Technical Paper No. 382

Socioeconomic Patterns in Subsistence Salmon Fisheries: Historical and Contemporary Trends in Five Kuskokwim River Communities and Overview of the 2012 Season

Edited 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

Alaska Administrative Code	AAC
all commonly-accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly-accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
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	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. 382

SOCIOECONOMIC PATTERNS IN SUBSISTENCE SALMON FISHERIES: HISTORICAL AND CONTEMPORARY TRENDS IN FIVE KUSKOKWIM RIVER COMMUNITIES AND OVERVIEW OF THE 2012 SEASON.

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October 2013

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 Resources Library and Information Services (ARLIS), the Alaska State Library and on the Internet: http://www.adfg.alaska.gov/sf/publications/. This publication has undergone editorial and professional review.

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TABLE OF CONTENTS

LIST OF FIGURES

Figure **Page**

LIST OF APPENDICES

Appendix **Page**

ABSTRACT

This report summarizes the results of ethnographic research conducted in 2009 on the subsistence harvest and uses of salmon in 5 Kuskokwim River communities: Tuntutuliak, Kwethluk, Kalskag, Sleetmute, and Nikolai. In addition, the follow-up study was conducted in the Bethel area in 2012, responding to the very low returns of king salmon, which resulted in subsistence fishing closures and restrictions in the Kuskokwim Management Area during the summer.

The major objective of the 2009 study was to understand the historical and contemporary social organization of fishing within each community and what sociocultural, economic, and environmental factors influenced variations in subsistence salmon harvests of Kuskokwim River salmon. The 5 study communities represent the cultural, social, and economic diversity present throughout the Kuskokwim River Drainage. They are located in three distinct regions: the Lower River (Tuntutuliak and Kwethluk), Central River (Kalskag and Sleetmute), and Upper River (Nikolai). Through participant observation and key respondent interviews, researchers documented data on gear types, preservation methods, and natural indicators used for salmon fishing in different parts of the drainage, changing fishing strategies that key respondents have been experiencing in their lifetime, and concerns about salmon management.

The research in 2012 focused on documenting the impact of declining king salmon abundance and subsistence fishing restrictions during the fishing season. Subsistence fishers were affected by the 12-day rolling closures of all subsistence salmon fishing in the Kuskokwim River and its tributaries. It resulted in particular hardship for the residents, many of whom rely heavily on salmon. Respondents often suggested that the value of salmon and salmon fishing go beyond nutrition and economic values, to compose part of their socio-cultural identities, as well as their way of life.

This report is a significant step toward filling a major data gap regarding subsistence salmon fishing in western Alaska. ADF&G divisions of Commercial Fisheries and Subsistence have collected harvest data since the 1960s, yet little ethnographic information was available to contextualize these data. This report will help to characterize contemporary subsistence salmon fishing in western Alaska and contribute to our knowledge of subsistence statewide.

Key words: Salmon, subsistence, fishing, Kuskokwim River, Tuntutuliak, Bethel, Kwethluk, Kalskag, Sleetmute, Nikolai, king salmon; Chinook salmon, chum salmon, coho salmon, sockeye salmon, 2012 season, management, ethnography, rolling closure, regulation.

INTRODUCTION

Prepared by Andrew R. Brenner, Anna Godduhn, and David Runfola

The purpose of this study is to explore how Kuskokwim River families and communities develop or modify subsistence salmon fishing strategies in response to changing sociocultural, economic, and environmental circumstances, and to document resulting changes in salmon fishing from the fishers' perspectives. In order to maintain consistency with regulatory language, "king salmon" shall be used throughout this report to also mean "Chinook salmon."

The subsistence salmon fishery in the Kuskokwim River drainage is among the largest in the state of Alaska. Since 1994 when Alaska Department of Fish and Game (ADF&G) statewide collection of subsistence harvest survey data greatly improved, some 54% of subsistence harvests of king salmon have been taken in the Kuskokwim Management Area, mostly in the Kuskokwim River drainage, and 30% in the Yukon Management Area. Division of Subsistence studies indicate that fish contribute up to 85% of the total pounds of wild foods harvested in Kuskokwim River communities, and salmon contribute as much as 53% of the total annual harvest of fish and wildlife for subsistence (Simon et al. 2007:1) . Residents of the Kuskokwim River harvest all 5 locally occurring species of Pacific salmon for subsistence purposes: king *Oncorhynchus tshawytscha*, chum *O. keta*, coho *O. kisutch*, pink *O. gorbuscha*, and sockeye *O. nerka* salmon.

While ADF&G divsions of Commercial Fisheries and Subsistence have collected harvest data continuously since the 1960s (with substantial improvement during the 1990s), little contemporary ethnographic information was available to contextualize these data prior to this report. In recent decades, Kuskokwim River subsistence salmon harvests have shown a decline in total harvest numbers for chum salmon and in per-household harvest for all species (Appendix A). At the time of this study, little research had been conducted to explore social, economic or environmental factors other than inriver abundance of salmon that could help explain these changes in salmon harvest patterns.

BACKGROUND

The Kuskokwim River drains the northwest portion of the glaciated Alaska Range and the southern side of the Kuskokwim Mountains, draining 48,000 square miles and reaching the Bering Sea on the southern edge of the Yukon-Kuskokwim Delta (YKD; Figure 1.1). The river moves from the mountains, through rolling hills and wetlands of subarctic boreal forest, to the treeless tundra of western Alaska. At 724 miles, the Kuskokwim River is the second longest river in Alaska. It is the longest river to exist exclusively within one U.S. state and the ninth largest river in the nation (Kammerer 1990). Charnley (1984) described the Kuskokwim River by dividing it into three distinct cultural and geographic regions: the Lower Kuskokwim (Central Yup'ik people); the Central Kuskokwim (Central Yup'ik and Athabascan peoples); and the Upper Kuskokwim (Athabascan people). All three regions have a minority of non-Alaska Native populations, including Russians, Europeans, and Euro-Americans.

Whether consumed, shared with friends, shipped to family far away, exchanged with neighbors, or sold for commercial export, reliance on salmon is deep and extends to other facets of life in the Kuskokwim region. Salmon have been a vital source of protein and a cultural and economic resource since time immemorial. One fisher in the lower river said:

> [Salmon is] essential. It's not something we really should have. It's something we have to have. And it's been going on for generations and generations and that's what we live on. Without fish I don't know how we'd live. (TUNT-5)

The relative importance of salmon and strategies of harvest vary somewhat along the river, but salmon are important throughout the drainage. Fishing is generally done by a social unit of production – meaning that the processes of fishing and preparing fish for long-term storage are carried out by groups, generally based on kinship relations, but often including friends and neighbors. Fishing groups in the Kuskokwim region generally include 2 or more generations from 2 or more households using 1 smokehouse. These cooperative units are referred to as fishing groups throughout this report. A fishing group needs to be large enough to buy gear, cover expenses, and handle the workload with flexible divisions of labor. They also need to be small enough to negotiate dividing up the fish between the households involved, which happens at the end of the season. It is usually easier for young married couples to continue fishing with a parent, because the parents are more established—with facilities for smoking and drying and money for gas. The structure of fishing groups is necessarily flexible, and seems to have become even more so with the complexities of contemporary living, as described in the chapters.

A long history of self-management is deeply entrenched in the processes, rules, and beliefs surrounding the preservation of salmon along the Kuskokwim. The rules of fishing seem to use respect for the fish themselves as a mechanism to promote safe and sustainable practices that result in healthy conditions, high quality food, and abundant fish. Nearly all of the respondents who were interviewed in this study referred to the importance of taking care of fish properly. Few used the language of "self-management," but the behaviors described demonstrate traditional ecological knowledge and culturally integrated resource management. Traditional ecological knowledge (TEK) influences the way in which people interact with their environment. Along the Kuskokwim, traditional management practices included reducing waste and keeping camp clean. These strategies are more thoroughly described in the chapters. People in the Kuskokwim region have an understanding that human behavior affects abundance and fishing success, and respondents often reflected a sense of personal responsibility to follow traditions in order to protect and sustain the salmon runs.

The need for fish was intensified by the fur trade and the gold rushes of the 19th and 20th centuries. At the time, it took all summer to collect enough fish (mostly chum salmon) to make those activities possible. In the early half of the 20th century, fish were mostly dried for local use and often sold or bartered to feed dog teams that provided the only winter transportation across the territory. The sales were generally opportunistic and small scale, and so have been categorized as customary trade—although some fishers may have earned substantial profit. The traditional practices of customary trade and barter indicate the importance of salmon in the regional economy, even prior to the introduction of cash (Gould et al. 1965; Oswalt 1990).

A full discussion of resource exchanges in the Kuskokwim drainage and the effect of the capital economy are beyond our scope here, but the interchangeability of fish and money must be noted. In research on the lower Yukon River, Polly Wheeler (1998) found that wild resources, salmon in particular, were a valuable currency of exchange. This continued even after the introduction of cash around the end of the 19th century. Cash, like other resources, was only available sometimes (seasonally) and had a relative rather than absolute value. Because cash itself is neither edible nor useful without a cash economy, that relative value was not especially high at first. Cash did eventually supersede fish as the primary currency of the region, but salmon are still a highly valued resource with which others can be acquired (Wheeler 1998).

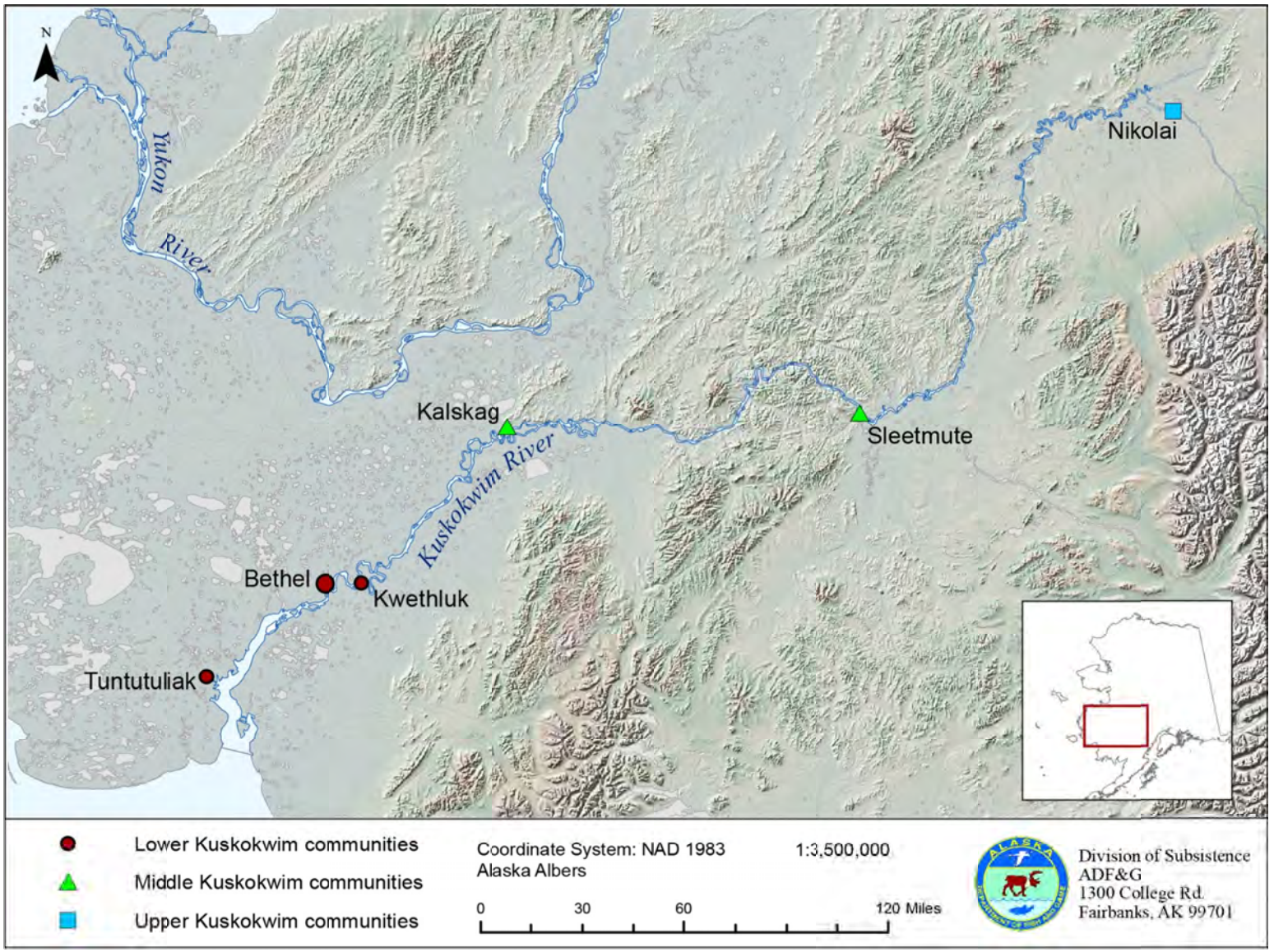


Figure 1-1.–Kuskokwim River map showing study communities.

The financial value of salmon was well established by 1920. That year, the federal government received reports that commercial fishing at the mouth and in the Bering Sea was harming subsistence fisheries in the Yukon and Kuskokwim drainages. From 1926–1929 there were conditional probations and from 1929-1952 commercial fishing occurred periodically, until complaints of declining subsistence catches closed the commercial fishery for two years. It was officially reopened in 1954 but not actually resumed until Alaska statehood in 1959 (Coffing 1991:29; Pennoyer et al. 1965:42). The 1960s–1980s were extremely profitable years for commercial fishers on the Kuskokwim, but in the 1990s, commercial fishing faced increasing restriction in western Alaska, and no commercial fishery targeting king salmon has occurred since 1987.

Some respondents expressed concern related to the "bycatch" or incidental catch of king salmon; however, these terms had at least three different usages in this study: 1) incidental catch of king salmon in lower Kuskokwim River commercial fisheries targeting other salmon species; 2) incidental catch of king salmon in the Kuskokwim River subsistence salmon fishery, particularly when restrictions are in place to prevent or minimize the catch of king salmon; and 3) incidental catch of king salmon in the walleye pollock *Theragra chalcogramma* fishery in the Bering Sea. This third usage of the word "bycatch" was most common in study communities. While respondents expressed concern that Kuskokwim River king salmon populations may be affected by all three types of incidental catch described above, this was especially true for incidental catch associated with the Bering Sea pollock fishery.

HISTORICAL SUBSISTENCE SALMON HARVEST

The importance of salmon harvested by Kuskokwim River residents has been well established by past quantitative harvest surveys. The Alaska Department of Fish and Game has collected salmon harvest data for Kuskokwim River communities through post-season household surveys since the 1960s, although harvest information collected before 1990 must be viewed with some discretion.[1] The annual subsistence harvest of all species of salmon by Kuskokwim River communities between 1991 and 2009 averaged nearly a quarter of a million salmon, indicating that in recent decades subsistence salmon continues to represent a staple food item in this region into the present (Appendix A).

In general, Kuskokwim River subsistence salmon harvests for all species other than chum salmon are estimated to have remained relatively stable between 1990 and 2009 in terms of total numbers of salmon harvested (Hamazaki 2011:31–34). However, increases in household numbers (Hamazaki 2011:44) and the human population (ADLWD 2011) in some Kuskokwim River communities suggest that per capita harvests of all salmon species have likely decreased. Chum salmon harvested for subsistence have experienced a decrease both in terms of total and per capita harvests that can mostly be explained by the decline of dog teams. While some of these variations may be related to fluctuations in resource availability and economic factors such as a general decline in commercial salmon fishing on the Kuskokwim (Howe and Martin 2009), prior to this study there had been little research on other factors and repercussions of this change.

Although king salmon populations had been above or near average levels from 2005–2009 (Estensen et al. 2009), abundance was poor in 2010, 2011, and 2012, and there has been a noticeable decrease in the average size of returning king salmon in recent years (Chuck Brazil, former Area Management Biologist, ADF&G, personal communication, October 2010). Low numbers of returning king salmon led to subsistence fishing closures in 2011 and 2012, and information collected as part of this study in 2009 provides an ethnographic baseline that documented the importance and patterns of king salmon fishing prior to recent increased king salmon fishing restrictions. Due to conservative management strategies in a

[1] Methods for the survey were redesigned in 1988. Data collection methods prior to 1988 were variable, and data published from the 1960s–1988 is not comparable with post 1988 data. Additionally, relatively minor variations in harvest data collection since 1990 led to reanalysis and updated harvest numbers from 1990–2009 (Hamazaki 2011).

time of record low abundance, an update to the 2009 field work provides ethnographic context and documents some of the impacts of salmon fishing closures on Lower Kuskokwim River residents in 2012.

REGULATORY CONTEXT OF THE KUSKOKWIM RIVER DRAINAGE

The ADF&G Division of Commercial Fisheries (CF) directs management of the Kuskokwim River subsistence salmon fishery in accordance with the *Kuskokwim River Salmon Management Plan* (5 AAC 07.365), the *Policy for the Management of Mixed Stock Salmon Fisheries* (5 AAC 39.220), the *Policy for the Management of Sustainable Salmon Fisheries* (5 AAC 39.222), and the *Policy for Statewide Salmon Escapement Goals* (5 AAC 39.223) As specified in the *Policy for the Management of Sustainable Salmon Fisheries*, the primary goal of salmon management is to ensure conservation of salmon (5 AAC 39.222(b)). This policy also directs ADF&G to manage salmon stocks so that a sufficient number of migrating adult salmon will reach their spawning grounds each year, the purpose of which is to conserve and sustain potential salmon production (5 AAC 39.222(c)(2)). The State of Alaska Board of Fisheries (BOF) and ADF&G have defined the annual estimated size of a spawning salmon stock as the escapement (5 AAC 39.222(f)(10)), and have determined the escapement goal for each managed salmon stock as an annual range of abundance of returning spawners (5 AAC 39.223). These escapement goals can change as a factor of the biological and stock assessment data that CF gathers each season. Managers use several assessment tools in season to estimate the total number of salmon that will reach their spawning grounds. If the estimated number of spawning adults is in excess of the lower range of the escapement goal, then the excess number is identified as a surplus which can be allocated for consumptive uses (AS 16.05.258). Customary and traditional subsistence uses of salmon have the highest priority above other consumptive uses, such as commercial and sport harvests, which means that Alaska residents must have an opportunity to harvest an amount of salmon reasonably necessary for subsistence use before other users have an opportunity to harvest for commercial, sport, or personal use (AS 16.05.258).

Regulatory authority for Kuskokwim River salmon management is shared by the BOF and the Federal Subsistence Board. The Division of Commercial Fisheries shares inseason discretionary management authority with the U.S. Fish and Wildlife Service (FWS), and both agencies' management decisions are advised by the Kuskokwim River Salmon Management Working Group (hereafter, WG). The WG was formed in 1988 by the Alaska Board of Fisheries in order to provide opportunity for local stakeholders to participate in the process of managing Kuskokwim River salmon fisheries (Francisco et al. 1989). The WG is an advisory body composed of 13 member organizations or constituencies. These members represent elders, subsistence fishers, processors, commercial fishers, sport fishers, a member at large, Federal Subsistence Regional Advisory Councils, and ADF&G (KRSMWG *n.d.*). The ADF&G representative is the CF Kuskokwim Area Manager. The Area Manager does not vote on management action recommendations; however, this member may vote on other actions that the WG proposes for deliberation (e.g. new members, by-law changes). The WG holds an annual meeting in March, and special meetings throughout the Kuskokwim River salmon fishing season at the call of the WG Co-Chairs.

The purpose of the WG meetings is to hear and review public concerns, salmon harvest activities, fishery assessments, and management strategies. The WG may also move to hold a consensus vote in order to take formal action on specific inseason salmon fishery management decisions that the Area Manager proposes to the WG. Although the WG may choose to take such formal actions, ADF&G has sole authority to implement and enforce all management actions allowed under Kuskokwim Area salmon management regulations (5 AAC 07). Also in attendance at WG meetings are representatives of the U.S. Fish and Wildlife Service (FWS). The FWS representatives review and discuss their own agency's salmon fishery management concerns as they relate to actions proposed by ADF&G. The Area Manager and FWS representatives attempt to reach consensus on management decisions. If federal and state managers do not come to consensus and ADF&G implements a management action to which federal managers are opposed, FWS may choose to issue a Federal Special Action superseding the State's

management action (50 CFR §100.27(20)(e)(4)). Federal Special Action in Kuskokwim River salmon management has occurred as recently as the 2011 season.

RECENT TREND IN KUSKOKWIM RIVER PACIFIC SALMON ABUNDANCE

Throughout Alaska's marine and freshwater fish habitats, researchers have observed a number of physical and biological stressors which are contributing to fluctuations in the abundance of many of Alaska's Pacific salmon stocks (Myers et al. 2009). Of the five species of Pacific salmon that return as adults to the Kuskokwim River each year, chum, sockeye, and coho salmon are considered by managers and fishers to have maintained their abundance throughout the previous decade or more (Brazil et al. 2011; Estensen et al. 2009). Since 2002, the numbers of returning adult chum, sockeye, and coho salmon have achieved the escapement goals set by ADF&G.

Perceived by many fishing families to be the most important of all fish species for subsistence in the Kuskokwim River, king salmon have not exhibited the same overall productivity as chum, sockeye, and coho salmon (Brazil et al. 2011; Volk et al. 2009). In 16 of the previous 30 years, Kuskokwim River king salmon returns have not reached their escapement goals. The number of returning spawners has declined each year since 2005 with the lowest returns on record occurring in 2010, 2011, and 2012 (Brazil et al. 2011).

The subsistence harvests of Kuskokwim River fishers represent a very large portion of all salmon harvests in Alaska, including the largest percentage of king salmon harvests for any river drainage in the State. As such, management organizations require clear information about current harvest methods, use patterns, and the economic, nutritional, and cultural importance of subsistence salmon to Kuskokwim River communities throughout the drainage. The following research objectives guided this project in an attempt to address these information gaps:

RESEARCH OBJECTIVES

- Through participant observation and key respondent interviews, describe the contemporary and historical social organization of fishing within each community.
- Identify what sociocultural, economic, and environmental factors have influenced variations in subsistence harvests of Kuskokwim river salmon.
- Describe changing fishing strategies for Kuskokwim families and communities over respondents' lifetimes.
- Document the impacts of subsistence fishing closures as well as declining king salmon size and abundance for the 2012 fishing season.

Twenty-six permanent communities are located within the Kuskokwim River drainage, and while Pacific salmon consistently forms an important component of the subsistence harvest throughout the drainage, differences in salmon fishing patterns between communities exist. This study explored differences in salmon fishing patterns in 5 communities throughout the Kuskokwim drainage based on regional affiliation with the lower, central, or upper Kuskokwim River[2]. While regional boundaries are not

[2] For the purposes of this discussion, Lower Kuskokwim River communities are defined as those communities from the mouth of the Kuskokwim river upriver to Tuluksak, the Central Kuskokwim River includes those communities from Lower Kalskag to Stony River and Lime Village, and the Upper Kuskokwim River includes those communities including and upriver from McGrath.

discreet, and there is some overlap in regional patterns for border communities in particular, there are a number of general similarities within each region's salmon fishing patterns, corresponding to their shared natural environments, cultural backgrounds, and histories.

RELATIONSHIPS WITH ALASKA NATIVE COMMUNITIES

A majority of the residents of western Alaska are Alaska Native or American Indian who have maintained their subsistence customs and traditions throughout their history. The project was intended to encourage a collaborative, working relationship among state and federal agencies, tribes, communities, nongovernmental organizations, and industries. The ethical conduct of all researchers will meet or exceed the principles of conduct adopted by the Alaska Federation of Natives in 1993 and the Interagency Arctic Research Policy Committee on June 28, 1990. All personnel are to work in a manner that develops, rather than jeopardizes, relations among the cooperators, and between the cooperators and the public.

METHODS

Prepared by Hiroko Ikuta

In 2009, the ADF&G Division of Subsistence designed and implemented the Kuskokwim Salmon Ethnography project with the goal of understanding and documenting salmon fishing in the Kuskokwim River drainage. During the year, researchers worked with five communities for this study to capture the social and economic diversity of Kuskokwim River communities in three distinct regions: the lower, central, and upper river. Communities were chosen to represent various aspects of village life along the Kuskokwim River. Specifically, communities were chosen to span population sizes and to represent as many distinct cultural and linguistic groups in the report as possible. It was important to include communities with different priorities for the use of different salmon species, particularly including both subsistence and commercial fishing in order to consider the relationship between the two.

The communities chosen were Tuntutuliak and Kwethluk in the lower river, Kalskag at the border of the lower and middle portions of the river, and Sleetmute and Nikolai in the upper portion of the Kuskokwim River. Additional research was conducted in the Bethel area, the largest community in the Kuskokwim drainage, concurrent to the very low 2012 return of king salmon, as described below. All participating communities are along or very close to the mainstem of the Kuskokwim River, and harvest fish directly from the river as well as nearby tributaries.

Researchers employed semi-structured ethnographic interviews and participant-observation to document salmon fishing practices among respondents, both qualitative approaches. There were 106 "key respondents" in total interviewed for this study in 88 separate ethnographic interviews (not including the "2012 Update"). The key respondent sample was designed to capture the array of fishing experiences along the river and also to span a time frame including the dramatic changes of the 1960s (when dog sleds were abandoned in favor of newly introduced snowmachines resulting in significant decreases of chum salmon harvested to feed dog teams) and longer history as possible. Experienced fishers knowledgeable of both historical and contemporary fishing activity were approached in consultation with local leadership.

Key respondents were asked about their fishing and fish related experiences from their earliest memories through the time of this study. Questions explored information about personal fishing histories over time, the locations and gear types used, experiences with and understanding of fishing regulations, the redistribution of salmon, and finally local recommendations for management. Interviews were audio-recorded then individually transcribed and coded.

PROCEDURES

In 2009, the principal investigator was Caroline Brown, subsistence resource specialist with the Division of Subsistence based in Fairbanks. In the early spring of 2009, ADF&G staff traveled to 5 communities to meet with tribal councils and review interview protocol and obtain community approvals. From May through June 2009, research teams traveled to the communities to implement the project. Working with the lead researcher in each community, the tribal councils of each community selected community liaisons for the research in their villages. Twelve community liaisons include 2 in Kalskag, 5 in Kwethluk, 1 in Nikolai, 1 in Sleetmute, and 3 in Tuntutuliak. These community contractors were paid $50 for each interview and $25 per hour to participate in an orientation and training session.

In each community, the ADF&G staff acted as the community lead for the data collection and conducted an orientation and training session with their community liaisons. During orientation, the group verified household lists and reviewed the interview protocol. At the end of training, each researcher selected a group of households to interview and made appointments with key respondents by phone, VHF radio, or in person.

Interviewers worked in teams of two: 1 community liaison and 1 ADF&G staff member. Interviews were conducted in person, usually at the respondent's home. After data collection, interview notes were reviewed for completeness and coded for data entry by ADF&G staff during fieldwork. After interview data had been entered, analyzed, and summarized, the lead researchers returned to each community in the spring of 2010 to conduct community review meetings. They delivered a Microsoft PowerPoint[3] presentation summarizing the results in each community. After these meetings, community leads prepared community chapters, which were then compiled into this report and supported by a regional discussion of the primary themes raised during the research.

UPDATE FOR 2012 CHAPTER

The methods used to collect data in the Bethel area differs from the other 5 communities, Tuntutuliak, Kwethluk, Kalskag, Sleetmute, and Nikolai. Responding to the difficult salmon harvest season for subsistence users, in June and July of 2012, two researchers spent 2 weeks conducting research in the Bethel area. The intention was to gather information and opinions about how new subsistence fishing restrictions affected subsistence salmon users' ability to get enough fish and whether the restrictions were changing their fishing or fish preservation strategies. To achieve this, informal interviews ranging from a few minutes to over an hour were conducted with people in Bethel, surrounding fish camps, and nearby villages.

Announcements were played on KYUK, the local radio station, in English and Yup'ik, and flyers were posted around Bethel asking residents to call the ADF&G office in Bethel to discuss their experiences with subsistence salmon fishing on the Kuskokwim, specifically regarding local closures.

Attempts were made to contact tribal representatives of the six villages closest to Bethel to request that a Division of Subsistence employee be allowed to visit the village and invite people to come and speak with them at the tribal office. Of the six villages, two were visited: Kwethluk and Akiak.

In addition, opportunities were taken to briefly interview people that were encountered in Bethel. This included visitors to the ADF&G Bethel office and individuals calling the Division of Commercial Fisheries to inquire about fishing management decisions. Interviews were also conducted with several people at the Bethel boat harbor who were traveling to or from fish camp.

[3] Product names are given because they are established standards for the State of Alaska or for scientific completeness: they do not constitute product endorsement.

TUNTUTULIAK

Prepared by Anna Godduhn

SETTING AND CONTEXT

LOCAL RESEARCH AND RESPONDENT PROFILE

Three researchers interviewed representatives of 24 households in Tuntutuliak in 2009; some of the interviews included more than one interviewee. All 14 men and 14 women, ages 34 to 92 at the time of interview, have relied on subsistence food throughout their lives. Additionally, researchers visited local fish camps and participated in salmon fishing activities. Research focused on documenting current fishing patterns as well as the effects of sociocultural, economic, and environmental changes on subsistence salmon fishing over time. Many of the interviews in Tuntutuliak were conducted in the Central Yup'ik language, with translation provided by local residents Robert Enoch, Sr. or Martina Chris. Direct quotes from those interviews are from the translators, who often mixed direct translation with paraphrases of what the respondent said. In those cases, and also when translated information is paraphrased rather than quoted, the translator's name is credited along with the respondent. Unless so noted, direct quotes are of the respondents themselves.

HISTORICAL BACKGROUND AND NATURAL ENVIRONMENT

Tuntutuliak is located on the Qinak[4] (Kinak) River, also referred to as the Tunt River, about 3 miles from the Kuskokwim River. Tuntutuliak is approximately 40 air miles southwest of Bethel and 440 miles southwest of Anchorage. Mather and Morrow (1998: 200) described Tuntutuliak as a Central Yup'ik word meaning "having many caribou." At the time, the authors stated that caribou "no longer frequent the area" (Mather and Morrow 1998) but in the following ten years the dynamic Mulchatna herd began to range closer again (ADF&G 2009)[5] Tuntutuliak is in the Yukon-Kuskokwim Delta (YKD), which is a vast expanse of marsh and tundra lowlands laced with an intricate network of lakes and rivers barely above sea level. The Kinak River at Tuntutuliak is influenced by tides and glacial silt carried by the Kuskokwim River. Most local and regional travel is by boat in summer and snowmachine in winter. Airplanes provide transportation for passengers to regional hubs and beyond throughout the year, as well as freight to and from the village in winter. In summer, most freight is delivered by several barge arrivals (ADCCED-DCRA 2010).

Tuntutuliak was established by the relocation of residents to higher ground from two former villages in the region: Kinak (*Qinaq*) and Qukakllircaraq (*Qukaqlirciraq*) (Ray et al. 2010). A Bureau of Education school was built in 1909 but closed and moved to the nearby village of Eek in 1917. In 1945 the village moved to its present location on higher ground (Brown 1983:215). The village grew when a new Bureau of Indian Affairs school was built in 1957.

The Native Village of Tuntutuliak is a federally recognized tribe located within the Lower Kuskokwim School District and the Bethel census area. Infrastructure includes a post office, the Lewis Angapak Memorial School, a health clinic operated by the Yukon Kuskokwim Health Corporation, a state owned

[4] If English names are common, they are used and followed by the ethnographic spelling in parentheses; we were not able to verify the spelling of all place names.

[5] The complex dynamics between wild caribou and domestic reindeer, which are different subspecies capable of interbreeding have been significant in the history of reindeer herding in western Alaska, but are beyond our scope.

gravel runway, a seaplane base on the river, and a system of boardwalks through the village (figures 3-1 and 3-4). The population of Tuntutuliak was estimated to be 380 in 2009 (ADLWD). Approximately 45% of residents were under 18 years old in 2010 and 96% identified themselves as American Indian or Alaskan Native (ADCCED-DCRA 2010). Like other Lower Kuskokwim River communities, Tuntutuliak relies very heavily on subsistence food, especially salmon. Job opportunities are limited and often seasonal: wage income depends on construction, education, local government, and facilities maintenance, as well as earnings from commercial fishing for salmon and herring roe (ADLWD 2010b). According to the U.S. Census Bureau 2005-2010 five-year estimate, the median household income in Tuntutuliak was $34,464.

COMMUNITY FISHING PROFILE

HISTORY OF LOCAL FISHERIES

Breakup generally occurs between the middle of May and the middle of June, and people start fishing "…as soon as the river is free from ice" (TUNT-5). Due to their geographic location and the salmon life cycle, lower river residents have the advantage of being the first fishers to encounter salmon as they enter the river and begin their seasonal runs toward spawning grounds. Fish populations are most abundant in the lower river and commercial fisheries have always been most active around the mouth of the Kuskokwim. Elders noted that salmon populations have fluctuated historically—some say depending on commercial activity.

Figure 3-1.–U. S. Post Office, Tuntutuliak.

Residents of the Lower Kuskokwim River have been fishing for salmon to eat, share, and trade for thousands of years. Beginning with the development of a Russian fur market in the mid-1800s, salmon fishing has been thoroughly integrated with the cash economy. Fishing effort, barter, and customary trade continued to expand with the gold rush at the end of that century. Commercial fishing for export in the Lower Kuskokwim River began no later than 1913 (Pennoyer et al. 1965) and has continued intermittently through the present as an industry with local, national, and international components.

The integration of commercial and subsistence fisheries in Tuntutuliak and other YK Delta communities is extraordinary. Many families that devote substantial portions of their summers to subsistence fishing also put time and effort toward commercial fishing. The number of active commercial fishers has fallen with the fish populations and the profitability of fishing over the last 25 years. In the 1970s and 1980s, a "significant percentage of families" in the Lower Kuskokwim district had at least one member with a CFEC permit (Andrews and Coffing 1986:3); today about half of households (47 of 96; ADLWD 2010b) retain commercial permits, but some reported not using them in 2009. During the first half of the 20th century, and into the 1980s, nearly continuous effort alternated between subsistence and commercial activity and fishers would use the same gear for both purposes. Fish were processed either by cutting for drying and long-term storage, or when the cutters were exhausted or the drying racks were full, fish were sold whole to commercial buyers. Processing for subsistence is described in later sections.

One respondent explained through a translator that, historically, fishers worked hard to harvest whatever salmon they could.

> Whatever they caught. You know, all species... There was no preference – they were catching whatever they can… That's true, that there are more reds [sockeye salmon] today. There were mostly chums back then. Today reds are increasing… They still got the silvers [coho salmon] but not as much as they did when the kings – they didn't do as much cohos because by that time they had gotten most of their winter supply, and they had to move back from fish camp. Once they moved back from fish camp they don't necessarily quit, but they quit harvesting for later use. And also they started doing other freshwater – other subsistence activities – like whitefish, berry picking, things like that. (TUNT-2)

Less harvest effort is required now than in the past, in part because there are hardly any dog teams to feed. One man commented that:

> Here in our family the women who are cutting the fish, when it's like 3 - 4 families, they do on an average close to 200 fish, and today they quit when they have enough...They used to, they had a saying, today my mom even tells us to get as much as we can while they're around. But today, with nets we have, outboard motors, the boats, it's easier to get the amount we need, it's also easy to get too much, more than what we need. The women they tell us, they tell their men, "it's time to quit, we have enough." (TUNT-21)

Prior to statehood, regulations were placed on the number of fish that commercial processors could buy. With statehood, regulations shifted to scheduled openings for commercial fishing that began to affect fishers directly as those openings declined in frequency and duration. One elder remembered that "If they felt like fishing, they'd go out fishing. They were not regulated as much as they are today" (TUNT-2). The same respondent explained that early on commercial fishing did not seem to have an effect on the number of fish and there were no subsistence closures before commercial openers like there are today (TUNT-2). Another man said he was one of the first five people to participate in commercial fishing out of Tuntutuliak and that he only subsistence fished for food after he did his commercial fishing (TUNT-18). Someone else remembered that commercial fishing used to be open all day, every day, all season; even if the fish buyers were paying a low price, fishers could still make good money. Now that commercial openings are more restricted it is much more difficult:

> In the commercial fishing period, you got opening sometimes only one time in a week, and sometimes two times in a week. In those periods there's a 4 hour period or 8 hour period nowadays, and it keeps going up and down on the time. (TUNT-19)

Elders remembered that when commercial fishing was lucrative, they were able to buy new gear, such as nets and boats, which made subsistence fishing much more efficient. One man said that it was not unusual to be able to make enough money to buy a complete subsistence net in just one hour of commercial fishing (TUNT-13). The same fisher talked about days when he was "getting unluck" on commercial openers: he decided it was better to eat the fish at home rather than sell it to commercial processors. He only tries to sell his fish when he catches 50 or more and his calculation implies that the subsistence value of fish can be much higher than their commercial price (TUNT-13).

An elder described how he has seen some families leaning more towards commercial fishing. He said "Some families where they became too dependent on the cash economy, they started doing less subsistence because they started getting money" (TUNT-17). Most people reported, however, that commercial fishing augmented the ability to fish for household use. Many of the people interviewed agreed that commercial fishing has not been profitable for some time, since the late 1980s or early 1990s. This change has resulted from fluctuations in the international market and especially the availability of lower cost farmed salmon (Herrmann 1994). The price to fishers has varied by roughly 10% to 30% each season (TUNT-21). One woman explained that she had six siblings, all brothers, and she was the only one without a permit. She occasionally commercial fished with her younger brother. These days, she said, the lack of openings makes it unprofitable (TUNT-5). Another respondent said:

> I commercial fish, but right now it's changing for us because the fish is getting poor, and fish buyers are pretty lack in this Kuskokwim area. I never bother, or want to go to Quinhagak sometimes depending on gasoline expenses. It doesn't cover use of expensive gasoline, and not enough to pay for my helper. (TUNT-21)

The same respondent (and others) explained that for many families commercial fishing had been the only substantial source of income for the entire year, especially for older men without formal education, who have long depended upon commercial fishing to support their subsistence practices. "Today, it's really gone down so that's affected some subsistence fishing" (TUNT-21). One respondent remembered an incident where the tender he was delivering to was full and not buying any more fish, so he buried the fish at home for winter dog food (TUNT-8).

FISHING PRACTICE

> It's like how you have to have maybe milk every day, or sugar. That's how dried fish is. It's something you have to have. (TUNT-28)

Fishing is a central part of life in Tuntutuliak and most fishers have learned their skills and acquired their habits over a lifetime. Many of the respondents who were interviewed were told by their elders to be observant in all things, but especially when it comes to fishing. If they were to see something unusual, they were told to study it instead of merely passing it by, as described in translation:

> …the elders used to tell them not to ignore anything, to be observant, and one thing was when one was traveling by canoe or kayak, they'd see fish behaving unusually, they were told to observe that fish because, you know, some of the behavior that the fish display can tell you how it's going to be in the wintertime or when it gets to be a certain time of the year, something is going to happen, or it could be a sign of a storm or something good. (TUNT 10)

Many fishing traditions related to avoiding waste were described by research respondents. People do not catch more fish than can be processed in a timely manner, and avoid cutting in the hottest time of day, when the quality of the meat degrades. Fishing during ideal weather produces a higher quality product

and allows fish to pass upriver while it rains. Proper cutting reduces waste so king salmon, the preferred eating fish, are cut by proficient cutters. Children learn by practicing on less important fish. Smoking is done with care. Fish abundance and fishing success are thought to depend on respectful treatment of fish and the avoidance of waste. Families use most parts of the fish for different products, and unused parts such as guts are to be disposed of properly, usually in the river or buried.

Elders in particular expressed concern about the consequences of not taking proper care of fish. Traditionally, if people keep fishing in the correct manner, there will be more fish every year. It was widely agreed among the respondents that if fish are wasted or disrespected, there will not be as many fish returning in the future. The fish remains were treated with great respect, so that the fish would not tell others to avoid these people.

> …when he was a kid, when they lived in *qasgiq* [men's community house], when they used to stay in *qasgiqs*, he would see, in the *qasgiq*, there's the rafters or whatever, and he would see little baskets, in there, put away somewhere, little baskets. Weaved, little, like when you carve wood, it's a thin, it comes out thin strips, they weaved those, I guess, this type of weaving, you know, the wooden baskets, he used to see little bowls like that, woven out of wood. He used to see those in the *qasgiq*, but, so, at some point, he got curious about those and asked about them, that's what they were, is those were little bowls that the men used when they ate to discard their waste, the little bowls. That's what were for, is when they ate they used those for their waste or bones. And then they'd empty those somewhere outside where they wouldn't be trampled on. They didn't feed them to the dogs. (TUNT-21)

An example of inappropriate behavior is embedded in a translated story about discretion:

> One thing was that they'd be discrete. If I have some fish, extra fish, and I want to share it, I'm not supposed to holler about it, the person across in that next house, if I want to share some of that fish, I'm not supposed to holler at him "Hey come and get" I have to go over and tell him, and that's because it's, maybe it's the spirits, she didn't mention it specifically, but I'm just assuming maybe it's the spirits that will let the other fish know that "they didn't treat me right." She tells of this one time where she mentions the name of the person. She says there's a lake back there, a place back there, a lake, and that guy had a fish trap, whitefish trap, and he, his trap filled up with fish totally, and he had a lot of extra. So he, I don't know how far it was, but I guess it was in shouting distance from that place where he had his fish trap, so he checked on his fish trap it was full so he hollered to that camp, to have whoever bring their grass baskets and fill them up with fish from his trap. He hollered at them. So from then on, the fish quit going to that area. So I think it's, I would assume that it's arrogance, or something, I would assume that's what the moral might be. You wouldn't be arrogant about your ability, what you get, or what you have. (TUNT-11)

A traditional Yup'ik belief is that fish go away if they are not used, and taken care of—which includes sharing. A respondent described what elders told him when he was little:

> …if you don't take care of fish or animals you'll be, ah – not a *nukalpiaq*, not a good hunter. Every time you'll go out bird hunting you'll catch one bird while others are catching more – because you don't take care of 'em, it's that way… He provides. If we take care, He'll provide more. Don't be stingy, share…. (TUNT-1)

One respondent reported learning from her parents that certain kinds of behavior could lead to no fish and that it was imperative to take good care of them, and not to throw them carelessly around outside (TUNT-23). Another remembered growing up at fish camp and recalled that everything was always kept clean. The fish racks, fish themselves, and cutting areas were the most important places to keep tidy. Fish were

to be kept in the shade to keep them from spoiling and waste product had to be buried out of the way of foot traffic (TUNT-20). Yet another said that his elders told him that the subsistence foods that Tuntutuliak residents depend on will never be depleted if they are treated properly, and the natural cycle is respected (TUNT-17). When asked why people had these views about rules regarding fish this respondent explained through translation that "It's traditional; it's the elders saying since we depend on that, we're told even if it becomes this way (bad) not to throw it away until the run starts coming in and he has new source that he is able to dispose of, following the proper procedure" (TUNT-17). In another interview, the respondent said that if fish

> …spoiled when it gets maggots like flies lay maggots on them we don't use that any more. But when I was a kid my mother used to clean those and still ate the meat on the fish and use the skin for other clothing too, mittens and boots. Maybe parkas too, or rain parkas, because they're waterproof. So even the skin was used, fish skin. (TUNT-9)

If animals are not treated with respect, they might go extinct or cause famine which some seem to fear is already happening:

> People are not watching their fish and their tools as good as they used to, as well as they used to, like sometimes they would find a piece of fish that had been chewed on or carried away by dogs. Those types of things are happening today sometimes.… Some people are getting careless about the ways they take care of their fish, their supplies, and their tools. At some point fish became less abundant. (TUNT-10)

Several respondents mentioned restrictions to be observed after certain events, such as the death of family members or daughters' first menstrual cycles. One respondent explained through a translator that if there was a death in the family, they would not fish or cut fish to avoid offending the fish: "the traditional rules, you know if the kid passes on or the wife passes on and you go fishing even though you're not supposed to, that affects the fish." This period of mourning in regards to fishing lasted five days in the past but one respondent said, through translation, that "then when religion got here they used that 40 day [period]" (TUNT-18). Whether other fishers provide for the grieving family was left unsaid, but seems likely.

Younger respondents sometimes acknowledged that the rules are no longer followed as closely as they were in the past. For example:

> Not to that extent, you know, we hear about those – we don't follow them to the extent that they use to. You know, today we're lazy. You know, we're totally different today. We're getting too modern. Like we have that waste basket and it's covered with containers that it shouldn't—. We have too much modern stuff, amenities that were introduced to us, that are, I think causing us to get careless, not respect as much as these guys used to. It's getting too easy for us today. And it's probably most of what we do today is contrary to their stuff, and the stuff that they used to observe or pay close attention to. (TUNT-21)

Fishing practice has changed over time in Tuntutuliak, but mostly the changes have been minor adaptations to traditional methods. Advancements in gear, particularly motor boats, have had much effect on fishing strategies, including the style and locations of fishing, as described in the sections that follow.

GEAR

Respondents described major changes to fishing gear. Overall, people approved of the tremendous improvements in gear that have occurred over the last three generations. Elder respondents, in particular, had witnessed drastic changes as they went from a childhood when people made almost all of their gear by hand from locally available materials, to an adult life when people used manufactured gear from stores. First there were nylon nets, and then there were motor boats, both of which have improved since their introduction. One elder exclaimed that "Most everything change. We got bigger gear, 50 fathom

nets. We have bigger motors, faster motors" (TUNT-9). Respondents widely agreed that improvements in gear technology have made it possible to get the necessary amount of fish in significantly less time. However, decades ago much of the fishing was done to provide for dog teams:

> They had to fish as long and as much as they could [in the past]. Today with our equipment, with the modern equipment we have today, we don't need as much time to get as much fish as we need. So that's, some families will quit fishing within two weeks, some within a month. When I was a boy people would be fishing most of the summer until middle of July, end of July sometimes. I think those are the main biggest changes I've seen. (TUNT-21)

A 91 year old man remembered that, when he was young, people used fish traps in the Kuskokwim River to catch salmon and other kinds of fish:

> The other type was the fish traps, the cone, you know those fish traps that have on the back part close the catch, and then there's the entrance, the trap part. It came in two sections. Some use those traps, but they used to make those out of split wood and then they would check on them every day, sometimes twice a day, and soon as the men brought the fish home the women would take care of them right away, soon as they brought them home. The women would work on them right then. (TUNT-10)

In a good spot, these traps could be very efficient for catching fish, and he remembered them often being full of more than 40 fish. The traps did not solely target salmon and would catch all kinds of fish, but he liked it best when they caught king salmon. Several elders recalled that dip nets used to be popular and that "They only used dip nets and setnets. The fish used to swim right beside the bank not way down there, and they used to catch those fish with dip nets" (TUNT-6). One woman remembers hearing stories from older people before her time using traditional equipment. Her late grandma, after she was widowed, began to do her own fishing and used dip nets on the river bank. She recalled that the fish were more abundant back then and they swam close to shore and "…they were able to catch them right off the bank" (TUNT-2). A number of people commented that now it would be impossible to catch salmon from the shore with a dip net and that salmon do not appear to swim as close to shore as they used to; some said this might be because of the eroding bank. "I think the salmon were more plentiful back then because sitting on the bank with their dip net, they'd get their whole cache that way" (TUNT-13). An elder man recalled historical river characteristics and events:

> That's what I used to hear from my mom. That river was really narrow—in my early days, when I was a kid, it was really narrow. Not like the ocean, right now. You could see the slough across the river when you're down there. And in those years before I was born, probably, across the river when they kayaking – you used to see their kayak oar across the river. In those days there used to be lots of fish and you dip nets for fishing. (TUNT-19)

Gillnets, whether set or drifted, have been the primary methods of catching salmon for residents of Tuntutuliak. Residents did not report fishing for different species in different locations but rather have long used different mesh sizes while fishing in the same spots. The materials used to make nets have evolved with the times. Early nets were made by hand using a variety of local materials, including caribou sinew, seal skin, and tree bark. One woman recalled her parents telling her about seal skin nets that her ancestors made (TUNT-22). Seal skin nets have not been in use for several generations, but many respondents actually remembered women making nets from willow bark.

An elder described how "tree bark" had to be dried and split. She said that willow bark was used because of the "straight up and down fiber. The willows have that fiber where you can peel it, but some trees[6] just

[6] The Kuskokwim Delta region is generally composed of treeless arctic tundra, but alder and willow shrubs grow there.

break off, it's the willows that have that long fiber and bark" (TUNT-21[7]). An elder man described the processing of willow bark into string-sized strips for making nets. The women would twist the thin pieces of bark, and once the material was ready, the men would actually turn it into net:

> And the nets averaged about 10 feet, those nets that they made and used, the tree bark ones were averaging about 10 feet. So they made both king salmon nets, for mesh sizes for king salmon, they'd make their own nets out of those tree barks for like king salmon, chums, different size. That's how they made them, the women would make the string out of tree bark and then the men would mend it. (TUNT-10)

Once cotton twine was introduced early in the 20th century, people learned to unravel it and then make it into nets. One elder explained, through a translator, that men used to weave the twine into nets using a wooden tool for measurement. The transition from nets made with local materials to nets made with twine was not immediate, and one elder remembered that during his childhood, his mother would make nets out of twine, but other people in the village were still using nets made from seal hide. As people began to make nets out of twine, they were able to make slightly larger nets than they had previously used. Several elders recalled times before the widespread use of nylon nets:

> In the early times in my lifetime, the king salmon webbing, dog salmon webbing was mostly cotton. Lotta work when you pull them out from the water, always hang them – you didn't hang them, leave them there, next day it's already rot. That's how we used to take care of our nets. (TUNT-24)

> I went fishing with my father at that time. There was no nylon for fishing at that time, and people had to make their own nets by weaving net [with cotton twine]. They make different sizes meshes, some for king salmon and some for chum salmon. And at that time the long net would be like 20 feet or a little more sometimes. So there must have been lotta fish that time on the river. But since the nets were sold in stores then people start buying 50 fathom nets. (TUNT-9)

> Back then, they fixed their own nets, each person would. They'd watch their nets real carefully back then. Today I have a hung king net, a hung chum net, but in her time they didn't have [multiple lines]. They had king webbing with float line, lead line; they'd use the same float line, lead line. Springtime, this time of year, they'd hang a king net. When they got done fishing for king they'd strip the net, replace it with the chum net using the same lead line or float line, rehang the net each time they do a different size fish. (TUNT-11)

Changes in fishing gear tended to be improvements to existing equipment rather than radical changes in forms. Traditional seal skin and tree bark nets have been replaced with more durable synthetic materials. The transition away from *umiaqs* and *qayaqs* (kayaks), made with natural materials such as whale bone and seal skin, reportedly began when lumber became available and people began to build wooden boats.[8] The new wooden boats with small motors also made fishers less vulnerable to the weather and have now been superseded by sturdy aluminum boats and powerful outboard motors that are extremely expensive, but very fast (Figure 3-2).

The increased cost of fishing gear left some families behind in terms of ability to fish efficiently, but even those without sufficient resources to fish on their own would go to fish camp and join forces with members of their extended families. For example, one woman whose father passed away when she was

[7] This respondent participated in two interviews; in this interview, he was translating for an unidentified older woman, possibly his mother.

[8] The *umiaq* is made with an open top for travelling and can be much larger than a *qayaq*; *qayaqs* are enclosed (around the waist) and made for just one or two people. The first is made for traveling and the second for hunting.

three years old described how she, her mother, and her brothers began to help with her uncle's fishing operation. She remembered steering the drifting boat while her uncle worked at the net: "I was the one who mostly went with him. And during commercial, I was the co-helper to him" (TUNT-22). In another case, a middle aged brother and sister, both unmarried, had continued to fish with their parents and then together after their parents passed away. The brother described the process of collaboration:

> Last year, my cousin and I fished - and my nephew - for ourselves, my sister, and I. First time we fished and then put up dried and smoked them ourselves. We fixed up the old timbers on the south side. And this year our married brother is building another fish rack on the other side of the river for them and our niece. (TUNT-20)

Figure 3-2.–Boats are essential to life in Tuntutuliak.

One respondent, born in the late 1950s, remembered that both set and driftnets were used at fish camp when he was small. "They'd start out with both and then when they wanted to slow down they just do setnet—or sometimes take the setnet out and just do drifts" (TUNT-21). The same respondent said he still sees setnets once in a while but not often. He thinks because drifting has become easier, with motors that let people get out to the Kuskokwim in 15 or 20 minutes, that people are doing well enough drifting and do not need to use setnets. "They usually try to get just enough that they can work on overnight or within a day" (TUNT-21). Historically, people were fishing for many dog teams that ate massive quantities of fish. With the arrival of airplanes in the 1930s and snow machines in the 1960s, dog teams began to disappear, and fishing effort declined.

A number of respondents remembered using setnets at Fish Camp Island in the 1960s and 1970s. The nets were relatively small, about 25 fathoms (often 50 fathom store-bought nets cut in half), and stayed in the

water 24 hours a day. Prior to motors, people would paddle to set and check them every morning and evening (TUNT-13).

> We have to watch how much fish we're catching, so [I prefer] the driftnet. You can use the driftnet at the same time after you see your catch and kinda estimate how many more weeks. It really depends on the fish swimming. We catch more fish in setnet, setnets you have to put maybe so many setnets with small, maybe 25 footers, and the currents are sometimes pretty bad at low [tide], so good spot, time to check them are high up tide and low up tide when the current stops. At the time when the current stops we can go there, catch, come back. (TUNT-1)

One man who used to setnet explained that when it is rough weather in the mouth of the river it is difficult to check the net, even with large boats. The waves generally cause problems and sometimes ruin the net. He also said if people setnet nowadays, they deal with beavers cutting the rope and ruining the whole net. "They're crazy! There's lots of 'em all over. In my early days, there was nothing at all, no beavers. Old timers tell us stories that animals from upriver go down to coast when they go hungry" (TUNT-19). Beavers, which are often said to be increasing in the Lower Kuskokwim region (Ray et al. 2010: 4) are just one reason that people have altered their fishing practices.

> [By the 1980s], [t]hey're starting to drift[net] in the middle of the Kuskokwim, and not just by the shore. That's the change. When they used to have setnet, they started catching less and less. They stop catching from the shore. They would say they're way down there, in the middle, or they'd say the fish would be on the bottom. (TUNT-6)

These kinds of observations promoted the transition to drifting. When people first began to drift, from wooden boats with oars or small outboard motors, it was a more labor intensive process.

> I watched my dad when I was 5 years old. Fishing with my dad, I watched him, 'cause my father had boat and outboard motor, small outboard motor. And when he wanted to save gas he sailed. We didn't have to burn motor, gas, to go fishing. And row sometimes. We used to get blisters on our hands when we go fishing, from rowing. Even commercial fishing, first few years commercial fishing nobody used motors to keep their nets straight, we rowed and rowed, 'cause we had 48 hour commercial fishing periods. And we'd be rowing for 24 hours, maybe. To home – sore. Them days there was no other way, we didn't think of other ways but that. And we see somebody idling their motor and keep their net straight, we start doing that. And when I was young we thought running motor would scare the fish away, too. Maybe it's true. Maybe that's why we catch more fish them days with small [short] nets. (TUNT-9)

Today in Tuntutuliak, the principal subsistence salmon fishing technique for harvesting salmon is the use of driftnets, with some families still using set gillnets. Tuntutuliak residents prefer drifting for several reasons—efficiency above all (Figure 3-3). Drifting is reportedly preferred because it allows better control over the numbers and timing of harvest, is more easily adapted to fishing restrictions, supplies fresher fish, and is more fun. Rod and reel, legal subsistence gear in the area, is used occasionally by people from Tuntutuliak.

> They catch salmon at Quinhagak with rod and reel because it is clear water. Here the water is murky, so with rod and reel we try it out once in a while, and we don't even catch. Rod and reel is for fun but also to get fish for freezing. (TUNT-19)

This type of gear is not effective for catching large volumes of salmon and is for when "…we're hoping to catch dinner or not hoping to catch lots—when [we're] not too serious. Out here [in muddy water] they don't bite. We go up across the river and go up Eek, way up there. (TUNT-21)

Figure 3-3.–Working a driftnet on the lower Kuskokwim River.

Regardless of whether people used driftnets or setnets, they tend to use similar mesh sizes. All nets catch a mix of fish, but the mesh size allows preferential harvesting. For king salmon, people reported mostly using 8 to 8½ inch mesh. Commercial fishing has been restricted to 6-inch mesh since the late 1980s in order to protect large king salmon. Beginning in 2011, after this research, regulations changed to restrict the mesh size for subsistence use to 6 inches during a portion of the king run. Many fishers already knew smaller mesh would yield more fish, though they would be smaller. Historically, Tuntutuliak fishers used commercial gear for subsistence fishing, and at least one man reports using his 6-inch commercial net. This man further commented that more and more people are trying smaller mesh sizes even when there are no restrictions because there are fewer large king salmon on the river. One man said "I noticed that it gets more fish, but the fish are a little bit smaller than the ones you get with an 8 inch web, and with the 7 ½ we tend to get more chum [that] we wouldn't be getting if we were using the 8" web." (TUNT-13)

Several respondents reported switching from king gear to chum gear in early July for the peak of the chum run. In translation, one said "You get used to the timing of things by seasons, but right now, it is easier to use the calendar and the clock" (TUNT 10). Chum, sockeye, and coho salmon require the use of a smaller mesh size, between 5 and 6 inches. Smaller mesh is "…good if you need more chums… you can catch over 200 if you find a good spot. A fish in every hole. Hard to pull net alone, need crew member to help you out" (TUNT-1).

Several respondents explained that there are a number of items that have made salmon fishing easier, such as five gallon buckets and plastic tarps. Residents also said that improvements in communication had

made fishing not only easier but safer and more efficient. VHF radios and now cell phones and texting are used to ask the fish cutters how many fish should be brought in.

FISHING, PROCESSING, AND PRESERVING

Fishing locations for Tuntutuliak residents have shifted a number of times. Before 1950, most people in Tuntutuliak travelled to fish camp directly across the Kuskokwim from the Qinaq River and the old village site; there were several fish camps on the other side of the river. An elder who grew up in Tuntutuliak remembered fishing there in an extended group that included her uncle and her mother and siblings (TUNT-3). They had one fish rack and one smokehouse. Another remembered a time when there were nine tents at that fish camp, each occupied by a family (TUNT-11). Fish camp was a communal activity that highlighted extended familial relationships. People fished with traps and setnets in areas right around that camp. The first major change in fishing locations was when nearly the entire town of Tuntutuliak stopped fishing across the river.

After 1950, people started moving up the Kuskokwim to Fish Camp Island (Kuiguyuk), in the Johnson River area for summer fish camp. Nasgiglik [sic.] was one of the first sites that people went to when they moved to the island, and there was already a fish camp—probably established by people from the tundra villages, like Kasigluk or Nunapitchuk (Ray et al. 2010). For a long time everyone went to the same vicinity, and the entire large village was dispersed among only three camps during summer—each of which included multiple extended families. One respondent explained "I don't really have the numbers, but the majority of the Tuntutuliak population came here [pointing at map] and some came right across the river here, to a different fish camp" (TUNT-13). In a different interview, this man's mother said that there were already people from other villages who went to fish camp in that area, but that it was not a problem for people from Tuntutuliak to establish fish camp in the same area. She thinks they were probably related somehow because she remembered people from the different camps eating meals together as though they were family (TUNT-11).

Another woman related that when she was a girl in the 1960s, her whole family would go to spring camp, fall camp, and summer camp. Summer camp was for salmon fishing and was just across the Johnson River. It was a community experience, and "the whole village used to go" (TUNT-15). Her family is one of the few that still goes to fish camp, including her husband, children, and grandchildren. They go around middle of June and come back at the end of July when it is time for salmonberries.

There were two major factors driving the change around 1950: the advent of motors and a decrease in fish abundance. People felt the need to move upstream to where the river narrows and catching was easier than from the old camp. One man recalled that about 80% of the people who went to fish camp made this move (TUNT-9).

Several respondents reported that their families moved from the fish camp across the Kuskokwim River to the Johnson River area because the slough it was on began to dry up, and access became a problem (TUNT-10). Another respondent also remembered this and said it was in 1965 (TUNT-13). Another respondent reported moving from the fish camp called Avoongoluk [sic.] to Fish Camp Island because it was a safer area for children. He explained that the other place had a steep bank, and he had fallen in as a child. He said that his family was "…usually concerned about the kids during the summer. Make sure they're safe, especially playing near the water." Today with powerful boat motors it takes people about two hours to get from Tuntutuliak to Fish Camp Island, whereas in the past with wooden boats and small motors families would take all day to get there and often stopped half way for lunch breaks (TUNT-15).

Before the advent of schools, families moved between several different seasonal camps. Because the time people went to fish camp coincided with school vacation, it was the only seasonal camp in which families with children could still participate, although school did impose limitations. Families used to subsistence fish for whitefish in the Johnson River area after the salmon season ended in the fall, but with a new

school in Tuntutuliak and a mandate for attendance, people could not do that. Fish camp was part of a seasonal lifestyle that one woman described this way:

> Every summer. After we go to Bart Lake, cut pike and then when they're half-dried, we'd go back to Nunap [Nunapitchuk (Nunapicuaq)], hang those and those fish camp first of June, stay there till [through] August. There were so many activities. Nowadays you don't see anybody stay that long, just right when the fish are done, they come home. Right before school starts or right before the berries start ripening, we'd move back. (TUNT-7)

Only two families responding to this research still go to fish camp, and they both emphasized how important the time is to them as a way to pass on their traditions and culture. They explained that they like to go to fish camp because they get away from the hustle and bustle of life in town. In addition, these families explained that fishing and fish processing are easier from fish camp. On Fish Camp Island, fish racks and smokehouses are located right next to the cabins where people live, and all of it is located right near the water. It only takes a couple of minutes to step out and check on the smokehouses. In Tuntutuliak women may need to travel across town or even by boat across the Kinak (Qinaq) River (TUNT-22). Tending fish carefully results in a much better quality of dry fish, and going to fish camp allows the whole family to really focus on producing quality fish. It is also gas efficient to fish once people are at fish camp because drifting can occur right next to fish camp, without the need for a 20 minute commute. There have been many changes due to technological advances. Respondents reported that before generators were available they just used wood stoves and that almost everything about camp life has been improved to make living there easier. Several respondents talked about the benefits of going to fish camp:

Figure 3-4.–Boardwalks serve as streets in Tuntutuliak.

> We run portable generators, have propane ranges that we can cook on and bake, which we didn't have back then when I was a youngster. And we have oil heaters in the cabins. That's major changes I've seen. All the conveniences we have in the villages we bring out to fish camp, and that makes work a whole lot easier. That's the major change I've seen. And one other thing is communication, we have VHF radios today that we can contact folks, family with, and for the first time this summer we have cell phones. (TUNT-13)

> …it's not for the weekend where you bring along food and something just for a weekend. It's for the whole summer. It's a hard life but we enjoy it; we're happy! We're happy during summer. Can sit down and talk to wife, listen to radio, otherwise we'll be quiet. (TUNT-9)

> We've seen how convenient fish camp is. Like if you go out there and fish you burn about 2, 3, 4 gallons whereas if you were at Tuntutuliak you'd burn maybe around 12 gallons. And that's a big plus. The big thing is family time we spend together in the summertime here at fish camp. If we were to fish at Tunt we'd have to build our fish rack close to the river there, and our smokehouse would be some place around there, and we'd have to go back and forth all day. Where at fish camp the smokehouse is right next door, and the fish rack is a little ways down here. And there's plenty of water, fresh water that we can work with. So those are the main reasons, I guess, we stay at fish camp. The fish camp bug has bitten us. (TUNT-13)

In the 1970s people began to fish from town as improvements in outboard motors made it feasible to reach the Kuskokwim quickly, and improvements in drifting technology made it efficient to fish the river in the wide area near Tuntutuliak. People had a number of reasons for preferring to fish from town. The required preparations and logistics make relocating an entire family and all their supplies quite complicated. As described in the introduction, fishing production units, or fishing groups, generally includes 2 or 3 generations from 2 or 3 families, often part of the same extended family. Fishing groups are often fairly large and usually include at least a few key members who have jobs in town. In prior decades, these groups used to spend the whole summer alternating between commercial fishing and subsistence fishing. People who are employed in town cannot always take time to go to fish camp, but they may be able to fish or cut fish after work hours if they have a cutting area and smoke house near home.

Some residents feel forced to fish from town not only because of high gas prices, but also because of their work schedules (TUNT-14). One woman explained that she would like to go fish camp for the summer, but her husband would have to earn income—so they would stay in town (TUNT-7). She described the difficulties people face with seasonal work:

> 'Cause most of the jobs are for the summer. Weatherization, boardwalk making, so half the men will be working, probably weekends will be the only option for people who are working. Weekend will be Saturday, weather permitting. So everything's getting tighter. Work. Everything going up. Most men will probably try to be working, fishing season or not. They have no choice. Wintertime—how will they do it? How will they provide for stove oil, lights. If they're thinking about that, then it'll probably be mostly weekends that they'll be fish, from my understanding. (TUNT-7)

The same respondent remembered that while growing up there was much less work-related interference with fishing. Her father worked during the winter, so the family was able to stay out at fish camp for the whole summer. Commercial fishing had also provided many families with convenient opportunities for income, but those opportunities have declined steeply in recent years.

Figure 3-5.–Hanging king strips.

Many families like to freeze some fish, and freezers are readily available in town, but not feasible in fish camp. One respondent said that he worried less about bears in town and also explained that fishing from town was more convenient because of the increasing availability of resources in Tuntutuliak:

> I think it's easier for us maybe for me too because we're close to the service [gas] station down here. I think it's easier because way back when we lived at the fish camp we have to go up to Bethel service, the tank farm, and purchase some drums of gas. (TUNT-20)

In addition, fishing takes a lot of infrastructure in the form of a smokehouse and drying racks, and it is more difficult to build these in a remote location. In the past, families either could not afford the amount of gas needed to fish from town because they did not have wage jobs, or if they fished commercially, they had income but preferred to work from camp. Now that commercial fishing is heavily restricted, most fishing families have at least 1 member, and usually more, with a wage job. It is not only more feasible but necessary to pay for the extra gas needed to fish from town.

Another common reason people stopped going to fish camp was because the trip to fish camp was not always possible for elderly or infirm members of fishing groups. Fishing from town allowed families to care for older members while still participating in subsistence activities. One man said that his family started fishing from town when his mother had a stroke. Another respondent explained that when her father got sick, her family started fishing from town. Someone else explained that her family stopped going to fish camp when her parents got arthritis. Despite some sense of loss, the majority of families fish from town today.

One man explained that he fishes on the south side of the Kuskokwim River when the tide is coming in and on the north side when the tide is going out (TUNT-12). Most respondents agreed that it was possible to get enough fish from either town or fish camp, and that people needed fewer salmon than in the past because they no longer had to fish for dog teams.

Figure 3-6.–Nearly dry slabs of king salmon with backbone removed.

Respondents reported that good spots for drifting are generally learned from parents but are also supplemented by experimenting. The most important characteristic of a successful drifting site is one with no snags (TUNT-13). One elder explained that:

> Most of it you learn from your dad, who's going out fishing. But afterwards, you can fish, and maybe that spot, you try different spots, and you might hit a good spot, long as there's no snags in the water and swift current. Or else your net will go down. If it doesn't get off early, use the motor, [or it will] tear up the net real bad. (TUNT-1)

Some mentioned that by communicating with friends using the VHF radios, they could keep track of where the fish were moving and target different areas. One woman explained that people share fishing spots and for her husband "like, if he goes fishing, and somebody's there right at his exact spot, he'll just maybe go somewhere else. No hard feelings" (TUNT-28).

Once fish have been caught for subsistence purposes, they must be processed for long term storage. Many respondents said that the most labor intensive part of fishing is the cutting and preserving of fish. The first steps of cleaning and gutting the fish are the least technical and can be done by men, women, or youth of either sex. However, cutting king salmon into strips or slabs is a practiced skill that is almost exclusively done by adult women (Figures 3-5; Figure 3-6). It is not common for men to cut fish for smoking, although men are usually quite adept at filleting fish for freezing or dog feed. Because salmon is such a valuable resource, especially once processed, adults involve children in the cutting process in a gradual manner (TUNT-5).

The knowledge of how to dry salmon has been passed down through generations, so it is generally done the same way as the past, although a wider variety of methods are employed in the Lower Kuskokwim region today. "Salmon harvested for subsistence use were prepared by a variety of techniques including drying, smoking, freezing, salting, canning, and fermenting in the ground" (Coffing 1991: 114) and still are. One thing that has not changed is the level of attention people must pay to the fish. A respondent described in detail the level of care women put into tending their fish:

> I guess the biggest thing was that they watched their fish carefully, that they don't waste any of it, and once the men bring it home, they have to watch it very carefully, constantly almost and on daily basis. Once they hung that fish up to dry, they would constantly watch it, you know keep it open and one of the things, the stomach part, the fattest part, when it dries up, it likes to shrivel, crimple, shrivel. The women on a daily, regular basis fix up the fish to make sure that it dries properly. They'd hang it a certain way and then the next day they turn it over to expose both - every part of that fish to dry. And then to make sure it doesn't touch any, it doesn't get wet, to make sure that it doesn't get wet once its hung to dry, the women would weave grass mats that when it rained, that they used to cover the fish up. (TUNT-13)

As elders from Tuntutuliak explained, preparing the salmon is an important job that can affect both the future abundance of the fish and the success of the fishers. When elders were asked how they made sure the salmon came back, they reported techniques for proper preparation and preservation of the fish – the respectful treatment already described, rather than fishing strategies that encouraged conservation. Peoples' parents and grandparents have passed down the knowledge that it is crucial to care for fish in the right way, and one woman recalled that "they used to stress since they were the main supply, their only, before the stores, before the freezers, they used to stress the importance of caring for the fish so that they don't spoil, so that they stay abundant" (TUNT-11). Given the amount of fish needed for winter, freezer space is not sufficient, and most fish has to be dried if it is to continue to serve as a primary source of protein.

The fundamental principle of responsible preparation is to not waste fish. Once caught, fish must be worked on promptly. Many women described nights when they cut fish until the early morning hours in order to process the day's catch. Most respondents agreed that sometimes fish could soak overnight, but any longer would result in a compromise in quality. To avoid this, no more fish are taken than can be cut within 24 hours, and usually no more than can be processed that day.

When fish are caught and brought to camp for preparation, they are washed, scaled, gutted, and washed again—usually by children—and then cut by older youths and women. Currently in Tuntutuliak, salmon are cut into slabs and strips. After the belly is sliced, the backbone is cut away from the flesh on each side and the skin can be kept intact (Figure 3-7). The backbones are also cut away from the meat for chum and

Figure 3-7.–Cutting out the backbone.

sockeye salmon, often by less qualified cutters who are learning. Backbones are tied together at the tail, hung, and dried. One elder explained how people used the fish in the past and said in translation:

> They never used to throw any guts out except for that part there. They keep that fish roe, hang it up, dry it up, and the liver they use it for stinkheads. And that thing, the stomach part, the throat part, they used to braid it and then hang it up for dry. They used to hang the hearts, too, dry 'em up (TUNT-6).

Many families still dry the roe and eat the hearts, although it is less common to clean, braid, and dry the stomach, esophagus, and intestines. Many also still make stinkheads and save the liver for that purpose. Most parts of the salmon are still used: dried backbones are consumed by people or fed to dogs; heads are prepared as salt fish or stinkheads for people, or either dried or boiled for dogs. Some people reported eating the skin and often feeding uneaten scraps to dogs.

In regards to preference between cutting strips or slabs, there was a mixed reaction from the respondents to whom we spoke. Both kinds of cuts can be marinated for seasoning before they are hung to dry, but it seems that slabs are the dominant style because they are much faster to prepare. When families are focused on getting enough fish processed for winter it is not always possible to prepare strips (TUNT-26). Strips must be cut and prepared when the fish are very fresh and firm, while slabs "can wait till tomorrow when fish is softer" (TUNT-16). Respondents explained that in the past, slabs were made of king salmon by removing the backbone in order to obtain the whole large skin. The backbone and the flesh were hung to dry, and the skins were used as waterproof material.

> With the king salmon, once they got dried and cured, they'd remove, some, you've seen how they cut the king salmon in slabs, with the whole fish, you know how they dry it. With the king salmon they remove the meat from some of the finished fish, and make baskets. They'd sew those skins together, and they'd put the [dry] king salmon in there and then when it got full they'd sew it, it's all sewed in. They'd put 'em in storage sheds and try to keep some other objects from touching that container so that it won't spoil. So that's what they did with the king salmon. She say the way they cut the fish is similar, but back then since, with the king salmon, back then they used to use the skin for clothing, like boots, waterproof boots, waterproof whatever. The only difference is that back then they would cut them carefully so that they don't damage the skin that they will use for clothing. (TUNT-11)

Figure 3-8.–Plastic and plywood are extremely useful additions to fish camp.

Sometimes people will make a lot of strips and sell them in wintertime, but often people choose not to sell their strips because of the extra work involved (TUNT-23). The sale of subsistence-caught fish is called customary trade, which is defined in state law as limited noncommercial exchanges of subsistence resources for minimal amounts of cash and has been practiced in Alaska since long before statehood (Fienup-Riordan 1986; Ikuta and Slayton 2012; Krieg et al. 2007; Magdanz et al. 2007; Moncrieff 2007; Pappas 2012; Wolfe et al. 2000; Wolfe and Magdanz 1993). One elder woman explained through a translator that while she makes more slabs than strips today, she still enjoys making strips—but only out of kings, and she makes sure to use the whole fish. (TUNT-2)

Another change reported was that a certain technique for cutting smaller chums was no longer used. The technique was described as filleting one side of the small chum and putting slits on the other side. One woman said that when people would catch hundreds of chums for their dog teams, they would cut and dry the fish with the head still on. In the past, people also tied dry fish up in bundles or used bags made of fish skin, whereas today people use five gallon buckets instead of fish skin (TUNT-18).

Once the fish are cut for drying, they are hung on wooden racks built for that purpose. According to several elders, tending to fish was more laborious in the past because the needed tools and equipment were made by hand and had to be replaced frequently. Historically, women wove mats out of grass to protect the fish from the sun and rain and made baskets with grass and fish skin in order to store the fish. Today, tarps and plywood make some aspects of preserving fish easier, but money is needed for their acquisition (Figure 3-8). According to the key respondents, even with contemporary tools and equipment, the process can be difficult because of changing weather patterns—especially in combination with constraints implemented by regulations.

The weather can have an enormous effect on the salmon preservation process, and several respondents explained that this is one reason why there was such controversy over the regulated fishing windows of the 2000s. During the interviews, respondents emphasized that good fish drying weather is breezy, but not too windy, and clear—because the fish will dry much faster on sunny days (TUNT-12). People say that fish preserved in poor weather are definitely of lower quality, and at least one family had some two years earlier that that were so bad they had to feed them to the dogs (TUNT-24). Without an enclosed smokehouse and a constant low fire, fish that are hung in rainy weather do not dry well and can be ruined.

Figure 3-9.–Layers of salt fish in a 5 gallon bucket.

One man explained:

> When weather's bad people even stay out to protect their fish from spoiling—they watch 'em. They didn't have plywood or something on top of the racks, the fish racks them days. They covered the fish with anything they can use to protect them to keep good fish. (TUNT-9)

Drying fish in rainy weather produces an inferior salmon product, and the investment of effort is much riskier. One respondent explained "When the weather is no good, we don't go out fishing. We don't want to spoil the fish from the rain" (TUNT-4). Hot weather is not ideal either. If it is too hot, then the meat can get "burned" and becomes hard and too dry (TUNT-24). As one woman described the difficulties with heat said "when it gets really hot and there's a lot of flies we have to watch, watch the fish that we have and make sure they won't try to spoil them, you know those little maggots. Make sure they don't – we have to take those off" (TUNT-5). Half dried fish (*egamaarrluk*) is sometimes frozen and eaten either boiled or fried in winter.

Drying and then smoking fish is by far the most common method of preserving fish, but alternatives are also practiced. A popular method is to make salt fish (*sulunaq*). Chosen heads or fillets are not smoked at all, but rather are soaked in salt brine before being packed with salt in a bucket where they cure for several months (Figure 3-9). The fish must be soaked in freshwater for several days before eating to rehydrate the meat. It appears that respondents each have their own way of preparing salt fish—in strips or fillets and sometimes with soy sauce—but most use coho salmon.

Another way that Tuntutuliak residents like to prepare fish is to make stinkheads (*tepa*). The heads and certain organs are buried fresh in the ground and allowed to ferment for about two weeks. *Tepa* is usually made of a mix of kings, chum, or silver salmon (TUNT-28).

Salmon eggs, or roe, are also processed for both human and dog food. During cutting, eggs are collected and set aside, and they are later spread out to dry, usually on wooden posts, as shown in Figure 3-10. Over the course of a couple days, the eggs are periodically flipped over to allow them to dry. After about two weeks, the egg sacs are slightly hardened and can be placed in containers but not sealed—today most people use five gallon buckets. The roe is aged and one respondent explained that a wooden stick is used to stir the eggs and avoid rotting. This is done until the roe hardens and can be stored in coffee cans or Crisco cans with lids in the refrigerator. The cured roe can be eaten as is, given to dogs, or used in *akutaq*[9] (TUNT-4). "These dried eggs were known for their ability to keep a person warm during winter. When preserved for dog food, dried eggs were added to fish heads inside a grass lined 55-gallon drum, which was buried (Coffing 1991: 118). An elder explained through translation:

> Sometimes we dry salmon roes. When they have dried … I put 'em in small buckets, for human use 'cause I like. Save 'em for winter, use for dogs or eating in 5 gallon bucket. Half dry it and put it in container. They're like that when they half dry, good enough to eat, salmon roe. Salmon roe we eat, buckets packed up so that they don't spoil. Sometimes when for the dogs we use some of this for the broth, and some of it we eat. Pretty sticky and some people compare it to cheese, but I don't know about that. Very rich. Like peanut butter. Sticks to teeth. You feel full even if you eat just a little bit. When you take it out of bucket, I put 'em in jars, no metal cans. Store 'em in cool, dry place away from sunshine, or put 'em in fridge. Just eat it like that. Kings are fatter than chums, cohos are fatty fish, so we like chums better cause they not as fat. (TUNT-8)

People used to make woven grass baskets or line large 55 gallon drums to hold and store fish, but the transition to freezers has completely transformed this process. The use of the grass baskets and drums has

[9] *Akutak*, otherwise known as Eskimo ice cream, is a traditional dish consisting of a "…mixture of berries, sugar, seal oil, shortening, flaked fish flesh, snow, etc" (Jacobson 2012).

Figure 3-10.–King salmon roe.

disappeared, and as one elder woman said "I did used to know how to make 'em, but right now I never do that" (TUNT-3). "My uncle told stories, like they didn't have freezers back then, so they dug pits underground. He said they used to use fish skins, like sew them up into bags or bag-like, container-like, containers and then you would put them in the fish skin bags and then bury them" (TUNT-28). Freezers became available in Tuntutuliak in the late 1960s, and some say "it really helped… they put everything that they catch in there and take them out and eat them when they want" (TUNT-4). As one elder put it:

> Now that the freezers are in every household, we preserve them in freezer, like in Ziploc bags and put 'em in the freezer to store for long term. During the silver season, we put up silvers, and then we come back and we dig up a hole, like for some folks that have dogs, they put the silver into the ground until they're aged, and then they pull 'em out before the freeze-up, you know, in the winter, like in the fall. Right after the ground start turning, it gets hard, and before the top surface starts hardening up, we pull out the whole fish for dog food or put it in the freezer for food. (TUNT-20)

While the general rules of proper care apply to all subsistence salmon, there are species-specific techniques of processing. King salmon (*taryaqvak*) is the most popular eating fish (Andrews and Coffing 1986:1; Simon et al. 2007:64). "The most hard work is doing all the kings, cause we have to cut the tail off, the head off, the gut out, and I think we work harder with the kings than the chums or the reds or the silvers" (TUNT-7). One woman freezes cut up king pieces in a resealable plastic bag with water inside a coffee can to guard against freezer burn (TUNT-5).

Chum salmon (*iqalluk*) for human consumption are generally preserved in the much same way as kings. One elder mentioned that he likes fish that are starting to look spawned out, where their color changes and their skins are thickened. People make slabs out of them and hang the whole fillets, with backbone attached, with a stick in middle on the skin side to keep it open for drying. Sockeye salmon (*sayak*) are dried in much the same way as kings and chums. Some women reported removing the backbone and hanging the slabs slightly differently than the kings (TUNT-2). Coho salmon (*qakiiyaq*) are not harvested as heavily as they once were, and few people smoke them or bury and ferment them anymore. Instead, people tend to freeze them or make salt fish. Elders explained that silver salmon could also be dried and smoked in the same way as king salmon and stored in fish-skin bags. In the past, silvers were processed in a particular way that would conserve them for a long time and as one elder remembered, "my parents told me that if you put the silvers underground, they never get old. Be edible year after year after year. They were stored gutted, fresh, and whole underground and would be allowed to ferment in ditches for wintertime use for eating and for dog feed" (TUNT-11).

Households often collaborate in extended family fishing groups that tend to be flexible and dynamic. For example, one respondent fishes for his immediate family, his wife's mother and older brother, and his parents (TUNT-21). Young people from all of the families help with the process, including his grown sons who do much of the actual fishing. The cutting and smokehouse operations are done by his wife, his niece, his daughter, and sometimes his two sisters from Bethel on the weekends. Older family members often provide the money for gas. Someone from each family usually helps out, and the fish are divided between families.

It is not unusual for people to split off from their parent's fishing groups when they get married or if they move away, yet some married adults continue fishing with their parents for many years. A married couple may decide to split off if they have a growing family and need a lot of fish, but only if they have the resources to establish their own fish camp. In many cases, leadership slowly shifts from one generation to the next, and families continue to share the financial costs, the work load, and the catch.

Many respondents stated that family members who no longer live in the area return when they can in order to help with the work and get some of the fish. One man explained that "our niece lives in Anchorage, she comes right over here with her kids, and then she's here for the summertime" (TUNT-20). These group arrangements often vary from year to year, with urban relatives participating when they are able, and fishing groups making different arrangements when they cannot. Many people with children live in Bethel and sometimes cannot return for fish camp because of work. Therefore, families team up with each other as members mature and take on different aspects of the operation as abilities change (TUNT-5).

Gender-based divisions of labor have generally been sustained, with children learning the basics of both major skill sets to allow for flexibility as needed. Historically,

> …men brought the fish home by canoe or kayak loads, that wasn't very much fish back then. So what the boys did would help out by unloading the fish, heading, cutting the fish, the head off, and then the ladies would take care of the rest and then once the ladies cut up the fish they (the boys) would do the hanging and they'd hang them up on the racks to dry. The other thing they did was haul the water to fill up that container to wash the fish. So they pretty much were, the boys were pretty much the handlers, the women would be there cutting up the fish, and they would be handling the fish for the ladies (TUNT-10).

Men and older boys were responsible for gathering wood for the campfire and smokehouse, and for maintenance of fishing gear and boats as well as camp infrastructure, such as the smokehouse. Women were the fish processors, and camp cooks and managers. "But other than that they have other stuff to do, like get ready for winter. Even making clothing from animals, there used to be lot of stuff going on. We didn't watch TV or use computer or anything them days. There's always [something] going on. Smoking fish and really take care of them so they won't spoil" (TUNT-9).

Today, the work is divided in a similar manner, with children learning by observation and then helping as they grow and become more able. The fishing itself is still done primarily by men, but a number of women report that they went along and helped when they were younger. Often, while women are busy cutting fish at the waterside, men are nearby working on the motor or the net, or making improvements to infrastructure such as the drying rack. Both men and women fix nets.

Women often contribute financially to the family fishing project, like the men who participated in commercial fishing. One respondent explained that there used to be a cannery that would pick young women up daily from the Tuntutuliak fish camp, so that they could work for a cannery wage while still participating in subsistence fishing. She explained that she worked in the cannery during the week and helped her parents cut fish on weekends. She gave the money to her father, so he could buy gas, food, or other things needed for the family fishing effort.

With years of experience observing and helping, most men were able to take a boat out for fishing alone by their mid-teens. As one man explained, he had been going out in boats probably as long as he had been walking. He described his early fishing experiences through a translator: "When he first started fishing, he couldn't put the fish in the boat. That's why he was saying that he used to bite the fish on the tail, with the help of his hands" (TUNT-18). His father showed him the fishing spots and eventually how to work the boat engine. Several men explained that it was an easy transition to fish for themselves, although one commented that the first time he went fishing alone he had a hard time pulling in the net (TUNT-12).

Women reported learning to cut fish in a very visual manner, watching their mothers, grandmothers, and aunties (TUNT-7). This observation and practice of cutting was a process that culminated in the ability to cut on one's own and work with king salmon. One woman explained that she started cutting fish when she was 5 or 6 years old, and she learned "by watching and my Mom showed me how" (TUNT-27). Another woman explained "I never used to work on the kings because they were too big for me" (TUNT-16). This woman did not start cutting kings until after she was married. Women either start cutting kings in their mid-teens or after they are married, depending on the need in their family fishing group. Most women explained that by the time they finally transitioned to cutting king salmon, it was fairly natural because they already knew what to do, from years of practice with smaller fish.

Despite time constraints, children continue to learn to fish by observation and increasing participation as they learn. Fishers frequently bring children along who are too little to help so that they begin learning by watching. "My granddaughter, she's two, my other granddaughter who will be turning one next month—my oldest boy took them along today. The two year old likes to go out already, so I know they will learn." (TUNT-21).

One man explained that children today take on many of the same tasks that he did when he was a boy. He described how his nieces got involved with fishing over the past few summers. They began with gutting and cleaning the fresh caught salmon, and they watched their mother cut them before hanging them to dry (TUNT-20).

> Parents, they told us, you know, you can learn by watching. And that's how everything I do, I learn by watching. I think it was my dad that was overprotective of me, because we were really close, me and my dad. I figured it was that, he didn't want me to hurt myself. That's why, these guys, I let them do it. I don't try to overprotect them. Learn! Learn something! (TUNT-7)

People are proud of young people getting involved with subsistence salmon fishing. One woman showed a picture of her daughter, who may have been three or four, cutting a chum salmon for the first time. Several respondents said that they celebrate their children's first successes in subsistence activities by throwing parties. These parties are held to mark occasions such as the first time a girl picks berries, or the first time a boy catches an animal such as a seal, a bird, or a muskrat. These parties are thrown by the

child's mother and attended by other women in the village. The hosting woman stands on the roof of the house and throws "towels, cups, anything that's throwable" (TUNT-27).

Many adults spoke of a concerted effort to involve children and grandchildren in the fishing process, regardless of whether they move to fish camp. On sunny days, most boats that go out subsistence fishing have at least one child between the ages of eight and twelve along—old enough to steer the boat while the fisher works the net. Boys continue to become proficient in boating at a young age by fishing with a variety of male relatives, including fathers, grandfathers, uncles, cousins, and older brothers. One woman eloquently summarized the system: "To teach our younger generations, we have to do it with them, to teach them we have to fish. If they're watching us they'll know that's what they have to do" (TUNT-22).

> So, nowadays, people are training the young people. Not everybody, though. Some people are training the young people to put away fish as soon as they can, and they help each other. Like my wife now, we use our grandkids to help us with putting away fish. My grandkids would help me go fishing and, when we come [back], my wife would cut up the fish and have my grandkids hang them on the fish racks. That way the fish is not laying on the ground that long. It's drying as soon as it can. Kids don't mind. Some of them, they don't want to get dirty. But most of my grandkids are good 'cause they're used to it (TUNT-9).

A number of people emphasized that subsistence salmon fishing is a critical means of survival. One respondent expressed that "I hope they continue 'cause without fish, winter time will be hard" (TUNT-12). Other participants in the interviews shared similar sentiments, and one woman explained that her grandchildren start asking about going to fish camp in March, as soon as the weather warms up a little bit. She thinks they will continue going to fish camp "Because it's in them now, they know. Even the smaller kids seems like they know that fish camp time" (TUNT-22). When asked if she felt that less people were interested in processing, the same woman commented that she felt that since her kids and grandkids love eating smoked salmon, they will continue the tradition of drying and smoking salmon. "They love smoked fish, they probably will. My kids, just before in May, they start saying that they can't wait for fresh dry fish—they can just taste it already" (TUNT-22).

One elder captured a common sentiment when he said "It'll be up to them, if they're willing to go or not" (TUNT-10). There seems to be a general reluctance to speculate on the future of subsistence salmon fishing in times of such dramatic social change. "My dad used to tell me, don't say anything that will offend you later on, so I don't like to…" (TUNT-7). One man wondered if the labor intensive processing would continue with the younger generations. "I've thought about it sometimes, these young people might just go out, catch fresh fish, not put away as much as we do. We know that some people will keep going, but I think they're losing interest in putting their fish to dry and smoke. Because I've seen changes, people are not working as hard as we used to" (TUNT-9). Respondents generally felt that it was healthy to go to fish camp and spend as much time outside with the family as possible and hope younger generations continue to do so.

SHARING, BARTER, AND CUSTOMARY TRADE

> There's always someone up there who's watching us, who gave us everything on this earth, and we don't tell anyone not to fish or hunt because everything on earth belongs to the people, everyone (TUNT-8).

Sharing food is extremely common and important in Yup'ik culture (Coffing 1991: 82). Sharing of fish is generally between familial relatives but also occurs within community relationships. When asked if he thought people would share fish with him when he grew old, one man replied, "Yeah, of course. Cause it's no good to crave for fish" (TUNT-13). One respondent and her relatives in Marshall trade fish at the end of the season while another claimed that everyone in town, including the elders, can get the fish they need for the winter through sharing between friends. "When they ask for it we give 'em. Just give,

sometimes they trade" (TUNT-3). Several elders highlighted the importance of not allowing oneself to become selfish with the catch because their generosity will be rewarded. "That's what they tell us. The (elders) say it's because our provider watches us, sees us, knows us" (TUNT-21). People tended to explain that sharing will cause people to be blessed and successful in subsistence activities (TUNT-22). Many respondents shared a view that it is essential to help out people who cannot fully provide for themselves anymore and to always try to include them when there is enough of a resource. One respondent described how he shared fish:

> Even though we have a little of something, when someone asks for something that we have, even though it's not extra, to always try and provide what we can. If someone is hungry or says that they don't have something and I have it, even though it might be the last of what I have, if I have it I can share it. I'm not supposed to say I have it, but it's not enough and be selfish about it. Those are some of the things that they tell us. The more we're willing to share, the more we will have to share. To me it seems like it's true. I see today some people will be selfish of some things, even tools, motors, things like that, and I've seen instances someone will want to borrow something like say a sled and then the owner not let him borrow because it might break, "It's my only sled, you might break it." And then, shortly after that it breaks, and sometimes I think it's because of that selfishness. Some people's equipment lasts longer than some, and it seems like those who share that the most lasts the most. (TUNT-21)

Although some elders noted that sharing seems less prevalent today, they did mention that if the fish start swimming up and people have extra from the winter, they will give fish out to people who can use them or to people who have dogs. Several said that the food stamps probably have something to do with that, but the elders were taught at an early age about helping and sharing, and they were taught from their elders right from the start. There is an understood belief that hoarding fish without sharing with those around you will bring consequences in regards to fishing. "The other issue if you're stingy and don't share, you won't be able to get as much, if you don't share you won't be able to be as productive. The more you share, the more you get. Everybody was taught that right from the beginning" (TUNT-2).

Some respondents referenced a growing feeling that if people keep giving their fish away, those on the receiving end will not learn to sustain themselves in a world with high food prices. "When we have enough, we share them too. But then sometimes you have to think that if we keep sharing them, they won't learn to fish for themselves" (TUNT-22).

The long tradition of bartering fish for other resources was only occasionally discussed, since no direct questions were asked:

> But there was some barter going on them days, too anyway. It's always going on, even nowadays, but now it's not much as it used to be. We traded our dry [fish] for other food them days when I was a kid. There was people all the way from Mekoryuk in the seal boat, they don't even have outboards or motors, there was some people with inboards, but they sailed up here on the Kuskokwim and traded us with walrus skins and dried meat and dried seal meat and other stuff, seal oil and we traded our dry fish for those, and it worked that way. Even us over here in Tuntutuliak we traded our dry fish for seal oil over at Kipnuk because Kipnuk didn't have that much salmon when I was a kid. (TUNT-9)

No direct question was asked about customary trade, either, but it was mentioned that sometimes the more labor-intensive fish products, such as stinkheads and strips, will be made for sale. One man learned to make stinkheads by watching his parents when he was growing up at the old fish camp sites, and continues the practice—in part to earn a little cash:

> I've been doing it since I've learned it. I've been doing it every summer. When 4th of July activities come around, I take some out, and I've been selling one head for $1 a head.

> People come around when they want some fish heads for dinner. Good bestsellers last year. (TUNT-20)

LOCAL OBSERVATIONS OF CHANGE IN SALMON FISHERIES

FISH AND ENVIRONMENT

ADF&G research has indicated that, although declined from historical highs, chum is still the most abundant salmon in the Kuskokwim River. Meanwhile, sockeye salmon ("red salmon") populations, have fluctuated, and king salmon have declined—and even more so since this research was conducted. When people discussed changes in fish run strengths, some found it difficult to judge because fishing efforts have changed so much over the decades, but these findings were generally supported by local observations.

"We don't fish like we used to fish long time ago, now just what we need for winter use" (M. Chris; TUNT-4). That said, there were indeed mixed reactions when it came to fish population fluctuations. Most people have observed fewer fish in the river, but noted that they are still catching enough: "Maybe less fish now, but like I said we have good equipment to do it now with good long nets, good fast motor, to me it's less than before, but we still catch good numbers" (TUNT-9). Some people felt that everything had changed for the worse because of governmental management, but this respondent said that "fish numbers goes up and down. Even I don't blame it on the people overfishing or management; I think it's nature that makes things go up and down" (TUNT-9).

Others point directly to commercial fishing to explain fish numbers and the relative success of subsistence fishing: "Been going up since they stopped using those king salmon nets (8½ inch mesh) for commercial… Now we only take, depends on our families, what we need. Try not to overtake anything cause of wasting. Just take what we need for winter" (TUNT-8). Another respondent said "Well, I know from what I've heard, there'll be times that fish aren't running as much but… we catch enough. So I don't know." (TUNT-5) Still others, elders in particular, felt as though declining adherence to rules of respect and appropriate care were responsible:

> They were told to care for the fish real carefully and with respect and if they don't they will not come back or the numbers will drop. She knows that's true because during her lifetime I guess she's aware of some times where we've gotten careless, the human, the person has gotten careless, and that affects the fish numbers. (TUNT-11)

Fewer near-shore fish and the limits of fishing a very wide river from shore were reported to be partly responsible for the move of fish camps from nearby to Fish Camp Island around 1965, which is about 30 miles upriver.

> When he was a kid when they used to move to that fish camp across the Kuskokwim, the fish at first there used to be abundant fish. Then at some point, they were not as abundant as they used to be. So that's why they started, he doesn't know why the numbers dropped or they became less abundant out there between here the other side where they used to set up camp. So that's why they started moving up to fish camp [to where the river was narrower]. (TUNT-10)

Rivers, especially glacial rivers that transport enormous amounts of silt to the sea, change constantly as beaches develop and cut banks erode. "The river changes, current changes, sandbars pop up, fish maybe change their routes" (TUNT-1). Changes in the Lower Kuskokwim are reported to be extreme, and this occasionally affects fish camps. There are stories of fish camps eroding away. One elder said the old fish camps across from the mouth of the Kinak River "…eroded out in the water, so the river got wider since I was a kid (TUNT-9). A few other respondents explained that a camp used by people from Napakiak was

taken by the river in 2 or 3 summers. One old village site was located on a slough across the Kuskokwim from the Kinak River that has since closed up:

> There used to be a river, probably just as big as this [the Kinak]. When they started moving from old village site to this one right here, most of the time I hear 1945. But back then, there was a small barge that they used when they were moving… They would attach two other skiffs to both sides of that small barge and they would load the houses on that and drive 'em up river. Today that river that they used that was that wide, it's like this. Today it's all land, no more river. And that's all happened within that period…. It is another change, how the land has changed. (TUNT-17)

Describing the affect these shifts have on fish, another responded said:

> When the channel was on the west side of the river there was not too much erosion on the other side. Now the channel is on the east side of the river, Kuskokwim, the main channel, cuts the bank more on that side, and this side is better. So that makes the fish harder to catch around here because of the channel's changing, and we have more than one channel some places. And so we have to look for fish now when we want to catch good numbers. Especially for during the commercial fishing too. I'm a commercial fisherman, too. (TUNT-9)

Water clarity also has an effect on the success of the fish harvest. The same respondent reported that the water surrounding Tuntutuliak is usually quite murky, but sometimes it is possible to see the prop on the motor, which is about a foot below the water's surface. He explained that if the prop is visible it will be more difficult to catch fish, maybe because they can see the net. However, if there are a lot of fish pulsing through it doesn't matter, and the clarity only is an issue when there are just a few fish (TUNT-9). These conditions are probably most likely to exist when the Kuskokwim is low but there has been substantial local rainfall, although this was not discussed.

Many respondents noted substantial weather changes. In general, it was said that summers are cooler and rainier than in the past and that winters are milder – with both warmer temperatures and less snow. These paraphrased translations provide examples of the comments that elders made:

> Today, there's not as much snow as there used to be. There's not much, you know, this spring there was hardly any flooding. Today, because of that, some of the fish, because it is too shallow some places upriver towards spawning grounds… it's getting harder—where some fish are not able to get to some spawning grounds because of the water nowadays, and maybe that's affecting the numbers. (TUNT-17)

> A long time ago, spring time used to be sunny and warm, not like that kind of weather we have now [windy, rainy, cold]. In fall time… winter never used to come that fast, but it do take time to make the trail not dangerous for travel. But when it got cold then it would get cold and make the ice sturdy…. Nowadays when it thaws out, it thaws out really quick; it's harder to travel. (TUNT-18)

Milder winters have also affected ground ice and hydrology. Permanently frozen ground, permafrost, was stable unless the vegetation was disturbed or a heat source was added—as residents of Tuntutuliak can attest:

> He said the elders used to say when you start occupying a certain piece of land that usually happens. The permafrost underground is starting to thaw out when you put a house on it… (TUNT-17)

Water occupies a greater volume of space when it is frozen than as a liquid, so the degradation of permafrost is accompanied by the subsidence of land. Because people used to move around more, related problems were limited to developed areas. However, the loss of permafrost even without the development

of infrastructure has been well documented in recent years (Osterkamp and Jorgenson 2005). Several respondents referred to the land sinking, which can be reasonably inferred as the collapse of thawing ground. For example, one elder respondent noted changes to the local ponds: "I've been subsistence hunting since I was 10 or 12 with a dog team all over tundra. I used to see little islands; they all gone and sink" (TUNT-19). He went on to say:

> Yeah when I was young there used to be lots of water in spring, nowadays not much. We don't have much snow in wintertime like in those days, sometimes when lots of snow, now there is less snow. Way less. When no snow, no water. In summertime when we got lots of rain last year, a little more water came. In the lakes right now, they're shallow because no water. When that happens, less fish in the tundra. On this land, all over AK probably. Used to be smaller lakes in upriver, now it is like an ocean up river lakes 'cause everything sink, after 1964 probably. The earthquake. Lots of cracks all over the tundra…. (TUNT-19)

Respondents in Tuntutuliak expressed a general consensus that the land and rivers are experiencing change, although opinions and levels of certainty regarding the effects of those changes on fish were variable. There seemed to be a general reluctance to predict that environmental change would mean the demise of salmon populations, perhaps because this would be such an unwelcome outcome. Many respondents described a sense that management is part of the problem.

MANAGEMENT

Several respondents expressed frustration with the influx of governmental management along the Kuskokwim River system, and some suggested a link to poor returns. From 2001 to 2006, the ADF&G applied the regulatory strategy of fishing windows for subsistence fishers along the Kuskokwim River (see footnote 5). As an elder female recalled through a translator:

> The abundance seemed good back then, but once the outsiders started dictating their subsistence, it seems that it decreased the number of fish they were able to harvest. Not necessarily the numbers, but their ability to harvest. The worst thing is the windows; it is a bad factor that affects number of fish they are able to harvest (TUNT-2).

There was a general consensus that regulatory fishing windows create a hardship. Respondents explained that windows can force people to fish in bad weather, which makes it harder to dry fish properly. Fishing in rough weather is also riskier and fishers are less likely to take youth along to learn. While the intention was to protect struggling king salmon runs, it was a policy that produced quite a bit of controversy. People mainly aim to fish when the weather is ideal because they want to produce the best possible fish for the winter. Respondents explained that when the fishing windows were closed, there could be ideal weather for fishing and processing, but people were not legally allowed to engage in their subsistence activities. "So during that time when it's open on a rainy day, it's not good for our fish, but then when it's closed and it's sunny, we wish that it was sunny when it was open" (TUNT-22). Another elder described the trouble with windows and weather:

> Even we depend on them for food, even they are our food source, we don't catch them when it's like this because if, you know, if they get 'em when it's like this [rainy] they won't taste as good. Even though they really depend on them, they don't taste good when it's like this. Even though they're still edible, they don't taste as good... It's what we've been hearing all along – we, our people have their own windows. These windows that western culture creates is not [natural]… [Background chatter interrupts] This is what he means [fish cured in damp weather is shown to interviewer]. This is what he means by windows and the weather. See if those regulators can eat that… You want to taste it? [Laughter, talking] It's still edible. It's still good – you know, you won't die from eating it – but, especially the younger generation is not able—they cannot eat that. (TUNT-17)

One man said,

> Some years ago when they had [openings] four days a week, sometimes I saw families go out in what I would say dangerous weather. Probably risking their lives more than they have to. The smaller boats we have, I've seen some boats get swamped, it gets pretty rough sometimes. (TUNT-21)

One elder female recalled that during the windows schedule, her family caught a good amount of fish, but they were forced to start preserving them during rainy weather, and the fish spoiled very quickly. "Yeah, I remember one time the whole fish in the racks was bad, even the strips. Not able to go out and get more fish" (TUNT-15). The 2009 field season when these interviews were conducted saw a lot of bad weather, exemplifying these problems even without the windows schedule.

Commercial and subsistence fishing have different, nearly opposite, ideal weather conditions, which may have aided their integration. Several respondents explained that subsistence fishing requires warm, dry weather because drying fish in wet weather is more demanding, takes longer, and produces an inferior product—if it works at all. In contrast, windy and stormy weather was good for commercial fishing because southern winds seem to drive the fish into the mouth, and therefore boats will catch a lot (TUNT-21). Commercial fishing does not require the extended periods of dry weather for processing, because the fish are sold whole—as quickly as possible.

"We don't bring kids when it's windy or when it's not safe. So we know those windows will probably affect how much we're able to teach our kids" (TUNT-21). There is a sense of acceptance and dealing with the restrictions, although they no doubt make subsistence fishing opportunities more complicated. At the time of this research, people in Tuntutuliak generally wanted to follow the rules and do what they have to get the fish they need for winter. While during the closures, many families were not getting enough fish in the beginning, by the end of the season most people got an adequate supply for the winter (TUNT-18). As one man said about the windows, they are "kind of limited but we manage" (TUNT-20).

Several residents voiced that they would like subsistence fishing to be open all the time because it was better to let the weather make the windows. One respondent said that he guessed the schedule was imposed to make more fish, but people were not given an explanation. This fisher (TUNT-12) found the windows to be extremely inconvenient, which was echoed by many. There was also the sense that people don't believe that subsistence uses are a substantial threat to salmon populations.

As prior to the distinction of fishing periods, some people use the same gear for subsistence and commercial fishing to save money. However, because large size king nets are no longer permitted for commercial use, only the smaller nets can be used for both currently (TUNT-9). Subsistence nets are still unrestricted on the Kuskokwim except in times of conservation. Beginning in 2011 net mesh size restrictions were imposed to allow for continued fishing while protecting large king salmon; subsistence fishers who had only king nets had to acquire new nets to keep fishing at all. Much controversy and some assistance surrounded the expensive replacement of 8 and 8½ inch nets with 6-inch nets – as discussed in the Update 2012 chapter of this report.

Some Tuntutuliak residents wanted to be involved in the decision making process regarding fishing regulations. In their messages to managers, they emphasized that traditional ecological knowledge should be valued as much as the science of ADF&G. Many respondents felt and expressed that people in Tuntutuliak already follow a set of behaviors that help to manage the fish and that "rules or no, everybody I think will continue respect the way of subsistence fishing" (TUNT-27).

The Kuskokwim River Salmon Management Working Group (KRSMWG) was established in 1988 by the Alaska Board of Fisheries with the goals of "managing Kuskokwim River fisheries through consensus (although emergency order authority was retained by ADF&G) and developing a comprehensive salmon management plan for the Kuskokwim" (Ebbin 2002: 158). Most respondents felt that the group has been

helpful in providing a forum for subsistence voices to be heard and for communication and cooperation between upriver and downriver peoples.

The group continues to blend science and fishers' knowledge in fishery administration (Senecal-Albrecht 1998) and this co-management seems to have accommodated various voices and enhanced the opportunities for interested people to contribute and be involved in the decisions along the river. An elder representative to the working group described the process of people with diverse perspectives working together:

> Working Group is, at that time, was different people, and different and they had different…we always have members with different interests, like commercial fishing representative or elder representative, subsistence fishing upriver, subsistence fishing downriver, and all those interests. We were – the first year was good, but after that people started arguing to each other more. Some people want more commercial fishing, and some people want subsistence fishing more. So it was kind of arguing more that time. Then after the working group have not changed too much anymore, the members have not changed more, like it used to them days. So they're learning, we downriver people here, I'm a member here, at the last village downriver, and there's a member at Eek now, same area, and the people all the way to Nikolai – McGrath/Nikolai, and, ah, it seems like it's working good now. We understand the problems upriver, and those upriver people understand what people want down here, too. So it's—they're working more together, and that helps. Not too much argument going. (TUNT-9)

People in Tuntutuliak generally felt better about management because of the KRSWG. Several respondents said they feel more comfortable when they are able to understand how and why the fish are managed and the role of the divisions of Subsistence and Commercial Fisheries at ADF&G. The elder in the working group said "the people understand more because I don't hide anything. I just make reports after I go to meetings. It works out" (TUNT-9). He went on to say: "I make reports when I come back from meetings, and people like that, lotta people like that. Sometimes I make announcement on the radio, or I let the people know what changes there are proposed. I let people know about those, and I don't mind doing that" (TUNT-9).

Respondents in Tuntutuliak recalled stories of the beginning of ADF&G's presence in the area and they consistently described negative sentiments. One elder recalled about her parents that "they didn't like them, the Fish and Games. I think my dad used to say that they're evil or something like. He didn't like Fish and Game. Even for the birds and stuff, not just fish" (TUNT-15). People mentioned missing the days when "they were free" (TUNT-7) and not told by agencies that they were harvesting too much salmon. Yet there are some who seem to recognize the good intentions of ADF&G policies and appreciate management of the Kuskokwim River's salmon. "Some people don't want anything to do with Fish and Game, but I don't mind Fish and Game. They're trying to do their jobs too. Everybody has their job" (TUNT-15). Most respondents felt that ADF&G had indeed changed the way people participate in subsistence salmon fishing. "You know, you hear every day now or maybe during summer time. Fish and Game, Fish and Game this, Fish and Game that" (TUNT-7). The constant monitoring and government presence was described as new with respect to the subsistence lifestyle. Several elders indicated that people do not want very much fish anymore and felt they should be allowed to harvest what they need according to their own schedules and without so much oversight.

OTHER CONCERNS

During the interviews, it became clear that Tuntutuliak residents were concerned with many aspects of salmon runs on the Kuskokwim River. One very common concern among older respondents was the development of the Donlin Creek Mine. One elder explained the main reason that development of the Donlin Creek Mine makes him nervous: "The fish spawn up there, and that's why we don't like that Donlin Creek opening up because that's where the fish spawn" (TUNT-20). Another elder explained that:

> When people talk about Donlin Creek mine and all the cyanide that they're going to use up there, that worries us a lot because we know that other places in the world where they've done mining has eliminated fish from rivers, and that really bothers us. I don't know how things will be if that place gets permitted and they start operating. I don't know how that will affect fishing. Not only the possibility of a cyanide spill or other toxic chemical spill, but the number of barges they say that is going to go up and down the river. Right now they're talking about 200 barges a day. And I don't know what that will do to the fish. That alone, the barge traffic…. (TUNT 13)

Residents also discussed fish farms and overseas salmon influences. One respondent was concerned that escaped farmed salmon might be mixing and breeding with the salmon that return each year to the Kuskokwim River. He explained:

> Sometimes when these ladies open it for drying sometimes there will be lot of milky stuffing in there. When those kind of spots is visible we don't eat those; we just dry 'em up and smoke 'em little bit and feed them to our dogs. That's how we try to affect our health. [He implied that this can happen with kings, chums, or silvers]. Sometimes we just imagine them—our talk is—maybe these are farmer's fish (TUNT-20).

Finfish farming is prohibited in Alaska waters. It is true that thousands of Atlantic salmon, escaped from farms in British Columbia, have been captured in Southeast Alaska fisheries (Morton and Volpe 2002), but no Atlantic salmon have been documented in the Kuskokwim region (T. Elison, personal communication, April 29, 2013).

The incidental catch of king salmon in commercial nets, either in high-seas pollock fisheries, or near-shore or in-river salmon fisheries (described on page 4 of this report's Introduction chapter), is another issue surrounded by frustration and confusion. One man talked about commercial fishing bycatch and said that Tuntutuliak fishers don't throw any fish away (TUNT-8). This comment seemed to be in defense to concerns related to the incidental catch of kings by Kuskokwim commercial salmon fishers. The sale of king salmon caught by commercial fishers on the Kuskokwim River was allowed when mesh size restrictions on the Kuskokwim were first implemented in the 1990s, but the sale of king salmon is now prohibited and those fish are taken home by the fisher or given away.

One respondent commented on worldwide issues that the person perceives are affecting subsistence activities and life in general in Tuntutuliak.

> I've, because of the recent, there's world tragedies, storms, floods, worldwide, natural catastrophes that have been occurring more often recently, I've heard some of our leaders encourage more subsistence activities just in case economy collapses, just in case we're unable to get shipments for our stores. I don't know, it's pretty hard to say how it will be. I've heard it being encouraged more, and I've kind of noticed some younger families are starting to do more subsistence activities. So I think it's, it'll still be nice, it'll still be going on. But like what happened in my past, there'll be improvements, they'll be some good some bad. But I think it'll still be going on, if the species are still around. Like there's pollution, there's activities that continually go on that threaten the species that we depend on, the land those species depend on, the waters the fish depend on. It's hard to say because today there's so much going on in the world that might instantly affect or slowly. For me it's hard to say, but given the species that are available, it'll be happening, be going on. (TUNT-21)

Economic problems hinder subsistence fishing. One man put it this way: "Some people can't go anymore, and they just get to be that way. You know mostly not by choice, can't afford things to fish" (TUNT-21). Fishing gear is better today, but it also is more costly than in the past. Buying nets, gas, and other gear is possible for those who are employed, but they are already working and have to fit subsistence fishing into

their schedules, whereas unemployed residents have the time to fish but not the money for the necessary equipment. Yet, people still find a way to continue subsistence fishing:

> If I'm able to row out to the fishing area I wouldn't need work. With the equipment we have today everything we use costs, especially the gas, or the nets. Just about everything we need costs today. So it's better to work and as for myself, because I work it's harder for me to go out fishing at the right time. But I have others in the family that don't work, so I'm able to buy the gas so there'll be fish in the family. And that's, I'm finding that it's good to have a job and it's good for subsistence. (TUNT-21)

The Yup'ik values of sharing and collaborating are strong in Tuntutuliak and may enhance resilience to the economic challenges posed by declining king salmon populations.

SUMMARY AND DISCUSSION

The benefits of fishing, and the problems of declining salmon runs, are central to any discussion of food security in Tuntutuliak, where salmon have been a primary staple of the local diet for many generations. Concurrent to the decline of king salmon and the heavy restrictions on all salmon fishing that have come with that decline, the reliance of younger generations on salmon has declined. Access to global markets, via storefronts in Bethel and Anchorage and increasingly via the internet, continues to improve.

Today many young people leave Tuntutuliak for education in larger cities, and buy store-bought food instead of procuring wild foods from the land. One woman explained that her younger grandchildren get tired of eating one thing, salmon, all the time (TUNT-2). This influx of non-traditional foods may already be affecting subsistence activities because "…they eat more Western stuff, our grandkids. They hardly eat Yup'ik food—just once in a while. They get tired of Yup'ik foods all the time. They want *kass'aq* [white people] food like chips, pops, or pizza. They crave for them I think. Not like when I was small" (TUNT-15). This comment identifies one major problem with the transition to a store bought diet: generally low quality foods—but there are others, too.

There is a common opinion from the older respondents that it is important to be able to be self-reliant and not depend on the village stores or government aid for food, and therefore survival. One man described the lessons he is trying to impart to his younger family. "Right now like I've been talking to my grandchildren that if they don't fish, if they have no job, they might have no way of buying any food from the store. Don't depend on federal government to grant us the money. Sometimes that's not enough" (TUNT-24). Several elders were worried that some of the younger generations are not learning to fish like their ancestors and that interest in traditional foods is waning. One woman said:

> I encourage the young couples who don't gather fish to start doing it for their selves and their kids. So they'll have fish for the winter and their kids. When starvation comes around, we'll have our fish, how 'bout the store bought food if they can't come to us? They'll starve. But when we know about our fish, we'll be there; we know how to eat 'em. But nowadays some little kids probably sometimes they don't know about the stinkheads or our food. They rather have pizza or hot dog or something. Too bad. They oughta learn about our fish, eat our fish, know our fish. So when starvation comes around, we know how to eat our own fish, our food. (TUNT-16)

Salmon fishing is so important to elders in Tuntutuliak that this was one of the villages most involved with the protests of 2012, described in the Update chapter of this report.

KWETHLUK

Prepared by Seth Wilson

SETTING AND CONTEXT

LOCAL RESEARCH AND RESPONDENT PROFILE

The research conducted in Kwethluk was a cooperative effort between the Alaska Department of Fish and Game's Division of Subsistence and the Organized Village of Kwethluk, the approving agency. Division of Subsistence staff member Amy Marsh traveled to Kwethluk on June 17, 2009. Data collection methods included 16 semi-structured interviews and participant observation in the form of prolonged fish camp visits. Interview candidates were selected by a snowball sampling method. Aided by local officials and one research assistant, knowledgeable fishers were identified once ADF&G staff members arrived at Kwethluk. Those fishers made further suggestions about whom ADF&G staff should contact. Fish camp visits, some ranging multiple days, were arranged with local assistance. After the interviews were conducted, they were transcribed and coded for analysis. Subsistence Resource Specialist Seth Wilson reviewed the findings with the Kwethluk IRA in June of 2010 and conducted additional interviews.

In all, 23 Kwethluk fishers contributed to this chapter of the study. The sample included eleven female key respondents and 12 male key respondents. The dates of birth ranged from 1939 to 1973 with an average age of 52 years old. Five of the interviews were conducted with fishing couples, and three interviews were conducted with fishers over the age of 65 years. All respondents were Alaska Native and longtime active fishers. Conducted by staff members, interviews were taped, transcribed, and analyzed according to subject matter, which included family histories, fishing methods, and traditional ecological knowledge. Each lasted about one hour.

A review of literature relevant to the community of Kwethluk was conducted and will be included for context where appropriate. The most comprehensive study on the people and subsistence harvests of Kwethluk was published by the Division of Subsistence in 1991 (Coffing 1991). The study reports on two years of ethnographic investigations, quantitative harvest monitoring, and land use mapping. The Division of Subsistence conducted a second comprehensive documentation of Kwethluk subsistence patterns in 2010 (Brown et al. 2013). Other important ethno-historical and archeological sources are the works of Oswalt (1980) and Ackerman (Ackerman 1996). Though not used for this study, a wealth of oral history and place names can be found in the ANCSA 14(h)(1) records kept at the University of Fairbanks Alaska and Polar Regions Collection and archives.

HISTORICAL BACKGROUND AND NATURAL ENVIRONMENT

The current town site of Kwethluk, traditionally called Kuikhlogamute[10] is located 11 air-miles east of Bethel and 390 miles west of Anchorage, on the south side of the Kwethluk River and adjacent to the Kuskokuak Slough (Figure 4-1). The community draws its name from the Kwethluk river, the original Yup'ik name meaning "bad river," which refers to the difficulty and dangers encountered in navigating the swift current (Brown et al. 2013). The community has a strategically centered location among the lower Kuskokwim communities and has experienced sporadic growth since the period of contact with Euro-American explorers.

[10] The spelling of ethnographic place names in this chapter were taken from Orth (1967).

Figure 4-1.–The community of Kwethluk.

Kwethluk was incorporated as a second class city in 1975. The city has one mayor and a six-member council. They administer the washeteria and refuse services, a city police force, and a library among other facets of the community. The IRA council oversees one store and meets regularly. Local hospitals or health clinics include Betty Guy Memorial Clinic and k-12 public education is provided at the Ket'acik Aap'alluk Memorial School (ADCCED-DCRA 2011). Kwethluk Incorporated, the ANCSA established village corporation, administers the 12(a) lands selections and also operates an electric generator, providing electricity to the village (Coffing 1991: 38). Kwethluk is not on the road system and relies on air transportation year round. Fuel and supplies are transported via barge in the summer months, and there is a regularly maintained ice road along the Kuskokwim River during the winter.

Located a short distance from the mouth of the Kwethluk River, the Kuskokuak Slough is tidally influenced. As a fishing community, Kwethluk is ideally located. It lies on the Kwethluk River, approximately one mile upstream of its confluence with the Kuskokuak Slough. Local fishers have the choice of targeting salmon migrating up the Kwethluk River or intercepting salmon traveling to nearby Kisaralik River, via the Slough, both major spawning tributaries of the Kuskokwim River. Respondents also noted that the Kwethluk River allows an open water route to the Kilbuck Mountains to pursue other subsistence activities. The soils adjacent to the community are primarily glacial silt and sand deposits and much of the nearby riverbanks are susceptible to erosion. Summer precipitation in Kwethluk averages 16 inches of rain, and winter snowfall averages 50 inches. Summer temperatures range from 42 to 62 °F; winter ranges are -2 to 19 °F. Extremes have been recorded from -46 to 86 °F. The Kuskokwim is typically ice-free from June through October (ADCCED-DCRA 2011).

People of the Kuskokwim River are identified as Augkumiut or Qaqkumiut in contemporary Central Yup'ik orthography (Jacobson 1984: 723), though residents of the lower Kuskokwim River have been referred to as *Kuskuqvagmiut* (or some variation thereof) in prior literature (Pratt 1984: 55), an inland group of Central Yup'ik, historically extending their range as far upriver as Crow Village between Aniak and Kalskag. The inland extension of a coastal group into the Kuskokwim River is unique, and archeological evidence suggests that it began as many as 3,000 years BP (Ackerman 1980: 13). Shaw (Shaw 1998: 242) suggests a more recent timeframe of inland migration, between 1,600 BP and 1,000 BP, based on the development of fish nets as a new technology. Leaving a coastal biome for the riparian environment would have provided hunters a safer lifestyle, subsisting off the regular and abundant salmon runs that surge up the Kuskokwim River each summer (Oswalt 1962: 2).

Earlier written accounts of the settlement of Kwethluk are varied. Iakov Netsvetov, a Creole cleric, was the first to write an account, between 1860 and 1863, of "Kviukgugliugmiut" as a winter village containing 28 residents and 6 dwellings (Netsvetov 1984: 488). The community was presumably growing, recording 75 individuals during the 10th federal census in 1880, and 115 individuals in the 11th federal census in 1890, but collapsed to reportedly seven families after the influenza epidemic in 1900 (Oswalt 1980: 50). Beginning before the 1900s and continuing later than the 1930s, residents of settlements along the Kisaralik and Kwethluk rivers and the lakes located in the mountains began migrating to the current

Figure 4-2.–Kwethluk scene.

location of Kwethluk. In 1939, the community members held stock in 31,000 reindeer and pastured them in the tundra and hills surrounding Three Step Mountain (Oswalt 1980: 50). Reindeer herding is still a source of pride and identity to Kwethluk residents. Many have ancestors who herded the animals or are descendants of the Laplanders who managed them.

The first Russian Orthodox Church was built in 1912 and first school began in 1922. The increase in services offered in Kwethluk enticed further migration to the community resulting in a sporadic population growth. A new Bureau of Indian Affairs school was built in 1940. The community was reorganized under the Indian Reorganization Act creating a federally recognized tribal council (Oswalt 1980: 50). At the time of Alaskan statehood in 1959, the population included 325 individuals. Summarizing the population in 1986, Coffing (1991: 10) wrote:

> There appear to be three primary groups of people that constituted the community in 1986. The first groups are those families who have lived in Kwethluk as long as anyone can remember. The second groups are families who, at the time, spent most of their time living primarily in the foothills and mountain areas east of the community. The third groups are families that have more recently moved to Kwethluk from other communities or from now-abandoned settlements in the lower Kuskokwim River region.

Ever a growing community, Kwethluk is now home to former residents of coastal and interior villages alike, as well as from outside the state of Alaska (Figure 4-2).

Kwethluk is a community with a diverse history and contains residents of backgrounds from within the community itself and the adjacent region. The history of seasonal camp movements, relocation to the region regarding fishing, and commercial and subsistence fishing practices are detailed in the next sections.

COMMUNITY FISHING PROFILE

> We are still doing pretty much the same thing we were doing when we were growing up. Taking care of the fish, getting them ready for the winter, and storing them. The process

> has changed in terms of storing them, but still the gathering of the food and everything like that is still the same. Getting ready for the winter. (KWT-8)

Salmon fishing continues to be an important facet of the lives of Kwethluk fishers. Although respondents assert that the significance of salmon in their subsistence lifestyle remains unchanged, all have noted substantial transformations in the ways that salmon is harvested, preserved, and used. This section describes the historic and contemporary Kwethluk fishing profile, including social organization, fishing practices and salmon harvest levels, through the accounts of Kwethluk fishers.

HISTORY OF LOCAL FISHERIES

At the time of first contact, residents of the lower Kuskokwim River were organized in discreet village groups, ranging between half a dozen to several hundred individuals, and encompassing a number of extended families. During the winter, nuclear families occupied single dwellings in the village settlement, though men typically resided in the *qasgiq* (men's house) and women in the family dwelling (VanStone 1984: 233). Extended family groups would span out during spring, summer, and fall, to seasonal subsistence camps reasonably close to the winter village. These village groups shared a regional confederation, a system of economic and social interrelation (Fienup-Riordan 1984: 70). Trading, and gifting of goods, ceremonial activities, and hosting were all important activities that supported this regional confederation. Salmon were inevitably an important commodity for exchange and fuel for transportation (dog food) in prehistoric times (Zagoskin 1967: 101).

During the summer, extended family groups moved to seasonal camps for the harvest and processing of salmon. It is unclear in the oral or written accounts whether present day Kwethluk was such a site, though it seems likely. Hrdlicka (1943: 309) noted the existence of 10 house pits next to the community. However, no excavation was conducted. In prehistoric times, as now, late run coho salmon were harvested for dog food and cached in earthen pits during the cold fall (VanStone 1984: 214). Fish camps were also located along the Kuskowkim River and nearby clear water tributaries as well.

No question garnered more discussion of the communal aspects of fishing than when elderly respondents described their early recollection of fish camps. In their memories, no two topics are so interwoven as summer fish camp and family bonding. Then, as now, fishing was a time to learn skills and rejuvenate family ties, as the seemingly routine chores of fishing, cutting, wood hauling, and cleaning were performed alongside cherished kin.

Respondent KWT-17 described fishing as a family collective in the 1960s. Lucy, originally from Akiak, 10 miles northeast from Kwethluk, described her childhood experiences in a large camp on the mainstem of the Kuskokwim River. Five families from two different communities with extended kinship ties worked together, sharing use and responsibility of facilities in a single location. The camp as a unit was able to provide the necessary skills to harvest and process salmon for those five families and people they shared with, as well as support two dog teams through the winter.

She describes the men of all the families working together to harvest salmon with gillnets and a number of boats and the women working closely to process the salmon. The camp had five smokehouses; one with multiple stories to smoke and store the salmon for dogs. The other four smokehouses were smaller and stored salmon processed for human consumption. Dried salmon was allocated to all the families at intervals, during and at the end of the season, by the authority of one elder.

Though not questioned as historical patterns of seasonal settlements, the relocation of extended family groups on the lower Kuskokwim River, as KWT-17 describes above may have been the exception rather than the norm in the 1960s. Only three respondents described participating in a "collective," with one located in Napaskiak Slough (KWT-22) and one at the mouth of Kuskokuak Slough. These camps were loosely formed along lines of kinship, but included unrelated individuals, and contained communal processing facilities, ample housing, and many fishers. In the above account, it was the authority of her

grandfather that defined the fishing group more than the ownership of equipment, site facilities, or the fish camp location itself.

In the context of the Kuskokwim River, Kwethluk was influenced by wage employment comparatively early. Its proximity to Bethel and the growing Bristol Bay fishery prompted adult family members to leave the community during the salmon season to earn wages in the canneries. Younger children had to pick up new roles as evidenced in the testimony of our eldest respondent when he took over the fishing responsibilities. He was 20 years old and the only household fisher. "I used to fish with my dad, but when he started going to the cannery….when Bumble Bee was in South Naknek….then I fished with my sister to have someone to cut them up" (KWT-15).

The shift of adult fishers from the subsistence to cash economy required adaptive social structures, especially to meet the persistent demand of subsistence needs. Smaller family based fishing units formed, which consisted of more than one household and spanned multiple generations. This was described by Coffing's research that created a census of salmon production units in Kwethluk in 1986 (1991: 111). Common among these groups are shared, central elements needed to harvest and process salmon: financial capital for gas and nets, human labor to harvest the fish, and processing expertise and facilities to preserve salmon. In addition, as will be discussed below, in order to be successful, salmon harvesting necessitates an immense body of specialized knowledge of harvest methods and processing techniques.

Respondent KWT-21 has been fishing ever since she can remember. At her youngest she had to row the boat as her grandpa would set the net. Then they would exchange, and he would row downriver while she did the more laborious job of pulling the net and picking the salmon. Then they would exchange, and she rowed back up river. Now she fishes with her parents each year. Her niece returns from school in Anchorage each year to help process. Now she prefers to setnet for salmon because neither she nor her 80 year-old father can pull a driftnet. Sometimes, when her eddy is not as productive or they want more strips for canning, she asks her brother's or sister's children to drift for them.

Wage labor was just one change of many that reached the Lower Kuskokwim River in the recent memory of our respondents. Growing life expectancy and baby booms resulted in a changing demographic characteristic of Kwethluk. Early educational opportunities in the area most often meant forced enrollment in a boarding school far from the community, where youth were discouraged, and even prohibited, from returning home for special events or during harvest seasons. New patterns of land ownership, heralded by ANCSA, necessitated a responsive and adaptable salmon harvesting family unit to acquire the season's take. A model of responsiveness is given in the form of one interviewee's account of fish camp. "We used to go fishcamp with them, across from Napaskiak on side of Oscarville, big bluffs. Went out in June … with grandparents. My dad used to work at Bethel. I mostly go with my grandparents … and cousin Paul" (KWT-13).

Two respondents spoke of the privatization of land following legislation such as the Alaska Native Claims Settlement Act (ANCSA) in 1971 and the Alaska National Interest Lands Conservation Act (ANILCA) in 1980. Prior to ANCSA, fish camp sites were occupied and maintained by families on an annual basis with rare debate of rights. Right of use was generally extended to family groups that occupied the site continuously. Respondents noted that the "Westernization" of fish camp site ownership by allocation of personal and village allotments was difficult for Kwethluk fishers.

> It changed over the years. The camps have got smaller and smaller because I think what really screwed us those days was act of Congress…. ANILCA [Alaska National Interest Lands Conservation Act in 1980]. People started fighting over fish camps. Prior to that, prior to 1980, people used to camp out and make their camps where ever they wanted to, as long as they get permission from the core families that use that camp. Now, you have to check your corporation and find out who owns that native allotment. Now they pick on their relatives, and tell them to find their own fish camp spots. It's terrible. (KWT-22)

When telling their personal stories of fishing, Kwethluk respondents organized their lives in two phases: their experiences as youth learning and participating with adults, and as adults assuming the role of managing a camp or family harvesting unit. Personal accounts were generally punctuated by events that let the storyteller assume an adult role either as the lead fisher or decision maker in their lives. This transition was gradual, such as taking over the camp from an aged parent, or sudden, such as the abrupt summer absence of a parent due to employment or sickness. Because most of our respondents were married, almost half of them described their marriage as a key event marking this transition.

This should be no surprise because subsistence harvesting and processing employ complimentary gender roles which will be discussed in depth below. Many middle aged respondents, especially women, noted that marriage brought a change in their fishing social network.

> After I got married, October 1985, following year, I camped with … that was the first time I took care of fish away from my family… with in-laws, and started helping them cut fish. After mother-in-law passed away in 1997, following year was when my husband and I made own camp, away from everybody, and now we're by ourselves. (KWT-8)

> We were married in our twenties. Our current camp was [my husband's] parent's house. Our parents, when we got married, they were pretty old, like 70s, 80s, around there. They were old. A couple years, maybe a couple years, they stopped coming, so we started using this. (KWT-13)

The previous testaments were from married couples in their 50s and 70s, respectively. The passages both portray a gradual process in which the couple moves into the in-law's camp, and eventually takes over the primary duties of processing salmon as their parents age. One respondent described moving to Kwethluk from Nunivak Island after marriage and having to learn very different subsistence techniques:

> When I first got married, 15 years ago, what I did was I watched my sisters-in-law, and my father-in-law cut the salmon … and I just learned by watching, first two years, first year actually. Then I started cutting fish. I had to watch first, because it was my first time watching how they cut fish, how the Kwethluk would cut fish. Very different from what I grew up cutting fish. (KWT-11)

The respondent describes gradually assuming a lead role in subsistence harvesting after marriage. This was a stark comparison to the discussions with some of the younger couples. Younger respondents that discussed marriage and fishing did so in the context of taking up more responsibilities as a couple and increasing their independence in the community. The story below seems to be an increasingly common account of a nuclear family that chooses to maintain a fish camp for one household.

New fish camps have sprouted up around Kwethluk, as the population has continued to grow. One of these camps belongs to respondent KWT-8 and her husband, a young couple in their thirties. She says, "It's very good to have your own camp." She knows some others her age who are also starting camps. "I've seen a few that have their own camps. Or they'd tell me. I'd be happy for them. I'd be proud, and say, 'Doesn't it feel better?' And they'd be like, 'Yeah.'"

They had to be resourceful to start their camp, including buying their own boat and motor. They worked, saved up money, and went commercial fishing. They built the camp themselves. During a flood, wood drifted down from upriver, and they salvaged poles to make drying racks. They cut poles for hanging fish from the nearby trees. Their smokehouse, made of scrap metal, is recycled. "It's old," the wife explained. "It used to be my cousin's. They made another camp of their own, and they left the smokehouse, and I asked for it, and they gave it to me."

Now that she is in charge of cutting fish, she has mainly received advice from her mom. "I look up to her and ask her and she tell me." There are moments when she feels like, "Holy cow! What am I supposed to do, I forgot. Even if it's in my head, I feel like I forgot it, but I'd still ask and they'd tell me, and I'd go,

‘That’s it!’” Alice says she has learned lots the last couple years. “More confident this year than the years before … still learning. … It’s always exciting to come to fish camp to work on fish … how to cut fish and take care of fish and what parts to save and what parts to throw.”

They are raising their boys to be fishermen as well. Their ten year old has been going out fishing with his dad for four years. When he came back with fish this summer, he didn’t say much, just, “It’s good!” Alice laughed, “We’d ask if he caught lots, and he’d say, ‘Yeah, just look!’” The three year old went out for the first time this year. (KWT-8)

The story above illustrates the resourcefulness and hard work a couple is willing to undertake to establish their own fish camp. It also hints at the immense cost, even when the location is provided. A boat and motor is a sizable investment in addition to the nets and gas needed to sustain a subsistence fishing operation. One respondent stated the financial burden this way “It’s expensive to do what we do. We buy gas, we buy the boat motor, oil, fish nets, and it takes gas and money to gather wood for the smokehouse, to keep things going” (KWT-11).

Some people enter into cost sharing partnerships to cope with the increasing prices of starting a camp and maintaining equipment. “When we decided to strike out alone, our grandma gave us a net. And a family offered to go half and half on the share of the catch. One net was too much for one women to cut so we shared the catch with another family. He agreed because he don’t have a king net” (KWT-17).

> Now there is a little break because the motor isn’t working. I mean it’s working, but something’s wrong with it. We just have to wait. When motor is bum, we’d ask, if they’re not too busy, a friend, his friend if they can fish for us. That we could buy them gas, if we had the money. …….Usually when our neighbors don’t have fish, he’d fish for them. He’d ask them first, then they’d buy him gas, and he’d fish for them. So that they could have fish too, as much as we do have, so they could catch up and not be late. (KWT-1)

One respondent commented on the financial partnership she entered with an ailing parent: “She has a bad leg. She was saying that, ‘If you guys want me to go, I’m going to go,” and I said, ‘no, I can do it. You can stay home. You can buy the buckets [for processing *sulunaq* or salt fish], and there’ll be lots. If you buy the buckets, it will be a lot of help’” (KWT-9) (Figure 4-3).

THE COMMERCIAL FISHERY

The commercial salmon fishery has operated intermittently in the Kuskokwim Bay since 1913, long before the memory of the respondents. Prior to 1961, the fishery was poorly monitored, sporadic, and fairly small (Pennoyer et al. 1965: 40; Regnart et al. 1971: 20). During this time, the commercial fishery was primarily limited to 1 or 2 salt fish operations. Larger buyers were short lived until air transport created a demand for fresh salmon to be flown to outside the Kuskokwim area (Pennoyer et al. 1965: 43).

The income from commercial fishing in Kwethluk has markedly declined since 1986. In 1986, Coffing found that 52% of Kwethluk households earned income from commercial fishing in the Kuskokwim River (Coffing 1991: 54). The average household income was $6,814, or about 16% of the total community income. There were 68 Commercial Fishery Limited Entry permits. In 2010 commercial fishing employed 23 households (15%) and averaged $3,304 per fishing household, or about 2% of the community’s total earned income (Brown et al. 2013). There were 50 permits and only 34 were fished in 2010 (CFEC 2012).

About one quarter of the respondents reported that they actively commercial fished. Two conceded that they do not commercial fish every year, though they would like to, due to the high price of gas, low price of salmon, and infrequent commercial fishing openers. Many other respondents reported that they commercial fished in the past but transferred their permit around a decade prior, when the industry began to wane.

Figure 4-3.–Salted salmon, also called *sulunaq*.

DIVISION OF LABOR AND SOCIAL ROLES

Subsistence fishing requires cooperation among various community and family members. The two main tasks of subsistence fishing, harvesting and processing, are generally divided along gender lines. Specialized skills improve with age, and older respondents serve as proficient and wise members well beyond the time when their children take over the most physical parts of the labor. Rules associated with gender are not rigid. Following the flexible composition of fishing units in Kwethluk, men can assume processing roles and females can assume harvesting roles. As one community member poignantly stated, "It depends on what needs to get done" (Kwethluk IRA Council Member, Kwethluk IRA Council, Kwethluk, June 11 2010, personal communication). Rules associated with age and expertise, however, are rigid and those with less experience watch, listen, and wait their turn.

In Kwethluk, the preparation for fishing begins before the first fish arrive. About the middle of May, many families make the initial trip to fish camp to prepare the site for salmon processing. Living quarters need to be cleaned, and the smokehouse gets repaired from any winter damages. Men prepare the fishing gear, which includes mending or hanging the nets, servicing the outboard motor, and cutting wood for the smokehouse. Men also play the primary role in construction and maintenance of fish camp infrastructure such as fish racks, net racks, and smokehouses.

After everything is prepared and the salmon arrive in early June, the men go fishing. Checking and picking the setnets and drifting can take between one and three individuals (Figure 4-4). Though possible, drifting alone can be very difficult because it requires making the set, maneuvering the boat, and picking the line alone while the boat is adrift. Freeing a snagged net by oneself alone is a dangerous prospect.

Most respondents reported fishing with two individuals in the boat, one fisher and a helper. Aside from technological advancements, the act of fishing has changed little from respondents' memories.

> My brothers used to go camp, and they used to go fishing at night, and they wouldn't come back until early morning. They would do how many drifts…and then once they catch enough, then they would bring them up onshore, and then they usually put them in a fish box. And then in the morning when we get up, after breakfast, we'd go out there and start cutting the heads and taking out the guts then start cutting them. (KWT-8)

> We go up there with 3 horse [power motor] and put the net out and keep rowing down, drift down, and when we're ready to put in the net, we'd put all the net in and go up there by boat again and same thing back and forth. Until there's enough fish, we bring them home; bring 'em up and later my mom and the girls start cutting 'em up before they dry. And we hang 'em up, and once they're kind of a little dry, we put in 'em in the smokehouse. (KWT-23)

Figure 4-4.–Checking the setnet early in the season.

As indicated above, the harvest is brought back to the women for processing. Processing was generally acknowledged in conversation and observations to be the most difficult job because of the skill and endurance needed to process the catch. Salmon are brought back and placed in water bins. The salmon are headed and gutted and filleted depending on the final product. Processing techniques will be discussed below. Women have a great deal of autonomy in setting harvest goals and choosing how to process the catch.

> She could do what else she wants to do. If she wants to make strips, she'll make strips. If she want to make king salmon she'll make. Or if she want to cook *sulunaq* [salt fish], the heads, they put them in salt, cut 'em up and put salt … for wintertime, these ladies will hang up, and these ladies will just … gonna wash all these fish. They're the ones. Men, they just help out hang 'em up and cut up the wood ready for smoke, and everything. (KWT-23)

As is hinted in the passage above, the men's role doesn't end at the fish bin. Men ease the burden of work on women during processing by performing the less specialized tasks. They'll head the salmon and remove the viscera, hang the split salmon on the racks, and bring fresh water. Another role that they perform, requiring more skill than might be assumed, is tending the fire in the smoke house.

> Help one another is better. Like when the king salmons are too heavy for ladies, then we both hang 'em. Put 'em in a bucket. There's easier ways like that, more faster, help by doing. I'm not the only one that's been doing that. I've seen a couple of them doing like that. (KWT-23)

The role of youth in the salmon fishing group was indicated by respondents' recollection of their chores at camp when they were young. By their accounts, and affirmed by observation at fish camp, the primary role of children and teenagers is as a learner and observer, secondary to the role of a producer. This role naturally changes to a primary producer as the children grow in strength and experience. Robert Wolfe (Wolfe 1981) found that in Norton Sound and Yukon Delta communities, subsistence output by weight was near zero until individuals reach 25 years of age. Output then peaks in their 30s and slowly tapers. Children are to provide support roles as indicated in the passages below.

> Research Staff: And what was your job out at fish camp [as a child]?
>
> KWT-2: Getting firewood, getting wood for the stove. Hanging fish. Digging, feeding the dogs. There were more chores than nowadays.
>
> Research Staff: Do you remember about how old you were when you started fishing?
>
> KWT-4: I don't … I can't recall … I just remember that we used to just go out fishing with them, helping them out, or just follow them.

When learning to cut fish, female respondents describe first being taught to cut smaller whitefish, trout, and less desirable chum salmon before moving on to larger king salmon. In some households, this would only take a couple of years. However, some women mentioned that they didn't begin cutting king salmon until their mothers retired.

> Since my mom's mom passed away early, my sister and mom used to cut fish all by themselves, and when I was growing up, mom used to tell to watch her carefully and pay attention, so that's all that I did most of the time. Because she didn't want her to do the things that [her mom] did while she was growing up. (KWT-2)

Serving in the role of helper was identified as instructive by many respondents, documenting the passing of knowledge that repeats itself as a generation ages. Two respondents commented on the role of elders in complementary relationship of learner and student:

> Everything. I mean, for my daughter and my son, I'm going to want them to keep doing what I'm doing. God willing, I'll grow old. And I want them to feed me what I love to eat the most, rather than going to the store and buying a can of beef stew. One can get tired of beef stew. One doesn't get tired of smoked fish, no. Life is hard, life will get harder. We're not going to grow any richer, money-wise, so I want my children to know what I know so they can fend for themselves, if they grow old, yes. (KWT-5)
>
> If we keep our mouths shut, they're not going to learn anything. Any kind of stuff. Hunting, building stuff, building house, cut fish, run dogs, or any kind. If you don't talk … if the elders don't talk to them, they're not gonna … if they don't teach them how to do it, they're gonna do nothing. They don't know how to do it. They won't even know how to cut fish or anything. That's how it was. We've got to learn this young generation how to take care of all that stuff. (KWT-23)

Kwethluk residents demonstrate a division of labor in fishing whereby women have relatively high autonomy, and children have long periods of observing fishing before becoming producers.

FISHING PRACTICES

GEAR

Historical methods of harvesting salmon near Kwethluk include gillnets, fish spears, fish traps, and dipnets. Though popular on the Yukon and upper Kuskokwim River, fish wheels have reportedly never been used. Rod and reel fishing has been used as early as the 1950s primarily for coho salmon. This section describes historical gear types and their uses in the waters surrounding Kwethluk.

Many of the respondents recalled the use of fish spears through ancestors that lived along the headwaters of the Eek and Kwethluk rivers in the early 1900s. Spearing was a common way to target whitefish, trout, and even spawning king salmon. The clear water tributaries allowed the salmon to be seen from the water's surface. "And for kings, they preferred spearing them with a line. They spear one and anchor it to a tree with the line. They used to catch lots that way" (KWT-22). Like the bow and arrow, the fish spear has fallen out of use. Only one respondent said that he had heard of this as a means to harvest salmon and freshwater fish in the tributaries, tying babiche rope to the arrows in order to retrieve the salmon (KWT-11).

Fish traps were used in both the clear water tributaries and the murky Kuskokwim River. Fish traps were cited by Zagoskin as being a primary method of harvesting salmon and many freshwater species in the 1800s. Fish traps were fastened to two poles to deploy in the main river and tributaries and were made different sizes to target different species of fish, analogous to the species selectivity of mesh sizes. All respondents knew of fish traps used to harvest salmon, though none reported having observed them. One respondent stated that fish traps to harvest salmon likely fell out of use because of competition with more widely available gillnets around the end of the 19th century (KWT-1).

Very little information was gathered on the past use of dip nets by Kwethluk fishermen. This method, still used locally for smelt in the spring, was once a common means of harvesting salmon on the lower Kuskokwim River, as indicated in historical reports (Zagoskin 1967: 219).

There is no evidence of fish wheels ever being used in the Kwethluk area, despite adequate resources and suitable locations. The researcher asked a couple of people why fish wheels were never utilized in this part of the river. "There is lots of wood here for fish wheel. You just got to know how to make it. My dad made it. He was from Marshall. But he didn't teach me. He made them every year." (KWT-20)

Rod and reel fishing is a recognized subsistence use in the Kuskokwim, but respondents indicated that the method is limited in utility. "Will rod and reel with family for a day for cohos, enough to freeze cohos. Maybe 15 fish frozen for winter" (KWT-5). "For rod and reel they go up the Y or below the Y[11] – anywhere where there is current. People do that here. Some catch and release and some catch to eat. It's more recreation. More fun" (KWT-20).

The use of gillnets in Kwethluk has a long and dynamic history. Gillnets have changed substantially as new materials have become available throughout the past century, and the practice and strategy of deploying them have changed along with the material and other technology. Gillnets, however, are the most enduring method of harvesting salmon, due to their efficacy and availability (Figure 4-5).

Coffing (1991) reports, from his elder interviews, that gillnet webbing was once constructed from coarse fiber twine woven from willow bark. By one account, it was first deployed as a seine, stretching the net over the whole river, one person on each side, in the narrow, clear water tributaries of the Kwethluk and Kisaralik rivers (KWT-13). Sections of caribou antler were used as sinkers and wood was used to keep the net afloat (Coffing 1991: 103). The elder recalled that this webbing may have fallen out of use before 1920, as cotton webbing became more common.

Our respondents could only remember cotton webbed gill nets as being used within their lifetime. These nets were short, rarely more than 20 fathoms. Coffing recounts that nets brought from Bristol Bay were cut in half lengthwise to better suit river conditions (Coffing 1991: 103). The Northern Commercial Store was another local source of commercially produced nets. One respondent recalled the weight and girth of those nets, especially when wet, which made them all the harder to handle (KWT-3). Despite endless care and maintenance of cotton nets, they had to be hung up to dry after each use, and they usually could not withstand more than one season of use, especially when used as a setnet. One respondent recalled that

[11] "The Y" generally refers to the confluence of the Kuskokuak Slough and the Kuskokwim River.

Photo by Seth Wilson

Figure 4-5.–$413.99: The price of locally available gillnets.

they could not afford store bought cotton nets and that his mother made homemade nets of cotton. It would take her all winter to weave one net less than 50 fathoms (KWT-20).

Nylon webbed nets appeared in the 1960s, and had become dominant by the 1980s (Coffing 1991: 104). Light, buoyant, foam corks replaced cedar corks, and individual sinkers were replaced by continuous lead-line. Despite the numerous technological innovations to gillnets, subsistence fishers in Kwethluk still display ingenuity when selecting their gillnets. The researcher regularly observed old jerry cans used in place of buoys and empty single quart oil jugs in place of corks.

By the 1980s, drifting was generally the preferred method of fishing, with 89% of the households using driftnets. In 1986 72% of fishing households used setnets, 90% used driftnets, and the majority of households (62%), use both (Coffing 1991). These ratios are reflected by our respondents, of whom, when asked about primary fishing gear used when growing up, 5 cited using primarily driftnets, 4 used primarily setnets, and 9 used both. Driftnets were used by 63% of the fishing households for harvesting salmon in 2009, as compared to 33% that used setnets (Carroll and Hamazaki 2012a).

Boats are a fixture in any riverine community, functioning as multi-use equipment for hunting, fishing, freighting, and general transportation. Boats and motors were a central topic in key respondent interviews because they have changed substantially over time but still provide the same general uses.

The earliest boats remembered by key respondents were homemade plywood and wooden plank boats constructed from materials bought locally. These boats required a low initial investment but lengthy upkeep.

> When I was a kid we used to have those wooden boats, 20 HP Evinrudes. People may have switched to metal boats because wooden boats you have to scrape the paint and caulk them every spring and then repaint them. Aluminum you don't have to work on them except to fix welds. (KWT-18)

The transition from wooden to aluminum boats was lengthy and relatively recent compared to other fishing technologies. As late as 1986, 55% of boats used by fishing groups were made of wood. The overall majority of boats 20 feet and over were constructed of lumber and plywood for sale locally in Kwethluk or Bethel (Coffing 1991).

> Now-a-days they rarely use oars; it much easier to fish with aluminum boats. The wooden ones were heavy and awkward. They were quieter. And I think they could hold more fish. There are very few people left that can still build one. (KWT-22)

Respondents typically remember their parents using motors to fish in the 1950s. Early motors were rated at 3 horsepower, and as access to larger motors increased, families traded up. Fishers used a combination of rowing and motor powered propulsion to fish in order to save gas and extend the life of the motor. Today motors used are commonly between 90 horsepower and 115. One respondent said he would gladly use a smaller motor for fishing. However, the boat must also serve as the family commuter to Bethel, hunting vehicle, and fishing equipment (KWT-2). Since most households can only afford a single boat and motor, the equipment has to be able to cover all the intended functions.

FISHING, PROCESSING, AND PRESERVING

Preparation for salmon fishing begins early, well before the first king salmon migrate upriver. Beginning in May, fishers make short trips to their camp to repair damages from winter, add new facilities such as a smokehouse or net rack, or cut brush around the drying racks. Those that don't fish from a camp, as with those that do, must service their boats and motors, repair old gear, and buy supplies and spare parts.

There was ample discussion about the use of a fish camp to harvest fish compared to fishing from town. Most respondents referred to the social and quality of life benefits of fishing from a camp. They enjoyed the time spent outside the village to work alongside their family. Older respondents enjoyed carrying on a tradition that has been practiced for time immemorial. When prompted by researchers about the strategic benefits of operating a fish camp, some respondents noted that camps are often closer to setnet locations, reducing the expense of commuting between town and the fishing location every day. Fish camps are also regarded as a more sanitary location to dry and smoke salmon. However, fishing from a camp site was characterized more as a conscious lifestyle choice rather than a strategic means of harvesting salmon (Figure 4-6; Figure 4-7).

During the interviews, respondents generally indicated a preference for owning a fish camp even though it is not an option for everyone. Some respondents that fish from town expressed their wish to one day operate a fish camp, and others said simply that they could not with their current social responsibilities. Respondents cited health reasons, lack of site availability, and family duties as reasons they do not operate a fish camp. However the most salient reason in the key respondent interviews was an obligation to wage based employment, a necessity for subsistence salmon fishing. Respondents that worked reported not operating a fish camp or, more likely, commuting to a nearby camp multiple times a week (Figure 4-8).

The first king salmon are expected at Kwethluk during the second week of June. Some fishers set four inch mesh nets to target whitefishes, and some set their larger mesh nets in anticipation of the arriving king salmon. Other fishers rely on catches from these early nets to know when the run begins, gaining information from word of mouth. When the king salmon run strengthens, fishers face the decision of leaving their setnets in the water to fish, switching to drift netting to harvest salmon, or operating both types of gear. A fisher's choice to operate a setnet or driftnet, or both, depend on numerous variables including run strength, gear availability, and processing capacity.

Figure 4-6.–A fish camp viewed from the water.

In the Kuskokuak Slough, near the Kwethluk and Kisaralik rivers, there are many eddies suitable to deploy setnets. When properly deployed at an eddy, a setnet is a very efficient means of harvesting salmon. Because they require a low investment in time and money to operate, setnets are appropriate for slow periods in a run when there are few fishing closures. "Now they use setnets. It's the same thing as in the past. The setnets get more than the drifting, but if you're lucky with the schools, you'll catch more [drifting], and that's what I used to do" (KWT-2). However the number of good eddies within a community's fishing area are essentially fixed. In 1986 there were 26 documented sites among 52 salmon production units (Coffing 1991: 106). Respondents observed that setnet sites remain under the exclusive rights of one family that use the site annually. Where these rights are not formalized, occupying a setnet site without consent can lead to fierce confrontation.

> One time my dad set a net where he's not supposed to set, and that person brought him to court to take it off….And they went to court and fight over that, and my dad said, "It's anybody's use," and that person "No, it's mine." It don't have no name on there. Court decided to give it to that person, that's where he sets every year. So we took it off and setnet somewhere else. (KWT-14)

Just as with setnets, there are only a finite number of river locations suitable for drift gillnetting. Fishers seek broad deep river channels with no snags. These channels are common knowledge and reserved for common use for all fishers. "And we can go up to Akiak and Akiachak. They are always happy to see us. They just park on the bank and wait till we get half way until they set. Close villages are always happy to see us. We don't fight over spots. Unity is a word for it." (KWT-17)

Figure 4-7.–Basketball court at fish camp.

Coffing shows that in 1986 drifting occurred on the Kuskokwim River beginning below Akiachak extending all the way below the confluence of the Gweek River (1991: 99). Respondents identified additional drift sites on the Kuskokuak Slough just adjacent to the Kwethluk community site not illustrated by Coffing. The researcher and research assistant noted that these parts of the river have been recently widened by extensive erosion.

As with setnetting, fishers drift during predetermined schedules set forth by ADF&G Emergency Orders issued by the Division of Commercial Fisheries. However, as respondents pointed out, these regulatory openings do not always coincide with the peak fishing times. Kwethluk respondents prefer to target the high tide, allowing them to drift longer, save gas, and intercept salmon that move with incoming current. Additionally, as one respondent indicated, fishing on a high tide provides extra clearance from snags on the river bottom. "Sometimes we never get enough fish because of the tide … we miss the tide or before the tide. But when we go out there and subsistence, we hit the tide, we get lucky, get more fish, lots of fish" (KWT-11). Since the time of research, restrictions have continued to tighten for both commercial and subsistence fishing, as described in the "2012 Update," Chapter 8 of this report.

Most respondents asserted that they take adaptive measures to counter the high price of gas. In addition to targeting the high tide and peak of the run to drift gillnet, some respondents said they favor fishing with a setnet as a measure to conserve gas; others seek out partnerships to share the expense. One respondent who could not afford gas during the study year set a king net very close to town. He conceded that he was not catching many fish a day, maybe 5 or 6, but any quantity is a sufficient return for the low expense and

Figure 4-8.–Fish drying rack near the outskirts of Kwethluk.

effort. Another respondent said he would like to return to rowing, as they had done before the advent of outboard motors, but boats are no longer designed for rowing. Many respondents alluded to other families that were not so fortunate and had to cease their fishing effort before they met their personal harvest quota because they could not afford gas.

Kwethluk fishers use a number of methods, some old and some relatively new, to process salmon. Fishers have the option to dry, smoke, freeze, salt, ferment, or can the salmon they harvest from the Kuskokwim River. These processes are described in the following paragraphs (Figure 4-9).

King and sockeye salmon caught early in the season are most commonly cold smoked. Kwethluk fishers endeavor to reach their personal harvest goals in June, so that fish can be processed during the driest weather possible. “In this month, June, it hardly rains, mostly sunny out. Middle of July, we start getting bad weather. That’s when the cold starts coming in, and the weather changes” (KWT-4). King salmon are cut into strips, and sockeye salmon are cut as slabs (Figure 4-10). The salmon, and often their heads, collars, hearts and roe, are moved to a drying rack and left in the open air for about a week (Figure 4-11). Once partially dried, the salmon are moved to the smoke house where a smudge fire of cottonwood or alder is kept to produce smoke. Even after the fish are moved into the smokehouses, the fish still require constant vigilance, especially in wet weather. Care is taken to not get the fire too hot and cook the fish on the rack. One respondent described a summer where the weather was bad, “practically wet all summer long.” She tried to salvage as much fish as she could; in addition to a smoldering smudge fire, she kept a burning fire to heat the smokehouse, which took substantially more wood and attention. Another respondent described how the fish must be wiped down and dried off during wet weather to prevent spoiling:

> When it's raining, we have to dry … and wipe the fish down when they get wet, and we have to constantly watch them so they won't get spoiled. … The fish that we process is priority for us for the winter. It'll be our survival food too … the time that is given to us we try and use as much as possible to save. (KWT-4)

Figure 4-9.–Salmon cutting table with tools of the trade: *uluaq*, sharpeners, towels, salmon, and bug spray.

At this time, some king and sockeye salmon are set aside to be frozen. Respondents believe the advent of freezers in their community was around the 1960s, though the point at which a fisher gained access to a freezer varied for different families (KWT-3). The freezers reportedly made preservation easier and preserve the fresh taste of the salmon. Salmon are processed into fillets and then sealed in reusable quart or gallon baggies or sealed in vacuum sealers. Some of the elder respondents say freezers changed how they preserved salmon, though not how they were stored, as many fishers had access to underground permafrost cellars during their youth. "We had underground … under our house, we had a freezer, ground freezer" (KWT-9).

Chum salmon, which run beginning in mid-June, are less likely to be preserved by freezing. Kwethluk residents historically relied on chum salmon to meet their personal harvest goal for their family and to secure salmon for dog food, when dog teams were a common means of transportation (Figure 4-12). Chum salmon are commonly cut into slabs and hung up to air dry. Once completely dried, respondents reported storing them in buckets or barrels in a cool location.

The beginning of July marks the peak of the chum salmon run for fishers in Kwethluk, and it is also the period where the weather changes. Respondents reported that traditionally the second half of the fishing season was reserved for harvesting dog food. Beginning in July and continuing into August, there are also more flies, and it is when flies lay eggs. Flies can lay their eggs in the fish, especially if the fish is too moist, and this can cause fish to spoil. In June, according to one respondent, "… it's good because the flies will just land and do nothing" (KWT-2). Smoke is also used to keep flies off of fish: "Flies – we smoke them" (KWT-12).

Coho salmon arrive late, after the drying season. Respondents reported that coho salmon were often harvested for dog food. In the cold fall season, fishers only needed to store them in a cool place, such as an indentation in the ground, to slowly ferment then freeze for winter dog food. Coho salmon were also preserved this way for human consumption. A hole is dug in a sandy area and lined with grass. The fish fillets and heads are stored with parts of the viscera and covered with grass and sand. The fermentation process takes about a month. This is still a common practice today and is referred to as stink fish (Figure 4-13). Though fishing effort for coho salmon is minimal, respondents reported freezing or jarring them as well.

SHARING, BARTER, AND CUSTOMARY TRADE

Sharing is an important use of salmon and other subsistence resources in Yup'ik culture, and one that garnered much attention in the key respondent interviews. Sharing, or distributing a finite resource, was often described in the context of giving freely without the expectation of immediate reciprocity (Krieg et al. 2007). In contemporary Yup'ik beliefs this type of exchange has deep implications for the social ties

Figure 4-10.–A family at work processing salmon.

within a community, as well as for the management and long term yield of the resource itself. “And they used to tell us, if you have share, they’ll come in more than before. Or what you share, you don’t run out” (KWT-12). Sharing clearly remains important today in Kwethluk (Figure 4-14).

Within the typology of exchange, the giving of salmon most often described by respondents to this research falls within “generalized reciprocity” (Sahlins 1972: 193). Salmon is most often given without the expectation of immediate return. Respondents often describe distributing salmon to those they deemed needed it most. For instance, one respondent described giving fish to households that lacked the means to fish (KWT-8). Other common recipients are family members who have since moved to urban areas and cannot fish but still enjoy having salmon from home. A number of respondents extended this concept of giving to other resources needed for salmon fishing, such as an old boat, smokehouse, or net. Sharing is an efficient means of safeguarding the food security of the least fortunate in Kwethluk. Salmon were freely given to “…those that came and asked. We already know how it is to have nothing in the freezer, nothing in the cupboard” (KWT-5).

A similar form of exchange is sharing food during meals at one’s house, or in ceremonial events such as a birthday party or memorial potlatch. “The more you give, the more you get, that’s what I learned,” one respondent explained (KWT-20). Hosts of such events share freely of what they have caught in the hopes that more will return in the future. Sharing in both scenarios is a method of ensuring the salmon return every year.

Figure 4-11.–Hanging roe to dry.

As described earlier, often families or individuals will cooperate to harvest and process salmon by sharing boats, nets, fish camps, labor, gas, or money. Sometimes this can happen very informally, but there is the expectation of receiving a portion of the harvest. For example, a female respondent reported obtaining salmon by helping another family process salmon. This act came with expectation of receiving a return for her labor into and can be described loosely as "balanced reciprocity" (Sahlins 1972: 194).

"Balanced reciprocity" indicates a direct exchange with a balanced value. In regulation, this is regarded as barter or, if cash is involved with the small exchange, customary trade. Respondents understood the term barter as a calculated exchange for something other than money and indicated that it rarely happens inside the community—reciprocation between locals is generally not calculated and does not occur immediately. Rather, barter of subsistence foods occurs between two households of different communities that do not share the same resource base. For example, the husband of one respondent barters with a family that lives on the coast. When that family wants salmon they send coastal goods such as herring eggs, seal oil, or seal meat to which they do not have access in Kwethluk. He arranges the exchange, and she sends them dry fish. Another respondent has taken salmon to Anchorage and exchanged it for groceries. All respondents that mentioned bartering stated that they do not harvest salmon specifically for this intent, and that haggling over value is viewed as disrespectful.

A second form of balanced reciprocity is the direct exchange of fish for money, referred to as customary trade in regulation. No respondent reported having exchanged salmon for cash themselves, but two alluded to the sale of subsistence salmon via the bulletin board at the local store. "And there are some families that do sell their fish—at the stores I see people advertising that they're selling fish for extra

income. Mostly families that … are not working" (KWT-2). They note that families need to make ends meet and do not see the exchanges as either commercial activity or a threat to the resource. A number of respondents, while speaking of exchange, noted that they do not intend to profit financially from the salmon they harvest. Instead of accepting cash for salmon, they accept gas or groceries, items that have a fixed value.

SUMMARY OF 2010 SUBSISTENCE HARVEST SURVEY DATA

In April of 2011, researchers from the Alaska Department of Fish and Game conducted thorough survey research in Kwethluk to document the 2010 harvest of subsistence resources, land use, and traditional ecological knowledge (Brown et al. 2012). The study was funded by Donlin Gold LLC and filled large data gaps, since no comprehensive survey of Kwethluk's subsistence patterns had been conducted since Michael Coffing's work in 1986. This section reviews basic demographic data and the findings related to salmon use and harvest.

Researchers surveyed 93 of the total 155 households (60%) in Kwethluk. The study estimated 713 individuals living in Kwethluk, as compared to 721 according to the 2010 U.S. Census. The population has steadily increased, approximately doubling in size since 1960. The average household size was 4.6 occupants, and the mean age was 28 years old. The gender ratio is fairly even, with 52% of the population male and 48% of the population female. Respondents also reported sources of income. They indicated that commercial fishing contributed an estimated $76,000 to Kwethluk and employed members of 23 different households out of a possible 155.

Figure 4-12.–Fish camp dog.

In 2010, salmon was harvested by 70% of households and used by 98%. Salmon was distributed via exchange to those households that used but did not harvest (28%) salmon. An estimated 19,347 individual salmon were taken by Kwethluk fishers, which contributed 121,514 lb of edible weight to the community's subsistence yield. King salmon was the highest harvested species (5,459 individuals, 51,525 lb), followed by sockeye (5,332 individuals, 26,871 lb), chum (5,230 individuals, 26,590 lb), and coho (2,967 individuals, 15,689 lb). The survey also documented 358 pink salmon harvested (839 lb). Both coho (312 individuals) and chum (245 individuals) salmon were harvested in limited amounts for dog food. Approximately 23% of the pink salmon harvested were given to dogs, the highest proportion of any salmon harvest. Approximately 3,563 lb of salmon were harvested for dog food. Subtracting this from Kwethluk's salmon harvest, the mean average per capita consumption of salmon was 165 lb per person. However, some of this was likely exchanged outside the community.

The most common means of harvesting salmon was by subsistence drift gillnet, which took 64,385 lb of salmon. These fish included an especially large proportion of the king salmon. Subsistence set gillnets harvested 36,468 lb of salmon. Fishers participating in a commercial fishery are allowed to remove salmon for their personal use, and this accounted for 19,533 lb of salmon harvested. This harvest was likely taken by drift gillnet. Lastly, rod and reel accounted for 1,127 lb of salmon, most of which was coho salmon.

Salmon fishing areas were concentrated along the Kuskokuak Slough and the Kwethluk and Kuskokwim rivers. Families also reported traveling to harvest salmon near the communities of Napaskiak,

Tuntutuliak, and Quinhagak. Respondents also reported rod and reel fishing for coho salmon south of Three Step Mountain.

To put these numbers in context, households assessed their 2010 harvest and use of salmon as relative to previous years. 51% stated that they got enough salmon, via exchange or active harvesting, for their household and 45% reported that they did not. The remaining 5% either did not respond to the question or did not use the resource. Sixty-six percent of households reporting the use of salmon reported using less salmon that same year and 23% reported getting the same amount; only 9% said they used more than they had the year before.

LOCAL OBSERVATIONS OF CHANGE IN SALMON FISHERIES

FISH AND ENVIRONMENT

Respondents described how fishers employ a practiced knowledge of the local environment to anticipate the arrival of the salmon runs and how those runs will develop through the season. In a study of Traditional Ecological Knowledge (TEK) in the Yukon River drainage, Moncrieff and Klein (2003) found that fishers implicitly separate their observations of natural phenomena into either causal or correlative indicators. There are those observations that are predictive to phenomena and those that correlate with phenomena.

Figure 4-13.–Salmon heads buried in a grass-lined pit for later consumption.

Key respondents made many references to the wisdom and ability of their ancestors, and recent elders, in accurately predicting the timing and magnitude of the salmon run. "I couldn't predict like the old people. The way they used to predict… I've been watching, but I've still never understood how they did it" (KWT-2). Respondents often lamented that they themselves could not make such predictions with exactness. "Only a few people around our area have that knowledge. My grandfather knew where the salmon went" (KWT-19). Another respondent indicated she had some knowledge of natural indicators to the salmon run, which was taught to her by her elders.

> Yeah, sometimes I do hear that. When there is a lot of snow, lot of mosquitoes flying around, they say that there'll be a pretty good run this year. The first time I heard about this, it was all … it was windy from the West most of spring time and then this elder told me when it's like this, when the wind is from the West, too much, he say the run will be short … or else they might be going fast, passing by fast, and then the way that story goes is the weir in Holitna … has already got its quota. … Going fast. (KWT-4)

Still relevant and useful to Kwethluk fishers, TEK must adapt to and operate in an increasingly complex environment. Fishers also use formal management assessment projects and predictions to gauge their own observations and knowledge, as in the passage above. In addition to using natural indicators on predicting the run timing of salmon, they now turn to Lower Kuskokwim River fishing reports from friends and ADF&G assessment projects. "We used to see the river full of fish year after year, but now we wait until people call us from Tunt or Bethel, and we know that in the next day or two they will get here" (KWT-22).

Though fishers use more tools by which to assess the run, respondents recognize that there are more risks posed to salmon, particularly king salmon, than in earlier years, as evidenced by diminishing abundance and smaller sized salmon compared to earlier generations, as observed by contemporary fishers. Respondents spoke of human activities that depleted salmon. Environmental degradation, such as the *Exxon Valdez* oil spill and past and current mining practices in the Kuskokwim River Drainage are seen as having a long term effect on salmon.

> What I noticed was that we used to catch kind of big kings when we're growing up, like around 80s they were getting smaller. It seems to me after the Exxon Valdez Oil Spill, it was like fish crashed. And it hasn't been like before ever since. (KWT-4)

Many respondents also attribute the decline in salmon abundance to large scale interception, referred to as "high seas fishing."

Key respondents also discussed in-river conditions. Erosion was an often mentioned occurrence that has changed fishing practices as well as affecting the fish and boating traffic.

> The vegetation is eaten away by erosion. The small fry they go up the rivers and swim on the sides. Now we have jet boats that go through shallow waters. They chew up the small fry, and the wakes affect them as well. There are jet boats going up the Kwethluk River. (KWT-19)

The prospects of Donlin Creek mine prompted two respondents to voice their fears about chemical contamination in the watershed. "One thing that I'm worried about is that mine up there. It might affect the fish if that … cyanide, whatever it's called, gets in the water. Or if mercury gets into the water" (KWT-7). "I told my wife, with Donlin Creek going on, if there's something happen, I tell her, our kids won't be doing the same thing we're doing now" (KWT-4).

MANAGEMENT

Management is not a new concept to subsistence fishers on the lower Kuskokwim River. Traditional self-management was historically practiced by autonomous extended family fishing groups as described above (see "History of local fisheries"). Large scale fishing for export, very early in the 20th century, however,

Figure 4-14.–Hanging salmon to dry. Slabs are on the right, strips in the middle and roe in the background.

prompted externally imposed regulations—as described in the introduction. This opened the era of professional fisheries managers, harvest quotas, allocation, and eventually open and closed windows of opportunity for fishing (Wolfe 1981: 102).

Traditionally, success in harvesting was less a factor of learned skill and knowledge of the natural world and more a factor of proper behavior in the human and natural domains. Wild resources are more likely to allow themselves to be taken by harvesters that act honorably and without offense. Following this, one harvester's success does not necessarily diminish the success of another. Fishing, and in general resource harvesting, was not typically characterized by competition between a resource user and their game or a resource user and other users. Rather it is a relationship culminating from the proper respect and use between the user and the resource (Hensel 1996). Respect was reflected by respondents insomuch as the resource is used, and the waste of harvested animals avoided. "If you keep hunting fish down river there'll be more fish every year.…… More fish you get, more fish every year" (KWT-23). "They say, if you don't take care of them, they'll be no more fish" (KWT-6).

When asked how regulations affect subsistence salmon fishing, respondents overwhelmingly expressed a strong denunciation of the closures and restrictions on subsistence fishing. In that year (2009) and for most of the prior 10 years, a 12 day closure beginning June 4 and ending June 18 had been implemented to protect the first pulse of king salmon. This subsistence salmon fishing schedule has its origins in the *Kuskokwim River Salmon Rebuilding Management Plan* (Rebuilding Plan) (5 AAC 07.365), which the Board of Fisheries (BOF) put into place in 2001 following steep declines in king and chum salmon

returns to the Kuskokwim River. The fishing schedule is intended to spread the fishing effort over mixed stocks destined for multiple tributaries. Respondents assert that the schedule forces them to expend more effort to harvest the same amount of salmon as they normally would.

Generally, it is unclear from the interviews whether or not the respondent was also referring to the subsistence closures that occur 6 hours before, during, and 3 hours after commercial fishing openings in District 1. One respondent said: "Some people would be commercial fishing and the others would be subsistence. Nowadays, subsistence being closed before the commercial fishing. That's a big turnaround. The majority of the time, I don't like it" (KWT-2).

All respondents view the subsistence salmon fishing closures as hindering their ability to achieve their annual harvest goal. Subsistence harvesters generally seek to optimize their efforts while fishing (see Gear, Fishing, and Preservation). Fishing during the periods of high salmon abundance (i.e., the peak of runs, incoming tide, less fishing competition) yields a high harvest for the amount of time and money spent fishing. From a fisher's perspective, imposing arbitrary fishing schedules thwarts this basic principle.

> They'd open them when the fish would have passed, so we'd have to spend some more on gas just to be drifting … I mean, ever since they started regulating it, there would be times when I'd have to be out there and drift all night long … all night long, and come back the next day, having spent that much gas, getting the amount [of fish] I would like to have in my smokehouse. (KWT-5)

The respondent argues that subsistence fishing windows are a useless hardship. All families strive to harvest a determined amount of salmon during the season, and then they quit fishing. The basic tenet of Yup'ik self-management is not to waste, and not overharvesting the resource is a cornerstone of this rule. Because this belief is so widely held, respondents view externally imposed fishing restrictions as an ineffective conservation measure.

> Wouldn't matter whether it's closed or not. We fish until we know we have enough, then we quit fishing. So it's not going to matter. … the amount of time I spend out there getting the amount of fish for me to see it's enough … even if they didn't close it, I would see that amount of fish, and then I'd quit. So it wouldn't have made no difference. It makes no difference whether they close it or not. I'm going to get the amount of fish I know is going to keep me until next year. (KWT-5)

In the practical experience of fishers, much more gas is spent attaining their harvest goal when closures inhibit their schedule. "I didn't like it when they were doing those closures, when you had to fish at a certain time because usually every day we try to take care of our fish, try to get everything done. And those closures kind of like delayed everything" (KWT-8). The closures, in effect, lengthened a family's fishing season, forcing them to reallocate time to harvesting and processing rather than to other obligations. "It affected me because I was working. I was trying to get to my quota. I had a hard time because I worked, because of that on and off closure, it really slowed me down. Really affected me" (KWT-3). From the perspective of an economy of scale, it is far easier to harvest, process, and smoke a large quantity of salmon at once than to tend to small quantities at a time over a long period (Figure 4-15). The burden of tending a smokehouse is multiplied when the weather sours and flies arrive in July and August, prompting spoilage.

> We couldn't go fishing on times that we wanted to go, so we had to wait … We didn't like it. I didn't like it because I wanted to get done at a certain time. I wanted to make sure that all my fish were cut and they were drying and starting to smoke before July. I don't like to take care of fish in July because of flies. That's when flies are laying eggs. (KWT-8)

Figure 4-15.–Tending to the smokehouse fire.

While current management practices, such as fishing windows, are somewhat unpopular among Kwethluk residents, people have adapted over the years and continue to harvest enough to meet their needs.

SUMMARY AND DISCUSSION

Kwethluk respondents eloquently described the role subsistence plays in their life. The majority of respondents immediately mentioned survival and the importance of salmon as food. For instance: "It's really important for us because it's our main food. We grow up, since I was small girl, same thing with my kids, that's our main food.… every day during the wintertime, always on the table, every day. Lunch, supper, lunch, supper, every day" (KWT-12).

> God created them for everybody to use for survival. My mom used to say that what you can gather from the land and the water, you harvest them as much as possible. When your stomach is empty, you're hungry, and you're sad; you get sick easily. While they're still around, or available, you harvest them … for yourself and your family. It's what we survive on. (KWT-16)

Some respondents spoke of the sense of identity that the salmon fishing brings. It is a defining act with near universal participation throughout the community and through family lines. It provides a tangible association to their ancestors:

> It has been going on and going on, and it's our way of life. That's how we got food. And it's been going on … for maybe even before my great-great grandparents were living, that has been going on. And it's still going on, and hopefully my grandchildren will carry it down too. It's our way of life, passed on from generation to generation. (KWT-7).

One respondent illustrated the importance of fishing as identity by speaking of the personal ramifications of its absence:

> It's our life …. It's the core of our being. If we don't have dried fish, if we don't collect the fish or prepare them, like I was telling my workmate when we first started cutting fish this year … 'It's … very important for me to cut fish, to gather fish, to cut them and prepare them. If I don't, then I'll feel empty and worthless.' … My life won't feel fulfilled if I don't cut fish. In my lifetime, I did not cut fish two or three summers, and I felt so empty because I did not get to cut fish. It's a very important part of our life, to gather and cut fish. (KWT-11).

During the interviews, respondents enumerated many perceived threats to the viability of the subsistence fishery. In a number of instances, respondents asked the ADF&G researcher whether or not Kuskokwim area managers will reduce the number of salmon, in future seasons, that people can harvest (KWT-6). There is often the perception that restrictions on the subsistence fishery are an issuance of blame for a poor return of salmon. One respondent acknowledged that there are many stakeholder groups in the Kuskokwim salmon fishery, but interpreted restrictions on one group rather than another as an implication of fault.

> They are kind of interfering with how we fish. Subsistence fishing should not be too regulated like they are trying to do. Setting days, hours, methods…They are kind of infringing upon your own right. It's like a no-no to us…. We had windows in the past because a concern about adequate fish returns to spawning grounds. We had those days and hours. Our main concern was to have an abundance of fish later on, but actually high seas trawling is having impact on our subsistence. But it's not our fault. We shouldn't be the ones to be blamed for our subsistence fishing. (KWT-18)

As indicated above, user conflict was typified as occurring between Kwethluk fishers and intercept fisheries. Respondents often referred to the Bering Sea trawl fishery, as well as the Area M/False Pass fishery as detriments to Kuskokwim salmon.

The largest barrier to participation in the subsistence fishery remains the high price of gas. Respondents described creating partnerships to pool resources to fish, such as nets, and described making the long-term investment in boats and motors. However, gas remains as a constant expense to subsistence fishers, and the lack of wage based employment in the community means fishers have to carefully meter their use of gas. As discussed earlier, some fishers quit early because they lack access to fuel.

Salmon continues to be an important resource for those families that have lived in Kwethluk for ages, and for those individuals that have moved to the community in recent years. It is used for personal and family sustenance, exchange and gifting, and to affirm personal identity and communal well-being. Particularly important is king salmon, of which harvest levels have remained steady over the 10 years preceding the research, varying by as little as 17% (Brown et al. 2013). Between 2000 and 2010, king salmon was consistently the most harvested salmon, averaging 5,892 fish per year by the community. Kwethluk respondents often expressed strong determination to attain their personal harvest goal each year in spite of restrictions, late runs, equipment malfunctions, and poor weather.

KALSKAG

Prepared by Andrew R. Brenner

SETTING AND CONTEXT

LOCAL RESEARCH AND RESPONDENT PROFILE

In June 2009, ADF&G Division of Subsistence researchers documented ethnographic information on Kalskag subsistence salmon fisheries. Researchers used participant observation and also completed 18 semi-structured interviews, each averaging around one hour in length, with 21 Kalskag residents. Eleven men and 10 women were interviewed. Respondents represented various ages, ranging from 23 to 79 years old. Most interviewed respondents began actively participating in salmon fishing activities as children and had fished for much of their lives.

HISTORICAL BACKGROUND AND NATURAL ENVIRONMENT

Upper Kalskag, known locally and referred to hereafter simply as Kalskag (Qalqaq in Central Yup'ik, Jacobson 1984), is located on the north bank of the Kuskokwim River, about 2 miles upriver from Lower Kalskag and 30 miles downriver from Aniak. The 2009 estimated population was 196 individuals (ADLWD 2012), the majority of whom are Alaska Native with predominately Central Yup'ik heritage. The climate in Kalskag is continental with influences from the Bering Sea, and temperatures range from -55° to 87° F (ADCCED-DCRA 2012). Kalskag is accessible by airplane year round, by boat during summer, and in winter months by snowmachine or by automobile via an ice road on the Kuskokwim River that (depending on ice and weather conditions) extends from below Bethel upriver to Aniak. The Kuskokwim River is generally ice free from mid-June through October (ADCCED-DCRA 2012). A short gravel road connects Kalskag to Lower Kalskag, and the Kalskag airport serves both communities. Kalskag and Lower Kalskag are the most downriver communities in the Central Kuskokwim region, and as such have many connections to the lower Kuskokwim River region. Kalskag is located near the intersection of large expanses of tundra characteristic of the lower Kuskokwim River region and boreal forest typical of the central Kuskokwim River region (Mason 1972: 18–19), and is located along the boundary between game management units 18 and 19.

While archeological information from prehistoric times in the immediate vicinity of Kalskag is limited, it is estimated that Yup'ik people have inhabited the surrounding region for many generations (KPMC 1991: 1). Kalskag is located at one end of a traditional and important portage route between the Kuskokwim and Yukon rivers (Sverdlov 1994: 181), and as such has likely been inhabited since very early times. The Russian explorer Vasily Ivanov provided one of the earliest descriptions of this route as he travelled from the Kuskokwim River to the Yukon River using the portage in the 1790s (Sverdlov 1994: 182). In 1843, Russian explorer Lavrentiy Zagoskin noted the presence of a village, "*Kkhalkagmyut,*" near present day Kalskag and Lower Kalskag (Zagoskin 1967: 249). The first U.S. Census to record Kalskag's population occurred in 1880, estimating that 106 people lived in a community recorded as "Kaltkhagamute" (Petroff 1884: 53) that likely corresponds to Old Kalskag, a settlement that existed between 1900 and 1910, before relocation to the present day (Upper) Kalskag village location (Oswalt 1980: 72).

The Kuskokwim drainage experienced a minor gold rush between 1890 and 1910 (Brown 1983: 100–106) and large numbers of stampeders probably crossed the summer portage between Russian Mission and Kalskag during this time period (Brown 1983: 433). Various Euro-American missionaries, prospectors,

and miners from outside the region began to have an increased presence in the central Kuskokwim region in the late 19th century (Brown 1983: 71–80), and Kalskag residents probably had fairly regular contact with these outsiders as they travelled through the area. In the early 20th century, reindeer herding was widespread in western Alaska, and Kalskag residents owned a herd of around 2,100 reindeer during this time period (KPMC 1991: 35). By the 1930s, a general store and federal Bureau of Education school were established in Kalskag (KPMC 1991: 35). Around this same time period, Lower Kalskag, previously a summer fish camp location for Kalskag residents began to be occupied year round as a permanent community when some Kalskag residents relocated "at least partially due to religious differences" (Oswalt 1980: 54). Upper Kalskag was incorporated as a second class city in 1975 (KPMC 1991: 36).

Many Alaska Native residents are shareholders in the sub-regional Kuskokwim Corporation[12] (TKC) and Calista Corporation, the regional corporation for much of the Kuskokwim River, lower Yukon River, and surrounding areas. Since early times and into the present, Kalskag has had a mixed subsistence/cash economy with heavy reliance on wild foods supplemented by income from government employment and assistance, seasonally available jobs such as firefighting, and limited mining, trapping, and commercial fishing.

HISTORY OF SALMON FISHERIES

EARLY HISTORY

Salmon has long been a primary component of the subsistence harvest throughout the Kuskokwim River drainage. Before 2,400 BP, groups ancestral to the current inhabitants of the Kuskokwim River drainage likely harvested salmon primarily with fish spears and traps. The subsequent development and increased use of more efficient fish nets for harvesting salmon around 2,200–2,400 BP likely accounted for a marked increase in the human population of the Yukon-Kuskokwim Delta region (Shaw 1998: 242). Predictable salmon runs, together with the development of this new and more efficient salmon harvesting technology, likely represented the key factor in the settlement of inland riverine environments such as the area near Kalskag by more coastal groups in ancient times (VanStone 1984: 207).

Upon contact with Russian explorers and fur traders in the early 19th century, residents of the central Kuskokwim River region maintained semi-permanent residence in winter communities while travelling throughout the area to harvest locally abundant wild food resources including salmon (Oswalt 1967: 88–89). Salmon fishing typically occupied the summer and provided food supplies on which families relied throughout the winter. Residents of the central Kuskokwim River also hunted and fished for food during winter to a greater extent than neighboring groups downriver (VanStone 1984: 231–233). Increased Russian demand for beaver pelts and other furs in the early to mid-19th century led to increased trapping activity during winter months (VanStone 1984: 237), and it is possible that increased needs for dog food to support trapping efforts led to a greater reliance on summer salmon fishing and dried salmon during winter months.

EARLY 20TH CENTURY

Several historical events in the early 20th century likely influenced a change in salmon fishing patterns in the area around Kalskag that resulted in more salmon harvested in shorter periods of time. Fish wheels, which enabled more efficient salmon fishing than previously used hand-woven gillnets and fish traps, were introduced to the Kuskokwim River around 1910 and rapidly became widely used for subsistence salmon fishing in Kalskag and communities further upriver. Around the same time, several minor gold rushes on the Kuskokwim River led to increasing contact between residents of Kalskag and prospectors from outside Alaska (Brown 1983: 103–107). The increased efficiency of fish wheels relative to past harvest methods may have enabled some residents of Kalskag to seek employment in local mining

[12] The Kuskokwim Corporation was formed when 10 Alaska Native Claims Settlement Act (ANCSA) village corporations located in the central Kuskokwim River region merged in 1977 (http://www.kuskokwim.com/content/about-us).

operations and Bristol Bay salmon canneries rather than spending the entire summer securing a supply of salmon for personal consumption and dog food (Brown 1983: 147).

Commercial salmon fishing for export at the mouth of the Kuskokwim River (Kuskokwim Bay) began in 1913 (Brown 1983: 147). Salmon populations were likely impacted in the early 20th century by commercial fishing, and the general influx of outsiders into the region probably led to a decline in populations of game animals and furbearers near Kalskag (Brown 1983: 147–149). In spite of the possible decline in salmon populations, chum salmon harvests may have increased during this time period due to increased needs for dog food. Schools, churches, and trading facilities encouraged settlement in larger communities, and this led to a need to travel greater distances to avoid competition in areas with recently reduced furbearer populations. This increased travel, together with increased shipping demands required more use of dog teams that likely stimulated more intensive salmon fishing (Mason 1972: 44). Most of the increased salmon harvest was probably made up of chum salmon, because this has historically been the major salmon species used for dog food in Kalskag. Barter and limited sale of dried salmon was important historically throughout the Kuskokwim River drainage (Albrecht 1990: 18), and there may have been an increase in the quantity of dried salmon sold or bartered during the early 20th century near Kalskag corresponding to increased dog food needs and availability of trading posts. One elder Kalskag respondent described that the sale or trade of dried chum salmon at trading posts in the Kalskag area had occurred from his earliest memories (KAL-12). However, with the adoption and greater use of airplanes for shipment of outside goods in the 1930s and of snowmachines for personal transportation in the 1960s, the harvest and sale of chum salmon for use as dog food began to decline throughout much of Alaska (Andersen and Scott 2010: 3,5; Brown 1983: 150; VanStone 1984: 240).

MID-20TH CENTURY TO PRESENT

Experiences from respondents' own lifetimes have illuminated the history of Kalskag salmon fishing since the mid-20th century. The general pattern of fishing that respondents remember from their childhood or early adulthood in the mid-20th century involved fishing from seasonal camps outside of Kalskag, using fish wheels as the primary fishing gear, and harvesting large numbers of chum salmon primarily for dog food. King salmon was the main salmon used for human consumption, and sockeye and coho salmon formed important but smaller portions of the harvest. Most respondents described that each summer from the time they were children they would travel to fish camps some distance away from Kalskag:

> We all moved to fish camp in the summer. Basically just about everybody in the village did back then. Back in '59–'60 when we came here. Summertime everybody moved out to fish camp, stayed out there all summer till September most of the time, when they moved back to the village. (KAL-4)

One or more families would work together catching and preserving salmon for most of the summer, returning to Kalskag only for brief periods. Older respondents typically grew up going to fish camps where fish wheels were used. "Back then when we were younger…we used to put in a fish wheel every year together…That was in the mid-'50s to the '60s" (KAL-3). As most families utilized dog teams as the primary form of winter transportation until the introduction of snowmachines in the 1960s, a great deal of the effort each summer was put into harvesting and processing chum salmon for dog food, and chum salmon likely formed the bulk of the total salmon harvest in the mid-20th century.

While salmon continue to form a major component of the subsistence harvest in Kalskag into the present (Brown et al. 2012: 306, see also "Summary of Donlin Salmon Data" below), patterns of salmon fishing changed in the second half of the 20th century: travel to summer fish camps is less frequent and time spent in fish camps is shorter than in the past for many residents, fish wheels have been virtually replaced by gillnets as the primary gear used to harvest salmon, and far fewer salmon are harvested for dog food than in the past. While some chum salmon are harvested for human consumption, and a limited number of households have harvested chum salmon for dog food into the present, the reduction in harvest of salmon

for dog food has led to king salmon representing the largest portion of the Kalskag salmon harvest in recent years.

COMMERCIAL FISHING

Commercial salmon fishing for export initially occurred for a brief period at the mouth of the Kuskokwim River between 1913 and 1920, but was banned due to its threat to the food supply of Kuskokwim River residents (Brown 1983: 147). Following Alaska statehood, commercial salmon fishing was reestablished on the Kuskokwim River in 1959 (Pennoyer et al. 1960: 21), and the fishery grew rapidly from 111 commercial salmon fishers in 1960 to 601 fishers in 1969 (Pennoyer et al. 1962: 4; Regnart et al. 1970: 18). The majority of commercial fishing was limited to District 1 of the lower Kuskokwim River, and respondents describe that some Kalskag residents travelled downriver near Bethel (97 miles downriver from Kalskag) to participate in this fishery (KAL-4, KAL-5). A smaller commercial salmon fishery did occur in District 2 of the central Kuskokwim River around Kalskag, from Mishevik Slough below Tuluksak, upriver to the Kolmakof River near Aniak[13]. In the 1960s, the commercial fishery in District 2 was limited to a quota of 2,000 kings and 2,000 coho salmon (Regnart et al. 1970: 21). Respondents in this study describe two or three Kalskag residents fishing commercially in District 2 during this time (KAL-3). Commercial fishing was supplemental to subsistence salmon fishing, requiring the same gear and also allowing the purchase of supplies that were essential to subsistence fishing. One respondent described this relationship between commercial and subsistence fishing, explaining that the proceeds from commercial fishing in the early summer near Bethel were transferred directly into his family's expenses for subsistence fishing later in the summer near Kalskag: "We would load the boat with food, gas, stove oil, whatever we needed before we came up. Or took care of any maintenance we needed on the engine or nets. We would get it right there in Bethel" (KAL-4). While the new commercial fishery provided an important source of cash income for Kalskag residents, subsistence salmon fishing for human and dog food generally continued to play a much larger role in the overall economy of the region (Regnart et al. 1970: 18).

Commercial fishing, initially for king and chum salmon and in later years primarily for chum salmon, continued to be important to Kalskag residents for much of the 20th century, but respondents described that commercial fishing on the Kuskokwim River near Kalskag has not occurred on a significant scale since the mid-1990s (KAL-14, KAL-15). Between 1980 and 1995, at least 17 commercial fishing permits were fished in District 2 around Kalskag. The fishery declined dramatically in 1996 and there has been no commercial salmon fishing in the middle river since the year 2000 (Brazil et al. 2011: 99). One respondent described the hardship felt throughout the community of losing the large source of income that commercial fishing provided, stating that they simply had to find other sources of income to survive (KAL-6).

FISHING PRACTICES

TIMING OF SUBSISTENCE SALMON FISHING

In late May or early June, families typically prepare for the arrival of salmon. Many respondents described that in the past, nearly the entire community of Kalskag travelled to family salmon fishing camps around this time.

> We move to fish camp on June 5th, to clean up and make things ready before we settle down and start fishing. Get some wood. The men get wood and water. The women mosey around and see what needs to be done, make sure buckets are clean, clean around the smokehouse and make sure no trash is around…. (KAL-17)

[13] District 2 was reduced in size in 1988 and again in 1990: the downstream boundary was moved upstream to Second Slough below Kalskag, the upstream boundary was moved downstream to Chuathbaluk (Brazil et al. 2011: 57).

In recent years, some families still travel to fish camps, while others prepare for fishing in Kalskag. Smelt arrive in Kalskag in late May, and many Kalskag residents use dip nets to harvest these fish around the same time they are preparing for the arrival of salmon.

June is the primary salmon fishing month in Kalskag. King salmon typically arrive in the area by the second week of June and are present into early July. Chum salmon arrive in mid-June and the peak of the run comes at the end of June; the first arriving chum salmon are typically in the best condition for eating (KAL-11). Sockeye salmon arrive in mid-June shortly after the arrival of chum salmon. Families that travel to fish camps generally make sure they are there in June to coincide with the king salmon run. Respondents emphasized that June is the preferred month for salmon fishing because of high quality fish and ideal drying conditions. Days are cool and sunny relative to July when "it gets hotter and more flies" (KAL-11).

Fishing continues for king salmon into early July, and chum salmon are abundant at this time as well. Respondents described trying to harvest most of the salmon they will eat before July 4th, and continue fishing for salmon to be used as dog food into late July (KAL-21). In the past, when most Kalskag residents needed to harvest large quantities of salmon for dog food, July was an intense harvest period for chum salmon. Flies and rain become a problem for those preserving fish in July, and fish that are drying need special attention to avoid spoilage and maggots (see "Preservation" below). Coho salmon arrive in late July and are often frozen to circumvent difficult drying conditions. July and early August is also the primary time Kalskag residents pick berries, and salmon fishers who also wish to harvest berries allot time to harvest this valued subsistence resource. In recent years, closures to subsistence fishing in June have led some families to harvest larger portions of their salmon in July than they normally would. One respondent summarized several of the challenges salmon fishers face in July: "In July, there's a rainy season, and you need to pick berries, and fish won't dry as well. People work very hard to catch up with openings and closures" (KAL-10).

Coho salmon continue migrating past Kalskag through August and well into September. Respondents described that in the past, many families would stay at fish camps through August, often not returning to Kalskag until school began in the fall if there were children in the family. "What we usually do was set a tent right there at the fish camp, and I'd stay from June til August, end of September" (KAL-19). Similar to July, some respondents prefer not to fish in August due to problems with flies and bad drying weather.

GEAR

Kalskag fishers described several gear types that are used or have been used in the past to harvest salmon. Most respondents over 60 years old grew up using fish wheels as the primary gear type for harvesting salmon, with additional use of drift and set gillnets. Beginning as early as the 1960s, fish wheels were gradually replaced with set and drift gillnets as the primary salmon harvesting gear in Kalskag. In recent years the majority of fishers use drift gillnets almost exclusively. Salmon harvested with rod and reel typically make up a very minor portion of the overall salmon harvest in Upper Kalskag, but rod and reel was a regularly used gear type for some respondents.

Fish wheels

From the introduction of fish wheels in the early 20th century, and continuing until the mid-20th century, residents on the Kuskokwim River above Lower Kalskag primarily used fish wheels for subsistence salmon fishery, while residents of communities downriver used gillnets almost exclusively for harvesting salmon (Pennoyer et al. 1961: 69). Respondents described cooperatively building fish wheels with locally harvested birch, or the preferred spruce or tamarack wood, and placed fish wheels at seasonally occupied fish camp locations. Some respondents used set gillnets as an indicator for the arrival of salmon runs, since they generally are easier to manipulate than fish wheels; once fish were caught in the set gillnet, the fish wheel would be put in motion, and a large quantity of fish could be harvested. Fish wheel operation during a strong salmon run generally required the team effort of an entire family, and fish wheels would

be stopped if there were not enough workers available to process fish as they accumulated in the fish wheel's holding box. While fish wheels are capable of harvesting all species of salmon present near Kalskag, fish wheels were generally used to harvest large numbers of chum salmon, many of which were used for dog food or as a trade good. Respondents emphasized the former importance of dogs and described harvesting hundreds to thousands of salmon exclusively for dog food; fish wheels were the most efficient method.

> The only motor transportation we had in the fall, winter, and spring was dog teams. Every family had dogs. I figure if you have 10 dogs, you need enough dog feed, say 1 fish a day per dog….Fall, winter, and spring, that's 9 months, 270 days, 270 fish per dog, times 10, that's 2700 fish for a team of 10 dogs. (KAL-12)

Some families used a drift gillnet to harvest the fish they would eat while using their fish wheel to harvest food for their dogs (KAL-12). Several factors likely contributed to the replacement of fish wheels with gillnets as the primary salmon harvesting gear type in Kalskag, including the introduction of snowmachines, increased availability of gillnets, and commercial fishing gear and techniques that became widely used in the subsistence fishery. Snowmachines largely replaced dog teams as the major form of local winter transportation throughout Alaska in the second half of the 20th century, and respondents in this study described that fish wheels were not necessary once they no longer needed to harvest large quantities of salmon for dog food each year.

Figure 5-1.–Fish wheel on the Kuskokwim River near Kalskag, 2009.

> Long ago they had dog teams, and the fish wheel would catch a lot of fish. Nowadays we just catch for our families what we need for winter. We don't have dogs, and we don't eat that much. I think that's the reason people don't use fish wheels now days. (KAL-12)

The replacement of dog teams with snowmachines and related abandonment of fish wheels may have been accelerated by a canine distemper epidemic in the mid-1960s that temporarily reduced the total number of dogs on the Kuskokwim River around the same time snowmachines first became available (Regnart et al. 1970: 28).

The highly involved process of constructing fish wheels also may have contributed to their eventual disuse. During respondents' lifetimes, fish wheels were constructed of locally available materials, and gillnets were purchased from manufacturing companies. While salmon gillnets represent a considerable investment of at least several hundred dollars today, they have been increasingly available by mail order, and purchasing a gillnet is likely easier for many respondents than constructing a fish wheel would be. Adding to the convenience of gillnets is the fact that until recently, fishers needed to purchase separate components of a gillnet and attach net webbing to the lead line and cork line themselves; Kalskag fishers can now purchase gillnets that are largely ready to use, or "pre-hung," once they arrive by mail.

The commercial salmon fishery in the central Kuskokwim River region, beginning around 1960, may have encouraged the increased use of gillnets and related decline of fish wheels for harvesting salmon. Initially the commercial salmon fishery in the Central Kuskokwim region was restricted to king salmon in early summer and coho salmon later in the season. Commercial fishers could use a larger size gill net mesh that harvested king salmon while allowing many smaller salmon such as chum and sockeye salmon to pass through the net. Gillnets came to be the exclusive gear type used in the commercial salmon fishery on the Kuskokwim River by the late 1960s (Regnart et al. 1970: 21), likely due to the increased selectivity of gillnets vs. fish wheels towards king salmon. While the complete replacement of fish wheels with gillnets may have first taken place in the commercial fishery, this gear shift eventually transferred into the subsistence fishery as well. In 1960, 65 fish wheels were in operation on the Kuskokwim River between Eek and the Swift River, declining to 30 in 1965 and 10 in 1981 (Jonrowe et al. 1982: 13). Only one Kalskag household reported using a fish wheel to harvest salmon in 2009 (Figure 5-1), and the contribution of this one fish wheel to the total harvest by the community was small (Brown et al. 2012: 316).

Gillnets

The majority of Kalskag salmon fishers currently use gillnets as their primary gear type for harvesting salmon. Gillnets are well integrated into current Kalskag fishing practices that emphasize the harvest of multiple salmon species, flexible fishing schedules that are time-efficient, and for many respondents salmon fishing while residing in Kalskag rather than long-term fishing camps. While the majority of Kalskag salmon fishers currently use drift gillnets, set gillnets were commonly used in the past and are still used by some Kalskag residents.

Kalskag salmon fishers harvest several different salmon species over the course of a summer, and are able to focus on particular species by utilizing different gillnet mesh sizes. Many Kalskag fishers currently focus their harvest efforts on king salmon over other salmon species; king salmon made up over 60% of the Kalskag salmon harvest by edible weight in 2009 (Brown et al. 2012: 315). In order to effectively harvest king salmon, Kalskag salmon fishers use gillnets with 6-8" mesh. Some respondents described using an 8" mesh gillnet if they want to harvest mostly king salmon and few chum or sockeye salmon. Other respondents prefer a mixture of salmon species and use a 6" mesh gillnet as an all-purpose net throughout the summer or to target chum and sockeye salmon after king salmon runs have passed.

Drift gillnets (Figure 5-2) are widely used by salmon fishers who require flexibility in their salmon fishing due to employment schedules, personal obligations, and salmon fishing restrictions. By drifting a gillnet when salmon are plentiful in a productive drifting location, salmon fishers can harvest large

Figure 5-2.–Salmon fisher deploying a drift gillnet on the Kuskokwim River near Kalskag.

quantities of salmon in short periods of time relative to fishing with other gear types. This efficiency of time allows some fishers to fish around their work schedules while still getting enough salmon for their needs.

> It's easier when you're working, if you have time off sometimes, it might be easier to drift, because work can keep you from checking the [set] net. Needs to be checked twice a day. (KAL-6)

Fishing with drift gillnets also enables those who are obligated or choose to stay in Kalskag during the salmon fishing season to successfully harvest salmon. While some salmon fishers are able to set gillnets close to Kalskag, respondents described that there are a limited number of good setnet locations in the area and that they are mainly occupied. Drift gillnetting locations are more accessible to multiple people because the nets do not continuously occupy one location. Some respondents also felt drifting was simply more exciting. One respondent said, "It's more fun to drift for me and watch the expression of the young people when you're catching fish" (KAL-12).

For Kalskag residents that used drift gillnets in the mid-20th century, boat motors were often used in a more limited fashion than in recent years, such as only while traveling upriver to fish camp or to position a boat for drifting a gill net. Several respondents described regularly rowing their boats with oars while drifting a gill net for salmon. One respondent explained:

> You get 5 gallons of gas, you go to fish camp, and you stay. You don't go running around. Not like now. It was totally different. A lot of times we wouldn't even use the motor except to go upriver. If we were going downriver then we just drifted. You would drift down to your drifting spots, and then you would use the engine, you know, always oared, never used the motor. You would drift, and you would come back upstream with the motor because it was a lot harder back then. There wasn't jobs available then like there is now. (KAL-4)

Use of oars was more fuel efficient and also was seen by some respondents as less likely to frighten fish away from the gillnet than a loud motor. While drift gillnets are the preferred gear type for most fishers, setnets also offer advantages and are used by some residents. High gas prices in recent years have made drift gillnetting difficult for some residents, and set gillnetting can be an affordable alternative. A respondent described:

> Last year we didn't get the fish we wanted, so this year is the first year I'll try a setnet, with the price of gas. My wife cuts fish all day but gas prices going up, gotta have a setnet. I usually drift. (KAL-20)

Set gillnetting can also be convenient for those who fish alone and may not have the "manpower" to drift a gillnet (KAL-12). Setnets were very commonly used in the past as families spent summers at seasonal fish camps; many families' fish camp locations were located directly at good, productive setnet sites. In recent years they have become less commonly used. One respondent said, "I see a few [set gillnets], less than before. Growing up there were a lot, almost every eddy taken by one or two nets. Nowadays, some select few who set the net." (KAL-6)

Rod and Reel

Rod and reel-caught salmon made up a very small portion of Kalskag residents' total salmon harvest in 2009 (Brown et al. 2012). Some respondents described fishing for salmon with rod and reel, particularly for coho salmon. One respondent described catching all species of salmon along with pike and sheefish with rod and reel, although this gear was preferred for its recreational quality rather than its ability to harvest large numbers of fish (KAL-2, KAL-18).

FISHING LOCATIONS

Most locations for salmon fishing are well-known by Kalskag's life long fishers, "where they fished for all their life, that's how we knew where to fish" (KAL-11). Several respondents described the conditions necessary for an ideal salmon fishing location. Ideal salmon fishing locations vary based on the gear type a fisher is using. The way fishers use salmon fishing locations around Kalskag has changed over respondents' lifetimes, reflecting changes in gear type and summer residency patterns.

Fish wheels are ideally located in water 6 to 8 feet deep with a gravel bottom, and one respondent described that deeper 8 foot water is best for harvesting king salmon with a fish wheel (KAL-2). Fish wheels must be placed in water with a strong enough current to keep the wheel turning at a constant speed (KAL-4). Fish wheels need to be periodically adjusted based on changes in water levels: baskets of the fish wheel should pass just above the river bottom. When a fisher hears the baskets scraping the bottom, the fish wheel needs to be pushed into slightly deeper water with "spars" attached between the beach and fish wheel (KAL-2). Because of this, fish wheels need to be in a location where they can be easily adjusted from shore. Many fishers prefer to build a fence between the beach and the fish wheel baskets to direct fish passing close to the shore into the baskets, so fish wheels should be kept at a moderate distance from the beach (KAL-2).

Setnets are placed in a strong, deep back eddy. Eddies' currents can change depending on the depth of the water, and setnetters must be able to adjust their nets further out in high water or find another setnet location if a normally strong eddy is weakened due to water level fluctuations (KAL-21). Since setnets

need to be checked regularly, usually twice a day, it is convenient to have setnets located close to Kalskag. One respondent described that most of the consistently productive eddies for setting gillnets near Kalskag are taken by families who have used the same location for multiple years, and that a prospective setnetter might have to go a considerable distance from Kalskag to find a good spot that is not in use (KAL-15). When considering using a setnet spot that was formerly used by another person, it is appropriate and respectful to ask the previous user's permission beforehand. In the past, setnets placed in a location "owned" by someone else were sometimes cut loose in the river, although this doesn't happen regularly anymore (KAL-15).

Drift gillnetting locations generally have gravel bottoms that are free of snags that could catch a net (KAL-12). With the danger of losing nets to snags, it is somewhat risky to "prospect" for a new drifting location (KAL-4), and good locations near Kalskag are well known and used year after year. Respondents described that king salmon swim near the river bottom; because of this, relatively shallow water that allows the net to pass near the river bottom is ideal (KAL-12). However, in years with low water levels, some normally desirable drifting locations can be too shallow to effectively drift (KAL-21). Because of the limited number of drifting locations near Kalskag, driftnetters sometimes need to share locations by taking turns until another boat has finished drifting, and sometimes multiple boats will drift in the same area at the same time (KAL-6). Some respondents drift at night, largely to avoid this competition. An additional concern in recent years is increasing numbers of barges on the Kuskokwim River near Kalskag. Respondents reported needing to be aware of barges when they are planning to drift; barges are thought to scare salmon away from drifting locations, and driftnetters may try to drift before a barge passes or wait until well after it has passed before attempting to drift (KAL-20).

Most fishing locations in recent years are located relatively close to Kalskag, which is partially related to changes in summer residency patterns. In the second half of the 20th century, the summer-long use of fish camps that many respondents remember was mostly replaced with a pattern of fishing from the village. Some families still stay in camp for a few weeks, but none reported staying for the majority of the summer as in the past. Respondents had a variety of explanations for this change, including the commitment to full-time employment in Kalskag, the inconvenience of not being able to fish continuously at a fish camp due to periodic subsistence fishing closures in recent years, the convenience of electricity and running water in Kalskag for processing fish, the difficulty of travelling long distance to a fish camp due to increased costs of fuel, and lack of need for large amounts of fish to be used as dog food.

PROCESSING AND PRESERVATION

Kalskag respondents described numerous ways in which salmon are processed, preserved, and prepared. While many techniques for processing and preservation are similar to those of respondents' early memories, old techniques have been adapted to incorporate new technology and changing socioeconomic conditions.

Once salmon are removed from gillnets, they are transferred to fish processing "rafts" that are located along the shore. Rafts are constructed with several large floating logs that are attached to each other in the form of a square with a large center open to the river (Figure 5-3). A fine mesh net is placed in the center opening, and recently harvested salmon are placed on this net and kept cool in the water. A fish cutting table is also set up on the raft, and salmon can easily be transferred from the net in the center of the raft to the table when families begin to cut fish. Some respondents prefer to leave recently harvested salmon in the water for a few hours or overnight to allow them to become more rigid, because this can make the fish easier to manipulate in the following processing steps (KAL-8). Some residents use processing stations on land rather than rafts.

Respondents emphasized that processing salmon is a team effort that begins soon after fish are harvested and continues until fish are safe from spoilage. One respondent explained:

Figure 5-3.–Salmon processing "raft" near Kalskag.

> We'd have one person cutting heads and another person gutting them, another person cleaning them and another one filleting them, another person cutting for the strips, and some of them with flat fish. Then you pass them on and they wash them and put them on poles. The men would take them up the bank and put them in the smokehouses. Everyone was doing something. (KAL-10)

People use several salmon cutting techniques to convert whole fish into a variety of preserved foods that can last throughout the winter. "Cutting" generally refers to all stages of cutting fish with a knife or more commonly an *uluaq* (commonly known outside of the Kuskokwim region as an *ulu,* a term originally from the Inupiaq language), such as removal of the head, filleting, slicing into strips, or scoring the flesh prior to drying. Most salmon cutting begins with removal of the entrails, head, and tail. The heads and tail are often saved for drying or to be frozen, and some entrails such as the heart and roe are often saved to be cooked and eaten immediately, frozen, or dried for later use (Figure 5-4).

Once the head and entrails are removed, salmon flesh is removed from the "backbone," made up of the vertebrae and rib bones. Flesh cut from the backbone can either be removed as fillets or "blanket fish." To make blanket fish, the skin and flesh along the dorsal (top) side of a salmon are left intact, resulting in what looks like two fillets connected at the salmon's back. At this stage of processing, salmon fillets may be cut smaller to be vacuum-packed or packaged in plastic bags, sometimes with a small amount of excess water to prevent freezer burn, and frozen. Freezing fish mid-summer is a relatively recent method of preservation, and prior to the introduction of commercial freezers, all salmon were either eaten fresh,

jarred, salted, aged, or dried and smoked. Jarring or canning in manufactured containers with a pressure cooker is still used by many Kalskag residents to preserve salmon. One respondent described that jarring is useful for preserving bony sections of salmon, because the high temperatures used in jarring soften bones and render them edible. Salt fish, *sulunaq*, involves alternating layers of salmon cut from fillets with layers of rock salt in a relatively large container, such as a wooden barrel or 5 gallon plastic bucket. The rock salt preserves the fish, which is soaked in water to remove some of the saltiness prior to eating. This method is especially common with the fatty belly sections of salmon that do not dry well.

Aged salmon is less common in recent years than in the past, although some residents do still make aged salmon heads or "stink heads." Aging usually involves burying salmon in a cool underground pit lined with grass and birch bark. Before freezers were available, people used the near freezing temperatures of the ground to delay the process of fermentation and preserve the salmon until colder winter temperatures froze the salmon. "In the winter when you dig them out, the fish on the bottom are pretty firm, the ones on the top are not decayed, but it's a natural process of preservation where you use the elements" (KAL-12). This was an ideal method for preserving salmon, such as coho salmon, that arrived later in the year when drying was difficult, and the result is a unique flavor and texture that some Kalskag residents appreciate.

Drying and smoking fish has been historically, and is likely still, the most common way Kalskag residents preserve salmon. Dried and smoked king salmon in particular is viewed by many Kalskag residents as an essential part of the diet during winter. Respondents emphasized that drying salmon is a labor- and skill-intensive process that takes years of practice, instruction, and observation of experts to become proficient. If salmon is to be dried, the thickness of the flesh cut off of the backbone is very important to the quality of the final product, and respondents described that this is one of the most difficult stages of cutting fish

Figure 5-4.–Salmon hearts.

to learn. “You can’t cut it too thick or too thin. Otherwise it’ll spoil if it’s too thick, and if it’s cut too thin it dries too hard” (KAL-10). After removing the appropriate thickness of flesh for drying, any substantial flesh remaining on the backbone is removed and may also be dried. There is normally very little edible flesh remaining on the backbone at this stage, and waste of this flesh is prevented by drying the backbone (Figure 5-5) to be used in soups or saving it for dog food. Once blanket fish or fillets (also referred to as “flats” if they will be dried) are removed from the backbone, they can be scored with an *uluaq* or knife, making regular slices through the flesh while leaving the skin intact to allow air circulation in later drying. Alternatively, fillets can be cut lengthwise into narrow sections known as “strips” which will be dried. While dried salmon strips have been commonly made in recent years and are very popular, older respondents reported that this product was not commonly made in Kalskag until recently. If salmon heads and tails are to be dried, they are usually split to allow more air circulation (Figure 5-6), and the gills and other parts of the head that will not dry well are removed and typically returned to the river.

Once salmon flesh has been properly cut for drying, it is usually soaked briefly in a saltwater brine, with other seasonings or brown sugar sometimes added for additional flavor. Fish are then hung to air dry for one day (Figure 5-7), preferably on a dry day with sunshine. Once a dry crust has developed on the outer flesh, fillets, blanket fish, and strips are moved to a covered smokehouse where they are hung on horizontal wooden beams or “racks.” Families maintain a small cottonwood or alder fire in the smokehouse that produces smoke and heat to dry, preserve, and flavor the fish as well as repel flies from the area. Smoke and heat levels in the smokehouse can be adjusted to some extent to account for fluctuations in outside moisture levels and flavor preferences. “You gotta really tend to the fish, make sure when it’s hot gotta have smoke, and when it’s rainy gotta have heat, you gotta make sure” (KAL-8).

Figure 5-5.–King salmon “backbones” hanging in smokehouse to be preserved for future use.

Figure 5-6.–Salmon heads and tails drying in Kalskag smokehouse.

To be properly dried, salmon usually needs to be kept in a smokehouse for around two weeks. Respondents emphasized that this is a time of vigilance: the salmon must be regularly turned or rotated to ensure even drying, smoke fires must be maintained constantly, and any sign of spoilage or fly eggs on the salmon must be removed rapidly.

Currently most of the salmon dried for human consumption in Kalskag is king salmon, although other salmon species are also dried by some families. Coho salmon is usually not dried, because they are present near Kalskag in late July, August, and September when drying salmon is most difficult due to cold or rainy weather. Respondents described that in the mid-20th century a great deal of effort was spent processing chum salmon for personal use as dog food and for sale as dog food. King and sockeye salmon were known as "eating fish" in contrast to chum salmon or "dog fish." Coinciding with the decline in dog teams in the second half of the 20th century, the harvest of chum salmon gradually declined to present levels: in 2009, 972 individual chum salmon made up 7% of the total subsistence harvest by edible weight, while 2,639 king salmon made up 36% of the total subsistence harvest by edible weight (Brown et al. 2012: 306, 315). The process of drying salmon for dog food is similar to that described in the preceding paragraphs, although dry salmon for dog food usually does not need to be as carefully prepared as salmon prepared for human food, and chum salmon generally dries slightly faster than king salmon due to its lower oil content.

SHARING, BARTER, AND CUSTOMARY TRADE

Salmon is widely shared throughout the community of Kalskag, and Kalskag respondents reported a variety of informal exchange practices that allow those unable to harvest and preserve their own salmon

Figure 5-7.–Drying king salmon "blankets" in challenging weather conditions.

to still secure enough salmon for their needs. In the past, formalized barter and sale of salmon at trading posts was common but has not occurred in recent years.

> First, they [youth] share with elders, and then to family members. And I'll notice they'll say "I caught a fish or bird, do you want one"? They'll bring it over and I'll praise them with soda, candy, cookies, something in exchange. I thank you very much, and you'll be a wonderful hunter, and this animal also thanks you for sharing this special gift. (KAL-10)

In 2009, over half of Kalskag households reported giving salmon to or receiving salmon from other households (Brown et al. 2012: 315). Respondents reported traditional sharing practices involving salmon, for example giving away the first salmon you cut and celebrating (KAL-1). Respondents emphasized the importance of sharing, especially within families, to ensure the successful harvest and distribution of salmon. This includes not only sharing salmon, but sharing the workload throughout the process of salmon harvesting and preservation, sharing equipment and supplies, and sharing salmon-related knowledge. Multiple respondents described sending salmon to families who are living in areas where they do not have access to subsistence harvested salmon, such as urban Alaskan centers. Sharing is also an important way to prevent waste when someone harvests more than they need. "When you have enough, you have enough. If you have too much you can always help somebody else" (KAL-5).

Barter, the exchange of salmon for other resources, is common in Kalskag and helps ensure distribution of salmon to those who are not able to fish. Resources regularly exchanged for salmon include other types of

food (both store-bought and subsistence harvested), supplies for harvesting or preparing salmon such as gasoline or salt, and labor such as helping to cut fish. Mutually beneficial relationships regularly develop that involve exchanges more complex than simple barter of one resource for another. As a typical example, an elder who is not able to fish said that she contributes gasoline and fishing advice to younger fishers, who bring her fish that she processes and shares throughout the community (KAL-10).

In the past, more formalized trading exchanges with salmon were common. Several respondents described that dried salmon was traded for food or cash to trading posts, passing barges, or people with large dog teams, and at one time functioned as a sort of currency in the area around Kalskag (KAL-1, KAL-10, KAL-16).

SUMMARY OF 2009 SUBSISTENCE HARVEST SURVEY DATA

In April 2010, ADF&G Division of Subsistence conducted additional subsistence research in Kalskag (reported as "Upper Kalskag" in Brown et al. 2012) to document levels of subsistence harvest and use for 2009. Research included household subsistence harvest surveys and land use mapping for 48 of the total 60 households (80%) in Kalskag, as well as in-depth interviews with 9 community members knowledgeable about long term and more recent trends in Kalskag subsistence patterns. This section provides an overview of quantitative and land use findings from this study related to salmon use and harvest in Kalskag in 2009.

In 2009, salmon was harvested by 77% of households and used by 96% of households. Kalskag fishers harvested an estimated 5,430 individual salmon, which contributed approximately 40,258 edible lb of food to the community. Kalskag fishers' harvest of an estimated 2,639 king salmon made up the majority of the salmon harvest, and represented 36% of Kalskag residents' total subsistence harvest of all fish, game, and edible plant resources in 2009 by edible weight. Kalskag fishers also harvested an estimated 972 chum salmon, 721 coho salmon, 705 sockeye salmon, and 10 pink salmon. Nearly all salmon were harvested with gillnets, primarily drift gillnets but also some set gillnets. Smaller numbers of salmon were harvested by fish wheel and rod and reel.

Salmon harvests all occurred on the mainstem Kuskokwim River, primarily within 20 miles of Kalskag. Some salmon harvests also occurred on the mainstem Kuskokwim River near the communities of Aniak and Napaimute.

LOCAL OBSERVATIONS OF CHANGE IN SALMON FISHERIES

ENVIRONMENTAL CHANGES

Compared to not long ago, used to catch a whole bunch in one drift and fill up your fishing for the day, and it was like a couple hundred fish one drift. Now it takes seven or eight drifts, maybe ten, to get enough fish for the day when it used to take one. (KAL-11)

Respondents described observing several general environmental changes over their lifetimes that are related to salmon and salmon fishing. The most pervasive observation of environmental change involved reduced numbers of returning salmon, especially king salmon, relative to past decades. Most respondents described that each time they drift a gillnet in recent years, far fewer salmon are caught than in previous decades. One respondent described that the Aniak River likely had much larger returns of chum salmon each year in the mid-20th century; this respondent not only saw more salmon returning but recalled that in the past the river would change color from clear to a cloudy white due to the large amount of salmon milt in the water, and he remembers being able to smell rotting salmon in the Aniak River from far away (KAL-12).

Other observations of environmental change included a decrease in the average size of king salmon and increasing problems with erosion near riverbanks. Respondents described that a 20 lb king salmon would

be considered average in the past but would be considered large in recent years, and that very large king salmon have been rare (KAL-2, KAL-3, KAL-15, KAL-20). Erosion of riverbanks was described as a natural occurrence but has been problematic recently for Kalskag residents who have established trails or fish camps near riverbanks (KAL-3, KAL-13).

MANAGEMENT

> It's an inconvenience really, people used to fishing whenever, wherever, how long they want. As far as the harvest, I didn't see any change in the numbers… people still catch the same amount because they only need so much and then they're done. (KAL-10)

Discussions of salmon management with respondents tended to focus on the restrictive effects of regulations, particularly subsistence salmon fishing closures. Subsistence salmon fishing was restricted and temporarily closed for all salmon species for the first time on the Kuskokwim River in 1993 and was restricted again in 2000 (Bavilla et al. 2010: 64-65). Subsistence salmon fishing closures were viewed as an inconvenience that disrupted normal patterns of fishing. Respondents emphasized that rather than limiting harvests of salmon, closures simply forced people to work more intensely during open periods to harvest usual levels of salmon. Additionally, weather is not generally considered in scheduling closures, while it is an important consideration to those who dry salmon. When open fishing periods are scheduled during rainy weather, fishers may feel the need to harvest salmon even at times when it is much more difficult to dry salmon.

> A few years ago we had the subsistence closure…it took longer for people to catch fish because of the closure. Try to get as much fish as they can before they close and then wait like three days. The people with setnets didn't like having to take out their nets and reset them, it was affecting the way they fished. They got enough, it just took longer. (KAL-11)

Kalskag residents with access to drift gillnetting equipment generally were able to harvest salmon at similar levels to other years by increasing their numbers of drifts during open fishing periods. Subsistence setnetters were generally not able to increase their harvests during the openings and were required to completely remove their nets during closed periods. As such, setnetters may have been more affected by subsistence fishing closures than drift gillnetters in terms of numbers of salmon harvested. One strategy for fishers using set gillnets to harvest enough salmon in these conditions was to continue fishing later in the summer, although this can lead to harvesting salmon when drying conditions are more difficult. Some residents viewed salmon fishing restrictions as putting them at risk of not having enough food.

While some viewed more intense salmon fishing efforts as a solution to this risk, others felt that in extreme cases of not being able to get enough food, regulations could be disregarded. One respondent said: "People still do it [fish during closures] even though they tell you not to. You have to eat if you have to eat" (KAL-16).

While respondents described the restrictive effects of fishing closures on Kalskag residents, some respondents also identified positive effects of closures. For example, fishing closures for communities downriver from Kalskag were seen as improving the numbers of salmon Kalskag fishers were able to harvest. One respondent exclaimed "When Bethel people quit fishing then all the fish came up here! Helped out here, brought some fish" (KAL-15).

EFFECTS OF SOCIOECONOMIC CHANGES ON KALSKAG SALMON FISHING

> We're a very adaptable people, we adapt to a lot of changes, especially (over) the last 100 years…From being fully dependent on subsistence, now we have a cash economy and schooling and you stay in one place with a home… you have to adapt or you won't survive. It takes a lotta guts. And then they wonder why are we changing so fast, especially the elders. (KAL-10)

Socioeconomic changes in Kalskag over the past century have resulted in continual adaptation of salmon fishing patterns. Discussions involving socioeconomic changes related to salmon fishing focused on technological innovations, challenges of economic shifts including an increase in employment opportunities in Kalskag over many respondents' lifetimes, and recent increases in the cost of gasoline.

Technological innovations such as freezers, readily available manufactured gillnets, and motorized vehicles have in some ways made fishing easier: "How has fishing changed? It's so much easier, you just go buy gas and then you go out come back, put it in your four wheeler and then on your table or smokehouse" (KAL-13). However, the additional financial resources needed to utilize these technological innovations can prove difficult for some Kalskag residents: even those residents who own technologically advanced fishing equipment such as manufactured boats, motors, and drift nets may not be able to use them if they cannot afford gasoline, which has increased in price in recent years. Due to the increasingly intertwined relationship between subsistence activities, cash, and technology, there is increasingly a need for families to maintain a steady source of income in order to pursue subsistence activities. "We are living in a bicultural world where we work but also want to do our subsistence activities" (KAL-12). Some respondents described the challenge of balancing the time required for both wage employment and subsistence activities: "It's very important to keep a job, but [also] a lot more stress on that person who wants to enjoy a subsistence way of life" (KAL-6). Other respondents reported strategies that allow them to maintain this balance. Such strategies included working "two weeks, on two weeks off" shift jobs that allow sufficient periods of time to pursue subsistence activities, driftnetting for salmon at night after work, and accumulating leave from work that can be used during prime salmon harvest periods.

SUMMARY AND DISCUSSION

Kalskag salmon fishing patterns have slowly and continually changed over the past century. Fish wheels have been replaced by drift gillnets as the primary salmon harvesting gear. The quantity of chum salmon harvested has declined dramatically, largely due to a reduced need for dog teams and associated dog food. Most Kalskag fishers now focus the majority of their salmon fishing efforts on king salmon for human consumption. Related to these changes, summer residency for most Kalskag residents has shifted away from long term fish camps to primary residences in Kalskag with fishing efforts occurring in shorter time periods during June and early July.

Commercial fishing on the Kuskokwim near Kalskag has not occurred for over a decade, and respondents described that the loss of this once important source of income has been difficult.

Respondents expressed several concerns related to salmon fishing. There was generally consensus that reductions in numbers and average size of returning king salmon are occurring, and some respondents were concerned about the current and future health of salmon populations. Kalskag residents were frustrated with management efforts designed to protect salmon populations, describing that salmon fishing restrictions in the form of temporary closures do not change the numbers of salmon that people need for food or actually harvest. Many Kalskag residents also expressed worry that restrictions may increase in the future and described that this could result in great hardship.

In spite of these changes and concerns, respondents expressed that salmon fishing remains an integral part of life in Kalskag. "It's very important. What we'll do without it? Starve I think. I know I'll starve if I don't have fish" (KAL-9). In particular, they emphasized the importance of salmon and salmon fishing to nutrition, personal finances, reinforcing family relationships, and maintaining local cultural traditions.

SLEETMUTE

Prepared by Anna Godduhn

SETTING AND CONTEXT

LOCAL RESEARCH AND RESPONDENT PROFILE

This research was conducted in three visits to Sleetmute between early June and mid-August of 2009. A total of 16 Sleetmute residents were interviewed for this study, including 12 Alaska Native, 4 non-Native, 9 female, and 7 male respondents. These key respondents consisted of 8 elders, 7 middle-aged individuals, and 1 youth. The elder and middle-aged Native respondents grew up subsistence salmon fishing in the Sleetmute area as members of multi-generational subsistence fishing families. The non-Native respondents were active subsistence fishers who were either homesteaders or school teachers of long-term residence in the area.

HISTORICAL BACKGROUND AND NATURAL ENVIRONMENT

Sleetmute is located on the north bank of the central Kuskokwim River, approximately 105 miles upriver from Kalskag and 128 miles downriver from Nikolai. The central Kuskokwim region has been a linguistic and cultural border region between Yup'ik and Athabascan people living on the Kuskokwim River, and is jointly settled by both people. Oswalt (1962:10) makes a strong case for historically amicable relations, as trade and intermarriage between Central Yup'ik and Deg Hit'an Athabascans had long been practiced. Other researchers found that some violent conflicts were likely, but probably buffered by strong trade relations (Ackerman and Ackerman 1973).

The majority of Athabascans in the region are Deg Hi'tan, but they also include Upper Kuskokwim and Dena'ina. Oswalt (1962, 1967, 1980) suggests that the upriver migration of Yup'ik people on the Kuskokwim led to a degree of assimilation and acculturation of Athabascan residents in the region. Some people were bilingual in Yup'ik and Athabascan, yet the majority of Athabascans became Yup'ik speakers (Oswalt 1962; 1967: 190, 241; Snow 1981: 620 citing Chapman 1907:15)

Similar observations date back to the early 20th century. In 1907, George Gordon counted approximately 150 residents in the village and "…noted that most people were Indian in appearance, others looked like Eskimo, and some had both Indian and Eskimo features. However, they all spoke Eskimo" (Oswalt 1980: 78 citing Gordon 1917:109–119). In the 1920s and early 1930s, a number of institutions were established in the village: a Bureau of Education school was built in 1920, a post office in 1923, and a Russian Orthodox Chapel in 1931 (Oswalt 1980: 78). The contemporary village name has its roots in the Yup'ik language in which Sleetmute is called *Cellitemiut*, which means "people of the whetstones," "people of the place with stone for whetstones," or "people of the place where they get the stone."[14] In Deg Xinag (the language of Deg Hi'tan), the village site is called *Tovíshq'uł ghunh*, which also means "whetstone place" (Kari et al. 1980: 1). The reference to whetstones originated from "an outcropping of slate close to the village which was historically used in making whetstones and was valued as a trade item" (Oswalt 1980).

[14] The Yup'ik translations were consulted with Steven Jacobson, Professor Emeritus at the Alaska Native Language Center, University of Alaska Fairbanks.

The current location of Sleetmute is across from and about a mile below the confluence of the Kuskokwim and Holitna rivers. Charnley (1983: 42) reports that the current village site of Sleetmute was historically a summer fish camp used by families from the Holitna River region. According to ADF&G biologists as well as our respondents, the fish on the south side of the Kuskokwim at Sleetmute are bank oriented to run up the Holitna to their spawning grounds, and the fish on the north side are farther from their spawning grounds. There were also reportedly fewer mosquitoes than on the Holitna River.

Beginning late in the 18th century, travelers explored the Kuskokwim River from major tributaries that enter near Sleetmute. In the early 1790s, the Russian explorer Vasiliy Ivanov and his party traveled from Bristol Bay up the Nushagak River drainage and descended the Hoholitna River to the Kuskokwim and went on to the Yukon River (Oswalt 1980: 9). Other Russian explorers also descended to the Kuskokwim from the Hoholitna River in 1818 and from the Holitna River in 1830 (Oswalt 1980: 9–10). In 1832, an expedition led by Russians Fedor L. Kolmakov and Semen I. Lukin established the first Russian settlement in the Central Kuskokwim. Referred to as "Kolmakov's Townlet," this settlement was located in the immediate vicinity of the current Sleetmute village site (Oswalt 1980: 46). In 1844 however, when Lavrentiy Zagoskin traveled to the upper Kuskokwim, no community existed there (Zagoskin 1967), though a population of 42 persons (Russians) was noted at the Kolmakovskiy Redoubt, some dozen miles downriver, at the time (Oswalt 1980: 47).

Historically, people in the region maintained a semi-nomadic life. In winter, people lived in larger settlements consisting of a few to several extended families between September and April (Charnley 1983:57 citing Oswalt 1967). The contemporary community of Sleetmute is said to have begun as a fish camp occupied by Ingalik (Deg Hit'an) Athabascan families who came down from the Holitna River drainage for the higher quality of fish and fewer mosquitos (Charnley 1984). One respondent stated that in winter, people traveled up the Holitna River by foot and/or by dog team for fishing, trapping, and hunting (SLQ-14). In early spring, families would disperse for caribou and small-game hunting (Charnley 1983: 58). At break-up, they traveled to summer fish camps by boat. The respondent stated that dogs were historically used to pull boats up river along the shore with the passengers using a paddle to keep the boat on open water (SLQ-14). They would then drift back down, bringing the dogs with them on a log raft. However, "this all changed when the kids had to go to school" (SLQ-14).

COMMUNITY FISHING PROFILE

HISTORY OF LOCAL FISHERIES

The Holitna River, and its major tributaries, the Hoholitna and Kogrukluk rivers, are important spawning grounds for Kuskokwim River salmon. These clearwater rivers produce substantial stocks of king, chum, sockeye, and coho salmon, along with a limited stock of pink salmon (Wuttig and Evenson 2002). Salmon runs often overlap, and fishing inevitably yields a mix of fish (Figure 6-1). King salmon begin to arrive at Sleetmute first, just a few days ahead of the chum and sockeye runs in mid-June. Another pulse of chum mixes with the coho run in late August through September. A very small run of pink salmon delivers near-spawning fish that are generally processed as dog food when they are found in nets. The region also supports at least 14 historically important nonsalmon species (Charnley 1984).

Prior to the introduction of cotton nets, fish traps and moose sinew nets were used to capture salmon (Charnley 1984: 81–82). One elder respondent remembered the need to dye the new, white cotton nets; she guessed so the fish would not see the twine:

> Long ago, they used to buy white colored nets, and grandma used to get those, uhh, some kind of roots, and dye them – make 'em dark. They don't like those white colored nets… Some kind of, like a tea, leaves, or something like that. Boil it in a big, big tub, and put the fish net in there, and you get 'em dark. (SLQ-13)

Figure 6-1:–Nets catch a mix of fish, including salmon and whitefish.

Beginning with the development of the Russian fur trade, demands for transportation increased, and salmon was a critical resource to feed the needed dog teams. With a Russian trading post at the mouth of the Holitna River, these demands were presumably felt quite strongly in the Sleetmute area, which was something of a crossroads for Russian and American explorers and trappers on the rivers in the early 1800s. Although there seems to have been no permanent settlement there during the late 1800s, the fishing was good, and seasonal camps were used by people of the Holitna drainage, who depended on the fish for sustenance and also likely traded some of their harvest for rifles, iron cookware, and other goods. The demand for sled dogs increased with the gold rush at the turn of that century, and fishing became an avenue to the American cash economy.

Fish wheels, introduced in the early 20th century, probably by miners from the Yukon River (Charnley 1983: 82), were the most efficient method to harvest large volumes of fish, especially the chum and sockeye that swim closer to shore than king salmon. From the 1930s until the 1960s, fish wheels were "… all over the Kuskokwim" (SLQ-1). One respondent remembered, "That's how we used to make our living... Summer time - we bundle 'em [salmon] and trade 'em with groceries and gas, or whatnot" (SLQ-7). Another respondent remembered her task as a small child in the process of bundling:

> We used to bundle them. I remember having to, because I was the smallest one in fish camp, they would let me step on the fish and because I was always barefoot, they would let me step on the fish so it'll get packed down. And then when they tie 'em up, I can get off... That was one of my jobs. Even though I didn't want it, it was mine. (SLQ-2)

Figure 6-2. Cutting coho salmon in late August.

Once bundled, dry salmon were easy to store or transport and made ideal trail food for dog teams. If this informal sale of fish is considered to have been part of the subsistence economy rather than commercial enterprise, then subsistence has always been the dominant use of fish in the middle Kuskokwim.

Commercial fishing, the formalized and regulated sale of salmon for substantial profit, was not as active in the upper-Central Kuskokwim as in the lower river, in part because "ocean bright"[15] fish are preferred by outside buyers and also because of difficult logistics for fresh delivery to markets. The improvement of air service and direct access to Anchorage markets with frozen fresh fish from the middle Kuskokwim allowed for commercial fishing in the early 1960s (Caulfield 1983: 26). Customary trade, the exchange of subsistence caught fish for limited cash, was prohibited by the newly formed State of Alaska in 1959—but these exchanges continued. In 1982, for example, "…king salmon strips sold in Aniak stores and stores outside the state for $15 per pound, and red salmon "split fish" sold for $10 per pound" (Charnley 1983: 119–120).

FISHING PRACTICE

Most fishers in Sleetmute were born into multi-generational fishing families and gained their skills by participating in fishing activities; they have relied on fish all their lives and expect to continue to do so. One respondent explained:

[15] "Ocean bright" refers to salmon that have just entered the river to begin the journey to their spawning grounds; these fish have a higher oil content and firmer flesh to go with their shiny silver skin. As fish move up river, they undergo morphological change that includes a softening of their flesh and dramatic coloration of their skin.

> I love the fish; I love dry fish. I can't go without smoked salmon; I gotta have it. I grew up with it, and as long as my hands and feet can walk and work with it I'm gonna have it. (SLQ-10)

Several non-Native residents have learned to harvest and process salmon by teaching themselves with local assistance, and they also hope to continue to do so. People in the central Kuskokwim River region generally fish for salmon in mid-June through early-August. The most popular salmon runs peak at Sleetmute in July—the kings early, then sockeye, and then chum. Respondents spoke of using coho and the later run of chum salmon that run into September to make up shortfalls (Figure 6-2). This strategy has long been used when the early runs did not provide sufficient fish (Charnley 1983: 79).

According to Brown et al. (2012: 224), fish made up 80% of the edible pounds harvested for subsistence use in Sleetmute during 2009. Almost 90% of the fish was salmon, about 40% of which was king salmon (an average of 109 lb per person). At least six nonsalmon species are consumed regularly, especially when salmon are less available (SLQ-6). Nonsalmon fishing on the lower Kuskokwim was recently described in detail (Ray et al. 2010).

Several respondents maintained full time employment while simultaneously pursuing fishing efforts. Employed fishers generally use setnets, checking them before and after work (Figure 6-3). In the evenings, they process fish. Sleetmute harvest efforts were mostly directed towards king and sockeye salmon. Coho salmon were also pursued, but less intensively. Chum salmon are generally not targeted except by families with dog teams.

Figure 6-3.–Setnets allow employed fishers to catch fish while they work.

Past reports (Charnley 1983; Jonrowe 1979; Stickney 1981) characterized Sleetmute as being primarily dependent upon big-game resources and secondarily dependent upon salmon. This primary dependence was strong in the 1980s but has shifted with a decline in the moose population, as described in the next few pages.

In 1982, Charnley observed that a dwelling with a single head of household "…may have a dramatically altered pattern of salmon harvest, or may not process salmon at all" (1983: 108). However, elders, young couples, and youth were all observed fishing in 2009. Middle-aged men and women continued to be the largest participants—some of them unmarried and from different households, but working together to create the needed labor force. For example, one elder man fishes for his own and two younger families. The young husbands work elsewhere, so he does the fishing and the women do the cutting and drying. Together, they produce enough fish for all three households (SLQ-4). With respect to gender based divisions of labor, one respondent remarked:

> I guess Dad's the one who brined 'em and hung 'em up and kept the fire going, and Mom and them would cut them—and, I don't know, we all would go and check the net. That's one thing that everybody got up for, that's the … anticipation, man. My grandmother, she'd be up at – just sitting there waiting to check the net. She was like me, couldn't wait to check the net. (SLQ-11)

Generally speaking, men are responsible for operating drift nets and women for cutting fish, but there is flexibility as needed. For example, a single young man expressed interest in improving his cutting skills; he said he would rather dry fish and eat salmon than move to Anchorage for work (SLQ-6). One married woman commented that she drifts with another neighbor: "We both found it easier to drift with two women than a man and a woman together—there's a lot less hollering" (SLQ-3).

A number of youth and young adults were active participants in subsistence salmon fishing, and respondents spoke of teaching both girls and boys all the skills. Some elders, however, were chagrined about a general loss of skill and interest. "I don't see them in a fish raft with their mom and dad" (SLQ-12). Another respondent said that 20-30 year olds can cut fish now, and the teenagers are learning, "but they do not need them to survive like we used to" (SLQ-13).

Most respondents reported more reliance on salmon than in the recent past (in the absence of moose hunting), but less use than 40 or more years ago. They noted that the community's level of dependence on salmon for subsistence, including the number of people fishing, has decreased over the course of their lifetimes. Suggested reasons for that decline were employment obligations and the demise of dog teams for transport. The 1940s to 1970s was a time of tremendous change in rural Alaska. As airfields were built, the wage economy grew stronger while airplanes and snow machines replaced dog teams. Fewer fish were needed in the subsistence practice of customary trade, and commercial fishing continued to increase as a primary avenue to the cash economy, even if the fishers had to go downriver to get involved.

One elder respondent maintained that Sleetmute's level of subsistence fishing activity has stayed consistent for as long as he can remember (SLQ-5) and another thought that more people from Sleetmute are subsistence fishing now than did during the 1970s (SLQ-11). These observations are not necessarily inconsistent. If the first is speaking of human consumption and the second is speaking of fishing effort, they are both well supported by the evidence. Only a fraction of the effort is needed without the use of dog teams, but people have always eaten a lot of salmon—with variability that depends, in part, on the availability of other resources from year to year. Several families directed a large effort towards fishing in 2009 and those families reported a significant reliance on salmon for subsistence. Several respondents explained that since 2006, when moose hunting was closed in their eastern portion of GMU 19A [more thoroughly discussed in Brown et.al (2012: 356)], they have become increasingly reliant on salmon and placed a greater effort towards fishing. Many respondents spoke of needing to produce their own food instead of paying high prices at the store. One 30-year resident said:

> Well, the instant you move here and you walk into a grocery store, the first thing that's going to hit you is the price tag, and unless you're independently wealthy, you really don't want to pay those prices and of course we weren't, so you just start looking around at the local resources; what can you bring in yourself? And so, of course we had the moose for years, that's closed down, so now we really rely on the fish. Several times a week, we eat fish just to keep our grocery bills down, and we assume it's healthier than about anything else we could buy… Even if we had 100% of all the moose meat we want I would still want to eat fish 1-3 times a week. (SLQ-14)

With the rising cost of living, wild foods are all the more important to stretch household dollars as far as possible. This respondent also commented on other benefits of local food production, although economic stimulation was not among them:

> I mean just the whole environmental impact, you know, how much it costs to bring a banana to Sleetmute, Alaska, how much does it cost to bring rice to Sleetmute, Alaska? And how much petroleum and gasoline and all this are you using on bringing these things in, so just, you know, the more you can do locally, the better off the entire world is. You know, you eat healthy. We're not particularly supporting the local economy by doing that [subsistence fishing], but there's lots of benefits for doing it. (SLQ-14)

Dependence on salmon for survival and the importance of cultural continuity were regular themes in these interviews. The importance of being able to use local resources rather than being entirely dependent upon a national economy that is increasingly unstable was just one major reason respondents expressed a desire for subsistence salmon fishing to continue into the future. They expressed significant concerns about the bycatch of salmon in high seas pollock fisheries, impacts from climate change, the proposed installation of the Donlin Creek mine, and a lack of youth motivation.

GEAR

As described above, the predominant gear type in Sleetmute changed from fish traps to gillnets long ago. Since the 1950s, nets have been made of nylon that is more durable than cotton and can be purchased in dark colors. The chosen mesh size of gillnets allows for preferential harvesting, but what you catch still depends on what is in the river. One respondent talked about how nets catch a mix of fish with timing providing some control over the harvest:

> With a net you are not targeting anything, you are catching whatever comes in that net. I mean if we hear that the red [sockeye] run is predominantly strong that's when we like to fish. You know, we don't like to hear that somebody's catching 10 chum to 1 red, I don't particularly wanna go out and set a net…if somebody's got a setnet and they are pulling, you know, 50% reds and 50% chum, that's a pretty good number; you gotta go with it 'cause it normally never gets better than that. (SLQ-9)

In 2009, residents were observed using driftnets, setnets, and hook and line gear for harvesting salmon (Figure 6-4). Fish wheels were said to no longer be in use because of the difficulty in their construction and maintenance and the absence of dog teams to feed. One respondent reported that there was a fish wheel near Stony River, about 40 miles upriver, in 2008, but it had been at least 20 years since she had seen one at Sleetmute (SLQ-2).

Driftnets and setnets are used mostly downriver from the village, and setnets are used at the mouth of the Holitna River and other clearwater streams. Hook and line, legal gear for subsistence fishing along the Kuskokwim River, is used to harvest coho and occasionally king salmon. The southeast bank of the Holitna River, the mouth of Vreeling Creek and other clearwater creeks on the main branch of the Kuskokwim are popular locations for casting. People still spear whitefish on the Holitna, just before freeze up (SLQ-12).

Figure 6-4.–Rod and reel fishing is popular for subsistence fishing in the Middle Kuskokwim.

One elder respondent, whose husband is no longer able to fish, said "I like to setnet 'cause at my age, I'm scared to drift. But when my sons are here, and they're not working, they usually do the drifting, and I do the cutting" (SLQ-10).

Many people use hook and line gear in the clear water of the Holitna River drainage, sometimes freezing the catches, but often for a fun fresh meal rather than winter stores. A young man said:

> I like rod and reel where you have to fight it to get your trophy, instead of just throwing your net and pulling it back in, 'cause you have to really fight it with that rod, especially a fly rod, burn your fingers holding that line - I like that! … One time when I caught a huge king, about that big, I had a little dinky rod and it just pulled out, zzzzzsst, just smoked out that line and everything—just barely hanging on, but I reeled it in. Took me like half an hour .... (SLQ-6)

Gear changes in Sleetmute have resulted from changes in technology and changes in demand. Most dramatically, fish wheels came and went with dog teams, and the volume of fish needed for subsistence is much lower now. Whether set or drifted, gillnets are the dominant method today. The choice depends on personal preference, work schedules, access to a boat and motor, and other factors that vary from family to family.

Figure 6-5.–As strips dry, they are moved up in tiered smoke houses.

FISHING, PROCESSING, AND PRESERVING

The location of Sleetmute near the confluence of the clearwater Holitna River and the muddy Kuskokwim River provides for excellent fishing for salmon and nonsalmon species reasonably close to home. Today, most people do their fishing directly from the village, although fish camps used to line the Kuskokwim River "…all the way to Bethel" (SLQ-13). Two families traveled to fish camps from the village during 2009. The camps were located approximately two miles downriver from Sleetmute. Each had overnight facilities, yet the families often went back to the village to sleep. Specific driftnet and setnet sites change with changes in water level and river flow but remain in the same general areas. With careful observation, despite the cloudy water, fishers can sometimes tell where the fish are: "When we're sitting around the campfire, we look down – could see fish. I mean you can't see the fish but you can see where the fin is, you know, shows this line going – you can see 'em going up river" (SLQ-5).

There are also several single family settlements 1-3 miles from Sleetmute, where residents live year-round—close enough to good fishing that relocating to fish camp is unnecessary and fishing is done from home. Historically, fish were dried on open-air racks with smudge fires to keep flies off the meat, as described by an elder respondent:

> Long ago, they never had smoke house like mine all covered up. Well, they never had lumber or anything. They had the fish house wide open. And they never had it really hot. They had it low. There's so many fish in there, I don't know, hundreds of 'em. Long and

Figure 6-6.–Slabs and strips of salmon hang to dry.

> low. This uh, fishcamps, not like you see right now, you know, plywood or lumber along it. They were open. Open air… And how many different fires they put in there—like, one, two, three, four. Because the smokehouse is long. And not high. (SLQ-13)

Today most fish is preserved by drying and smoking in enclosed smokehouses, which are often tall rather than long and low. Fish to be dried is usually cut into strips, which do not require cross hatching, or fillets (Figure 6-5). The fillets are cut so that, when placed on racks, bite sized morsels hang down—exposed to air circulation (Figure 6-6). One respondent explained the need to spread the fish for drying and the shift to "king strips" in her lifetime. When she was a child:

> They never had strips, they had blankets. I never heard of strips until later, later on in my life. I don't know where that came from. Different size blankets. Half size, full size. If it's a full size big king salmon, they always used some kind of stick on the back, not on the meat side, but on the skin side. They make long skinny sticks to put in the fish so they can dry. Instead of folding they can spread out. If you use stick, just straight out, like this, they dry faster, if you don't they start smelling, because the air wouldn't get in there. They don't use sticks anymore because they cut it and they just, you know, small pieces. (SLQ-13)

Cottonwood, alder, or driftwood is used to smoke fish, depending on both personal taste preferences and availability. At least one respondent remembered the hard work of handsaws and commented that "…chainsaws have made it easier to smoke fish" (SLQ-10). Fish heads, hearts, and eggs are also used, sometimes dried in the smokehouse or placed directly into soup. Children watch these processes to learn, and are often tasked with hanging the fish and keeping the smoke going in the smokehouse (Figure 6-7). Some fish are stored in the freezer, which decreases the immediate workload of processing fish when the runs are heavy and extends the bounty of summer into the winter: "Of course, we like freezing fish—we can eat fresh fish from the freezer!" (SLQ-13). Another respondent lamented that "Some of them just freeze fish and they don't bother with dry fish. Hopefully that will change" (SLQ-8).

SHARING, BARTER, AND CUSTOMARY TRADE

Although sometimes said to be in decline, sharing seems widespread. Several respondents spoke of an obligation to make sure those who cannot fish for themselves have fish. Those able to handle fish but lacking equipment usually either help with the effort and receive processed fish, or do not help and receive whole fish. Those unable to help, or far away, receive processed fish—ready to store for winter or eat right away. According to the comprehensive subsistence harvest survey in 2010 (Brown et al. 2012), it was estimated that 75% of Sleetmute households harvest salmon, but almost all households consume salmon. Most fishers seem to harvest beyond their own needs, so they can meet social and cultural obligations within and beyond extended kinship networks (Figure 6-8).

Distribution to elders was common: "If we catch fish we think about the older people" (SLQ- 2). Another respondent described it this way: "Lots of sharing… especially the first few weeks when the fish is kinda slow in coming up, 'cause it's kinda slow up here – takes them quite a while to get here. If we had already

Figure 6-7.–These small coho blankets will need to be turned to allow drying on both sides.

our share, and we catch the second batch, then we usually call around and ask if they want some" (SLQ-10). Fish is also distributed to family members living far away: "Oh, we just fill up that smoke house. We got lots of family living in town [probably Bethel or Anchorage], and we send them fish. They can't come out and do their own fishing, so we send them fish" (SLQ-5).

Motives vary, and the long tradition of sharing can involve efficiency for the fishers. Sometimes people share simply because they do not want to cut all the fish they catch (SLQ-8). Another respondent described how, rather than stopping the wheel when they had enough fish, his father would

> …share them with other people, let 'em check the fish wheel. Same way now, sharing. You give 'em what you don't want. You don't throw 'em. You keep everything you've got, or you catch. If you don't want 'em, give it to somebody else. (SLQ-1)

Without specific questions, little was said about the exchange (barter) of fish for other resources, or its trade for limited cash. Respondents seem to think of exchanging fish for cash as a commercial activity, and customary trade is prohibited for fish harvested from the state waters of the middle Kuskokwim. Many implied that the effect of upriver subsistence uses on the fishery was minimal and restrictions should apply to the lower river commercial fisheries but not to upriver subsistence users. One respondent said:

> I hope they do something about that, every time they change mesh net… They shouldn't monkey around way up here; they can do it down there. We don't catch too much; we're just fishing to eat. Down there they sell 'em. But up here we keep what we catch. (SLQ-1)

Noting the size of Bethel and heavy subsistence participation by the city's residents, some Sleetmute fishers mentioned subsistence in the lower river in discussions of salmon shortfalls at Sleetmute. At the same time, misunderstandings of the regulations persist:

> There's a large subsistence usage on the lower river, it's just sheer population numbers that demand that. It's also, under the subsistence deal, they are allowed to sell products, you know, strips and stuff like that and there's families that do that down there because they have a running market down there. (SLQ-9)

The lowest third of the river, from Aniak down to Kuskokwim Bay, is controlled by federal managers, while the remaining upper two thirds are managed by the State of Alaska. The rules regarding customary trade are the same in Sleetmute as in the lower river, except for the proximity to federal waters. Subsistence fish caught in federally managed waters can be exchanged for small amounts of cash while subsistence fish caught in state managed-waters cannot. Even those fish caught in federal waters and exchanged for cash, however, must be fresh or frozen whole, because of requirements set by the Alaska Department of Environmental Conservation (ADEC) regarding home-based food processing and sales—meaning that the sale of informally processed strips or other non-certified products is illegal no matter where the fish are caught [18AAC31.210(7)].

SUMMARY OF 2009 SUBSISTENCE HARVEST SURVEY DATA

In 2010, a comprehensive survey was conducted in Sleetmute to document contemporary patterns of resource use for the year 2009 (Brown et al. 2012: 232). Population estimates vary. The 2010 survey, expanded to include all households, estimated a population of 90 residents (Brown et al. 2012: 227). This seems to be a realistic estimate given U.S. Census Bureau data: the population was found to be 100 in the year 2000 and 86 in 2010, demonstrating the outmigration trend noted in a recent study of Alaska's demographics (Lowe 2010) . These data suggest the survey estimate of 90 was reasonable, supporting the strength of our data, and will be assumed correct in this review.

Figure 6-8.–One king salmon can provide several meals for a family.

Data regarding resource uses were collected from 32 of 37 households (86%), and then expanded to determine estimated totals. Salmon figured heavily in the numbers. Approximately 4,015 salmon were harvested by Sleetmute residents in 2009: 1,246 sockeye, 1,041 king, 976 chum, 728 coho, and 24 pink salmon. Each species has a different average weight and the estimated number of usable pounds varies. For example, the large size of king salmon means they provide more food per fish than other species (9.5 lb as compared to the 3-6 lb from other species; Brown 2012:412). The remainder of this review will be in terms of edible pounds.

All Sleetmute households reported using some of the estimated 31,420 edible lb of wild food harvested by residents during 2009. Of those edible pounds, 81% (29,770 lb) was fish, 68% (24,991 lb) was salmon, and 27% (9,844 lb) was king salmon. The estimated portion of households using salmon was variable: 91% of households reported using sockeye, and the total estimated harvest for the whole community was 5,977 lbs of sockeye, giving an average per capita consumption of 161 lb; likewise, 88% of households reported using 9,844 lbs of king salmon (266 lb per capita), 72% reported using 4,125 lbs of coho (111 lb per capita), and 69% reported using 4,983 lbs of chum (135 lb per capita).

The different size of fish explains how king salmon provided the greatest numbers of estimated edible pounds both per household and per capita. Of the estimated average 675 lbs. of salmon consumed in each

household (average 3 people per household) in 2009, approximately 266 lbs. were king salmon, 161 lbs. were sockeye, 135 lbs. were chum, and 111 lbs. were coho salmon. These numbers must be qualified by the selective, but not exclusive, use of chum salmon as dog food. While it cannot be assumed that the nearly 5,000 lb of chum harvested in 2009 was all fed to dogs, neither can it be assumed that those pounds were split across households. Most households process and consume the chum salmon that happen to get caught in their nets, and a few dog owners harvest chum salmon intentionally. Some fishers reported liking chum salmon to eat, and others reported throwing live chum back.

Although 97% of households reported using salmon, only 75% indicated harvest of salmon. This can be explained by the fact that an estimated 59% of households give salmon away, as described above. More than half the households (56%) also report receiving salmon, so some of this sharing necessarily occurs between households that have successfully harvested salmon—perhaps sharing different species depending on the luck of their draw.

Figure 6-9.–Small and medium king salmon; large kings are reportedly rare now.

Many respondents to the comprehensive subsistence harvest survey, like many in this research, report a heavier reliance on salmon in recent years with the decline of moose populations and the moratorium on moose hunting in the area (since 2006). Some fishers say they would fish the same even if they got moose, with an implication that they would be able to share more.

LOCAL OBSERVATIONS OF CHANGE IN SALMON FISHERIES

FISH AND ENVIRONMENT

King salmon size and abundance were generally reported to be in decline (Figure 6-9). Many respondents noted that they rarely catch big fish anymore and that it takes more time to catch the same amount of fish. One respondent said that he used to be able to catch as many fish in 24 hours as in two weeks now (SLQ-4). Some respondents suggested that other salmon species are also in decline, although one noted that sockeye salmon are a relatively new phenomenon and seem to be continuing their increase. “You talk to the old folks around here. They don’t remember you know these, 30-40 reds in a net” (SLQ-3). Also,

respondents reported king salmon abundance in 2009 to be greater than in 2008. Decreased subsistence harvests are not thought to be solely attributable to declined runs, but "nowadays they have snow machines for transportation, boats, and that's why nobody wants to go fishing anymore—they have no dogs to feed" (SLQ-12).

Changing environmental conditions, ocean bycatch, downriver fisheries, and pollution were consistently blamed for the observed decline in most salmon species. Several respondents spoke of the dramatic effects of commercial fishing in the lower river. One fisher said that back in the 1970s,

> I could easily, in a 60 ft subsistence net, take 200 chum a day, checking morning and evenings; now if I could get 20 chums a day it's a good day, and that's better than it was before they had the [commercial fishing] closures. I mean, there was a year [before the closures] where I betcha all summer long I didn't catch 20 chums. It was scary, like somebody had turned a switch, how quickly they disappeared. (SLQ-3)

Generally speaking, reports concur that winter is shorter than it used to be, and summers are rainier and sometimes colder. Changes in weather, ice conditions, water temperature, and water quality were also noted:

> We don't have long winters like we used to. Spring is earlier, fall is later – summer isn't necessarily warmer. Fall drags out until the end of November, and spring starts in March and drags on into May.... Used to be here, anything to do with a boat after October 1 was extra; you could have ice any day, just instantaneous – now we assume we'll be boating until Halloween. You know, it might run a little ice around the first of October, but then it disappears, and you're boating for three more weeks… That's a big change. We don't seem to get those prolonged cold spells, you know, 40, 50 below that lasted three weeks. Now if it gets that cold, it's only for a night or two...Yeah, and the killing frost is a lot later. (SLQ-3)[16]

Some people judge whether salmon smolt are present by the sheefish that eat them: "If the sheefish don't stick around very long around here, there's no salmon smolt for them to feed on. If the sheefish stick around, there's a lot of smolts moving down the river" (SLQ-3).

Weather affects fish processing as well as ecology. With respect to how long it takes to dry fish, one respondent said "Well, if it's good weather—sunny, like long ago it used to get sunshine and hot—I don't know, two weeks, sometimes three weeks" (SLQ-13). With rainier summers,

> …oh, they don't wanna dry. They spoil. And you've gotta move 'em around, always move that fish around. There's a can, you know, a drum, there, that heats up – or smokes. Right now you don't need no heat, 'cause it's dry. But, in like July, somewhere, when it starts raining, and now because of the climate change, you can never predict what to expect; rainy days, more rain, or thunder. We don't get that anymore here. Lightning and heavy rain. And the rain was strong. Here, it's just steady rain, and light rain, a little heavier, just goes on and on. But long ago it's big heavy rain, and it'd just clear up and the sun comes out. Thunder and lightning. We don't even get thunder here anymore. Just once in a while we'll get a little bit of lightning. (SLQ-13)

Another respondent felt as though in-river fishing had little to do with declining numbers:

> It's obvious what's happening to the fish is happening out on the ocean because there is nothing changing here in a big way… something has to be happening on the spawning

[16] There were two participants in the interview coded SLQ-3; they often finished each other's sentences. Most quotes are of one or the other individual, but this quote and one noted below include both of their voices.

> ground or out in the feeding area out in the ocean and nothing's changing on the spawning area; the changes are in the ocean with the commercial fishing. (SLQ-3)

MANAGEMENT

> Usually the big ones are caught down below, so we get the leftovers (SLQ-4).

Many respondents in Sleetmute expressed the sense that they are not harming the fish populations. Fishers suggested that the rolling subsistence closures implemented in recent years were misguided and that commercial fisheries downriver and in the ocean are the entities requiring regulation. Nonetheless, people generally reported following the rules. One resident said that she had not heard a lot of grumbling because people want the resource to recover:

> It was interesting a few years ago, knowing that those closures were going to be coming, and I wondered how the folks here in Sleetmute would react and, you know, "would they pay attention to it?" or whatever. But it got just to be, you know, you'd walk to the post office and somebody would say "hey," you know, "we can start fishing at midnight tonight," and you know – they were paying attention....
>
> Yeah we grumbled if on Tuesday afternoon we couldn't go fishing when we had time and the weather was good and we wanted to fish, but on the other hand, you're just really pleased to do anything you can to help them survive. It's like the moose closure here. That's hard on everybody. I mean you're out here with the poorest of the poor, and the only easy way for them to feed themselves and their families is to go get a moose, and if they can't do that that's a tremendous hardship, but people don't really grumble about it because they think its good for the resource and allow it to rebound, give it a little bit of a rest. (SLQ-14)

Another respondent said that in the future, she hopes that the fishery will be managed more effectively for subsistence fishers rather than commercial. If those issues are addressed, the fishing will be good in 20-30 years. Her children live in Anchorage, and they know how to fish. "If they come back, they will be fishing" (SLQ-11).

Speaking specifically of the discontinuation of the king salmon fishery in the lower Kuskokwim River in the late 1980s, one respondent commented that

> …our situation up here is different – like I said the only thing that I notice different in this whole thing as far as a commercial fishery affecting it is that we don't have the holes, we don't have those big holes, and we used to have, I mean literally, there was nothing in the river during the salmon run, you know, it's just you would catch nothing, and that is, you know, was just pure commercial fishery, you know because, like I said, in those days there was such a market for fish, you know, there were 600 permits on that lower river (SLQ-9).

A pair of respondents (SLQ-3; two respondents, one interview) had a lot to say about commercial fishing and local enterprise. The woman said:

> I used to be real pro-commercial fishing on the Kuskokwim River, 'cause I knew a lot of people in Bethel who made their living doing it. But I worked in the fisheries on a tender one year down there, and it just made me sick how those fish were handled, how much waste there is, the fact that a lot of those fish are just stripped of their roe and the carcasses are tossed, you know, not the kings [Chinook salmon], but the chum and stuff. So I gotta say my sympathies for the commercial fisheries, at least in the Kuskokwim, just isn't there. (SLQ-3)

Beyond the industrial nature of commercial fishing, these respondents felt that the local benefit of commercial fishing is mostly lost with the commercial sale of whole fish. The man suggested:

> If they have a commercial fishery on the river, I think it has to be a value added fishery with somebody smoking fish and selling it, som'in' like that. There's money in that – but just catching fish to fly into Anchorage to process is, that is ridiculous. If you have guys with a smokehouse smoking fish and selling strips, they can make some money doing that, even with a small number of fish…. (SLQ-3)

Several respondents discussed a desire to ensure that chum salmon were not killed in their nets. Some people said that the use of driftnets allow the release of unwanted fish, while use of setnets killed unwanted fish before they could be released. Most respondents said they process those fish, but chum salmon are not a preferred species for most fishers, who may give them away.

SUMMARY AND DISCUSSION

> It's a wonderful resource…that river does so much to sustain a lifestyle; it is a highway, it provides access to hunting, and it's always got some kind of protein in the water, and that's a real gift, you know, most places don't have that, and you get real accustomed to having it, you know, and you would miss it if it wasn't there…whatever's good for this river is good for everything else; it's real important. (SLQ-9)

The high values placed on fish and on fishing were clear in the interviews for this chapter, and concerns regarding the sustainability of salmon fishing were common. Many respondents worry about whether the river will have fish for their grandchildren and how a lack of fish would affect the community. One respondent said that if they cannot get the fish they need "then we'd have to be on welfare" (SLQ-4). Another describes warnings from elders to not forget skills that took generations to acquire:

> What holds us together is the love for each other. We try our best to live traditionally because pretty soon the world is gonna run out of gas, and we have to know these things. That's what's we been told long time ago. The elders said that this oil would run out and we have to teach our kids how to live off the land like we used to long ago. (SLQ-2)

The need for cash is clear. However, while jobs provide income, they interfere with subsistence activities. Local employment allows the use of a setnet for those with the energy to process fish in the evenings, but few job opportunities exist in Sleetmute; employment often means leaving the village for two weeks at a time. This type of schedule might allow for some fishing, if the two weeks off coincide with the peak of the run, but makes the long term commitment required for drying fish difficult. The balance between cash income and fishing is not always a choice:

> Sometimes we work and sometimes we don't, 'cause here this village some guys get all the jobs and the rest of us have no choice but to just go out and do fishing then if they don't want to hire us. So we just take care of the family, make sure we have enough fish and everything. (SLQ-5)

Both short and long term effects of proposed development of the Donlin Creek mine are of concern. Barge traffic, expected by respondents at 4 large boats per day in the summer, is feared as disruptive in terms of noise and rolling water on the shores. With respect to the proposed mine:

> People here need work, mining is fine and nice, but just do it in a reasonable manner. To me that doesn't mean foreigners coming in and operating mines. They're gonna bankrupt themselves when they've made their money, sell it to 'Joe Blow's Fly-by-Night Corporation.' They're gonna bankrupt themselves and disappear and then the government is gonna clean it… The people who are going to make the money off that mine need to bear the cost of it… Those mining companies on that scale do not have a good track record, no matter what nice little Donlin Creek things come out every month showing all

> the local guys working there, and everybody's name that you know, and it's fun to see the pictures. But those aren't the guys making the big bucks, and Donlin Creek is not doing this to be nice to the Native villages, they're doing it 'cause they're making a killing on it. (SLQ-3; direct quote, including two voices)

The hardships imposed by the increasing cost of fuel and commodities are substantial. "Boy I tell you, it's really *really* bad. Boy. Seven dollars and seventy cents a gallon? Holy smokes. Compared to when I was a kid, five - six dollars for a can of gas. Now it's fifty something" (SLQ-1). Increases in fuel costs were reported to create a large financial burden for fishers. However, respondents reported that they were more inclined to take adaptive measures, such as using setnets rather than driftnets or drifting with the motor off to reduce fuel consumption, rather than to discontinue fishing activities. "If there's no gasoline, it's gonna be tough…we're all gonna be out there looking for those eddies, and we're gonna be glad we have kayaks" (SLQ-14).

NIKOLAI

Prepared by Andrew R. Brenner

SETTING AND CONTEXT

In May, June, and July 2009, 2 ADF&G Division of Subsistence researchers documented information on Nikolai subsistence salmon fisheries. Researchers completed a total of 13 semi-structured interviews, averaging 63 minutes in length, with 18 Nikolai residents. Ten men and 8 women were interviewed. While respondents represented a range of age groups (19–81 years old), the majority were community elders. Most interviewed respondents began actively participating in salmon fishing activities as children and had fished for much of their lives.

Historical background and natural environment

Nikolai is an Interior Alaska community located on the South Fork of the Kuskokwim River with a 2009 population of 100 (ADLWD 2012). Located 46 air miles east of McGrath, Nikolai lies within the upper Kuskokwim River region, geographically corresponding to the broad Minchumina Basin that is bordered by the Kuskokwim Mountains to the north and the Alaska Range to the south (Stokes 1985: 13). The upper Kuskokwim River region has a continental climate with temperatures ranging between extremes of -60°F and 90°F. Numerous rivers and lakes with interspersed black spruce forest, marshy tundra, and riparian white spruce and balsam poplar forest is typical of the region (Holen et al. 2006: 2). The majority (>90%) of Nikolai residents are Alaska Native, primarily of Upper Kuskokwim Athabascan (*Dina'ena* or *Dichinanek Hwt'ana*[17]) descent. A number of residents are members of or have genealogical and social ties to other cultural groups within and outside of Alaska, especially neighboring Athabascan, Middle Kuskokwim Yup'ik, and Euro-American peoples (Holen et al. 2006: 65). The Upper Kuskokwim Athabascan people historically occupied and still use much of an area encompassing approximately 22,000 square miles (Hosley 1966: 6), with a traditional territory ranging roughly from the mouth of the Stony River on the Kuskokwim River northeast to Lake Minchumina, and extending north and south into the surrounding mountains. Today, most residents of the upper Kuskokwim region live in the communities of McGrath, Nikolai, Takotna, and Telida (Stokes 1985: 33).

Information about the inhabitants of the upper Kuskokwim River region prior to 1830 is limited. Although relatively little is known about the ancient prehistory of the area in the immediate vicinity of Nikolai, nearby archeological evidence indicates that the area has been occupied by humans of various cultural traditions for over 10,000 years (Saleeby 2010: 125). Oral histories and early historical documents provide a more detailed image of subsistence for more recent times near Nikolai. The general pattern of subsistence in pre-contact times likely involved a small nomadic population not exceeding 300 people that traveled in small groups throughout the year, with travel heavily influenced by seasonal concentrations of caribou, sheep, salmon, and whitefish and the majority of time spent in upland areas rather than river lowlands.

The first direct contact between Russians and Upper Kuskokwim Athabascan people probably occurred in the 1830s as fur traders traveled into the upper Kuskokwim (Zagoskin 1967: 80–81). A trading post was established at Vinasale (twenty miles south of McGrath) by 1850, and trade between Russians and local

[17] Self-referential terms for Upper Kuskokwim Athabascan people include Dina'ena "the people", not to be confused with the neighboring Dena'ina of Southcentral Alaska, and Dichinanek Hwt'ana "Timber River people" (Collins 2004 (revised): 8).

residents took place primarily at this trading center, with few Russians traveling upstream of the mouth of the Takotna River (Oswalt 1980: 86).

Following the American purchase of Alaska in 1867, Euro-American presence increased in the upper Kuskokwim. It is likely that an increased use of sled dogs corresponding with the development of the fur trade in this period resulted in an increased emphasis on summer salmon fishing for dog food, a trend also noted for other areas of Interior Alaska during this time period (Andersen 1992). In 1898, an exploratory expedition led by Josiah Spurr first documented the seasonal community of Nikolai, which has since moved twice from its original location at the confluence of the Little Tonzona and South Fork Kuskokwim rivers (Brown 1983: 159–160).

After significant gold discoveries in the Innoko River drainage in 1906, mining opportunities in the upper Kuskokwim led to an influx of American prospectors who required food for themselves and their dog teams (Stokes 1985: 28–29). Local residents supplied this increased demand for food with game meat and fish, and this effort was helped by the adoption of highly efficient fish wheels in upriver communities by 1918 (Schneider 1985: 12). While 19th century residents of the upper Kuskokwim River region relied primarily on caribou, bear, and sheep that were hunted over a large area in and around the Alaska Range, by the beginning of the 20th century moose had increased in abundance in the region's lowlands (Collins 2004 (revised): 132–133) and eventually became a staple food resource. Together with increased access to trade goods at river locations, salmon and moose provided a consistent and localized food supply that may have promoted the development of riverside communities at Medfra, Big River, East Fork and Salmon River (Collins 2004 (revised): 12–13; Stokes 1985: 31). Epidemics in the early 20th century, together with the draw of increased trade opportunities and the establishment of a Russian Orthodox church in the 1890s led to the consolidation of some members of these smaller communities at Nikolai (Collins 2004 (revised): 29; Stokes 1985: 27). When a permanent school was established in Nikolai in 1948, remaining residents of surrounding communities moved to Nikolai during the winters so that children could attend school and Nikolai became further established as a permanent community (Collins 2004 (revised): 15).

The gradual abandonment of dog teams as a primary mode of transportation affected the nature of subsistence salmon fishing by Nikolai residents during the 20th century. In the 1930s, airplanes came to replace dog teams as the primary mode of long distance mail delivery and shipping. Mining intensity declined in the region with the onset of World War II and the need for heavy equipment elsewhere in Alaska in support of the war effort (Stokes 1985: 30), reducing demand from miners for dog food. Finally, the introduction of snowmachines in the 1960s replaced dog teams as the primary mode of local transportation in winter in a relatively short period of time. Prior to the adoption of snowmachines, many residents of Nikolai and Telida spent a large part of each summer using fish wheels to harvest chum salmon to be used as dog food (Stokes 1985: 61). At Alaska statehood, subsistence salmon fishing regulations changed and fish fences that had been used before this to harvest king salmon became illegal. (Holen et al. 2006: 93). This regulatory change led to the replacement of fish fences with a rod and reel subsistence king salmon fishery that, along with the harvest of king salmon with set gillnets, currently yields a large portion of Nikolai's total wild food harvest.

FISHING PRACTICES

TIMING OF SUBSISTENCE SALMON FISHING

> We always went to fish camp every summer after school, and my grandma…both my parents…they'd all set out fish nets ... We'd be there all summer long and come back for school. (NIK-13)

The seasonal pattern of salmon fishing in Nikolai has changed from harvesting multiple salmon species over the entire summer to emphasizing mainly king salmon from late June until mid-July. Fishing for other salmon species continues for some residents into August or September.

Nikolai residents prepare for salmon fishing in early summer. In the past, a portion of the community relocated downriver to Medfra in May to prepare for salmon fishing and to take advantage of limited employment opportunities including work at a local trading post and selling dried chum salmon for dog food. “Everybody would pack up their boats and dogs, everything, and go down to Medfra and camp out in wall tents and come back in the fall” (NIK-1). In late May, prior to regulatory prohibition on the use of fish fences (see “Gear” section below), some families traveled to fish camps and began preparing wooden fish fences, drying racks, and making other preparations for the arrival of salmon. In recent years, socioeconomic changes, including more reliable year-round employment opportunities in Nikolai, have led to fewer Nikolai residents using fish camps for extended periods of time each summer. Those families that do travel to fish camps tend to leave Nikolai in mid to late June or early July in anticipation of the arrival of king salmon.

The first king salmon reach the Nikolai area in late June or early July. Respondents emphasized that the arrival of king salmon varies depending on which tributary the salmon are returning to. For example, king salmon normally reach Big River and Blackwater Creek in mid to late June; king salmon returning to the Little Tonzona River arrive slightly later, and king salmon return to Salmon River around the 4th of July. Corresponding to this variation in timing of salmon arrival, fishers leave Nikolai for salmon fishing at different times depending upon in which tributary they fish. King salmon fishing for most families peaks soon after the 4th of July. Many Nikolai residents who do not spend much time at fish camps will travel for day or weekend trips to favorite fishing locations during early July to ensure that they harvest king salmon. King salmon fishing continues less intensively through the remainder of July. Respondents described that the numbers and quality of king salmon begin to deteriorate after early July and fishing effort correspondingly diminishes throughout the month.

Chum salmon arrive about a week after the first main king salmon pulse in early July. While in the past, many families remained at fish camps to fish for chum and coho salmon throughout July and August to secure a food supply for dog teams or for trading, most families now return to Nikolai once they have harvested king salmon. Some residents continue fishing for coho salmon in the immediate vicinity of Nikolai. Respondents described that the best coho salmon fishing is typically during the first two weeks of August.

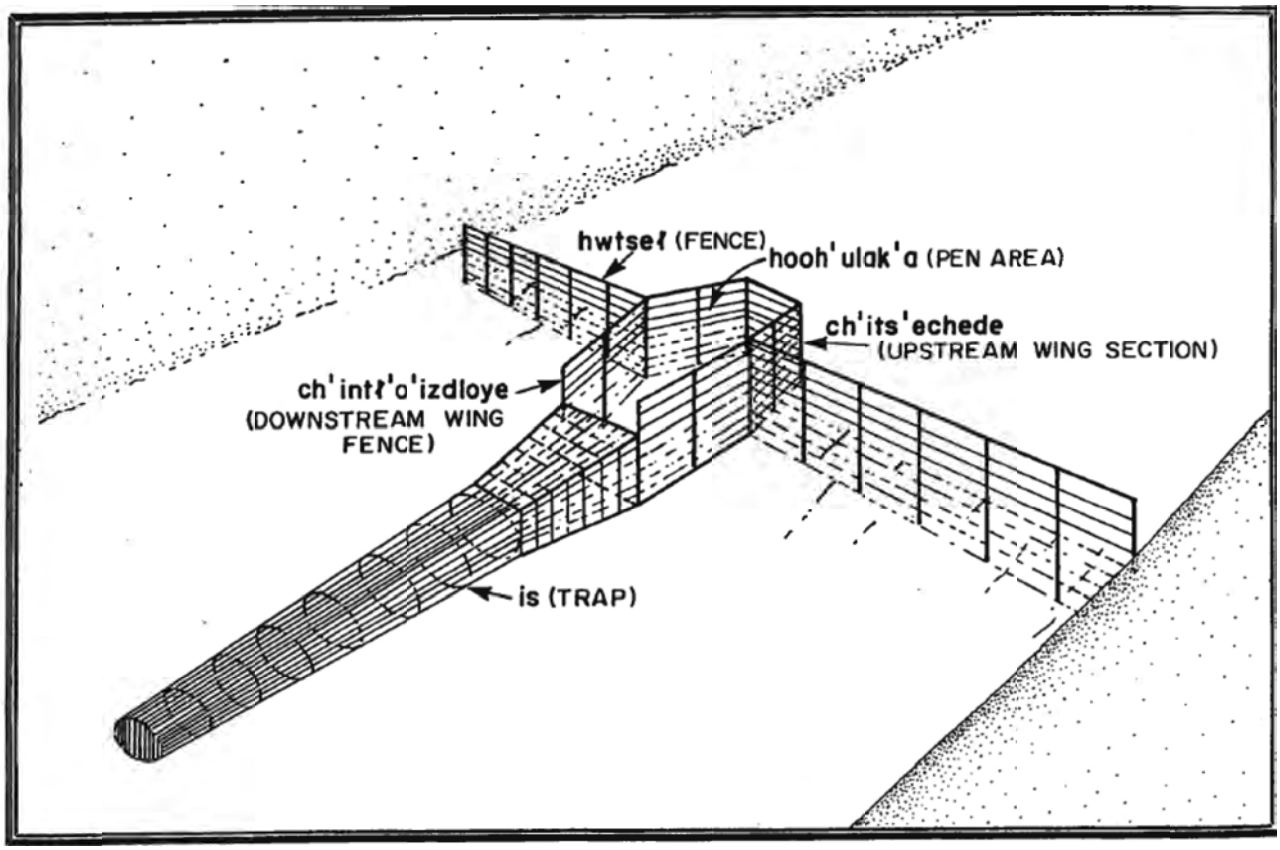
GEAR

Key respondents described several gear types and associated techniques that are used in Nikolai or were used in the past to harvest salmon, including fish weirs and fences, fish traps, fish wheels, rod and reel, set gillnets, dip nets, and fish spears.

FISH FENCES/FISH TRAPS

> They were so smart that they would open up the fence and let the salmon go through…they got as much as what they needed, how much they could handle, they’d let it go through, they never spoiled nothing. They knew the fish had to go through to keep coming. So they’d tear off a section of that fish fence. (NIK-1)

Wooden salmon weirs and attached traps were widely used in the past to harvest king salmon. While such weirs or “fish fences” were not used by Nikolai residents at the time of this study, key respondents regularly discussed the former importance of fish fences in their subsistence fishing. Stokes (1985) provides illustrations of a fish fence used to harvest king salmon in the area around Nikolai (Figure 7-1). Fence construction involved driving numerous wooden stakes across shallow clear water tributaries of the Kuskokwim River, temporarily blocking passage of salmon and utilizing their upstream movement to divert them into a small hole in the fence that led into a holding pen area. From the holding pen, king salmon would drift with the current into a trap constructed of long white spruce splints. Respondents in this study elaborated that they also remembered fish fences being used without a trap to concentrate fish downstream of the fence, and then using other gear including dip nets, spears, and rod and reel to harvest



Source: (Stokes 1985: 383)

Figure 7-1.–Upper Kuskokwim fish fence.

the salmon more efficiently than would be possible if they were not gathered below the fence. "I know there was a lot backing up behind the fence. We were just using rod and reel…fishing. I think that was what was usually…what we had it [the fish fence] for then. Just for the fish to get behind…." (NIK-14).

The use of fish fences that block upstream migration of salmon as a harvest method became illegal concurrently with Alaskan statehood in 1959, largely as a conservation measure in response to what was perceived as an unsustainable commercial salmon trapping operation that employed large scale fences and traps (Colt 1999). Wooden fish fences were still used to harvest king salmon in the vicinity of Nikolai until the mid-1960s when the regulation prohibiting the use of fish fences was first enforced in this area (Stokes 1985: 224). Respondents born prior to this date generally had detailed first-hand memories of fish traps.

Although Stokes (1985: 214) describes the efficiency of traditional fish fences and traps used in tandem as "probably unparalleled today," key respondents in this study emphasized the concerted effort of large groups of people required to construct and maintain wooden fences in the face of the constant onslaught of both river currents and the large fish themselves. Respondents also described the near impossibility of completely blocking off the river channel to the passage of salmon due to the regular gaps that formed in the fence and due to the fact that they were temporary structures because they were used to harvest only the portion of the salmon run needed for food.

> We just doing it for our own use, subsistence, what we use. And that's what we get. When it's enough, enough. We just quit right there. Even still more fish, but sometimes we quit early. Soon as our smokehouse even started getting full. We just pulled the fence out, fishtrap. Threw it in the bank. And all the fish go by. (NIK-7)

In general, respondents were skeptical of the ability of such traditional fish fences to cause significant damage to salmon populations, an argument they bolstered with the fact that this technology was in regular use long before their lifetimes and yet salmon continued to arrive every year. While several respondents expressed a desire to be able to employ fish fences without restriction in the present, other respondents described the amount of fish potentially harvested with this technology as above the current needs of Nikolai residents. Some respondents were concerned about the knowledge of fish fence construction and use not being passed down to younger generations. One respondent had constructed a fish trap for educational purposes that was located in the school at the time of this study, although the actual demonstration of fish fences' use as a harvest method for salmon is currently not legal under state regulations (AS 16.10.100). However, a small fyke net with a lead that does not obstruct more than half the stream or channel is legal subsistence gear for nonsalmon fishes (5 AAC 01.270; 5 AAC 39.105 (d)(17)).

FISH WHEELS

Fish wheels formerly played a large role in salmon harvests near Nikolai, although none were in use in Nikolai at the time of this study. Respondents described operating fish wheels in the past to harvest large numbers of chum salmon for use as dog food (both to supply trading posts and for personal dog teams), particularly in the now largely abandoned community of Medfra downriver from Nikolai. The need for salmon as dog food declined with the arrival of airplanes and then snow machines, and as trapping and mining activity in the region lessened, decreasing the need for multiple roadhouses and trading posts along the upper Kuskokwim River (Stokes 1985). Consequently, the use of fish wheels to harvest large quantities of salmon and whitefish to sell as dog food eventually stopped. Some families continued to operate fish wheels for their own dog teams and for personal consumption after this period, although this seems to have been rare in the past few decades (Stokes 1985). An additional factor leading to the reduced use of fish wheels may be improvements in other fishing gear. Respondents described the preference of fish wheels over nets of the past that were more prone to rot and tearing than those available today.

> Interviewer: When you used to come to fish camp as a little boy, you came up to Nikolai and then did you say you used a fish wheel?
>
> (NIK-19) Yeah. That's all they ever use. Fish net is too much trouble. They tear up real easy.
>
> (NIK-20) Everybody used to have fish wheel.
>
> (NIK-19) They rot too...there was no good material. Today even you can buy them gill nets and they last a long time if you don't tear them up.

Respondents described constructing a community fish wheel in Nikolai in recent years, which was eventually abandoned because there was little need for the large quantities of chum salmon and whitefish it produced as well as continual problems with maintenance, although some respondents expressed interest in constructing a community fish wheel again in the future.

ROD AND REEL

Following restrictions on fish fences and traps in the 1960s and the decreased need to use fish wheels to harvest large amounts of chum salmon for use as dog food, the use of rod and reel for king salmon in clear water tributaries of the Kuskokwim River developed into a major component of the annual subsistence harvest. Rod and reel fishing for salmon was only recently reclassified from sport fishing gear to a legal subsistence gear type in the upper Kuskokwim region. Some respondents were somewhat uncomfortable describing rod and reel fishing as a subsistence practice relative to other more well-known subsistence gear types such as fish traps and gill nets; however, in many ways, rod and reel fishing has come to replace the historically used fish fences and traps. Respondents described the tributaries where

fish fences were traditionally used as less effective for gill nets due to the nets' visibility in clear water. Fishers have refined rod and reel techniques such that they can usually harvest sufficient king salmon to meet their subsistence needs at the same harvest locations. A respondent described, "There was a transition where rod and reel became the method of subsistence because there were other methods that were taken away. So I think it wouldn't be fair to say that it's sport. I think it is food. You just don't get as much. And they get quite a bit…." (NIK-15).

Rod and reel fishing in Nikolai primarily targets king and secondarily coho salmon, in addition to nonsalmon species such as northern pike and sheefish. The use of rod and reel for king salmon harvest normally takes place in clearwater tributaries of the Kuskokwim and involves large spinning rods used with heavy monofilament line and large spinners as lures (Figure 7-2). Fish are landed with commercially produced landing nets or by reeling them into shore so that a bystander can grab and dispatch them with a wooden club. Fishing takes place either from shore or from small beached or anchored boats and often involves small groups or families fishing simultaneously and nearby each other with several people helping to land individual fish. Although the number of king salmon an individual fisher is able to harvest is variable, one respondent who was highly active in the rod and reel fishery in recent years described a typical individual catch of between 5 and 9 king salmon over a long night of fishing at Salmon River. This same respondent also described limiting his catch to this range, even when it became possible to catch more, due to concerns with the time needed to process more salmon than this concurrent with regular summer employment during the week and long travel (typically around 8 hours) between Salmon River and Nikolai.

Figure 7-2.– Nikolai youth fishing for king salmon with rod and reel at Salmon River.

Some respondents described regularly releasing large female king salmon as a self-regulated conservation practice, although other respondents expressed concern that catching and releasing salmon may lead to higher overall mortality for fish. In addition to king salmon, respondents also described use of rod and reel to target coho salmon (locally referred to as either red, silver or coho salmon; sockeye salmon more commonly referred to as "reds" in other areas of the Kuskokwim river do not regularly occur in the vicinity of Nikolai) and nonsalmon species including northern pike, Arctic grayling, sheefish, and other whitefish.

NETS

Set gillnets are used in Nikolai as gear for harvesting salmon and nonsalmon fish species (Figure 7-3), although currently their use is less common than in the past. Similar to the patterns of historical use described for fish wheels above, fishers used setnets to harvest large quantities of chum salmon for dog food at remote fish camps or near former trading post towns such as Medfra. In general, set gillnets are currently used in turbid, low visibility waters in contrast to the use of rod and reel in clear water tributaries, and they may be used to harvest a variety of fish species at the same time. Several respondents in this study described using set gillnets as their primary salmon fishing gear, while others, and especially younger Nikolai fishers, relied more heavily on rod and reel. One respondent described traveling much further away from Nikolai than others to set a gillnet specifically for king salmon. "See, I go way out and catch lots of fish" (NIK-10). He had gained a great deal of expertise in predicting when and where king salmon would arrive based on personal experience as well as in-season reports on salmon runs from

Figure 7-3.–Nikolai salmon fisher retrieves a king salmon from a setnet placed in a Kuskokwim River tributary.

downriver communities. Set gillnets are also set in slow current backwaters or "eddies" close to Nikolai, which often have limited access or ownership.

> It's kind of owned I guess...people have a certain pole they put in the banks…so that's where he wants his net. Just pretty much leave it alone. Then you find a different spot. There's not very many spots so you just tend to find one and just stick with it for years on end. (NIK-14)

Mesh size is variable, but one respondent described generally using multiple nets, all with a relatively small mesh size of between 4 and 5 1/2 inches. This allowed him to catch king salmon, chum salmon, sheefish, and other whitefish, and had the additional benefit of catching king salmon "around the nose" rather than in the gills, which he felt allowed easier removal from the net. In addition to the previously described species, some respondents described using gillnets to specifically target coho salmon (locally "reds") into the fall (see next quote below). No respondents described current or past use of drift gillnets near Nikolai, where generally shallow waters with large amounts of debris make driftnetting impractical.

One respondent described "drifting" with a dip net while simultaneously setting gillnets for coho "red" salmon and whitefish:

> We'd set out a little whitefish net and just toss it out and across the river down here we'd set out a regular fish net for reds. And same time we'll use driftnet and go down, walk down the bank, along the bank…my dad has a long pole and we put our little, small dip net on there-at the end and we just go down the bank and get either whitefish or dog salmon or reds. (NIK-16)

Although setnetting near Nikolai is less selective towards highly prized king salmon than rod and reel fishing at Salmon River and other locations, some respondents favored setnetting for its relatively low investment requirements in time, energy, and financial resources. Setting a gillnet near town overnight enables some fishers to maintain regular summer employment in town, avoid spending large amounts of money on fuel for travel to traditional fishing locations such as Salmon River, and still secure the benefits of harvesting their own fish.

FISHING LOCATIONS

In contrast to downstream Kuskokwim River communities with direct access to the main stem of the Kuskokwim River, the environment surrounding Nikolai is characterized by numerous smaller river channels and tributaries that vary in returning salmon abundance and species composition. Nikolai salmon fishers are knowledgeable of when and where to fish for specific species of salmon within the Upper Kuskokwim and regularly use several different locations as primary fishing areas.

The South Fork Kuskokwim River in the immediate vicinity of Nikolai is used for salmon fishing by some residents. Setnets are placed in calm backwaters locally referred to as eddies close to Nikolai and are used to harvest some salmon as well as whitefish and other fish species. Most Nikolai fishers, however, fish for king salmon in locations relatively distant from Nikolai where it is often more productive. For example, king salmon are harvested at Salmon River, Big River, Blackwater Creek, and Tonzona River. Set gillnet locations are located in turbid glacial waters such as Big River and the South Fork Kuskokwim River near Nikolai. Gillnets were described as effective in these locations because fish are not able to see the net webbing. Clearwater tributaries including Salmon River and the Little Tonzona River were traditional fish fence sites for kings, but king salmon are now largely targeted in these locations with rod and reel due to restrictions on fish fences and the limited effectiveness of gillnets in clear water.

For much of the 20th century, Nikolai residents traveled to the small encampment of Medfra downriver from Nikolai to conduct summer fishing activities and to harvest large quantities of chum salmon with

fish wheels for use as dog food. The use of this site for salmon fishing has declined in tandem with a decline in reliance on dog teams for transportation.

PROCESSING AND PRESERVATION

Drying

> Just wash those fish and put them up. And we dried those fish eggs too. And they cut those fish head, and we dry those too. We dried, put them up, everything. (NIK-18)

Nikolai respondents described numerous ways in which salmon are processed, preserved, and prepared. Salmon preservation and preparation often involves both traditional and more recently adopted methods that utilize nearly all of each fish and minimize waste. Prior to the introduction of freezers as a method of food preservation, nearly all salmon was either eaten fresh, smoked and dried, or aged.

Figure 7-4.–Removing bark section from white spruce tree to be used as a non-slip surface for salmon processing.

Many Nikolai respondents continue to dry or partially dry some salmon, primarily king salmon, each year for human consumption. Drying king salmon requires a great deal of skill and attention to detail, and household heads usually direct several less experienced family members throughout the process. Preparation for drying salmon begins before salmon are harvested with the construction, repair, or cleaning of fish cutting tables and drying racks, normally built using local wood. Carefully removed sheets of white spruce bark (Figure 7-4) are often used as non-slip covers for the fish cutting tables, and were traditionally used to cover the drying racks. Commercially available plastic tarps are often used as drying rack covers today, although some respondents still prefer spruce bark sheets for this use because they can create a cooler environment conducive to slowly drying fish during hot days and "at nighttime, it doesn't sweat…the plastic tarp, at nighttime, it sweats, water condensation" (NIK-5). Wood is gathered for smoking fish while the fish begins to dry: green or dry alder and cottonwood were all used at the time of this study according to individuals' preferences. Once salmon are caught, they are either left to sit in water overnight, which respondents reported was traditional and made cutting easier, or are cut for drying immediately. The basic method of cutting salmon in the Nikolai area involves removing the flesh from the backbone in either individual

fillets or one large piece, also known as a “blanket,” and this step is often described as the most difficult and left to experts. Other parts of the salmon, such as the roe, head, and backbone, are also saved for drying. Deep linear cuts are made in the flesh side of fillets (Figure 7-5) to promote drying and this is followed by rinsing in clean water, soaking in a saltwater brine for 10 to 20 minutes, and inserting several carved wooden skewers into opposite edges of each fillet or blanket “so it will dry flat and get more smoke on em” (NIK-5). The salmon are then hung to dry in the covered smoke house with smoke and heat levels carefully monitored, and the salmon fillets are periodically rearranged for up to several weeks, depending on ambient moisture and temperature, until they are dry (Figure 7-6). Salmon are regularly removed prior to complete drying to make “half-dry” fish that must be preserved by other means such as freezing eventually, but is more resistant to spoiling than fresh fish and has a similar flavor and texture to the traditional dry fish.

The majority of salmon that is currently preserved by drying in Nikolai is king salmon. For much of the 20th century, large quantities of chum salmon were also dried and packaged as “bundles” of forty salmon for use as a trade item. Dried chum salmon bundles were essentially a form of currency in the past and were also used as dog food for family dog teams. Such use has been extremely minimal in recent years due to the near absence of working dog teams in Nikolai, although some chum salmon is still dried for human consumption and as food for non-working dogs. The process is generally similar to that for dried king salmon, yet less care is typically put into food to be dried for dogs than for human consumption.

Figure 7-5.–Scoring king salmon fillets with knife prior to smoking and drying.

Other Methods

In addition to smoking and drying salmon, several methods of preservation were used before commercial freezers became available, including underground caches, fermentation, and preserving with salt. Underground permafrost caches of dried, partially dried, or fresh salmon flesh, heads, and roe were common in the past, and respondents identified several old cache sites located near current fish camps. Respondents described a careful process of covering food with birch bark and grasses as it was being buried, and emphasized that in the past, concealment of caches was essential in preventing animals as well as neighboring and sometimes hostile groups of people from discovering and stealing the primary winter food supply.

Figure 7-6.–King salmon fillets hanging in the smokehouse.

Respondents indicated that aging or fermentation of fish used to be quite common in the area around Nikolai, although it has only rarely been done in recent years.

> Used to prepare a stinkfish, you'd eat all the time you know a long time ago I remember. They used to put it in a burlap bag and let it hang in the water down there. When they started floating, that one's done they know. You get a big fish pan, put it in there and pour water over it, and it's done. (NIK-5)

In addition to the process of soaking in water described above, respondents also recalled preparing fermented salmon roe and whole fish by burying them underground at specific times of year and removing them once they had "soured."

Two respondents with familial roots in Central Kuskokwim communities described making *sulunaq* or salt fish by completely covering fresh salmon in a barrel with salt. This preserves the fish for at least an entire winter. The heavily salted fish is soaked in several changes of water in order to remove excess salt prior to eating.

Freezing

> Interviewer: What did you think when you first saw the freezers for the fish?
>
> NIK-10: Wow! (Laughing) Better. I got one, two, three, four freezers.

Interviewer: Four freezers?!

NIK-10: Gotta have at least two for fish, and you gotta think about moose too, right. Gotta have one big freezer. And you've gotta have number four, not too big, salmonberries, cranberries, blueberries… No, there are never enough berries…

Freezers were widely used in Nikolai to preserve salmon at the time of this study, and Nikolai residents have developed unique strategies to utilize the convenience of freezers while maintaining connections to older traditions. In comparison to traditional methods of drying fish, freezers are remarkably time-efficient and simple. While respondents described that years of experience are required to gain the skills necessary for preparing high quality dried salmon, using freezers is relatively simple. "I don't have to do all that work, you know? I can just throw it in the freezer. Cut it up and throw it in the freezer" (NIK-14). In addition, drying fish requires a much larger time and energy commitment than freezing fish, which is difficult to set aside for those Nikolai residents who are employed or have other commitments during salmon fishing season.

> The dry fish takes several weeks of constant, continuous maintenance, and so if you're not in a situation when you even go to fish camp, and you're going back and forth, that doesn't work. You need to kind of be there until it's done. You've got to take weeks or a summer and it just doesn't work with the kind of life we have (NIK-15).

Some residents have developed strategies that represent a compromise between traditional preservation methods and freezing fish due to lack of time. For example, some residents put fresh salmon in a smokehouse for around a day or more without fully drying it, and then freeze this fish to be cooked later. This technique imparts some of the flavor and texture of traditional dried fish without requiring as much of a time commitment.

PREPARATION

Prior to consumption, salmon may be prepared in a variety of ways. Salmon hearts and livers are often fried and eaten shortly after fish are harvested because they are somewhat difficult to preserve. Dried and smoked salmon is typically eaten without further preparation. Fresh or frozen salmon may be prepared by frying, baking, or cooking in a soup. *Nemaje*, or "fish ice cream" is prepared by combining cooked and flaked fish, either salmon or other fish species, with a mixture of berries, fat, and sugar (Figure 7-7). Salmon is often prepared in large quantities and shared at gatherings including holidays, funeral potlatches, and other important community events.

SHARING, BARTER, AND CUSTOMARY TRADE

Sharing is an important way of distributing salmon throughout Nikolai. While several respondents described that levels of sharing for salmon in particular have declined in recent years relative to the past, recent survey results show that in 2011 50% of Nikolai households gave salmon to other households and 73% of households received salmon from other households in Nikolai or elsewhere in Alaska. Sharing is common between Nikolai and communities downriver, particularly McGrath where multiple households have family connections to Nikolai.

> My dad used to sell fish. Dry fish for dogs. To that guy at Medfra. He must be a storekeeper…Bundles of fish. We had to bundle it up. So many in a bundle I think. I don't know how much he sold em, but he used to sell fish. Mostly for dogs, not for people to eat. (NIK-11)

Although there has never been a formally regulated commercial salmon fishery in the Nikolai area, for much of the 20th century there was a substantial market for salmon to be used as dog food, and Nikolai residents described that trade and sale of fish for this purpose was important in the past.

Figure 7-7.–Nemaje, or "fish ice cream" prepared here with flaked northern pike flesh. It is also sometimes prepared with salmon.

ENVIRONMENTAL CHANGES

Respondents described observing several environmental changes over their lifetimes that are related to salmon and salmon fishing. The most pervasive observation of environmental change involved an overall reduction in the size of returning king salmon for at least the past decade. "They're mostly about two feet long I guess. The fish [king salmon] right now. Back then they used to get three or four feet long. Salmon. They were huge. Now they're small" (NIK-14). Some respondents also described reductions in the number of returning king salmon. "My parents say they are getting to be less and less, and I believe them. They've been going at it for a long time now; they're telling the truth" (NIK-1). Another environmental change that some respondents reported noticing over their lifetimes is less predictable and generally warmer weather conditions. Related to salmon, one respondent described preserving chum salmon for dog food by burying it underground in permafrost: he recently lost salmon preserved in this way to spoilage when the permafrost warmed to a much greater extent than he was accustomed to in the late summer. "We put it right on the permafrost, there, I dug a hole with the Cat. For dog feed. But, you know it stayed warm that summer, all through" (NIK-5). Some respondents reported noticing changes in river conditions near Nikolai, such as generally lower water, increasing levels of erosion on the banks with thawing permafrost, unusual river ice conditions, and the loss of several eddies where setnets used to be placed.

SUMMARY OF 2011 SUBSISTENCE HARVEST SURVEY DATA

In January 2012, ADF&G Division of Subsistence conducted comprehensive subsistence harvest research in Nikolai to document annual levels of subsistence harvest and use for 2011. Research included household subsistence harvest surveys, subsistence land use mapping, and in-depth interviews with 6 community members knowledgeable about long term and more recent trends in Nikolai subsistence patterns. This section provides an overview of quantitative findings and land use data from this study related to salmon use and harvest in Nikolai for 2011.

Researchers surveyed 26 of the total 39 households (67%) in Nikolai. Harvest and use estimates were extended to un-surveyed households, assuming that un-surveyed households' harvest and use of salmon reflected the average of the remainder of the community. However, researchers believe it is likely that nearly all households that actually fished for king salmon in 2011 were surveyed. As such, it is probable that the actual salmon harvests fall towards the lower end of the harvest estimates' 95% confidence intervals in the case of Nikolai.

In 2011, salmon was harvested by 46% of households and used by 85% of households. Nikolai fishers harvested an estimated 2,021 individual salmon, which contributed 15,336 edible lb of food to the community. Nikolai fishers' harvest of an estimated 1,143 (±40%) individual king salmon made up the majority of the salmon harvest and represented 18% of Nikolai's total subsistence harvest of all fish, game, and edible plant resources in 2011. Nikolai fishers also harvested an estimated 416 coho salmon, 340 chum salmon, 119 sockeye salmon[18], and 5 pink salmon[19]. The majority of salmon were harvested with set gillnets, although rod and reel was used to harvest 26% of all king salmon and 11% of all coho salmon. While use of salmon for dog food is minimal in comparison to historical levels, 13% of the salmon harvest by edible weight was used for dog food: the majority (77% by edible weight) of this was made up of 308 individual chum salmon, although smaller numbers of king, coho, and sockeye salmon were also used for dog food.

MANAGEMENT

Discussions of salmon management with Nikolai respondents focused on concerns about the impacts of downriver fisheries on salmon that eventually return to the upper Kuskokwim River, a need for more research on salmon in the Nikolai area, and disagreement with the prohibition of traditional salmon fish fences and fish traps over the past several decades. Since fieldwork for the current project in 2009, several management actions affecting Nikolai salmon fisheries have taken place; this is discussed in the "2012 Update" section.

Several respondents expressed concerns about the potential for over-harvesting salmon in Bering Sea commercial fisheries as well as both commercial and subsistence fisheries in the lower Kuskokwim River. "They're really hitting it hard, and there's more fishermen down there, whereas a long time ago there used to be only a few people fishing. Now everybody's got a power boat and a net" (NIK-1). Those respondents who had noticed a decrease in the size or numbers of returning king salmon often attributed this to downriver fisheries where greater numbers of people consistently harvest far more salmon than up river fisheries.

Some respondents were hopeful that increased research on salmon in the upper Kuskokwim River near Nikolai would take place and lead to better management. One respondent suggested that a salmon

[18] Respondents reported that sockeye salmon are only on rare occasions harvested in the vicinity of Nikolai. The majority of the sockeye salmon harvest is from outside the upper Kuskokwim region.

[19] It is possible that the harvest estimate for pink salmon can be attributed to misidentification of salmon species. While it is highly unlikely that pink salmon are ever found in the vicinity of Nikolai, one respondent was adamant that pink salmon were harvested near Nikolai in 2011.

monitoring weir located in an upper Kuskokwim tributary near Nikolai, such as the Little Tonzona River, would allow managers to better monitor the health of upper Kuskokwim River salmon stocks that are utilized by Nikolai residents.

As described above in the "Gear" section, some respondents were also in disagreement with the long-term prohibition of traditional fish weirs and fish traps for harvesting salmon and suggested that this harvest method never seriously endangered salmon stocks in the area around Nikolai.

> You know years ago we used to fish with a fish trap all the time. And nowadays they say you can't do it cause fish spawning and be running out of fish. I don't know how they can, how they keep fishing every year years ago. I don't know if that really affects fish. (NIK-5)

While most respondents were not interested in using fish fences and traps for salmon in the present day due to the difficulty in constructing and maintaining them, there was some concern that future generations in Nikolai would not have the knowledge to construct salmon traps or use this once important subsistence harvest method.

EFFECTS OF SOCIOECONOMIC CHANGES ON NIKOLAI SALMON FISHING

Discussions of socioeconomic changes affecting Nikolai salmon fisheries focused on recent high fuel costs as well as the challenge of maintaining salmon fishing traditions at the same time as year round or seasonal employment that is currently essential to survival in Nikolai.

> Hardly anybody will be going out this year. Gas prices so high. I was wishing I stayed longer and helped my parents out this year. But I have to go back and do the rest of my…go back to work. (NIK-16)

As many Nikolai families travel considerable distances away from Nikolai to access salmon fishing locations, high gas prices can sometimes limit individual families' ability to fish for salmon. In spite of this, some respondents emphasized that their families will continue to fish for salmon even at great personal cost.

> (NIK-18): [Gasoline costs] $8 a gallon I think right now.
>
> Interviewer: Has that really changed the way people fish?
>
> (NIK-1): No. You got to do what you got to do. Fish is really important. More than anything.

Related to increased expenses in recent years such as higher gasoline prices, Nikolai residents emphasized the importance of securing available work opportunities. Respondents described that year round employment or seasonal employment during salmon fishing season, such as summer firefighting, limits families' ability to devote large amounts of time to salmon fishing and processing during the summer months. This has likely been influential in an overall decrease in the number of families traveling to long term fish camps during the summer as well as changing methods of fish processing and preservation such as a decrease in the number of families drying and smoking salmon.

SUMMARY AND DISCUSSION

The upper Kuskokwim River subsistence salmon fishery provides a major component of the food source in Nikolai. While some residents described that salmon are not as important as a food source when compared to the past, salmon continues to be harvested in substantial numbers and represented over 15,000 edible lb of food for the community in 2011 (Ikuta et al. *In prep*).

Major changes have taken place in Nikolai's subsistence salmon fishing practices over the past century, changes that highlight the adaptation of old patterns to new realities. Types of gear, methods of preservation, and timing of subsistence salmon fishing have changed for many residents, but elements of

traditions have been readily incorporated into current fishing practices. For example, fish fences have not been used to harvest king salmon in the Upper Kuskokwim region since their elimination in the 1960s, but a rod and reel fishery has developed in exactly the same locations that fish fences were used.

Respondents in this study expressed concern about the future of salmon fishing in Nikolai. Nikolai residents face challenges such as finding ways to balance salmon fishing, related expenses, and limited employment opportunities. Concerns related to environmental changes including reduced numbers and size of returning salmon and unpredictable weather conditions are shared by many residents as well.

Nikolai respondents emphasized the nutritional and cultural importance that salmon continues to hold in their community. Of particular importance to respondents was the perspective that the subsistence harvest of salmon links generations together and connects Nikolai residents to unique family and cultural traditions.

2012 UPDATE

Prepared by David Runfola

INTRODUCTION

The 2012 subsistence salmon fishing season was unique not only in the very low returns of king salmon, but also in ADF&G's resulting management strategy and the public's response to its actions. The seminal event of the season that most affected the livelihood of subsistence fishers was the initial 12-day rolling closure of all subsistence salmon fishing in the Kuskokwim River and its tributaries (Appendix B-Summary of Subsistence Closures). During this closure subsistence fishing was restricted to gillnets with a mesh size of 4 inches or less[20] and to fish wheels with a livebox.

These subsistence fishing restrictions resulted in particular hardship for fishing families for a variety of reasons. Overall, the 2012 subsistence salmon fishing management strategy in the Kuskokwim River placed two major constraints on residents of the region: 1) the inability to harvest what fishers perceived to be enough king salmon due to gear restrictions and a limited fishing schedule; and 2) the difficulty of processing large numbers of chum salmon and sockeye salmon later in the season. This chapter provides a brief summary of ADF&G's management actions and the effects that these actions had on fishers and their families during the 2012 salmon fishing season in the Kuskokwim River. Results of ethnographic interviews and relevant background information are organized into the following categories: restrictions to king salmon harvest, effects of mesh size restrictions, harvest of chum salmon, value of king salmon, preservation methods, weather, and difficulties of the 2012 season.

SUMMARY OF KUSKOKWIM RIVER SALMON MANAGEMENT AND ITS EFFECTS, 2012

In March 2012, the WG held their annual meeting in Anchorage during an ADF&G and FWS interagency management meeting in Anchorage, with special meetings throughout the season in Bethel, Alaska and via teleconference, beginning on May 30, 2012. Alaska Department of Fish and Game management staff began their inseason run assessment projects in May. The Bethel Test Fishery (BTF) was the first assessment project to provide any salmon run-size data, beginning with king salmon in late May. Early season run size estimates based on the BTF catch per unit effort indicated a late and weak king salmon run, and that there was not a sufficient return of king salmon to achieve the management objective agreed upon by ADF&G and FWS and supported by the WG. As a result, in a June 8 WG meeting, ADF&G and FWS recommended a 7-day rolling closure for all subsistence salmon fishing to begin in the lower section of Kuskokwim River Subdistrict 1-B (Appendix B: Working Group Meeting Packet) effective June 10, 2012.[21] A rolling closure is so called because as the calendar progresses, the period of restriction

[20] Gillnet mesh dimensions in this report are given in stretch-mesh size, which is the length of a single mesh when the net is stretched taut (Hubert 1996: 160). Gillnet mesh sizes typically used by subsistence fishers in the Kuskokwim River are varied depending upon the species to be targeted. Fishers usually target nonsalmon fishes with set gillnets ranging in size from approximately 2- to 5-inch mesh. Fishers often target chum, sockeye, and coho salmon with set and drift gillnets ranging in size from approximately 5- to 6.5-inch mesh. King salmon are usually targeted with drift gillnets that have a mesh size from approximately 7 inches to 8.5 inches.

[21] A closure to subsistence salmon fishing prohibits the use of any gear type for the targeted harvest of salmon by subsistence fishers (5 AAC 07.365). In the Kuskokwim River subsistence salmon fishing rolling closure that began on June 10, 2012, fishers were prohibited from harvesting king salmon with hook and line gear and restricted to the use of gillnets with 4-inch or less mesh not exceeding 60 feet in length. Subsistence fishers were permitted to retain incidental catches of king salmon with

progresses (or "rolls") upriver. Thus, as a period of restriction ends in a lower river section, it begins in the adjacent upper river section.

On June 8, the WG voted unanimously to accept the recommendation for the initial closure. By June 15, results from the BTF indicated continued returns of king salmon that were not sufficient to meet the management objective. In a June 15 WG meeting, ADF&G and FWS managers recommended a 5-day extension to the original 7-day rolling closure. The WG voted not to support the recommendation, objecting on the basis that a 12-day closure for subsistence salmon fishing would result in an extraordinary hardship for Kuskokwim river families that rely upon harvesting king salmon in early June.

The initial 12-day rolling closure ended in the lower section of Subdistrict 1-B on June 22. Following the 12-day closure, ADF&G lifted the original restrictions on subsistence salmon fishing, allowing the use of gillnets of 6-inch or less mesh. Subsistence salmon fishing opened for 6 consecutive days following the rolling closures. After the 6-day opening, ADF&G and FWS initiated a 2-day rolling closure, after which subsistence fishing was opened, with the use of gillnets with 6-inch or less mesh permitted. Subsistence salmon fishing remained open with a 6-inch mesh restriction through July 15, when daily catch per unit effort for the BTF indicated the end of the king salmon run in the lower river. On July 16, ADF&G ended restrictions on subsistence salmon fishing, allowing the unrestricted use of gillnets, hook and line gear, and fish wheels in the lower section of Subdistrict 1-B. The restrictions were lifted in the upriver sections with the rolling schedule.

A description of the management regime is helpful in understanding the regulatory context present during the 2012 salmon fishing season in the Kuskokwim River; however, it fails to represent the social, cultural, and nutritional aspects of the salmon fishery that exist for subsistence fishers of this region. Throughout summer 2012, many fishers expressed—not only in ethnographic interviews but also in public forums—that harvesting and storing salmon is critical to many families' survival each year. People explained that restrictions to salmon fishing and the resulting disruptions in the seasonal round cause serious limitations to food supplies and the threat of extreme hardship in months to come. Recent comprehensive subsistence harvest studies in 17 communities of the Kuskokwim River drainage indicate that salmon frequently compose the largest percentage of total community subsistence harvest in comparison with all other fish, mammal, and plant resources (Brown et al. 2012, 2013; Ikuta et al. *In prep*). Studies such as these, as well as ethnographic information discussed throughout this report, support the idea that residents of this region have a very strong reliance on salmon. They also suggest that a lack of salmon can potentially result in a serious threat to the food security of families that rely on large harvests of salmon each summer. The results presented here attempt to summarize the concerns expressed in key respondent interviews conducted in 2012, as well as the adaptive strategies that many fishers employed as means to overcome what many perceived to be an extraordinarily difficult situation.

RESULTS

RESTRICTIONS TO KING SALMON HARVEST

For 12 days beginning in June 2012, the majority of Kuskokwim River fishers were limited to using 4-inch mesh gillnets to harvest subsistence-caught fish. Throughout most of the Kuskokwim River drainage, subsistence fishers typically use 4-inch mesh gillnets to target nonsalmon fish species such as whitefishes and burbot. Fishers prefer to use gillnets with mesh sizes from 7 to 8.5 inches to target king salmon, and 5 and 3/8-inch to 6-inch mesh gillnets to target chum, sockeye, and coho salmon. Pink salmon which are present in the lower Kuskokwim River (Morrow 1980: 80) can be effectively harvested using gillnets of various mesh sizes, including those used to harvest nonsalmon fishes. Although fishers commonly use set gillnets and drift gillnets in the Kuskokwim River drainage upstream of the mouth of the Holitna River,

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the use of a legal gillnet. Fish wheels were permitted; however, they were required to be equipped with a livebox, which fishers were required to check at least every six hours and return all king salmon to the water alive.

some families in this area also operate fish wheels. From the start of the rolling closure until mid-July, these fishers were prohibited from retaining king salmon when they operated their fish wheels. In the upper Kuskokwim River and its headwaters where three species of Pacific salmon are present—king, chum, and coho salmon—many fishers use hook and line gear. Hook and line subsistence fishing was prohibited during the rolling closure and afterward. Managers did not lift this restriction until mid-July when one upriver fisher described that many king salmon were advanced in pre-spawning morphological changes and were considered by local fishers to be largely unsuitable as food.

The purpose of the 12-day rolling closure was to prevent or minimize the harvest of king salmon in the subsistence fishery. Managers made the decision to initiate the closure due to what they observed to be a late and weak run of king salmon, which was likely to result in total returns that would not achieve the escapement needed to meet the management objective. The 12-day rolling closure occurred during the earliest portion of the 2012 king salmon run when returning spawners were at low abundance; however, this was also the period of time when subsistence fishers expected to harvest king salmon. The traditional salmon fishing season begins when migrating king salmon first enter the river. This is typically early June for lower Kuskokwim River fishers, the middle of June for central Kuskokwim River fishers, and late June for fishers in the upper Kuskokwim River region (Appendix D). Restrictions prevented fishers from harvesting fish according to the region's traditional seasonal round, forcing residents to wait later into the season before attempting to target salmon. Most key respondents expressed this concern in 2012, with one individual stating, "[Salmon fishing] opened too late. People know when it's time to go fishing…We're usually done fishing by Fourth of July" (BET-12).

EFFECTS OF MESH SIZE RESTRICTIONS

While fishers were allowed to retain any salmon caught incidentally in 4-inch mesh set gillnets, these nets were generally inefficient at harvesting salmon, particularly the principal species, king salmon. When management actions permitted the use of 6-inch and smaller mesh gillnets, chum salmon and sockeye salmon were in greater abundance than king salmon. The 6-inch mesh and smaller mesh drift gillnets deployed during the peaking chum salmon and sockeye salmon runs were very efficient at catching these species, much more so than they were at catching king salmon. As a result, the majority of subsistence salmon harvests immediately following the 12-day rolling closure was composed of chum and sockeye salmon. Several respondents discussed the effects of having an excess of chum salmon, explaining that their larger than normal harvest of chum salmon resulted from restrictions requiring them to fish with smaller mesh gillnets during the peak of the chum salmon run.

HARVEST OF CHUM SALMON

Many fishers in 2012 discussed the prevalence of chum salmon in their subsistence harvests. While some respondents shared the opinion that chum salmon are not as desirable as king salmon, others expressed a general acceptance of the abundance of chum salmon in their harvests. Some indicated that chum salmon were acceptable and welcome, with one respondent stating, "We're eating more chums this year, but they are fatter and better than they used to be" (BET-5). Another explained that his family "always uses chums" (BET-10), indicating a somewhat common sentiment among respondents that chum salmon are a species that is typically harvested by many fishers each summer. One woman described strips made from chum salmon as "really good, and they dry faster than kings. We'll use more chums this year" (BET-14). Another respondent explained, "Even though [the chums] are smaller [than kings], we have plenty of fish. The kings get to pass and hopefully come back strong. It's a win-win" (BET-20). This sentiment, which was shared by several respondents, demonstrated the adaptability of some lower Kuskokwim River subsistence fishers to the below-normal harvests of king salmon during the 2012 season.

There were also respondents who described the difficulty of getting too many chum salmon. Respondents' concerns about harvesting too many chum salmon are likely related to a widespread social prohibition on wasting subsistence resources described in other chapters of this report: several respondents in 2012 described preventing waste of wild foods as a deeply felt cultural and even spiritual

mandate. An attempt to harvest some king salmon was often inhibited by a large harvest of chum salmon that respondents felt obligated to keep from going to waste. One key respondent described his harvest of chum salmon as unusual in his experience, stating that "in a normal year we get a few incidental chums. This year we got 50. We cut them all into dry fish" (BET-1). Another respondent explained that she disliked cutting chum salmon because she would "get so many all at once" (BET-9), indicating the common concern regarding the increased effort required to process a large number of fish. Some explained that they would try to limit their harvest of chum salmon by trying to return some alive to the river if they were taken from the net "still flipping and not bleeding" (BET-8). Another respondent explained that he shortens his drift gillnet or uses a short net to prevent catching too many chum salmon (BET-6).

VALUE OF KING SALMON

Although fishers typically harvest large numbers of chum and sockeye salmon each year in the Kuskokwim, king salmon are the most highly desired of the Pacific salmon species for various economical, nutritional, and sociocultural reasons. Focusing only on the economical and nutritional incentives, king salmon are very large fish—the largest salmon on average by weight—and rich in oil. Processing a large number of king salmon is potentially the most efficient use of a family's time and resources for these reasons. Each processed king salmon will produce the greatest amount of food by weight, and the greatest amount of calories in the least amount of processing time and fish rack space. Relative to smaller chum salmon and sockeye salmon—approximately half the weight of king salmon on average—high harvests of king salmon can help to maximize a fishing family's food production efficiency.

Several key respondents discussed their disappointment and anxiety over harvesting many fewer king salmon than their families normally obtain. One fisher described getting only 10 king salmon, when his family normally harvests 100 each summer. (BET-19) Another fisher explained that her smaller harvest of king salmon would result in serious hardship: "We only got 15 this year where we usually get 70 to 90. Now I can't share with my family in Anchorage. We need kings. It's what we grew up with" (BET-23).

PRESERVATION METHODS

Families in the lower Kuskokwim River normally begin harvesting and processing king salmon and chum salmon in early June. As described in several of the Results chapters of this study, salmon are cut into fillets and the various parts of the fish (i.e., fillets, heads, bones, and roe) are processed into different final products. A portion of deboned king salmon fillets are often processed into a popular product known locally as strips. These are made by slicing deboned king salmon fillets into lengthwise strips. The strips are brined, hung to dry in covered, outdoor racks for a few days to a week, then hung in the smokehouse where wood smoke saturates the flesh with preserving compounds (Kjällstrand and Petersson 2001) and they dry more completely (see Kwethluk and Tuntutuliak "Results" chapters). This method is also referred to as a cold-smoke process, so-called because drying occurs at temperatures sufficiently low to prevent cooking of the fish. Cold-smoking is a process wherein brining, drying, and smoking each contributes to the fish's preservation. Proper drying of fish for preservation in a cold-smoke process cannot occur at high relative humidity (Crapo 2011). Cold-smoking of strips is one of the preferred processing methods for king salmon in many parts of the Kuskokwim River because individuals of this species tend to be very large. Large, thick fillets will often not dry thoroughly before spoiling, unless the ambient relative humidity of the fish rack is sufficiently low and the ratio of surface area to mass of the flesh is greatly increased, as it is in these strips.

Smaller species of salmon such as chum, sockeye, and coho salmon, are often processed into a product known locally as dry fish. In this process, salmon are headed, gutted, and filleted. The fillets are cross-cut through the flesh down to the internal surface of the skin. These fillets are hung on a covered fish rack for several days until dry. The cross-cutting of the fillets increases the ratio of surface area to mass of the flesh, allowing quicker and more complete air-drying. It is usually unnecessary for processors to cut

smaller fish into strips, because cross-cutting the thinner fillets sufficiently increases the surface area to mass ratio to allow for drying. Large king salmon fillets are also processed in this fashion by some Kuskokwim River fishers when weather conditions permit it. Some fishers refer to these as slabs or blankets.

Although dry fish is not normally cold-smoked, weather conditions may require processors to move their dry fish fillets into the smokehouse for proper preservation. The small smudge fire of the smokehouse results in a temperature slightly higher than the ambient outdoor temperature. The higher temperature decreases the relative humidity. As compared to the ambient conditions of an outdoor, covered fish rack, the lower relative humidity of the smokehouse decreases the time required to dry the fillets during a period of humid weather conditions.

WEATHER

Another challenge in harvesting salmon (of any species) later in the 2012 season was the fact that the majority of harvests occurred during a time when weather had cooled, precipitation was common, and egg-laying flies were abundant, particularly in the lower Kuskokwim River. These conditions made preserving salmon with traditional techniques much more difficult than in the periods of warmer, drier weather that the region experienced in early June 2012 when subsistence salmon fishing had been closed.

In the 2012 portion of this study, respondents from communities of the lower Kuskokwim River indicated that, as is typical of this region, during early June 2012 weather was favorable for successful traditional fish processing activities. The wetter and cooler weather from late June to mid-July made processing fish more time consuming. When weather is wetter and cooler (i.e., higher relative humidity) and flies are laying eggs on processed salmon hanging in fish racks, fishing families must spend more time keeping fish dry. This usually entails moving the processed fish into smokehouses when rain begins to fall, and moving the fish back to the drying racks when the weather becomes drier and less overcast. Unfortunately, despite people's vigilance at their fish racks, many reported that spoilage of fish often occurred, much more so than if fish had been processed earlier in the season at lower relative humidity and when flies were less abundant. Many respondents described devoting an unusual amount of time tending processed fish. One fisher explained that "it's hard to cure fish in this wet weather. You have to baby them, and we still lose some" (BET-11). Another fisher discussed this challenge, stating that "I had to smoke my dry fish constantly and we still lost some to maggots. It was worse than ever" (BET-18).

DIFFICULTIES OF 2012 SEASON

All of these conditions combined to make an extraordinarily difficult season of harvesting, processing, and preserving salmon for many Kuskokwim River families. People's unease with these challenges resulted in a season of frustration, anxiety, and sometimes outrage over subsistence salmon fishing and management. One fisher, a single mother, described that "this summer it's scary" (BET-5). Some respondents openly expressed their displeasure with management agencies, with one fisher shouting to a researcher that "all we can get is chums. Chums are for dogs. We don't eat dog food" (BET-13). This frustration and conflict with management decisions culminated when subsistence fishers in a number of lower Kuskokwim River communities chose to deploy their drift gillnets in violation of the fishing closure. These acts resulted in several arrests and the seizure of fishing gear and fish by law enforcement officers (Hopkins 2012a). At the time, 61 people received citations from law enforcement officers for violating subsistence salmon fishing restrictions. Community leaders described the situation as a crisis for people who needed to be able to harvest food for their families, despite the apparent need to conserve a low run of king salmon. As a result, fishers justified their acts by explaining that the elders of their community had instructed them to harvest fish for their families, demonstrating the conflict between local traditional values and state and federal management objectives. One community leader summarized this conflict of values when he said,

> We have done this because there were many people from the river who stated that they did not have any fish hanging…on their racks…The Elders have directed their fishermen to fish without any fear of breaking laws. They said that putting up fish for their survival is not breaking the law. (Hopkins 2012b)

The 2012 salmon fishing season in the Kuskokwim River was remarkable in that fishery managers initiated some of the most extensive restrictions on subsistence fishing ever implemented in the Kuskokwim River. While some individuals of the region claimed that they were able to adapt to these restrictions, many fishers, their family members, and regional community leaders expressed extreme distress over fishing closures and the associated difficulty of harvesting and processing enough salmon to meet their needs for food. In the process of monitoring the 2012 season, ADF&G Division of Subsistence personnel, among others, recognized the unprecedented nature of these events. The Division of Subsistence determined that documenting people's concerns about salmon management and recording local knowledge of salmon fishing and processing would make a significant contribution to the department's understanding of the effects of low king salmon returns for Kuskokwim River residents. Results from ethnographic interviews conducted in the lower Kuskokwim River region in summer 2012 revealed that many subsistence salmon fishers experienced difficult challenges in meeting their needs for salmon, particularly king salmon. Despite these challenges and the resulting hardships described by some fishers, many respondents expressed an ability to adapt to the decreased availability of king salmon and the difficulty of processing fish later in the season during periods of cool and wet weather.

KUSKOKWIM SALMON ETHNOGRAPHY DISCUSSION

Prepared by Andrew Brenner

The importance of salmon harvested for subsistence in the Kuskokwim River has persisted into the present, and communities are heavily reliant on annual returns of salmon not only for basic nutrition, but also for maintenance of cultural identity and values. Current patterns of social organization surrounding salmon fishing revealed that salmon fishing continues to play an important role in intergenerational transmission of knowledge and traditions.

Salmon fishing in all communities involved the active participation of multiple generations working together. Children continue to learn salmon fishing and processing techniques by observation from very early ages. Respondents described learning to fish and process fish by watching their parents, grandparents, and other relatives. Even children who are too young to assist their elders are included so that they can observe fishing and processing in practice. Some reported bringing infants to be with the family during fishing outings. Multiple key respondents explained that children today fulfill the same roles in fish camp that they have for generations. Some key respondents described a decline in youth participation in salmon fishing and processing activities. While it is difficult to assess the extent of this phenomenon based solely on ethnographic interviews and limited observation of fishing activities, researchers regularly observed children and young adults participating in subsistence salmon fishing during this study.

REGIONAL SALMON FISHING PATTERNS

While Pacific salmon consistently form an important component of the subsistence harvest in all Kuskokwim River communities, differences in salmon fishing patterns between communities exist. This study explored differences in salmon fishing patterns in 5 communities throughout the Kuskokwim drainage based on regional affiliation with the lower, central, or upper Kuskokwim River[22]. While regional boundaries are not discreet, and there is some overlap in regional patterns for border communities in particular, a number of general similarities within each region's salmon fishing patterns emerged, corresponding to similar natural environments, as well as related cultural and historical backgrounds. The following section details current regional salmon fishing patterns for the lower, central, and upper Kuskokwim River regions. A summary of regional differences is provided in Appendix D.

LOWER KUSKOKWIM RIVER

For the purposes of this discussion, communities defined as lying within the lower Kuskokwim River region follow Haynes and Andrews (1985: 217), who describe the lower Kuskokwim River region as including 12 villages (Tuluksak, Akiak, Akiachak, Kwethluk, Oscarville, Napaskiak, Napakiak, Nunapitchuk, Kasigluk, Atmautluak, Tuntutuliak, and Eek) and the regional center community of Bethel. Lower Kuskokwim River communities are socially connected through a shared Yup'ik history, language, and culture that permeates the region. The annual harvest of subsistence resources is crucial to area residents, and survey data consistently documents the large contribution of salmon to the subsistence

[22] For the purposes of this discussion, Lower Kuskokwim River communities are defined as those communities from the mouth of the Kuskokwim River upriver to Tuluksak, the Central Kuskokwim River includes those communities from Lower Kalskag to Stony River and Lime Village, and the Upper Kuskokwim River includes those communities including and upriver from McGrath.

harvest of lower Kuskokwim River communities. Out of all salmon species in the Lower Kuskokwim River region (hereafter lower river), king salmon is the most important in terms of its contribution to the diet of area residents (Andrews and Coffing 1986: 1), and respondents regularly emphasized the importance of king salmon relative to other salmon species in this study.

Salmon has long been a primary component of the subsistence harvest in the lower river (Patton and Carroll 2011: 2). Before 2,400 years BP, groups ancestral to the current inhabitants of the lower river region likely harvested salmon primarily with fish spears and traps. The development and increased use of more efficient fish nets for harvesting salmon around 2,200–2,400 years BP likely accounted for a marked increase in the human population of the Yukon-Kuskokwim Delta region (Shaw 1998: 242). Predictable salmon runs, together with the development of this new and more efficient salmon harvesting technology, likely represented the key factor in the settlement of inland riverine environments (including the Lower Kuskokwim River and other major river systems in Southwest Alaska) by coastal groups in ancient times (VanStone 1984: 207). The importance of salmon harvested for subsistence in the lower river has persisted into the present: for four lower river communities in 2010, salmon contributed 47% on average to the total annual wild food harvest by edible weight (Brown et al. 2013).

The lower river is densely populated relative to the Central and Upper Kuskokwim River regions: the average size of communities, even when the regional center of Bethel is excluded, is larger than for upriver regions, and there are more communities overall located along a smaller portion of the river. Corresponding to this higher human population, Lower Kuskokwim River communities typically harvest the majority of salmon within the drainage (Patton and Carroll 2011: 2). In 2010, residents of communities in the lower river took 79% of the overall Kuskokwim Area subsistence salmon harvest[23], with 34% of the total Kuskokwim Area salmon harvest taken by Bethel households (Carroll and Hamazaki 2012b).

All five species of Pacific salmon found in Alaskan waters return to the lower Kuskokwim River. Given its downriver position, salmon fishing begins and ends earlier in the lower river than in upriver regions. June is currently the primary month in which salmon fishing takes place in the lower river: king salmon, the most important salmon for most families, is largely available only in very late May and throughout June, and June is normally the only month that traditional fish drying methods are practical due to weather conditions. Chum and sockeye salmon arrive in mid-June and are present in the region into mid-July. Chum and sockeye salmon are important food resources for many families, and the commercial fishery for chum salmon in the Kuskokwim is important to some lower river residents (see "Commercial Salmon Fishing" below). Pink salmon are harvested in small numbers, generally incidental to fishing efforts for other salmon species from mid-June through July. Fishing efforts for coho salmon generally take place from late July and throughout August.

The natural environment of the lower river differs somewhat from upriver regions: the river is on average deeper, wider, and is influenced by tidal forces. Especially for the most downriver communities, conditions are often intermediate between riverine and marine; large waves and marine weather patterns periodically affect residents' ability to fish for salmon. Floating obstacles, commonly referred to as "drift," are generally less of a concern in the lower river than in upriver regions. These conditions generally allow larger nets to be used more easily.

Drift gillnets are currently the most common gear type used for harvesting salmon in the lower river. As described above, river conditions in the lower river often consist of deep water in wide, open stretches, and as such salmon fishers in the lower river often use drift gillnets of the maximum allowable size. Set gillnets are also common and are typically smaller than drift gillnets. Some residents use rod and reel to

[23] Lower Kuskokwim River communities harvested an estimated 152,009 salmon of all species, while communities in the greater Kuskokwim Area (including the entire Kuskokwim River, Kuskokwim Bay, and nearby Bering Sea Coast) harvested an estimated 191,667 salmon of all species.

harvest smaller numbers of salmon for subsistence, although this is not generally considered a primary subsistence harvest method in lower Kuskokwim River communities. The most common boat style seen in lower river communities is a 16 to 18 ft. riveted aluminum boat with a partial V-hull and around a forty horsepower motor. Such boats are used by area residents for salmon fishing as well as for transportation to other communities and subsistence harvest areas. Water conditions in the lower river, especially in communities near Kuskokwim Bay, make it beneficial for some salmon fishers to use larger boats and motors that are well equipped to handle marine conditions. Relatively large welded aluminum boats with motors over 70 horsepower were widely used for commercial fishing when income from commercial fishing was more reliable in past decades, and some salmon fishers have maintained this equipment into the present for subsistence and limited commercial salmon fishing use.

Commercial Fishing

Kuskokwim River salmon are currently harvested primarily for subsistence use, although commercial salmon fishing does occur in the lower river and is important to many area residents. Commercial salmon fishing in the lower river until relatively recently represented the largest single source of non-governmental income in the Yukon-Kuskokwim Delta (USFWS 1987: 20) but in recent years has largely been reduced to a supplemental source of income. While the commercial fishery initially focused on king salmon, chum and coho salmon were also fished commercially beginning in the 1970s, and by the 1980s represented a large portion of the fishery's commercial value (Albrecht 1990: 24–26). Directed king salmon commercial fishing in the Kuskokwim River was discontinued in 1987 by regulation, in order to reach management objectives (Francisco et al. 1989: 13). The Kuskokwim River commercial salmon fishery was generally stable during the 1980s and mid-1990s, with chum salmon harvests accounting for the largest portion of the regional exvessel value (Buklis 1999: 44). Reduced value of salmon and poor returns of king and chum salmon in the late 1990s influenced a reduction in exvessel value, fishing effort, and number of fish harvested through the early 2000s. Although abundance of returning chum and king salmon improved by the mid-2000s, poor market conditions and limited processing capacity continued to limit commercial fishing opportunities relative to historic levels (Bavilla et al. 2010: 11). Exvessel value has rebounded somewhat in recent years from the early 2000s, partially due to an improving chum salmon market (Brazil et al. 2011: 5). Coho salmon have accounted for the largest portion of the exvessel value in recent years in the Lower Kuskokwim River region, generally followed by sockeye salmon, chum salmon, and king salmon (Brazil et al. 2011: 5).

CENTRAL KUSKOKWIM RIVER

For the purposes of this discussion, central Kuskokwim River communities follow Brown et al. 2012, who describe the central Kuskokwim River region as including 8 permanent communities from Lower Kalskag upriver to Stony River.[24] Georgetown and Napaimute, once permanent but recently largely seasonal communities (with a small permanent population in Napaimute) are also located within this region. Central Kuskokwim River communities share a similar natural environment characterized by boreal forest and bordered by the Kuskokwim Mountains. Although individual differences exist, communities in the central Kuskokwim region generally share a culture characterized by a blend of Yup'ik and Athabascan heritages and traditions, as well as long standing influences from a European and Euro-American presence in the region dating from mining in the early 20th century.

[24] Lower Kalskag, Kalskag (Upper Kalskag), Aniak, Chuathbaluk, Crooked Creek, Red Devil, Sleetmute, and Stony River. Lime Village may be considered to be marginally part of the central Kuskokwim River region, although due to its location on a tributary river relatively distant from the mainstem Kuskokwim River, as well as its cultural and historical connections to groups outside of the Kuskokwim River drainage, patterns that apply to other communities in this region do not necessarily transfer to Lime Village.

Historical and archeological sources suggest that until the early-20th century, residents of the central Kuskokwim River region (hereafter central river) likely followed a harvest pattern of caribou, moose, and beaver as primary sources and fish as secondary sources of food (Redding-Gubitosa 1992: 63). In the early-20th century, because of the development of highly efficient fishing technologies including fish wheels and commercially available nets, salmon became the greater portion of the subsistence harvest over large game (Redding-Gubitosa 1992: 156–157). Mining activity was widespread in the central river region in the early 20th century, and such mining activity was supported by dog teams for winter transportation. Similar to other areas of Alaska described in Andersen (1992: 8) relatively high harvests of chum salmon to feed dogs probably occurred in the central river region from at least the early 20th century until relatively recently. All communities in the region continue to depend heavily on the subsistence harvest of wild foods into the present, and out of all wild foods, salmon is currently among the most important: salmon of all species made up 65% of the total subsistence harvest by edible weight for 8 central Kuskokwim communities in 2009 (Brown et al. 2012: 350).

In terms of population density, the central river is intermediate between the lower and upper Kuskokwim River regions. Communities are generally smaller than those located in the lower Kuskokwim Region, with populations in 2009 ranging from 32 people in the smallest community of Red Devil to 502 people in Aniak, the largest community in the region and subregional hub for other communities (Brown et al. 2012: 339). The percentage of subsistence salmon harvested in the entire Kuskokwim River that is harvested by central river communities is relatively small, forming about 16% of the total salmon harvest for all species in 2010 (Brazil et al. 2011).

While all five species of Pacific salmon found in Alaskan waters may be found in the central river, pink salmon are rare and make up a very small portion of the salmon harvest even when compared to the small harvest in the lower river. Salmon fishing in the central river begins somewhat later than in the lower river. King salmon fishing typically occurs from mid-June into early July. While respondents in this study described that king salmon are still available in the first part of July, similar to residents in the lower river, many fishers prefer to do most of their fishing for king salmon in June as weather conditions in July often make traditional fish drying techniques difficult. Chum and sockeye salmon fishing generally takes place from late June though late July, and coho salmon fishing takes place from mid-August and into early September.

Drift gillnets are currently the most common gear type used for harvesting salmon in the central river, although setnets are also widely used. Water depth in the central river was described by respondents as much shallower than in the lower Kuskokwim River region, and while some respondents described using full length nets of 50 fathoms as is typical in the lower Kuskokwim River, they also described that depth of nets needs to be less than the maximum legal mesh depth to avoid the numerous snags and shallow stretches typical of the central Kuskokwim river. While gillnets are used to harvest the majority of subsistence salmon in the central river, area residents use rod and reel to a greater extent than in the lower river, and rod and reel harvest typically makes up a substantial portion of the overall harvest for coho and king salmon.

UPPER KUSKOKWIM RIVER

For the purposes of this discussion, Upper Kuskokwim River communities include McGrath, Nikolai, Takotna, and Telida as defined by Stokes (1985). Upper Kuskokwim River region (hereafter “upper river”) communities share a common Athabascan cultural background, and the communities of McGrath and Takotna also have relatively long histories of Euro-American settlement in the area dating back to early 20th century mining efforts. Subsistence utilization of wild foods is extremely important to area residents. In contrast to downriver regions, a larger percentage of the annual wild food harvest in the Upper River typically comes from large land mammals (in recent years primarily moose) than from fish. Nevertheless, king and coho salmon form a major component of the annual subsistence harvest, particularly for the communities of McGrath and Nikolai.

Salmon fishing has been a major component of the subsistence harvest in the upper river for many generations of area residents. While there is little archeological information related to salmon fishing in the upper river, oral accounts from lifelong area residents as well as the presence of salmon storage pits of apparent antiquity indicate that salmon have been actively harvested by area residents since at least the mid 1800s (Stokes 1985: 212). Upper river residents developed unique and highly efficient fish fences and traps constructed from locally available materials that were used prior to historical contact and continued to be used until the mid-1960s when their then recent illegality was first enforced. In the historic period, salmon was important as both a subsistence resource and in a limited market or quasi-commercial fishing industry that supported European and American trappers and traders in the region from the early 20th century through at least the 1930s (Stokes 1985: 215). The importance of the subsistence salmon fishery in the upper river has persisted into the present: Recent research indicates that in 2011, salmon made up 22% of the total harvest of wild foods by edible weight in Nikolai and 29% in McGrath.

The upper river is the mostly sparsely populated region of the Kuskokwim River. Only four permanent communities are currently located in the region, and they are all relatively small: the hub community of McGrath (population 341) and the smaller communities of Nikolai (pop. 101), Takotna (pop. 49) and Telida (pop. 2) (ADLWD 2010a). Corresponding to this relatively small human population, upper river communities consistently harvest a very small portion (2% in 2010) of the total Kuskokwim River subsistence salmon harvest.

The upper river is shallower and narrower than downriver portions of the Kuskokwim River. While downriver from McGrath, the Kuskokwim River is characterized by one continuous mainstem channel, above McGrath the river branches into several smaller tributaries or forks. Seasonal flooding or high water is a regular occurrence in this region, often interfering with salmon fishing efforts. The river is bordered by dense stands of riparian forests, and large amounts of submerged or floating vegetation can also hamper fishing efforts.

Generally, only three species of Pacific salmon are found in the upper river: king, chum, and coho salmon. Sockeye salmon are not regularly present, although some residents travel outside of the region during salmon fishing season, typically to communities of the central Kuskokwim River region, and harvest sockeye salmon as well as other salmon species at these locations. Within the region, the distribution and run timing of each salmon species is not uniform. For example, coho salmon is the only salmon species that regularly occurs near the small community of Telida. Fishing for individual salmon species by the community of Nikolai requires knowledge of particular tributary drainages and the presence or absence of each species there along with run timing by drainage.

Salmon fishing in the upper river begins and ends later than for other regions of the Kuskokwim River. Very late June and early July is generally the primary season for king salmon fishing. Some fishing for king salmon takes place in later July, although Nikolai respondents described that the quality of fish deteriorates rapidly as July progresses. Chum salmon fishing generally takes place from mid-July through late August, and coho salmon fishing takes place from late August to as late as mid-October. In general, salmon that have reached the upper river are further progressed in pre-spawning morphological changes. Chum salmon and late season king and coho salmon are often considered to be less suitable for human food than in downriver regions.

Currently setnets are used to harvest the majority of salmon in the upper river, although rod and reel is also used as a primary or the only salmon harvesting gear by many families. The use of driftnets is generally not feasible in the upper river due to the smaller size of river channels and greater number of snags and drift relative to downriver. Fish wheels were formerly used to harvest large numbers of chum salmon for use as dog food, but have not been used in recent years. Corresponding to shallower river conditions in the upper river, salmon fishers generally use flat bottom boats as transportation to setnet or rod and reel fishing locations.

CHANGING PATTERNS OF SALMON FISHING

Respondents in all five study communities, from lower, central, and upper river regions, reported experiencing economic and ecological changes that altered salmon-fishing patterns over their lifetimes. The following section describes changes in salmon fishing patterns that are likely representative of general patterns of change throughout Kuskokwim River communities. While it is perhaps impossible to determine precise mechanisms for individual changes that have occurred, it is likely that these changes have not occurred in isolation from other factors: this suggests that changes in salmon fishing patterns reflect holistic strategies that area residents have developed to adapt to broad socioeconomic changes while maintaining the importance of salmon fishing.

In recent years, families have spent less time in remote fish camps than in past decades. Many respondents described that prior to the 1990s families would spend the majority of each summer at a fish camp continuously harvesting successive runs of multiple salmon species. In contrast, most families currently fish for salmon in shorter periods while residing in permanent communities. Some families continue to utilize traditional fish camp locations, although this usually occurs only during the king salmon fishing season. This major change in seasonal residency patterns is intimately connected to other region-wide changes related to salmon fishing, including increased employment opportunities, changes in preferred gear types, and the decreased need to harvest salmon for dog food.

Increasing obligations to employment have restricted many respondents' ability to travel away from permanent communities for the time typically required to fish from a seasonal camp. In addition, increased employment opportunities have provided greater amounts of cash that can be used for gasoline and other expenses related to fishing. Many respondents remembered earlier decades when limited access to cash required that families stay in a productive fishing location for the majority of each summer in an attempt to conserve gasoline. In recent years, the increased availability of cash for purchasing gasoline has enabled many salmon fishers to fish many times each summer for short periods directly from their home community, or visit traditional fish camp locations over several shorter periods of time each summer. However, recent dramatic increases in the price of gasoline have led some salmon fishers to be especially conscious of their fuel efficiency. Fuel conservation strategies in recent years have included staying at fish camps for longer periods (particularly for retired or unemployed individuals), eliminating short trips between permanent residences and fish camps and fishing as close to permanent communities as possible, purchasing more fuel efficient motors, and finding ways to cooperate with other families and share the cost of fishing.

Changes in fish camp residency patterns are also likely associated with a shift away from stationary to more mobile salmon fishing gear. In each study community, respondents described changes in salmon fishing gear over their lifetimes, although these changes are generally region-specific. Stationary fish wheels in the central and upper river, and fish fences in the upper river, have been largely replaced by gillnets and rod and reel gear. This allows for more mobility in the fishery. Fish fences in the upper river have not been used since the 1960s due to regulatory restrictions. While fish wheels were very common for much of the 20th century in both the middle and upper river, in recent years only a handful of fish wheels have been operated in the Kuskokwim River. Positioning a fish fence or fish wheel in a productive location requires the cooperation of multiple individuals. Once in place, these gear types require regular maintenance and are seldom moved. Such salmon fishing gear is ideal in a long-term salmon fishing camp or in the immediate vicinity of a community, but impractical if productive salmon fishing locations are far from a permanent community and if fishers with wage jobs only have short periods of time to fish. In contrast, rod and reel gear can be used for brief periods of time such as a weekend fishing trip. Set gillnets can be easily transported and deployed, providing more flexibility to salmon fishers with time limitations. A similar shift involving a transition from set gillnets to drift gillnets has likely occurred to a lesser extent in the lower and middle river regions. While setnets are still utilized by many families in these regions, the efficiency of driftnets over short periods of time, and reduced need for maintenance and

monitoring relative to setnets, makes driftnets an ideal harvesting method for those who are limited in time by employment obligations.

Respondents in all communities described that far fewer salmon are being harvested for dog food relative to what was common in previous decades. A reduced need for salmon used as dog food generally coincides with reductions in dog team winter transportation following the widespread adoption of snowmachines throughout rural Alaska. This reduction in salmon used as dog food is likely associated with greatly reduced overall harvests of chum salmon in the past 50 years. One Kalskag respondent described that his family's 10-dog team prior to the introduction of snowmachines required up to 2,700 fish a year (primarily chum salmon) exclusively to be used as dog food, while a recent chum salmon harvest estimate for the entire community of Kalskag in 2009 was 972 chum salmon (Brown et al. 2012: 315). Associated with the decreased need for dog food, those families that continue to use fish camps often do not remain through the chum salmon fishing season.

Respondents described that income from commercial fishing in the lower and central river regions has been greatly reduced since the 1990s. Families have developed strategies that compensate in some ways for the loss of this source of income, thereby continuing subsistence fishing activities that were formerly supported by commercial fishing. Families in recent years generally rely more on other sources of wage labor. In addition, some families attempt to maintain a balance of individuals who specialize in either wage labor or subsistence production, ensuring that there is both cash to support subsistence activities and individuals with the time and expertise to harvest wild food for the entire family.

RECOMMENDATIONS FOR FUTURE RESEARCH

This project provides a foundation for understanding the subsistence use of Kuskokwim River salmon in 2009 from a social and historical perspective. The broad scope of this project revealed overarching patterns in the Kuskokwim River subsistence salmon fishery but necessarily failed to capture many of the specific and important details of salmon fishing in this region. Specific recommendations for additional research include further analyses of economic patterns in the Kuskokwim River subsistence salmon fishery.

Results from this study reveal the increasing interplay between subsistence salmon fishing and the cash economy. For example, respondents in this study described complex strategies for maintaining a balance between limited opportunities for cash income and increasing cash expenditures on subsistence salmon fishing resulting from rising gasoline prices. An in-depth, quantitative analysis of current economic trends in the subsistence salmon fishery may prove helpful in understanding non-ecological factors that could potentially affect the economic viability of the fishery in the future. Specific suggestions for lines of inquiry include:

1) **Potential relationships between specific regulatory actions and the amount of cash families spend to subsistence fish for salmon.** Respondents in 2012 indicated that subsistence fishing closures can lead salmon fishers to fish during open periods when desired fish species may be less abundant; e.g., later in the king salmon season. Currently, more information is needed to describe the economic impacts that reductions in king salmon harvest opportunities will have on subsistence communities. Potential effects could involve an increase in overall costs to families as they spend more gasoline during longer or more frequent drifts in an attempt to reach their harvest goals. Similarly, respondents described that harvesting salmon during limited open periods that coincide with poor fish drying conditions generally requires more time and effort to properly dry salmon. It is possible that this increased time and effort dedicated to drying fish has some impact on individuals' earned cash income or harvest of other subsistence resources, such as berries.

2) **Potential relationship between a decline in commercial fishing opportunities and increased cost of subsistence salmon fishing.** Some residents of the Kuskokwim River who formerly obtained a substantial portion of their income from commercial fishing have maintained boats, gear, and fishing

techniques that were common when commercial fishing was far more lucrative than in recent years. Some area residents use boats and motors that are suitable for harvesting large numbers of fish for commercial fishing and are more expensive to operate, but it is likely that their primary function is increasingly shifting towards subsistence fishing. The extent of this phenomenon is unclear. However, in the event that subsistence fishing would become less productive in the future (in terms of the amount of food that can be harvested per cash expenditure) due to continued low abundance of returning king salmon and increased costs of fuel, this pattern may result in the subsistence fishery becoming overcapitalized for some area residents. Preliminary data indicates that in 2011, the lower Kuskokwim communities of Napakiak and Napaskiak invested on average 7% and 5% respectively of total annual community income on boats and motors (Ikuta et al. *In prep*). While these figures do not account for costs of fuel and nets used for salmon fishing, and boats and motors are also used extensively for transportation and hunting, in-depth analysis may reveal to what extent subsistence fishing for salmon continues to be economically feasible to area residents. In the event that there is a pattern of increasing costs and decreasing productivity in the subsistence salmon fishery, it would be particularly important to determine whether subsistence salmon fishing will develop into a fishery accessible only to smaller percentages of households with higher than average income.

3) Further investigation of strategies families or communities adopt to maintain a balance between cash income and subsistence salmon fishing. This study identified several patterns that some families use to maintain a balance between cash income and subsistence salmon fishing. These include sharing the costs of fishing with other households, decreasing time spent at seasonal fish camps, purchasing more fuel-efficient motors, and maintaining diversity within families between individuals who specialize in either cash or subsistence production. Further investigation of strategies that families or communities currently use and could potentially use in the future would be beneficial to understanding trends in the fishery.

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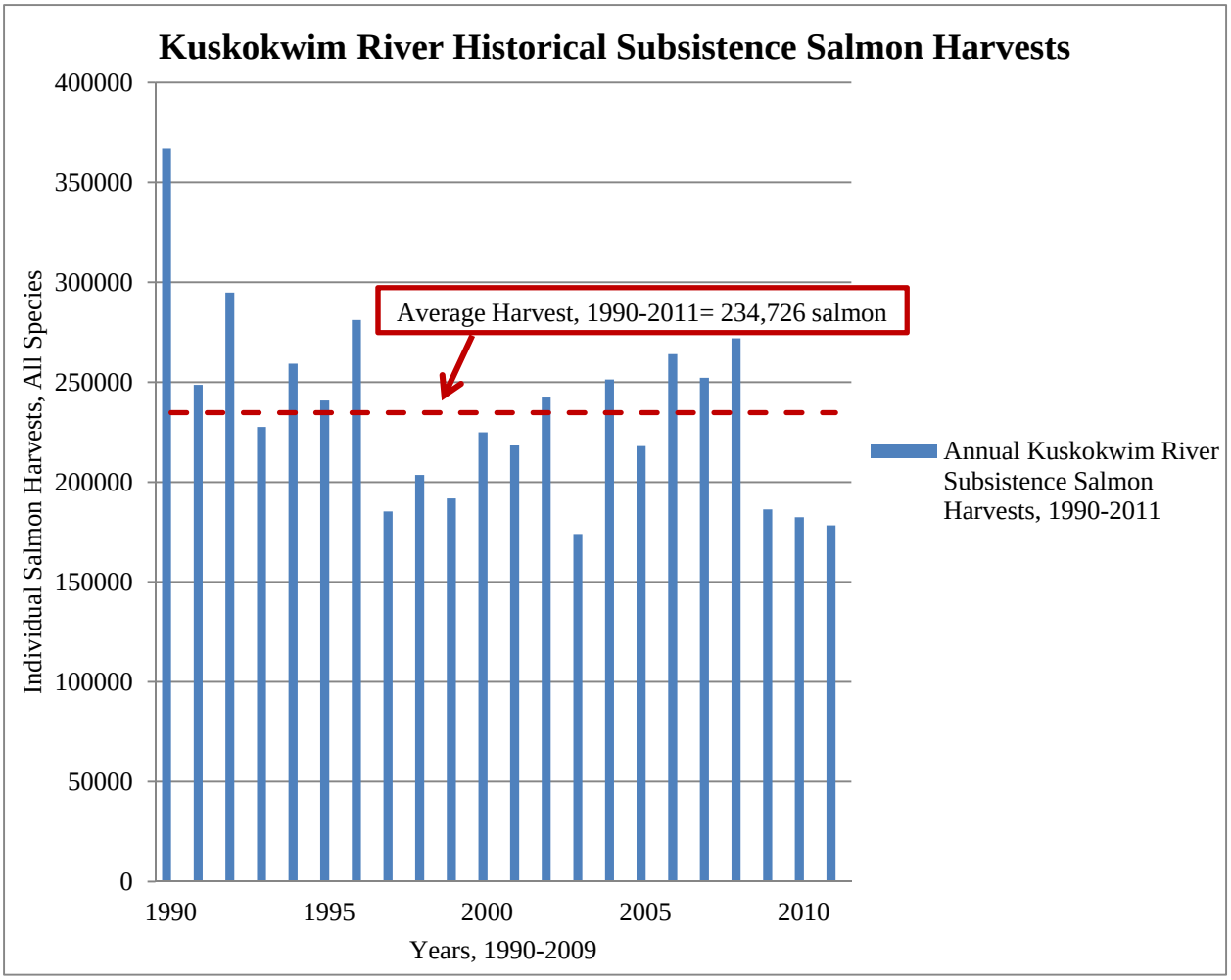
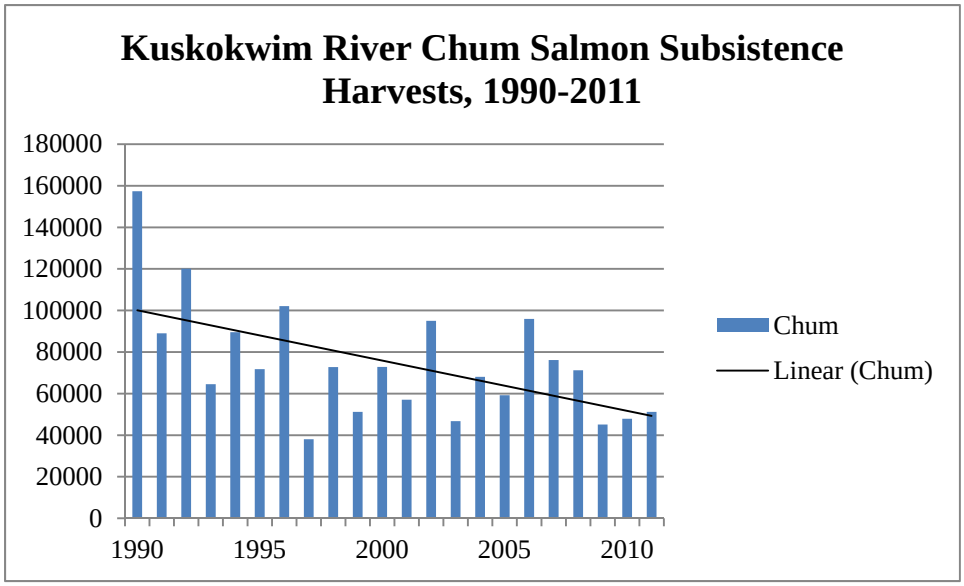
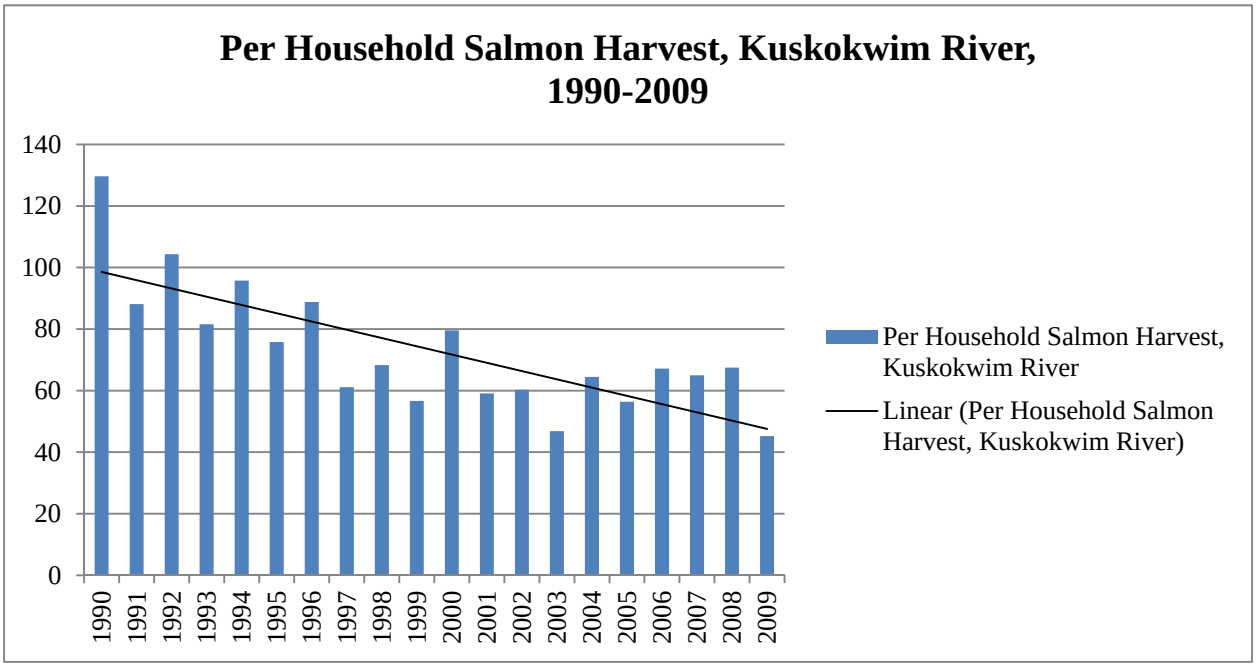
APPENDIX A: KUSKOKWIM RIVER HISTORICAL SUBSISTENCE SALMON HARVESTS

Year	King	Chum	Sockeye	Coho	Total
1990	109,778	153,825	45,897	57,560	367,060
1991	74,820	87,237	47,370	39,252	248,679
1992	82,648	116,373	43,486	52,305	294,811
1993	87,674	59,797	51,616	28,485	227,572
1994	103,343	76,937	42,362	36,609	259,251
1995	102,110	70,977	30,905	36,828	240,819
1996	96,415	100,900	40,589	43,199	281,103
1997	79,382	37,366	38,745	29,817	185,309
1998	81,219	61,652	36,052	24,623	203,545
1999	72,775	44,242	47,360	27,409	191,786
2000	70,833	59,369	48,766	45,911	224,878
2001	78,009	56,005	53,245	31,089	218,349
2002	80,983	86,406	32,272	42,617	242,278
2003	67,228	41,217	32,237	33,291	173,973
2004	97,110	64,899	40,405	48,898	251,312
2005	85,097	58,020	41,517	33,351	217,984
2006	90,094	89,500	43,143	41,272	264,009
2007	96,139	73,561	47,272	35,212	252,184
2008	98,099	68,678	58,732	46,461	271,970
2009	78,225	43,621	34,943	29,559	186,348
5-year average (2005-2009)	89,531	66,676	45,121	37,171	238,499
10-year average (2000-2009)	84,182	64,128	43,253	38,766	230,328
Historical average (1990-2009)	86,599	72,529	42,846	38,187	240,161


Kuskokwim River Historical Subsistence Salmon Harvests
400000
350000
300000
250000
200000
150000
100000
50000
0
Individual Salmon Harvests, All Species
Average Harvest, 1990-2011= 234,726 salmon
1990
1995
2000
2005
2010
Years, 1990-2009
Annual Kuskokwim River Subsistence Salmon Harvests, 1990-2011


Kuskokwim River Chum Salmon Subsistence Harvests, 1990-2011
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
1990
1995
2000
2005
2010
Chum
Linear (Chum)


Per Household Salmon Harvest, Kuskokwim River, 1990-2009
140
120
100
80
60
40
20
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Per Household Salmon Harvest, Kuskokwim River
Linear (Per Household Salmon Harvest, Kuskokwim River)

APPENDIX B: ROLLING CLOSURE INFORMATION FROM KUSKOKWIM RIVER SALMON MANAGEMENT WORKING GROUP

RECCOMMENDATION

Rolling Closure Section Descriptions

Lower Section of Subdistrict 1-B: Section 1

This area is defined as, that portion of the Kuskokwim River and its tributaries upstream from a line from Apokak Slough to the southernmost tip of Eek Island to Popokamiut to a line between ADF&G regulatory markers located between the Kialik and Johnson Rivers. This area is also known as the Lower Section of commercial fishing Subdistrict 1-B.

Excluded waters are nonsalmon spawning tributaries; those portions of Kinak, Kialik, and Tagayarak rivers more than 100 yards upstream from the mouth of these rivers, are open with any mesh size gillnet and are not affected by these closures.

Upper Section of Subdistrict 1-B to Tuluksak: Section 2

This area is defined as that portion of the Kuskokwim River and its tributaries upstream from a line between ADF&G regulatory markers located between the Kialik and Johnson Rivers to a line between ADF&G regulatory markers located approximately half a mile upstream of the Tuluksak River mouth. This section includes the slough (locally known as Utak Slough) on the northwest side of the Kuskokwim River adjacent to the Tuluksak River mouth.

Excluded waters are nonsalmon spawning tributaries; the Whitefish Lake drainage near Aniak and those portions of Discovery, Birch, and Swift creeks more than 100 yards upstream from the mouth of these rivers, are open with any mesh size gillnet and are not affected by these closures.

Tuluksak to Chuathbaluk: Section 3

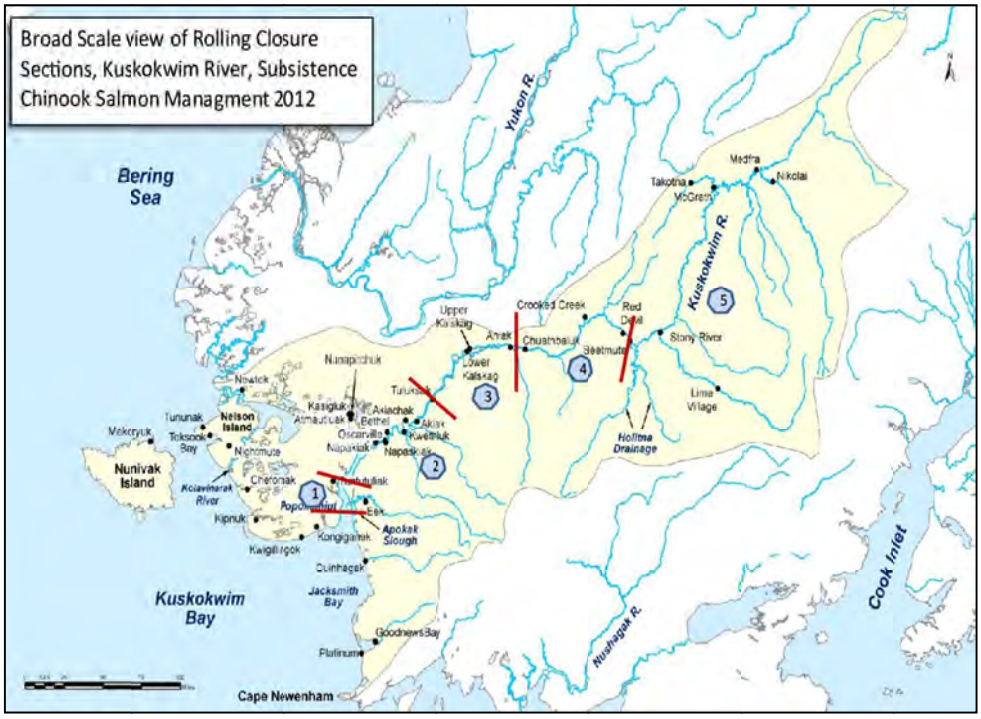
This area is defined as that portion of the Kuskokwim River and its tributaries upstream from a line between ADF&G regulatory markers located approximately half a mile upstream of the Tuluksak River mouth to a line between ADF&G regulatory markers located at the downstream edge of Chuathbaluk. This section does NOT include the slough (locally known as Utak Slough) on the northwest side of the Kuskokwim River adjacent to the Tuluksak River mouth.

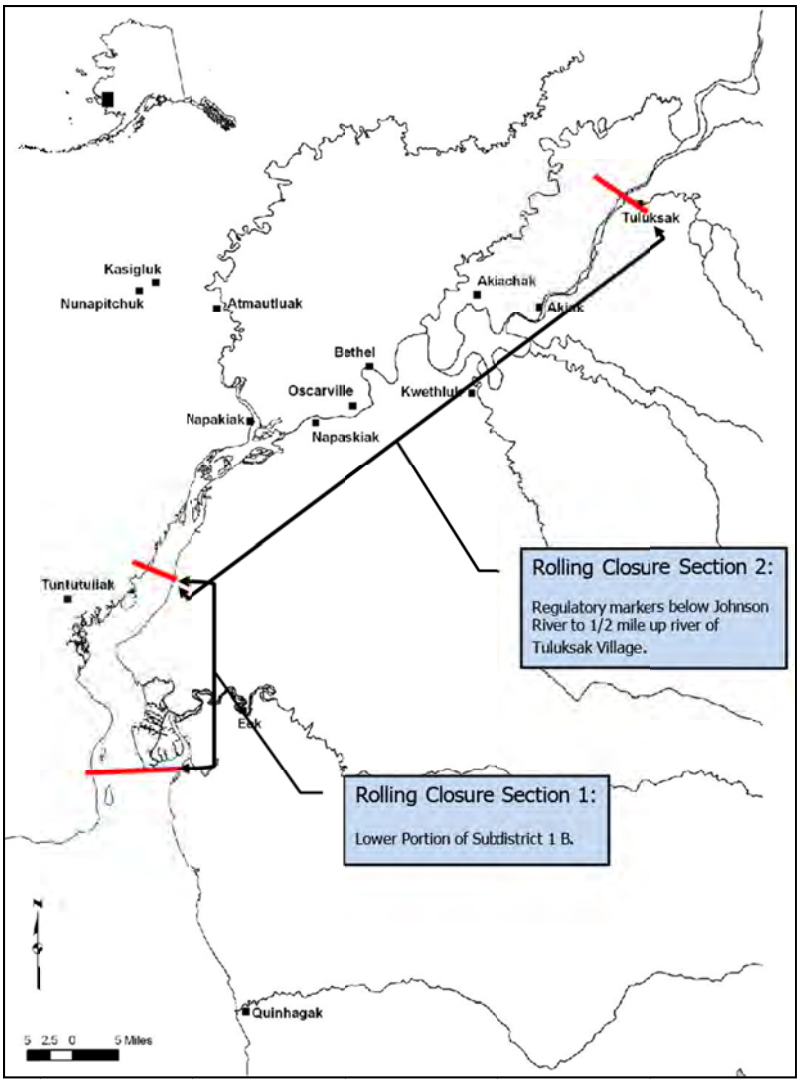
Chuathbaluk to the Holitna River mouth: Section 4

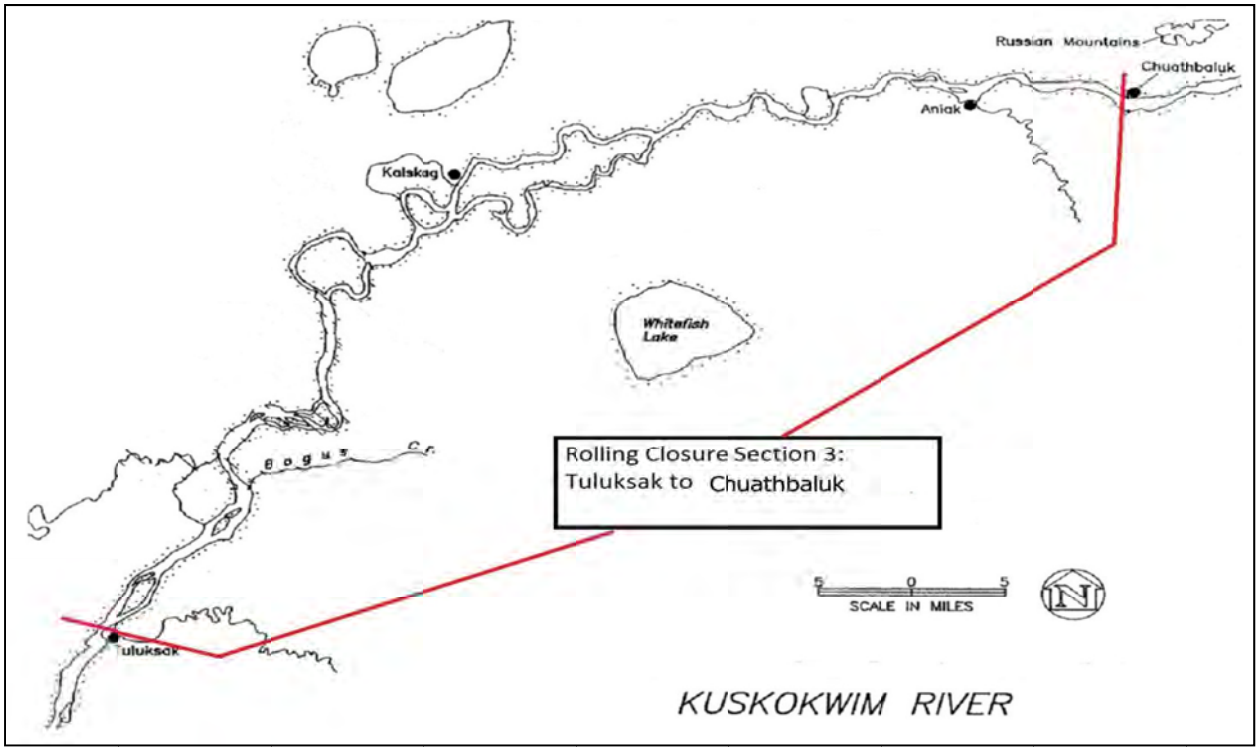
This area is defined as that portion of the Kuskokwim River and its tributaries upstream from a line between ADF&G regulatory markers located at the downstream edge of Chuathbaluk to a line between ADF&G regulatory markers located downstream of the Holitna River mouth.

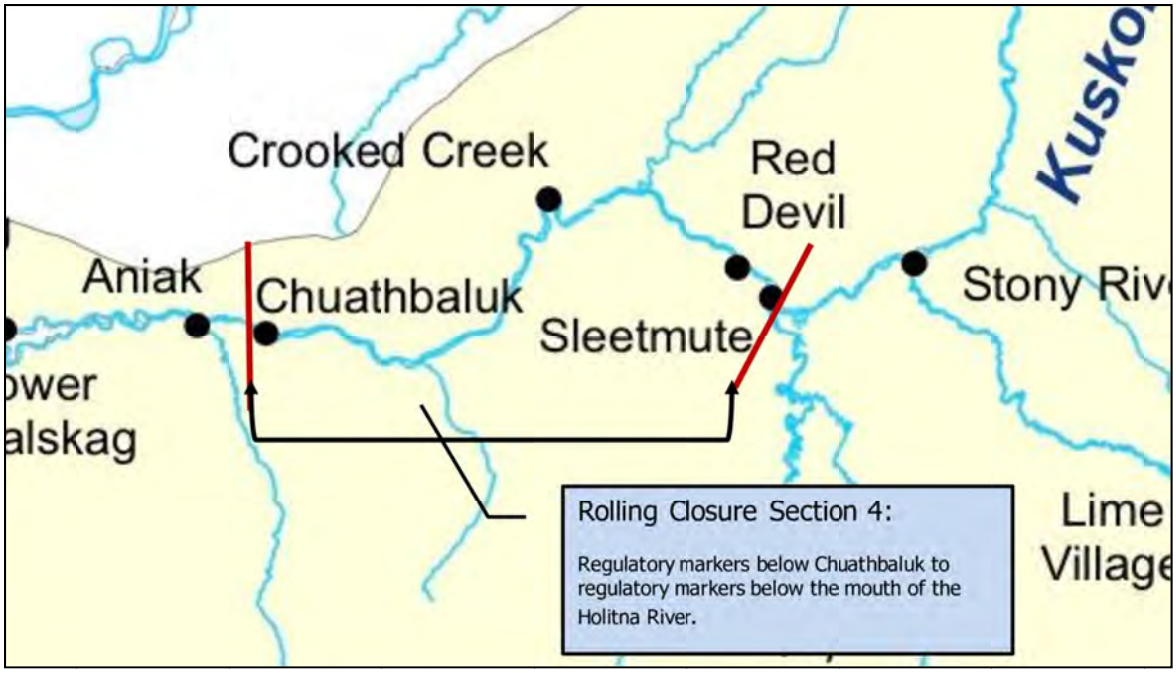
The Holitna River mouth to the Headwaters of Kuskokwim River: Section 5

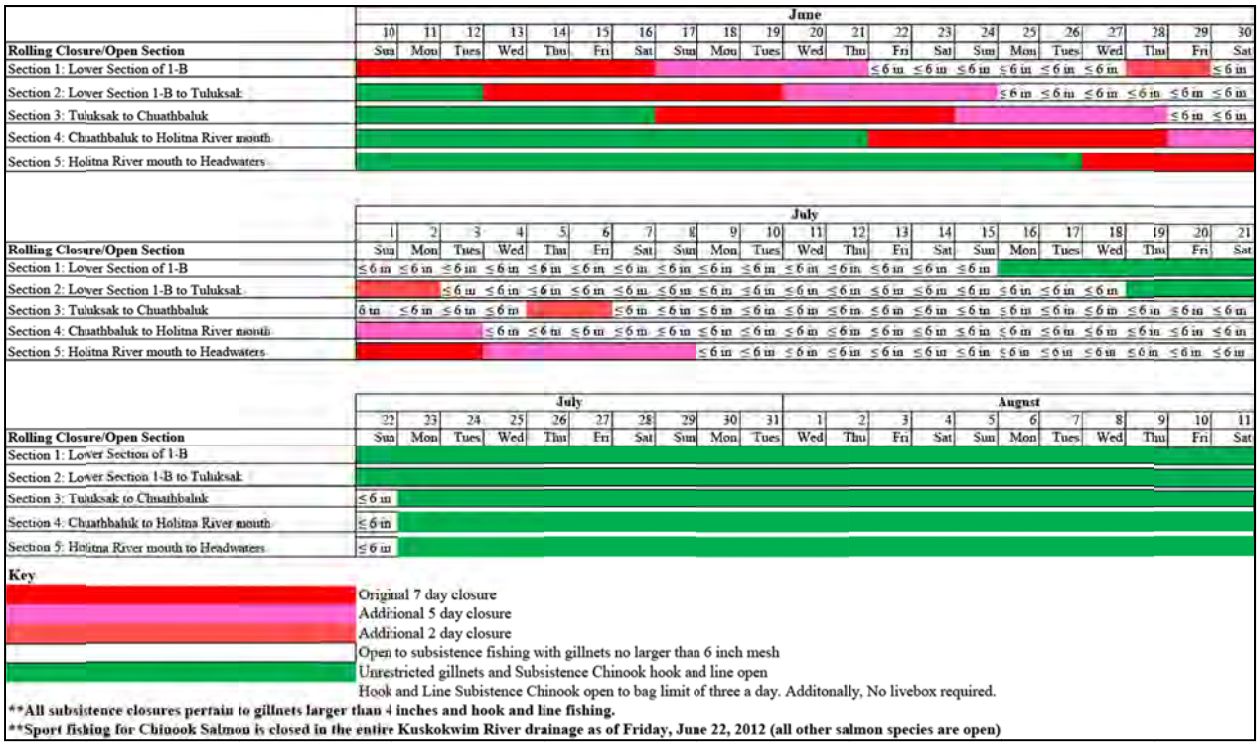
This area is defined as that portion of the Kuskokwim River and its tributaries upstream from a line between ADF&G regulatory markers located downstream of the Holitna River mouth upstream to the headwaters of the Kuskokwim River.


Broad Scale view of Rolling Closure Sections, Kuskokwim River, Subsistence Chinook Salmon Managment 2012
Bering Sea
Yukon R.
Medfra
Takotna
McGrath
Nikolai
Kuskokwim R.
Upper Kalskag
Crooked Creek
Red Devil
Stony River
Aniak
Chuathbaluk
Sleetmute
Lower Kalskag
Lime Village
Holitna Drainage
Nunapitchuk
Napaskiak
Oscarville
Bethel
Akiak
Kwethluk
Atmautluak
Kasigluk
Tuluksak
Akiachak
Napaimiut
Tununak
Nelson Island
Toksook Bay
Nightmute
Nunivak Island
Kolavinarak River
Cheronak
Kipnuk
Kongiganak
Kwigillingok
Eek
Apokak Slough
Quinhagak
Jacksmith Bay
Kuskokwim Bay
Goodnews Bay
Platinum
Cape Newenham
Nushagak R.
Cook Inlet
1
2
3
4
5


Tuluksak
Kasigluk
Nunapitchuk
Atmautluak
Akiachak
Akiak
Bethel
Oscarville
Kwethluk
Napakiak
Napaskiak
Tuntutuliak
Eek
Quinhagak
5 2.5 0 5 Miles
Rolling Closure Section 2:
Regulatory markers below Johnson River to 1/2 mile up river of Tuluksak Village.
Rolling Closure Section 1:
Lower Portion of Subdistrict 1 B.


Russian Mountains
Chuathbaluk
Aniak
Kalskag
Whitefish Lake
Bogus Cr.
Rolling Closure Section 3:
Tuluksak to Chuathbaluk
5 0 5
SCALE IN MILES
N
Tuluksak
KUSKOKWIM RIVER


Crooked Creek
Red
Devil
Aniak
Chuathbaluk
Sleetmute
Stony Riv
Kusko
Rolling Closure Section 4:
Regulatory markers below Chuathbaluk to regulatory markers below the mouth of the Holitna River.
Lime
Village


June
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Rolling Closure/Open Section
Sun Mon Tues Wed Thu Fri Sat Sun Mon Tues Wed Thu Fri Sat Sun Mon Tues Wed Thu Fri Sat
Section 1: Lower Section of 1-B
Section 2: Lower Section 1-B to Tuluksak
Section 3: Tuluksak to Chuathbaluk
Section 4: Chuathbaluk to Holitna River mouth
Section 5: Holitna River mouth to Headwaters
≤ 6 in
July
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Rolling Closure/Open Section
Sun Mon Tues Wed Thu Fri Sat Sun Mon Tues Wed Thu Fri Sat Sun Mon Tues Wed Thu Fri Sat
Section 1: Lower Section of 1-B
Section 2: Lower Section 1-B to Tuluksak
Section 3: Tuluksak to Chuathbaluk
Section 4: Chuathbaluk to Holitna River mouth
Section 5: Holitna River mouth to Headwaters
July
August
22 23 24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11
Rolling Closure/Open Section
Sun Mon Tues Wed Thu Fri Sat Sun Mon Tues Wed Thu Fri Sat Sun Mon Tues Wed Thu Fri Sat
Section 1: Lower Section of 1-B
Section 2: Lower Section 1-B to Tuluksak
Section 3: Tuluksak to Chuathbaluk
Section 4: Chuathbaluk to Holitna River mouth
Section 5: Holitna River mouth to Headwaters
≤ 6 in
Key
Original 7 day closure
Additional 5 day closure
Additional 2 day closure
Open to subsistence fishing with gillnets no larger than 6 inch mesh
Unrestricted gillnets and Subsistence Chinook hook and line open
Hook and Line Subistence Chinook open to bag limit of three a day. Additonally, No livebox required.
**All subsistence closures pertain to gillnets larger than 4 inches and hook and line fishing.
**Sport fishing for Chinook Salmon is closed in the entire Kuskokwim River drainage as of Friday, June 22, 2012 (all other salmon species are open)

APPENDIX C: 2012 UPDATE QUESTIONS

2012 Update Questions

1. How did the Rolling closures impact your family? What did you do differently this year?
    a. Fishing effort
        i. What fish species did you use? How many of each species?
        ii. What factors impact you fishing effort?
        iii. Do you use a setnet or driftnet?
        iv. Do you ever fish in nonsalmon tributaries during restrictions?

    b. Mesh sizes
        i. What size mesh nets do you own or use?
        ii. Did you fish with a 4 inch mesh net during mesh size restrictions?
            1. Did you have to exert more effort than usual?
            2. What did you catch?
            3. Did you drift?
            4. Was finding a setnet sight difficult?
        iii. Did you fish for kings with a larger net once restrictions were lifted?

    c. Preservation
        i. Drying (strips and dry fish)
            1. Did you have difficulty drying fish this year?
            2. Can you dry King salmon in July?
            3. What techniques increase success in the late season / wet weather?
                a. What techniques prevent maggots?
                b. What techniques prevent mold and spoilage?
        ii. Freezing
        iii. Canning
2. Conservation and management
    a. What is your opinion about saving king salmon for future generations?
    b. What are your opinions and ideas about management?
3. History
    a. Has usage of chums changed over time?

APPENDIX D: KUSKOKWIM REGIONAL SUMMARY AND COMPARISON

	Lower River	Middle River	Upper River
Number of Salmon Species Commonly Present	5	4	3
Most Common Gear Types	Drift gillnet, set gillnet	Drift gillnet, Set gillnet, fish wheel, rod and reel	Set gillnet, rod and reel
Percentage of Total Subsistence harvest from salmon, edible weight	47%[a]	65% [b]	26% [c]
Estimated Percentage of total Kuskokwim River salmon harvest in 2010[d,e]	86%	12%	2%
River conditions	Large, low gradient, estuarine river	Wide, relatively shallow, moderate gradient	Shallow, narrow, multiple forks, high sinuosity
Formal Commercial Fishery	1959-Present	1959-mid-1990's	None
Major Cultural Affiliation	Central Yup'ik	Central Yup'ik and Athabascan	Upper Kuskokwim Athabascan
Number of Permanent Communities/(Relative Population Density)	13 (High)	8 to 10 (Medium)	3 to 4 (Low)
Chinook Salmon Season	Early June-Late June	Early/Mid June-Early July	Late June-Mid July
Chum Salmon Season	Mid- June-Mid July	Mid June-Late July	Mid July-Late August

Sockeye Salmon Season	Mid June-Mid July	Mid June-Late July	NA
Coho Salmon Season	Late July-Late August	Early August-Mid September	Late August-Mid October

a) Brown, C. L., J. S. Magdanz, D. S. Koster, and N. M. Braem. *In prep* Subsistence harvests in 6 communities in the Kuskokwim River drainage, 2010. Alaska Department of Fish and Game, Division of Subsistence Technical Paper, NNN. Fairbanks.

b) Brown, C. L., J.S. Magdanz, D.S. Koster, and N. M. Braem. 2012. Subsistence harvests in 8 communities in the Central Kuskokwim River drainage, 2009. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 365, Fairbanks.

c) Ikuta, H., Brown, C. L., and D. Koster. *In prep* Subsistence harvests in 8 communities in the Kuskokwim and Yukon River Drainages, 2011. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. NNN, Fairbanks, Alaska.

d) Regions in this table are defined differently than in Carroll and Hamazaki 2012. Lower Kuskokwim River communities include communities from Tuntutuliak upriver to Tuluksak. Central Kuskokwim River communities include communities from Lower Kalskag upriver to Stony River and including Lime Village. Upper Kuskokwim River communities include McGrath, Nikolai, and Takotna.

e) Carroll, H., and T. Hamazaki. 2012. Subsistence Salmon Harvests in the Kuskokwim Area, 2010. Alaska Department of Fish and Game, Division of Commercial Fisheries.