Technical Paper No. 455

Inseason subsistence salmon harvest assessments in 9 communities of the middle Kuskokwim River, 2015–2018

by

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and

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

Symbols and Abbreviations

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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. 455

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by

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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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ABSTRACT

Recent declines in Kuskokwim River Chinook salmon stocks have resulted in severe restrictions on subsistence harvests of this species by the region's residents. Since 2012, Kuskokwim Area fishery resource managers have implemented restrictions that have aimed to prevent the directed harvest of Chinook salmon while minimizing its incidental harvest during times when fishers were permitted to target chum and sockeye salmon for subsistence. This management strategy requires stock assessment projects that provide run timing and relative stock abundance information in-season. During subsistence salmon fishing seasons in 2015–2018, this study developed methods by which fishery research agencies and community organizations can collaborate to obtain inseason information about salmon harvests during subsistence fishing openings. The study also conducted surveys with households that rely upon subsistence salmon resources in nine communities of the middle Kuskokwim River region. Surveys recorded progress toward meeting household, community, and regional needs for subsistence. Data from surveys were shared with Kuskokwim Area fishery managers and advisory stakeholder groups during weekly management meetings in Bethel, Alaska. Managers and advisory stakeholder groups applied information from these methods to increase the accuracy and timeliness of their management decisions during the study years. Field research activities also gave fishing households opportunities during each fishing season to interact directly with fishery management agency staff and provide comments and questions regarding their subsistence salmon fishing experience to managers and advisory stakeholder groups for consideration during fishery management meetings.

Key words: Catch per unit effort; coho salmon; Chinook salmon; chum salmon; creel survey; household harvest assessment survey; inseason harvest estimation; Kuskokwim River; sockeye salmon; subsistence salmon fishing.

1. INTRODUCTION

PROJECT BACKGROUND

Recent declines in Kuskokwim River Chinook salmon *Oncorhynchus tshawytscha* stocks have resulted in severe restrictions on subsistence harvests of this species by residents of the region. Since 2012, Alaska Department of Fish and Game (ADF&G or the department) and U.S. Fish and Wildlife Service (USFWS) fishery managers have implemented restrictions to prevent the directed harvest of Chinook salmon. Also, managers have attempted to minimize incidental Chinook salmon harvest during times when fishers were permitted to target chum and sockeye salmon for subsistence. These management strategies require stock assessment projects that provide run timing and relative stock abundance information in season. Inseason management decisions in the Kuskokwim Area are currently informed by a limited number of data sources, including two test fisheries, one at Bethel and another at Aniak (Lipka and Tiernan 2018); a sonar weir near the test fishery at Bethel (Birchfield and Smith 2018); creel surveys conducted in the lower Kuskokwim River during and after each fishing opening (Staton 2018); and sporadic and qualitative harvest reports from a small number of subsistence fishers (Shelden and Chavez 2016). Systematic harvest monitoring methods that assess subsistence fishers' harvests in season would supplement these data sources by providing additional information to guide agency staff in the management process. The results of such an approach could increase accuracy and timeliness of management decisions that allow subsistence fishing opportunity while minimizing incidental harvest of Chinook salmon during times of conservation. They would also support an inseason evaluation of the State of Alaska's ability to provide for annual amounts of Pacific salmon[1] reasonably necessary for subsistence (ANS) in the Kuskokwim Area (AS 16.05.258(b); 5 AAC 01.286), and of the USFWS's ability to provide opportunity for qualified rural residents to harvest salmon in the Kuskokwim River (94 Stat. 2371).

Recent declines in Kuskokwim River Chinook salmon abundance have challenged many subsistence users' ability to obtain the resources they need (Brown et al. 2012). In 2012 and 2014, prior to initiation of this study, inseason run abundance indices projected low escapements of Chinook salmon. As a result, ADF&G and USFWS placed significant and unprecedented restrictions on subsistence fishing in order to conserve Chinook salmon.[2,3] Comprehensive subsistence survey data from 2009–2013 in several Kuskokwim River communities, including those of this study (Figure 1-1), suggest that if managing agencies implement similar restrictions in the future, many households of the region could potentially suffer significantly adverse economic and food security conditions (Brown et al. 2012; 2013; Ikuta et al. 2014; 2016; Runfola et al. 2017).

Accurate estimates of total annual Chinook salmon returns are essential in understanding productivity of the species and proper management of the fishery (Schaberg et al. 2012). Kuskokwim Area managers calculate an estimate of total Chinook salmon run abundance in the Kuskokwim River through a Maximum Likelihood Estimation model that compiles escapement and harvest data from several individual run assessment projects simultaneously (Liller et al. 2018). Escapement is monitored by enumerating Chinook salmon passing through weirs located on several Kuskokwim River tributaries (Brazil et al. 2013; Schaberg et al. 2012). Managing agencies are limited in their ability to increase the coverage of spawning streams by both the high costs and logistical barriers of operating more weirs in the area. Furthermore, although each weir generally provides a reliable count of spawning adult abundance,

1. Hereinafter salmon.
2. Alaska Department of Fish and Game (ADF&G). 2012. 2012 preliminary Kuskokwim Area salmon season summary. Division of Commercial Fisheries news release, October 3, 2012, Anchorage. http://www.adfg.alaska.gov/static/home/news/pdfs/newsreleases/cf/229503860.pdf (Accessed on June 3, 2016.)
3. McCaffery, B. J. 2014. Saving our king salmon: what to expect this fishing season. U.S. Fish and Wildlife Service News Release, May 6, 2014, Bethel, Alaska. http://www.doi.gov/subsistence/news/fishing/upload/Saving-Our-King-Salmon-BJM-06-May-2014.pdf (Accessed on June 3, 2016.)

weir operations can be compromised during occasional unexpected events when it is difficult or impossible to count fish passing upriver (e.g., high water at weir sites, wildland fires, etc.). Also, existing weirs do not monitor significant portions of the Kuskokwim River watershed, which could prevent detection of severely depleted or potentially extirpated stocks of Chinook salmon. These and other obstacles introduce potential sources of error into escapement estimates. As a result, ADF&G recognizes the limitations of expanding results merely from weir counts to represent total escapement (and, in turn, total run abundance) in the entire drainage (Bue et al. 2012).

In addition to escapement, managers must estimate total harvest of Chinook salmon to calculate total run abundance each season. Sources of harvest can include fish sampled by ADF&G in the Bethel test fishery (BTF), as well as harvests from commercial, sport, and subsistence fisheries.[4] Department technicians record all Chinook salmon harvested in the BTF each day; and when commercial fishing occurs, fish buyers report to ADF&G all deliveries of Chinook salmon through the commercial fish ticket system (Brazil et al. 2013). Total harvests of Chinook salmon from the sport fishery are estimated through implementation of mailed, postseason surveys among a sample of sport fishers. In years prior to 2012, sport fishers had harvested fewer than 1,000 Chinook salmon annually on average in the Kuskokwim River drainage (Chythlook 2018), often less than 1% of the total annual Kuskokwim Area harvest.

The department determines a comprehensive subsistence fishery harvest estimate through completion of postseason household surveys in approximately 26 Kuskokwim River communities (Lipka et al. 2019). Each autumn following the salmon fishing season, researchers complete surveys with a stratified sample of households in most communities. In the smallest communities, researchers attempt a census of households, and in Bethel staff survey a simple random sample of all households. Survey results are expanded to estimate total subsistence harvest. The accuracy of estimates is dependent largely upon the sample size achieved in each community and the ability and willingness of respondents to accurately recall their harvest amount from several months prior to the survey. After analysis, harvest data from post-season subsistence surveys are typically available within six months of the end of the Chinook salmon fishing season (see Shelden et al. 2016). In addition to estimating total run abundance, the department is directed by State of Alaska statute to manage the fishery in a manner that supports the Alaska Board of Fisheries' (BOF) determination of what constitutes a reasonable opportunity for fishers to obtain an amount of salmon that is necessary for subsistence (ANS) (AS 16.05.258). The BOF established that Chinook salmon are customarily and traditionally taken or used for subsistence in the Kuskokwim River drainage (5 AAC 01.286(a)(3)), and that the ANS for Chinook salmon in the Kuskokwim River drainage ranges from 67,200 to 109,800 fish annually (5 AAC 01.286(b)(1)). The Federal Subsistence Board has also determined that permanent residents of the Kuskokwim Area have customary and traditional uses of salmon in waters adjacent to federal public lands in the Kuskokwim Area (50 CFR § 100.24(a)(2)). Under ADF&G's current data collection procedures as described herein, managers assess harvest levels after the close of the salmon fishing season and all harvest data have been compiled and analyzed. A method of collecting harvest data in-season would greatly improve the department's ability to assess progress toward achievement of ANS in the drainage each season, and give managers a more complete understanding of harvest in relation to stock abundance and run-timing data that are available in real time from the BTF and various qualitative sources.

Subsistence harvests of Chinook salmon are critical to the livelihood of many residents of the middle Kuskokwim River region and represent a large portion of the diet of households active in subsistence, and the households with whom they share their wild foods. Recent research completed by ADF&G Division of Subsistence recorded that Chinook salmon composed an average of 27% of total community subsistence harvests for residents of eight of the nine middle Kuskokwim River study communities

4. In order to reach management objectives to conserve the species, directed king salmon commercial fishing in the Kuskokwim River was discontinued in 1987 by regulation; however, incidental catches of Chinook salmon have since been permitted in commercial harvests directed at other species (Francisco et al. 1989; Poetter et al. 2016). Since 2012, the Kuskokwim River Chinook salmon sport fishery has been closed by ADF&G Emergency Order each season, and no fish of that species have been recorded in sport fishing harvests (Chythlook 2018).

(Brown et al 2012). The estimated 10-year average annual subsistence Chinook salmon harvest from 2002 to 2011 was 9,053 fish for the same study communities. However, in both 2012 and 2014 preseason forecasts of very low Chinook salmon runs (see Liller et al. 2018) prompted ADF&G and USFWS to implement unprecedented subsistence fishing restrictions (Elison et al. 2015; Lipka et al. 2016).[5] These restrictions resulted in the lowest subsistence Chinook salmon harvests in the Kuskokwim River since 1990. Subsistence fishers in the nine study communities have decreased their Chinook salmon harvests overall since 2012. In 2012–2017, the average annual harvest for middle Kuskokwim River communities was 2,448 Chinook salmon, less than a third (27%) of the average harvest for the previous 10-year period, 2002–2011 (Carroll and Hamazaki 2012).[6]

Out of concern for their ability to get the salmon they need each season, some fishing communities have requested, under the provisions of the Alaska National Interest Lands Conservation Act (ANILCA) (94 Stat. 2371), that Alaska's Federal Subsistence Board restrict Chinook salmon fishing to federally qualified users. Subsequently, since 2014 the USFWS has managed the subsistence Chinook salmon fishery in waters within the Yukon Delta National Wildlife Refuge (YDNWR). Three cooperating communities in this study—Lower Kalskag, Upper Kalskag, and Aniak—are situated within the federal fishery management area of the YDNWR (Figure 1-1). Each subsistence salmon fishing season since 2014, two advisory stakeholder groups, the Kuskokwim River Salmon Management Working Group (Working Group) and the Kuskokwim River Inter-Tribal Fish Commission (Fish Commission), have collaborated with the USFWS to manage the fishery within the YDNWR.

Key respondent interview information collected in middle Kuskokwim River communities by division staff during the 2014 season indicated widespread hardship among many subsistence fishers as a result of these very low Chinook salmon harvests. In response, fishers described attempting to compensate by targeting more chum and sockeye salmon.[7] Unfortunately, fishing closures during times when Chinook salmon were still relatively abundant in the river, as well as the presence of what fishers described as many poor-quality chum salmon, presented additional challenges. Numerous key respondents expressed serious concern that with such low salmon harvests they feared that their families would not have the amount of food necessary for the year. In response, middle river fishers in 2014 chose to rely on the later run of coho salmon more than they typically had in seasons prior to 2014. Many respondents reported their goal was to harvest approximately twice as many coho salmon as they would in July and August during a typical fishing season. Subsequently, post season subsistence salmon household surveys estimated that fishers in the nine study communities harvested 13,862 coho salmon in 2014, which was an increase of 145% over the previous ten-year (2004–2013) average of 5,650 fish (Shelden et al. 2016a).

With support from USFWS and the Kuskokwim Native Association, a now dissolved Alaska Native nonprofit organization formerly based in Aniak, ADF&G Division of Subsistence deployed a rapid response project to monitor coho salmon harvests in the middle Kuskokwim River. The purpose of the 2014 fieldwork was to record subsistence harvests as a means of detecting run timing of the coho salmon stock as well as to monitor fishers' progress toward harvesting the salmon that their households needed for the year. Researchers traveled by boat to eight permanent and two seasonal communities within the middle Kuskokwim River area and administered inseason surveys in approximately 180 households. These surveys recorded fishers' observations of chum, sockeye, and coho salmon run timing and the species' relative abundances, all of which directly informed the management of subsistence and commercial fisheries. Also, a significant accomplishment of the 2014 fieldwork was the good will that it brought to residents of the region. Dozens of survey respondents commented on their appreciation for management agencies' presence in middle Kuskokwim River communities during the salmon fishing

5. McCaffery, B. J. 2014. Saving our king salmon: what to expect this fishing season. U.S. Fish and Wildlife Service News Release, May 6, 2014, Bethel, Alaska. http://www.doi.gov/subsistence/news/fishing/upload/Saving-Our-King-Salmon-BJM-06-May-2014.pdf (Accessed on June 3, 2016.)
6. C. G. Lipka, T. Hamazaki, M. Horne-Brine, D. Koster, and J. Esquible. *In prep*. Subsistence salmon harvests in the Kuskokwim Area, 2017. Alaska Department of Fish and Game, Fishery Data Series No. XX-XX, Anchorage.
7. David Runfola, ADF&G Div. of Subs, field notes, 7/30–8/15/2014.

season.[8] Many residents expressed grave concerns about their ability to get the food that their families needed that season, and they shared their interest in supporting further inseason research in their region. Information such as this demonstrated the need for fishery management agencies to improve outreach to the public in these communities.

Division research staff involved in the 2014 fieldwork developed this study, one goal of which was to initiate improved outreach efforts to the region by continuing implementation of inseason surveys that documented household progress toward annual subsistence salmon harvest goals. The study also aimed to give fishing households an opportunity to speak to ADF&G staff about questions and concerns they may have had during the fishing season. Similar to the surveys completed in 2014, the information recorded in this study assisted management agencies and fishery stakeholder groups in tracking the progress of the salmon runs as fishers harvested them over time from near Lower Kalskag to the furthest upriver study communities of Stony River and Lime Village. It also gave managers insight into understanding the nature of fishers' engagement in the fishery, whether they had been able to get the salmon they had needed by the midpoint of the season, and if not, what they planned to do differently to try to fulfill their needs.

An additional goal of this study was to evaluate the feasibility of developing an inseason harvest monitoring program in the middle Kuskokwim River communities with the greatest populations: Lower Kalskag, Upper Kalskag, and Aniak. Researchers intended to facilitate this aspect of the study through collaboration with Native Village of Napaimute (NVN), a Federally Recognized Tribe. This collaboration recruited local fishers to record their harvest and fishing effort in season, and to report this information to NVN staff who would manage their data. The purpose was to explore whether these methods can provide an index of salmon run timing and stock abundance in season that can be useful to fishery managers. The intention was to determine if study results indicate that it would be feasible to establish a research program with similar methodology. If so, managers would benefit from the reliable source of inseason harvest and effort data that it could record. Accurate indices of harvest amounts would also support an inseason evaluation of the department's ability to provide for ANS in the Kuskokwim Area. These would increase the understanding of utilization of Chinook salmon by Kuskokwim River fishers and distribution of harvest among the communities of the region. Furthermore, if management agencies were to develop a project such as this study into a research program, increased harvest data collection could result in increased confidence in each season's harvest estimates, thereby decreasing the uncertainty of total run abundance estimates.

FINAL REPORT ORGANIZATION

This report summarizes the results of systematic household surveys and subsistence salmon fishing creel surveys related to the harvest and use of salmon in 2015–2018, including information provided by key respondents, tribal council members, and other residents at community approval and review meetings. Study results are organized by community. The Results chapter includes information collected during the subsistence salmon fishing season that reports the following: 1) community members' assessments of their progress toward harvesting the salmon that their households' needed for subsistence; 2) household plans for salmon fishing; 3) household daily capacity to harvest salmon and process it for storage; 4) sharing of subsistence salmon resources; and, 5) fishing gear used for the subsistence harvest of salmon. The Results chapter also describes daily salmon harvest and fishing effort information that local research assistants in Lower Kalskag, Upper Kalskag, and Aniak recorded during fishing openings near their communities, and analysis of these data to determine the feasibility of the study as a method of estimating daily salmon drift gillnet harvests during block fishing openings. In May 2019, Division of Subsistence research staff traveled to all study communities and presented a summary of final data analysis to tribal councils and members of the public for review and comment. The report was finalized after receipt of comments.

8. David Runfola, ADF&G Div. of Subs, field notes, 7/30–8/15/2014.

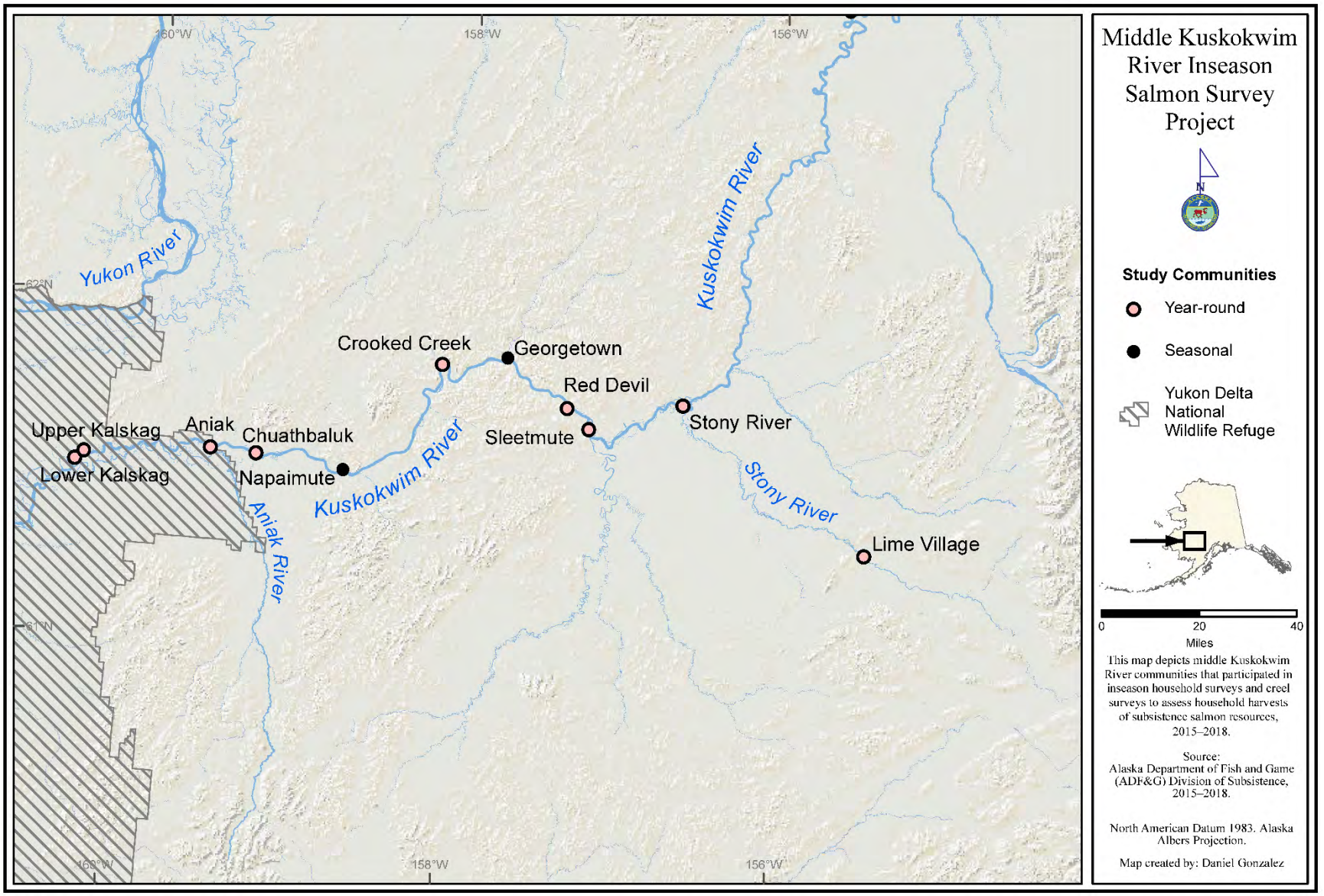

Figure 1-1.–Study communities, middle Kuskokwim River, 2015–2018.

2. METHODS

ETHICAL PRINCIPLES FOR THE CONDUCT OF RESEARCH

The project was informed by principles outlined in the Alaska Federation of Natives Guidelines for Research[1] and by the National Science Foundation, Office of Polar Programs in its Principles for the Conduct of Research in the Arctic[2], the Ethical Principles for the Conduct of Research in the North (Association of Canadian Universities for Northern Studies 2003), as well as the Alaska confidentiality statute (AS 16.05.815). These principles stress community approval of research designs, informed consent, anonymity or confidentiality of study participants, community review of draft study findings, and the provision of study findings to each study community upon completion of the research.

STUDY OBJECTIVES

The project aimed to achieve the following objectives:

- Record a weekly sample of fishing households' qualitative assessments of their progress toward obtaining their annual subsistence needs for salmon among households in communities from Lower Kalskag to Stony River and Lime Village in the Kuskokwim River drainage.
- Develop inseason fishing effort and catch per unit effort (CPUE) estimates among subsistence salmon fishers in a section of the middle Kuskokwim River by collecting daily fishing effort statistics from a sample of fishers active near the communities of Lower Kalskag, Upper Kalskag, and Aniak.
- Record daily estimates of the number of boats fishing in a section of the middle Kuskokwim River near the communities of Lower Kalskag, Upper Kalskag, and Aniak.
- Evaluate the effectiveness of inseason harvest and fishing effort monitoring as a tool to estimate total subsistence harvest by fishers from the communities of Lower Kalskag, Upper Kalskag, and Aniak.

PROJECT PLANNING, AND APPROVALS

During May, June, and July in 2015–2018, ADF&G staff traveled to the study communities of Lower Kalskag, Upper Kalskag, Aniak, Chuathbaluk, Crooked Creek, Red Devil, Sleetmute, and Stony River (Figure 1-1) and met with tribal councils to present project background (including justification and need, research goals, project objectives, and proposed timeline). Staff also discussed the project methods and requested each council's approval to conduct research with volunteer members of their Alaska Native tribes, and to administer voluntary and confidential household surveys during the salmon fishing season. Division of Subsistence staff received approval and support from all tribal councils each season. Staff also conducted household surveys in Lime Village in 2016 and 2018. Community approval for surveys in Lime Village occurred telephonically in coordination with the Lime Village Tribal Council Chief and the Lime Village Tribal Administrator. Department data available prior to 2015, the first field season, indicated that among approximately 450 total households in the 9 study communities there were an estimated 364 fishing households (81% of total households) (Brown et al. 2012; Shelden et al. 2016a). The majority of middle Kuskokwim River fishing households (308 households) resided in Lower Kalskag, Upper Kalskag, and Aniak (Shelden et al. 2016).

1. Alaska Federation of Natives. 2013. "Alaska Federation of Natives Guidelines for Research." Alaska Native Knowledge Network. http://www.ankn.uaf.edu/IKS/afnguide.html (accessed September 7, 2019).
2. National Science Foundation Interagency Social Science Task Force. 2012. "Principles for the Conduct of Research in the Arctic." http://www.nsf.gov/od/opp/arctic/conduct.jsp (accessed September 7, 2019).

In June and July of each study year, research teams returned to Lower Kalskag, Upper Kalskag, and Aniak to collaborate with Kuskokwim Native Association (KNA) staff in 2015, and Native Village of Napaimute (NVN) staff in 2016–2018 to recruit volunteer fishers for participation as data technicians or local research assistants (LRAs) in the project. Each community's tribal council or their staff, KNA or NVN staff, and ADF&G researchers collaborated to select LRAs to record their fishing harvest and effort information while they fished during subsistence salmon fishing openings near their communities in the Kuskokwim River mainstem, each July and August from 2015–2018. During all study years, researchers recruited a total of 19 different LRA fishers from the communities of Lower Kalskag, Upper Kalskag, and Aniak, ranging from 14 to 18 per year.[3] Each season a KNA or NVN employee, sometimes assisted by an ADF&G field researcher, acted as the community lead for data collection and conducted an orientation and training session with LRAs. Training included field data recording and data management techniques. The LRAs were instructed to record date fished, net stretch-mesh size in inches, net length in feet, net depth in number of meshes, the location of each fishing drift relative to their home community, individual drift start and stop times, and number of salmon harvested in each drift by species (i.e., Chinook, chum, or sockeye salmon); each time they deployed a drift gillnet to target salmon during a subsistence fishing opening in June through early July. Following training, each LRA received several blank data collection log sheets printed on waterproof paper (Appendix A), a plastic folder in which to retain the log sheets, and several pencils. Each LRA was paid an annual stipend of $350 by KNA or NVN for each respective season during which he or she participated in orientation, training, and data collection efforts. All LRAs chose to participate in field research voluntarily. Names of LRAs were not shared with any individuals outside KNA or NVN and ADF&G Division of Subsistence research staff.

SURVEY IMPLEMENTATION

Research in this study was conducted consistent with the Division of Subsistence policy on research ethics. Participation in both inseason fisher sampling and household surveys was voluntary, and information was and continues to be kept confidential.

In late June and early July of each field season KNA or NVN staff led field operations out of Aniak for completion of objectives regarding inseason harvest and effort data collection. During fishing openings in late June and early July, KNA or NVN researchers also attempted to travel through a section of river from Aniak downstream to Lower Kalskag in order to count boats actively fishing in that section. In mid-July through early August each field season, division staff based their field operations out of Aniak and traveled with KNA or NVN technicians by boat to all study communities to complete inseason household harvest assessment surveys. The project principal investigator was David Runfola, a Fairbanks-based Subsistence Resource Specialist with the Division of Subsistence. The cooperating principal investigator was Daniel Gillikin, NVN Environmental Program Director based in Aniak. Division field research staff included Odin Miller, Andrew Brenner, Jeffrey Park, Christopher McDevitt, Anna Godduhn, Daniel Gonzalez, DeAnne Lincoln, Alea Robinson, and Kathleen Roush, who were assisted by numerous technicians employed with the study's research partners, KNA or NVN. In 2015, David Phillips, USFWS Refuge Information Technician, also assisted ADF&G staff with household harvest assessment surveys. Data management and analyses were completed by Loraine Naaktgeboren and David Koster, ADF&G Division of Subsistence research analysts.

Household Harvest Assessment Surveys

During each study year in mid-July through early August, researchers implemented a household survey in nine middle Kuskokwim River study communities to record residents' assessments of their fishing success and progress toward their salmon fishing goals for the season. Research staff consulted with the ADF&G Kuskokwim Area fisheries manager and fisheries research biologist and USFWS Yukon Delta National Wildlife Refuge fishery management staff. Survey design was developed from specific

3. Researchers contracted with 18 key respondent fishers in 2015, 16 in 2016, 18 in 2017, and 14 in 2018. Several fishers participated in the study for multiple years.

information needs identified in collaboration with these state and federal management agency staff. Following receipt of comments at the community approval meetings, ADF&G Division of Subsistence finalized the survey instrument. The survey instrument asked questions of one consenting adult resident of each contacted household regarding the following areas of information: whether members of the household subsistence fished for salmon; types of salmon fishing gear used by the household; household progress toward achieving salmon fishing goals for the season and qualitative assessments regarding household progress; sharing of subsistence salmon resources with other households; household salmon harvest and processing productivity; and expected salmon harvest through the remainder of the fishing season. Respondents were also invited to provide comments or concerns regarding their experiences with the subsistence salmon fishing season or with salmon fishery management and regulation in general.

Division research staff finalized the first version of the survey instrument in June 2015. After completion of the 2015 season, researchers made two changes to the protocol of survey questions. The first change was consolidation of two questions into one. The two questions in the 2015 protocol were "Which kind(s) of salmon do you plan to target for the remainder of the season?" and "About how many will you need of each?" For the sake of brevity, survey protocols in subsequent study years instead asked: "How many of each kind of salmon will you try to catch for the rest of the fishing season?" The second change eliminated one question from the original protocol. The 2015 survey asked respondents to describe any environmental factors they felt had affected their salmon fishing that season. This question was removed from surveys in subsequent study years because research staff were concerned that it biased respondents to correlate harvest success specifically with environmental factors. The survey protocol also had a question asking those respondents who reported they had not gotten the salmon their household had needed to explain why they believed that had happened. Staff felt the most appropriate method was to exclude the question directed at environmental factors and allow respondents to comment on those as perceived factors affecting their fishing in their reasons for not getting the salmon they needed. These two changes were implemented in the 2016, 2017, and 2018 household surveys (Appendix B; Appendix C).

Qualitative harvest assessment data from questionnaires were collected in face-to-face interviews using the survey form and lasted approximately 5–10 minutes per household, depending on the nature of each respondent's experience with subsistence fishing-related activities. Respondents were asked to provide qualitative assessments of their household's progress toward meeting its subsistence needs for salmon. Household surveys were administered by teams of two, including one ADF&G researcher and a KNA or NVN technician. Following data collection, the surveyors reviewed forms for completeness and accuracy. Where necessary, responses were coded following standardized codebook conventions used by Division of Subsistence to facilitate data entry. A data collection supervisor reviewed coded forms prior to sending them to the principal investigator.

Survey communities included Lower Kalskag, Upper Kalskag, Aniak, Chauthbaluk, Crooked Creek, Red Devil, Sleetmute, Stony River, and Lime Village (Table 2-1). In 2015 and 2017, research teams traveled by boat to all survey communities except Lime Village, which was inaccessible in those study years due to budget limitations and availability of personnel. In 2018, research teams traveled to all survey communities except Chauthbaluk, which remained uncontacted due to loss of available NVN staff. Using household identification lists obtained from ADF&G postseason subsistence salmon household survey databases, and with assistance from local KNA or NVN technicians and tribal council staff, lead community researchers organized daily household sampling efforts. In the larger communities of Lower Kalskag, Upper Kalskag, and Aniak, staff divided communities into blocks, identified survey respondents in separate blocks, and attempted a census throughout each community block. Local tribal nonprofit technicians assisted ADF&G researchers in tracking all contacts and planning remaining attempts each survey day. Potential survey households were removed from survey lists if a resident declined to complete a survey; was unavailable after three attempts at different times on different days; if the dwelling appeared to be abandoned, destroyed, or no longer present in the community; or if household residents were otherwise unavailable to complete a survey. When a household list was exhausted or when

schedules with other communities deemed it necessary, staff moved upriver to the next survey community. Staff returned to some communities for more than one survey trip when schedules required them to do so.

2015 Household Survey Sample

In Lower Kalskag, staff completed 20 surveys out of 74 potential households (27% sample) on July 20 and 22, 2015 (Table 2-1; Table 2-2). In Upper Kalskag, staff completed 28 surveys out of 62 total community households (45% sample) on July 20–22. In Aniak, staff completed 72 surveys out of 180 total community households (40% sample) on July 13–15 and July 26. In Chuathbaluk, staff completed 20 surveys out of 29 total community households (69% sample) on July 21, 25, and 27. In Crooked Creek, staff completed 22 surveys out of 31 total community households (71% sample) on July 16 and 23. In Red Devil, staff completed 10 surveys out of an estimated 9 potential total community households (111% sample) on July 17. In Sleetmute, staff completed 28 surveys out of 36 total community households (78% sample) on July 17–18 and 24–25. In Stony River, staff completed 11 surveys out of 13 total community households (85% sample) on July 24.

2016 Household Survey Sample

In Lower Kalskag, staff completed 10 surveys out of 84 potential households (12% sample) on July 30–31, 2016 (Table 2-1; Table 2-2). In Upper Kalskag, staff completed 19 surveys out of 62 total community households (31% sample) on July 25–27. In Aniak staff completed 97 surveys out of 178 total community households (55% sample) on July 13 and 23–29. In Chuathbaluk, staff completed 15 surveys out of 31 total community households (48% sample) on July 30. In Crooked Creek, staff completed 10 surveys out of 36 total community households (28% sample) on August 3. In Red Devil, staff completed six surveys out of an estimated eight potential total community households (75% sample) on August 3. In Sleetmute, staff completed 4 surveys out of 34 total community households (12% sample) on July 18. In Stony River, staff completed 4 surveys out of 13 total community households (31% sample) on July 18. In Lime Village, staff completed five surveys out of nine total community households (56% sample) on July 20.

2017 Household Survey Sample

In Lower Kalskag, staff completed 23 surveys out of 85 potential households (27% sample) on July 16–17, 2017 (Table 2-1; Table 2-2). In Upper Kalskag, staff completed 18 surveys out of 58 total community households (31% sample) on July 16–17. In Aniak, staff completed 40 surveys out of 167 total community households (24% sample) on July 14–15. In Chuathbaluk, staff completed 7 surveys out of 32 total community households (22% sample) on August 12–13. In Crooked Creek, staff completed 12 surveys out of 33 total community households (36% sample) on July 19. In Red Devil, staff completed eight surveys out of eight total community households (100% sample) on July 21. In Sleetmute, staff completed 14 surveys out of 31 total community households (45% sample) on July 22. In Stony River, staff completed 4 surveys out of 14 total community households (27% sample) on July 24. In Lime Village staff, completed five surveys out of nine total community households (56% sample) on July 20.

2018 Household Survey Sample

In Lower Kalskag, staff completed 51 surveys out of 95 potential households (54% sample) on July 16–18, 2018 (Table 2-1; Table 2-2). In Upper Kalskag, staff completed 27 surveys out of 68 total community households (40% sample) on July 16–17. In Aniak, staff completed 94 surveys out of 183 total community households (51% sample) on July 12–16. In Crooked Creek, staff completed 17 surveys out of 35 total community households (49% sample) on July 20–21. In Red Devil, staff completed 10 surveys out of an estimated 8 potential total community households (125% sample) on July 25–27. In Sleetmute, staff completed 18 surveys out of 35 total community households (51% sample) on July 23. In Stony River, staff completed 1 survey out of 17 total community households (6% sample) on July 25. In Lime Village, staff completed four surveys out of seven total community households (57% sample) on July 25.

Inseason Harvest and Effort Creel Surveys

In 2015, 2016, and 2017, ADF&G research staff provided LRAs with their contact telephone numbers and instructed LRAs to call the lead researcher or other designated ADF&G staff after a fishing opening or immediately after they had completed their fishing for the day and recorded all appropriate fishing data. Researchers also preemptively contacted LRAs telephonically or in person to transfer fishing harvest and effort data from log sheets to a master data sheet and into a Microsoft® Excel®[4] spreadsheet. In 2018, the ADF&G researchers traveled to Lower Kalskag, Upper Kalskag, and Aniak and completed a dockside creel survey with each consenting fisher as he or she returned to their home port immediately after a fishing trip (Appendix D). Lead community researchers retained all completed creel surveys following a fishing opening and retained the original copies. Data recorded included date fished; net stretch-mesh size in inches; net length in feet; net depth in number of meshes; the location of each fishing drift by community (i.e., Lower Kalskag, Upper Kalskag, or Aniak); individual drift start and stop times in 2015, 2016, and 2017; individual trip start and stop times in 2018; and number of salmon by species (i.e., Chinook, chum, or sockeye salmon) harvested in each drift in 2015, 2016, and 2017, or trip in 2018. Harvest quantities were recorded for Chinook salmon and for the cumulative number of chum salmon and sockeye salmon. Recording harvest amounts in these two sets allowed for calculation of ratios of Chinook salmon harvest to all other salmon (i.e., chum salmon plus sockeye salmon) for each fishing opening. After initial data entry in the spreadsheet, data were exported into a Microsoft® Access® relational database for analysis.

A catch-per-unit-effort (CPUE) was calculated for two separate species categories: 1) Chinook salmon, and 2) the cumulative number of chum salmon and sockeye salmon. In 2015, 2016, and 2017, the CPUE was calculated for the two species categories harvested in each drift by each fisher. In 2018, it was calculated for the two species categories in each fishing trip by each fisher.[5] Each fisher's CPUE was computed and evaluated as a separate fishing effort statistic. This was accomplished by converting differences in net length and mean fishing time of each drift to the number of fish caught by 150 feet of net (hereinafter 25 fathoms) fished for 60 min in river sections where regulation allowed for a maximum net length of 25 fm. This standardized net length and fishing time is used in gillnet test fisheries conducted by ADF&G and NVN. Each drift CPUE (I) was computed for sections of river where regulation allowed for a maximum net length of 25 fm

$$I = (25\text{fm})(60\text{min})\frac{x}{L \times T}$$

where x is the harvest of salmon (i.e., Chinook salmon or chum and sockeye salmon combined) in numbers of fish, L is the length in fathoms of the net fished, and T is the mean fishing time in minutes (see Molyneaux 1997, equation 1, page 6).

Each fishing opening, a mean CPUE index was calculated for each species category ($\bar{I}_f$) for the sample of fishers

$$\bar{I}_{f,i} = \frac{1}{n}\sum_{j=1}^{n} I_{f,i,j}$$

where $I_{l,i,j}$ is the drift CPUE for species category f, drift j of fisher i, and n is the number of applicable drifts throughout the sample (see Molyneaux 1997, equation 2, page 6).

4. Product names are given because they are established standards for the State of Alaska or for scientific completeness; they do not constitute product endorsement.
5. Hereinafter, incorporation of total fishing trip time into harvest and effort calculations will be considered analogous to a single drift.

A harvest ratio (*R*) of chum and sockeye salmon combined to Chinook salmon was calculated for each fishing opening

$$R = \frac{(\sum_{i=1}^{n} k_i)}{\sum_{i=1}^{n} c_i}$$

where c_i is the total cumulative chum and sockeye salmon harvest of fisher *i* in a sample of *n* fishers, and k_i is the total Chinook salmon harvest of fisher *k* in a sample of n fishers. The harvest ratio was used as an index of the progress of the Chinook salmon run relative to the progress of the later chum and sockeye salmon runs. By monitoring this fishery statistic, the harvest ratio allowed managers to determine at what point in the fishery less restrictive management techniques could reasonably be implemented without significant risk of excessive incidental harvest of Chinook salmon. Managers typically felt confident to allow unrestricted subsistence fishing when the subsistence harvest ratio was approximately one Chinook salmon to 10 other salmon per fishing opening.

Fishing Boat Counting Surveys

During each fishing opening, ADF&G staff recorded the number of subsistence fishing boats in surface surveys by boat within approximately a 30-mile reach of the Kuskokwim River from approximately 1 mile below the community of Lower Kalskag to a point approximately 1.5 mi below the mouth of the Aniak River (Figure 1-1). During each survey trip, researchers traveled by boat through each section. One staff member piloted the boat while one or two staff, depending on availability of personnel, counted all fishing skiffs they could see. During survey trips staff used tally counters. Counters assumed that all skiffs (typically 18–24 ft open aluminum boats with one to four passengers and a 25 fm drift gillnet) in the river were participants in the subsistence salmon fishery. Researchers did not count commercial, agency, and other nonfishing vessels in their tallies. Boat pilots traveled at a steady pace that allowed for ease of counting and slowed the boat when counters signaled the pilots to do so. Each boat-counting survey trip extended from one end of the survey reach to the other. Thus, a round-trip from the downriver end of the section to the upriver end of section and back composed two boat-counting survey trips. Staff attempted to complete boat-counting survey trips at least once every four hours of a subsistence fishing opening. This rate was reduced to three trips per day during 24-hr openings when they occurred.

Boat counts were recorded in field data sheets and transferred in Bethel to a Microsoft® Excel® spreadsheet. Average boat counts per section per opening were calculated and recorded in a Microsoft® Access® database. Average boat survey counts were reviewed as potential representatives of the universe of fishing boats during each opening. Fishing sample results were evaluated in comparison with the putative universe of fishing boats to determine the feasibility of using sample fishery statistics to estimate a total Chinook salmon harvest per opening.

DATA ANALYSIS AND REVIEW

Household Survey Data Entry and Analysis

Surveys were coded for data entry by research staff and reviewed by the project leads in each community for consistency. Responses were coded following standardized conventions used by the Division of Subsistence to facilitate data entry. A division Information Management Section research analyst designed database structures within Microsoft® Access® at ADF&G in Anchorage to hold the survey data. The database structures included rules, constraints, and referential integrity to ensure that data were entered completely and accurately. Data entry screens were available on a secured internet site. Daily incremental backups of the database occurred through routine file-system backups conducted at regular intervals daily, and weekly. This ensured that no more than a day of data entry would be lost in the unlikely event of a catastrophic failure.

ADF&G staff also used SPSS for analyzing the survey information. Analyses included review of raw data frequencies, cross tabulations, table generation, and summaries of information collected. Estimates were

not generated for these data and descriptive statistics such as sample means, and percentage of sampled households reporting, are used to represent the population of each sampled community. Missing information was dealt with on a case-by-case basis according to standardized practices, such as minimal value substitution or using an averaged response for similarly characterized households. Typically, missing data are an uncommon, randomly occurring phenomenon in household surveys conducted by the division. In unusual cases where a substantial amount of survey information was missing, the household survey was treated as a "non-response" and not included in community estimates. ADF&G researchers documented all adjustments.

Project Reporting

As soon as was practical following any data collection effort in season, division research staff shared with ADF&G and USFWS management staff preliminary results from household surveys and harvest and effort data calculated from the sample of volunteer LRA fishers (i.e., 2015–2017) or dockside creel surveys (i.e., 2018). Division staff presented preliminary survey findings and associated management applications of preliminary results at weekly meetings of the Kuskokwim River Salmon Management Working Group (WG) and the Kuskokwim River Inter Tribal Fish Commission (KRITFC). Research staff's intent in presenting preliminary data to agency managers, the WG, and the KRITFC was to allow those individuals opportunities to consider, in their management decisions and recorded information, harvest, effort, and fisher satisfaction in the study communities.

Division staff conducted a meeting in each community in May 2019, subsequent to completion of the study. No community review meeting was held in Lime Village. Instead, also in May 2019, a division researcher contacted the Lime Village Tribal Council Chief and the Lime Village Tribal Administrator to discuss with them project results and request comments, concerns, and recommendations for the final technical report. All data, how the data were applied to management decisions inseason, and potential implications of the study were discussed with tribal councils and other community members. Division staff answered community members' questions and addressed any concerns they shared. Community comments were recorded and incorporated into the content and organization of the final technical report where appropriate. Paper copies of the report were mailed to tribal councils in all study communities and to the tribal council of the cooperating organization, NVN. At the time of final technical report publication, division staff mailed a 4-page project summary report to all boxholders—approximately 620 addresses—in each study community (Appendix E). The summary report described a brief overview of the project background, justification, methods, results, and conclusions.

Table 2-1.–Middle Kuskokwim River inseason survey sampling, 2015–2018.

		Households			Population	
			Sampled		Post-Season	ACS 5-year
Community	Study Year	Total	Number[a]	Percent	Survey[b]	Average[a]
Aniak	2015	180	72	40.0%	581	540
	2016	178	97	54.5%	569	
	2017	167	40	24.0%	571	
	2018	183	94	51.4%	575	
Chuathbaluk	2015	29	20	69.0%	97	124
	2016	31	15	48.4%	98	
	2017	32	7	21.9%	111	
	2018	35	not sampled	0.0%	107	
Crooked Creek[c]	2015	31	22	71.0%	86	89
	2016	36	10	27.8%	108	
	2017	33	12	36.4%	97	
	2018	35	17	48.6%	88	
Lime Village[c,d]	2015	14	not sampled	0	–	10
	2016	9	5	55.6%	20	
	2017	7	not sampled	0.0%	10	
	2018	7	4	57.1%	15	
Lower Kalskag	2015	74	20	27.0%	275	309
	2016	84	10	11.9%	271	
	2017	85	23	27.1%	329	
	2018	95	51	53.7%	347	
Red Devil[c,e]	2015	9	10	111.1%	18	27
	2016	8	6	75.0%	15	
	2017	8	8	100.0%	19	
	2018	8	10	125.0%	18	
Sleetmute[c]	2015	36	28	77.8%	106	91
	2016	34	4	11.8%	83	
	2017	31	14	45.2%	82	
	2018	35	18	51.4%	101	
Stony River[c]	2015	13	11	84.6%	34	46
	2016	13	4	30.8%	48	
	2017	14	4	28.6%	40	
	2018	17	1	5.9%	47	
Upper Kalskag	2015	62	28	45.2%	211	232
	2016	62	19	30.6%	249	
	2017	58	18	31.0%	222	
	2018	68	27	39.7%	228	

-continued

Table 2-1.–Page 2 of 2.

a. ACS 5-yr avg, 2014–2018.

b. Estimates pulled from the 2015–2018 Kuskokwim Postseason survey results.

c. ACS 4-yr avg, 2014–2017 (ACS 2018 population estimate not available).

d. Lime village was not surveyed for the Kuskokwim Postseason Survey in 2015, no population estimate is available.

e. The number of permanent households identified for the postseason survey were fewer than those sampled. This is a product of differing methodologies that ACS and ADF&G each applied to identify elegiblity for the survey and permanent residence.

Table 2-2.–Middle Kuskokwim River inseason survey sampling dates by study community, 2015–2018.

		Survey Community								
	Study Year	Lower Kalskag	Upper Kalskag	Aniak	Chuathbaluk	Crooked Creek	Red Devil	Sleetmute	Stony River	Lime Village
Dates of household harvest assessment surveys	2015	7/20, 7/22	7/20, 7/22	7/13–15, 7/26	7/21, 7/25, 7/27	7/16, 7/23	7/17	7/17–18, 7/24–25	7/24	no surveys
	2016	7/30–31	7/25–27	7/13, 7/23–29	7/30	8/3	8/3	7/18	7/18	7/20
	2017	7/16–17	7/16–17	7/14–15	8/12–13	7/19	7/21	7/22	7/24	no surveys
	2018	7/16–18	7/16–18	7/12–16	no surveys	7/20–21	7/25–27	7/23	7/25	7/25

Source: ADF&G Division of Subsistence household surveys, 2015–2018.

3. RESULTS

HOUSEHOLD HARVEST ASSESSMENT SURVEY

2015 SEASON

Salmon fishing progress and plans for remainder of the season

Lower Kalskag

In 2015, research staff conducted surveys in Lower Kalskag on July 20 and July 22 (Table 2-2). Seventeen respondents in Lower Kalskag answered questions regarding their household's progress toward their fishing goals and their plans for the remainder of the season. Of those 17 respondents, 29% reported that they were not fishing in 2015 (Table 3-1), and 29% stated that they had harvested approximately 75% of their goal for salmon that season. Also, 12% of respondents reported being finished with their fishing, and 12% reported being about halfway to reaching their goals for salmon.

Eighteen of 20 households sampled in Lower Kalskag responded to the question that asked whether they had gotten enough salmon for their households as of the date of their surveys. Half (50%) of those respondents reported that they had not gotten enough salmon for subsistence (Table 3-2). Some respondents explained that the reasons why they could not get the fish they needed mostly included fishing regulations or closures and conflicts with work or otherwise insufficient time to harvest. People also cited that they were unsuccessful while fishing, that they experienced equipment failures or a lack of equipment, as well as personal and other reasons. Survey respondents were also asked if they would do anything differently as a result of not getting the salmon they needed. In response, two Lower Kalskag households said that they planned to fish more for coho salmon or other salmon (Table 3-3).

Fourteen Lower Kalskag households responded to survey questions that asked about their salmon fishing plans for the remainder of the season (Table 3-4). Among the responses from households that expected to fish more, the average planned harvest was no Chinook salmon or chum salmon, 33 sockeye salmon, and 46 coho salmon.

Upper Kalskag

Surveyors deployed in Upper Kalskag on July 20 and July 22, 2015 (Table 2-2) where 28 respondents reported their household's fishing progress and plans. Forty-three percent stated that their households were not fishing in 2015 (Table 3-1). Most respondents who were fishing for salmon (18% of valid responses to the question) reported that they were about halfway done for the season. Fourteen percent of respondents reported that they had made no progress, and another 14% stated that they had reached approximately a quarter of their goal for subsistence salmon harvests. All households sampled in Upper Kalskag responded to the question that asked whether they had gotten enough salmon for their households as of the date of their surveys. A majority of respondents (79%) reported that they had not gotten enough salmon for subsistence (Table 3-2). When asked why they did not get the fish they needed, 64% of respondents who gave a reason cited that regulations and fishing closures prevented them from harvesting enough salmon. Other common reasons given included failure or lack of equipment, the availability or lack of abundance of salmon, unsuccessful fishing, and the weather or other environmental factors. Survey respondents were also asked if they would do anything differently as a result of not getting the salmon they needed. Upper Kalskag respondents explained that they planned to buy more food commercially, harvest other wild foods, and fish for coho salmon and nonsalmon fish (Table 3-3).

In Upper Kalskag, 16 households responded to survey questions that asked about their salmon fishing plans for the remainder of the season (Table 3-4). Among the responses from households that expected to fish more, the average planned harvest was 53 coho salmon. One household also reported that they planned to fish for goals of 35 Chinook salmon, 10 chum salmon, and 25 sockeye salmon.

Aniak

During survey implementation in Aniak on July 13–15 and July 26, 2015 (Table 2-2), 72 respondents reported information regarding assessments of their household's salmon fishing progress and estimated their plans for the season, 28% of whom stated that they were not fishing for the season. More than a third of respondents (36%) reported that their households had made no progress in fishing that season (Table 3-1). Fourteen percent were a quarter of their way toward completing their fishing for the season, and 10% were three-quarters done fishing for salmon. Of households sampled in Aniak, 71 of 72 responded to the question that asked whether they had gotten enough salmon for their households as of the date of their surveys (Table 3-2). More than half of respondents (56%) described not getting enough salmon for subsistence. Out of 39 Aniak households that gave a reason to explain why they did not get the fish they needed, 44% perceived that fishing regulations prevented them from getting the salmon they needed. Twenty-three percent of respondents stated that their household had not invested enough effort fishing. Respondents also shared other reasons such as a lack of equipment, the low abundance of salmon, or lack of time due to work schedules. Some respondents also described what they would do differently as a result of not getting the salmon they needed. A quarter (25%) of survey respondents who answered said that they planned to increase their overall salmon fishing effort by targeting coho salmon. Others also said they planned to receive or buy more salmon from others, purchase more food from stores, harvest other wild foods, and fish for nonsalmon fish (Table 3-3).

In Aniak, 53 households responded to survey questions that asked about their salmon fishing plans for the remainder of the season (Table 3-4). Among the responses from households that expected to fish more, the average planned harvest for 51 households was 103 coho salmon. A small number of households also reported plans to harvest additional Chinook, chum, and sockeye salmon during the remainder of the season.

Chuathbaluk

In Chauthbaluk, researchers completed surveys on July 21, 25, and 27, 2015 (Table 2-2). Of 20 sampled households, 30% reported that they had made no progress in salmon fishing for the year, and 30% reported that they had caught three-quarters of their subsistence salmon harvest goals for 2015 (Table 3-1). An additional 10% reported that they had completed their fishing, and 15% stated that they were not fishing that year. Half of all households sampled in Chuathbaluk reported that, as of the date of their surveys, they had not yet gotten the salmon that they needed for the season (Table 3-2). When asked why they did not get the fish they needed, 40% of the respondents who gave a reason stated that they lacked the equipment needed to fish for salmon, 30% reported that fishing closures were the cause of their low harvest, and 20% explained that they experienced schedule conflicts between work and fishing openings. When asked what they planned to do differently to compensate for their lack of salmon, eight respondents provided a variety of options. Some stated that they planned to fish for coho salmon and other salmon, and some would increase their fishing effort. Other strategies included changing how they cooperated with other fishing households, fish for nonsalmon fish, and buy more food commercially (Table 3-3).

In Chuathbaluk, 18 households answered questions that asked about their salmon fishing plans for the remainder of the season (Table 3-4). Among the responses from households that expected to fish more, the average planned harvest was 4 Chinook salmon, 17 sockeye salmon, and 39 coho salmon. One household also reported that they planned to harvest four more chum salmon before the end of the fishing season.

Crooked Creek

In Crooked Creek, twenty-one respondents reported their fishing progress and plans for the remainder of the season in surveys conducted on July 16 and 23 (Table 3-1; Table 2-2). Thirty-three percent of respondents reported that their households had made no progress in subsistence salmon fishing that season. Similarly, 33% stated that their households had caught approximately one-quarter of their 2015

salmon harvest goals, and 29% of respondents stated that they were not fishing that season. Out of 19 households that answered a question about whether they got the salmon they needed up to that point in the season, 79% reported that they did not get enough salmon for subsistence (Table 3-2). Reasons for not getting the salmon they needed included fishing closures or fishing regulations, lack of time, low numbers of salmon, and lack of effort fishing or poor success while fishing. Some respondents also described what they planned to do to make up for their low salmon harvests. Several reported that they would fish for coho salmon or other salmon, increase their fishing effort, and receive or buy more salmon from another household (Table 3-3).

Of 13 Crooked Creek households that answered questions about their salmon fishing plans for the remainder of the season, households that expected to fish more planned an average harvest of 68 chum salmon, 48 sockeye salmon, and 167 coho salmon (Table 3-4). One household also reported that they planned to harvest an additional seven Chinook salmon before the end of the fishing season.

Red Devil

On July 17, 2015, 10 Red Devil respondents answered questions regarding their fishing progress for 2015 (Table 2-2). Thirty percent reported that their households were not fishing for the season (Table 3-1). An additional 20% reported that they had made no progress in fishing. Another 20% were about one-quarter done with salmon fishing, and 20% stated they had progressed about three-quarters toward reaching their salmon fishing goals. No one reported that they had finished subsistence salmon fishing for 2015. Of the households sampled in Red Devil, 50% reported that they had not gotten enough salmon for the year (Table 3-2). Some respondents explained that the reasons why they could not get the fish they needed included lack of functional equipment, fishing regulations or closures, conflicts with work schedules, and high cost of fuel. Respondents in Red Devil provided no answers to the question regarding what they may do differently to get the subsistence salmon their households needed (Table 3-3).

In Red Devil, seven households answered questions that asked about their salmon fishing plans for the remainder of the season (Table 3-4). Among the responses from households that expected to fish more, 5 households had an average planned harvest of 44 coho salmon. One household also reported that they planned to harvest 45 more chum salmon, and 2 households said they hoped to harvest an average of 44 sockeye salmon before the end of the fishing season. No one expected to target any additional Chinook salmon.

Sleetmute

In Sleetmute research staff conducted surveys on July 17–18, and July 24–25, 2015 (Table 2-2). All 28 respondents in Sleetmute answered questions regarding their households' progress and plans for subsistence salmon fishing (Table 3-1). Among the 28 respondents, 32% stated that their households were not fishing that season. Eighteen percent reported that they had reached their goals for salmon, 21% were halfway toward completion, and 14% had made no progress as of the date of their household's survey. Of the household sample 26 of 28 respondents answered survey questions about their households' needs for salmon (Table 3-2). More than a quarter (27%) of respondents to the question said that they had not gotten enough salmon for the year. When asked why they were unable to get enough salmon, reasons included lack or failure of equipment, low salmon run sizes, fishing closures, and a lack of time to fish. In order to make up for their lack of salmon, respondents said they would fish for coho salmon and other salmon and purchase more food commercially (Table 3-3).

In Sleetmute, 18 households answered questions that asked about their salmon fishing plans for the remainder of the season (Table 3-4). Among responses from households that expected to fish more, 10 households expected an average planned harvest of 29 sockeye salmon, and 14 households expected to get an average of 47 more coho salmon. One household also reported that they planned to harvest 20 more Chinook salmon before the end of the fishing season, and one household stated that they would try to catch 20 additional chum salmon.

Stony River

In Stony River, staff deployed to conduct surveys on July 24, 2015 (Table 2-2). Of 11 Stony River households sampled, 7 responded to questions about their salmon fishing progress and plans (Table 3-1). More than half of the households (57%) that answered questions about their progress in salmon fishing stated that they had made none. Fourteen percent reported that they were finished for the season, and another 14% described being one-quarter of the way toward finishing their salmon fishing. Out of 11 survey respondents in Stony River, 7 reported that they had not gotten the salmon their households needed for the season (Table 3-2). Those respondents cited fishing regulations, work schedule conflicts, and weather or other environmental factors as reasons why they did not get enough salmon. To compensate for their lack of subsistence salmon respondents reported that they expected to fish for coho salmon and other salmon, increase their effort spent fishing, and buy more food from stores (Table 3-3).

Two households in Stony River reported that would harvest an average of 18 sockeye salmon before the end of the season, and 5 households planned to catch an average of 25 additional coho salmon (Table 3-4). No respondents said that their households expected to fish for more Chinook salmon or chum salmon.

Salmon Fishing Capacity and Sharing

Survey respondents in all communities were asked to estimate how many salmon their households would be able to catch in a day. In 2015, households were also asked about how many days they would need to process those fish.[1] Responses ranged from an average of 13 fish harvested daily in Stony River to 59 salmon per day in Crooked Creek (Table 3-5). Respondents in Crooked Creek thought they would need an average of approximately 15 days to process their harvests. Other respondents' estimates ranged from an average of 1.5 days in Stony River to 8 days of processing time in Lower Kalskag.

Survey respondents also answered questions to describe their sharing of salmon resources with other households. Respondents who said that they fished for others reported that they shared their salmon harvests with an average number that ranged from approximately one to two households (Table 3-6). Eighty percent of Stony River survey respondents reported fishing for other households. Other communities ranged from 21% of Chuathbaluk respondents who fished for others to 47% of survey respondents in Crooked Creek.

1. In all study years, respondents were asked, "About how many salmon can your household catch in a day before you would need to stop fishing?" Only in 2015, as a complement to that question the next in the survey asked, "About how long does it take for your household to process that many salmon so that they're ready to put away for the year?" Surveyors did not prompt respondents with a definition of the term process. If a respondent asked for a definition of the term, surveyors indicated that the respondent's definition of processing of salmon is determined by whatever means their household typically practices to prepare their salmon harvests for long-term storage, (e.g., cutting, drying, smoking, and packaging; pressure jarring or canning; packaging and freezing; etc.). This question was excluded from surveys deployed in 2016–2018.

Fishing gear used

Surveys asked respondents what types of fishing gear they used to harvest their salmon for subsistence. In Stony River, 43% of fishers responding to the survey used a set gillnet (Table 3-7). Similarly, 41% of Crooked Creek households did the same. In other communities, set gillnet use ranged from 10% of fishers in Aniak and 12% of Lower Kalskag respondents up to 36% of Sleetmute fishers. All respondents in Lower Kalskag and Red Devil said that they owned their set gillnets. Eighty-nine percent of Crooked Creek households responding and 86% of Aniak respondents reported that they owned the set gillnets they used, and 33% of Stony River fishers owned theirs—the lowest percentage of set gillnet ownership in the study communities. Fishers also deployed drift gillnets to harvest salmon for subsistence. In Lower Kalskag, 76% of fishers responding to the survey reported using drift gillnets to catch salmon (Table 3-8). Surveys recorded similar rates of drift gillnet use in Chuathbaluk (75% of fishers) and Crooked Creek (73%). In other communities about half of the fishing households responding to the survey said they used drift gillnets, ranging from 43% in Stony River to 54% in Upper Kalskag. Ownership of a drift gillnet was greatest in Crooked Creek at 94% of responding fishers, and least in Upper Kalskag at 43% of fishing respondents. Fishers in all communities except Lower Kalskag used rod and reel gear to harvest salmon for subsistence, and most of those respondents owned their rod and reel equipment (Table 3-9). Although many households in some communities may have received fish from a fish wheel, very few reported directly harvesting salmon from a fish wheel. In 2015, Aniak, Chuathbaluk, and Sleetmute were the only survey communities that reported using a fish wheel. Research staff did observe two other fish wheels deployed in the area in 2015: one near Napaimute and one at Georgetown; however, no households in those seasonal fishing communities were contacted for surveys.

Plate 3-1.–In 2015 this fish wheel was located on the Kuskokwim River bank immediately opposite the community of Chuathbaluk. Here, an Aniak key respondent backs his boat away from the fish wheel with a fresh harvest of salmon and whitefish to bring to the Chuathbaluk Tribal Council for distribution in the village. The key respondent constructed the wheel for the Chuathbaluk community's use. Photo by David Runfola, ADF&G.

2016 SEASON

Salmon fishing progress and plans for remainder of the season

Lower Kalskag

In 2016, research staff conducted surveys in Lower Kalskag on July 30 and July 31 (Table 2-2). Ten respondents in Lower Kalskag answered questions regarding their household's progress toward their fishing goals and their plans for the remainder of the season. Of those 10 respondents, 30% reported that they had not started fishing or made any progress as of the survey dates (Table 3-10). Of the households that responded, 20% stated that they had harvested approximately a quarter of their goal for salmon that season, 20% had caught half of their goal, and 20% of respondents were done fishing. Also, 10% of respondents explained that they were not fishing for salmon that season.

In Lower Kalskag, nine households responded to the question that asked whether they had gotten enough salmon as of the date of their surveys. Of those respondents 44% reported that they had not gotten enough salmon for subsistence (Table 3-11). Some respondents explained that they could not get the fish they needed because of the low abundance of salmon, equipment failures or a lack of equipment, a lack of success while fishing, or fishing closures. When asked, survey respondents did not provide any information about what they may do differently as a result of not getting the salmon they needed. (Table 3-12).

In Lower Kalskag, seven households responded to survey questions that asked about their salmon fishing plans for the remainder of the season (Table 3-13). Among the responses from households that expected to fish more, the average planned harvest was 60 chum salmon, 25 sockeye salmon, and 13 coho salmon. Three respondents expected to harvest an average of 18 more Chinook salmon per household during the remainder of the season.

Upper Kalskag

Surveyors deployed in Upper Kalskag on July 25–27, 2016 (Table 2-2) where 18 respondents reported their household's fishing progress and plans. No respondents said they were not planning to fish for salmon in 2016 (Table 3-10). More than half of the respondents (56%) reported that they had completed their fishing for the season. Eleven percent reported that they had made no progress. Similarly, 11% reported to be a quarter of the way toward reaching their goal, 11% said they were about halfway to their goal, and another 11% of respondents stated that they were about three-quarters done with their household's subsistence salmon harvests. In Upper Kalskag, 18 of 19 respondents answered the question that asked whether they had gotten enough salmon as of the date of their surveys. In Upper Kalskag in 2016, 22% of respondents reported that they did not get the fish they had needed. (Table 3-11). All respondents cited that they suffered a failure or lack of equipment, and half (50%) said that their effort to catch fish was too low. Survey respondents were also asked if they would do anything differently as a result of not getting the salmon they needed. No Upper Kalskag respondents who answered that question cited anything that they would do differently because they did not get the salmon their household needed (Table 3-12).

Of 17 Upper Kalskag households that responded to survey questions that asked about their salmon fishing plans for the remainder of the season, households that expected to fish more, the planned an average harvest per household of 18 Chinook salmon, 24 chum salmon, 17 sockeye salmon, and 19 coho salmon (Table 3-13).

Aniak

During survey implementation in Aniak on July 13 and July 23 - 29, 2016 (Table 2-2), 97 respondents reported information regarding assessments of their household's salmon fishing progress and estimated their plans for the season, 28% of whom stated that they were not fishing for the season. Fifteen percent reported that their households had made no progress in fishing that season, and another 15% stated that

they were finished with fishing (Table 3-10). Thirteen percent were halfway complete with fishing for salmon, and 21% said that they had accomplished approximately three-quarters of their goal. Of households sampled in Aniak 69 of 97 responded to the question that asked whether they had gotten enough salmon for their households as of the date of their surveys (Table 3-11). One-quarter of respondents answering the question (25%) described not getting enough salmon for subsistence. Fourteen Aniak households gave a reason explaining why they did not get the fish they needed. Out of the respondents who gave a reason, 43% explained that they did not expend the effort needed to catch enough salmon; twenty-one percent experienced a lack of equipment needed to catch fish, and 14% cited that they lacked time needed to fish. Interestingly, 7% of respondents reported that they did not get enough salmon because they chose to reduce harvest to conserve the resource. Among 11 respondents who also described what they would do differently as a result of not getting the salmon they needed, 73% stated they would harvest other wild foods to replace the salmon they lacked, and 18% said that they planned to target coho salmon (Table 3-12).

In Aniak, 70 households responded to survey questions that asked about their salmon fishing plans for the remainder of the season (Table 3-13). Among the responses from households that expected to fish more, the average planned harvest was 30 Chinook salmon, 229 chum salmon, 51 sockeye salmon, and 64 coho salmon.

Chuathbaluk

In Chauthbaluk, researchers completed surveys on July 30, 2016 (Table 2-2). Of 15 sampled households, nearly half (47%) reported that they were not fishing for salmon that season. Thirteen percent reported that they had made no progress in salmon fishing for the year, and 7% reported that they had caught half of their subsistence salmon harvest goals for 2016 (Table 3-10). An additional 20% reported that they had completed their fishing. No respondents in Chuathbaluk reported not getting the salmon their household needed for the year (Table 3-11).

When asked about their fishing plans for the rest of the season, six households answered questions that asked about their salmon fishing plans for the remainder of the season (Table 3-13). These households planned on average to harvest 81 additional coho salmon. A small number of respondents also reported planned harvests of more Chinook, chum, and sockeye salmon during the remainder of the season.

Crooked Creek

In Crooked Creek, 10 respondents reported their fishing progress and plans for the remainder of the season in surveys conducted on August 3, 2016 (Table 3-10; Table 2-2). Ten percent of respondents reported that their households were not fishing that year. Also, 20% of households surveyed caught approximately one-quarter of their salmon harvest goals, 30% stated that they harvested half of their goals, and 40% reported that they were approximately three-quarters done with fishing. All Crooked Creek respondents answered a question about whether they got the salmon they needed up to that point in the season. Out of those households, 40% reported that they did not get enough salmon for subsistence (Table 3-11). Reasons for not getting the salmon they needed included fishing closures or fishing regulations, too little effort spent fishing, schedule conflicts, and problems with equipment. Some respondents also described what they planned to do to make up for their low salmon harvests. Equal percentages of respondents reported that they would harvest other wild foods, increase their fishing effort, or change their methods of processing fish so they could store more fish effectively (Table 3-12).

Of 10 Crooked Creek households that answered questions about their salmon fishing plans for the remainder of the season, households that expected to fish more planned an average harvest of 64 Chinook salmon, 31 chum salmon, 23 sockeye salmon, and 51 coho salmon (Table 3-13).

Red Devil

Also, on August 3, 2016, six Red Devil respondents answered questions regarding their fishing progress (Table 2-2). All households reported that they were fishing for the season (Table 3-10). Half of those households (50%) described being halfway to their salmon harvest goals for the season. Another 33% were about three-quarters done with salmon fishing, and 17% were done. One third of households (33%) sampled in Red Devil reported that they had not gotten enough salmon for the year (Table 3-11). Half of those respondents cited that fishing regulations or closures and poor weather prevented them from getting the salmon they needed. Among respondents who did not get the salmon they needed, two explained that they would target nonsalmon fish to replace the salmon they lacked that year (Table 3-12).

All Red Devil, respondents answered questions about their salmon fishing plans for the remainder of the season (Table 3-13). Among the responses from households that expected to fish more, the average planned harvest was 8 Chinook salmon, 17 chum salmon, 41 sockeye salmon, and 41 coho salmon.

Sleetmute

In Sleetmute, research staff conducted surveys with four households on July 18, 2016 (Table 2-2). All respondents answered questions regarding their households' progress and plans for subsistence salmon fishing (Table 3-10). One respondent reported that their household was not fishing that season, one household had harvested 25% of its goal for salmon, one household was halfway toward completion, and one household had completed its fishing for 2016. (Table 3-11). All respondents reported that they had gotten enough salmon for the year (Table 3-12).

Three Sleetmute respondents answered questions about their salmon fishing plans for the remainder of the season (Table 3-13). Among those households, the average planned harvest was for 21 more Chinook salmon, 17 sockeye salmon, and 28 coho salmon. One household also reported that they planned to harvest 10 additional chum salmon before the end of the fishing season.

Stony River

Researchers completed 4 surveys in Stony River on July 18, 2016 (Table 2-2; Table 3-10). All respondents stated that they were not fishing for salmon that season. Out of the four survey respondents, three answered a question that asked whether they had gotten enough salmon (Table 3-11). One of those respondents (33%) reported that their household did not get enough salmon. This respondent did not provide any reasons why they did not get the salmon they needed, nor what, if anything, they planned to do differently to make up for their lack of salmon (Table 3-12). No respondents in Stony River expected to harvest any additional salmon in 2016 (Table 3-13).

Lime Village

In Lime Village, researchers completed surveys on July 20, 2016, achieving a sample of five households (Table 2-2; Table 3-10). More than half (60%) reported that they were not fishing for salmon that year. Among the remaining respondents, one household (20%) explained that they had reached approximately three-quarters of their goal for salmon for the year, and one household (20%) had finished harvesting salmon (Table 3-11). One Lime Village respondent (20%) reported that, as of the date of their surveys, they had not yet gotten the salmon that they needed for the season (Table 3-11). No respondents in Lime Village expected to harvest any additional salmon in 2016 (Table 3-13).

Salmon Fishing Capacity and Sharing

In 2016, when survey respondents were asked to estimate how many salmon their households would be able to catch in a day, responses ranged from an average of 9 fish harvested daily in Sleetmute to 28 per day in Red Devil and approximately 28 per day in Lime Village (Table 3-14). Most responses averaged from 22–28 fish harvested per day. Respondents were also asked to estimate the total number of salmon that their households would need for the year. Most communities reported, on average, that annual harvest

goal amounts ranged from approximately 53 fish per year in Sleetmute to 222 salmon in Crooked Creek. Lime Village fishers reported needing the greatest number of salmon at an average of 495 fish annually per household. This is possibly because they target mainly the smaller species of salmon (i.e., chum, sockeye, and coho salmon) without harvesting many of the larger Chinook salmon (Fall et al. 2019). Lime Village is situated on the Stony River where Chinook salmon are typically not fit for human consumption when they reach fishers there.[2]

Survey respondents also answered questions to describe their sharing of salmon resources with other households. People who said they fished for others reported sharing salmon harvests with an average number from approximately one to five households (Table 3-15). All Chuathbaluk respondents said that they fished for other households. In other communities, results ranged from 50% of Lime Village respondents who fished for others to 78% of survey respondents who did so in Lower Kalskag.

Fishing gear used

Surveys asked respondents what types of fishing gear they used to harvest their salmon for subsistence. In Lime Village, 40% of fishers used a set gillnet (Table 3-16). In other communities, set gillnet use ranged from 14% of respondents in Aniak and 10% of Lower Kalskag respondents to as high as 26% of Upper Kalskag respondents. All respondents in Chuathbaluk and Lime Village said that they owned their set gillnets. In Aniak, 92% of households surveyed reported that they owned the set gillnets they used, as did 80% of Upper Kalskag respondents. Middle Kuskokwim River fishers also used drift gillnets to harvest salmon in 2016. In Crooked Creek, 90% of fishers responding to the survey reported using drift gillnets to catch salmon (Table 3-17). In Upper Kalskag 84% of households used drift gillnets, as did 80% of respondents in Lower Kalskag. Drift gillnet use in other communities ranged from 29% of respondents in Chuathbaluk to 75% of respondents in Sleetmute. Ownership of a drift gillnet was greatest in Chauthbaluk at 100% of responding fishers, and least in Red Devil at 50% of fishing households answering the question. Fishers in Aniak, Chuathbaluk, Crooked Creek, Red Devil, and Lime Village used rod and reel gear to harvest salmon for subsistence, and most of those respondents owned their rod a reel equipment (Table 3-18). Although many households in some communities may have received fish from a fish wheel, very few reported directly harvesting salmon from a fish wheel. In 2016, Lower Kalskag, Aniak, and Crooked Creek were the only survey communities that reported using a fish wheel. Survey crews also observed fish wheels at sites near Napaimute, Georgetown, and Sleetmute.

2017 SEASON

Salmon fishing progress and plans for remainder of the season

Lower Kalskag

In 2017, research staff conducted surveys in Lower Kalskag on July 16 and July 17 (Table 2-2). Out of 23 households sampled in the community, 21 respondents in Lower Kalskag answered questions regarding their household's progress toward their fishing goals and their plans for the remainder of the season. Of those 21 respondents, 29% reported that they were not fishing in 2017 (Table 3-19). Additionally, 29% of respondents stated that they had made no progress toward reaching their salmon harvest goals for the season. Fourteen percent of respondents harvested approximately 25% of their season goals, and an additional 14% were halfway complete with salmon fishing for the year. Also, 5% of respondents reported being finished with their fishing, and 10% reported catching about three-quarters of the salmon they needed.

When asked whether their household had gotten enough salmon as of the date of their surveys, 41% of 17 respondents stated that they had not (Table 3-20). Some respondents explained that the reasons why they could not get the fish they needed mostly included that they were unsuccessful while fishing, that they experienced equipment failures or a lack of equipment, and that they did not or were unable to put in the

2. Fred Bobby, Sr., First Chief Lime Village Tribe, personal communication, April 2018.

effort needed to catch enough salmon. Survey respondents were also asked if they would do anything differently as a result of not getting the salmon they needed. Two Lower Kalskag respondents said that they planned to fish more for coho salmon or other salmon (Table 3-21).

Among the sampled households, 12 Lower Kalskag respondents answered survey questions regarding their salmon fishing plans for the remainder of the season (Table 3-22). Among the responses from households that expected to fish more, the average planned harvest was for 10 chum salmon, 15 sockeye salmon, and 49 coho salmon per household. No respondents planned to harvest any additional Chinook salmon.

Upper Kalskag

Surveyors deployed in Upper Kalskag on July 16 and July 17, 2017 where 15 out of a sample of 18 respondents reported their household's fishing progress and plans (Table 2-2; Table 3-19). Among respondents to the question, 40% percent stated that their households were not fishing in 2017. Most other respondents reported that they were either one-quarter of their way to catching the fish they needed (20% of respondents), or that they had finished their salmon fishing (20%). Thirteen percent of respondents stated that they had reached approximately half of their goal for subsistence salmon harvests. Within the sample, 14 Upper Kalskag households responded to the question that asked whether they had gotten enough salmon as of the date of their surveys. A majority of those 14 respondents (71%) reported that they had not gotten enough salmon for subsistence (Table 3-20). Respondents gave several reasons to explain why they did not get the fish they needed. These reasons included regulations and fishing closures that prevented them from harvesting enough salmon (44% of respondents), a lack of equipment (22%), low abundance of salmon (11%), low fishing effort (11%), and a lack of success while fishing (11%). When survey respondents were asked if they would do anything differently as a result of not getting the salmon they needed, four Upper Kalskag households said that they planned to fish for coho salmon or receive or purchase salmon from another household (Table 3-21).

Ten Upper Kalskag households responded to survey questions that asked about their salmon fishing plans for the remainder of the season (Table 3-22). Among the responses from households that expected to fish more, the average planned harvest was for 55 Chinook salmon, 38 sockeye salmon, and 31 coho salmon per household. One household said they would attempt to catch an additional 50 chum salmon during the remainder of the season.

Aniak

During survey implementation in Aniak on July 14–15, 2017, 40 respondents reported information regarding assessments of their household's salmon fishing progress and estimated their plans for the season, 10% of whom stated that they were not fishing for the season (Table 2-2; Table 3-19). Nearly half of respondents (45%) reported that their households had made no progress in fishing that season. Fifteen percent were half of their way toward completing their fishing for the season, and another 15% were done fishing for salmon. Among the 40 households sampled in Aniak, 37 responded to the question that asked whether they had gotten enough salmon for their households as of the date of their surveys (Table 3-20). More than half of those respondents (51%) described not getting enough salmon for subsistence. Nineteen Aniak households gave a reason to explain why they did not get the fish they needed. The most common reasons included the low abundance of salmon, a lack of equipment needed to fish, and a reduced effort trying to catch fish. Respondents also shared other reasons such as fishing restrictions, a lack of time possibly due to work schedules, and lack of success while fishing. Of respondents who also described what they would do differently as a result of not getting the salmon they neededk, 15 said that they planned to increase their overall salmon fishing effort by targeting coho salmon. Some households also reported that they planned to harvest other wild foods or receive or buy more salmon from others (Table 3-21).

In Aniak, 35 households responded to survey questions that asked about their salmon fishing plans for the remainder of the season (Table 3-22). Among the responses from households that expected to fish more, the average planned harvest was 19 Chinook salmon, 138 chum salmon, 64 sockeye salmon, and 67 coho salmon per household.

Chuathbaluk

In Chauthbaluk, researchers completed surveys on August 12–13, 2017 with seven households (Table 2-2; Table 3-19). All respondents reported that they were actively fishing for salmon in 2017. Although 14% reported that they had made no progress in salmon fishing for the year, most respondents (43%) reported that they were done. An additional 29% reported that they had harvested about a quarter of their goals and 15% were about halfway done with fishing for the year. Seventeen percent of households sampled in Chuathbaluk reported that, as of the date of their surveys, they had not yet gotten the salmon that they needed for the season (Table 3-20). One of those households said the reason for their low salmon harvest was that they lacked the equipment to be able to fish enough to meet their needs. That household also stated they planned to harvest other wild foods to supplement their overall subsistence harvest for the year due to their lower than expected salmon harvest (Table 3-21).

In Chuathbaluk, seven households answered questions that asked about their salmon fishing plans for the remainder of the season (Table 3-22). Among the responses from households that expected to fish more, the average planned harvest was for 39 additional Chinook salmon, 94 chum salmon, 46 sockeye salmon, and 29 coho salmon per household.

Crooked Creek

In Crooked Creek, 12 respondents reported their fishing progress and plans for the remainder of the season in surveys conducted on July 19, 2017 (Table 2-2; Table 3-19). Of those respondents, 17% said they were not fishing for salmon, and another 17% reported that their households had made no progress in fishing that season. Also, 25% stated that their households had caught approximately one-quarter of their 2017 salmon harvest goal, and another 25% were three-quarters toward completion of their fishing goal. Ten Crooked Creek households answered a question about whether they got the salmon they needed up to that point in the season. Of those households, six reported that they did not get enough salmon for subsistence (Table 3-20). Eighty percent of the households that gave a reason for not getting the salmon they needed stated that fishing closures or fishing regulations limited their harvest. Five respondents also described what they planned to do to make up for their low salmon harvests. Several reported that they would fish for coho salmon or other salmon, fish for other nonsalmon fish, or increase their fishing effort (Table 3-21).

Eight Crooked Creek households answered questions about their salmon fishing plans for the remainder of the season (Table 3-22). Among the responses from households that expected to fish more, the average planned harvest was for 19 more Chinook salmon, 47 chum salmon, 50 sockeye salmon, and 31 coho salmon.

Red Devil

On July 21, 2017, seven Red Devil respondents answered questions regarding their fishing progress for 2017 (Table 2-2). Approximately one-third (29%) reported that their households were not fishing for the season (Table 3-19). An additional 14% reported that they had made no progress in fishing. The remaining 57% reported that they had finished subsistence salmon fishing for 2017. Within the sample, five households responded to the question asking whether they had gotten the salmon they needed to that point in the season. Of those respondents, one reported that they had not gotten enough salmon for the year (Table 3-20). This respondent explained that the reasons why they could not get the fish they needed included fishing restrictions or fishing closures and time conflicts. One respondent in Red Devil also said that they would fish for coho salmon or other salmon to make up for their low harvest that season (Table 3-21).

Red Devil respondents answered questions that asked about their salmon fishing plans for the remainder of the season (Table 3-22). Among the responses from four households that expected to fish more, the average planned harvest was for 11 more Chinook salmon, 30 more chum salmon, 38 sockeye salmon, and 35 coho salmon.

Sleetmute

In Sleetmute, research staff conducted surveys on July 22, 2017 (Table 2-2). Thirteen respondents in Sleetmute answered questions regarding their households' progress and plans for subsistence salmon fishing (Table 3-19). The majority of respondents (54%) stated that their households were not fishing that season. Also, 15% of households reported that they were done fishing for the season. Within the sample of households, seven respondents answered survey questions about their needs for salmon, 43% of whom reported that they had not gotten the salmon they needed for the year (Table 3-20). Two households reported reasons why this was true, both stating that fishing closures and schedule conflicts between work and fishing limited their ability to catch the salmon they needed.

In Sleetmute, six households answered questions that asked about their salmon fishing plans for the remainder of the season (Table 3-22). Among the responses from households that expected to fish more, the average planned harvest was for 8 additional Chinook salmon, 26 more chum salmon, 63 sockeye salmon, and 20 coho salmon per household.

Stony River

In Stony River, staff completed surveys on July 24, 2017 with four households (Table 2-2; Table 3-19). A quarter of the households (25%) said they were not fishing for salmon that year, and another 25% stated that they had made no progress. Another 25% reported that they were finished for the season, and the remaining 25% described being three-quarters of the way toward finishing their salmon fishing. All Stony River households sampled reported that they had gotten the salmon their households needed up to that point in the season (Table 3-20).

One household in Stony River reported that would attempt to harvest 20 more Chinook salmon. Also, one household planned to target 23 additional sockeye salmon, and one household expected to get 13 coho salmon before the end of the season (Table 3-22).

Salmon Fishing Capacity and Sharing

Survey respondents in all communities were asked to estimate how many salmon their households would be able to catch in a day, and about how many salmon they try to catch in a year. Responses ranged from an average of 24 fish harvested daily in Crooked Creek to 61 salmon per day in Chuathbaluk (Table 3-23). The greatest expected annual average household salmon harvest was 192 fish for Aniak respondents. The least was 53 salmon per household each year for Sleetmute residents.

Survey respondents also answered questions to describe their sharing of salmon resources with other households. Respondents who said that they fished for others reported that they shared their salmon harvests with an average number that ranged from approximately one to three households (Table 3-24). In Aniak, more than a third of respondents (37%) said that they fished for other households. In all remaining survey communities, greater than half of respondents reported fishing for others, ranging from 50% of Crooked Creek respondents to 67% of respondents in Sleetmute.

Plate 3-2.–Many households fishing in the middle Kuskokwim River will filet, hang, dry, and smoke Chinook salmon and other salmon to prepare for long-term storage throughout the year. Photo by James M. Van Lanen, ADF&G.

Fishing gear used

Surveys asked respondents what types of fishing gear they used to harvest their salmon for subsistence. No Crooked Creek respondents reported using a set gillnet. In other survey communities, the use of set gillnets ranged from 10% of respondents in Lower Kalskag to 25% in Aniak and Stony River (Table 3-25). In every community except Aniak, all respondents said that they owned their set gillnets. When asked about use of drift gillnets, 75% of Stony River respondents, 71% in Red Devil, and 71% in Chuathbaluk said that they used this gear type to fish for salmon. In other communities, drift gillnet use ranged from 21% among Sleetmute residents to 67% of Crooked Creek fishers completing the survey. Most respondents in all communities reported that they owned the drift gillnets they used (Table 3-26). A portion of surveyed fishers in Aniak, Chuathbaluk, and Sleetmute reported that they used rod and reel gear to harvest salmon for subsistence, and most of those respondents owned their rod and reel equipment (Table 3-27). Several households in Lower Kalskag, Aniak, Chuathbaluk, Crooked Creek, and Sleetmute reported harvesting salmon with a fish wheel in 2017. During that fishing season, fish wheels were operated near all of those communities. Research staff also observed two other fish wheels deployed in the area in 2017: one near Napaimute and one at Georgetown.

2018 SEASON

Salmon fishing progress and plans for remainder of the season

Lower Kalskag

In 2018, research staff conducted surveys in Lower Kalskag on July 16–18, 2018 (Table 2-2). Fifty respondents in Lower Kalskag answered questions regarding their household's progress toward their fishing goals and their plans for the remainder of the season. Of those 50 respondents, 46% reported that they were not fishing in 2018 (Table 3-28). Another 20% of respondents stated that they had harvested approximately 75% of their goal for salmon that season. Also, 2% of respondents reported being finished with their fishing, and 12% reported being about halfway to reaching their goals for salmon.

Within the survey sample, 40 households in Lower Kalskag responded to the question that asked whether they had gotten enough salmon as of the date of their surveys. Nearly half (48%) of those respondents reported that they had not gotten enough salmon for subsistence (Table 3-29). The most common reasons cited to explain why their households did not get enough salmon were a lack of time to fish, a lack of success while fishing, restrictions on fishing, and a low abundance of salmon. Survey respondents were asked if they would do anything differently as a result of not getting the salmon they needed. In Lower Kalskag, 90% of respondents who answered that question said that they planned to fish more for coho salmon or other salmon (Table 3-30). Others said they would increase their fishing effort or cooperate with others to get more salmon.

Twenty-seven Lower Kalskag households responded to survey questions that asked about their salmon fishing plans for the remainder of the season (Table 3-31). Among the responses from households that expected to fish more, the average planned harvest was to target a harvest of 58 Chinook salmon, 78 chum salmon, 34 sockeye salmon, and 44 coho salmon per household.

Upper Kalskag

Surveyors deployed in Upper Kalskag on July 16–18, 2018 (Table 2-2) where 27 respondents reported their household's fishing progress and plans. Forty-eight percent stated that their households were not fishing in 2018 (Table 3-28). Approximately a third of respondents (30%) reported that they had achieved about three-quarters of their goal for salmon that season. The remaining fishers were one-quarter, halfway, or completely done with salmon fishing. Within the survey sample, 22 households in Upper Kalskag responded to the question that asked whether they had gotten enough salmon for their households as of the date of their surveys. Among those respondents 41% reported that they had not gotten enough salmon for subsistence (Table 3-29). When asked why they did not get the fish they needed, equal percentages of the eight respondents who gave a reason cited that a lack of equipment, lack of success fishing, or environmental conditions such as the weather prevented them from harvesting enough salmon. Five survey respondents described what they planned to do differently as a result of not getting the salmon they needed, which included fishing for nonsalmon fish and coho salmon, harvest other wild foods, buy more food commercially, and increase their fishing effort (Table 3-30).

Fourteen Upper Kalskag households responded to survey questions that asked about their salmon fishing plans for the remainder of the season (Table 3-31). Respondents reported an average planned harvest of 40 sockeye salmon and 27 coho salmon per household. One household also reported that they planned to fish for a goal of 35 Chinook salmon, and one household planned to catch 20 additional chum salmon.

Aniak

During survey implementation in Aniak on July 12–16, 2018 (Table 2-2), 92 respondents reported information regarding assessments of their household's salmon fishing progress and estimated their plans for the season, 33% of whom stated that they were not fishing for the season. The greatest number of respondents (29%) reported that their households had made no progress in fishing that season (Table 3-28). Another 22% were three-quarters of their way toward completing their fishing for the season. Of 92

households sampled in Aniak 71 responded to the question that asked whether they had gotten enough salmon for their households as of the date of their surveys (Table 3-29). Nearly half of respondents (45%) described not getting enough salmon for subsistence. Thirty-two Aniak households gave a variety of reasons to explain why they did not get the fish they needed. These reasons included lack or failure of equipment, lack of effort or lack of success while fishing, or conflicts with work schedules. Some respondents also described what they would do differently as a result of not getting the salmon they needed. Respondents who answered that question said they planned to fish for coho salmon, increase their overall salmon fishing effort, or receive or buy more salmon from others (Table 3-30).

In Aniak, 63 households responded to survey questions that asked about their salmon fishing plans for the remainder of the season (Table 3-31). Among the responses from households that expected to fish more, the average planned harvest was for 61 sockeye salmon and 57 coho salmon per household. A small number of households expected an average planned harvest of 40 Chinook salmon and 100 chum salmon.

Crooked Creek

Seventeen respondents in Crooked Creek reported their fishing progress and plans for the remainder of the season in surveys conducted on July 20–21, 2018 (Table 2-2; Table 3-28). Among respondents, 47% reported that their households were not subsistence salmon fishing that season. Households that were fishing all reported some progress, with 24% of respondents stating that they had reached about 75% of their goals for the year. Also, 12% of respondents were halfway finished and another 12% were completely done with fishing. Out of 10 Crooked Creek households that answered a question about whether they got the salmon they needed up to that point in the season, 30% reported that they did not get enough salmon for subsistence (Table 3-29). Three households gave reasons for not getting the salmon they needed. Their reasons included low salmon abundance, equipment failure, fishing closures or fishing regulations, and not enough time to fish. Two respondents also described what they planned to do to make up for their low salmon harvests. Both reported that they would fish for coho salmon or other salmon (Table 3-30). Several Crooked Creek households reported an average planned harvest for the remainder of the season of 24 sockeye salmon and 24 coho salmon per household (Table 3-31).

Red Devil

On July 25 and 27, 2018, 10 Red Devil respondents answered questions regarding their fishing progress for 2018 (Table 2-2; Table 3-28). Twenty percent reported that their households were not fishing for the season. An additional 20% reported that they had made no progress in fishing. Another 20% were about three-quarters done with salmon fishing, and 40% stated they had reached their salmon fishing goal for the year. Of the households sampled in Red Devil, 33% reported that they had not gotten enough salmon for the year (Table 3-29). Three respondents explained that the reasons why they could not get the fish they needed included lack of functional equipment and a lack of fishing effort. When asked, one household reported that they would target coho salmon to get the subsistence salmon their households needed (Table 3-30).

In Red Devil, nine households answered questions that asked about their salmon fishing plans for the remainder of the season (Table 3-31). Among the responses from the eight households that expected to fish more, the average planned harvest was 18 coho salmon per household.

Sleetmute

In Sleetmute, research staff conducted surveys on July 23, 2018 (Table 2-2). All 18 respondents in Sleetmute answered questions regarding their households' progress and plans for subsistence salmon fishing (Table 3-28). The majority of respondents (61%) stated that their households were not fishing that season. Seventeen percent reported that they were halfway done with fishing, and 11% had reached their goal for salmon for the season. In Sleetmute, seven respondents answered survey questions about their households' needs for salmon (Table 3-29). Among people answering the question, 43% said that they had not gotten enough salmon for the year. When asked why they were unable to get enough salmon,

respondents cited equipment failure, lack of effort spent fishing, and schedule conflicts possibly with work. In order to make up for their lack of salmon, two respondents said they would fish for coho salmon and other salmon or increase their fishing effort (Table 3-30).

In Sleetmute, seven households answered questions that asked about their salmon fishing plans for the remainder of the season (Table 3-31). Among the responses from households that expected to fish more, the average planned harvest was for 20 additional sockeye salmon and 16 coho salmon per household.

Stony River

In Stony River, staff deployed to conduct surveys on July 25, 2018 (Table 2-2). During the survey attempt, many Stony River households were absent from the community; however, one household responded to the survey. This respondent explained that their household was approximately three-quarters of the way to meeting their salmon fishing goal for the season, and that they were satisfied with the amount of fish they had harvested up to the date of the survey (Table 3-28; Table 3-29). The same respondent reported that their household planned to catch approximately 100 coho salmon before completing their subsistence salmon fishing for the season (Table 3-31).

Lime Village

In Lime Village on July 25, 2018, four households responded to the survey (Table 2-2). Of these, two respondents reported that they were not fishing for the season, and two stated that they had finished salmon fishing for the year (Table 3-28). All four respondents reported that they had met their needs for salmon as of the date of the surveys (Table 3-29). Two households also answered questions about their plans for salmon fishing. Between them, their average planned harvest was for 20 coho salmon per household before the end of the fishing season.

Salmon Fishing Capacity and Sharing

Survey respondents in all communities were asked to estimate how many salmon their households would normally be able to catch in a day, and about how many salmon they would plan to catch in a year. Responses ranged from an average of approximately 17 fish harvested daily in Red Devil and Crooked Creek to as many as 70 per household each day in Stony River (Table 3-32). The respondent in Stony River thought their household would harvest approximately 250 salmon in a season. In other communities, average total harvests were from 56 per household in Red Devil to 196 per household in Aniak.

Survey respondents also answered questions to describe their sharing of salmon resources with other households. Respondents who said that they fished for others reported that they shared their salmon harvests with an average number that ranged from approximately two to five households (Table 3-33). In Sleetmute, 67% of survey respondents reported fishing for other households. In Aniak, Red Devil, and Lime Village, about half of survey respondents reported that they shared salmon with other households.

Fishing gear used

Surveys asked respondents what types of fishing gear they used to harvest their salmon for subsistence. In Lime Village half of surveyed fishers used a set gillnet (Table 3-34). Crooked Creek and Stony River respondents reported no use of set gillnets for salmon fishing. In remaining survey communities, rates of set gillnet use ranged from 6% in Lower Kalskag to 18% in Aniak. Most fishers reported that they owned the set gillnets that they used for salmon fishing. Drift gillnets were also a common gear type used by middle Kuskokwim River fishers in 2018. Neither Lime Village nor Stony River fishers reported using drift gillnets. In other communities, the use of drift gillnets ranged from 22% of fishers reporting in Sleetmute to 53% of fishers in Crooked Creek (Table 3-35). All surveyed fishers in Upper Kalskag, Crooked Creek, and Sleetmute reported that they owned the drift gillnets they used for salmon fishing. In other communities where fishers used them, drift gillnet ownership ranged from 60% of fishing households in Red Devil to 82% in Lower Kalskag. Fishers in Lower Kalskag, Aniak, and Crooked Creek

reported using used rod and reel gear to harvest salmon for subsistence (Table 3-36). Although many households in some communities may have received fish from a fish wheel in 2018, very few reported directly harvesting salmon from a fish wheel. In 2018, survey respondents in Lower Kalskag, Aniak, Sleetmute, and Stony River reported using a fish wheel for harvesting salmon. Research staff also observed three other fish wheels deployed in the area in 2018, one each near the communities of Chuathbaluk, Napaimute, and Georgetown.

Inseason Harvest Monitoring

During the 2015–2017 study years prior to the start of each salmon fishing season, ADF&G research staff deployed to Lower Kalskag, Upper Kalskag, and Aniak with NVN technicians to identify and train local research assistants (LRA) who would record their daily harvest and fishing effort information during each block fishing opening (see Methods chapter of this report). Department staff assigned NVN technicians the task of maintaining contact with LRAs to record fishing data immediately following each opening. The NVN technicians were also assigned the task of completing the boat counting survey tasks related to the research objectives. Each study year ADF&G staff also maintained contact with NVN technicians to support this effort. Despite a considerable time investment by ADF&G and NVN staff, LRA daily harvest and fishing effort data and boat counts were sparse during each block opening, such that no harvest estimates of statistical significance could be calculated. Thus, no data describing individual or fishing fleet harvest and effort characteristics are presented for 2015–2017 in this chapter.[3]

During the 2018 subsistence salmon fishing season, three division staff and two Native Village of Napaimute staff deployed in Lower Kalskag, Upper Kalskag, and Aniak (Figure 2-1) and administered a creel survey in each community to record fishing harvest and effort information (Appendix D). Researchers also traveled from the mouth of the Aniak River to approximately one mile downriver from the community of Lower Kalskag by boat or by air during fishing openings to count the number of boats actively fishing. Data from these counts were also transferred to USFWS analysts for incorporation into their daily harvest estimates for the observed fishing fleet.

Data are presented here for the first two subsistence drift gillnet salmon fishing openings for the section of river from Lower Kalskag to Aniak, on June 12 and 16, 2018. During both fishing opportunities subsistence fishers in the Kuskokwim River were permitted to deploy a 25-fm drift gillnet with a stretched mesh width of no greater than six-inches in a section of river extending from approximately 20 miles downstream of Lower Kalskag to a point approximately 1.5 miles downstream of the Aniak River mouth. Fishing opportunities occurred for 12 hours from 10:00 a.m. to 10:00 p.m. on both days (Table 3-37). Fishing restrictions relaxed following the second opening, such that fishing activity was dispersed indefinitely over time which made the development of daily harvest estimates infeasible. Data presented include number of sampled fishers; total sample harvest of Chinook, chum, and sockeye salmon; average fishing duration for each trip; average total harvest of Chinook, chum, and sockeye salmon per trip; average catches per unit effort (CPUE) of Chinook salmon and chum and sockeye salmon combined for one hour of fishing with a drift gillnet of the same dimensions allowed by regulation for that day; average ratio of Chinook salmon to chum and sockeye salmon combined; and the average number of boats counted for each river study section during each opening.

Subsistence Drift Gillnet Opening, June 12, 2018

Research staff conducted dockside creel surveys in Lower Kalskag, Upper Kalskag, and Aniak with 20 fishers, all of whom fished with drift gillnets in that river section (Table 3-38). Each fisher's total time fishing was recorded as one drift. The average boat fished for a duration of 3.3 hr. The total sample harvest reported by all fishers was 47 Chinook salmon and 27 chum and sockeye salmon combined (Table 3-39). The average catch per fisher was two Chinook salmon and approximately one chum or sockeye salmon combined per trip. The overall catch ratio for the sample was one Chinook salmon for every 0.6

3. Please see the Discussion and Conclusions chapter of this report for further consideration of this topic.

chum and sockeye salmon combined. The average boat fished with a CPUE of 1.8 Chinook and 1 chum or sockeye salmon for a 25-fm drift gillnet fishing for one hour in that section of river (Table 3-40). During the June 12 opening, researchers in six boat counting survey trips counted an average of eight boats actively fishing through the section (Table 3-41).

Subsistence Drift Gillnet Opening, June 16, 2018

On June 16, 2018, research staff conducted dockside creel surveys in Lower Kalskag, Upper Kalskag, and Aniak with 22 fishers, all of whom fished with drift gillnets in that river section (Table 3-38). Each fisher's total time fishing was recorded as one drift. The average boat fished for a duration of 4.7 hr. The total sample harvest reported by all fishers was 84 Chinook salmon and 55 chum and sockeye salmon combined (Table 3-39). The average catch per fisher was four Chinook salmon and approximately three chum and sockeye salmon combined per trip. The overall catch ratio for the sample was one Chinook salmon for every 0.7 chum and sockeye salmon combined. The average boat fished with a CPUE of 1.9 Chinook and 0.9 chum or sockeye salmon for a 25-fm drift gillnet fishing for one hour in that section of river (Table 3-40). During the June 12 opening, researchers in four boat counting survey trips counted an average of 11 boats actively fishing through the section (Table 3-41).

Comments and Concerns, 2015–2018

Comments and concerns shared by survey respondents were generally similar during all study years. For this reason, they are presented here in one section to represent the overall themes that many respondents discussed with research staff during the entire study. Survey respondents shared a variety of comments when research staff gave them opportunities to discuss them. The principal responses from middle Kuskokwim River residents were criticisms of how agencies were managing the salmon fishery. Some criticisms were regarding specific regulatory actions. For example, numerous respondents complained that implementing a few short fishing openings in late June and early July resulted in crowded fishing conditions and insufficient time to harvest more than a small number of salmon. Particularly in the larger middle Kuskokwim River communities, this created significant competition for the space and time needed to drift with a 25-fm gillnet. One Upper Kalskag fisher commented:

> The first few openers there were too many fishermen. There's only a few drifting spots around here. We tied up and waited and waited and waited and finally we left, 'cause there's only three hours left in the opener and everybody's hitting it so hard there can't be much left. The old way of doing things was that you catch only what we can take care of in one day, then go back out over a period of days and weeks. But lately we feel like we have to catch as much as we can all at once because it's only little bit of fishing time.

Several other residents of Lower Kalskag and Upper Kalskag described specific conditions in the river near their communities that reflected this concern. These comments are paraphrased here. Relatively shallow and sinuous river channels and deposits of large woody debris create difficult drift gillnet fishing conditions at this location. As a result, fishers in Lower Kalskag and Upper Kalskag historically have removed snags of large woody debris from the river, and for years have kept a relatively short stretch of river (approximately one mile) as clear as possible from these obstructions. During brief fishing openings such as those implemented during the study years, fishers from both communities queued on the beach and riverbank while one boat at a time drifted through the stretch. After a boat completed its drift, other fishers continued to wait before beginning the next drift to allow time for salmon below the drift to move upstream and fill the stretch. Many respondents complained that the bottleneck of fishers prevented their communities from having the time needed to catch more than a few salmon. To a lesser extent this occurred for Aniak fishers when they were crowded into a short stretch of river below a closed section immediately upstream of the community beach where fishers typically start their drifts. An Aniak fisher shared his concern that the "openings were too short. Most of the fish are gone, and people needed to wait their turn to drift."

There were many other more general concerns shared about short and infrequent fishing openings. One Aniak fisher stated, “We were only given so many hours to get out and drift on certain days. That’s terrible, because everyone goes out and tries to fish on these days and that’s why we can’t catch anything.”

Another Aniak respondent noted a similar opinion.

> They should leave subsistence fishing alone, ‘cause when they have closures, then once they have an opener everybody’s out there all at once. If they’d leave it alone people would just be out catching what they need rather than plugging up the river with boats. They clean out the river in one opening.

In Lower Kalskag, survey staff recorded another general complaint about competitive fishing openings:

> My son hasn’t even bothered going out because there were so many people drifting and no one here goes up towards Chuathbaluk to drift [where it was open under State of Alaska regulations]. Those openings made some people catch even more than normal. People just go out and get them because they don’t know when they’ll get a chance again.

Also common were criticisms of the later schedule of fishing opportunities that occurred in late June and early July, after the time that fishers in the region customarily fished for salmon. A Crooked Creek resident commented, “After the Fourth of July there’s nothing but chums, but earlier in the [2017] season it was open in the lower river, not in the middle. In Crooked we go for the second run of kings. It was closed during the 2nd run. Fishing is closed during the best drying time.” A Chuathbaluk respondent suggested, “Open fishing earlier next year, so it won’t be too rainy [to process fish] in the late year.” Another respondent from Upper Kalskag simply commented, “More fishing earlier would really help.” More general comments about the schedule of openings demonstrated concern over schedule conflicts that are more likely for people when there are only a few short opportunities to fish. A Crooked Creek respondent explained the desire to have fishing openings on days, such as weekends, when people are more likely to be off from work “so people working could go on a day off and fish. Not letting us fish on Sundays to be religiously sensitive hurts people who only have off Sundays.” An Upper Kalskag resident shared the same concern. “When there’s openings they should have it more on the weekends and not during the weekdays when the majority of people have to work.”

There were other general comments about management throughout all study years. The primary opinion regarding regulatory decisions demonstrated residents’ perception that salmon fishing opportunities in the lower Kuskokwim River region negatively affect middle Kuskokwim River fishers’ ability to get the salmon they need. One Aniak resident summarized the general feeling: “The attitude up here has been annoyance, because the lower river seems to be getting all the fish, by the time the fish get up here, there’s only a few left.” Another Aniak fisher commented succinctly, “[ADF&G] should close the lower river longer and prioritize the middle and upper river for once.” In Upper Kalskag, survey crews recorded, “Seems like the middle and upper Kusko residents always get the shorter end of the stick. It’s a lot easier for lower villages to get their salmon.” A Crooked Creek respondent stated, “Opening the fishing season downriver is hurting us up here, because people downriver are targeting king salmon.” More specifically, a respondent from Chuathbaluk cited the effect that longer drift gillnets permitted in the lowest portion of the Kuskokwim below Bethel have on the abundance of salmon for subsistence fishers in the middle Kuskokwim River:

> The length of nets downriver still sweeps the river. The length up and down the river should be the same because people in both sections are targeting the same amount of fish. People would still get their fish and there would be more escapement. It’s fair for everyone.

Other comments in this regard were related to competition with larger population centers downriver, such as this comment from Sleetmute: "The way the fish are going, all the thousands of people down in Bethel, we gotta make sure we get some here."

Similarly, this comment was recorded during surveys in Lower Kalskag:

> Bethel is too big. There's too many residents down there…There's so many people that they're decimating the river. It would be nice to have some kind of a system for allocating fish like they're doing for moose, permits and Tier II type king permit. Bethel is more urban, so people have a lot more options for food.

A Sleetmute resident shared this concern about the population center of Bethel and a similar recommendation for potential regulatory change:

> There's no hope for subsistence fishing unless you come up with a local priority and eliminate the city of Bethel from subsistence. You can't have a city of 7,000 people choking off a river. I'm concerned that now…the extra pressure on the other species could work its way down, affecting other species of salmon, especially with reds [sockeye salmon], where there's not that many of them, but people just haven't been fishing 'em as hard.

A resident of Upper Kalskag offered another suggestion for a specific management action in the subsistence salmon fishery based on their opinion of the impact of salmon fishing in the lower Kuskokwim River:

> I was telling 'em they should shut down the river for five years like they did moose hunting. The lower guys are always catching all the fish. Seems like we only get two or three salmon in a drift up here. Been that way forever.

Many also discussed criticism of commercial fishing pressure on salmon stocks and emphasized the need to prioritize subsistence salmon fishing. These sentiments can be summarized by the statement of this Aniak respondent: "They should definitely close commercial fishing for all fish until people up here get enough for subsistence." Another Aniak fisher commented, "Commercial [fishing] for silvers [coho salmon], and in general on the Kuskokwim, is wrong and should just be gone." In Aniak, this comment reflected the common concern that residents have about not getting the food their households need if commercial salmon fishing in the lower Kuskokwim River threatened to reduce the subsistence harvest in the middle Kuskokwim River communities: "I sure hope they wait on silver commercial fishing. We need them." This concern was also present further upriver, as noted by one Crooked Creek resident: "I'm just concerned about fish, 'cause we hardly catch any fish, and I'm worried that the downriver people are commercial fishermen." Several respondents also had specific comments related to management of Bering Sea trawl fisheries and the effect on salmon populations. This statement from a Crooked Creek resident exemplified these concerns:

> Fisheries out in the ocean, the pollock trawlers, having a negative impact on middle river subsistence fisheries…Even for just one year, let's experiment with the deep-sea fisheries. Shut them down and see what happens. Because they've already experimented with shutting us down here on the river. We've got to be able to get some fish to be able to live.

Other comments recommended better outreach to fishers and improved communication about management decisions from agencies such as ADF&G. An Aniak resident made this comment:

> [ADF&G] needs better announcements, especially involving the boundary at [Aniak] between the state and federal lands. They need better communication on regulations and closures and openings. Can the state and the federal combine it

> into one opening announcement? Post it around the entire river to cover the whole area.

An Upper Kalskag respondent made the comment, “I’ve been hearing lots of people talking about problems with ADF&G. Downriver people weren’t understanding the regulations. Enforcement officers were even mistaken about them.” Others were very specific, such as this comment from Aniak: “[ADF&G] should have an office here [in Aniak]. Why McGrath?” The same respondent made a comment recommending better implementation of a relatively new ADF&G household permit allowing a harvest of 10 Chinook salmon in state waters in the Kuskokwim River (Runfola et al. 2018).

> Not everyone has cell phones or internet to get permits and licenses. It hurts subsistence by not giving people a way to comply…The permit system confused people because it was open during fishing closures…If it’s closed to kings, just close fishing…Conservation is a good priority. People will adjust, and they want to follow the rules, but they need better information and easier access to information and the permits.

Plate 3-3.–Following several years of lower than average Chinook salmon run sizes, many survey respondents have expressed support of efforts to conserve the species. In 2015 a middle Kuskokwim River tribal organization fashioned this sign and posted it at the mouth of a tributary to Kuskokwim River that historically has been a popular location for subsistence Chinook salmon fishing with rod and reel gear. Photo by David Runfola, ADF&G.

There were also many positive comments shared with survey crews throughout all study years. For example, by the 2017 and 2018 study years, fishing regulations in the middle and upper Kuskokwim River implemented by ADF&G were much less restrictive than in seasons from 2012–2016. These regulations allowed fishers above the mouth of the Aniak River to fish nearly unrestricted beginning in mid-June of 2017 and 2018. Many survey respondents in those years commented that they were

appreciative of the increased opportunity, and that they were able to harvest what they needed on a more flexible schedule. Comments in Aniak in 2018 included:

"I'm glad for what I got, and glad for conservation."

"People we ran into were happy. It was a good job on management."

"I'm happy to be fishing. We've done better than in past years. My [four-year-old] son said he's so happy that he learned to fish and that we have fish for a long time."

Other positive comments reflected middle Kuskokwim River residents' general support of efforts to conserve Chinook salmon stocks. One survey from Sleetmute commented, "I like to see escapement be made. It's coming to the point where we're gonna have to put a quota system saying how many fish each person can get. It's not an unlimited fishery anymore." Another fisher from Sleetmute made the following statement regarding conservation of king salmon and management of the fishery in the Kuskokwim River:

> Restrictions have been good for those of us that live upriver. I think we're getting a better stock of kings to the breeding grounds. We hadn't seen big kings for a number of years, but this year there's been a number of them. Thanks to [ADF&G] and the [Kuskokwim River Salmon Management Working Group] for wading through such a tricky subject. Everybody is so passionate about it, but they did a good job of making it work.

Other positive comments reflected the good will that many respondents had toward research such as this study, as well as the community outreach that accompanied it. A Chuathbaluk respondent noted, "You guys coming around and taking people's comments asking peoples advice is pretty good, especially up here, but all over." In Aniak a resident offered this comment:

> It's good for surveys like this to be done, and any effort to report back the information gathered from these surveys reinforces people's desire to provide truthful information. I think it's absolutely critical they try to save the salmon, whatever it takes. Some places in the country have lost their salmon already.

Overall and throughout the four study years, respondent comments frequently demonstrated middle Kuskokwim River residents' significant concerns regarding the ways in which lower than average Chinook salmon stocks and severely restrictive fishing conditions had limited their ability to get the salmon they needed each year for subsistence. Many people also perceived that fisheries managers failed to balance time and area restrictions on subsistence salmon fishing in a manner that provided equity between lower Kuskokwim River fishers and fishers residing in communities from Lower Kalskag to the Kuskokwim River headwater streams. These concerns were somewhat alleviated in later study years when both state and federal fishery managers significantly relaxed fishing restrictions for most of the region. Despite their criticisms of the decisions made by agency staff, respondents were largely very supportive of researchers' presence in their communities while salmon fishing was in progress. Many expressed their gratitude that ADF&G Division of Subsistence staff traveled to their communities to record information about residents' experiences with the subsistence salmon fishing season, and that researchers gave them an opportunity to share these experiences and their concerns directly with fishery managers working primarily in the relatively distant community of Bethel.

Table 3-1.–Household fishing progress summary of households contacted inseason, Middle Kuskokwim River, 2015.

		Fishing progress						
Community	Sampled households	Valid Responses	Not fishing	No progress	25% Complete	50% Complete	75% Complete	100% Complete
Aniak	72	72	28%	36%	14%	6%	10%	7%
Chuathbaluk	20	20	15%	30%	5%	10%	30%	10%
Crooked Creek	22	21	29%	33%	33%	0%	5%	0%
Lower Kalskag	20	17	29%	12%	6%	12%	29%	12%
Red Devil	10	10	30%	20%	20%	10%	20%	0%
Sleetmute	28	28	32%	14%	4%	21%	11%	18%
Stony River	11	7	14%	57%	14%	0%	0%	14%
Upper Kalskag	28	28	43%	14%	14%	18%	4%	7%

Source ADF&G Division of Subsistence household surveys, 2015.

Table 3-2.–Households not getting enough salmon for the season and reasons why not, Middle Kuskokwim River area communities, 2015.

		Household not getting enough salmon			Reasons why not				
Community	Sampled households	Valid Responses	Percent not gettting enough	Households providing a reason	Personal	Conservation	Resource availability/low abundance of salmon	Equipment	None given
Aniak	72	71	56%	39	18%	8%	13%	13%	13%
Chuathbaluk	20	20	50%	10	0%	0%	10%	40%	0%
Crooked Creek	22	19	79%	15	7%	0%	13%	7%	7%
Lower Kalskag	20	18	50%	9	11%	0%	0%	11%	0%
Red Devil	10	10	50%	5	0%	0%	0%	20%	40%
Sleetmute	28	26	27%	7	29%	0%	14%	29%	14%
Stony River	11	7	57%	3	0%	0%	0%	0%	0%
Upper Kalskag	28	28	79%	22	9%	0%	9%	32%	18%

Table 3-2.–Continued.

	Reasons why not								
Community	Effort	Unsuccessful	Weather/ environment	Other	Not enough time/working	Regulations/ Fishing restrictions or closures	Animals too small/diseased/ unhealthy	Gas prices too high	Competition
Aniak	23%	5%	3%	3%	8%	44%	0%	0%	0%
Chuathbaluk	0%	10%	0%	0%	20%	30%	0%	10%	0%
Crooked Creek	7%	7%	0%	0%	20%	73%	0%	0%	0%
Lower Kalskag	0%	11%	11%	22%	22%	33%	11%	0%	0%
Red Devil	0%	0%	0%	0%	20%	20%	0%	20%	0%
Sleetmute	0%	0%	0%	0%	14%	14%	0%	0%	0%
Stony River	33%	0%	33%	0%	33%	33%	0%	0%	0%
Upper Kalskag	0%	9%	9%	5%	5%	64%	0%	0%	0%

Source ADF&G Division of Subsistence household surveys, 2015.

Table 3-3.–Households doing something different because they haven't gotten enough salmon for the season, Middle Kuskokwim River area communities, 2015.

Community	Sampled households	Household not getting enough salmon: Valid Responses	Household not getting enough salmon: Percent not gettting enough	Households doing something differently	Household reported doing something differently: Fish for cohos (or other salmon)	Household reported doing something differently: Fish for nonsalmon fish	Household reported doing something differently: Harvest other wild foods
Aniak	72	71	56%	16	25%	19%	19%
Chuathbaluk	20	20	50%	8	38%	13%	0%
Crooked Creek	22	19	79%	5	0%	40%	40%
Lower Kalskag	20	18	50%	2	100%	0%	0%
Red Devil	10	10	50%	0	0%	0%	0%
Sleetmute	28	26	27%	3	33%	0%	0%
Stony River	11	7	57%	2	50%	0%	0%
Upper Kalskag	28	28	79%	12	17%	17%	25%

Table 3-3.–Continued.

Community	Household reported doing something differently: Buy more food from store	Change cooperation and/or sharing strategy	Change processing method	Increase effort	Receive or purchase salmon from elsewhere	Made do without salmon
Aniak	19%	0%	0%	13%	19%	0%
Chuathbaluk	13%	13%	0%	25%	13%	0%
Crooked Creek	60%	0%	0%	20%	0%	0%
Lower Kalskag	0%	0%	0%	0%	0%	0%
Red Devil	0%	0%	0%	0%	0%	0%
Sleetmute	67%	0%	0%	0%	0%	0%
Stony River	50%	0%	0%	50%	0%	0%
Upper Kalskag	50%	0%	8%	0%	0%	0%

Source ADF&G Division of Subsistence household surveys, 2015.

Table 3-4.–Household fishing plans for the remainder of the season, Middle Kuskokwim River area communities, 2015.

		Chinook			Chum		
Community	Sampled Households	Valid Responses	HHs planning to fish more	Avg planned harvest	Valid Responses	HHs planning to fish more	Avg planned harvest
Aniak	72	53	1	200	53	4	390
Chuathbaluk	20	18	3	4	18	1	4
Crooked Creek	22	13	1	7	13	2	68
Lower Kalskag	20	14	0	0	14	0	0
Red Devil	10	7	0	0	7	1	45
Sleetmute	28	18	1	20	18	1	20
Stony River	11	6	0	0	6	0	0
Upper Kalskag	28	16	1	35	16	1	10

Table 3-4.–Continued.

		Sockeye			Coho		
Community	Sampled Households	Valid Responses	HHs planning to fish more	Avg planned harvest	Valid Responses	HHs planning to fish more	Avg planned harvest
Aniak	72	53	6	42	54	51	103
Chuathbaluk	20	18	4	17	18	16	39
Crooked Creek	22	13	11	48	13	13	167
Lower Kalskag	20	14	3	33	14	14	46
Red Devil	10	7	2	44	7	5	44
Sleetmute	28	18	10	29	18	14	47
Stony River	11	6	2	18	6	5	25
Upper Kalskag	28	16	1	25	16	16	53

Source ADFG Division of Subsistence household surveys, 2015.

Table 3-5.–How many fish households can catch in a day before stopping and how many days to process the catch, Middle Kuskokwim River area communities, 2015.

		Number of fish in a day				Number of days to process			
Community	Sampled households	Valid responses	Min	Max	Mean	Valid responses	Min	Max	Mean
Aniak	72	39	1.5	120	29.2	34	0.5	14	5.2
Chuathbaluk	20	17	4	200	48.0	16	1	7	3.3
Crooked Creek	22	12	20	200	58.8	11	2.5	28	15.4
Lower Kalskag	20	7	20	80	36.8	5	2	30	8.4
Red Devil	10	6	20	200	57.5	6	1	30	7.0
Sleetmute	28	18	15	100	27.3	17	0.5	21	4.8
Stony River	11	5	6	20	13.0	4	1	3	1.5
Upper Kalskag	28	15	8	200	43.7	14	1	10.5	2.6

Source ADFG Division of Subsistence household surveys, 2015.

Table 3-6.– Households reporting the number of other households they fish for, 2015.

Community	Sampled households	Valid responses	Households fishing for others		Average number of household fished for
			no.	pct.	
Aniak	72	53	12	23%	1.9
Chuathbaluk	20	19	4	21%	2.3
Crooked Creek	22	15	7	47%	1.8
Lower Kalskag	20	13	5	38%	1.8
Red Devil	10	7	3	43%	1.3
Sleetmute	28	18	7	39%	1.3
Stony River	11	5	4	80%	1.0
Upper Kalskag	28	16	4	25%	2.4

Source ADFG Division of Subsistence household surveys, 2015.

Table 3-7.–Use and ownership of set gillnets, middle Kuskokwim River area communities, 2015.

	Aniak	Chuathbaluk	Crooked Creek	Lower Kalskag	Red Devil	Sleetmute	Stony River	Upper Kalskag
Using a setnet								
Valid responses	71	20	22	17	10	28	7	28
Number	7	6	9	2	3	10	3	8
Percent of responses	10%	30%	41%	12%	30%	36%	43%	29%
Owning a setnet								
Valid responses	7	4	9	2	3	9	3	5
Number	6	2	8	2	3	5	1	3
Percent of HHs using a setnet	86%	50%	89%	100%	100%	56%	33%	60%
Setnets owned								
Number	8	2	8	2	3	8	1	4
Mean per household	1.1	0.5	0.9	1.0	1.0	0.9	0.3	0.8

Source ADF&G Division of Subsistence household surveys, 2015.

Table 3-8.–Use and ownership of drift gillnets, middle Kuskokwim River area communities, 2015.

	Aniak	Chuathbaluk	Crooked Creek	Lower Kalskag	Red Devil	Sleetmute	Stony River	Upper Kalskag
Using a driftnet								
Valid responses	71	20	22	17	10	28	7	28
Number	33	15	16	13	5	14	3	15
Percent of responses	46%	75%	73%	76%	50%	50%	43%	54%
Owning a driftnet								
Valid responses	32	13	16	13	5	14	3	14
Number	21	6	15	10	4	8	2	6
Percent of HHs using a driftnet	66%	46%	94%	77%	80%	57%	67%	43%
Driftnets owned								
Number	21	6	15	10	4	8	2	6
Mean per household	0.9	0.5	1.1	0.8	0.8	0.6	0.7	0.5

Source ADF&G Division of Subsistence household surveys, 2015.

Table 3-9.–Use and ownership of gear other than gillnets, middle Kuskokwim River area communities, 2015.

	Aniak	Chuathbaluk	Crooked Creek	Lower Kalskag	Red Devil	Sleetmute	Stony River	Upper Kalskag
Using Rod and reel								
Valid responses	71	20	22	19	10	28	11	28
Number	38	9	4	0	3	11	5	2
Percent of responses	54%	45%	18%	0%	30%	39%	45%	7%
Owning a rod and reel								
Valid responses	38	7	4	1	3	9	5	1
Number	37	7	4	0	3	8	5	1
Percent of HHs using a rod and reel	97%	100%	100%	0%	100%	89%	100%	100%
Using a fish wheel								
Valid responses	71	20	22	19	10	28	11	28
Number	6.0	1.0	0.0	0.0	0.0	2.0	0.0	0.0
Percent of responses	8%	5%	0%	0%	0%	7%	0%	0%
Owning a fish wheel								
Valid responses	7	1	0	1	0	2	0	0
Number	1	0	0	0	0	2	0	0
Percent of HHs using a fish wheel	14%	0%	0%	0%	0%	100%	0%	0%

Source ADF&G Division of Subsistence household surveys, 2015.

Table 3-10.–Household fishing progress summary of households contacted in season, Middle Kuskokwim River, 2016.

		Fishing progress						
Community	Sampled households	Valid Responses	Not fishing	No progress	25% Complete	50% Complete	75% Complete	100% Complete
Aniak	97	97	28%	15%	7%	13%	21%	15%
Chuathbaluk	15	15	47%	13%	7%	7%	7%	20%
Crooked Creek	10	10	10%	0%	20%	30%	40%	0%
Lime Village	5	5	60%	0%	0%	0%	20%	20%
Lower Kalskag	10	10	10%	30%	20%	20%	0%	20%
Red Devil	6	6	0%	0%	0%	50%	33%	17%
Sleetmute	4	4	25%	0%	25%	25%	0%	25%
Stony River	4	4	100%	0%	0%	0%	0%	0%
Upper Kalskag	19	18	0%	11%	11%	11%	11%	56%

Source ADF&G Division of Subsistence household surveys, 2016.

Table 3-11.–Households not getting enough salmon for the season and reasons why not, Middle Kuskokwim River area communities, 2016.

		Household not getting enough salmon			Reasons why not				
Community	Sampled households	Valid Responses	Percent not gettting enough	Households providing a reason	Personal	Conservation	Resource availability/low abundance of salmon	Equipment	None given
Aniak	97	69	25%	14	0%	7%	7%	21%	0%
Chuathbaluk	15	6	0%	0	0%	0%	0%	0%	0%
Crooked Creek	10	10	40%	4	0%	0%	0%	25%	0%
Lime Village	5	5	20%	1	0%	0%	0%	0%	0%
Lower Kalskag	10	9	44%	4	0%	0%	25%	25%	25%
Red Devil	6	6	33%	2	0%	0%	0%	0%	0%
Sleetmute	4	3	0%	0	0%	0%	0%	0%	0%
Stony River	4	3	33%	0	0%	0%	0%	0%	0%
Upper Kalskag	19	18	22%	2	0%	0%	0%	100%	0%

Table 3-11.–Continued.

	Reasons why not								
Community	Effort	Unsuccessful	Weather/ environment	Other	Not enough time/working	Regulations/ fishing restrictions or closures	Animals too small/diseased /unhealthy	Gas prices too high	Competition
Aniak	43%	0%	14%	7%	14%	0%	0%	0%	0%
Chuathbaluk	0%	0%	0%	0%	0%	0%	0%	0%	0%
Crooked Creek	25%	0%	0%	0%	25%	25%	0%	0%	0%
Lime Village	0%	0%	0%	100%	0%	0%	0%	0%	0%
Lower Kalskag	0%	25%	0%	25%	0%	25%	0%	0%	0%
Red Devil	0%	0%	50%	50%	0%	50%	0%	0%	0%
Sleetmute	0%	0%	0%	0%	0%	0%	0%	0%	0%
Stony River	0%	0%	0%	0%	0%	0%	0%	0%	0%
Upper Kalskag	50%	0%	0%	0%	0%	0%	0%	0%	0%

Source ADF&G Division of Subsistence household surveys, 2016.

Table 3-12.–Households doing something different because they haven't gotten enough salmon for the season, Middle Kuskokwim River area communities, 2016.

Community	Sampled households	Household not getting enough salmon: Valid Responses	Household not getting enough salmon: Percent not gettting enough	Households doing something differently	Household reported doing something differently: Fish for cohos (or other salmon)	Household reported doing something differently: Fish for nonsalmon fish	Household reported doing something differently: Harvest other wild foods
Aniak	97	69	25%	11	18%	0%	73%
Chuathbaluk	15	6	0%	0	0%	0%	0%
Crooked Creek	10	10	40%	3	0%	0%	33%
Lime Village	5	5	20%	0	0%	0%	0%
Lower Kalskag	10	9	44%	0	0%	0%	0%
Red Devil	6	6	33%	2	0%	100%	50%
Sleetmute	4	3	0%	0	0%	0%	0%
Stony River	4	3	33%	0	0%	0%	0%
Upper Kalskag	19	18	22%	0	0%	0%	0%

Table 3-12.–Continued.

Community	Household reported doing something differently: Buy more food from store	Change cooperation and/or sharing strategy	Change processing method	Increase effort	Receive or purchase salmon from elsewhere	Made do without salmon
Aniak	9%	0%	0%	0%	0%	0%
Chuathbaluk	0%	0%	0%	0%	0%	0%
Crooked Creek	0%	0%	33%	33%	0%	0%
Lime Village	0%	0%	0%	0%	0%	0%
Lower Kalskag	0%	0%	0%	0%	0%	0%
Red Devil	0%	0%	0%	0%	0%	0%
Sleetmute	0%	0%	0%	0%	0%	0%
Stony River	0%	0%	0%	0%	0%	0%
Upper Kalskag	0%	0%	0%	0%	0%	0%

Source ADF&G Division of Subsistence household surveys, 2016.

Table 3-13.– Household fishing plans for the remainder of the season, Middle Kuskokwim River area communities, 2016.

		Chinook			Chum		
Community	Sampled Households	Valid Responses	HHs planning to fish more	Avg planned harvest	Valid Responses	HHs planning to fish more	Avg planned harvest
Aniak	97	70	32	30	70	20	229
Chuathbaluk	15	6	1	10	6	2	11
Crooked Creek	10	10	5	64	10	5	31
Lime Village	5	0	0	0	0	0	0
Lower Kalskag	10	7	3	18	7	2	60
Red Devil	6	6	3	8	6	2	17
Sleetmute	4	3	3	21	3	1	10
Stony River	4	0	0	0	0	0	0
Upper Kalskag	19	17	5	18	17	4	24

Table 3-13.–Continued.

		Sockeye			Coho		
Community	Sampled Households	Valid Responses	HHs planning to fish more	Avg planned harvest	Valid Responses	HHs planning to fish more	Avg planned harvest
Aniak	97	70	37	51	70	67	64
Chuathbaluk	15	6	1	10	6	6	81
Crooked Creek	10	10	6	23	10	9	51
Lime Village	5	0	0	0	0	0	0
Lower Kalskag	10	7	2	25	7	3	13
Red Devil	6	6	3	41	6	4	41
Sleetmute	4	3	3	17	3	2	28
Stony River	4	0	0	0	0	0	0
Upper Kalskag	19	17	3	17	17	8	19

Source ADF&G Division of Subsistence household surveys, 2016.

Table 3-14.–How many fish households can catch in a day before stopping and how many days to process the catch, Middle Kuskokwim River area communities, 2016.

		Number of fish in a day				How many do you try to catch in a year			
Community	Sampled households	Valid responses	Min	Max	Mean	Valid responses	Min	Max	Mean
Aniak	97	63	2	60	15.6	66	10	5000	170.5
Chuathbaluk	15	6	5	50	23.3	5	60	300	132.0
Crooked Creek	10	9	7	60	26.6	9	30	700	221.7
Lime Village	5	1	27.5	27.5	27.5	2	40	950	495.0
Lower Kalskag	10	7	5	50	22.1	5	32.5	400	168.5
Red Devil	6	5	8	50	28.0	5	30	95	59.0
Sleetmute	4	3	6	10	8.7	3	30	80	53.3
Stony River	4	0	0	0	0.0	0	0	0	0.0
Upper Kalskag	19	12	2.5	75	26.7	15	12	175	69.5

Source ADF&G Division of Subsistence household surveys, 2016.

Table 3-15.–Households reporting the number of other households they fish for, 2016.

Community	Sampled households	Valid responses	Households fishing for others		Average number of household fished for
			no.	pct.	
Aniak	97	70	38	54%	2.7
Chuathbaluk	15	6	6	100%	3.8
Crooked Creek	10	10	6	60%	2.5
Lime Village	5	2	1	50%	1.0
Lower Kalskag	10	9	7	78%	4.0
Red Devil	6	6	4	67%	1.3
Sleetmute	4	3	2	67%	4.5
Stony River	4	0	0	0%	0.0
Upper Kalskag	19	19	10	53%	3.9

Source ADF&G Division of Subsistence household surveys, 2016.

Table 3-16.–Use and ownership of set gillnets, middle Kuskokwim River area communities, 2016.

	Aniak	Chuathbaluk	Crooked Creek	Lime Village	Lower Kalskag	Red Devil	Sleetmute	Stony River	Upper Kalskag
Using a setnet									
Valid responses	96	14	10	5	10	6	4	4	19
Number	13	3	2	2	1	1	0	0	5
Percent of responses	14%	21%	20%	40%	10%	17%	0%	0%	26%
Owning a setnet									
Valid responses	12	3	2	2	1	1	0	0	5
Number	11	3	1	2	0	0	0	0	4
Percent of HHs using a setnet	92%	100%	50%	100%	0%	0%	0%	0%	80%
Setnets owned									
Number	11	3	1	2	0	0	0	0	4
Mean per household	0.9	1.0	0.5	1.0	0.0	0.0	0.0	0.0	0.8

Source ADF&G Division of Subsistence household surveys, 2016.

Table 3-17.–Use and ownership of drift gillnets, middle Kuskokwim River area communities, 2016.

	Aniak	Chuathbaluk	Crooked Creek	Lime Village	Lower Kalskag	Red Devil	Sleetmute	Stony River	Upper Kalskag
Using a driftnet									
Valid responses	96	14	10	5	10	6	4	4	19
Number	47	4	9	0	8	4	3	0	16
Percent of responses	49%	29%	90%	0%	80%	67%	75%	0%	84%
Owning a driftnet									
Valid responses	46	3	9	0	6	4	3	0	15
Number	40	3	7	0	5	2	2	0	11
Percent of HHs using a driftnet	87%	100%	78%	0%	83%	50%	67%	0%	73%
Driftnets owned									
Number	40	3	7	0	5	2	2	0	11
Mean per household	0.9	1.0	0.8	0.0	0.8	0.5	0.7	0.0	0.7

Source ADF&G Division of Subsistence household surveys, 2016.

Table 3-18.–Use and ownership of gear other than gillnets, middle Kuskokwim River area communities, 2016.

	Aniak	Chuathbaluk	Crooked Creek	Lime Village	Lower Kalskag	Red Devil	Sleetmute	Stony River	Upper Kalskag
Using Rod and reel									
Valid responses	96	14	10	5	10	6	4	4	19
Number	22	3	1	1	0	3	0	0	0
Percent of responses	23%	21%	10%	20%	0%	50%	0%	0%	0%
Owning a rod and reel									
Valid responses	22	3	1	1	0	3	0	0	0
Number	21	2	1	1	0	2	0	0	0
Percent of HHs using a rod and reel	95%	67%	100%	100%	0%	67%	0%	0%	0%
Using a fish wheel									
Valid responses	96	14	10	5	10	6	4	4	19
Number	4.0	0.0	2.0	0.0	1.0	0.0	0.0	0.0	0.0
Percent of responses	4%	0%	20%	0%	10%	0%	0%	0%	0%
Owning a fish wheel									
Valid responses	5	1	2	0	1	0	0	0	0
Number	1	0	0	0	0	0	0	0	0
Percent of HHs using a fish wheel	20%	0%	0%	0%	0%	0%	0%	0%	0%

Source ADF&G Division of Subsistence household surveys, 2016.

Table 3-19.–Household fishing progress summary of households contacted inseason, Middle Kuskokwim River, 2017.

			Fishing progress					
Community	Sampled households	Valid Responses	Not fishing	No progress	25% Complete	50% Complete	75% Complete	100% Complete
Aniak	40	40	10%	45%	5%	15%	10%	15%
Chuathbaluk	7	7	0%	14%	29%	14%	0%	43%
Crooked Creek	12	12	17%	17%	25%	8%	25%	8%
Lower Kalskag	23	21	29%	29%	14%	14%	10%	5%
Red Devil	8	7	29%	14%	0%	0%	0%	57%
Sleetmute	14	13	54%	8%	8%	8%	8%	15%
Stony River	4	4	25%	25%	0%	0%	25%	25%
Upper Kalskag	18	15	40%	0%	20%	13%	7%	20%

Source ADF&G Division of Subsistence household surveys, 2017.

Table 3-20.–Households not getting enough salmon for the season and reasons why not, Middle Kuskokwim River area communities, 2017.

		Household not getting enough salmon			Reasons why not				
Community	Sampled households	Valid Responses	Percent not gettting enough	Households providing a reason	Personal	Conservation	Resource availability/low salmon abundance	Equipment	None given
Aniak	40	37	51%	19	21%	5%	16%	16%	16%
Chuathbaluk	7	6	17%	1	0%	0%	0%	100%	0%
Crooked Creek	12	10	60%	5	0%	0%	0%	0%	20%
Lower Kalskag	23	17	41%	7	14%	0%	0%	43%	14%
Red Devil	8	5	20%	1	0%	0%	0%	0%	0%
Sleetmute	14	7	43%	2	0%	0%	0%	0%	0%
Stony River	4	3	0%	0	0%	0%	0%	0%	0%
Upper Kalskag	18	14	71%	9	11%	0%	11%	22%	22%

Table 3-20.–Continued.

	Reasons why not								
Community	Effort	Unsuccessful	Weather/ environment	Other	Not enough time/working	Fishing regulations/ restrictions or closures	Animals too small/diseased/ unhealthy	Gas prices too high	Competition
Aniak	16%	5%	5%	5%	11%	11%	0%	5%	0%
Chuathbaluk	0%	0%	0%	0%	0%	0%	0%	0%	0%
Crooked Creek	0%	0%	0%	20%	0%	80%	0%	0%	0%
Lower Kalskag	14%	29%	0%	0%	0%	0%	0%	0%	14%
Red Devil	0%	0%	0%	0%	100%	100%	0%	0%	0%
Sleetmute	0%	0%	0%	50%	0%	50%	0%	0%	0%
Stony River	0%	0%	0%	0%	0%	0%	0%	0%	0%
Upper Kalskag	11%	11%	0%	0%	0%	44%	0%	0%	0%

Source ADF&G Division of Subsistence household surveys, 2017.

Table 3-21.–Households doing something different because they haven't gotten enough salmon for the season, Middle Kuskokwim River area communities, 2017.

		Household not getting enough salmon		Households doing something differently	Household reported doing something differently		
Community	Sampled households	Valid Responses	Percent not gettting enough		Fish for cohos (or other salmon)	Fish for nonsalmon fish	Harvest other wild foods
Aniak	40	37	51%	15	100%	0%	13%
Chuathbaluk	7	6	17%	1	0%	0%	100%
Crooked Creek	12	10	60%	5	60%	20%	0%
Lower Kalskag	23	17	41%	2	100%	0%	0%
Red Devil	8	5	20%	1	100%	0%	0%
Sleetmute	14	7	43%	1	0%	0%	0%
Stony River	4	3	0%	0	0%	0%	0%
Upper Kalskag	18	14	71%	4	50%	0%	0%

Table 3-21.–Continued.

	Household reported doing something differently					
Community	Buy more food from store	Change cooperation and/or sharing strategy	Change processing method	Increase effort	Receive or purchase salmon from elsewhere	Made do without salmon
Aniak	0%	0%	0%	0%	7%	0%
Chuathbaluk	0%	0%	0%	0%	0%	0%
Crooked Creek	0%	0%	0%	20%	0%	0%
Lower Kalskag	0%	0%	0%	0%	0%	0%
Red Devil	0%	0%	0%	0%	0%	0%
Sleetmute	0%	0%	0%	0%	0%	100%
Stony River	0%	0%	0%	0%	0%	0%
Upper Kalskag	0%	0%	0%	0%	50%	0%

Source ADF&G Division of Subsistence household surveys, 2017.

Table 3-22.–Household fishing plans for the remainder of the season, Middle Kuskokwim River area communities, 2017.

		Chinook			Chum		
Community	Sampled Households	Valid Responses	planning to fish more	Avg planned harvest	Valid Responses	planning to fish more	Avg planned harvest
Aniak	40	35	7	19	35	11	138
Chuathbaluk	7	7	4	39	7	4	94
Crooked Creek	12	8	5	19	8	6	47
Lower Kalskag	23	12	2	0	12	3	10
Red Devil	8	6	4	11	6	4	30
Sleetmute	14	6	3	8	6	3	26
Stony River	4	2	1	20	2	0	0
Upper Kalskag	18	10	5	55	10	1	50

Table 3-22.–Continued.

		Sockeye			Coho		
Community	Sampled Households	Valid Responses	HHs planning to fish more	Avg planned harvest	Valid Responses	HHs planning to fish more	Avg planned harvest
Aniak	40	35	23	64	35	29	67
Chuathbaluk	7	7	4	46	7	6	29
Crooked Creek	12	8	8	50	8	5	31
Lower Kalskag	23	12	4	15	12	9	49
Red Devil	8	6	4	38	5	4	35
Sleetmute	14	6	6	63	6	3	20
Stony River	4	2	1	23	2	1	13
Upper Kalskag	18	10	6	38	10	7	31

Source ADF&G Division of Subsistence household surveys, 2017.

Table 3-23.–How many fish households can catch in a day before stopping and how many days to process the catch, Middle Kuskokwim River area communities, 2017.

		Number of fish in a day				How many do you try to catch in a year			
Community	Sampled households	Valid responses	Min	Max	Mean	Valid responses	Min	Max	Mean
Aniak	40	22	1	200	33.2	27	2.5	2000	192.2
Chuathbaluk	7	6	5	100	60.8	7	9	300	153.0
Crooked Creek	12	2	20	27.5	23.8	6	50	100	83.3
Lower Kalskag	23	11	5	150	47.1	14	10	200	97.6
Red Devil	8	2	10	45	27.5	3	70	175	105.0
Sleetmute	14	4	14	40	24.8	4	10	75	52.5
Stony River	4	0	0	0	0.0	1	100	100	100.0
Upper Kalskag	18	7	6	70	33.4	8	5	225	95.6

Source ADF&G Division of Subsistence household surveys, 2017.

Table 3-24.– Households reporting the number of other households they fish for, 2017.

Community	Sampled households	Valid responses	Households fishing for others		Average number of household fished for
			no.	pct.	
Aniak	40	35	13	37%	2.6
Chuathbaluk	7	7	4	57%	3.0
Crooked Creek	12	10	5	50%	1.9
Lower Kalskag	23	11	7	64%	1.8
Red Devil	8	6	3	50%	1.3
Sleetmute	14	6	4	67%	2.0
Stony River	4	2	1	50%	2.0
Upper Kalskag	18	7	4	57%	2.3

Source ADFG Division of Subsistence household surveys, 2017.

Table 3-25.–Use and ownership of set gillnets, middle Kuskokwim River area communities, 2017.

	Aniak	Chuathbaluk	Crooked Creek	Lower Kalskag	Red Devil	Sleetmute	Stony River	Upper Kalskag
Using a setnet								
Valid responses	36	7	12	20	7	14	4	15
Number	9	1	0	2	1	2	1	3
Percent of responses	25%	14%	0%	10%	14%	14%	25%	20%
Owning a setnet								
Valid responses	9	1	0	1	1	2	1	3
Number	8	1	0	1	1	2	1	3
Percent of HHs using a setnet	89%	100%	0%	100%	100%	100%	100%	100%
Setnets owned								
Number	8	1	0	1	1	2	1	3
Mean per household	0.9	1.0	0.0	1.0	1.0	1.0	1.0	1.0

Source ADF&G Division of Subsistence household surveys, 2017.

Table 3-26.–Use and ownership of drift gillnets, middle Kuskokwim River area communities, 2017.

	Aniak	Chuathbaluk	Crooked Creek	Lower Kalskag	Red Devil	Sleetmute	Stony River	Upper Kalskag
Using a driftnet								
Valid responses	36	7	12	20	7	14	4	15
Number	21	5	8	11	5	3	3	6
Percent of responses	58%	71%	67%	55%	71%	21%	75%	40%
Owning a driftnet								
Valid responses	21	5	8	11	5	3	3	6
Number	19	4	7	9	5	2	2	5
Percent of HHs using a driftnet	90%	80%	88%	82%	100%	67%	67%	83%
Driftnets owned								
Number	19	4	7	9	5	2	2	5
Mean per household	1.0	0.8	1.0	0.8	1.0	0.7	0.7	0.8

Source ADF&G Division of Subsistence household surveys, 2017.

Table 3-27.–Use and ownership of gear other than gillnets, middle Kuskokwim River area communities, 2017.

	Aniak	Chuathbaluk	Crooked Creek	Lower Kalskag	Red Devil	Sleetmute	Stony River	Upper Kalskag
Using Rod and reel								
Valid responses	36	7	12	20	7	14	4	15
Number	14	1	0	0	0	1	0	0
Percent of responses	39%	14%	0%	0%	0%	7%	0%	0%
Owning a rod and reel								
Valid responses	18	1	0	3	1	1	0	3
Number	14	1	0	0	0	1	0	0
Percent of HHs using a rod and reel	78%	100%	0%	0%	0%	100%	0%	0%
Using a fish wheel								
Valid responses	36	7	12	20	7	14	4	15
Number	5.0	1.0	5.0	4.0	0.0	3.0	0.0	0.0
Percent of responses	14%	14%	42%	20%	0%	21%	0%	0%
Owning a fish wheel								
Valid responses	9	1	5	5	1	3	0	3
Number	1	0	0	1	0	2	0	0
Percent of HHs using a fish wheel	11%	0%	0%	20%	0%	67%	0%	0%

Source ADF&G Division of Subsistence household surveys, 2017.

Table 3-28.–Household fishing progress summary of households contacted in season, Middle Kuskokwim River, 2018.

			Fishing progress					
Community	Sampled households	Valid Responses	Not fishing	No progress	25% Complete	50% Complete	75% Complete	100% Complete
Aniak	94	92	33%	29%	7%	7%	22%	3%
Crooked Creek	17	17	47%	0%	6%	12%	24%	12%
Lime Village	4	4	50%	0%	0%	0%	0%	50%
Lower Kalskag	51	50	46%	8%	8%	12%	20%	2%
Red Devil	10	10	20%	20%	0%	0%	20%	40%
Sleetmute	18	18	61%	6%	6%	17%	0%	11%
Stony River	1	1	0%	0%	0%	0%	100%	0%
Upper Kalskag	27	27	48%	7%	4%	7%	30%	4%

Source ADF&G Division of Subsistence household surveys, 2018.

Table 3-29.–Households not getting enough salmon for the season and reasons why not, Middle Kuskokwim River area communities, 2018.

		Household not getting enough salmon			Reasons why not				
Community	Sampled households	Valid Responses	Percent not gettting enough	Households providing a reason	Personal	Conservation	Resource availability/low abundance of salmon	Equipment	None given
Aniak	94	71	45%	32	19%	6%	9%	28%	13%
Crooked Creek	17	10	30%	3	0%	0%	33%	33%	33%
Lime Village	4	4	0%	0	0%	0%	0%	0%	0%
Lower Kalskag	51	40	48%	17	29%	0%	12%	6%	6%
Red Devil	10	9	33%	3	33%	0%	0%	33%	0%
Sleetmute	18	7	43%	3	0%	0%	0%	33%	0%
Stony River	1	1	0%	0	0%	0%	0%	0%	0%
Upper Kalskag	27	22	41%	8	25%	0%	0%	13%	25%

Table 3-29.–Continued.

	Reasons why not								
Community	Effort	Unsuccessful	Weather/ environment	Other	Not enough time/working	Regulations/ fishing restrictions or closures	Animals too small/diseased/ unhealthy	Gas prices too high	Competition
Aniak	13%	13%	3%	6%	9%	6%	0%	3%	0%
Crooked Creek	0%	0%	0%	0%	33%	0%	0%	0%	0%
Lime Village	0%	0%	0%	0%	0%	0%	0%	0%	0%
Lower Kalskag	0%	18%	6%	18%	24%	12%	0%	6%	0%
Red Devil	67%	0%	0%	0%	0%	0%	0%	0%	0%
Sleetmute	33%	0%	0%	33%	33%	0%	0%	0%	0%
Stony River	0%	0%	0%	0%	0%	0%	0%	0%	0%
Upper Kalskag	0%	13%	13%	13%	0%	0%	0%	0%	0%

Source ADF&G Division of Subsistence household surveys, 2018.

Table 3-30.–Households doing something different because they haven't gotten enough salmon for the season, Middle Kuskokwim River area communities, 2018.

Community	Sampled households	Household not getting enough salmon: Valid Responses	Household not getting enough salmon: Percent not gettting enough	Households doing something differently	Household reported doing something differently: Fish for cohos (or other salmon)	Household reported doing something differently: Fish for nonsalmon fish	Household reported doing something differently: Harvest other wild foods
Aniak	94	71	45%	22	86%	0%	0%
Crooked Creek	17	10	30%	2	100%	0%	0%
Lime Village	4	4	0%	0	0%	0%	0%
Lower Kalskag	51	40	48%	10	90%	0%	0%
Red Devil	10	9	33%	1	100%	0%	0%
Sleetmute	18	7	43%	2	50%	0%	0%
Stony River	1	1	0%	0	0%	0%	0%
Upper Kalskag	27	22	41%	5	20%	40%	20%

Table 3-30.–Continued.

Community	Household reported doing something differently: Buy more food from store	Change cooperation and/or sharing strategy	Change processing method	Increase effort	Receive or purchase salmon from elsewhere	Made do without salmon
Aniak	0%	0%	0%	23%	18%	0%
Crooked Creek	0%	0%	0%	0%	0%	0%
Lime Village	0%	0%	0%	0%	0%	0%
Lower Kalskag	0%	10%	0%	10%	0%	0%
Red Devil	0%	0%	0%	0%	0%	0%
Sleetmute	0%	0%	0%	50%	0%	0%
Stony River	0%	0%	0%	0%	0%	0%
Upper Kalskag	20%	0%	0%	20%	0%	0%

Source ADFG Division of Subsistence household surveys, 2018.

Table 3-31.– Household fishing plans for the remainder of the season, Middle Kuskokwim River area communities, 2018.

		Chinook			Chum		
Community	Sampled Households	Valid Responses	HHs planning to fish more	Avg planned harvest	Valid Responses	HHs planning to fish more	Avg planned harvest
Aniak	94	63	2	40	62	6	100
Crooked Creek	17	9	0	0	9	0	0
Lime Village	4	2	0	0	2	0	0
Lower Kalskag	51	27	2	58	27	4	78
Red Devil	10	9	0	0	9	0	0
Sleetmute	18	7	0	0	7	0	0
Stony River	1	1	0	0	1	0	0
Upper Kalskag	27	14	1	35	14	1	20

Table 3-31.–Continued.

		Sockeye			Coho		
Community	Sampled Households	Valid Responses	HHs planning to fish more	Avg planned harvest	Valid Responses	HHs planning to fish more	Avg planned harvest
Aniak	94	63	26	161	63	60	57
Crooked Creek	17	9	9	24	9	8	24
Lime Village	4	2	0	0	2	1	20
Lower Kalskag	51	27	19	34	27	26	44
Red Devil	10	9	0	0	8	8	18
Sleetmute	18	7	4	20	7	6	16
Stony River	1	1	0	0	1	1	100
Upper Kalskag	27	14	9	40	14	10	27

Source ADF&G Division of Subsistence household surveys, 2018.

Table 3-32.–How many fish households can catch in a day before stopping and how many days to process the catch, Middle Kuskokwim River area communities, 2018.

		Number of fish in a day				How many do you try to catch in a year			
Community	Sampled households	Valid responses	Min	Max	Mean	Valid responses	Min	Max	Mean
Aniak	94	42	2	85	20.6	55	4	4601	196.4
Crooked Creek	17	7	6	30	17.3	5	60	200	132.0
Lime Village	4	2	30	54	42.0	1	120	120	120.0
Lower Kalskag	51	20	10	70	35.5	19	20	500	181.3
Red Devil	10	7	5	30	16.9	4	15	100	56.3
Sleetmute	18	5	12	30	19.4	5	30	175	73.0
Stony River	1	1	70	70	70.0	1	250	250	250.0
Upper Kalskag	27	10	9	60	26.4	9	40	500	140.0

Source ADF&G Division of Subsistence household surveys, 2018.

Table 3-33.–Households reporting the number of other households they fish for, 2018.

Community	Sampled households	Valid responses	Households fishing for others		Average number of household fished for
			no.	pct.	
Aniak	94	55	27	49%	1.7
Crooked Creek	17	9	3	33%	3.7
Lime Village	4	2	1	50%	2.0
Lower Kalskag	51	23	11	48%	8.6
Red Devil	10	8	4	50%	2.3
Sleetmute	18	6	4	67%	5.0
Stony River	1	1	0	0%	0.0
Upper Kalskag	27	13	5	38%	2.6

Source ADF&G Division of Subsistence household surveys, 2018.

Table 3-34.–Use and ownership of set gillnets, middle Kuskokwim River area communities, 2018.

	Aniak	Crooked Creek	Lime Village	Lower Kalskag	Red Devil	Sleetmute	Stony River	Upper Kalskag
Using a setnet								
Valid responses	87	17	4	48	10	18	1	25
Number	16	0	2	3	1	2	0	2
Percent of responses	18%	0%	50%	6%	10%	11%	0%	8%
Owning a setnet								
Valid responses	16	0	2	3	1	2	0	2
Number	14	0	2	3	1	1	0	2
Percent of HHs using a setnet	88%	0%	100%	100%	100%	50%	0%	100%
Setnets owned								
Number	14	0	2	3	1	1	0	2
Mean per household	0.9	0.0	1.0	1.0	1.0	0.5	0.0	1.0

Source ADF&G Division of Subsistence household surveys, 2018.

Table 3-35.–Use and ownership of drift gillnets, middle Kuskokwim River area communities, 2018.

	Aniak	Crooked Creek	Lime Village	Lower Kalskag	Red Devil	Sleetmute	Stony River	Upper Kalskag
Using a driftnet								
Valid responses	87	17	4	48	10	18	1	25
Number	36	9	0	22	5	4	0	9
Percent of responses	41%	53%	0%	46%	50%	22%	0%	36%
Owning a driftnet								
Valid responses	36	9	0	22	5	4	0	7
Number	28	9	0	18	3	4	0	7
Percent of HHs using a driftnet	78%	100%	0%	82%	60%	100%	0%	100%
Driftnets owned								
Number	28	9	0	18	3	4	0	7
Mean per household	0.8	1.0	0.0	0.8	0.6	1.0	0.0	1.0

Source ADF&G Division of Subsistence household surveys, 2018.

Table 3-36.–Use and ownership of gear other than gillnets, middle Kuskokwim River area communities, 2018.

	Aniak	Crooked Creek	Lime Village	Lower Kalskag	Red Devil	Sleetmute	Stony River	Upper Kalskag
Using Rod and reel								
Valid responses	87	17	4	48	10	18	1	25
Number	18	1	0	1	0	0	0	0
Percent of responses	21%	6%	0%	2%	0%	0%	0%	0%
Owning a rod and reel								
Valid responses	21	1	0	4	0	0	0	2
Number	14	1	0	1	0	0	0	0
Percent of HHs using a rod and reel	67%	100%	0%	25%	0%	0%	0%	0%
Using a fish wheel								
Valid responses	87	17	4	48	10	18	1	25
Number	2.0	0.0	0.0	2.0	0.0	4.0	1.0	0.0
Percent of responses	2%	0%	0%	4%	0%	22%	100%	0%
Owning a fish wheel								
Valid responses	8	0	0	5	0	4	1	2
Number	1	0	0	1	0	2	1	0
Percent of HHs using a fish wheel	13%	0%	0%	20%	0%	50%	100%	0%

Source ADF&G Division of Subsistence household surveys, 2018.

Table 3-37.–Fishing openings by date, Lower Kalskag to Aniak, 2018.

Opening date	Net length (fm)	Time Fishing Open	Time Fishing Close	Total Fishing Duration (hr)
6/12/2018	25	10:00	22:00	12
6/16/2018	25	10:00	22:00	12

Source ADF&G Division of Subsistence, inseason surveys, 2018.

Table 3-38.–Fisher participation by opening date, Lower Kalskag to Aniak, 2018.

	Fisher information		
Opening date	Fishers contacted	Total Drifts reported	Mean fishing duration / fisher
6/12/2018	20	20	3.3
6/16/2018	22	22	4.7

Source ADF&G Division of subsistence inseason surveys, 2018.

Table 3-39.–Catch by opening date, Lower Kalskag to Aniak, 2018.

	Catch												
	Chinook					Chum and Sockeye					Chinook : Chum and Sockeye		
Opening date	Min.	Max.	Med.	Avg.	Tot.	Min.	Max.	Med.	Avg.	Tot.	Min	Max	Tot.
6/12/2018	0	13	2	2	47	0	4	1	1.4	27	0.0	0.3	0.6
6/16/2018	0	9	4	4	84	0	11	2	2.5	55	0.0	1.2	0.7

Source ADF&G Division of subsistence inseason surveys, 2018.

Table 3-40.–Catch per unit effort, by opening date, Lower Kalskag to Aniak, 2018.

Opening date	CPUE							
	Chinook				Chum and Sockeye			
	Min.	Max.	Med.	Avg.	Min.	Max.	Med.	Avg.
6/12/2018	0.0	4.0	1.7	1.8	0.0	3.0	0.9	1.0
6/16/2018	0.0	3.1	2.0	1.9	0.0	2.5	0.9	0.9

Source ADF&G Division of subsistence inseason surveys, 2018.

Table 3-41.–Boat counts by opening, Lower Kalskag to Aniak, 2018.

Opening date	Number of sample counts	Total boat counting trips	Average number of boats counted
6/12/2018	20	6	8.00
6/16/2018	22	4	11.00

Source ADF&G Division of Subsistence inseason creel surveys, 2018.

4. DISCUSSION AND CONCLUSIONS

INSEASON HARVEST ASSESSMENT HOUSEHOLD SURVEY

This study successfully achieved its objective to record a weekly sample of fishing households' qualitative assessments of their progress toward achieving their annual subsistence needs for salmon among households in communities from Lower Kalskag to Stony River. During four seasons of subsistence salmon fishing in 2015–2018, multiple staff deployed to contact hundreds of middle Kuskokwim River fishing households and complete surveys that asked respondents to assess their ability to get the salmon they needed for the year, and other aspects of their fishing activity. The effort occurred in nine study communities over approximately 250 river miles in the Kuskokwim River with research staff from ADF&G collaborating with local Alaska Native tribal nonprofit organizations to complete the survey effort, and to provide essential fishery information to survey respondents and their families. Success also came through delivery of preliminary inseason survey results to management staff and advisory stakeholder groups (i.e., Kuskokwim River Salmon Management Working Group and Kuskokwim River Inter Tribal Fish Commission)[1] in time for discussion and consideration at fishery management meetings. As salmon runs progressed upriver each day in season, agency fishery managers, the Working Group, and the Fish Commission were able to evaluate whether the fishery was providing middle Kuskokwim River fishing subsistence households with reasonable opportunities to harvest the subsistence salmon they needed. Considerations of survey results occurred in conjunction with agency and stakeholder group efforts to conserve Chinook salmon, stocks of which had been returning to the Kuskokwim River in reduced abundances each year at least since 2010.

Motivation to initiate the study arose in this period of lower Chinook salmon returns and the resulting critically low subsistence salmon harvests by Kuskokwim River fishers. From 2012–2014 during meetings of the Working Group and other public fishery management forums, middle Kuskokwim River fishing households voiced their concerns about the effects of low Chinook salmon returns and historically low salmon harvests on their families and communities. Public discussions described many fishers' perception that fishery management staff were providing subsistence and—in the case of ADF&G—commercial salmon fishing opportunities for fishers in the lower river to the detriment of the middle Kuskokwim River region. Although in that period from 2012–2014, all Kuskokwim Area fishers had suffered the effects of fishing closures on their ability to get and process the salmon they needed, middle Kuskokwim River fishers shared widespread concerns that fishing practices downstream of their communities significantly reduced salmon abundance further, compounding residents' challenges to get the fish they needed.

Throughout the study period, survey respondents shared many comments that supported this perceived conflict between the river's regions as a result of management and regulation. As the study progressed, weekly information from surveys, including these comments and the summary assessment data that came directly from respondents, assisted agency staff and stakeholder groups in their developing understanding of the effects of fishery management decisions on middle Kuskokwim River communities. For example, each week during the study years, research staff reported preliminary survey results of fisher progress and plans to the Working Group and fishery managers. These reports gave timely information that helped managers track survey households' fishing as they approached their goals for salmon for the year. The data helped identify communities where fishing progress was approaching relative satisfaction with fishing opportunities, and, perhaps more importantly, communities where many people were not getting the fish they needed. When the latter occurred—such as in Lower Kalskag and Upper Kalskag in 2015 and 2016—managers considered survey data and other sources of information about fishing progress along with public commentary and were able to assess alternative management options that had potential

1. Hereinafter Working Group and Fish Commission, respectively.

to ameliorate public concern. In Lower Kalskag and Upper Kalskag, fishers felt that local conditions prevented them from harvesting enough salmon during short and infrequent fishing openings. Results from surveys and fisher outreach during this study substantiated this locally serious concern, and managers reacted by increasing fishing opportunities for fishers in this section of river. Since 2017, managers have recognized the unique fishing conditions present in these communities, and fishing openings have been set to accommodate those conditions in a way that provides what fishers perceive as equity in fishing opportunity in the middle Kuskokwim River relative to other sections of river.

Survey results could have other applications in management. For example, managers can consider the relative progress of fishing success by community or section of river along with evaluations of survey respondents' tentative fishing plans to develop more precise fishing schedules. Fishing opportunities that are scheduled based upon these aspects of the survey results could compare fishing progress as an index of progress of a salmon run as it migrates upriver. This can allow for closures that protect discrete pulses of fish, if they occur. This strategy was perceived by survey respondents as beneficial both to Chinook salmon stocks that were present in early season runs and to middle and upper river fishers whose future subsistence harvests would likely benefit from heathier stocks spawning in the headwater streams.

Managers could also use survey information to implement management actions that avoid short and infrequent openings and disperse overall fishing pressure on the run by spreading harvest over longer periods of time. This can also reduce the likelihood of overharvest on a pulse of fish, in addition to relieving competitive fishing conditions that increase fisher anxiety and risk. In this example, longer openings would potentially allow fishers to harvest salmon when it is convenient to their household's schedule, better accommodating fishing families' capacity to catch and process fish in a way that is socially and culturally appropriate.

Other survey data regarding fisher progress and planning can inform managers of potential harvests of other species arriving later in the season. As survey results in this study indicated, for example, many households may choose to target more coho salmon than is customary to supplement smaller than expected harvests of other species that were not obtained earlier in the season due to closures. This can directly guide managers in planning future openings, both for subsistence and commercial fishing. For example, survey results that attempt to quantify future harvest based on fisher progress and planning could potentially be applied to management decisions that have the goal of further reducing harvests. If survey results indicate the likelihood of increased pressure on a low run of salmon, managers may use these data to maintain restrictions that minimize subsistence harvests after commercial, sport, and personal use harvests have been restricted or eliminated. Although managers and stakeholders may see this approach as necessary in conservation efforts, survey respondents could see this technique as applying survey data in a way that directly harms fishing families. If residents were to develop a negative perception of the ways in which agencies apply survey data to fishery management decisions, fishers may become untrustworthy of any survey efforts, especially those occurring during the relatively tense subsistence fishing season. However, data from this study would much more likely help managers and the Alaska Board of Fisheries improve their precision in determining restrictions for all user groups. Thus, future similar inseason survey efforts could augment the department's ability in meeting its statutory requirement to provide reasonable fishing opportunities for subsistence users above all other consumptive uses.

Certain practical challenges arose with these surveys throughout the study period. Variable data collection schedules did not allow for the geographic and temporal progression of survey sampling that researchers had originally proposed to begin in Lower Kalskag and end in Stony River and Lime Village each study year. Division staff intended to administer surveys essentially timed with the movement of salmon stocks and fishing activity on those stocks as fish migrated from downriver to upriver. Such a plan, if successfully executed, would have provided the ideal means by which researchers and managers could track average household harvest progress by community and salmon stock run timing as fishing activity and the fish moved upriver. Division of Subsistence researchers and NVN technicians needed to plan their

fieldwork schedules according to participating communities' needs and the recommendations of tribal council staff, usually a tribal administrator. An individual community's schedule or other circumstances related to its unique needs did not always coordinate with staff availability or with fieldwork plans that staff made with other participating communities. When fieldwork scheduling conflicts arose, staff would sometimes need to deviate from the original sampling plan that progressed from the downriver end of the study area to the upriver end. Furthermore, the same unpredictability in schedule coordination sometimes prevented researchers from achieving the desired sample of community households, requiring them to return to complete a sample later in the season. When that occurred, the first portion of a sample in one community recorded characteristics of the fishery that likely differed from those recorded in the second portion of a sample in that same community. Thus, fisher progress data each season are not comparable among and within the study communities.

Another common difficulty was that, as with all surveys involving human respondents, many questions can have several interpretations resulting in challenging or inaccurate data analysis. The most common example cited by respondents in the study occurred when they were asked questions about whether they had caught the salmon they needed as of that point in the season. Many respondents did not know whether to answer based on their memory of how many and which species of fish their household had caught in the past as of that date, or to answer based upon the context of their current and recent harvests which were most often significantly lower than they had experienced historically. This demonstrates the subjective nature of such questions, and how applying them to assessments of fisher satisfaction can be challenging unless researchers adhere to strict survey protocols regarding question intent and analysis. Additionally, survey respondents' perspectives about and assessments of their fishing experiences and household needs inevitably differed. Thus, researchers were challenged to design survey questions to capture information that was accurately and consistently representative of fishery characteristics, especially those that could have significantly affected management decisions.

Similarly, technicians hired by cooperating tribal organizations occasionally misunderstood the intent or value of various survey questions. This resulted in similar difficulties of interpretation when their surveys were incomplete or incorrectly completed. Confusion occurred primarily because the compressed timeline of survey implementation did not allow for thorough training. More time in training would have significantly increased project costs. Replacing the local research assistants with presumably well-trained and experienced survey researchers from management agencies such as ADF&G would likely result in more consistently reliable data, given limited opportunities for training; however, this approach eliminates local labor from work opportunities and reduces public engagement in a fishery where many subsistence fishing stakeholders have identified the critical need for improving such opportunities. Future studies need to allocate adequate funds and time for thorough training as well as systematic review and evaluation of completed surveys in the field.

Plate 4-1.– A view of sunset from a fish camp across the Kuskokwim River from Upper Kalskag. Photo by Anna Godduhn, ADF&G.

Regardless of the challenges, there are many more benefits to collaboration among ADF&G, local tribal organization staff, and the fishing public. Each study year, many survey respondents commented on their approval of—and even surprise that—ADF&G expended time and effort to travel to their communities by boat and connect with fishers and their families personally. Inseason surveys provided opportunities to connect with communities and fishers, answer their questions about the fishery, resolve challenges, and record comments and concerns to be shared directly with fishery managers and stakeholder groups in public management meetings.

INSEASON FISHING EFFORT AND HARVEST ESTIMATION

An additional goal of this study was to assess the feasibility of estimating harvest in a section of the middle Kuskokwim River during subsistence salmon fishing openings. During study years 2015–2017, Native Village of Napaimute (NVN) research staff recruited a cohort of participating fishers to act as local research assistants while they fished with drift gillnets during subsistence salmon fishing openings in the Kuskokwim River from near the communities of Lower Kalskag, Upper Kalskag, and Aniak. Participating fishers were instructed to record the dimensions of their drift gillnets, the amount of time of each drift, and the number of Chinook, chum, and sockeye salmon they harvested in each drift. Researchers planned to contact participants following fishing openings to record fishers' harvest information. Researchers were then planning to calculate average effort statistics, such as CPUE, for the sample for each opening. Research staff had also planned to count fishing boats during subsistence salmon fishing openings to calculate an average boat count. The intent of the boat counts was to estimate the fleet size during each day of fishing and evaluate an estimate of total salmon harvest by expanding the effort statistics of the sample to the total fleet.

The proposed objective of assessing the feasibility of estimating total harvest for the study area was not achieved with these methods. During the 2015–2017 study years, Division of Subsistence research staff trained and assigned NVN technicians working in Lower Kalskag, Upper Kalskag, and Aniak with the task of coordinating harvest and fishing effort data collection with LRA fishers and operating boat-counting surveys during fishing openings. Division researchers maintained regular contact with NVN technicians while supervising and supporting them remotely from Bethel. However, the NVN technicians were unable to consistently staff the project in the participating communities during fishing openings often due to conflicts with family responsibilities or work schedules required by other jobs. For example, some NVN technicians were unable to collect LRA fishing data because the technicians themselves unexpectedly needed to fish for salmon and assist their households to process the catch during the fishing openings that this study attempted to monitor. Staff turnover also created challenges, as some technicians opted to separate service to the project when they obtained more lucrative employment elsewhere. As a result, NVN staff not originally assigned to the project strived to complete data-collection tasks to meet the study objectives even though they lacked the time or resources to do so due to their commitments to other critical and time-sensitive NVN projects.

The small samples of LRA fishers obtained for each opening also demonstrate the methods' poor feasibility. Small samples were achieved for a number of reasons, all of which elucidate the challenges experienced with the study. Immediately prior to the 2015, 2016, and 2017 fishing seasons in May and June of each year, ADF&G research staff made several trips to study communities to assist NVN research staff in recruitment of participating fishers for harvest and effort data collection. The first recruitment trips of the season typically resulted in a cohort of approximately 15 to 20 volunteer LRA fishers among all participating communities. Staff made additional trips to recruit more LRAs with the understanding that despite each participating fisher's intentions to commit to inseason data collection, many LRAs would drop out of the study or be unable to consistently provide the necessary data for a variety of reasons. Division staff discovered that by the first fishing openings many fishers either dropped out of the study or could not be contacted. Furthermore, as was expected, not every participant would be able or would choose to fish during any given opening. Some could not fish due to job or family responsibilities that conflicted with the fishing schedule. Others experienced equipment failures or did not have the resources to go fishing during every opening. Many fishers either stopped fishing after two or three openings or substantially reduced their effort as the season progressed. Nonetheless, given sufficient overall fisher participation in the study, these factors affecting individual participation may not have been a limitation on developing harvest estimates.

Another challenge encountered during the study was that most fishers did not follow instructions to proactively contact research staff to transfer their recorded data after they were done fishing each opening. Therefore, NVN technicians and sometimes ADF&G research staff needed to take the initiative to call participating fishers at the end of each day that LRAs could have fished. When staff were unable to contact all fishers, the potential sample size diminished further. Despite training prior to the fishing season, and despite the requirement that all participants provide a valid phone number to research staff, many fishers chose not to return phone calls and many telephone numbers were found to be either disconnected from service or for a telephone belonging to another person, usually a family member. Within approximately 24 to 48 hours following a fishing opportunity, research staff had obtained all possible data from participants who could be contacted. The number of successful contacts was usually a small fraction of the full list of potential fishers.

Given these challenges, the number of sample fishers in contact with researchers after each fishing opening was not sufficient to provide reliable harvest estimates for each opening. Broad confidence intervals in harvest estimates demonstrated the low likelihood that results were statistically significant. This aspect of the study results remained inconclusive, and thus, the study results were not applicable to inseason management decisions that required robust harvest estimates.

Other Division of Subsistence studies have evaluated methods of inseason community-based harvest assessment in rural Alaska communities. In 2007, the division completed a study to evaluate the effectiveness of community-based inseason harvest surveys for the Alaska Migratory Bird Co-Management Council's annual bird harvest survey throughout rural Alaska (Naves et al. 2008). Naves et al. (2008) determined that survey technicians performed best when researchers implemented effective and efficient training protocols, among other recommendations. These needed to be accompanied by a clear chain of supervision from agency researchers to community survey technician with consistent and reliable communication between the two. In an inseason salmon harvest assessment study similar to the study discussed in this report, division staff trained local research assistants in two Yukon River communities to complete household salmon harvest surveys immediately following each fishing opening during the 2013 and 2014 salmon fishing seasons (Brown and Jallen 2019). Although the methodology between Yukon and Kuskokwim river inseason harvest assessment projects differed significantly, they shared the same principal approach of training local technicians to complete all data collection tasks independently during or immediately following each fishing opportunity. None of the technicians in either study were agency employees: rather, they were under contract with representatives of ADF&G whose responsibility was to train local technicians in data collection methods in person then supervise their efforts remotely.

Researchers in Yukon River communities noted several critical factors that affected the quality of survey results under these circumstances. Training in survey techniques was critical to the success of data collection efforts. Not only do technicians need effective instruction in how to ask all survey questions properly and to accurately record responses, they must also be trained to understand how the individual survey questions relate to the objectives and scope of the research project. Without clear understanding of the purpose of recording the data requested, technicians were much more likely to misinterpret questions or exclude information that they believed to be unnecessary for completion of their tasks. Technicians also needed to anticipate challenging circumstances that can disrupt the survey process. For example, technicians must be prepared to address common misunderstandings that respondents may experience when interpreting and answering survey questions. Technicians should anticipate that unexpected problems will arise occasionally, and they must be able to troubleshoot and find solutions in the field without immediate guidance from their ADF&G research supervisor. Typically, a community-based harvest assessment project operated by a government agency or a local nonprofit organization has limited time and funding resources, which prevents researchers from effectively training all local technicians to the point of mastery of the required survey administration and data management skills. Survey administration is a skill, and effective training and experience will vary by survey length and complexity. However, if research or assessment projects rely upon data collected by remotely supervised community-based technicians, surveys need to be relatively brief and simple. Additionally, in order to recruit capable technicians, community-based surveyors must receive adequate compensation for the time needed to administer surveys effectively, a cost which must be covered by limited research and management funds available to agencies.

An additional concern with community-based harvest assessment is the difficulty in maintaining consistency of data collection techniques and data quality. High variability in the skills of local technicians (e.g., employees of a collaborating community-based organization such as a tribal nonprofit corporation) will often result in inconsistent survey quality. Technicians with good reading and comprehension skills, organizational capacity, and who possess an initiative to engage frequently and positively with respondents will be most likely to show consistently high quality in their data collection. The same is also true for technicians who are reliably available to work, often on an irregular schedule. Some technicians were challenged by data collection techniques or, as was not unusual in the Kuskokwim River project, were unlikely to initiate the critical step of effectively contacting local fishers or transferring data to ADF&G researchers for analysis immediately following a fishing opening. In these examples in both the Yukon and Kuskokwim river projects, poor comprehension of data collection techniques and lack of adherence to essential data collection and data management protocols sometimes resulted in data of poor quality or the absence of data. For both projects, researchers experienced higher

data quality results when ADF&G employees deployed in some fishing openings to assist technicians in person; however, the fundamental social networking with fishers that was so critical to local technicians' duties in this research was often lacking such that there was often little additional data for ADF&G employees to salvage.

In 2018, Division of Subsistence staff altered its research methods in collaboration with a similar USFWS harvest estimation project in the lower Kuskokwim River (see Methods chapter of this report). Agency staff conducted creel surveys in Lower Kalskag, Upper Kalskag, and Aniak after two fishing openings in June 2018 and again achieved small sample sizes, despite the preseason expectation that many fishers would be available as survey respondents. Division staff also experienced difficulties with fisher participation as researchers had in previous study years.

Although ADF&G staff experienced multiple challenges, this aspect of the study accomplished a number of important successes. One clear benefit of the project was that, despite small sample sizes, fisher data were able to supplement other sources of information that managers and stakeholders needed to consider during management meetings. Any source of demonstrably reliable, albeit potentially not universally representative, catch data had the potential to provide an index of the average fisher's experience, regardless of whether the data were expanded to broader harvest estimates. This study recorded real harvest amounts of actual fishers and calculated their CPUE and catch ratio values provided insight into fishing that day. Catch ratios can be particularly informative, especially when paired with other inseason data sources that track run timing throughout the drainage, such as the test drift gillnet fisheries operated at Bethel and Aniak. Run timing estimates informed by catch ratios are critical to managers when they need to determine the point at which the average Kuskokwim River fisher is likely to catch multiple chum and sockeye salmon and only a very small number of Chinook salmon. When this point in the concurrent runs is detected, managers can relax fishing restrictions and expect that fishers will catch their personal daily limits of fish without jeopardizing Chinook salmon conservation efforts. Such an application of Kuskokwim River Chinook salmon to chum and sockeye salmon catch ratios from inseason harvest monitoring surveys has been implemented in critical management decisions since at least 2015.[2]

A greater success arose with the development of excellent working relationships with the communities of Lower Kalskag, Upper Kalskag, and Aniak throughout all study years. Each year, staff often conducted long, informal community approval meetings during which they encouraged community members to discuss all aspects of the project. Discussions at these community meetings often expanded into broad conversations about community concerns regarding the state of subsistence salmon fishing in the Kuskokwim River. This gave ADF&G staff many opportunities to provide much-needed outreach, education, and support for middle Kuskokwim River communities that rarely consult directly with management agencies, and usually only do so remotely through select community representatives who are active in advisory stakeholder groups such as the Working Group and the Fish Commission. Staff answered questions and clarified important management and regulatory actions related to fishing. Community members were also able to provide their recommendations for managers.

Similar to outreach that occurred in all nine study communities during the household harvest assessment survey portion of the study, outreach and education opportunities occurred with individual participating fishers and NVN technicians as well. Research staff developed relationships with many fishers and other members of their households, particularly those who expressed an interest in the progress, results, and applications of the study. Their cooperation gave them an opportunity to engage directly in the management process by contributing useful information and logistical support in the field. Consistent annual contact between ADF&G and NVN staff and some community members increased some residents' awareness of the utility of harvest data collection, its importance in managing fisheries, and the value of stakeholder participation in efforts to improve fishery management.

2. Aaron Tiernan, Kuskokwim Area Management Biologist ADF&G Division of Commercial Fisheries, Personal communication with author, April 17, 2019.

Outreach to fishers was not limited to staff's work in communities. Researchers also provided information and assistance to fishers while they were on the river during staff surveys. Research staff avoided disturbing active fishers mainly out of respect for fisher privacy, and to avoid interfering in the normal operation of the fishery. However, on numerous occasions, by being available and present during openings, much like the social science method of participant-observation, staff were fortunate to experience opportunities to have positive interactions with fishers while on the water. Sometimes these interactions were friendly conversations about the day's fishing; other times staff provided fishers pertinent information about current fishing regulations. The value of building positive relationships between department staff and fishers should not be understated.

COMPARISON WITH A SIMILAR AND CONCURRENT STUDY

Historically, Kuskokwim Area fishery managers have not directly applied a comprehensive and quantitative inseason estimate of subsistence harvests from consecutive salmon fishing openings in their decisions whether to allow for additional fishing openings. Since 2012, consistently lower than average Chinook salmon run sizes have resulted in a fishery management regime with the primary goal of Chinook salmon conservation, particularly during the early part of the season when migrating adults of that species are most abundant in the mainstem Kuskokwim River where the majority of fishing occurs. Therefore, decisions to allow fishing have primarily been based upon management agencies' putative knowledge of Chinook salmon run strength in season. Management's assessments of run strength are based upon various sources of information. These sources include a preseason Chinook salmon run size forecast projected from a maximum likelihood quantitative run reconstruction model (Liller et al. 2018) and inseason assessment projects that estimate run strength and run timing. The primary inseason assessment projects are ADF&G's Bethel Test Fishery, NVN's Aniak Test Fishery, and qualitative interviews of subsistence fishers conducted in the Bethel area by Orutsararmiut Native Council (ONC) technicians in cooperation with ADF&G (Lipka and Tiernan 2018). These sources of information are supplemented by other qualitative assessments of harvest and run timing by subsistence fishers during inseason meetings with the Working Group and Fish Commission.

At the time of publication of this report, ADF&G had not implemented a systematic inseason harvest assessment research program in the Kuskokwim Area; however, since 2015 and as noted in the Methods chapter of this report, the USFWS in collaboration with the Fish Commission had deployed a quantitative harvest estimation project in a portion of the lower Kuskokwim River (YDNWR; Staton 2018). Justification for the USFWS inseason harvest estimation project came following federal special actions (FSAs) enacted by the Federal Subsistence Board (FSB) beginning in 2014 that directed the USFWS to assume management of the Chinook salmon subsistence fishery in the Kuskokwim River within the boundaries of the YDNWR. The FSB's rationale for the FSAs was that years of lower than average Chinook salmon returns and subsequent unprecedented salmon fishing restrictions had prevented subsistence fishers from meeting their annual needs for salmon. Under the Alaska National Interest Lands Conservation Act (ANILCA; 16 US Code Chapter 51), each year the FSAs required the USFWS to ensure that federally qualified rural subsistence users had a priority over all other fishers to harvest Kuskokwim River Chinook salmon, the species for which management agencies deemed special conservation measures were necessary.

From 2015 through 2018, USFWS deployed a project that included dockside fisher creel surveys and aerial boat-counting surveys during each fishing opening. The ADF&G study described in this report assisted with those creel surveys in 2018 in Lower Kalskag, Upper Kalskag, and Aniak. Surveys in the lower Kuskokwim River provided a harvest and effort sample from fishers contacted primarily at the Bethel boat harbor as well as several outlying communities. Also, USFWS aerial boat-counting surveys provided a sample of the fishing fleet size in the same sections of the river during each opening. In the simplest of terms, fisher harvest and effort data from USFWS creel surveys were used to calculate an average salmon catch per boat per opening. The average catch was expanded to an estimated total fleet size to calculate an estimated total salmon catch per opening. The USFWS analysts incorporated into their

harvest estimation model data collected by ADF&G and NVN in Lower Kalskag, Upper Kalskag, and Aniak in 2018. For a complete description of the USFWS creel survey project methods, results, and conclusions see Staton (2018). In 2016 and 2017, the USFWS and Fish Commission utilized Chinook salmon harvest estimates to determine fisher progress toward a total harvest target for the season. The two organizations had set this harvest target and a Chinook salmon escapement target prior to the 2016 and 2017 fishing seasons. They determined that these targets were their primary management goals each season.

With a large paid staff of creel surveyors that included employees of USFWS, the Fish Commission, and ONC, that project had the capacity to contact several hundred fishers during each opening. This critical factor provided the sample sizes necessary to make harvest estimates that USFWS and the Fish Commission determined to be representative of actual harvests, such that these two groups chose to directly apply creel survey data to the inseason management of fishing schedules in the YDNWR. However, that project focused harvest estimation on lower Kuskokwim River communities, and only provided harvest estimates from middle Kuskokwim River fishers when ADF&G supplemented their data with information from Lower Kalskag, Upper Kalskag, and Aniak. Thus, a survey sample biased in favor of lower Kuskokwim River respondents, Bethel in particular, potentially underestimated total harvest. Expanding survey efforts to outlying communities is necessary but difficult. Some communities have been unable to provide local staff to survey fishers, which requires that agency staff travel to remote locations for one- or two-day survey trips. Other practical challenges arise in small communities. For example, many lack a central harbor or a boat dock, which often results in fishers spreading to multiple locations throughout the community when they return from fishing. Surveyors then must attempt to contact fishers who are dispersed throughout the community, increasing the likelihood of missing potential survey respondents. In 2018, ADF&G staff addressed this issue by deploying a snowball sampling technique to identify and contact as many fishers as possible. Finally, USFWS harvest estimates in the lower Kuskokwim River relied upon aerial surveys to count fishing boats, as opposed to surveys operated by boat in the research described in this report. Effective inseason harvest monitoring is expensive in large fisheries such as the Kuskokwim River subsistence salmon fishery. Depending on the temporal or geographic scale of a harvest assessment program, budgetary constraints in designing a project that utilizes fishing boat counts may require that such counts be conducted by water-based technicians in boats, rather than technicians in relatively more expensive chartered or agency airplanes.

Efforts that USFWS and the Fish Commission made to expand creel survey data collection from Bethel into other smaller and more remote lower Kuskokwim River communities faced the same pitfalls that division researchers experienced in this study, as well as in the ADF&G Division of Subsistence inseason migratory bird and inseason salmon harvest assessment studies discussed earlier in this chapter (Naves et al. 2008). The USFWS and Fish Commission training methods may not have effectively prepared a large enough corps of capable and reliable community-based data technicians to work in communities other than Bethel. While in some remote communities data collection was relatively successful, in other communities technicians provided very small numbers of completed surveys after each opening or failed to record any fishing data at all. Researchers from USFWS, the Fish Commission, other tribal organizations, and the project's funding organization conducted survey training workshops each year in Bethel prior to the fishing season. Survey technicians from all participating communities attended. A Division of Subsistence researcher was also invited to meetings in 2017 and 2018 and attended. Division staff observed that several topics in the training agenda focused primarily on background information about the project's goals and need, the role of tribal organizations in the management process, and justification for social science research in fishery management. These were all important and valuable points of discussion, especially because trainers also desired to develop their staff's awareness of these issues as a way to motivate and inspire young technicians to choose careers in fisheries management, an essential and laudable service to the subsistence fishing communities that the organizations represent. However, a noticeable portion of the instruction was not directly applicable to the skill development needed for successful harvest data collection in season.

The experiences described in Naves et al. (2008) and Brown and Jallen (2019) and those of multiple other survey projects completed by Division of Subsistence staff demonstrate the need for efficient and effective survey technician training methods that focus on the following critical aspects of quality data collection: 1) knowledge and comprehension of the survey questionnaire; 2) effective methods of asking survey questions and recording survey responses in a manner that is consistently precise and accurate; 3) ability to anticipate and appropriately respond to unexpected difficulties when conducting surveys and interacting with respondents; and 4) development of logistical and organizational skills for survey implementation and data management in the field. Although project background is important for understanding the purpose and scope of a study, it should be discussed briefly and with the goal of providing technicians with the information they will need to explain the purpose and scope of the project to survey respondents, particularly when informing respondents of the ways in which their household's harvest data will be applied to management and regulation.

Creel surveys are commonly deployed in many fisheries worldwide, including relatively unregulated artisanal fisheries, which suggests their value as a possible inseason management tool (Jones and Pollock 2012). Fishery managers have also utilized these methods in many artisanal commercial and subsistence fisheries worldwide (see McCluskey and Lewison 2008; Padilla and Trinidad 1995; Pelletier and Ferraris 2000). However, in North America creel surveys are most often deployed in recreational fisheries, and respondents are unlikely to be contacted by researchers on more than one occasion. When creel surveys are deployed in the lower Kuskokwim River during multiple subsistence fishing openings each season, fishers are likely to be contacted by a surveyor each day they return home or to a boat harbor after fishing. This can result in survey fatigue among respondents, which can bias survey results in favor of people who possess the will to withstand multiple surveys or even increase the chance that respondents will become annoyed and give incomplete, misleading, or even false information in order to end the survey quickly or avoid it altogether. Survey fatigue can also diminish the likelihood that fishing households will agree to participate in the equally important post-season household harvest survey project that occurs each year in the Kuskokwim Area. The USFWS inseason harvest assessment project provides harvest estimates that quantify and track Chinook salmon catches roughly through the end of the Chinook salmon season. Recently that has been the point in the season when USFWS has ended the FSA to manage the salmon fishery, and management authority in YDNWR waters has returned to ADF&G. The USFWS project has not coordinated with postseason survey efforts; for example, by storing inseason data by household identifiers to be retrieved during a postseason survey and shared with respondents to assist them with recall.

Both the ADF&G harvest and effort project that recruited LRA fishers and the USFWS project that deployed creel surveys encountered challenges in their research. Both were labor intensive projects that required multiple staff to contribute hundreds of person-hours, often at overtime pay scales, in a 24- to 48-hour period to obtain data from each opening. Boat-counting surveys required expensive and potentially high-risk travel by airplane or boat for several hours each opening. Also, to the extent the inseason survey design worked, it was dependent upon a limited number of open fishing periods. Increasing these in number or length would call for more staff effort, time, and funding for monitoring; or managers would need to develop some alternative sampling strategy. Furthermore, an ideal inseason survey project would need to anticipate unpredictable fishing schedules and adapt to them efficiently and effectively.

Plate 4-2.–Boats parked in the Stony River at Lime Village, 2016. Photo by Chris McDevitt, ADF&G.

Overall, USFWS managers consider their lower Kuskokwim River creel survey project a success in meeting its objectives to provide robust harvest estimates during each subsistence salmon fishing opening and to achieve the goal of tracking Chinook salmon catches until fishers reach a target harvest amount within the boundaries of the YDNWR, a subset of the total salmon fishery (Staton 2018). However, this goal understandably cannot accommodate the need for an estimate of a total drainagewide harvest of all salmon species. The USFWS creel survey results are not currently included as part of ADF&G's annual run size estimation methods (Liller et al. 2018). Thus, the value of USFWS results is currently only realized in season, and cannot be applied to achieving ADF&G's more comprehensive goal of estimating total harvest to inform annual run size estimation, which in turn allows for evaluation of escapement goal achievement, annual run forecasts, and long-term assessment of drainagewide salmon population and harvest trends. If managers and researchers are to evaluate the overall feasibility of studies similar to those discussed herein, they must consider the fundamental limitations of less than comprehensive harvest assessment goals that are solely applied to inseason harvest estimation. If a drainagewide inseason creel survey project were to be considered as part of a future research program that supports the entire scope and goals of salmon fishery management in the Kuskokwim Area, its results would need to be applicable to a comprehensive annual run size estimate. Additionally, this would likely replace the postseason household harvest survey program, a long-standing program with consistency in methods that ask selected respondents to complete one brief survey for their entire household each year. However, a drainagewide inseason creel survey project would be cost prohibitive and result in survey respondent fatigue, each of which would reduce such a program's effectiveness and efficiency.

Despite some recent successes in inseason harvest assessments, many Kuskokwim Area fishery stakeholders still feel disenfranchised by the lack of fishing opportunities, a confusing regulatory system, and the challenge of engaging in the public process of fishery management when they live in remote communities distant from fishery management and regulatory forums. The ADF&G study was successful in developing collaborative relationships in subsistence fishing communities—relationships that establish foundations upon which researchers can improve inseason harvest assessment projects that have widespread community support and stakeholder involvement. This result is critical to the development of more comprehensive and precise fishery assessment projects and management strategies and is a fundamental step toward better fisher engagement in management and regulation.

CONCLUSIONS AND RECOMMENDATIONS

The principal accomplishment of this study was the deployment of ADF&G and NVN staff in nine communities in the middle Kuskokwim River to conduct surveys that assessed the fishing progress and plans of subsistence salmon fishing households. Middle Kuskokwim River households had opportunities to provide fishing information pertinent to the management process. Data from these surveys were shared directly with management agency staff and stakeholder groups to be incorporated into discussions of fishery management decisions that affected all fishers. Inseason household surveys offered a novel tool for hundreds of individual stakeholders to contribute directly to the management process. Surveys also gave agency staff opportunities to improve outreach and information-sharing directly with stakeholders, to answer their questions relevant to their experience as subsistence fishers, and to resolve concerns or challenges that could be addressed by direct contact with ADF&G representatives. Quantification of subsistence salmon harvests, particularly for Chinook salmon, has become a critical part of the management process in the Kuskokwim Area each year. Implementation of inseason projects that estimate salmon harvests and assess subsistence fisher satisfaction are likely to continue during seasons when conservation of Chinook salmon is the primary concern of fishery managers. A more practical and possibly more effective harvest estimation and household harvest assessment program would be likely to succeed with coordination and financial support among multiple Kuskokwim Area research partners. The status of communication among state and federal agencies and stakeholder groups has potential to improve so that all partners can collaborate on development of common project objectives and goals, agree to efficient divisions of labor, and assist in effective techniques of consulting with tribal partners.

Despite the need for improved inseason assessments of subsistence salmon fishing activity in the Kuskokwim River each year, management agencies' increased intrusion into the daily affairs of area residents' summer activities has serious risks. Managers and researchers must carefully consider the effects of multiple survey contacts on the willingness of fishers to participate and share fishing information. Not only can data collection methods result in biased samples, but researchers, particularly those employed by the state and federal governments, can also fail to meet stakeholder expectations that they will minimize intrusion into the personal lives of the fishing public while protecting their privacy and confidentiality. A possible solution to the potential problem of excessive surveys by government agencies would be a permit system linked with a harvest calendar or recording form that allows fishers to report total harvest once at the end of the fishing season through an internet website or in the mail. However, it is also unlikely that the postseason harvest survey program could be discontinued, due to its demonstrated effectiveness in supporting salmon run size estimation and the management decision-making process. Rather, inseason harvest sampling methods could be refined to support or ground-truth the postseason survey results while providing reliable inseason information for managers. If a permit system were implemented, it could not immediately replace the postseason surveys with their high level of participation and general reliability; however, the surveys could potentially be used to evaluate the effectiveness and accuracy of a permit system before committing to one as a primary harvest reporting system. More widespread use of harvest calendars by fishing households could also reduce the likelihood that managers would need to consider implementation of harvest permits (see also Fall 2003; Fall and Shanks 2000).

The most successful and sustainable inseason harvest assessment program will work with Tribes to develop a system of community-based harvest monitors, while addressing the challenges discussed in this chapter. Agency staff and stakeholder groups must facilitate the research process by traveling to fishing communities to provide training of data collection technicians, data management and analysis services, and logistical support. In addition to providing employment opportunities for residents of fishing communities, a project that relies on community-based harvest monitors will improve local engagement in fishery management and likely result in more reliable data. In order to develop better collaboration with tribes and fishers, managers and researchers must increase their time spent in communities and among fishers directly engaging with the public during the salmon fishing season—as did Division of Subsistence staff during this study. As an important admonition, this final point is a prospect that would require significantly increased funding of agency staff for inseason fieldwork.

One of the goals of this project was to evaluate whether reliable harvest estimates could be based on inseason sampling. This would be done by determining the size of the fleet each day and applying the average harvest to unsurveyed boats day-by-day. For this to produce reliable estimates, a representative sample must be obtained on each of those days. Based on historical sampling efforts in subsistence fisheries, the division relies on the assumption that either 30 households or 50% of a population, depending on community size, must be sampled in order to produce reliable estimates. In this case, researchers were unable to contact enough households throughout the observed openings to calculate estimates or draw any definitive conclusions about the total estimate of the fleet for any given day; however, selected data were shared with USFWS fishery research staff. Using data from this study, the USFWS researchers had the capacity to develop a preliminary harvest estimate for fish caught during approximately three fishing openings in 2018.

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APPENDIX A:

MIDDLE RIVER FISHER DATA SHEET

Salmon Harvest Study 2016

Native Village of Napaimute/Alaska Department of Fish and Game Division of Subsistence

Please write down information from each salmon fishing drift in one line across. Someone will contact you to get this information after you go fishing.

What is your home community?_____

								Harvest amounts		
Date	**Drift number**	**Mesh size**	**Net length**	**Net depth**	**Location**	**Drift start time**	**Drift stop time**	**Kings**	**Chums**	**Reds**

APPENDIX B:

2015 MIDDLE RIVER INSEASON SURVEY

ADFG Subsistence Division Middle Kuskokwim Inseason Subsistence Salmon Survey **JULY 2015**

HHID		Person Interviewed	
DATE		Home Community	
Start Time		Location of Interview	
Stop Time			
Interviewer			

What kind of gear do you usually use to fish for salmon?	Set net	Drift net	Rod & reel	Fish wheel	Other	**NOTES**
Do you own or borrow this gear?	O/B	O/B	O/B	O/B	O/B	
If set or drift... Length in ft						
Mesh in inches						
When you think about the amount of salmon you plan to get this year, about how much have you been able to get so far?	None/just starting	1/4	1/2	3/4	Done	

Have you been getting the salmon your household has needed up to this point in the year?	Y / N
If NO... Why?	
Also if NO... Will you do anything differently because you haven't gotten enough salmon?	Y / N
If YES... What?	
Is your household responsible for providing salmon to any other households?	Y / N
If YES How many?	
About how many salmon can your household catch in a day before you would need to stop fishing?	
About how long does it take for your household to process that many salmon so that they're ready to put away for the year? *(Record number of days.)*	

Which kind(s) of salmon do you plan to target for the remainder of the season?	CHIN	CHUM	SOCK	COHO
	Y / N	Y / N	Y / N	Y / N
About how many will you need of each?				

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ADFG Subsistence Division Middle Kuskokwim Inseason Subsistence Salmon Survey **JULY 2015**

Are there any environmental factors that have affected your salmon fishing this year? Y / N

NOTES

If YES ... What?

Do you have any questions, comments, or concerns?

Interviewer comments

STOP TIME

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APPENDIX C:
2016–2018 MIDDLE RIVER INSEASON SURVEY

ADFG Subsistence Division Middle Kuskokwim Inseason Subsistence Salmon Survey **JULY 2016**

HHID		What is your home community?	
Date		*Location of Interview (if not in home community)*	
Time			
Interviewer			

1	What kind of gear do you usually use to fish for salmon?	Do Not Fish	Set net	Drift net	Rod & reel	Fish wheel	Other	**NOTES**
2	Do you own or borrow this gear?		O / B	O / B	O / B	O / B	O / B	
3	*If set or drift...* Length in ft							
4	*If set or drift...* Mesh in inches							

5	How far along is your household with salmon fishing this year?	Not fishing this year	Haven't fished or just starting	1/4	1/2	3/4	Done

6	Have you been getting the salmon your household has needed up to this point in the year?	Y / N	Don't need/use

7 *If NO...* Why?

8 *Also If NO...* What do you plan to do to make up for the salmon you didn't get?

9	Do you fish for other households?	Y / N
10	*If YES...* How many?	
11	When you go fishing, how many salmon do you try to catch before you need to stop **for the day?**	
12	How many salmon do you try to catch **for the year?**	

13	How many of each kind of salmon will you try to catch for the rest of the fishing season?	Kings	Chums	Reds	Silvers

Page 1

14 Do you have any questions, comments, or concerns?

Interviewer comments

APPENDIX D:

2018 MIDDLE RIVER CREEL SURVEY

MIDDLE KUSKOKWIM RIVER COMMUNITY-BASED
MONITORING INTERVIEW FORM
ADF&G - Division of Subsistence / Native Village of Napaimute

☐ CHECK if NVN PARTICIPATING FISHER ☐ CHECK if DATA TRANSFERRED

Village Monitor (Name and Village): _____

Interview Date (MM/DD): _____/_____/ 2018 Interview number this date: _____

Where is the person you are interviewing? ☐VILLAGE ☐FISH CAMP ☐BOAT LAUNCH ☐OTHER: _____

Date Trip Started (MM/DD): _____/_____ Fishing Location Zone (code from map): _____

Time Trip Started (hh:mm): _____/_____ Time Trip Ended (hh:mm): _____/_____

Net Type (*ONLY ONE TYPE PER SURVEY. If 2 types fill out 2 surveys.*): ☐ Drift net ☐ Set net

Net Length: _____ How is length recorded? ☐Feet ☐Fathoms ☐Shackles

Mesh size (inches): ☐ 4 ☐ 5 ☐ 5 1/8 ☐ 5 ¼ ☐ 5 3/8 ☐ 5 ½ ☐ 5 5/8 ☐ 5 ¾ ☐ 5 7/8 ☐ 6 ☐ _____ OTHER *(Specify)*

Time with net in water fishing: _____ : _____
(hours colon nearest 15 minutes; e.g., 2:30 is 2 hours and 30 minutes)

Number **KINGS** harvested _____

Number **CHUMS** harvested _____

Number **SOCKEYE** harvested _____

Number of **SHEEFISH** harvested _____

Number of **OTHER WHITEFISH** harvested _____

Thank you for your help. This process is designed to contribute to in-season management decisions based on community-based monitoring. Is there any other information or questions you would like to share, or any suggestions to improve the survey, or comments to fishery managers?

_____

_____

Interviewer's Comments:

_____

_____

APPENDIX E:
COMMUNITY SUMMARY

COMMUNITY SUMMARY - Technical Paper No. 455

Inseason Subsistence Salmon Harvest Assessments in 9 Communities of the Middle Kuskokwim River, 2015-2018

This is a summary of an Alaska Department of Fish and Game Subsistence Division project from 2015 to 2018 in the middle Kuskokwim River. Its goal was to develop methods to estimate salmon harvests during the fishing season. Data gathered during this study helped Kuskokwim Area fishery managers with making inseason management decisions during the study years.

Background

Kuskokwim River residents rely heavily on salmon as part of their subsistence diet. However, due to recent declines in Kuskokwim River Chinook (king) salmon, fishery managers have significantly limited fishing openings in the Kuskokwim River to protect Chinook salmon from over harvest. They also made other severe restrictions to prevent the harvest of Chinook salmon when fishers were allowed to target chum (dog) salmon and sockeye (red) salmon for subsistence. The decline in Chinook salmon together with fishing regulations have made it challenging for many Kuskokwim River subsistence users to get the fish they need.

In order to regulate the fishery as well as possible, managers need to have accurate estimates of total Chinook (and other) salmon returns each year. To get those essential run size estimates, ADF&G needs to count all the fish that are harvested and all the fish that make it to the spawning grounds (escapement). Currently, harvest is estimated with the annual postseason household subsistence surveys; escapement is monitored by counting the number of Chinook salmon that swim past weirs located in several Kuskokwim River tributaries.

Information from surveys and weirs only comes after each season is over. Therefore, managers get an estimate of the total Chinook salmon run size a few months after fishing season is over. ADF&G researchers and managers thought it would be helpful to collect harvest data in season to improve the department's ability to know how well fishing households are doing as they try to get the salmon they need. This could help agencies adopt inseason management ideas that maximize fishing opportunities while still conserving as many Chinook salmon as possible.

"It's good for surveys like this to be done, and any effort to report back the information gathered from these surveys reinforces people's desire to provide truthful information. I think it's absolutely critical they try to save the salmon, whatever it takes. Some places in the country have lost their salmon already"
Aniak resident, 2015

The goal of this study was to develop methods for fishery research agencies and community organizations to work together to collect inseason information about salmon harvests during subsistence fishing openings. Conducted during subsistence salmon fishing seasons in 2015–2018, the project included surveys with households that rely upon subsistence salmon resources in 9 communities of the middle Kuskokwim River region: **Lower Kalskag, Upper Kalskag, Aniak, Chuathbaluk, Crooked Creek, Red Devil, Sleetmute, Stony River,** and **Lime Village**. Participation in this study was voluntary and all information shared remained anonymous.

Study Objectives

1. During the subsistence salmon fishing season, conduct surveys in 9 study communities by going door-to-door and asking households to assess their progress as they try to meet their yearly needs for salmon.
2. Collect daily harvest and fishing effort information from a sample of fishers active near Lower Kalskag, Upper Kalskag, and Aniak to develop inseason fishing effort and catch per unit effort (CPUE) estimates among all subsistence salmon fishers in those communities.
3. Record daily estimates of the number of boats fishing near the communities of Lower Kalskag, Upper Kalskag, and Aniak.
4. Evaluate the effectiveness of inseason harvest and fishing effort monitoring as a tool to estimate total subsistence harvest in the study communities.

HOUSEHOLD HARVEST SURVEYS

During each study year in mid-July through early August, researchers conducted a household survey in up to 9 middle Kuskokwim River study communities to record residents' assessments of their fishing success and progress towards their salmon fishing goals. A total of 729 surveys were conducted from 2015–2018. The survey asked respondents about the following questions:

- Did members of the household subsistence fish for salmon?
- What types of salmon fishing gear did the household use?
- How far along was each household in getting the salmon it needed? If they were not getting the salmon they needed, why they had not met their goals by that point of the season? *(see example in Figure 1)*
- How many households did respondents share subsistence salmon with?
- Each time they go fishing, how many salmon can households catch and how long does it take to process those fish?
- How many more salmon did households plan to harvest through the rest of the fishing season?

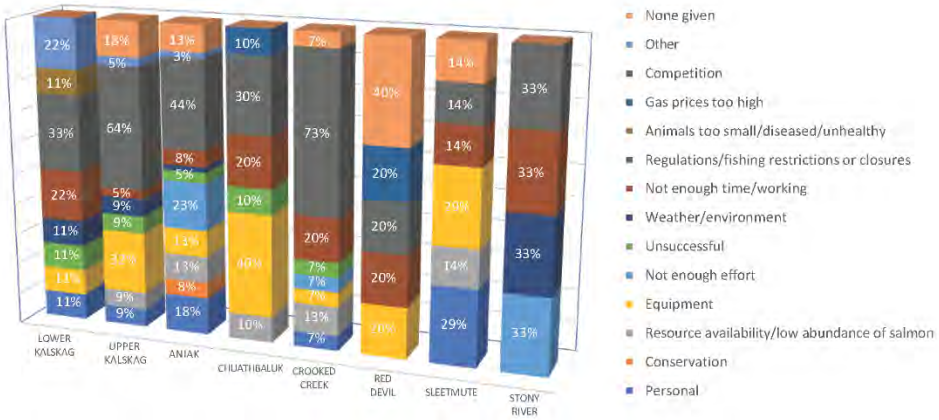

Figure 1 – Reasons provided by sampled households who did not get enough salmon, middle Kuskokwim River area communities, 2015. (ADF&G was not able to contact fishers in Lime Village in 2015)

Data from surveys was shared with Kuskokwim Area Fishery managers and advisory stakeholder groups like the Kuskokwim River Salmon Management Working Group (the Working Group) and the Kuskokwim River Inter-Tribal Fish Commission (the Fish Commission) during weekly management meetings in Bethel. Information from this research was used to make more precise management decisions during the study years in order to respond to the needs of subsistence fishing households.

INSEASON HARVEST and EFFORT ESTIMATES

During study years 2015–2017, Native Village of Napaimute (NVN) research staff recruited participating fishers to act as local research assistants while they fished with drift gillnets near the communities of Lower Kalskag, Upper Kalskag, and Aniak. In 2018, ADF&G researchers slightly altered the project methods when they collaborated with a similar US Fish and Wildlife Service (USFWS) harvest estimation project that was happening in the lower Kuskokwim River.

In all years, participating fishers were asked questions about the length and mesh size of their drift gillnets, the amount of time of each drift, and the number of Chinook, chum, and sockeye salmon they caught in each drift. Researchers were then planning to calculate average effort statistics such as the catch per unit effort (CPUE) and the ratio of Chinook salmon to chum and sockeye salmon in their catch. The CPUE tells managers about how many salmon of each species the average fisher caught with a 25 fathom (150 foot) drift gillnet during an opening. The catch ratio provides an idea of when the average fisher is likely to catch many more chum and sockeye salmon than the number of Chinook salmon. That is usually the point in the season when managers can think about letting people go out and catch more fish without worrying about an over harvest of Chinook salmon. However, despite the expectation that many fishers would be available to be contacted during each study year, the number of participating fishers after each opening was not enough to provide reliable harvest estimates.

Another goal of this project was to evaluate whether reliable harvest estimates for all fishers could be based on this inseason sampling. This would be done by counting the number of boats fishing each day, and then applying the average harvest from participating fishermen to all the boats that were counted.

ADF&G staff working with tribal employees and local research assistants were unable to contact enough households or complete enough boat counts throughout the observed openings. Therefore, they could not calculate harvest estimates or draw any accurate conclusions about the total number of boats fishing in any given opening. However, data were shared with the USFWS Yukon Delta National Wildlife Refuge, and their staff were able to use that information to get better ideas about harvests in Lower Kalskag, Upper Kalskag, and Aniak.

Even though results from contacting fishers and counting boats during each opening were inconclusive, the project helped develop excellent working relationships with the participating communities. It also provided several important insights for managers, the Working Group, and the Fish Commission to consider during their management meetings.

COMMENTS and CONCERNS

Household survey respondents were also invited to provide comments or concerns regarding their experiences with the subsistence salmon fishing season, or with salmon fishing management and regulations in general. Overall, comments and concerns shared by survey respondents were similar during all study years.

> *"The first few openers there were too many fishermen. There's only a few drifting spots around here. We tied up and waited and waited and waited and finally we left [...]. The old way of doing things was that you catch only what you can take care of in one day, then go back out over a period of days or weeks. But lately we feel like we have to catch as much as we can all at once because it's only little bit of fishing time."*
>
> Upper Kalskag resident, 2015

Closures & fishing schedule:

- Numerous respondents said that implementing a few short fishing openings in late June and early July resulted in **crowded fishing conditions** and **insufficient time to catch the salmon they needed.** This created significant competition especially in the larger communities such as Lower Kalskag, Upper Kalskag, and Aniak, where river conditions provide a limited amount of fishing locations.
- Some people explained that **earlier fishing opportunities in June would be helpful** because weather conditions are more favorable to process and dry the fish at that time.
- Some fishers expressed the **desire to have openings on days, such as weekends,** when people are more likely to be off work.
- Many respondents shared their concern that salmon **fishing openings in the lower Kuskokwim River make it harder for middle Kuskokwim River fishers to get the salmon** they need, citing both the competition with larger population centers and the longer drift gillnets permitted downriver.

> *"Not everyone has cell phones or internet to get permits and licenses [...]. Conservation is a good priority. People will adjust, and they want to follow the rules, but they need better information and easier access to information and the permits."*
>
> Aniak resident, 2018

Commercial fishing:

- Multiple respondents discussed the **pressure of commercial fishing on salmon stocks,** both in terms of commercial fishing in the lower Kuskokwim River and in the Bering Sea trawl fisheries. People emphasized the need to prioritize subsistence salmon fishing over commercial fishing.

Communication & outreach:

- Several people recommended **better outreach** to fishers and **improved communication** about management decisions.

> *"Restrictions have been good for those of us that live upriver. I think we're getting a better stock of kings to the breeding grounds. We hadn't seen big kings for a number of years, but this year there's been a number of them. Thanks to [ADF&G] and the [Kuskokwim River Salmon Management Working Group] for wading through such a tricky subject. Everybody is so passionate about it, but they did a good job of making it work."*
>
> Sleetmute resident, 2015

Positive Feedback:

- Many fishers expressed **appreciation for the increase in fishing opportunities** provided by managers during the 2017 and 2018 fishing seasons. They said that they were able to harvest what they needed on a more flexible schedule.
- Other comments reflected middle Kuskokwim River residents' **general support of efforts to conserve Chinook salmon.**
- Several comments also reflected the **good will that many respondents had bout research like this study,** as well as the community outreach that accompanied it.

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ADF&G complies with OEO requirements as posted at *http://www.adfg.alaska.gov/index.cfm?adfg=home.oeostatement*.

Conclusions

- The main accomplishment of this study was ADF&G and NVN staff working together in 9 communities in the middle Kuskokwim River to complete household surveys during the 2015–2018 fishing seasons. The information recorded in the surveys helped track the progress of the salmon run as fishers harvested them through the season from near Lower Kalskag to the furthest upriver study communities of Stony River and Lime Village. It also gave managers insight into whether fishers had been able to get the salmon they needed by the midpoint of the season, and if not, what they planned to do differently to try and fulfill their needs.
- Many Kuskokwim Area fishers told researchers that their families were feeling stressed by the lack of fishing opportunities and years of unpredictable fishing seasons. They explained that being able to participate in the public process of fishery management is difficult to do, especially when they live in remote communities.
- People's concerns and other data collected during this study were shared directly with management agency staff, the Working Group, and the Fish Commission to be used in management meetings that affected all fishers. In this way, inseason household surveys offered a new tool for hundreds of individual fishers to contribute directly to the management process.
- Surveys also gave ADF&G opportunities to improve outreach and information-sharing directly with stakeholders. ADF&G researchers provided fishing information and answered people's questions about subsistence fishing. Staff also helped with many other concerns about management and regulation that affected fishermen and their families in the study area.
- This study was successful in building collaborative relationships between subsistence fishing families and ADF&G staff. ADF&G can use results from this project to improve inseason harvest assessments that have widespread community support and stakeholder involvement. This result is critical to the development of more comprehensive and precise fishery assessment projects and management strategies, and it is a fundamental step toward better fisher engagement in management and regulation.

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