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Patterns and Trends in Subsistence Fish Harvests, Northwest Alaska, 2009–2010 Annual Report

by

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

Symbols and Abbreviations

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

all atomic symbols

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

General

all commonly-accepted abbreviations e.g., Mr., Mrs., AM, PM, etc.

all commonly-accepted professional titles e.g., Dr., Ph.D., R.N., etc.

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

Measures (fisheries)

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

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations

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

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by

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ABSTRACT

This annual report summarizes the progress of the third year of a 3-year project to explore subsistence fishery harvest patterns and trends in 6 Northwest Alaska communities: Ambler, Kiana, Kobuk, Noatak, Noorvik, and Shungnak. Research efforts in 2009–2010 focused on analyzing responses from 92 household interviews, and on merging interview data with 11 years of household survey data (1994–2004) to create a balanced panel dataset of reported harvests and factors reported as affecting harvests. As a group, the 92 interviewed households reported an average harvest of 418 lb of salmon *Oncorhynchus* and sheefish *Stenodus leucichthys* each year from 1994 through 2004. Reported harvests showed no significant increasing or decreasing trend, either for the communities as a whole or for the interviewed households. Environmental factors, such as "unusual water levels" or "unusual weather," were most frequently named as affecting fishing, and accounted for 34% of reported factors. Personal factors, such as health and age, accounted for 21%, while financial factors, such as employment and rising costs, accounted for 19% of reported factors. Within the stable overall harvest pattern, it was expected that 1) some households' harvests would be decreasing while other households' harvests would be increasing, 2) interviewed households would be able to identify factors contributing to these changes, and 3) factors contributing to changing patterns and trends in harvests could be identified. Researchers have not found such associations, at least in preliminary analyses for all fish harvests combined; however, associations between factors and harvests may emerge for individual species. Observed trends in community harvests have been at the species level (i.e., salmon decreasing, sheefish increasing), not for all species combined. The project is now in the data analysis and writing phases, with a final report due December 31, 2010.

Key words: subsistence fishing, chum salmon, *Oncorhynchus keta*, sheefish, *Stenodus leucichthys*, whitefish, *Coregonus* , Dolly Varden, *Salvelinus malma*, Ambler, Kiana, Kobuk, Noatak, Noorvik, Shungnak, Kotzebue District, Cape Krusenstern National Monument, Kobuk Valley National Park, Kotzebue Sound, Noatak National Preserve.

INTRODUCTION

This project explores patterns and trends in subsistence fish harvests in 6 Northwest Alaska communities: Ambler, Kiana, Kobuk, Noatak, Noorvik, and Shungnak (Figure 1). The goal is to identify factors associated with changes in fish harvests in project communities, and to distinguish changes related to social, economic, and environmental factors from changes related to fisheries management. The project relies in part on analyses of previously collected subsistence fish harvest data to explore trends in harvests at the community level and patterns in harvests at the household level. The project also relies on interviews with selected fishing households. Respondents were asked to review and comment on factors affecting their household's and community's subsistence harvests. The results are expected to improve the reliability of predictive modeling regarding the subsistence harvest of fish.

This annual report summarizes progress during the third year of the 3-year project. This introductory section summarizes the research problem, literature and data review, and methods that were presented in more detail in prior annual reports (Magdanz et al. 2008; Magdanz et al. 2009).

THE RESEARCH PROBLEM

From 1994 through 2004, estimated harvests of Pacific salmon *Oncorhynchus* decreased in each of the 6 project communities. The moving 4-year average[1] of the communities' total salmon harvest declined from 42,987 salmon in 1997 to 25,327 salmon in 2004 (Magdanz et al. 2008). In some communities, declines in harvests of salmon have been mitigated by increases in harvests of other fish, but in other communities this has not occurred. The reasons for these changes in harvests, whether ecological, social, or economic, are not well understood.

Previous annual reports have summarized environmental and economic factors that might account for some of these changes. These include widespread Western Alaska salmon run failures (Kruse 1998), collapse of the international market for commercially-caught wild salmon (Buklis 1999), increased mineral prices leading to increased revenues and employment from extractive mineral activities (Fried and Robinson 2008), and rapid changes in Alaska's environment associated with atmospheric warming (Chapin III et al. 2004; Grebmeier et al. 2006:1463; Hassol 2004; Hinzman et al. 2005; Magnuson et al. 2000; Overland and Stabeno 2004).

Given the accumulating impacts of environmental and economic changes in the Northwest Arctic, time–series and panel analyses of subsistence harvest data were an obvious line of inquiry. For the 6 Northwest Arctic communities in this project, the available data may be unique in 2 ways: 1) household subsistence harvest records include not only all 5 of the Pacific salmon species found in Alaska but also 3 other major fish species; and 2) consistent annual household identification codes allow panel analyses at the household level. Consequently, researchers can explore relationships over time among the subsistence harvests of major fish species—salmon, sheefish *Stenodus leucichthys*, Dolly Varden *Salvelinus malma*, and whitefishes *Coregonus*—at the household level.

LITERATURE AND DATA REVIEW

Prior surveys[2] showed that residents of the 6 Northwest Arctic communities harvested an estimated average of 95,000 fish annually from 1994 through 2004. Converting numbers of fish to estimated pounds of fish using standard ADF&G conversion factors (Appendix A), fish contributed an estimated average edible weight in excess of 200,000 lb to annual subsistence harvests: more than one-third of the total

1 The 4-year average is used because the salmon harvest was 98% chum salmon *O. keta*, commonly saltwater-age-4 fish.

2 This project relies in part on analyses of previously collected subsistence fish harvest data to explore trends in harvests at the community level and patterns in harvests at the household level. The methods and results of the surveys have been published in a series of ADF&G annual reports (Georgette 1996a, 1996b; Georgette et al. 2003a, 2003b; 2004; Georgette and Koster 2005; Georgette and Utermohle 1997, 1998; 1999, 2000, 2001; Magdanz and Utermohle 1994) and summarized in ADF&G annual management reports (Banducci et al. 2003; Brennan et al. 1999; Bue et al. 1996a, 1996b, 1997; Kohler et al. 2004), and discussed in prior annual reports for this project (Magdanz et al. 2008; 2009).

estimated subsistence harvest of all wild foods, by weight. A significant proportion of fish harvest effort occurred within the boundaries of the Kobuk Valley National Park, the Noatak National Preserve, and the Cape Krusenstern National Monument.

A previous analysis of patterns and trends in salmon harvests for 10 Seward Peninsula communities examined several hypotheses about factors related to salmon harvests (Magdanz et al. 2009). Results were consistent with subsistence harvest patterns observed by other researchers. "A relatively small proportion of households typically produced most of the wild foods by weight harvested within a given community."[3] These highly productive households typically included multiple working age males, were involved in commercial fishing, and had higher wage incomes. Given these patterns, it was reasonable to assume that in each community there existed a stable core of high harvesting households that took the majority of the salmon year after year. Wolfe was among the first to formally hypothesize this phenomenon, and coined the term "super-households" (Wolfe 1987).

The analysis of the Norton Sound salmon harvest data suggested that the "super-households" could not be fully understood by analyzing single-year datasets. Norton Sound researchers found that while some high-harvesting households consistently contributed to the community harvest, other households' contributions were unpredictable (Magdanz et al. 2005:61–66). Surprisingly, some households that fished on an intermittent basis were among the highest harvesting households in their communities in a given year (Magdanz et al. 2005:52–53).

In the Norton Sound project, researchers based their analyses primarily upon the harvest database and attributes of each household collected from other databases or provided by key respondents. While patterns and trends could be observed in the data, explanations for those patterns and trends were speculative (Magdanz et al. 2005:75). Changes in community harvests are the result of changes in harvests by individuals and families. Fishing families themselves are best able to explain changes in their own fish harvests, which is why this project relied on both household harvest records and on interviews with selected fishing families in the study communities.

During the first 2 years of the project, researchers conducted a preliminary analysis of harvest trends in the 6 project communities. As reported in prior annual reports, for all species and all communities combined, no trend in total pounds harvested was evident (0.1% change). However, considerable differences were observed among species and among communities. Estimated salmon harvests trended downward by 7.3% annually. Downward trends in estimated salmon harvests were observed in all communities, and were of similar magnitudes. In comparison, estimated whitefish harvests changed very little overall (–0.5% annually), but varied widely among communities. Estimated sheefish harvests trended upwards by 3.4% annually, except in Noorvik, where the harvest trend was slightly downward. In most years, Dolly Varden data were collected only for Noatak, where these "trout" harvest estimates trended upwards by 3.4%. These results were reported in the 2008–2009 project annual report (Magdanz et al. 2009).

RESEARCH QUESTIONS

Based on a review of the literature and data, a series of research questions was developed to further clarify patterns and trends in subsistence harvests of salmon, whitefishes, sheefish, and Dolly Varden in Northwest Alaska. The first set of questions explores trends in fisheries harvests, specifically:

1. How did subsistence fish harvests change in the 6 project communities from 1994 through 2004?
2. What factors might account for these changes?
3. What factors might account for differences observed among the 6 project communities?

[3] Wolfe, R. J., C. L. Scott, W. E. Simeone, C. J. Utermohle, M. C. Pete, and the National Science Foundation. *In prep* [2009]. The "super-household" in Alaska Native subsistence economies. Draft manuscript. Hereinafter cited as Wolfe et al. *In prep* [2009].

A second set of questions explores patterns in fishing harvests:

1. Why do some households, and not others, cycle in and out of the fisheries?
2. Why do some intermittently fishing households harvest large quantities when they do fish?
3. Why are intermittently fishing households more common in some communities?

OBJECTIVES

This project has 5 related objectives which address 6 related research questions:

1. Compare community and household harvest databases; identify and correct data errors.
2. Analyze the community database to identify harvest trends for 4 fish species in 6 communities.
3. In 2 communities, work with high school students to review community harvest patterns and trends and work with respondents in selected households to review household harvest patterns and trends.
4. In 6 communities, collect household attributes (age of heads of household, changes in health status, deaths, marriages, etc.) from key respondents and through household interviews.
5. Summarize data from interviews and add household interview data to the harvest database.
6. Analyze the household database to identify correlations between harvests and social, economic, and demographic variables.

METHODS

The project design requires a coordinated analysis of 2 related ADF&G datasets. One dataset is a community time series dataset in which each record contains a single year of fish harvest data for a single community. The other dataset is a household panel dataset in which each record contains a single year of fish harvest data for a single household. Within the household dataset is a balanced panel of households: that is, data are available every year for each household. The household panel data are supplemented with additional data on household attributes acquired during key respondent interviews and household interviews conducted by staff from Maniilaq Association and the Alaska Department of Fish and Game (ADF&G), and by high school students in Noatak and Shungnak.

Instruments

Researchers relied on 2 instruments. The first is a one-page household verification form whose primary purpose is to verify that each household identification number in the data file tracks a single household over time. The second instrument is a five-page interview protocol that was used to collect information from fishing households about factors that affect their fishing. Prior to conducting the interviews, researchers designed a household history report (Magdanz et al. 2008:Appendix B) that summarized each selected household's harvests in numbers and pounds of fish and by species, as well as the respondent's community harvests in a similar format. These household history reports were used as prompts during household interviews.

Samples

Two samples were used for this project: 1) the annual samples of 191 to 446 households contacted in the original harvest surveys, and 2) a sample of 92 of households interviewed for this project (Table 1). The sample of interviewed households was a subsample of the original harvest survey samples. To ensure that interviewed households could provide data relevant to changes in harvests, a household was considered for interviews only if it 1) had been surveyed at least 6 times in the 11-year survey period; 2) had actually harvested fish in at least 1 year in the 11-year survey period; and 3) had a consistent household identifier

so that a panel dataset could be constructed. As a practical matter, the sample was limited to households present in the communities in 2008.

Although harvest surveys are conducted ever year, only 3 communities have been surveyed in all the 11 years from 1994–2004. Research efforts were concentrated in 2 of those 3 communities (Noatak and Shungnak). In these core study communities, the goal was a 50% random sample of eligible households. In the 4 other study communities (Ambler, Kiana, Kobuk, Noorvik), the goal was a 5% random sample of eligible households. Table 1 summarizes the sampling results for both the annual surveys and the project interviews. In Noatak, 68 households were eligible, and 37 were interviewed (a 54% sample of eligible households). In Shungnak, 33 households were eligible, and 25 were interviewed (a 76% sample). In the other four study communities combined, 142 households were eligible, and 30 were interviewed (a 21% sample). The final interview sample included 92 households, 38% of eligible households, and 19% of the median number of all households present in the study communities during the annual surveys from 1994–2004.

Data Collection and Reduction

During the first phase of the project, researchers cleaned, restructured, and verified the 2 ADF&G harvest datasets (Objective 1), as described in previous annual reports (Magdanz et al. 2009). Then researchers used Microsoft Excel[4] to analyze trends in the harvests of each species from the community-level data (Objective 2). During the second phase of the project, researchers visited each project community to verify household identifiers, gather household characteristics data (which supplemented each household's harvest data) and conduct interviews with selected fishing households.

Data collection began in Noatak in April 2008, where researchers worked with 12 high school students, and continued in Shungnak in November 2008, where researchers worked with 9 high school students to review their own community's harvest data and conduct household interviews (Objective 3). In February and June 2009, Maniilaq and ADF&G researchers visited Ambler, Kiana, Kobuk, Noatak, and Noorvik to collect household verification data and conduct interviews with randomly selected households (Objective 4). At the end of the second phase, researchers had 862 verification forms: 1 form for all but 14 of the 874 households surveyed in the 6 study communities from 1994–2004, as well as additional interviews with 92 fishing households in the study communities.

Data Analysis

In the third phase of the project, researchers will use statistical modeling software for the social sciences from SPSS, Inc. to merge the aggregated harvest database from phase 1 with the household characteristics data from phase 2 (Objective 5). Researchers are using SPSS aggregate, compute, recode, categorize, and transform procedures to characterize households based on their harvesting histories. Some household's harvesting histories indicated that they fished continuously during the 11-year period, while the histories of other households indicated that they had fished intermittently. Some households' harvests varied little from year to year, while other households' harvests varied greatly. Researchers will also use SPSS to test for associations between reported harvests and factors reported as affecting fish harvests.

Researchers are using Microsoft Excel to prepare household interview data for analysis, and to prepare quantitative data from the interviews for merging with the SPSS harvest datasets. Researchers will also summarize the results of the household interviews in Shungnak and Noatak and review the explanations households offered for their harvesting patterns.

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

PRELIMINARY RESULTS

Research efforts in 2009–2010 focused on responses from 92 household interviews. Each interview began by verifying the household identification number, and reviewing the household's history of harvests by showing respondents a table and a chart of the household's own reported harvests and asking them: "Is this how you remember your household's fish harvests?" Of the 92 households, 9 households' recollections (2 in Noorvik, 3 in Noatak, and 4 in Shungnak, 10%) were somewhat different from the data presented in the table and chart. The most common difference reported (by 3 households) was in whitefish harvests. One household commented that it harvested most of its whitefishes through the ice in winter; thus whitefish harvests are perhaps not fully captured by a fall survey. One household recalled harvesting salmon that were not evident in its data; 2 households were credited with salmon or sheefish that they did not recall harvesting. Several households noted the challenges of assessing shared harvests. One respondent noted that his/her household's harvests appeared to be the result of his/her son fishing with his brother, who lives in another household. Another respondent said that the number of fish on a household harvest report "mainly depends on who has the boat and motor, and [who] helps out other families with the fall seine for salmon and whitefish." Reported differences usually affected only a single survey species.

Ideally, all respondents would agree completely with their harvest records; in fact, most did. Of the 92 interviewed households, 78 households (85%) said that harvest survey data agreed with their harvest recall (5 households' responses to this question were missing). Given that 85% of the interviewed households agreed with the record of their harvests, researchers concluded that harvest survey data were of sufficient quality to conduct the planned analyses.

The next section of the interview asked respondents to name, without prompting, 3 factors that affected their household's fishing from 1994 through 2004, beginning with the most important factor, then continuing to the second and third most important factors. After they identified each factor, respondents were asked to describe it, categorize its effect on their harvests (up, down, or no change), and identify the year or years in which their household was affected.

Environmental factors, such as "unusual water levels" or "unusual weather," were named most frequently overall, and most frequently as the single most important factor affecting harvests, accounting for 34% of the reported factors (Figure 2). An Ambler respondent said "August has been rainier and rainier; [we] try to start earlier so we can dry [fish] in July." Another noted that the water had been "too low. There is hardly any river to fish: we have to go down, then up. Some fishing spots dried up. Some lakes drained out. Our camp is eroded-out."

After environmental factors, personal factors, including: health, age, family responsibilities, and food preferences (21%), and financial factors (19%) were mentioned most often. By far the most common financial concern was the cost of gasoline, mentioned by 29 of 92 households (32%) as 1 of the 3 most important factors affecting their harvests. This was exceeded only by the 34 of 92 households (37%) that mentioned water levels, an environmental factor. Various equipment concerns were mentioned by 26 households (28%), and employment concerns by only 14 households (15%).

Factors could have positive and/or negative effects on harvests, or could have no effect. A job, for example, might negatively affect fishing by limiting time available to fish; at the same time, it could positively affect fishing by providing money for equipment and supplies. One factor could affect different households in different ways. For example, one Shungnak respondent observed: "When water is high, we don't get as much. When water is very stable, we get more. If [water] rises, fish go up river from village." However, another Shungnak respondent reported the opposite effect: "When weather is bad, we catch more [spoiled fish] …" she said.

In addition to asking for the 3 most important factors affecting fishing, researchers asked respondents whether their households were affected by each of 19 factors; if so, whether the factor increased harvests,

decreased harvests, or had no effect on harvests. Of the 92 interviewed households, 90 responded to these prompted factor questions, and all 90 households reported that their fishing was affected by at least 1 of the prompted factors. Figure 3 summarizes responses to the 19 prompted factors, excluding cases in which the factor had no effect on the household, or no affect on harvests.

Of the 19 prompted factors, 17 factors (89%) were cited as having primarily negative impacts on harvests. For example, 31% of interviewed households cited unusual weather for decreasing harvests, while only 2% of households cited unusual weather for increasing harvests. The only 2 factors that were cited primarily for increasing harvests were the cost of store foods (by 23% of households) and the availability of store foods (by 12% of households). In other words, some respondents believed that high food costs and limited food availability resulted in increased subsistence harvests.

An important aspect of the analysis was the linking of interview data with harvest survey data. For the interviewed households, researchers combined harvest survey data with factor responses from the interviews. As a group, the 92 interviewed households harvested an average of about 418 lb of salmon and sheefish each year from 1994 through 2004, 88 lb (27%) more than the 330 lb average harvest reported by all surveyed study community households in the same period. This difference was not unexpected because by design the interview samples did not include nonfishing households and households with fewer than 6 years of fishing data. For both groups, there was an insignificant increasing trend of about 6 to 7 lb per year, or 2% of the annual average (Table 2). In other words, harvests by the interviewed households were predictably greater than harvests by all surveyed households, but harvests by both groups were similarly stable.

Within the stable overall harvest pattern, it was expected that 1) some households' harvests would be decreasing while other households' harvests would be increasing, 2) interviewed households would be able to identify factors contributing to changes, and 3) factors contributing to changing patterns and trends in harvests could be identified. Researchers were unable to find such associations, at least in preliminary analyses.

Table 2 summarizes 8 factors that were reported by at least 10% of the interviewed households. These included 6 factors reported as having negative effects on harvests, and 2 factors reported as having positive effects on harvests. For each group of households reporting an effect from a particular factor, researchers compared the mean annual harvests (in edible pounds of salmon and sheefish), the annual harvest trend, in pounds and as a percentage of the average annual harvest, and categorized the trend as increasing, stable, or decreasing.

The most commonly reported factor having a negative effect on harvests was unusual weather. Oddly, the 23 households reporting a negative effect actually reported modestly increasing harvests during the study period, by about 42 lb more (8% more) per year. The 66 households reporting no effect or no change had stable harvests during the study period. Indeed, every single group of households that reported that a factor decreased their harvests also reported stable or increasing harvests during the study period. Households reporting a negative effect had higher harvests than other interviewed households, sometimes much higher (such as for "unusual water levels"). The largest negative harvest trends were for factors most frequently identified as positive, such as the cost and availability of store foods. These negative trends were not statistically significant, as they were reported by only 2 and 1 household(s), respectively.

DISCUSSION

In the third year of the project, researchers worked primarily on the fourth, fifth, and sixth of the 6 project objectives[5]. The fourth objective (collect household attributes) was completed early in the third year.

5 The first objective (compilation and comparison of datasets) was completed in the first year. The second objective (trends analysis) began in the first year, and is continuing in the third year. The third objective (work with high school students and key respondents in two communities) was completed in the second year.

Efforts to meet the fifth objective (summarize interview data and merge them with the harvest data) and the sixth objective (analysis of the household-level dataset) are ongoing.

The apparent lack of significant associations between reported factors and reported harvests was unexpected, but there are possible explanations. Table 2 included only a portion of the factor data from interviews; that is, factors that respondents did not link to a specific year. Table 2 also excludes harvests of whitefishes and Dolly Varden, harvest data for which were not collected during the first 3 years of the Northwest salmon survey project. Yet to be analyzed are factors linked to specific years and factors associated with harvests of individual species: more complicated analyses that may provide different results. Observed trends in community harvests have been at the species level (i.e., salmon decreasing, sheefish increasing); household level associations between factors and harvests may emerge for individual species. These are preliminary findings, and researchers will continue to explore this subject.

Previous research has found that age of household heads is one of the best predictors of subsistence harvest levels (Wolfe 1987; Wolfe et al. *In prep* [2009]), but that did not appear to be the case with respect to respondents in this study. Respondents' ranked age lower (12 of 19 prompted factors) and mentioned age much less frequently than most of the other factors, including weather, water levels, employment, gasoline costs, and equipment. One possible explanation is that although the effects of age on harvest levels are real and thus observable by Wolfe and others, most respondents have already factored age into their harvest expectations.

Factors notably absent from the interviews are those related to management. Regulations and enforcement were among the 19 prompted factors, but were identified as a factor by only 1 household each. This result was not unexpected in an area without subsistence fishing limits, fishing periods, or closed waters, and only standard statewide restrictions to gear, methods, and means. The one regulatory complaint was about the state's fishing license requirements for rods and reels. The state considers rod and reel fishing to be sport fishing, and therefore requires a sport fishing license. Under federal regulations, rods and reels are legal subsistence gear, and therefore do not require a license on federal lands and waters for federally qualified subsistence users.

As in the Norton Sound projects, researchers spent far more time cleaning, organizing, and merging data than in actual analysis. Data challenges delayed the completion of this annual report. A number of planned analyses could not be completed because researchers were not confident that data issues had been fully resolved. In particular, researchers had hoped to more fully explore harvests patterns associated with different fishing factors. The data issues are not insurmountable, but require considerable time and care to resolve correctly. Data cleaning and restructuring will continue to be a major focus of researchers' efforts in the coming weeks.

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TABLES AND FIGURES

Table 1.–Sample sizes for original harvest surveys and for this project.

	Original harvest survey project													This project
	Annual sampling results											1994–2004		
	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	Mean	Median	2008
Core study communities														
Shungnak														
Eligible households[a]	55	53	56	57	56	51	46	46	54	50	56	53	54	33
Contacted	52	44	51	47	50	28	34	39	51	33	47	43	47	25
Sample fraction	95%	83%	91%	82%	89%	55%	74%	85%	94%	66%	84%	82%	84%	76%
Noatak														
Eligible households[a]	84	92	88	84	97	91	102	96	101	104	105	95	96	68
Contacted	68	76	74	75	90	14	61	67	90	103	103	75	75	37
Sample fraction	81%	83%	84%	89%	93%	15%	60%	70%	89%	99%	98%	79%	84%	54%
Core community subtotal														
Eligible households[a]	139	145	144	141	153	142	148	142	155	154	161	148	145	101
Contacted	120	120	125	122	140	42	95	106	141	136	150	118	122	62
Sample fraction[d]	86%	83%	87%	87%	92%	30%	64%	75%	91%	88%	93%	80%	84%	61%
Other study communities														
Ambler[b]														
Eligible households[a]	74	78	82	83	80	71	70	69	69	67	63	73	71	28
Contacted	29	68	80	69	73	21	34	0	0	62	60	45	60	9
Sample fraction	39%	87%	98%	83%	91%	30%	49%	0%	0%	93%	95%	62%	83%	32%
Kiana[c]														
Eligible households[a]	104	101	103	108	102	91	88	87	91	95	87	96	95	42
Contacted	59	76	88	86	88	67	51	66	0	90	77	68	76	9
Sample fraction	57%	75%	85%	80%	86%	74%	58%	76%	0%	95%	89%	71%	76%	21%
Kobuk[c]														
Eligible households[a]	24	27	24	26	25	23	30	26	30	34	28	27	26	11
Contacted	22	23	22	22	25	13	15	24	0	23	28	20	22	3
Sample fraction	92%	85%	92%	85%	100%	57%	50%	92%	0%	68%	100%	73%	85%	27%
Noorvik														
Eligible households[a]	122	126	124	124	129	118	112	108	115	138	133	123	124	61
Contacted	64	103	111	114	109	48	42	56	101	135	125	92	103	9
Sample fraction	52%	82%	90%	92%	84%	41%	38%	52%	88%	98%	94%	75%	84%	15%
Other community subtotal														
Eligible households[a]	324	332	333	341	336	303	300	290	305	334	311	319	324	142
Contacted	174	270	301	291	295	149	142	146	101	310	290	224	270	30
Sample fraction[d]	54%	81%	90%	85%	88%	49%	47%	50%	33%	93%	93%	70%	84%	21%
All communities														
Eligible households[a]	463	477	477	482	489	445	448	432	460	488	472	467	472	243
Contacted	294	390	426	413	435	191	237	252	242	446	440	342	390	92
Sample fraction[d]	63%	82%	89%	86%	89%	43%	53%	58%	53%	91%	93%	73%	84%	38%

a. For the original survey, an "eligible" household was any occupied household in the community. For this project, an "eligible" household was a household that a) was surveyed in at least 6 of the 11 survey years, b) actually harvested fish in at least 1 year, c) had a consistent household identifying number, and d) was present in the community in 2008.

b. Ambler was not surveyed in 2001 and 2002. Number of eligible households is an average of 2000 and 2003.

c. Kiana and Kobuk were not surveyed in 2002. Number of eligible households is an average of 2001 and 2003.

d. Summary mean and median values are based on results in each individual community each year, not on summary values.

Table 2.–Household harvest patterns, by reported factor and effect.

	Mean annual harvest per household (edible pounds)	Annual harvest trend, 1994–2004 for households citing factor		
		Change in pounds per household	Percentage of mean harvest	Trend category[a]
Factors most frequently reported as harvest negative ("harvests down")				
Unusual weather				
"Harvests down" (n=23)	519 lb	+42 lb	8%	Up
"No change in harvests" (n=66)	333 lb	+3 lb	1%	Stable
"Harvests up" (n=2)	1,821 lb	-144 lb	-8%	Down
Cost of gasoline				
"Harvests down" (n=22)	429 lb	+2 lb	1%	Stable
"No change in harvests" (n=69)	417 lb	+7 lb	2%	Stable
Availability of gasoline				
"Harvests down" (n=19)	431 lb	+23 lb	5%	Up
"No change in harvests" (n=72)	415 lb	+1 lb	0%	Stable
Employment				
"Harvests down" (n=9)	475 lb	+2 lb	0%	Stable
"No change in harvests" (n=82)	410 lb	+7 lb	2%	Stable
Condition of boat or motor				
"Harvests down" (n=8)	474 lb	+12 lb	3%	Stable
"No change in harvests" (n=83)	409 lb	+6 lb	1%	Stable
Unusual water levels				
"Harvests down" (n=17)	718 lb	+31 lb	4%	Stable
"No change in harvests" (n=72)	339 lb	+7 lb	2%	Stable
"Harvests up" (n=2)	816 lb	-37 lb	-5%	Stable
Factors most frequently reported as harvest positive ("harvests up")				
Cost of store food				
"Harvests down" (n=2)	148 lb	-26 lb	-17%	Down
"No change in harvests" (n=68)	386 lb	+4 lb	1%	Stable
"Harvests up" (n=21)	556 lb	+24 lb	4%	Stable
Availability of store food				
"Harvests down" (n=1)	227 lb	-42 lb	-19%	Down
"No change in harvests" (n=54)	441 lb	-13 lb	-3%	Stable
"Harvests up" (n=11)	386 lb	+44 lb	11%	Up
Interviewed households (n=92)	418 lb	+7 lb	2%	Stable
All surveyed households (median n=472)	330 lb	+6 lb	2%	Stable

a. Harvests were categorized as "stable" if the annual harvest trend was no more than 5% of the mean annual harvest.

Figure 1.–Northwest Alaska and the project communities.

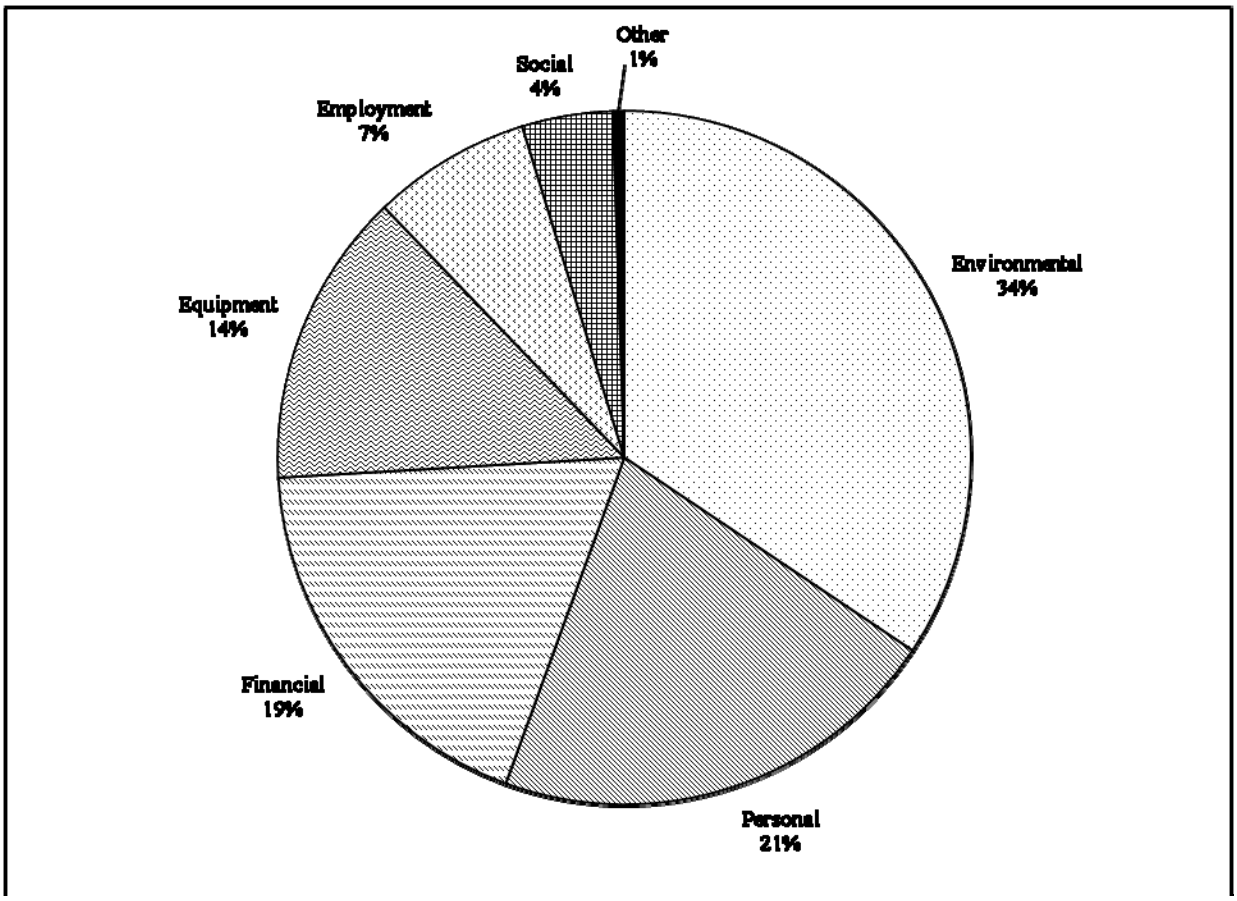

Figure 2.–Categories of factors affecting subsistence fish harvests, 1994–2004.

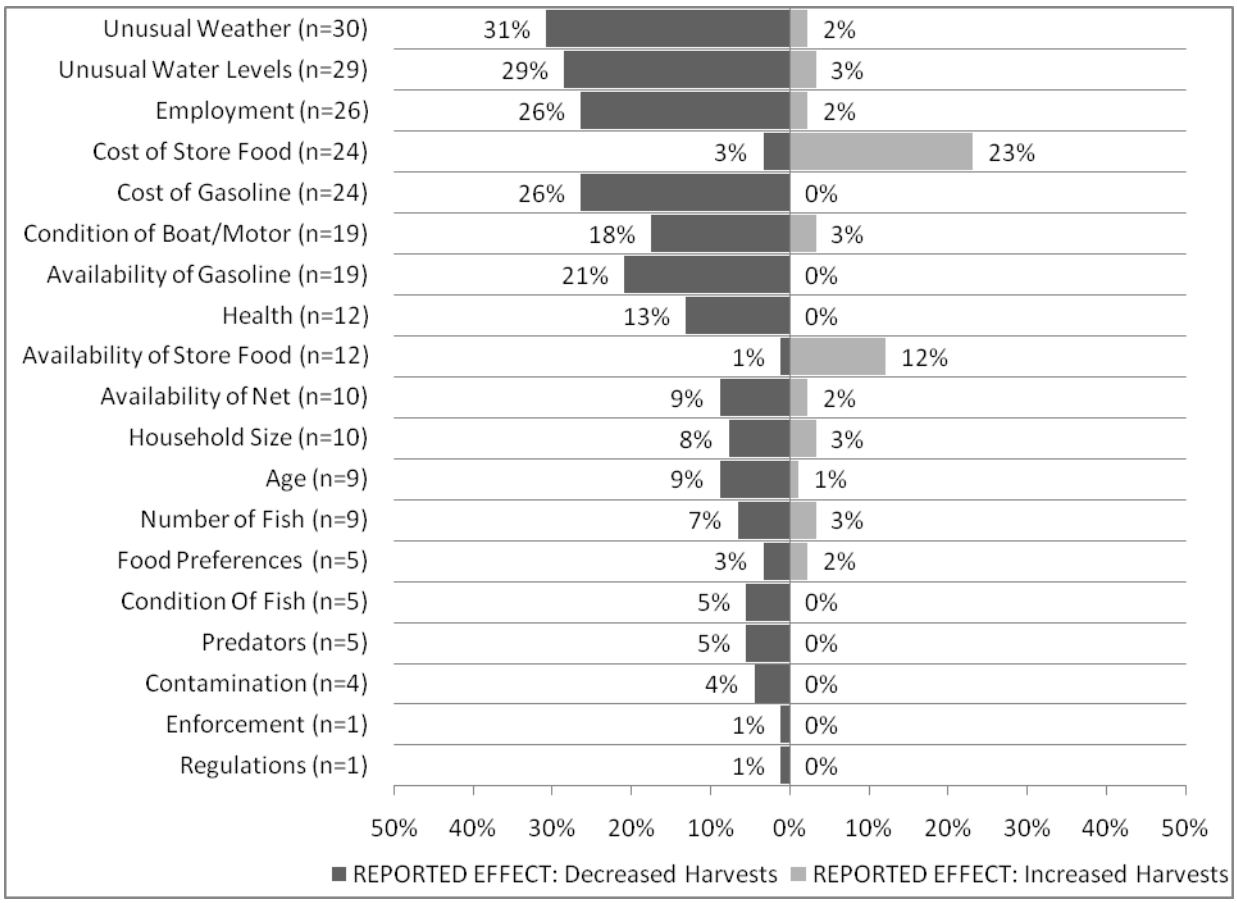

Figure 3.–Percentage of households reporting effects on harvests, by factor and reported effect, 1994–2004.

APPENDIX A: CONVERSION FACTORS

	Estimated pounds per individual fish		Estimated number of individual fish per…[a]						
	Round	Edible	Shopping (AC) bag	5-gallon bucket	Garbage sack	Gunny sack	Metal washtub	Garbage can	55-gallon drum
Salmon[b]									
Chinook salmon	17.7 lb	12.4 lb	1	2	3	6	7	11	17
Chum salmon	8.5 lb	6.0 lb	2	4	7	12	15	24	35
Coho salmon	7.4 lb	5.2 lb	2	4	8	14	17	27	41
Pink salmon	3.0 lb	2.1 lb	5	10	20	33	42	67	100
Sockeye salmon	7.2 lb	5.0 lb	2	4	8	14	17	28	42
Unknown salmon[c]	8.5 lb	6.0 lb	2	4	7	12	15	24	35
Whitefishes									
Humpback whitefish	3.0 lb	2.1 lb	5	10	20	33	42	67	100
Round whitefish	1.0 lb	0.7 lb	15	30	60	100	125	200	300
Broad whitefish	4.5 lb	3.2 lb	3	7	13	22	28	44	67
Mixed whitefishes[d]	2.9 lb	2.0 lb	5	10	21	34	43	69	103
Unknown whitefishes	2.8 lb	1.4 lb	5	11	21	35	44	71	106
Bering cisco	2.0 lb	1.4 lb	8	15	30	50	63	100	150
Least cisco	0.8 lb	0.6 lb	19	38	75	125	156	250	375
Other fishes									
Sheefish[e]	15.9 lb	11.14 lb	1	2	4	6	8	13	19
Dolly Varden (“trout”)	4.7 lb	3.30 lb	3	6	13	21	27	43	64
Saffron cod (“tomcod”)[f]	0.3 lb	0.21 lb	33	67	150	250	333	500	667
Arctic cod (“blue” cod)[f]	0.2 lb	0.11 lb	64	127	286	477	636	955	1,273
Arctic flounder	1.5 lb	1.10 lb	10	20	40	67	83	133	200
Burbot	6.0 lb	4.20 lb	3	5	10	17	21	33	50
Northern pike	4.7 lb	3.30 lb	3	6	13	21	27	43	64
Arctic grayling	1.3 lb	0.90 lb	12	24	48	80	100	160	240
Rainbow smelt	0.2 lb	0.14 lb	75	150	300	500	625	1000	1,500
Pacific herring	0.3 lb	0.18 lb	58	115	231	385	481	769	1,154
Container useful capacities			~2 gal	~4 gal	~10 gal	~15 gal	~15 gal	~25 gal	~50 gal
Container loaded weights[g]									
Wet fish	-		15 lb	30 lb	60 lb	100 lb	125 lb	200 lb	300 lb
Frozen fish	-		10 lb	20 lb	45 lb	75 lb	100 lb	150 lb	200 lb

a. Estimated number of individual fish = loaded container weight for wet fish divided by the estimated round weight of individual fish.

b. Salmon weights are based on average weights reported in Kotzebue District commercial fisheries.

c. Unknown salmon are assumed to be mostly chum salmon, the predominant species in Northwest Alaska.

d. Mixed whitefishes conversion assumes 95% are humpback whitefish and 5% are round whitefish.

e. Sheefish conversion based on average weights of sheefish caught in the Kobuk River (Alt 1987, Taube 1996, 1997; Taube and Wuttig 1998).

f. Estimated number of saffron cod or Arctic cod = loaded container weight of frozen fish divided by the estimated round weight of individual fish.

g. Container loaded weights from Georgette and Loon 1993.