29	24	82.76%	5	0	54
All Communities		253	242	95.65%	11	0	644

Pre-fieldwork Training Session

A pre-fieldwork training session for local research assistants took place in February 2003 prior to the harvest survey work. The goals of the training session were as follows:

1. Summarize and discuss previous subsistence research in the survey communities;
2. Review project goals and procedures;
3. Train local research assistants in all survey procedures and practice conducting surveys; and
4. Discuss non-salmon fish population trends and other local observations and issues pertaining to fish.

Following the training session, research assistants were supplied with survey packets which included a training manual to guide the instruction of local research assistants in survey administration and other record keeping; a color identification guide showing photographs of the fish species; informational sheets to provide to each participating household; and survey forms.

Data Collection Phase

Harvest and use data for all communities were collected for the calendar year 2002, during face-to-face interviews between the local research assistants and at least one member of each participating household. Surveys were conducted during March and April 2003. By design, the survey occurred after the first phase of TEK work had been completed and prior to the second round of TEK interviews. This strategy allowed the survey component to benefit from and take advantage of information gathered from the initial TEK work and allowed the final round of TEK interviews to follow-up and build upon questions arising out of the survey data. ADF&G and TCC staff monitored local research assistants in the field to answer questions and provide additional information or clarification on the survey process as needed. Local research assistants were compensated at a rate of $20 per completed survey form.

The Division of Subsistence has found that subsistence data collected using household surveys have consistently resulted in harvest estimates that are more precise and typically higher than

those provided by other formalized means of harvest reporting such as permits or harvest tickets (Andersen and Alexander 1992). Previous research projects utilizing local research assistants have demonstrated that village residents are generally more comfortable discussing harvests with local interviewers, generating more accurate information and higher levels of participation. This survey represents a continuation of this proven methodology. The exceptionally high rates of participation and survey completion that were achieved speak to its continued success.

RESULTS OF THE TEK COMPONENT

Regional Overview of Koyukuk River Fishing Methods and Gear

Over its 700-mile length, the Koyukuk River changes in ways that affect both fish distribution and the methods used to harvest them. Fish distribution will be discussed in more detail under the specific account for each fish species. A general description of both traditional and contemporary fishing methods and gear types requires a basic understanding of the river conditions found throughout the drainage.

The lower Koyukuk River (see Fig. 1 on page 2 or Appendix C), from its confluence with the Yukon River to the Hogatza River above the village of Huslia, is relatively muddy and meandering, with a river bottom composed largely of mud and sand. In the middle Koyukuk, from the vicinity of the Hogatza River to Henshaw Creek just above the Alatna River mouth, the waters of the Koyukuk become somewhat clearer, less meandering, and the river bottom is composed mostly of gravel. Above Henshaw Creek, the Koyukuk River begins to drain more mountainous country and splits into the North, Middle, and South forks. As one ascends these forks into the headwaters region, the Koyukuk diminishes in size, transforming into relatively swift, rocky, and shallow streams. Except for deep pools, large sections of the headwater region freeze completely during the winter, and the river bottoms in these upper reaches are largely composed of ice-scoured rocks and boulders.

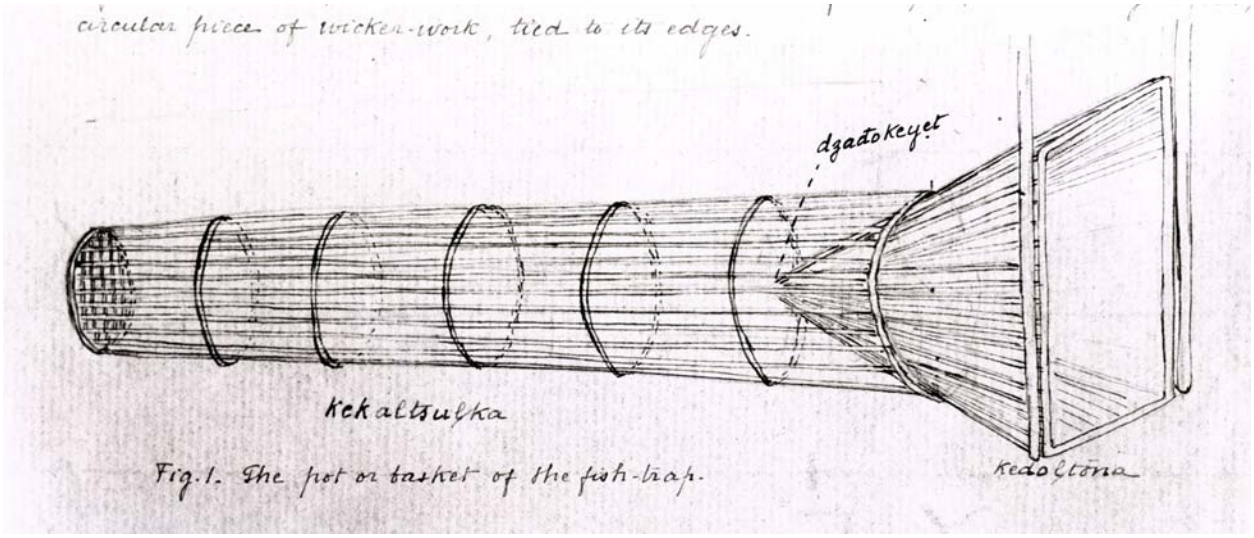
Within the Koyukuk River drainage non-salmon fish species have been and continue to be taken with a variety of nets, traps, and hook-and line gear types. Some gear and fishing methods are

relatively species-specific by virtue of placement or timing. Other gear types might be used to target one primary species with the recognition that other species will also be caught. The various river conditions described above, such as water clarity, water speed, depth, and composition of the river bottom make some gear types more practical in some areas than others. A few traditional gear types were described by respondents that are no longer in common use today. Each of these gear types will be discussed based on information provided by respondents.

The Use of Fish Traps

Respondents made frequent references to the use of fish traps. Three major trap types are described, all involving the use of wood or wire enclosures with funnel entrances. Large wooden basket traps were used in both main river locations and in fenced-off creeks to harvest a variety of fish species. The Koyukon term for these fishtraps is ***taal'one***, meaning "that which is placed in the water" (Jetté and Jones 2000). A smaller version of the basket trap is used in lakes and ponds specifically to harvest Alaska blackfish. In the upper Koyukuk River mainstem, a box-and-fence style of trap is utilized to harvest burbot, locally referred to as "loche" (pronounced "lush"). Each of these trap types is discussed in more detail below.

Large In-River Funnel Traps. Large, elongated funnel or basket traps of traditional design, 10 to 12 feet long and several feet in diameter, were used historically to harvest a variety of non-salmon fish (plate 3). These were generally made of split spruce, carefully selected for certain qualities such as straight grain, and their construction was a specialized skill. According to one respondent (see below) twentieth century versions of these traps sometimes incorporated a removable panel of canvas or burlap at the rear, which served as a door to empty the trap. On the Koyukuk River, traps of this type were most often used in relatively small tributary streams or creeks that could be easily "fenced off" to channel fish into the traps, and where the water depth was approximately equal to the diameter of the trap. Traps were placed at specific locations in late summer and fall from mid-August to freeze-up to target the fall out-migration (downstream movement) of whitefish. According to one respondent, fish would sometimes be "driven" into the traps by people walking towards the trap from far upstream and slapping the water with willow sticks.



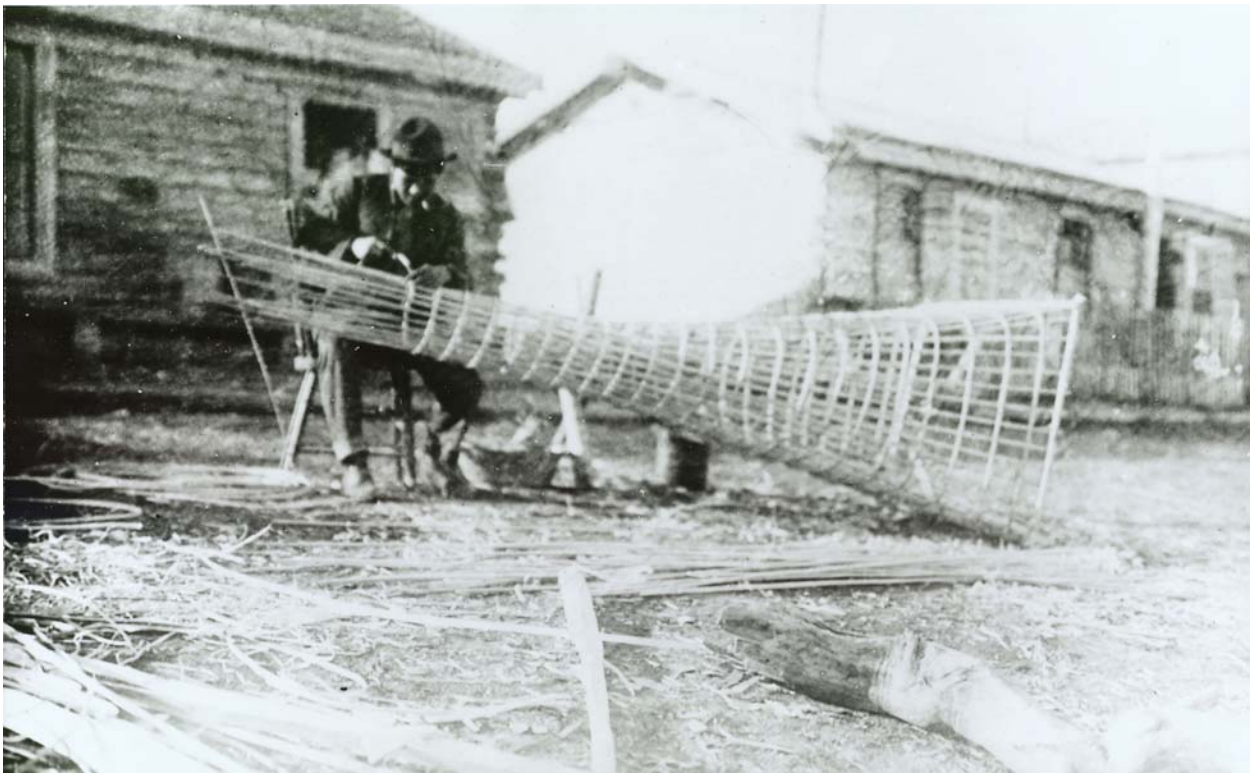


Plate 3. Traditional Koyukon fishtraps consisted of a tapered basket approximately 10 feet in length with a funnel-shaped entrance cone. An unidentified man constructs a fishtrap at Nulato in 1914. Drawing (archival image 502.6) and photo (archival image 510.10) by Jules Jetté and used with the permission of the Jesuit Oregon Province Archives, Gonzaga University.

Small whitefish or ciscoes, referred to in the Koyukon language as ***tsaabaaye,*** were often cited by respondents as the primary target species using this method, but a mixture of fish species including large whitefish, northern pike, arctic grayling, and longnose suckers were common and welcome additions to the catch in these traps as well. All fish species taken in these traps were retained, processed, and utilized as food for humans or dogs as needed.

While fish traps of this type were replaced by commercially manufactured nets beginning early in the twentieth century, many elderly respondents recalled the use of traps from their childhood and several respondents noted that they themselves had been involved in the use of fish traps into the 1940s. Details offered relative to trap construction, placement, storage, and use include the following excerpts:

> "Lake Creek…..that's where we use to put fish trap long time ago. My dad used to make 'em out of spruce tree—you get it [the trap] about maybe ten foot long—ten or twelve, and get about that big around [2 or 3 feet] and put funnel on the front—they go through this funnel and get inside. You could open it on the back—they make somethin' out of gunny sack and put it over on the back, and they take them back to the shore and open it back there, pick up the fish from in there. You get to where there is shallow water, like Lake Creek, and you get your posts down in there and put your fish trap right there. To check it you walk in the water way up there, hit water with willow, chase all the fish in there. Them old timers, they don't use gumboots, no gumboots that time. They use little shoes….maybe no shoes. They go in water, late September, cold, ice water….cold! They go in the water and walk down, …..about that deep water. They get down there, get all the fish and they walk back. Some make fire back there. They go back there and warm up….change their clothes and warm up. Tough guys!" [A080901, Allakaket]

The excerpt below offers interesting insight into the construction, setting of traps, and how they were stored from year to year at the fishing site:

> "About this month [August] they used to make a fish trap for all these fish coming down. Used to do it back in Lake Creek [up Kanuti River]. Catch all kind of fish….except no dog salmon though……whitefish, pike. You know, I was the last one to make that fish trap….nineteen…..nineteen forties maybe. There was no law you know. That's our life. When there is no fish on the [main] river, you know, that's where people used to go in summer time. Lotta times it was like that. They go back to this place. They make fish trap, you know, and a fence…poles standing like this. And that's how people make a livin'. Good fish too! Rich! Good eating! The fence went down, and then fish trap tunnel, you know, tunnel trap like that. We use spruce and tree roots to tie it. I work on that too, because half of it break and I copied how they did that. Last a long time as long as you hang it up under a tree. Big tall tree. Put it right next to it. Stand it up so snow wouldn't spoil it or anything. They tie them around to that tree, you know. I think they could last four or five years. More than that maybe. And they put something under so it wouldn't stay on the ground. It's [the trap] about ten feet long maybe, and this big around [two or three feet]. Not that heavy…..they got long pole under it. Sits on bottom of creek and

water just about at top. Not that wide creek too in summer time, you know. But when leaves started coming down it just plug up so it wash under. Lots of work when the leaves start coming down. Every evening we take turn and watch it, clean it out. Fall time…..they start around this month [August]. We get up there around first of August one time….too early….couldn't do nothing. They [the fish] never come out yet. Mostly we go after little whitefish….tsaabaaye…..but whatever goes in there, we dry it, and put smoke under….winter time we eat it. Boy it's good!" [F080901, Allakaket]

Basket traps were not always reserved for small, shallow streams. They were sometimes placed with large fences in major sloughs or even main-river locations. One respondent described her parents' use of an in-river basket trap to harvest pike and whitefish in Dulbi Slough, a sizable waterway off the Koyukuk mainstem near Huslia:

"The pike is always there, but the whitefish will be up there in the Dulbi Slough. About 12 miles up here is the end of it and ah…..well….ah, I'm not supposed to spill the beans and tell you everything…..(laughs) but Momma's gone, Daddy's gone, they wouldn't go to jail……(laughs). You know, they make fence all the way across this Dulbi Slough and they block it. But cripes sake they got about 10 or 12 kids….what they gonna eat? They got almost 20 dogs, what they gonna eat all winter? They put the trap in there, in the middle, and its ah….going like this [motions]….the fish supposed to come back down the slough by that time of the year….like September or something. It's going back downstream. It's going back downstream and it's all going to try to get out of the streams to get to the deep river I guess, I don't know. That fish trap will lay down this way….on the bottom, and it's blocked at the top too. And there is so much fish that it's all packed up behind the fence and it's going into big trap…about this long [ten feet] and maybe about two, three feet across. Something like that. You can't even lift it up. They tow it in and then they take the funnel out and they kind of dump it out on the beach and put it back in the boat." [X070503, Huslia]

Blackfish Traps. A smaller version of the ***taal'one,*** or funnel trap described above was utilized to harvest the tiny Alaska blackfish in lakes and ponds. These wooden traps, known as ***oonyeeyh taal'one*** (Jetté and Jones 2000) were described by respondents as being 3 to 5 feet long and approximately 18 inches in diameter with a funnel entrance at one end. Traditionally they were constructed of split spruce or tamarack. According to several respondents, trees used to make these traps had to be carefully selected for the proper straight grain. Tamarack trees were preferred for the small blackfish traps because they split easily into thin strips. A small ceremony or offering was sometimes associated with the cutting of a tree for this purpose:

"Blackfish traps can be made with spruce or tamarack. They say they used to make fish traps with tamarack long ago and the reason they use tamarack is because it separate like in slats, and then you split those up so you get nice even slats of wood. Cut it in fall and the story I heard is that with tamarack, before you cut it down you talk to the tree and say….I'm cutting you down for a reason….make good use of you…… and sometimes they

> make like a……tie a ribbon at the base or drop certain kind of beads on the ground around there—make an offering to the tree. And they say those kind split real easy. You gotta use the willow bark for tying it too, the old time way. What I saw as a child was, you know, flour use to come in flour sacks and they strip those, tear those flour sacks into strings and they use that." [W050503, Koyukuk]

These small traps could be constructed fairly quickly, as needed, and in just a few hours time, according to one respondent:

> "I come home and my Dad, late in the evening come back in with that long pack of wood. He get some kind of spruce tree out there. He split it all up in about my finger size and drop it by the stove. And probably in about one or two hours he's sitting down in there, cutting it. He make it to my finger wide, about all of them. Then he get two flat piece about that thick and he's making them round. Then he start from the smallest area. He tie stick all around……long stick. It's tapered like that. He get little short funnel about like that. Next morning when I wake up there was a fish trap lying on the floor standing up right there by the wall." [T061603, Allakaket]

Unlike the large in-river fish traps described previously, which were placed horizontally in flowing streams, blackfish traps were commonly fastened to a pole and set vertically in the lake or pond with the funnel entrance facing upward and about six inches below the surface of the lake. One respondent reported that a crude but functional version of a blackfish trap could be made from a gunnysack hung in the water just below the surface with sticks placed to keep the top open. In addition to the vertical placement described above, blackfish traps can also be set horizontally in grassy shallow margins of lakes or the narrow waterway between two lakes. Small fences made of twigs and grasses are sometimes used to direct fish into the trap opening. This horizontal placement was apparently used in late fall and early winter before blackfish became concentrated at breathing holes. Modern versions of the blackfish trap are typically made from wire screen or hardware cloth. Because the blackfish trap is quite species-specific, additional information on the use of these traps is included in the species summary for Alaska blackfish (pages 36-45).

Burbot Traps. A third type of fish trap, still in common use the Koyukuk River communities of Hughes, Alatna, and Allakaket, is the ***k'eleyh taal'one*** (Jetté and Jones 2000), a box-and-fence type trap used to catch burbot. The method generally involves the construction of an in-river box, pen, or enclosure fitted with a funnel entrance facing downstream. The funnel-shaped entrance cone is constructed of split spruce or willow sticks similar in design to the funnel entrances

utilized in basket traps and blackfish traps, but sized for burbot; approximately two feet in diameter at the large end and tapering to five or six inches in diameter at the small end, and about three feet long. Selecting the proper location for the trap was largely determined by specific river bottom conditions and was scouted out long before freeze-up:

> "My parents, my Dad, really used to know how to set a trap for loche. Summer time, before freeze up, he go up and down the river around here looking at the bottom where you could see it….clear water. We see him, he'd be lookin' down at the gravel on the bottom. Then he pick out where it gonna be. Because different places there is a bunch of big rocks, you know, other places just small gravel…smooth gravel, so he pick out that area. How big the gravel is. If he push it [the trap] down between big rocks, the big rocks will keep it open for fish to go through. So he have to find the areas that is smooth……..And ah, it have to be after the ice settle you know. It probably freeze up here….then water dropping, dropping, finally it settle about where it gonna be all winter. That's when they make the water hole and set the fish trap so it won't shift, you know. They did that all the time since I can remember." [T061603, Allakaket]

Plate 4. Koyukuk elder Andrew Edwin (left) explains the setting of a wire-mesh blackfish trap to researcher Dave Andersen. Photo by Caroline Brown

Other respondents noted that large numbers of burbot moving upstream and swimming near the gravel riverbed, would actually scrape algae off the gravel bottom and create a visible "fish trail" that could be used to help identify a likely trap location.

> "…….and pretty soon this old man look down and boy!.....you talk about smile on him, he said. He found what he was lookin' for. About four feet of water and down there is all gravel bottom, clear water, and down there he found a fish trail where fish [burbot] go. Fish don't go everywhere you know, just certain place they go. He found regular trail down there. You know them rock in the river up there is kind of moist, you know, kind of coated with moss. But the rocks there was just clean…that's what he was lookin' for. Fish trail! He start hollerin' Fish Trail! Chief Henry thought he was crazy. But he say little trap right there feed both sides of the river all winter. Just have to be the right place." [G103101, Huslia]

Strategically placed fences or leads help direct fish toward the trap entrance. Burbot traps are built following freeze-up by cutting through the ice and allowing the trap components to freeze in place. Trap enclosures were traditionally constructed by driving split spruce or cottonwood poles into the river bottom and fences or leads were constructed using willow poles and sticks. The upriver and downriver ends of the trap need to allow some current to continue flowing through the trap box in order to entice fish to enter. Modern versions of this trap typically utilize dimensional lumber, plywood, and wire mesh to construct key components. A Hughes resident who was primarily responsible for building and maintaining the community burbot trap used in the winter of 2001-2002 described the dimensions and construction details of that trap.

> "I work on that trap again yesterday. The ice settle, so the box open up in spots. Four by eight foot box with plywood sides. The ends is one-by strips….one by two, so the current will go through it. And facing downriver is that funnel….split spruce….small end could be about five inch 'round, big end anywhere from eighteen to twenty-four inches high. About three and one half foot long. And from the beach there is a fence. Build it in November. Good run, good season, used to average a hundred loche a night." [L013002, Hughes]

Another Hughes elder talked about the relative ease of making a burbot trap today compared to the old days:

> "Fall, after ice, November month, and after ice settle down, they make fish trap for this one [burbot]. That's what we do. We use screen nowadays—chicken wire—so you don't have to use willows. People used to make willow fence and chop ice with axe……lots of work! Right now they use chain saws and cut ice. Easy! Everything easy nowadays." [K013002 Hughes]

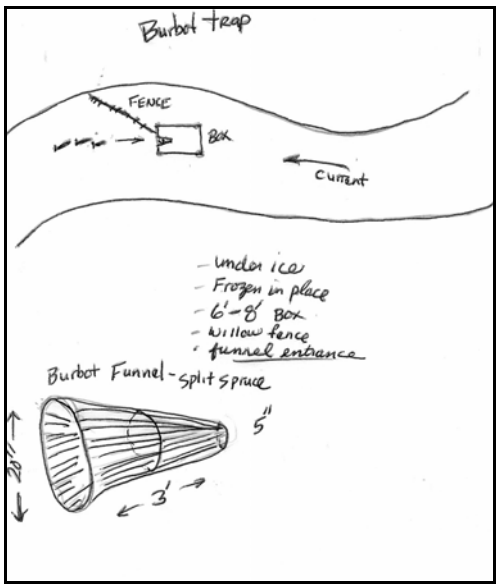


Plate 5. Sketch of an under-ice burbot trap (above) and entrance funnel detail (below). From interview notes with Steven Attla of Huslia and Henry Beatus of Hughes.

In the past, several burbot traps might be built in the vicinity of a single village in order to meet the needs of several extended families. One respondent remembered a time when there were as many as five burbot traps in the Allakaket area alone:

> "There used to be one [burbot trap] down around Four-Mile, one straight across this gravel bar, one about the middle of this gravel bar…that's the old airport……one at mouth of Alatna, one up a little ways in the Koyukuk (mouth of Henshaw Creek)…..that many fish trap when I was small. People own them, the people that build the fish trap, they own it….that's the way it was." [T061603, Allakaket]

Today, it is more common for one burbot trap to be built and operated in each village as community property, providing food for anyone in that community in need of fish. Burbot traps can produce hundreds of fish per night during the peak of the run, and harvests of burbot are widely shared within communities and make their way up and down the Koyukuk River through sharing and trade networks. Burbot traps are relatively species-specific and additional information on the construction and use of burbot traps is included under the species summary for burbot (pages 52-63).

The Use of Nets

Two types of fish nets--gillnets and seine nets--are typically used to catch non-salmon fish species in the Koyukuk River drainage today. While commercially manufactured nets with cork- and lead-lines are universally utilized today, both net types had traditional counterparts that will be discussed in this report. Several respondents also recalled that, well into the twentieth century, traditional dipnets were sometimes used to harvest certain fish at certain times of the year. Use of dipnets apparently faded with the availability of relatively inexpensive and effective commercially manufactured gillnets. The past and present use of nets is briefly discussed below based on information provided by respondents.

Gillnets. Gillnets approximately 50 to 100 feet in length, and of various mesh sizes, are perhaps the most common method used to take a wide variety of fish species. Gillnets are used in main river eddies, sloughs, and lakes and can be used in open water conditions as well as under the

Plate 6. A fisherman pulls pike from his gillnet set in an ice-free channel of the Koyukuk River. Photo by Dave Andersen.

ice. For under-ice fishing, the net is suspended between holes in the ice and the cork-line is sometimes removed to keep the top of the net from freezing to bottom of the ice. The species of

fish targeted with gillnets can be controlled to some extent by where and when the net is set, and by selecting a certain mesh size, but by-catch of non-target species is common and expected. The non-salmon species typically taken in gillnets include northern pike, sheefish, a variety of small and large whitefish, and longnose suckers. Gillnets are a passive gear that can be set and left to fish while people attend to other tasks. Nets are often set and allowed to fish overnight before being checked.

Gillnet technology has undergone steady change over the last century. Prior to western contact interior Alaska Athabascans crafted traditional gillnets or ***taabeeł*** (Jetté and Jones 2000) out of willow bark. According to one respondent who was taught as a young girl to make willow bark nets by her grandmother, the fibrous inner bark of the willow was stripped to form strands using a bone tool and then twisted by hand into a twine or bast that could be used to make nets or braided into rope.

> "With them willow net it can't be any kind of willow. It got to be bar willow, about this big [thumb size] around. They used to cut it in winter long ago…bring them in house and start spinning their willow bark. You don't use the outer bark, you use the white one inside. It come in strands. In springtime, we start a little too early and the bark was stuck to the willow. It's better to wait a little longer and toward fall I think they get like, woody, a little, and it doesn't stay too good. Grandma used to have little bone [tool] that she put like that and pry the inner bark out and she make the bark just the right width she want. She split the bark. I watch her do it and she tell story…….she didn't make net that time, she make rope…..they have commercial net, commercial rope, but the rope was not long enough when they seine so she just…..I was real small, maybe five years old, we stop on this bar, she get whole bunch of willows and she pack it up the bank to our camp and she start peeling them and I was watching her and she braid rope out of it to make our rope longer. The rope you gotta braid. The twine you got to spin. You hold it like this [finger tips] and spin it like this [using both palms]. For sinker they use bone, caribou leg joint, sheep horn, caribou antler, maybe moose antler, whale rib bone…..like leftover scrap from sled runner. For floaters they use that spruce root that is just like cork and don't retain water." [U061703, Alatna]

The above account is interesting because it documents that the traditional use of willow bast overlapped with the availability of commercially manufactured counterparts. In this case, traditional methods and materials were used to lengthen the rope of a store-bought net in order to make it more usable.

Willow bast nets were relatively fragile, had to be carefully fished to avoid damage, and had to be kept wet to remain pliable. The introduction of cotton twine following contact allowed a new

and more durable material to be utilized for nets of traditional design. Prior to the wide availability of net twine, threads were salvaged from cotton flour sacks and burlap gunnysacks and used to make nets and support ropes. A first-hand account of making homemade gillnets prior to about 1920 is offered by Kitty David of Alatna in the biography of Oscar Nictune Sr.:

> "Lots I learned from Elma after mother died. From Grandma, too. That time she used to let us rip flour sack to make thread. She spin it. One strand at a time and she always tell me how many to put for certain kind of fishnet. She just make whole ball of twine so we help her knit it. It was east to knit too. It won't slip. That's how we catch fish, we make our own fish twine. And you know those gunnysacks. We help her pull thread and make rope. She had strong grip and we help her make rope with that for fishnet. Then after that we have to get all kinds of worn out jeans together. We make sinkers by putting rocks inside of that and help her sew. And they make floaters, any kind out of cottonwood bark that's thick. That's how we get training. But we never try those willow bark nets. Grandmother tell us it never tangle. I use to play with it but never try to make one. It got to stay damp all the time too. They say if you let it dry it might uncurl and come apart." (Nictune, 1980: 58)

In addition to the use of gillnets in open water conditions, they are sometimes fished under the ice as well. The process of fishing under lake ice with a gillnet was described by Huslia elder Edwin Simon in his biography (Simon 1981:55-56):

> "We make holes in the ice about five feet apart as long as the net. Then we tie a rope on a stick and push it through from one hole to the other until we have that rope stretched all the way under the ice. We tie the net on the rope and pull it right along until it is hanging under the ice. When we look at the net we pull it out and it drags the rope back in. To reset it we just pull the rope back out at it will pull the net in. We hold each end in place by tying it to a long pole about twenty-five feet long and sticking the pole in the mud. We have to keep the net about two feet under the ice so the floaters wouldn't freeze to the ice. If that happens we have to cut up the net or lose it. Rich fish we got. Awful rich. Lake fish is awful rich. But right now the lake is going dry in there. Cotton trees growing on the edge where there used to be water. Lakes is going dry around here."

Home-manufactured gillnets were slowly replaced in the mid-twentieth century by commercially manufactured cotton twine nets fitted with cork floats and lead weights. These were followed by the contemporary gillnets made of more durable nylon twine, and fitted with plastic floats and lead-lines. In her biography, Koyukuk elder Madeline Solomon (born 1905) offered additional recollections on the home manufacture of nets and on the pros and cons of modern pre-hung gillnets:

> "While the mens work on those fish wheels at camp, woman would work at fishnets. Fifty years ago everybody used to make their own things. Their own fishnets. There was no nylon in those days, just cotton. Six or seven ply they call it. It takes two balls of that to make king salmon net. And if there's nothing else we used to buy one yard of those

heavy canvas. We would undo that and then make fish nets out of it. One yard of that canvas could make about fifteen fathoms of fishnet. It didn't last long but we had to use anything that we could get. Homemade floats would be from them dry stumps of spruce. Just carve it, make a hole and tie it on the fishnet. Then every time drift goes on top of it. It doesn't bother the fishnet at all. Nowadays, those nylon nets we order have too many floater. It's too close. We have to cut out every other one. All those floaters keep the whole fishnet up and when the driftwood is coming in it gather all of that. Some people still make their own nylon fishnets. But most everybody is getting the same things. They get fishnets read-hung. Then they don't have to bother with sewing materials to put rocks in for the sinker. Don't have to carve floats. It's just ready to fish with. This nylons, they last longer. Five, six years if we take care of it and mend it whenever there's a hole in there. Those cotton ones don't last. One season that's all." (Solomon, 1981:75-76)

Seine Nets. Another type of fishnet used on the Koyukuk River is the seine net or beach seine. The use of seine nets is generally confined to the upper Koyukuk and Alatna rivers, where river conditions and seasonal concentrations of fish are conducive to their use. Seine nets in use today are typically 150 to 300 feet in length and approximately 10 feet deep. The mesh size of seine nets is approximately one inch or one and one-quarter inch square—small enough to catch and retain all but the smallest fish. This netting method is primarily used to target concentrations of least ciscoes, humpback whitefish and sheefish during the fall. Because of the small mesh size used, other non-target fish species such as longnose suckers, northern pike, and arctic grayling are also commonly taken during seining operations. As with gillnets, seine nets were traditionally made from willow bark. Traditional nets were somewhat smaller in size than contemporary nets, due to the time and effort required to make them, but still reached lengths of 150 feet or more. According to one respondent, the manufacture of a willow bast seining net was a task undertaken by several women working together all summer long and sometimes incorporated recycled portions of nets made the previous year:

"My grandmother say three women will make one seining net. They're going to be partners for the summer. So each woman has to make twelve stretch measures……from finger tip to finger tip, twelve times that much. Each woman. These three women put their twelve times together, and they want it a little longer then they put last year's one on the ends. Every year they make new. Five feet deep or so. The mesh is about one and a fourth inch square. They make new center section every year and used that last years portion for the ends." [U061703, Alatna]

Plate 7. A seine net is retrieved on an Alatna River gravel bar, October 2003. Photo by Dave Andersen.

Unlike gillnets, which can be set and left unattended for a time, seining is an activity, requiring a team of fishers actively working together to deploy and retrieve the seine net. This is reflected in the Koyukon term for the seine net, ***telkeyhdle,*** which translates literally to "that which is put in a direction repeatedly" (Jetté and Jones 2000). The process of seining was described by several respondents as follows:

> "We need three people to one seining net. It could be more if there's whole bunch of us, but three people to do the seining. One hold the line back in the shore because…..this would be the river bend [sketching]…..when we're seining we have to drop off one guy here with the rope. And there is the current and this place is dead water here behind the bar. We go out to the current with the seining net and we throw the net in the water right here…..200 feet long….and we land with long rope again. Tie the boat here and we start pulling both line. Pull them back to the shore and the net is just way out like this….and when there is lots of fish in there, way out from shore you can hear knocking sound….and seining net get tight. They all hit the net at one time you know. We seine in daytime when the fish are resting. They travel at night." [T061603, Allakaket]

> "Then, fall time you can seine on the bar. You can get three or four boatloads if you hit it the right time. Enough for all winter for dogs. Couple people walking on the bar with the ropes and the boat floats down, floating down, floating down, and then you start heading to shore. Three people can do it if you are short of people. We use maybe three hundred foot net. Favorite place is on the bars where there is no snag. Seine net catch everything that there is in the river….we use it!.....have to! You use quite a bit of fish when you have dogs." [K013002, Hughes]

The use of seine nets is largely restricted to the upper Koyukuk and Alatna rivers, where gravel river bottom conditions exist. Seine nets are fished in a way that makes them particularly susceptible to being caught and damaged on snags. Snags are reportedly much more common in the Koyukuk River from about the Hogatza River downward, and seine nets are therefore much less practical for fishers in the lower portions of the drainage. Furthermore, the upper Koyukuk and Alatna Rivers have fall concentrations of spawning whitefish and sheefish that are not found in the lower reaches of the river, and are the primary target species of most seining operations. Where seining is practiced, it can be a very efficient way to harvest large quantities of fish for family and community use, and it remains one of the primary subsistence activities for residents of Hughes, Alatna, and Allakaket. Some additional information on the use of seine nets is contained in the species summaries for sheefish and whitefish.

Dipnets. Dipnets are not commonly used by Koyukuk River residents to catch fish today. According to respondents, a traditional dipnet, or ***'etl***, was manufactured and used in parts of the Koyukuk and Yukon River drainage to harvest certain fish at certain times of the year. As plate 7 illustrates, the ***'etl*** consisted of a spruce-pole handle eight to ten feet in length and a terminal hoop three or four feet in diameter made of bent willow. Willow bark netting with one-inch

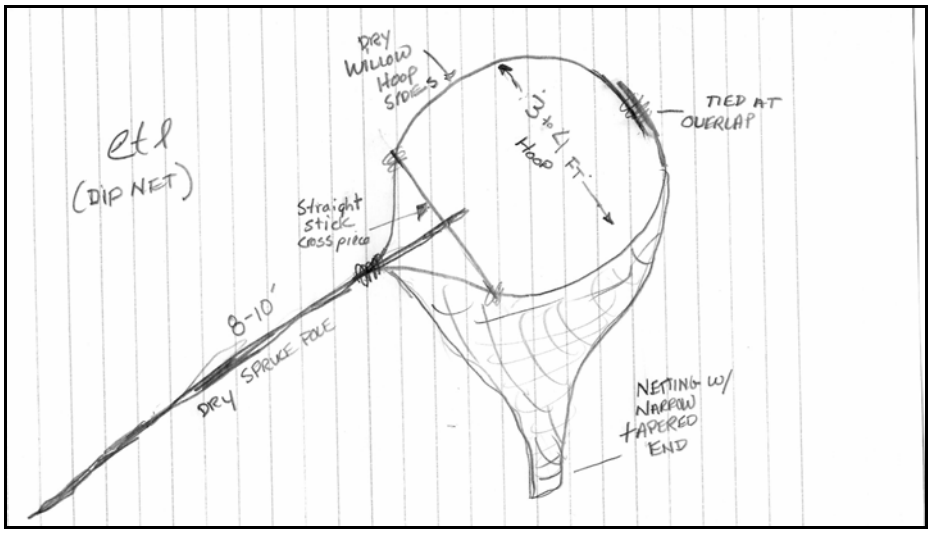


Plate 8. Sketch of a traditional Koyukon dipnet or *'etl.* From interview notes with Benedict and Eliza Jones of Koyukuk.

mesh was attached in a distinctive cone shape to the willow hoop. The tapered cone-shaped netting was designed to more easily entrap the fish. Dipnets were reportedly used to take whitefish, sheefish and pike moving up-river in the spring. Ideal dipnetting locations were places where fish might be concentrated in deep ice-free side channels off the main river and where murky water conditions made the nets difficult for the fish to see. Fish moving up-stream and swimming close to the surface would make "fish waves" that could be spotted allowing the fisherman to net the fish. At popular dipnetting locations, dipnets would be stored by hanging them in nearby trees for common use by anyone who wanted to fish. One Koyukuk elder recalled using dipnets as a young man to fish for spring whitefish during a stay in the Tanana area:

> "Springtime they got three or four dip nets hanging there (Long Lake/Hay Slough vicinity near Tanana) all the time, all along the bank where the bank cave in. Yukon River is over here, Tanana is over here and its about a mile from the point. Old River bank, it's about half mile up. And the whitefish that goes on the Yukon River…it moves….. when the ice start breaking up it moves over—goes up in that creek….goes up in that slough. That slough is wide and deep and always open up early." [Q050603, Koyukuk]

Use of the dipnet apparently continued into the first half of the twentieth century, but faded with the availability of commercially manufactured and less labor intensive gillnets.

The Use of Hook and Line

Several types of hook and line gear are used to take non-salmon fish species. Some fishermen use conventional rod-and-reel gear and artificial lures to take northern pike, sheefish, and arctic grayling during the open water period at specific locations. These same species are also occasionally taken during the ice-covered period by fishing through holes in the ice. Winter fishing, often referred to as "hooking," commonly utilizes homemade or commercially manufactured lures or baited hooks on relatively short lines which are "jigged" by fishers using short poles or sticks.

A third hook and line technique, used primarily during the winter months to catch burbot, is the "set hook" whereby baited hooks on a line are dropped through holes in the ice and allowed to fish unattended for a time, often overnight. These "sets" can consist of a single baited hook, or a

line of multiple baited hooks strung under the ice between holes in the same way nets are fished under the ice. Because this fishing method is almost exclusively used to target burbot, additional detail on the use of set hooks is offered under the species summary for burbot (pages 52-63).

Native Names and Taxonomy of Non-Salmon Fish

Prior to the discussion of each fish species, it is useful to review some of the Native language terminology pertaining to fish in this region. Respondents were asked to provide the Native names of the various non-salmon fish species in their area. While Koyukon Athabascan is the predominant Native language for the Koyukuk drainage as a whole, in the vicinity of Alatna, Inupiaq is the Native language spoken by individuals whose families emigrated to the region from the Kobuk River drainage. Both the Koyukon and Inupiaq language names for fish were collected and confirmed during interviews. Table 3 compares the English, Linnaean taxonomic terms, and Native language names for commonly harvested non-salmon fish species in the Koyukuk River region.

Plate 9. Language expert Eliza Jones plucks a goose while discussing Koyukon Athabascan terminology for fish with researcher Caroline Brown. Photo by Dave Andersen.

This report section is not intended to provide a comprehensive linguistic discussion of fish terminology for either Koyukon or Inupiaq languages. In both languages, there is a rich collection of terms pertaining to fish, fish products, fish anatomy, fishing activities, and fishing gear that is barely hinted at here. Because only three of the 29 respondents spoke Inupiaq, the linguistic detail obtained for Inupiaq terms is much less than that offered by the 25 Koyukon speakers. The intent is simply to present those terms offered by respondents in the course of discussions, in a way that is orthographically accurate and provides some basic insight into local terminology and taxonomy of fish. In reviewing the information provided on tape by the respondents, consultations were made with an Inupiaq language specialist at the UAF Alaska Native Language Center, acknowledged Koyukon language expert Eliza Jones, and the published Koyukon Athabascan Dictionary (Jetté and Jones 2000).

Among the Koyukon terms provided by respondents, dialectical differences result in slightly varied terms for some fish, i.e., ***ledlaaghe*** or ***nedlaaghe*** are both terms for sheefish. In other cases the regional terms go beyond dialectic differences and constitute separate and distinct regional names, i.e., ***tl'eghes*** refers to burbot in the lower Koyukuk River, and ***ts'oneye*** refers to burbot in the upper Koyukuk.

In some cases, the Native language terms indicated a more complex taxonomy for fish than is recognized under the English or Linnaean taxonomic systems. For example, respondents offered three Koyukon terms for the Alaska blackfish; one general term applicable to all blackfish—***oonyheey***-- and two terms that pertain to blackfish of a particular size, condition, or time of year. The term ***toonoone*** is used to refer to those blackfish in late winter that become bloated and filled with water, and ***k'edzeeł baanh*** is the term used for the largest blackfish that reach eight to ten inches in size. Nelson (1983) reported two additional Koyukon terms for blackfish: one that distinguished a brown variety (***dzonhyee***) and another that referred to a slender, flat version of this fish (***degheets'eele***). These five terms, and there may be others, point to a very rich Native taxonomy for a fish that Western science knows by a single name. Similarly, three terms are used to refer to northern pike; ***k'oolkkoye*** which refers generally to all fish of that species, ***notet'aale,***

Table 3. Native language terms for various non-salmon fish species in the Koyukuk River drainage

ENGLISH NAME	LINNAEAN NAME	KOYUKON NAMES	INUPIAQ NAME (Alatna)
Alaska Blackfish	*Dallia pectoralis*	**oonyeeyh**[1]	**iluuqiñiq**
small blackfish filled with water		**toonoone**	
large blackfish		**k'edzeeł baanh**	
brown colored blackfish		**dzonhyee**	
flat, slender blackfish		**degheets'eele**	
Arctic Grayling	*Thymallus arcticus*	**tleghelbaaye**	**sulukpaugaq**
Burbot	*Lota lota*	**tl'eghes, k'eleyh, or ts'oneye**	**tittaaliq**
Longnose Sucker	*Catostomus catostomus*	**toonts'ode**[2]	**kaviqsuaq**
Northern Pike (General term)	*Esox lucius*	**k'oolkkoye**	**siulik**
Early spring-caught pike		**notet' aale**[3]	
Very large (slow) pike		**taah dletonee**	
Sheefish	*Stenodus leucichthys*	**ledlaaghe** or **nedlaaghe**	**sii**
Whitefish		**ts'oł**	
Broad Whitefish	*Coregonus nasus*	**taaseze** or **telaaghe / telaaye**[4]	**qausriḷuk**
Humpback Whitefish	*Coregonus pidschian*	**holehge** or **telaaghe / telaaye**[4]	**qaalġiq**
Bering Cisco	*Coregonus laurettae*	**tsaabaaye** or **delbege**[5]	**qauttaq**[13]
Least Cisco	*Coregonus sardinella*	**tsaabaaye** or **delbege**[5]	**saavaayiq**
Round Whitefish	*Prosopium cylindraceum*	**hułten'** [6]	**quptik**
Miscellaneous Species			
Arctic Lamprey	*Lampetra japonica*	**dots'e tl'egheze** [7]or **dots'e tl'ooł**[8]	
Lake Trout	*Salvelinus namaycush*	**tl'uh laaghe**	**qalukpik**
Slimy Sculpin	*Cottus cognatus*	**netsoo tlee'** [9]	
Other Terms			
General term for "fish"		**łookk'e**[10]	
Any small or juvenile fish		**k'etlehone**[11]	
Any fish in fry (eye) stage		**k'enohlusge**[12]	

1. Name translates to "subsistence fish" or "the ones that you survive on."
2. Name translates to "something bad went in to the water," a reference to the traditional stories surrounding this fish.
3. Name refers to their spring movement or migration: "coming out of the creeks."
4. ***telaaye*** refers to both species of large whitefish when they are moving up-stream in the spring.
5. ***delbege*** is a Yukon River (lower Koyukon) term for both cisco species, sometimes used on the upper Koyukuk to refer to any small fish.
6. Name translates to "sleigh handle," a reference to their round shape.
7. Name translates to "down-river loche."
8. Name translates to "down-river rope."
9. Name translates to "your grandmother's head."
10. Sometimes also used as a general term for all whitefish.
11. Name refers to their habit of eating scraps (fish scraps) thrown into the water
12. Name refers to their prominent eye.
13. This unknown term was provided by only one respondent. Bering cisco are uncommon in the Inupiaq speaking region of the Koyukuk.

which refers to pike that are the first to move up the rivers in the spring time, and ***taah dletonee,*** which refers to very large, slow-moving pike found in some area lakes.

The Koyukon term used by respondents to refer to both cisco species (***tsaabaaye***) illustrates a case where the English or Linnaean taxonomic system may be more specific than the Koyukon language system. It should be noted, however, that there was some confusion among respondents when shown pictures of these two very similar-looking fish. Most ciscoes found in the Koyukuk River apparently are least cisco, and the distribution and abundance of Bering cisco in the drainage is currently unconfirmed and under investigation by biologists. The use of the term ***tsaabaaye*** to refer to both species of cisco may be because they look similar, are mingled together, and are therefore harvested and processed similarly. Alternatively, it could be that Bering cisco are uncommon or even absent in much of the Koyukuk drainage and the term is one that, in fact, pertains only to the more common least cisco. A recent TEK study of whitefish in the upper Yukon region (Andersen and Fleener 2001) found very distinct Gwich'in language terms for the two cisco species there, which suggests that if both species of cisco were present in the Koyukuk, there would be specific local terms for each species. Additional biological and TEK work is needed to clarify this issue in the Koyukuk region.

One or two respondents were able to contribute insight into the meanings or translations of some of the Koyukon names for fish. These appear in footnotes to Table 2 and provide examples of naming systems that are both descriptive and practical in nature, (i.e., ***notet'aale,*** meaning "coming out of the creeks"), and those with a certain poetry not commonly incorporated into Western systems of naming, such as ***toonts'ode***, meaning "something bad went into the water" or ***netsoo tlee'***, which translates to "your grandmother's head." Additional information with regard to fish-related names and terminology is offered under the individual species summaries below.

Species Summaries

This section summarizes the information provided by respondents on each species of fish discussed in the interviews and has been subdivided into two general categories. The sections on "Distribution, Seasonal Movement, and Spawning" are intended to highlight those pieces of

information that might be broadly categorized as biological in nature. Topics such as distribution within the drainage, preferred habitats, population status, fish behavior, feeding, and spawning are summarized under this heading. Sections on "Harvest and Use" focus more on the subsistence aspect of each fish and offer descriptions of past and present fishing methods, gear-types, and how fish are used, preserved, and prepared.

A section containing "Miscellaneous Information" has also been included for some species and summarizes any additional information offered by respondents that could not be categorized as biological or subsistence-related. Traditional stories, myths, beliefs, and spiritual aspects pertaining to a specific fish have been included in this portion of the species summary.

Alaska Blackfish (*Oonyeeyh*)

> "Mostly people survive with blackfish—They say a lot of people live with that one. They say there is more vitamins in it than any fish. I don't know what it eat in that lake but they must eat really good one. There wasn't that kind there would be no people—that's what they survive on—really important! [J110101, Huslia]

The tiny Alaska blackfish may seem an unlikely candidate for playing such a critical role in the survival of the Koyukon people, but as the above comment illustrates, this small fish was described by numerous respondents as an extremely important food resource historically. The importance of this particular fish had to do with its high nutritional value and the fact that it could be harvested in large quantities at what was traditionally a very lean time of year—late winter. The Inupiaq term for the blackfish was reported by Alatna residents as "***iłuuqiñiq.***" The Koyukon name for this fish is "***oonyeeyh***" which roughly translates to "subsistence fish" or "the ones you survive on." As shown in Table 2 above, at least four additional Koyukon terms are used to distinguish blackfish with certain characteristics. While they are harvested in smaller amounts today than they once were, the role that blackfish played in the feeding of people and dogs in the not too distant past has not been forgotten. Information surrounding the behavior, harvest, and use of this odd fish is summarized below.

Distribution, Seasonal Movements and Spawning. Most non-salmon fish species present in the Koyukuk River drainage are widely distributed across other parts of the Yukon drainage and the Interior. This is not the case with the Alaska blackfish. Along the Koyukuk there is a local perception that blackfish are not found east of the Koyukuk River drainage. As one respondent put it:

> "They don't have these [blackfish] farther up the Yukon. The story is that certain animal choose to go up Yukon or Koyukuk and this one chose the Koyukuk." [WW050503, Koyukuk]

This perception is supported by the fact that subsistence baseline studies done in the central and eastern interior generally do not report harvests of blackfish. However, one respondent who had lived for several years along the Kantishna River, a tributary of the Tanana, reported that blackfish were present in some Kantishna area lakes. The eastern limit of blackfish distribution into the Interior is not clearly defined but these fish appear to be more common south and west of the Koyukuk region.

The Alaska blackfish is apparently thinly distributed in lakes throughout the lower and middle Koyukuk River drainage. According to respondents, blackfish commonly seen in the Koyukuk region range in length from about two to eight inches. They were described as a "flats fish" inhabiting certain large grassy lakes in the lowland portions of the Koyukuk and Alatna River drainages. Several respondents stressed that blackfish are always found in lakes, never in rivers, except for the small connecting stream between two lakes. They also stressed that only certain lakes have blackfish in them. The exact characteristics that make a lake suitable for blackfish were not clear. The presence of weeds or grass was often mentioned. Others noted that blackfish lakes tended to be deep so they would not freeze, and that these lakes are typically land-locked, with no direct connection to major rivers. Because blackfish are only found in lakes, they are sometimes simply referred to as "lake fish." They are also sometimes referred to as "devil fish" for the dangerous thin-ice conditions they can create, as described below.

In those lakes where blackfish occur, respondents said that they tend to be present in relatively large numbers. During the open water period of summer and fall, blackfish are said to be relatively evenly distributed throughout their resident lake. With the onset of winter, as these

water bodies begin to freeze, blackfish reportedly concentrate in large schools and swim in a "churning" motion near the surface in order to maintain open areas or "breathing holes" in the ice. This winter schooling behavior of blackfish is sometimes focused around existing ice-holes such those associated with muskrat pushups or beaver houses. One respondent said that the swimming motion of blackfish schools is always in a clockwise direction. Others described a vertical cycling pattern whereby fish swim rapidly to the surface to "gulp air" and then swim downward. Several noted that as blackfish swam to the surface to "breathe" they ate-away at the ice with an audible sucking or snapping sound.

> "Oh yeah, geez! I live off of it [blackfish]. Oh yeah, you bet, our family up there at Hog River Johnny Lake….big lake there. We'd move up there around March. That's when the blackfish…….if there's any in the lake they all come together, see, and they make a big hole in there. They eat the ice some way. I guess they have to get air, because they keep comin' up and go back down. See, get fill up with air and come up…then they go back down. ……..they come up for air see…….they make a snapping sound when they come up for air and then they go back down. Some looks pretty big you know [swollen]…….but I guess it's all air in there." [H110101, Huslia]

> "Those fish come up for air and they suck on the ice and keep it open. " [GG103101, Huslia]

> "They [blackfish] are landlocked in the lake…..certain lake where there is weeds for them. I look for them certain place where it is open. They have to have oxygen so they just swarm…..clockwise….go round and round clockwise, then they'll cut through the ice and keep swarming around there to have the air. " [W050503, Koyukuk]

Many respondents made a connection between this mid-winter behavior of blackfish and a need for the fish to "breathe," possibly because the lakes they inhabit become increasingly oxygen-deprived as winter goes on. As winter progresses it is reportedly common for some small blackfish to exhibit a condition where they become bloated with water. These blackfish are referred to in the Koyukon language by the special name, "***toonoone,***" a term which makes reference to being "filled with water." One respondent thought this bloated condition signaled a late-winter die-off of fish.

> "[blackfish] when they start filling up with water that's when they start dying off….. they gonna start dying off. I don't know why, just get filled up with water….late, maybe late March or April, they fill up with water. But they're still good, we use 'em for dog food." [I110101, Huslia]

> "The ones that get all puffed up with water is called toonoone. If you bust it, its all water. We don't know how they get like that, not all of them are that way. Pretty much when they start comin' up for air it look like…….they just drink water. " [GG103101, Huslia]

> "Grandma used to tell me……..deep lakes, they're [blackfish] suppose to be big like this [picture]. But down where I trap in the open lakes they're small, smaller and thinner, and there is some that is like a little balloon……not all, but some like that. Probably just filled with water, I don't know. [L013002, Hughes]

Trappers and winter travelers make a special note of lakes that have concentrations of blackfish. In addition to representing a potential source of food for themselves or their dogs, the open holes and areas of thin ice created by blackfish represent a potentially deadly hazard that travelers must be alert for.

> "Lots of people drown in those kind of places too [blackfish holes]. They're covered but there is no ice in them. Sometimes when there was white-out they would fall in there. There is some peoples that drowned in that kind of hole around here. You can go through in sno-machine too, and fall in." [I110101, Huslia]

> "That's how my grandma drowned. Without testing the ice, she walk into a muskrat house, there's a big place that just open….can't tell…..must be cloudy day, and she went through with the ice and she drowned. That's dangerous." [J110101, Huslia]

Major blackfish lakes are well known to area residents. Those traveling in unfamiliar country, however, keep an eye out for these areas of dangerously thin ice caused by blackfish. One respondent noted that ravens, foxes and other furbearers often feed and congregate around blackfish holes and their presence out on a lake can sometimes serve as a warning of holes or thin ice conditions.

Comments from respondents regarding the diet of blackfish indicate that they feed mostly on moss, algae, and micro-organisms found in lake water. As one respondent put it, "all they live on is water," noting that blackfish could be kept alive in jars in the house for six or seven months if natural pond water was used and if the water was changed frequently. Blackfish also have a curious reputation of being able to remain alive for hours out of water altogether. This property allows them to be transported from one location to another by fishermen, and remain alive for use as a bait fish. This is discussed in more detail under the Harvest and Use section below. Numerous stories recounted the ability of blackfish to survive being frozen for weeks or even months. Almost every respondent who had used frozen blackfish to feed sled dogs had a story about occasionally seeing them "come back to life" in the bottom of the warming dog pot.

> "If you gonna cook it for dogs you throw it in the pot and it start swimming around again! [laughs]. They're strong. [R051203, Evansville]

> "I try it [blackfish] one time. They were getting it for dogs at Blackjack, in the lake. I eat 'em. Even if it freeze then it turn alive again. Frozen…. just like frogs I guess." [C081001, Alatna]

Respondents were generally unfamiliar with the spawning timing or spawning behavior of blackfish. Spawning activity of blackfish is not something that had been directly observed by any of the respondents. Because of their small size, blackfish are not typically cut open or gutted in preparation for use. Thus, less attention is paid to the presence or condition of blackfish eggs than those of other fish species.

A few respondents, particularly those in the Huslia area, thought that the population of blackfish in some area lakes had declined in recent years. They pointed to predation by northern pike as the suspected cause of this apparent decline.

Harvest and Use. Blackfish are harvested and used almost exclusively during the ice-covered months of the year. The late-winter tendency of blackfish to form into large schools and congregate at breathing holes made them vulnerable to harvest at a time of year when food for people and dogs was most likely to be in short supply and few other fishery resources were available. The indigenous inhabitants of the Koyukuk drainage utilized an ingenious funnel-trap design that took advantage of the vertical cycling behavior of the fish as they gulped air at the surface and then swam downward. Blackfish traps were briefly described in a previous report section describing gear types (pages 20-21) and will be discussed in more detail here.

Funnel or basket traps for blackfish were typically three to five feet in length and approximately eighteen inches in diameter. They were constructed of green, straight grain spruce or tamarack wood split into thin strips and tied together using willow bast or twine. According to several respondents, tamarack trees were preferred for blackfish trap construction because they could be split easily into thin slats. The selection of straight grain trees of a certain size was a critical part of the process and a small offering or ceremony of respect was sometimes performed as a tree was cut down for this purpose.

> "Blackfish traps can be made with spruce or tamarack. They say they used to make fish traps with tamarack long ago and the reason the use tamarack is because it separate like in slats, and then you split those up so you get nice even slats of wood. Cut it in fall and the story I heard is that with tamarack, before you cut it down you talk to the tree and say

'I'm cutting you down for a reason….make good use of you' and sometimes they make like a……tie a ribbon at the base or drop certain kind of beads on the ground around there—make an offering to the tree. And they say those kind split real easy. You gotta use the willow bark for tying it too, the old time way. What I saw as a child was, you know, flour use to come in flour sacks and they strip those, tear those flour sacks into strings and they use that." [W050503, Koyukuk]

The trap was fitted with a funnel opening at one end. At winter blackfish holes, these traps were tied to a pole and placed in the water vertically with the top of the trap approximately six inches below the surface and the entrance funnel facing upward. Fish swimming to the surface and then rapidly downward would enter the funnel entrance of the submerged trap and be unable to escape.

"You set it down in the hole, standing up, and when they come up, they gotta go back down inside the trap. We make a funnel in there, with a hole only about that big, see, and they go down and they can't come out, they have to stay in there. That's how we did it." [H110101, Huslia]

"Our Indian people was sharp. Yeah, they got anything they could get. They make fish trap. Same shape as the other one, but smaller. And it's not just anywhere……in certain spots….and they stick it down [the blackfish trap]……straight down. And I don't know how it swim…….they say it always swim and it go down and it get caught in there. And I used to see it. I used to see ah…..full of fish trap, that kind. They just dump it right there, just like wood pile. And after while, when it freeze, they go get it and we use it for dogs." [X070503, Huslia]

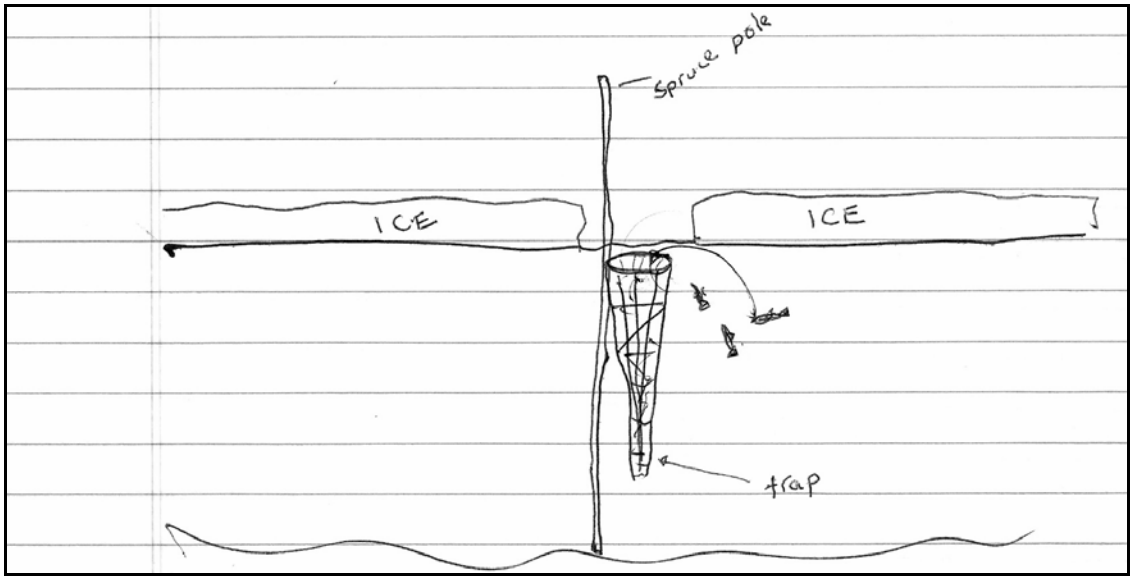


Plate 10. Sketch of a traditional blackfish trap illustrating the vertical placement of the trap at blackfish holes in mid-winter. From interview notes with Edith Bifelt of Huslia.

According to some respondents, good blackfish fishing locations could produce hundreds of pounds of blackfish in an overnight set of the trap. Sometimes multiple traps would be set at one location and traps could be repeatedly set and filled. During the days of dog team transportation this access to winter supplies of fish to feed dogs was of critical importance and winter camps, trapping cabins, or trapping locations would often be situated near a good blackfish fishing spot.

> "Before beaver trapping, maybe in January, we go out look for place to put blackfish trap. And then we put trap in, and if we got good place, maybe one weeks time I got enough dog food for whole winter. Best dog food. They really make dogs fat…….. and slick hair. We use a little tallow in there too. Cook 'em up. The big ones we eat. Cook 'em up in oven and we eat it." [I110101, Huslia]

> "We went up there just to get blackfish. Have to, that's an old way of doing it—they look for a good blackfish spot and they move there. And they live off that, live with the dogs if you catch enough—stay there about a month. When the trap was full just dump it out in the snow—make a nice place for it and it freeze right there and then put the trap back." [H110101, Huslia]

> "Ah, oonyeeyh! (laughs). We used to have dogs. And we have cabin over Hog River and I got some spruce trees, split 'em—small ones you know….give it to her [his wife] and she make fish trap. And out on the lake they [blackfish] make the ice thin, especially on muskrat house or in front of beaver house right in front of our cabin over there. We got 10, 12 dogs. Every night she get that fish trap about that far [6 inches] below the ice. Straight up with….we got pole on the side to pull it out…. And she [his wife] look at it every morning. Pour the fish out and on the ice. Food for the dogs you know." [K013002, Hughes]

As indicated in the comments above, the mid-winter harvest timing for blackfish in February and March allowed harvested fish to be preserved by freezing. Harvested fish were simply poured from traps onto the ice near the harvest location and allowed to freeze naturally. For use as dog food, blackfish were generally cooked into a broth, and mixed with rice, tallow, or cornmeal if available. Blackfish were known for being extremely rich in fat, and provided food for people as well. According to one respondent, blackfish harvests were sometimes segregated into two piles, with small, damaged, or "bloated" fish being utilized for dog food and the best large-sized fish retained for human consumption.

> "People used to get lots and lots and lots of oonyeeyh and when you catch it you separate it in two piles……the one you gonna cook for the family separate from the ones you gonna cook for dogs. The healthy lookin' ones is the ones you gonna put aside to cook for the family. ' [WW050503 Koyukuk],

For human consumption, whole, un-gutted blackfish were generally prepared by baking them in the oven. Respondents recalled that baking pans would fill with oil as the blackfish cooked and that they were so rich that one six-inch fish would provide a meal for one person.

> "That's rich fish. Good for dogs they say. Good for me too. Rich fish. They're small….but they say you eat one, you get full from that one. Biggest one might be about that big [6 inches]. They're full with water though. Some of 'em got big stomach, full with water." [A080901, Allakaket]

> "…….he put it [blackfish] in oven pan, little oven pan and he lay……I don't know how many in there. Biggest one is about that long [six inches]. I look at it and I think….that's too small…..I'm not gonna get enough to eat with that. Time to eat…..he give me one….he cook six of them, six little fish…….I barely eat that little fish. And that little oven pan full to the top with grease from those six little fish. That's how rich they are. So I just barely eat one and it fill me up. That's rich fish I'll tell you that." [T061603, Allakaket]

> "Long time we used to……years and years back I remember I use to eat them [blackfish]. My mother used to get them from them lakes…..big lakes. Bring a whole bunch home and we used to eat them. Bake it, bake the whole thing. Don't even gut 'em or nothin'. Mom used to bake it like that in the oven. " [P050603, Koyukuk]

Blackfish are said to be highly nutritious. A broth made by boiling blackfish could reportedly be used as a substitute for breast milk to feed infants if circumstances required it. Numerous elderly respondents recalled survival stories from their past that credited the small but nutritious blackfish with making the difference between life and death.

> "You know, doctors found out, they study that people used to use that [blackfish broth] in place of milk long time ago. And they put it next to can of milk and its just as good. I remember my brother survive with the broth. He was just little and there's no milk in the house. And it's dry…no oil in it or nothing….. Really something, that broth." [GG103101, Huslia)]

> "[blackfish] Lots of vitamins……must be right because….lot of people died with the flu around here…..the last flu they had around here. [Names] used to be…..none of them live right now…..they had the flu too, and they move back up to their camp, and that's a good camp for this kind [blackfish]. And she set trap again and the kids don't eat at all, so she started drink broth from fish…….in one week time they all get up. We heard this story all the time. Lot of people died from that flu--Grandpa died too." [J110101, Huslia]

> "Boy they [blackfish] taste good! They taste the best. They're pretty small but they taste good and its broth is the best. They say there is vitamin A and D in there. Somebody was attending class…..one of the health aids, and when they came back they talk about these ones. And it's got vitamin A and D in there and the broth of it is good for babies. So I think that's what they used to feed to infants, you know, long time ago…..before white man came, they used its broth." [X070503, Huslia]

In addition to the blackfish traps described above, blackfish could also be taken by more improvised means. One respondent described using a burlap sack as a crude blackfish trap by suspending it the water at a blackfish hole and using sticks to keep the top open while it filled with fish.

> They used to put a….the only way to catch it is gunny sack, with a stick across….brace or something to keep it open. Put it down water. Put that deep down in water…..in the lake. This fish just come up and go back down. Fill the sack, they say. They just keep going in and they stay there. And the check it…..half full. Some big ones, about that big [eight inches]…really fat. Long ago they eat it. They cook it in oven. Taste good they say. Really fat. Good dog food too." [E080901, Allakaket]

If time did not permit the construction of a trap or a large number of fish was not needed, small numbers of blackfish could also be caught by simply dipping them out of the water at blackfish holes with a dipper or frying pan.

With the decline in the use of dog teams today, blackfish are no longer harvested in the quantities they once were. Only a few fishermen still go to the effort to set blackfish traps for use as dog food. Contemporary blackfish traps utilize traditional design but are typically made of wire mesh. Blackfish today are more commonly trapped in relatively small numbers for use as bait on set-lines for burbot. For this purpose, small wire mesh traps are often placed horizontally in the shallow, grassy margins of lakes known to have blackfish, and small fences of twigs and grass are used to direct fish into the trap. This method of trapping blackfish typically occurs under the ice of early winter in November and December before blackfish have fully congregated into schools and have not yet become concentrated at breathing holes. Blackfish are the preferred bait for burbot because, if properly attached to the hook, they will reportedly stay alive--and thus remain an effective bait--for more than a week. Also, their ability to remain alive for a time out of water allows them to be easily transported by fishers to favorite burbot fishing locations. According to some respondents, special rabbit skin pouches were traditionally used by fishermen to carry blackfish for use as live bait to catch burbot. Comments surrounding the use of blackfish as bait include the following:

> "Blackfish….oh yeah……the ones in the lake. That's what we use for bait for loche, pike…..pike will grab it too…….Anyway……they say when you gonna use 'em for bait you don't hit no bone. You put the hook right through on the back….it'll come out the other side….put it in there just so you don't hit the backbone. If you don't hit the back bone he's

gonna live for a little while. You can use the same fish for whole week…..and ten days later he'll be swimming around as long as it just hit the flesh. " [Q050603, Koyukuk]

"Mostly…my parents used to use rabbit skin to keep them [blackfish] warm when they go out. Rabbit skin so they won't freeze….keep them alive. In the house they use water, water pot…..its gotta be water from the lakes or the river, but they won't use just well water. Then they put the fish in that rabbit skin….no water, they keep alive…..just long enough for them to be alive. Then you hook the tail, and it moves around and moves around…and that's what attract the loche." [N050503, Koyukuk]

Miscellaneous Information. The largest blackfish, those eight to10 inches in length, are referred to in the Koyukon language as "***k'edeeł baanh***." Several respondents spoke of a traditional belief that said children, especially young boys, should not be allowed to eat ***k'edeeł baanh*** because it would make them slow runners. According to this belief, if a child eats a large blackfish, the spirit of the fish wraps its tail around the legs of the child when he or she tries to run. Blackfish are not widely utilized for human food today, making this particular rule somewhat moot, but respondents remember being taught these things as children and they are endeavoring to pass them on to future generations as an important part of their culture.

"Around Huslia, actually Cutoff, for good part of the winter they live on oonyeeyh. This was before moose and they live on rabbit, ptarmigan, grouse…..but the main thing they subsist on all winter……they had that trap and actually live off oonyeeyh. But they didn't let the children eat the real big ones….k'edzeeł baanh, because those real big ones they said is goin' slow and you don't want you children to be slow." [WW050503, Koyukuk]

"All the kids are not supposed to eat that big blackfish 'cause it make them slow. If you try to run, the fish just get its tail around you." [GG103101, Huslia]

Arctic Grayling *(Tleghelbaaye)*

The Koyukon language term for the Arctic grayling is ***tleghelbaaye***. The literal meaning of this term is uncertain, but "***lebaaye***" translates to "that which is gray"so the name is thought to incorporate some reference to the fishes gray coloring (Jetté and Jones 2000). The grayling's large and distinctive dorsal fin is referred to in the Koyukon language as ***ts'ede*** meaning "its shawl." The Inupiaq term for grayling is ***sulukpaugaq***. Grayling are common and are widely harvested throughout the Koyukuk River drainage. Information provided by respondents pertaining to the behavior, harvest, and use of the arctic grayling is summarized below.

Distribution, Seasonal Movements and Spawning. Arctic grayling are widely distributed throughout the Koyukuk River drainage from the Yukon River to the Brooks Range. They were described by many respondents as a "clear water fish," preferring to spend most of the open water period in fast moving, clear water tributary streams and headwater areas.

> "These [grayling] are in the creeks, way up in the clear water areas. Well, in the fall time, say late September, they start comin' down. Some peoples catch them down here on the river, but they go to, like, Dalkli……way up Dalkli, you know….those little ponds….that's where they catch them grayling." [I110101, Huslia]

> "They [grayling] go up the Huslia River—go way up the north fork….you know, way up and then fall time they come back out. Same as anything else. When the water drop, well the fish have to stay in the water so they come out. [H110101, Huslia]

Plate 11. Koyukuk River elder Florence Nictune at her home in Evansville, May 2003. Photo by Dave Andersen

Respondents say that because these smaller headwater tributaries are particularly susceptible to winter freezing, there are defined seasonal movements of grayling into and out of these tributary habitats; a spring movement into tributary streams occurring immediately after breakup in April

or May, and a fall movement out of tributary streams in late September and October. Comments collected pertaining to the spring and fall movements of grayling include the following:

> "In September, as soon as the leaves start fallin' into the creeks, the graylings start migrating out of the creeks into deep water." [W050503, Koyukuk]

> "April to October….open water…..they run up in spring and out in October. They usually get them heavy after the ice freeze up." [R051203, Evansville]

> "They [grayling] live in the streams, like down by my camp there's…..what they call Pocahontas…..there's not a bunch, but there's some good sized ones. I seen 'em back there. They just go there August or September. Before freeze-up they all come back out to the main river. " [L013002, Hughes]

> "Right now (June 20) all the graylings in all the side creeks in the last couple weeks are up there eating bugs. Middle of September they're all gonna come back down. They're all gonna go into the mainstem (Middle Fork Koyukuk). They're gonna go into the deeper holes. A whole bunch of them migrate. They move along the bars and they move down river quite a ways." [V062003, Wiseman]

One respondent offered the opinion that the fall movement of grayling out of small side streams was triggered specifically by dropping water temperature.

> "And when the temperature starts to cool down in mid September they [grayling]…..it gets to a certain point then they move back in the main river. You know, they don't want to get trapped in there. All these creeks…..Wiseman Creek freezes to the bottom. Mainly it's temperature of the water. I think if the temperature starts dropping it triggers them to go back in the main river. And then they begin this down movement. [V062003 Wiseman]

Another noted that, of all the fish descending the smaller tributary streams in the fall, grayling were among the last to make this exit.

> "That's another good one [grayling]. That's the last ones to come out of Kanuti…..fall time. They're the last one. Coming out of that Lake Creek….this kind. About freeze up. That what fish is doing. Spring time they go back, you know, all those fish go far as they could go…..to lake I guess. And fall time they start all coming down again." [F080901, Allakaket]

The Koyukuk River mainstem and major tributaries such as the Alatna and Kanuti rivers apparently serve largely as travel corridors for grayling to access their preferred summer habitats and also serve as over-wintering areas. In the extreme upper reaches of the drainage, some of the large Brooks Range lakes also function as over-wintering areas for grayling. In the swift clear-water tributary streams where they spend much of the summer months, grayling are relatively free from predation by other fish. During the winter months, however, when they are forced to

occupy lakes or deeper slow-moving streams, they are said to be subject to predation by other fish such as lake trout and northern pike.

According to respondents, grayling are spring spawners with the spawning event taking place soon after their return to tributary habitats. Grayling spawn in clear, shallow tributary streams in late May and early June. One respondent noted that grayling spawn during a fairly brief three-week time frame and that the exact timing of spawning varies with the timing of breakup.

> "In springtime they come back up. They go to spawning creeks……those little tiny creeks that they go in for spawning. That's in ah……you see 'em spawning from like, the middle of May to the first part of June. I've seen 'em spawning for about a 3 week time. Depends on break-up timing a lot." [V062003, Wiseman]

"Bugs" and fish eggs were the most common food items eaten by grayling that were mentioned by respondents. In salmon spawning streams where salmon eggs are abundant in the fall, grayling are said to gorge themselves on the eggs of spawning salmon, and the largest, fattest graying are reportedly found in or near salmon spawning areas. The eggs of other spawning fish such as whitefish and sheefish are also eaten by grayling. Grayling were described by one respondent as "following behind the whitefish eating their eggs in the fall."

Plate 12. Jack Reakoff (left) of Wiseman maps important fish habitats and fishing locations in the upper Koyukuk River with Dave Andersen. Photo by Barb Andersen.

In many of the swift headwater streams occupied by grayling, insects appear to be the primary source of food for grayling. An interesting hierarchy or "pecking order" for feeding grayling was described by one respondent, whereby the largest grayling occupy the farthest upstream pools, with lower pools occupied by smaller and smaller grayling. The upstream position of the large grayling is said to give them first access to insects coming down from upstream areas blocked by obstacles or too shallow for fish to reach.

> "Their main food here is terrestrial insects falling in the water. They don't have……the upper drainages….they scour…..and there's very little nutrient in the mainstem. We have a steep grade—drops a hundred and thirty feet between here and Coldfoot…..so it scours the bottom off. So their main food source is going up in these side creeks. And they stack up…..they gradient themselves out—largest ones to the top, smaller ones towards the lower part. And it's a pecking order. The first ones are getting all the best food. That's the way they do it. The biggest ones are way up at the top…..the farthest, deepest pool before it goes over a waterfall—that's where you're gonna get your….in this country, fourteen-inch grayling. It's just a pecking order. [V062003, Wiseman]

The grayling population in the Koyukuk drainage as a whole appears to be healthy. Many respondents spoke of favorite grayling fishing areas where grayling appeared as abundant as they ever had been.

> "LOTS of graylings. There's lots of graylings everywhere……South Fork, Fish Creek…..all over." [T061603, Allakaket]

Flood events in the last decade, however, have reportedly taken a toll on grayling numbers in the upper reaches of the drainages. The steep and swift headwater streams that are typical of the upper Koyukuk as it exits the Brooks Range foothills, are subject to rapid and sometimes violent flooding from summer rains and spring run-off. Grayling populations occupying these headwater areas can be adversely affected by such flooding events as evidenced by the following comment:

> "These big floods—the '94 flood that washed away Allakaket and the '98 spring flood…..we had another big flood in '98 from fast snow melt…..those had huge mortality on these river grayling. It flooded over its banks. The grayling got out there in those old sloughs…..out there in the woods, down in those holes out of the way of the main blast, like all these trees and all this high siltation. Then, because its got a steep grade, it dropped in, like, 14 hours, and a bunch of fish got stuck out in the woods. There was huge mortality. Another thing I've seen….in these August flood events, those grayling hold behind rocks. And so this channel went dry and I went down there and I'd seen a black bear had been walking along flippin' these rocks over and I looked…..there was seven boulders he'd rolled over and there was crushed graylings underneath those

boulders. They'd been holding behind the rocks…..the rocks turned and smashed the fish. That's another way they get killed. So the grayling population, because '94 and then '98, I think 80% mortality and then another 80% mortality…..so it cut it really low right now. You go up these creeks—a lot of old timers would go up some of these creeks and catch 75 grayling in the summer time. You walk up there now and you see about 20 grayling total. It's still recovering. There's lots of baby grayling. There's good rearing, but they were hurt pretty bad up here in the mountains." (V062003, Wiseman)

To the east of the Koyukuk headwaters region, grayling on the "Chandalar side" were reported to be commonly infested with a parasite:

"Over in the Chandalar [River] they [grayling] got a round worm….a larvae….a cystate in the meat and I've been reluctant to eat raw graylings in the Chandalar. I've never seen that kind over here. It's a big round cystate in the meat. About a quarter inch in diameter. I've eaten raw grayling over here, but not on that side…..I was told it was a round worm larva." (V062003, Wiseman)

While this condition had not yet been noted in Koyukuk River grayling, the possibility that it might begin to appear was a concern for the respondent reporting it because of the common local practice of eating grayling raw. This practice is described in more detail in the Harvest and Use section below.

Harvest and Use. The harvest of arctic grayling takes place primarily with hook and line gear during the fall as grayling make their downstream movement to deeper wintering areas. As rivers begin to freeze in October, fishers cast artificial lures into open eddies using rod and reel to catch grayling. As fall progresses and river ice becomes strong enough to stand on, holes are made in the ice and grayling are caught by hooking with lures or baited hooks. Fall harvests using these methods can result in individual fisherman taking hundreds of grayling.

"Ah….son of a gun they [grayling] couldn't be any better. …. They're fat! They are fat and they taste really good. We get it in the fall time. They could get it all fall. In November they used to go out. They make hole through the ice….and they're really going for it. Hooking. Sometimes they catch 300 a day and we use it for dogs too." [X070503, Huslia]

"Up Allakaket in the fall, everybody out on the ice during feeze-up. In the fall, that's when they [grayling] come around. Before they come down river to where it's deep I guess—for the winter. Up here [Hughes] is too cold. The water too cold during the winter. Freeze too deep. I guess that's why they are leaving. Main river, fall, October month—lots of ice running on the Koyukuk River. On the shore there is ice way out and people make water hole and use hook….not Whiteman hook…but Indian hook—piece of bone and they drill right though it and they make it sharp point like that and they use that. They used to make that kind. They put bait on it…..fish heart or something……fish eggs, and catch graylings." [K013002, Hughes]

As the above comments indicate, grayling are considered prime in the fall. The cold weather that typically coincides with this fall fishing activity also allows fall-caught grayling to be preserved for future use by natural freezing.

Grayling are commonly consumed un-cooked as frozen fish. Eaten as frozen fish, the grayling is simply cut into thin slices and eaten as-is. Some respondents referred to letting the frozen fish sour slightly, or eating it with salt or dipped in grease.

> "We eat it [grayling] frozen. We let it get sour. There's no food better than that. We eat it with salt. Frozen and just like its cured. And then we eat it with salt. Every time I go to Nulato that's what I eat in winter time. I say…..I don't want to eat nothing I just want to eat frozen grayling (laughs)." [X070503, Huslia]

> "We eat that [grayling] frozen in winter time. No cooking. I don't have to cook when I trap, you know, long time ago. No time. So I eat it frozen. Better than cook it. Waste time when you cook. ……. The bigger ones are really fat. That's when you get lots of food out of it when they're fat. 'Cause when you open the stomach you can see they're just white inside with fat. Around the guts you know. Just fat. That's how I know there's lot of eggs on them too in the fall. Yeah, they are not fat in the summer time. They gotta eat all summer….. then in October that's when they're fat…..or September, middle of September, they're fat around that time." [T061603, Allakaket]

> "We eat the liver frozen and the fat…..there is always pink fat over the stomach in the fall time and we can eat it raw. This is the only one we eat raw…… I don't know why." [U061703, Alatna]

> "Fall time when they are seining, that's what they eat all time [grayling]. You don't have to cook it. You can't cook it…..you are out there working on the gravel bar seining…..you just eat the eggs fresh, eat the fish frozen….cut this tail off and just cut the skin off and slice it and eat it. " [R051203, Evansville]

As the above comments indicate, in addition to eating the frozen flesh of grayling, eggs, concentrations of internal fat, and some internal organs were also consumed raw. These products were considered quick, high-energy, and nutritious food items that could be eaten without the need for cooking or utensils and thus made ideal mid-day meals for travelers, trappers, fishermen and others in need of a quick snack or meal—a traditional "fast food" item if you will.

" [Grayling] They're good eating. Frozen. You spoil 'em when you cook 'em. No cooking. Eat 'em frozen. In winter when you trap or out camping, pull the skin out and just slice it and eat it—lunch time. I used to get big sack of 'em when I was set to go out." [K013002, Hughes]

"My papa used to just split it [grayling] and we eat it froze when I come back from school at lunch time. Taste good to eat frozen." [KK013002, Hughes]

Grayling are not exclusively eaten as frozen fish. They can be cooked by the usual variety of methods; boiling, baking, frying or roasting over a fire. Some respondents described grayling as a common breakfast food.

Aside from the use of hook-and-line gear, grayling are occasionally caught in small-mesh nets. Their small size allows them to avoid being caught in most large-mesh nets but they are frequently caught as by-catch in fall seining activities targeting spawning whitefish. In the days when large wooden basket traps were still in common use, grayling were among the many species of fish that would be taken in fish traps at fall fishing locations to feed both people and dogs.

In general, arctic grayling are considered human food today. Comments from some respondents indicated that, during the dog team days, if grayling were harvested in large numbers, and food for sled dogs was in short supply, they would occasionally be used to supplement supplies of dog food. Two trappers commented that grayling could also be used as an effective trapping bait for marten.

> "Oh yeah, if we catch them [grayling] that is best marten bait. Really good. Slice it up…use it for marten bait. " [I110101, Huslia]

> "[Grayling] I use it for marten bait…age it, let it get sour and fermented. Marten really go for it. [L013002, Hughes]

Burbot (*Tl'eghes* or *Ts'oneye*)

Burbot is an important food fish in the Koyukuk region because of its broad distribution in the drainage and because it is available for harvest during the very heart of the winter months when other fish species are less available. Burbot are commonly referred to as "loche," (pronounced "lush"). In the Koyukon language the burbot is called by two names: ***tl'eghes,*** in the dialect of the lower Koyukuk River, and ***tsoneye*** in the upper river dialect. The Inupiaq term for burbot reported by residents of Alatna is ***tittaaliq***. Information provided by respondents concerning the behavior, harvest, and use of burbot is summarized below.

Distribution, Seasonal Movements and Spawning. Burbot can be found in all portions of the Koyukuk River mainstem from the headwater vicinity near the community of Wiseman to the village of Koyukuk near the Yukon River confluence. While burbot apparently do not occupy small, swift tributary streams and creeks, they are present in most major Koyukuk tributaries and there are said to be lake-adapted populations of burbot residing year-round in several of the large headwater lakes in the Brooks Range foothills. Near Bettles, burbot are said to ascend the John River, with a notable concentration of burbot in that tributary near Crevice Creek.

> "There's burbot in all those big lakes [Brooks Range foothills]. They live there. They live there all the time. They live in Bob Johnson Lake, they live in Chandalar [Lake], they live in Twin Lakes. They just live in the lake all the time. There's all those lakes in the Arctic have 'em……Toolik [Lake], Galbraith [Lake]…..they're in the North side lakes….Chandler [Lake]. They call 'em tittaaliq. As far as I know those things live in all these lakes in the Brooks Range……the bigger lakes. [V062003, Wiseman]

> "Ah…..fall time is the best time to get them [burbot]. October we put hook down. Full of eggs in fall. Their eggs is real firm when we get them in October. They say there is lots up John River at Crevice Creek." [R051203, Evansville]

Burbot are generally known to Koyukuk River residents as a fall and winter fish. Small numbers of burbot are said to be present in the Koyukuk River throughout the summer months. But a large upstream movement of burbot reportedly begins in the late fall, around October, and continues under the ice of winter until January or February. When most other fish species are abandoning the upper reaches of the drainage in a down-stream movement to deeper over-wintering locations, burbot are moving upstream, apparently to reach spawning locations. According to one respondent, burbot stay in shallow water, following riffles along the smooth gravel bottoms as they ascend the river. Because spawning takes place under the ice, the exact location of major spawning areas for burbot were not described, but the timing of spawning was commonly reported to be late December or January, based on the presence or absence of eggs in harvested fish.

> "These [burbot] come up sometime in October, every once in a while somebody get one in net in springtime, but mostly we get them under the ice where we got fish trap. October-November. They maybe eat graylings—I see them with grayling in their mouth with half sticking out yet. Must spawn in December. The ones we catch around Christmas have no more eggs and their liver gets small too. But earlier in fall their liver is big and tastes good." [A080901, Allakaket]

> "They spawn in winter time in the middle of the winter and when the ice falls in around December….if it turns warm and snows, the ice will calve down in places and I'll throw

> some lines in the deep holes, and they've got roe. And they're spawning around that time." [V062003, Wiseman]

While December and January were commonly identified as the spawning period for burbot, it is possible that spawning varies in different parts of the Koyukuk drainage, or that spawning can occur over a relatively broad time period. As noted above, some respondents stated that burbot caught after Christmas typically had no eggs in them. Others noted that burbot caught in late January still had mature eggs in them and that spawning must take place in February.

> "We catch it [loche] in summer time…just one or two and then fall time they come. They catch lots in the fish trap then. They still have eggs in them now [late January]….good eggs, you could eat it…..big eggs! Just boil it up." [M013002, Hughes]

Another respondent thought that burbot spawning might occur as late as March and might be somehow connected with the beginning of the downstream movement of fish noticed at that time of the year.

> "They spawn under the ice. We get them all winter……. until March. They get them November 'till March when they start going down stream—Maybe they spawn in March." [C081001, Alatna]

Respondents generally agreed that the downstream movement of burbot occurred in February and March, and that burbot taken during this period were empty of eggs. Major differences were reported by fishermen in the "richness," and condition of pre- and post-spawning fish, with pre-spawning fish described as "fat," and "rich" with large livers, and post-spawning fish described as "skinny" and "poor" with "shriveled up" livers. In the traditional Koyukon diet, energy-rich fats and oils were commodities in great demand and relatively short supply. Koyukon hunters and fishers, therefore, placed an emphasis on harvesting food resources that were in "prime" condition. Local hunters and fishers appear remarkably cognizant of where, when, and how to best take advantage of fat reserves in the various food animals. With burbot, the oil-rich liver was particularly prized and much attention was paid to the size and condition of the burbot liver at various times of the year. This aspect is discussed further in the section on harvest and use below. It is noted here only because the significant seasonal shifts in the oil content of the burbot livers mentioned by respondents, and the implied connection to spawning, relate directly to the biology of this fish.

The winter upstream and downstream movement of burbot in the Koyukuk described above, while pronounced, is apparently not universal. Respondents from all sections of the river noted that small numbers of burbot remain present in the river through the summer and spring months as well. It is also unclear from information provided by respondents, where the burbot that make up this large winter run of fish are coming from and returning to. Presumably, they originate from and return to locations elsewhere in the Yukon River drainage, but this could not be confirmed.

The diet of burbot is said to consist of other small fish, and it appears they are not particular about the species of fish they eat. Arctic grayling, juvenile northern pike, slimy sculpin, salmon smolt, and Dolly Varden were specifically identified by respondents as food for burbot.

No comments were received to indicate that burbot numbers in the Koyukuk River drainage had declined from previous decades. One comment from a Huslia resident, however, expressed concern about a large number of burbot caught in the fall of 2002 that had spots or areas of discoloring on their livers, and appeared to be sick (see also R. Stimmelmayr 2004):

> "You know what I notice, last fall we couldn't eat it [burbot]. Look like it's all sick inside, and they are all poor. I didn't find no good ones. Lots of people give us some but look like they're all sick. I tried them. I cook it…..but it's….it's different. All of them was that way. The liver…….it's all dots. It's liver is pretty shrunk, like it's sick……it's all sick. I don't think I want it now 'cause look like it's all sick." [X070503, Huslia]

Harvest and Use. Burbot, or loche, are occasionally caught as by-catch in nets set for other species in the main Koyukuk River during the open water period. Because they are known for swimming on or near the bottom, the harvest of a burbot in a gillnet or a seine net is sometimes used by fishermen as an indicator of how the net was positioned relative to the river bottom. Aside from this incidental harvest of burbot, a targeted harvest of burbot occurs during the ice-covered months using two fishing methods: traps and set-hooks. Both methods are described here.

In the middle Koyukuk River near the communities of Hughes, Alatna, and Allakaket, river conditions are right for the construction of burbot traps. According to respondents, relatively clear water and a river bottom composed of small gravel are required for this kind of trap. The

gravel river bottom found in the upper Koyukuk minimizes the possibility of the river current washing-out or undercutting portions of the trap enclosure and allowing fish to escape. Burbot traps have reportedly been tried in lower portions of the river with mud or sand bottoms, and while a few fish can sometimes be taken, the traps must be frequently monitored for holes in the enclosure and fences that allow fish to pass without being trapped. Burbot traps are built in channels of the main river shortly after freeze-up and allowed to freeze in place and operate throughout much of the winter. Trap construction typically takes place as early in November as possible in order to take advantage of the large run of burbot moving upstream at that time. Trap construction can only take place, however, after the Koyukuk River has iced over and the early winter ice has "dropped." Following freeze-up, water levels often decline and early winter ice will gradually collapse under its own weight, becoming relatively stable at levels that are then maintained for the remainder of the winter. This generally occurs by mid-November and those involved in the construction of burbot traps wait for this to occur before construction commences.

Certain locations near Hughes and Allakaket are known to be reliably good burbot trapping locations and are utilized repeatedly from year to year. To select a new site for a burbot trap, or to confirm the presence of burbot at a previous site, fishers make holes in the river ice and examine the river bottom looking for "fish trails." According to respondents, burbot travel upstream along the river bottom, scraping silt and algae from the gravel to form visible trails in places they repeatedly travel. The presence of a "fish trail" identifies a promising trap location. The relatively clear waters and gravel bottom of the upper Koyukuk are conducive to this prospecting process.

> "[Loche] Ah! Good meat and really rich, big liver, good eggs. What people do is….you know its clear water in the fall, and lot of times, after it freeze over, people would make little holes and look at the bottom, and you can see their trail…..it'll be clean , you know cause there is mud, and wherever they travel it is rubbed off and that's how they know where to put their fish trap. Some people still do it. Long time ago it used to be everybody, now we usually make one a year." (B080901, Allakaket)

Trap boxes were traditionally constructed by driving spruce or cottonwood poles into the river bottom to form a pen or enclosure three or four feet wide and twice as long. Contemporary trap boxes frequently incorporate the use of lumber, plywood, and wire mesh. The down-river end of

this enclosure is fitted with a "funnel" entrance similar in design to those used in traditional basket traps. The funnel entrance is made of split spruce or willow sticks forming a cone approximately three feet long, two feet in diameter at the large end and six inches in diameter at the small end. According to respondents it is important that the upriver and downriver ends of the trap box allow the river current to continue flowing through the enclosure in order to entice burbot to enter the entrance hole. Willow or wire leads or "fences" are constructed out from the enclosure to help direct fish into the trap box.

> "They make, like, that long funnel [two feet], that wide and narrow….made of spruce sticks…..for or five inches around. Have to make a house….maybe three feet fish trap house, and funnel on the down side of the house…..fish going up river, and you just have to put it in good place. They hammer it down and it freeze there and the sticks stick to the ice. Good place is….you look around the bar…..good place is small rocks on the bottom of the water…..not them big rocks place…..they make a fence back that way, and a fence out to help them move into the trap." [E080901, Allakaket]

Trap boxes are generally fitted with a lid to reduce the amount of ice forming on the surface of the trap. Trapped fish are removed by chipping through the accumulated surface ice of the box and using a long-handled gaff hook to snag the fish.

The comments below illustrate that whole families participated in the construction of burbot traps and that numerous family-owned traps would sometimes be built in the vicinity of a single community.

> "Our grandpa used to tell us…cut those willows, time to set the fish trap….for fence. So, we were all out there cutting the willows. We use dogs and sled to haul it. Willows about that big around [one inch]. For that funnel they split spruce trees certain way. When I was small I make it." [M013002, Hughes]

> "[burbot traps] They use those willows there….put the posts down and put the little willows in between. Us womens used to go out and cut willows for them so they don't have to work too much….in November….that's when the ice settle I think, that's why its always in November. We don't get too many fish like that in winter time….only these." [D080901, Allakaket].

> "There used to be one [burbot trap] down around Four-Mile, one straight across this gravel bar, one about the middle of this gravel bar…that's the old airport……one at mouth of Alatna, one up a little ways in the Koyukuk [mapped later at mouth of Henshaw Creek] …..that many fish trap when I was small. People own them, the people that build the fish trap, they own it….that's the way it was." [T061603, Allakaket]

Plate 13. The community burbot trap near Hughes, January 2002. (Top) Note the willow poles marking the location of the trap fence. (Middle) Hughes residents remove snow from the trap lid. (Bottom) Fishermen lift the lid to check the trap box. The trap had been emptied earlier in the day and held no burbot. Photos by Dave Andersen

While the funnel entrance and fences of the burbot trap are primarily designed to harvest fish as they move upstream, the traps will also trap burbot on their downstream movement. Fishermen explained that the traps create eddies or areas of slack water below them, similar to a boulder or other large obstacle, and fish descending the river sometimes seek out these areas to rest out of the current. Burbot "holding' behind traps are often drawn to the funnel entrance of the trap just as they were on their upstream movement and become trapped. Burbot moving downstream after spawning were said to be skinny and less desirable than fish on their upstream movement but were still utilized.

> "My Dad used to make trap in mouth of Alatna….fish trap for loche. One day in February….January it's going up river, February its going down. He say, pretty soon there will be whole bunch in the trap, but they will be skinny. First of February, first week I think, he go check it and we watch him from our house that time……Mom say, Where's your Dad? And we say, he's still working. When he come back we say how many you caught? And he say two hundred fifty!" [D080901, Allakaket]

During the dog team days, when the need for winter supplies of fish for dog food was a more universal concern, it was common for several family-operated burbot traps to be constructed near a community. Today it is more common for a single "community trap" to be built. A properly constructed and situated trap can produce hundreds of burbot a week. Burbot taken in community traps are widely shared within communities and between neighboring communities through trade networks. A burbot trap reportedly operated in Allakaket during the winter of 2000-2001, and one was in use and observed by the authors at Hughes in January 2002.

In the headwaters and lower portions of the Koyukuk, where river conditions are not ideal for the construction of the traps described above, burbot are commonly taken by the use of set-hooks. Using this method, single baited hooks, or "lines" of multiple baited hooks, are fished through holes in the ice. With burbot moving upstream in large numbers in late October, November, and December, these hooks or lines are set out and allowed to fish unattended, often overnight. Fishers identified Alaska blackfish as the most common bait used because of its ability to remain alive on the hook for a long period of time—up to a week or more according to some respondents. A trapper in the Wiseman area also reported using wolf meat as a reliable bait for burbot. Comments relating to the use of set-hooks for burbot include the following:

> "In the fall time they fish for them in the river with hooks, like right now (November). Just like you put fish net under the ice….but they put hooks under there with little fish, like

blackfish, for bait. Up there around Allakaket they use fish trap and they catch them all winter. They could do that around here too but the river is more gravel up there and too much mud here." [I110101, Huslia]

"[burbot] "They're in this river right here. Those things live here all the time, in this river. They're here, I don't know of big concentrations. They spawn in winter time in the middle of the winter and when the ice falls in around December….if it turns warm and snows, the ice will calve down in places and I'll throw some lines in the deep holes, and they've got roe. And they're spawning around that time…."But I catch those mostly in April. I'll go and throw lines….only one….in different deep holes along this river. So I'll throw a set line in there. Use wolf meat for bait and throw those set lines in there and catch those. They are scattered all along the drainage. I just wait for a place to calve-in and put a line on a ….'bout a three or four foot line on the end of a stick and just jam it into the bottom. And just come back in the morning and cut the stick out. Mostly in April when the ice is caving in." [V062003, Wiseman]

[Burbot] "Wherever there is eddy, they put hole in the ice. As soon as the ice is strong enough we cut hole for set hooks. Last fall we set 6 hooks and we got five the next morning. Mostly they use hook. They catch some in net and fishwheel, but mostly in the fall people are after them [burbot] and they use mostly hooks with bait on it. Set hook. Cut a hole through the ice, string 8 or ten hooks…just hanging in the water off the bottom, with little blackfish that move around. …….. you hook the tail, and it moves around and moves around…and that's what attract the loche." [N050503, Koyukuk]

According to respondents, "burbot lines" can consist of as many at 30 hooks spaced three feet apart with each hook dangling on a 15-inch line. These lines are strung under the ice between a series of holes using a pole to thread the line from one hole to the next.

Because the harvest of burbot typically coincides with the advent of cold weather, harvested burbot are usually preserved by natural freezing. Some respondents reported that burbot caught through the ice were simply preserved and stored by piling them outdoors near the harvest location and covering them with snow. Burbot meat has the reputation of not preserving well. According to respondents it quickly "dries up to nothing," so an effort is made to consume it fresh or within days or weeks of harvesting.

"This [burbot] is the only fish you can't preserve…..it dries up really fast. There is no nutrition in it after a month or so……it withers away. Better to cook it fresh. You can keep it for maybe a month, but no more than that. Even frozen it lose its flavor." [W050503, Koyukuk]

"Good to eat! I like the liver….. good eating. Fry it or boil it. Meat is good too, eggs, yeah, the whole thing is good, everything. Only trouble is they dry up too fast, can't keep it all winter, it dry up too fast. It won't keep long, so as soon as we catch it we eat it and it's good. Freeze it—it keep for a while—month or so." [J110101, Huslia]

> "[Burbot] You just pull 'em out and freeze. But loche, it don't keep very long. Gets wind-dry fast, and once it get wind-dry it turn hard. Even a week and it starting to get hard, so we give it away. The liver is the best part. The liver and the eggs." [L013002, Hughes]

As the above excerpts indicate, the oil-rich liver and nutritious eggs of burbot taken at this time of year (early winter) are particularly prized. Nearly every respondent made reference to burbot livers in their discussions about this fish. One respondent equated the richness of burbot livers to that of bear fat. The livers, described as being fist-sized in large fish apparently increase in size and oil content prior to spawning. Respondents offered many comments on how burbot meat, liver, and eggs were prepared and on what an important food source this was to families in the middle of winter when they were growing up.

> "[Loche] That's really good fish right there for the winter. They use 'em for dogs but we use 'em mostly for eatin'. Right now we get some every year from Hughes or Allakaket. We boil it or bake it. We never eat the guts, but the liver is good. We eat the eggs too. Fall time they got lots of eggs in them." [I110101, Huslia]

> "Loche!...oh man that a good fish. You can boil it, gut 'em out, you know, cut it up and boil it. You can also bake it too. And then I see somebody bone it out and deep fry it….make chowder out of it too. Fry the liver too." [G103101, Huslia]

> "Best fish you can get in fall time [burbot]. Summer time we catch it in fish wheel once in a while but we feed it to dogs. They're poor in summer and when they're poor, their liver kind of dries up like. They get rich in the fall. Some loche ain't so good. All you have to do is split it open, you know, depend upon how big loche it is. If the liver is pure white it'll be almost as long as the gut is. But if it turns brown it's not very good….means its poor, when it should be fat. All loche should be fat in fall time. When the liver come out you take that and boil it. That's a good one they say. That's about the best tasting liver you'll ever taste out of any fish as far as I know." [Q050603, Koyukuk]

> "But the best part on this one [burbot] is the liver……..the liver is just so rich, so delicious. They're big! If it's a big loche it's just about the size of my hand. It get that way in the fall. The summer time the liver is big but it doesn't have flavor and its skinny. Fall time it's fat!" [WW050503, Koyukuk]

> "That's what saved us growing up [burbot]. Because I come from a family with ten children, and eight of us grow up to be old age. And that's unusual because our cousin's were dying of T.B. But we eat lot of fish. We grow up on mostly fish. And this [burbot] is what save us because it has fat liver and good eggs. What my Mom used to do is….. she get the eggs and she get the liver and she fry it in a big frying pan and put a little bit shortening. Then it has its own grease. Then she put pepper and salt and then she boil the burbot [meat]. Then we get piece of the burbot on our plate and the liver and eggs is all mixed up and you have it all together." [U061703, Alatna]

One respondent noted that burbot harvested in the winter were sometimes allowed to age under the snow until spring which gave a special flavor to the oily livers.

> [burbot] "Put them away in the cache for use all winter—freeze them. I really like the liver, meat is good too. But that liver…..in April, after it age in the fish all winter under the snow—gee it was good. Just like candy. Long time ago my mom use to put them in big pile right by the fish trap—cover them up with snow, and then we come back in April we eat the liver raw. Its good—frozen, good fish. The meat, you gotta cook it, but the liver, we eat it frozen. Lots of eggs in there too." [A080901, Allakaket]

While burbot are generally considered a source of human food, several respondents mentioned that burbot are sometimes used for dog food if other food sources are unavailable. This is particularly true of burbot caught incidentally or at a time of year when they are skinny or in poor condition.

Finally, in addition to the contemporary use of traps and set-hooks to catch burbot during the winter months, one respondent reported of the traditional use of spears to take burbot during the summer months in the upper Koyukuk River and Bob Johnson Lake, referred to here as "Big Lake":

> [burbot] "They're here in the summer too. Arctic Johnny used to go up…..about five miles up here there's some bedrock, and there's…..around the mouth of the Hammond River….there's a scoured place in the main channel here. And when the water drops real low in summer time, there's some big rocks. And there's these cracks in that bedrock, and those burbot sit there in behind those rocks. And he would wade out there with a spear and walk around and spear those. They speared them over in Big Lake too. There's big flats or shallow places and on a calm day they'd go with a boat and go across and its like seven or eight feet deep and just drift over those burbots with a spear and just drop it and spear 'em in the head." (V062003, Wiseman)

Other Miscellaneous Information. Several respondents made reference to stories or traditional beliefs regarding burbot. Several versions of a traditional story attempted to explain the burbot's long and tapered shape:

> " I have story on this one……Loche got mad and the whole town tried to hold him. And he slide down the bank and he stretch out long like that. I learn that from my parents…. all that fishing and hunting…..you know, I learn that from my parents when I was little girl." [HH110101, Huslia]

> "You know loche, how long it is? Okay, when he started to become fish, start goin' into the water, they hang on to him and didn't want him to go. Just hang on him, make him long. That one has part bear fat in its liver. 'Round here bear fat is the most delicacy…. that's why people really go for it. Loche liver is the richest of all of them." [GG013101 Huslia]

> "The story that I know about this burbot is that……there was a village and ah……the big chief and the main hunter was this tl'eghes [burbot]. And when he came home, something happened to his family……his wife and child died while he was gone and he was so

> distressed he did not want to live. He was gonna leave this world. And the people said, 'no, no, no…. you are our main provider, you can't leave us'…..but he was going in the river and people said 'get a hold of him!' so everybody got a hold of him and they were just hanging on to him…..he must have been near water, and he just slip out of peoples hand. And he took a piece of fat and put it on his chest and he slipped into the water and turned into a loche. And they say that's why it's big in the front and it's tail is all skinny. 'Cause he squeezed out of these peoples hand. And the fat that he put on his chest is the liver." [WW050503, Koyukuk]

There is also a traditional belief that young women should not eat the eggs of burbot. According to this belief, young women just entering their child-bearing years are to avoid eating the large bulky egg sacks from burbot because they could cause her (future) children to have fat legs and make them slow. It is unclear how widely held this belief is today. Comments relating to this taboo include the following:

> "[Burbot] Eggs is good too, only teenage girls don't eat it [eggs] because it is short and round and their kid's legs will be too big and slow. Long time ago you need to be fast to kill your animal—you have to catch it." [GG103101, Huslia]

> "Ah, Loche! Long ago when I was up there [Allakaket] every year and them… all over they use fish trap, so we catch this kind. All winter we eat loche. And we get tired of it. The liver is good too—fry it up in the frying pan. And eggs too…but Momma told us "don't eat the fish eggs' [loche eggs], you know, she say it make your kids legs fat, just like those fat eggs! But we eat loche all winter and we got tired of it and can't eat it no more. And while momma never see us, we eat the eggs (laughing). I ate it or else I'd be hungry! It was good…and my kids is okay, that's what I think." [KK013002, Hughes]

Longnose Sucker (*Toonts'ode*)

The longnose sucker is found in small numbers throughout the Koyukuk River drainage. It is not commonly targeted for harvest by local fishers today, but is frequently caught as by-catch in small-mesh nets set for whitefish or pike and was important historically for feeding both people and sled dogs. The Koyukon language term for the sucker, "***toonts'ode,***" translates to "something bad went into the water," a reference to the colorful traditional stories surrounding this fish. The reported Inupiaq language name for the sucker is "***kaviqsuaq.***" Information provided by respondents pertaining to the behavior, harvest, and use of the longnose sucker is summarized below.

Distribution, Seasonal Movements and Spawning. Longnose suckers occur throughout the Koyukuk River drainage including the headwaters region. Suckers are said to rarely occur in

large concentrations, although several specific locations were identified as having lots of suckers. These included the Kanuti River, Wild River, Wild Lake, Jim River, and the mouth of Siruk Creek on the Alatna River. Suckers reportedly prefer rocky, nutrient-rich streams with abundant algae growth.

During the open water period, suckers can be found in a wide variety of habitats including the Koyukuk mainstem, sloughs, large and small tributary streams, as well as lakes. Suckers apparently winter in deep main-river holes on the lower Koyukuk or Yukon River. Shortly after breakup they begin an upstream movement into small streams where they spawn. Respondents identified early June as the peak of spawning activity for suckers based on observations of "loose eggs" in suckers harvested at that time. One respondent provided a particularly detailed description of the habitat preferences and seasonal movements of suckers, noting that the behavior of suckers was similar and perhaps loosely associated with the movement of arctic grayling:

> "In the springtime they [suckers] show up and the go up those little tiny creeks with the graylings. And they go up and spawn in those same streams….there's only a few of those in this river. I think they come up and move with the grayling into those….I've never seen 'em spawning in the gravel riffles like the grayling. I think they spawn in deeper places….sloughs and stuff. And then they want to go back out in the river. And they stay in the river all ….pretty much all summer…..in deep holes. They stay down eating off rocks and stuff. But there's only a few here. The Wild River…..the real rocky rivers….and Jim River down here….lots of nutrients on the bottom. Three types of salmon that come in….and there are more of those suckers." [V062003, Wiseman]

Additional comments pertaining to the spawning of suckers include the following:

> "Ah!....I like that [sucker]. Yeah, right now (mid-June)….I guess pretty quick now they're gonna spawn I bet, because they're the first one I think spawning. Right now they're just full of eggs. They're spawning already, I bet, in the creeks you know, some place in June. Because, a lot of times when they used to catch them they open it up and the eggs are just huge by this time….so, ready to spawn." [T061603, Allakaket]

> "Spring, right after the ice go, kind of the end of May…..lots [of suckers] going up Kanuti River. Big ones! And the big eggs then too. Springtime. They're fat too in spring." [(U061703, Alatna]

In the fall, suckers are reportedly among the first fish to exit tributary streams and return to the Koyukuk mainstem. They tend to move at night, making a gradual downstream migration back down to deeper wintering areas. Again, an association with the movement of grayling

Plate 14. Koyukuk River elder Bertha Moses offered memories of her life growing up in Alatna. Photo by Dave Andersen

was suggested--with suckers moving down-river as soon as grayling began to enter the mainstem from tributary habitats:

> "I've seen them [suckers] migrating at night in fall time. They move down. Lot of those kind move at night. I've had a light on the river out here at night and seen those moving around. They seem to be more secretive about moving down. They move down early in the fall. The ones I've seen moving were like right after the graylings moved into the river….they start moving down." [V062003, Wiseman]

Small numbers of suckers apparently move in the Koyukuk mainstem during the winter months as they are sometimes taken in under-the-ice traps targeting burbot in November and December.

Suckers are known for being bottom feeders. They have no teeth and rarely take a lure. Insects, algae, water plants, seeds, and fish scraps were all identified as food items for the longnose sucker.

> "They [sucker] eat anything on the bottom of the stream….they suck it up, that's why the nose is like that. They sometimes eat fish scraps around fish camp." [W050503, Koyukuk]

Several respondents noted that suckers appear to be prone to skin diseases and often have visible sores or fungus infections.

Harvest and Use. Longnose suckers are most commonly taken in the spring in small-mesh gillnets targeting small whitefish. Fall seining activities for whitefish and sheefish in the middle Koyukuk and Alatna rivers frequently result in significant harvests of suckers as well. They are used primarily to feed dogs. The harvest of suckers today is mostly incidental, but this was not always the case. Several respondents, particularly those with ancestral ties to the South Fork and Kanuti River regions, reported that a generation ago, suckers were specifically targeted in the spring when they were rich with eggs. Both the meat and eggs were utilized for human consumption and to feed dogs. According to these comments, spring-caught suckers could be preserved by drying or cooked and eaten fresh.

> "When we were children they cook it [sucker] for us for food in the spring. But they cut off the lower half and throw it in the dog pan for the dogs. Probably about behind the fin, they cut if off, and that's dog food because it has lot of little bones in it. And this part [front half] you could eat. And I remember it was good. It had a different kind of taste to it." [WW050503, Koyukuk]

> "We eat these [suckers] springtime. They have eggs springtime too and they eat them too……they fix them too with berries. There was a way they dry it. You could eat 'em cooked or dried. They are real good dry. You gotta cut 'em off and cook just this part….front part. Lots of bones on this one…..bones……spears like. They say he fight with some other fish I guess and all the bones look like little spears." [R051203, Evansville]

> "How I know there is a lot of them is, back…..Kanuti River, long ago, around the first of June when we're coming out from the spring camp, my parents set net everywhere, you know, in Kanuti River. Little short net from the bank out, and they catch a lot of this [sucker] in Kanuti River. I try every year around here but I never catch not one yet……I must be doing something wrong someplace. I want to eat that eggs alright……just open it up and eat it raw, you know…..drink cup of coffee and eat the eggs." [T061603, Allakaket]

> "Way back in the old days….really, sometimes there would be nothing to eat, like mostly springtime. They [suckers] are fat all the time. We used to catch it, and my mother used to clean it and bake it in the oven. It's rich! Its got lotsa bones. We have to watch it. Yeah, we ate those ones too. They got good eggs." [X070503, Huslia]

As these excerpts illustrate, one of the more universal comments about longnose suckers pertains to the abundance of small bones in the tail portion of the fish. The back one-half of the sucker, from the dorsal fin rearward, was described by numerous respondents as so full of tiny bones as to be inedible. In cases where suckers were being utilized for human consumption, the fish

would generally be cut in half at the dorsal fin and the front half, including the head, would be cooked for human use while the back half was almost always fed to dogs or discarded. Suckers apparently have a small concentration of tasty fat in the neck or throat, near the pectoral fins, that is particularly sought after by some. This was described as "a little piece of bear fat" by one respondent.

The harvest and use of the longnose sucker has diminished from what it once was. Those still harvesting fish to feed dog teams welcome the incidental harvest of suckers that inevitably find their way into their nets. But many fishermen now specifically avoid certain fishing locations that are known for producing large harvests of suckers.

Other Miscellaneous Information. Respondents recounted several versions of a traditional Koyukon story or legend involving the longnose sucker. While several other fish species are also the subject of traditional food taboos or beliefs, no other fish species discussed in the course of key respondent interviews had the distinction of being so richly featured in local stories as the longnose sucker. In general, these stories revolved around the premise that the sucker had, in ancient times, been a thief. The odd collection of bones that can apparently be found in the sucker's head, and the extremely bony posterior portion of the fish are said to be the consequences of its thievery. These stories were often recalled by respondents from their childhood and recounted with some amusement.

> "Well the story is that, um…..you know all these animals were people at one time. And toonts'ode [sucker] was the bad man in there. He was a thief. He stole everything. And one of the things that it stole, ah….this one I heard from a person in the Gwich'in area…..they say he stole an old caribou skin parka that's all worn out and they say its why it has a skin like that…..you know the skin is not pretty and it looks kinda ragged….he stole an old parka. And he stole a bag of quills……and he stole, ah, caribou antler, and he stole a chunk of fat….and he stole a stump….a log with a stump on there, and he stole the front leg of a bear. And then when he died and turned into a fish, the parka he stole is his skin. The bag of quills he put it in his tail…that's why they say this part is full of bones…..really tiny bones, just, some of it is not even connected….its just really tiny bones all over in this part of it. And ah…..oh, he stole a wooden comb too and you find that right around its mouth….like around the gill. And the antler….the caribou antler…..its in the head, I think I have some of those bones around….And ah, the bear arm you find somewhere, and the stump is its whole backbone, and if you lay it all out its like this long log with a stump on one end. And the fat is right between its two front fins…..a chunk of meat that is kind of fatty…taste good." [WW050503, Koyukuk]

“When I was a kid, one old lady said….I’m gonna cook the head and show you. She said that this fish [sucker] used to be a stealer, you know, steals….so everything that the fish stole is all over in the head. So, you cook the head you gonna get all shape of bones. ‘Cause whatever it steal long time ago, it just all up there in the head. Like them old Indian tomahawk….shape of those. She told me-- don’t eat the head….you be a stealer too then. That’s what they told me.” [B080901, Allakaket]

“[sucker] I know it stole lots and ah…it put lots in back…..closer to the tail….and this fish even have bear fat in it….bear fat in its throat. It’s about that long [one inch] and about that wide [one inch]. That’s what it did when it became fish. He went in the water…this guy went in the water…stole all that stuff and he even stole bear fat and put it right there and went into the water.” [GG103101, Huslia]

“We don’t eat it [sucker] much…..too much bone, but sometimes we do. We use for dog feed, and sometimes we eat it, but the tail part is too much bone. Why he got lotsa bone…..they got story for it….he used to steal….he used to steal lots of needle and put it in his tail, that what they say (laughs).” [HH110101, Huslia]

“Spring camp when we caught this one [sucker] we tell Mama…cook the head!...They say this kind of fish steal lots of thing long ago, so lots of things in his head. So we want to eat it, see it, see what’s in there. So my Mama cook this much [front half including the head] and put this for dogs [pointing to back half]. We take it out, all the bones, and we say this one he steal long ago, and we have fun with it. There is moose horn [bone shaped like a moose horn] and everything in there. Soon as we see it we want to eat it so we can see what it been doing!” [KK013002, Hughes]

Northern Pike (*K'oolkkoye*)

Northern Pike are referred to as ***k'oolkkoye*** in the Koyukon language and ***siulik*** in Inupiaq. Pike are recognized as a very important food resource in the Koyukuk River region. Much of their utility lies in the fact that they are year round residents of the region and in times of need can be caught using a variety of harvest methods during almost any month of the year.

> "…..pikes are good eating year 'round…… year 'round that's a good one. Save a lot of people's lives these pike, because they're everywhere, you know, in all the lakes and rivers. Yeah, those pikes are some fish." [T061603, Allakaket]

Plate 15. Koyukuk fisherman Benedict Jones hauls spring-caught northern pike up the river bank to the cutting table. Photo by Dave Andersen.

For this reason, some respondents referred to pike as "survival food". Pike are thoroughly utilized, with the meat, eggs, and entrails subject to a wide variety of preservation and preparation methods for both human use and as dog food. Information provided by respondents pertaining to the behavior, harvest, and use of pike is summarized below.

Distribution, Seasonal Movements and Spawning. Northern Pike are said to be present throughout most of the Koyukuk River drainage, inhabiting most of the Koyukuk mainstem, area lakes, sloughs, and slow-moving tributaries. In the swifter headwaters region of the drainage the distribution of pike apparently becomes more spotty. Respondents indicated that pike were known to be fairly abundant in the John River as far as Crevice Creek and were resident in some of the large lakes of the Brooks Range foothills. Pike were described as present, but not abundant in the Koyukuk River near Bettles, and were reportedly absent from the swift waters of the Middle Fork in the vicinity of Wiseman.

Most respondents said there was only one kind of pike in the Koyukuk region but that they varied greatly in size. Large pike, those reaching perhaps three or four in length, have a special name in the Koyukon language: ***taah dletonee,*** which translates to "that which stays still on the bottom" (Jetté and Jones 2000). One Huslia resident spoke of a "different kind" of pike found in the Hog River vicinity that he referred to as "muskatuk." No details were offered on the appearance of these pike other than they looked different from those pike commonly caught around Huslia. Another respondent from Allakaket thought there was a different kind of pike that lived in some land-locked lakes which had more rounded fins and did not grow a large as "river pike."

Good pike habitat was described as lowland areas with large grass lakes and sloughs that were connected to the main river by slow-moving channels or creeks. The area around Huslia was frequently referred to as a place where pike were both abundant and large. Several respondents cited a major flood event in 1994 as the cause of low pike numbers in the upper half of the Koyukuk drainage.

> "I think they [pike] mostly live in the lakes where they can eat blackfish or whatever. Down around Huslia area there is some big ones….not so much around here [Hughes]. There was some….some good sized ones until the 1994 flood. I haven't seen much of it any more after that. Must have washed back down the river. That was something, that flood!.....the whole river just sluiced-out, channel change." [L013002, Hughes]

> They [pike] live in the lakes. You can get a few in the main river, but mostly they are back in the lakes. They stay where the bugs is….they live on bugs. Down around Huslia they got better fish….this kind [pike]….Fat!" [K013002, Hughes]

Respondents explained that pike adhere to a pattern of seasonal movements into and out of area lakes and sloughs and that these movements are brought about by changes in water level and water temperature. Pike are said to over-winter in deep lakes and "holes" associated with major river eddies. During periods of spring high water associated with break-up, pike reportedly move out of these over-wintering areas into still-water habitats of shallow grass lakes and smaller sloughs.

> "Right now (early May) from mid- April through breakup they [pike] are coming up the Koyukuk. They probably winter around here, but ah…..they winter in the deep water area, then they start heading up the creeks for spawning." [W050503 Koyukuk)]

> "When water rises, these things [pike] go up the slough, see, and as soon as the water start droppin' they come back out. All depend on the water. If we know a good place that where we head for. If the water come up, pikes go in there…… but we can't catch them. But when the water drop, they come out all at one time, see, and you get quite a few." [H110101, Huslia].

> "They [pike] are here almost year 'round as far as I know. But they come out of the lakes in the spring, I believe, 'cause they stay in the lakes all winter long. They are on the river too, but they don't migrate up the Yukon like salmon do." [N050503, Koyukuk]

The spring movement of pike into lakes and sloughs is apparently done in order to reach favored summer habitats where they can spawn and have access to a wider variety of food. According to respondents, spawning occurs in early summer—variously reported as May to July. The timing of spawning was typically gauged by the condition of eggs in harvested fish.

> "When we catch them [pike] in the spring they are full of eggs. After breakup their eggs are ready. They spawn early I guess. " [WW050503 Koyukuk]

> "They [pike] spawn in spring—May/June. We know that because we see their eggs and they are just about ready. They spawn in the old rivers (sloughs)." [C081001 Alatna]

> "Those pikes are somethin' you know, they eat everything….muskrat, beaver, everything. They spawn in the lakes…..lakes and rivers….both areas they spawn. They'll be spawning about…..maybe July they spawn. Because that's the time we see the eggs is just ready. They spawn in the lakes and the creeks and in the rivers. They spawn just everywhere. That's what I hear from them old peoples way back." [T061603, Allakaket]

Pike have a reputation of eating "anything that moves" including other fish, frogs, insects, ducklings, mice or voles, muskrat, and even young beaver. An over-abundance of pike, and predation by large pike was cited by several respondents as the cause for declining populations of other fish, waterfowl, muskrat, and beaver.

> "They [pike] eat everything! Mouse, frogs, muskrat and beaver, ducks, young ducks…..they eat those little beaver in springtime because those pikes are big." [R051203, Evansville]
>
> "Pikes clean up on the rats, the young rats, the young beaver…… that's why our rats and beaver and everything is goin' down. That's what I think…..too many pikes." [110101, Huslia]
>
> Oh, they're [pike] getting big in the lakes. Nobody kill them no more and they're eating all the other fishes. They get stuck in there. Pikes get real big in the lakes. Pikes are getting too big in the lakes and they eat all the little fish…..muskrat even……anything. They get the ducks if they could. They could bite your finger off now! [S051203, Evansville]

Respondents reported another movement of pike during the fall. After mid-September, when the land and tributary streams begin freezing and water levels begin to drop, pike move rapidly out of their summer habitats back toward the main river and larger deeper lakes where they will spend the winter. One elder thought that this fall movement of pike was triggered by dropping water temperatures rather than by water levels.

Harvest and Use. Northern pike are one of the more widely used fishery resources in the Koyukuk River region. Not only are pike large and widely distributed, but they are available for harvest virtually year round, can be taken using a variety of harvest methods, can be very thoroughly utilized to feed both people and dogs, and can be preserved and prepared in many ways. These characteristics combine to make it one of the most universally used subsistence resources throughout the region, and each of these attributes pertaining to harvest and use is discussed in more detail below.

The seasonal movements of pike described above were well known and exploited by Koyukon fishermen for harvesting. Both spring and fall were identified as major harvest periods for pike. In the spring, gillnets are set in ice-free channels of the Koyukuk to catch pike as soon as river conditions permit. According to one Koyukuk fisherman, this spring movement of pike consists of fish of very uniform size--medium-sized pike about two feet in length, and pike of both sexes. Pike are said to be very susceptible to being caught in gillnets of almost any mesh size because they have a habit of chasing small fish and they have a large mouth full of sharp teeth that easily become tangled in nets.

In the past, when families commonly spent the spring months out on the land at spring camps pursuing a variety of hunting fishing activities, pike were among the first fish that were available to be taken in significant quantities using nets or fish traps. Spring camps were often situated at key fishing locations to take advantage of movements of fish. These early spring pike were referred to by a special name in the Koyukon language: ***notet' aale,*** which roughly translates to "coming out of the creeks" and represented a prized variation in the diet after a winter of eating dried meat.

> "In spring time, when we were in spring camp, our parents used to put in fish trap in water that's comin' out of the lakes….creeks comin' out of the lakes. Used to set fish trap and that's where they used to catch those pikes. Notet'aale….those small pikes comin' out of the lakes. Those fish comin' out, springtime…..they're fat! Tasty! Lot of it was used for dogs, but my parents used to bake some of it in oven with tallow…..that was so good!" [WW050503, Koyukuk]

Plate 16. Eliza Jones of Koyukuk cuts a fresh-caught northern pike, May 2003. Photo by Dave Andersen.

> "Usually, when I was growing up we see them [pike] in the spring time. And early spring…….. you know we don't have freezers……. And when all the fish are not in the

> river like salmon and other whitefish has not started coming up the river yet, [pike] was really important. We catch them in the sloughs…..this was in the 1950s and 60s……up the Alatna River. Fishing for them with a hook….June, before the fish start coming up. And at that time we eat some of it and we feed the rest to our dogs." [U061703, Alatna]

Koyukon fishermen also took advantage of the fall movement of pike out of summer spawning and feeding habitats in order to put up large supplies of fish for the winter.

> "In fall time, like in ah, September….middle of September, kind of end of September, then they start really come out heavy and that's when we stock them up for dogs. We use lots of that for dogs too around here. We used to get a couple thousand easy, and that's enough for all winter." [I110101, Huslia]

In the days when all families owned dog teams, pike represented a major source of dog food for those communities without access to salmon. As the above statement illustrates, thousands of pike might be taken in the fall by a single family, for use as food for both people and dogs. Large pike tended to be set aside for table use while smaller pike and pike scraps would be utilized for dog food. For pike being fed to dogs, care was taken to remove and discard the nose or mouth portion because of the many sharp teeth that, if swallowed, could be harmful to the dog.

In addition to the major spring and fall harvest periods, pike are sometimes caught during the summer using artificial lures and rod and reel gear in area lakes or specific river or slough locations known for being good pike fishing. Pike are also frequently taken as by-catch in summer nets and fishwheels targeting salmon. Through the ice "hooking" for pike was not cited as a major fishing activity, but several respondents said pike might be harvested in this manner if fresh fish was desired. Good winter fishing or "hooking" locations for pike were said to be at the inlet or outlet streams of large lakes.

> "Winter time they say they catch them [pike] with a hook through the ice. I try it when I was snaring beaver one winter, but I make water hole in wrong area. I told somebody, an older person, I told them I fish for pike out in the middle of the lake. He said, oh, he said, you don't fish for pike in winter time in the middle of the lake. He said, go to the outlet or the inlet, you know, if its deep in those area that's where they are in winter time. You find a deep area in that area…..the inlet or the outlet. You try that area you might catch pike, he said, but not in the middle of the lake." [T061603, Allakaket]

Long ago, basket traps were reportedly used to take pike in the winter by placing the traps in the vicinity of lake outlet that tended to remain ice-free.

Interview excerpts above describe the common use of gillnets, fish traps, and hook and line gear to take pike. Other gear types used to take pike include dipnets, spears, and even snares. The ability to take pike using unusual methods contributed to the utility of pike as a subsistence resource. Comments from respondents that touched upon unique harvest methods sometimes used to take pike include the following:

> "Springtime, after the ice go out, everyone go up to Nikolai Slough. That's where they get lot of pike and sheefish, whitefish…..up the Koyukuk River. At Grandpa's camp [Toby's Camp on map] I remember one time we spring-out there and we went back there, this time of the year (May) and there is water all around that lake, you know, on the edge. And there was lot of pikes, and yeah, people used to snare them too, those days. They got pole and they set it like rabbit snare, then I think they get them in that snare and just pull it." [P050603 Koyukuk]

> "Mouth of Fish Creek…you know, near Fish Lake (Tanana vicinity)…it forms a lake…ice about that thick (2 inches) you know….fall time….sun shining. Everywhere you look there is pike taking sun bath. They lay right up against the ice. And they [fishermen] sneak right up to it….never move…. Hit it right on the side of the…right over the head you know…tap it and it rolls over and they pull 'em out. Say they caught about 300 in one day. The concussion of the ice kills it, it just rolls over—they cut little hole and use a hook or something to fish it out." [Q050603, Koyukuk]

Pike are apparently susceptible to being temporarily stunned by loud noises-- a trait that allowed them to be taken through thin ice by hammering on the ice above them as described above, or by firing a bullet into the water near a fish, as reported in this account:

> "One time when I was little girl, my grandma went rat hunting. I go with her. We walk around the lake…Chelatna…..we walk all day around the lake and she say, go look for pike down there. I see pike, I tell her I see one big one down there. She went down to the bank and she say…if I shoot then it will turn over and you grab it. I was ready. I was scared to touch the mouth but she told me to do it so….she shoot and it just turn around, and I grab it…. grab the eyes, and throw it way back there. She run to it and she kill it and she open it and take that thing out…the liver……she put it on a stick and cook it. Oh my it was good! That's what we had for dinner. And we had it for breakfast…cook up the whole thing. Good dinner and breakfast." [D080901, Allakaket]

Another feature of pike is that they are reported to be good eating or "rich" throughout most of the year. Their omnivorous diet apparently is responsible for this. Respondents noted that fish species that were restricted to a diet of seasonally available insects or aquatic plants generally became skinny or "poor" during the winter and spring months. Pike, on the other hand, which are known for eating almost anything, are able to feed throughout the winter and can retain fat reserves year 'round.

"Yeah, that one [pike] is not poor all year 'round, you know. We could get it any time, and ah….its pretty good too. It's in good shape. Spring time we see it and they're pretty much in good shape those ones." [X070503, Huslia]

"When we first set fish net in springtime, right after the ice leave, we used to call these fish "spring fish." The little whitefish and the humpbacked one, they're not fat in spring….not too fat….and ah….not as good eating as they would be in July. But the fish that come up the river around July is good eating. So we usually eat pike and we make dry fish with them too when they are big." [U061703, Alatna]

A small number of respondents identified a short time in the spring when the fat reserves of pike are somewhat depleted. This is apparently associated with spawning. For this reason, some cited fall as the prime time to catch pike.

"Pike, I think they are good eating now (June). In the spring….. May…..starting in May they're not really good eating, they're kind of skinny. But after that, this month, they're getting fat. They're better now. They're good eating now. Year 'round…. people live on those things year 'round way back. You know, when they was….my grandparents…… you know I'm 78 years old now and I had grandpa too, long ago, when he tell story he say…..pikes are good eating year 'round. Its only that short time…. before they spawn there's a time there's not much to eat on them. [T061603, Allakaket]

"Pike—oh, that's our food long time ago. Best time to get them is fall time. Springtime they're poor, not fat like fall time. Nets—that's all we use. They got good meat…..hard meat, fall time is best. Cut it sometime just like salmon." [H110101, Huslia]

Another valuable attribute of pike is that they could be very thoroughly utilized. The meat is cooked fresh, frozen or dried for future use. Dried pike are cut and hung in a manner similar to salmon except that less scoring of pike flesh is needed to promote drying. Pike meat is known for drying to a very hard consistency and dried pike is often prepared for eating by soaking it in water to soften it or by dipping the meat in rendered bear grease, beaver fat, or even seal oil obtained from coastal communities through sale or trade. If eggs are present in pike, they can be fried or boiled and eaten. Raw pike eggs are sometimes mashed and mixed with sugar and berries to make a traditional pudding-like dish known in the Koyukon language as ***kk'oondzaah***. A respondent from Alatna had the following recollection of using pike eggs in this manner:

"I think their eggs [pike] are biggest in the spring time. We eat the eggs in spring time. I remember when my Mom was still living, years ago….1942, we have lots of dry meat, but she wants to eat fresh fish. So she go back in the lake and make water hole, and she's fishing….and she caught one good sized one [pike] about two, two and a half feet long, and it had eggs. And we pick cranberries from the ground…..spring time, the last years cranberries. So my sister smashed the eggs up and with the raw eggs she put the berries in and smash it up and make something like a pudding. So it was really good change from just eating dry meat!" [U061703, Alatna]

In cutting pike for drying, especially for use as dog food, a special cutting method is sometimes used in order to retain the egg sacks with the flesh of pike.

Fresh or frozen pike can be prepared by frying, roasting, baking, boiling, or even deep frying. In speaking of the important role pike have played as a "survival food," several respondents spoke of a traditional method of cooking pike over a fire without utensils. The technique involved a special method of skewering a whole un-gutted pike so that it could be turned for even cooking without falling into the fire as it cooked:

> "I tell you, old people used to cook that [pike] with stick. It really taste good. Catch it with fish net I guess…or hook. When they hunt you know, they got long spear, and they cook it that way…..used to. I never did try, but I heard about it. And when they cook it, you know, it taste good. Just king of water inside, you know that's way I like it. Doesn't dry out. They cook it right there some way. They tie it down with willows, narrow willows, so it wouldn't fall down. They know how, you know." [F080901, Allakaket]

Plate 17. A northern pike cut for the drying rack is held by Eliza Jones of Koyukuk. Photo by Dave Andersen.

> You can cook 'em [pike] with a stick. You can cook 'em like that. You have to cook 'em on the bone side [backbone] first or it will fall down. You can turn it around after it cook on one side, then the bone would hold the meat, otherwise it fall down." [K013002, Hughes]

Numerous respondents mentioned that "pike guts" or ***k'ets'eege'*** were often fried and eaten. Pike livers were specified as favorites by many respondents and would sometimes be singled out as a special treat for frying or roasting over a fire.

> "When we were growing up that was our treat, was to cook whitefish liver and pike liver over a campfire. And it was always a challenge to put this liver on a stick and turn it over and cook it good without it falling into the fire." [WW050503, Koyukuk]

> [pike] "What I do right there is I clean the guts too. I scrape it really hard. I split it and scrape it inside out and then I put it in salt water for little while. Man they're good! I just throw away one end of it. Liver is the best. Everybody just go for it. It's just like cheese…..just like cheese. We fry it up." [X070503, Huslia]

As described above, in addition to the liver, the stomach, intestines and other internal organs from pike are also cooked and eaten. According to respondents there are high concentrations of fats and oils in the various body organs of pike. The amount of oil is reported to be greater in late summer and fall-caught fish than at other times of the year. Pike oil can be extracted or rendered from the various organs by frying them and pouring off the oil so it can be utilized for other cooking and consumptive purposes. Pike stomachs were traditionally inflated with air and dried as a container to hold grease rendered from the organs (Nelson et. al.1982). One Allakaket elder offered recollections from her childhood of a traditional dish that involved the use of rendered pike oil from fall-caught fish:

> "Grandma, up at south fork…..this time of year [August]……we were there and she tell me to go look for rosehip back there. I was thinking…..what she will do with it? We went back in the cotton trees and we pick some and give it to her. She had big skillet on stove—Yukon stove---and there was big pike guts in there cooking. She was cooking salmon in the oven too, and she say 'clean it' [the rosehips], so we clean it and put it in one bowl. We gave it to her, that pike guts cook now—lot of oil in it!—she say you girls watch me? We say yeah—she get that skillet and she put it in that rosehip—bowl full of rosehip—she put all the oil in there and she put it away. Hot oil. She put that in bowl and give it to us. Boy it taste good! Pike with berries!" [D080901 Allakaket]

Pike is one of several species of fish that is used to make a traditional dish commonly referred to today as "Indian ice cream" and traditionally referred to in the Koyukon language as ***nonaałdlode*** or "that which has been whipped up." Individual recipes for this dish vary slightly

but the main ingredients are fish, berries or raisins, sugar, and rendered bear grease or Crisco. These items are mixed or "whipped" in a bowl to make this sweet and nutritious dish that is often served at large community gatherings. Pike was often cited as the preferred fish for this use because of its mild flavor and dry, flaky consistency. In preparation for use in Indian ice-cream, the fish is boiled and then squeezed to remove excess moisture and then crumbled or shredded in the hands before being mixed with other ingredients.

> "To use it in that ice-cream, you can use pike, whitefish, sheefish, fish like that--salmon is too rich--need dry fish for that. We boil it up and we squeeze the water out of it and then you make it just like, you know, just like sawdust. Then we mix, well, we use to use moose grease, right now I just use shortening and Wesson oil, and sugar. I mix that—well, I first mix that oil and shortening, and then I start mix in that fish. It get kind of thick, you know, and when I mix sugar with it, it dissolve, and it make it fluffy, and then I put any kind of berries. Salmon berries is the best, next is cranberries. Blackberries is good too." [G103101, Huslia]

Pike was also used to make a nutritious soup or broth known as ***k'oolkkoy toledle'***. One Koyukuk resident, speaking of the importance and versatility of pike, specifically recalled the use of pike broth to feed her family during hard times as a child:

> "Well that good to eat, that one, [pike]….good for everything, Indian ice-cream, everything. Springtime they used to catch them and dry them, sun-dry….outdoors….right now (early May)…..Nice hard meat. Lots of vitamins too I thinks. You see, I was brought up on this one…..the broth, no milk. Long time ago we have hard days, our family, my Mom and Dad. You know we used to live out camp all the time, year 'round, year round before we started school and no milk or nothin'. So my mother just boil this up and give us the broth for milk….k'oolkkoy toledle', they call it (pike broth)." [P050603, Koyukuk]

Several trappers noted that pike heads made good trapping bait for some species of furbearers. Their bony structure made them a durable attractant that could be nailed in place as part of a set for otter. Other trappers said that a pike tail might sometimes be hung as an attractor over a pole-set for marten or that fermented pike might be spread around a trap as an attractant for other furbearers.

While some respondents indicated that the 1994 flood event in the Koyukuk had resulted in lower pike populations in the upper portion of the drainage, several Huslia-area elders thought pike populations were increasing in both size and number in the lower Koyukuk. They cited declines in local muskrat and beaver populations as evidence that pike were on the increase. Pike are increasing in both size and number, they say, because of laws that prohibit the fencing-

off of creeks and because people are not exploiting the pike population along the Koyukuk as they did a generation ago when they were a primary source of dog food.

> "Pikes clean up on the rats, the young rats, the young beaver…… that's why our rats and beaver and everything is goin' down. That's what I think…..too many pikes." [H110101, Huslia]

> "Oh pikes…..lots of it…and pikes today is big too. Eatin' all the muskrat. Ya see, every trapper, long time ago had a dog team. So, in order to get enough fish, people used to go back to their fall camp and put in fish trap, fence the creeks off, you know. That's in the fall….only goin' for whitefish and pike, that's all there is then, and ah…..the law came along and said you can't do that. Before that, all the pike we know around here…the biggest is about like that [20 inches]. Only place there was big pike was up the Huslia River…North Fork….only place, because nobody bother them or hunt them up there. That was the reason up there. But up here in the slough the biggest pike in the slough was about that big [20 inches]. Lots of 'em. But the fish trap, ya know, the law said you can't do that. Nobody fence the creeks off no more. Pretty much everybody used to fence the creeks off, and then the pike keep getting bigger and bigger and they start eatin' off everything. Only pike is what we get in the net after that. Last fall I was really surprised, [brother's name] was fishing down by mouth of Dulbi Slough…..gee whiz!…. there's not that big pike in Dulbi Slough! But boy did we caught them big ones in the net….gee whiz big ones! [G103101, Huslia]

Miscellaneous Information. In many Koyukuk River homes it is common to see a dried pike tail tacked to the wall. Often this is placed over a door or window. Sometimes the tail of other fish species is used, but pike tails are most common. This is said to act as a sort of good luck charm to keep harmful spirits away. One respondent explained:

> "If you try to hold a fish by the tail it will just slip away. So we put that tail there and they say anything bad will just slip away out of your house. They do that especially right after somebody pass on" [R051203, Evansville]

For the same reasons, some Koyukuk River residents carry a dried fish tail in their pocket when traveling to an area they have never been to before. From his work in Huslia in the late 1970s, Nelson offered some additional observations on this belief:

> "A small bit of dried fish nailed inside a house will safeguard its occupants. Children may be protected from the lingering spirit of someone who has recently died by carrying a piece of dried or fresh fish, or especially dried vertebrae from the tail end of a fish. In old days they even wore vests made from dried fish skin, purely for spiritual protection. I have also seen men weave a strip of fish skin into their snowshoes to protect themselves from supernatural encounters in the remote forests." (Nelson 1983: 69)

The heads of harvested pike warrant some special handling according to traditional Koyukon belief. In warm weather pike are said get lethargic and hang out motionless in the shallow margins of lakes. Local knowledge makes reference to pike suffering from a headache under these conditions and there is a belief that one should not eat the heads of pike because you will be prone to getting headaches. This does not apply to old people, who sometimes boil up pike heads and enjoy the distinctive flavor of the meat. Beyond this occasional consumption by elders, pike heads are commonly fed to dogs once the mouth and nose have been disposed of.

No discussion about pike in the Koyukuk River region would be complete without mentioning the numerous stories of area lakes that were once inhabited by pike of extraordinary size. Some of these stories are rather thin second- or third-hand accounts from sources going back a century or more, and are probably best classified as local myth. Three respondents, however, offered detailed first hand accounts of seeing, and in one case killing, a "monster pike." One such story, from 1950, involved a trapper who did not heed local warnings of a dangerous pike and ventured across the frozen lake where it lived. He was reportedly chased off the lake by the huge pike as it broke through several inches of ice to try and reach him. Another respondent claimed to have killed a pike in 1938 that had reached enormous size. In his colorful retelling of the story he described the fish as "all stomach and head," as big as a human, and weighing an estimated 300 pounds. He killed it in the shallow margin of the lake with 16 shots from his .22 rifle and it took three people to drag it out of the water. In response to the interview question "What is the biggest pike you have ever seen?" another respondent told this story:

> "I've seen one eleven feet long and three foot wide. This was 1948. I was havin' tea there, you know, there was little island and I was gonna get back in my canoe. And somethin' caught my attention…..my eye….and I look. And there's a pike lying right along side my canoe. 14-foot canoe and it was three foot shorter than my canoe. I took a 30-30 and I was gonna shoot it…..and just when I was gonna pull trigger I said……..better not shoot it, 'cause my canoe was right along side it. And if it bust my canoe I'd be stranded and Mother wouldn't know where I'm at. So I let it go and it swim back out in the lake.(location mapped)" [W050503, Koyukuk]

Accounts of monster pike are by no means new. Nelson (1983) recounts similar reports of giant pike from his Koyukon informants, including two Huslia elders who reported shooting a gigantic pike that "was so large that they cut it into three sections and carried away only the middle part." (Nelson 1983:67). Nor are stories of enormous pike restricted to the Koyukuk River region, or

even to Alaska. James Morrow, in his 1980 book, *The Freshwater Fishes of Alaska*, skeptically recounts a published record from eighteenth century England that describes a 170 pound pike that was found and hoisted alive from a waters of a lime quarry (Morrow 1980:166). Whether or not one believes the stories of monster pike from the Koyukuk, local residents regard them as true. And even if these stories have been somewhat embellished through more than a half century of retelling, it is clear that the waters of the Koyukuk drainage are capable of producing the occasional pike of remarkable size.

Sheefish (*Ledlaaghe* or *Nedlaaghe*)

Western science tends to include the sheefish as one of the whitefishes, and Koyukuk River fishermen acknowledge certain similarities between the run timing and spawning areas of whitefish and sheefish. Because of their large size, fish-eating diet, and tendency to take a lure, however, sheefish were generally thought of as being distinct from the other whitefishes by Koyukuk River fishermen and they are separated out for discussion here as well.

The Koyukon language term for sheefish is ***ledlaagha*** (lower Koyukon dialect) or ***nedlaaghe*** (central Koyukon dialect). The literal translation of this name means "the swimmer" (Jetté and Jones 2000). Alatna elders refer to the sheefish by the Inupiaq name "***sii***." Sheefish are large in size, reportedly reaching up to three feet in length and weights of 60 pounds. They are seasonally abundant in much of the Koyukuk and Alatna river mainstems and represent a major subsistence resource, both historically and today. Information provided by respondents pertaining to the behavior, harvest, and use of sheefish is summarized below.

Distribution, Seasonal Movements and Spawning. Sheefish have a rather defined and distinct geographic distribution in the Koyukuk River drainage. They move seasonally up the Koyukuk River, apparently restricting themselves to the Koyukuk mainstem and virtually all bound for spawning locations in the upper Alatna River. As a result, they are reportedly not found in any of the upper Koyukuk forks or any other tributary streams other than the Alatna River and it is said to be a bad omen or "***hutlaanee***" if sheefish are seen in the upper reaches of the drainage.

> [sheefish] “That’s one fish I think they only go up the Alatna—not up the Koyukuk from here—cause about 60 miles up [the Alatna] that’s where they spawn.” [B080901, Allakaket]

In the lower Koyukuk River community of Koyukuk, near the confluence with the Yukon River, fishermen identified two pulses or “runs” of sheefish. One pulse arrives in March, moving up the river under the ice. These early fish are said to be particularly large, with some reaching 60 pounds. A second pulse of sheefish passes the community of Koyukuk in June. According to respondents these June sheefish run about two weeks in advance of the king salmon, and their arrival is used by fishers to anticipate the arrival of the salmon fishing season. Both runs of sheefish are said to originate in ocean waters.

The March run of sheefish was mentioned only by respondents in the community of Koyukuk, and fishing areas used to catch these early-run sheefish under the ice were all located at or near the Yukon River confluence. This leads to speculation that perhaps the bulk of this early run of sheefish may be headed up the Yukon River rather than the Koyukuk. Respondents in the middle river community of Huslia generally viewed sheefish as a summer species in that portion of the drainage, with fishing activities for sheefish taking place in July and August at the mouths of certain local tributaries and sloughs.

> “That sheefish is not all over. Where they’re gonna be is at the mouth of Dulbi Slough, way down there about 40 or 50 miles down. They’re in certain places. I think it’s got what it eat down there.” [X070503, Huslia]

> “Certain time of year they [sheefish] hit the mouth of Dulbi Slough—they never go up the slough, but there is little fish coming out and they pile up at the mouth and we go down there—use hook, boy that a lot of fun. By that time they are really fat too—maybe August—get them three feet long—they are coming up river then.” [G103101, Huslia]

Continuing up the drainage, residents of Alatna and Allakaket note that sheefish typically pass by those villages in late August headed for spawning locations farther up the Alatna River.

> “Sheefish usually come last part of August going up the river. They come steady. Occasionally you can catch one or two stray ones in spring time, but in my area [Alatna] in the Koyukuk River, they come last part of August and they go up the river. They’re fat around then.” [U061703, Alatna]

Using information provided from all parts of the drainage, it appears that large numbers of Koyukuk River sheefish probably enter the mouth of the Koyukuk in June. They take most of

the summer to make their way upstream, stopping to feed along the way at the mouths of major tributaries and sloughs, and reaching their Alatna River spawning grounds in September.

The spawning event for sheefish is said to occur in late September just prior to freeze-up as slush ice is beginning to form on the rivers. Specific mention was made of the connection between slush ice and the sheefish spawning event, as if the presence of slush ice in the stream served as a signal to the sheefish that they had gone far enough and it was time to spawn. Sheefish spawning takes place in shallow riffles throughout a broad stretch of the middle Alatna River forty to sixty river miles above the Alatna River mouth. Two specific locations identified as "*Sinyalak*" and "*Chebanika*" were mentioned in connection with fall concentrations of spawning sheefish as well as whitefish. Spawning reportedly takes place mostly at night. According to respondents, the activity of spawning fish at these locations can be observed and even heard as fish roll in the river and release their eggs.

> "In August and September these [sheefish] are coming up[river]. They spawn up the Alatna in September where it is shallow all the way across. We camp there—you can hear them when they spawn—sounds like someone spitting. They turn over and squirt out their eggs—whole bunch of them." [D080901, Allakaket]

> "We start getting them [sheefish] first part of September…..up Alatna. They migrate way up. That's where they spawn. They spawn around middle of September. Start second week in September…… they're spawning it look like because, you know, its dark by that time, up Alana, and if we have a camp close to riffle, at night time you hear squirting sound….water and spawn. All these [whitefish and sheefish] spawn same time." [T061603, Allakaket]

> "Up the Alatna, you could hear them [sheefish] at night…..dogs used to bark 'cause the sheefish are spawning at nighttime." [R051203, Evansville]

With slush ice moving in the streams, sheefish apparently turn downstream and begin an out-migration from the Koyukuk before freeze-up.

> "As soon a slush ice is coming down the fish [sheefish] are coming down with it." [F080901, Allakaket]

> "Then later on they are coming down the river just before freeze-up. And they don't go up the Koyukuk…..sheefish doesn't go up the Koyukuk [above Alatna]. And they would be spawning when they are coming down too….because, night time, in the riffles you hear them. People would listen and say they hear them spawning…….spilling like, in the riffles. This was right before the ice come, because we used to be able to seine for them. September….. after the middle of September." (U061703, Alatna)

The out-migration of sheefish is apparently much more hurried and defined than their summer-long movement upstream. Several fishermen described the fall movement of sheefish out of the Koyukuk as lasting only a week or 10 days and ending abruptly. In some years, fishermen noted that an early or rapid freeze-up could trap sheefish in the upper portions of the drainage, forcing them to overwinter in deep river holes and sloughs. In years when this happens, upriver fishers sometimes benefit from an early availability of sheefish the following spring.

> [sheefish] "I think sometimes some of them stay around for winter. One time we caught this one springtime, right after breakup so….must be that they are around in the river all winter like them other fish. Not too many, but just a couple I guess." [F080901, Allakaket]

Plate 18. Fresh Koyukuk River sheefish are piled in an Allakaket smokehouse to freeze, October 2003. Photo by Dave Andersen.

As noted previously, sheefish are known for eating other fish, and on their migration up the Koyukuk they reportedly concentrate at the mouths of side streams where they feed on small fish that are moving into and out of these tributaries. Prolonged or unusually muddy water conditions

can apparently affect the ability of sheefish to feed. One respondent noted that after a recent summer of particularly murky water conditions, all the sheefish seemed skinny.

> "One year the Koyukuk was very muddy all summer long and it affected the sheefish. They were not too good all summer, nothing to eat I guess." [R051203, Evansville]

The only other comment pertaining directly to the diet of sheefish came from a Huslia resident who described the unusual experience of once finding the stomach of a sheefish full of lamprey, also commonly referred to as eels.

> "One time we got one [sheefish], they put it on the table and gee whiz….it's just like a balloon! I said….I wonder what they eat….I started get it ready for supper and…..big stomach—BIG stomach inside, with long something in there, and I wanted to see what they eat so I cut it little bit, and that was eel! My…lots of eel in there!" [J110101, Huslia]

Lamprey are known to occur primarily in the Lower Yukon River and this was taken as an indication that the sheefish had fairly quickly traveled the considerable distance separating Huslia and the Lower Yukon River.

Harvest and Use. Sheefish are taken with a variety of gear types. They are known for readily taking a lure and are one of the few fish that respondents reported actively pursuing with rod and reel gear. Respondents often noted favorite rod and reel fishing locations for sheefish where large quantities of fish could be caught at certain times of the year. These included the mouths of certain sloughs and tributaries where sheefish feed as they are migrating upstream and several well-known fall spawning concentrations up the Alatna River.

> "They [sheefish] can be mushy, but if you get a good fat one it makes a difference. Mostly use hook and line…..sometimes in nets too." [G103101, Huslia]

> "We get these [sheefish] with seine net or rod and reel. One time them guys went up there [Alatna River] with rod and reel and caught a whole pile of them [sheefish] one night—fat too. That place is 60 miles up the Alatna—late fall—place is called "Chebanika." People cut them and hang them. I seen some people even make strips out of them. Hang them, half-dry them and throw them in the freezer. They keep better I guess." [B080901, Allakaket]

Large-mesh gillnets are also used to take sheefish. At the community of Koyukuk, fishermen reported using gillnets set under the ice to take advantage of the March run of sheefish there. In the middle Koyukuk gillnets set primarily for salmon in July and August will sometimes produce

more sheefish than salmon. Fishermen in Hughes, Allakaket, and Alatna also reported using seine nets to take spawning sheefish in September. The use of small-mesh seine nets, and the

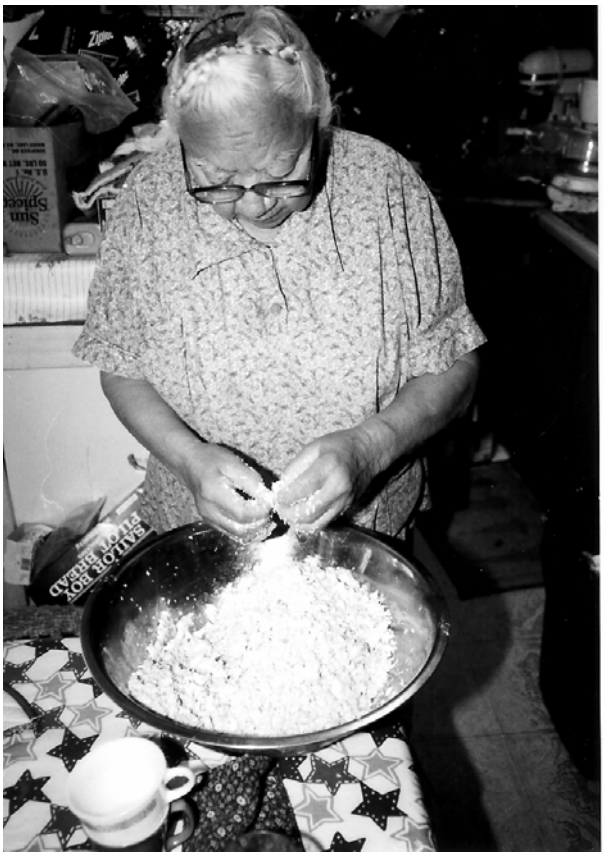


Plate 19. Huslia elder Rose Ambrose shreds a bowl of sheefish for making a dish known as Indian ice-cream or *nonaaldlode*, July 2003. Photo by Dave Andersen.

specific characteristics of the river that restrict this fishing method to the upper Koyukuk river region, were detailed in an earlier report section highlighting gear types (pages 28-30). Much of the information offered by respondents relative to seining was focused on whitefish and will be discussed in a later section of the report. But whitefish and sheefish are frequently mixed on the Alatna River spawning grounds and fishermen reported taking large harvests of both. Some seining locations are known for producing more of one species than another and sheefish can reportedly be targeted if fishers are familiar with the various fishing eddies. One Alatna elder remembered seining on the Alatna River as a young girl and catching so many sheefish in the seine net that the net could not be pulled in.

> "I started seining with my brother-in-law and my brother when I was 15 years old. And when they were away, my oldest sister and me, and my younger sister, we seine. I would line the boat with two dogs up to where we were going to seine. And I row while my sister throw the net in the water, and my younger sister was on shore with the rope. We don't know what's in the eddy. But certain eddy have certain kind of fish. Some have mix, some have mostly this one (humpback) or this one (cisco), and people know that. And this one place, we didn't know it was all sheefish in there. It was kind of a little riffle and we started way up and float down……drift…..and it was just full of these ones [sheefish]……..300 maybe, but it was too much to pull for us and I think we only got 42." [U061703, Alatna]

Hooking was also described as a way to catch sheefish in the late fall. As sheefish migrate downstream under the ice of late fall and early winter they can reportedly be taken with lures fished through holes in the ice.

> "In late fall, when you can stand on the ice, you can get them [sheefish] with hook through the ice. Way up the Alatna is a good place. We use nets too." [F080901, Allakaket]

Preservation techniques for sheefish include all the usual methods used for other fish species. They can be cooked and eaten fresh, frozen for future use, and dried with or without the use of smoke. Summer-caught sheefish are typically cut and hung to dry. Dried sheefish can be cut in such a manner as to retain the egg sacks. Because of their large size, sheefish are sometimes cut like salmon into strips and then smoked and dried. Sheefish caught in the late fall are typically allowed to freeze naturally outdoors.

> "Sheefish caught in the fall you just put away in the cache frozen….September month, catch them and spread them out on gravel bar with willows under it and let it froze—do that just before slush ice comes. They have good eggs too." [K013002, Hughes]

A unique system for freezing and storing fish (primarily whitefish and sheefish) developed in association with fall seining activities in the upper Koyukuk region. Stream-side storage boxes constructed of logs were strategically located near seining locations to negate the need for transporting large quantities of fish over long distances. Details on the construction and use of these storage boxes, known by the Eskimo term "suluun," are described in the species summary for whitefish below. Respondents commented that sheefish are known for being fat and full of eggs in the late fall. The heads of sheefish are known for having lots of "cheek meat" and are sometimes removed and cooked separately. While the entrails of sheefish are not generally used for human consumption, reference was made to a "gizzard" or portion of the sheefish stomach which is sometimes cooked and eaten. The rich eggs of fall-caught sheefish are also cooked and

eaten or mixed with berries and sugar and eaten raw. As with northern pike, sheefish can also be used to make the traditional dish known as "***nonaałdlode"*** or Indian Ice-cream (see northern pike summary pages 78-79). Another popular way of eating sheefish is as "frozen fish." As with grayling, sheefish eaten as frozen fish are simply cut into thin, frozen slices and eaten raw, sometimes dipped in grease or oil.

Like most species of fish in the Koyukuk region, sheefish were used to feed dogs as well as people. Because of their large size and the ability of fishermen to take large numbers of them in the fall when they could be easily preserved by freezing, sheefish represented a significant source of dog food for residents of the Koyukuk during the heyday of family dog teams. This is still the case for those in Koyukuk River villages that continue to maintain dog teams and feed fish to them.

Whitefish (*Ts'oł*)

Several species of whitefish are commonly harvested for food in Koyukuk River communities. As a group, whitefish constitute one of the most heavily harvested fish resources in the Koyukuk region. The generic Koyukon language term for whitefish is "***ts'oł.***" Sometimes the collective term for fish "***łookk'e***" is also used to refer to whitefish.

Two species of large whitefish--broad and humpback whitefish, are widely distributed throughout the drainage. In the Koyukon language, broad whitefish are called "***taaseze***" which translates to "water bear," and humpback whitefish are known as "***holehge,"*** meaning "it swims upward" (Jetté and Jones 2000). The term "***telaaye"*** or "***telaaghe"*** is sometimes used to refer to both species of large whitefish when they first emerge from wintering areas and begin moving in the high waters that are characteristic of early spring. The Inupiaq language terms for broad and humpback whitefish were given as "***qausriḷuk"*** and "***qaalġiq,"*** respectively.

At least two species of small whitefish are also found in Koyukuk waters. The least cisco is seasonally abundant throughout much of the drainage, and is known by the Koyukon term "***tsaabaaya***" and the Inupiaq Eskimo term "***saavaayiq.***" These two terms sound similar when spoken and the Inupiaq term is said to be an Eskimo language adaptation of the Koyukon term

for this fish. This term came into use as Eskimos relocated to the Koyukuk from the upper Kobuk River region where the least cisco was not present.

Another species of small whitefish that is thinly distributed in the Koyukuk is the round whitefish. The round whitefish is known by the Koyukon name "***hułten***" and the Inupiaq term "***quptik.***" The round whitefish is infrequently harvested and seldom used. While most respondents recognized it when shown a photograph, only a small number knew the Koyukon name for this fish and very few had eaten it.

There is some uncertainty surrounding the distribution of a fifth species of whitefish in the Koyukuk River. The Bering cisco, similar in size and general appearance to the least cisco, is found in many parts of the Yukon River drainage and was included in photographs shown to respondents during interviews. Respondents frequently puzzled over the photograph, struggling to note the differences between the Bering and least cisco. In the end, most referred to the Bering cisco by the same name as the least cisco "***tsaabaaye***" with the comment that they "must be the same thing." The Inupiaq term for the Bering cisco "***qauttaq***" was provided by a single respondent who admitted she was not familiar with the fish herself, but thought she had heard of it from relatives in the Kobuk River region "down towards the coast." The Alaska Native Language Center at the University of Alaska in Fairbanks was unfamiliar with this term and could not shed any light on its origin.

Respondents generally demonstrated instant familiarity with the photographs of fish they were shown, but this was not the case with the Bering cisco. This, and the apparent lack of a distinct Koyukon term for this fish, suggest that Bering cisco may not be common in the Koyukuk River. Native language taxonomies tend to be very descriptive and detailed. The two cisco species are distinct enough that separate Koyukon terms would likely exist for them if they were common to the area. In the neighboring Gwich'in language region of the upper Yukon, for example, where both the least cisco and Bering cisco occur, there are very distinct Gwich'in terms for the two species (Andersen and Fleener 2001). What is curious about the lack of Koyukon terminology for this fish, is that the Bering cisco almost certainly occurs in the Yukon River portion of the Koyukon language area (Nulato and Kaltag vicinity). Even if the Bering cisco does not turn into

the waters of the Koyukuk River proper, there should be a term for this fish in the Koyukon lexicon. For now, the extent to which the Bering cisco is distributed within the Koyukuk River drainage remains in question.

Because the various species of whitefish described above have similar patterns of seasonal movement, are frequently mixed together, and are harvested and used in generally the same way, respondents tended to talk about whitefish collectively. For the most part, the summary of information presented below takes the same approach and discusses whitefish in general terms. Where a respondent provided information that was specific to a particular species of whitefish, that distinction is made.

Distribution, Seasonal Movements and Spawning. Whitefish are present throughout the drainage from the Yukon River confluence to the headwaters. They occupy a wide variety of habitats seasonally and are reported as year round residents in certain lakes. The seasonal movement of whitefish in the Koyukuk drainage appears to be somewhat indistinct, with some fish occupying lake habitats, and others of the same species remaining in the Koyukuk River and adjacent sloughs. Similarly, in winter, some whitefish apparently over-winter in deep local lakes while others migrate out of the drainage to fresh or salt-water habitats farther down the Yukon River. Whitefish of the same species are said to sometimes do different things. With these complexities in mind, the seasonal round of whitefish in the Koyukuk River is outlined as follows.

According to respondents, whitefish are moving up the Koyukuk prior to and during spring break-up. During the swift, high water associated with spring run-off, whitefish move into side streams and sloughs to avoid the current and remain in these calmer waters until water levels begin to drop.

> "I usually fish for them [whitefish] in spring. After break-up they get out of the way of the swift water and go up into the creeks. Right after break-up. They stay in there maybe two weeks then they move back out when the water starts droppin'. They are really sensitive to water elevation. They know…. if water drop an inch…..they go out." [W050503, Koyukuk]

This sensitivity to water levels was mentioned by several respondents, who noted that whitefish, like pike, often utilize high water periods to access rich lake habitats for feeding during the spring and summer months. Insects, snails, and plants were all identified as food items for whitefish in lakes, providing a wider variety of food items for whitefish than the river. Those whitefish that spent their summers feeding in lakes were noted for being especially fat when they emerged in the fall.

> "Whenever water start to raise here on the Koyukuk River the whitefish, pike, all lake fish will go up stream. They go to headwater as long as there's lotta of water……in springtime, and all summer long whenever the water come up. And start to drop…. they all come out. A lot of times they all come out and then water start raise again and they go back. Back and forth. Back and forth." [G103101, Huslia]

> "These [whitefish] come out of the slough, certain time when it's high water. After high water, then they go back in its lake. Water drop and water raise and it go back to the lake…….it used to…..can't do that right now, too many beaver dams. It go back in the lakes to eat better food. I don't think they have anything much to eat in the river. Must be something good because we get them when they come back out and they are nothing but oil—Fat!" [J110101, Huslia]

According to respondents, a pulse of mostly broad whitefish and sheefish moves up the Koyukuk River in June approximately two weeks ahead of the king salmon. This June run of whitefish is sometimes referred to in the Koyukon language as "***betsy yedolggule***" which roughly translates to "its grandfather is pushing it along," a reference to being out in front of the king salmon. For lower Koyukuk River fishermen who have reasonable access to king salmon, this run of whitefish signals the imminent arrival of the salmon fishing season. These spring whitefish are said to arrive in very robust shape as well. One respondent recounted how he and another traveler once ran out of motor oil on a boat trip and used oil rendered from spring-caught broad whitefish to keep the engine running:

> "I remember one spring……1940s…..we used to get this broad whitefish, and a guy was coming out with a boat, and he ran out of motor oil so we stopped in the creek…..we ran for about 2 hours and any little creek he see he put in little fish net. And he catch about 10-12 in an hour with net. And he boil the fish up….put it all in one pot. And there'd be skim of oil about one inch deep….whitefish oil. Then he'd skim the oil into a can. Used that for motor oil." [W050503, Koyukuk]

According to respondents, a lake near Huslia used to have a year-round population of broad whitefish known for being particularly fat. The location of this lake was not identified and the implication was that whitefish no longer inhabited the lake in large numbers. Not all whitefish

occupy lake habitats during the summer. Comments from fishermen indicate that some whitefish remain in the Koyukuk and major sloughs during July and August.

> "All these, the whole thing, all the same, whitefish, holehge, tsaabaaye, [humpback and cisco] they all come up the same time. I would say in August they come up. That's when they catch lots of them like, end of July. These [broad whitefish] ones never move much in July, they stay someplace—I don't know where. But this holehge, and all these [humpback and ciscos] they're up here in July—all mixed up, and they fish them with hook. Good to eat too. We split them and dry them with salt—that's the best fish right there for me to eat. Dry fast, never spoil. If you dry them with salt they're good. Hook for them in the main river, catch lots of them sometimes. Use small nets too." [I110101, Huslia]

One respondent thought that whitefish moving in the Koyukuk River were attracted to "brown water areas" that are sometimes associated with the mouths of tributary streams. This was especially true for broad whitefish.

> "You know, this kind of fish [whitefish], they like them brown water areas, you know, brown water from, like, the creeks. They always seem to pile up in them brown water areas—like down there at Oldman [Kanuti River], 12 miles down, there's an eddy right where the Kanuti run out….below there is eddy, and one time we seine down there and got almost a boat-load of these (broad whitefish)." [B080901, Allakaket]

In the headwaters region, humpback whitefish are said to be year-round residents of the larger lakes in the Brooks Range foothills, and small whitefish, possibly least cisco or round whitefish, are summer residents of the swift Middle Fork near Wiseman.

> "This humpack is a very predominant one in the lakes. See those quite a bit. They live in the lakes, and then, in the river itself……you talk about the main stem of the Koyukuk here, um….I can't say for sure, it could be this round whitefish, or this [least cisco], one of these smaller ones is living in the river here. You can catch 'em with little hooks….I mean little tiny nymphs. I think they're feeding. They stay down low in the water column. They're a little hard to catch." [V062003, Wiseman]

In general, the round whitefish was described by respondents as a clear-water fish that was not often seen in the lower Koyukuk and more often encountered in smaller streams and headwater areas, similar to grayling. A small lake and creek system on the upper Alatna River (Help-me-Jack Creek) was identified as an area where round whitefish were known to concentrate.

In the fall, there appears to be a general movement of whitefish toward spawning areas. During late August and September, whitefish that have occupied lake habitats connected to the Koyukuk, move out of those lake systems down tributary streams to the main Koyukuk and join other whitefish moving towards spawning areas. Whitefish spawning is said to take place in late

September just as freeze-up approaches. Major spawning locations for whitefish were identified up the Alatna River and most respondents referred to these locations as the primary spawning areas for a variety of whitefish and sheefish. The comment above pertaining to "brown water" areas may identify a spawning concentration of broad whitefish near the mouth of the Kanuti River. Comments from several respondents indicate that other whitefish spawning areas may be located in the Koyukuk River near Hughes and above the Alatna River mouth.

> "Lot of them [broad whitefish] up the Alatna in certain eddies. They go up the Koyukuk too, but lots go up the Alatna—fall time—full of eggs."(B080901, Allakaket)

> "Whitefish around here are mostly going up the Alatna River in late summer. They keep going up river until they see slush ice in fall, then they turn around. They spawn fall time……September. After they turn around they are in the river spawning, you can see them float up-side down……float backwards and let go of their eggs. You can hear it……sheefish too, but sheefish are spawning later. Broad whitefish spawn late—when we catch them under the ice they are spawning. Up the Alatna is our place to catch them. Some go up the Koyukuk too." [C081001, Alatna]

> "They [whitefish] travel upstream in August and about middle September, maybe 20 September up headwater they head back downstream going to the ocean. They go up full of eggs and when they come back by here…already empty stomach [no eggs]. Whitefish, the ones I caught in late September they were all full of eggs and under the ice in October they were spawning. Right where I got my whitefish net…..little grayling pile up in that area to eat the eggs." [L013002, Hughes]

During fall movements to and from spawning areas, whitefish reportedly move mostly at night and rest in river eddies during the day.

> "Daytime in September they [whitefish] rest in the eddies behind bars. They travel upstream in nighttime where they gonna spawn. I know they come back down after they spawn but I don't know where they go. I hear they catch them in the Yukon River, March time." [T061603, Allakaket]

As freeze-up approaches, there is a physical change in the scales of some whitefish that makes them rough, almost prickly to the touch. Local fishermen refer to whitefish in this condition as having "put on their winter coat" and it is taken as a sign that winter weather is not far off.

> "Towards fall time its [whitefish] getting fat, you know, as soon as it getting cold, they start getting fat. They're getting ready for the winter. You know, we start scaling them…….our mother, she got smoke house and we're scaling the whitefish for her and ah….we can't even scale it in the fall time. Its ah…..we go like this to try to scale it and it can't even come off. And we don't know why, and we're just young kids growing, and our mother, we ask her, how come it's pretty had to scale it now? And she say…..it's getting ready for the winter….for cold weather, just like its putting on its warm coat." [X070503, Huslia]

Wintering areas for whitefish were usually described simply as “deep lakes” or “deep holes,” meaning main river locations. Some respondents indicated that at least some whitefish leave the Koyukuk River drainage after spawning and continue moving down the Yukon River to wintering areas elsewhere. Others reasoned that the early appearance of whitefish in the spring was an indication that their wintering areas could not be too far way, and that they probably over-wintered in deep local lakes.

> “They [whitefish] winter in a deep hole somewhere because……..there’s a lake up here we call Willow Lake, that’s a shallow water lake, and early this spring, right after breakup, me and her we went up there and we had fish net, we want to set fish net, trying to get some fish to eat, just the two of us, I don’t know why, we just traveling, traveling….we finally came to Willow Lake and there is high water everywhere, so we went up this kind of one stream……cripes! there was whitefish all over! Where they come from? There got to be a deep hole somewhere—couldn’t be too far.” [G103101, Huslia]

Whitefish reportedly become very inactive during the winter months and were described by several respondents as “resting” during the four-month period December to March. Because they are inactive and do not eat, the meat of whitefish in the winter reportedly becomes watery and poor.

> “I think they [whitefish] find a deep place to spend the winter. I know grandma used to say late March they start moving again. Late December into March grandma used to say it’s no use to have net for it, ‘cause when they don’t travel there is no taste to it……meat is just watery. Summer, into August they are rich.” [L013002, Hughes]

Based on the observation that spring-caught whitefish frequently have rocks or pebbles in their stomach, one respondent was of the opinion that whitefish weight themselves down in the winter by eating gravel and sand, making it easier to remain motionless on the lake bottom all winter.

> “In springtime they’re (whitefish) full of rocks. ‘Cause in February they sleep and they stay on the bottom……there’s a deep place, that’s where the fish go in fall time. Then in spring time…..I don’t know where they come from, you get them out in spring camp. But that place was deep and that’s where the fish spend the winter. And they fill themselves up with rocks first and sink to the bottom and they stay there until the ice goes. That’s why they are full of rocks in springtime when we get them. All the insides is rocks. That’s how they survive I think.” [R051203, Evansville]

With the arrival of spring, whitefish become active again and utilize the high water frequently associated with break-up and spring run-off to exit their wintering areas and begin moving to various summer feeding habitats, bringing the seasonal movement of whitefish full-circle.

Plate 20. Large and small whitefish taken by seine net on the Alatna River. Broad whitefish (bottom), humpback whitefish (second from bottom), and three least cisco (top). Photo by Dave Andersen.

Several people expressed concerns about the overall health of local whitefish populations. One active fisherman spoke about a general decline in both the number and quality of whitefish harvested today relative to years past, and cited specific habitat changes that he thought had adversely affected whitefish.

> "The population is going down on all these fish population, because….ah, the oil in the fish is depleting….they're not as fat as they use to be. Like for whitefish, right now you don't see any oil, I think it's on account of its habitat, change of habitat in the lakes and steams. I know with whitefish, the population is way down, 'cause in the fall time we used to catch over 200 a day in one whitefish net. Lot of change in the fish from sixty years ago. They're not as much nutrition as they used to be. Catch any fish, anytime of the year they were fat……all the time. But now, you catch fish and it's just poor. They're not oily as they used to be. Sixty years ago there was more weeds in the bottom of the creeks and lakes than there is now. There's not that much weeds…….what they use to feed on. Used to be bugs….lot more bugs……used to be if you're trapping beaver you'd see lot more beetle bugs. Now you don't see 'em. You see very few of them. Like, I trap this winter…..there was a few of them that come out in certain lake. But that's why the fish were more rich, more oil in it, had more flavor." [W050503, Koyukuk]

In addition to the lack of weeds and insects mentioned in the above excerpt, this respondent thought warmer winters and melting permafrost in recent decades had increased silt levels in local streams and increased water temperatures, which had negative impacts on all fish, but particularly whitefish. Another respondent from Huslia remarked about a similar decline in the quality of whitefish and blamed this decline on an earthquake that occurred in the 1950s.

> "Right now fish is different, they bring fish in, frozen…….just nothing but ice…….no grease at all……poor……just nothing but ice, no fat. Long time ago we never see it like that. It's bad since earthquake (in the 1950s). We had a bad one here. Everything start going down after that, beaver, muskrat, everything." [J110101, Huslia]

The tendency of whitefish to take advantage of periods of high water to access lake systems that might not otherwise be accessible makes them susceptible to occasionally becoming trapped in lakes too shallow to survive in. Large die-offs of whitefish can occur when this happens, as several fishermen reported having observed.

> "When there is flood and the lakes fill up and they [whitefish] get into the lakes and then the water drop, they get stuck in the lakes. And sometimes when the water drops there will be a lot of seagulls in the lakes, where it is like grass lakes, and then while it is drying up the fish get stuck in there and they die or seagulls and stuff feed on them. Whitefish and pikes is real sensitive to oxygen. They land in some lakes where there is no oxygen they'll die off." [W050503, Koyukuk]

No particular diseases or parasites were mentioned as being especially prevalent in whitefish. The occasional occurrence of hermaphroditic whitefish was reported by one elder who noted that unusual observations such as this were taken as a sign of bad luck for the fisherman and his family.

> "Sometimes you see a whitefish that are cross gender, you know….eggs on one side, male on the other, and they say that's a bad sign, bad luck for that family." [WW050503, Koyukuk]

Harvest and Use. Whitefish have long been a major subsistence food resource for people inhabiting the Koyukuk River drainage. The seasonal movements of whitefish described above have been carefully observed by local fishermen for millennia, and local knowledge of how and when whitefish move through local streams, sloughs, and lake systems made them vulnerable to harvest at specific locations at certain times of the year, using a variety of methods.

Gillnets are often set near the mouths of sloughs and tributary streams right after spring breakup to take advantage of fish moving into and out of side streams. Throughout the summer whitefish might also be caught in nets set for salmon. Gillnets are also used to target whitefish again in the fall as fish are moving out of lake systems through smaller streams toward the Koyukuk River. Because the different species of whitefish vary significantly in size, fishermen use gillnets of various lengths and mesh-sizes, often placing multiple nets out at the same time in different locations to maximize their harvest of whitefish.

> "Fall time…… September, I set out a bunch of nets. Longest net I got is hundred foot. Some are eighty, couple sixty's. Last fall I had 7 nets out ….for whitefish, that's 5 and 5/8 inch mesh. Ciscoes are mainly caught with seining net. I don't go seining anymore. We have special 4 inch mesh net for these ones [ciscoes] back in sloughs…high water. High water they get back in dead end slough to get out of current." [L013002, Hughes]

Fishers report that there is a difference in the taste of whitefish that have spent the summer feeding in lakes compared to those that remain predominantly in the rivers.

> "Any of these fish that live in lakes [whitefish] we call them lake fish….and they have a grassy taste to them." [WW050503, Koyukuk]

Fall whitefish are reported to be in prime condition—fat and full of eggs. Spring and summer-caught whitefish often are dried, while fall-caught fish are commonly frozen whole.

> "We get lot of them [whitefish] just after break-up in springtime and then in middle of August. After the dog salmon are declining we start catching them and catch them 'till freeze-up. Set net for them after freeze-up too. Best place is a place called Sinyalik. We catch this one [broad whitefish] in our salmon nets sometimes. Cut them and dry them……make half-dry or freeze them whole. "[B080901, Allakaket]

> "People cut and dry them [whitefish] just like salmon. Even the little ones—Oh! The little ones are good when they are dry." [J110101, Huslia]

Large funnel traps or basket traps made from split spruce were formerly used to harvest whitefish at key locations as they exited lake systems and tributary streams in the fall. The use of traps was discussed in a previous report section describing gear types (pages 17-20) but is briefly reviewed again here because information offered by respondents on fish traps was most often given in the context of describing harvest methods for whitefish.

Fish traps were strategically placed in relatively shallow side-streams and incorporated the use of fences or weirs to direct fish into the traps. Processing sites were typically located at or near fish

trap locations. Fish traps of this type have not been used for perhaps a half century but several respondents remembered and described the process:

> "This one [least cisco]….there's lots around. Good! These ones is fat! We used to get them small ones…..so fat! Back in Lake Creek we get 'em in fish trap…..in September. So we just put them away in little log house for winter. We use them for dogs. We eat it frozen too. Lake Creek…..that's where we use to put fish trap long time ago. My dad used to make 'em out of spruce tree—you get it (the trap) about maybe ten foot long—ten or twelve, and get about that big around [2 or 3 feet] and put funnel on the front—they go through this funnel and get inside. You could open it on the back—they make somethin' out of gunny sack and put it over on the back, and they take them back to the shore and open it back there, pick up the fish from in there. You get to where there is shallow water, like Lake Creek, and you get your posts down in there and put your fish trap right there. To check it you walk in the water way up there, hit water with willow, chase all the fish in there. Them old timers, they don't use gumboots, no gumboots that time. They use little shoes….maybe no shoes. They go in water, late September, cold, ice water….cold! The go in the water and walk down, …..about that deep water. They get down there, get all the fish and they walk back. Some make fire back there. They go back there and warm up….change their clothes and warm up. Tough guys." [A080901, Allakaket]

The Lake Creek site mentioned above was described by several respondents as the site of a traditional settlement prior to contact. After the establishment of the contemporary community of Allakaket in the early twentieth century, Lake Creek remained a popular location for spring camps and fall fishing activities. Fishing activities there primarily targeted whitefish, and often involved the use of fish traps. Lake Creek was an important site but other similar sites were located throughout the Koyukuk region. Information offered by other respondents provide additional information on the construction and use of traps, the variety of fish harvested, processing methods, and the division of labor between the sexes at these important multi-generational family fish camps.

> "My parents used to make big fish trap in fish camp up at Oldman River. Big trap with fence. We help them. They told us to help them 'cause we had lot of work to do. This was years ago. Papa take us back to Oldman River in canoe. Go back there and make fish trap. Then we help cut up the fish. Every summer we go to fish camp every year. My old grandma….my momma's mom, live with us then, she live to be 113 years old. She help keep the fire going for the camp for us. I remember, twelve o'clock he [Papa] come back with really good whitefish—really rich ones—small whitefish, and we start cut fish. We cut it all while he was sleeping. He sleep in daytime after getting that fish." [KK013002, Hughes]

> "About this month [August] they used to make a fish trap for all these fish coming down. Used to do it back in Lake Creek [up Kanuti River]. Catch all kind of fish….except no dog salmon though……whitefish, pike. You know, I was the last one to make that fish trap….nineteen…..nineteen forties maybe. There was no law you know. That's our life. When there is no fish on the [main] river, you know, that's where people used to go in summer time. Lotta times it was like that. They go back to this place. They make fish

> trap, you know, and a fence…poles standing like this. And that's how people make a livin'. Good fish too! Rich! Good eating! The fence went down, and then fish trap tunnel, you know, tunnel trap like that. We use spruce and tree roots to tie it. I work on that too, because half of it break and I copied how they did that. Last a long time as long as you hang it up under a tree. Big tall tree. Put it right next to it. Stand it up so snow wouldn't spoil it or anything. They tie them around to that tree, you know. I think they could last four or five years. More than that maybe. And they put something under so it wouldn't stay on the ground. It's [the trap] about ten feet long maybe, and this big around [two or three feet]. Not that heavy…..they got long pole under it. Sits on bottom of creek and water just about at top. Not that wide creek too in summer time, you know. But when leaves started coming down it just plug up so it wash under. Lots of work when the leaves start coming down. Every evening we take turn and watch it, clean it out. Fall time…..they start around this month [August]. We get up there around first of August one time….too early….couldn't do nothing. They [the fish] never come out yet. Mostly we go after little whitefish….tsaabaaye…..but whatever goes in there, we dry it, and put smoke under….winter time we eat it. Boy it's good! If there is salmon in the Koyukuk we don't go back there. But when there's no salmon in the Koyukuk River….around here, you know…..downriver its different I guess, but up here, far as I know, it was nothing….good enough to feed dogs all summer long. We had to do everything we could to make a living, you know." [F080901, Allakaket]

While fish traps tended to target fish exiting small streams headed for the spawning grounds, seine nets evolved as the primary method for taking whitefish once they reached the spawning grounds. Unlike fish traps, seine nets are still used today, and seining probably accounts for the harvest of more whitefish than any other gear type. In late summer and fall, small-mesh seine nets are used to harvest spawning concentrations of whitefish in the upper reaches of the Koyukuk and Alatna Rivers. The use of seine nets and the river conditions that restrict their use to the upper river were described in a previous report section on gear types (pages 28-30). Because this activity is primarily targeting whitefish, it is described in more detail here.

The large concentrations of spawning whitefish and sheefish found in the upper Koyukuk and Alatna rivers in September and October are especially vulnerable to harvest as they rest in shallow eddies. Small-mesh seine nets 150 to 300 feet in length are used to encircle schools of fish congregated in these eddies and pull them shore. A team of three or more fishers is typically needed for seining operations. Nets are deployed from small boats with team members positioned on shore holding one end of the net and following on foot as the net "sweeps" the eddy or bar. The sweep is completed when the boat reaches the bank and the net is pulled ashore by team members on both ends, bringing entrapped fish onto the gravel bar or shallows where they can be retrieved. Several respondents provided good descriptions of the seining process

Plate 21. Allakaket fisherman Pollock Simon prepares to set a seine net on the upper Alatna River, October 2003. Photo by Dave Andersen.

and the large harvests that could result.

> "Then fall time you can seine on the bar. You can get three or four boatloads if you hit it the right time. Enough for all winter for dogs. Couple people walking on the bar with the ropes and the boat floats down, floating down, floating down, and then you start heading to shore. Three people can do it if you are short of people. We use maybe three hundred foot net. Favorite place is on the bars where there is no snag. Seine net catch everything that there is in the river….we use it!.....have to! You use quite a bit of fish when you have dogs." [K013002, Hughes]

> "We need three people to one seining net. It could be more if there's whole bunch of us, but three people to do the seining. One hold the line back in the shore because…..this would be the river bend [sketching]…..when we're seining we have to drop off one guy here with the rope. And there is the current and this place is dead water here behind the bar. We go out to the current with the seining net and we throw the net in the water right here…..200 feet long….and we land with long rope again. Tie the boat here and we start pulling both line. Pull them back to the shore and the net is just way out like this….and when there is lots of fish in there, way out from shore you can hear knocking sound….and seining net get tight. They all hit the net at one time you know. We seine in daytime when the fish are resting. They travel at night." [T061603, Allakaket]

The abundant late-fall harvest of whitefish and sheefish produced by seining activities on the Alatna River, lead to the development of a unique technique for storing and preserving the fish.

Near major seining locations, fishing families built log storage cribs on the river bank to hold harvested fish. These storage cribs are known by the Eskimo term "***suluun***," the Inupiaq word for "box." This tradition was apparently brought to the Koyukuk by Eskimos from the Kobuk River.

> "We get a boatload [of whitefish] sometime, over a boat load. Twenty-eight foot long boat we had one time, me and my wife, and it was five feet wide in bottom and the side was pretty high. And we seine one time and we load it down to six inch freeboard. Sheefish, broad whitefish, humpback, tsaabaaya [ciscoes], all mix. We grab them one at a time and throw them back on shore. They flopping for a little time and then they're dead. We string them out on willow, make one pack out of it. Ten or twelve little ones [cisco] on a willow and on these [large whitefish] two at a time. They make a little box out of logs. If you go up Alatna River you could see them still there. They call that "suluun'….that's Eskimo word for it. We never did have that down around our area. It's only up Alatna I know that they put fish in suluun. " [T061603, Allakaket]

Fish held in a suluun would slowly freeze with the onset of cold temperatures, sometimes aging or "souring" slightly in the process, and would provide food for people and dogs all winter long. According to respondents, a family-owned suluun would often be located near winter trapping or hunting areas and would function as a food cache to support these winter activities. A huge savings in transportation was achieved through the use of a suluun, as it reduced the need to haul boat-loads of fresh-caught fish long distances to communities in the fall, and back to winter trapping locations with the onset of winter.

> "All these fish in here (whitefish)…..you have to get them in fall time, seining. They put those fish away fall time. They make them little…….put logs or whatever…..put all the fish there and freeze it. "Suluun" the Eskimos call it……suluun. You put 'em away in fall time. You put willows down….don't put just any willows, but those red willows only……that's the best willows. You could even put that in your cache and put all your dry fish in there…good willows. Just like building a log house. Just willows on the bottom, then fish. You gotta lay them certain way. You string them while they seine, ten fish to a willow. Then tie the tips together and that's one willow. Then you lay them certain way so when they freeze it they can just chop on it and it comes right out. They go there with dog team and get fish. And if someone gonna trap in a certain place they seine there and store fish. Trapping season start, they got their food right there." [R051203, Evansville]

Suluuns were typically constructed of logs and were approximately four or five feet wide, six or eight feet long, and two feet high. Heavy logs and stones were placed on the top to avoid entry by animals. The bottom of the suluun was lined with willows to keep fish off the ground.

> "My Dad had a big suluun. It must have been about five feet wide and maybe eight feet long. Made from spruce logs so it last long time. It doesn't have a floor. And fall time you clean it out….take all the old willows out and put new ones. The logs are notched, that's why I say like Lincoln log house, about two feet high. Fill it with fish and put poles across

top with big logs and rocks. We have this suluun and we seine above and below and we got camp right by the suluun." [U061703, Alatna]

There was an organized system associated with filling the suluun. Fish were strung on tied willow loops that functioned as handles and allowed them to be easily carried from the boat or seining location to the suluun. For making fish stringers, a special kind of willow was utilized that became limber when cut and could be tied in a knot. There were conventions regarding how many large or small whitefish would be placed on each willow stringer and how fish should be laid in the suluun to allow for easy removal once they were frozen.

"You put willows in the bottom of suluun and you lay the fish in with the heads all one way. And it age in there…not rot, but it age. We put the willow down to keep it clean. And then after you put all the fish one way, then you put poles on top and put weight on it so the animals don't get in. You have to get certain kind of willow to string them [the fish]. Skinny dark color…..dark brown, and if you leave them over night they don't break. You get them from kind of high on the bank or hillside with pocket knife. Get a whole bunch. And the longer you keep it the limberer it get. When you just cut it right now, sometime it break. And you need to tie the willow right way too, to make a handle. 2 sheefish per willow, 15 whitefish per willow. We string them real fast and tie it just right so it can't slip and I would be doing that and then just throw it in the shallow river to keep. And after we string about maybe 30 willows, then we would line the boat with willow leaves and grab the fish with willow and wash it like this [hand motion] and start putting it in the boat." [U061703, Alatna]

"They put it [whitefish] in the suluun, you know, they lay it one way…..one way to the end and another layer on top they lay different way again. One way, all one way. You just throw them all mixed you gonna have somethin' to take off. I never learn that since I was small. So first time I make suluun up there, they never watch me, you know, those people I work with. My suluun is away from them a little ways. Pack my fish up real fast, just throw them in just like that, you know. They never watch me, I cover it back up. And here they were working and I'm all ready to go and they just hanging around the suluun for long time. They workin' inside you know. Finally leave….okay, when we come back with dog team after freeze-up I open my suluun and…..fish are all mix up….just like that—frozen solid! I see them with little ax at their suluun. These other guys go like this little bit [one little chop] and get whole big pile….leave……and here I'm hanging there for another four or five hours and get little pieces that long….[laughs]." [T061603, Allakaket]

Within the Koyukuk drainage, the Alatna River appears to be the only location where this organized network of family-owned suluuns was utilized. This unique and efficient storage and preservation system evolved in response to circumstances not found elsewhere in the drainage—the large harvests of whitefish and sheefish associated with fall seining operations on the spawning grounds. The advent of the snowmobile in the 1960s reduced the demand for dog food and allowed winter trips to be more centrally based out of village locations.

Plate 22. Allakaket fishermen use a seine net to harvest spawning whitefish on the Alatna River, October 2003. Photos by Dave Andersen

The decaying remnants of 40-year old suluuns can still be found along the banks of the Alatna River. Today, the late-fall harvests of whitefish and sheefish produced by a three or four day seining trip to the spawning grounds are typically transported back to home communities by boat and stored whole in family smokehouses where they are allowed to freeze naturally, much as they would have in a traditional suluun.

Gillnets are also used in main river locations to take whitefish making their fall exit from the spawning grounds to wintering areas. During freeze-up in October, gillnets placed in eddies can be productive for whitefish, and fishing for them sometimes continues under the ice into November. This late fall period was also described as the best time to harvest humpback whitefish that reside year round in some large lakes in headwaters region. Bob Johnson Lake, known locally as "Big Lake" reportedly has a large resident population of humpback whitefish that were formerly taken by Eskimo inhabitants using gillnets set under the ice. According to a Wiseman resident who had heard stories from Eskimo elders residing in the Koyukuk headwaters region, prime fishing areas for lake whitefish were said to be at lake trout spawning areas where whitefish would congregate to feed on lake trout eggs.

> "The main way they caught those [humpback] was drilling holes through the ice, and they come around the lake trout spawning areas. There's lots of spawn and what not and they hang around. So there's an area in Big Lake that [name] cut holes and sent a line under the ice and she would set a net. She told me just before she died, one time she went there and she cut the line loose and went to pull it up and it was real heavy. And she hooked her dog team on it and it wouldn't come up. And she thought it was stuck…frozen to the ice. She chopped all the ice away and looked through the hole…..but the line was going straight down, and it was something real big and white down there…scared her. So then she got a better bite on it and got her dog team and she pulled it up and the net had sunk with whitefish. It was loaded with whitefish. This was in late October and early November. The trouts are spawning in September and so these whitefish come around there getting those eggs in that area. It's an area where they [lake trout] spawn." [V062003, Wiseman]

In addition to gillnets, seine nets, and traps, a few other methods of taking whitefish were mentioned by respondents. These included the use of dipnets and rod and reel.

> "After all the ice go out we get these (whitefish), a whole bunch of them. You can stand on shore and get them with dip net. They use hook some times too. Fall time, the kids make their own hook out of nail or wire. They put bait on it….pike eggs or liver." [P050603, Koyukuk]

The construction and use of traditional hoop or dipnets was described in a previous report section on gear types (page 30-31). Dipnets were largely abandoned with the availability of commercially manufactured gillnets and are seldom used today. The harvest of whitefish using hook and line methods was mentioned as more of a novelty or occasional practice and probably does not represent a major method of catching whitefish today in any of the Koyukuk River communities.

Only a few respondents offered comments pertaining to the harvest and use of round whitefish. The round whitefish is uncommon in many parts of the drainage and its slender size allows it to avoid being caught in all but the smallest mesh-size nets. Many respondents were unfamiliar with the fish and few knew the Native term for it. Those that knew of the fish noted that it was not abundant and preferred headwater habitats similar to the arctic grayling. Round whitefish are most often taken incidentally in conjunction with seining activities and only in small numbers. Two respondents indicated that round whitefish had the reputation of always being "rich" despite its slender size. One respondent made reference to this fish being reserved for elders and indicated that young people were prohibited from eating it. The round whitefish was reported to have an odd "tinny" taste and was apparently used mostly to feed dogs, even in former times, unless food was very scarce.

> "This one [round whitefish] is quptik. We don't eat it. I don't know why. They say it taste funny. They use it for dogs sometime, but we don't get too many down around Alatna." [R051203, Evansville]

Miscellaneous Information. For being such a major subsistence resource, there seemed to be remarkably few traditional stories or taboos that focused on whitefish. A few brief comments received about whitefish fell into the category of local or traditional belief systems, and are included here. Some local residents believe that certain weather or natural events, specifically floods and severe winters, can be predicted by conditions found in some whitefish.

> "Whitefish sometimes have fluid, like a bag of fluid in the stomach….. and they say that mean it gonna flood. And then sometimes whitefish caught under the ice will have spots on their nose. And they say that means its going to be cold weather….they use it for predictor for cold winter." [W050503, Koyukuk]

Miscellaneous Other Fish

In addition to the major non-salmon species discussed above, several other species of fish were mentioned over the course of discussions with respondents. Interviews typically wrapped-up with the question, "Are there any other kinds of fish in this area that we have not discussed?" Some respondents mentioned incidental species that might be considered oddities or only occasionally seen. Others had more detailed information about the life history and use of uncommon or incidental species. Positive identification of these species was sometimes difficult because pictures of these fish were not part of the interview materials. The information offered on incidental species is as follows:

Arctic Lamprey (Dots'e tl'egheze or Dots'e tl'ooł). The two Koyukon language terms for the arctic lamprey *(Lampetra japonica)* translate to "down-river loche" and "down-river rope." Arctic lampreys, locally known as "eels," are not generally found in the Koyukuk River. A few respondents reported sighting an occasional eel in the Koyukuk, or in the stomach of fish caught in the Koyukuk, but this was considered rare. There was a general awareness that eels were harvested and used in other parts of the Yukon River drainage. Several thought that eels were restricted to the Lower Yukon near Anvik and Holy Cross. Others had heard of eels being harvested in the vicinity of Tanana and Stevens Village. A few elders with relatives or past ties to the Holy Cross area had tasted eels and knew first-hand how rich with oil they were. Comments pertaining to eels include the following:

> "At Holy Cross….November…..through the ice down there, they make a hole under the ice and then they use dip net. Go around….and that's mostly for dog food. They're awful rich. Nothing but grease. They go as far as Anvik, as far as I know and then they go back down." [N050503, Koyukuk]

> "I only seen it [lamprey] once back in the 40s. They don't migrate this far. They sometimes migrate to unusual places and are seen but people don't fish for them." [W050503, Koyukuk]

> "To tell you the truth I don't think I've ever seen an eel. I've never seen one but they say it is full of fat, full of oil. Chief Henry…..early 1900s came to Yukon from Koyukuk River, wintering near Stevens Village, close to Ray River……he said people put in fish trap in the winter, catch lots of fish, lots of loche, and then he said they pull out the trap and there is like rope thing in there whipping around. And he got scared of it. And he said they call it dok'etl' egheze [downriver loche] and that was eel." [WW050503, Koyukuk]

Dolly Varden (Seł yee lookk'e). Two respondents mentioned the presence of Dolly Varden (*Salvelinus malma*) in the Koyukuk River drainage. The Koyukon language name for the Dolly Varden was not provided by respondents but is listed in Jetté and Jones (2000) as ***seł yee lookk'e*** which translates to "in the mountains fish." As this name implies, they apparently prefer swift, clear headwater areas of several tributary streams. One respondent described them as being "Way up the Kateel and Hog [Hogatza] rivers." Fishers in Koyukuk reported that small numbers of Dolly Varden are also occasionally caught in Yukon River fishwheels targeting salmon. According to one Wiseman resident, Dollys of small size, known locally as "golden fins," are year round residents of the Koyukuk's Middle Fork, occupying swift tributary streams in the summer, wintering in deep holes with arctic grayling, and spawning in the Dietrich River.

> "Another fish we have here [Wiseman area] is these tiny little dolly vardens. And they winter in the deep holes of the river too….with the grayling. And they go up these side creeks and they like to stay right under water falls where the water is boiling down. They stay right there under those….around those water falls. And they only get about ten inches long. Some people call them golden fins….just little tiny dolly varden. They stay….they live here. They spawn up near the Dietrich River…..get real red bellies. And I've caught them out of the holes in winter time fishing through the ice, like in March and Aprils. They're real good eating." [V062003, Wiseman]

Lake Chub (Tokkodoodze). A small shiny fish referred to as "lake herring" was reported to reside year round in Bob Johnson Lake in the Brooks Range foothills. The fish was described as approximately six inches long with a prominent eye. No pictures were available during the interview to positively identify this fish, but from the description provided it has been tentatively identified as a lake chub (*Couesius plumbeus*). Jetté and Jones (2000) provide the Koyukon name for this "small pearly whitefish" as ***tokkodoodze***. This fish apparently occurs in large enough numbers to have been targeted for by harvest by Inupiat Eskimos that traditionally occupied this portion of the Koyukuk River headwaters. The Inupiaq term for this fish was not collected.

> "Bob Johnson Lake's got a fish that the ah…..I've seen a few of them, I've never fished for 'em but the old times call them lake herrings. They're a little fish about six inches long. They got a great big eye. I don't know if they're a kind of whitefish or what. I've seen where loons have killed 'em and they've floated up on the beach. They live real deep in the lake. I've heard that they go out of the lake in the spring. You see, in the springtime, those things spawn in the creeks that run out of the lakes. I never have seen it, but I've heard about them catching them with a funnel trap at those outlets. They knew about those, they tried to catch those." [V062003, Wiseman]

Lake Trout (Tl'uh laaghe). Lake trout (*Salvelinus namaycush*), which reach large size and occupy many Brooks Range area lakes, were utilized for subsistence purposes historically. A few Alatna and Evansville elders with historic ties to the Alatna River region spoke of occasionally harvesting lake trout in Iniakuk Lake in the upper Alatna River vicinity. While the Koyukon language has a term for lake trout; "***tl'uh laaghe***," that portion of the Koyukuk River drainage where lake trout are common, is defined by the southern slopes of the Brooks Range, and was traditionally occupied by bands of inland Eskimos. The Inupiaq term for lake trout was given as "***qalukpik***."

According to Wiseman residents, lake trout occasionally make "forays" out of lake habitats and are sometimes caught in the middle fork of the Koyukuk River on baited hooks set for burbot. These solitary trout were described as skinny. For the most part, lake trout are confined to the larger area lakes where they are a major predator of smaller fish and adhere to seasonal movement patterns within those lakes. One respondent was able to provide significant detail on the spawning, feeding habits, and seasonal movements of lake trout in Brooks Range lakes:

> "We've caught them in the [Koyukuk] river on set lines here, but they are usually real skinny, and it's very unusual. They primarily live in lakes. I think there's some that make forays out and that's how the got to that lake some time, you know. And they're on the bigger lakes like Big Lake [Bob Johnson Lake], Twin Lakes, Wild Lake, Chandalar Lake on the Chandalar side….and all the biggest lakes. And then on the north side, on the arctic slope, there's ah…….Toolik and Galbraith and all those big lakes on that side have those lake trout. Those spawn from the first of September to the end of September. There's certain rocky places, like in every lake that has a spawning area there's a big rocky drop off with rocks like bowling balls and ah….very coarse gravel. And they spawn in that drop off place. That's a real good place to fish in fall time. You'll practically see every fish in the lake at that time. There's big balls of 'em. In the evening they'll be in big balls….and you'll see just trout….ten, fifteen feet of water and you'll see all these fish just swim. Hundreds, like 250 fish all swimming around. Big females, and males chasin' 'em around. Real neat. They're a beautiful fish. And then …….so they spawn and then they go to the inlet and outlet and those grayling are still coming in. And they get done spawning and they zip up there and start to catch those. So old [name] used to go up to the inlet of Chandalar and he'd catch those great big trouts. Late in September, the lake is freezing, the river is running ice and these graylings are coming way up and moving into the lake. And these trout and just stacked up there hangin' around where the river pours in and starts to drop into the lake. They actually move up into the river itself a little ways. And they're just chomping away on these grayling and whitefish and stuff. That's their last big feeding frenzy before they go deep. They go dormant…..get real sluggish. They don't really get active again until around the first of May. You can catch 'em, but you have to do a lot of jigging, like in March and April….you can catch 'em if you jig for a long time. [V062003 Wiseman]

As the above excerpt implies, lake trout were commonly harvested for subsistence purposes by jigging or hooking through holes in the ice. Lake trout lures approximately three inches long were traditionally crafted from bone or horn. The authors were shown examples of lake trout lures made by area Inupiat Eskimos in the 1920s from sheep horn and nails that incorporated intricate inlaid designs to mimic eyes and side markings of a juvenile fish (see photo below).

Hooking for lake trout was most productive in late April and May when lake trout first emerge from their winter dormancy and began eating again. Lake ice in these high-latitude lakes is at its seasonal maximum during this time, and local inhabitants adopted an ingeniously simple method of creating fishing holes. According to the respondent, Eskimos passing by these lakes on their way to hunt caribou early in the spring would place large, dark-colored rocks on the lake surface at prime fishing locations. Over a period of weeks, while they hunted caribou, heat from the sun would slowly melt the rocks through the surface of the ice, providing them with fishing holes when they returned in May.

> "Late April, early May you cut a hole or melt…….the old times used to melt a hole in the ice with the black rocks. They told me they put these black rocks on the ice, you know, first part of May they pick up all this sunlight and just go right through the ice. They just lay those rocks on there where they want to fish, they lay them out when they are caribou hunting and after the rocks went through they start fishing. [V062003 Wiseman]

Plate 23. Lake trout lure handmade by Eskimos using horn and nails, circa 1920s. Length of lure is approximately three inches. Photo by Dave Andersen.

Today, in addition to hooking through the ice, fishers sometimes use rod and reel gear to take lake trout in open water. One trapper reported using set-lines baited with wolf meat to catch lake trout in the spring. From descriptions, lake trout average approximately two to 10 pounds in weight, but large lake trout can reportedly reach 15 to 30 pounds

> "We use set let lines for 'em too……lake trout have a big nostril, they have an excellent sense of smell and they don't have much problem finding……like I use wolf meat for bait. And when I fish set lines I just throw it down to the bottom. The biggest one I've ever caught was 15 pounds but my dad caught a 22 pounder at Chandalar [Lake]….springtime. And I've heard about 30 pounders caught in Wild Lake. Ordinarily those big ones don't bite. I've seen those….I've seen real big ones in those spawning areas…..big females…. but they won't take a lure." (V062003, Wiseman)

Slimy Scuplin (Netsoo tlee'). A fish that was only briefly mentioned as being present in the Koyukuk River, and sometimes shows up in the stomachs of predator fish, is the small slimy sculpin (*Cottus cognatus*). There was no reported subsistence use of the sculpin. Its wonderfully descriptive Koyukon language name "**netsoo tlee'**" translates to "your Grandmother's head."

Unidentified "Mountain Trout". A small fish referred to as a "mountain trout" was described by one respondent. This fish reportedly occurs in the headwaters of the Hogatza River where it narrows to a four-foot wide gravel stream. The individual describing this fish was familiar with both arctic grayling and Dolly Varden and insisted this fish was distinctly different from either of these species. This six to ten inch fish was described as "similar to grayling in color but without the big fin……almost like Dolly Varden, but different." Multiple mid-summer (July) observations of this fish were made during work connected with a mining operation. A positive identification of this fish could not be made from the description provided.

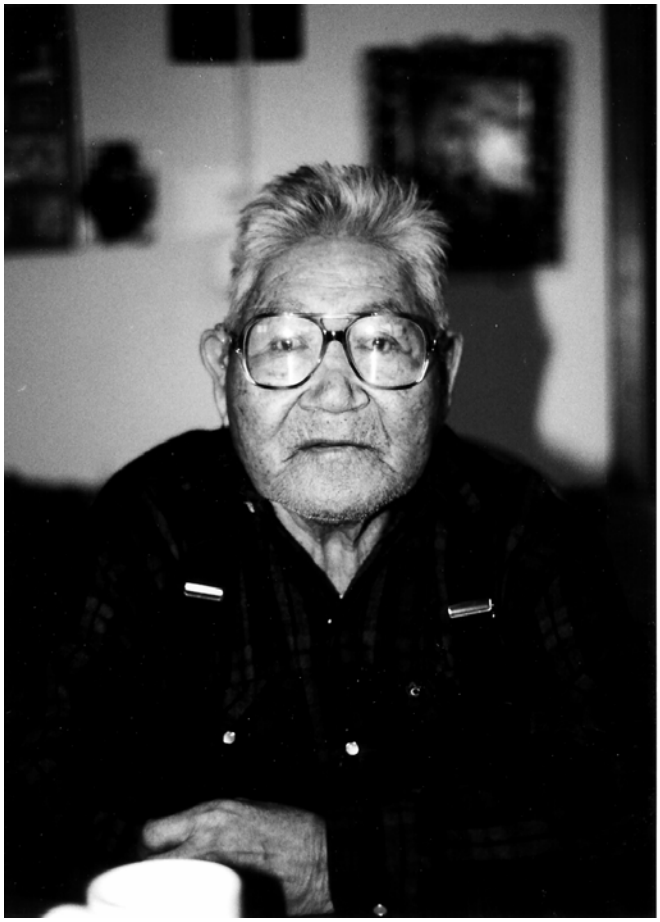


Plate 24. Joe Beetus, born in 1915, spoke from his home in Hughes about a lifetime of fishing in the Koyukuk River. Photo by Dave Andersen.

RESULTS OF THE 2002 HARVEST SURVEY

While the TEK portion of this narrative presents findings by species, bringing together a rich drainage-wide body of local knowledge pertaining to each fish, harvest survey data are presented below by community. This is how the data were collected, and given the nature of sharing and distribution networks within communities that is characteristic of subsistence economies, this approach makes sense. Generally speaking, the harvest and use patterns of the communities surveyed follows Wolfe's (1987) conclusions regarding the "super-household", or a specialized unit within subsistence economies. According to Wolfe, "Whereas many households may participate in subsistence activities and sharing networks in rural communities, a smaller subset

of households tend to be extremely productive in subsistence activities…it is not uncommon for about 30 percent of the households in a community to produce about 70 percent or more of the community's wild food harvest" (Wolfe 1987: 16-17).

While some sharing of resources occurs between communities and even beyond the set of communities surveyed, analyses of harvests by community provide a sound picture of community needs and practices. In the discussion of community harvests below, communities are listed in geographical sequence from the lower river to the upper river—Koyukuk to Bettles/Evansville. Tables 4-19 referenced in the text below appear as a block at the end of the text beginning on page 124.

Overview of Current State and Federal Fishing Regulations

In 1987 and again in 1993, the Alaska Board of Fisheries (BOF) made a positive customary and traditional use determination for non-salmon fish species by Koyukuk River residents including sheefish, whitefish, lamprey, burbot, sucker, grayling, pike, and char. Under state regulations, there are no bag limits or season restrictions for subsistence non-salmon fish harvests. Non-salmon fishing is generally open by regulation seven days per week, twenty-four hours a day, year round. These state regulations continue to apply to subsistence fisheries in the Koyukuk River drainage, unless superceded by federal regulations in the future. Federal management authority over subsistence uses is implemented under Title VIII of ANILCA. Under ANILCA, rural Alaskan residents have a priority in subsistence activities as federally qualified subsistence users. Prior to 1999, this authority was generally understood to extend only to the management of terrestrial wildlife on federal public lands. Since the ruling to extend federal management to navigable waters, federal managers work in conjunction with state managers to ensure that existing regulations adequately accommodate subsistence use.

With declining salmon runs in the Yukon and Koyukuk Rivers in the past few years, however, state managers proposed to restrict set net mesh size for non-salmon fish species during summers where inseason salmon restrictions are necessary in order to protect salmon moving up the Koyukuk River. While fishers from the Koyukuk River strongly opposed this move, the action

was approved by the BOF in January 2004. In general, though, there remain few restrictions on non-salmon fishing in this region. Under state regulations, fish other than salmon may be taken only by set gillnet, drift gillnet, beach seine, fish wheel, longline, fyke net, dip net, jigging gear, spear, a hook and line attached to a pole, handline, or lead. Until 2004, subsistence fishing was closed in the South Fork of the Koyukuk River system upstream from the mouth of the Jim River and in the Middle Fork of the Koyukuk upstream from the mouth of the North Fork.

Drainage-wide Harvest Overview

Table 4 provides a drainage-wide perspective on non-salmon harvests by species by community. Of the non-salmon species harvested in the communities of Koyukuk, Huslia, Hughes, Allakaket, Alatna, and Bettles/Evansville, whitefish stands out as the primary subsistence species as measured in pounds. This discussion of drainage-wide harvests focuses on pounds of fish, rather than numbers of fish, to highlight their contribution to subsistence diets. Smaller fish, while potentially harvested in large numbers, might contribute relatively few pounds of food to subsistence diets, constituting a smaller percentage of the overall subsistence resources utilized by a community or household (see Appendix E for conversion factors). Koyukuk River communities harvested an estimated total of 94,934 pounds of non-salmon fish species in 2002. Whitefish constituted 67% (63,209 lbs.) of this total, with 86% of the total whitefish pounds comprised of nearly equal contributions of broad and humpback whitefish species. Harvests of ciscoes, most reported as least cisco, contributed another 8,791 total pounds. Given the uncertainty surrounding the distribution of Bering cisco in the Koyukuk River, it is interesting that three communities -- Allakaket, Hughes, and Huslia -- reported harvesting Bering cisco. In Huslia more Bering cisco were reported harvested than least cisco. It is also noteworthy that the community of Koyukuk, which is closest to the Yukon mainstem where Bering cisco are thought to be more common, reported no harvest of either cisco species. These findings deepen the mystery surrounding the presence of Bering cisco in the Koyukuk River. While the cisco species can be difficult to tell apart, surveyed fishers had no difficulty reporting their whitefish harvests by species as demonstrated by the fact that no whitefish were included in the “unknown” category. The presence or absence of Bering cisco within the Koyukuk drainage will be examined in more detail in a TEK and biological study by D. Andersen (Research North) and R.

Brown (USFWS) scheduled for 2004 and 2005 and funded by the USFWS, Office of Subsistence Management (Project #04-269). For now, these data can only be presented as they were reported by surveyed households.

The larger non-salmon species, such as sheefish and pike, also constituted significant portions of the total subsistence harvest at 19% and 9% by pounds, respectively. Burbot and sucker accounted for 2.3% and less than 1% of the total harvested pounds, respectively. As one might expect, the reported harvest of grayling and lake trout increases as one moves up the river closer to the clear, fast-moving tributary streams and headwater areas. These are relatively minor species, however, accounting for only 2% and less than 1% of the total drainage harvest, respectively.

Non-Salmon Harvests by Residents of Koyukuk

Residents of Koyukuk harvested nine species of non-salmon fish during 2002, including hooligan, blackfish, burbot, grayling, pike, sheefish, sucker, and two species of whitefish-- broad and humpback whitefish (Table 5). Of these species, sheefish and whitefish (specifically broad whitefish) comprised the majority of the annual harvest in 2002. An estimated 384 sheefish and 1,047 whitefish were harvested by Koyukuk residents and both of these species figured prominently in subsistence use patterns for the community. For example, while 48% of Koyukuk households fished for and harvested sheefish, 16% of the harvesting households shared their fish with approximately 41% of households so that a total of 66% of the community's households used sheefish in 2002 (Table 5). The harvest of whitefish shows similar patterns. Forty one percent (41%) of households harvested whitefish. Approximately one-half of those households gave some portion of their catch to households in the community such that 64% of households in Koyukuk reported using whitefish. Pike, and to a lesser extent burbot, also contributed significantly to the annual harvest. An estimated total of 233 pike and 62 burbot were harvested by Koyukuk households. Both species were shared between households. Overall, Koyukuk fishers harvested an estimated 7,395 pounds of non-salmon species (approximately 71 pounds per person) and of that amount, 56% was whitefish and 31% was sheefish.

Although Koyukuk's annual harvest was less than that of other surveyed communities in the drainage, it is the only community that reported some harvest in every month during 2002. This is due largely to the effort directed at the harvest of pike, which is present year round and therefore can be caught in any month; this is clearly a significant species as a subsistence resource for Koyukuk River communities. Interestingly, pike harvests did increase slightly in the fall and spring during their seasonal migrations into and out of summer feeding and spawning habitats, as reported by TEK respondents.

Table 6 shows harvest estimates by species, by month for Koyukuk. Broadly speaking, residents appeared to take sheefish during a seven month period from May through November. This fits with TEK information describing an early run of sheefish on the lower Koyukuk that arrives just prior to break-up, and a more sustained run that coincides with summer salmon fishing and returns downstream following freeze-up.

Whitefish harvests in Koyukuk were concentrated in the fall months of August through November, with a small spring harvest in May and June. The most significant harvests of whitefish occurred in November, right after freeze-up in the late fall, when whitefish are considered prime. Some respondents commented that whitefish become inactive during the deep winter months, and as a result, their meat is not as good. Though much of the whitefish harvest is likely taken with gillnets set in eddies, some respondents commented that dipnets and rod and reel might also be used.

Grayling harvests occurred primarily in September and October, when they are moving out of their summer habitats of swift, clear-water tributary streams. Burbot were taken in the fall, primarily in October, with smaller harvests reported in September and November. Information collected from TEK respondents indicates that burbot in the Koyukuk vicinity are commonly caught using set-lines baited with blackfish. The harvest data support this general pattern, and the small harvest of blackfish reported in October and November is probably connected to the use of blackfish as burbot bait.

Koyukuk residents also reported harvesting eulachon, referred to locally as hooligan. The month of harvest was reported as "unknown". Hooligan are primarily a coastal fish so it is likely that an individual or household harvested eulachon near the coast and brought it to Koyukuk where it was distributed to others. It is also possible that these were random strays that made it further up the Yukon River drainage and harvested incidental to other fishing activities.

Non-Salmon Harvests by Residents of Huslia

Table 7 shows the estimated harvest and use of non-salmon species in Huslia in 2002. Residents of Huslia harvested an estimated total of 33,365 pounds of non-salmon fish. Approximately 64% of the harvest consisted of four whitefish species: humpback whitefish, broad whitefish, Bering cisco, and least cisco. The importance of whitefish in the total subsistence harvest of Huslia residents is documented by their use patterns: a total of 73% of households reported using whitefish. Approximately one-half of the community households harvested whitefish species, while 39% of households shared some portion of their catch with other households. This high level of harvest and sharing accounts for a per capita harvest of 85 pounds of whitefish per person per year.

Besides whitefish, residents of Huslia relied heavily on pike (5,501 lbs. harvested), sheefish (5,410 lbs. harvested), burbot (485 lbs. harvested) and grayling (274 lbs. harvested). Over one-half of the households reported using both pike and sheefish, while just under one-half reported using grayling and burbot (Table 7). Tracking harvests by month, Table 8 shows that Huslia residents fished throughout the year, with the exception of April and May. Whitefish were harvested in significant numbers between June and November. July accounted for the largest portion of that harvest (including all four species of whitefish) and the largest percentage of households participating in the fishery. Whitefish harvests in October, November, and the small harvest in December are most likely the result of under-the-ice fishing with gill nets. Around Huslia, where respondents observed whitefish emerging in the fall from summer feeding in lakes, whitefish are reported to be fat in the fall. Pike harvests were remarkably stable throughout most of the year, and pike was the only species reported in February, March, and

December, presumably because of its year-round availability. Huslia residents also reported an incidental catch of lake trout during July.

Non-Salmon Harvests by Residents of Hughes

Located at the approximate mid-point of the Koyukuk River drainage, the community of Hughes demonstrated the heaviest reliance on non-salmon fish species during 2002. As indicated in Table 9, the estimated harvest of 26,952 pounds of non-salmon fish in Hughes results in a harvest of just over 411 pounds per person, a per capita rate that is more than two and one-half times that of any other surveyed community. Significantly, whitefish species comprised approximately 88% (23,802 lbs.) of the total harvest. The estimated per capita harvest of whitefish in Hughes was 363 pounds per person in 2002, over four times that of Huslia, which has the second highest community per capita rate for whitefish. Humpback and broad whitefish account for the largest percentage of the whitefish harvest, accounting for 43% and 33% of the harvest in pounds respectively. Bering and least cisco comprised the remaining 24% of the whitefish harvest in pounds. It is important to note, however, that in terms of numbers of fish, least cisco made up the second largest portion of the total whitefish catch at 5,726 fish, but because of their smaller size, they account for a smaller percentage of the harvest in pounds. The importance of whitefish is demonstrated both in raw harvest numbers and in documented use patterns. While 44% of Hughes households fished for and harvested whitefish species, 26% of the harvesting households shared their fish with approximately 30% of households, so that a total of 74% of the community's households used whitefish in 2002 (Table 9).

Sheefish, grayling and burbot also registered as important fish species in Hughes. Approximately 180 sheefish were harvested, primarily between July and September (Tables 9 and 10). Thirty five percent of households reported harvesting sheefish, and through sharing patterns, 61% of households reported using sheefish.

Harvest patterns by month for Hughes show a slightly more focused pattern than Huslia and Koyukuk (Table 10). The geography of the Hughes vicinity restricts most fishing to the Koyukuk mainstem; no major tributaries are nearby and the area has fewer lakes than are found in Huslia

or Allakaket. For Hughes residents, the vast majority of fishing in general, and whitefish harvest in particular, occurred during the month of September, while sheefish and pike fishing were spread out between July and September. Winter fishing centered on burbot and sucker in November and December and on into January and February. During the 2002 survey year, Hughes residents harvested an impressive 1,133 pounds of burbot, primarily during the heart of the winter months when burbot are moving upstream and when few other non-salmon fish species were being harvested. This timing is consistent with the use of an under-the ice burbot trap, as previously described in the TEK section of the report. Hughes is one of the locations where under-the-ice traps for burbot are still used. This relatively large harvest of burbot -- the largest reported by any of the survey communities in 2002 -- is likely attributed to the construction and operation of burbot traps in both the winter of 2001-2002 (pictured on page 58) and another trap constructed after freeze-up in November 2002. As winter spawners, burbot are prized during this time for their big eggs and oil-rich liver. Suckers are often caught as by-catch in burbot traps as well, and the timing of that harvest in Hughes appears closely linked with the harvest of burbot.

Similar to Huslia, Hughes residents did not report fishing for non-salmon species during the spring months of March and April or in the fall month of October. These months correspond with break-up and freeze-up when fishing is difficult due to thin or moving ice. In general, September was the most significant month for non-salmon harvests in Hughes, when every species included on the survey except blackfish was reported harvested. Since traps are used for burbot rather than baited set-lines, there is no need to take blackfish for use as bait, and lakes containing blackfish are said to be less common in the Hughes area than in other parts of the Koyukuk drainage.

In Kokukuk, Hughes, and Huslia, sheefish, whitefish, and pike were commonly harvested during summer months. This may reflect the abundance of these species in the Koyukuk River compared to other non-salmon species. Further, it might suggest that residents use the same types of gear catch salmon species. Whitefish, sheefish, and pike are big enough to get entangled in the type of gear and mesh size used that also catches species such as chinook and chum salmon.

Non-Salmon Harvests by Residents of Allakaket

Residents of Allakaket harvested ten species of non-salmon fish during 2002, including burbot, lake trout, grayling, pike, sheefish, sucker, and four species of whitefish (Table 11). The estimated total of 25,556 pounds of non-salmon fish harvested translated into a harvest of almost 155 pounds per person. Whitefish made up the majority of this harvest, contributing 13,134 pounds (approximately 80 lbs. per person), or more than one-half of the total community harvest. Sheefish contributed another 8,778 pounds, or 50 pounds per capita. Both of these species figured prominently in subsistence use patterns for the community. For example, while 40% of Allakaket households fished for and harvested whitefish species, 24% of the harvesting households shared their fish with other households so that a total of 69% of the community's households used whitefish in 2002 (Table 11). Similarly, 49% of Allakaket households harvested sheefish and approximately one-half of those households gave some portion of their catch to other households in the community such that 73% of all households used sheefish. Grayling and pike also contributed significantly to the annual harvest. An estimated 868 grayling (868 lbs.) and 538 pike (1,614 lbs.) were harvested by Allakaket households. Both species were widely shared between households.

In terms of the timing of activities, Allakaket households appeared to do most of their fishing during the summer and fall months (Table 12). But a significant portion of the harvest (especially burbot) was not accounted for by month by survey respondents. No harvest was reported during the winter and early spring months of December, January, February, or March. Whitefish species were harvested between July and September, with the most significant harvest in September. Allakaket is located near the mouth of the Alatna River where most of the Koyukuk River sheefish and whitefish are reported to spawn in the fall. Allakaket residents harvested fully one-half of their annual harvest of sheefish and more than one-half of their whitefish harvest in September (Table 12).

During 2002, Allakaket households reported the largest harvest of sucker in the region (342 fish/684 lbs.). While not all of the sucker harvest for Allakaket was reported by month, for that

portion of the harvest where timing is given, the catch of suckers coincides closely with the timing of whitefish harvests and it is likely that suckers are taken incidental to whitefish harvesting activities. According to some respondents, sucker move down-river in early fall right after grayling move into the main river, and about 15% of the sucker harvest occurred in October.

Non-Salmon Harvests by Residents of Alatna

Located just across the Koyukuk River from Allakaket, the community of Alatna has the smallest population of surveyed communities in the drainage, with only 12 households (21 people) in 2003. The estimated total harvest of non-salmon fish in Alatna for 2002 was 1,076 pounds (Table 13). Again, whitefish made up two-thirds of the total harvest, with 237 fish contributing 725 total pounds. Alatna residents harvested three species of whitefish – broad, humpback, and least cisco. While 25% of Alatna households fished for and harvested whitefish species, 8% of the harvesting households shared their fish with approximately one-half of the households in the community, resulting in a total of 58% of Alatna households using whitefish in 2002 (Table 13).

Alatna fishers concentrated their fishing effort during the summer and fall months of July through November with no fishing activity reported during the winter months of December, January or February, or the spring and early summer months March through June (Table 13). Broad whitefish were harvested in October and November, while least cisco species were harvested in July and August, and humpback whitefish were pursued in September and October. It is important to note here that in such a small community, only a handful of households are responsible for the majority of the harvests. While this is not technically different in principle from the patterns reported by the other communities, it is more pronounced in such a small community (12 households) where literally 2 to 4 households reported harvesting the fish, underlining the importance of those households to the subsistence economy of the entire village. In general, a far larger percentage of households reported using whitefish in all of the communities than reported actually harvesting them.

According to local respondents, seining is largely done in the upper Koyukuk River and the Alatna River because of gravel bottom conditions, which produce less snags (see pages 28-30 for a description of seining), and where there are spawning concentrations of whitefish. In general, seining practices result in concentrated bumps of whitefish harvest, usually in September or October. Hughes, Allakaket, and Alatna all have a history of seining, and the data for those communities do show that whitefish harvest is concentrated in the fall. While whitefish harvests are also an important component of the total non-salmon fish harvest for the lower Koyukuk River villages, the data suggest that the more likely strategy for taking whitefish in Koyukuk and Huslia would be to use set gill nets throughout the open water period and into fall under the ice.

After whitefish, grayling represent the next largest contribution to the total pounds harvested in Alatna, with 148 fish contributing 148 pounds or 14% of the overall harvest by weight. This was followed by pike (10% or 35 fish) and sheefish (7% or 13 fish). Grayling were harvested by Alatna households between July and November, when, according to local residents, the fish begin migrating out of the creeks and tributaries and into the main river to avoid freezing waters in the tributary streams. Pike were harvested primarily in July and August and all of the sheefish caught by Alatna residents were taken in August by just three fishing households.

Non-Salmon Harvests by Residents of Bettles/Evansville

The co-located communities of Bettles and Evansville are the farthest upstream communities surveyed. According to the survey data, fishers in Bettles and Evansville harvested or used ten species of non-salmon fish during 2002, including herring, halibut, burbot, arctic char, lake trout, grayling, pike, sheefish, and two species of whitefish -- broad whitefish and humpback whitefish (Table 15). While the list of species used is diverse, harvest amounts were small and the estimated total harvest of 320 pounds of fish represents the lowest per capita harvest of all communities surveyed (6.6 pounds per person). The harvest pattern in Bettles-Evansville departs from that of other surveyed communities in that grayling make up the largest proportion of the harvest and no harvest of whitefish was reported. Grayling accounted for 36% of the total harvest of non-salmon fish species in pounds. One-third of the community's households

participated in the grayling fishery while just over one-half of the households reported using grayling. Grayling were harvested primarily in June, July, and August using rod and reel gear.

Lake trout, pike, and sheefish accounted for the reminder of the non-salmon fish harvest by Bettles and Evansville residents, with each contributing nearly equally to the total non-salmon harvest in pounds (Table 16). Sheefish and lake trout are not generally present in the immediate vicinity of Bettles/Evansville, so fishing for those species would have probably involved travel to other areas in the drainage. Bettles/Evansville residents also reported receiving arctic char, halibut, and herring, though they did not harvest these species themselves. Arctic char are both anadromous and resident freshwater lacustrine, or lake-resident, populations that spawn in lakes. This species is generally found closer to the coast of Alaska and further to the north near Barrow, though an isolated population inhabits the interior**.** According to one respondent, there are small resident char in the Wiseman area that spawn in the Koyukuk. Since residents did not report actually harvesting arctic char, it is possible that households in Bettles/Evansville received it from their northern neighbors.

In general, the harvest component of this study presents significantly more detailed information about non-salmon fish harvests in the Koyukuk River drainage than previous studies. In addition to the harvest data summarized above, the survey form included a section where residents could make additional comments about fishing and the fishery resources. A total of 107 comments were recorded from the surveys, representing approximately 43% of the 253 total households in the region. Most of the comments fall generally into the following five categories: fish health and condition, abundance, environmental factors (water levels, pollution, habitat, etc.), harvest and sharing practices, and concerns about increasing regulation. In particular, residents seemed concerned about decreasing numbers and size of whitefish and grayling, due possibly to changing water levels and disease. For example, while some Koyukuk River residents commented on the continued abundance of grayling in their areas, according to one Wiseman resident, the grayling population in the upper reaches of the drainage is sensitive to flood events over the last decade. During recent floods, high water carried grayling back into old sloughs where they were caught when the water dropped again rapidly, effecting as much as an estimated 80% mortality. Likewise, whitefish can be extremely susceptible to rapid changes in water

levels, according to several respondents who witnessed large die-offs over the years after flooding. However, respondents also commented on the overall health of whitefish populations in the drainage primarily through concerns about habitat. Noting that whitefish are not as fat or abundant as they once were, especially in the spring, respondents expressed concerns about eh availability of food for whitefish as well as the warmer winters and melting permafrost that increases silt levels and raises water temperatures in local streams. While these conditions may affect all fish, whitefish are believed to be particularly sensitive to such changes in their habitat. Residents reported that the fish are not as fat as they once were, nor can they be found in such abundance as once observed. See Appendix D for a complete listing of comments received.

Table 4. Estimated Pounds of Non-salmon fish Harvested in Koyukuk River Communities, 2002.

Resource	Allakaket	Alatna	Bettles/ Evansville	Hughes	Huslia	Koyukuk	**Grand Total**
Non-Salmon Fish	25,556	1,076	320	26,952	33,635	7,395	**94,934**
Smelt	0	0	0	0	0	30	**30**
Eulachon (hooligan, candlefish)	0	0	0	0	0	30	**30**
Blackfish	0	0	0	0	126	19	**145**
Burbot	476	6	7	1,133	485	124	**2,230**
Char and Trout	2	6	65	0	19	0	**92**
Arctic Char	0	0	0	0	0	0	**0**
Lake Trout	2	6	65	0	19	0	**92**
Grayling	868	148	114	543	274	19	**1,966**
Pike	1,614	105	69	292	5,501	699	**8,279**
Sheefish	8,778	78	65	1,078	5,410	2,304	**17,714**
Sucker	684	8	0	104	412	60	**1,268**
Whitefish	13,134	725	0	23,802	21,408	4,140	**63,209**
Broad Whitefish	7,140	600	0	7,922	9,715	3,996	**29,373**
Humpback Whitefish	3,885	57	0	10,123	10,836	144	**25,045**
Cisco	2,109	68	0	5,757	856	0	**8,791**
Bering Cisco	280	0	0	32	722	0	**1,033**
Least Cisco	1,829	68	0	5,726	135	0	**7,757**
Unknown Whitefish	0	0	0	0	0	0	**0**

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Survey, 2003.

Table 5. Estimated Harvest and Use of Fish, Koyukuk, 2002.

Resource Name	Percentage of Households					lbs Harvested			Amount Harvested		
	Use	Att	Harv	Recv	Give	Total	Mean HH	Percapita	Total		Mean HH
Non-Salmon Fish	75.0	56.8	56.8	56.8	38.6	7,395	168.1	71.1	7,395	lbs	168.1
Smelt	4.5	2.3	2.3	4.5	2.3	30	0.7	0.3	30	lbs	0.7
Eulachon (hooligan, candlefish)	4.5	2.3	2.3	4.5	2.3	30	0.7	0.3	30	lbs	0.7
Blackfish	4.5	6.8	6.8	2.3	0.0	19	0.4	0.2	19	lbs	0.4
Burbot	34.1	25.0	25.0	13.6	13.6	124	2.8	1.2	62	ea.	1.4
Grayling	9.1	4.5	4.5	9.1	2.3	19	0.4	0.2	19	ea.	0.4
Pike	54.5	43.2	43.2	20.5	20.5	699	15.9	6.7	233	ea.	5.3
Sheefish	65.9	47.7	47.7	40.9	15.9	2,304	52.4	22.2	384	ea.	8.7
Sucker	6.8	6.8	6.8	2.3	4.5	60	1.4	0.6	30	ea.	0.7
Whitefish	63.6	40.9	40.9	47.7	22.7	4,140	94.1	39.8	1,047	ea.	23.8
Broad Whitefish	63.6	40.9	40.9	47.7	22.7	3,996	90.8	38.4	999	ea.	22.7
Humpback Whitefish	18.2	11.4	11.4	15.9	9.1	144	3.3	1.4	48	ea.	1.1
Cisco	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	ea.	0.0
Bering Cisco	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	ea.	0.0
Least Cisco	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	ea.	0.0
Unknown Whitefish	0.0	0.0	0.0	1.8	0.0	0	0.0	0.0	0	ea.	0.0

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Survey, 2003.

Table 6. Estimated Harvest of Non-salmon Fish by Month, Koyukuk, 2002.

Resource Name	Units	Any month		January		February		March		April		May		June	
		Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total
Eulachon (hooligan, candlefish)	lbs	30	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Blackfish	lbs	19	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Burbot	ea.	62	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Grayling	ea.	19	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Pike	ea.	233	100.0%	5	2.1%	4	1.7%	22	9.4%	10	4.3%	20	8.6%	17	7.3%
Sheefish	ea.	384	100.0%	0	0.0%	0	0.0%	0	0.0%	1	0.3%	38	9.9%	23	6.0%
Sucker	ea.	30	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Broad Whitefish	ea.	999	100.0%	0	0.0%	0	0.0%	0	0.0%	2	0.2%	100	10.0%	25	2.5%
Humpback Whitefish	ea.	48	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	5	10.4%
Bering Cisco	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Least Cisco	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Unknown Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Resource Name	Units	July		August		September		October		November		December		Unknown month	
		Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total
Eulachon (hooligan, candlefish)	lbs	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	30	100.0%
Blackfish	lbs	0	0.0%	0	0.0%	0	0.0%	6	31.6%	3	15.8%	0	0.0%	10	52.6%
Burbot	ea.	0	0.0%	0	0.0%	6	9.7%	39	62.9%	12	19.4%	0	0.0%	5	8.1%
Grayling	ea.	0	0.0%	0	0.0%	10	52.6%	8	42.1%	0	0.0%	0	0.0%	1	5.3%
Pike	ea.	10	4.3%	17	7.3%	17	7.3%	95	40.8%	12	5.2%	4	1.7%	0	0.0%
Sheefish	ea.	23	6.0%	7	1.8%	57	14.8%	125	32.6%	103	26.8%	5	1.3%	2	0.5%
Sucker	ea.	0	0.0%	0	0.0%	0	0.0%	13	43.3%	17	56.7%	0	0.0%	0	0.0%
Broad Whitefish	ea.	0	0.0%	70	7.0%	199	19.9%	570	57.1%	33	3.3%	0	0.0%	0	0.0%
Humpback Whitefish	ea.	0	0.0%	10	20.8%	30	62.5%	3	6.3%	0	0.0%	0	0.0%	0	0.0%
Bering Cisco	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Least Cisco	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Unknown Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Survey, 2003.

Table 7. Estimated Harvest and Use of Fish, Huslia, 2002.

Resource Name	Percentage of Households					lbs Harvested			Amount Harvested		
	Use	Att	Harv	Recv	Give	Total	Mean HH	Percapita	Total		Mean HH
Non-Salmon Fish	78.8	57.6	55.3	55.3	48.2	33,635	382.2	133.7	33,635	lbs	382.2
Blackfish	7.1	5.9	4.7	3.5	2.4	126	1.4	0.5	126	lbs	1.4
Burbot	38.8	14.1	12.9	29.4	11.8	485	5.5	1.9	242	ea.	2.8
Char and Trout	2.4	2.4	2.4	0.0	2.4	19	0.2	0.1	9	ea.	0.1
Lake Trout	2.4	2.4	2.4	0.0	2.4	19	0.2	0.1	9	ea.	0.1
Grayling	40.0	22.4	21.2	20.0	12.9	274	3.1	1.1	274	ea.	3.1
Pike	55.3	42.4	40.0	23.5	31.8	5,501	62.5	21.9	1,834	ea.	20.8
Sheefish	60.0	30.6	29.4	37.6	25.9	5,410	61.5	21.5	902	ea.	10.2
Sucker	11.8	10.6	10.6	2.4	5.9	412	4.7	1.6	206	ea.	2.3
Whitefish	72.9	49.4	49.4	36.5	38.8	21,408	243.3	85.1	6,691	ea.	76.0
Broad Whitefish	28.2	17.6	17.6	12.9	16.5	9,715	110.4	38.6	2,429	ea.	27.6
Humpback Whitefish	67.1	47.1	47.1	31.8	36.5	10,836	123.1	43.1	3,612	ea.	41.0
Cisco	23.5	14.1	14.1	11.8	11.8	856	9.7	3.4	650	ea.	7.4
Bering Cisco	22.4	12.9	12.9	11.8	10.6	722	8.2	2.9	516	ea.	5.9
Least Cisco	2.4	2.4	2.4	0.0	2.4	135	1.5	0.5	135	ea.	1.5
Unknown Whitefish	0.0	0.0	0.0	1.8	0.0	0	0.0	0.0	0	ea.	0.0

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Survey, 2003.

Table 8. Estimated Harvest of Non-salmon Fish by Month, Huslia, 2002.

Resource Name	Units	Any month		January		February		March		April		May		June	
		Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total
Blackfish	lbs	126	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Burbot	ea.	242	100.0%	10	4.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lake Trout	ea.	9	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Grayling	ea.	274	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	4	1.5%
Pike	ea.	1,834	100.0%	207	11.3%	207	11.3%	207	11.3%	0	0.0%	0	0.0%	348	19.0%
Sheefish	ea.	902	100.0%	0	0.0%	0	0.0%	4	0.5%	0	0.0%	0	0.0%	88	9.8%
Sucker	ea.	206	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	57	27.6%
Broad Whitefish	ea.	2,429	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	409	16.8%
Humpback Whitefish	ea.	3,612	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	627	17.4%
Bering Cisco	ea.	516	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	135	26.1%
Least Cisco	ea.	135	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	104	76.9%
Unknown Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Resource Name	Units	July		August		September		October		November		December		Unknown month	
		Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total
Blackfish	lbs	0	0.0%	0	0.0%	0	0.0%	41	32.8%	64	50.8%	21	16.4%	0	0.0%
Burbot	ea.	9	3.8%	0	0.0%	10	4.3%	55	22.6%	100	41.5%	57	23.5%	0	0.0%
Lake Trout	ea.	9	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Grayling	ea.	4	1.5%	5	1.9%	133	48.3%	74	26.8%	55	20.0%	0	0.0%	0	0.0%
Pike	ea.	149	8.1%	189	10.3%	29	1.6%	25	1.4%	248	13.6%	223	12.1%	1	0.1%
Sheefish	ea.	278	30.9%	98	10.9%	19	2.1%	207	23.0%	207	23.0%	0	0.0%	0	0.0%
Sucker	ea.	30	14.6%	16	7.5%	0	0.0%	52	25.1%	52	25.1%	0	0.0%	0	0.0%
Broad Whitefish	ea.	488	20.1%	456	18.8%	207	8.5%	414	17.1%	440	18.1%	16	0.6%	0	0.0%
Humpback Whitefish	ea.	1,256	34.8%	647	17.9%	212	5.9%	419	11.6%	435	12.0%	16	0.4%	0	0.0%
Bering Cisco	ea.	325	63.1%	56	10.8%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Least Cisco	ea.	31	23.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Unknown Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Survey, 2003.

Table 9. Estimated Harvest and Use of Fish, Hughes, 2002.

Resource Name	Percentage of Households					lbs Harvested			Amount Harvested		
	Use	Att	Harv	Recv	Give	Total	Mean HH	Percapita	Total		Mean HH
Non-Salmon Fish	78.3	52.2	52.2	34.8	39.1	26,952	1,036.6	411.1	12,541	ea.	482.3
Blackfish	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	lbs	0.0
Burbot	26.1	17.4	17.4	13.0	13.0	1,133	43.6	17.3	566	ea.	21.8
Grayling	34.8	26.1	26.1	8.7	13.0	543	20.9	8.3	543	ea.	20.9
Pike	34.8	21.7	21.7	13.0	17.4	292	11.2	4.4	97	ea.	3.7
Sheefish	60.9	34.8	34.8	26.1	17.4	1,078	41.5	16.4	180	ea.	6.9
Sucker	21.7	17.4	17.4	4.3	0.0	104	4.0	1.6	52	ea.	2.0
Whitefish	73.9	43.5	43.5	30.4	26.1	23,802	915.5	363.0	11,103	ea.	427.0
Broad Whitefish	73.9	43.5	43.5	30.4	26.1	7,922	304.7	120.8	1,981	ea.	76.2
Humpback Whitefish	56.5	30.4	30.4	26.1	17.4	10,123	389.3	154.4	3,374	ea.	129.8
Cisco	13.0	13.0	13.0	0.0	0.0	5,757	221.4	87.8	5,748	ea.	221.1
Bering Cisco	4.3	4.3	4.3	0.0	0.0	32	1.2	0.5	23	ea.	0.9
Least Cisco	13.0	13.0	13.0	0.0	0.0	5,726	220.2	87.3	5,726	ea.	220.2
Unknown Whitefish	0.0	0.0	0.0	1.8	0.0	0	0.0	0.0	0	ea.	0.0

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Survey, 2003.

Table 10. Estimated Harvest of Non-salmon Fish by Month, Hughes, 2002.

Resource Name	Units	Any month		January		February		March		April		May		June	
		Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total
Blackfish	lbs	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Burbot	ea.	566	100.0%	113	20.0%	113	20.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Grayling	ea.	543	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Pike	ea.	97	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	11	11.6%
Sheefish	ea.	180	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Sucker	ea.	52	100.0%	11	21.7%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Broad Whitefish	ea.	1,981	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	23	1.1%	6	0.3%
Humpback Whitefish	ea.	3,374	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	23	0.7%	6	0.2%
Bering Cisco	ea.	23	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Least Cisco	ea.	5,726	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Unknown Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Resource Name	Units	July		August		September		October		November		December		Unknown month	
		Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total
Blackfish	lbs	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Burbot	ea.	0	0.0%	0	0.0%	1	0.2%	0	0.0%	283	49.9%	57	10.0%	0	0.0%
Grayling	ea.	0	0.0%	0	0.0%	543	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Pike	ea.	34	34.9%	16	16.3%	36	37.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Sheefish	ea.	57	31.4%	42	23.3%	81	45.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Sucker	ea.	0	0.0%	5	8.7%	36	69.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Broad Whitefish	ea.	59	3.0%	0	0.0%	1,893	95.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Humpback Whitefish	ea.	0	0.0%	0	0.0%	3,346	99.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Bering Cisco	ea.	0	0.0%	0	0.0%	23	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Least Cisco	ea.	0	0.0%	0	0.0%	5,726	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Unknown Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Survey, 2003.

Table 11. Estimated Harvest and Use of Fish, Allakaket, 2002.

Resource Name	Percentage of Households					Pounds Harvested			Amount Harvested		
	Use	Att	Harv	Recv	Give	Total	Mean HH	Percapita	Total		Mean HH
Non-Salmon Fish	78.2	65.5	65.5	45.5	43.6	25,556	464.7	154.9	8,559	ea.	155.6
Blackfish	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	lbs	0.0
Burbot	18.2	9.1	9.1	9.1	3.6	476	8.7	2.9	238	ea.	4.3
Char and Trout	1.8	1.8	1.8	0.0	0.0	2	0.0	0.0	1	ea.	0.0
Lake Trout	1.8	1.8	1.8	0.0	0.0	2	0.0	0.0	1	ea.	0.0
Grayling	60.0	56.4	49.1	16.4	20.0	868	15.8	5.3	868	ea.	15.8
Pike	50.9	45.5	43.6	12.7	25.5	1,614	29.3	9.8	538	ea.	9.8
Sheefish	72.7	49.1	45.5	34.5	25.5	8,778	159.6	53.2	1,463	ea.	26.6
Sucker	27.3	27.3	27.3	0.0	14.5	684	12.4	4.1	342	ea.	6.2
Whitefish	69.1	40.0	40.0	38.2	23.6	13,134	238.8	79.6	5,109	ea.	92.9
Broad Whitefish	56.4	29.1	29.1	34.5	10.9	7,140	129.8	43.3	1,785	ea.	32.5
Humpback Whitefish	40.0	23.6	23.6	20.0	7.3	3,885	70.6	23.5	1,295	ea.	23.5
Cisco	43.6	27.3	27.3	18.2	20.0	2,109	38.3	12.8	2,029	ea.	36.9
Bering Cisco	3.6	1.8	1.8	1.8	0.0	280	5.1	1.7	200	ea.	3.6
Least Cisco	41.8	27.3	27.3	16.4	20.0	1,829	33.3	11.1	1,829	ea.	33.3
Unknown Whitefish	1.8	0.0	0.0	1.8	0.0	0	0.0	0.0	0	ea.	0.0

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Survey, 2003.

Table 12. Estimated Harvest of Non-salmon Fish by Month, Allakaket, 2002.

Resource Name	Units	Any month		January		February		March		April		May		June	
		Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total
Blackfish	lbs	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Burbot	ea.	238	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lake Trout	ea.	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Grayling	ea.	868	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Pike	ea.	538	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	45	8.4%	81	15.1%
Sheefish	ea.	1,463	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Sucker	ea.	342	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	35	10.2%	30	8.8%
Broad Whitefish	ea.	1,785	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	20	1.1%
Humpback Whitefish	ea.	1,295	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Bering Cisco	ea.	200	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Least Cisco	ea.	1,829	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	170	9.3%	364	19.9%
Unknown Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Resource Name	Units	July		August		September		October		November		December		Unknown month	
		Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total
Blackfish	lbs	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Burbot	ea.	5	2.1%	5	2.1%	8	3.4%	20	8.4%	0	0.0%	0	0.0%	200	84.0%
Lake Trout	ea.	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%
Grayling	ea.	20	2.3%	20	2.3%	270	31.1%	483	55.6%	60	6.9%	0	0.0%	15	1.7%
Pike	ea.	196	36.4%	89	16.5%	67	12.5%	60	11.2%	0	0.0%	0	0.0%	0	0.0%
Sheefish	ea.	0	0.0%	434	29.7%	778	53.2%	50	3.4%	0	0.0%	0	0.0%	201	13.7%
Sucker	ea.	166	48.5%	0	0.0%	0	0.0%	55	16.1%	0	0.0%	0	0.0%	56	16.4%
Broad Whitefish	ea.	20	1.1%	95	5.3%	1,155	64.7%	265	14.8%	10	0.6%	0	0.0%	220	12.3%
Humpback Whitefish	ea.	110	8.5%	120	9.3%	825	63.7%	0	0.0%	0	0.0%	0	0.0%	240	18.5%
Bering Cisco	ea.	0	0.0%	0	0.0%	200	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Least Cisco	ea.	145	7.9%	550	30.1%	400	21.9%	0	0.0%	0	0.0%	0	0.0%	200	10.9%
Unknown Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Survey, 2003.

Table 13. Estimated Harvest and Use of Fish, Alatna, 2002.

Resource Name	Percentage of Households					Pounds Harvested			Amount Harvested	
	Use	Att	Harv	Recv	Give	Total	Mean HH	Percapita	Total	Mean HH
Non-Salmon Fish	75.0	58.3	58.3	50.0	16.7	1,076	89.7	33.6	443 ea.	36.9
Blackfish	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0 lbs	0.0
Burbot	16.7	8.3	8.3	8.3	8.3	6	0.5	0.2	3 ea.	0.3
Char and Trout	8.3	8.3	8.3	8.3	0.0	6	0.5	0.2	3 ea.	0.3
Lake Trout	8.3	8.3	8.3	8.3	0.0	6	0.5	0.2	3 ea.	0.3
Grayling	50.0	33.3	25.0	25.0	16.7	148	12.3	4.6	148 ea.	12.3
Pike	33.3	25.0	25.0	8.3	16.7	105	8.8	3.3	35 ea.	2.9
Sheefish	50.0	50.0	25.0	25.0	8.3	78	6.5	2.4	13 ea.	1.1
Sucker	8.3	8.3	8.3	0.0	8.3	8	0.7	0.3	4 ea.	0.3
Whitefish	58.3	25.0	25.0	50.0	8.3	725	60.4	22.7	237 ea.	19.8
Broad Whitefish	41.7	8.3	8.3	33.3	8.3	600	50.0	18.8	150 ea.	12.5
Humpback Whitefish	16.7	16.7	16.7	8.3	0.0	57	4.8	1.8	19 ea.	1.6
Cisco	41.7	16.7	16.7	25.0	8.3	68	5.7	2.1	68 ea.	5.7
Bering Cisco	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0 ea.	0.0
Least Cisco	41.7	16.7	16.7	25.0	8.3	68	5.7	2.1	68 ea.	5.7
Unknown Whitefish	0.0	0.0	0.0	1.8	0.0	0	0.0	0.0	0 ea.	0.0

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Survey, 2003.

Table 14. Estimated Harvest of Non-salmon Fish by Month, Alatna, 2002.

Resource Name	Units	Any month		January		February		March		April		May		June	
		Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total
Blackfish	lbs	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Burbot	ea.	3	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lake Trout	ea.	3	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Grayling	ea.	148	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Pike	ea.	35	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Sheefish	ea.	13	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Sucker	ea.	4	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Broad Whitefish	ea.	150	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Humpback Whitefish	ea.	19	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Bering Cisco	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Least Cisco	ea.	68	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Unknown Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Resource Name	Units	July		August		September		October		November		December		Unknown month	
		Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total
Blackfish	lbs	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Burbot	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	3	100.0%	0	0.0%	0	0.0%
Lake Trout	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	3	100.0%
Grayling	ea.	0	0.0%	25	16.9%	35	23.6%	63	42.6%	25	16.9%	0	0.0%	0	0.0%
Pike	ea.	8	22.9%	23	65.7%	0	0.0%	4	11.4%	0	0.0%	0	0.0%	0	0.0%
Sheefish	ea.	0	0.0%	13	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Sucker	ea.	4	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Broad Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	100	66.7%	50	33.3%	0	0.0%	0	0.0%
Humpback Whitefish	ea.	0	0.0%	0	0.0%	17	89.5%	2	10.5%	0	0.0%	0	0.0%	0	0.0%
Bering Cisco	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Least Cisco	ea.	26	38.2%	42	61.8%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Unknown Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Survey, 2003.

Table 15. Estimated Harvest and Use of Fish, Bettles/Evansville, 2002.

Resource Name	Percentage of Households					lbs Harvested			Amount Harvested		
	Use	Att	Harv	Recv	Give	Total	Mean HH	Percapita	Total		Mean HH
Non-Salmon Fish	75.0	37.5	33.3	66.7	45.8	320	11.0	6.6	320	lbs	11.0
Herring	4.2	0.0	0.0	4.2	4.2	0	0.0	0.0	0	lbs	0.0
Halibut	8.3	0.0	0.0	8.3	4.2	0	0.0	0.0	0	lbs	0.0
Blackfish	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	lbs	0.0
Burbot	4.2	4.2	4.2	0.0	0.0	7	0.3	0.2	4	ea.	0.1
Char and Trout	37.5	8.3	8.3	37.5	8.3	65	2.3	1.4	33	ea.	1.1
Arctic Char	4.2	0.0	0.0	4.2	0.0	0	0.0	0.0	0	ea.	0.0
Lake Trout	33.3	8.3	8.3	33.3	8.3	65	2.3	1.4	33	ea.	1.1
Grayling	54.2	37.5	33.3	33.3	20.8	114	3.9	2.4	114	ea.	3.9
Pike	29.2	16.7	12.5	20.8	12.5	69	2.4	1.4	23	ea.	0.8
Sheefish	45.8	8.3	8.3	37.5	16.7	65	2.3	1.4	11	ea.	0.4
Sucker	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	ea.	0.0
Whitefish	16.7	4.2	0.0	16.7	0.0	0	0.0	0.0	0	ea.	0.0
Broad Whitefish	12.5	0.0	0.0	12.5	0.0	0	0.0	0.0	0	ea.	0.0
Humpback Whitefish	8.3	0.0	0.0	8.3	0.0	0	0.0	0.0	0	ea.	0.0
Cisco	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	ea.	0.0
Bering Cisco	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	ea.	0.0
Least Cisco	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	ea.	0.0
Unknown Whitefish	4.2	4.2	0.0	4.2	0.0	0	0.0	0.0	0	ea.	0.0

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Survey, 2003.

Table 16. Estimated Harvest of Non-salmon Fish by Month, Bettles/Evansville 2002.

Resource Name	Units	Any month		January		February		March		April		May		June	
		Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total
Blackfish	lbs	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Burbot	ea.	4	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lake Trout	ea.	33	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Grayling	ea.	114	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	36	31.9%
Pike	ea.	23	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	11	47.4%
Sheefish	ea.	11	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Sucker	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Broad Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Humpback Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Bering Cisco	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Least Cisco	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Unknown Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Resource Name	Units	July		August		September		October		November		December		Unknown month	
		Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total	Amt.	% of total
Blackfish	lbs	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Burbot	ea.	4	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lake Trout	ea.	18	55.6%	15	44.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Grayling	ea.	70	61.7%	7	6.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Pike	ea.	12	52.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Sheefish	ea.	0	0.0%	11	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Sucker	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Broad Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Humpback Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Bering Cisco	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Least Cisco	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Unknown Whitefish	ea.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Survey, 2003.

DISCUSSION

Together, the TEK interviews and the 2002 harvest survey formulate a data set that, for the first time, provides a comprehensive look at the harvest and use of non-salmon fish in the Koyukuk River drainage. The importance of fish as a food resource to the inhabitants of this region, both in the past and today, is supported and reinforced by the findings.

The TEK component of this project specifically sought out elderly respondents and asked questions about "the old days" in an attempt to tap into a rich body of traditional knowledge pertaining to fish. It is worth examining for a moment the temporal context from which most respondents were offering their observations. With an average age of 74, the time period portrayed in the first-hand accounts of respondents is the period from about the mid 1930s to the present. In some instances, respondents relayed specific bits of information from their childhood that they attributed to being taught by a parent or grandparent. It is important to step back and realize that these are references that derive from an even earlier era—almost certainly 19th century, and in some cases from individuals that had experienced the contact era first hand. Taken together, the information provided by the 29 respondents encompasses a time of incredible transition on the Koyukuk, when present day communities were just beginning to be settled and family groups still lived predominantly out on the land moving between seasonal camps. It also encompasses the pre-snowmobile era when nearly every family was involved in a year-round struggle to feed the family dog team. Fish played a premier role in seeing families through those times and this fact becomes evident in the statements of those who lived through that era.

As a whole, the information collected from respondents with respect to non-salmon fish represents knowledge handed down and accumulated through many lifetimes of interaction with the natural world. For each fish species, the information collected falls generally into the following categories: 1) Native terms and taxonomy, 2) distribution, seasonal movements and spawning, 3) traditional and contemporary harvest methods, 4) Use, preparation, and preservation methods, 5) relative abundance, and 6) traditional stories and beliefs. In collecting

and then analyzing this information, this report has produced a body of information that adds significantly to what is known about non-salmon fish in the Koyukuk River drainage and their use for subsistence purposes. Some of the more intriguing findings include the following:

- The research documents several instances where the Native taxonomy of a fish species is more detailed than the western scientific (Linnaean) system and incorporates aspects of fish behavior and size. For example, the Koyukon language recognizes at least three separate terms for northern pike: a general term used to denote the species, a second term used to identify the largest specimens of that species, and a third term used to identify pike arriving at a specific season of the year. Similarly, Koyukon terms for the Alaska blackfish point to a particularly detailed Native taxonomy for this species--a general species term, and at least four additional terms for blackfish of a certain size, color, or condition. These linguistic markers offer several clues for comprehending the role of blackfish in Koyukon life. While the general term attests to the species' significance for drainage residents, the other terms, such as ***toonoone***, suggest more specific information about seasonality and condition of fish. In essence, these terms provide more detailed descriptive information about these fish and their role in subsistence than their English or Latin counterparts.
- Ingenious and sometimes labor-intensive harvest methods were (and still are) employed that rely on very precise knowledge of fish movements, biology, and behavior in order to maximize results. Under-the-ice trapping methods for burbot and Alaska blackfish provide specific examples of harvest methods that have not been well documented in the Koyukuk River by previous studies and are described in detail here.
- Mapped data from respondents identified several key fishing areas that represent significant seasonal concentrations of certain fish. Some of these might be of immediate interest to those involved with current or future biological studies on these fish species. Spawning areas identified for whitefish and sheefish on the Alatna River, for example, may host the drainage-wide population of some species of fish for a short period of time in the fall. The precise location and extent of these critical habitats was previously undocumented. Marcotte and Haynes (1985) identified and carefully mapped Alatna River seining locations, but the connection to and correlation with spawning concentrations of whitefish and sheefish was not made at that time.

- Interviews revealed that in addition to the flesh of harvested fish, the eggs, entrails, and organ meats of many fish species are consumed. These practices give users special insight into the feeding habits, spawning biology, parasitic loads, and fat metabolism of the various fish. These data may also have implications for those conducting contaminant studies and related public health issues.
- A unique labor-saving system for preserving and storing fish was developed by fishers on the Alatna River to deal with the large seasonal harvests of fish produced by seining activities. This system involved a network of family-maintained boxes or cribs built on the river bank called "suluuns." Details regarding the location, construction, and use of the suluun in the Koyukuk River drainage have not been mentioned or documented in previous research.

These are just a few of the research highlights from the TEK component. A wealth of information on other topics was documented and re-affirmed through the TEK work, such as the Native names of fish and their meanings, traditional beliefs and lore pertaining to fish, and fishing methods, practices, and technologies that are no longer in use.

A door-to-door harvest survey was the second component of this study. In examining contemporary harvest and use, the household survey proved to be a most effective tool. In general, the harvest survey was important for providing detailed information about seasonal harvests by household, while also contextualizing harvest information with basic distribution patterns for each species. This is significant in that it not only provides an index for the enormous contribution non-salmon species make to subsistence economies along the Koyukuk, but it also illustrates how these resources circulate within a community. The harvest survey also rounded out a picture of non-salmon fishing practices in the Koyukuk River, reflecting specific patterns discussed in the ethnographic interviews.

These drainage-wide harvest data are a critical addition to existing harvest surveys of the region. The harvest survey component of this project provides the first overview of non-salmon fishing in the Koyukuk River drainage since Marcotte and Haynes (1985) and Marcotte (1986) compiled their initial baseline studies in the mid-1980s with follow-up work conducted by the USFWS in

the Kanuti National Wildlife Refuge (1986). In addition, the ADF&G, Division of Commercial Fisheries collects data on non-salmon fish harvests during their post-season salmon surveys along the entire Alaska portion of the Yukon River. While the primary focus of these surveys is salmon harvests rather than non-salmon fish harvests, this project serves to ground truth these post season data. Together, these three sources offer particularly useful comparisons.

According to Marcotte and Haynes (1985), fish species are critical to the subsistence economies of the Koyukuk River drainage. While Marcotte and Haynes considered a larger body of fish species (including salmon), this study provides much more detailed information regarding actual harvest data, gear types, harvest patterns, and sharing patterns for all non-salmon species harvested by residents of Hughes, Allakaket, Alatna, and Bettles/Evansville. In general, this study parallels the findings of Marcotte and Haynes' work in identifying the summer months between break-up and freeze-up as significant non-salmon fishing months. Additionally, these authors point to the opportunistic nature of non-salmon fishing, "Fishermen did not stress the importance of a single target species for most fishing activities since all fish caught were a welcome addition to the household food supply" (Marcotte and Haynes 1985:34).

Fish harvests can vary significantly from year to year, depending on various factors, including run strength, fishing effort, environmental conditions such as water levels, availability of other subsistence resources, drying conditions, and regulatory actions. Harvests should be understood within a longer range of time that accounts for annual variation. However in terms of actual harvests in one village, Hughes, this study documents some potentially shifting patterns. In comparison to Marcotte and Haynes' 1985 study, grayling, pike, and sheefish harvests have decreased, while whitefish harvests have increased dramatically. For example, in the 1982 survey year, Hughes residents harvested 211 pike and 2,135 whitefish. In the 2002 survey year, Hughes residents harvested an estimated 97 pike and 11,103 whitefish. This dramatic increase in whitefish harvests might suggest increasing dependence on the species in light of compromised salmon runs. Comparing the communities of Allakaket and Alatna, whitefish harvests are much more consistent (4,858 in 1982/ 5,346 in 2002), while the sheefish harvest is nearly five times as high in 2002 than reported in 1982.

Strong and McIntosh (1986) of the USFWS prepared the results of a follow-up study in the upper Koyukuk River communities of Bettles, Evansville, Alatna, and Allakaket. This study documented important fishing sites and measured the rates and participation and actual harvests of salmon and non-salmon fish species by the four communities in 1984. Interestingly, the study documents decreases in participation and harvest in the non-salmon fishery for Bettles and Evansville, while harvests of most non-salmon fish species increased for Alatna and Allakaket residents.[1]

Marcotte (1986) also collected harvest information for the community of Huslia, in the lower reaches of the drainage, in 1981 through 1983. Non-salmon fish harvests by residents of Huslia were remarkably consistent between survey years 1983 and 2002, with the primary difference in whitefish harvests (one-third higher in 2002). According to Marcotte, Huslia residents depend primarily on whitefish, followed by pike, sheefish, and sucker, a pattern consistent with the 2002 survey.

A final comparison can be drawn between the harvest survey component of this study and the non-salmon harvest data collected by ADF&G during post-season salmon surveys. However, it is important to keep in mind that collection of non-salmon harvest data is not the primary purpose for the post-season surveys. Furthermore, the implementation of this post-season survey immediately following the salmon season may not be timed to produce the most accurate results for non-salmon harvests. In general for the same survey year, post-season salmon surveys recorded a much smaller harvest for all non-salmon species harvested in the region. For example, the harvest survey for this project recorded approximately six times what was recorded in the post-season salmon survey (63,209/ 10,192 whitefish). Another important species, sheefish, was also under-represented in the post-season surveys. Residents of Koyukuk River communities reported harvesting an estimated total of 17,714 sheefish, while the post-season salmon survey recorded only 1,575 fish for those same communities in 2002. These differences point to the value of conducting these types of focused household surveys, especially contextualized within a rich body of ethnographic information.

[1] According the to authors, the reported harvest of whitefish by Alatna and Allakaket residents might be artificially low because of the inability of one very active household to accurately estimate their harvest (Strong and McIntosh 1986:10).

Implications for Fisheries Management

Fisheries management has as much to do with understanding the actions of people as it does the biology of fish. Nationwide, there is a long tradition in fisheries management of conducting user surveys with fishermen, creel surveys, and human-dimension studies to assess what makes fishermen tick, what motivates them, and how they might respond to proposed management actions. In Alaska, where resources such as fish are being managed as an important subsistence resource, the human side of management is greatly amplified. Alaska's unique subsistence regulations (both state and federal) are grounded in the concept of what is "customary and traditional" (C&T) with respect to seasons, methods of harvest, harvest areas, and uses of a particular resource. The C&T concept has an implied temporal component that demands examination, and in some cases accommodation, of the past. Fisheries managers, especially those managing for subsistence uses, as well as policy makers, need to have a thorough understanding of the role that fish and fishing have played and continue to play in the lives and culture of those that use the resource. For geographic areas and fish species where this kind of information has not been adequately documented, the collection of TEK and estimates of baseline harvest levels are not only relevant, but essential to the goal of management.

As such, the kinds of information collected and presented here are relevant to federal subsistence fisheries management in three important ways. First, the Koyukuk River drainage contains significant federal lands and waters, and non-salmon fish species are not only a major component of the fauna of this region but a major subsistence resource as well. Harvest estimates are among the most basic statistics needed to properly manage a resource. Surveys of annual harvest and distribution within communities and between households quantify the significance of non-salmon species and provide documentation of the levels at which this use should be protected. Harvest surveys provide one index of the importance of these species.

Another index of the importance of non-salmon fish species and implications for federal management derives from the ethnographic data set of traditional ecological knowledge presented in this report. The TEK data set provides a critical context for the contemporary

harvest information by supplying additional detail on fishing methods, gear types utilized, preservation techniques, and how harvests are prepared and used. These methods and techniques, generally understood as "customary and traditional" use are also protected under regulation to ensure the sustainability of subsistence practices.

Finally, the TEK data set contributes significantly to a basic understanding of the historic and cultural context in which subsistence fishing in this region takes place. As mentioned above, an analysis of "customary and traditional" uses demands attention to the temporal aspects of these practices. The information provided in this report begins to document the time-depth of these practices, how they have been maintained, or changed to accommodate shifting needs, priorities, and availability of fish. Significantly, the knowledge shared by the elder respondents interviewed works in conjunction with the harvest survey information to underline the fluidity and adaptability of these practices.

This last point deserves some additional elaboration. Subsistence economies are resilient, enduring, changeable and complex *systems*. An understanding of how these systems worked traditionally, and how they function today, requires a basic understanding of the component parts. Non-salmon fish were an unusually important cog in the seasonal round of the Koyukon Athabascans. The collection and analysis of TEK, properly done and appropriately focused, is the best way, perhaps the only way, to shed light on how this important piece of the subsistence economy of this region was carried out.

All the research objectives associated with this project were met. The harvest survey was completed with an exceedingly high percentage of area households. In total, 242 of 253 households (96%) were surveyed about their use and harvest of non-salmon fish species. Tribal organizations were involved in the design, collection, and synthesis, of data. TEK interviews were completed with a very knowledgeable group of Koyukuk River elders and fishermen, and the data have been summarized here and compiled into a computer database. However, the research raises additional questions as well. This project provides an adequate "big picture" view of fish and subsistence fishing in the Koyukuk River. But single interviews with respondents covering multiple species of fish result in only the most basic kinds of information

being collected on each species. It became obvious early in the research effort that several of the fish species--northern pike, whitefish, and burbot, just to name a few -- could have easily been the subject of smaller, more focused research projects by themselves. Some of the environmental changes mentioned by respondents that appear to be affecting fish should be considered more closely, perhaps with complimentary biological components. Comments describing a general decline in the oil content and quality of whitefish over the last several decades and abnormalities noticed recently in the livers of burbot deserve follow-up. Mapping elements with respect to fishing areas and fish-related place names deserve to be more directly and systematically addressed, focusing on a geographic unit that is much smaller than the entire drainage, expanding our understanding of the important relationship between people and place that inform these cultural systems of production. These are just a few ideas for further study. These, and others ideas for follow-up research, are outlined in more detail in the Recommendations section below.

CONCLUSIONS

The significant body of TEK synthesized in this report makes significant contributions to our understanding of the historic and cultural context surrounding fish and fishing in the Koyukuk River. This project was designed to provide baseline and background information on harvest and use of non-salmon species in Koyukuk River villages. It was not designed to answer specific research questions. For the Koyukuk River drainage as a whole, little information had been previously documented regarding the traditional ecological knowledge of non-salmon fish species or contemporary levels of fish harvest and use. Current, accurate estimates of harvest are among the most elemental statistics needed for proper management of any wildlife resource. Data from the 2002 harvest survey administered as part of this project provide the most current and precise estimates of non-salmon fish harvest available for this region. This is particularly important as people in this area heavily rely on non-salmon species, and much less so on salmon species (for which ADF&G annually collects harvest data). These quantitative and qualitative data are crucial for managers as well, as they help establish, support, and contribute to new and existing C&T findings that are the very basis of subsistence fisheries management in Alaska.

There can be no doubt about the importance of non-salmon fish to residents of the Koyukuk River drainage, both historically as well as contemporarily. The TEK collected and analyzed here demonstrate how adept residents of the Koyukuk are at utilizing the non-salmon fishery resources of the region for subsistence purposes. In virtually every calendar month, even in the depths of winter, fish of one species or another can be harvested to provide food. The remarkable body of knowledge and skills required to exploit the non-salmon fish resources in the Koyukuk River drainage evolved out of necessity over millennia of careful observation. In the 21st century, some of these skills and the knowledge associated with them are beginning to fade from memory. Nonetheless, people in this region continue to efficiently and effectively harvest large amounts of non-salmon species. While some information disappears with the passage of time, projects like this one can continue to make important new contributions through the collection of TEK. For example, the use of family-maintained "***suluuns***"—streamside structures to store fish at fall harvest locations along the Alatna River, is described here for the first time. Not only is this type of information valuable from a social science perspective, it can also contribute to Western biological science.

In general, this project demonstrates that links between TEK and Western biological science are not difficult to make. The viewpoint of the traditional Koyukon fisherman (as harvester) and the modern biologist (as scientist) may appear dramatically different at first glance, but the utilization of fish for food has everything to do with understanding fish behavior, anatomy, biology, and life history. When and where whitefish are ripe with eggs, what month burbot livers swell with oil, when grayling exit the headwater streams, and when blackfish congregate at lake ice openings—these are examples of the practical insights of TEK that can shed light on aspects of spawning biology, fat metabolism, and the seasonal movement or distribution of fish. The holistic nature of TEK is demonstrated by the Koyukon fisherman's understanding of how water levels, river currents and eddies, water clarity, ice action, and river bottom conditions affected fish and the operation of fishing gear. Detail found in the Native names and taxonomy of non-salmon fish speaks to both the length of time and the thoroughness with which the various fish and fisheries have been the focus of keen observation. It is the conclusion of this report, that these observations, carefully considered and interpreted, have contributions to make to Western

science. Perhaps most important, these observations can help to develop new research questions, or guide existing research, especially on species like blackfish, for which little has been documented by Western science.

Against this TEK backdrop, the results of the 2002 harvest survey show that certain species of non-salmon fish continue to be harvested in significant quantities and used by a large percentage of households in Koyukuk River communities today. To illustrate, the average household harvest of non-salmon fish in Hughes during 2002 was estimated at 482 pounds. This level of harvest rivals the household harvest of moose in many rural interior Alaska communities, and far surpasses the annual harvest of all wild food by the majority of urban households in Alaska. Non-salmon fish clearly are an important subsistence resource in the Koyukuk River region. The health of this resource and access to it through appropriate regulations will remain important regional issues.

RECOMMENDATIONS

This project took a broad-brush approach to the topic of non-salmon fisheries in the Koyukuk River, collecting a single year of baseline harvest data and questioning respondents throughout the drainage on the behavior, harvest and use of seven species of fish. This approach worked well to produce the drainage-wide overview that was envisioned in the research design. With this foundation work now done, there is room to build upon this study by examining specific questions and issues that emerged from this work, monitoring harvests over time, pursuing more detailed lines of questioning with respondents on one or two key species, and sharpening the geographic focus of work to a particular region within the Koyukuk drainage. Suggestions for future work include the following specific recommendations:

1. Harvest Monitoring. A single year of harvest data is useful for documenting general levels of harvest but does not provide insight into how participation in fishing and harvest levels may vary from year to year or harvest trends over time. Additional harvest survey work will be

necessary in select communities, or the full set of communities, if these kinds of data are of interest or required.

2. Follow-up TEK Work. Each of the individual fish species discussed above could be the subject of a smaller, more focused TEK study. The general topics covered on each fish species with this study only scratched the surface with respect to the traditional knowledge surrounding these fish. By focusing on a specific fish, additional respondents with special knowledge of that particular fish might be identified, and more detailed lines of questioning might be pursued. This study purposely sought out older respondents who could offer a historical perspective to the TEK component. Follow-up TEK work might build upon this effort by interviewing additional elders or younger fishers who are still actively fishing today and can incorporate a contemporary perspective to this body of knowledge. Specifically, local practices of distribution and sharing need to be more closely examined to better understand how these resources contribute to local subsistence economies and the management implications of those practices. A follow-up study on whitefish is already planned for 2004 and 2005 that will expand upon the information offered here and have a more narrow geographic focus within the Koyukuk River drainage. Other species such as northern pike, sheefish, and burbot could be similarly addressed.

3. Contaminants, Parasites, and Health Issues. In documenting how the various fish species are used for subsistence purposes, we found that the eggs and internal organs of many species are commonly consumed. Additionally, fish eggs are frequently eaten raw and the flesh of several species of fish is preferred as raw, frozen fish. While there are no indications of public health problems resulting from these practices and the benefits of eating traditional foods appears to far out-weigh any potential risk, Alaskan researchers studying contaminants or parasitic loads in fish may want to at least be aware of these ongoing practices and conduct appropriate follow-up studies. Several survey comments were received concerning the effects of mining and river pollution on fish health (see also R. Stimmelmayr 2004).

4. Fish Abnormalities Issues. Comments collected from both TEK respondents and household harvest surveys identified several abnormalities with recently harvested fish that warrant follow-up from biologists. These include:

- spots and areas of discoloration on burbot livers
- increased observations of white spots or lesions on whitefish
- decreasing size of whitefish and grayling
- report of “glowing” sheefish reported in Hughes

5. Detailed Place-Name Mapping. There is a potentially rich source of fish-related information that could be gained from a systematic effort to collect and map Koyukon and Inupiaq place-names in the various subregions of the Koyukuk River drainage. Place names mapped by Jones (1986) focused primarily on the Yukon River portion of the Koyukon language area. Little else has been done in the Koyukuk drainage. This is a specialized area of data collection that requires linguistic skills and a geographic focus smaller than the drainage-wide scope addressed here.

ACKNOWLEDGEMENTS

This project would not have been possible without the cooperation of a remarkable group of people who recognized the importance of the work and welcomed the chance to tell their stories. For their patient participation in TEK interviews we wish to thank: Rose Ambrose and her late husband Harry, Steven and Catherine Attla, Celia and Joe Beetus, Henry Beatus, Lindberg Bergman, Edith Bifelt, David David, Roger Dayton, Ann Edwards, Andrew Edwin, Moses Henzie, Marion Huntington, Ben and Eliza Jones, Rita Koyukuk, Bertha and Johnson Moses, Florence Nictune, Jack Reakoff, Emily and Tony Sam, Andy Simon, Jean Stevens, Effie Williams, and Bobby and Mary Vent. Thanks also to Pollock Simon for his boat driving skills and the invitation to participate in fall seining activities on the Alatna River.

Stanley Ned was key research partner from the early stages of this project, obtaining community approvals for the work, assembling a cast of elders, coordinating the interview schedule with them, and providing a critical presence during the interviews themselves. His work behind the scenes and personal interest in seeing this project through to completion made a significant contribution to the research effort. Mr. Matt Ganley of Map Alaska deserves recognition for producing report maps. Eliza Jones provided critical orthographic assistance with Koyukon language terms. Inupiaq language terms on tape were expertly deciphered by Dr. Larry Kaplan at the UAF Alaska Native Language Center.

A significant body of harvest data was collected by seven research assistants form the participating villages: Kelly Dilbeck (Fairbanks and Bettles/Evansville), Clyde Peter (Koyukuk), Harold Yatlin (Koyukuk), Catherine Henzie (Allakaket), Derek Derendoff (Huslia), Shena Bifelt (Hughes), and Alfred Attla Jr (Hughes). The diligent and thorough work of these individuals documented the profound reliance on non-salmon fish resources by Koyukuk River residents in the harvest data. This data was then expertly entered and analyzed by Erin Baldwin, Maria Kerlin, and Robert Walker, all with ADF&G. Many thanks go to these individuals for their hard work to construct the harvest tables contained in this report.

Interns Valli Peterson (TCC), Louann Rank (ADF&G), Irv Frank (ADF&G), and Susan Vanek (ADF&G) also contributed greatly to the final product. Valli was central in compiling the poster that accompanies this report and organized the community review of the research. Louann and Irv worked together to construct the askSam database, using interview clips, pictures, table and maps to build a text-searchable database for use in the communities themselves. Susan Vanek turned a detailed eye towards the harvest tables and formatted them for publication. And finally, Craig McCaa (BLM) provided high-resolution scanned images for use in the final report and poster.

No report ever gets to final form without several “fresh” sets of eyes. Jim Simon, Regional Supervisor for the Interior/Western/Arctic region for the Subsistence Division at ADF&G, Terry Haynes, Federal Liaison in Wildlife Conservation, ADF&G, and Jesse Dizard, Research Director

for the Subsistence Division provided careful and engaged readings of this report. Polly Wheeler's (Office of Subsistence Management, USFWS) thorough review of the draft report contributed invaluably to the content, structure, and organization of this report.

Finally, we would like to express our gratitude to the U.S. Fish and Wildlife Service, Office of Subsistence Management, who provided $205,102 in funding support for this project through the Fisheries Resource Monitoring Program, under agreement number 701811J335.

LITERATURE CITED

Andersen, D.B. and C.L. Fleener
2001 Whitefish and Beaver Ecology of the Yukon Flats, Alaska. Division of Subsistence, Alaska Department of Fish and Game, Technical Paper No. 265.

Andersen, D.B.
1992 The Use of Dog Teams and the Use of Sugbsistence-Caught fish for Feeding Sled Dogs in the Yukon River Drainage, Alaska. Division of Subsistence, Alaska Department of Fish and Game, Technical Paper No. 210.

Andersen, D.B. and C. Alexander
1992 Subsistence Hunting Patterns and Compliance with Moose Harvest Reporting Requirements in Rural Interior Alaska. Division of Subsistence, Alaska Department of Fish and Game, Technical Paper No. 215.

Beatus, H.
1981 Henry Beatus, Sr., Hughes. Yukon Koyukuk School District. Hancock House Publishers.

Beetus, J.
1980 Joe Beetus, Hughes. Yukon Koyukuk School District. Hancock House Publishers.

Clark, A.M.
1981 Koyukon. In Subarctic. Handbook of North American Indians, Vol. 6. J. Helm, ed. Pp582-601. Washington, D.C.: Smithsonian Institution.

Freeman, M.M.R.
1992 "The Nature and Utility of Traditional Ecological Knowledge." Northern Perspectives 20(1):9-12.

Hardesty, D.
1977 Ecological Anthropology. New York: Wiley.

Hunn, E.
1988 "What is Traditional Ecological Knowledge?" In Traditional Ecological Knowledge: Wisdom for Sustained Development, N. Williams and G. Baines, Eds. Pp. 13-15. Canberra:Australian National University.

Jetté, J. and E. Jones
2000 Koyukon Athabascan Dictionary. Alaska Native Language Center, University of Alaska, Fairbanks.

Jones, E
1986 Koyukon Ethnogeography. Alaska Native Language Center, University of Alaska, Fairbanks, Alaska Historical Commission Studies in History No. 171.

Marcotte, J.R.
1986 Contemporary Resource Use Patterns in Huslia, Alaska, 1983. Division of Subsistence, Alaska Department of Fish and Game, Technical Paper No. 133.

Marcotte, J. R. and T. L. Haynes
1985 Contemporary Resource Use Patterns in the Upper Koyukuk Region, Alaska. Division of Subsistence, Alaska Department of Fish and Game, Technical Paper No. 93.

Morrow, J.E.
1980 The Freshwater Fishes of Alaska. Alaska Northwest Publishing Company, Anchorage, Alaska.

Nelson, R.K., K.H. Mautner, and G.R. Bane
1982 Tracks in the Wildland: A Portrayal of Koyukon and Nunamiut Subsistence Anthropology and Historic Preservation, Cooperative Park Studies Unit, University of Alaska, Fairbanks.

Nelson, R.K.
1983 Make Prayers to the Raven: A Koyukon View of the Northern Forest. The University of Chicago Press.

Nictune, O.
1980 Oscar Nictune, Sr. Alatna. Yukon Koyukuk School District. Hancock House Publishers.

Simon, E.
1981 Edwin Simon, Huslia. Yukon Koyukuk School District. Hancock House Publishers.

Solomon, M.
1981 Madeline Solomon, Koyukuk. Yukon Koyukuk School District. Hancock House Publishers.

Stimmelmayr, R.
2004 Traditional Ecological Knowledge on non-salmon subsistence fish such as lush, pike, and whitefish in the Yukon Koyukuk Interior Subregion. In TCC Final FOODCAP Report.

Wenzel, G.W.
1999 "Traditional Ecological Knowledge and Inuit: Reflections on TEK Research and Ethics." Arctic 52(2): 113-124.

Wolfe. R.J.
1987 "The Super-Household: Specialization in Subsistence Economies." Paper presented at the 14th Annual Meetings of the Alaska Anthropological Association, Anchorage, Alaska.

APPENDIX A. Interview Topics -- Koyukuk River Non-Salmon Fish T.E.K. Project

TAXONOMY and NATIVE LANGUAGE NAMES
Can you tell us the local or Native names for these fish? (Viewing Photographs of Fish)

Northern Pike-
Arctic Grayling-
Longnose Sucker-
Burbot-
Sheefish-
Whitefish (sp)-
Broad Whitefish-
Humpback Whitefish-
Least Cisco-
Bering Cisco-
Round Whitefish-
Alaska Blackfish-
Arctic Lamprey-

LIFE HISTORY (Asked for each species of fish)

- What can you tell me about the seasonal movements of (*species*)—(Do they come and go? Are they in this area year-round? When do people catch them?)
- Do you know what they eat?
- Do you know where and when they spawn?
- Where do they spend winters?
- Where do they spend summers?

HARVEST AND USE (Asked for each species of fish)

- Where do you go to catch (*species*) (Map these and collect place names.)
- What do you look for in selecting an area to fish for (*species*)?
- What kinds of fishing gear are/were used?
- How is the catch normally preserved? (freezing, drying, smoking, canning)
- How are (*species*) prepared for eating?
- Use of fish as trapping bait or dog food?

POPULATION TRENDS (asked for each species of fish)
Do you think the number of (*species*) in this area now is increasing, decreasing, or about the same as always?

OTHER MISC. INFO (for each species of fish)

APPENDIX B. Harvest Survey Instrument

2002 Koyukuk Non-Salmon Fish Survey

HOW MANY PEOPLE LIVE IN THIS HOUSEHOLD?_____ ALASKA NATIVE? **YES** **NO**

COMMUNITY_____(_____)

HOUSEHOLD ID NUMBER _____

DURING 2002, DID THIS HOUSEHOLD CATCH OR USE ANY KIND OF NON-SALMON FISH? **YES** **NO**

IF NO, SKIP TO BOTTOM SECTION. *IF YES, COMPLETE SPECIES SECTION BELOW.*

	Activity Log							Number Harvested: Total and by Month													
SPECIES	Use	Fish For	Catch	Receive	Give Away	Units	Total Harvest	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Unk
Pike						individual														
Grayling						individual														
Sucker						individual														
Burbot (Lush)						individual														
Sheefish						individual														
Whitefish:																				
Broad Whitefish						individual														
Humpback Whitefish						individual														
Bering Cisco						individual														
Least Cisco						individual														
Unknown Whitefish						individual														
Blackfish						pounds														
Others (List)																				

HOW DID YOUR HARVEST AND USE OF THESE FISH IN 2002 COMPARE TO THE LAST 4 OR 5 YEARS?

WE USED **MORE** FISH THAN USUAL _____ (MORE)

WE USED **LESS** FISH THAN USUAL _____ (LESS)

OUR USE OF FISH WAS ABOUT THE **SAME** AS USUAL _____ (SAME)

DO YOU HAVE ANY COMMENTS ABOUT THE FISH IN THIS AREA?

APPENDIX C. Mapped Information Collected During Interview Sessions

Respondents participating in mapping sessions identified 88 specific geographic locations associated with fishing activities in the Koyukuk River. It is important to stress that these maps are not intended to depict community use areas or the complete extent of fishing activities in the Koyukuk region. Rather, these maps simply identify areas and locations mentioned in the course of TEK interviews by a subset of 14 key respondents.

Four maps are used to present these data. Map 1 provides an overview of the entire Koyukuk River drainage and shows how the drainage has been subdivided in subsequent maps. Map 2, Map 3, and Map 4 provide detail for the lower, middle, and upper Koyukuk River regions, respectively. Each data point or feature has been identified with a number which is referenced and explained in the accompanying keys. Some data points include gear type, season of use, and target species, while others are less specific. Readers are also referred to Marcotte and Haynes (1985) for mapped data collected in the Upper Koyukuk River drainage during the early 1980s.

Respondents providing mapped information include the following individuals:

Allakaket/Alatna
Lindberg Bergman
Andrew Simon
Ann Edwards
Effie Williams
David David
Moses Henzie
Johnson Moses
Stanley Ned (Fairbanks)

Hughes
Joe Beatus
Henry Beetus

Huslia
Harry Ambrose

Koyukuk
Benedict Jones

Bettles/Evansville
Florence Nictune

Wiseman
Jack Reakoff

APPENDIX D. Survey Comments

Community Name	HHID	Comment
Koyukuk	6	More lesions on fish than before. Also, the fish are smaller.
Koyukuk	10	Where's all the fish?
Koyukuk	12	Pretty poor fishing out there.
Koyukuk	17	During Sept. and Oct. we fished for white fish until the river ice started moving. The fish seemed to be smaller.
Koyukuk	20	They sure taste good.
Koyukuk	21	Where are the hot fishing spots?
Koyukuk	23	Environmentally, the stream and lakes, what the fish feed on is changing - fish are skinier. Less water lillies in the lakes. Only the lake last fall had water lillies, but they used to show up every lake. Less glaciers out in the flats or hills that c...?
Koyukuk	27	Where oh where have all the fish gone?
Koyukuk	29	The fish were better this year because we had it in the right place.
Koyukuk	32	I think we are getting less fish from years before. I feel the fish are declining in our rivers. We depend on our fish as subsistence during the winter, along with berries, etc.
Koyukuk	34	We had a fish net in only a couple of days.
Koyukuk	37	Fish are abundant, but I'm worried about the pollution of the rivers and sloughs from mining, etc.
Koyukuk	38	Stock up on fish in land-locked lakes.
Koyukuk	40	Did not fish.
Koyukuk	49	I mostly receive my fish through other people's catch. I eat some of these fish at potlatches.
Koyukuk	50	Too short a fishing schedule.
Huslia	41	Shouldn't close the season.
Huslia	42	More people were fishing.
Huslia	46	Fish around here are poor compared to the Yukon's fish.
Huslia	51	Only used less fish because he wasn't here to fish this fall.
Huslia	52	Lot less fish than before, maybe too low water.
Huslia	54	White fish isn't the same, too much water now. Not enough for white fish to get to the lakes. Beaver dams are higher.
Huslia	60	Really big grayling. Teachers, so not used to fishing around here.
Huslia	61	One person is allergic to fish, so can't fish for any.
Huslia	62	Should just leave Huslia out of the closures that they have with fish because they need as much fish as they can get.
Huslia	63	It's getting hard to catch it. There's lots of fish, but harder to get.
Huslia	64	Less fish have been around last few years.
Huslia	65	Bad weather, so didn't fish as much.
Huslia	67	The fish are getting less.
Huslia	73	Use more, but has been less fish.
Huslia	75	More some, and less others. Pike and white fish less, and more lush. Sheefish is doing good.

Huslia	76	Fish are not as healthy as they used to be. Not as fat, not running the same. Every year they run differently.
Huslia	84	Test the fish for mercury and acid rain to see how fish are affected.
Hughes	1	The fish around Hughes tastes better than down river, maybe because the rocks and not sand.
Hughes	2	Got a sheefish that was yellow and glowing. Were going to send it to Fish & Game, but ravens ate it.
Hughes	3	They should limit the fishing season. Hughes is so far up the river that only so much fish make it up.
Hughes	4	Not very many fish.
Hughes	5	Not as many grayling than last few years.
Hughes	10	Too old to go fishing. No one put net in this year.
Hughes	12	Less because the water was too high. The water has to be low enough for the beaches to come out. For good fishing. And no fish trap this year.
Hughes	15	Some of the white fish had sores or some kind of stuff on the neck.
Hughes	17	The fish run's are not the same, there slow and poor when they make it this far up the river.
Hughes	18	This summer they seen the really small fish. Not white fish. There was lots.
Hughes	20	The fish around here are OK, but the way it is now (bad in other places), it will only get worse before better. Mining camps around here could play a part in less fish, things that are dumped in water.
Hughes	22	Not enough fish coming up the river.
Hughes	25	Can't eat fish.
Hughes	26	The ice this year on the river was real bad, and couldn't put a trap in. And that's the way I really get all my fish is in a trap.
Allakaket	201	No fish.
Allakaket	202	We have to pull out our nets according to the law. It makes it hard for us.
Allakaket	203	So far we've been doing good seining, but so low water it's hard to get to where we usually seine.
Allakaket	205	No fish lately (last 4-5 years).
Allakaket	206	Salmon - hardly catch any females with eggs. Can count on my hand how many of those we caught.
Allakaket	207	It seems like we're not getting as much a we used to. We have to put out more nets. Also, we have too high water when we're trying - lots of rain.
Allakaket	209	Didn't fish, but people gave us some.
Allakaket	210	We elders need our young people's help to get our fish - it's our food. Closing fishing for us is hurting us.
Allakaket	211	Too low / high water - bum fishing.
Allakaket	212	I hardly go fishing lately.
Allakaket	213	We are forced to pull out our nets because of the law. Also, we have to travel so far from our town nowadays.
Allakaket	214	My son goes fishing with his hook. We don't use fishnet (no boat), but people give us fish (whitefish).

Allakaket	215	Hardly any fish nowadays.
Allakaket	216	I just use a hook, not a fish net. Didn't do that good this year.
Allakaket	219	As we're getting older, we are doing less fishing. Also, we don't get hardly any salmon.
Allakaket	220	Not enough fish.
Allakaket	221	Not that we're older, we depend on our people to give us fish. Seems like we're getting less fish too, in the Koyukuk River.
Allakaket	222	They're good eating. I usually help folks with fish trap, but we didn't make one this year.
Allakaket	223	Seems like there's less and less fish every year.
Allakaket	225	Hardly any grayling this, no salmon either.
Allakaket	226	No fish (salmon) - horrible year. Did my fishing by seining.
Allakaket	229	Lost nets, so I did not fish as much as I would have liked.
Allakaket	230	No fish - not enough anyway.
Allakaket	236	We hardly go fishing these days.
Allakaket	237	Salmon - we really need this fish and please don't restrict our fishing. Hardly any fish.
Allakaket	238	Hardly any fish nowadays, plus too low or high water right when fish run seems like.
Allakaket	239	We never get good fish anymore. Sometimes water is too high or low. Hardly any fish around here now days.
Allakaket	240	Maybe there's fish, but we haven't been fishing since we're getting older it's harder for us. We depend on people to give us fish these days.
Allakaket	241	We need our fishing seasons open - closing this while we barely get any fish as it is. Also, fish has some kind of spots on them - from what I don't know.
Allakaket	242	It's declining.
Allakaket	244	No salmon - we tried but didn't get any.
Allakaket	245	There's too little bit fish around here lately.
Allakaket	246	No fish.
Allakaket	247	CH
Allakaket	256	Seems like we're having harder time with fish, not much anymore.
Alatna	101	We're just lucky to get the fish we have and use each and every one.
Alatna	102	Hardly any more fish around - not like long ago.
Alatna	104	No water (in river) to get up the Alatna River where we usually go fishing. Also, fish in this area is declining - don't know why.
Alatna	105	Didn't have much luck fishing this year - probably too low water.
Alatna	106	What fish? We're barely getting any. No good king salmon, hardly any grayling. We used to pull in hundreds - not any more.
Alatna	107	I've hardly gone fishing the last few years, but have noticed that there's less fish.
Alatna	108	No salmon
Alatna	110	Too bum water condition, too low or too high.
Alatna	111	Running out of fish.
Alatna	112	Too restricted. Parents have not enough time as it is and they have to pull their nets.

Bettles	1	Need more.
Bettles	3	Sheefish is great. Trout was good. Pike wasn't very good.
Bettles	5	Not very good fishing, lots got away. Bettles is not good fishing, but Brook Range is.
Bettles	17	Um um good.
Bettles	24	We need more. Have to go away to find fish. Survey is good to find out what is going out in. Increase number of salmon for other areas to continue to grow.
Bettles	28	Very good tasting.
Bettles	29	Would like to see something done about numbers of fish being grown for local fishers.
Evansville	2	No Delectable
Evansville	7	Used to fish more, but now people are giving more. Not many salmon, not very many white fish, don't come up the river, maybe up the John.
Evansville	8	Great sunny fishing.
Evansville	9	Usually get a lot of grayling, but not so many now. Every year at grayling fish time (September), rivers usually high and muddy. End of Sept., Oct. river clears up. Good idea to survey. Keeps village more aware of what is going on in their community.
Evansville	13	Just didn't fish.
Evansville	15	Low salmon runs - wish they would get people up here to hatch fish like they do in Southeast.
Evansville	19	Doesn't seem like there is as much grayling as in past years.
Evansville	22	Grayling are getting smaller in size and fewer in number. White fish were soft this year. Lake trout were good.

APPENDIX E. Conversion Factors

Below is a list of the Conversion Factors used in 2002 Koyukuk non-salmon fish surveys to convert numbers of fish into useable pounds. Recent/most often used conversion factors identified in the ADF&G Community Profile Database (CPDB) for the resource in the Interior Region was used for all resources, except for Bering Cisco and Least Cisco where recent/most often used conversion factor statewide was used (i.e., not previously identified with Interior Region survey data set).

Code Number	Fish Species	Measurement in pounds
120200000	Herring	lbs*
120404000	Hooligan	lbs
121200000	Eel	lbs
124600000	Blackfish	lbs
124800000	Burbot (Loche)	2.0
125002000	Arctic Char	0.9
125010000	Lake Trout	2.0
125200000	Grayling	1.0
125400000	Pike	3.0
125600000	Sheefish	6.0
126000000	Sucker	2.0
126200000	Trout	1.5
126204000	Rainbow Trout	1.4
126404000	Broad Whitefish	4.0
126406040	Bering Cisco	1.4
126406060	Least Cisco	1.0
126408000	Humpback Whitefish	3.0
126499000	Unknown Whitefish	3.0

*Where “lbs” is listed for measurement (Herring, Hooligan, Eel, and Blackfish), community residents reported their subsistence harvests in pounds only, rather than in individual fish numbers, generally because of the small size of these species.

The Office of Equal Opportunity (OEO) statement for use in Alaska Department of Fish and Game publications:

The Alaska Department of Fish and Game administers all programs and activities free from discrimination on the bases of race, color, national origin, age, sex, religion, marital status, pregnancy, parenthood, or disability. The department administers all programs and activities in compliance with Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972.

If you believe you have been discriminated against in any program, activity, or facility, or if you desire further information please write to ADF&G, P.O. Box 25526, Juneau, AK 99802-5526; U.S. Fish and Wildlife Service, 4040 N. Fairfield Drive, Suite 300 Webb, Arlington, VA 22203; or O.E.O., U.S. Department of the Interior, Washington DC 20240.

For information on alternative formats for this and other department publications, please contact the department ADA Coordinator at (voice) 907-465-4120, (TDD) 907-465-3646, or (FAX) 907-465-2440.