Technical Paper No. 448

Pilot Inseason Monitoring of Subsistence Salmon Harvests in the Yukon River Drainage

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

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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. states	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

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

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ABSTRACT

Accurate and timely harvest data are a key tool in sustainable fisheries management. Since 2009, multiple stakeholders have expressed interest in exploring inseason subsistence salmon harvest monitoring for the Yukon River subsistence salmon fishery in order to 1) provide more robust salmon harvest timing data in coordination with inseason genetics data, and 2) produce aggregated salmon harvest estimates throughout the drainage to better meet the harvest share obligations of the Yukon River Salmon Agreement under the Pacific Salmon Treaty. Currently, subsistence salmon harvest data are collected by the Alaska Department of Fish and Game (ADF&G) Division of Commercial Fisheries in a postseason survey in which ADF&G staff conduct face-to-face household surveys with a stratified sample of fishing households in most Yukon River communities. To explore the feasibility of inseason harvest data collection, researchers used a combination of methods, including in-person household surveys, participant observation, and detailed documentation of community responses to the research. The research was designed to occur over two years in four communities (one community in the first year and three communities in the second year), but ultimately only two communities participated (one in each year). Although there are several potential strengths to inseason data collection and aggregation, researchers found that methods chosen in this pilot study were not sufficient to produce the amount and quality of data currently collected in the postseason survey and also that the project was not cost effective. A primary concern was the dearth of consistent capacity on the local level in the skills needed for independent work with complex survey designs. Other models for an inseason survey program could be considered, including voluntary reporting by fishers or limiting data collection to fishing households only. However, these approaches limit the types of data collected and would prohibit some analyses currently produced.

Key words: household surveys, subsistence, salmon, Yukon River, survey methods.

1. INTRODUCTION

Project Background

Beginning in 2009 with the most recent Chinook salmon declines on the Yukon River, several stakeholders expressed interest in exploring inseason subsistence salmon harvest monitoring in order to provide aggregated salmon harvest estimates to managers as the season progressed. Currently, subsistence salmon harvest data are collected by the Alaska Department of Fish and Game (ADF&G) Division of Commercial Fisheries in a postseason survey in which ADF&G staff conduct face-to-face household surveys with a stratified sample of fishing households in every Yukon River community, except those near the road system where harvest permits are required. These data are collected each October and generally not available to managers until spring of the following year (Jallen et al. 2017a:5–12). An inseason approach as a potential alternative to the current postseason survey program may provide managers with additional tools to more effectively manage salmon harvests by 1) providing more robust salmon harvest timing data in coordination with inseason genetics data, and 2) producing aggregated salmon harvest estimates throughout the drainage to better meet the harvest share obligations of the Yukon River Salmon Agreement that is part of the Pacific Salmon Treaty.

As a result, evaluation of inseason subsistence salmon harvest monitoring was identified as a priority for the Chinook Salmon Research Initiative funds allocated by Governor Parnell in 2013 (ADF&G Chinook Salmon Research Team 2013). This pilot project for the Yukon River included two phases of data collection (Figure 1-1). The initial year of data collection allowed an opportunity for researchers to experiment with survey methods in a single community (Grayling) and provide preliminary assessments of costs and community response to this more intensive data collection approach. The second year of data collection was originally designed to be conducted in three other communities in the drainage, but ultimately was only conducted in one other community (Marshall). Data collection in Marshall built on the results of the research in Grayling.

This pilot project utilized a combination of the existing catch calendars and an inseason survey based on the original postseason survey format. ADF&G staff worked with local research assistants to collect harvest data on a weekly basis over an approximately 12- to 15-week period. The data collection effort began in early June in both study years (2013 and 2014) timed with the regulatory subsistence window openings and continued through October, when the coho salmon run ended.

Two key research questions guided this project: what are the costs associated with inseason harvest data collection, and are these data useful enough to managers to justify the cost? To address these over-arching questions, we asked the specific questions below:

1) What are the costs associated with inseason salmon harvest data collection in communities along the Yukon River?
2) What are the most effective methods to collect these data?
3) Can these data be reported and processed quickly enough for managers to effectively use them?
4) What are the most useful aspects of inseason harvest data for managers?
5) Does an inseason harvest component result in more reliable or precise data than relying solely on postseason recall surveys?

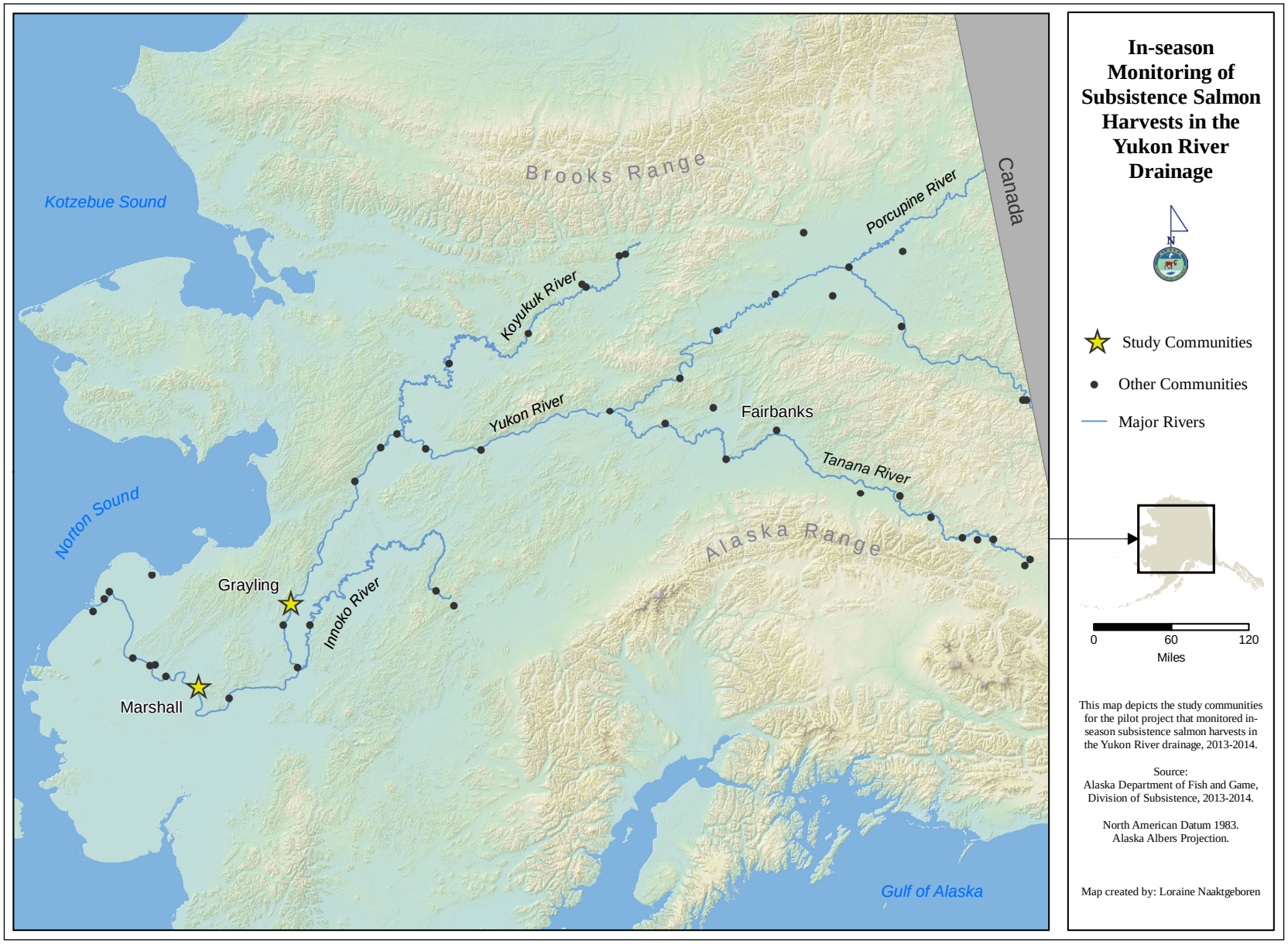

Figure 1-1.–Yukon River drainage study communities, 2013 and 2014.

Regional Background

The Yukon River stretches approximately 2,000 river miles[1] from the eastern side of the Boundary Range of British Columbia's coast to the Bering Sea and drains 331,726 square miles of diverse and productive habitat for northern wild resources, especially salmon. Prior to contact with Europeans, this landscape was inhabited by indigenous populations organized into small, family-based groups that moved between seasonal camps, hunting, fishing, and gathering wild resources for food. Although the resource base available for harvest differed from area to area, salmon were one of the few resources available the length of the river due to their annual migrations to spawning grounds throughout the drainage. The people of the Yukon River relied on these annual runs of salmon and spent summers harvesting and processing salmon to feed their families through the long, cold winter.

The presence of large dog teams used for winter transportation created a need for harvesting large quantities of salmon for dog food. As described by Andersen and Scott (2010), an expanded use of dogs in support of the fur trade introduced with the first waves of Europeans in the mid-1850s led to an increased focus on harvesting salmon to feed dogs in addition to people. Through the late 19th century and into the early 20th century, dogs moved the freight and wood that supported the opening of Interior Alaska to steam-powered river travel and the early development of rural settlements. By 1918, about one million salmon were being harvested each summer to feed approximately 6,000 sled dogs along the Yukon River (Andersen and Scott 2010:3). By the mid-1900s, advances in transportation technology—airplanes and snowmachines—led to the decreased use of dogs for transportation, though dog teams, sometimes quite large, are still kept in many communities for trapping, hauling goods, and recreation.

Technological advances in gear have also influenced the harvesting of Yukon River salmon. Lower river fishers historically used dip nets and, later, setnets to catch Chinook and summer chum salmon for subsistence. Fishers in the middle river practiced a labor-intensive, traditional form of drift dipnetting into the 1920s (O'Brien 2011:77). After the introduction of fish wheels in 1910, middle river fishers employed them to efficiently harvest large quantities of chum salmon needed to feed dogs (Andersen 1992:8; Clark 1981). Upriver fishers historically targeted Chinook and fall chum salmon with dip nets, shifting to fish wheels and setnets beginning in the 1960s (Brown et al. 2015).

In addition to the historical importance of salmon for local subsistence, salmon played a role in inserting the Yukon River into global markets. The commercial sale of Yukon River salmon in the lower river had already begun by 1900, but was prohibited in 1924 to protect the salmon runs for subsistence uses in support of the developing territory (Pennoyer et al. 1965; Schwatka 1983rep.). Limited commercial fishing started again in the 1930s and continued after statehood, mostly on a quota system, though subsistence fishing remained unrestricted (Pennoyer et al. 1965). In 1961, only 27% of the total catch was sold commercially; however, by 1975, the relative dominance of the fisheries had flipped: in that year, 76% of the total catch was purchased by commercial processors (Shirley 1992:2).

Today, the Yukon River is home to about 40 rural communities and over 11,000 people.[2] Nearly 90% of the population in the region is Alaska Native, including Central Yupiit along the lower river and Athabascans along the middle and upper stretches of the river. The local economy in the region is characterized by high production of wild foods and low cash incomes (Wolfe 1981; 1984; Wolfe and Scott 2010). Salmon, especially Chinook salmon, remains a keystone subsistence resource for the region, both as a heavily harvested and used resource and as the center of the exchange networks that operate in rural communities to distribute wild foods and resources among households within and between communities (Brown et al. 2015; 2017). These social networks are a foundation of mixed subsistence-cash economies.

The Yukon River drainage supports five species of Pacific salmon: Chinook *Oncorhynchus tshawytscha*, chum *O. keta*, coho *O. kisutch*, pink *O. gorbuscha*, and sockeye *O. nerka* salmon (Brown et al. 2015). The majority of subsistence harvests are made up of Chinook, chum, and coho salmon. Since the 2000s,

1. ADF&G Division of Commercial Fisheries. "Yukon River Drainage Miles." Unpublished document.
2. Alaska Department of Labor and Workforce Development (ADLWD), Research and Analysis Section, Juneau, n.d. "Population Estimates." Accessed April 2019. http://live.laborstats.alaska.gov/pop/

however, Chinook salmon runs have been in decline, which has led to severe subsistence restrictions and the elimination of directed commercial opportunities, as well as several federal disaster declarations. Although the seasonal chum salmon runs are currently strong and may even be replacing lost Chinook salmon harvest, the importance of sustainable management of Yukon River Chinook salmon cannot be overstated.

For management purposes, the Yukon Area is divided into seven districts and 15 subdistricts (5 AAC 05.200). The Coastal District includes the coastal waters around the communities of Hooper Bay and Scammon Bay; the harvests of these two communities may contain fish that are not Yukon River-bound (Kerkvliet [*n.d.*]). The Lower Yukon Area includes districts 1, 2, and 3 and encompasses coastal waters not included in the Coastal District and the Yukon River drainage from its mouth to river mile 301 above Anvik (Jallen et al. 2015). The Upper Yukon Area is composed of districts 4, 5, and 6 and includes the area upstream of Old Paradise Village at mile 301 to the U.S.–Canada border (river mile 1,224). The Upper Yukon Area includes three large (>400 miles) silt-laden tributaries where harvests occur: the Koyukuk, Tanana, and Porcupine rivers. Two communities within the Yukon Area, Chevak and Arctic Village, are not included in the postseason harvest survey based on their distance from the Yukon River proper and harvest of very few salmon.

A History of Subsistence Salmon Data Collection Along the Yukon River

Accurate harvest estimates are critical to the sustainable management of any fishery. Between the early 1900s and statehood in 1959, only limited and likely incomplete summaries of subsistence salmon harvests are available. After statehood, ADF&G began building an annual program for harvest estimation. For example, in 1961, an estimated 23,719 Chinook salmon and 405,632 chum salmon were harvested by Yukon River fishers in Alaska (ADF&G Division of Commercial Fisheries 1962).. Two ADF&G technicians obtained counts by boat from the mouth of the Yukon River upstream to and including Dawson City. The technicians enumerated fish on drying racks and in smokehouses in all fish camps along the route. The chum salmon counts should be considered a minimum since large numbers of chum salmon were still being harvested in the communities upriver of Galena during the survey This method was used for several years with some modifications. For example, harvests from the Koyukuk and Porcupine rivers and communities upstream of Fort Yukon were obtained from catch calendars mailed to households prior to the season or catch questionnaires after the season was over (ADF&G Division of Commercial Fisheries 1966). Around 1970, ADF&G subsistence fisheries harvest assessment programs were expanded to reach more households along the river and included personal interviews, although specific methods and techniques varied from year to year, potentially influencing the harvest estimates (ADF&G Division of Commercial Fisheries 1988).

In 1988, the harvest assessment program was redesigned by the ADF&G Division of Subsistence to produce comparable results between years; it was implemented for the first time in 1989, when ADF&G identified a total of 2,908 households in the Yukon area and surveyed 60% of the 1,378 households that were identified as usually fishing for subsistence salmon (Holder and Hamner 1990). This voluntary survey program to estimate the total subsistence salmon harvest for the majority of communities along the Yukon River and its tributaries continues to be used today. To improve harvest estimates, the harvest assessment program uses a stratified random sample of households that harvest salmon at different levels. For communities not accessible by road, harvest information is collected using a combination of voluntary subsistence harvest calendars and postseason surveys. In road-accessible portions of the Yukon Area, harvest data are collected through required subsistence salmon fishing permits.

Every year prior to salmon fishing activities, ADF&G mails return-postage-paid harvest calendars to all identified fishing households within the survey communities and encourages households to fill them out as they fish. Calendars provide additional Yukon Area run and harvest timing information that is not obtained by other data collection methods. Additionally, they assist with recall since fishers document daily or weekly harvests that can be provided in detail during the postseason survey. The Lower Yukon Area calendars contain the months of May through September, and the Upper Yukon Area calendars contain the months of June through October to accommodate the differing seasonality of fishing throughout the river.

The calendars allow fishers to record their daily subsistence harvests of salmon by species. At the end of the season, posters sent to community post offices and announcements on area radio stations remind fishers to give their calendars to research staff. For example, in 2013, Division of Commercial Fisheries staff distributed a total of 1,760 calendars to Yukon River households. Approximately 19% of calendar recipients (330) returned harvest calendars either by mail or through research staff during their fall surveys (Jallen et al. 2017a).

After the fishing season, ADF&G Division of Commercial Fisheries staff members conduct in-person interviews with a stratified random sample of all households in surveyed communities within the Yukon River drainage. Survey questions focus on Chinook, summer chum, fall chum, and coho salmon, but households are also asked about other species, such as pink salmon (primarily taken by coastal communities) and nonsalmon species. Households in the sample that are not contacted in person by the surveyors are contacted by telephone. Those households not contacted by telephone are mailed a survey questionnaire and a postage-paid return envelope.

A subsistence permit is required in the road-accessible portions of the Yukon River drainage.[3] Subsistence fishers record their daily salmon harvests on a household permit and return it within ten days of the expiration date printed on the permit. Subsistence permit applications are mailed to all who returned the prior year's permit along with instructions on how to apply by mail. ADF&G staff travels to select communities to issue permits in person. Permits are also issued in several ADF&G offices or by mail throughout the season. Those who do not return permits are sent up to two reminder letters. Telephone contacts with households that do not respond to the reminder letters are attempted as a final measure.[4] In 2013, a total of 414 salmon fishing permits were returned from households in the Yukon Area, including 348 subsistence and 66 personal use permits (Jallen et al. 2017a). ADF&G considers permit holders who did not return their permits to have not fished; households are not eligible to receive a permit the following year until the previous year's permit was returned. Through the combined program of calendars, household surveys, and permits, department staff collect data from over 1,000 households in the Yukon Area concerning their subsistence salmon harvests each year. In 2013, a total of 1,193 households were surveyed of the 1,542 selected households in 34 communities (Jallen et al. 2017a).

By 2013 and 2014, Yukon River residents were familiar with the harvest assessment program and knew what to expect. The labor and material costs of the postseason project are well-outlined. The efficiency of the postseason survey during which surveyors can collect an entire season's data in a short visit is balanced by the limitations of postseason recall: households have to estimate their harvests if they did not tabulate them on a daily catch calendar. An effective inseason program may provide more accurate harvest estimates as well as earlier critical harvest information for managers engaged in postseason assessment of management actions and run abundance and health.

Study Objectives

This research had several objectives based on the research questions:

Phase 1:

1. Test methods for inseason data collection in Grayling by conducting an inseason, door-to-door salmon harvest survey with specific reference to:
    a. Local research assistant capacity and staff oversight

3. This area includes the majority of the Tanana River drainage, the area around the Yukon River Bridge, near Eagle at the U.S.–Canada border, the area around the community of Rampart, and the Middle and South fork areas of the Koyukuk River where the Dalton Highway comes into range.
4. Subsistence salmon permit holders in a portion of Subdistrict 6B (the Tanana River drainage above a point three miles upstream of Totchaket Slough to the boundary with Subdistrict 6C) and the personal use fishers in Subdistrict 6C are required to report their harvests weekly for inseason management purposes. To maximize the return of permits, ADF&G staff also send reminder letters to these households (Jallen et al. 2015).

b. Financial cost

c. Community response

2. Provide regular updates of survey results to managers
3. Produce a preliminary report outlining results of Phase 1

Phase 2:

1. Conduct interdivisional review of Phase 1 results and jointly assess potential changes to the survey instrument for a second year of data collection
4. Using the revised survey, conduct an inseason, door-to-door salmon harvest survey in three communities
5. Maintain an ongoing, interdivisional dialogue about specific utility of the results
6. Assess the overall feasibility of an inseason data collection program by evaluating the results (data, costs, success of methods) of the inseason methods
7. Compare the measurable benefits and costs of each program

Research Methods

Methods for this project included household surveys, participant observation, and detailed documentation of community response to the research.

Project Planning and Approvals

During Phase 1 of the project, principal investigators approached the community of Grayling, located in the lower-middle region of the Yukon River in District 4A. ADF&G Division of Subsistence had recently completed several successful projects there involving traditional knowledge and harvest surveying, and researchers had developed relationships with community leaders. The Grayling IRA[5] Council met to discuss the brief project proposal and approved the research on May 24, 2013.

Phase 2 of the project was designed to build on Phase 1 by acknowledging community differences in project implementation. Costs and reactions to inseason data collection may differ from community to community: as a result, principal investigators needed to test the instrument and methods in multiple communities. Collecting these data in a single community in Phase 1 allowed principal investigators to test methods that minimized the burden on the community in order to make this project more effective when attempted in multiple communities.

After interdivisional consultation following the completion of Phase 1, principal investigators approached three additional communities (one each in the lower, middle, and upper river) in spring 2014 to participate in data collection during the following summer salmon season. Communities were selected based on an assessment of salmon species harvested, community fishing patterns, and community size in order to include in the sample a variety of community characteristics that might affect data collection. In May 2014, principal investigators approached the Gwichyaa Zhee Gwich'in Tribal Government (Fort Yukon, District 5), the Nulato Tribal Council (District 4A), and the two tribal councils in Marshall (District 2)—Marshall Traditional Council and the Ohogamiut Traditional Council. Nulato and Marshall approved the pilot inseason survey project, but Fort Yukon did not, citing concerns about survey fatigue. Researchers then approached the Stevens Village IRA Council, which approved the project. Ultimately, as discussed in more detail below, only Marshall participated in the project in 2014. See Table 1-1 for a complete listing of project staff.

5. Indian Reorganization Act.

Table 1-1.–Project staff.

Task	Name	Organization
Northern Regional Program Manager	James Simon	ADF&G Division of Subsistence
Principal Investigator	Caroline Brown	ADF&G Division of Subsistence
Co-Principal Investigator	Deena Jallen	ADF&G Division of Commercial Fisheries
Administrative Support	Pam Amundson	ADF&G Division of Subsistence
	Tamsen Coursey-Willis	ADF&G Division of Subsistence
	Deanne Lincoln	ADF&G Division of Subsistence
Data Management Lead	Toshide Hamazaki	ADF&G Division of Commercial Fisheries
Data Entry	Sam Decker	ADF&G Division of Commercial Fisheries
Data Cleaning/Validation	Deena Jallen	ADF&G Division of Subsistence
Data Analysis	Toshide Hamazaki	ADF&G Division of Commercial Fisheries
Editorial Review Lead	Rebecca Dunne	ADF&G Division of Subsistence
Production Lead	Rebecca Dunne	ADF&G Division of Subsistence
Field Research Staff	Caroline Brown	ADF&G Division of Subsistence
	Alida Trainor	ADF&G Division of Subsistence
	Loraine Naaktgeboren	ADF&G Division of Subsistence
	Deena Jallen	ADF&G Division of Commercial Fisheries

Source ADF&G Division of Subsistence, 2019.

Systematic Household Surveys

The primary method for collecting subsistence harvest and use information in this project was a systematic household survey. For Phase 1, principal investigators developed a survey instrument based on the existing postseason survey form. Following receipt of comments at the community approval meeting, staff from the divisions of Subsistence and Commercial Fisheries finalized the survey instrument in May 2013. The survey instrument was structured to collect harvest and other data that are comparable with information collected through the annual postseason survey (Appendix A). The new inseason instrument was divided into three parts: Part 1 was a one-time interview that documented basic household demographics and was conducted with each household at the start of the season; Part 2 was used by local research assistants to collect harvest data on a weekly basis for each sample household; and Part 3 was a one-time final survey that concluded the season and was primarily focused on assessment data. Appendix B is an example of the survey instrument used in Phase 1.

As noted above, the inseason survey incorporated the data questions from the postseason survey so that the results would be comparable. An important aspect of this was the definition of a "fishing group" and how cooperative fishing is tracked in order to achieve an accurate accounting of harvest by individuals who participate in the fishing group. Understanding how cooperative fishing is structured in each community is important for producing accurate estimates that neither over- nor underestimate harvest. To do this, the postseason survey includes questions for each household to identify others that they fish with so that household harvests can be compared and cooperative shares confirmed by household. Local research assistants collecting data inseason attempted to track these cooperative fishing efforts on a weekly basis.

The Phase 1 survey was reviewed by principal investigators after the salmon season in order to assess any parts of the survey that were particularly problematic. Through interdivisional coordination, including between principal investigators and others involved in implementing the postseason survey, principal investigators refined the survey for Phase 2; changes are detailed below in the Results chapter. An example of the Phase 2 survey instrument can be found in Appendix C.

Sampling

The household harvest survey methodology for the postseason survey is based on a stratified random sample design (Cochran 1977). In this design, a household within the community is the primary sampling unit. A household generally consists of one or more people living together in a dwelling and sharing the same land line phone number and mailing address. Multiple generations living in one dwelling is considered one household. Individuals living in detached but physically related structures are considered part of a household if they participate as a unit in harvesting, processing, and distributing resources and share contact information. Prior to finalizing the sample, updated household lists and community maps are generated or updated with the assistance of the tribal council and local research assistants. An updated and accurate household list is the foundation of the data collection sample.

Households are stratified into five groups based on the level of harvest: heavy harvesters (≥500 fish/year), medium harvesters (<500 fish/year, but >100 fish/year), light harvesters (<100 fish/year), do not fish, and unknown. Placement in a particular stratum is determined by the total number of salmon harvested by each household in the most recent two of the previous five years. Total salmon harvest includes Chinook, summer chum, fall chum, and coho salmon and does not include pink or sockeye salmon. When two recent years of harvest data are unavailable, such as from new households or households that have not participated in the survey, the household's harvest group designation remains the same or the household is classified as unknown.

Table 1-2 shows the sample sizes in each participating study community for each year of the inseason project. In 2013, there were 53 households in Grayling; Phase 1 of the research attempted a census of all households in Grayling in order to 1) achieve comparability with the postseason survey in data quality and 2) potentially provide additional data on the stratified sampling design in Grayling for future postseason or inseason survey efforts.

During Phase 2 of the project, ADF&G staff planned a stratified random sample approach for households in both Marshall and Nulato based on the Division of Commercial Fisheries' postseason survey samples for 2014. In Stevens Village, the proposed sample was a census of all households, because of the small size of the community.

Household Survey Implementation

Phase 1: Grayling

On June 6, 2013, subsistence research specialists (SRS) Brown, Trainor, fisheries biologist Jallen, and fish and wildlife technician Naaktgeboren traveled to Grayling to select and train local research assistants, introduce the project to community members, and participate in local fishing opportunities during the open season prior to the start of the regulatory windows schedule (June 9 at 6 pm). With the help of the tribal council, they identified and hired three local research assistants who agreed to work through September, mainly surveying households during the weekends.

After principal investigators conducted a training on the survey instrument, the group broke up into teams of two (one ADF&G staff member and one local research assistant) to provide on-the-job survey training. Each research assistant was assigned between 17 and 18 households to survey each week. According to the survey implementation plan, during this initial trip, all households in Grayling would be contacted and provided a copy of the 2013 harvest calendar if they did not already have one. Local research assistants would administer parts 1 and 2 (the first week) to each sample household on the initial visit. Assistants would conduct Part 2 on each subsequent weekend, which allowed them to ask about all of the fishing that occurred in the two subsistence windows openings each week for District 4A. Researchers were to travel to Grayling every other week to work with local research assistants in person. Surveys were to continue on a weekly basis through October unless local fishing ended before that time. During the final interview of the season with each household, local research assistants would administer Part 3 of the survey. This "exit" interview reviewed the household's cumulative harvest to double check inseason harvest reports for the household. Local research assistants were to attempt to contact all sample households every week. If a

Table 1-2.–Sample achievement, study communities, 2013 and 2014.

Sample information	Community	
	Grayling	Marshall
Number of dwelling units	54	100
Survey goal	54	69
Households surveyed	39	67
Households failed to be contacted	8	1
Households refused	6	1
Households moved or occupied by nonresident	1	0
Total households attempted to be surveyed	53	69
Final estimate of permanent households	53	100
Percentage of total households interviewed	74%	67%
5-year average population estimate	67[a]	101[b]

Source ADF&G Division of Commercial Fisheries, 2013, 2014.

a. U.S. Census Bureau American Community Survey 2009–2013 population estimate.

b. U.S. Census Bureau American Community Survey 2010–2014 population estimate.

household was unavailable during a survey time, assistants were encouraged to document that household's weekly data at the earliest opportunity. Unfortunately, by June 6, no salmon had reached Grayling yet, so ADF&G staff were unable to assist in the first week's data collection.

Local research assistants were paid $10 per survey per week. They were encouraged to document comments and reactions regarding the salmon runs, management strategies, and surveying effort. Local research assistants were directed to fax a modified data sheet of harvest estimates weekly to principal investigators for data entry and analysis (Objective 2); the original data collection forms were to be sent back to ADF&G after exit interviews were conducted and stored by the Division of Commercial Fisheries. Finally, if the inseason data collection effort produced adequate data to estimate the community level harvest, a postseason survey would not be conducted.

Phase 2: Marshall, Nulato, and Stevens Village

Phase 2 of the pilot inseason survey program contained two important changes to the approach outlined in Phase 1. First, Phase 2 was designed to occur in multiple communities in order to test the survey in different circumstances and contexts. Second, ADF&G staff would not work with local research assistants in person every other week as they did in Phase 1, but rather would monitor progress and provide support to local surveyors telephonically throughout the season. Principal investigators planned this change in oversight for two reasons: first, the level of oversight in the first year of this project would be cost-prohibitive when working in multiple communities. Second, because of the size of the drainage and the sheer number of communities in which to collect data, local research assistants would need to have the ability to collect data without significant in-person oversight as was done in the first year. The shift in the methods during the second year was meant to test the possibilities of that local capacity. Other aspects of the methods remained the same, however. Local research assistants would be trained in person in their communities; surveys would continue on a weekly basis with all sample households through October unless local fishing ended before that time; data would be sent to ADF&G on a weekly basis using a modified tracking sheet; original surveys would still be sent to ADF&G at the end of the season; and final interviews would still be conducted with each participating household.

Salmon migrate through the lower river community of Marshall ahead of the other participating study communities. SRS Brown traveled to Marshall on June 12 in advance of the first subsistence openings. On that trip, Brown hired and trained two local research assistants, both of whom assisted in updating the community household map and list in order to finalize the sample of households to be surveyed. Local research assistants divided the household list for weekly sampling, which started in the week of June 9

(the first week of data collection was conducted by one surveyor only, so the count was incomplete). Both surveyors collected data in weeks 2 and 3. In week 4 (July 4), one local research assistant assumed responsibility for the entire sample and surveyed the majority of sample households every week.

After posting a job flyer in early June, Nulato Tribal Council selected two local research assistants to help with the inseason survey effort there. SRS Trainor traveled to Nulato on June 23 to conduct the training and assist in the implementation of the first week of surveying (June 20–27). After that week, one local research assistant decided not to participate, and the second failed to collect any data in the future weeks despite continued check-ins from Fairbanks ADF&G staff.

The survey was scheduled to begin later in Stevens Village because of its upriver location. After some difficulty maintaining contact with the community, researchers sent a job flyer to tribal council staff on June 6 to advertise hiring a local research assistant. A trip was scheduled later in June to hire and train the local research assistant; however, that trip was cancelled due to continued difficulty maintaining contact with the community. Inconsistent staffing of the tribal council office may have been a problem during that time period. The effort was eventually abandoned in mid-July after the season had progressed long enough that data collection would not be inseason and thus would not be useful as part of this project.

Ethical Principles for the Conduct of Research

The project was guided by the research principles outlined in the Alaska Federation of Natives Guidelines for Research[6] and by the National Science Foundation, Office of Polar Programs in its Principles for the Conduct of Research in the Arctic[7], 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.

Data Analysis and Review

Survey Data Entry and Reduction

This pilot program produced several types of data including information about the demography of each sample household, weekly harvests of salmon and nonsalmon fish species, fishing group information, fishing areas and gear types used by species, retention of salmon from commercial opportunities, household participation in sharing and receiving salmon, salmon fed to dogs, and household assessments of the salmon runs and needs met.

Local research assistants transcribed weekly household harvests and gear information onto a single sheet (Appendix D) and faxed this information to Division of Subsistence staff in Fairbanks once per week. The collected weekly harvest data were entered into the Arctic-Yukon-Kuskokwim database system (AYKDBMS), and the original survey forms were archived at ADF&G Division of Commercial Fisheries, Fairbanks office. Survey comments and field notes were collated and stored in the ADF&G Division of Subsistence Fairbanks office for use in the report writing.

In Phase 1 and Phase 2 of the project, Division of Commercial Fisheries staff entered received data from Grayling (Phase 1) and Marshall (Phase 2) into a Microsoft® Excel®[8] spreadsheet and estimated a total community harvest for each salmon species each week. Data were entered into the AYKDBMS by one staff member and reviewed by a different staff member for errors. The database structures included rules,

6. Alaska Federation of Natives. 2013. "Alaska Federation of Natives Guidelines for Research." Alaska Native Knowledge Network. (Accessed February 9, 2018). http://www.ankn.uaf.edu/IKS/afnguide.html

7. National Science Foundation Interagency Social Science Task Force. 2012. "Principles for the Conduct of Research in the Arctic." (Accessed February 9, 2018). http://www.nsf.gov/od/opp/arctic/conduct.jsp

8. Product names are given because they are established standards for the State of Alaska or for scientific completeness; they do not constitute product endorsement.

constraints, and referential integrity to ensure that data were entered completely and accurately. Estimated harvest totals were emailed each week to project staff in the Division of Subsistence and to fishery managers.

Following the salmon fishing season, ADF&G project leads reviewed the completed sets of weekly surveys by household (including the final survey that summarized the household's total reported harvest) from each community for consistency and compared to harvest data reported on calendars when available. When information provided on Part 3 of the survey or calendar was inconsistent with the weekly data reports, local research assistants or ADF&G staff attempted to resolve those inconsistencies with the households themselves. ADF&G researchers documented all adjustments, and the original survey forms were archived at ADF&G Division of Commercial Fisheries, Fairbanks office.

Harvest data were entered and expanded weekly to produce a running community harvest estimate. Once data were entered and confirmed, information was processed with the use of Microsoft® Excel® and Statistical Analysis System (SAS®) software. Initial processing included the performance of standardized logic checks of the data. Logic checks are often needed in complex data sets where rules, constraints, and referential integrity do not capture all of the possible inconsistencies that may appear.

ADF&G staff also used SAS® for analyzing the survey information. Analyses included table generation, estimation of population parameters (such as number of households, number of fishing households, and number of people) and harvest amounts, and calculation of confidence intervals for the estimates. When fewer than ten households in a stratum responded or when the proportion of households that responded to a survey question was less than 0.2, the response of a harvest group was treated as missing and the harvest of the missing group was assumed to be an average harvest of the rest of the groups.

For the survey data, classical stratified random sampling methods (Cochran 1977) were used to estimate the average and total number of fish caught by each of the five harvest strata.

Denote that:

i = individual household,

j = harvest stratum (j = 1 … 5)

k = community,

w = survey week

Survey responses are denoted by:

y_{ijkw} = the number of salmon (Chinook, chum, coho, and pink) harvested by a sampled (i) in the harvest stratum (j) of the community (k) on the survey week (w)

n_{jkw} = the number of sampled households in the harvest stratum (j) of the community (k) on the survey week (w); and

N_{jk} = the total number of households in the harvest stratum (j) of the community (k).

Inseason Community Harvest Estimates

Weekly subsistence harvest totals for each community by species were estimated with these methods. The average number of fish harvested each survey week by harvest stratum was calculated by summing the total number of fish harvested by week divided by the number of sampled households responding each week

When the number of surveyed households in a harvest stratum was greater than or equal to ten, or the proportion of surveyed households was greater than 0.2, the mean response of a harvest group of a community ($\bar{y}_{jk}$) was calculated as:

$$\bar{y}_{jkw} = \frac{\sum_i y_{ijkw}}{n_{jkw}} \quad . \tag{1}$$

Its standard error (SE_{jk}) was calculated as:

$$SE_{jkw} = \sqrt{\frac{s^2_{jkw}}{n_{jkw}}\left(\frac{N_{jk} - n_{jkw}}{N_{jk}}\right)} \quad \text{where} \quad s^2_{jkw} = \hat{V}(y_{jkw}) = \frac{\sum_j \left(y_{ijkw} - \bar{y}_{jkw}\right)^2}{n_{jkw} - 1} \quad . \tag{2}$$

An estimate of total number of fish harvested by the community ($\hat{Y}_{kw}$) was calculated as:

$$\hat{Y}_{kw} = \sum_{j=1}^{5} N_{jk}\bar{y}_{jkw} \tag{3}$$

and its 95% confidence interval (95%CI_k) was calculated as:

$$95\%\text{CI}_k = t_{(0.025, df = n_{kw}-1)} \cdot \sqrt{\hat{V}(Y_{kw})} \quad \text{where} \quad \hat{V}(Y_{kw}) = \sum_{j=1}^{5} N^2_{jk}\left(\frac{N_{jk} - n_{jkw}}{N_{jk}}\right)\left(\frac{s^2_{jk}}{n_{jkw}}\right). \tag{4}$$

When the estimation criteria for equation (1) was not met, the response of a harvest stratum of a community ($\bar{y}_{jkw}$) was treated as missing. In this case, harvest of the missing harvest stratum was assumed to be an average harvest of the rest of the harvest strata.

In this case, the total response of the community ($\hat{Y}_{kw}$) was calculated as:

$$\hat{Y}_{kw} = \frac{N_k}{\sum_{j=1} N_{jkw}} \sum_{j=1} N_{jk}\bar{y}_{jkw} \tag{5}$$

where N_k is the total number of households in a surveyed community.

Its 95% confidence interval (95%CI_k) was calculated as:

$$95\%\text{CI}_k = t_{(0.025, df = n_{kw}-1)} \cdot \sqrt{\hat{V}(Y_{kw})} \quad \text{where} \quad \hat{V}(Y_{kw}) = \left(\frac{N_k}{\sum_{j=1} N_{jk}}\right)^2 \sum_{j=1} N^2_{jk}\left(\frac{N_{jk} - n_{jkw}}{N_{jk}}\right)\left(\frac{s^2_{jkw}}{n_{jkw}}\right) \quad . \tag{6}$$

Cumulative number of fish harvest by the community on the survey week was calculated by summing weekly harvested by the community ($\bar{Y}_{kw}$) as

$$\hat{Y}_{kwc} = \sum_{w=1} \hat{Y}_{kw} \tag{7}$$

where N_k is the total number of households in a surveyed community.

Its 95% confidence interval ($95\%CI_{kwc}$) was calculated as:

$$95\%\mathrm{CI}_{kwc} = t_{(0.025, df = n_k - 1)} \cdot \sqrt{\hat{V}(Y_{kwc})} \text{ where } \hat{V}(Y_{kwc}) = \sum_{w=1} \hat{V}(Y_{kw}) . \tag{8}$$

Finally, the post-season harvest was estimated by summing the total weekly harvest of each sampled household, and estimating the average harvest by each harvest stratum as:

$$\overline{y}_{jk} = \frac{\sum_i \sum_w y_{ijkw}}{n_{jk}} \tag{9}$$

and using equations (2)–(6).

To summarize, ADF&G estimated the weekly harvest by community and then summed the community harvests to get a cumulative inseason harvest. This procedure was necessary because not all sampled households were available each week. As a result, community harvests had to be estimated separately for each week. At the end of the season, once all data inconsistencies were resolved, harvests were re-estimated.

Final Report Organization

This report summarizes the results of systematic household surveys conducted by staff from ADF&G and divisions of Subsistence and Commercial Fisheries as well as local research assistants. The report also documents resident feedback provided during the final surveys (Part 3). The findings are organized by project phase and study community. A Results chapter includes tables and figures that report survey findings for salmon harvests and an assessment of procedural challenges and successes. A Discussion and Conclusions chapter analyzes the findings to answer the primary research questions of the pilot project.

Plate 2-1.–Left and center: Grayling resident fishing for chum salmon during a 2013 subsistence opening. Right: Jarred chum salmon.

2. RESULTS

Phase 1–Grayling, 2013

2013 Run and Regulatory Context

Salmon harvests are often directly related to abundance in the Yukon River. This review of the 2013 Chinook salmon run provides context for understanding certain aspects of inseason harvest data collection. By 2013, the Yukon River had already experienced several years of below average to poor Chinook salmon runs; the drainage-wide run outlook for 2013 was 98,000–144,000 Chinook salmon, based on the average value for both sibling and Ricker models and adjusted to account for model performance over the prior six years (JTC 2014). This would make the 2013 run potentially weaker than the run in 2012. A run of this size would present challenges in meeting escapement goals and border passage obligations; as a result, no directed commercial opportunity for Chinook salmon was planned, and managers expected to implement a conservative approach for subsistence fishing. Prior to the beginning of the season, managers encouraged fishers to restrict their harvests voluntarily to approximately 25% of their usual take and to shift their harvests to other, more abundant salmon species.

Late river-ice breakup delayed the Chinook salmon run, and high water and debris kept nets, including test nets, out of the water early in the season. However, inseason run assessments confirmed the poor run. Chinook salmon passage at the Pilot Station sonar was estimated at 117,000 fish, which was much lower than the historical average of 145,000 (JTC 2014). Per regulation, the first pulse was closed to all fishing in the lower river beginning on June 20 (a late run), and closures progressed chronologically upriver. Grayling is located in District 4A, which was subdivided into upper and lower areas to improve management flexibility and precision and to enable managers to more fully protect Chinook salmon through the subsistence fishing schedule as they migrated upriver. Because of continued inseason run assessments, each of the three subsequent pulses of Chinook salmon was also protected; subsistence fishing was allowed only between pulses and with restricted gear to allow the harvest of non-Chinook salmon species (Plate 2-1). Table 2-1 shows the reduction of fishing opportunity by district, highlighting District 4A where Grayling is located. Table 2-2 shows the actual fishing schedule for Grayling subsistence fishers in 2013.

At the same time that managers were protecting Chinook salmon from harvest, they were also struggling to provide subsistence and commercial opportunity on an abundant summer chum salmon run as it co-migrated with Chinook salmon. The Alaska Board of Fisheries adopted new regulations in 2013 allowing the commercial harvest of summer chum salmon using dip nets, beach seines, and attended fish wheels in order to allow the live release of any Chinook salmon caught in the nets (5 AAC 01.220(n)).

By regulation, the summer chum salmon season ends on July 15 and the fall season begins on July 16 in District 1 (5 AAC 01.249): any chum salmon entering the river after July 15 are counted as fall chum

Table 2-1.–Reduction in subsistence fishing opportunity from the implementation of the first pulse closure through the end of restrictions, by Yukon River mainstem districts and subdistricts, 2013.

District/ Subdistrict	First pulse closure beginning date	End of restrictions	Percentage reduction
1	June 20	July 15	68%
2	June 23	July 13	67%
3	June 26	July 12	73%
4A	June 30	July 16	70%
4B & C	July 3	July 19	70%
5A, B, & C	July 5	July 21	70%
5D lower	July 10	August 6	92%
5D middle	July 14	August 8	96%
5D upper	July 16	August 14	96%

Source Newland 2013:7.

Table 2-2.–Subsistence fishing openings, Yukon Subdistrict 4A, 2013.

Fishing period length	Dates
24 hours/7 days	Up to June 8
Two 48-hour periods/week	June 9–11
	June 12–14
Two 48-hour periods/week	June 16–18
	June 19–21
Two 48-hour periods/week	June 23–25
	June 26–28
Fishing closed	June 30–July 2
	July 3–July 5
Two 24-hour periods/week	July 7–9
	July 10–12
Two 24-hour periods/week	July 14–16
Two 48-hour periods/week	July 17–19
Two 48-hour periods/week	July 21–23
	July 24–26
Two 48-hour periods/week	July 28–30
	July 31–August 2
5 days/week	August 4–6
	August 7–9
5 days/week	August 11–13
	August 14–16
5 days/week	August 18–20
	August 21–23

Source Estensen and Borba 2013; Newland 2013.

salmon. In 2013, the fall chum salmon count at the Pilot Station sonar was below average until mid-August, when a large pulse passed the sonar. This large pulse catapulted fall chum salmon counts to above average, at which point commercial openings were provided.

Summary of Weekly Subsistence Data Collection Effort

The data collection in this first year of the pilot study was designed around weekly collection of subsistence harvest data in Grayling punctuated by in-person staff visits every two weeks. These visits were included in order to ensure that data collection continued smoothly, that staff members were available in-person to address local surveyor questions, and to assure quality control of data. Between in-person visits, staff members were available to local surveyors at any time by phone and text. Although this level of oversight would not be sustainable for an annual project in every community along the Yukon River, it did provide a consistent understanding of the day-to-day challenges and questions that may arise in the course of local data collection. This ground work was necessary to provide a solid foundation on which to build an inseason project.

Local surveyors began work during the first staff field trip (June 6–10). Table 2-3 provides the directed dates of local harvest data collection that were to be sent to ADF&G. Although no harvest or harvest efforts occurred in that first week, ADF&G staff provided on-the-job training to local surveyors by conducting Part 1 of the survey with them. Local surveyors were directed to collect harvest data (Part 2 of the survey) each weekend after the windows closed for that week (end dates in Table 2-3) and then meet every Monday morning to compile their harvest numbers and fax the results to the Fairbanks office. During the first two weeks of data collection, two local surveyors were available each week to complete their surveys. ADF&G staff members were in regular telephonic contact with available surveyors during this time.

A second staff field trip occurred during June 27–30. Restricted salmon fishing had begun in Grayling so staff members were able to participate in the fishery and help local surveyors gain a better understanding of the survey instrument. However, two incidents prevented data collection during this visit. First, during week 3 (June 22–28), a Grayling man passed away in Anchorage on June 26; the entire community was focused on preparing for the arrival of the body, the funeral potlatch, and the funeral. In most rural Alaska communities, a death involves members of the entire community in various tasks involved with carrying

Table 2-3.–Data collection effort by week, Grayling, 2013.

Week	End date	Households contacted (sample=53)	Number of surveyors collecting data	Comments
1	June 14	34	2	Data submitted June 19
2	June 21	34	2	Data submitted June 25
3	June 28	0	0	No data collected due to a death in the community and citations issues for illegal fishing
4	July 5	0	0	Pulse closure, no data collected
5	July 12	0	0	Pulse closure, no data collected
6	July 19	28	2	Data collected late with ADF&G staff on July 22
7	July 26	31	2	Data submitted August 1 (submission included 4-6 weeks of data for several households)
8	August 2	22	2	Data submitted August 6
9	August 9	31	2	Data submitted August 12
10	August 16	33	3	Data returned by ADF&G staff on August 20
11	August 23	33	3	Data submitted August 27 and August 30
12	August 30	32	3	Data submitted September 4
13	September 6	7	3	Data collected by ADF&G staff during field trip
14	September 13	10	2	Data returned by ADF&G staff on September 28

Source ADF&G Division of Subsistence, 2013.

out a funeral and potlatch, including building a casket, digging a grave, and preparing the hall and food to feed the community and guests, among others. These events can last three to four days. Local cultural values make this time inappropriate to survey community households while they are busy taking care of the decedent and his or her family and planning the funeral. Second, during the subsistence fishing openings, several fishers received citations from the Alaska Wildlife Troopers for the use of illegal nets, and their fish were confiscated. In addition to the ongoing funeral preparations, this made surveying impossible.

Over the next several weeks, harvest data collection was hampered by several factors. On July 1, there was a death in a neighboring community; two of the local surveyors and several community members attended that funeral. Additionally, the period between June 30 and July 12 marked several pulse closures with only a shortened 24-hour window of subsistence fishing opportunity on the last day of that time period. ADF&G staff traveled to Grayling for a third field trip on July 22. During this visit, ADF&G staff retrained the local surveyors to reinforce their data collection methods. However, at least one surveyor remained unavailable. ADF&G staff identified and trained a fourth local surveyor.

ADF&G staff took four more trips to Grayling over the next month. During the August 8–11 trip, staff provided oversight for harvest data collection. During that visit, the fourth surveyor decided not to participate, so the tribal chief assisted ADF&G staff in identifying a fifth surveyor for training. A fifth field trip occurred during August 17–20, during which staff reinforced training and assisted with several surveys. During September 6–8, staff traveled to Grayling for a sixth time to prepare final surveys (Part 3 of the survey) and train local surveyors on the procedures. Local surveyors conducted seven final surveys during this trip. Over the course of the entire field season, 39 of 53 total households provided data for this project. Of the 53 households in the community during the summer of 2013, one had moved away for the season, eight were unavailable, and six refused to participate. Local surveyors continued to administer the final surveys until September 23–28, when ADF&G staff made a final field trip. ADF&G staff and local surveyors conducted a total of 31 final surveys (70% of data-providing households; 57% of total households).

Harvest Quantities and Composition

The inseason survey administered in Grayling was modeled after the postseason survey (Appendix A) in order to produce comparable data. Table 2-4 reports estimated salmon harvests by species by Grayling residents in 2013. Harvests are reported in numbers of fish. Throughout the season, the number of households surveyed each week ranged from 22 to 34. Between June and September, surveyed (sampled) Grayling households reported harvesting 69 Chinook, 573 summer chum, 401 fall chum, and 24 coho salmon. Accounting for harvest by unsurveyed households, the sum of inseason weekly harvest estimates was 134 Chinook, 868 summer chum, 653 fall chum, and 115 coho salmon. In the final inseason survey, surveyors contacted all sampled households. Surveyed households were provided totals from their inseason responses, and had

Table 2-4.–Inseason and postseason estimates of salmon harvest by species, Grayling, 2013.

	Reported harvest	Inseason estimate[a]		Postseason estimate[b]	
		Number	95% C.I.	Number	+/- 95% C.I.
Households					
Surveyed		39	-	41	-
Total		53	-	51	-
Resource					
Chinook salmon	69	134	-	226	66
Summer chum salmon	573	868	-	618	345
Fall chum salmon	401	653	-	470	169
Coho salmon	24	115	-	34	14

a. *Source* ADF&G Division of Subsistence household surveys, 2013.

b. *Source* ADF&G Division of Commercial Fisheries, expansion calculated on February 13, 2014 using SAS software.

the opportunity to confirm or correct the information supplied inseason. Households were also asked how many salmon were fed to dogs and whether their needs were met for salmon. Information from the final survey was entered into the database in the same manner as information from postseason surveys from other communities. Once any data inconsistencies were resolved and these data were collated in the postseason, expanded estimates were 226 Chinook salmon, 618 summer chum salmon, 470 fall chum salmon, and 34 coho salmon (Table 2-4). The differences between the aggregated weekly estimates and the postseason estimate were primarily due to the fact that not all sampled households were available for survey each week (resulting in an interim estimate for those households based on averages from households surveyed in that week) and the resolution of data discrepancies.

Survey Assessment

The final survey asked respondents for their reactions to or reflections about the inseason survey as opposed to the postseason survey. Table 2-5 shows households' assessments of the inseason survey effort. Of the 32 households (60%) that provided comments on the survey during the final survey, 78% commented favorably, 13% opposed the survey, and 9% did not have an opinion. Some households provided additional information about their experience of the inseason survey: 44% of households thought weekly reports were more accurate than postseason estimates, and 6% appreciated the employment opportunities for residents. Of the four households that did not like the inseason survey, most felt it was a nuisance to be contacted every week.

Phase 2–Marshall, 2014

2014 Run and Regulatory Context

Even more than in 2013, low Chinook salmon runs in 2014 led to restricted fishing opportunity and reduced harvest. The 2014 Chinook salmon run outlook attempted to account for low productivity observed since 2008; ADF&G estimated that the run would likely be 64,000–121,000 Chinook salmon (JTC 2014). Prior to the season, the 2014 Yukon River Chinook salmon run was anticipated to be extremely poor and potentially the worst on record. Escapement goals and border passage obligations would be difficult to meet, with no harvestable surplus for subsistence or other consumptive uses. At the same time, the 2014 preseason outlook for summer chum salmon estimated a run of 1.3 to 1.5 million fish, thus challenging managers again to provide fishing opportunity on an abundant species while conserving a desirable yet limited resource. Prior to the season, ADF&G fisheries managers worked cooperatively with fishers, federal managers, tribal council representatives, and other stakeholders to identify inseason strategies to conserve Chinook salmon while providing opportunity on summer chum salmon. Subsistence fishing for salmon would be closed in each district for most of the Chinook salmon run beginning in the Coastal District and District 1 at the start of the migration. As in 2013, this closure would be similarly implemented in upriver fishing districts and subdistricts based on migratory timing.

Inseason assessments supported by the test fisheries were limited by the need to reduce mortality of Chinook salmon. River ice broke up on May 9, which was earlier than the historical average date of May 23 (JTC 2014). Despite the early breakup, the first Chinook salmon was not caught in the test nets until May 27. The cumulative passage estimate at the sonar project located near Pilot Station was approximately 137,500 Chinook salmon, which was below both the historical average (143,000) and the average for years with early run timing (195,800). Because the preseason outlook suggested an early and poor run of Chinook salmon, managers took the precautionary approach of restricting gillnets to six-inch or smaller mesh size beginning May 18 in the lower river districts and the Coastal District. The restriction was meant to provide fishing opportunity for nonsalmon species traditionally harvested in the lower Yukon River immediately following breakup while having a gear restriction already in place at the beginning of the Chinook salmon migration. The first pulse was closed to all fishing in the lower river beginning on May 26 in the Coastal District and districts 1–3, and the closure progressed chronologically upriver. When inseason assessment information indicated that summer chum salmon were beginning to enter the river, managers implemented a seven-day-a-week subsistence fishing schedule beginning June 1 in districts 1–3 by dip nets only. Fishers on the Yukon River experienced the most restrictive summer season in recent history.

Table 2-5.–Responses to exit interview assessment question, Grayling, 2013.

	Do you have any comments on the inseason survey approach?
+	Well taken care of because post season workers are not as thorough or consistent
0	Either way
-	It's a waste of time and what good does it do?
+	It was okay because it is hard for an old woman to remember at the end of the summer
+	Better each week because she never uses her fishing calendar and can't remember her fishing numbers
+	It was good because it was easier to keep track of the fish they caught
-	Didn't like inseason monitoring because too many questions—prefers fall season survey
+	No big deal, 100% okay
+	Weekly surveys are better, easier to keep track, don't mind someone calling or stopping by
+	If it helps out in the long run it is okay to give some time up every week
+	It was good even though we didn't fish much
-	End of the year is better because summer is the busiest time of year for people
+	Good to get the info every week and it is a job for someone in the village
+	It's alright, weekly surveys are fine. Weekly surveys are easier to remember numbers
-	A nuisance, we don't have time to be bothered. Post season better.
+	Easier to remember numbers on inseason than postseason
+	Inseason survey is more accurate. It is better this way. Doesn't mind being bothered
+	It was alright, pass by or call, doesn't matter
+	It was okay
+	Better because they forget at the end of the season and just guess
+	It was good, it keeps mind and memory fresh
+	It was good, prefer when people call first in case they are busy. Feel bad to have to ask them to come back
+	Doesn't mind weekly surveys, same as post season
+	It was good, more accurate
+	Likes it way better, easier to remember each week. Don't typically use calendar anyways
+	It was okay to have someone ask questions once a week
+	Doesn't mind weekly surveys, it gives someone a job
0	Don't have a preference between inseason surveys and postseason surveys
+	It was okay, not a bother to be surveyed each week
+	Better than postseason because it is more accurate, people don't use calendars
0	Doesn't matter, phone calls are better
+	Pretty cool, better this way because it's too hard to remember at the end of the season.

Source ADF&G Division of Subsistence household surveys, 2013.

Note + indicates positive response, 0 indicates neutral response, and - indicates negative response.

Marshall is located in District 2. Although 2014 inseason assessments indicated a slightly better run than anticipated, the run was still below average, and managers maintained restrictive fishing opportunity between pulses only and with selective gear (JTC 2015). The Chinook salmon run was protected for its entirety: only when managers determined that more than 90% of the run was complete in the lower river districts did they incrementally relax subsistence fishing restrictions and closures (Newland 2014a). The use of gillnet gear was delayed until all three pulses of Chinook salmon had migrated out of districts 1 and 2. On June 28, July 5, and July 6, managers provided special three- to six-hour subsistence-only fishing opportunities using six-inch mesh gear (Table 2-6). Beginning on July 7, subsistence fishing was opened seven days per week for 24 hours per day, except around commercial openings, for six-inch mesh gear.

In 2014, the fall chum salmon run developed slowly because pulses were slow to enter the river; however, all districts were placed on their full regulatory windows schedules, and commercial openings were offered twice a week in districts 1 and 2 (JTC 2015). Unseasonably hot weather likely contributed to a lower than average sonar count in early August, and commercial fishing was suspended until August 15. A large pulse entered the river on August 13, after which subsistence fishing was liberalized to seven days per week and 24 hours per day, and commercial fishing opportunities resumed.

Summary of Weekly Data Collection Effort

As it was in Grayling, the inseason survey administered in Marshall was modeled after the post-season survey in order to produce comparable data. Because Marshall is a larger community (more than 40 households), a stratified selection of households was used based on harvest strata described earlier. Surveyors attempted to survey 69 of the total 100 households in the community. As described earlier in this chapter, ADF&G staff oversight of surveying was designed to allow more independent operation of the survey effort by local surveyors in Phase 2. In general, this worked well in Marshall. Because of the more typical run timing of Chinook salmon in 2014 than the late run in 2013, residents were able to subsistence fish using gillnets until May 26, and there was a closure from May 26 to May 31. On June 12–13, ADF&G staff traveled to Marshall to hire and train local surveyors and launch the survey; the first week of data collection included all prior subsistence fishing for salmon. Surveyors worked well independently—in most weeks, both surveyors were available to collect data and survey the entire sample—and faxed data to ADF&G in a timely manner

Table 2-6.–Subsistence fishing openings, Yukon District 2, 2014.

Fishing period length	Dates	Comments
Open	Up to May 26	6-inch or smaller mesh
Closed	May 26–31	-
7 days/week	June 1–8	Dip nets only Chinook salmon to be released alive immediately
7 days/week	Beginning June 9	Dip nets and beach seines Chinook salmon to be released alive immediately
3 hours	June 28	6-inch or smaller mesh drift and set gillnets Chinook salmon may be kept
4 hours	July 5	6-inch or smaller mesh Chinook salmon may be kept
6 hours	July 6	6-inch or smaller mesh Chinook salmon may be kept
Two 36-hour periods/week	Beginning July 7	6-inch or smaller mesh Chinook salmon may be kept
7 days/week for 24 hours/day except around commercial openings	Beginning July 19	7.5-inch or smaller mesh

Source Newland 2014b.

(Table 2-7). ADF&G staff members were available for questions throughout the season. As in Phase 1, the final surveys and returned calendars documented some discrepancies to the inseason estimates that were reconciled in the postseason survey.

Harvest Quantities and Composition

Table 2-8 shows estimated salmon harvests by species by Marshall residents in 2014. Harvests are reported in numbers of fish. Throughout the season, a 67% random stratified sample of Marshall households was surveyed weekly (67 of 100 households). Between June and September, Marshall households reported harvesting 98 Chinook, 4,053 summer chum, 772 fall chum, and 276 coho salmon. Weekly harvest reports were estimated to account for data from unsurveyed households and provided to project staff. The sum of these inseason weekly estimates was 201 Chinook salmon, 7,441 summer chum salmon, 1,624 fall chum salmon, and 759 coho salmon. When these data were collated in the postseason and correlated with harvest reported on calendars and when data inconsistencies were resolved, expanded estimates were 128 Chinook salmon, 6,189 summer chum salmon, 1,100 fall chum salmon, and 468 coho salmon. Variation between the two estimates is due to corrections made to the raw data in the final postseason review and due to differences in the calculations made by Microsoft® Excel® (inseason) and SAS® (postseason). In the process of finalizing the data, harvest was sometimes attributed to a household in a different use group, which affected the final harvest estimate. The difference between the inseason and postseason estimates is within the 95% confidence interval for the inseason estimate for all salmon species except Chinook salmon.

Survey Assessments

The final survey asked respondents in Marshall for their reactions to or reflections about the inseason survey as opposed to the postseason survey, as it did in 2013. However, it also asked respondents about how their season in 2014 went compared to 2013 in order to understand how households fared under the more conservative management actions. Table 2-9 shows households' assessments of the 2014 season and inseason survey effort. Of the 69 households surveyed, only 16 (23%) commented on the inseason survey program itself: many more (40 households; 58%) provided an assessment of the 2014 season more generally. Of the household members that provided comments on the survey during the exit interview,

Table 2-7.–Data collection effort by week, Marshall, 2014.

Week	End date	Households contacted (sample = 69)	Number of surveyors collecting data	Comments
1	June 13	36	1	Data submitted June 15
2	June 20	69	2	Data submitted June 21 and 24
3	June 27	69	2	Data submitted June 30
4	July 4	35	1	Data submitted July 5
5	July 11	69	2	Data submitted July 15
6	July 18	69	2	Data submitted July 19 and 21
7	July 25	69	2	Data submitted July 28
8	August 1	69	2	Data submitted August 8
9	August 8	69	2	Data submitted August 10
10	August 15	69	2	Data submitted August 16 and 21
11	August 22	69	1	Incomplete data submitted Data set updated on October 16 with remaining data
12	August 29	69	2	Data submitted September 11
13	September 5	69	2	Data submitted September 11
14	September 12	69	2	Data submitted September 14

Source ADF&G Division of Subsistence, 2014.

88% (14 of 16) supported the effort with positive comments and only 13% opposed it (two households). Residents who supported the project mostly just commented that it was "good" and a few added that they would like to see the Marshall test fish project restarted in their area.[1]

Table 2-8.–Postseason and inseason estimates of salmon harvest by species, Marshall, 2014.

	Reported harvest	Inseason estimate[a]		Postseason estimate[b]	
		Number	95% C.I.	Number	95% C.I.
Households					
Surveyed		67	-	70	-
Total		100	-	102	-
Resource					
Chinook salmon	98	201	61	128	27
Summer chum salmon	4053	7,441	1,718	6,189	858
Fall chum salmon	772	1,624	743	1,100	375
Coho salmon	276	759	366	468	140

a. *Source* ADF&G Division of Subsistence household surveys, 2014.

b. *Source* ADF&G Division of Commercial Fisheries, expansion calculated on February 5, 2015 using SAS software.

1. The Marshall drift gillnet test fish project was operated from 1999 to 2000 to provide an index of Chinook salmon passage. However, with the startup of the Chinook salmon radiotelemetry project, which also utilizes drifts, the two projects interfered with each other. The index drift gillnetting was discontinued and then resurrected from 2005 to 2007 once the Chinook salmon telemetry project was completed.

Table 2-9.–Responses to exit interview assessment questions, Marshall, 2014.

How did this year compare to last year?
Still the same because we can't harvest kings
Not good; lost mother and didn't fish
Wish we can get kings alright
Getting too old to do things on his own
Was better—less rain and fish dried well
Was good
Ok, was good
Better—my husband was home to help. He had no work to be at.
Same, I guess. Miss cutting and having kings
Not so good—need king salmon
Was ok; miss king salmon
Got more summer chum than last year—very good year
Not so good—dogs and hard times
Very bad year for me. I had heart surgery and didn't have my strength and I had motor problems
Was good this year
Was a good subsistence year
New fish camp, good year
Not as much as last year; wife takes care of old mother
Tough summer. Wife spent a lot of time in hospital with auntie and her other auntie died, then we didn't really cut fish. Need to set up test fishing here in Marshall; it is beneficial here and now they don't do it anymore.
Not good, mom died and never did much subsistence
Too much health problems
It's been tough not to harvest kings. Hope in the future we can get to cut them again.
It was ok
It was good—didn't get to cut fish last year
Kind of tough; had motor problems
Was a good harvest
Was ok—did more than I expected
Very poor; never catch fish
My fish are from rod and reel and ice fishing
Mom died; didn't do much
Very good year
Not a fish eater

-continued-

Table 2-9.–Continued.

	Was ok
	Getting old, can't do much
	Got more than expected—was good
	Bad
	Doesn't do any subsistence
	Was ok; first time doing subsistence for our family
	No boat, bad season
	Was good

Do you have any comments on the inseason survey approach?

+	Good job!
+	It was good
+	Ok, I guess
+	It's good. It's ok
+	Good you're doing this. We can use the YDFA test fish project in Marshall again. Why ain't it being done here, like Russian Mission has it?
+	Was glad this is being done. Wish we had a test fishery project for kings here in Marshall again.
+	Good job!
+	Was good I say
+	Good project
+	I think it was good
+	It's ok
+	This is a good project, I guess
-	Pick someone else to survey next year
+	Was a good thing, this project—keep it up
-	Pick someone else to interview please.
+	This is a good project

Source ADF&G Division of Subsistence household surveys, 2013.

Note + indicates positive response, 0 indicates neutral response, and - indicates negative response.

3. DISCUSSION AND CONCLUSIONS

Inseason harvest data collection may provide two potential primary benefits. First, inseason subsistence salmon harvest monitoring, especially of Chinook salmon, could be useful for the management of subsistence fisheries in the Yukon River. Recording harvest throughout the season may help managers understand harvest levels and patterns more accurately as they evolve; however, there are issues with this, as described below. Second, inseason data collection relies heavily on community participation. A more active role in data collection would encourage communities to have more ownership of their harvest data, thus building their relationship and strengthening their voice with managers as stewards of the resource. That said, there are also multiple challenges and potential problems with inseason harvest data collection such as cost, capacity, and respondent burden. The following sections address both the possibilities and limitations. The Results chapter provided information about the data collection in each community, which included basic demography, community harvest estimates by species, season assessments, regulatory openings, and data collection efforts. This chapter evaluates the inseason data collection approach as compared to the existing postseason program through the categories of staff effort and programmatic cost, local capacity, and community response. It concludes with a description of the utility of inseason data for management.

Comparison of Data Collection Approaches and Accuracy

One potential benefit of an inseason data collection program is the possibility of more accurate or precise harvest estimates because data would be collected soon after harvest occurred and thus would improve recall of harvest amounts. This section compares the data resulting from the inseason program to the surrounding years when data were collected through the postseason survey for each community. Table 3-1 describes harvest estimates for each community between 2010 and 2016.

Harvest on the community level generally varies year to year based on a variety of factors ranging from local or regional environmental conditions, to salmon abundance and regulations, to personal factors.[1] Solely in terms of abundance and resulting regulations, the period between 2010 and 2016 was characterized by highly variable salmon returns. Briefly, all salmon experienced a crash in returning numbers in the

Table 3-1.–Postseason and inseason salmon harvest estimates, Grayling and Marshall, 2010–2016.

	Grayling					Marshall				
	Salmon species					Salmon species				
Year	Chinook	Summer chum	Fall chum	Coho	Total	Chinook	Summer chum	Fall chum	Coho	Total
2010[a]	2,122	1,612	202	132	4,068	2,110	2,395	56	33	4,594
2011[a]	1,374	838	1,152	119	3,483	2,686	3,810	562	150	7,208
2012[a]	1,081	2,616	804	26	4,527	1,409	5,903	184	567	8,063
2013[b]	226	618	470	34	1,348	328	3,986	853	508	5,675
2014[c]	3	1,617	1,451	403	3,474	128	6,189	1,100	468	7,885
2015[a]	22	509	1,184	212	1,927	128	4,351	1,731	1,511	7,721
2016[a]	370	878	499	35	1,782	512	5,180	1,106	409	7,207

a. *Source* ADF&G Division of Commercial Fisheries postseason surveys, 2010–2016.

b. *Sources* ADF&G Division of Subsistence inseason surveys, 2013, for Grayling; ADF&G Division of Commercial Fisheries postseason surveys, 2013, for Marshall.

c. *Sources* ADF&G Division of Commersial fisheries postseason surveys, 2014, for Marshall; ADF&G Division of Subsistence inseason surveys, 2014, for Grayling.

1. Brown et al., *In prep*. Patterns and trends of salmon fishing on the Yukon River, 1990–2014. Alaska Department of Fish and Game Division of Subsistence, Fairbanks.

1999–2001 period; Chinook salmon runs began slowly rebuilding until 2009, when they crashed again. Rebuilding has been minimal since then, and 2013 and 2014 marked the worst years since the 2009 crash. Conservative management actions taken in 2013 resulted in an estimated harvest of approximately 12,500 Yukon River Chinook salmon by Alaska communities, which was a 75% reduction of the average annual subsistence harvest of approximately 50,000 fish (Jallen et al. 2017b). Yukon River fishers demonstrated flexibility and cooperation in complying with short-notice changes to subsistence fishing schedules and gear restrictions. Conservative management actions taken again in 2014 in response to reduced runs restricted subsistence fishing time even more during the summer season than in 2013. In 2014, Yukon River households harvested approximately 3,286 Chinook salmon, which is a 93% reduction of the average annual harvest of approximately 50,000 fish (Fall et al. 2017).

These dramatic trends in abundance can limit an evaluation of data accuracy resulting from different data collection methods. However, run abundance trends were evident in the harvest datasets for each community, including both inseason and postseason approaches, with significant reductions in harvest of Chinook salmon in 2013 and 2014 regardless of data collection method. The harvests of summer chum and fall chum salmon by residents of Grayling already contained a level of variability not likely explained by data collection method; rather, the increased fall chum salmon harvests in 2014 and 2015 may be a short-term species replacement response to make up for lost Chinook salmon harvests. In Marshall, the increase in summer chum and fall chum salmon harvests after 2013 may be for the same reasons. Further, the Alaska Board of Fisheries approved the use of dip nets to harvest summer chum salmon[2] during the summer season for commercial purposes in 2013 (5 AAC 05.362(k)); some of those fish may have been retained for subsistence use given the minimal subsistence opportunity provided in 2013 and 2014 (described in Results chapter). Overall, the inseason methods appear to have produced reasonable harvest estimates given the variety of factors that affect fishing in any given year; it is impossible to tell whether those estimates are more accurate than postseason methods with only one year of data or a dual-method approach.

Inseason Management

Beginning with the first point, inseason data may provide managers with additional tools to more effectively manage salmon harvests by 1) providing more robust salmon harvest timing data in coordination with inseason genetics data, and 2) producing aggregated salmon harvest estimates throughout the drainage to better meet Yukon River Salmon Agreement harvest share obligations. A mixed stock fishery of the Yukon River's magnitude challenges managers in providing harvesting opportunity across stocks without overharvesting any particular stock. Different stocks are not consistently phenotypically diverse; therefore, individual fish offer minimal clues in the field to which stock they belong. For example, a fisher from Grayling is not always able to tell whether a harvested fish is headed for Canada, the Koyukuk River, or another tributary. Managers rely on relatively recent inseason genetic sampling conducted at the sonar near Pilot Station in the lower river to construct a basic understanding of each pulse of Chinook salmon by stock composition in terms of Canada or Alaska origin. If managers have a gross understanding of each pulse in terms of stock origin, they could potentially build a general understanding of the harvest by stock composition by considering the harvest by pulse at various locations. Although this analysis would not likely be precise, it would provide additional information about the stock composition of the run and the harvest as fish travel through the Yukon River at various time points. The postseason harvest survey does break down harvest into district, subdistrict and tributary locations for each community, but it does not associate harvests to specific time periods or openings. Daily harvest information can be documented on calendars provided by the department and returned post season; however, a relatively small number of households record and return the calendars.

Producing aggregated salmon harvest estimates as the season progresses would also guide managers in their efforts to meet the mandates of the Yukon River Salmon Agreement of the Pacific Salmon Treaty. That agreement lays out harvest sharing requirements between Canada and Alaska on the following basis:

2. Incidentally caught Chinook salmon had to be released into the water alive.

1. when the Total Allowable Catch (TAC) is between zero and 110,000 Chinook salmon, the guideline harvest range for Canada shall be between 20% and 26% of the TAC; and
2. when the TAC is above 110,000 Chinook salmon, the guideline harvest range for Canada shall be between 20% and 26% of 110,000; i.e., 22,000 and 28,600 Chinook salmon, plus 50% of the portion of the TAC greater than 110,000 Chinook salmon (YRDFA 2005).

However, there are challenges to applying inseason harvest data. Managers use preseason abundance outlooks along with inseason run indices to produce an evolving estimate of the harvestable surplus of Chinook salmon. Producing aggregated harvest estimates in order to address harvest share guidelines in the treaty process on an annual basis would require a relatively quick turnaround time for data collection, database entry, and analysis to expand for community-level estimates. To produce complete harvest estimates would require the cooperation and timely participation by all communities. To date, managers have demonstrated the ability to meet border passage and most escapement goals with general management strategies using restrictions to fishing time and allowed gear, including district-specific restrictions based on regulatory schedules to spread out harvest and allow for proportional fishing time. Additionally, although Yukon River residents participate voluntarily in the current postseason project, many residents express concerns about perceived uses of the data to close fishing if harvest is high. Tracking aggregated harvests inseason with an eye towards treaty harvest shares may exacerbate this perception. These issues may limit the utility of inseason harvest data.

Inseason estimates of harvest could also allow managers to better understand harvest by stock and potentially provide opportunities for harvest that distribute the total harvest between stocks more beneficially. As managers begin to develop a picture of the stock composition of each pulse through inseason genetics work at Pilot Station sonar, adding time- and area-specific harvest data to this equation could help managers understand how different stocks are represented in the total harvest of Chinook salmon. However, this would likely be a longer term, postseason exercise for a few reasons. First, salmon are continually moving upriver through districts, often faster than genetics data or harvest data can be collected, entered, analyzed, assessed for providing targeted opportunities, and communicated to fishers. Further it is unclear what kind of resolution such an analysis might provide and whether it would be enough for managers to provide additional harvesting opportunities on some stocks or to protect other stocks from harvest. Ultimately, the use of inseason harvest data for providing opportunity would need to be balanced with stakeholder desires for predictability of fishing times and advance notice of fishing schedules. Finally, there is a dearth of context for any single year of data collection: it would take multiple years of analysis to see harvest trends, if any, because a community may always harvest the bulk of their fish early, or spread it over the course of the season, or have no detectable pattern.

Because of the scale of the Yukon River, the subsistence salmon fishery along the river is perhaps best understood as a series of regional fisheries characterized by commonalities but also significant differences. Regional specificity, such as commercial fishing in the lower river, greater use of fish wheels and limited setnet sites in the middle river, and braided channels and the availability or unavailability of certain salmon species in the upper river, all contribute to differential structuring of the subsistence fisheries in different parts of the river. In terms of the two study communities, the overlap between commercial and subsistence fishing by Marshall fishers had different implications for the survey implementation than the absence of commercial fishing and the local attempts to accommodate increasingly conservative fishing regulations in Grayling. As part of the survey, department staff attempted to map the presence and structure of fishing groups in each community in order to understand how individuals and households work together to harvest and in order to not over- or undercount harvested fish. In this sense, a successful survey contains at least two requirements that frame the data collection: the first is the need for a standardized approach that will produce comparable data in each place for comparison and aggregation; the second is a requirement for a certain level of local knowledge and an understanding of how residents specifically structure their fishing in any given year.

The people who have the most fluency in these practices are local residents, and their knowledge is critical to understanding the structure of actual harvests that the survey is designed to estimate. In this sense, local knowledge provides both the harvest data and the social context that gives it additional meaning. Inviting communities to collect these data can provide them with a stronger sense of ownership, a commitment to data quality, and confidence in the reliability of harvest estimates. This ownership is the foundation of the stewardship that Yukon River communities have long expressed over their salmon runs. Several studies have documented ways in which fishers have traditionally understood and monitored the runs (Brown et al. 2005; Moncrieff et al. 2009); providing quantitative harvest data adds another dimension to this stewardship effort.

Since 2002, the Yukon River Drainage Fisheries Association (YRDFA) has engaged in an ongoing effort to collect weekly inseason harvest data, along with local observations of run strength, fishing conditions, and concerns (Moncrieff et al. 2014). This project, funded by the USFWS, has proven to be an important communication tool in concert with the weekly fishery teleconferences conducted throughout the season where these data and observations are reported. The project does not attempt to provide a cumulative community estimate of harvest, but rather an index of harvest that gives managers an idea of how fishers and communities are faring throughout the season. Moncrieff et al. (2014) note similar challenges about data collection addressed in this report:

> The active nature of these fishers is one reason that in-season subsistence information is difficult to collect. Many households relocate to fish camps during summer months and as a result have limited access to teleconferences and management information. Interviewers conduct weekly interviews face to face in local villages at fishers' houses or fish camps, village boat launches, and, to a lesser extent, over the telephone and VHF [radio].

However, the YRDFA project provides direct, two-way communication between fishers and managers, which is likely more valuable than harvest estimates alone. Any project utilizing inseason data collection methods should also recognize the communication potential between fishers, communities, and managers.

Community Response and Respondent Fatigue

At the outset of this pilot project, researchers were concerned about respondent fatigue with weekly data collection, or how individuals would respond to being asked the same questions week after week. If respondents become impatient or frustrated with regular surveying, they may choose not to participate at all, thus ending any opportunity to collect these important data. The Results chapter provided an accounting of individual household responses to a series of assessment questions designed to describe respondents' reactions to or reflections about the inseason survey specifically in contrast to the postseason project. In 2013, the majority of Grayling respondents responded favorably to the inseason approach or did not have an opinion one way or another between the two projects (Table 2-5). In 2014, the survey included a question to provide feedback on the inseason approach similar to the 2013 inseason survey; it also asked respondents to compare their 2013 and 2014 harvest. A smaller percentage of community households responded to these assessment questions in Marshall, and fewer still (24% of the sample) provided feedback on the inseason project itself, opting instead to only compare their 2014 harvests to 2013 harvests (Table 2-9). Without more households commenting on their assessment of the inseason program, it is difficult to understand how the effort was experienced by the community as a whole. However, of the relatively small number of households that responded, only two felt that being contacted every week was burdensome. Most of the others described that it was easier and more accurate to remember the harvest from just one week rather than the harvest from an entire summer. Despite this relatively favorable result, several issues arose with the structure of the pilot program and with weekly data collection, as described in the following sections.

Effort and Cost

Postseason Survey Program

Currently, the postseason survey program is staffed by a collection of individuals who divide up the tasks of completing the entire project from community coordination to finished report (Table 3-2). A full-time Fisheries Biologist (FB) II is a Project Lead who oversees all components of the project and is ultimately responsible for its annual completion. Preparing for this work usually begins in the spring, when the FB II coordinates with communities, hires surveyors, and updates survey documents (e.g., survey forms, community household lists, community maps). One FB I works to oversee the details of field operations and database management. The FB I lead in charge of field operations commits approximately five months to the tasks of assisting the Project Lead with coordinating survey scheduling with communities; developing or revising field protocols; assisting with the hiring of field surveyors; assisting with the coordination with the YRDFA program to supply local research assistants in some communities; organizing and printing the survey materials for field staff; coordinating field logistics, including travel, lodging, and other scheduling; and providing real-time support for field staff when they have questions or logistical problems. This FB I is also responsible for the bulk of survey data entry including receiving harvest data sheets from field surveyors, entering those data and running cross-checks to ensure quality control, and flagging any problems with the data for follow-up. Permit data are an important component of the overall harvest estimation program for the Yukon River drainage. In addition to the positions listed above, another FB I assists with permit harvest data and dedicates approximately 3 months per year to managing the permit database, including issuing permits and receiving, entering, and error checking permit data. However, this position is not included in the costs for this inseason project, because this project is testing survey methods only. These survey and permit projects involve a large amount of data; for instance, in 2013, 1,193 households were surveyed, 330 harvest calendars were returned, and 414 subsistence and personal use permits were returned. A similar amount of data was collected in 2014 (1,312 surveys, 288 calendars, 394 permits). If inseason harvest estimates were deemed to be necessary for Yukon River salmon management, the permit system would also need to be modified to include inseason harvest estimation.

Two Fish and Wildlife Technician (FWT) IIIs perform the actual data collection in each community by traveling community to community and visiting a stratified sample of households in each survey community (see Introduction for a more detailed description of the sampling strategy and Appendix A for specific survey questions). Two surveyors work together to visit all of the sample communities (33 communities from Scammon Bay to Fort Yukon); they begin in the lower river and work upriver until they have visited every survey community. This intensive data collection effort takes approximately two months. Because fieldwork often begins in the lower river before fall fishing is even completed in the upper river, the time that passes between the activity and when people have to recall the harvest is minimal: postseason data collection begins in late September in the lower river and continues through late October in the upper river. After data collection is complete, all project staff work with the Project Lead (FB II) to finalize the data for analysis, and then work with a staff Biometrician to statistically analyze the data to produce community estimates by species. Lastly, the Project Lead writes up a final report during the winter and early spring of the following year. In all, the successful completion of the postseason survey project takes approximately 19 staff months and costs approximately $193,648 (Table 3-2), not including the costs of the permit component.

It is difficult to compare the overall costs of the postseason project to the pilot inseason project because the latter was conducted on a much smaller scale with different methods. Table 3-2 describes the actual costs of conducting the pilot project in 2013 and 2014 (state fiscal years 2014 and 2015). Because of this difference in scale, the pilot project assessed harvest in only one community per year, and, as a result, produced much fewer data. As described in the Results chapter, the first year involved work in only one community (Grayling), took 7.5 staff months, and cost approximately $85,000. The Subsistence Resource Specialist (SRS) III and SRS II worked together to address a similar set of tasks as those listed above for the

Table 3-2.–Comparison of postseason and inseason annual budgets, fiscal years 2013 and 2014.

			Commercial Fisheries Postseason Survey, Fiscal Year 2014				Division of Subsistence Inseason Pilot Project							
							Fiscal Year 2014				Fiscal Year 2015			
Budget Line	Type	Description	Per unit	Number	Unit	Total cost	Per unit	Number	Unit	Total cost	Per unit	Number	Unit	Total cost
Personnel	Fisheries Biologist II	Project lead	$8,346	9	months	$75,114	-	-	-	-	-	-	-	-
	Fisheries Biologist I	Field lead	$6,933	5	months	$34,666	-	-	-	-	-	-	-	-
	Fish and Wildlife Technician III	Surveys	$8,881	2	months	$17,761	-	-	-	-	-	-	-	-
	Fish and Wildlife Technician III	Surveys	$8,881	2	months	$17,761	-	-	-	-	-	-	-	-
	Subsistence Resource Specialist III	Project lead	-	-	-	-	$9,866	2	months	$19,732	$10,162	1	months	$10,162
	Subsistence Resource Specialist II	Field lead	-	-	-	-	$7,251	3	months	$21,753	$7,637	1.75	months	$13,365
	Fish and Wildlife Technician III	Survey oversight	-	-	-	-	$5,509	2.25	months	$12,395	$6,077	1.5	months	$9,116
	Fish and Wildlife Technician III	Data entry, database management	-	-	-	-	$5,509	0.25	months	$1,377	$5,509	0.5	months	$2,755
	Publications Technician II	Publications	-	-	-	-	-	-	-	-	$7,072	0.5	months	$3,536
Travel	Emmonak to Lower Yukon villages					$2,400	-	-	-	-	-	-	-	-
	Anchorage to Emmonak					$2,400	-	-	-	-	-	-	-	-
	Anchorage to Emmonak					$3,200	-	-	-	-	-	-	-	-
	Fairbanks to Upper Yukon villages					$4,800	-	-	-	-	-	-	-	-
	Fairbanks to Anchorage					$2,000	-	-	-	-	-	-	-	-
	Employee instate surface transport					$1,200	-	-	-	-	-	-	-	-
	Lodging and meals					$6,500	-	-	-	-	-	-	-	-
	Fairbanks to study community	Project orientation				-	$1,800	3	trips	$5,400	$1,430	3	trips	$4,290
	Fairbanks to study community	Project oversight				-	$1,800	9	trips	$16,200	$1,430	3	trips	$4,290
	Fairbanks to study community	Training				-				N/A				
Contractual	Freight					$1,000	-	-	-	-	-	-	-	-
	Postage					$1,000	-	-	-	-	-	-	-	-
	Equipment/Leases					$2,500	-	-	-	-	-	-	-	-
	Local assistant					$10,000	-	-	-	-	-	-	-	-
	Print/Copy/Graphics					$1,500	-	-	-	-	-	-	-	-
	Household sample					-	$10	728	household-weeks	$7,280	-	-	-	-
	Local research assistant	conduct surveys				-	-	-	-	-	$2,000	6	surveyors	$12,000
Supplies	Unspecified supplies					$1,500				-				-
	Printing					-				$500				$500
Project Total						**$185,302**				**$84,638**				**$60,013**

Sources ADF&G Divisions of Commercial Fisheries and Subsistence, 2015 and 2016.

Table 3-3.–Comparison of project staffing in current postseason and projected inseason projects.

Position	Role	Cost per unit	Number of units	Units	Cost per year	Duties
Subsistence Resource Specialist III	Project lead	$14,195	3	months	$42,585	coordination and hiring), general project oversight, report writing
Subsistence Resource Specialist II	Field lead	$10,820	5.5	months	$59,510	Oversight of field season, field logistics, training, database maintenance
Fish & Wildlife Technician III	Survey oversight	$7,499	3.5	months	$26,247	Training, assistance with field support
Fish & Wildlife Technician III	Survey oversight	$7,499	3.5	months	$26,247	Training, assistance with field support
Local research assistants	Survey administration, travel for training	$2,500	65	each	$207,500	Training, survey implementation $162,500 for data collection +$45,000 for centralized training
Publications Technician II	Report editing and publication	$8,713	0.5	months	$4,357	Report planning, editing, layout, and publication
Total					**$366,445**	

Source ADF&G Division of Subsistence, 2019.

postseason project, except for overseeing database management or involvement in report writing. Two FWT IIIs assisted with training local research assistants, traveled multiple times to participating communities to provide in-person support, and were available by phone and text in real-time to provide remote support.

Because this project represents the first time inseason collection of subsistence salmon harvest data for the Yukon River was contemplated and attempted, the time and cost could be considered a maximum in redesigning survey sheets for weekly data collection, hiring and training local research assistants in the community, and monitoring and supporting data collection. However, it is a major investment of time to find and train local research assistants. These costs may go down if local research assistants stay with the project year after year and build capacity, but it is more likely that these will be high turnover positions. Additionally, the inseason project budget only includes data collection: it does not include database management, data analysis or report writing. Instead, as noted earlier, data were provided on a weekly basis to regular postseason staff for data entry, management, analysis, and report writing.

Expanding the inseason data collection project to the entire U.S. portion of the river using this centralized approach for data aggregation, analysis, and reporting would require some significant changes. First, project staff could not travel to each community for hiring and survey training; instead, hiring would need to happen by tribal or city councils or remotely by ADF&G staff, and training would need to be localized either in Fairbanks or regionally (for example, in Emmonak, Grayling, Galena, and Fort Yukon). Also, ADF&G staff could not be physically present in all of the communities during the summer season; rather, community research assistants would need to operate independently with remote support from ADF&G project staff. Staff would need to devote time during the inseason project to data cleanup, entry, and analysis.

In an assessment of the Alaska migratory bird subsistence harvest survey implementation, Naves et al. (2008) concluded that the standardization of survey methods is critical to obtaining good data (see also Fowler 2004) and hence, to the success of large, geographically extensive and diverse survey programs. A centralized approach that ensures effective coordination to oversee data collection, analysis, and reporting sets up the necessary chain of supervision, survey support, accountability, and timeline for project milestones. Addressing problems associated with missing or inaccurate data proving challenging on the small scale of this pilot program: nonresponse errors created by missing data and response errors caused by inaccurate reporting in some cases made data quality assurance and quality control difficult to achieve. It stands to reason that these problems will multiply when the program includes more than 30 communities. As a result, the cost estimate of a full inseason program attempts to take into account the need for centralized management and adequate quality assurance and quality control procedures. Table 3-3 estimates the minimum costs to implement the inseason project with this level of independent work from communities. An ADF&G Project Lead would still be responsible for the overall success of the project. That individual would spend approximately one month on pre-fieldwork preparation tasks, one month of fieldwork logistics support, and at least an additional month writing up results for publication. A Field Lead and two FWT IIIs would be responsible for all field logistics, daily oversight of community research assistants, and database management. Table 3-4 provides the basis for the number of community research assistants that would be required to collect data in each community for the length of the salmon season. This accounts for data collection and oversight only: significant funds would still be required for the analysis of the data to produce community estimates. A large component of the budget is designated to compensate the community research assistants for data collection and data reporting for the entire summer fishing season. Alternatives could be considered. For example, Yukon River community governments, (e.g., tribal councils or city governments) may decide to provide in-kind data collection either by taking on the costs of research assistants or adding data collection tasks to existing jobs. However, it is beyond the scope of this project to predict the financial capabilities of communities to provide this support. Either way, an inseason monitoring project will require extensive community buy-in and support to successfully complete comprehensive data collection in each community across the U.S. portion of the river.

Table 3-4.–Population estimates, Yukon River communities, 2014.

Place	July 2014 population estimate (ADOL)
Kusilvak Census Area	
Alakanuk	733
Emmonak	844
Hooper Bay	1,181
Kotlik	655
Marshall	446
Mountain Village	859
Nunam Iqua	182
Pilot Station	636
Pitkas Point	125
Russian Mission	326
St. Mary's	548
Scammon Bay	529
Yukon-Koyukuk Census Area	
Alatna	20
Allakaket	175
Anvik	80
Beaver	58
Bettles	13
Birch Creek	29
Central	85
Chalkyitsik	78
Circle	120
Evansville	8
Fort Yukon	574
Four Mile Road CDP	31
Galena	450
Grayling	191
Holy Cross	178
Hughes	86
Huslia	339
Kaltag	183
Koyukuk	92
Manley Hot Springs	110
Minto	206
Nulato	247
Rampart	21
Ruby	187
Shageluk	80
Stevens Village	46
Tanana	230
Venetie	187
Wiseman	16

Source Alaska Department of Labor and Workforce Development, Research and Analysis Section, 2018.

Local Capacity and Accountability

Conducting harvest surveys, even relatively simple ones, requires training and experience (Plate 3-1). Survey instruments are designed to document information efficiently and to facilitate coding, data entry, and data analysis. As such, surveyors must be skilled in translating this documentary structure into a comfortable, face-to-face conversation with a respondent. This requires knowing why certain types of information are collected and how they will be analyzed and used. Survey trainings attempt to provide this information, but trainers can never predict all of the circumstances that may arise in the field that can confuse the accurate recording of data. Some surveys attempt to bridge this experience gap by providing a script for each question. However, scripts are not usually space-efficient on the survey form itself, do not usually facilitate natural conversation, and even the best scripts still cannot predict the variety of circumstances that might complicate a respondent's understanding of or answer to a question. In short, data collection requires adequate training and benefits greatly from appropriate experience.

Additionally, data collection should be consistent in order to ensure comparability. Having multiple data collectors introduces the possibility of multiple interpretations of questions and answers, increasing variability in the meaning of the data. For example, documenting the harvests of different salmon species requires systematic species identification. Many salmon species are called by locally specific names that mean one thing in the community but something very different in another context. For example, many residents of Grayling refer to fall chum salmon as "silver salmon," but "silver salmon" is also a common name for coho salmon. This could introduce significant issues with species identification and thus accounting of the harvests of each species. Although techniques exist to minimize these types of misidentifications or variations in understanding certain questions (e.g., pictorial species identification charts, training on local taxonomies), there are multiple examples of these types of evaluative issues that can all confound data collection. Minimizing multiple interpretations of questions and answers usually requires relying on the smallest number of data collectors feasible. These issues could be addressed with comprehensive training and rigorous oversight.

Further, the variability of salmon fishing practices along the Yukon River challenges the design of any survey instrument that aims to collect data in a standardized way. Certain aspects of harvest, especially the structure of fishing groups (so that the actual harvest is not over- or undercounted), the distribution of the harvest (sharing, etc.), and gear types used are extremely variable. As noted earlier, local knowledge and involvement in data collection would greatly benefit the overall project by ensuring a deep understanding of the fishing social structure, thus resulting in a more accurate accounting of harvest. However, local capacity in Yukon River communities also varies widely. These issues also exist for the current postseason survey effort, but there, respondents are asked to summarize their cooperative fishing efforts. Weekly data collection for this project revealed a level of variability in cooperative fishing efforts that was challenging to track in detail.

Plate 3-1.–ADF&G staff train local research assistants in survey data collection.

Because surveying is done in the community physically away from the project leader in Fairbanks, strong local capacity is critical to the success of the project. Local research assistants must be reliably available for the whole season. They must be available to survey households on a regular schedule or on-call to survey after openings. They must

be willing and able to follow the sample, diligently contact households regularly, compile the data, make it available to ADF&G staff on a regular basis, and troubleshoot problems or represent complicated fishing events in an understandable way on data sheets. Training provides the basis for this work, and extended experience doing the work season after season strengthens local capacity. Ideally, there would be continuity in local surveyors from year to year, though program budgeting would need to include adequate oversight and survey support to guarantee quality control of data.

The capacity and reliability of local research assistants varied considerably between participating communities during the two study years of this pilot project. Although some local research assistants understood the work clearly, operated independently week to week, and consistently produced clear data with minimal mistakes, others found the work to be challenging for a variety of reasons. Some individuals were too shy to talk to others, others had young children whose care took priority over work. Some individuals experienced conflict with other community members making effective communication difficult, and others were challenged by negative local sentiments about the fish and game management practices of ADF&G. Still other events were completely outside the control of individual surveyors. Deaths or accidents involving community members for example, understandably hampered local research assistants' ability to do their jobs. Events such as these affect the entirety of a small community, and the entire community is usually involved in addressing them. For all of the reasons discussed above, the selection of active and back-up local research assistants is the most fundamental building block of a successful inseason monitoring project.

However, even when local community research assistants were comfortable with the surveys and data collection activities, staff researchers still needed to frequently check the actual surveys (in addition to the faxed-in data forms) in order to make sure they were completed properly. Most data collection incorporates regular review of data sheets as standard practice in order to ensure quality control on the data sheets themselves and in their transfer to the faxed-in sheet. Although this type of review is critical to ensuring accurate and quality data collection, it is challenging enough when just a few individuals are involved in collecting and reviewing data. Whether it would be feasible to conduct this research on a large scale with so many data collectors remains unclear.

Cooperative Fishing and the Sharing of Wild Resources

One of the most challenging components of the inseason survey was the documentation of sharing and cooperative harvests. Subsistence research in Alaska has long noted the importance and value of cooperation in both the production and distribution of edible wild resources in subsistence economies. Previous studies (Wolfe 1987; Wolfe et al. 2010) have shown that in most rural Alaska communities, a relatively small portion of households produces most of the community's fish and wildlife harvests, which they share with other households. A recent study of 3,265 households in 66 rural Alaska communities found that about 33% of the households accounted for 76% of subsistence harvests (Wolfe et al. 2010). Although overall the set of very productive households was diverse, factors that were associated with higher levels of subsistence harvests included larger households with a pool of adult male labor, higher wage income, involvement in commercial fishing, and community location. Sharing is thus an important form of cooperative distribution of wild resources in most subsistence economies (Brown et al. 2017; Charnley 1984; Kari 1983; Lonner 1980; Magdanz 1988; Magdanz et al. 2007; Magdanz and Wolfe 1988; Moncrieff 2007; Pete 1991; Schroeder et al. 1987; Stickney 1984; Wolfe et al. 1993). Depending on how the data are collected, some of this distribution may also represent cooperative harvests. Although subsistence harvest surveys collect information based on individual households, in reality, much of the production (harvesting and processing) of subsistence foods is achieved by households within a community that also work cooperatively. This cooperation is often organized based on kinship or other social ties where the cooperative units each take home a "share" of the resulting consumable goods (Kofinas et al. 2016).

Accounting for these subsistence practices in any harvest survey is critical to producing accurate harvest estimates and to avoid overcounting or undercounting the harvest. To do this, the postseason survey defines "harvesting" as being involved in the harvesting *and* processing activities that result in a consumable product which is then divided among the participating households as shares of the harvest. For example, suppose members of two households (A and B) fish together and harvested 150 salmon, and a member of a

third household (C) cut and hung all of those fish. When the processing was complete, the three individuals split the harvest in three equal parts at 50 fish each. However, in a stratified random selection of households, only households A and C may be selected to be surveyed. The postseason survey considers households that process to also be harvesting households; if enough data are provided by respondents, each household (A, B, and C) is attributed 50 salmon. However, if only one household provides information, or households do not answer questions about participation in group fishing activities or distribution of group harvests, it becomes difficult to account for shared harvest. Staff closely analyze and compare postseason harvest data to track and account for these relationships. Survey questions 5, 6, 7, 11, and 12 all address sharing from different angles to help managers fully understand these important practices (Appendix C).

Recording collective harvests accurately by household can also be challenged by the variability of collective harvesting itself. Fishing practices and fishing partners can vary greatly week to week, depending on a household's needs and circumstances, and having too many surveyors in the field may increase the chances of losing these details and thus introducing inconsistency into the data collection. In the two years of this pilot study, one of the local research assistants who had a firm grasp of fishing patterns in her community was able to translate the variability into coherent data that accurately represented the harvest. Even with careful training, other surveyors struggled with the concepts of "sharing" versus "shares" as categories of resource distribution. Often, local surveyors did not necessarily differentiate the two categories or comprehend the implications each offered for accurate data collection; other local research assistants were less familiar with the fishing groups in their communities and the variability of those groups. Collecting data inseason introduced data collection procedures to the weekly details of this variability, and this variability challenged surveyors' capacity to interpret complicated fishing events into consistent data.

ADF&G staff spent a great deal of time attempting to standardize the collection of these data through the survey format and survey training. However, training two individuals to collect these data consistently is a far easier task than training 60 people to do the same; a greater number of data collectors have a greater potential to introduce alternative understandings or interpretations of reported practices (see earlier section). When data collection is expanded to a large group, it often needs to be simplified in order to ensure or promote consistency.

Overall Feasibility and Recommendations

As noted earlier, inseason subsistence salmon harvest data could provide managers with additional tools to more effectively manage salmon harvests by 1) providing more robust salmon harvest timing data in coordination with inseason genetics data, and 2) producing aggregated salmon harvest estimates throughout the drainage to better meet U.S.–Canada Yukon River Salmon Agreement harvest share obligations. To do so, accurate harvest reports must be consistently collected, reported, and processed in a timely manner. The use of local research assistants can provide much needed local knowledge and context to these reports, but the inclusion of a large number of surveyors over such a geographically expansive and diverse fishery poses some significant challenges that may outweigh the benefits of local data collection:

1. Because of the scale of the Yukon River and the need for data collection in over 35 independent communities, community support of inseason monitoring is critical. Local capacity and reliability are crucial but variable across the Yukon River area. Even with the small sample of communities participating in this project, the levels of capacity to do this work varied greatly; it is reasonable to assume that this variability would be greater across so many communities.
2. A cost assessment of the data collection component suggests that local data collection will not lead to any savings without significant community level in-kind support of the project.
3. Methods:
    a. Consistency and systematicity in data collection are already difficult in small projects even when methods for data collection and interpretations of resulting data can be more tightly controlled. In order to ensure accuracy and consistency, project

designers may need to minimize complexity (such as documenting the number of dogs and whole salmon fed to dogs or primary gear types used) to increase likelihood of success. However, this may result in a loss of complex data useful to management.

b. The survey will need careful definition of and training regarding the differences between sharing one's harvest with others and taking a share of a cooperative harvest. Although this is an issue for the postseason survey program as well, minimizing the number of people who actually collect data also reduces the potential interpretations of this difference and leads to more standardized data collection. Additionally, collecting data just once in the postseason reduces the complexity and detail of sharing versus cooperative harvesting data documented. The increased detail in this type of data does not appear to improve the resulting overall harvest estimation.

c. The weekly data collection displayed in the survey should be flexible with regard to the change of subsistence fishing open periods throughout the summer and fall seasons that accommodate changes in abundance (i.e., from two 48-hour periods to five-day-openings) in order to address the best manner and timing to collect the data.

d. A community meeting preceding fieldwork would assist in informing community residents about the project and the uses (and utility) of the resulting data. This may also facilitate finding back-up local assistants and assisting all surveyors in talking to their sample households.

e. Community programs will need to detail contingencies, such as paying for late surveys, weeks where data were not collected, or the challenges of having to replace surveyors, etc.

Other models for the survey program could be considered. For example, the program could be restructured to focus only on surveying fishing households to document reported harvest rather than estimating community-level harvests. This approach, however, would reduce reliance on harvest sharing data which would ultimately reduce understanding of the entire harvest picture. An incomplete understanding of the total harvest picture may also lead to underestimation of harvests if the surveyor misses fishing households. Another model could focus on asking fishers to voluntarily stop by or call the tribal council with their weekly harvest numbers for someone to document. This would shift the responsibility of reporting to the individual fisher or fishing household and reduce the need for a single individual or set of individuals to contact households every week. This approach has challenges for consistency and systematicity of data collection: developing a community estimate would be difficult to impossible using this approach because it does not begin with an assessment of how many fishers are participating. The fisher-based voluntary reporting approach also does not address the need for centralized data aggregation, analysis, and reporting.

The increased communication between managers and stakeholders resulting over the last decade of decreased Chinook salmon runs has highlighted the foundational importance of good data, including harvest data, to sustainable management. However, the inseason harvest reporting program as described here is not likely a good replacement for the current postseason survey program on the scale demanded by the Yukon River drainage. An inseason effort may provide managers with useable data earlier the postseason program and may eventually provide greater support for the overall concept of harvest reporting if the effort was more locally driven. However, it is not clear that those benefits outweigh the costs, both financial and in terms of effort, of the increased requirement for oversight of multiple surveyors in multiple communities. Collecting harvest data far exceeds simply asking households how many fish they harvested, though it starts there. The development of community estimates that account for annual variation, represent whole communities and not just the fishing households, and provide managers with the context needed to understand the actual numbers (of fish harvested), rely on capacity to address all of the technical and statistical aspects of survey research.

REFERENCES

ADF&G Chinook Salmon Research Team
2013. *Chinook salmon stock assessment and research plan, 2013*. Alaska Department of Fish and Game, Special Publication No. 13-01: Anchorage.

Alaska Department of Fish and Game, Division of Commercial Fisheries
1962. *1961 Annual report, Arctic-Yukon-Kuskokwim Area*. Alaska Department of Fish and Game, Division of Commercial Fisheries, Annual Management Report: Anchorage.

1966. *1965 Aannual report, Arctic-Yukon-Kuskokwim Area*. Alaska Department of Fish and Game, Division of Commercial Fisheries, Annual Management Report: Anchorage.

1988. *Annual management report, Yukon Area, 1987*. Alaska Department of Fish and Game, Department of Commercial Fisheries, Regional Information Report 3A88-30: Anchorage.

Andersen, D.B.
1992. *The use of dog teams and the use of subsistence-caught fish for feeding sled dogs in the Yukon River drainage, Alaska.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 210.

Andersen, D.B. and C.L. Scott
2010. *An update on the use of subsistence-caught fish to feed sled dogs in the Yukon River drainage, Alaska*. Final Report 08-250. U.S. Fish and Wildlife Service, Office of Subsistence Management, Fisheries Resource Monitoring Program.

Association of Canadian Universities for Northern Studies
2003. *Ethical principles for the conduct of research in the North*. The Association = L'Association: Ottawa. ISBN 0-921421-10-9

Brown, C., J. Burr, K. Elkin, and R.J. Walker
2005. *Contemporary subsistence uses and population distribution of non-salmon fish in Grayling, Anvik, Shageluk, and Holy Cross.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 289: Fairbanks.

Brown, C.L., A. Godduhn, H. Ikuta, B. Retherford, A. Trainor, and S.J. Wilson
2015. *Socioeconomic effects of declining salmon runs on the Yukon River*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 398: Fairbanks.

Brown, C.L., B.M. McDavid, C.F. Moncrieff, A. Trainor, and J.S. Magdanz
2017. *Customary trade and barter as part of a continuum of exchange practices in 3 upper Yukon River region communities: Fort Yukon, Manley Hot Springs, and Venetie*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 437: Fairbanks.

Charnley, S.
1984. *Human ecology of two central Kuskokwim communities: Chuathbaluk and Sleetmute.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 81: Juneau.

Clark, A.M.
1981. "*Koyukon*" [in] *William C. Sturtevant, editor. Handbook of North American Indians: Subarctic*, 6: Subarctic. Smithsonian Institution Press: Washington, D.C.

Cochran, W.G.
1977. *Sampling techniques*, 3rd edition. John Wiley & Sons: New York.

Estensen, J. and B. Borba
2013. *2013 Yukon River fall season summary [press release]*.

Fall, J.A., A. Godduhn, L. Hutchinson-Scarbrough, B. Jones, M. Kukkonen, L.A. Sill, A. Trainor, and T. Lemons
2017. *Alaska subsistence and personal use salmon fisheries, 2014 annual report*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 427: Anchorage.

Fowler, F.J.
2004. "*Reducing interviewer-related error through interviewer training, supervision, and other means*" [in] P.P. Biemer, R.M. Groves, L.E. Lyberg, N.A. Mathiowetz, and S. Sudman, editors, Measurement Errors in Surveys. Wiley & Sons: Hoboken.

Holder, R.R. and H.H. Hamner
1990. *Preliminary estimates of subsistence salmon harvest in the Yukon River drainage, 1989*. Alaska Department of Fish and Game, Division of Commercial Fisheries Regional Information Report 3F90-22: Anchorage.

Jallen, D.M., S.K.S. Decker, and T. Hamazaki
2015. *Subsistence and personal use salmon harvests in the Alaska portion of the Yukon River drainage, 2012*. Alaska Department of Fish and Game, Fishery Data Series No. 15-28: Anchorage.

2017a. *Subsistence and personal use salmon harvests in the Alaska portion of the Yukon River drainage, 2015*. Alaska Department of Fish and Game, Fishery Data Series No. 17-39: Anchorage.

2017b. *Subsistence and personal use salmon harvests in the Alaska portion of the Yukon River drainage, 2013*. Alaska Department of Fish and Game, Fishery Data Series No. 17-08: Anchorage.

JTC (Joint Technical Committee of the Yukon River US/Canada Panel)
2014. *Yukon River salmon 2013 season summary and 2014 season outlook*. Alaska Department of Fish and Game, Division of Commercial Fisheries Regional Information Report No. 3A14-01: Anchorage.

2015. *Yukon River salmon 2014 season summary and 2015 season outlook*. Alaska Department of Fish and Game, Division of Commercial Fisheries Regional Information Report No. 3A15-01: Anchorage.

Kari, P.R.
1983. *Land use and economy of Lime Village*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 80: n.p.

Kerkvliet, C.M.
[*n.d.*] *1986 Hooper Bay salmon tagging study*. Bering Sea Fishermen's Association: Anchorage.

Kofinas, G., S.B. BurnSilver, J. Magdanz, R. Stotts, and M. Okada
2016. *Subsistence sharing networks and cooperation: Kaktovik, Wainwright, and Venetie, Alaska.* BOEM Report 2015-023DOI, AFES Report MP 2015-02. University of Alaska Fairbanks, School of Natural Resources and Extension: Fairbanks.

Lonner, T.D.
1980. *Subsistence as an economic system in Alaska: theoretical and policy implications*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 67: Anchorage.

Magdanz, J.S.
1988. *Harvest and exchange of eulachon from the Chilkat and Chilkoot rivers, Alaska*. Alaska Department of Fish and Game, Division of Subsistence Special Publication No. SP1988-03: Juneau.

Magdanz, J.S., S. Tahbone, A. Ahmasuk, D.S. Koster, and B.L. Davis
2007. *Customary trade and barter in fish in the Seward Peninsula Area, Alaska.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 328: Juneau.

Magdanz, J.S. and R.J. Wolfe
1988. *The production and exchange of seal oil in Alaska*. Alaska Department of Fish and Game, Division of Subsistence Special Publication No. SP1988-001: Juneau.

Moncrieff, C.
2007. *Traditional ecological knowledge of customary trade of subsistence harvested salmon on the Yukon River*, Final report to the Office of Subsistence Management, Fisheries Information Services, study 04-265. Yukon River Drainage Fisheries Association: Anchorage.

Moncrieff, C., C. Brown, and L. Sill
2009. *2009 Arctic Yukon Kuskokwim sustainable salmon initiative project final product: natural indicators of salmon run abundance and timing, Yukon River*. Yukon River Drainage Fisheries Association and the Alaska Department of Fish and Game, Division of Subsistence: Anchorage, Fairbanks.

Moncrieff, C., J. Klein, T. Willova, and G. Maschmann
2014. *Yukon River In-season salmon teleconferences and harvest survey, 2013.* Annual report for FWS Agreement No. F12AC00196. Yukon River Drainage Fisheries Association: Anchorage.

Naves, L.C., D. Koster, M.G. See, B. Easley, and L. Olson
2008. *Alaska Migratory Bird Co-Management Council migratory bird subsistence harvest survey: assessment of the survey methods and implementation*. Alaska Department of Fish and Game, Division of Subsistence Special Publication No. 2008-05: Anchorage.

Newland, E.
2013. *2013 Preliminary Yukon River summer season summary* [press release].

2014a. *2014 Yukon River summer salmon fishery news release #28, summer update #8, Yukon Area salmon fishery*.

2014b. *2014 Preliminary Yukon River summer season summary* [press release].

O'Brien, T.A.
2011. *Gwich'in Athabascan implements: history, manufacture, and usage according to Reverend David Salmon*. University of Alaska Press: Fairbanks, AK.

Pennoyer, S., K.R. Middleton, and M.E. Morris, Jr.
1965. *Arctic-Yukon-Kuskokwim Area salmon fishing history*. Alaska Department of Fish and Game, Division of Commercial Fisheries Informational Leaflet 70: Juneau.

Pete, M.C.
1991. *Contemporary patterns of wild resource use by residents of Russian Mission, Alaska*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 127: Juneau.

Schroeder, R.F., D.B. Andersen, R. Bosworth, J.M. Morris, and J.M. Wright
1987. *Subsistence in Alaska: Arctic, Interior, Southcentral, Southwest, and Western regional summaries.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 150: Juneau.

Schwatka, F.
1983rep. *[1885] Along Alaska's great river,* Northern History Library. Alaska Northwest Publishing Company: Anchorage.

Shirley, S.M.
1992. *Background report on limited entry in the Arctic-Yukon-Kuskokwim salmon fisheries*. A CFEC report to the Alaska Board of Fisheries. CFEC Report Number 92-5. Alaska Commercial Fisheries Entry Commission: Juneau.

Stickney, A.
1984. *Coastal ecology and wild resource use in the central Bering Sea area: Hooper Bay and Kwigillingok*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 85: n.p.

Wolfe, R.J.
1981. *Norton Sound/Yukon Delta sociocultural systems baseline analysis.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 59: n.p.

1984. *Subsistence-based socioeconomic systems in Alaska: an introduction*. Alaska Department of Fish and Game, Division of Subsistence Special Publication No. SP1984-001: Juneau.

1987. *The super-household: specialization in subsistence economies.* Paper presented at the 14th annual meeting of the Alaska Anthropological Association, March 1987, Anchorage, Alaska. Alaska Department of Fish and Game Division of Subsistence: Juneau.

Wolfe, R.J. and C. Scott
2010. *Continuity and change in salmon harvest patterns, Yukon River drainage, Alaska*, U.S. Fish and Wildlife Service, Office of Subsistence Management, Fisheries Resource Monitoring Program No. 07-253. Robert J. Wolfe and Associates: San Marcos, CA.

Wolfe, R.J., C.L. Scott, W.E. Simeone, C.J. Utermohle, and M.C. Pete
2010. *The "super-household" in Alaska Native subsistence economies*. Final Report to the National Science Foundation, Project ARC 0352611.

Wolfe, R.J., W.E. Simeone, C.J. Utermohle, M.C. Pete, and National Science Foundation
1993. *The sharing, distribution, and exchange of wild resources in Alaska: a compendium of materials presented to the Alaska Board of Fisheries*. Alaska Department of Fish and Game Division of Subsistence: Juneau.

Yukon River Drainage Fisheries Association (YRDFA)
2005. *Yukon River Salmon Agreement Handbook*. Yukon River Drainage Fisheries Association and the Yukon River Panel: Anchorage.

APPENDIX A–DIVISION OF COMMERCIAL FISHERIES POSTSEASON SURVEY FORM

Date of Survey _____
Person Interviewed _____
Relation to HH _____
Interviewer _____

Community LABEL HHID#
Head of Household LABEL
Significant Other LABEL
Mailing Address LABEL Telephone#

CONFIDENTIAL INFORMATION - 2012 Yukon Area Post-Season Subsistence Salmon Harvest Survey

District 3 – GASH (District 3, 4, Innoko)

1. We would like to make sure we have the correct name and address for your household.

Head of Household _____ Permanent Note _____
Mailing Address _____ Telephone _____
Significant Other _____ Permanent Note _____

2. How many people live in your household? _____

3. Did anyone in your household harvest salmon for subsistence use OR keep fish for subsistence use from commercial fishing?
Yes ____ No ____

Harvest includes catching or cutting salmon. If household retained fish from commercial openings, or subsistence fished, complete all of PART 1. Otherwise go to PART 2.

Adult household member declined to be interviewed. [ ] Reason given: _____

4. May I have your salmon catch calendar? Yes ____ No ____ Already mailed ____ (Entire harvest on calendar? _____)

PART 1: HOUSEHOLDS THAT CAUGHT SALMON

5. How many total salmon did <u>you or your fishing</u> GROUP catch?
CHINOOK _____ SUMMER CHUM _____ FALL CHUM _____ COHO _____ PINK _____

6. How many households helped to catch these fish? _____ (Names) _____
_____

*__7. Where did you harvest your salmon? How many total salmon did <u>your household</u> harvest for subsistence purposes?__
(Include <u>only fish caught by this household</u>, not the group, <u>includes fish kept from commercial periods</u>.)

Ocean 1 **2 3 4A 4B 4C** 5A 5B 5C 5D (Ft Yukon ↑ or ↓) **Innoko Koyukuk** Chandalar Porcupine Black

Area _____ CHINOOK _____ SUMMER CHUM _____ FALL CHUM _____ COHO _____ PINK _____
Area _____ CHINOOK _____ SUMMER CHUM _____ FALL CHUM _____ COHO _____ PINK _____
Total (two areas) CHINOOK _____ SUMMER CHUM _____ FALL CHUM _____ COHO _____ PINK _____

8. What is your household's PRIMARY type of salmon fishing GEAR? ('Primary' is gear that catches the most salmon)
(1= primary, 2 = secondary) SET NET ____ DRIFT NET ____ FISH WHEEL ____ HOOK & LINE ____ OTHER _____

♦ <u>8A.</u> **For households that harvested <u>Chinook salmon</u>: Estimate <u>number</u> of Chinook salmon caught by each gear type.**
SET NET _____ DRIFT NET _____ FISH WHEEL _____ HOOK & LINE _____ OTHER _____

9. How many subsistence fish did your household retain from COMMERCIAL fishing? (___ Did not commercial fish)
CHINOOK _____ SUMMER CHUM _____ FALL CHUM _____ COHO _____ PINK _____

10. Did your household "LOSE" any salmon? (e.g. to bears, birds, flies, spoilage, diseased fish, etc.) (____ None lost)
(If fish was not fit for humans but <u>was</u> fed to dogs, then it was not "lost.")
CHINOOK _____ SUMMER CHUM _____ FALL CHUM _____ COHO _____ PINK _____
Reason(s) for LOSS: _____

11. Did your household SHARE the salmon catch with any other households? (names, species and numbers)
_____
_____

__12. How many salmon did you KEEP for <u>your household's</u> use?** (do not include fish given away or 'lost")
CHINOOK _____ SUMMER CHUM _____ FALL CHUM _____ COHO _____ PINK _____

District 3 – GASH (District 3, 4, Innoko)

PART 2: TO BE ASKED OF ALL HOUSEHOLDS

****13. Was your household GIVEN any salmon? Yes ____ No ____** Code: S=Subsistence, C=Commercial, T=Test Fish

Code: _____ Fishermen/Project (Name) _____

CHINOOK _____ SUMMER CHUM _____ FALL CHUM _____ COHO _____ PINK _____

Code: _____ Fishermen/Project (Name) _____

CHINOOK _____ SUMMER CHUM _____ FALL CHUM _____ COHO _____ PINK _____

14. Did YOUR household get enough salmon this year? (compared to Question 7 or 13). If the household has no need or usually does not harvest the species, indicate '0'. If the number needed/wanted is more/less than the household got, ask why.)

Were you able to harvest or receive enough:

CHINOOK ?	Y / N	How many did you need/want: _____	Comment:_____
SUMMER CHUM ?	Y / N	How many did you need/want: _____	Comment:_____
FALL CHUM ?	Y / N	How many did you need/want:_____	Comment:_____
COHO ?	Y / N	How many did you need/want:_____	Comment:_____

15. Did your household catch any OTHER FISH besides salmon? Yes _____ No _____

(Harvest numbers should include from September/October of last year to now. Large Whitefish are 4 pounds or greater.)

Large whitefish: BROAD _____ HUMPBACK _____ SMALL WHITEFISH (Cisco*, Round whitefish) _____

SHEEFISH _____ BURBOT _____ PIKE _____ BLACKFISH _____ GRAYLING _____ SUCKERS _____

TROUT (Arctic Char) _____ EELS (Lamprey) _____ OTHER/NOTES _____

*MONTHS WHEN CISCO WERE HARVESTED or Other FISH Notes_____

16. How many SOCKEYE (red) salmon did your household catch? _____ (Mark '0' if household didn't fish for sockeye)

17. How many DOGS (including puppies) does your household have? _____ (if "none" go to question 21)

18. Do you feed WHOLE salmon to your dogs? Yes _____ No _____ Only Feed **SCRAPS** ____ (if "No" go to question 21)

19. Were any of the salmon put up for the dogs from the commercial fishery? Yes _____ No _____

20. Estimate harvest of salmon put up for dogs this year by fishery (numbers should represent WHOLE FISH, not scraps):

(Subsistence) CHINOOK _____ SUMMER CHUM _____ FALL CHUM _____ COHO _____ PINK _____

(Commercial) CHINOOK _____ SUMMER CHUM _____ FALL CHUM _____ COHO _____ PINK _____

21. Do you have any additional comments?_____

_____

_____

How did this year compare to last year?_____

THANK YOU! THIS INFORMATION IS USED TO DOCUMENT THE SUBSISTENCE SALMON HARVEST WITHIN THE YUKON RIVER DRAINAGE AND TO TRY TO ENSURE THERE WILL BE ENOUGH SALMON FOR THE FUTURE.

Surveyor Comments:

Reminder: How many people live in this Household? _____ Please verify correct address and phone numbers

Official Use - This area is to be filled in by Fish and Game.

HOUSEHOLD'S TOTAL SUBSISTENCE SALMON CATCH (Totals from question *7)

CHINOOK _____ SUMMER CHUM _____ FALL CHUM _____ COHO _____ PINK _____

HOUSEHOLD'S TOTAL SUBSISTENCE SALMON USE (Add totals from questions **12 and **13)

CHINOOK _____ SUMMER CHUM _____ FALL CHUM _____ COHO _____ PINK _____

Complete Survey _____ Partial Survey _____ No Survey _____

District 3 – GASH (District 3, 4, Innoko)

APPENDIX B–INSEASON SURVEY, PHASE 1

Date of Survey _____
Person Interviewed _____
Relation to HH _____
Interviewer _____

Community LABEL HHID#
Head of Household LABEL
Significant Other LABEL
Mailing Address LABEL Telephone#

CONFIDENTIAL INFORMATION - 2013 Grayling In-Season Subsistence Salmon Harvest Survey

Adult household member declined to be interviewed. [ ] Reason given: _____

PART 1: Household Information

1. We would like to make sure we have the correct name and address for your household.

Head of Household _____Permanent Note _____

Mailing Address _____Telephone _____

Significant Other _____Permanent Note _____

2. How many people live in your household? _____

3. How many DOGS (including puppies) does your household have? _____ (if "none" go to question 21)

4. Do you feed WHOLE salmon to your dogs? Yes _____ No _____ Only Feed **SCRAPS** ____ (if "No" go to question 21)

5. Do you intend to harvest this summer for (check all that apply): _____ **Chinook** _____ **summer chum** _____ **fall chum** _____ **coho**

Harvest includes catching or cutting salmon!

Surveyor Comments:

APPENDIX C–INSEASON SURVEY, PHASE 2

	1	2	3	4	5	6	7	8
WEEK	Did anyone in your HH harvest salmon for subsistence OR keep fish for subsistence from commercial fishing? **IF NO, SKIP TO 2** **IF YES, SKIP TO 3**	Did you process fish for anyone outside of your HH? **IF NO, SKIP TO 13** **IF YES, REPORT # OF FISH KEPT IN COLUMN 5, THEN SKIP TO 10**	Did you **fish with anyone outside of your household**? **IF NO, SKIP TO 6**	What was the TOTAL CATCH from fishing with others? *(report # of fish)*	Of the total catch, what was YOUR HOUSEHOLD's SHARE? *(report # of fish)*	Did **your household fish alone?** *(If yes, report # of fish)*	Did you go **commercial fishing for salmon?** **IF YES,** did you **retain any for subsistence use?** *(report # of fish)*	*[Add #s from columns **5, 6** and 7 and write the total for each species]* **REPORT THESE # ON FAX FORM**
May 24 - 30	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**
May 31 - June 6	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**

June 7 - 13	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**
June 14 - 20	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**
June 21 - 27	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**
June 28 - July 4	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**

July 5 - 11	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**
July 12 - 18	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**
July 19 - 25	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**
July 26 - Aug 1	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**

Aug 2 - 8	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**
Aug 9 - 15	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**
Aug 16 - 22	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**
Aug 23 - 29	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**

Aug 30 - Sept 5	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**
Sept 6 - 12	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**
Sept 13 - 19	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**
Sept 20 - 26	Y / N	Y / N If YES, for whom? _____ How many of these fish did you keep for your HH? _____ ***[Report # in 5 & SKIP TO 10]***	Y / N If YES, who did you fish with? _____ _____ _____	GROUP TOTAL king _____ sc _____ fc _____ coho_____ pink _____	**HH SHARE** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HH CATCH** **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	Y / N **king _____** **sc _____** **fc _____** **coho_____** **pink _____**	**HOUSEHOLD TOTAL** **king _____** **sc _____** **fc _____** **coho _____** **pink _____**

9	10	11	12		13	14
Did anyone outside of your own HH process your fish?	Did you give any of YOUR fish away? *(YOUR fish include:* *- Q5: your share while fishing with others* *AND* *- Q6: any fish you caught when your HH fished alone* *AND* *- Q7: any fish retained from commercial fishing)* *(record # of fish)*	Where did you harvest your salmon? *(circle district)*	What gear did you use to catch **your fish**? For **kings** *(record # of fish)*	For **all other salmon** combined *(record # of fish)*	Was your HH given any salmon? By whom? *(record # of fish and persons' name)*	Comments
Y / N If YES, who? _____ _____ _____	king _____ sc _____ fc _____ coho_____ pink _____	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel _____ dip net _____ hook&line _____ other _____	set net ___ mesh: __ drift net ___ mesh: __ fish wheel _____ dip net _____ hook&line _____ other _____	king ___ Names: _____ sc ___ Names: _____ fc ___ Names: _____ coho___ Names: _____ pink ___ Names: _____	
Y / N If YES, who? _____ _____ _____	king _____ sc _____ fc _____ coho_____ pink _____	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel _____ dip net _____ hook&line _____ other _____	set net ___ mesh: __ drift net ___ mesh: __ fish wheel _____ dip net _____ hook&line _____ other _____	king ___ Names: _____ sc ___ Names: _____ fc ___ Names: _____ coho___ Names: _____ pink ___ Names: _____	

Y / N If YES, who? ___________ ___________ ___________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	
Y / N If YES, who? ___________ ___________ ___________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	
Y / N If YES, who? ___________ ___________ ___________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	
Y / N If YES, who? ___________ ___________ ___________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	

Y / N If YES, who? ____________ ____________ ____________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	
Y / N If YES, who? ____________ ____________ ____________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	
Y / N If YES, who? ____________ ____________ ____________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	
Y / N If YES, who? ____________ ____________ ____________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	

Y / N If YES, who? ____________ ____________ ____________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	
Y / N If YES, who? ____________ ____________ ____________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	
Y / N If YES, who? ____________ ____________ ____________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	
Y / N If YES, who? ____________ ____________ ____________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	

Y / N If YES, who? ____________ ____________ ____________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	
Y / N If YES, who? ____________ ____________ ____________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	
Y / N If YES, who? ____________ ____________ ____________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	
Y / N If YES, who? ____________ ____________ ____________	king ________ sc ________ fc ________ coho________ pink ________	Ocean **1** **2** **3** 4A 4B 4C 5A 5B 5C 5D Innoko Koyukuk Chandalar Porcupine Black	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	set net ___ mesh: __ drift net ___ mesh: __ fish wheel ______ dip net ______ hook&line ______ other ___________	king ___ Names: __________ sc ___ Names: __________ fc ___ Names: __________ coho___ Names: __________ pink ___ Names: __________	

APPENDIX D–DATA TRANSMITTAL FORM

IN-SEASON SALMON FISHING SURVEY - GRAYLING FAX NUMBER:

Date:

Week of Harvest:

Surveyor Initials	HH ID#	Survey Status*	Harvest Data				Gear Type	Comments**
			King	SC	FC	Coho		

*** Survey Status examples:** Completed, Out of town, Refused...

**** Comments:** Please, indicate if harvest data includes previous week(s)