

Technical Paper No. 330

**Bethel Subsistence Fishing Harvest Monitoring
Report, Kuskokwim Fisheries Management Area,
Alaska, 2001-2003**

by

Jim Simon,

Tracie Krauthoefer,

David Koster,

Michael Coffing,

and

David Caylor

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Alaska Department of Fish and Game

Division of Subsistence



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Weights and measures (metric)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative Code	AAC	fork length	FL
deciliter	dL			mid-eye-to-fork	MEF
gram	g	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	mid-eye-to-tail-fork	METF
hectare	ha			standard length	SL
kilogram	kg	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	total length	TL
kilometer	km			Mathematics, statistics	
liter	L	at	@	<i>all standard mathematical signs, symbols and abbreviations</i>	
meter	m	compass directions:		alternate hypothesis	H _A
milliliter	mL	east	E	base of natural logarithm	<i>e</i>
millimeter	mm	north	N	catch per unit effort	CPUE
		south	S	coefficient of variation	CV
Weights and measures (English)		west	W	common test statistics	(F, t, χ^2 , etc.)
cubic feet per second	ft ³ /s	copyright	©	confidence interval	CI
foot	ft	corporate suffixes:		correlation coefficient	
gallon	gal	Company	Co.	(multiple)	R
inch	in	Corporation	Corp.	correlation coefficient	
mile	mi	Incorporated	Inc.	(simple)	r
nautical mile	nmi	Limited	Ltd.	covariance	cov
ounce	oz	District of Columbia	D.C.	degree (angular)	°
pound	lb	et alii (and others)	et al.	degrees of freedom	df
quart	qt	et cetera (and so forth)	etc.	expected value	<i>E</i>
yard	yd	exempli gratia		greater than	>
		(for example)	e.g.	greater than or equal to	≥
Time and temperature		Federal Information Code	FIC	harvest per unit effort	HPUE
day	d	id est (that is)	i.e.	less than	<
degrees Celsius	°C	latitude or longitude	lat. or long.	less than or equal to	≤
degrees Fahrenheit	°F	monetary symbols		logarithm (natural)	ln
degrees kelvin	K	(U.S.)	\$, ¢	logarithm (base 10)	log
hour	h	months (tables and figures): first three letters	Jan, ..., Dec	logarithm (specify base)	log ₂ , etc.
hour	h	registered trademark	®	minute (angular)	'
minute	min	trademark	™	not significant	NS
second	s	United States (adjective)	U.S.	null hypothesis	H ₀
		United States of America (noun)	USA	percent	%
Physics and chemistry		U.S.C.	United States Code	probability	P
all atomic symbols		U.S. state	use two-letter abbreviations	probability of a type I error	
alternating current	AC		(e.g., AK, WA)	(rejection of the null hypothesis when true)	α
ampere	A			probability of a type II error	
calorie	cal			(acceptance of the null hypothesis when false)	β
direct current	DC			second (angular)	"
hertz	Hz			standard deviation	SD
horsepower	hp			standard error	SE
hydrogen ion activity (negative log of)	pH			variance	
parts per million	ppm			population	Var
parts per thousand	ppt, ‰			sample	var
volts	V				
watts	W				

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by

Jim Simon

Alaska Department of Fish and Game, Division of Subsistence, Fairbanks

Tracie Krauthoefer

Alaska Department of Fish and Game, Division of Subsistence, Anchorage

David Koster

Alaska Department of Fish and Game, Division of Subsistence, Anchorage

Michael Coffing

Alaska Department of Fish and Game, Division of Subsistence, Bethel

and

David Caylor

Alaska Department of Fish and Game, Division of Subsistence, Anchorage

Alaska Department of Fish and Game
Division of Subsistence
PO Box 115526, Juneau, Alaska, 99811-5526

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Final Report to the U.S. Fish and Wildlife Service, Office of Subsistence Management, Fisheries Resource Monitoring Program, to fulfill obligations for Study No. 01-024 under agreement 701811J335.

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*Jim Simon,
Alaska Department of Fish and Game, Division of Subsistence,
1300 College Road, Fairbanks, Alaska 99701-1599, USA*

*and
Tracie Krauthoefer, David Koster, Michael Coffing and David Caylor,
Alaska Department of Fish and Game, Division of Subsistence,
333 Raspberry Road, Anchorage, Alaska, 99518-1599, USA*

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ABSTRACT

This final report documents subsistence fish (salmon and non-salmon) harvest estimates for the community of Bethel for the years 2001, 2002, and 2003. Data included total number of Bethel households; number of households that harvested salmon for subsistence; number of households that did not harvest salmon for subsistence; numbers of Chinook salmon, chum salmon, sockeye salmon, coho salmon, and pink salmon harvested for subsistence uses; and numbers of resident freshwater and other non-salmon fish species harvested for subsistence uses by residents of Bethel. Estimates of Bethel subsistence salmon harvest in 2001 included 27,209 Chinook salmon (*Oncorhynchus tshawytscha*); 11,319 chum salmon (*O. keta*); 15,709 sockeye salmon (*O. nerka*); 748 pink salmon (*O. gorbuscha*); and 14,949 coho salmon (*O. kisutch*), for a total of 69,934 salmon. Estimates of the subsistence salmon harvest for the community of Bethel in 2002 included 19,305 Chinook salmon (*Oncorhynchus tshawytscha*); 15,082 chum salmon (*O. keta*); 7,350 sockeye salmon (*O. nerka*); 721 pink salmon (*O. gorbuscha*); and 12,966 coho salmon (*O. kisutch*); for a total of 55,424 salmon. Estimates of the subsistence salmon harvest for the community of Bethel in 2003 included 21,475 Chinook salmon (*Oncorhynchus tshawytscha*); 9,829 chum salmon (*O. keta*); 10,542 sockeye salmon (*O. nerka*); 261 pink salmon (*O. gorbuscha*); and 13,237 coho salmon (*O. kisutch*); for an estimated total of 55,344 salmon. This salmon harvest monitoring research continues to be critical tool in Kuskokwim subsistence fisheries management.

Bethel residents harvested an estimated total of 95,440 usable pounds, 126,861 usable pounds, and 78,615 usable pounds of non-salmon fish in 2001, 2002, and 2003, respectively. Estimated Bethel non-salmon harvests, based on usable pounds, represented about 12% of the estimated total 2001 subsistence fish harvest, 19% of the 2002 fish harvest, and 15% of the 2003 Bethel subsistence fish harvest.

Key words: Bethel, Kuskokwim River, Yukon-Kuskokwim Delta, subsistence fishing, harvest monitoring, Chinook salmon, chum salmon, sockeye salmon, pink salmon, coho salmon, northern pike, whitefish, inconnu

INTRODUCTION

This report presents the results of the subsistence salmon and non-salmon harvest monitoring efforts in the community of Bethel for 2001-2003. Methods utilized for gathering data were established by Alaska Department of Fish and Game (ADF&G), Division of Subsistence (Subsistence) in 1988 and 1989 (Francisco et al. 1989; Walker and Coffing 1993).

The Kuskokwim area (Figure 1) subsistence salmon fishery is one of the largest in the state; resident freshwater fish and other non-salmon fish also are harvested in significant numbers for subsistence uses. From June through August, the daily activities of many Kuskokwim area households revolve around harvesting, processing, and preserving salmon for customary and traditional uses or subsistence; freshwater fish and other non-salmon fish are harvested for subsistence throughout the year. The movement of families from permanent winter residences to summer fish camps, situated along rivers and sloughs, continues to be very important in annual subsistence harvest efforts.

The significance of salmon and other fish harvested and used for subsistence in the Kuskokwim Management Area is well documented for the region (e.g., Andrews 1989:154; Andrews and Coffing 1986; Barker 1993; Coffing 1991; Fienup-Riordan 1990:184ff, 1994:120, 123; Hensel 1996; Himmelheber 1987:32; Oswalt 1963a, 1963b, 1990; Pete 1993; Senecal-Albrecht 1990, 1998; Walker and Coffing 1993; Wolfe, Gross, Langdon, Wright, Sherrod, Ellanna, Sumida, and Usher 1984). Studies indicate that fish (salmon and non-salmon) contribute 68% to 85% of the total pounds of fish and wildlife harvested in a community; salmon contribute 49% to 53% of the total annual wild food harvest. The harvest of salmon for subsistence ranges from 241 usable pounds per capita in some communities (e.g., Nunapitchuk, 1983) to 446 (e.g., Kwethluk, 1986) and 649 (e.g., Akiachak, 1998) usable pounds per capita in other Kuskokwim River communities (e.g., Andrews 1989, 1994; Coffing 1991; Coffing, Brown, Jennings, and Utermohle 2001; see also ADF&G 2007). Kuskokwim area communities are heavily reliant upon the annual returns of salmon and other fish throughout the year not only for basic nutrition, but also for maintenance of cultural identity and cultural values, in addition to economic opportunities for commercial sales. Many people who are not directly involved in harvesting salmon, assist family and friends with cutting, drying, smoking, and associated preservation activities.

The significance of subsistence salmon fisheries to residents of the Kuskokwim Management Area becomes much more obvious when compared to estimates of U.S. per capita salmon consumption. For example, Professor Gunnar Knapp of the Institute of Social and Economic Research, University of Alaska Anchorage has estimated U.S. salmon consumption in 1990 at less than 1 pound per person, which increased during the 1990s to almost 2 pounds per person in 1999 (Knapp 2000).

Annual household subsistence surveys, like the 2001-2003 harvest surveys reported in this paper, gather summary harvest data on Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*O. keta*), sockeye salmon (*O. nerka*), and coho salmon (*O. kisutch*), including numbers of each fish species harvested and types of fishing gear used. The results of subsistence harvest monitoring efforts are an important tool for state and federal fisheries management.

Because of the relatively low harvest of pink salmon (*O. gorbuscha*) in the Kuskokwim area, data on this species typically have not been collected (Walker and Coffing 1993:58); however, information on pink salmon and other fish harvests by Bethel households was collected for 2001, 2002, and 2003 as part of this study. While non-salmon fish harvests are not typically monitored

annually in the Kuskokwim area, previous ADF&G research has documented the uses of freshwater resident fish and other non-salmon fish for subsistence purposes (e.g., Andrews 1989; Coffing 1991; Coffing et al. 2001; Coffing, Morgan and Rank 2003; Holen, Simeone, and Williams 2006; Krauthoefer et al. 2007, Stokes 1985; Wolfe et al. 1984; see also ADF&G 2007). For example, subsistence herring surveys were conducted in the mid 1980s through the early 1990s in the Nelson Island region (Pete 1984, 1989, 1991a, 1991b, 1992). Non-salmon harvest estimates also have been provided for communities such as Kwethluk (Coffing 1991), Nunapitchuk (Andrews 1989, 1994), Akiachak (Coffing et al. 2001), Nikolai, McGrath, Telida, and Takotna (Stokes 1985), and Goodnews Bay and Quinhagak (Wolfe et al. 1984) from community baseline surveys conducted in the Kuskokwim region in the 1980s and 1990s. More recently, studies have documented non-salmon harvests for Lake Minchumina and Nikolai (Holen et al. 2006), Aniak (Coffing et al. 2003), Bethel (Simon et al. 2007), and Aniak and Chuathbaluk (Krauthoefer et al. 2007). Non-salmon fish harvest information also was collected as part of this study.

Information on specific salmon harvest locations has not been annually collected, although ADF&G Subsistence research conducted largely in the 1980s documented harvest location information for a number of Kuskokwim area communities, but not for Bethel specifically (e.g., Brelsford, Peterson, and Haynes 1987; Coffing 1991; Coffing et al. 2001, 2003; Charnley 1982, 1984; Kari 1983, 1985; Krauthoefer et al. 2007; Pete 1984, 1989, 1991a, 1991b, 1992; Stickney 1981; Stokes 1982, 1984:166, 1985; Williams, Venchuk, Holen and Simeone 2005).

THE STUDY AREA

The community of Bethel, located on the lower Kuskokwim river drainage (Figure 1), is the largest community in the Kuskokwim Fisheries Management Area with an estimated population of 5,471, 68% of whom are Alaska Native, with approximately 1,741 occupied households (U.S. Census 2000). Many Bethel households actively engage in subsistence fishing and Bethel fish harvests represent significant proportions of total areawide harvests of fish. Bethel residents generally harvest salmon and other fish from the Kuskokwim River, tributaries and local lakes and ponds.

As noted in the final report for FRMP study number FIS 00-009 entitled, "Bethel Post-Season Subsistence Fisheries Harvest Surveys, 2000," specific harvest areas and methods are as follows:

. . . salmon are generally harvested with gillnets primarily from the Kuskokwim River located between Akiachak and Napakiak. Other species caught by gillnet in open water are taken in the same general area. Gillnets set under the ice are utilized primarily in the area from Oscarville upstream to the upstream end of Steamboat Slough located near Bethel. Fishing for smelt generally occurs in the Kuskokwim River from Napakiak to the lower end of Kuskokuak Slough. Blackfish are caught in tundra streams generally within a 10-mile radius from Bethel.

Bethel residents focus much of their summer rod and reel fishing efforts on tributaries in the lower Kuskokwim area, such as the Kwethluk, Kasigluk, and Kisaralik rivers. Some families travel to Quinhagak to fish for salmon. Individuals commonly harvest fish with rod and reel gear in association with

summer berry picking activities and late summer-early fall hunting activities throughout the Kuskokwim river drainage. Fishing from the Bethel seawall is also a popular activity during the summer months and affords people an opportunity to harvest fish for subsistence use without requiring the investment of a boat and motor or a gillnet. Likewise, during winter, some individuals walk to fishing areas near Bethel or drive on the Kuskokwim river ice road to access fishing areas near the Johnson and Gweek rivers. The primary harvest areas used by subsistence fishers with hook and line gear included the Kwethluk river drainage, the mouth of the Johnson River, the Bethel seawall, and the Kisaralik river drainage (Coffing 2001:5).

BACKGROUND: BETHEL SUBSISTENCE SALMON FISHING

HARVEST MONITORING

This project documenting Bethel subsistence fishing was conducted as part of the larger annual Kuskokwim Management Area subsistence salmon harvest monitoring program, which has been described elsewhere and therefore is not repeated here (e.g., Simon, Krauthoefer, Koster, and Caylor 2007; Walker and Coffing 1993).

REGULATORY CONTEXT

Under federal regulations, individuals must be Kuskokwim area residents to participate in the Kuskokwim subsistence salmon fishery. Under state regulations, fishers must be Alaskan residents for the preceding 12 months before harvesting salmon for subsistence uses. Most subsistence salmon fishers in the region continue to be primarily Kuskokwim area residents, but some who are domiciled in other parts of Alaska return annually to assist family or friends harvest or process salmon.

Licenses, Permits, and Harvest Limits

Licenses and permits have never been required under state or federal regulations for subsistence salmon fishing in the Kuskokwim area. During the 2001, 2002, and 2003 fishing seasons, with the exception of the Aniak River, there were no regular restrictions on the number of salmon or other fish harvestable by individual fishers or households for subsistence uses in the Kuskokwim Management Area. Under state regulations, rod and reel fishers upstream of Doestock Creek on the Aniak River had a combined daily bag limit of six fish. No more than three of these could be salmon, and no more than two of those could be Chinook salmon; further, neither chum salmon nor rainbow trout could be retained (5 AAC 01.295; see also ADF&G 2003b, 2005a; Krauthoefer et al. 2007:3). In the absence of permits to track harvest data, subsistence salmon harvest information is collected through harvest monitoring efforts, including household surveys, harvest calendars, and postcard surveys. Community and household participation in the harvest monitoring effort is voluntary.

Fishing Gear

During the period 2001-2003, under both state and federal regulations, salmon could be harvested for subsistence use by set and drift gillnets, beach seines, fish wheels, and hook and line attached to a rod or pole, "rod and reel." Spears could only be used in the Holitna,

Kanektok, Arolik, and Goodnews River drainages. Individual set or drift gillnets could not exceed a total length of 50 fathoms (300 feet). Unless changed by Emergency Order, gillnets used for harvesting salmon could be of any size mesh. However, nets with six-inch or smaller mesh could not be more than 45 meshes deep, and nets with mesh greater than six-inches could not be more than 35 meshes deep. Fishers were required to have their names and addresses attached to their gillnets and fish wheels.

Rod and reel gear, or hook and line attached to a rod or pole, through open water was gear for subsistence under state regulations until March 2000, when the Alaska Board of Fisheries recognized rod and reel gear as legal subsistence fishing gear in the Kuskokwim Fisheries Management Area, except that portion of the Kuskokwim river drainage upstream of the Tatlaswiksik River (e.g., ADF&G 2003a).

Subsistence Salmon Fishing Schedule

Following declines in Chinook and chum salmon returns to the Kuskokwim River beginning in 1997, and, in anticipation of poor returns in 2001, the Alaska Board of Fisheries (BOF) designated both species as stocks of concern (specifically, “yield concerns”) under the Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222) in September 2000. To guide the department in the management of these stocks of concern, the Board replaced the Kuskokwim River Salmon Management Plan in January 2001 with the Kuskokwim River Salmon Rebuilding Management Plan (Rebuilding Plan) (5 AAC 07.365). Under the Rebuilding Plan, Kuskokwim River salmon stocks are to be managed conservatively, especially for the months of June and July. The Federal Subsistence Board (FSB) adopted this designation and Rebuilding Plan in 2001.

The Rebuilding Plan provides direction for implementing a subsistence fishing schedule which allows salmon net (with mesh size greater than four inches) and fish wheel fisheries to operate for four consecutive days per week in June and July, as announced by Emergency Order (EO), and implemented in association with salmon run-timing in a step-wise progression upstream. The subsistence fishing schedule is based on run strength, by EO to achieve escapement goals. Once escapement goals are projected to be met for Chinook and chum salmon, subsistence fishing can be allowed seven days per week.

State and federal fisheries representatives polled communities throughout the Kuskokwim river drainage in 2001 for guidance on which three days would be the most desirable for the subsistence fishing closures. Based on community response, the recommendation of the Kuskokwim River Salmon Management Working Group (Working Group) was to close the Kuskokwim River to subsistence net and fish wheel fisheries Sunday, Monday, and Tuesday. Subsistence fishing with a hook and line attached to a rod or pole or “rod and reel” was not included in this schedule nor were Kuskokwim Bay subsistence salmon fisheries. It is important to note, however, that subsistence salmon fishing prior to 2001 also was scheduled, meaning that there were subsistence closures before (16 hours), during (16 hours), and after (6 hours) commercial fishing periods (e.g., ADF&G 2001:46; ADF&G 2002:50).

During the subsistence salmon fishing closures on the lower Kuskokwim River, fishing for fish other than salmon was allowed only with hook and line gear and gillnets with four-inch or smaller mesh that are 60 feet or less in length. However, subsistence salmon fishing regulations did not apply to fishing for fish other than salmon in non-salmon tributaries 100 yards upstream

from their confluence with the Kuskokwim River. Non-salmon tributaries include Gweek, Johnson, Kinak, Kialik, and Tagayarak rivers (e.g., ADF&G 2003b, 2004).

Subsistence Closures During the Commercial Fishery

Areas within commercial salmon fishing districts were closed to subsistence salmon net and fish wheel gear 16 hours before, during, and 6 hours after commercial fishing periods as described in 5 AAC 01.260. Many fishers participating in the Kuskokwim commercial fisheries are local residents who also fish for subsistence. The purpose of these closures was to discourage illegal fishing activity, such as the sale of subsistence-caught salmon in the commercial fishery.

2001 Subsistence Salmon Fishing Season Regulatory Summary

In 2001, the Kuskokwim River subsistence salmon fishing schedule began the first week of June in District 1 (lower Kuskokwim River), which extends from the mouth upstream to Bogus Creek, which is 9 miles upstream of Tuluksak, and includes the Eek, Kwethluk, Kisarialik, Kasigluk, and Tuluksak salmon spawning tributaries (Figure 1). Starting the second week of June, the schedule was expanded to District 2, which includes all waters downstream of Chuathbaluk. Starting the third week of June, the subsistence fishing schedule was expanded to include all waters of the Kuskokwim river drainage; this schedule did not affect the waters outside the Kuskokwim River. Then, more restrictive adjustments were made to the fishing schedule in mid-July when it became apparent that additional steps were necessary to protect a poor chum salmon return. In addition, a poor chum and Chinook salmon return in the George river drainage prompted a closure of the subsistence salmon fishery in that drainage for much of the 2001 season. The weekly subsistence salmon fishing schedule ended August 1 and reverted back to seven days per week fishing, except for periodic closures around the commercial fishing periods (ADF&G 2003a).

During 2001, additional restrictions on the subsistence fishery in the Kuskokwim river drainage were implemented on July 8. Following a commercial fishing period on July 5, ADF&G and the Federal Office of Subsistence Management restricted the subsistence fishery throughout the Kuskokwim river drainage. The restrictions required that gillnets must have 6-inch or less stretched mesh and limited individuals to a daily subsistence rod and reel bag limit of one Chinook salmon (e.g., ADF&G 2003a).

In 2001, the specific waters closed to subsistence fishing before, during, and after commercial fishing periods varied district to district. These closures began in District 1 on August 2 prior to the season's first commercial coho salmon fishing period in the Kuskokwim River. These periodic closures around commercial periods were more frequent in District 4 (Quinhagak) and District 5 (Goodnews Bay and Platinum) because of the more frequent and numerous commercial fishing period in those districts in 2001 (ADF&G 2003a).

2002 Subsistence Salmon Fishing Season Regulatory Summary

As in 2001, subsistence salmon fishing throughout the Kuskokwim river drainage in 2002 was regulated by a fishing schedule as part of the salmon management rebuilding plan adopted by the Alaska Board of Fisheries in January 2001. The schedule started June 2 in District 1, was expanded to include all waters downstream of Chuathbaluk (District 2) starting June 9, and was further expanded to include all waters of the entire Kuskokwim river drainage starting June 16. The subsistence salmon fishing schedule was lifted June 30, when ADF&G opened the commercial salmon fishing season in Districts 1 and 2 (ADF&G 2003b).

During 2002, the specific waters closed to subsistence fishing before, during, and after commercial fishing periods varied district to district. These closures in District 1 began August 1 and lasted until August 3. Three additional closures occurred in District 1 from August 4 to August 13. There were numerous periodic subsistence fishing closures in both Districts 4 (Quinhagak) and 5 (Goodnews Bay and Platinum) areas from June through August (ADF&G 2003b).

2003 Subsistence Salmon Fishing Season Regulatory Summary

As in 2001 and 2002, subsistence salmon fishing throughout the Kuskokwim river drainage in 2003 was regulated by a fishing schedule as part of the salmon management rebuilding plan adopted by the Alaska Board of Fisheries in January 2001. The schedule started June 1 in District 1 (all waters downstream of Bogus Creek), was expanded to include all waters downstream of Chuathbaluk (District 2) starting June 8, and was further expanded to include all waters of the entire Kuskokwim river drainage starting June 15. The subsistence salmon fishing schedule was lifted July 2, when ADF&G determined that salmon run strength was large enough to meet escapement goals (Brown et al. 2005a).

On August 3, 2003, ADF&G issued an Emergency Order that decreased the duration of subsistence closures associated with commercial fishing in District 1 to 6 hours before, during, and 3 hours after commercial fishing periods. The purpose of the EO was to allow adequate opportunity for fishers to fulfill their subsistence needs during the commercial fishing season. The specific waters closed to subsistence fishing varied district by district. In 2003, there were 21 commercial fishing periods in District 1. Two periods occurred prior to August 3, when subsistence salmon fishing was subject to closures 16 hours before, during and 6 hours after commercial fishing periods. The remaining 19 periods had subsistence closures of 6 hours before, during, and 3 hours after commercial fishing periods. There were weekly scheduled subsistence fishing closures in both District 4 (Quinhagak) and District 5 (Goodnews Bay and Platinum) from June through August (Brown et al. 2005a).

ADF&G also issued an Emergency Order in 2003 that modified the subsistence salmon fishing closures associated with commercial fishing periods in Kuskokuak Slough, similar to an EO issued in 2002. By regulation, Kuskokuak Slough remained open to subsistence salmon fishing seven days per week after July 31. The modified regulation established subsistence salmon fishing closures in Kuskokuak Slough consistent with the remainder of District 1 waters.

PROJECT OBJECTIVES

This study addresses the following six research objectives, all of which were met for each of the three study years (2001, 2002, and 2003):

1. Determine the total number of households in Bethel.
2. Identify the number of households that harvested salmon and other fish as well as the number of households that did not harvest salmon for subsistence use.
3. Estimate the number of Chinook salmon, chum salmon, sockeye salmon, coho salmon, and pink salmon harvested for subsistence uses by Bethel residents.

4. Estimate the number of resident freshwater and other non-salmon fish harvested by Bethel residents for subsistence uses.
5. Identify the types of salmon fishing gear used by residents.
6. Update the Bethel household list so that subsistence fishing households can be mailed subsistence salmon harvest calendars the following season.

HARVEST MONITORING METHODS

The Division of Subsistence conducts an annual postseason harvest monitoring program to document the majority of Kuskokwim River subsistence salmon harvests by residents of the Kuskokwim area (e.g., Simon et al. 2007; Walker and Coffing 1993). Community subsistence harvest monitoring research uses a household survey instrument as the primary means of collecting data, although limited data also are gathered through harvest calendars and postcard surveys as discussed below. Households in the Kuskokwim Management Area are assigned a “household identification number” (HHID) to aid in tracking an individual household’s subsistence harvest over time. Household level data remain confidential and household participation is voluntary. Household data are analyzed to develop estimates of subsistence salmon harvest by each participating community in the Kuskokwim Management Area. Specific harvest monitoring and data analysis methods are described elsewhere and therefore are not repeated here (see Simon et al. 2007; Walker and Coffing 1993).

Bethel subsistence salmon harvests are monitored as part of this areawide harvest monitoring program. The Division of Subsistence implemented the postseason subsistence salmon harvest monitoring program from 1988 to 1998 without the involvement of other Kuskokwim area organizations. During this time period, Bethel salmon harvests were estimated based upon postcard returns or telephone surveys alone. Then, in 1999, the Orutsararmiut Native Council (ONC) began conducting face-to-face interviews with Bethel households, in partnership with ADF&G, using federal funding administered through the Alaska Department of Community and Regional Affairs (Burkey et al. 2000). Since then, ONC has continued Bethel household surveys with funding received from FWS, Fisheries Resource Monitoring Program (FRMP)(e.g., FIS Study No. 00-009, FIS Study No. 01-024), of which this report is a result. Bethel surveys also included questions about subsistence harvest of non-salmon species (see Appendix A).

Orutsararmiut Native Council (ONC) Natural Resources Director, Greg Roczicka, hired two to three survey technicians to conduct house-to-house surveys in Bethel in 2001-2003. They were Nick Kameroff, Jeremy Woods, and Nick Cooke in 2001; Muriel Bell, Stephan Koruba, and Christopher Nevak in 2002; and Christopher Nevak and Art Santamour in 2003. Subsistence staff trained the technicians and oversaw their survey efforts. Data collected by ONC followed methods and protocols developed by Subsistence Division.

Household checklists were used to identify residents to contact for surveys. Each checklist included all known households in the community, identified those households that were reported to have subsistence fished for salmon during the previous year, and indicated which households were mailed harvest calendars. Knowledgeable individuals at ONC and in the community helped update the community household list, identify households that “usually fish” and households that “usually do not fish” and households that subsistence fished for salmon in 2001, 2002, and 2003, respectively, on an annual basis.

Attempts were made to contact all households identified as “usually fish” or were known to have fished for salmon for subsistence use during 2001, 2002, 2003, respectively. Other households were contacted about their subsistence fishing activities when time permitted.

House-to-house interviews were conducted in Bethel during October, November, and early December in 2001, 2002, and 2003. Unlike other communities, Bethel has no agency or organization that provides a current household list. A map of the community, originally developed by the Bethel Fire Department, was used to identify household street addresses and to organize survey efforts by housing subdivisions. All Bethel households identified through previous surveys and those that had returned harvest calendars were categorized by subdivision. Each of the surveyors was then assigned responsibility for specific subdivisions. As with the smaller communities, an effort was made to contact every occupied household in Bethel.

In addition to collecting subsistence salmon harvest information through household surveys, postcard surveys are used to collect data on how many salmon of each species were caught for subsistence, the type of fishing gear used, and each household’s qualitative evaluation of the subsistence fishery when a household is unable to be contacted face-to-face. Survey technicians attempted to contact households in Bethel for face-to-face interviews three times, on the third attempt, if still unable to contact the household, technicians left a postcard survey for the household to complete and return to the division. The return portion of the postcard was postage paid and addressed to ADF&G Division of Subsistence in Bethel.

2001-2003 BETHEL SAMPLING SUMMARIES

2001 HOUSEHOLDS CONTACTED

Of an estimated 1,721 households in Bethel in 2001, contact was made with 851 households or 49% of the Bethel community through a combination of household surveys, returned calendars and/or postcards (Table 1).¹ Subsistence salmon harvest data were obtained from 836 households, which exceeded historical averages. In 2001, the third year in which Bethel households were interviewed, during face-to-face household surveys, 795 households were interviewed. Eighty-four (84) Bethel households returned harvest calendars, representing a 12% return rate in 2001 and the largest number of returned harvest calendars from Bethel in the harvest monitoring program’s history. Thirty-five (35) postcard surveys were returned, representing an 11% return rate; fewer postcard surveys were mailed out because of the number of face-to-face interviews conducted in 2001 (Table 1).

2002 HOUSEHOLDS CONTACTED

Of an estimated 1,499 households in Bethel in 2002, contact was made with 1,312 households or 88% of the Bethel community through a combination of household surveys, returned calendars and/or postcards (Table 2). Subsistence salmon harvest data was obtained from 1,306 Bethel households, which exceeded historical averages and represents the largest number of households from which harvest data were obtained in the harvest monitoring program’s history. The fourth

¹ In many instances, households who returned calendars also were surveyed in person. However, the numbers under “Total Contacts” in Table 1 are not a summation of the total number of calendars returned, postcards returned, and households surveyed since a household is only counted once as a contact.

year in which Bethel households were interviewed in person, 2002 represents the largest number of Bethel households interviewed (1,263) in the monitoring program's history. Eighty-seven (87) Bethel households returned harvest calendars, representing a 14% return rate in 2002 and the largest number of returned harvest calendars from Bethel in the harvest monitoring program's history. Forty-three (43) postcard surveys were returned, representing a 14% return rate (Table 2).

2003 HOUSEHOLDS CONTACTED

Of an estimated 1,651 households in Bethel in 2003, contact was made with 1,077 households or 65% of the Bethel community through a combination of household surveys, returned calendars and/or postcards (Table 3). Subsistence salmon harvest data was obtained from 1,046 Bethel households, which exceeded historical averages. The fifth year in which Bethel households were interviewed in person, 2003 represents the third largest number of Bethel households interviewed (1,057) in the monitoring program's history. Seventy-five (75) Bethel households returned harvest calendars, representing a 11% return rate in 2003 and the third largest number of returned harvest calendars from Bethel in the harvest monitoring program's history. Three (3) postcard surveys were returned, representing a 2% return rate (Table 3).

2001-2003 BETHEL HARVEST MONITORING SAMPLING ASSESSMENT

Subsistence fishing household harvest monitoring in Bethel during 2001, 2002, and 2003 represented three of the highest household contact rates during the 15-year history of the existing Kuskokwim area subsistence salmon harvest monitoring program. Based on the high rate of household contact in all three years, subsistence fishing harvest estimates are likely more representative of total Bethel community harvests than previous estimates. Conducting face-to-face interviews among Bethel households has resulted in better total community harvest estimates; however, this change in the monitoring program implementation affected the overall cost of implementing the monitoring program on an annual areawide basis.

RESULTS OF BETHEL SUBSISTENCE SALMON HARVEST MONITORING, 2001-2003

HARVEST OF SALMON

Of an estimated total of 1,721 households in Bethel, 344 (20%) of which were identified as having subsistence fished in 2001 (Table 1). Subsistence harvests of Chinook salmon, sockeye salmon, coho salmon, and chum salmon combined exceeded historical average harvest estimates (Table 4).

Of an estimated total of 1,499 households in Bethel, 579 (39%) were identified as having subsistence fished in 2002 (Table 2). Subsistence salmon harvests of Chinook salmon, sockeye salmon, coho salmon, and chum salmon combined fell below historical average harvest estimates (Table 5), despite the record number of Bethel households contacted in 2002.

Of an estimated total of 1,651 households in Bethel, 439 (27%) were identified as having subsistence fished in 2003 (Table 3). Subsistence salmon harvests of Chinook salmon, sockeye salmon, coho salmon, and chum salmon combined fell below historical average harvest estimates (Table 6), despite the record number of Bethel households contacted in 2003.

Chinook Salmon

Bethel residents' estimated harvests of Chinook salmon in 2001 (27,209 +/- 3,628 fish; see Table 7) exceeded the recent 5-year average harvest, the 1991-1995 historical 5-year average, and the 1989-1990 2-year average harvests (Table 4). In 2001, Bethel residents' subsistence Chinook salmon harvest estimates represented 37% of the total estimated Kuskokwim River Chinook salmon harvest (e.g., Simon, Krauthoefer, Koster, and Caylor 2007).

Estimated Bethel Chinook salmon harvests in 2002 and 2003 fell below estimated historical averages. Bethel residents' estimated harvests of Chinook salmon in 2002 (19,305 +/- 877 fish; see Table 7) and 2003 (21,475 +/- 1,562 fish; see Table 7) fell below historical average harvest estimates (Tables 5 and 6). In 2002 and 2003, Bethel residents' estimated subsistence Chinook salmon harvests represented 29% and 32% of the estimated total Kuskokwim River Chinook salmon harvest, respectively (e.g., Simon et al. 2007).

Sockeye Salmon

Bethel residents' estimated harvests of sockeye salmon for subsistence uses in 2001 (15,709 +/- 1,907 fish; see Table 7) exceeded historical average harvests, but fell below historical averages in 2002 (7,350 +/- 482 fish; see Table 7) (Tables 4 and 5). In 2001 and 2002, Bethel residents' subsistence sockeye salmon harvests represented 31% and 29% of the estimated total Kuskokwim River sockeye salmon harvest, respectively (e.g., Simon et al. 2007).

Bethel harvests of sockeye salmon in 2003 (10,542 +/- 1,063 fish; see Table 7) fell below the recent 5-year estimated average Bethel harvest, but exceeded the 1993-1997 5-year and the 1989-1992 4-year estimated historical average harvests (Table 6). In 2003, Bethel residents' subsistence sockeye salmon harvest estimates represented 31% of the estimated total Kuskokwim River sockeye salmon harvest (e.g., Simon et al. 2007).

Coho Salmon

Bethel subsistence coho salmon harvests in 2001 (14,949 +/- 1,926 fish; see Table 7) exceeded the recent 5-year average harvest, but fell below the 1991-1995 5-year and 1989-1990 2-year average harvests (Table 4). In 2001, Bethel residents' estimated subsistence coho salmon harvests represented 51% of the estimated total Kuskokwim River coho harvest (e.g., Simon et al. 2007).

Bethel residents' estimated harvests of coho salmon in 2002 (12,966 +/- 762 fish; see Table 7) fell below historical average harvests (Table 5). In 2002, Bethel residents' estimated subsistence coho salmon harvests represented 40% of the estimated total Kuskokwim River coho harvest (e.g., Simon et al. 2007).

Bethel residents' harvest estimates of coho salmon in 2003 (13,237 +/- 1,480 fish; see Table 7) were slightly above the 1998-2002 5-year estimated average harvest, but fell below the 1993-1997 5-year and 1989-1992 4-year average harvest estimates (Table 6). In 2003, Bethel residents' estimated subsistence coho salmon harvests represented 38% of the estimated total Kuskokwim River coho harvest (e.g., Simon et al. 2007).

Chum Salmon

Subsistence chum salmon estimated harvests by Bethel residents in 2001 (11,319 +/- 1,793 fish) and 2003 (9,829 +/- 1,058 fish; see Table 7) fell below historical average harvest estimates

(Tables 4 and 6). In 2002, estimated Bethel subsistence chum salmon harvests (15,082 +/- 1,354 fish; see Table 7) exceeded the 1997-2001 and 1992-1996 5-year average harvest estimates, but fell below the estimated 1989-1991 3-year average harvest (Table 5). In 2001, 2002, and 2003, Bethel residents' estimated subsistence chum salmon harvests represented 23%, 22%, and 23% of the estimated total Kuskokwim River chum salmon harvests, respectively (e.g., Simon et al. 2007).

Pink Salmon

In 2001-2003, Bethel residents harvested an estimated 748, 721, and 261 pink salmon for subsistence uses, respectively, representing less than 1% of the estimated total subsistence salmon harvests by weight (Tables 8, 9, and 10). Pink salmon subsistence harvests in the Kuskokwim Management Area have not been monitored historically, so 2001, 2002, and 2003 pink salmon harvests are not able to be compared with historical Bethel subsistence harvest estimates.

Salmon For Dog Food

Historically, salmon (chum and/or coho usually) harvested for dog food was a significant portion of the total harvest. In the last 15 years, however, the number of households reporting the harvest of salmon specifically for dog food has declined. This may be related to decreased use of dog teams for transportation, reduced run abundance of salmon used for dog food in some years, and the availability of commercial dog food. During 2001-2003, no Bethel households reported harvesting salmon specifically for dog food.

Salmon Fishing Gear

Fishing households often use more than one type of gear (i.e., set gillnet, drift gillnet, fish wheel, or rod and reel) when harvesting salmon. During 2001-2003, 68% to 72% of Bethel fishing households used drift gillnets for harvesting salmon for subsistence uses, 15% to 21% used rod and reel gear, and 5% to 10% used set nets; however, 16% to 21% of Bethel fishing households did not report salmon gear used (Table 11).

Tables 8, 9, and 10 provide Bethel subsistence fish harvest estimates by gear type for 2001, 2002, and 2003, respectively. In 2001, 87% of the salmon harvested by Bethel residents were harvested with drift gillnets; in 2002 and 2003, drift gillnets were used to harvest 89% and 70% of the Bethel subsistence salmon harvest (Tables 8, 9, and 10).

In 2001, 2002, and 2003, Bethel rod and reel subsistence fishers salmon harvest was 68%, 72%, and 75% coho salmon, respectively (Tables 8, 9, and 10).

Salmon Retained from Commercial Fishing for Subsistence Uses

Households involved in commercial salmon fishing sometimes keep a portion of their catch for subsistence use; however, the number of salmon retained is usually relatively small (Table 12). During 2001, one Bethel commercial fishing household reported retaining one Chinook salmon and one coho salmon from their commercial catch. In 2002, 4 Bethel commercial fishing households retained salmon from their commercial catch, including 17 Chinook salmon, 30 sockeye salmon, and 18 coho salmon. Again in 2003, 4 commercial fishing households in Bethel reported retaining 20 coho salmon from their commercial catch for subsistence uses (Table 12).

OTHER FISH HARVESTED

Bethel Non-Salmon Harvests, 2001

Bethel residents harvested an estimated 20,479 number of non-salmon fish of various species and 648 gallons of blackfish and 2,367 gallons of smelt, or an estimated total of 95,440 usable pounds of non-salmon fish in 2001, as summarized in Table 8 and Figure 2. In 2001, the most significant non-salmon fish harvested by Bethel residents was whitefish species (9,815 fish or 32,900 usable pounds of whitefish and sheefish), representing 34% of the total 2001 Bethel non-salmon harvest, followed by northern pike (5,510 fish or 24,795 usable pounds), representing 26% of the total 2001 non-salmon harvest. Burbot harvested by Bethel residents in 2001 represented 19% of the total non-salmon fish harvest (3,963 fish or 17,834 usable pounds), and smelt (2,367 gallons or 14,202 usable pounds) represented 15% of the total Bethel non-salmon harvest in 2001. In 2001, Alaska blackfish harvest (648 gallons or 3,888 usable pounds) represented 4% of the total Bethel non-salmon harvest. Bethel residents' harvests of Arctic grayling (315 fish or an estimated 473 usable pounds), Dolly Varden (692 fish), rainbow trout (127 fish), and lake trout (57 fish) in 2001 each represented less than 1% of the total non-salmon harvest (Table 8).

Bethel Non-Salmon Harvests, 2002

Bethel residents harvested an estimated 28,500 number of non-salmon fish of various species and 711 gallons of blackfish and 2,191 gallons of smelt, or an estimated total of 126,861 usable pounds of non-salmon fish in 2002, as summarized in Table 9 and Figure 3. In 2002, the most significant non-salmon fish harvested by Bethel residents was northern pike (9,783 fish or 44,024 usable pounds), representing 35% of the total 2002 non-salmon harvest, and whitefish species (11,375 fish or 36,880 usable pounds of whitefish and sheefish), representing 29% of the total 2002 Bethel non-salmon harvest. Burbot harvested by Bethel residents in 2002 represented 21% of the total non-salmon fish harvest (5,809 fish or 26,141 usable pounds), followed by smelt (2,191 gallons or 13,146 usable pounds) represented 10% of the total Bethel non-salmon harvest in 2002. In 2002, Alaska blackfish harvest (711 gallons or 4,266 usable pounds) represented 3% of the total Bethel non-salmon harvest. Bethel residents' 2002 harvests of Arctic grayling (553 fish or an estimated 830 usable pounds), Dolly Varden (478 fish), rainbow trout (357 fish), and lake trout (145 fish) in 2002 each represented less than 1% of the total non-salmon harvest (Table 9).

Bethel Non-Salmon Harvests, 2003

Bethel residents harvested an estimated 17,693 number of non-salmon fish of various species and 635 gallons of blackfish and 743 gallons of smelt, or an estimated total of 78,615 usable pounds of non-salmon fish in 2003, as summarized in Table 10 and Figure 4. In 2003, the most significant non-salmon fish harvested by Bethel residents was northern pike (9,730 fish or 43,785 usable pounds), representing 56% of the total 2003 Bethel non-salmon harvest, followed by whitefish species (3,838 fish or 12,725 usable pounds of whitefish and sheefish), representing 16% of the total 2003 Bethel non-salmon harvest, and burbot (2,520 fish or 11,340 usable pounds), representing 14% of the total non-salmon harvest. Smelt harvested by Bethel residents in 2003 represented 6% of the total 2003 Bethel non-salmon harvest (743 gallons or 4,458 usable pounds). In 2003, Alaska blackfish harvest (635 gallons or 3,810 usable pounds) represented 5% of the total Bethel non-salmon harvest. Bethel residents' harvests of Arctic grayling (1,088 fish

or an estimated 1,632 usable pounds) represented 2% of the total 2003 Bethel non-salmon harvests. Dolly Varden (326 fish), rainbow trout (185 fish), and lake trout (6 fish) in 2003 each represent less than 1% of the total non-salmon harvest (Table 10).

Bethel Non-Salmon Fishing Gear, 2001-2003

The number of non-salmon fish harvested by Bethel residents by gear type are listed in Tables 8, 9, and 10. In contrast to Bethel fishers' predominant salmon fishing gear, drift gillnets were used to harvest only 2%-3% of the total number of non-salmon species harvested in 2001-2003. Most non-salmon (62%, 60%, and 73%, respectively) were caught by hooking through the ice or by netting under the ice mainly for northern pike, burbot, and whitefish in 2001-2003 (Tables 8, 9, and 10). In 2001, 2002, and 2003, 27%, 21%, and 17% of the total number of non-salmon fish caught were harvested by set gillnets, respectively, and mainly for whitefish. In 2001, 9% of the non-salmon harvest was by rod and reel, 17% in 2002, and 8% in 2003. Smelt were harvested exclusively with dipnets, and blackfish were harvested using small, locally made fish traps called *taluuyaq*.

HOUSEHOLD COMMENTS RELATED TO QUALITY OF SALMON FISHING

Chinook Salmon

In 2001, 51 Bethel households commented on subsistence Chinook salmon fishing, 51% of which indicated that it was a poor Chinook salmon run, 18% noted that there was insufficient fishing time due to the subsistence fishing schedule, 8% of Bethel households had a labor, time, or equipment shortage that affected their ability to harvest Chinook salmon. Two households noted that gillnet mesh size was too small. Two households reported they got a late start, and finally a single household mentioned high seas interception affected salmon returns, there were too many people fishing, high water, limited access to fishing sites, and four households made other comments.

In 2002, comments on subsistence Chinook salmon harvests were obtained from 65 Bethel households, 37% of which indicated that the run was poor, 23% of reporting Bethel households noted insufficient time, labor, or equipment shortage affected their Chinook salmon harvests. Ten (10) Bethel households indicated that the subsistence fishing schedule affects their ability to harvest salmon. Three (3) households reported fishing late or late runs, one household indicated that the weather was too hot, another indicated that there was too much commercial fishing, another Bethel household reported that there were too many people, too much gear in the water, and too many boats, another indicated that there were insufficient Chinook salmon availability because of poor management, with remaining households making a variety of other comments.

In 2003, 27 Bethel households reported observations regarding the quality of subsistence Chinook salmon fishing, 8 of which indicated that the subsistence fishing schedule affected their ability to harvest Chinook salmon, another 8 households indicated that they either had insufficient time, labor, or equipment to subsistence salmon fish. Five (5) Bethel households reported poor Chinook salmon returns in 2003, two households indicated that Chinook salmon were overfished due to high seas interception, and one household indicated that there were too many people attempting to fish at the same time.

Sockeye Salmon

In 2001, 8 Bethel households made comments about subsistence sockeye salmon fishing; two households indicated there were too few fish, one household blamed high seas interception, another indicated that they fished too late, another that they had no help to go fishing, another Bethel household reported boat motor trouble, improper mesh size to harvest sockeye salmon effectively, and finally another household indicated that there was too much debris in the water.

Approximately 96 Bethel households provided comments on the quality of the subsistence sockeye salmon harvests in 2002; 54% of which indicated poor sockeye salmon returns, 17% of the comments pertained to the effects of the subsistence salmon fishing schedule resulting in missing the fish. Ten (10) Bethel households indicated that they had too little time to fish, motor trouble, or otherwise didn't have the proper gear to target sockeye salmon. Two (2) households reported a late run, one household reported that the sockeye salmon were in poor health, and another didn't fish because there were too many chum salmon to drift; 9 other households made other comments.

In 2003, 16 Bethel households reported observations on the subsistence sockeye harvests, 25% of which indicated poor sockeye returns, three (3) households reported that they did not fish as much, two households indicated that they missed the runs, and two other households indicated that there was insufficient time or the wrong time to fish due to subsistence salmon fishing schedule. One household reported that there were too many fishers, another reported that the sockeye salmon had been overfished, another indicated that they had the wrong gear to harvest sockeye salmon, another reported no boat motor, and finally another household did not catch the number of sockeye salmon they wanted because their fish camp had eroded.

Coho Salmon

In 2001, five (5) Bethel households reported observations on the subsistence coho salmon fishing; three (3) of which indicated that it was a poor coho salmon return, one household noted that it was too wet and rainy, and another indicated that there was insufficient time to fish for coho salmon.

In 2002, 35 Bethel households provided comments on the quality of subsistence coho salmon fishing, 50% of which reported poor coho salmon returns, 7 households indicated that they did not fish enough, and 6 Bethel households stated that they had insufficient fishing time due to the subsistence salmon fishing schedule. One household reported having the wrong gear to harvest coho salmon, two households indicated that they missed the run, and another household reported catching coho salmon from the Copper River.

In 2003, only three Bethel households provided comments on subsistence coho salmon fishing quality, one indicated that the run was poor, another indicated that they missed the run, and finally the remaining reporting Bethel household indicated that they fished for coho salmon too early in the season.

Chum Salmon

In 2001, 27 Bethel households provided comments on the quality of the chum salmon fishing season, 70% of which indicated that the chum salmon run was poor. Four (4) Bethel households indicated that the subsistence salmon fishing schedule provided insufficient time to harvest chum salmon, while one household indicated they did not have enough help to harvest chum salmon,

another household reported that they do not target chum salmon, and another reported having motor trouble, which is why they were unable to harvest chum salmon in 2001.

In 2002, 44 Bethel households reported observations on the quality of subsistence chum salmon fishing; 32% of which indicated that there was a poor chum salmon run and 20% stated that the subsistence salmon fishing schedule provided insufficient time to harvest chum salmon, while one household reported that the run was a little better than last year and another reported that the run was a little better than average. Two (2) household reported missing the run, two other households reported that they had the wrong gear to harvest chum salmon. Three (3) households indicated that they didn't fish for chum salmon for personal reasons, while one household reported they had a shortage of labor to fish, another household reported that the chum salmon were unhealthy, and another household reported that there was too much commercial fishing. Finally, and perhaps most interesting is the fact that 7 households indicated that they had no interest in harvesting chum salmon for subsistence uses.

In 2003, only 13 Bethel households reported observations on the subsistence chum salmon fishery; 46% of which indicated that there was a poor chum salmon run. Three (3) Bethel households reported no interest in chum salmon for subsistence uses, while two households reported they had no motor or boat to subsistence fish for chum salmon. Finally, two Bethel households reported they did not harvest chum salmon because they had the wrong sized gear for chum salmon.

DISCUSSION AND CONCLUSIONS

SALMON

In 2001, the Alaska Board of Fisheries (Board) revised the amount reasonably necessary for subsistence (ANS) findings to include species specific ranges rather than a range for all salmon in the Kuskokwim river drainage. They therefore adopted amounts reasonably necessary for subsistence uses for Chinook salmon, chum salmon, sockeye salmon, and coho salmon harvested from Kuskokwim River stocks codified in 5 AAC 01.286² to assist the Board in evaluating reasonable opportunities for subsistence uses of salmon within the Kuskokwim river drainage pursuant to the Alaska Subsistence Statute (AS 16.05.258). The Board established these ANS ranges based on the results of the Kuskokwim subsistence salmon harvest monitoring program.

Estimated Kuskokwim River subsistence Chinook salmon harvests in 2001, 2002, and 2003 fell within the range adopted by the Board. Kuskokwim River subsistence sockeye salmon harvests in 2001 exceeded the upper limit of the ANS range, but 2002 harvests fell below the lower limit of the ANS range; 2003 sockeye salmon harvests fell within the ANS range. Kuskokwim River subsistence coho salmon harvests in 2001 and 2002 fell within the ANS range, while 2003 harvests exceeded the upper limit of the ANS range. Kuskokwim River subsistence chum salmon harvests in 2001, 2002, and 2003 also fell within the ANS range (e.g., Simon et al. 2007).

² ANS ranges are 64,500-83,000 Chinook salmon, 39,500-75,500 chum salmon, 27,500-39,500 sockeye salmon, and 24,500-35,000 coho salmon in the Kuskokwim River drainage and 7,500-13,500 salmon (all species combined) in the remainder of the Kuskokwim Area.

BETHEL METHODOLOGY

From 1989 to 1998, Bethel subsistence salmon harvests were estimated on the basis of data gathered from harvest calendars, mail-in postcard reports, and telephone surveys; whereas, among other Kuskokwim River communities, the primary method of data collection was the systematic household survey. During this 10-year period, the total number of Bethel households from which subsistence salmon harvest data were obtained ranged from 459 to 757 with a mean of 564 households contacted (e.g., Table 6). However, in 1999 with the aid of federal funding, the Orutsarmiut Native Council (ONC) began directly participating in the Kuskokwim postseason salmon harvest monitoring program by conducting systematic door-to-door household surveys in Bethel to better estimate subsistence salmon harvests for the entire community. This census approach to household harvest monitoring in Bethel was continued in 2001, 2002, and 2003, with funding primarily from FWS, FRMP.

From 1989 to 1998, on average approximately 44% of Bethel households were contacted to document subsistence salmon harvests. The mean reported harvest during this decade was 37,856 salmon (of all species) and the mean estimated total number of salmon harvested was 65,170. In contrast, from 1999 to 2003, on average approximately 69% of Bethel households were contacted, with a mean reported harvest of 43,144 salmon and a mean estimated total of 60,030 salmon (Table 13). The increase in the number of contacted households (increased sample sizes) resulted in increased reported harvests, and thereby tightened the extrapolated estimated total number of salmon harvested for subsistence uses such that there was actually a decrease in the estimated total salmon harvests. Previous harvest estimates likely over-estimated numbers of salmon harvested for subsistence uses because of more limited contact with Bethel households that usually did not fish.

NON-SALMON HARVESTS

Bethel household harvest monitoring in 2001, 2002, and 2003 demonstrated that subsistence salmon harvests represent 88% (716,613 usable pounds), 81% (542,661 usable pounds), and 85% (433,124 usable pounds) of the total Bethel subsistence fish harvests by weight, respectively. While most Bethel subsistence fishing consists of salmon, non-salmon harvest monitoring results in 2001 (95,440 usable pounds), 2002 (126,861 usable pounds), and 2003 (78,615 usable pounds) are still significant reminders of the importance of non-salmon fish to the Bethel area subsistence economy.

The results of the non-salmon survey indicate that, in 2001-2003, non-salmon fish species contributed significantly to Bethel area subsistence fish harvests. Previous research in other communities on the Kuskokwim River also demonstrates the significance of non-salmon to Kuskokwim area subsistence fish harvest (e.g., Andrews 1989, 1994; Coffing 1991; Coffing et al. 2001; Coffing et al. 2003; Holen et al. 2006; Krauthoefer et al. 2007; Pete 1984, 1989, 1991a, 1991b, 1992; Simon et al. 2007; Stokes 1985; Wolfe et al. 1984). However, it is important to note that much of this research was timed to survey residents regarding non-salmon harvest during times other than immediately after the salmon fishing season concluded. Recently, Brown et al. (2005b) compared non-salmon harvest estimates identified during a postseason salmon survey with estimates for approximately the same time period resulting from a specific non-salmon harvest assessment project in the lower-middle Yukon River region (Grayling, Anvik, Shageluk, and Holy Cross). The comparison found that postseason household surveys implemented immediately following the salmon fishing season may not be timed to produce the

most reliable results for non-salmon harvest given the considerable differences resulting from the two harvest assessment projects (Brown et al. 2005b:154).

Additionally, the postseason salmon survey program on the Kuskokwim and in Bethel targets those households that usually participate in subsistence salmon fishing. It may be that these households differ from those involved in fishing for non-salmon, such that the method may not produce accurate estimates of non-salmon subsistence harvest levels. The harvest estimates for non-salmon fish resulting from this project should therefore be viewed as minimum estimates, recognizing that a specific project focused on assessing the annual subsistence harvest and use patterns of non-salmon fish might lead to greater and more reliable estimates of non-salmon harvest levels. It is recommended that further methodological assessment of salmon and non-salmon harvest estimates be considered in future research.

This project successfully accomplished the principal objectives identified in the investigation plan to document subsistence fish harvests of the Bethel community from the Kuskokwim River, which is one of the largest subsistence fisheries in Alaska. The 2001-2003 salmon harvest monitoring efforts in Bethel resulted in higher than average numbers of households interviewed and from which subsistence salmon harvest information was collected compared to previous monitoring program efforts. In conclusion, the 2001-2003 Bethel subsistence fish harvest monitoring efforts resulted in representative and comparable harvest estimates of the total number of salmon, resident freshwater fish, and other non-salmon fish harvested by Bethel residents for subsistence uses.

RECOMMENDATIONS

Subsistence salmon harvest surveys of one type or another have been conducted in the Kuskokwim region for a number of decades. The current annual Kuskokwim area postseason subsistence salmon harvest monitoring program, and its associated methods, has been in place since 1989. There are several recommendations related to monitoring harvests and four related to assessment³ of these fishery resources.

Considering the magnitude and importance of the Bethel subsistence fishery, and the need for management consistent with the sustained yield principle and other statutory requirements, a scientifically based annual harvest monitoring program is necessary for managing the Kuskokwim Management Area salmon and other fish resources. It is, therefore, recommended that annual subsistence salmon harvest in the Kuskokwim Management Area should continue to be monitored by ADF&G. Data on subsistence salmon harvests should be collected annually, using the method developed by Subsistence to ensure data comparability through time.

State and federal agencies should continue to collaboratively partner in funding the Kuskokwim area subsistence salmon harvest monitoring program as monitoring results are vital to both state and federal management programs. Capacity building efforts develop local community involvement in harvest monitoring activities should be continued. Cost efficiencies should continue to be explored, but in keeping with the existing methodology to ensure data comparability across years.

³ The American Heritage Dictionary defines “monitoring” as keeping track of systematically with a view to collecting information. In contrast, “assessment” refers to the evaluation of the information.

Chinook and chum salmon, in particular, are major food sources for residents in the Kuskokwim Management Area and account for a significant part of the total harvest of wild resources in any given year (ADF&G 2007). Most of the Chinook salmon caught in the state for subsistence purposes are harvested here; one of every two statewide is harvested in the Kuskokwim Management Area. Their escapement numbers often fluctuate, sometimes considerably in any 10-year period (Whitmore et al. 2005). It is important for fisheries management purposes to know what the total harvest of these species is relative to total run size (i.e. total exploitation rates) on an annual basis and to identify trends in the fishery. It is, therefore, recommended also that biological monitoring of escapement numbers in index streams be continued and expanded.

It is also recommended that non-salmon subsistence harvest information should be collected whenever possible, given its significance in annual subsistence in the Kuskokwim area, demonstrated by this project and others. A survey, independent of salmon surveys, should be conducted minimally in representative communities throughout the Kuskokwim Management Area. The FRMP funded study, FIS Study No. 01-112, which documented the harvest of non-salmon fish by residents of Aniak and Chuathbaluk, 2001-2003 provided information for a portion of the middle Kuskokwim river region. Similarly, the ongoing project, FIS Study No. 06-351, documented subsistence harvests of non-salmon fish among residents of Eek, Nunapitchuk, and Tuntutuliak on the lower Kuskokwim River. Local concerns also have been expressed about changes in whitefish populations, which would be better understood given additional research in harvest monitoring and traditional ecological knowledge, as well as continuation of stock status and trends projects.

Finally, mineral and gas development in the area need to be monitored in terms of its potential impacts on the Kuskokwim subsistence fisheries, given the significance of salmon and other fish to local residents.

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TABLES AND FIGURES

Table 1.–2001 Bethel harvest monitoring program sampling summary in historical context.

Year	Total HH'S	Calendar		Postcard		Surveyed	Phone Contact	Total Contacts*	Any Info.**	Subsistence Fished*	Harvest Data***
		Mailed	Returned	Mailed	Returned						
1989	1281	276	53	744	182	0	630	n/a	843	411	757
1990	1215	377	49	172	171	0	87	n/a	592	295	546
1991	1174	306	60	662	227	1	631	n/a	648	360	627
1992	1183	421	56	636	176	0	550	n/a	594	322	548
1993	1156	455	52	715	205	0	356	n/a	513	319	492
1994	1071	443	62	631	170	0	331	n/a	461	288	459
1995	1556	379	53	1392	447	0	284	n/a	682	403	673
1996	1569	372	69	730	102	0	477	n/a	531	291	530
1997	1424	535	63	834	113	0	398	n/a	560	314	537
1998	1322	464	58	812	113	0	366	n/a	509	288	475
1999	1508	371	65	478	116	973	0	n/a	1135	517	1082
2000	1739	594	74	286	35	1221	0	1258	1262	545	1213
1996-2000											
5-yr Avg	1512	467	66	628	96	439	248	n/a	799	391	767
1991-1995											
5-yr Avg	1228	401	57	807	245	0	430	n/a	580	338	560
1989-1990											
2-yr Avg	1248	327	51	458	177	0	359	n/a	718	353	652
2001	1721	687	84	305	35	795	0	851	847	344	836

* Households directly contacted by returning a calendar or postcard or by being interviewed in a face-to-face or telephone survey.

** Includes information for an uncontacted household's fishing effort derived from another household's survey form or in consultation with village officials.

*** Households that did not fish and those households which did fish and provided harvest numbers.

Table 2.–2002 Bethel harvest monitoring program sampling summary in historical context.

Year	Total HH'S	Calendar		Postcard		Surveyed	Phone Contact	Total Contacts*	Any Info.**	Subsistence Fished*	Harvest Data***
		Mailed	Returned	Mailed	Returned						
1989	1281	276	53	744	182	0	630	n/a	843	411	757
1990	1215	377	49	172	171	0	87	n/a	592	295	546
1991	1174	306	60	662	227	1	631	n/a	648	360	627
1992	1183	421	56	636	176	0	550	n/a	594	322	548
1993	1156	455	52	715	205	0	356	n/a	513	319	492
1994	1071	443	62	631	170	0	331	n/a	461	288	459
1995	1556	379	53	1392	447	0	284	n/a	682	403	673
1996	1569	372	69	730	102	0	477	n/a	531	291	530
1997	1424	535	63	834	113	0	398	n/a	560	314	537
1998	1322	464	58	812	113	0	366	n/a	509	288	475
1999	1508	371	65	478	116	973	0	n/a	1135	517	1082
2000	1739	594	74	286	35	1221	0	1258	1262	545	1213
2001	1721	687	84	305	35	795	0	851	847	344	836
1997-2001											
5-yr Avg	1543	530	69	543	82	598	153	n/a	863	402	829
1992-1996											
5-yr Avg	1307	414	58	821	220	0	400	n/a	556	325	540
1989-1991											
3-yr Avg	1223	320	54	526	193	0	449	n/a	694	355	643
2002	1499	627	87	305	43	1263	0	1312	1320	579	1306

* Households directly contacted by returning a calendar or postcard or by being interviewed in a face-to-face or telephone survey.

** Includes information for an uncontacted household's fishing effort derived from another household's survey form or in consultation with village officials.

*** Households that did not fish and those households which did fish and provided harvest numbers.

Table 3.—2003 Bethel harvest monitoring program sampling summary in historical context.

Year	Total HH'S	Calendar		Postcard		Surveyed	Phone Contact	Total Contacts*	Any Info.**	Subsistence Fished*	Harvest Data***
		Mailed	Returned	Mailed	Returned						
1989	1281	276	53	744	182	0	630	n/a	843	411	757
1990	1215	377	49	172	171	0	87	n/a	592	295	546
1991	1174	306	60	662	227	1	631	n/a	648	360	627
1992	1183	421	56	636	176	0	550	n/a	594	322	548
1993	1156	455	52	715	205	0	356	n/a	513	319	492
1994	1071	443	62	631	170	0	331	n/a	461	288	459
1995	1556	379	53	1392	447	0	284	n/a	682	403	673
1996	1569	372	69	730	102	0	477	n/a	531	291	530
1997	1424	535	63	834	113	0	398	n/a	560	314	537
1998	1322	464	58	812	113	0	366	n/a	509	288	475
1999	1508	371	65	478	116	973	0	n/a	1135	517	1082
2000	1739	594	74	286	35	1221	0	1258	1262	545	1213
2001	1721	687	84	305	35	795	0	851	847	344	836
2002	1499	627	87	305	43	1263	0	1312	1320	579	1306
1998-2002											
5-yr Avg	1558	549	74	437	68	850	73	n/a	1015	455	982
1993-1997											
5-yr Avg	1355	437	60	860	207	0	369	n/a	549	323	538
1989-1992											
4-yr Avg	1213	345	55	554	189	0	475	n/a	669	347	620
2003	1651	683	75	126	3	1057	0	1077	1083	439	1046

* Households directly contacted by returning a calendar or postcard or by being interviewed in a face-to-face or telephone survey.

** Includes information for an uncontacted household's fishing effort derived from another household's survey form or in consultation with village officials.

*** Households that did not fish and those households which did fish and provided harvest numbers.

Table 4.—2001 Bethel subsistence salmon harvest estimates in historical perspective.

YEAR	Estimated	No. of HH	Contact	Estimated Bethel Salmon Harvests				Total Salmon
	Total HH	Harvest Data	Rate (%)	Chinook	Sockeye	Coho	Chum	
1989	1281	757	59	24655	7316	22390	25581	79942
1990	1215	546	45	19641	6392	19341	18436	63812
1991	1174	627	53	28817	17669	28136	22770	97392
1992	1183	548	46	17196	7173	15902	14908	55178
1993	1156	492	43	22083	10503	13764	9172	55522
1994	1071	459	43	24515	8563	12258	12341	57677
1995	1556	673	43	29568	8190	19906	15821	73485
1996	1569	530	34	20783	7112	12929	16403	57227
1997	1424	537	38	21253	10868	15108	8790	56019
1998	1322	474	36	23963	8134	11294	12057	55449
1999	1508	1082	72	24996	13145	12414	11163	61719
2000	1739	1213	70	22515	12536	13794	10616	59461
1996-2000 5-yr Avg	1512	767	50	22702	10359	13108	11806	57975
1991-1995 5-yr Avg	1228	560	46	24436	10419	17993	15002	67851
1989-1990 2-yr Avg	1248	652	52	22148	6854	20866	22009	71877
2001	1721	836	49	27209	15709	14949	11319	69186

Table 5.—2002 Bethel subsistence salmon harvest estimates in historical perspective.

YEAR	Estimated	No. of HH	Contact	Estimated Bethel Salmon Harvests				Total Salmon
	Total HH	Harvest Data	Rate (%)	Chinook	Sockeye	Coho	Chum	
1989	1281	757	59	24655	7316	22390	25581	79942
1990	1215	546	45	19641	6392	19341	18436	63812
1991	1174	627	53	28817	17669	28136	22770	97392
1992	1183	548	46	17196	7173	15902	14908	55178
1993	1156	492	43	22083	10503	13764	9172	55522
1994	1071	459	43	24515	8563	12258	12341	57677
1995	1556	673	43	29568	8190	19906	15821	73485
1996	1569	530	34	20783	7112	12929	16403	57227
1997	1424	537	38	21253	10868	15108	8790	56019
1998	1322	474	36	23963	8134	11294	12057	55449
1999	1508	1082	72	24996	13145	12414	11163	61719
2000	1739	1213	70	22515	12536	13794	10616	59461
2001	1721	836	49	27209	15709	14949	11319	69186
1997-2001 5-yr Avg	1543	828	53	23987	12078	13512	10789	60367
1992-1996 5-yr Avg	1307	540	42	22829	8308	14952	13729	59818
1989-1991 3-yr Avg	1223	643	52	24371	10459	23289	22262	80382
2002	1499	1312	88	19305	7350	12966	15082	54703

Table 6.—2003 Bethel subsistence salmon harvest estimates in historical perspective.

YEAR	Estimated Total HH	No. of HH Harvest Data	Contact Rate (%)	Estimated Bethel Salmon Harvests				Total Salmon
				Chinook	Sockeye	Coho	Chum	
1989	1281	757	59	24655	7316	22390	25581	79942
1990	1215	546	45	19641	6392	19341	18436	63812
1991	1174	627	53	28817	17669	28136	22770	97392
1992	1183	548	46	17196	7173	15902	14908	55178
1993	1156	492	43	22083	10503	13764	9172	55522
1994	1071	459	43	24515	8563	12258	12341	57677
1995	1556	673	43	29568	8190	19906	15821	73485
1996	1569	530	34	20783	7112	12929	16403	57227
1997	1424	537	38	21253	10868	15108	8790	56019
1998	1322	474	36	23963	8134	11294	12057	55449
1999	1508	1082	72	24996	13145	12414	11163	61719
2000	1739	1213	70	22515	12536	13794	10616	59461
2001	1721	836	49	27209	15709	14949	11319	69186
2002	1499	1312	88	19305	7350	12966	15082	54703
1998-2002 5-yr Avg	1558	983	63	23598	11375	13084	12047	60103
1993-1997 5-yr Avg	1355	538	40	23640	9047	14793	12505	59986
1989-1992 4-yr Avg	1213	620	51	22577	9637	21442	20424	74081
2003	1651	1077	65	21475	10542	13237	9829	55083

Table 7.—Confidence intervals for Bethel subsistence salmon harvest estimates, 2001-2003.

Bethel Chinook Salmon Subsistence Harvests, 2001-2003

	Do Not Usually Fish				Usually Fish				TOTAL						
	Total HHs	HHs Contacted	Mean	Standard Deviation	Total HHs	HHs Contacted	Mean	Standard Deviation	Total HHs	HHs Contacted	Mean	Reported Harvest	Estimated Total	Confidence Interval	
														+/-	% +/-
2001	957	470	1.8	11.9	764	366	33.3	61.8	1721	836	15.8	13056	27209	3638	13.4%
2002	978	864	6.4	21.8	521	448	25.0	39.3	1499	1312	12.9	16748	19305	877	4.5%
2003	1051	624	2.5	12.0	600	453	31.4	51.0	1651	1077	13	15787	21475	1562	7.3%

Bethel Sockeye Salmon Subsistence Harvests, 2001-2003

	Do Not Usually Fish				Usually Fish				TOTAL						
	Total HHs	HHs Contacted	Mean	Standard Deviation	Total HHs	HHs Contacted	Mean	Standard Deviation	Total HHs	HHs Contacted	Mean	Reported Harvest	Estimated Total	Confidence Interval	
														+/-	% +/-
2001	957	470	1.2	8.7	764	366	19.1	31.7	1721	836	9.1	7539	15709	1907	12.1%
2002	978	864	2.7	10.9	521	448	9.1	22.5	1499	1312	4.9	6382	7350	482	6.6%
2003	1051	624	1.6	6.8	600	453	14.8	35.8	1651	1077	6.4	7694	10542	1063	10.1%

Bethel Coho Salmon Subsistence Harvests, 2001-2003

	Do Not Usually Fish				Usually Fish				TOTAL						
	Total HHs	HHs Contacted	Mean	Standard Deviation	Total HHs	HHs Contacted	Mean	Standard Deviation	Total HHs	HHs Contacted	Mean	Reported Harvest	Estimated Total	Confidence Interval	
														+/-	% +/-
2001	957	470	1.6	10.2	764	366	17.6	31.5	1721	836	8.7	7180	14949	1926	12.9%
2002	978	864	5.4	21.9	521	448	14.7	31.4	1499	1312	8.6	11274	12966	762	5.9%
2003	1051	624	2.2	10.4	600	453	18.1	49.2	1651	1077	8.0	9613	13237	1480	11.2%

Bethel Chum Salmon Subsistence Harvests, 2001-2003

	Do Not Usually Fish				Usually Fish				TOTAL						
	Total HHs	HHs Contacted	Mean	Standard Deviation	Total HHs	HHs Contacted	Mean	Standard Deviation	Total HHs	HHs Contacted	Mean	Reported Harvest	Estimated Total	Confidence Interval	
														+/-	% +/-
2001	957	470	0.6	4.6	764	366	14.1	30.7	1721	836	6.6	5429	11319	1793	15.8%
2002	978	864	4.7	23.8	521	448	20.0	67.4	1499	1312	10.1	13078	15082	1354	9.0%
2003	1051	624	1.3	7.3	600	453	14.1	35.2	1651	1077	6.0	7199	9829	1058	10.8%

Table 8.—Estimated subsistence fish harvests by gear type, Bethel, 2001.

Species	Conversion Factor (# to Pounds)	Households*		Number of Fish Harvested for Subsistence**							Useable Pounds of Fish Harvested for Subsistence**						
		Number	%	Set Net	Drift Net	Net Under Ice	Other Gear	Hooking Thru Ice	Rod & Reel	TOTAL	Set Net	Drift Net	Net Under Ice	Other Gear	Hooking Thru Ice	Rod & Reel	TOTAL
Chinook	17	495	28.8%	4,855	22,134		0		221	27,209	82,535	376,278		0		3,757	462,570
Chum	6	327	19.0%	838	10,445		0		37	11,319	5,028	62,670		0		222	67,920
Sockeye	6	403	23.4%	1,782	13,781		0		146	15,709	10,692	82,686		0		876	94,254
Coho	6	389	22.6%	355	13,727		0		868	14,949	2,130	82,362		0		5,208	89,700
Pink	2.9	32	1.9%	304	442		0		2	748	882	1,282		0		6	2,169
TOTAL SALMON				8,133	60,528		0		1,273	69,934	101,267	605,278		0		10,069	716,613
Northern Pike	4.5	176	10.2%	246	20	195	0	4,723	326	5,510	1,107	90	878	0	21,254	1,467	24,795
Burbot	4.5	162	9.4%	119	12	1,258	0	2,541	33	3,963	536	54	5,661	0	11,435	149	17,834
Least Cisco	0.75	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bering Cisco	0.75	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Humpback Whitefish	2	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Broad Whitefish	4	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Round Whitefish	1.5	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unknown Whitefish	3	203	11.8%	4,784	148	2,579	0	565	752	8,828	14,352	444	7,737	0	1,695	2,256	26,484
Sheefish	6.5	131	7.6%	268	160	410	0	16	133	987	1,742	1,040	2,665	0	104	865	6,416
Grayling	1.5	49	2.9%	0	0	0	0	6	309	315	0	0	0	0	9	464	473
Dolly Varden	1.5	49	2.9%	41	4	410	0	12	225	692	62	6	615	0	18	338	1,038
Rainbow Trout	2	39	2.3%	2	0	0	0	18	107	127	4	0	0	0	36	214	254
Lake Trout	1	8	0.5%	0	0	0	0	0	57	57	0	0	0	0	57	57	57
TOTAL NON-SALMON				5,460	344	4,852	0	7,881	1,942	20,479	17,802	1,634	17,556	0	34,550	5,808	77,350
TOTAL FISH BY GEAR TYPE				13,593	60,872	4,852	0	7,881	3,215	90,413	119,069	606,912	17,556	0	34,550	15,877	793,963

	Conversion Factor	Households		Rake	
		No.	%	No.	lbs
Lamprey	6 lbs per gal	0	0.0%	0	0
Blackfish	6 lbs per gal	Households		Trap	
		No.	%	(Gallons)	lbs
		61	3.6%	648	3,888
Smelt	6 lbs per gal	Households		Dipnet	
		No.	%	(Gallons)	lbs
		275	16.0%	2,367	14,202

* Household number and percentage estimates expanded from household surveys only; total number of households is 1,721

** Salmon harvest estimates from all sources reallocated to gear types according to survey distribution.

NOTE: Salmon harvest data are from summer. Data for other species are from October 1 to September 30.

SOURCE: Alaska Department of Fish and Game, Division of Subsistence and Orutsaramiut Native Council, Household Surveys, 2001.

Table 9.—Estimated subsistence fish harvests by gear type, Bethel, 2002.

Species	Conversion Factor (# to Pounds)	Households*		Number of Fish Harvested for Subsistence**							Useable Pounds of Fish Harvested for Subsistence**						
		Number	%	Set Net	Drift Net	Net Under Ice	Other Gear	Hooking Thru Ice	Rod & Reel	TOTAL	Set Net	Drift Net	Net Under Ice	Other Gear	Hooking Thru Ice	Rod & Reel	TOTAL
Chinook	17	507	33.8%	2,146	16,923		0		236	19,305	36,482	287,691		0		4,012	328,185
Chum	6	395	26.4%	972	14,004		0		106	15,082	5,832	84,024		0		636	90,492
Sockeye	6	392	26.1%	511	6,700		0		139	7,350	3,066	40,200		0		834	44,100
Coho	6	433	28.9%	586	11,144		0		1,236	12,966	3,516	66,864		0		7,416	77,796
Pink	2.9	47	3.2%	77	641		0		2	721	223	1,859		0		6	2,088
TOTAL SALMON				4,293	49,412		0		1,719	55,424	49,119	480,638		0		12,904	542,661
Northern Pike	4.5	222	14.8%	617	4	190	0	7,747	1,225	9,783	2,777	18	855	0	34,862	5,513	44,024
Burbot	4.5	172	11.5%	261	10	826	23	3,674	1,015	5,809	1,175	45	3,717	104	16,533	4,568	26,141
Least Cisco	0.75	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bering Cisco	0.75	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Humpback Whitefish	2	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Broad Whitefish	4	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Round Whitefish	1.5	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unknown Whitefish	3	198	13.2%	4,800	278	3,519	11	823	1,157	10,588	14,400	834	10,557	33	2,469	3,471	31,764
Sheefish	6.5	115	7.7%	283	113	224	0	76	91	787	1,840	735	1,456	0	494	592	5,116
Grayling	1.5	69	4.6%	0	1	0	0	12	540	553	0	2	0	0	18	810	830
Dolly Varden	1.5	74	4.9%	76	15	1	0	13	373	478	114	23	2	0	20	560	717
Rainbow Trout	2	64	4.3%	2	7	0	0	44	304	357	4	14	0	0	88	608	714
Lake Trout	1	19	1.3%	0	0	0	0	31	114	145	0	0	0	0	31	114	145
TOTAL NON-SALMON				6,039	428	4,760	34	12,420	4,819	28,500	20,309	1,670	16,587	137	54,514	16,234	109,449
TOTAL FISH BY GEAR TYPE				10,332	49,840	4,760	34	12,420	6,538	83,924	69,428	482,307	16,587	137	54,514	29,138	652,110

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	Conversion Factor	Households		Rake	
		No.	%	No.	lbs
Lamprey	6 lbs per gal	0	0.0%	0	0
Blackfish	6 lbs per gal	Households		Trap	
		No.	%	(Gallons)	lbs
		63	4.2%	711	4,266
Smelt	6 lbs per gal	Households		Dipnet	
		No.	%	(Gallons)	lbs
		241	16.1%	2,191	13,146

* Household number and percentage estimates expanded from household surveys only; total number of households is 1,499

** Salmon harvest estimates from all sources reallocated to gear types according to survey distribution.

NOTE: Salmon harvest data are from summer. Data for other species are from October 1 to September 30.

SOURCE: Alaska Department of Fish and Game, Division of Subsistence and Orutsamiut Native Council, Household Surveys, 2002.

Table 10.—Estimated subsistence fish harvests by gear type, Bethel, 2003.

Species	Conversion Factor (# to Pounds)	Households*		Number of Fish Harvested for Subsistence**							Useable Pounds of Fish Harvested for Subsistence**						
		Number	%	Set Net	Drift Net	Net Under Ice	Other Gear	Hooking Thru Ice	Rod & Reel	TOTAL	Set Net	Drift Net	Net Under Ice	Other Gear	Hooking Thru Ice	Rod & Reel	TOTAL
Chinook	17	427	25.9%	1,451	13,982		346		175	21,475	24,667	237,694		0		2,975	265,336
Chum	6	255	15.4%	447	7,505		346		113	9,829	2,682	45,030		0		678	48,390
Sockeye	6	341	20.7%	547	7,434		139		142	10,542	3,282	44,604		0		852	48,738
Coho	6	357	21.6%	376	9,925		0		1,349	13,237	2,256	59,550		0		8,094	69,900
Pink	2.9	29	1.8%	157	84		0		21	261	455	244		0		61	760
TOTAL SALMON				2,978	38,929		831		1,800	55,344	33,342	387,122		0		12,660	433,124
Northern Pike	4.5	111	6.7%	271	0	231	0	8,920	308	9,730	1,220	0	1,040	0	40,140	1,386	43,785
Burbot	4.5	89	5.4%	29	7	299	0	1,873	312	2,520	131	32	1,346	0	8,429	1,404	11,340
Least Cisco	0.75	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bering Cisco	0.75	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Humpback Whitefish	2	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Broad Whitefish	4	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Round Whitefish	1.5	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unknown Whitefish	3	81	4.9%	2,317	333	565	0	74	203	3,492	6,951	999	1,695	0	222	609	10,476
Sheefish	6.5	53	3.2%	145	137	49	0	9	6	346	943	891	319	0	59	39	2,249
Grayling	1.5	32	1.9%	139	0	693	0	0	256	1,088	209	0	1,040	0	0	384	1,632
Dolly Varden	1.5	32	1.9%	21	4	0	0	186	115	326	32	6	0	0	279	173	489
Rainbow Trout	2	34	2.1%	32	0	0	0	0	153	185	64	0	0	0	0	306	370
Lake Trout	1	3	0.2%	0	0	0	0	0	6	6	0	0	0	0	0	6	6
TOTAL NON-SALMON				2,954	481	1,837	0	11,062	1,359	17,693	9,548	1,927	5,438	0	49,128	4,307	70,347
TOTAL FISH BY GEAR TYPE				5,932	39,410	1,837	831	11,062	3,159	73,037	42,890	389,049	5,438	0	49,128	16,966	503,471

	Conversion Factor	Households		Rake	
		No.	%	No.	lbs
Lamprey	6 lbs per gal	0.00	0.0%	0	0
Blackfish	6 lbs per gal	Households		Trap	
		No.	%	(Gallons)	lbs
		34	2.1%	635	3,810
Smelt	6 lbs per gal	Households		Dipnet	
		No.	%	(Gallons)	lbs
		99	6.0%	743	4,458

* Household number and percentage estimates expanded from household surveys only; total number of households is 1,651.

** Salmon harvest estimates from all sources reallocated to gear types according to survey distribution.

NOTE: Salmon harvest data are for summer. Data for other species are from October 1 to September 30.

SOURCE: Alaska Department of Fish and Game, Division of Subsistence and Orutsaramiut Native Council, Household Surveys, 2003.

Table 11.—Subsistence salmon fishing gear types used by Bethel households, 2001-2003.

	Fishing HH'S*	Gear Types**													
		Setnet		Drift Net		Fish Wheel		Rod & Reel		Seine		Spear		Not Reported	
2001	344	34	10%	249	72%	0	0%	53	15%	0	0%	0	0%	59	17%
2002	579	55	9%	397	69%	0	0%	121	21%	0	0%	0	0%	90	16%
2003	439	23	5%	300	68%	0	0%	70	16%	0	0%	0	0%	91	21%

* Data on subsistence fishing households based upon interviews, postcards, or calendars.

** A household may use multiple gear types.

Table 12.—Commercially harvested salmon retained for subsistence uses, Bethel, 2001-2003.

BETHEL HOUSEHOLDS								
HOUSEHOLDS INTERVIEWED			COMMERCIAL FISHING CATCH		FISH RETAINED FROM COMMERCIAL FISHING			
YEAR	INTERVIEWED	COMMERCIAL FISHING	CATCH	INOOK	CKEYE	COHO	CHUM	TOTAL
2001	795	1	1	1	0	1	0	2
2002	1263	4	4	17	30	18	0	65
2003	1057	4	4	0	0	20	0	20

Note: Data are based upon surveyed households only without expansion to the community as a whole.

Table 13.—Bethel subsistence salmon reported harvests and estimated total harvests, 1989-2003.

Year	Total HHs	HH contacted	Contact Rate	Total Reported	Estimated Total
1989	1,281	757	59	47,216	79,942
1990	1,215	546	45	35,097	63,812
1991	1,174	627	53	57,061	97,392
1992	1,183	548	46	32,761	55,178
1993	1,156	492	43	34,780	55,522
1994	1,071	459	43	37,743	57,677
1995	1,556	673	43	42,033	73,485
1996	1,569	530	34	30,916	57,227
1997	1,424	537	38	31,022	56,019
1998	1,322	474	36	29,933	55,449
1989-1998 avg	1,295	564	44	37,856	65,170
1999	1,508	1,082	72	49,030	61,719
2000	1,739	1,213	70	45,713	59,461
2001	1,721	836	49	33,204	69,186
2002	1,499	1,312	88	47,482	54,703
2003	1,651	1,077	65	40,293	55,083
1999-2003 avg	1,624	1,104	69	43,144	60,030



Figure 1.—Kuskokwim Management Area commercial fishing districts.

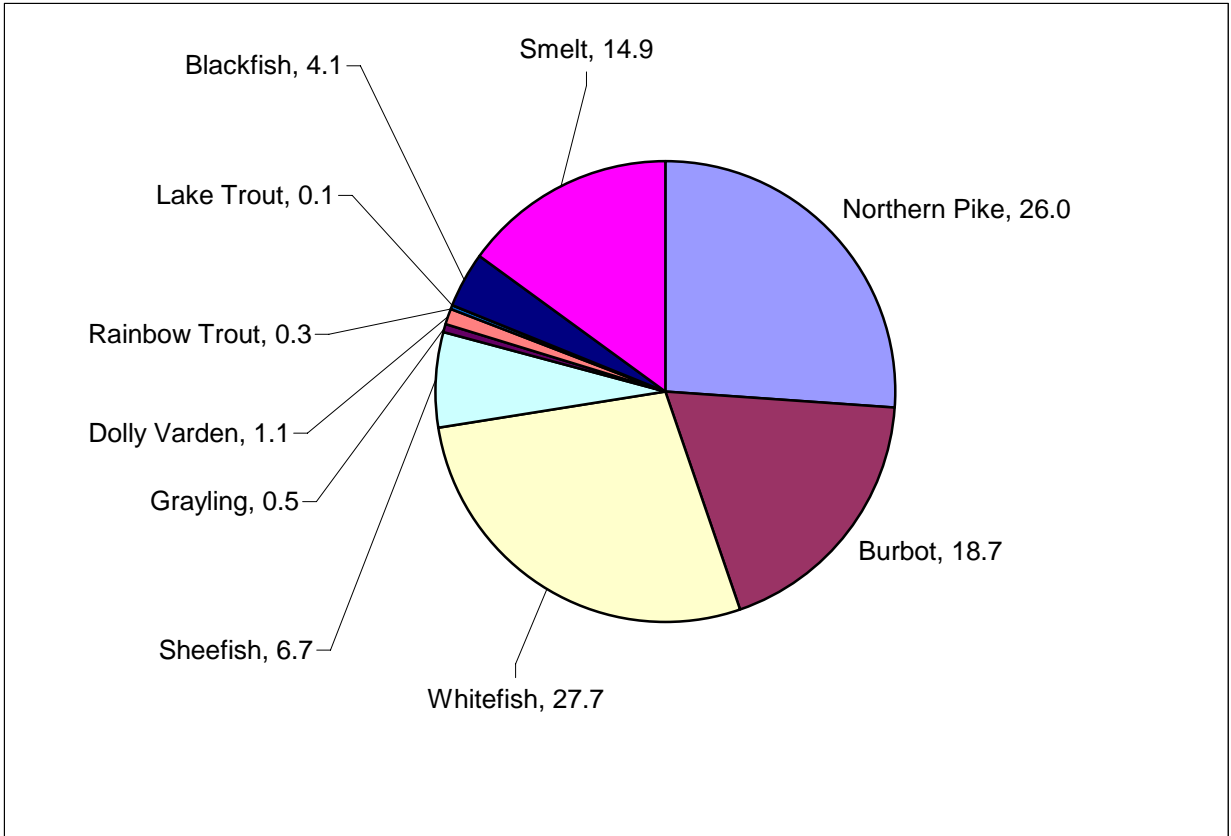


Figure 2.—Bethel non-salmon fish relative harvest contribution by species and usable pounds (%), 2001.

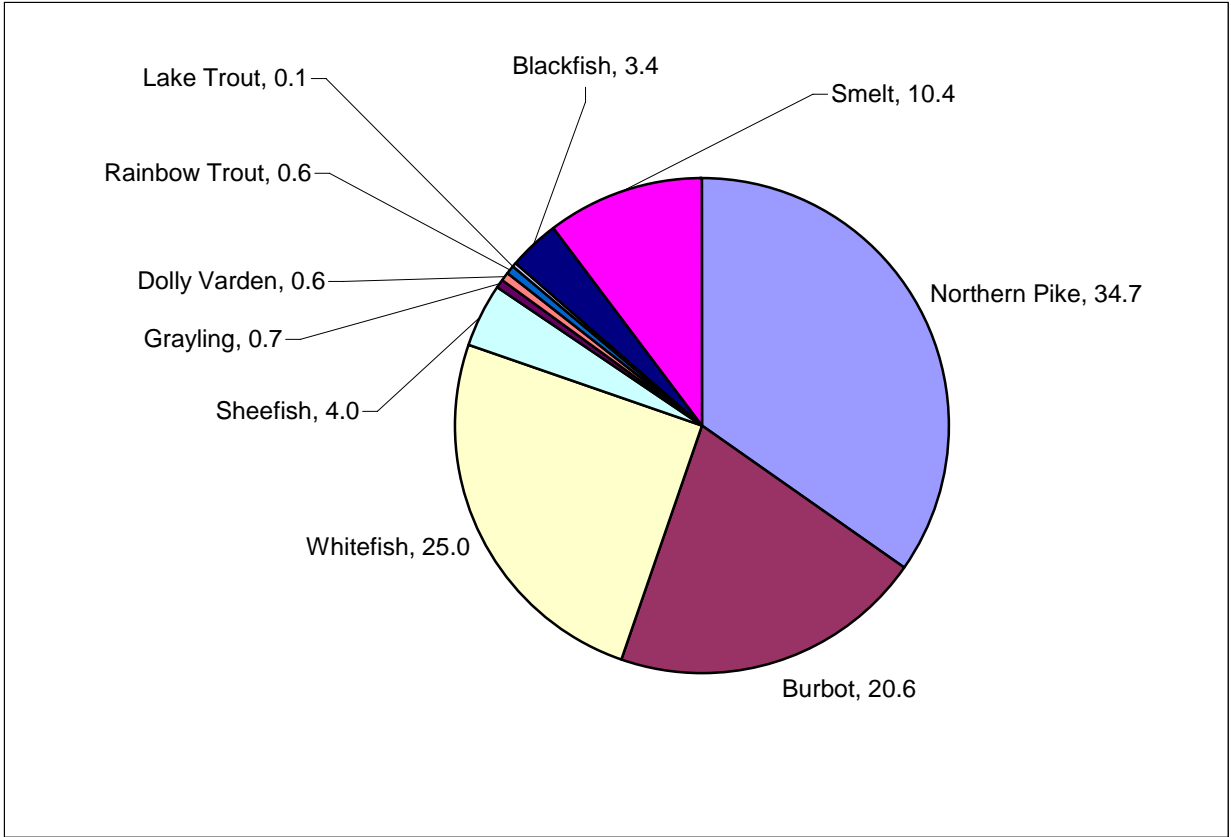


Figure 3.—Bethel non-salmon fish relative harvest contribution by species and usable pounds (%), 2002.

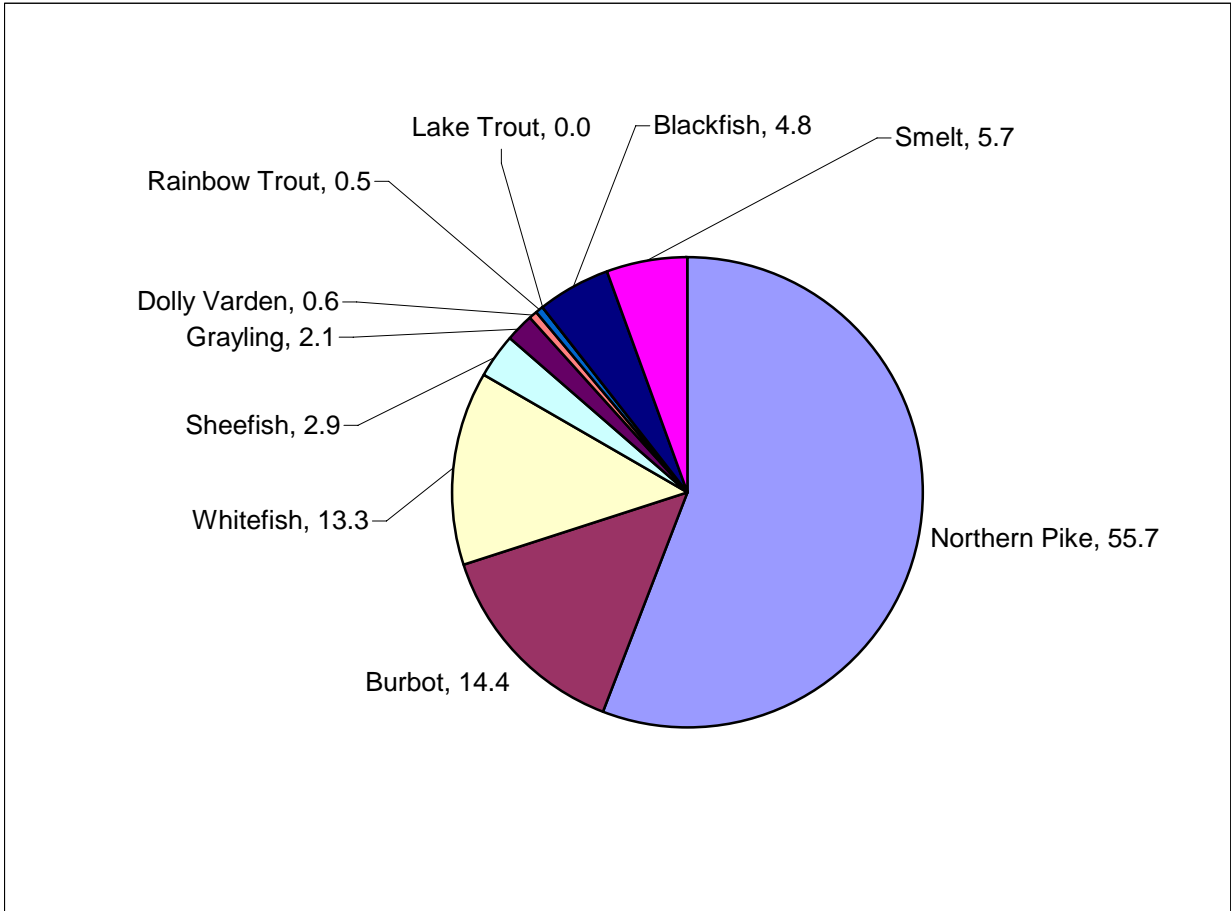


Figure 4.—Bethel non-salmon fish relative harvest contribution by species and usable pounds (%), 2003.

APPENDIX. BETHEL HOUSEHOLD SURVEY FORM, 2002

Household Street Address:

SubDivision _____ Street Name _____ House Number _____ Apartment Number _____

Household Name: _____ Household PO Box Number: _____

Interviewer Initials: _____ Survey Date: Oct. Nov. 2002

BETHEL HOUSEHOLD SURVEY: Alaska Fish and Game Subsistence and Orutsaramiut Native Council

Household participation is voluntary, Survey forms will be turned in to Alaska Dept of Fish and Game, Subsistence. Household data will not be released without permission of Household Head. Covering Harvest Periods of: October 1, 2001 - September 30, 2002.

1. Did this household catch ANY KIND OF FISH FOR SUBSISTENCE during the past year ? ___ YES ___ NO (If NO, the survey is done.)

2. Did this household catch SUBSISTENCE salmon this year ? ___ YES ___ NO (If NO, go to back side and complete survey for other fish).

FOR SALMON FISHING HOUSEHOLDS ONLY

3. Did you use a salmon harvest calendar? ___ YES ___ NO (If NO then get estimates , Gear types, Rod and Reel harvest locations)

4. Are all of the salmon you harvested on the calendar ? ___ YES ___ NO (If NO then get estimates of additional fish)

If YES, Place a check mark for each gear type used, Get mesh size for Chinook, Ask for number harvested and locations for salmon caught with Rod and Reel.

**NON-COMMERCIAL USE OF SALMON, DO NOT INCLUDE SALMON THAT WERE SOLD
NUMBER OF SALMON THIS HOUSEHOLD HARVESTED**

SPECIES	HARVESTED Y/N	SET	Mesh	DRIFT	Mesh	OTHER GEAR	Fish Kept From	ROD AND REEL		KEY TO ROD AND REEL HARVEST LOCATIONS
		NET (number)	Size Inches	NET (number)	Size Inches	Write in gear type	Number (of fish)	Commercial Fishing (number)	HARVESTS (number) Location	
CHINOOK SALMON King Taryaqvak										A. Kuskokwim River
CHUM SALMON Dog Iqalluk										B. Kanektok River drainage
SOCKEYE SALMON Red Sayak										C. Kwethluk River drainage
COHO SALMON Coho, Silver Qakiyak										D. Kasigluk River drainage
PINK SALMON Pink, humpy Amaqaayak										E. Kisaralik River drainage
										F. Aniak River drainage
										G. Holitna River drainage
										H. Stony River drainage
										I. Hoholitna River drainage
										J. Goodnews River drainage

5. How was subsistence salmon fishing for your household this year ?

Kings: ___ Very Good ___ Average ___ Poor If poor, Why ? _____
 Chums: ___ Very Good ___ Average ___ Poor If poor, Why ? _____
 Sockeye (reds) ___ Very Good ___ Average ___ Poor If poor, Why ? _____
 Coho (silvers) ___ Very Good ___ Average ___ Poor If poor, Why ? _____

HOUSEHOLD FISH HARVEST SURVEY: Alaska Fish and Game Subsistence and Orutsamiut Native Council

Participation is voluntary, Survey forms will be turned in to Alaska Dept of Fish and Game, Subsistence. Household data will not be released without permission of Household Head.
 Covering Harvest Periods of: October 1, 2001 - September 30, 2002.

DO NOT WRITE IN THE GRAY AREAS

NON- SALMON FISH

Do not include fish that were released

* Use CF if caught while commercial fishing and used for Subsistence

NUMBER OF FISH HOUSEHOLD HARVESTED

SPECIES	HARVESTED Y/N	SET NET (number)	DRIFT NET (number)	NET UNDER ICE (number)	OTHER GEAR *		HOOKING Thru Ice (number)	ROD & REEL Open water (number)	KEY TO HARVEST LOCATIONS
					Write in gear type	Number (of fish)			
NORTHERN PIKE Luqruiyak:									A. Kuskokwim River B. Kanektok River drainage
BURBOT (lush):									C. Kwethluk River drainage D. Kasigluk River drainage
WHITEFISH									E. Kisaralik River drainage F. Aniak River drainage
SHEEFISH Ciiq:									G. Holitna River drainage H. Stony River drainage
GRAYLING Culugpauk:									I. Hoholitna River drainage J. Goodnews River drainage
DOLLY VARDEN Yugyatk:									K. Bethel Seawall L. Mouth of Johnson River
RAINBOW TROUT Talaariq:									M. In Johnson River drainage O. Mouth of Gweek River
LAKE TROUT Cikigniq:									P. In Gweek River drainage R. Kialik River drainage
BLACKFISH					Taluyaq				S. Atchuelinguk River (Yukon) T. Other Yukon Areas
SMELT					Dipnet				W. X.
									Y.
									Z.

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