Technical Paper No. 358

Traditional Ecological Knowledge and Harvest Survey of Nonsalmon Fish in the Middle Yukon River Region, Alaska, 2005–2008

by

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and

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Alaska Department of Fish and Game **Division of Subsistence**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the reports by the Division of Subsistence. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

all commonly-accepted abbreviations e.g., Mr., Mrs., AM, PM, etc.	
all commonly-accepted professional titles e.g., Dr., Ph.D., R.N., etc.	
Alaska Administrative Code	AAC
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters (Jan,...,Dec)	
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

TECHNICAL PAPER NO. 358

TRADITIONAL ECOLOGICAL KNOWLEDGE AND HARVEST SURVEY OF NONSALMON FISH IN THE MIDDLE YUKON RIVER REGION, ALASKA, 2005–2008

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The Division of Subsistence Technical Paper series was established in 1979 and represents the most complete collection of information about customary and traditional uses of fish and wildlife resources in Alaska. The papers cover all regions of the state. Some papers were written in response to specific fish and game management issues. Others provide detailed, basic information on the subsistence uses of particular communities which pertain to a large number of scientific and policy questions.

Technical Paper series reports are available through the Alaska State Library and on the Internet: http://www.subsistence.adfg.state.ak.us. This publication has undergone editorial and professional review.

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ABSTRACT

Nonsalmon fish species are an important year-round subsistence resource in the Middle Yukon River communities of Tanana, Ruby, Galena, Nulato and Kaltag and residents have developed a complex generational body of knowledge about these species, which include whitefishes *Coregonus* spp. and *Prosopium* spp., sheefish *Stenodus leucichthys*, northern pike *Esox lucius*, Arctic grayling *Thymallus arcticus*, burbot *Lota lota*, and Alaska blackfish *Dallia pectoralis*, among others. Residents have expressed concerns about the availability and health of nonsalmon fish species in light of decreasing abundance of Pacific salmon *Oncorhynchus* spp. and other environmental factors. However, baseline harvest information for some communities does not exist or is at least 20 years old, and there has been little effort to document traditional ecological knowledge (TEK) in these communities. Through household surveys and key respondent interviews, this project expanded existing harvest information for nonsalmon fishes and captured local concerns. Themes emergent from this research indicated that the harvest and uses of nonsalmon fishes appear to be linked to several factors, including the presence of elders, the maintenance of dog teams, and cultural events. Additionally, residents placed importance on place and placename information to understand the seasonal movements of nonsalmon fish species and other environmental factors.

Keywords: nonsalmon fish, Middle Yukon River, Galena, Kaltag, Nulato, Ruby, Tanana, traditional ecological knowledge, TEK, harvest survey, whitefish, *Coregonus* spp., *Prosopium* spp., sheefish, *Stenodus leucichthys*, northern pike, *Esox lucius*, Arctic grayling, *Thymallus arcticus*, longnose sucker, *Catostomus catostomus*, burbot, *Lota lota*, Alaska blackfish, *Dallia pectoralis*, Arctic lamprey, *Lampetra japonica*.

INTRODUCTION

The goal of this project was to document traditional ecological knowledge (TEK) and to assess the subsistence harvest and uses of nonsalmon fish species in the communities of Tanana, Ruby, Galena, Nulato, and Kaltag (Figure 1). Traditional ecological knowledge is increasingly recognized as important to natural resources management as a means of integrating important and long-term local observations with western scientific observations (Wheeler and Craver 2005). Household harvest surveys can be among the more valuable management tools in a fisheries management and regulatory system. Accurate harvest enumeration by species promotes the sustainable management and protection of customary and traditional (C&T) uses of fisheries resources during the management and regulatory process. Community patterns of use and distribution, as was documented in this project, provide critical empirical information about subsistence practices, which is essential for implementing state and federal subsistence laws and regulations. Documenting past and current harvest levels as well as community fishers' observations of individual fish species, groups of fish, and resource abundance, health, and condition, helps fishery managers identify important information needs and management concerns (e.g., declining abundance trends) about a particular species.

This project was also part of an ongoing effort by the Alaska Department of Fish and Game (ADF&G) Division of Subsistence to evaluate the possibility of integrating survey work into the high school curricula of selected school districts (Magdanz et al. 2007). By utilizing both ethnographic and survey methods to collect data on nonsalmon fish ecology, high school students may learn a more holistic approach to data collection and research, and how these disciplines and methods are useful for addressing federal, state, and community resource management issues. The goal was to generate interest in the biological and social sciences, an interest which students could then bring to bear on their future educational, professional, and technical work experiences. Finally, this approach supports one of ADF&G's core services of involving the public in the management of fish and wildlife. [1]

During public meetings held in the Middle Yukon region in 2004, residents of the region expressed concerns about the availability and health of resident freshwater fish species in light of 15 years of declining abundance of Pacific salmon *Oncorhynchus* spp., as well as other environmental factors. While

[1] "Involve the public in management of fish and wildlife resources" (http://www.gov.state.ak.us/omb/results/view_details.php?p=55).

salmon continue to be an important resource to rural Alaskan economies, residents of these communities have expressed significant concerns that decreasing salmon abundance and the resultant decline in salmon harvests may affect nonsalmon species and their harvests. Residents were also concerned that there may be systemic environmental or ecological changes affecting salmon which could also affect nonsalmon fish species and that the composition of their subsistence harvests could change if salmon were to become less available[2]. Residents believed that the health and viability of these nonsalmon fish species were critical because they are a wild food source offering additional, year-round sources of meat, especially if salmon stocks were to falter or were otherwise unavailable.[3]

Because of these concerns, during their 2004 meeting in Anvik, the federal Western Interior Regional Advisory Council identified a need for comprehensive data on nonsalmon fish populations, life histories, and the range of their subsistence uses. This project complements 7 U. S. Fish and Wildlife Service (USFWS) Office of Subsistence Management (OSM) projects (01-100 Koyukuk River, 01-101 Kaktovik, 01-112 Aniak, 02-037 "GASH" area, 02-040 Kotzebue, 04-253 Upper Tanana, 06-252 Yukon Flats). The first of these projects (Andersen et al. 2004), conducted in Koyukuk River communities, suggested potential relationships between whitefish and salmon harvests over time. For example, two single-year harvest estimates seventeen years apart show dramatic increases in particular whitefish species in specific communities on the Koyukuk River, where salmon harvests have been declining over the same time period. While single-year harvest estimates cannot demonstrate trends and other factors, such as socioeconomic change, the provocative shifts in harvest estimates suggests significant questions worth pursuing. Further, these TEK and harvest monitoring projects are important when read with recent biological findings on whitefish species in the Yukon drainage (R. Brown 2000; R. Brown et al. 2007) that suggest the ways in which some whitefish species move between fisheries. Together, all of these projects provide a more comprehensive picture of the subsistence harvests of whitefishes *Coregonus* spp. and *Prosopium* spp. sheefish *Stenodus leucichthys*, northern pike *Esox lucius*, Arctic grayling *Thymallus arcticus*, longnose suckers *Catostomus catostomus*, burbot *Lota lota*, Alaska blackfish *Dallia pectoralis*, and Arctic lampreys *Lampetra japonica* in Interior, Western, and Northwest Alaska.

This project will also assist in the federal management of subsistence fisheries associated with the Koyukuk, Nowitna, and Innoko national wildlife refuges by assessing the harvests of nonsalmon species and documenting TEK about the species in those areas.

The historical and anthropological literature about the residents and communities of Interior Alaska documents the significance of nonsalmon fish species to subsistence practices. In addition to Jetté (1908; 1911; 1913), a Jesuit missionary who documented important aspects of Koyukon life and language in the early 1900s, de Laguna (1947), Clark (1981), Huntington (1993); Loyens (1966), Sullivan (1942), and VanStone (1974) address aspects of subsistence, including the harvest of nonsalmon fish species. For example, according to Clark (1981:588, 589):

> 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.

Between breaks in hunting, keyhole or basket traps, and, in later times, nets, were set in rivers under the ice to harvest burbot, sheefish, whitefishes, and northern pike; inverted traps were set in lakes to harvest Alaska blackfish, a fish that frequently sustained these small communities in periods of otherwise poor fishing and hunting success.

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[2] Also, from 1992 to 2002, poor returns of chum *O. keta* and Chinook salmon *O. tshawytscha* to the Yukon drainage resulted in restrictions to all fisheries and several state disaster declarations (Whitmore et al. 2005:137–141).

[3] Sidney Huntington, a 91 year old elder living in Galena in 2006, remembered stories told by Chief Henry (1883–1976) about earlier salmon collapses (Huntington 1993:139).

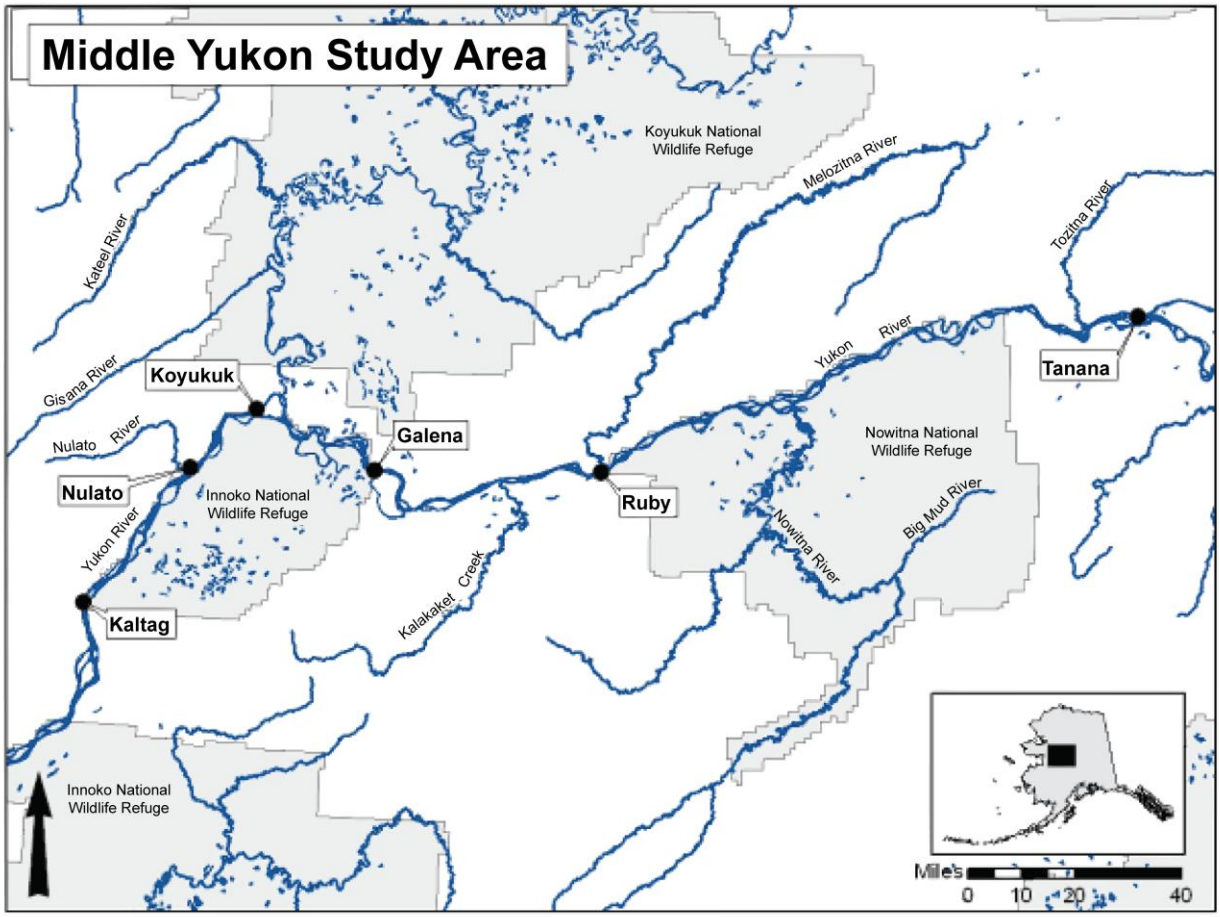

Figure 1.–Map of Middle Yukon River area and project communities, Alaska.

Loyens (1966) considers the roles of freshwater fish and salmon in the relationship between social organization and natural resources through his documentation of fish taboos in the Nulato area. Specifically, he points to shifting connections between gear types used and the effects of changing harvest techniques on social organization, noting that the historical shift in settlement patterns "from scattered camps to a settled village" did not restrict subsistence activities (Loyens 1966:148),

> ... but on the contrary enhanced and heightened some of them … Fishing was seen as the most important pursuit, because possible both winter and summer with the fishtrap … The Yukon River fishing continued as before and was even easier as it no longer involved a major displacement.

Descriptions of harvest techniques, species utilized, and their roles in seasonal aspects of local subsistence economies offer important insights into, and raise significant questions about, the historical and contemporary roles of these species in local perceptions and understandings. Placenames are also important to the analysis of the relationship between humans and their geography. As Caulfield et al. argue (1983:11), "Placename data are a valuable source of information about the land, wild resources and their use, environmental conditions, local history and folklore, and material culture." Stories about a place imbue the landscape with meaning, underlining connections that, in part, form cultural identity. Places are not simply collections of plants, animals, and other features, such as hills, cabins or lakes. In this sense, connections to the land reflected through naming, stories, and activities (such as harvest) show how

culture is spatialized (Gupta and Ferguson 2007). Subsistence practices, such as fishing, often have their historical basis in long established patterns of land use, signaled in part by references to placenames which locate shared experiences and shape cultural identity. The inclusion of placenames in an analysis of local, traditional ecological knowledge is significant because placenames are indices on the larger mental map that fishers maintain about how fish move around the area. Such an understanding is critical knowledge for successful and efficient harvesters. By talking about what happens at particular places, which are generally occupied during particular time periods or seasons, one can learn a great deal about the seasonal aspects of fish life histories and fish harvests. The discovery of placenames can also provide a shared geographical language between local fishers and biologists as well as other researchers to use during discussions about the area and significant fish habitats. Placenames are not simply named places but also reference the stories behind such places that signal important aspects of a community's shared cultural identity and history.

The Alaska Department of Fish and Game (ADF&G) Division of Subsistence has also produced some baseline subsistence harvest estimates in the Middle Yukon region that indicate the importance of nonsalmon fish species. In Tanana, Case and Halpin (1990) estimated that 71% of all households attempted to harvest nonsalmon fish for human food, dog food, bait, and other purposes. While Case and Halpin's work provided baseline data to facilitate the development of appropriate harvest regulations on state and federal (e.g., the Nowitna National Wildlife Refuge and the Innoko National Wildlife Refuge) lands, their efforts did not focus on documenting the social context and ecological complexity of these harvests through the contribution of local and traditional knowledge. Marcotte's (1990) work in Galena also documented significant amounts of nonsalmon fish harvested for subsistence uses. Marcotte (1990:75–80,125) explored the social organization of subsistence uses through an examination of the social ties between Galena (a regional hub) and other communities, as well as the social ties in the family and household relationships within Galena. Wheeler (1987) examines the effects of state fishing regulations on traditional fishing practices in Kaltag. Finally, Robert (1984) offers an exploration of the relationship between trapping and nonsalmon fishing in the Kaiyuh Flats. These sources and their relationships to this project's data set will be more fully examined in the "Discussions and Conclusions" section, below.

OVERVIEW OF CURRENT STATE AND FEDERAL FISHING REGULATIONS

In 1987 (and reconfirmed in 1993), the Alaska Board of Fisheries (BOF) made a positive C&T use determination for freshwater fish species in the Yukon area, including sheefish, whitefishes, Arctic lampreys, burbot, longnose suckers, Arctic grayling, northern pike, and Arctic char *Salvelinus alpinus* (see 5 AAC 01.236). Under state regulations, there are no bag limits or season restrictions for subsistence harvests of nonsalmon fish in the study area. Nonsalmon fishing is generally open by regulation 7 days per week, 24 hours per day, year-round under both state and federal regulations. Federal subsistence management regulations are applicable only to federally qualified subsistence users. Federal management authority over subsistence uses on federal lands is implemented under Title VIII of ANILCA. Under ANILCA, rural Alaskan residents of the Yukon–Northern Area (except those living in ADF&G Game Management Unit 26B) and residents of the Yukon River drainage have a C&T use determination for nonsalmon fish and are therefore qualified to participate in subsistence activities on federal public lands, even if other uses and/or users have been prohibited from subsistence fishing in federal waters due to conservation concerns (USFWS 2008).

OBJECTIVES

This project had 3 objectives:

1) To estimate the subsistence harvests of, and the percentage of households harvesting, using, giving away, and receiving resident freshwater fish species (nonsalmon) for the calendar year 2006 by species and season in 5 Middle Yukon region communities: Galena, Kaltag, Nulato, Ruby, and Tanana.

2) To document local knowledge related to traditional and contemporary patterns of subsistence harvests of nonsalmon fish, including:
    a) species used, their common names as used by residents, and basic taxonomic analysis;
    b) fish ecology, including information about habitat, spawning, and seasonal movements;
    c) contemporary and traditional methods and timing of harvest;
    d) contemporary and traditional methods of preparation and preservation;
    e) mapping of harvest areas and other significant habitats by species and season;
    f) traditional management practices and their effects on fish populations; and
    g) fish-related placenames.
3) To develop guidelines for working with rural Alaskan students on TEK, harvest monitoring, and harvest assessment projects.

METHODS

As an applied social science government agency, ADF&G Division of Subsistence utilizes a number of social science methods, both quantitative and qualitative, to fulfill its mission of documenting the subsistence practices and patterns of Alaskan residents. Much of the research conducted by the Division of Subsistence is quantitative in nature and involves documenting the amount of fish and wildlife resources harvested by a community of users. The principal unit of analysis is the household, a group of individuals living in a single dwelling who are usually related through immediate or extended kin ties.

COMMUNITY CONSULTATION AND RESEARCH APPROVAL

The research was conducted consistent with ADF&G policy on research ethics. During the first year of the project, ADF&G researchers consulted with each community and tribal council to approve the research plan and select key respondents for the interviews. Additionally, ADF&G researchers and the staff of the Louden Tribal Council worked with the Galena Interior Learning Academy (GILA), a secondary charter school in Galena, to design a pilot project that would integrate ethnographic and harvest survey methods in a classroom setting through a focused project for upper level high school students. This work began early in the project consulting with Paul Apfelbeck, a teacher at GILA. He agreed to incorporate the data collection process as part of a larger writing class where his students would learn how to conduct the data (including harvest surveys and TEK interviews) and, as part of the class, learn the writing skills to characterize the data. ADF&G staff trained the students to conduct the survey and also provided guidance, including digital voice recorders, a digital camera, and the interview protocol, on how to conduct interviews with key respondents. ADF&G staff and Louden Tribal Council staff discussed potential respondents with Apfelbeck. The data collected as part of Apfelbeck's class was ultimately used in the report; Louden Tribal Council staff were ultimately responsible for the Galena component of this report.

Systematic household surveys (Appendix A) designed by the Division of Subsistence were administered in each community by local research assistants. This project also utilized ethnographic, semistructured interviews (Appendix B) with key respondents in each community in order to document residents' experiences with and knowledge of nonsalmon fish.

HARVEST ASSESSMENT

Face-to-face household surveys generally provide more accurate estimates of harvest in rural Alaska than surveys conducted by mail or harvest calendars returned by mail in rural Alaska (Andersen et al. 2004; C. Brown et al. 2005).

In each community, students or research assistants hired from within the community worked with the principal investigators to collect harvest data through in-person household harvest surveys. Staff collected limited demographic information as well as information on sharing of fish species, seasonality of harvest, and numbers and species harvested, based on a 12 month retrospective recall.

The survey instrument was based on a survey instrument previously used by ADF&G in similar nonsalmon fish projects in the Upper Tanana, Lower Middle Yukon River (Grayling, Anvik, Shageluk, and Holy Cross—"GASH" communities), and Koyukuk River regions (C. Brown et al. 2005; Andersen et al. 2004). The only change from the previous survey instruments was to the title and year (Appendix A). The 1 page harvest survey instrument included questions about 10 nonsalmon fish species, including sheefish and 4 other species of whitefishes[4], and "unknown whitefishes." There were also spaces for additional species not listed on the instrument but harvested in the area. While Arctic lamprey have been included in nonsalmon fish harvest surveys for other Interior Alaska communities, they were not included on this harvest survey since most Middle Yukon River communities do not see or harvest them. The survey instrument asked about fishing for, using, receiving, and giving away fish, by month, for 1 calendar year, in order to capture the community and household sharing patterns characteristic of subsistence activities. A space was provided for respondents to give comments as well, such as observations about long-term trends in stock abundance. Participation in the survey was voluntary and the information provided remains confidential at the household level.

Survey Sampling Goals

In small communities of 100 or fewer households, Division of Subsistence sampling designs often strive for a complete census in order to survey each household regarding their resource harvest and use activities. In larger communities, the Division uses simple random samples or stratified random samples to estimate a community's harvest and use patterns. Principal investigators worked with the tribal governments of each community to compile complete household lists for use in the surveying effort. Principal investigators sought sampling goals of 100% (census) in Tanana, Ruby, Nulato and Kaltag. Of 536 total households, 357 households were surveyed, representing an overall household sample achievement of 67%. Of the communities in which a census was attempted, an average of 91% of households were surveyed. Samples ranged from 80% to 99% in 4 of the villages. Because of its larger size in terms of number of residents, principal investigators sought a 50% random sample in Galena; however, only a 25% sample was achieved due to a high refusal rate and key respondent fatigue, according to Louden Tribal Council staff.

The division applied the weighted means method (Cochran 1977) to generate harvest estimates for nonsalmon from households sampled within each community. This approach applies the mean harvest of sampled households to all households in the community that were not surveyed. In cases where a household was known to have harvested, but the actual harvest was unknown, the mean was used in place of that household's actual harvest. The weighted means principle was also applied when generating the estimated number of fishers in each community. Information Management staff used the following formula to generate these estimates:

$$H = N\left(\frac{\sum x}{n}\right) \tag{1}$$

Where

H = total estimated harvest,

N = total number of households identified,

[4] Although sheefish are a member of the whitefish family, they are often managed differently from other whitefish species, and so the sheefish data are presented separately throughout this report.

n = number of sampled households, and

x = household's reported harvest.

In using this approach, the mean of the estimate remains the same as the sampled mean and percentages derived from the sampled households can be applied to the entire household list. The principal assumption is that the group of unsurveyed households has the same harvest and use patterns as the households that were successfully contacted. Since the mean is the primary statistic used to develop the estimates, Information Management staff produced a confidence interval (CI), represented as a percentage, to measure the relative precision of the mean. The CI can also be applied to the total estimated harvest to obtain a likely upper and lower range for the estimate. The following formula was applied to create the CI percentage:

$$CI\% = \frac{t_{\alpha/2} \times \frac{s}{\sqrt{n}} \times \sqrt{1 - \frac{n}{N}}}{\bar{x}} \quad (2)$$

Where

s = sample standard deviation,

n = sampled households,

N = total households identified,

$t_{\alpha/2}$ = student's t statistic for alpha level ($\alpha = 0.05$) with n−1 degrees of freedom, and

$\bar{x}$ = mean harvest.

KEY RESPONDENT INTERVIEWS

Traditional ecological knowledge interviews with key respondents constituted the second component of data collection for this project, as discussed in the objectives above (Figure 2). In each community, principal investigators worked with tribal council staff and other community members to identify key respondents. Generally, tribal council members suggested key respondents who had a significant history of fishing for nonsalmon species. In the community of Ruby, Lisa Kangas assisted Caroline Brown with the interviews as part of an independent study internship, with college credit awarded as part of her undergraduate degree in fisheries biology. Kangas, originally from Ruby, focused her internship on the interviews in order to gain experience in the human dimensions aspects of fisheries science.

Principal investigators considered several factors in selecting key respondents, including age, fishing experience, kinship, and gender. Because this project aimed to document historical and contemporary fishing practices, individuals who were interviewed had either long-term fishing/processing experience (such as the Athabascan elders) and/or had recently spent a great deal of time fishing (including younger respondents in their 40s and 50s) and thus had a good sense of contemporary fishing practices, concerns, and locations. Both age groups tend to have multiple decades of fishing experience though their knowledge might differ based on when, where, how, and with whom they learned to fish. Different family lines might also fish in different locations through time; therefore, it is important that a key respondent list include most of the community's family lines in order to provide a more comprehensive harvest use area description. Finally, it is also important to interview both men and women since some knowledge tends to be gender specific; that is, women tend to be more informed about such things as the stomach contents (diet) of fish, the condition of their flesh, and the parasite load, all of which are gleaned from long-term processing experience.

Table 1.–Sampling goals and achievement for the 2006 Middle Yukon nonsalmon fish household harvest survey.

Community	Type of design	Total number of households	Household sample goal, number	Number of surveyed households	Percentage of households sampled	Number unable to contact[a]	Number declined survey	Population of sampled households	Estimated population of community
Tanana	Census	115	115	114	99%	0	1	256	258.2
Ruby	Census	65	65	52	80%	13	0	144	180.0
Galena	Random sample	199	100	50	25%	–	0	138	549.2
Nulato	Census	85	85	74	87%	11	0	236	271.1
Kaltag	Census	72	72	67	93%	4	1	196	210.6

Source ADF&G Division of Subsistence household surveys, 2007.

a. The design for Galena was a simple random sample. Of the 50 households selected, only 25% of households responded.

Figure 2.–Mapping with Justin Patsey in Nulato, 2007.

The semistructured interview format provided enough flexibility to capture a wide range of experiences while assuring a measure of consistency over the topics discussed (Bernard 1995:209–210). The guide consisted of an extensive list of questions and topics focusing on residents' perceptions regarding: 1) the local taxonomy of fish species under investigation; 2) their life history, including habitat, spawning seasons, and seasonal movements, including observations of relative abundance and population trends as assessed by the key respondents; 3) the traditional and contemporary uses and harvest methods on these species, including harvest timing and gear types used; 4) traditional and contemporary preparation and preservation methods; 5) the mapping of harvest areas and the location of fish-related placenames; 6) descriptions of traditional management practices and their effects of fish populations, where available; and 7) fish-related placenames. Interviews also documented traditional fisheries management practices employed by local subsistence fishers.

During the interviews, historical illustrations and photographs, primarily from the archives of Gonzaga University, although some had been produced by local fishers, of nonsalmon fishing in the area were used to prompt recollections, and color photographs of the nonsalmon fish species on the survey were used to elicit Koyukon Athabascan words for each fish species. Principal investigators used Mylar (transparent polyester film) overlays and topographic maps (at 1:63,360 or 1:250,000 scale, whichever was more appropriate to the mapping in a given community) from the U.S. Geological Survey (USGS), to document fish-related placenames, spawning areas, rearing habitats, and harvest locations, as well as to ensure systematic mapping data collection from respondents.

Overall, researchers anticipated conducting 25–30 interviews among residents of the 5 communities, each lasting approximately 1 to 2 hours in length. Respondents were compensated for their time. All interviews were digitally recorded and are currently housed with the Division. The number of interviews, interviewees, and trips are presented in Table 2, and the interview guide used by the interviewers is presented in Appendix B.

Table 2.–Key respondent interviews by community.

Community	Number of interviews	Number of individuals interviewed	Trips to each community
Tanana	6	7	2
Ruby	7	9	3
Galena	6	6	n/a
Nulato	8	11	3
Kaltag	9	9	3

RESULTS

This section details the results of the harvest survey with 357 households of the Middle Yukon area and the ethnographic interviews with key respondents. It begins with a brief summary of the scope and types of data collected in the harvest survey and the key respondent interviews, followed by a review of the linguistic inventories of nonsalmon fish in the area based on Andersen's work in the Koyukuk River drainage (Andersen et al. 2004).

Next is a regional overview of the importance of nonsalmon fish within a seasonal round which transitions into individual community summaries. Over the course of data collection, it became increasingly clear that each community's harvest patterns and locations were largely distinct with a few notable exceptions, reflecting important differences in the fisheries themselves and among communities. For example, winter under-the-ice fisheries were an important part of the seasonal subsistence round for some communities, but far less common for others. Others factors distinguished communities based on their geography; e.g. choosing between the mainstem river and tributaries and sloughs for harvest,

residents' uses of nonsalmon fish species, the seasonal timing of harvest, and the gear types used. Because of this, the results are presented by community in order to facilitate a comprehensive understanding of the details of the breadth and variance of fisheries in the Middle Yukon area and how they are related.

Several themes emerged in these community analyses, including an introduction to the role of place and placenames in understanding the importance of nonsalmon fish species in Athabascan culture, examples of community-specific harvest patterns and processing techniques, and residents' observations of environmental change.

SUMMARY OF HARVEST ASSESSMENT

Table 3 provides information on nonsalmon harvests by species and community for the Middle Yukon area during the calendar year 2006. This discussion of Middle Yukon area harvests provides information both in pounds and numbers of fish, to highlight the proportion of their contribution to subsistence diets and to provide harvest information in a format most useful to fisheries managers (see Appendix C for conversion factors). Although sometimes harvested in larger numbers, the smaller fish often contributed a smaller proportion of food, in terms of pounds, to subsistence diets. The villages of Tanana, Ruby, Galena, Nulato and Kaltag harvested an estimated total of 158,397 lb of nonsalmon fish during the 12 month period from January 1, 2006, through December 31, 2006. Whitefishes constituted 75% (118,839 lb) of this total, with 71% of the total whitefish pounds comprised of the physically larger species of broad whitefish (49,346 lb) and humpback whitefish (35,482 lb). While many households readily differentiated between "large" whitefishes (broad and humpback) and "small" whitefishes (ciscoes and round whitefish), several households reported harvesting whitefishes of "unknown" species, the estimated harvest of which totaled 21,729 lb, with the largest harvest reported in Galena (19,140 lb). A significant proportion of unknown whitefishes reported might have been the smaller species, which were less often differentiated by respondents. The practice of categorizing these smaller species as one group was consistent with those of most Yukon River drainage communities, (e.g., C. Brown et al. 2005). Reported harvests of large whitefishes totaled 84,828 lb, while small whitefishes harvests totaled around 12,282 lb, or approximately 10% of the identified whitefish harvest.

In terms of weight, sheefish and northern pike were the next most significant nonsalmon species harvested for the Middle Yukon area, at 14% (22,685 lb) and 6% (9,440 lb), respectively. The relatively minor harvests of longnose suckers, Alaska blackfish, and Arctic grayling accounted for <1% of the total harvest each. The harvest of burbot, or "loche" as this species were often referred to locally, accounted for approximately 2% of the total nonsalmon fish harvest by weight.

Only residents from Galena and Ruby reported harvesting Alaska blackfish and only Kaltag and Nulato residents reported harvesting Dolly Varden *Salvelinus malma*.[5] While Arctic grayling were not harvested in large numbers (1,896 lb, 2,709 fish estimated total harvest), all communities reported harvesting them during both the harvest surveys and the ethnographic interviews, with the most used fishing areas the clear, cold, rocky streams draining into the north bank of the Yukon River.

Generally speaking, however, the results of the harvest survey suggested some general fishing patterns in Middle Yukon communities. For example, a few fishers in Galena and Tanana appear to have harvested very large numbers of whitefishes (>2,000 fish per year), possibly further supporting Marcotte's (1990) observation that Galena serves as a clearinghouse for resources distributed to family members in surrounding communities. This high harvest amount may also have been an indication of the higher rates of participation in sled dog mushing activities in these 2 communities than in Kaltag, Nulato, or Ruby. As

[5] No attempt was made on the harvest survey to differentiate between the Dolly Varden *S. malma* and the closely related Arctic char *S. alpinus* and the two species are usually managed as one. Furthermore, Nulato residents reported harvesting "trout." However, because juvenile salmonids can be difficult to distinguish, these fish may not have been the less naturally abundant rainbow trout *Oncorhynchus mykiss*, but rather the more naturally abundant Arctic char / Dolly Varden in a subadult life stage.

pointed out in earlier sources (Andersen 1992; Andersen et al. 2004), the maintenance of dog teams has long been a driver of nonsalmon fish harvests, in addition to their use as human food. Additionally, there were significant levels of sharing between Nulato and Kaltag, as evidenced by data on Kaltag surveys that indicated fish were received from Nulato. It is highly probable that this sharing followed family lines, since many extended families were split between the 2 communities. While in Nulato, principal investigators also witnessed large shipments of fish to Kaltag households from Nulato. This movement of resource was likely in preparation for "Stickdance," a well attended annual memorial ceremony (Loyens 1966; Madros 1975) that alternates between Kaltag and Nulato. In 2008, the Stickdance occurred in Kaltag during the last week of March.

SUMMARY OF KEY RESPONDENT INTERVIEWS

Thirty interviews were conducted by ADF&G staff with 34 individuals in Tanana, Ruby, Nulato, and Kaltag (see Table 2). Louden Tribal Council took the lead on the Galena data. The GILA students, accompanied by their teacher, Paul Apfelbeck, and by staff of the Louden Tribal Council, conducted 6 interviews in Galena with a total of 6 individuals. In all, 36 interviews were conducted with 40 individuals.

The key respondent portion of the project focused on documenting the local knowledge and resource use patterns of residents of Tanana, Ruby, Galena, Nulato, and Kaltag along the middle portion of the Yukon River and involving the Tozitna, Nowitna, Nulato, Khotol, Kaltag, and Melozitna rivers and Kaiyuh Slough/Flats, among other area drainages. The interview questions about harvest and use of nonsalmon species in particular places elicited significant placename information, especially in Nulato and Kaltag, where residents relied heavily on the interconnected creeks and lakes of the Kaiyuh Slough and the American Creek drainage in the Kaiyuh Flats for much of their seasonal harvests of whitefishes, northern pike, and other nonsalmon species. Placenames revealed important aspects of the seasonal movements and important habitats of several nonsalmon species, including whitefishes, Arctic grayling, northern pike, burbot, and sheefish.

Additionally, community residents' fishing places appeared to have changed over time due to social reasons, such as village relocation. For example, the 1950s relocation of Kokrines residents to the contemporary village site of Ruby also resulted in changes to their fishing patterns and locations, as expected given the adaptive nature of subsistence economies and cultures. Fishing areas shifted downriver, from the area around the Nowitna River/Mouse Point/Peter Slough to the area more immediately around Ruby, including Deep and Big creeks, the Melozitna River, and Big Eddy.

Finally, the reported processing techniques for many nonsalmon fish species differed from community to community. In Nulato, for example, which had a large proportion of actively fishing elders, older techniques used by previous generations for processing fish, such as the "flat fish" method of drying fish, were still used. The flat fish method, usually used on northern pike and whitefishes, involved splitting the fish along the ventral, or belly, side, removing the back bone, and using 2 sticks to hold the fish open so that it would dry in the sun (Figure 3).

Table 3.–Estimated harvest and use of nonsalmon fish in Middle Yukon communities, 2006.

	Tanana		Ruby		Galena		Nulato		Kaltag		**Total**	
Resource	Number of fish	Pounds of fish	Number of fish	Pounds of fish	Number of fish	Pounds of fish	Number of fish	Pounds of fish	Number of fish	Pounds of fish	Number of fish	Pounds of fish
Pacific herring[a]					199	1,194					199	1,194
Pacific halibut[b]						8						8
Alaska blackfish[b]	0	0		1		139		0		0		141
Burbot	128	307	28	66	768	1,844	91	218	52	124	1,066	2,559
Dolly Varden[c]							136	339	1	3	137	342
Arctic grayling	109	76	91	64	350	245	1,394	976	764	535	2,709	1,896
Northern pike	358	1,612	78	349	1,150	5,176	257	1,158	255	1,146	2,098	9,440
Longnose sucker	127	89	0	0	513	359	20	14	0	0	660	462
Trout[c]							558	832			558	832
Sheefish[d]	834	5,006	199	1,193	1,982	11,892	559	3,356	206	1,238	3,781	22,685
Whitefishes												
Broad whitefish	2,706	10,822	14	55	8,832	35,326	786	3,143	0	0	12,337	49,346
Ciscoes												
Bering ciscoes	3,016	4,223	0	0	3,980	5,572	0	0	0	0	6,996	9,795
Least ciscoes	474	474	0	0	1,990	1,990	23	23	0	0	2,487	2,487
Subtotal, ciscoes	3,490	4,697	0	0	5,970	7,562	23	23	0	0	9,483	12,282
Humpback whitefish	2,070	6,210	299	896	9,234	27,701	225	675	0	0	11,827	35,482
Unknown whitefishes	12	36	35	105	6,380	19,140	238	713	578	1,734	7,243	21,729
Subtotal, whitefishes	8,278	21,765	348	1,056	30,415	89,729	1,272	4,554	578	1,734	40,890	118,839
TOTAL, nonsalmon fish		28,855		2,729		110,587		11,447		4,780		158,397

Source ADF&G Division of Subsistence harvest surveys, 2007.

Notes Blank cells represent instances where harvest information was unavailable. For conversion factors, see Appendix C.

a. Harvest was reported and estimated in gallons, not in numbers of fish.

b. Harvest was reported and estimated in pounds, not in numbers of fish.

c. It is unclear whether local classifications of "Dolly Varden" and "trout" reflect different species according to Linnaean taxonomies, or another distinction, such as the same species at different life stages (see footnote 5).

d. Although sheefish are a whitefish species, they are often managed differently than other whitefish species, and so the data are presented separately.

Figure 3.–Northern pike and whitefishes prepared by the flat fish method for a Nulato Stickdance.

In Tanana, where several families still maintained dog teams of 10–15 dogs (although some lots have over 30 dogs), the harvest and uses of whitefish and other nonsalmon species differed from other project communities in which human consumption of these fish was their primary use. Tanana fishers reported that whitefish species were highly valued as dog food, more than salmon, because of their stable nutritional properties (Figure 4). For example, one dog musher placed ciscoes (various spp.) in buckets, froze them, and repackaged them in bags after they were frozen. He then combined them with salmon to feed to his team as they traveled to and participated in sled dog races.

Figure 4.–Tanana "dog pot:" a large cooking vessel generally used to cook large quantities of food for dogs; may also refer to the food cooked in such a vessel. This dog pot is filled with salmon and whitefishes.

NONSALMON HARVEST BY COMMUNITY

Tanana

Perhaps more than any other community in the Middle Yukon region, Tanana residents' harvest and use patterns of nonsalmon fish species in 2006 were marked by their long-term involvement with dog teams.

For the key respondent interview portion of this project, 7 individuals were interviewed (Figure 5). These individuals represented 6 family lines in Tanana and there were some connections between the lines through marriage and kinship. Of the 7 individuals, 4 were elders (2 women, 2 men), one of whom still actively fished for the majority of his harvest. One elder was born and raised in Galena while a second elder was born and raised in Ruby; both moved to Tanana as young adults and had lived there since. Six individuals (2 married couples and 2 additional individuals) were active fishers. All the individuals kept dog teams and all still spent a great deal of time in summer at their respective fish camps harvesting fish with fish wheels. The selection of these key respondents was partly based on the results of the harvest survey, which identified the major harvesters of nonsalmon fish species in Tanana.

Figure 5.–Elder Helen Peters of Tanana, 2007.

The nonsalmon fish harvest areas used in 2006 by Tanana residents were quite broad: essentially a 50–60 mi length of the Yukon River between "the Rapids," (approximately 30 mi upriver of the community) and the Tozitna River and Whiskey Jack Slough (approximately 10 and 20 river miles below Tanana, respectively), about 20 river miles of the Tanana River, and the lakes and sloughs between the Tanana and Yukon rivers as well (Figure 6). According to the elders interviewed, these areas approximately matched historical harvest locations, with a few exceptions for areas that were no longer used or used irregularly. Generally speaking, however, according to the interviews, Tanana fishers harvested the majority of their nonsalmon fish from a small number of locations known to be productive during specific times of the year, or as part of their summer salmon fishing efforts with fish wheels at fish camp.

Figure 6. Tanana Non-Salmon Harvest and Use Areas.

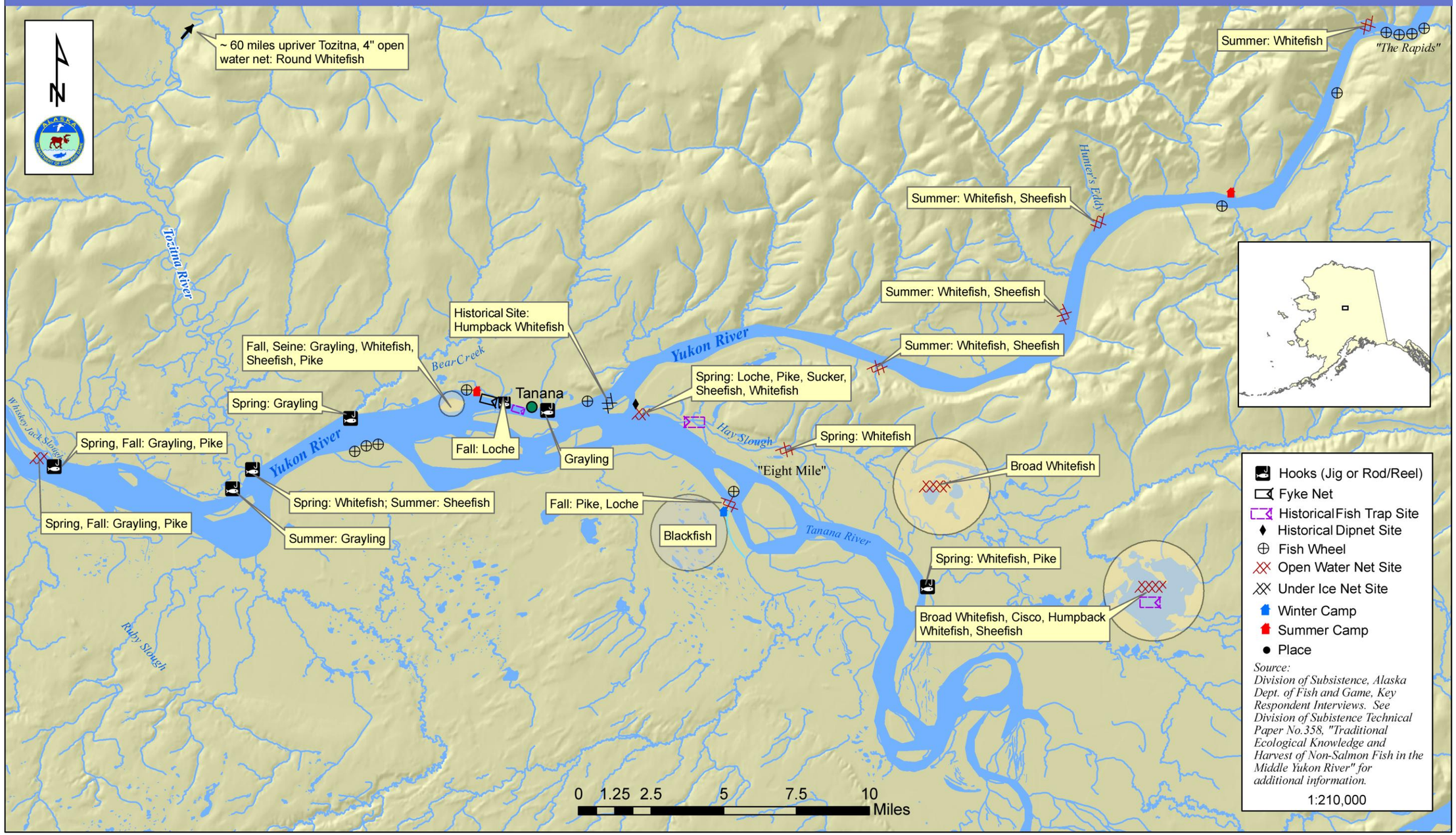

Figure 6.–Map of Tanana residents' nonsalmon fish harvest locations, 2006.

Seasonality of Harvest and Gear Types

The elders interviewed for this research once followed a seasonal round of subsistence and economic activities with their families, beginning in childhood and continuing into adulthood, before settling more permanently in Tanana and following the seasonal round from this base.

> They all did that. It's just like a cycle. In springtime in April, we move to spring camp so they could hunt muskrat … With muskrat they pay the bills, and they get a grubstake again to move to fish camp. And then they fish—lot of fish cause they used to bale fish them days. They used to sell it by the bundle to the store … [And] everybody buy fish, all along the Yukon, downriver, around the coast, that's what I heard anyway. And then the falltime, we go to fall camp because they're going to cut wood for steamboat, and they trap the same time. And they get grubstake again. With the steamboat, the wood they cut, they pay for their grubstake again. And then in December, that's when we move back to [the village] to go to school. So we go to school from December to April. That was the time we go to school … Just about four months. [010108T]

Nonsalmon fish had different uses at each seasonal camp. During spring, when residents used dog teams to travel around the land "ratting," or muskrat *Ondatra zibethicus* trapping, families would set small nets in sloughs and creeks to fill out dog food stores, and to get fresh meat for human food after the long winter when little else was available. "We always had little fish net to put in the creek. All the time, we always had fresh fish no matter where we went. ... It's not a big long net like for the Yukon, but it's big enough for the creek. … Not all the way across the creek." [010108T] These short nets harvested northern pike, burbot, and the larger whitefish species. Spring trapping was also a time to harvest Alaska blackfish. While residents did not report harvesting any Alaska blackfish in 2006 and most key respondents confirmed that Alaska blackfish were no longer actively harvested, several elders remembered the practice, often mentioned in conjunction with trapping activities:

> March [1938] one time we decided we were gonna go trapping, set muskrat traps around the lake [southwest of Galena, across the river] so we … pitch up tent … and we lived on blackfish …We go out and look for muskrat houses and set traps, and we came across [an] open hole where that fish come out and we just scooped it up and freeze it. We used to scoop those blackfish out with a big frying pan. We just dig a hole in the snow and pour it in there and it would freeze like that and we used to bake it with bacon, salt and pepper, and onion. [010108T]

Alaska blackfish were not only used as human food, but were fed to dogs as well. Another elder recalled that his father used a trap to harvest Alaska blackfish in the lakes around the 8 Mile area:

> He get a washtub full everyday. He had a fish trap, what you call a fish trap, made a funnel … In winter, like right now [January]. That was entertainment! In the lakes, he set them straight up and down. We had a greedy dog—I used to throw them at him and he'd swallow them whole. He'd roll around and I'd hear those fish sloshing around! … Dogs get shiny fur with those blackfish. They're real rich. [030108T]

Other spring fishing methods once used provided efficient means of harvesting large quantities of nonsalmon fish for dogs and humans. One elder recalled that her father-in-law used to set a fish trap in Garden Creek (near the contemporary location of the aircraft landing strip in Tanana) and others used to set a fish trap in Hay Slough, a major creek at the confluence of the Yukon and Tanana rivers. The Garden Creek trap was set under the ice, under laborious conditions since chain saws did not exist at that time and men had to use 5 or 6 ft saws as well as axes to cut holes in the ice. The Hay Slough trap was set in open water: "Hay Slough's not very wide, and there's another creek as you're going up, and it's a little deep, and that's the kind of place they used to put fish trap in. … That was their way of getting a lot of fish." [010108T]

Hay Slough was also a historically productive spot for dipnetting and several residents recalled this method, even those who had never participated:

> Springtime we used to dipnet over at Hay Slough, but it's not as good as it used to be. There's a sandbar way below there and the fish go way out, I guess. We used to have dip net with a long pole, you know, with a net at the end, and you just go like that [makes a sweeping motion in the direction of downriver] and pretty soon you feel it and you lift it up and there's the fish. It's good only for springtime. [010108T]

> Early spring, after the ice went out … By net and dip net—they used to use nets. From the bank and from the boat—just get in the boat and dip—a paddle boat. Whatever they can get, in the springtime, they bring them and cook for dogs, and some they cut to dry. [020108T]

One fisher reported that people used to harvest broad whitefish in the spring in Hay Slough, "cause they're coming out and they come out in big bunches right after the ice. The old people used to fish in that area. … There were so many [fish], they dipped from the shore, and then they put up little racks and they hang them for dogs. It'll help them over 'til the salmon come." [030108T]

After spring trapping, families moved to the Yukon or Tanana rivers for summer fish camp, where, although salmon were the primary focus, nonsalmon species were scooped up indiscriminately by fish wheels. Fall and winter residency was usually in the village or at a wood cutting or hunting/trapping camp. Nonetheless, nonsalmon fishing continued into fall and winter. Though no longer practiced today, according to respondents, setnets under the ice were utilized by residents as an efficient means of getting fish in the winter. One elder recalled a particular example set in front of the village and maintained by community members:

> In fact, they used to put in net up at the mission, up at the island—wintertime—and leave it open for whitefish … The island in front of it —they used to cut a long place just for fishnet to be in, long as the net. They put the net in and they cover the top at night … They cover it with tin … The men, everybody, used to go over there and get fresh fish from there all winter long. They get those whitefish, those little humpback. No sheefish, no loche [burbot]. I don't know why they just get those humpback fish … I used to remember tubfuls! A couple of tubfuls —they just pass it around the village and everybody get fish. [020108T]

Other methods were also used. During one interview, an elder fisher remembered his father harvesting northern pike in the Green Slough area, off the Tanana River, upriver of 8 Mile Island:

> I look around back there and there's lots of pike back there—but, like I was telling you, long time ago, them old guys in the falltime—like this place up there. The pike would come out of there in the falltime—I don't know why, they'd come out right there [at the mouth], and my dad used to go up there and just rake them pike out—I remember him just making piles, with a rake, with this much water. That's falltime, before it froze—they were coming out [toward the Tanana]. There was loche [burbot], too—I remember lot of loche [by his camp]. We catch them … He'd rake them up for dog food … The water was really low there right at the mouth. They sometimes went back into the slough, but the mouth was really clear. [030108T]

One elder remembered processing whitefish species as part of the summer harvest which was saved for winter use in the village. And one fisher remembered older women jigging through the ice during December and January in front of the downriver half of the village: "Just about every day, there'd be another old lady, all them old women. … These people have been deceased for some time."

One elder remembered seeing whitefishes in the fish wheel throughout summer. She helped her family cut the fish before her father dried and stored them.

> They got sheefish in the salmon wheels all summer, but they would get humpback in the fall … He used to feed a lot, my father, and he was having a potlatch during Christmas—they have potlatch every night in the hall—and then he'd bring out a big bag and pass that whitefish along, cut and dried. Yeah, I had a little table and I had a little knife, and so that was my job, to cut the whitefish! [020108T]

After the whitefish were cut into approximately 8 in fillets, and dried and smoked in the smokehouse (without salt), her father would pack the whitefish fillets in sacks and bring them out at Christmas potlatches. Her brothers and father or other older people cut the larger whitefishes: "They saved everything. Even the guts they dried for the dogs. They put them on a rack next to the bank and they hang them, fish eggs and everything. The heads and everything. They pack them in a bag, a gunnysack." [020108T]

In 2006, most Tanana residents focused the majority of their fishing effort in the late spring, summer, and early fall months of May through September, with occasional effort in October. Much of this fishing took place at summer fish camps, primarily with the use of fish wheels, as was done for generations, according to key respondents. The timing of this harvest also provided contemporary residents with clues to the seasonal movements of sheefish, humpback whitefish, and cisco species.

Another fish wheel fisher, who fished primarily in the Rapids area, said that while the fish wheels in front of Tanana harvested whitefish and other nonsalmon species prior to the salmon run, whitefishes did not usually show up in the Rapids fish wheels that early:

> ... [W]hat I find is that up in this Rapids area, we put the fish wheel in as early as we can, and usually we're really trying to find something to put in the dog pot [see Figure 4] at that time of year—this would be, like, early to mid June, before the salmon show up. Boy, we could spin the wheel for twenty-four hours and just get maybe a whitefish or two. It's really slim pickin's that time of year. [050108T]

The relationship between gear selectivity and fish behavior may have played a role in this example of seasonal movement since some species, such as northern pike, rarely end up in fish wheels because they tend to stay closer to shore. This fisher expressed curiosity if nets, instead of fish wheels, used at the Rapids would harvest nonsalmon fish species; however, he noted, early June tends to bring high water and debris to the Rapids area, making nets problematic at that time.

In this fisher's experience running a fish wheel, whitefish species started showing up in July when they became "a significant amount of the [dog]pot," especially Bering ciscoes, or "shiners," as they were referred to locally [050108T]. Bering ciscoes started to show when the Chinook salmon run picked up and also when fishers started to see more summer chum salmon at the Rapids. Since whitefishes were harvested by the bucketful in fish wheels, dog pots could include "maybe three bucketfuls of [smaller] whitefish and one bucket of assorted larger whitefish—but not much sheefish at that time," since that species arrived later, in early August or September [050108T].

One lifelong Tanana fisher who used to set a net most often used a fish wheel. He used the fish wheel at the Rapids to target Chinook salmon in the summer then moved it to the village in August and September to use it for fall chum salmon, or "silvers," as they were referred to locally. He used to catch sheefish in the Chinook salmon nets. Of the broad whitefish, ciscoes, and sheefish he harvested through the season, the majority were harvested in the fish wheel he set in the late summer and fall for fall chum salmon.

Another fisher who ran a fish wheel immediately downriver of the village of Tanana usually started to fish in late June or early July. He reported seeing Bering ciscoes in early summer and that he did not usually harvest sheefish until around July 10. He harvested whitefishes throughout summer, primarily

Bering ciscoes with a few broad whitefish. Respondents reported that using a fish wheel to harvest food for dogs was a delicate balance between the salmon-to-nonsalmon ratio a fisher may want to achieve. The fisher who ran the fish wheel immediately downriver of Tanana noted that salmon often disappeared from the north bank by September 15 and so he often fished the south bank at that time as salmon were just beginning to run in the Tanana River. He noted, however, that fish wheels on the north bank near the village usually yielded significant quantities of nonsalmon fish species, especially as the summer progressed while the south bank fish wheels primarily harvested salmon. While fishing the south bank, he generally harvested about 2 sheefish per day and 2 to 3 whitefishes throughout summer. He noted that there were "so many salmon on top of them [the sheefish and whitefishes]." On the north bank, in contrast, he could harvest "a pickup truck full" of nonsalmon fish in a day [040108T].

This fisher considered sheefish a particularly valuable source of dog food, so he targeted sheefish at a particular spot with a fish wheel. He said sheefish usually ran more heavily between August 10 and September 20. In addition to the value as dog food, he also cut and dried them for human food: "They're probably greasier than a king [Chinook salmon]. Up here, they're as oily as a king, if not maybe more." [040108T]

As residents have described above, the Rapids has been one of their major traditional fishing areas (Figure 7). In addition to the Rapids, there were several places closer to the village that residents knew were historically productive fishing spots at different times of the year and with different types of gear. Directly in front of the village was one such locally favored area that was used for late summer/fall fishing with setnets. In the fall, several fishers used a series of small eddies in front of the gravel pit that was also used to store fish wheels through the winter. Residents most often used 3 or 4 nets, usually about 3 ¾ to 4 ½ in mesh size, to target ciscoes; sometimes a much smaller mesh size was used. Residents who used a larger mesh size harvested mostly broad whitefish which, they said, could outnumber chum salmon in late September. The nets with the smaller mesh size could also harvest significant amounts of ciscoes; both ciscoes and broad whitefish were usually harvested for use in dog pots.

Hay Slough, at the junction of the Tanana and Yukon rivers, was a common spot fishers used to harvest many species of nonsalmon fish. Specifically, an eddy at the mouth of the slough was a prime area to harvest fish as they moved in and out of the slough. While the dipnetting described earlier was no longer practiced, spring and early summer net fishing continued in Hay Slough. Broad whitefish, humpback whitefish (called "humpies" locally), and northern pike were the most commonly harvested species. One fisher noted that the mesh size generally used prohibited fishers from knowing if or how ciscoes used the area. Additionally, the mouth of Hay Slough had a tendency to fill with silt from the upper reaches of the slough, so fishers had to be active in order to use the area effectively [050108T]. Tanana residents also used Hay Slough for what residents often referred to as "recreational" fishing—fishing with a rod and reel or hook and line for food—mostly for northern pike during summer [040108T].

The Tozitna River, which many residents often called the "Tozi," also afforded valuable fishing opportunities for Tanana residents. One resident had homesteaded approximately 60 river miles (approximately 30 air miles north of Tanana) up the Tozitna River. He fished a handmade, 4 to 5 in mesh net that harvested only salmon, and he noted that round whitefish (or "river" whitefish, as they were called locally) and Arctic grayling were also present in the area, but not the larger nonsalmon fish species. Northern pike were present downriver from his camp and these fish approached 5 lb in size as one moved closer to the Yukon [060108T]. The mouth of the Tozitna River was also popular with Tanana residents. Upriver waters such as Bluebell Creek, approximately 20 mi upriver, were productive Arctic grayling spots in mid July. Sheefish were also present near the Tozitna River mouth during June and July and especially, according to one fisher, in the second half of July until northern pike "take over at the mouth of the Tozi and you don't see sheefish again." [040108T] One fisher recalled fishing at the Tozitna River with his wife:

> Down here at Tozi —my wife and I had a lot of fun fishing for sheefish. That's in June. We used to go down there after work—we both worked at the hospital—we used to go down there until one or two o'clock in the morning, rod and reel. I think mainly they go in there [into the Tozitna River] —they were feeding on something, minnows [juvenile fish], maybe. You could see them jump once in a while. But sheefish, when you fish for them, they're kind of hard to get. If you tried fishing for sheefish and you think you got one, you gotta give it a quick jerk, 'cause if you don't get [them] the first time you feel a nibble, you'll lose them! But they were a lot of fun. We cut them and make half dried fish out of them. You know: scored them, smoked them, freeze them. Boy, they were good! [070108T]

Figure 7.–Don Johnson, Tanana resident, mapping fishing areas he had used throughout his life, 2007.

As was practiced over many generations by Tanana residents, "recreational" fishing with a hook and line attached to a rod or pole remained a favorite method of bringing dinner home. In addition to Hay Slough and the Tozitna River, residents also fished with a rod and reel in Fish Lake, Fish Creek, Bear Creek, and Mason Slough (also referred to as Whiskey Jack Slough), all downriver locations, in the evenings during spring and fall, especially targeting Arctic grayling and northern pike [060108T, 070108T].

Residents related that seining remained a method that efficiently harvested large quantities of nonsalmon fish species. Residents used a net with a small mesh size that corralled fish rather than gillnetted them. Seining was usually practiced in very specific spots, during fall, with several people working together: "... [T]hey can do pretty good with that some time—come back with a pretty good boatload of assorted whitefish species." [050108T].

> We walk along the beach with anchor line. And the boat, with the other end of the net, [is] way out there [north side of Bull Island]. We start pretty close at the end and go only about three or four hundred feet down there, right along this end, on the inside. It had to

be rock beach. As soon as you could feel it—the net, it get pretty heavy—by the time it get fish—from one end to the other, it bowed, like this, you know. And then once they do that, they tell you to stop, and you stop right there while they go around with the boat and drift it back into shore. And then you start pulling both ends … Everything! Grayling, small whitefish, every kind of fish, even dog salmon, sheefish—and, once in a while, you get a pike. [070108T]

Finally, one fisher noted that he has used a fyke net in the past, primarily to harvest for dogs, when his wheel or nets are not productive (Figure 8). This does not, however, appear to be a widespread practice.

Figure 8.–Contemporary fyke net on the banks of the Yukon at Tanana, 2007.

Harvest and Use of Nonsalmon Fish

Given the presence of large dog teams in Tanana, it was not surprising that one of the major uses of whitefish species and other nonsalmon fish species is for dog food (Figure 9). In fact, many of the dog mushers in town claimed that whitefishes were a better source of quality dog food than were chum salmon, locally called "dog salmon" (Figure 10). The mushers said that they attempted to harvest enough whitefishes to both fill and augment their dog pots throughout winter. One fisher positioned his fall fish wheel on the north bank, which allowed him to harvest more whitefishes than salmon. He said:

> Whitefish is the best fish [for dog food] there is! Way better than salmon—salmon is on the low end for them … And if you're feeding them salmon or salmon heads, you'll be in

> the rear end of the race! Whitefish is WAY better! I don't know: I think it's the calcium in there. Salmon doesn't have that as much. [030108T]

And, according to another musher/fisher who did not distinguish between whitefish species used in his dog pot:

> I notice that when you feed all whitefish, it's kind of like putting a lot of bone meal in their diet. Bone meal will turn their turds white, and if you feed them whitefish, the same thing will happen … I think, from whitefish and sheefish—generally, late in the fall—when we put them up, we don't cut them and they have more oil—and I believe that dogs are able to digest their bones for calcium a little better than they can salmon. [040108T]

Most of the mushers interviewed stated that they preserved whitefishes specifically for their dogs. One musher/fisher harvested whitefishes in the fall months and then froze them whole in paper boxes and then stacked the boxes in his storage shed. He claimed that including whitefishes in their diet kept his dogs injury-free. He also said that salmon were heavily relied on only because a musher could usually procure them in abundance and a lot of fish were required to feed a large dog lot through the year.

Figure 9.–Lead dogs ready to go on a training run in Tanana, 2007

Figure 10.–Whitefish species used for dog food and stacked like firewood, 2007

While freezing (during the cold fall months) was a common method of storage for nonsalmon fish used as dog food, other methods were also used, especially for Bering ciscoes, which showed up earlier and were not abundant by around September 15, before the weather allowed freezing and storing whole fish. One musher told of how he preserved ciscoes in white plastic bags or in gunnysacks:

> [I] wrap it up and make sure there's no blow [flies] and I'll hang those bags and it keeps them from going south [spoiling] —good dog food. Geez, you don't even freeze it before you boil it—you go out there with a shovel—take your skinny dogs—that stuff'll be green, stink to high heaven … Cut the bag open, and you just take the shovel—and if I had skinny dogs, I'd just give it to them because they'll get fatter than hell on that stuff in no time. Right out of the bag, all green and slimy! Boy, they love it—they would growl—like if you had two dogs tied up, and the one in the middle got the whitefish, and the other two would be looking at him, and he'd be growling out of the sides of his mouth—they really love it. That stuff is way gone [fermented] but they really put on weight from it. [040108T]

He stored the bags on the ground near his shop, where they "cooked" and resisted freezing even in cold winter temperatures.

Residents related that good dog food could be made from other fish in addition to whitefishes. One fisher recalled spending time at Fish Lake, about 20 miles north of the village between the Yukon and Tanana rivers. Another fisher said that during a particular time of shortage, several mushers pooled their resources and traveled up Fish Creek, while it was still frozen, to Fish Lake, in order to feed their approximately 90 dogs off the land:

> As soon as the ice broke in the creek, we put a net in [Fish Creek at Fish Lake]. … Like I said, as soon as the creek broke open we put a net in … 'Cause we knew we could feed our dogs off the land up there. We got—we were catching thirty huge [northern] pike a day. [The net] was up there—it was almost all the way to the lake. It's about ten, fifteen miles long, but we were closer to the lake. We were probably, as the crow flies, we were maybe a quarter-mile from the lake, but as the creek goes, we were another three or four, maybe even five miles before it got into the lake and I think we were ten miles up the creek. There was enough, where I was cutting the leftovers, in the springtime—I brought them back with me and I had enough fish with me to feed my dogs. We were catching these pike in a chum net. … We took off about April tenth, before the ice went out, and came back after the ice went out. I drug a boat up… [040108T]

As the mushers/fishers moved their fishing closer to the mouth of the creek, they started to harvest whitefishes in addition to northern pike.

Nonsalmon species were prized by mushers not only for the dogs, but also for themselves, in order to help with the heavy workload that is often a part of running dogs (Figure 11). Broad whitefish in particular were slightly fermented, frozen, and then eaten without cooking. They were a readily available source of energy during trap line activities:

> Years ago, maybe I was nineteen or twenty, and I start going with these old guys, you know. They take these broad whitefish and you kind of sour them just a little bit—and when we used to go trapping, say about three-thirty PM, we went up to look for a place where we were going to put up a tent at night—and we were pretty well pooped out, you know. So we set up our stove and bring out one of these fish to eat where it's a little bit soft but still frozen and kind of chewy and we used to eat it. And I tell you what, that's the biggest adrenaline rush you'll ever get. We put salt on it and drink tea—oh man, in one hour you feel like you didn't do anything all day. You can go out and fix your dog's bedding, cut wood—and before that, you're so damn tired, you just barely move … In the falltime—you let them ferment a little bit, you don't cut them, you just leave them whole—everything. Just let them sit a few days and [then] freeze them. [030108T]

Many fishers stated that while they did not target ciscoes for human food because of their size, they were favored as a tasty addition to a subsistence diet: "We don't target, but we utilize the Bering ciscoes for human food—we dry them and cut them. We just filet them out, dip them in salt, and dry them." [040108T; 050108T]

Figure 11.–Lester Erhart, a musher and fisher from Tanana, and Caroline Brown visit before Erhart leaves on a dog training run, 2007.

Sheefish were also consumed by Tanana residents. They were often dried, or filleted and skinned before being frozen, or, in contemporary times, vacuum sealed and frozen. "The fat's close to the skin so it makes it go rancid." [040108T] Tanana residents valued sheefish for use in making "Indian ice cream,"

because sheefish tend to be larger, with more meat for the delicacy. Tanana residents made this traditional dessert from dried and flaked fish meat, sugar, rendered animal fat or commercially available vegetable shortening, and berries, and usually reserved it for ceremonial events such as potlatches [060108T].

The roe from broad and humpback whitefishes was always sought after while the roe from sheefish was somewhat less preferred.

Burbot were considered a delicacy by some individuals and were generally used during fall. Arctic grayling were generally used during spring. One fisher suggested that the community's focus on whitefishes, of all the nonsalmon fish species, might have been because of the species' annual and predictable migrations, during which one could harvest them in great numbers: "Tanana fishermen don't like to fish without abundance!" [030108T]

Ecology of Nonsalmon Fish Species in Tanana

Residents of Tanana are in a unique position among residents of the Middle Yukon River region to know about the seasonal movements of nonsalmon fish species and specifically whitefish species, because not only have they relied on generations of observations based on harvest patterns and practices, but also because several Tanana residents have been involved in multi year USFWS research projects (R. Brown 2000; R. Brown et al. 2007) in the Rapids area to track the migrations of whitefish species.

Based on these experiences, several respondents were able to discuss their knowledge of the seasonal movements of whitefish species. Stan Zuray, a long-time resident of Tanana who also administered the Rapids Research Center[6], noted that the 2007 run of Bering ciscoes was the largest he had documented since 2000 (approximately 400 per day) and was also the largest documented at the mouth of the river. According to Zuray, Bering ciscoes are anadromous. He further noted that they may be one-time spawners based on his observations of migrating Bering ciscoes that were of similar weight, size, and age. Additionally, he noted that there were several pulses of Bering ciscoes throughout the summer, specifically in June and again in July, while "humpies, broads, and sheefish are all basically fall-run fish." [060108T]

While not always distinguished locally, least ciscoes were also present in the area and were often harvested by residents:

> There's actually a run, though, around September, maybe October first, or the very end of September—and there's an actual run of least [ciscoes], and they'll overtake the Bering, and you'll see lots of them. There might be fifty or something a day—but all the cisco we catch inseason at the Rapids up until quitting time up there, it's all just Bering. [060108T]

Most fishers noted that while they saw small numbers of sheefish throughout summer, sheefish generally migrated during fall which made them easier to harvest in larger quantities. One fisher in particular, referring to significant spawning areas documented in the Yukon Flats (R. Brown 2000), observed that sheefish harvested early in the summer had smaller, undeveloped eggs. The eggs from sheefish harvested in midsummer were of medium size:

> ... [A]nd then there's the ones that come late, like the big rush, the big push—that we'll see the bulk of them—and they'll have pretty good-developed eggs, and they're in a rush. … Obviously, the ones I'm catching in June here, either they're gonna go there and sit—which I don't think they do, I think they just kind of meander, 'cause we're not catching

[6] The Rapids Research Center, located on Interior Alaska's Yukon River "Ramparts Rapids," 40 mi upriver from the community of Tanana, is dedicated to research projects involving salmon and nonsalmon fish species that migrate through the area. Projects include otolith chemistry work on whitefish species, salmon run timing, and abundance indices, among others. These projects are primarily led by Stan Zuray, a long time Tanana resident, along with state and federal agency staff and multiple years of students and other community volunteers who have contributed to the research. It is also the site of an active summer fish camp harvesting salmon and nonsalmon fish species for subsistence. http://www.rapidsresearch.com/

> them in the [fish]wheels but we'll catch them in the eddies and stuff. That's the thing: lots of whitefish but they're not moving through the Rapids area—they're not migrating, they're just hanging around in the eddies. But late in the fall, there's lots of movement—that's when all the movement is, so I have this impression that sheefish are a lot different than salmon … They just want to get to Fort Yukon by November one [to spawn]. You know the party's on [the fish are spawning] November first. [060108T]

One elder fisher pointed specifically to an upriver area on Hay Slough, a heavily used, productive fishing spot, as an area that nonsalmon fish used for summer feeding and possibly for fall spawning as well:

> You come all the way up in here to the lake, the big lake … Well, I just know that that's where they go, these whitefish, these broads go there. They go in the falltime, like I told you—and then there's freshwater shrimp there and that's what they eat—'cause this guy went up there one time to catch them, just [to] see what they're eating. … That's where they spawn—they must spawn in the falltime—they go up there and stay up there all winter and come back in the spring—and they're kind of mossy. I know this 'cause they taste mossy, but after they swim on for a while, it goes away. [030108T]

He also observed that the whitefishes they harvested during fall were in much better shape and had better flesh quality than those harvested during spring. In spring, he said, whitefishes were "soft" until they resumed movement. "I noticed—you can tell in the falltime when their scales and skin get thicker. And my mother used to say, in our language, 'Oh, they're putting on their overcoat now,' she said. And their skin get thicker, kinda rough." [030108T]

This elder also suggested that many sheefish and some whitefishes migrate to the Yukon Flats to spawn because when he observed them in his fish wheel at the Rapids the fish were headed upriver [030108T]. Other Tanana fishers also observed the seasonal movements of other nonsalmon fish species. One fisher told of a small but noticeable movement of burbot occurring during fall, usually around early September, in front of his camp at the Rapids.

Concerns of Tanana Residents

In general, Tanana fishers reported that the overall health and quantity of nonsalmon fish species in their area was similar to historical levels. However, some fishers raised specific concerns about particular species or important habitats. Several respondents talked about fishing in Fish Lake as children or young adults, usually for northern pike and whitefishes. However, contemporary use of Fish Lake was not mentioned. One interviewee suggested that pollution from mining activities was one possible explanation for the decreased contemporary use of Fish Lake. One fisher remembered that, when he was 9 or 10 (in the late 1940s or early 1950s), Fish Lake was deep (8 ft) in places and so clear that he could see a nut lost from his outboard motor shining on the bottom of the lake. However, he believed, mining in the area killed all the fish, once plentiful before mining activity:

> Every kind of whitefish in there. …That's why I tell you, you know—some place down in this way, they plug that creek—you know where that creek comes up? Well it would be below Clear Lake, and they would dam it off when the leaves were falling. And they would take willows and put a fish trap in the middle of it—catch like three, four, or five thousand. … They'd make it out of willows, you know. Every two or three hours, they'd pull it out—it'd be full and they'd empty it, throw 'em out, go get some more until they had about three or four thousand [all kinds of whitefishes]. [030108T]

Respondents said that these temporary weirs had been set periodically over the years, but had not been used since the 1950s.

The relationship between beavers *Castor canadensis* and fish was also of concern for some Tanana fishers. When more trappers went after beavers and spent time back in the lakes breaking up dams, they

also harvested other nonsalmon species for dog and people food. These harvesting practices had effects on other animal species. "Long time ago, the people really went after northern pike and stuff. Especially the trappers—and a lot of people went really heavy duty on the pike because I think they [the fishers] protected the ducks and the muskrat babies, mink babies. I mean, there was a lot more of that in there back then. Not any more, nobody does that anymore." [030108T] As residents perceive an increase in the abundance of beavers, many then share the reported concerns of fishers elsewhere in the Interior that beaver dams cause difficulties during the seasonal migrations of fish between lakes, sloughs and rivers (Andersen and Fleener 2001).

Two fishers, both of whom harvested large quantities of whitefishes for dog food, mentioned a concern about water quality. Both fishers recalled that just as the whitefishes started to increase in fall 2006, the water inexplicably turned dark brown and dirty [030108T]:

> Something happened—the whitefish started to increase in numbers and then the sheefish increased in numbers and then the water turned brown, it just turned—something up in Canada, high water in Canada—and man it was dirty! … And when it got dirty, all the chum salmon turned black … Like, 'we're going to spawn tomorrow'—and then the whitefish disappeared. And the sheefish disappeared. [040108T]

According to the fishers, some whitefishes returned after the dark water, though not many and for one of them, it was time to pull the fish wheel anyway (October 1), thus both missed many of the whitefishes they might have otherwise harvested for their dogs.

Tanana Harvest Survey Results

During 2006, residents of Tanana reported harvesting 9 species of nonsalmon fish, including northern pike, burbot, sheefish, Arctic grayling, longnose suckers, and 4 species of whitefishes (broad whitefish, humpback whitefish, least ciscoes, and Bering ciscoes). The only nonsalmon fish species on the survey that Tanana fishers did not report harvesting was Alaska blackfish (Table 4). An estimated 28,855 lb of nonsalmon species were reported harvested by Tanana residents (approximately 112 lb per person). In terms of estimated pounds harvested, of all of the nonsalmon species reported harvested, broad whitefish (10,822 lb, 2,706 fish) and humpback whitefish (6,210 lb, 2,070 fish) comprised the majority of the annual harvest in 2006. Tanana fishers also harvested an estimated 5,006 lb (834 fish) of sheefish and a similar harvest, by weight, of Bering ciscoes (4,223 lb, 3,016 fish). Conversion factors are found in Appendix C.

Comparing the results of the harvest survey to information provided in the TEK interviews suggests that the patterns of nonsalmon fish harvest and use reflect Tanana residents' focus on the use of these fish for dogs. While Tanana fishers reported harvesting a significant number of nonsalmon fish (28,855 fish), compared to other project communities, only 18% of Tanana households reported harvesting them and only 32% of households reported using them. In contrast, other project communities reported much higher percentages of households harvesting and using nonsalmon fish. The lower percentages of harvest and use do not necessarily suggest that nonsalmon fish species were less significant to Tanana residents, as evidenced by the high number of fish reported harvested, only that their patterns of use for these fish may differ from the other communities.

Thirty percent of households reported using broad whitefish, while 17% reported actually harvesting the species and 13% reported receiving broad whitefish from other households. Similarly, 23% of households reported using sheefish, while 16% of households reported harvesting sheefish and 7% of households reported receiving them. For burbot, 10% of households reported using them as well as actually harvesting them, and no households reporting sharing, suggesting that most, if not all, burbot harvested were used within the harvesting household. Finally, while also not heavily used (12% of households), northern pike were minimally shared between households, with 2% of households reporting the receipt of northern pike and 3% of households reporting giving them away).

The timing of nonsalmon fish harvests by Tanana also suggests a seasonal harvest pattern. According to the survey, Tanana residents reported harvesting nonsalmon fish species during the spring, summer, and fall months of May through September, which are generally the months when there is open water, between spring breakup and winter freeze-up. Comparing these data to the ethnographic interviews, it is likely that many of these fish were harvested in fish wheels, while a smaller percentage were likely taken by setnets and hook and line. This seasonal pattern of spring, summer, and fall fishing was consistent with the information reported during the TEK interviews.

There were harvest patterns by species in 2006 (Table 5). For example, nearly one-half of the Bering cisco harvest (48%) occurred in June, followed by July (25%) and August (22%). This harvest pattern was also consistent with information provided by fishers who observed that Bering ciscoes appeared to migrate through the area beginning in late June. In contrast, Tanana fishers recalled that, while at their fish wheel sites, they saw broad whitefish throughout summer. This pattern also appeared during the harvest survey: residents reported significant broad whitefish harvests beginning in June and continuing at even levels through July, August, and September. Other species, such as Arctic grayling, were reported harvested primarily during spring and early summer. Residents reported taking 66% of the total Arctic grayling harvest in May and June. Many Tanana key respondents described their practice of fishing for Arctic grayling with a hook and line during the winter in open water areas or in holes chipped out of the ice; they chummed (or baited) the water with moose *Alces alces* bones or other bait. Northern pike and burbot, on the other hand, showed up in fishers' harvests fairly evenly from May through August.

The seasonal distribution of harvest departed from the patterns demonstrated by many other Yukon River drainage communities, such as the lower Middle Yukon communities of Grayling, Anvik, Shageluk, and Holy Cross and many of the Koyukuk River villages, all of whom reported taking nonsalmon species during most months of the year (Andersen et al. 2004; C. Brown et al. 2005). While it has been well established that many communities rely on nonsalmon species for fresh fish during lean winter months, the patterns reported by Tanana fishers suggested a fish wheel driven effort concentrated during the summer months, during which the majority of fish, both salmon and nonsalmon species, were harvested and preserved for both humans and dogs. It is also important to keep in mind, however, that single-year harvest estimates show only what happened in that year and do not account for single year anomalies. For example, while key respondents did discuss winter fishing opportunities, none were reported in the harvest survey for 2006; however, a survey in another year or a time series of data might show some winter fishing effort.

Table 4.–Estimated harvest and use of nonsalmon fish, Tanana, 2006.

	Percentage of households					Pounds harvested			Number harvested		95% confidence limit (±)
Resource name	Use	Att	Harv	Rec'd	Give	Total	Mean HH	Per capita	Total	Mean HH	harvest
Alaska blackfish[a]	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0	–
Burbot	10%	10%	10%	0%	0%	307.5	2.7	1.2	128.1	1.1	5%
Arctic grayling	10%	9%	9%	1%	1%	76.3	0.7	0.3	108.9	0.9	6%
Northern pike	12%	11%	11%	2%	3%	1,611.5	14.0	6.2	358.1	3.1	7%
Longnose sucker	8%	8%	8%	0%	1%	89.0	0.8	0.3	127.1	1.1	5%
Sheefish[b]	23%	16%	16%	7%	4%	5,005.5	43.5	19.4	834.3	7.3	5%
Whitefishes											
Broad whitefish	30%	17%	17%	13%	8%	10,822.1	94.1	41.9	2,705.5	23.5	6%
Ciscoes											
Bering ciscoes	6%	6%	6%	0%	0%	4,222.7	36.7	16.4	3,016.2	26.2	9%
Least ciscoes	6%	6%	6%	0%	0%	474.1	4.1	1.8	474.1	4.1	8%
Subtotal, ciscoes	6%	6%	6%	0%	0%	4,696.8	40.8	18.2	3,490.4	30.4	8%
Humpback whitefish	16%	13%	13%	3%	7%	6,210.0	54.0	24.0	2,070.0	18.0	5%
Unknown whitefishes	2%	2%	2%	0%	0%	36.3	0.3	0.1	12.1	0.1	9%
Subtotal, whitefishes	32%	18%	18%	14%	9%	21,765.3	189.3	84.3	8,278.0	72.0	6%
TOTAL, nonsalmon fish	32%	18%	18%	14%	11%	28,855.0	250.9	111.7			5%

Source ADF&G Division of Subsistence household surveys, 2007.

Note For conversion factors, see Appendix C.

a. Harvest was reported and estimated in pounds, not in numbers of fish.

b. Although sheefish are a whitefish species, they are often managed differently than other whitefish species, and so the data are presented separately.

Table 5.–Estimated nonsalmon fish harvest by month, Tanana, 2006.

		May		June		July		August		September		Totals	
Resource	Units	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest
Burbot	ea.	17.1	13.4%	31.3	24.4%	31.3	24.4%	26.2	20.5%	22.2	17.3%	128.1	100.0%
Arctic grayling	ea.	25.2	23.1%	46.4	42.6%	21.2	19.4%	0.0	0.0%	16.1	14.8%	108.9	100.0%
Northern pike	ea.	70.6	19.7%	86.8	24.2%	119.0	33.2%	71.6	20.0%	10.1	2.8%	358.1	100.0%
Sheefish	ea.	70.6	8.5%	193.7	23.2%	153.3	18.4%	125.1	15.0%	291.5	34.9%	834.3	100.0%
Longnose sucker	ea.	28.2	22.2%	48.4	38.1%	35.3	27.8%	9.1	7.1%	6.1	4.8%	127.1	100.0%
Broad whitefish	ea.	157.4	5.8%	605.3	22.4%	711.2	26.3%	701.1	25.9%	530.6	19.6%	2,705.5	100.0%
Bering ciscoes	ea.	85.7	2.8%	1,437.5	47.7%	756.6	25.1%	655.7	21.7%	80.7	2.7%	3,016.2	100.0%
Least ciscoes	ea.	45.4	9.6%	146.3	30.9%	90.8	19.1%	50.4	10.6%	141.2	29.8%	474.1	100.0%
Humpback whitefish	ea.	181.6	8.8%	353.1	17.1%	383.3	18.5%	708.2	34.2%	443.9	21.4%	2,070.0	100.0%
Unknown whitefishes[a]	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	7.1	58.3%	12.1	100.0%

Source ADF&G Division of Subsistence household surveys, 2007.

Note In Tanana in 2006, no harvest of nonsalmon finfish was reported for January, February, March, April, October, November or December. No harvest of Alaska blackfish, Pacific herring, or Pacific halibut was reported in any month of 2006.

a. In Tanana in 2006, month of harvest was not specified for 5.0 unknown whitefishes (41.7% of the estimated 2006 harvest).

Ruby

The community of Ruby got its start in gold mining and its contemporary residents come primarily from the former village of Kokrines, which was located on the north bank of the Yukon River approximately 30 river miles upriver from Ruby. Prior to the establishment of the contemporary village, however, Zagoskin (1967; Hart 1981) documented 5 or 6 settlements in the Ruby area, from the Yuki River upriver to the Nowitna River, including settlements or camps at Big Creek, the mouth of the Melozitna River, Mouse Point, and at Novikaak'at ("mouth of the Nowitna River"; Figure 12)—all documented as significant use areas for nonsalmon fish species by contemporary Ruby residents (Figure 13). Like other Middle Yukon residents, Ruby residents historically followed a seasonal round of subsistence activities and often used dog teams as the main form of transportation for hunting, trapping, and fishing activities. Unlike residents of its close neighbor, Tanana, however, most contemporary Ruby residents no longer kept large dog teams. Indeed, at the time of this research, only 2 large dog teams remained. As a result, perhaps, contemporary fishing patterns and practices differed from those described for Tanana.

In Ruby, 7 interviews were conducted with 9 individuals (4 men, 5 women), including 2 married couples, 6 elders, and 3 younger fishers. All but 1 key respondent actively fished. The key respondents represented 5 family lines from the Kokrines area with multiple kinship relations between them and 1 family line from the Koyukuk River that has lived in Ruby for approximately the last 15–20 years.

Figure 12.–Mouth of the Nowitna River, the site of the historical spring gathering after a long winter trapping, before returning to Kokrines, 2007.

Figure 13.–Caroline Brown maps with Martha Wright in Ruby, 2007.

Seasonality of Harvest and Gear Types

Significant oral history exists in Ruby that traces fishing practices and locations as far as the late 1800s. One elder, who was 88 years old at the time of her interview, remembered her grandmother or great-grandmother, who originally came from the Koyukuk River area, paddled upstream to Big Eddy in an attempt to get to a large spring gathering at the mouth of the Nowitna River (Figure 14). As the summer progressed, her ancestor ran out of time and decided to winter at Big Eddy, which was originally called *Dentaa dendaah Denh* after the large eddy there. Following this, several generations of the respondent's family lived at Big Eddy, and she spent much of her life there with her own husband and children: "That was our regular home [Big Eddy]—and we trap all over on the flats on this side. That was our life, trapping and fishing. How we made our living. … In wintertime, we live up the Novi [Nowitna River] most, in summertime, we come to Big Eddy." [06028R] She also recalled how the people of the area travelled during winter and spring from the Nowitna area to the small village or camp at the Bluff, which was called *Kaaltsaa'e Ghunh (swallow bluff)*, and which is near the contemporary community of Ruby, Many of the women of her grandmother's time were making nets from willow bark before twine or other materials were available. Other elder respondents remembered how their parents or grandparents carved net needles and flat, square, spruce wood disks used as net gauges to measure mesh size.

Figure 14.–Fish camp at Big Eddy, 2007

Ruby residents' fishing areas could be divided into 3 major locations reflecting seasonality of harvest and changes in residence over time. One would be a historical use area, not heavily used today, around Kokrines/Mouse Point/Nowitna River. This area was used by Kokrines residents prior to the 1960s, when many Kokrines residents were still following a seasonal round or modified seasonal round centered on trapping, hunting, and fishing activities. A contemporary use area was downriver from Ruby, at Twin Slough and June Slough. These 2 sloughs were often used by many residents, especially those who were older and who grew up using the area. The third location, also contemporary, was the area immediately around Ruby, including Big and Deep creeks, the Melozitna River, "the Bluff," and other downriver locations (Figure 15; Figure 16).

Figure 15.–Lisa Kangas with a sheefish, Deep Creek, 2007.

Figure 16.–Mouth of the Melozitna River, by Ruby.

As with the other communities described in this report, all fishing occurred within a seasonal round of subsistence activities.

> Well, they never had welfare and stuff like that, or food stamps, they were just busy all the time from one camp to the next. Ok, it's getting near fall and almost the end of fishing, so they would be getting ready, after silver salmon [fall chum salmon], to go back up the Novi [Nowitna River] and [dry] their fish for winter—you know, for dog food and for eating. Lot of places: Big Eddy, Kokrines, Mouse Point. That was the old village. [010208R]

One elder key respondent's winter camp was "way up the Novi [Nowitna River], above the canyon." Her family spent the summer at Mouse Point, where she was born, until a fire forced the handful of families living there to move to Kokrines. For Kokrines residents, muskrat trapping on the Nowitna River was the focus of the winter and early spring seasons. However, fall and winter were also significant fishing times: "... [I]n the fall, Mom used to go ice fishing below our camp—mostly pike and sheefish, with hooks [jigging through the ice]." [010208R].

Other species were not actively fished or targeted but were sometimes present in other winter and spring activities. For example, one trapper remembered seeing Dolly Varden in Deer Creek, off the Sulatna River, which meets the Nowitna River approximately 75 mi from its mouth at the Yukon River. He described seeing Dolly Varden in the water near a beaver house during his beaver trapping activities:

> ... [W]e punched a hole and … Man, that water was pressured—it was just shooting water up, like that. Lucky thing we had a lot of snow —so, we're standing on the snow with snowshoes and these Dolly Vardens are popping out, going back, popping out, going back. … We grabbed the shovel and stood there, and every time a Dolly Varden popped out, we tried to throw him out. Little while, we had a gunnysack full. [020208R]

Peter Slough, immediately downriver from the mouth of the Nowitna River, was also an important muskrat and beaver trapping area in the Nowitna region and much fishing effort also occurred during these activities. An actively fishing Ruby elder told of trappers building willow traps to harvest Alaska blackfish, used primarily for dog food, in the same areas as trapping efforts:

> They're [Alaska blackfish] out there in some of the lakes. When I was a kid, about the same years, I guess, when I went muskrat hunting with my dad—over here, they call this Timber Lake—and in those days there was a portage—so, many trappers used this portage up to the Nowitna areas. They used that—and [on] this Timber Lake, my dad had a fish trap there for blackfish and there was LOT of them! I remember he'd go over there and he'd have a heck of a time pulling that fishtrap out, it was so full. They're only about five to six inches. The only reason—I don't know, he was a hard worker—he said he was trapping them [was] to feed the dogs, fatten them up right now before we get fish, but I remember then they always had plenty of dog fish left over. I don't know, I guess he just did that to have something to do, but they had to be for the dogs 'cause they weren't too good eating. They cooked them up for the dogs. He said they weren't too nourishing but it was enough to keep the dogs healthy while the ice's moving out [and there was] no fishing. So they cooked them up for the dogs—and I remember even muskrats coming out of that. They get in there and they can't come out. It's round, it had a willow frame, like. All tied up at one end, and the bigger end is about like that [1 ft circumference], maybe from here, to you, long [5 ft]. At the end, he had a funnel going in there. He set it down—the fish go in there and then they can't come out. [020208R]

After a long winter of trapping, Kokrines families travelled to the mouth of the Nowitna River, where they gathered to wait for others before returning to Kokrines. Several Ruby respondents described this spring gathering after a long winter of trapping on the Nowitna River:

> At the mouth, that's where we wait for everybody. If somebody's boat don't show up, some family don't show up, they send a boat back up to see what's wrong. … They fished there—they fished with fish net or hooks for sheefish and pike in the spring after the ice break up. They stay 'til everybody get there then when they start to leave, they … Tie the boats together and we all drift, kinda idle down—and get down to this area, past Hardluck Slough there. … We get all our fish there for dogs and for eating, you know—sheefish and pike, whitefish. That'll tide us over 'til we get down to Kokrines. [010208R]

According to another elder:

> All the people that stayed in spring camps up the Nowitna from their winter trapping camps came on down before the Yukon even went out. They would all meet at the mouth of the Novi [Nowitna River]. See this little slough right behind that island? There would be a big camp right there. They would camp there for three, four days until the Yukon moved out, opened enough for them to come on down with their rafts and boats. That's where they wound up—they camped and they dried their fish and smoked their moose meat, muskrats, and beavers and all that. Ducks. They had a good time there. I heard a lot of it. … There were quite a few, maybe about six or seven families. [020208R]

It took this elder's family approximately 2 to 3 days to get to the large temporary village at the mouth of the Nowitna River after breakup, where they waited for the rest of the Nowitna River families. The temporary camp provided an opportunity for the groups' efforts to harvest large amounts of nonsalmon fish species, primarily whitefishes and northern pike, for their families and their dogs. While they were at the mouth of the Nowitna River, the women stayed busy by sewing, cutting fish, and "stay[ing] busy with their fish nets" in the evenings. Men and women worked together to harvest fish and women did most of the net repair as well as the setting or checking of nets primarily used to harvest nonsalmon fish species.

Spring was an important time for fishing. Kokrines residents occasionally dipnetted in front of the village: "They used to dipnet after the ice go out. …While the ice is moving—you know it pile up on the beach—he [her father] stand on one of the cakes of ice and when the ice kind of stopped a little bit, there'd be a clear spot—and he'd stand out there and he'd get whitefish." [010208R] After winter camp, they moved to one of several spring camps, including one at the mouth of June Slough, downriver approximately 8–10 mi from Kokrines. According to one elder, a fluid collection of 2 or 3 families could be found living there during spring in any given year, and other families and individuals came and went. "Everybody used to go back and forth from Kokrines to June Slough—all excited because lots of fish, you know!" [010208R] They harvested primarily whitefishes and burbot with hooks as residents knew them to be bottom feeders.

> Then from Kokrines, we go to spring camp over at Junekaket, [a camp at the mouth of June Slough]. They call it Twin Sloughs. And then they spring camp in there. They have big spring camp in one of those sloughs, the first one, I think. Sometimes they have it right at the mouth—and they stay there to get fish. … [And they went] muskrat hunting up those sloughs. Probably 'til around when it's June, you know, May and June, and then they go back to Kokrines, and they pack up again and they move to fish camp. There was lot of camps—and they, then they stay there 'til fall. And then they go back to Kokrines, and back to Novi [Nowitna River] again. It just go on and on, year after year: it's a cycle. [010208R]

One elder reported that he was raised at the June Slough spring camp. He recalled the importance of spring fishing, noting that they set nets with approximately 2 to 3 in mesh in order to harvest northern pike, sheefish, broad whitefish and humpback whitefish: "Springtime is good for fresh fish—falltime is the best time—but to eat fresh fish in the spring—anything is good to you in the springtime!" [040208R]

The Twin Sloughs area was also productive during winter for Alaska blackfish. "There's a lake in the winter—you go over there and you'll see where it keeps the ice thawed. There's June Lake and then there's June Slough—two sloughs are together—that's where the camp was. They used to have traps in there in the wintertime, fish traps for those blackfish." [010208R]

In late May or June, Kokrines residents returned to the Yukon River for summer fish camps, since summer was the time to focus on salmon harvests. Most families operated fish wheels or setnets to build summer and winter stores of dried salmon for human and dog food. However, fish wheels produced significant quantities of nonsalmon fish, just as was described by residents of other project villages. Additionally, respondents noted that the time before the fish wheels started turning was also a productive fishing time, when women seined for whitefishes, sheefish and northern pike:

> That something that the women did while the men were working on the fish wheel. The women would go and drift with a net just to get enough to eat [with a shorter net]. Get their fish for eating, 'til when the wheel is done. Yeah, one walks along the beach with a long rope and then the other one's in the boat. But that's how we used to eat. It wasn't practiced all the time, just to eat. They go up above the camp and come down—and she pulls, the one on the beach pulls the boat in as the other one is pulling the net in. [010208R]

One elder recalled how many families used to setnet under the ice along the Yukon River during late fall or early winter, before returning to their winter camps. The Nowitna River would get very low during winter, they said, which prohibited the use of under-the-ice nets, but fishers could harvest dog and human food in preparation for winter camps on the Yukon River. One elder remembered how they did it:

> Under the ice—oh, we just make holes here and there, far apart—and we bend a long willow and tie it to make a hook, like. Put it down in the hole and go to the next hole. We tie milk can on the end of it, and we just go along until we reach the other hole, and we

> maneuver it around, and the can would come up, and that's how we thread the rope through the ice. We do that in the winter, all winter long. [060208R]

Many families stayed upriver on the Nowitna for winter furbearer trapping, traveling downriver to the Twin Sloughs during spring. Other families fished and trapped in the Peter Slough area, just downriver of the Nowitna. Once most of the Kokrines residents moved to Ruby in the late 1950s, the locations of these spring and summer fishing activities extended to Big and Deep creeks, just upstream of Ruby.

> In fact, I remember when I was a kid I used to go out with this old guy, his name was Timothy Pitka. I used to go out with him—I liked that, camping out. And that bluff up here below Big Creek—before the ice move, there's water along the beach, and there's an eddy right at the foot of that bluff. … You know, where the point comes out, it makes the water go back? And he had a dip net, homemade dip net, and we'd sit there—this was before the Yukon ice moved. He'd sit there and fill the darn canoe up with whitefish with that dip net. There was so much whitefish—he'd fill that canoe up with all he could hold and bring it down [to Ruby] and give it away. … They were all different sizes. … The bigger ones on down to smaller ones. I remember there was plenty of them, lot of whitefish. … We're going up to Big Creek to hunt and fish, and, see, he stopped there at that little eddy spot. There was water along the beach—and we were paddling up. [020208R]

Deep Creek and Big Creek were, and continue to be, favored fishing spots for Ruby residents. Ruby elders interviewed for this project remembered that in the 1950s and 1960s, elders made their own nets which they set in the mouths of both creeks after ice-out in the spring, to target sheefish and northern pike.

For contemporary residents, Main Creek, just downstream of Ruby, was another preferred spot to setnet after breakup in the spring, to target whitefishes, northern pike, and, especially, sheefish. Fishers were unsure if fish were migrating out of the creek at that time or if they were milling about at the mouth in order to escape breakup on the Yukon. All respondents noted that Main Creek was an excellent place to target sheefish and broad whitefish, or *taaseze*. [030208R]

Similarly, the mouth of the Melozitna River, just a few miles upstream of Ruby, was reported by residents to be a productive spot to use nets as well as hook and line. Fishers repeatedly noted that they targeted areas where there was a mix of clear water and muddy Yukon River water, such as at the mouth of the Melozitna River:

> Just go to the mouth—the end of the mix, you know. Wherever there's a creek and the clear water and the muddy water mix, that's good fishing. … [Named a person who set her net] in the creek—it depends—where the water's kind of slack. … And I have a net right above town. … There's an eddy there. [010208R]

> At the mouth [of the Melozitna River] quite a bit, you know, just like sport fishing. … Hook and line for sheefish. End of June, first part of August, I think they hit pretty heavy. It's the only time we could fish for sheefish, now, is like at the mouth of these creeks, right after breakup. They don't seem to be around where you can catch them—probably you can fish right now with the hook, right now [late May]. [020208R]

Though the Melozitna River is quite shallow during the summer months, which prohibits much boat travel, many residents continued to travel the approximately 9 mi to Grayling Creek, near one elder key respondent's camp, in order to fish with a rod and reel for Arctic grayling. Hardluck Slough, approximately 35–40 mi upriver from Ruby on the Melozitna River was another productive Arctic grayling and Dolly Varden spot: "... [T]here's a creek that runs in there—and they go there in the mix there—the clear water and the muddy water. All these little creeks coming off of Hardluck." [020208R]

And Long Creek, at about Mile 24 of the Poor Man's Road, a mining road south of Ruby, was a location favored by contemporary residents of Ruby for Arctic grayling fishing.

Just like residents of other Middle Yukon project communities reported, summer fishing around Ruby was dominated by the use of fish wheels and setnets targeting Chinook and fall chum salmon, but which also harvested significant numbers of nonsalmon fish (Figure 17). In 2007, during the TEK interviews, there were 4 active fish wheels fishing near Ruby: 2 within 1 mi upstream of the village and 2 near the bluff just downstream of the village. Another fish wheel that usually fished was not used that year. According to one fisher whose fish wheel was upstream of the village, most fish wheels and nets harvested broad whitefish and humpback whitefish, but not necessarily at the same time. They also harvested longnose suckers in the fish wheel, but not as many in the fish net unless they were using the smaller nets; these fish were usually fed to the dogs.

Figure 17.–A fish wheel just upstream of Ruby, 2007.

Ruby residents reported that their winter fishing efforts were more limited than in the past, when many families stayed in winter camps to trap. However, one or two spots within the immediate vicinity of Ruby were used periodically. On the north bank, just upstream of one active fish camp located downstream of the village, large quantities of whitefishes could be harvested in January by using nets set from the downriver end of a sandbar. One elder recalled that his father also set a net under the ice, near the bluff,

> starting in mid November and I remember they did pretty good there. …'Cause the water slowed there and there's a sandbar there too—right out in front of that one, yeah. Right out from the point, where the water's deepest—the channel is right along the banks, all the time. And right in that little stretch of water they had the nets sticking out. Sheefish, whitefish, pike. [020208R]

Ruby residents reported rarely harvesting Alaska blackfish, but noted that they were available in the lakes across the Yukon from Ruby (Figure 18; Figure 19).

Figure 18. Ruby Non-Salmon Harvest and Use Areas.

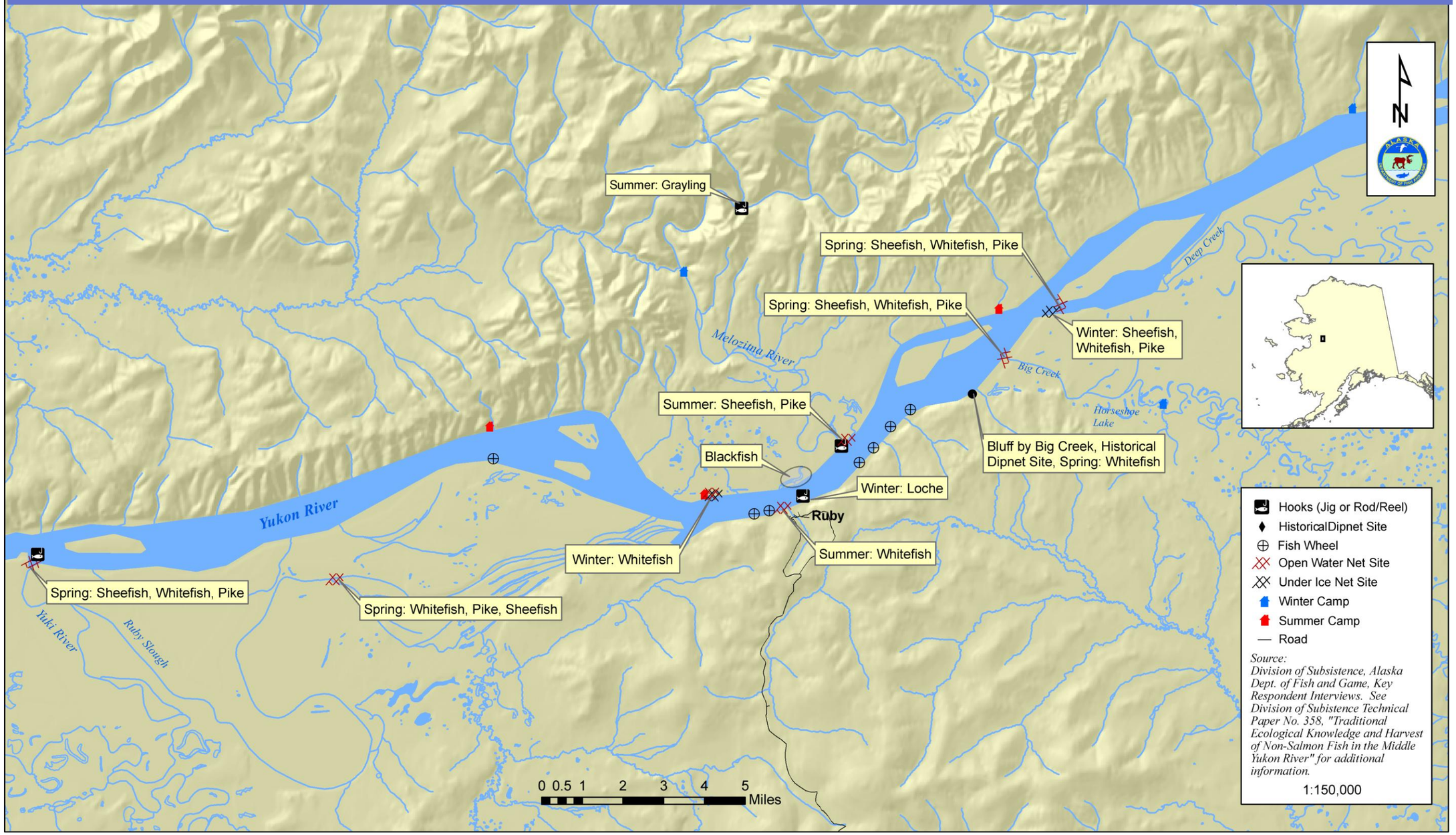

Figure 18.–Map of Ruby residents' nonsalmon fish harvest locations, west of Ruby, 2006.

Figure 19. Ruby Non-Salmon Harvest and Use Areas.

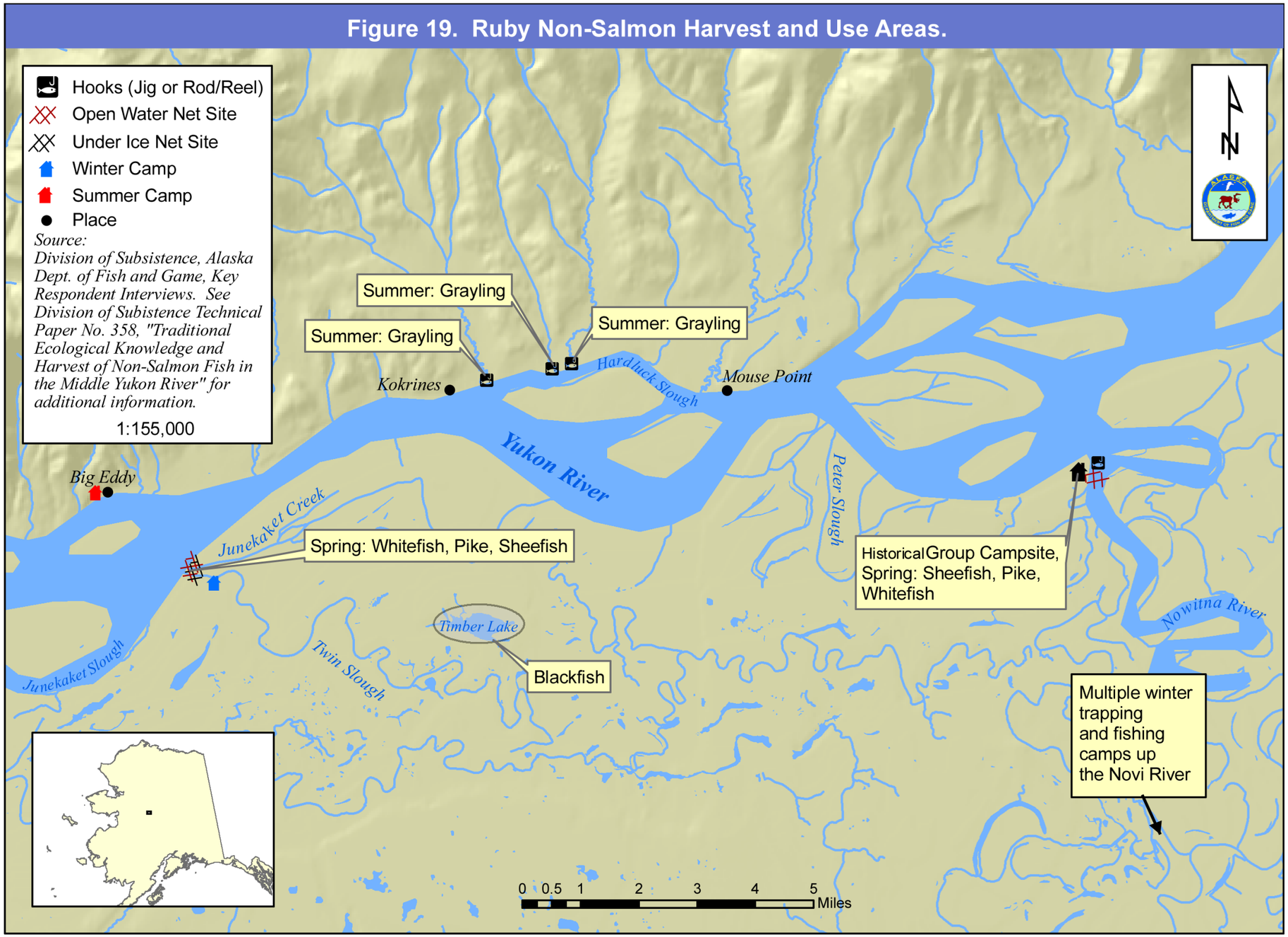

Figure 19.–Map of Ruby residents' nonsalmon fish harvest locations, east of Ruby, 2006.

Harvest and Use of Nonsalmon Fish

Ruby residents reported that the community used to be home to several dog teams, when fishers harvested large quantities of nonsalmon fish to feed dogs (Figure 20). However, in 2006 and 2007 when most of the data was collected for this project, only 2 large dog lots remained. Perhaps as a result of this, Ruby residents' harvest and use of nonsalmon species also experienced some shifts over time. At the time of this project, 2 individuals harvested large quantities of nonsalmon fish for dog food; the rest of the community's harvest was used primarily for human food. Methods for scoring whitefish fillets differed depending on the ultimate use: more heavily when they were to be dried for human food and further apart when they were to be dried for dog food.

Figure 20.–Lisa Kangas maps fishing locations with dog musher and fisher Emmitt Peters, the "Yukon Fox," Ruby, 2007.

Residents reported that northern pike, sheefish, and whitefish species were the most heavily used nonsalmon species in Ruby. The traditional chief of the community noted that residents "get hungry for sheefish" during spring, so they harvest them with nets set under the ice, in open water with nets, or with hook and line immediately after ice-out (Figure 21). Sheefish were cooked fresh, or were frozen, dried, made into strips, or jarred.

> Oh yeah, sheefish, I used to make strips out of them, too. Smoke them for a couple of days—and I'd leave them thick, big—and smoke them for a couple of days and then jar them. … That smoke give it delicious taste. [9060208R]

Figure 21.–Billy McCarty sets a net during spring at Deep Creek, 2007.

Residents reported that the differences between northern pike and sheefish were legion: "I love to fish pike, 'cause it's vicious! Sheefish are so calm. I just grab it—but pike is just like an alligator! Must be their cousin or something." [9060208R] Northern pike harvested in nets were noted for rolling and thus tangling the nets.

Even though they were no longer heavily harvested, several respondents talked about using Alaska blackfish for bait to harvest burbot:

> I want them [Alaska blackfish] for bait! Nobody eat them no more—we used to long time ago, we always did at Kokrines. I remember Grandma used to put some in the oven frozen and pretty soon they're splashing around. When they quit splashing, it's time to eat! They don't die—they're frozen, but they thaw. [9060208R]

One fisher who harvested Alaska blackfish for bait threaded his hook through the dorsal fin and fished the live blackfish in order to attract burbot. Burbot were also harvested in fish wheels during fall [020208R].

Ecology of Nonsalmon Fish Species In Ruby

Every respondent said that the spring movements of fish, especially sheefish, were central to their spring fishing practices. They tied these movements to the break up and movement of river ice. According to fishers, sloughs and creeks off of the mainstem Yukon River generally became ice free before the

mainstem and so fishers could target these areas before the Yukon River ice moved. Therefore, they said, fishers could observe the spring locations of major concentrations of fish:

> These sloughs are always wide open before the Yukon even moves. And they had a fish net right in there, inside the mouth [at Twin Sloughs]. … Right before the ice goes out—that's in April, end of April. Whitefish, pike, and sheefish. … I always notice that they move in there quite a bit as the river is getting ready to move—but there's all kinds of fish in the mouth of them sloughs. [020208R]

Several respondents noted that sheefish were often present and available for harvest during spring and early summer, but that they disappeared during the heaviest portions of the salmon runs and did not show up again until late summer and fall. On the other hand, they reported, whitefishes, although harvested during spring along with sheefish, did not usually show up in larger concentrations until fall, when they were harvested in nets and fish wheels. And they related that northern pike were most often harvested during fall, which offered clues to their seasonal movements:

> Mostly just get pike in the early fall. … They're all coming out of the lakes in the falltime. … Well, the fish go up in the spring, all the creeks and stuff, where they spawn. That's why I say I always like to get the pike and sheefish—'cause they're predators, they eat all those little salmon that's coming out, all the little babies that's coming out ... Cut the number down, it give the salmon a better chance. They won't eat the frys [juvenile fish] that are coming out. [010208R]

The harvest survey results supported these relations of seasonal movements of whitefishes, sheefish, and northern pike between lakes and sloughs and the Yukon mainstem during spring and fall months, at least for the 2006 year.

Because their observations were often linked to harvesting practices, there were fewer observations of winter movements of nonsalmon fish species made by the Ruby residents interviewed for this project. However, some recollections of winter fishing that occurred in an earlier time on a regular basis provided additional information about the presence of nonsalmon fish species during winter months. One elder recalled that, beginning in November, his father used to set a net under the ice by the bluff just downstream of the contemporary community. That net, set near others from a sandbar near where the water slowed due to a deep channel by the bluffs, harvested significant amounts of sheefish, whitefishes, and northern pike.

> I kind of imagine they were just hanging around the mouth of those areas. … Like I said, the water is coming out there all the time—this direction—and you always go across your stream [across the current] 'cause the fish are milling around. You find the deepest spot in there. They kind of knew and they checked it, too. They punch a hole with an ice pick and put a pole down, and if you got six or seven feet of water, then it was deep enough. In November, the ice is not that thick. It's early in the winter. [020208R]

Or, according to another elder who actively fished, "... [W]e used to catch fish through the ice, so they must be around," in the fall and winter months [010208R].

Several species of fish were harvested with hook and line; most of this activity occurred during the open water months. Sheefish were targeted during spring while whitefishes and northern pike were most often harvested during fall. Arctic grayling were available in very specific, productive locations on the Melozitna River, or in several sloughs off the north bank of the Yukon River, such as Hardluck Slough, during mid summer.

Concerns of Ruby Residents

In general, Ruby residents raised concerns about the size and quantity of fish in their area, specifically sheefish and whitefishes. They noted that both species seemed to have declined in both size and number available for harvest, but were unsure of reasons for this decline.

Fishers also raised concerns about northern pike and the relationship between pike populations and other fish populations. Many suggested that since spring camping practices abated and fewer people spent time during spring harvesting northern pike for fresh human food and dog food, the number of northern pike increased and this increased abundance was affecting the survival of other fish, primarily salmon: "That's why I say that since they don't have spring camps no more, what's happening? Pike are multiplying all the time and the salmon is going down 'cause they're eating all their babies. That's why I wonder if they could still practice their spring camps?" [010208R]

Another active elder fisher agreed that northern pike abundance could also help to explain the decline in abundance of whitefishes as well as other species such as muskrat, a primary target for trapping activities. He told a story about an elder who trapped on the Nowitna River in the 1960s and who told him of the northern pike's legendary, voracious habits:

> They were parked at the edge of the lake and they were having lunch, you know coffee, tea, and stuff, eating. And this muskrat was out there and they said, 'Oh we'll get him after we have lunch.' He was swimming around and pretty soon they heard a splash. I don't know how true this story is, but this was an honest guy. He said they heard a splash out there and that was it: no more muskrat! And one of the guys walked along the edge of the lake there—and you know, it's about a foot of water. Right now, you could see them, the pike, moving around there. And they shot this pike, took him out, cut him open and this muskrat rolled out. It wasn't dead yet—he said they just cut it open and the muskrat rolled out and he laid there for a few seconds, shook himself, dove back into the lake! [020208R]

Another concern raised by residents, especially elders familiar with the old trapping areas around the Nowitna River and Peter Slough area, was that the lakes and sloughs were drying up. One fisher observed that these areas had dried significantly over the last 20 years, which changed the habitats used by many fish species, made lakes landlocked, and made other areas unavailable to fish [020208R].

Ruby Harvest Survey Results

In 2006, Ruby residents reported harvesting a total of 7 nonsalmon fish species, including 2 species of whitefishes (Table 6). Among the species not harvested or used were longnose sucker and the smaller species of whitefishes, least and Bering ciscoes. Ruby residents reported harvesting an estimated total of approximately 2,729 lb of nonsalmon fish, or approximately 15 lb of nonsalmon fish per person, with the majority of this harvest (82%) comprised of sheefish (1,193 lb, 199 fish) and whitefishes (1,056 lb, 348 fish). Only 2 species of whitefish, broad whitefish and humpback whitefish, were reported harvested in 2006, and of these, humpback whitefish were estimated to comprise the largest component (896 lb) of the whitefish harvest by weight. While Ruby fishers reported harvesting an estimated 55 lb of broad whitefish (14 fish), 105 lb of unknown whitefishes were also reported harvested. After sheefish and whitefishes, northern pike were the most heavily harvested fish at 349 lb (78 fish). Approximately 91 Arctic grayling (64 lb) were estimated to have been harvested, which were used by approximately 13% of Ruby households in 2006.

These harvest levels in conjunction with information from the key respondent interviews suggested that while nonsalmon fish used to be an important source of dog food, they were currently used primarily for human food. Approximately one-half of the community reported that they used some species of nonsalmon fish, while approximately 33% of the community's households harvested them. Sheefish were estimated to have been used most heavily by Ruby residents (38%). More households reported using

northern pike (23%) than whitefishes (21%), even though the reported whitefish harvest was approximately three times, by weight, the size of the northern pike harvest. Approximately 12% of Ruby households reported harvesting Arctic grayling, the harvest of which was raised several times during the interviews. In 2006 there were measureable levels of sharing between community members, which was also mentioned during key respondent interviews. In 2006, 12% of Ruby households reporting giving away fish to approximately 33% of households. The species shared the most was sheefish (not surprisingly, given this was the species most harvested), followed by whitefishes and burbot.

In 2006, nonsalmon fish species were reported harvested in one-half of the months of the year, primarily in the late spring, summer and fall months of May through September and also November (Table 7). Fish were not reported harvested in January, February, March, April, October, or December. This suggested that most fishing occurred in the open water months, and key respondent interviews indicated that fish wheels, setnets, and hook and line were the primary gear types used for harvest by contemporary residents. Even though Ruby residents considered burbot to be prime eating in fall, 73% of the total annual harvest was reported to have occurred in May, consistent with the interviews which suggested that burbot were also harvested in nets during spring. Many of Ruby's fishers also discussed recreational fishing as a significant source of fish during the summer, and this effort was evidenced in the harvest survey results. Arctic grayling and burbot were harvested by Ruby fishers using hook and line, and the harvests of these species spiked in July and May, respectively.

Residents reported that their harvest timing often reflected the seasonal movements of fish. This was most clearly seen in the sheefish harvests, which peaked in May and August, before and after the salmon runs. In addition, most of the key respondents had reported that sheefish were more regularly found during May and August. The 2006 reported harvest of northern pike appeared to follow a similar pattern, which called to mind one key respondent's comment that these fish seemed to disappear during the salmon runs. Also, during the interviews whitefishes were described as being primarily a fall-run fish; not surprisingly, therefore, over one-half of the harvest was reported on the harvest survey to have occurred in September. These patterns differed significantly from those described in Tanana, where whitefishes, sheefish, and northern pike were reported to be present throughout the summer months. Ruby fishers used a combination of fish wheels and setnets throughout the summer. It was unknown if gear bias played a role in Ruby fishers' harvests compared to fishers in other communities.

Table 6.–Estimated harvest and use of nonsalmon fish, Ruby, 2006.

Resource name	Percentage of households					Pounds harvested			Amount harvested		95% confidence limit (±)
	Use	Att	Harv	Rec'd	Give	Total	Mean HH	Per capita	Total	Mean HH	harvest
Alaska blackfish[a]	2%	2%	2%	0%	0%	1.3	0.0	0.0	1.3	0.0	54%
Burbot	8%	12%	12%	0%	6%	66.0	1.0	0.4	27.5	0.4	28%
Arctic grayling	13%	12%	12%	6%	4%	63.9	1.0	0.4	91.3	1.4	26%
Northern pike	23%	17%	17%	12%	4%	348.8	5.4	1.9	77.5	1.2	19%
Longnose sucker	0%	0%	0%	0%	0%	0	0	0	0	0	–
Sheefish[b]	38%	27%	27%	23%	10%	1,192.5	18.3	6.6	198.8	3.1	15%
Whitefishes											
Broad whitefish	8%	6%	4%	4%	6%	55.0	0.8	0.3	13.8	0.2	38%
Ciscoes											
Bering ciscoes	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0	–
Least ciscoes	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0	–
Subtotal, ciscoes	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0	–
Humpback whitefish	19%	13%	12%	10%	8%	896.3	13.8	5.0	298.8	4.6	35%
Unknown whitefishes	4%	4%	4%	2%	2%	105.0	1.6	0.6	35.0	0.5	41%
Subtotal, whitefishes	21%	15%	15%	12%	10%	1,056.3	16.3	5.9	347.5	5.3	30%
TOTAL, nonsalmon fish	50%	33%	33%	33%	12%	2,728.6	42.0	15.2			16%

Source ADF&G Division of Subsistence household surveys, 2007.

Note For conversion factors, see Appendix C.

a. Harvest was reported and estimated in pounds, not in numbers of fish.

b. Although sheefish are a whitefish species, they are often managed differently than other whitefish species, thus the data are presented separately.

Table 7.–Estimated harvest of nonsalmon fish by month, Ruby, 2006.

		May		June		July		August		September		November		Totals	
Resource	Units	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest
Alaska blackfish	Lb	0.0	0.0%	0.0	0.0%	0.0	0.0%	1.3	100.0%	0.0	0.0%	0.0	0.0%	1.3	100.0%
Burbot	ea.	20.0	72.7%	0.0	0.0%	2.5	9.1%	0.0	0.0%	1.3	4.5%	3.8	13.6%	27.5	100.0%
Arctic grayling	ea.	7.5	8.2%	15.0	16.4%	46.3	50.7%	12.5	13.7%	10.0	11.0%	0.0	0.0%	91.3	100.0%
Northern pike	ea.	25.0	32.3%	0.0	0.0%	5.0	6.5%	26.3	33.9%	8.8	11.3%	12.5	16.1%	77.5	100.0%
Sheefish[a]	ea.	20.0	10.1%	36.3	18.2%	25.0	12.6%	62.5	31.4%	30.0	15.1%	0.0	0.0%	198.8	100.0%
Broad whitefish	ea.	0.0	0.0%	0.0	0.0%	2.5	18.2%	3.8	27.3%	7.5	54.5%	0.0	0.0%	13.8	100.0%
Humpback whitefish	ea.	0.0	0.0%	0.0	0.0%	7.5	2.5%	82.5	27.6%	208.8	69.9%	0.0	0.0%	298.8	100.0%
Unknown whitefishes	ea.	10.0	28.6%	0.0	0.0%	0.0	0.0%	0.0	0.0%	25.0	71.4%	0.0	0.0%	35.0	100.0%

Source ADF&G Division of Subsistence household surveys, 2007.

Notes In Ruby in 2006, no harvest of nonsalmon finfish was reported for January, February, March, April, October, or December. No harvest of Pacific herring, Pacific halibut, longnose sucker, Bering cisco, or least cisco was reported in any month of 2006.

a. In Ruby in 2006, month of harvest was not specified for 25 sheefish (12.6% of total 2006 harvest).

Galena

In Galena,[7] 6 individuals were interviewed, including 2 elders who were a married couple, 1 additional elder, 2 men who had lived in Galena for most of their lives, and 1 person who had lived in the Galena area for about 15 years. All of the interviewees depended on subsistence resources for most of their food and livelihood. Two of the men supported sled dog teams and fed them with fish from year-round fishing activities.

Interviewees in the Galena area reported primary driftnet fishing effort in the Koyukuk River portion of the Yukon River drainage, but had also fished, both historically and recently, as far upriver as Big Eddy and as far downriver on the Yukon River as the Nulato area, as well as on tributaries of the Koyukuk River, including the Kateel and Gisasa rivers. Fish wheels were occasionally moved miles up- or downriver, and fish camps, setnet sites, and sport fishing areas were used within about 50 mi of Galena.

Seasonality of Harvest and Gear Types

Fishing patterns in the Galena area included heavy driftnet fishing effort primarily during the early spring Chinook salmon season. This effort was supplemented by year-round harvest of many other Yukon River species, including setnet and fish wheel fishing for summer and fall chum salmon and for whitefish species as well as the incidental harvest of northern pike and burbot; fishing with hook and line for northern pike and sheefish; and bottom fishing with hook and line for burbot after fall freeze-up. Residents fished the Yukon River mainstem as well as the major tributaries such as the Koyukuk, Nulato, and Yuki rivers, and the associated creeks and nonflowing sloughs and lakes.

Fishing began in spring as soon as the river ice and debris had dissipated enough to permit setting nets. A small net (4 in mesh) was used during early spring to harvest fish for use as dog food and human food. The small net was used from the end of May until freeze-up, except during the salmon openings when a 7 in or larger mesh net was used. The early fishing tended to harvest northern pike and sheefish.

The 5 species of whitefishes harvested by Galena residents included broad and humpback whitefish, Bering and least ciscoes, and sheefish. Nonsalmon fishing occurred when salmon fishing was closed; nonsalmon species were kept as incidental harvest during the salmon openings.

During and after freeze-up, residents trapped Alaska blackfish to use for bottom fishing for burbot. As soon as the ice was thick enough, some residents setnetted under the ice: the local under-ice fishing location was at the mouth of Kala Slough, on the "fish trail," where there was a mild current. Residents said that such eddies helped setnets during the open water season as well as under the ice, but that an eddy may not be necessary for whitefishes because, residents observed, whitefishes tended to travel more randomly than migrating salmon. Residents preferred to harvest burbot in the fall, when their livers, considered a delicacy by many, were larger.

Harvest and Use of Nonsalmon Fish

Galena residents observed that the process of setting a net under the ice was critical to successful harvest. One fisher described the process in detail. Soon after the ice stopped forming and moving, this fisher said, a trail was made across the river to the fishing area, close to the mouth of Kala Slough, for example. The net needed to be set in approximately 30 ft of water because the water level dropped about 15 ft during winter. If a net was not set with care, the ice "set down" on the net (formed on the net), which caused the fisher to lose his net. Since the average net was about 60 ft long, the fisher chopped holes in the ice about 60 ft apart, to anchor the ends of the net. The ice was only about 3 or 4 in thick at that time of year.

The next step in setting the net was to run a rope from one hole to the other by chopping additional holes in the ice about 12 to 15 ft apart. A willow stick with a hook-shaped fork was cut to be long enough to go

[7] This chapter was provided by Phil Koontz of the Louden Tribal Council in Galena.

from hole to hole. The stick had the rope tied to one end and was then pushed into the first hole. At the second hole, the hook-shaped fork was caught with another stick. It worked like a giant needle: the stick was shoved through the hole across the current and caught at the next hole, then pushed to another hole, all the while pulling the rope until was all the way across the net site. The net was then tied onto the rope and pulled back through. All or most of the floats were removed from the net so it could stay on the bottom, away from the ice.

To check the net, the ends were chopped free of the ice and the net, with the rope still attached to one end, was pulled through while the rope went into the water to hold its place. As winter progressed, the ice "dropped," i.e., got thicker, so that by late winter or spring, it was about 3 ft thick. Some work was saved in chopping the holes open to check the net by covering the holes with cardboard or insulating board and snow. Net fishing under the ice continued until breakup, about late April or early May, at which time the nets were pulled so they wouldn't be lost as the ice went out.

Some families said that they ate nonsalmon fish once or twice a week. One fisher noted that he used most of the fish he harvested to feed his dog team:

> Well, you know, I've got ten dogs, I want at least five tons. Probably over the course of the year, I'll probably go through ten tons of fish. … Well, I want five tons on, in the crib, by freeze-up. That's what I put up. … Counting the winter camps and summer camps, now that I've got dogs. But if I didn't have dogs, I'd probably—maybe two tons would be plenty, and I would give most of it away. (Galena interview 1).

Other less commonly harvested species included Arctic grayling, Arctic lamprey, Dolly Varden, and longnose suckers.

Fishing locations in the Galena area tended to be close to home during winter; residents traveled more during spring, summer, and fall in order to take advantage of preferred fishing locations for setnets and fish wheels as well as hook and line fishing sites for northern pike as the pike moved out of the lakes and creeks during spring.

Sloughs tended to be fished preferentially when the fishing conditions were bad on the mainstem Yukon River due to ice or debris.

Principal summer fish camps have been established at Bishop Rock (which residents also called *Yistletaw*), along and around Pilot Slough, Fish Island, Dainty Island, and Big Eddy, among other traditional fishing locations.

Dried fish were further preserved in several forms, including "summer cutting" (scored fillets that are smoked and dried), split (cut into 2 fillets attached at the tail and either dried or frozen), and "green fish" (fermented, usually used for dog food), depending on the temperature and season. In warm summer weather, fish have to be dried quickly and thoroughly. As the weather cools during fall, the fish were either split or frozen in the round without drying. Residents begin to process nondried split fish around mid or late September, and green fish were stored around the end of September. One consideration residents had when choosing a fish camp location was the quality of fish drying that could occur due to the local air movement.

Jarring, or pressure canning, fish is a modern technique used for human food preservation. The several forms of processing dried and smoked fish included making strips, "half-dry" (*giaga*), and jarring smoked strips.

Ecology of Nonsalmon Fish in Galena

Residents described what they observed as 2 populations of sheefish, 1 local and 1 migratory. Northern pike, they said, were nonmigratory, but did move to and from the local lakes. Arctic lamprey migrated from the ocean to about as far as Kaltag while burbot were strictly local. Respondents suggested that many whitefishes migrated through the local area to preferred seasonal locations. Residents tended to

target whitefishes during fall, after summer fattening and when their eggs were well developed. Northern pike, they said, were predators and preferred clear water, but other fish did not have a strong preference for clear water.

Concerns of Galena Residents

Since residents had reduced their seasonal pursuit of northern pike moving out of lakes during spring, there was some concern expressed about the predatory northern pike reducing other subsistence resources, including ducks and marten *Martes americana*.

Harvest Survey Results

Galena was the only project community where a census was not attempted; rather, a simple random sample of 25% of the community was surveyed. Residents of Galena reported harvesting or using all 10 species of nonsalmon fish surveyed for, and 2 additional species as well: Pacific herring *Clupea pallasi* and Pacific halibut *Hippoglossus stenolepis* (Table 8). The latter two species, which do not occur in the local area, appeared on the survey likely due to out-of-the-area harvest trips and/or through trade with friends and relatives from elsewhere. An estimated 110,587 lb of nonsalmon species were reported harvested by Galena residents (approximately 201 lb per person). Of all of these nonsalmon species, broad whitefish (35,327 lb) and humpback whitefish (27,701 lb) comprised the majority of the annual harvest in 2006 by pounds. There was also a significant harvest of "unknown" whitefishes amounting to 19,140 lb. Galena fishers harvested an estimated 8,832 broad whitefish and 9,234 humpback whitefish, followed by 6,380 "unknown" whitefishes. The smaller whitefish species, Bering and least ciscoes, were reportedly harvested in smaller amounts, totaling approximately 7,562 lb (5,970 fish). Additionally, 11,892 lb of sheefish (1,982 fish) and 5,176 lb of northern pike (1,150 fish) were also harvested (Figure 22).

As with Tanana, the patterns of nonsalmon fish harvest and use appeared to reflect the community's focus on harvesting large quantities of fish for dog food. Relatively large harvests of whitefish species in Galena were consistent with Galena key respondent interviews that revealed whitefishes were often fed to dogs. Furthermore, by species, whitefishes were reported harvested by a relatively small percentage of households. However, 62% of households reported using nonsalmon fish, and 42% of households reported using whitefish species, indicating that nonsalmon species in general, and whitefish species specifically, were also used for purposes other than dog food.

With harvests that suggested significant human use as well as use for dog food, nonsalmon species were clearly an important component of the subsistence diet in Galena when compared to an earlier baseline of subsistence harvests in Galena (Marcotte 1990). The species with the largest percentage of use was northern pike (5,176 lb). Additionally, 38% of households reported harvesting northern pike, and the levels of sharing northern pike were higher than those reported for any one species. Sheefish were another species that was also shared around the community: 22% of households reported giving sheefish to other households.

The timing of nonsalmon fish harvests by Galena also suggested a seasonal harvest pattern. Fish were reported as harvested in all months except January, February, May, and December; the majority of whitefishes were harvested between August and October, likely during their fall migrations. Indeed, the majority of the total nonsalmon fish harvest took place in the late summer/fall months, with few exceptions. Approximately 41% of the sheefish harvest occurred during the spring months of March and April. Additionally, the entire Alaska blackfish harvest occurred in March, likely in conjunction with trapping activities and environmental factors that facilitated Alaska blackfish harvests, such as milder cold weather temperatures and easier access. Finally, the largest monthly harvest of burbot occurred in November, when they were considered prime eating because of their condition and large livers. These data were consistent with the information documented during the key respondent interviews.

Within these late summer and early fall months of heavy harvesting, there were differential harvesting patterns by species in 2006 (Table 9). For example, while one-half the Arctic grayling harvest occurred in July, there was minimal harvest of any whitefish species during this time. Rather, one-half the broad (54%) and humpback whitefish (54%) and Bering cisco (50%) harvests occurred in August; least ciscoes were primarily harvested in September and October (80%).

In contrast, Tanana fishers reported seeing broad whitefish throughout the summer during fish wheel fishing activities, an observation reflected in the Tanana harvest survey results. Given the focus on fishing for dogs by some fishers in Galena, it is possible that the concentration of whitefish harvests in August and September reflected the use of fish wheels during August and September when whitefish are targeted during their migration with fall chum salmon.

Figure 22. Galena Non-Salmon Harvest and Use Areas.

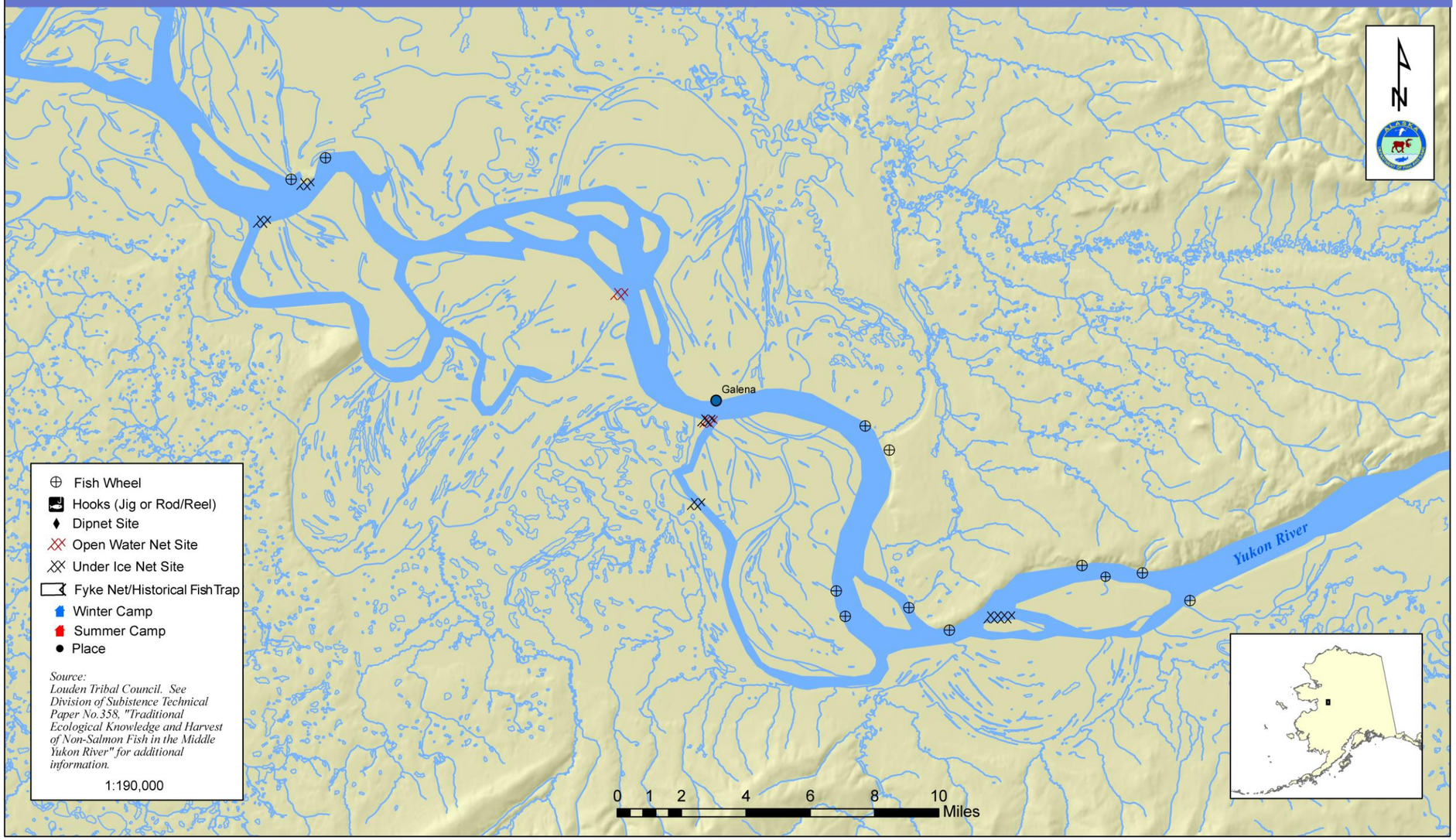

Figure 22.–Galena residents' nonsalmon fish harvest locations, 2006.

Table 8.–Estimated harvest and use of nonsalmon fish, Galena, 2006.

	Percentage of households					Pounds harvested			Amount harvested		95% confidence limit (±)
Resource name	Use	Att	Harv	Rec'd	Give	Total	Mean HH	Per capita	Total	Mean HH	harvest
Pacific herring[a]	2%	2%	2%	0%	0%	1,194.0	6.0	2.20	199.0	1.00	–
Pacific halibut[b]	6%	2%	2%	6%	2%	8.0	0.04	0.01	8.0	0.04	–
Alaska blackfish[b]	8%	4%	4%	6%	2%	139.3	0.7	0.30	139.3	0.70	92%
Burbot	20%	16%	16%	8%	10%	1,843.5	9.3	3.40	768.1	3.90	47%
Arctic grayling	18%	10%	10%	8%	4%	245.2	1.2	0.40	350.2	1.80	53%
Northern pike	50%	40%	38%	12%	24%	5,176.0	26.0	9.40	1,150.2	5.80	43%
Longnose sucker	6%	6%	6%	2%	0%	359.4	1.8	0.70	513.4	2.60	84%
Sheefish[c]	36%	30%	28%	10%	22%	11,892.2	59.8	21.70	1,982.0	10.00	60%
Whitefishes											
Broad whitefish	10%	8%	8%	4%	4%	35,326.5	177.5	64.30	8,831.6	44.40	96%
Ciscoes											
Bering ciscoes	2%	2%	2%	0%	2%	5,572.0	28.0	10.10	3,980.0	20.0	106%
Least ciscoes	2%	2%	2%	0%	2%	1,990.0	10.0	3.60	1,990.0	10.00	106%
Subtotal, ciscoes	2%	2%	2%	0%	2%	7,562.0	38.0	13.80	5,970.0	30.00	106%
Humpback whitefish	14%	12%	12%	8%	6%	27,700.8	139.2	50.40	9,233.6	46.40	91%
Unknown whitefishes	30%	18%	18%	16%	10%	19,139.8	96.2	34.80	6,379.9	32.10	80%
Subtotal, whitefishes	42%	30%	30%	22%	16%	89,729.1	450.9	163.40	30,415.2	152.80	76%
TOTAL, nonsalmon fish	62%	56%	56%	36%	34%	110,586.7	555.7	201.3			68%

Source ADF&G Division of Subsistence household surveys, 2007.

Note For conversion factors, see Appendix C.

a. Harvest was reported and estimated in gallons, not in numbers of fish.

b. Harvest was reported and estimated in pounds, not in numbers of fish.

c. Although sheefish are a whitefish species, they are often managed differently than other whitefish species, and so the data are presented separately.

Table 9.–Estimated harvest of nonsalmon fish by month, Galena, 2006.

		March		April		June		July		August	
			Percentage of		Percentage of		Percentage of		Percentage of		Percentage of
Resource	Units	Amount	2006 harvest	Amount	2006 harvest	Amount	2006 harvest	Amount	2006 harvest	Amount	2006 harvest
Pacific herring	Gal	0.0	0.0%	0.0	0.0%	199.0	100.0%	0.0	0.0%	0.0	0.0%
Pacific halibut	Lb	0.0	0.0%	0.0	0.0%	0.0	0.0%	8.0	100.0%	0.0	0.0%
Alaska blackfish	Lb	139.3	100.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Burbot	ea.	99.5	13.0%	0.0	0.0%	0.0	0.0%	99.5	13.0%	95.5	12.4%
Arctic grayling	ea.	0.0	0.0%	0.0	0.0%	23.9	6.8%	183.1	52.3%	39.8	11.4%
Northern pike[a]	ea.	0.0	0.0%	218.9	19.0%	406.0	35.3%	191.0	16.6%	71.6	6.2%
Sheefish	ea.	398.0	20.1%	409.9	20.7%	43.8	2.2%	175.1	8.8%	477.6	24.1%
Longnose sucker	ea.	0.0	0.0%	0.0	0.0%	15.9	3.1%	0.0	0.0%	199.0	38.8%
Broad whitefish	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	4,776.0	54.1%
Bering ciscoes	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	1,990.0	50.0%
Least ciscoes	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	398.0	20.0%
Humpback whitefish	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	4,979.0	53.9%
Unknown whitefishes[a]	ea.	218.9	3.4%	0.0	0.0%	19.9	0.3%	39.8	0.6%	1,313.4	20.6%

		September		October		November		Totals	
			Percentage of		Percentage of		Percentage of		Percentage of
Resource	Units	Amount	2006 harvest	Amount	2006 harvest	Amount	2006 harvest	Amount	2006 harvest t
Pacific herring	Gal	0.0	0.0%	0.0	0.0%	0.0	0.0%	199.0	100.0%
Pacific halibut	Lb	0.0	0.0%	0.0	0.0%	0.0	0.0%	8.0	100.0%
Alaska blackfish	Lb	0.0	0.0%	0.0	0.0%	0.0	0.0%	139.3	100.0%
Burbot	ea.	155.2	20.2%	59.7	7.8%	258.7	33.7%	768.1	100.0%
Arctic grayling	ea.	39.8	11.4%	63.7	18.2%	0.0	0.0%	350.2	100.0%
Northern pike[a]	ea.	159.2	13.8%	99.5	8.7%	0.0	0.0%	1,150.2	100.0%
Sheefish	ea.	238.8	12.0%	238.8	12.0%	0.0	0.0%	1,982.0	100.0%
Longnose sucker	ea.	167.2	32.6%	131.3	25.6%	0.0	0.0%	513.4	100.0%
Broad whitefish	ea.	2,013.9	22.8%	2,013.9	22.8%	27.9	0.3%	8,831.6	100.0%
Bering ciscoes	ea.	995.0	25.0%	995.0	25.0%	0.0	0.0%	3,980.0	100.0%
Least ciscoes	ea.	995.0	50.0%	597.0	30.0%	0.0	0.0%	1,990.0	100.0%
Humpback whitefish	ea.	2,212.9	24.0%	2,013.9	21.8%	27.9	0.3%	9,233.6	100.0%
Unknown whitefishes[a]	ea.	1,592.0	25.0%	3,184.0	49.9%	0.0	0.0%	6,379.9	100.0%

Source ADF&G Division of Subsistence household surveys, 2006.

Note In Galena in 2006, no harvest of nonsalmon finfish was reported for January, February, May, or December.

a. In Galena in 2006, month of harvest was not specified for 4.0 northern pike (0.3% of estimated 2006 harvest) or for 11.9 unknown whitefishes (0.2% of estimated 2006 harvest).

Nulato

Patterns in the fishing practices of Nulato residents were perhaps most characterized by their historical and continued use of the Kaiyuh Flats, a large expanse riddled with lakes, sloughs, and creeks south of the community on the east side of the Yukon River (Figure 23). The Kaiyuh Flats figured prominently in most residents' memories of growing up at spring, fall, and winter camps as well as in their contemporary descriptions of fishing. In her analysis of trapping patterns in the Kaiyuh area, Robert (1984) drew a strong link between historical trapping practices and fishing practices, both of which were undertaken in the same areas and times at seasonal winter and spring camps in the Kaiyuh Flats. "Winters were spent at the camps in the Kaiyuh, where people lived in semisubterranean houses and from which they trapped and fished through the ice in the lakes" (Robert 1984:12). Robert documented some of the earliest placename work in the Kaiyuh, much of which remained relevant for today's users of the area. It was clear that Kaiyuh, as it is simply referred to locally, remained central to understanding the subsistence fishing practices of Nulato residents, even though some of the use patterns had changed over time. In the descriptions by key respondents, Kaiyuh was often described as a collection of linked places used for most of the year, except the summer, as seasonal camps. Kaiyuh harvests contributed significant components to the subsistence diet, especially nonsalmon fish.

Figure 23.– Sommers' spring camp in the Kaiyuh Flats, still in use at the time of this research.

Source L. Sommers.

Eleven individuals were interviewed from Nulato, including 8 elders and 3 younger fishers. Another young fisher, although not interviewed, assisted with mapping the significant trails and places in the Kaiyuh Flats that were referenced in the interviews. The 3 younger fishers were male. Four elder men and 4 elder women were interviewed, including 2 married couples. All key respondents, including the elders, actively fished around the community and in the Kaiyuh Flats. Key respondents were selected initially

with assistance from the Nulato Tribal Council and then through a snowball, or chain referral method of references from other respondents; all of the interviews were conducted in English. Most key respondents were lifelong residents of Nulato except for one elder who was raised downriver, in the Eagle Island area near Kaltag. Many actively fishing elders resided in Nulato, providing a tremendously rich resource for understanding fishing practices in Nulato and how practices have changed through time.

In general, Nulato fishers concentrated their efforts within roughly a 9 mi radius of the community or in a concentrated area of lakes off the Kaiyuh Slough, approximately 20 mi from the village. Residents reported that the latter area was a quick snowmachine day trip in contemporary times, but a 2 or 3 day paddle in the old days. Unlike Tanana or contemporary Ruby residents, who harvested significant quantities of nonsalmon fish incidental to salmon fishing with fish wheels, Nulato residents focused their nonsalmon fishing during spring, fall, and winter months and used specific gear for targeting larger nonsalmon species such as sheefish, humpback whitefish, northern pike, broad whitefish, and burbot, or smaller nonsalmon species such as ciscoes, Arctic grayling, and "trout." While Nulato residents drew distinctions in the harvest survey between Dolly Varden and "trout," it is likely that the fish were Dolly Varden at different life stages (Figure 24). The elected chief of Nulato, Mickey Stickman, consulted photographs with an ADF&G biologist; however, everyone agreed that actual samples of the fish would be required in order to resolve the matter which could be a topic of future inquiry.

Figure 24.–Nulato River Dolly Varden, 2006.

With one or two exceptions, Nulato residents did not maintain large dog teams; as a result, the largest proportion of their nonsalmon harvest was used for human food.

Seasonality of Harvest and Gear Types

As mentioned above, Kaiyuh figured prominently in the seasonal subsistence round followed by most Nulato residents. The village was settled early in 1838 as a Russian trading post and then was later used as a missionary and military outpost (Joe 1987). Seasonal residence in the community occurred throughout the lives of the elders interviewed, with many of them spending far more time in the Kaiyuh Flats than in the village.

> We were raised there—mostly in camp. My parents, they bring us out in the springtime. Falltime we go to Kaiyuh. Come back for Christmas, and for beaver season, we move back out [around February], then we come back down—sometimes March—the [beaver] season used to be open 'til the thirtieth of March in our young days—and when the

> season closed, we moved back down for Easter Sunday. Then after Easter Sunday, we move back up [to Kaiyuh] for the spring. And then after we move back out in June—about tenth of June or somewhere around there—then we move down to fish camp [on the Yukon]. [010308N]

This interviewee described a seasonal residence pattern in the Kaiyuh Flats for most of spring, fall and winter, with short trips to Nulato for holidays where residents visited, participated in short stints of schooling, cashed in on furs, and resupplied for their next camp.

This pattern of traveling the land in pursuit of various resources, including fish, continued through the 1950s until compulsory school requirements kept families in Nulato for more of the year, as it did in other communities. However, respondents said that many families continued to "spring out" or "fall out" for the next several decades, depending on their reliance on trapping or fishing resources. In present times, respondents said, only 1 or 2 families departed the village to go to spring camp for the season (or part of it). Many contemporary families and individuals made day trips or several camping trips to the Kaiyuh at different times of the year in order to target a particular species; e.g., northern pike during spring.

When asked about these practices in the Kaiyuh in more detail, elder residents described similar fishing activities throughout the area. Beginning in spring, families would travel to Kaiyuh before the Yukon River ice broke up, to setnet for whitefishes and northern pike in those sloughs and lakes that were ice free.

> We catch only whitefish and pikes up there. Well, we put in our net early because when the slough went out, the Yukon River don't move yet. We put our net in then. We could tell when the ice in the Yukon move because … the water start raising and then there's chunks of ice coming up [the slough]. And when the water is too high in the slough, then you can't catch fish, 'cause the water's too high for the fish—and they go into the lakes as the water's draining into the lakes. So we put in our net right in front of the camp [in the lake], when the water's too high in the slough. … Any place, so long as the water is high—the fish all come into the lakes if the water's too high in the slough. And that water—you know, the food—there's a lot of food in the lakes for the fish. There's lot of—when we cut them—there's lot of little shells, like clams, in the whitefish. [010308N]

Multiple camps dotted through the Kaiyuh Flats were occupied by individual families, and sometimes by fluid groups of families working together. After the spring season, during which they fished to feed families and dogs, Kaiyuh families would gather briefly, similarly to Ruby residents gathering at the mouth of the Nowitna River, before returning to Nulato, after which many families would travel to summer fish camps on the Yukon River.

> They came out in the spring—like about the first of June, somewhere around there, end of May—we move back. Everybody communicate with each others. I don't know how many different camps. … They're all up and down the slough—and they kind of tell each other when they're going to the mouth of the Kaiyuh Slough—so we all gather there. As soon as we land right there they put in fish net. … Everybody gather right here—'cause there's about seven or eight families sometimes. [050308N]

Boats were lashed together for stability then floated down Kaiyuh Slough to the Yukon River where motor boats towed those without motors back to Nulato.

Summer fish camps around Nulato were primarily established in order to cut and dry salmon for winter use. However, as in other communities, nonsalmon species were harvested in fish wheels, though the harvest seemed to be incidental rather than targeted, given Nulato residents' focus on harvesting nonsalmon species at other times of the year. Of the nonsalmon species, one elder recalled seeing

primarily sheefish in the fish wheel at the beginning of the summer season, then "little whitefishes" as summer moved into fall; both were cut and dried.

The fall months meant a return to Kaiyuh where a significant amount of effort was focused on fishing activities. Several respondents talked about building, setting, and checking fish traps that were deployed throughout those Kaiyuh area sloughs and creeks that were known to be productive. In the colder months of late fall, families would make large piles of frozen whitefishes and northern pike that had been harvested by these traps and then return by dog team to collect their fish caches after snowfall. The following 2 quotes describe not only the process of setting traps for various fish, but also a keen attention to the details of place and movement across the land.

> It took two or three days for us to get to that Cottonwood City that I'm talking about [September]. And we rest for a couple of days—we have cabin there and then we have to go back down slough, then we have to cut wood. … Then we wait for a couple of more days again and go back down that way, same way, but we go to a place where there's lot of cranberries. … And then we paddle back up again—and then after that—slough freeze across, we cross—and then there's a lake across that little camp—Donut Lake…and then we cross that lake and then we go into the Bonanza Slough, and then from there we put fish traps in. Bonanza Slough is kind of shallow water: you could just walk across and drive picks and put fish traps in for pikes, whitefish, loche [burbot], and suckers. And around the bend or two, we put another fish trap and we catch the same thing from there—and we pile them up and after it start snowing, we haul it with the dog sled. [The traps] are about six feet long, they're about maybe fourteen, eighteen inches in diameter—and then there's a funnel where the fish goes in and then there's a back you could open and let all the fish drop out. … The funnel is made of spruce tree but the wood is stripped in pieces. We set about two traps, sometimes we put them right at where we come out of the mouth of Bonanza Creek—and as it's freezing we do that—and then we go further down above the bend or two and then we put in another fish trap and then that will be in for all winter. It freezes after we put in the fence and then the fish traps. … That's our winter supply of fish for the dogs and for the family. … There was seven families there! You had to be lucky to get something. [050308N]

Or, in the words of another elder whose family also maintained both spring and fall/winter camps in the Kaiyuh Flats:

> And what we used to do, too—my dad used to set little trap—and there'd be a little creek coming out from a lake—and he set trap just big enough for the width of the creek [at the winter cabin]. We used to catch bunch of sardines! That's little whitefish [likely juvenile whitefish]. In the falltime, that's when we move up, before it start freezing, you know—the water's dropping, so he just blocked their way with fish trap, coming out into the main slough. They're all different sizes [4–5 or 6–7 in], going into Bonanza. Our cabin's right here, and then there's a lake, and you go around that lake, walk around when the water is low, and then you go through portage, short portage, and right there is Bonanza. That would be up this way, up the Bonanza, not too far up from the portage. There was a lake, and then there's a creek coming from there into the slough. [During summer] we just make round trips up to the spring camp, in the evening, when the sun is setting. Daylight all hours of the night, but we go up there, round trip—sometime we stay one night in the summertime—and in the lakes in front of the spring camp it just sparkles, all them little fishes. Sardines! [010308N]

These descriptions contributed to the documentation of historical fishing activities during particular seasons. They also demonstrated an intimate knowledge of and engagement with the land and its cycles (e.g., fish migrations, water levels, maps of open waterways) which controlled how and when these

important resources could be harvested. The Kaiyuh Slough, Bonanza Creek (also known as Eddie Creek), Donut Lake, Elbow, Herman's Camp, Green Water, American Creek, Shortcut Creek, and a host of smaller unnamed, but well understood, creeks, portages, and camps figured prominently in the mental map of elders who lived in Kaiyuh (Figure 25; Figure 26).

Figure 25.–Tekla Esmailka talks about the Kaiyuh area, 2007.

Figure 26.–Elder Eddie Hildebrand of Nulato, 2007.

For families that lived in the Kaiyuh during winter, the fish traps were not only a method of harvest, but also were a traditional management technique.

> So, they make the fence with the willows to dam the creek. And they usually put the funnel facing downriver so the fish coming upriver get it. I could see it was wrong, the fish is coming out—in the fall—but they had it backwards. That was their reason for it,

> they don't want all the fish to come out. They don't want all the fish to come out of the slough. They want to hold some for the winter. See, the fall, when it's freezing, they all move out to deeper water. But with this dam, they hold back a few, not that many. But that kept them through the winter. [060308N]

Adult fish were not the only fish harvested in the Kaiyuh. Though species identification could be imprecise, several respondents talked about targeting small fish, referred to locally as "sardines," during fall. The small fish, which were perhaps juvenile whitefishes, were a favored food source.

> I remember one fall my brother-in-law came home and he said, 'We're going to go fishing,' and I thought to myself, 'Gee, we're fishing every day! What kind of fish we're going to fish for?' So we hop into the boat, and he had this wire—he made a ring out of a wire, big enough to put over a gunnysack, a hundred pound gunnysack. And he tied that on, then we went downriver, and we came to this one creek. Gosh, we could just see those little fish coming down like that, so many of it! Anyway, he put that gunnysack with the opening like this—and the water is rushing down and he put that thing right there. In no time, that gunny sack got full of sardines. And then he said, 'Get another sack ready,' so we got another sack ready and he did that until we fill up four gunnysacks. You have to fill it up to where you can handle it, though, you know. This is when we're living in Kaiyuh. I guess he was hunting or getting ready to put out mink traps and he saw this fish coming down. And all winter long, my mom said, 'Get me chunk of sardines!' [050308N]

This story documented Nulato residents' targeting and use of juvenile fish as well as the interconnectedness of their subsistence activities (trapping with fishing, in this example): how fishing has been integrated into a much wider spectrum of subsistence activities.

While many Nulato families spent fall and winter in Kaiyuh, others maintained winter camps on the Yukon River, usually downriver of the community in areas referred to locally as "Nine Mile," "Halfway," and "Six Mile," among other places. Also, respondents said, the Yukon River was a good place to set traps after families stopped traveling regularly to fall or winter camps in the Kaiyuh. Families worked together to set large fish traps under the ice in the Yukon River. These traps, usually larger than those set in the small, shallow sloughs and creeks of the Kaiyuh, nonetheless harvested the same set of fish during winter: northern pike, whitefishes, burbot, sheefish, and occasionally Arctic grayling. One elder recalled how the entire family participated in making, setting, checking, and storing the traps:

> He cut up the ice, and then he kind of put fence all the way back to the beach and out—and the fish trap is right there. … The fence, we made it with some kind of spruce tree, fresh one, make that kind. He get willow and tie them all the way around. All night, us girls, we used to help Dad. … Fish trap is not that big [5 to 6 ft]. … We don't want to get it too full, anyway. We bring bunch [of willow] home, thaw it out little while, and then we split it all the way—by our mouth—we're holding it. … It's [the fence] all one willow! That's the funnel in front of it. That's where the fish can't come back out. We make them! He [her father] tell us what to do and we make them for him. You take that off [the back] and all the fish come out and you put it back on again. … Checked it every other day. Not every day. We get loche [burbot], graylings—beautiful fish we get! What you call those little round fish? *Delmega* is those little whitefish, those little fat fish [a species of cisco]. … When you're done, put it away, you know. Hang it up so no one will touch it. The ones that do it [go fishing] down here, they gets lots down this way. Some hang it in a tree, some off their cache, and then they use it again next year if they want to. [030308N]

She made Arctic grayling nets and whitefish nets from twine, and her father made the floaters from cottonwood. She set her nets for Arctic grayling in the Nulato River.

Another elder who set traps in the Yukon River until about 2000 recalled how and where he used to set them. Two key respondents from Kaltag and Ruby recalled assisting him in setting a trap during his last several trips. He set it under the ice along the islands around Two Mile, downriver from the Nulato River. He preferred to set it soon after January 1, after the water level dropped under the ice. The trap was approximately 8 ft long and 30 inches in diameter, with a 4 ft square funnel that tapered to 8 in.

> Well, any place the ice is smooth—and you make a hole and you check the water for current. And then you find good current and you check the bottom to see if it's solid. If it's soft, it's no good. If you put your trap in, it might wash under it. So we try to look for gravel bottom most of the time. And then your fence is—you know how deep the water is and the formation of the bottom. I put in a trap one time, and I had to go a hundred and fifty feet to get the beach. It's shallow, but it's still open enough for fish to get by. You have to shut the water all of the way. You put your trap in about six or seven feet under the ice, near the bottom … Wherever you're going to put your trap in, you got that spot, from there you start cutting your trench. About thirty-five degree angle to the beach—and from there you gotta put a lead down, about eight feet, ten feet—I made mine about thirty, forty feet. [060308N]

Again, these key respondent interviews suggested that close observations of the characteristics of a place have long provided success in most subsistence activities, especially fishing, because fishers who paid close attention to place often accumulated information about the characteristics of a good spot to find fish. One elder's story can be given to illustrate this point. He recalled a conversation his grandfather had with several other men about setting traps near open water, but his lack of attention at the time left him without the point of the conversation. Many years later, as a young man, when he was setting his own traps in the Yukon River, he found what he thought was a good spot in terms of current strength, river bottom formation, and depth; it was just downstream of a section of open water. After working for 3 days to place the trap, his first day yielded a large quantity of good fish; the second time he checked it, the fish were fewer and not as good. The final check produced only 1 burbot, the last fish he harvested in the trap. And when he removed the covering over the trap, he could see that the current was flowing sideways against the trap, rather than through it. Ice crystals that had formed in the open water had broken off and lodged in the trap fence, blocking water movement through the fence and diverting the current, as well as the fish, around the fence.

> Then I figure out what Grandpa was talking about … When Grandpa was talking to those peoples, I should've been listening. I heard him mention that a guy was catching lots of fish and it tapered down to weak fish, and he said something about open water, but I wasn't paying attention. I tried to remember it, what he said, but I didn't have it. Here's what he meant: you see that open water, that's what he's talking about. Every day, it's making crystals that shootin' under the ice—and we got this fence here. So, the whole fence got blocked off and there's no place for the current to go but straight out [sideways] and the fish follows the current, which creates a big eddy in front of the trap so no fish enter. [060308N]

In contemporary times, Alaska blackfish, which Nulato residents also called "devil fish," were not harvested in large quantities; instead, they were harvested irregularly and usually used as bait. Elders, however, remembered their parents and other relatives targeting Alaska blackfish and were able to identify specific productive Alaska blackfish areas, though these elders also observed that Alaska blackfish had mostly disappeared from the area, an observation made in other Middle Yukon communities as well:

> There's not as many blackfish as there used to be—too much otters, pikes, maybe. They used to go up this way on the Kaiyuh trail—what they call 'Dinner camp' [above Nine

> Mile on the Kaiyuh trail] and they used to put trap in for them right there. Any time of the year, long time ago. They used to come back with sled load of devil fish! [010308N]

During another story about setting traps in the lakes around a winter camp, another elder recalled one of the Alaska blackfish's more peculiar traits:

> Oh yeah, I remember my brother-in-law come home and he said he see where there's lots of—after the sloughs and lakes freeze—he see where there's lot of blackfish coming up. So he make a small fish trap—same thing, with little funnel in there, not too big, and he tie it to the pole like this, and he put it in that hole and—I don't know why those fish, they go like this [makes a circular movement with her hands] and then that fish trap get full. And this one day, my mom said, 'Cook some blackfish.' And she didn't tell me, and they were frozen, so I washed them and put them in a pan, and they started getting alive … They just got alive, all over the stove, all over the floor! She didn't tell me they come alive when they thaw out! Man, I was just running all over the place, grabbing fish all over the place, off the floor! [050308N]

Most contemporary Nulato families did not "spring out" to the Kaiyuh, or stay through fall and winter seasons, or go to camps along the Yukon River for extended periods of time. However, they still regularly targeted nonsalmon species seasonally in areas close to the village and they still made occasional trips further out, to Kaiyuh, for example.

Residents directly linked the seasonal presence of nonsalmon fish, especially whitefishes, to seasonal migrations. Residents related the seasonal presence of nonsalmon fish, especially whitefishes, to seasonal migrations. "They go out—they come out when the water is dropping in the fall, yeah. Some hide and wait up there in the lakes [during winter] but most of them come out of the slough. You could catch them any time in the summer—you put in net, you could catch them." [010308N]

One of the most valued seasonal activities was spring northern pike fishing with hook and line in Kaiyuh. Several families reported that they went to Kaiyuh and either camped there for a few days or made day trips.

> They could catch it any time all winter if they go out for it, but they don't go out for it until it seems like in March or April—they go out for it. … In the sloughs. We make holes in the creeks, put the hook down there. They like to live out in the lakes, that Bonanza, and American Creek, it runs into that Kaiyuh Slough. That's where you get them big pikes, there. [020308N]

On the Yukon River, the mouth of Nine Mile River (the general area is also referred to as "Half way") was an important and productive area where fishers setnetted during fall for whitefishes, sheefish, northern pike, burbot, and cisco species. One fisher noted that he mostly set whitefish or Arctic grayling nets (approximately 2 to 4 in mesh).

> We use the grayling net for those small ciscoes. And that's where you get burbot: while you're checking your net, you see them coming up every once in a while—you get the net under them and scoop them. They put that whitefish net in the front and then that little grayling net in back of it, upriver from it. Those little whitefish go through the bigger net in front and get caught in the grayling net behind it. Every year we do that. [040308N]

The downriver end of the island across from Nine Mile River was a good spot to setnet under the ice, residents reported (Figure 27). One fisher who regularly set a net there during winter observed that whitefishes, sheefish, and northern pike could be harvested there in November and December, but that their abundance slightly declined until March and April, at which time their run was again more abundant.

Figure 27.–Dean Painter sets a net at Nine Mile, 2007.

The Nulato River just upriver from Nine Mile was another place mentioned by every respondent interviewed. Many fishers stated that the Nulato River was also a good place to set traps during spring. After the ice went out, traps could be set anywhere one could walk across the river. Several species of nonsalmon fish milled about at the mouth of the Nulato, they said, and residents using hook and line could target large sheefish there in late June and July (Figure 28). Other fishers had observed sheefish "dancing" around there: "... [T]hey come out of the water—their head and part of their body—they dance right on top the water." [010308N] Fall fishing was mostly for Arctic grayling and "trout:" "We used to go up there when the ice was strong enough to walk on [late October]—that's where we used to go and there was a lot of grayling in that place. You can fish through the open water [holes in the ice] after it freezes." [060308N]

Upriver of the community are Happy Slough and Patsey Slough, residents reported that both were excellent spots for spring setnetting, after breakup, for whitefishes and northern pike. Patsey Slough was also productive during fall, and that's when fishers setnetted from the mouth and from the point of the island across from the mouth. Fishers reported finding "sardines" or "minnows" (likely juvenile fish) far into Happy Slough, if the water was high during fall.

As mentioned above, Alaska blackfish were not generally harvested in contemporary times, though fishers still knew where to go. One elder described a historical practice:

> We used to call it Big Lake but now they call it Jay's Lake. Fall, as soon as the ice forms. What we used to do is put a trap in there—you know, right in the grass—put willows down—and right at the end, cut out the ice and set the willows down in there [like a fence] out to the edge of the grass and put the trap in by the grass all the way down to the beach—and right at the edge of the grass—we put the trap down. Lay it down [horizontally]. They travel along the edge of the grass. Now, we use them for loche [burbot] bait. [010308N]

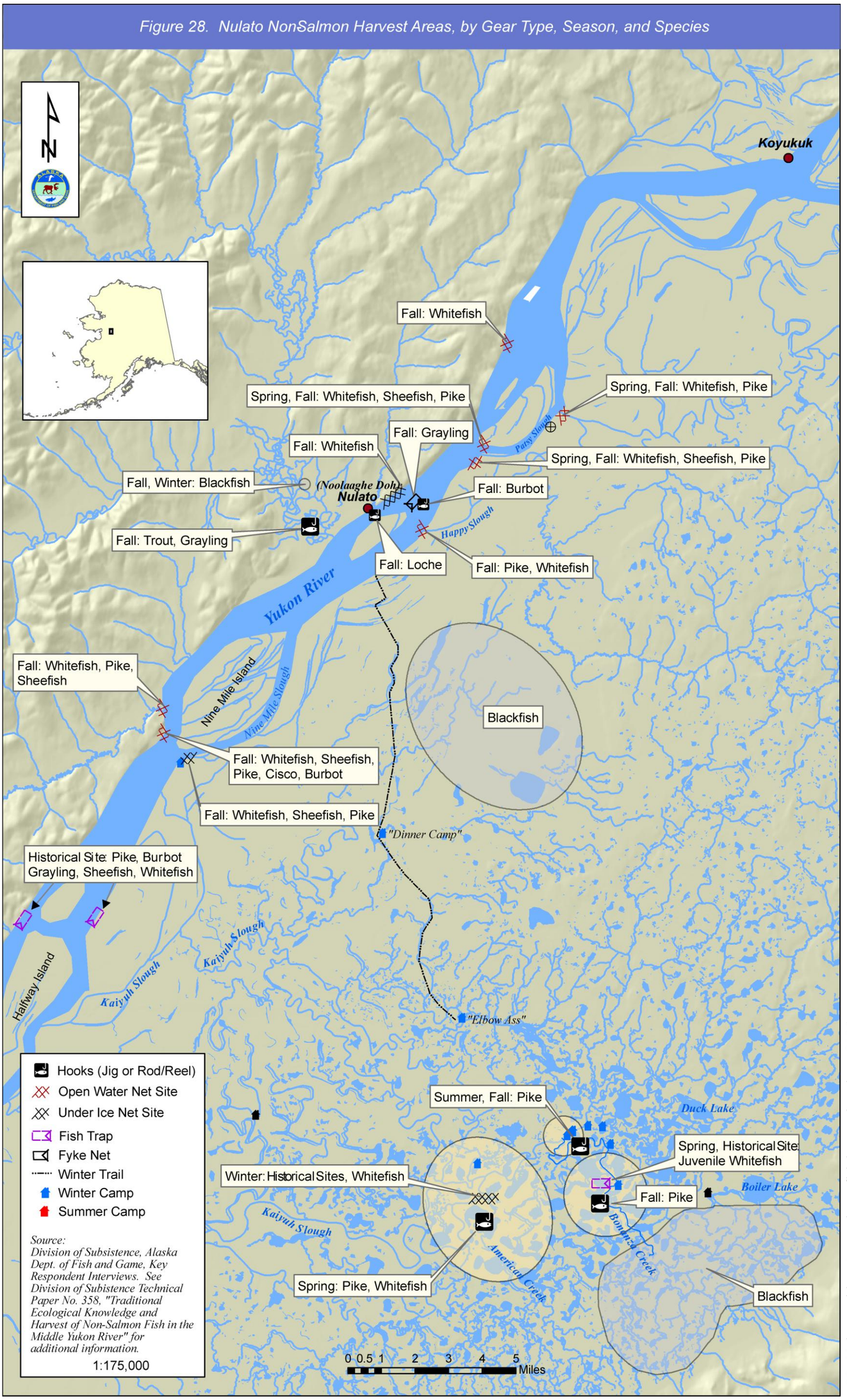

Figure 28.–Nulato residents' nonsalmon fish harvest locations, 2006.

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8

Harvest and Use of Nonsalmon Fish

As described above, a variable set of gear types was used for the seasonal harvest of nonsalmon fish species. Historically in Kaiyuh, traps (e.g., fyke nets) and nets were used primarily during spring, while traps dominated fall fishing, and hook and line was used all year in open water as well as through the ice. On the Yukon River, nonsalmon fish were harvested incidentally in fish wheels, and targeted with traps used almost exclusively during winter by families with winter camps there. Since historical times, as the need for the quantities of fish harvested in traps declined, contemporary fishers reported that they have been using nets to harvest nonsalmon fish on the Yukon River, either under the ice during winter or in open water at the mouths of sloughs and creeks. Many residents also used hook and line to target nonsalmon fish in some choice locations. One family reported that they used nets when they "spring out" to Kaiyuh although hook and line was their favored method for spring northern pike fishing through the ice in Kaiyuh. No respondents remembered using dip nets, nor was there any discussion of seining techniques which were used in other communities during fall harvests.

While contemporary nets were commercially purchased, in the past, most Nulato fishing families had made their own nets:

> The nets they have now with those lead lines are good 'cause they don't tangle up—all around like this. When we used to have net long time ago, Mom used to sew stones on the bottom, you know, so far apart. Those ones [handmade nets], they used to really—like rope if you catch pike—would make it go into, like, rope! … That's what they used to do long time ago is make their own nets. You know, there was none of this ordering like now, and they used to make their own rope, like, you know, with gunnysacks? They unravel it and braid it and they make the top line and the bottom line with that. And then they make their own floaters, you know. They make them out of cottonwood or stumps, dry spruce stumps that don't rot right away. And then they pick them stones in this shape [oblong]. Then they sew canvas or any kind of cloth around it to sew it on the net. [010308N]

Before freezers, the preservation of nonsalmon fish harvests was achieved in several ways. Most winter-caught fish were used immediately as a source of fresh meat, but could also be simply frozen on the spot. Fish harvested during spring, summer and early fall were usually split then smoked or sun-dried. One elder described how a cooler could be fashioned by digging a hole in approximately 4 ft below the frost line and lining it with grass: "And then they used to dig a big hole where they used to keep the fish or the ducks or whatever we get. Until it get cold—and then we leave it in the cache." [050308N].

Young and elder fishers described a historical process of preserving whitefishes through fermentation that was still practiced in contemporary times. The larger whitefish species were targeted in late September or early October, just before freeze-up, when their eggs were large.

> ... [T]hey make rotten fish. Just throw grass on the ground, and make a box around it, and throw fish in there, and then some more grass into it, on the fish, and they rot—whole fish. Then they get green and then that's the best time to eat them. But that's the way you fix them: you don't put them in plastic bags or anything, you put them in grass. Until they freeze. Late September, early October, before it freeze—so you gotta have time to let it ferment and then freeze. Their eggs are big then—humpback and broad, both. [040308N]

After fermentation, the fish could be eaten frozen, or baked then dipped in seal oil that had been traded from relatives or friends on the coast.

Though northern pike were not the most heavily harvested nonsalmon fish reported by Nulato households, their harvest and use was extensively discussed during the interviews. As mentioned above, many Nulato families continued the practice of traveling to the Kaiyuh during spring to target northern pike. In the early days, respondents said, many people cut and dried northern pike so as to make sun-dried

"flat fish," which were occasionally lightly smoked (Figure 29). The flat fish were held open with 2 sticks made into crosspieces.

> Now we got smokehouse up there [in Kaiyuh], but when we have no smokehouse, we just cut it and hang it up, then—and put canvas around the fish rack, and then we make smudge underneath, and we smoke it like that. I have one way of cutting, there's different ways to cut it, but I cut it one way. I cut it by the back, from the back. [010308N]

Fat northern pike harvested during spring were also boiled and rendered into cooking grease, which was spooned off the top and stored in bottles, jars, or anything handy. Nets were checked once per day, early in the day, in order to allow northern pike to "sit" a while before cutting.

> The pikes, you can't cut them right away. If it's fresh, it's just like rubber, like cutting rubber or something. The meat's too hard to cut. We leave it out all day—leave it in the sun in water, and if the water warm up, and then it soften the meat. Easier to cut like that. The way I cut them is the only way I know how to cut them—sun dry. They don't have long ribs, you know, it's short, the backbone, and it look like elbow. That one is in the flesh—you gotta cut pike—you can get the tip end of that bone. [010308N]

Northern pike were favored for their meat and roe, as well as for their viscera which were split, scraped, cleaned, and fried. After the removal of the membranes, northern pike roe could be mashed and then combined with cranberries and sugar to make a foamy dessert. Northern pike flesh was also a featured ingredient in "Indian ice cream," an important ceremonial potlatch food which was made by mixing the northern pike with vegetable shortening or moose tallow, berries, and sugar. Finally, key respondents related a common method their ancestors used to prepare northern pike, and which some still used in contemporary times, as *kk'oontusge* (literally translated as "one swollen or fat with eggs"). "... [Y]ou know, inside the rib cage—but they pull their guts out but leave only the eggs in there and dry it and smoke it—the whole fish with the eggs inside the ribcage. Pike. They do that up in Kaiyuh in the springtime. We don't use pike head, so they're headed and gutted." [040308N]

Figure 29.–Dried northern pike stored in a Nulato cache, 2007.

Other nonsalmon fish were singled out for their utility as food, among other things. One elder recalled how fresh whitefish heads were boiled and eaten at the spring gathering of families in the Kaiyuh before

they returned to Nulato together. Interviewees also said that another whitefish, (likely least ciscoes from their description, although not specifically identified as such) was harvested during fall in front of the village, scaled, gutted, and roasted with the eggs inside; this dish was called *naadlekk'oon*. While residents reported that longnose suckers were neither targeted nor eaten much in contemporary times, one elder did recalled her mother serving the bottom, less bony halves of longnose suckers to her and her siblings. Her mother also cooked the head of the longnose sucker, recalling the Koyukon story about longnose suckers and their thieving ways which had made them so bony (Andersen et al. 2004): "... [S]ometimes they cook the head, to take out that little side comb in side the head? Yeah, little side comb. Little comb this big—they [the sucker] stole that side comb from somebody!" [030308N]

Another story was related about burbot, who stole Chinook salmon's tail (Figure 30):

> King [Chinook] salmon—in the story, somebody stole its tail, a loche [burbot]. Loche stole its tail. It's got it like this, and you can see that tail on it, right here. If you happen to get loche, and you can see that tail on its side right here [on the head behind the gills]. You see the woman standing right there and she's packing a big tail, salmon tail, right by its gills—you gotta look for it, like a pattern in the scales. [030308N]

Stories such as these have value as signifiers of people's connection to the land and the animals on which they live. In these stories, humans remember and actively participate (through harvesting the comb or reading the history of the burbot on its gills) in a larger history that serves to reinforce and maintain cultural identity.

Figure 30.–Flora Nicholi cuts up a burbot for soup, 2007.

ECOLOGY OF NONSALMON FISH IN NULATO

Nulato residents maintained a detailed understanding of fish movements and other aspects of their life history, which they used to effectively harvest them. Most of the key respondents noted that the Kaiyuh area primarily produced broad whitefish, northern pike, burbot, and longnose sucker in the spring and fall/winter months (Figure 31; Figure 32). They saw humpback whitefish much less frequently, and most had only recently seen sheefish in the area. The sheefish they saw were relatively "skinny." "I don't know—the last couple of times we 'spring out' up there, we been catching sheefish, too [in May, in setnets in the sloughs or lakes, depending on water levels]. That's unusual." [010308N]

Northern pike were another prized fish from the Kaiyuh. Harvesting them in summer or winter required a working knowledge of their habits.

> But when the water gets high, you hardly catch them. You catch them lots in the lakes—you know, like I said—we put in the net in front of our camp 'cause they're sort of, like, shallow water fish … They stay in there [the lake] mostly. They go in the grass towards the beach—you see lot of them, where it's shallow-like. [010308N]

Northern pike were primarily targeted with jigs in the still frozen spring months, prior to breakup, during "spring out" trips of a few days or a few weeks, or during day trips. Setting nets was another method used to harvest northern pike and whitefishes during spring. One elder explained that although she normally travels to her spring camp in April, she does not usually start fishing until the water starts forming in the slough, around the first week in May. One elder reported that after she traveled to her spring camp in April was the time she usually saw northern pike that had mature eggs. Whitefish eggs were still small at that time, she said, and she further noted that whitefish eggs did not become mature until later in August, which is when she harvested whitefishes from the Nulato River. Many residents observed that burbot eggs were fully grown around February.

Figure 31.–Rita Painter holds her grandmother's burbot hooks, 2008.

Figure 32.–Detail of Nulato burbot hooks.

Though egg color can be quite variable even within individuals of the same species (e.g., broad whitefish), local fishers had general guidelines to help with species identification. Broad whitefish eggs were generally considered to be white or pale, humpback whitefish eggs were yellow orange, and the smaller cisco species were more orange red. Sheefish eggs were generally considered to be orange. On elder explained a distinction between small whitefish species, those referred to as *delmege*, and another type referred to as *naadlekk'oon* (or "one with eggs"), the latter of which was a small "flat" fish harvested in front of the village or in the Nulato River during fall. *Naadlekk'oon* were about 6 to 8 in long with orange eggs and white, watery flesh [030308N]. This resident may have been describing a species distinction between Bering and least ciscoes, or the difference could be ascribed to physiological condition or location/seasonality of harvest.

Concerns of Nulato Residents

Nulato residents expressed concerns about 2 primary topics: a perceived increase in northern pike abundance and perceived changes to the waterways near Nulato, especially in the Kaiyuh Flats. Several fishers noted that since most families no longer lived in Kaiyuh during spring and fall, when they used to take "their share" of northern pike, the abundance and size of northern pike has significantly increased ("exploded") and increased pike predation has led to a decline in other species, such as whitefishes, muskrats, and ducks.

A second issue observed by several fishers was changing siltation patterns in and drying of the waterways around Nulato and in the Kaiyuh Flats. The mouth of the Nulato River has filled in over the last 5 to 10 years, they said, which has changed their fishing practices as they try to adapt to an ever changing waterway. Several elders observed that the Kaiyuh area has experienced significant drying over time, making it look very different than when they were young: "Too much trees! Didn't used to be so many trees—and everything's growing so much that you don't even know where you are any more!" [050308N] Another elder suggested that historical practices may not be possible due to contemporary changes in the water levels: "Gee, long time ago, they use to put in a fish trap—I don't know what happen to the slough—now the water just goes so low." [010308N]

Harvest Survey Results

Nulato residents reported the most extensive levels of use of nonsalmon fish species in 2006, based on the percentage of households using a particular species (Table 10). Residents reported harvesting an estimated total of 11,447 lb of nonsalmon fish. The largest contribution of nonsalmon fish, in terms of the number of pounds, made to subsistence diets in Nulato was made by whitefishes (4,554 lb harvested). Approximately 34% of the 2006 harvest consisted of 3 whitefish species: broad whitefish, humpback whitefish, and least ciscoes, with broad whitefish constituting the largest percentage (69%) of this whitefish harvest (3,143 of 4,554 lb). During key respondent interviews, Nulato fishers noted that they harvested large quantities of larger whitefish species, mostly broad whitefish, during spring and fall setnetting at the mouths of productive sloughs, as well as under the Yukon River ice during winter. The importance of whitefishes in the total subsistence harvest of Nulato residents was also demonstrated by their use patterns: a total of 64% of households reported using whitefishes. Approximately 38% of the community households harvested whitefish species, while 26% of households shared some portion of their harvest with other households, and 45% of households reported receiving whitefishes from other households. This high level of harvest and sharing contributed to a per capita harvest of 17 lb of whitefishes per person per year.

While broad whitefish constituted the most significant nonsalmon species harvested by pounds, more households reported using sheefish (76%) and Arctic grayling (76%) than whitefishes (64%), possibly suggesting higher sharing rates of sheefish than of whitefishes. In 2006, Nulato households harvested an estimated 3,356 lb of sheefish (29% of total nonsalmon fish harvest by weight) and 976 lb of Arctic grayling (9%). In addition to whitefishes and sheefish, residents of Nulato relied heavily on northern pike (1,158 lb harvested, or 10% of total nonsalmon fish harvest by weight) in 2006. Much of this amount was likely harvested during spring and fall setnetting or in the spring hook and line northern pike fishery in the Kaiyuh Flats.

Harvests by month are presented in Table 11. Nulato residents' highest amount of subsistence fishing effort occurred in the spring, summer, and fall or early winter months; their least amount of effort occurred during January, February and March. Depending on the species, the summer and fall months accounted for the largest harvests by Nulato residents. For example, sheefish were primarily harvested in June and July, coincident with the salmon runs, while the largest Arctic grayling and "trout" harvests occurred in October, when they were more available perhaps due to their migration from the clear, rocky streams on the higher elevations on the north bank of the Yukon.

Northern pike and whitefish harvests occurred throughout spring, summer, fall, and early winter, with an increase in harvest in September and October. Nearly 75% of the broad whitefish harvest occurred between August and October, also likely coincident with the seasonal movements of these fish.

Table 10.–Estimated harvest and use of nonsalmon fish, Nulato, 2006.

Resource name	Percentage of households					Pounds harvested			Amount harvested		95% confidence limit (±) harvest
	Use	Att	Harv	Rec'd	Give	Total	Mean HH	Per capita	Total	Mean HH	
Alaska blackfish[a]	3%	0%	0%	3%	0%	0.0	0.0	0.0	0.0	0.0	–
Burbot	32%	12%	12%	23%	9%	217.8	2.6	0.8	90.7	1.1	17%
Dolly Varden[b]	8%	8%	8%	1%	5%	338.9	4.0	1.3	135.5	1.6	59%
Arctic grayling	76%	46%	46%	51%	36%	976.1	11.5	3.6	1,394.5	16.4	7%
Northern pike	46%	22%	20%	24%	19%	1,157.8	13.6	4.3	257.3	3.0	15%
Longnose sucker	4%	4%	4%	0%	1%	13.7	0.2	0.1	19.5	0.2	27%
Trout[b]	39%	39%	39%	11%	28%	832.2	9.8	3.1	558.2	6.6	11%
Sheefish[c]	76%	45%	43%	46%	30%	3,356.4	39.5	12.4	559.4	6.6	8%
Whitefishes											
Broad whitefish	47%	23%	23%	28%	19%	3,142.7	37.0	11.6	785.7	9.2	12%
Ciscoes											
Bering ciscoes	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0	–
Least ciscoes	3%	1%	1%	1%	1%	23.0	0.3	0.1	23.0	0.3	40%
Subtotal, ciscoes	3%	1%	1%	1%	1%	23.0	0.3	0.1	23.0	0.3	40%
Humpback whitefish	32%	20%	20%	20%	15%	675.4	7.9	2.5	225.1	2.6	13%
Unknown whitefishes	22%	15%	14%	11%	5%	713.3	8.4	2.6	237.8	2.8	17%
Subtotal, whitefishes	64%	38%	38%	45%	26%	4,554.4	53.6	16.8	1,271.6	15.0	10%
TOTAL, nonsalmon fish	92%	62%	61%	76%	54%	11,447.2	134.7	42.2			8%

Source ADF&G Division of Subsistence household surveys, 2007.

Note For conversion factors, see Appendix C.

a. Harvest was reported and estimated in pounds, not in numbers of fish.

b. While Nulato residents drew distinctions in the harvest survey between "Dolly Varden" and "trout," it is probable that both fish were Dolly Varden at different life stages.

c. Although sheefish are a whitefish species, they are often managed differently than other whitefish species, and so the data are presented separately.

Table 11.–Estimated nonsalmon fish harvest by month, Nulato, 2006.

		March		April		May		June		July		August	
Resource	Units	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest
Burbot	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	1.1	1.3%
Dolly Varden[a b]	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Arctic grayling[b]	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Northern pike	ea.	0.0	0.0%	8.0	3.1%	3.4	1.3%	62.0	24.1%	14.9	5.8%	54.0	21.0%
Sheefish[b]	ea.	0.0	0.0%	0.0	0.0%	34.5	6.2%	269.9	48.3%	142.4	25.5%	75.8	13.6%
Longnose sucker	ea.	0.0	0.0%	0.0	0.0%	11.5	58.8%	2.3	11.8%	0.0	0.0%	5.7	29.4%
Trout[a b]	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	6.9	1.2%	0.0	0.0%
Broad whitefish[b]	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	68.9	8.8%	14.9	1.9%	164.3	20.9%
Least cisco	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Humpback whitefish[b]	ea.	3.4	1.5%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	45.9	20.4%
Unknown whitefishes[b]	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%

		September		October		November		December		Totals	
Resource	Units	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest	Amount	Percentage of 2006 harvest
Burbot	ea.	12.6	13.9%	27.6	30.4%	49.4	54.4%	0.0	0.0%	90.7	100.0%
Dolly Varden[a b]	ea.	0.0	0.0%	83.9	61.9%	17.2	12.7%	0.0	0.0%	135.5	100.0%
Arctic grayling[b]	ea.	189.5	13.6%	1,059.1	75.9%	103.4	7.4%	23.0	1.6%	1,394.5	100.0%
Northern pike	ea.	91.9	35.7%	23.0	8.9%	0.0	0.0%	0.0	0.0%	257.3	100.0%
Sheefish[b]	ea.	28.7	5.1%	1.1	0.2%	0.0	0.0%	0.0	0.0%	559.4	100.0%
Longnose sucker	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	19.5	100.0%
Trout[a b]	ea.	40.2	7.2%	400.9	71.8%	68.9	12.3%	11.5	2.1%	558.2	100.0%
Broad whitefish[b]	ea.	230.9	29.4%	189.5	24.1%	0.0	0.0%	0.0	0.0%	785.7	100.0%
Least cisco	ea.	23.0	100.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	23.0	100.0%
Humpback whitefish[b]	ea.	58.6	26.0%	71.2	31.6%	0.0	0.0%	0.0	0.0%	225.1	100.0%
Unknown whitefishes[b]	ea.	11.5	4.8%	94.2	39.6%	63.2	26.6%	0.0	0.0%	237.8	100.0%

Source ADF&G Division of Subsistence household surveys, 2007.

Note In Nulato in 2006, no harvest of nonsalmon finfish was reported for January or February. No harvest of Pacific herring, Pacific halibut, Alaska blackfish, or Bering cisco was reported in any month.

a. While Nulato residents drew distinctions between Dolly Varden and "trout," it is more likely that they were Dolly Varden at different life stages.

b. In Nulato in 2006, month of harvest was not specified for 34.5 Dolly Varden (25.4% of the estimated 2006 harvest), 19.5 Arctic grayling (1.4%), 6.9 sheefish (1.2%), 29.9 trout (5.3%), 117.2 broad whitefish (14.9%), 45.9 humpback whitefish (20.4%), and 68.9 unknown whitefishes (29.0%).

Kaltag

Kaltag fishing practices were very similar to those described by Nulato fishers; indeed, the 2 communities were closely related in several ways. Fishers from both villages claimed historical use of the Kaiyuh Flats area, especially in the lower reaches of the Kaiyuh Slough, which drains into the Yukon River 22 mi downstream of Kaltag and thus is usually referred to as "22 Mile." Kinship relations were strong between Kaltag and Nulato and several respondents for this project had lived in both communities at times in their lives. Furthermore, Kaltag and Nulato were the only 2 communities in Alaska that celebrated the Stickdance, a type of annual memorial potlatch ceremony for individuals who had passed away up to several years prior. The 2 communities usually alternated hosting duties for the week-long event. As a memorial potlatch, traditional foods, including nonsalmon fish species, were the centerpiece of the menu. The primary author (Brown) attended a Stickdance in Kaltag in March 2008, which will be described below.

Nine key respondents were interviewed for this project: 6 men and 5 women (Figure 33). These 9 individuals also included 1 married couple, 4 elders (2 men and 2 women), and 8 active fishers (including 1 elder). Most respondents had either lived in Kaltag since birth, or had lived there for most of their adult lives. Two men, married to community residents, had lived in Kaltag since the 1970s. At least one of the respondents was born in Nulato and moved to Kaltag as a child, and several of the respondents had lived with relatives in Nulato for periods of time. One respondent was originally from the lower Middle Yukon area, but had lived in Kaltag for the entirety of her married life. All respondents were initially selected in consultation with the tribal council. A local resident was hired as a research assistant for the interviews, all of which were conducted in English.

Figure 33.–Mary Rose Agnes maps placenames near Kaltag, 2007.

Just as with Nulato, the relationship between placenames and subsistence activities around Kaltag, including fishing, emerged as a significant theme early in the project. Several elders in Kaltag had been involved with language documentation projects and regularly referred to these places in discussion. As a result, many of these place names are known and used by younger generations of fishers. These will be considered throughout this section and the Discussion section as the fishery is described.

In the 1800s, respondents related, Kaltag residents' ancestors lived at *Tloge kkayeh*, or "fish village," which was located on the Kaiyuh Slough. Then, a war between neighboring Koyukon groups killed many of the residents of *Tloge kkayeh* and drove many others away. Another area respondents identified as a historical village site was *Ggaal doh,* a Koyukon phrase literally meaning "before the king salmon," and from which, they said, the name of the contemporary community of Kaltag was derived. According to Kaltag residents, this site was across the river from the current site and was where residents used to dip net from canoes and maintain a community smokehouse. Residents also said that a settlement was located at *Rodokaket*, a few miles downstream of the contemporary community; *Rodokaket* was now referred to as "Old Village." Respondents noted that residents moved to Kaltag around 1935 after excessive flooding in the *Rodokaket* area [050408K]. Thus, two of the placenames indicated resource use areas important to Kaltag residents. Even if community residents did not fish, they knew these places were important fishing spots because of placenames.

Several respondents mentioned an area just downstream of the cemetery approximately 1 mi upstream of Kaltag where a small section of the river remained ice free during winter. One respondent noted that he thought that this was an area with upwelling current or where a spring fed into the river, thus keeping it open during winter. Several other respondents related other stories to explain the unusual spot. According to these respondents, the elders said that many years ago, the village residents would cut a hole in the ice there so that a medicine man could jump into the freezing water, turn into a fish, and swim downriver to the ocean in order to determine how many fish would be returning the following summer. Because it took a long while to make this journey, villager residents would have to keep the hole open all winter; since then, it has never frozen.

Not surprisingly, respondents noted that the primary seasonal fishing areas used by Kaltag residents spanned a greater stretch of the river and associated sloughs and lakes several generations ago, when families were still traveling a seasonal subsistence round to different camps during different times of the year. One elder's childhood summer and winter camps were approximately 12 mi upstream of Kaltag, near "Halfway," at the lower end of fishing areas described by Nulato fishers. On the lower end of Kaltag residents' use area was 22 Mile, or the lower end of Kaiyuh Slough, approximately 22 mi downstream of the current location of the village. These areas were still used in contemporary times, although less regularly, and Kaltag families no longer lived in these areas for entire seasons.

Seasonality of Harvest and Gear Types

As with the other project communities, the historical seasonal round for Kaltag residents included multiple camps and limited residency in the village. According to the seasonal patterns of one elder, harvesting nonsalmon fish resources at all camps was critical to survival:

> We were raised up twenty-five miles below Kaltag—the name of that camp is *Khotolkaket* [the traditional Koyukon name for 22 Mile]. Spring and fall camp. That's where we were raised up. We stay in camp from September to December and then in March we'll go back down beaver trapping with my parents … for about a month, then we come back up [to Kaltag], and then in June, we go to our fish camp, three miles down here [downriver from Kaltag] at *Rodokaket*. That's the mouth of that creek. Row boat, no motor: arm power. August, yeah—and then we had to bring up our dry fish, you know. Row back up. Back and forth to store away our fish. It was tough life. August, September, we go back down to this *Khotolkaket* for the winter. 'Round and round,' yeah. [050408K]

This elder's family spring and fall camp centered around fishing, hunting, and trapping activities:

> In this river [Kaiyuh Slough], right in front of our camp, we used to have fish net. We watch it—it pull, pull. Just get filled with pikes, and whitefish, and shee. We check it

> morning and evening. We cut it in the springtime. Falltime, we put it away for frozen fish. [050408K]

Shortly after spring trapping, her family returned to Kaltag where they stayed for approximately 1 month while getting ready for summer fish camp. During this time, her family fished at specific spots which were known by their placenames.

> We … set nets early in May, we had nothing to eat early on long time ago—no refrigerator, no freezer. We barely make it through that winter, so we have to setnet for sheefish or whitefish after the river opened. … *Na ha ten* is the name of the place where they used to set that spring net. Pike, too. They would get about ten fish a day that way, and then go back to Kaltag and cut fish there for a while, until it's time to move down to the fish camp when they finish the fish wheel. Then we move. Stay there 'til August. Then September we go down *Khotolkaket* for the winter, all winter, 'til Christmas. [050408K]

Her family's summer fish camp at *Sakay Huyledlo Denh* ("children were in that place"), approximately 5 mi downriver of the village, was primarily focused on salmon, though significant numbers of nonsalmon species were harvested in the fish wheels and used mostly for dog food. Other elders remembered fishing with hook and line for whitefishes from the beach at fish camp when they were young, using salmon roe for bait and sometimes harvesting upwards of 2 "tubs" full of fish at one time. Fall would find the family back at *Khotolkaket*, setting nets in open water until September and October, or until the slough started to freeze. Her family did not have a motor for their boat, so fishing spots needed to be within rowing distance. After freeze-up, they set the net under the ice until about late November when the ice was too thick to check the net. Fall nets harvested whitefish species, sheefish, northern pike, and burbot.

Her family returned to Kaltag for Christmas and stayed there until returning to *Khotolkaket* around March to start the cycle again. While in Kaltag, her family set a net under the ice across the river to harvest sheefish, whitefishes, northern pike, and burbot. She also remembered another family setting a fish trap near the same spot as well as downriver near the bluff at Eight Mile. That family checked the trap regularly, used the dog team to retrieve the harvest, and widely shared the fish with other families in town: "They give it away—they say for luck!" [050408K] Another elder remembered the fish trap that was set by Nine Mile, downstream of Nulato, described earlier: "We used to help him look at his net, once a week, on Sundays—his trap. And he used to pay us with fish. He used to give us fifty pound gunnysack full—everybody. And he'd still have ten sacks to take home." [010408K] Several respondents remembered a fish trap set at "Slow Roadhouse," a location on Kaiyuh Slough where there was a cabin used by mail carriers coming up from the Innoko River. After this dog team mail service ceased, a Kaltag resident assumed control of the area and set fish traps during fall and winter.

A younger fisher described the process of making and setting a trap as he remembered it from his relatives' efforts. While most traps harvested a variety of fish, the following quote suggested that fishers did put some effort into targeting particular species:

> They used to use fish traps. ... After it freeze up, under the ice. … They would make a square and then a long funnel on there—make like, a basket—and then, the inside—they'd put a cone inside and the fish would swim into the hole there and then come back—they couldn't hit that hole again. They'd hit the back, underneath the cone there. … Well, long time ago, they used to make it out of spruce—but my father-in-law knows how to do it, but I never made it out of spruce. I used chicken wire or fencing wire. Once we put the poles in, and then they'd leave a slot in the middle. They'd put the poles in all the way across and kind of tie them together—the poles would just hold wire, either that, or they'd just use willows. And there they'd put two posts to hold the basket. Then right behind there, they put two crosspieces and the current would just hold that thing there. And when we pull that thing out—we just chisel around there, and then chisel the hole

> out, and then pull that trap straight up. Check it every day. [Facing downriver.] They would get lot of loche [burbot]—loche is good eating, you know, that liver. You eat that liver, man, that's really good! They would get a mixture of everything in there, but some places are good for shee, some places are good for loche, some places are good for whitefish. You know, it all depends on what they wanted. [020408K]

Some elders stayed at winter camps through the season. One elder, originally from Nulato, used the farthest upriver winter camp site, near Halfway, used by Kaltag residents documented during this research. This elder's family moved to their winter camp just before freeze-up in order to trap. They kept one net under the ice during winter, which was checked on a daily basis:

> ... [A]t the beginning of the year, they used to get lots—forty, maybe fifty a day. From when they first set it [in November], it go like that 'til before Christmas—and then it slacks off, and it never pick up again like that. Eight, seven, maybe, every other day. We just let it freeze and if we want to eat fresh fish, we just thaw it out, and cook it or freeze it, and stack it like cordwood. [010408K].

Contemporary Kaltag fishers concentrated their nonsalmon fishing efforts in a much smaller area more closely tied to the community itself, although periodic fishing farther out occurred, especially at 22 Mile and on Kaiyuh Slough (Figure 34).

Upstream of Kaltag, at Three Mile, fishers setnetted during spring and fall in an established eddy. During a field trip made by the principal investigator in early June 2006, fishers were using this spot to harvest summer chum salmon, whitefishes, and the occasional sheefish. During late fall, just before freeze-up, fishers used this spot to set nets targeting whitefishes: "We have net below Three Mile—we used to have net around that eddy around there. We used to get stragglers, dog [chum] salmon, whitefish, a few shee—not too many, though, in the falltime. Once in a while, you get a pike. Falltime. Before the ice froze." [010408K] According to another fisher, "When the ice start, just before the ice start running, people start putting in nets and then their nets just swamp with whitefish, big whitefish. ... Up at Three Mile, above Kaltag." [020408K]

One mile downstream of Kaltag was *Ukk'et,* the Koyukon word for eddy, which was a good place to setnet for whitefishes during fall. Similarly, 3 mi downstream of Kaltag at *Rodokaket*, or Old Village, respondents said sheefish could be harvested during spring and Arctic grayling and Dolly Varden during fall and winter.

> I go down Old Village in the open water right after the ice goes out—right at the mouth there. We do that for our memorial potlatch, you know, for Memorial Day weekend. A lot of people like giving out dish for the potlatch, so we go out and get sheefish and beaver meat and smoke them—ducks, same way, too. [020408K]

22 Mile remained a significant summer fishing spot for northern pike, sheefish, and, especially in fall, whitefishes. In summer, fishers setnetted or used hook and line to harvest northern pike and sheefish that were migrating through the mouth and at the inlet to Oxbow Lake, not far up the Kaiyuh. Sheefish and northern pike could also be found much farther up Kaiyuh Slough, into the flats, where the clear water of the flats drained into Kaiyuh Slough downstream of American Creek.

Whitefish species were also harvested in fish wheels at summer fish camps. Harvestable quantities of the smaller whitefish species showed up in the fish wheel in August while the larger whitefish species could be harvested in the fish wheels if the wheels continued to fish in October, before freeze-up, as they periodically were. One fisher who had done this recalled that the whitefishes harvested in October were large fish, around 2 ft, and so were likely broad whitefish.

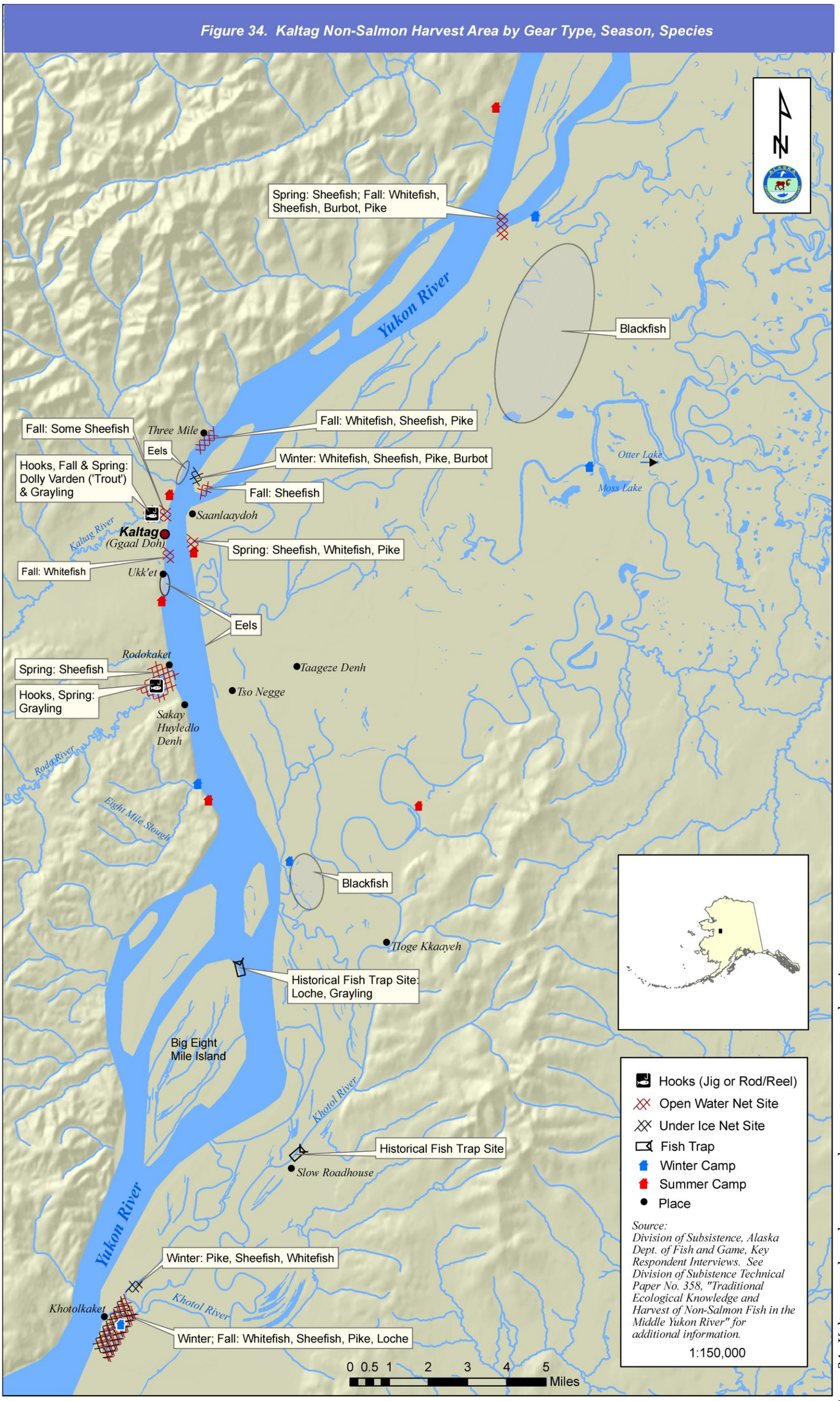

Figure 34.–Kaltag nonsalmon harvest area by gear type, season, and species.

During winter months, 3 or 4 fishers setnet under the ice in the same area across from the village, described above (Figure 35). According to several respondents, fishers, especially women, used to setnet throughout winter, even in the coldest months of January and February. According to one fisher, some individuals "would set right in that channel over there, right in the entrance to that channel, because the upper end of that channel is shallow, and in the wintertime it's dead water, so it's a good place—whitefish go up in there." [040408K] In contemporary times, most nets were set in early spring, from late February through April or early May, while the ice was still good.

Nets used to setnet under the ice were of different sizes. During a March 2008 research trip to Kaltag, the principal investigator accompanied a fisher during a trip to check his net at that site. The net yielded whitefishes, sheefish, and northern pike. The net itself was about 3 ½ in mesh, 60 ft long, and 12 ft deep. One active elder fisher remembered one of the constraints of setting a net in that area:

> I usually put mine right at the point, right there. I still put it there—even last winter I had one there. … One time, I put in net parallel with the sandbar. I brought my Uncle Franklin [Franklin Madros, traditional chief of Interior Alaska, deceased]. The bar was right here, and I had the net about eight feet off of the bar. He tell me, 'How come you put your net like that?' I tell him, 'Well, fish got no trail,' I tell him. He just look at me—then I told him, after that, the reason I put it like that is the water was too deep straight out away from the island. I put it where the shallow water is. We get whitefish, sheefish, pike, and burbot. Not very much, but once in a while, we have a good treat. [010408K]

Figure 35.–Kaltag resident Bobby Nicholas checking his net on the Yukon River, 2008. Kaltag in the background.

Setnets were not the only gear used by Kaltag fishers: "A lot of people put loche [burbot] hooks in [used a setline]—they call them—right in front of the village. Right below this little creek here [Kaltag Creek]. And some right in front of the village. … My brothers put some out [during late fall]. All the ice is

freezing instead of running on the river." [010408K] One younger fisher remembered that moose bone hooks were used to catch Arctic grayling and Dolly Varden in Kaltag Creek: "I don't know what he did on the end—but he had some kind of nail on the end, and make like a prong on there, and he'd make like a hook on the back side of it so the fish didn't come off of it." [020408K]

Arctic lamprey were not targeted by contemporary Kaltag fishers because many believed that the run was too dispersed by the time it reached their area. They rarely saw them, though they had been able to harvest them on one or two occasions. One elder remembered that his grandparents used to fish for Arctic lamprey, or "eels," as they were referred to locally, but that contemporary residents usually did not:

> They used to fish down here across from Four Mile with dip nets. Somewhere in here, over the bar, where there's not too deep water. That time we caught most of ours probably about a mile and a half below the village, on this side [west side of the river]. And then they caught a whole bunch around the cemetery [just above the village]. … Good fish. They just passed them all around, they didn't save them very long. They say they don't keep very long—they turn yellow after a while, even after they're frozen. Most of the ones we got we just pass them around—send some to Koyukuk or Nulato to a bunch of relatives. [010408K]

Another fisher recalled stories that Arctic lamprey were historically harvested by the sled load for use as dog food. This fisher also said that elders would watch for Arctic lamprey when the first ice overflow came because the lamprey were usually migrating through the area at that time.

Some Kaltag residents traveled, with relatives and friends from Nulato or on their own, to American Creek in the Kaiyuh Flats in order to jig through the ice for northern pike in April.

Harvest and Use of Nonsalmon Fish

Prior to the availability of commercial nets or even the availability of nylon twine, people from the Kaiyuh area made their own nets from fabric threads recycled from old gunnysacks, and before that, from willow.

> Oh yeah, when we were growing up we have to make net! A long time ago, they used to get sugar and flour in something like this, a burlap sack—and then we gotta rip, one at a time, and twist it, and make the net. They did that all the time, and then they braid that gunnysack—they braid for the sinker and the top line—and they get rocks down at the beach, all kinds of rocks. They make their own floaters—that cottonwood bark. Oh, they did a lot of good things long time ago, they knew how to survive. Before this one, they used willows, make fish net. Willow bark, they strip it, strip it—they make net out of that. When I was growing up this is what they did, but before my time, they used willow bark. Then nylon thread came around. Order it and make net. [050408K]

While commercial nets have standardized mesh sizes to target particular species or groups of species, nets handmade by Kaltag residents also achieved that result because the maker looped the net material around flat wooden boards, or net gauges, which created standardized mesh sizes. The boards were often made from the wooden shipping boxes that 5 gallon containers of gasoline were shipped in. One younger fisher (approximately 45 years of age), who kept his mother's boards, noted that she used different colors of twine depending on the water in which the net would be set:

> She had different colors [of twine] for different types of water. Like in the creek—then some time of the year, they had to use the greener one, and sometimes you'd use the lighter one. This is the bottom one [lead line] and this is the top one [floater line] and this is for the darker water, like on the Yukon. [020408K]

While in contemporary times men usually checked the net (sometimes this was shared), one elder recalled that women predominantly used to set and check nonsalmon nets, during both summer and winter:

> Mens go with us but we're the ones who look at the net. It was always like that—and mens keep the boat straight while we're setting it in. We tie it to the tree back on the beach or bank, you know—we tie the rope and somebody's keeping that boat straight while we're putting it in. After that, we put in sinker with it so it's nice and straight. We always do that, only wintertime we don't use that anchor 'cause it's tight between the poles, both sides. Wintertime we don't anchor. Only summertime we use anchor. [050408K]

There were several ways that Kaltag residents used and preserved the various nonsalmon species (Figure 36). As mentioned earlier, whitefishes were targeted during their fall migration out of sloughs and lakes and as they were migrating downriver. Fall whitefish harvests were valuable in many ways, according to one active fisher. Residents liked the meat, and, as the fish approached their spawning phase, their eggs increased in size and were favored delicacies.

> But the eggs are very good at that time of the year and that's when they make caviar. Oh, my gosh! You take it out of the skein, and make sure it's clean, and then they dice up onion and put in white vinegar and let it set a couple of days. But anyway, you take it out and just put it on a saltine cracker. [040408K]

Another use and form of preservation of nonsalmon species mentioned by several people was *k'etseedle'*, or "fermented fish." Nonsalmon fish that were harvested when the temperatures were just above the freezing range were placed in plastic totes or cardboard boxes in smokehouses, where the temperature was cool. The meat would then go through an aging process without rotting. "Leave them whole—and then when you use them—of course they're frozen in the wintertime—you pull them out and thaw them a little bit so they're about half thawed, and then you take a knife and just slice it." [040408K] *K'etseedle'*was usually eaten frozen, but was sometimes eaten with seal oil or baked. Frozen, but not aged, Arctic grayling were also sliced and eaten.

Figure 36.–Dorothy Sommer of Nulato prepares a sheefish for a Kaltag potlatch in Kaltag, 2008.

Kaltag residents did eat whitefishes, but they also fed them to their working dogs, just as fishers in other Middle Yukon villages did. Kaltag residents also valued whitefishes for their high moisture value and

ability to keep dogs hydrated while in harness. "That's why we put the fish net in—we'd give them that—cut off slice of whitefish and snack them with that, frozen, while we were running long trips. And it gives them moisture in their bodies. Lot of moisture in there." [020408K]

During spring, when sheefish are abundant, families had to cut and dry it in order to preserve it: "... [T]here's nothing we can do about it, no freezer, we have to cut it. Keep it for dried fish for the winter. About two or three nights, two days maybe, with just enough smoke on it—sheefish and pike." [050408K] Dried, smoked sheefish and northern pike strips were stored on long poles stretching the length of their caches so as to avoid mold. Cutting, smoking, and drying of sheefish and northern pike continued in contemporary times:

> When I put my net in, I just get enough to eat, you know. But then in the spring, after April, my wife starts saving them. She starts cutting them for half dry, and then she smoke 'em and eat 'em. And while my net is in, if I get too much, I just pass them around. Pike, she cut them for sun dry. [010408K]

Freezers allowed families to save sheefish and northern pike for later baking, or for other uses, such as making fish "ice cream," a favored delicacy usually reserved for special occasions such as family celebrations and Stickdance, a memorial potlatch ceremony, usually hosted by several families, honoring loved ones who have passed away (Figure 37; Figure 38). The ceremony hastens the reincarnation of the decedent's soul and also provides the family with a way to repay those individuals who helped with the funeral arrangements or to honor those who were particularly close to the decedent (Madros 1975). Stickdance lasts 5 days and is structured around a series of community potlatches and dancing. There is usually one night when representatives of the deceased selected by their families are "dressed," and a distribution of gifts on the last night. Every night of the Stickdance is marked by a feast, and families are expected to feed the representatives 3 meals a day for the entire week. This level of feasting throughout the week requires a great deal of traditional foods, including nonsalmon fish which are primarily in baked dishes, served in dried form, and made into fish ice cream. During one field trip to Kaltag, the principal investigator observed that during the Stickdance, at least 2 fishers were setting nets under the ice across from the community, checking them every other day, and distributing the fish around the village to individuals who would cook them for the nightly feasts.

Figure 37.–Kaltag resident with fish ice cream for Stickdance 2008.

Figure 38.–Fish ice cream in paper cups, ready for Stickdance 2008.

More recently, northern pike have been used as an alternative for sun-dried chum salmon, which was a favorite in Kaltag. Many fish wheels used to operate in Kaltag to harvest salmon for subsistence purposes and also for commercial sale of their roe. When the commercial fishery declined severely, fewer fish wheels stayed in operation.

> It was not that we couldn't have built the wheels and done it, but it would've been a lot of extra effort to just catch the fish for sun dried [male chum salmon with white flesh], and so when we didn't have those, sometimes we'd be catching some pike. … We'd be out fishing for pike and catch a bunch—nice size ones—we'd bring them home here, and skin them out, flesh them out, and make sun dried out of them, and that's what we'd use as an alternate source for sun dried. That was pike. [040408K]

Finally, burbot were considered prime eating during fall, when the liver was large. Many fishers targeted them in front of the village at that time. Burbot were usually eaten fresh, baked, or made into soup. One elder recalled an interesting way the old timers showed respect for the burbot: by braiding the small intestines before cooking. While he could not recall the reason for the practice, he remembered that it was a sign of respect for the fish [010408K].

Ecology of Nonsalmon Fish Species in Kaltag

Kaltag fishers' harvest practices and observations provided essential clues for understanding important dimensions of the life histories of nonsalmon species harvested in the Kaltag area, not only at the species level, but also at the general fish ecology level. Additionally, placenames, especially those that specified spring, fall, and winter camps such as *Rodokaket* and *Khotolkaket*, marked residents' important seasonal locations for harvesting fish during seasonal migrations.

Kaltag residents provided several observations about sheefish, signifying the importance of this resource to residents. In early spring, residents said, higher numbers of sheefish began to be harvested in setnets under the ice near the community. While sheefish were sometimes harvested before early spring, they were generally considered to be in poor shape, perhaps because of diet.

> We used to get some of those stragglers before, but they were skinny and the meat was not firm, like in March. … No, in the middle, like in January, February, their meat is not

> firm like in March, April and May. The meat is really firm then. Towards ice breakup, then they're really fat. Then the meat turns firm, the flavors change—their diet I guess. [010408K]

Kaltag fishers also noticed that in late spring schools of large sheefish often arrived just prior to the Chinook salmon run, an observation also made by their downriver neighbors in the GASH area (C. Brown et al. 2005). One Kaltag resident said:

> So when you're catching them, it was always—you didn't have to look at a calendar or anything else, people just know that the kings [Chinook salmon] are right behind them. Not only is it the front of the run, they're also at the rear of the run. They don't have the numbers at the rear of the run—but the shees are also a telling sign that the [king salmon] run is over. [010408K]

According to most residents, sheefish migrated up the Yukon River during spring, heading for the sloughs and creeks off the Yukon to begin summer feeding.

> In the springtime [sheefish] go up the creeks, you see—they go after the grayling or the little frys [juvenile fish] that are there. You can catch them with hooks—you can catch thirty or forty if you want. They run with the king [Chinook salmon] too, on the side [south] of the river—before the king usually, but I hear more mixed in now. [010408K]

As mentioned above, residents said that sheefish were also harvested in larger numbers during late summer, after the salmon runs, when they were likely heading up the Yukon to spawning grounds on the Alatna River or in the Yukon Flats, 2 known sheefish spawning grounds (Alt 1970; R. Brown 2000).

In contrast, residents said, northern pike appeared to be resident in the area, an observation they based on winter long harvests in setnets under the ice and their hook and line harvests at stream mouths.

> And at the entrance at the Oxbow Lake [up the Kaiyuh Slough from 22 Mile], those pike sit right there, right at the mouth. They just sit there and wait. It's a natural spot for those fish to just lay in wait because there's whitefish and sheefish that go up in here, and there's lot of smaller ones, and the big pike will wait right here as they're entering or coming out of there, and they just pick them off. … Just use hook and line. This time of the year [summer], yeah, there's sheefish in there, too. At times you cast, and every cast you're catching thirty-six inch pike, forty inch pike, forty-two inch pike. As big as forty-eight inches—we caught several of those. You can go in the upper Kaiyuh, too. Not in the main slough so much, but there's these little side sloughs that are clearer—when it's stagnant—so those are the places. [040408K]

Thus while sheefish showed up heavily in setnets under the ice during spring, in late fall or early winter (November), the nets harvested mostly northern pike, burbot, and whitefishes. "Mostly in the spring we get sheefish—but most of the winter, like right when you first set it, we get a lot of whitefish and burbot. Lot of pike—and then springtime, like after February, we start to get sheefish." [010408K]

Two fishers observed daily changes in the presence of sheefish and northern pike, in addition to seasonal changes in the same locations. According to these fishers, who often spent time in the Kaiyuh Flats, northern pike, sheefish, and even whitefishes seemed to be present on a cyclical basis within a short period of time in particular spots, perhaps due to feeding habits.

> There's one place where it's kind of clear water coming out of the flats, and it enters into Kaiyuh Slough, and it's pretty clear right there. Man, you can really nail those sheefish. … Below American Creek, down where it empties into the main slough there. ... Whitefish, sheefish: they come in sequence. The pike, sheefish, they have kind of like a cycle. You'd be catching sheefish steady, and then, all of the sudden, you'll switch to pike. Just flips right over, and you'll catch nothing but pike. You could be doing it in an

> hour. And then they'll switch back. I think it's feeding habits. Either that, or they move out. [040408K]

Concerns of Kaltag Residents

The primary concern expressed by Kaltag residents was their perception of extensive drying of the Kaiyuh Flats area, similar to the concern expressed by Nulato residents. One Kaltag fisher described a Kaiyuh Slough lake, in the Kaiyuh Flats across from Kaltag, that once was a grass lake when he first arrived in Kaltag in the 1970s.

> See this lake here—when I first came to Kaltag—and there's a trail that goes right across this, and you end up on this slough here—but this lake here, when I first came, you could come out into this lake and it was grass lake all the way to about this line of vegetation—you could see all the way straight across, 'cause it was just grass. ... Seemed like a blink of the eye, but I know it had to be a period of time—you can't see now, there's willow growing in there twenty-five feet tall, you can't drive through it. And spruce trees that are coming up now. It's dried out long enough that these species are starting to grow in there, where before it was always wet enough that it was just grass. [040408K]

While many elders from both Kaltag and Nulato remembered that the water levels in Kaiyuh Flats creeks and sloughs fluctuated seasonally, thus limiting the types of gear that could be used for fishing in certain places, they also said that the more recent widespread drying of lakes had limited access to particular areas for subsistence activities, including fishing and moose hunting.

Several fishers also said that they had observed an increase in both the size and abundance of northern pike in the area. Most felt that this was the result of less year-round harvest pressure since seasonal residence in the Kaiyuh Flats had lessened, as well as the harvest of larger northern pike in traps: "There used to be—and they're way bigger. … A lot of people used to live in Kaiyuh, you know—trap in the wintertime—and they used to fish a lot of pike for dogs. Here, we used to have a fish trap in Kaiyuh Slough and we used to get mostly pike." [010408K]

Harvest Survey Results

Residents of Kaltag harvested at least 6 genera of nonsalmon fish during 2006, including Dolly Varden, burbot, Arctic grayling, northern pike, sheefish, and whitefishes, although the whitefishes were not identified by species (Table 12). Whitefish species comprised the majority of the annual harvest in 2006. Thirty seven percent (37%) of households harvested whitefishes while 58% of households reported using whitefishes. Approximately 19% of the households using whitefishes gave some portion of their harvest to households in the community or to households in another community. Sheefish and northern pike also contributed significantly to the annual harvest. An estimated total of 206 sheefish (1,238 lb) and 255 northern pike (1,146 lb) were harvested by Kaltag households. Both species were shared between households. For example, 15% of Kaltag households reported giving sheefish away while 37% of the community's households reported receiving sheefish, and thus 63% of households reported using sheefish. While the total pounds of northern pike harvested by Kaltag residents were similar to the total pounds of whitefish species and sheefish harvested, far fewer households reported harvesting (25%) or using (33%) northern pike, suggesting that the community harvest of northern pike occurred in a limited number of households (Figure 39).

Figure 39.–Bobby Nicholas pulls a northern pike out of his winter net near Kaltag, 2008.

While whitefish species, sheefish, and northern pike comprised the largest components of the subsistence harvests of nonsalmon fish, Kaltag residents reported harvesting significant numbers of Arctic grayling, which figured prominently in the community's harvest and use patterns. An estimated 764 Arctic grayling (535 lb) were harvested by Kaltag residents. An estimated 49% of households reported harvesting Arctic grayling, while 19% of these households also shared Arctic grayling with other households, and 61% of households reported using Arctic grayling. Overall, Kaltag fishers harvested an estimated 4,780 lb of nonsalmon species (approximately 23 lb per person), and, of that amount, 26% were sheefish, 24% were northern pike, and 36% were whitefishes.

In 2006, Kaltag residents reported harvesting nonsalmon fish species in all months except February and March (Table 13); however, a certain amount of annual variation was expected in these harvests. For example, while respondents did not report harvesting fish in March 2006, in March 2008, the principal investigator accompanied 2 Kaltag fishers to check setnets under the ice in preparation for the community Stickdance. This net yielded approximately 15 fish over a 3 day span (broad whitefish, northern pike, and sheefish), all of which were distributed among community members who cooked them for the nightly potlatches. At least one other fisher from the community had also setnetted in the same area in March 2008.

Sheefish harvests occurred in more months (9) than any other species, while northern pike and whitefish species were harvested in 7 of the 12 months (Figure 40). Most of these harvests occurred in the late spring, summer, and fall months, with a significant spike in September in the number of northern pike and whitefishes harvested, which was consistent with information provided during key respondent interviews about seasonal harvest patterns and seasonal migratory patterns of the fish. Smaller numbers of northern pike, sheefish and whitefish species were harvested in October, November and December, and these

species were most likely harvested with set gillnets under the ice. Northern pike harvests did increase slightly during their fall and spring migrations to and from summer feeding and spawning habitats, as reported by TEK respondents. While whitefishes and northern pike were targeted during the spring, fall, and sometimes winter months, they were also harvested in salmon nets during the summer. Sheefish harvests appeared to be concentrated in the summer months, coincident to the salmon runs in this area. Arctic grayling were harvested only during the summer and fall months, with greater numbers harvested during the fall migration from their summer habitats in tributary headwaters. A significant increase in Arctic grayling harvests (54% of the annual harvest) occurred in September, suggesting that Kaltag residents were taking advantage of this pattern. Similarly, burbot were harvested only during the fall and early winter months of September through December, which is when they were considered to be in prime eating condition.

Figure 40.–Leftover potlatch food and a sheefish to be prepared for the next night's potlatch, 2008.

Table 12.–Estimated harvest and use of nonsalmon fish, Kaltag, 2006.

	Percentage of households					Pounds harvested			Amount harvested		95% confidence limit (±)
Resource name	Use	Att	Harv	Rec'd	Give	Total	Mean HH	Per capita	Total	Mean HH	harvest
Alaska blackfish[a]	0%	0%	0%	0%	0%	0.0	0.00	0.00	0.0	0.00	–
Burbot	24%	19%	18%	6%	10%	123.8	1.70	0.60	51.6	0.70	12%
Dolly Varden[b]	1%	1%	1%	0%	0%	2.7	0.04	0.01	1.1	0.01	–
Arctic grayling	61%	51%	49%	19%	19%	534.8	7.40	2.50	764.1	10.6	6%
Northern pike	33%	27%	25%	15%	19%	1,146.1	15.90	5.40	254.7	3.50	11%
Longnose sucker	0%	0%	0%	0%	0%	0.0	0.00	0.00	0.0	0.00	–
Sheefish[c]	63%	45%	43%	37%	15%	1,238.0	17.20	5.90	206.3	2.90	7%
Whitefishes											
Broad whitefish	0%	0%	0%	0%	0%	0.0	0.00	0.00	0.0	0.00	–
Ciscoes											
Bering ciscoes	0%	0%	0%	0%	0%	0.0	0.00	0.00	0.0	0.00	–
Least ciscoes	0%	0%	0%	0%	0%	0.0	0.00	0.00	0.0	0.00	–
Subtotal, ciscoes	0%	0%	0%	0%	0%	0.0	0.00	0.00	0.0	0.00	–
Humpback whitefish	0%	0%	0%	0%	0%	0.0	0.00	0.00	0.0	0.00	–
Unknown whitefishes	58%	37%	37%	30%	19%	1,734.4	24.10	8.20	578.1	8.00	–
Subtotal, whitefishes	58%	37%	37%	30%	19%	1,734.4	24.10	8.20	578.1	8.00	9%
TOTAL, nonsalmon fish	91%	69%	66%	52%	40%	4,779.8	66.40	22.70			7%

Source ADF&G Division of Subsistence household surveys, 2007.

Note For conversion factors, see Appendix C.

a. Harvest was reported and estimated in pounds, not in numbers of fish.

b. No attempt was made on the harvest survey to differentiate between the Dolly Varden *S. malma* and the closely related Arctic char *S. alpinus* and the two species are usually managed as one.

c. Although sheefish are a whitefish species, they are often managed differently than other whitefish species, and so the data are presented separately.

Table 13.–Estimated nonsalmon fish harvest by month, Kaltag, 2006.

Resource	Units	January Amount	January Percentage of 2006 harvest	April Amount	April Percentage of 2006 harvest	May Amount	May Percentage of 2006 harvest	June Amount	June Percentage of 2006 harvest	July Amount	July Percentage of 2006 harvest	August Amount	August Percentage of 2006 harvest
Burbot	ea.	5.4	10.4%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Dolly Varden	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	1.1	100.0%
Arctic grayling	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	60.2	7.9%	26.9	3.5%	95.6	12.5%
Northern pike	ea.	0.0	0.0%	33.3	13.1%	0.0	0.0%	14.0	5.5%	19.3	7.6%	36.5	14.3%
Sheefish	ea.	10.7	5.2%	0.0	0.0%	5.4	2.6%	25.8	12.5%	45.1	21.9%	45.1	21.9%
Unknown whitefishes	ea.	31.2	5.4%	0.0	0.0%	0.0	0.0%	16.1	2.8%	36.5	6.3%	133.3	23.0%

Resource	Units	September Amount	September Percentage of 2006 harvest	October Amount	October Percentage of 2006 harvest	November Amount	November Percentage of 2006 harvest	December Amount	December Percentage of 2006 harvest	Totals Amount	Totals Percentage of 2006 harvest
Burbot	ea.	6.4	12.5%	16.1	31.3%	19.3	37.5%	4.3	8.3%	51.6	100.0%
Dolly Varden	ea.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	1.1	100.0%
Arctic grayling	ea.	412.7	54.0%	168.7	22.1%	0.0	0.0%	0.0	0.0%	764.1	100.0%
Northern pike	ea.	107.5	42.2%	33.3	13.1%	10.7	4.2%	0.0	0.0%	254.7	100.0%
Sheefish	ea.	25.8	12.5%	2.1	1.0%	26.9	13.0%	19.3	9.4%	206.3	100.0%
Unknown whitefishes	ea.	162.3	28.1%	0.0	0.0%	86.0	14.9%	112.8	19.5%	578.1	100.0%

Source ADF&G Division of Subsistence household surveys, 2007.

Note In Kaltag in 2006, no harvest of nonsalmon finfish was reported for February or March. No harvest of Pacific herring, Pacific halibut, Alaska blackfish, longnose sucker, broad whitefish, Bering cisco, least cisco, or humpback whitefish was reported in 2006.

DISCUSSION AND CONCLUSIONS

This project extended the documentation of contemporary subsistence harvests and uses of nonsalmon and the traditional ecological knowledge about nonsalmon fish in the Yukon River drainage through the addition of the Middle Yukon communities of Tanana, Ruby, Galena, Nulato, and Kaltag. Earlier reports provided this information for the lower Middle Yukon River communities of Grayling, Anvik, Shageluk, and Holy Cross (C. Brown et al. 2005) and the Koyukuk River communities of Alatna, Allakaket, Bettles/Evansville, Hughes, Huslia, and Koyukuk (Andersen et al. 2004). Together, these projects provide a greater understanding of the historical and contemporary harvest and use of nonsalmon fish species across the Yukon River drainage.

As with the other projects, ethnographic research documenting the traditional ecological knowledge of nonsalmon fish in the Middle Yukon area confirmed a rich and historical body of knowledge regarding the life histories, harvest, and use of nonsalmon fish species by Middle Yukon residents. Prior research also documented continuing high levels of subsistence uses of these fish species throughout the year. The data set of interviews and the harvest survey results for this project were analyzed to identify general themes that emerged, such as patterned regularities (i.e., occurrences that happen in patterned ways, such as connections between harvest practices and observations of fish life history or sharing that follows particular patterns), comparisons of perspectives, the impact of key events, and residents' ecological observations, in order to draw connections between key respondents' information and experiences (e.g., Miraglia 1998). Below, methodological issues that arose during the key respondent selection process are addressed, followed by a basic taxonomic analysis of the word choices residents used to describe species, comparisons of contemporary and historical information (including special attention to the importance of place and placenames), regional differences between these data and other areas in the Yukon River drainage, and specific implications for fisheries management.

In research projects where significant components of the data set are derived from ethnographic interviews, the processes for selecting key respondents and sample sizes are paramount. The sampling goal for the interview portion of project was 4–5 interviews per community for a total of 20–25 interviews. Researchers achieved a larger sample than this proposed figure: community totals for interviews ranged from 6–9 (see Table 2) and included a wide range of respondents, thus increasing the quantity and quality of data. Researchers focused selection efforts on age and experience, keeping in mind that knowledge within a community is not homogenous or static; rather, it varies depending on factors such as age, gender, social class, and experience (e.g., Guyer 1991; Robinson et al.[8])

Gender can also be an important factor in selecting key respondents for a subsistence research project. As Robinson and Morrow (*In press*) argue, paying attention to the types of knowledge embedded in women's practices can provide new and different perspectives on subjects and to the practice of science itself. Though women also fish, they are often mainly responsible for the processing of the harvest, and because of this, have valuable information on various aspects of nonsalmon fish species and fishing, including knowledge about the health and condition of the fish, traditional and contemporary processing techniques, and harvest patterns that are important both within the scientific community and in terms of fisheries management. Researchers therefore sought out a varied intersection of respondents, not just the most experienced fishers in each community, in order to document a wider range of fishing practices and knowledge.

Many of the elder women interviewed for this study recalled that setting and checking setnets for nonsalmon species such as northern pike, whitefishes, and sheefish, was usually done by the women when they were younger. They further recalled that men would sometimes accompany them in order to

[8] Robinson M., P. Morrow, and D. Northway. *In press*. Gender, knowledge, and environmental change regarding humpback whitefish in Interior Alaska. Accepted for publication by Kafarowski, J., ed., Gender and Fisheries in the North, University of British Columbia Press. Hereinafter cited as Robinson et al. *In press*.

help with the boat, or sometimes several women would go and do all the work. As a result, the elder women interviewed for this project provided significant information about certain historical harvest areas, whereas the elder men did not volunteer such information, although both were asked the same questions (Appendix B). Additionally, since this task of setting and picking the net, especially under-the-ice nets, is now done primarily by men, talking to both men and elder women is critical to understanding shifts in these harvest practices over time.

Today, men and women in the Middle Yukon share many of the fishing responsibilities. In all project communities, both men and women checked nets and handled fish. As a result, both men and women contributed information for this project about the general condition and health of the nonsalmon fish they harvested. While contemporary harvesting practices are more gender neutral, processing practices still tend to be largely the provenance of women. Fish were cut for various purposes, including human food and dog food. Of those cut for human food, the interviews suggested that this was a task primarily accomplished by women and more women respondents than men provided detailed information about fish physiology, such as the stages of egg development. Detailed research on and understandings of the migratory patterns of many whitefish species in the Yukon drainage is emergent. Using traditional ecological knowledge may provide critical information to contribute to this growing body of knowledge, although local species identification sometimes provides challenges to this task. Detailed knowledge of egg color and size at different times of the year may assist with species identification and contribute to the growing body of knowledge about the timing and location of whitefish spawning events, as well as general knowledge of their life histories.

BASIC TAXONOMIC ANALYSIS

The language used to describe fish, fishing activities, and harvest locations offers important insights into understanding Koyukon Athabascan culture and worldview, signifying locally important ecosystemic connections between human, animals, the environment, and place. Language is an important index of how groups treat specialized knowledge, an index that is often manifest through specialized vocabularies, including placenames. While a focused study on Koyukon language structure and use is beyond the scope of this project, the following analysis builds on an introduction to Native taxonomies of fish-related terms first described by Andersen et al. (2004).

The majority of the individuals interviewed in this study identified themselves as Koyukon Athabascan; to varying degrees, Koyukon Athabascan was spoken by approximately one-half of the respondents, though all of the interviews were conducted in English. There are 3 major Koyukon dialects currently used in the Middle Yukon area described in this study: Upper Koyukon, Central Koyukon, and Lower Koyukon. Tanana speakers generally use a mixture of Upper and Central Koyukon, Central Koyukon is generally spoken in Ruby and Galena, and Kaltag and Nulato speakers generally use the Lower Koyukon dialect (Sumida 1988; Krauss and Stadnicky 1985). Thus, these dialects may account for some of the spelling and pronunciation differences described below.

Attempts were made to document Koyukon Athabascan words for various fish species during the interviews in order to provide greater detail to the work in Andersen et al. (2004:32–35), where Koyukon Athabascan is also the primary Native language. Andersen et al. provide an excellent introduction to local Koyukon taxonomies of nonsalmon fish species and points out important differences between local classifications and western scientific taxonomies. For example, they note that in some cases, Athabascan provides a different taxonomy for fish than the Linnaean taxonomic systems. In Koyukon Athabascan, at least 5 terms are used to describe Alaska blackfish in various life stages and morphologies, distinctions not made in the Linnaean classification. However, in other cases, Athabascan speakers appear to combine into one term some species that Linnaean classification distinguishes: Bering ciscoes and least ciscoes, both *tsaabaaye* or *delbege* in Koyukon Athabascan. While the Linnaean classificatory system focuses on specific aspects of physical structure or morphology to distinguish species, Koyukon linguistic taxonomies make distinctions based on seasonality of harvest, other morphological distinctions such as

size or age, and even habitat—indices that bear a relationship to important cultural practices of harvest and use. At the same time, Koyukon speakers might not recognize other distinctions, such as those between Bering and least ciscoes, since both species are generally found in the same places, harvested the same way at the same time of year and used in similar ways. The morphological distinctions reflected in their Linnaean classifications are less important to Koyukon speakers. The important point is that taxonomic systems can provide different understandings what is being classified. Recognizing the differences between classificatory systems can illuminate important aspects of culture and worldview.

Andersen et al. (2004:34) document the general Koyukon word for whitefish as *ts'ol* and also document terms used to describe species as defined by Linnaean taxonomy: *taaseze* meaning broad whitefish and *tsaabaaye* meaning Bering ciscoes. These glosses are Koyukuk River usage, and do not appear to hold as strongly downriver in Nulato or Kaltag. Elders in these villages, as Lower Koyukon speakers, refer to whitefishes as *tloge*, which, according to several elders, was also the general term for "fish." This appears to follow conventions more similar to the gloss used by Deg'Xinag and Holikachuk residents downriver in the GASH area, where the general terms for whitefishes were *loogg*, (Holikachuk) and *legg* (Deg Xinag), which also served as general terms for "fish" (C. Brown et al. 2005:26). The linguistic relationships between these 3 terms—*ts'ol*, *tloge*, and *loogg*—and the cultural meaning of having a word for whitefishes that is also the general term for fish relationship between having could be a topic for further investigation.

Several additional species-specific terms, primarily given by elders in Kaltag and Nulato, were documented. Most Koyukon Athabascan speakers referred to northern pike as *k'oolroche (spelling unclear)* or *k'oolghos* rather than the Koyukuk River *k'oolkkoye* documented by Andersen et al. (2004:34). However, none of the interviews for this project elicited morphological or seasonal distinctions in the names for northern pike, as they did on the Koyukuk River. It is unclear if this is because Nulato and Kaltag speakers do not make these distinctions, or just that they were not a focus of the interviews. Also, while the Middle Koyukon speakers interviewed for this project said *tsaabaaye* or *delbege* when referring to the smaller cisco species, lower Koyukon speakers called them either *naadlekk'oon* or a variation of the Koyukuk River word *delmege*, which was similar to their downriver neighbors' term *dilmig*. Interestingly, Middle Koyukon Athabascan speakers described *naadlekk'oon* as small, flat, watery-fleshed whitefish with orange colored eggs harvested with a net along the beach in the Nulato River during fall. Their description of *naadlekk'oon* appeared to the principal investigator to be similar to the description of a least cisco. *Delmege*, however, they said, were harvested in fish wheels in the mainstem Yukon River in late July and August, consistent with emerging information about Bering cisco migrations through the area. Whether *naadlekk'oon* and *delmege* referred to separate whitefish species as classified under the Linnaean system or merely reflected dialectical differences requires an in depth linguistic analysis beyond the scope of this study. Finally, speakers from Nulato and Kaltag referenced Arctic grayling as *hok'elmaay* (lower Koyukon dialect) and *tleghelmaay (lower Koyukon dialect)*.

TEK and the Importance of Place

Unlike previous traditional ecological knowledge projects on nonsalmon fish species, where much of the data was organized primarily by fish species and their respective roles in the lives of local people (e.g., Andersen et al. 2004; C. Brown et al. 2005), much of the data collected in this research was organized and analyzed by community and use areas. One of the primary reasons for this organization was the nature of the information collected. First, while there were many similarities in the harvest and use of nonsalmon fish between these Middle Yukon communities, there were also significant differences in use patterns depending on community characteristics such as the number of dogs, location histories, and variable adherence to a modified seasonal round. Also, most respondents provided information that suggested a detailed knowledge of fish species informed by their relationship to space. For example, most key respondents presented their knowledge of fish life history through a discussion of harvest areas or seasonality of harvest. Successful nonsalmon subsistence fishing often requires this intimate knowledge of fish migrations, a knowledge that respondents intimated proved the difference between starvation or

full caches and dog pots. Thus, much of the information collected during this project was described through an idiom of space.

As discussed earlier, the documentation of placenames can also demonstrate the connections humans hold to land and resources and provide an important dimension to understanding fishing in the Middle Yukon, especially in the communities of Kaltag and Nulato. Attention to space also figured prominently in fishers' descriptions of the changes in their fishing practices or patterns. For example, when a community moved, as did Ruby, its fishing locations and patterns also shifted in response to changed residence, access, and technology. Placename information as related to TEK was especially prominent in the interviews with Nulato and Kaltag residents.

Contemporary subsistence practices of using historically known and shared harvest areas become one way in which local people continually remake their connections to the land and mark their differences from other nonlocal users. For example, during her interview for this project, Kaltag resident Mary Rose Agnes documented important placenames, many of which were fish- and fishing-related, or what Fair (1997:473) has called "descriptive and activity toponyms:" those placenames associated with a particular activity in a particular place. Elders said that the names of Kaltag and its neighboring village, Nulato, themselves derived from fishing-related Koyukon words for "before the king salmon" (*Ggaal Doh*) and "before the chum salmon" (*Noolaaghe Doh*). In addition, while she was looking at a topographical map of Kaltag, Agnes pointed out that "up there, where that creek is, in front of Kaltag Creek—*Le'onkk'e dooleelenh Denh*—means 'it's flowing over the rocks.'" This location was another historical village site for Kaltag residents, one that remained an important fishing site in contemporary times. Another historical settlement of Kaltag people was at *Tloge kkaayeh*, or "ancient village" or "fish village," just south of Kaltag on the Kaiyuh Slough (*Tloge kkaayeh* was also the site of the massacre described in the Kaltag section). Directly across from the contemporary community of Kaltag is *Saanlaay Doh*, which means "before the silver fish." Agnes remembered stories about her relatives dipnetting and spearing salmon and other fish during the summer at *Saanlaay Doh*, then putting up their fish in a community smokehouse. One mile downstream of Kaltag is *Ukk'et*, the Koyukon word for "eddy," where Kaltag residents historically and contemporarily setnetted for whitefishes during fall. Finally, across from Four Mile (downstream of Kaltag), are 2 lakes which are named for fishing activities: *Tso Negge*, which means "behind the cache," referring to a place where fish were stored for winter, and *Taaseze Denh*, or "place of broad whitefish."

Residents of the project communities valued these places for subsistence fishing, a value which also links these communities to political, economic, and legal arenas of regulation and management. Caulfield et al. (1983:12) point out that traditional knowledge derived from placename data can increase the sensitivity of managers to local land use patterns, and in so doing, in the development of "locally relevant, sensitive, and acceptable" management priorities." For example, the long-term observation of a particular area such as the Kaiyuh Flats or the mouth of a particular river can yield important information about the relationships between changes in the land and the harvest of certain species, as well as raise possible concerns and potential research questions. In Nulato, for example, several fishers pointed out that the main channel next to the village, at the mouth of the Nulato River, had shifted in the last few years, dramatically changing fishing practices and locations for targeting specific species of fish. Also, many respondents discussed the drying of the Kaiyuh Flats and the implications for fish movements or habitat.

CHANGE AND CONTINUITY IN FISHING PRACTICES OF THE MIDDLE YUKON RIVER COMMUNITIES

This research provides an up-to-date, contemporary perspective on the subsistence harvest and uses of nonsalmon fish in the Middle Yukon River region. Several prior studies documenting these practices can be usefully compared to these data to better understand the fishery over time.

As mentioned in the Introduction, several anthropological sources documented historical fishing practices throughout the Middle Yukon, and analyzed the relationships between shifting social circumstances such

as residence and fishing practices. Loyens (1966) argues that the movement of many Koyukon Athabascan families from scattered, seasonal camps to a sedentary village did not, in fact, prohibit the continued participation in nonsalmon fisheries. Indeed, this profound social change may have supported continued fishing because increased access to technology improved harvest efficiency and preservation methods. The results of this study support the position that significant changes in the social and residential organization of Middle Yukon people did not significantly diminish the harvest and uses of nonsalmon fish species, despite overall changes in land use patterns associated with an increased preference to remain in the village. However, the data collected in several of the communities suggested that, over time, fishing patterns did change in terms of areas used, perhaps in response to the movement of the community (Ruby) or to the decline in the use of dog teams (Kaltag, Nulato, and Ruby). Other patterns appear to have shifted as well. For example, while many respondents indicated that net fishing for nonsalmon species, either under the ice or in open water, was conducted by women and elder women several decades ago, as discussed above; today, this task appears to be more practiced by men, as observed by principal investigators and discussed by respondents. Some gear types, such as fish traps and dip nets, were not used as much in contemporary times as they had been historically; contemporary residents favored fish wheels and nets. In her analysis of salmon fishing in Kaltag, Wheeler (1987) notes the relationship between the use of fish traps and the historical organization of seasonal camps where several related families worked together to effectively operate a fish fence and trap. The introduction of the fish wheel, increased sedentarization, and residents' improved means of mobility perhaps shifted traditional fishing patterns from camp-based to community-based.

Additionally, there did not appear to be significant changes in the species composition of residents' harvests, suggesting little change in the distribution of fish species throughout the Middle Yukon region. Most fishers still targeted larger nonsalmon species such as humpback and broad whitefish, northern pike, and sheefish, with smaller harvests of the cisco species, burbot, Arctic grayling, and Dolly Varden. The exception to this was Alaska blackfish, which were no longer regularly harvested, and when they were, it was mostly for bait. While Alaska blackfish do not appear to have been harvested in significant numbers historically by Middle Yukon residents, key respondent interviews suggested that they were sometimes harvested as "survival fish" when food stores were low as well as for dog food at a time when more families relied on dog teams for transportation to seasonal camps and trap lines. Most respondents also noted that diminishing harvests were due to a combination of decreased harvest effort because of diminished uses and decreased availability as lake habitats dried.

The ADF&G Division of Subsistence has produced baseline studies of subsistence resource use in 2 of the 5 participating communities, Tanana and Galena, studies which indicate the importance of nonsalmon fish species in the Middle Yukon area. In Tanana in 1987, Case and Halpin (1990) estimated that 71% of all households attempted to harvest nonsalmon fish for human food, dog food, bait, and other purposes. A review of their 1987 interviews with residents suggests that seasonal fishing patterns of that time are comparable to those described in this study. Fishers targeting nonsalmon fish setnetted seasonally in open water or under the ice, and seined during fall (Case and Halpin 1990:33,36). In addition, in 1987 a large majority of some species—92% of whitefishes and 87% of sheefish harvested—were fed to dogs. Table 14 below presents a comparison of available harvest estimates for sheefish and whitefishes for Tanana and Galena. It is important to keep in mind that 1) the baseline and household surveys are point estimates, thus the relationship between them does not necessarily suggest a trend, but is useful as a snapshot of harvest at a given time; and 2) whitefish estimates are generated as one category instead of by species because the data were not collected by species in either the baselines or the postseason surveys. Nevertheless, according to these data, sheefish harvests have remained stable while whitefish harvests in 2006 were approximately one-third what they were in 1987. This is likely explained by the maintenance of fewer dog teams, even though Tanana residents still maintain a significant number of them. While the human population in Tanana has decreased since 1987 by approximately 100 people, it is unclear how changes in the human population might have affected whitefish harvests. Rates of sharing have also declined between the 1987 and 2006 estimates. While 30% of Tanana households reported harvesting,

and 32% using, sheefish in 1987, in 2006, 16% reported harvesting and 23% reported using sheefish. Fewer households reported giving away sheefish in Tanana in 2006 than in 1987, though roughly the same percentage of households reported receiving them.

Table 14.–Comparison of harvest estimates, number of fish, sheefish and whitefishes, Tanana and Galena.

	ADF&G Division of Subsistence baseline studies Tanana (1987), Galena (1986)		ADF&G Division of Commercial Fisheries' postseason salmon surveys 10 year average, (1997–2006)[a]		ADF&G Division of Subsistence 2006 household survey, (this project)	
	Sheefish	Whitefishes	Sheefish	Whitefishes	Sheefish	Whitefishes
Tanana	5,250	24,918	1,144	9,008	5,006	8,278
Galena	519	10,402	296	3,404	1,982	30,415

a. *Sources* Borba and Hamner 1998, 1999, 2000, 2001; Brase and Hamner 2002, 2003; Busher and Hamazaki 2005; Busher et al. 2007, 2008; W. H. Busher, Yukon Area Fall Season Asst. Management Biologist, AFD&G Fairbanks; personal communication 2008.

Similarly, Marcotte's 1986 work in Galena also documented significant amounts of nonsalmon fish harvested for subsistence uses (Marcotte 1990). In addition, Marcotte explored the social organization of subsistence uses through an examination of the social ties between Galena, a regional hub, and other communities, as well as of the family and household relationships within Galena (1990:75–80,125). He argued that, as a regional hub, Galena residents maintain harvest and use areas throughout the Middle Yukon, likely because of kinship ties with other related communities, and that subsistence products, including nonsalmon species, have long been distributed throughout the area (Marcotte 1990:14). The Galena household survey results for this project showed an estimated increase in the harvest of both sheefish and whitefishes over the 1986 estimates. This increase in harvest might be explained by a greater percentage of households reporting the harvest of both sheefish and whitefishes in 2006 than in 1986, especially since the human population of Galena was roughly the same as it was in 1986. For example, 30% of households reported harvesting whitefishes in 2006 while 19% of households reported harvesting whitefishes in 1986.

Additional subsistence harvest estimates of nonsalmon fish are produced as part of an ADF&G Division of Commercial Fisheries' postseason salmon survey. As has been noted in other studies (Andersen et al. 2004; C. Brown et al. 2005), these postseason subsistence surveys are designed to collect data about salmon harvests and therefore may not be an accurate measure of nonsalmon fish harvests. The Commercial Fisheries survey sample includes households that participate to varying degrees in the salmon fishery; these households may or may not participate in various nonsalmon fisheries. Finally, the Commercial Fisheries survey is administered in early fall, to collect data on the summer salmon run, during which time the fall nonsalmon fish harvests are in full swing. Given these sideboards, however, the data from the Commercial Fisheries survey are an established time series and sometimes the only data on nonsalmon harvests available for some communities. Table 14 presents a comparison of Commercial Fisheries' survey data with Division of Subsistence baselines (Case and Halpin 1990; Marcotte 1990) and the 2006 household survey data gathered during this project. While the Commercial Fisheries' survey data and the 2006 survey data generated similar estimates of the Tanana whitefish harvest (9,008 and 8,278, respectively, both approximately one-third that of the 1987 baseline study in Tanana), the Commercial Fisheries' estimates for Galena's estimated harvest of whitefishes (3,404) are much lower than either the 2006 household survey data (30,415) or the 1986 baseline study (10,402). Furthermore, the Commercial Fisheries' harvest estimates for sheefish are significantly lower than either the baseline

studies or the 2006 household survey for both communities. Looking more specifically at the data that comprises the 10 year average in the Commercial Fisheries' survey estimates, the annual reported whitefish harvests, which are reported as large whitefishes and small whitefishes, vary widely for both communities. For example, Tanana community estimates for whitefish harvests range from 3,356 fish to 15,991 fish. This wide range of annual estimates could be a result of some combination of annual harvest variation, changes in the sampling methods, or other reasons.

INTERREGIONAL DIFFERENCES AND SIMILARITIES

When comparing the data generated from this project to those of earlier nonsalmon projects in the GASH area (C. Brown et al. 2005) and the Koyukuk region (Andersen et al. 2004), some interesting convergences and divergences emerge. First, it is clear that residents of all 3 areas have, in the past as well as in contemporary times, relied heavily on whitefish species and other nonsalmon fish species for subsistence uses. Further, all data suggested that the residents of the 3 areas maintain rich, textured, and evolving bodies of information regarding the life histories of nonsalmon species and their harvest and uses over time. For example, fishers in these 3 areas have, historically and in contemporary times, targeted nonsalmon species, specifically whitefishes, northern pike, and sheefish, during their fall and spring migrations in sloughs and tributaries of the Yukon River. Most residents who were interviewed observed a general migratory pattern whereby these fish species moved into sloughs and creeks in late spring, around breakup, returned to lakes for summer feeding, and then migrated to the mainstem Yukon River during fall. Through these observations, fishers in all 3 areas have learned how to successfully time their harvesting activities so as to target fish during these movements. Residents also observed that smaller whitefish species migrated through these areas in late summer, usually July and August, and harvested them in fish wheels along with chum salmon. Residents of all 3 areas also considered burbot prime eating in late fall, around November, when their livers, a favored delicacy, were enlarged.

On the other hand, the species with lesser use, such as Arctic grayling, Dolly Varden, and longnose sucker, could be harvested most efficiently during either spring or fall, and fishers tended to focus on one season or the other, depending on fish migrations in their specific areas. For example, in the GASH area, Arctic grayling fishing was almost exclusively a fall activity, with fishers intercepting these fish during their return to the mainstem from the clear, coldwater streams off the west side of the Yukon River. In contrast, Kaltag residents, just upriver, appeared to focus their harvest of Arctic grayling during spring, fishing through the ice at the mouths of sloughs and creeks.

Several other differences in fishing patterns emerged, often related to the nature of fish migrations. For example, while GASH fishers reported using a measureable run of sheefish that immediately precedes the salmon runs as a natural indicator for salmon arrival, residents of the Middle Yukon communities of Tanana and Ruby did not report seeing this pulse of sheefish. Rather, these residents observed sheefish arriving later in summer, *following* the salmon run. Given the documented locations of sheefish spawning grounds in the Alatna River off the Koyukuk River (Alt 1970; R. Brown 2000), it is likely that large numbers of sheefish observed by GASH residents leave the Yukon River prior to reaching Tanana and that the fall pulse observed by upper Middle Yukon villages is headed to another large spawning area in the Yukon Flats. Additionally, while GASH residents reported significant harvests of Arctic lamprey, it appears that the run is too dispersed by the time it reaches upriver communities, because fishers reported little to no harvest, and because lamprey did not figure prominently in the interviews. The low availability of Arctic lamprey in communities upstream of Kaltag may account for this area's general lack of cultural taboos about harvesting Arctic lamprey compared to the GASH area.

A comparison of the nonsalmon harvests across the Yukon River drainage also suggests differences regarding nonsalmon fish harvests and uses (Table 15). Clearly, all regions of Interior Alaska rely on nonsalmon fish harvests in their total annual subsistence take. And in all regions, whitefish species constitute the largest component of the nonsalmon fish harvest. Each region's whitefish harvest is comprised of different ratios of the different species, though ciscoes are only present in any quantity in

the Middle Yukon and the Koyukuk River regions, perhaps because of migratory patterns or the harvest patterns of the communities. By far, the largest harvest of whitefish species was reported in the Middle Yukon region, primarily by the communities of Tanana and Galena.

The 118,839 lb of whitefish species harvested by Tanana and Galena fishers in 2006 were likely primarily used for dog food, according to the key respondent interviews. In Tanana, for example, many fishers stated that they harvested most of their whitefish species in fish wheels during summer and early fall, rather than through under-the-ice nets used by many other communities in the Middle Yukon. Tanana residents also maintained more dog teams than residents of other Middle Yukon communities. While dog owners can and do feed dogs from fish harvested in setnets under the ice or in open water in fall and spring, residents' use of these nets appeared to be more focused on producing fish for human food whereas fish wheels were more efficient at harvesting the quantities of fish (salmon or nonsalmon species) needed to feed a large dog lot. Location could also have influenced Tanana residents' preference to maintain large dog teams. According to one Tanana fisher, "Tanana is a natural for that exact scenario because the fish arrive in bulk just at the time that it's good to cut them. Just when it's starting to get cool. I mean, it really fits in about perfectly" [050108T].

The harvest data of other species by region offer interesting comparisons as well. Sheefish harvests in the Yukon Flats area were much lower than the other 4 areas, which is significant because one of the few sheefish spawning grounds identified in the Yukon River drainage is in the Yukon Flats. Furthermore, fishers further downriver observed annual late summer/early fall migrations of sheefish upriver to the Yukon Flats. Harvests of northern pike, a more resident species available year-round in most areas, were comparatively even throughout the Yukon River drainage.

IMPLICATIONS FOR FISHERIES MANAGEMENT

The data collected as part of this project directly speak to the mission of ADF&G and its core services to 1) provide information on Alaska fish and wildlife resources and 2) involve the public in management of fish and wildlife resources. The Division of Subsistence documents and contextualizes information about the subsistence uses of fish and wildlife resources throughout Alaska, including harvest data, harvest and use practices, and traditional ecological knowledge, in order to inform the public and support sustainable management.

As Andersen et al. (2004:142) say, "fisheries management has as much to do with understanding the actions of people as it does the biology of fish." In other words, appropriate management must exceed the simple presentation of fish life histories to include attention to the actions and needs of fishers and communities. Perhaps more importantly, a manager must grasp the distinct relationships between human and fish, relationships that shape fish populations, and spawning, feeding, rearing, and migration areas. These relationships are not static; rather they change through time and space while remaining critical to effective management. Detailed descriptions of subsistence fisheries through time, in addition to estimates of harvest levels, are important pieces of the informational puzzle for managers and researchers alike. It is also important to understand how these fisheries are linked to each other as well as to people. Through a combination of biological inquiry and social science research on local, traditional knowledge, it is becoming clear that many of these fish, particularly whitefishes, which are heavily utilized throughout the Yukon River drainage, migrate between areas of the Yukon River drainage and thus between fisheries. As a result, whitefishes harvested by lower river communities are likely to be of the same stock as those harvested further upriver. These are important insights for federal and state subsistence fisheries management, since fish move between jurisdictions and fisheries.

Table 15.–Comparison of selected nonsalmon fish harvests across Yukon River drainages.

	Koyukuk River			Upper Tanana			GASH			Yukon Flats (partial)			Middle Yukon		
Resource	Number of fish	Pounds of fish	Pounds per capita	Number of fish	Pounds of fish	Pounds per capita	Number of fish	Pounds of fish	Pounds per capita	Number of fish	Pounds of fish	Pounds per capita	Number of fish	Pounds of fish	Pounds per capita
Alaska blackfish		145	0.20	0	0	0.00		14	.02	0	0	0.00		141	0.10
Burbot		2,230	3.50	1,399	4,758	3.00	326	945	2.00	378	907	1.00	1,066	2.559	2.00
Dolly Varden[a]		92	0.14	1,351	3,958	2.00	1	3	0.00				137	342	0.20
Arctic grayling		1,966	3.00	3073	2,458	1.00	581	1,064	2.00	728	509	0.60	2,709	1,896	1.00
Northern pike		8,279		1028	4,626	2.00	3,045	11,547	18.00	1,394	6,272	8.00	2,098	9,440	6.00
Longnose sucker		1,268		272	408	0.20	94	281	0.40	116	81	0.10	660	462	0.30
Sheefish[b]		17,714	28.00	5	30	.010	2,007	13,670	21.00	478	2,869	4.00	3,781	22,685	15.00
Whitefishes															
Broad whitefish		29,373	46.00	910	1,821	1.00	6,627	32,234	49.00	2,091	8364	11.00	12,337	49,346	34.00
Humpback whitefish		25,045	39.00	11,970	35,909	19.00	2,624	9,983	15.00	925	2,775	6.00	2,775	35,482	24.00
Bering ciscoes		1,033	2.00	0	0	0.00	5	7	0.01	39	55	0.10	6,996	9,795	7.00
Least ciscoes		7,757	12.00	0	0	0.00	21	21	0.03	287	287	0.40	2,487	2,487	2.00
Unknown whitefishes		0	0.00	225	450	0.20	17	43	.07	24	71	0.10	7,243	21,729	15.00
Subtotal, whitefishes		63,209	98.00	13,795	38,525	20.00	9,290	42,302	65.00	3,368	11,553	15.00	40,890	118,839	81.00
TOTAL		94,934	147.00		54,869	29.00		87,589	134.00		22,191	28.00		158,397	107.00

Source ADF&G Division of Subsistence harvest surveys, 2004, 2005, 2006, 2007.

Note Blank cells represent instances where harvest information was unavailable.

a. No attempt was made on the harvest survey to differentiate between the Dolly Varden *S. malma* and the closely related Arctic char *S. alpinus*, and the two species are usually managed as one.

b. Although sheefish are a whitefish species, they are often managed differently than other whitefish species, and so the data are presented separately.

The 2 components of this study—harvest assessment and the documentation of TEK through key respondent interviews and mapping—also have significant implications for federal and state subsistence fisheries management. Both speak to the concept of C&T uses, or C&T use determinations, the foundations of federal and state subsistence regulations in Alaska. The C&T concept outlines which resources have been used, by area, for subsistence purposes. In other words, when the Alaska Board of Fisheries or the Alaska Board of Game make a C&T determination, this is a statement that the resource has long been used for subsistence purposes in a particular area, usually by a particular set of communities. This determination sets into motion a requirement to establish an "amount reasonably necessary for subsistence" (ANS) under state management. Harvest estimates are one of the most important and basic elements needed to sustainably manage a fishery, especially if the management of those fisheries includes the principle of maximum sustained yield, as it does in Alaska. Along with abundance estimates, managers need to have a basic understanding of existing harvest levels to accurately model or estimate population dynamics. This project provides more data on Yukon River drainage nonsalmon fish harvests (see Table 15) that can be used to 1) support the current C&T use determinations of nonsalmon fish species in the Yukon and Northern fisheries management areas, 2) provide information on harvest levels to assist the Alaska Board of Fisheries when establishing ANS findings for nonsalmon fish in the Yukon Management area, 3) provide more accurate estimates of species-specific harvests for the establishment or continuation of fishing opportunities beyond subsistence (e.g., management plans supporting sustainable subsistence, commercial, and recreational fisheries), and finally 4) suggest community patterns in the nonsalmon fish harvests that would inform biological and management concerns. For example, research biologists may glean clues about migratory patterns from the nature of community harvests and fishery knowledge.

The relevance of TEK for management or biological research hypothesis testing has been examined in several studies (Nadasdy 2003; C. Brown et al. 2005; Andersen et al. 2004) and is an important aspect of integrating divergent data sets in order to address management questions. On one hand, the documentation of historical fisheries and contemporary patterns clearly speaks to the C&T use determinations required in order to ensure protections for subsistence, especially in light of the possibility of new commercial fisheries on nonsalmon species that may have implications for the fish populations. Importantly, while studies such as this examine the relationships between a place, a set of subsistence resources, a group of people, and their practices, they also shed light on the political economy of a subsistence way of life that is vital to maintain the links between these communities and the larger political and economic systems, such as commercial fisheries or regulatory arenas.

TEK can take many forms useful to management and research biologists. Usher (2000) outlines 4 general categories of TEK, including empirical observations of the natural world (e.g., weather, or animal behavior), historical and contemporary descriptions of land use, and cultural proscriptions on appropriate human–animal–land relationships. Usher subsumes these 3 categories under a larger fourth category, termed "cosmology," which he defines as the framework by which observations and understandings about the world are organized and given meaning (2000:186). In addition to providing factual information about harvest levels and use areas, these nonsalmon fish traditional knowledge projects, as a group, describe these data within the larger context of the role these fisheries play within the social, economic, political, and cultural life —the cosmology— of each community.

Additionally, TEK studies provide managers and biologists with a regional perspective on the nature and scope of nonsalmon fisheries, a perspective that speaks to biological questions arising from emerging research and management concerns. The focus on whitefish species in this study as well as in other studies provides an areawide map of whitefish use that helps link fishery based research such as this and localized biological research into a drainagewide perspective. For example, seasonal harvest estimates and information provided in key respondent interviews suggests patterns in the migrations of sheefish, broad whitefish, and ciscoes through or between areas of Yukon River drainage. Some of this information is complicated by inconsistencies in local species differentiation, especially between the cisco species.

However, in general, many of the migratory patterns hold. Comparing these types of TEK with recent biological research on otolith chemistry and telemetry (R. Brown et al. 2007) raises important questions about the management implications of various fisheries as fish migrate through the drainage and are subject to harvest in multiple areas.

RECOMMENDATIONS

This project was designed to provide a detailed description of the annual nonsalmon harvest practices and uses by residents of the Middle Yukon River area. In so doing, it raised several additional questions and concerns that warrant further inquiry.

HARVEST MONITORING

Available research provides managers with access to limited data on nonsalmon fish harvests for most communities of Interior Alaska. Most of these data are single-year estimates, and some can be compared to earlier baseline studies in ways that suggest trends in specific fisheries. For example, comparisons between baseline years and the 2006 survey in the communities of Tanana and Galena can assist managers in understanding how harvest levels and locations may or may not have changed over time. While these data are certainly welcome additions to a growing body of information regarding the harvest of whitefishes and other nonsalmon fish species, single-year estimates have limited utility in defining trends or responses in the fisheries, as well as understanding relationships between fisheries, especially because many biologists are beginning to investigate the relationships between fisheries through stock identification.

To that end, continued harvest monitoring provides essential information for managers to track changes in the fisheries that may indicate social (changes in harvest or use), ecological (changes in the environment), or biological (effects on the fish population) shifts. It is likely too expensive and time consuming to monitor harvests everywhere; ideally, however, fisheries could be monitored on a rotating basis, providing harvest estimates every 5 to 10 years.

SPECIES IDENTIFICATION

Accurate species identification was critical to this study in several ways. In order to discuss the traditional knowledge of various species, researchers and knowledge holders had to feel confident that they were talking about the same fish. Also, accurate harvest estimates assume that fishers identify all the species they harvest in the same way or according to Linnaean classifications. While many fishers maintained detailed knowledge about various species, especially whitefish species, several issues confounded accurate species identification. First, as was the case in earlier studies (Andersen et al. 2004; R. Brown et al. 2005), some fishers could identify all or most of the whitefish species that occurred in their area of the Yukon River. Others, however, referred to them as "large" whitefishes (usually broad whitefish and humpback whitefish) and "small" whitefishes (usually least ciscoes, Bering ciscoes, and round whitefish). Sheefish were always identified separately from other whitefish species. Second, local taxonomies sometimes differed from Linnaean taxonomies because some fishers made several distinctions within one species, depending on such factors as habitat, body condition, size, or age for example.

Indeed, species identification is often challenging for fisheries biologists, who presumably have a shared understanding of Linnaean taxonomy. For this project, researchers used a guide with photographs of 5 species of whitefishes during interviews and surveys. However, future projects would benefit from a field guide that provided additional photographs or illustrations of nonsalmon species at different ages, and additional morphological visual clues to species identification, such as jaw orientation and fin coloration. One caveat: while such a guide may prove very useful during interviews or harvest surveys, it may be unrealistic to expect that fishers will choose to take the time to distinguish very similar species, such as least ciscoes and broad ciscoes, during harvest and processing activities, due to the amount of fish that are necessary for subsistence uses and some of the ways in which they are processed.

While assuring that researchers and fishers are talking about the same fish during interviews and harvest surveys is important, a field guide could also help to overcome linguistic differences among Athabascan dialects when talking about fish, and whitefishes in particular. As noted in the Discussion, these linguistic differences are an important aspect of understanding, through traditional knowledge, the subsistence patterns of Alaskan communities.

PLACENAME RESEARCH

Research in the communities of Kaltag and Nulato revealed a wealth of information about placenames and their roles in identifying fishing locations or important cultural and historical stories as they relate to fish and the fishing cultures of these communities. Fair makes a similar point in her essay about Inupiat naming in the Shishmaref area: "For Native people themselves, the presentation of these names and their significance may result in how some lands important to them are designated by the federal government or used by others" (Fair 1997:467). Placename work also documents changes in places that may have important considerations for scientific research (e.g., climate change research or dynamics of fish populations). While this project documented some placenames in the Middle Yukon region, additional research focused on placenames and toponyms in the Middle Yukon and the entire Yukon drainage could reveal much more about the histories of these places, including fishing histories. As noted earlier, the value of placenames links these communities to larger, political, economic, and legal arenas of regulation and management (see Caulfield et al. 1983).

CLIMATE CHANGE RESEARCH

Recently there has been a great deal of attention on climate change concerns, especially in Alaska. While Alaskan coastal communities have experienced changes in the amounts and movement of sea ice, for example, residents of Interior Alaska communities have also raised concerns about changes in their environment. Based on the key respondent interviews for this project, local observations are usually long-term, with many changes in the environment, both positive and negative for subsistence activities, increasingly attributed to climate change. However, without further research, it remains unclear which observed changes are truly related to climate change, which are longer term cyclical patterns, and which might be due to another set of circumstances. Several observations of suspected climate change were documented as part of this research, primarily related to the drying of Yukon River drainage lakes and sloughs throughout the Middle Yukon, and especially the Kaiyuh Flats and the area between the community of Ruby and the Nowitna River drainage. Residents said that these areas, formerly productive muskrat trapping areas and fishing spots, were often inaccessible during certain seasons because of low or no water in the connecting sloughs and creeks. Residents expressed the concern that nonsalmon fish populations, such as whitefishes, could not migrate between spawning and feeding habitats.

Additional research might be able to address some of these questions by considering long-term weather patterns and geographical shifts. TEK will continue to be critical to any such effort because it is often be the only record of historical uses and observations.

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APPENDIX A. SURVEY INSTRUMENT

Appendix A.–Survey instrument, 2006.

2006 MIDDLE YUKON NON-SALMON FISH SURVEY

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

DURING 2006, DID THIS HOUSEHOLD CATCH OR USE ANY KIND OF NON-SALMON FISH? **YES** **NO** HOUSEHOLD ID NUMBER _____

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

	Activity Log						Number Harvested: Total and by Month												
SPECIES	Use	Fish For	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 2006 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 B. INTERVIEW TOPICS

Appendix B.–Interview topics.

LOCAL TAXONOMY and NATIVE NAMES in Koyukon[9] [10]

Can you tell us the local or Native names for these fish? [surveyor shows photographs of each fish species]

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? Any observations about why they move?–time of day, temperature, season, daylight/darkness, water level)

Do you know what they eat?

Do you know where and when they spawn? What do their eggs look like at different times of the year? Color? Size?

Where do they spend winters? Fall?

Where do they spend summers? Spring?

[9] Much of the key respondent interview work was completed by David Andersen and Eliza Jones (Andersen et al. 2004); additional documentation of Koyukon words was elicited during this project in order to document local or regional variations.

[10] Key respondents interviews for this project largely followed the protocol developed for the Koyukuk nonsalmon project (Andersen et al. 2004) and the Grayling–Anvik–Shageluk–Holy Cross (GASH) nonsalmon project (Brown et al. 2005), in order to maintain comparability in data. However, some divergences occur. For example, greater attention was paid in this project to mapping placenames and use areas, and asking questions about environmental change and traditional management practices.

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? Other uses?

Were there ever times when you stopped fishing before you got what you needed? Why? what were the things you looked for?

Have there been changes to fishing areas over time?

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?

APPENDIX C. CONVERSION FACTORS

Appendix C.–Conversion factors.

Resource	Unit	Convert to lbs		Convert to individual units
Pacific herring	Gal	6	15	
Pacific halibut	Lb	1	0.05	
Alaska blackfish	Lb	1	1	
Burbot	Ea	2.4	1	
Dolly Varden[a]	Ea	2.5	1	
Arctic grayling	Ea	0.7	1	
Northern pike	Ea	4.5	1	
Sheefish	Ea	6	1	
Longnose sucker	Ea	0.7	1	
Trout[a]	Ea	1.5	1	
Broad whitefish	Ea	4	1	
Bering ciscoes	Ea	1.4	1	
Least ciscoes	Ea	1	1	
Humpback whitefish	Ea	3	1	
Unknown whitefishes	Ea	3	1	

Source ADF&G Division of Subsistence Community Subsistence Information System, accessed November 2007.

a. It is unclear whether local classifications of "Dolly Varden" and "trout" reflect different species according to Linnaean taxonomies, or another distinction, such as the same species at different life stages (see footnote 5).