Technical Paper No. 294

Patterns and Trends in Subsistence Salmon Harvests, Norton Sound and Port Clarence, 1994-2003

By

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

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Weights and measures (metric)	
centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm
Weights and measures (English)	
cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd
Time and temperature	
day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s
Physics and chemistry	
all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General	
Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. 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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The Division of Subsistence Technical Paper Series was established in 1979 and represents the most complete collection of information about customary and traditional uses of fish and wildlife resources in Alaska. The papers cover all regions of the state. Some papers were written in response to specific fish and game management issues. Others provide detailed, basic information on the subsistence uses of particular communities which pertain to a large number of scientific and policy questions. Technical Paper Series reports are available through the Alaska State Library and on the Internet: http://www.subsistence.adfg.state.ak.us/geninfo/publctns/techpap.cfm

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Abstract

Using harvest data from the northwest salmon survey project, this project explored patterns and trends in subsistence salmon harvests in ten communities in the Norton Sound – Port Clarence Area. Researchers retrieved archived annual data files, imported them into a SQL database, and then aggregated the ten annual data sets into a single household-level SPSS database. Working with local research assistants, researchers verified household identifiers and gathered additional information on household characteristics.

Estimated subsistence salmon harvests from 1994 through 2003 trended lower by 5.8 percent annually. Most of the declines occurred during the first five years (1994-1998), when harvests trended lower by about 8 percent annually. During the latter years (1999-2003), harvests trended lower by about 1 percent annually across all communities. While harvests appeared to have stabilized in the latter years, it would not be correct to characterize the overall situation as improving, at least through 2003. For half of the study communities, the lowest estimated harvests occurred in 2003.

Despite variation in household harvests, there were harvest patterns, patterns that might be used to refine estimation and prediction. Through many different levels of abundance, through a decade of varied weather, with harvests ranging from 67,000 to 140,000 salmon, each year about 23 percent (range, 21.8 to 24.6 percent) of the households harvested 70 percent of the salmon, by weight. Predictable patterns were also apparent in the harvests by the age and gender of household heads. Setting aside teacher households and households that usually did not fish, harvests increased with the age of the household heads, and decreased when household heads were single, especially single males. Households that consistently harvested salmon also were among the high harvesting households in their communities. Neither commercial fishing retention nor family events (death, marriage, divorce) seemed to affect harvest levels.

Given these predictable overall patterns, were the *same* households responsible for a majority of the harvests year after year? Some households did contribute consistently to the community harvest. Yet in every community, there were many unpredictable households, households that usually contributed much and then in one year contributed little, or vice versa. This was not apparent without time-series data on household harvests.

Revision Notes for the Second Printing

January 2006

Page i: "Given these predictable overall patterns, were the *same* households responsible for a majority of the ~~households~~ harvests year after year?"

Page 25: Figure 3-4 revised to remove vegetation data from the pie chart. Figure title and note changed to clarify that only meat and fish are included.

Page 26: "Wild fish and meat accounted for ~~74~~ 75 percent of all meat and fish consumed by the respondents. Salmon alone contributed ~~36~~ 33 percent of the total." (To reflect changes to Figure 3-4).

Page 26. "one of the largest contributors to the local diet wild salmon" changed to "wild salmon are one of the largest contributors to the local diet."

July 2006

Corrected minor typographical errors throughout document.

Page 6. Removed sentence in final paragraph: "A series of supplemental figures allows readers who are interested in a particular analysis or a particular community to explore those subjects in greater detail than was possible in the body of the report."

Page 27. Reversed headings "Patterns" and "Trends" in the definitions box. (Error introduced in the January 2006 revision.)

Page 36. "Elim havested 3,529 large salmon in ~~1995~~ 2003."

Page 43. References to Figure 4-12 changed to Figure 4-13.

Page 46. "Lines that fall to the upper ~~right~~ left..." Reference to Figure 4-13 changed to Figure 4-16.

Page 53. Second paragraph rewritten to improve clarity. Reference to Figure 2-2 added to caption.

Page 66. "...were the *same* households responsible for a majority of the ~~households~~ harvests year after year?"

Page 77. "...were the *same* households responsible for a majority of the ~~households~~ harvests year after year?"

Revision Notes for the Third Printing

October 2008

Corrected misspelling of Kurt Kamletz' name on cover. Replaced author name "Brian Davis" with author name "Kurt R. Kamletz" on title page and colophon to match cover page.

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Acknowledgments

Scores of people in all ten study communities worked over an entire decade to gather the data analyzed in this project, and the analysis would not have been possible without them. The average sample included 88 percent of the occupied households, 784 households a year. Achieving such consistently large samples was not easy to do, and was a testament to the dedication of community researchers and the fisheries technicians who worked with them. It was also a testament to the growing capacity of Kawerak Inc. to direct field research projects, under the guidance provided by Eileen Norbert, Rose Atuk-Fosdick, Sandra Tahbone, and Don Stiles.

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Many more people than we can name here have contributed to this effort. To each of you, we offer our appreciation.

1
Introduction

From 1994 through 2003, the Alaska Department of Fish and Game and Kawerak Inc. documented subsistence salmon harvests in the Norton Sound – Port Clarence area through a series of systematic household surveys, the northwest salmon survey. The survey data were used primarily to estimate the total annual harvests of salmon by residents of the survey communities. Survey results were published in annual management reports and in annual summary reports. No additional analyses had been conducted on this data set.

This project retrieved the ten annual harvest survey data files, translated them into a common data format, standardized variable names across years, and then merged the ten separate data sets into a single database. This project also verified household identification codes in each survey community, corrected household identification code errors, collected additional information on household characteristics, and then merged the harvest survey data with the household characteristics data. Using the merged database, researchers explored patterns of salmon harvests at the household level. Researchers stratified households and explored patterns and trends in salmon harvests among groups of similar households. The project also tested hypotheses on subsistence production that have not been explored previously with time-series data.

The project was funded by the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative (AYK-SSI). It was conducted jointly by Kawerak, Inc., the regional non-profit corporation for the Norton Sound – Bering Strait region, and the Division of Subsistence of the Alaska Department of Fish and Game.

The project addressed three objectives listed as interim priorities for the AYK-SSI request for proposals for 2004-05. First, it refined an existing salmon database, which will be available for additional research in the future. Second, it conducted retrospective data analyses that increased knowledge of harvesting patterns at the household level, which in turn could be used to refine models that attempt to predict future salmon harvests. Third, it should help future researchers design sampling strategies for village-based harvest surveys if declining funding requires reductions in sample sizes.

While the objectives of this study tended to be technical – sampling strategies and analyses methods – the study also was an opportunity to review the recent history salmon harvests in the Norton Sound – Port Clarence Area in more detail than had been possible previously. The surveys occurred during a time of declining subsistence harvests and even more pronounced declines in commercial harvests (Figure 1-1). These declines created considerable hardship in the region, which will be evident in the harvest data.

Objectives

The project had five objectives:

1 Review annual survey data sets to verify variable naming consistency and to verify year-to-year household identifiers, then combine household records of subsistence salmon harvests for ten Norton Sound and Port Clarence district communities from 1994 to 2003 in a single database.

2 Gather additional data on household characteristics, and add these data to the database.

3 Stratify households into different social and economic categories, based on their harvest histories and other characteristics.

4 Compare harvest patterns among the different household strata over time, and test hypotheses about factors related to subsistence salmon harvests.

5 Publish a technical paper describing findings.

Rationale

Estimating and predicting wild food harvests in rural Alaska presents many challenges. Most management agencies and independent researchers rely primarily on household surveys to gather wild food harvest data. This project – which analyzed subsistence harvest data from 7,838 household surveys conducted over ten years – is yet another example. Surveys are time consuming and labor intensive, so researchers are inclined to sample rather than census rural populations. Because household harvests are widely varied and are not normally distributed, sampling introduces a host of challenges. This project explores some of those challenges, using salmon harvest data collected in a series of ten annual censuses.

Most wild food survey projects can be categorized into two general types. One type is the recurrent, annual survey of a particular species by residents of many communities. The northwest

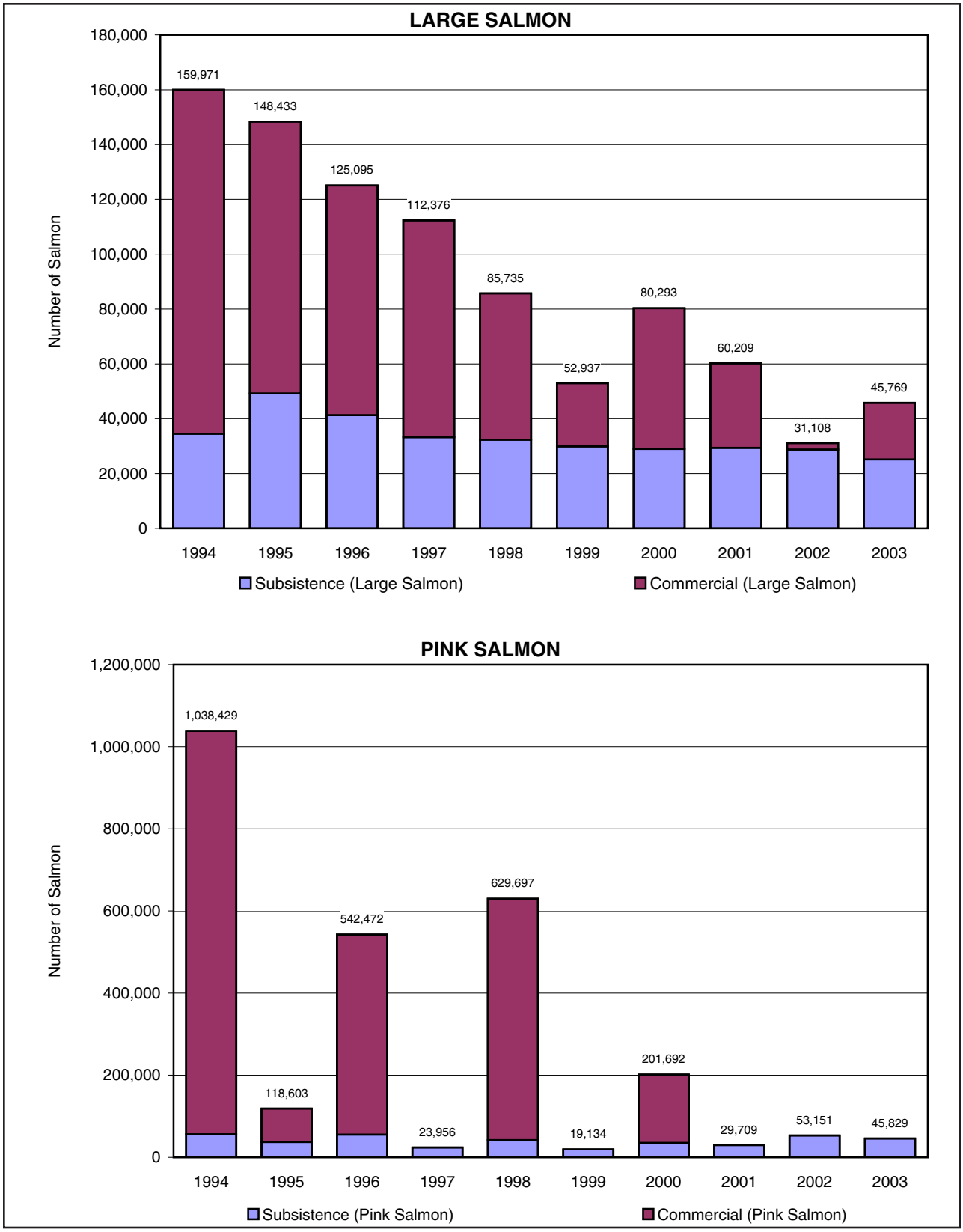

Figure 1-1. Estimated subsistence and reported commercial salmon harvests, subdistricts 2-6, Norton Sound, 1993-2004. Declining salmon abundance and deteriorating salmon markets both contributed to declines in harvests. (There are no commercial salmon fisheries in subdistrict 1 of Norton Sound or in Port Clarence.)

salmon survey project is an example of a recurrent project (Figure 1-2). The second type is the occasional, comprehensive survey of the harvests of all species by residents of a single community or small group of communities during a single year. Most analyses of subsistence harvests have been based on occasional comprehensive surveys (e.g. Anderson et al 1999, Georgette and Loon 1993). A much smaller group of studies have explored comprehensive data from more than one year (Braund 1993; Burch 1985; Fall and Utermohle 1995, 1999).

Relatively few analyses have been conducted on recurrent harvest assessments spanning a decade or more. If one is interested in how communities adapt to changing social, economic, or ecological changes over time, then analyses of time series data such as the northwest salmon surveys should be more instructive than analyses of single-year data. If one is interested in improving sampling strategies, then an exploration of harvest data from a multi-year census should suggest approaches to increase confidence in estimations.

In any analysis based on household level data, the assumption must be that the household is a useful unit of analysis. Some researchers consider households to be the primary unit of subsistence production in the North (Usher et al 2003). That's true if one is comparing a capital-industrial economy with a domestic subsistence economy, but it is a simple truth about a complex system. Few rural Northern households harvest and process wild foods in isolation from other households. Most households produce, process, and distribute wild foods within family-based networks of cooperating households. Magdanz, Uterhmohle, and Wolfe (2002) argue that household production is best understood in the context of extended family networks.

Evidence for the latter perspective is the observation that approximately 30 percent of the households harvest 70 percent of the wild foods in most small, rural, subsistence-dependent communities in Alaska (Wolfe 1987). If the analysis is limited to a single type of wild food, such as salmon or seals, specialization in harvests often is even more pronounced. It is not uncommon to find 20 percent of the households harvesting 80 percent of a community's total while another 50 percent harvests none, as some data in this study show.

Regardless of one's perspective about the role of households in subsistence economies, several things are clear:

- Compared with social networks, households are easy to identify and locate. For practical and logistical reasons, household surveys will continue to be a primary method of gathering wildlife harvest information in the North.

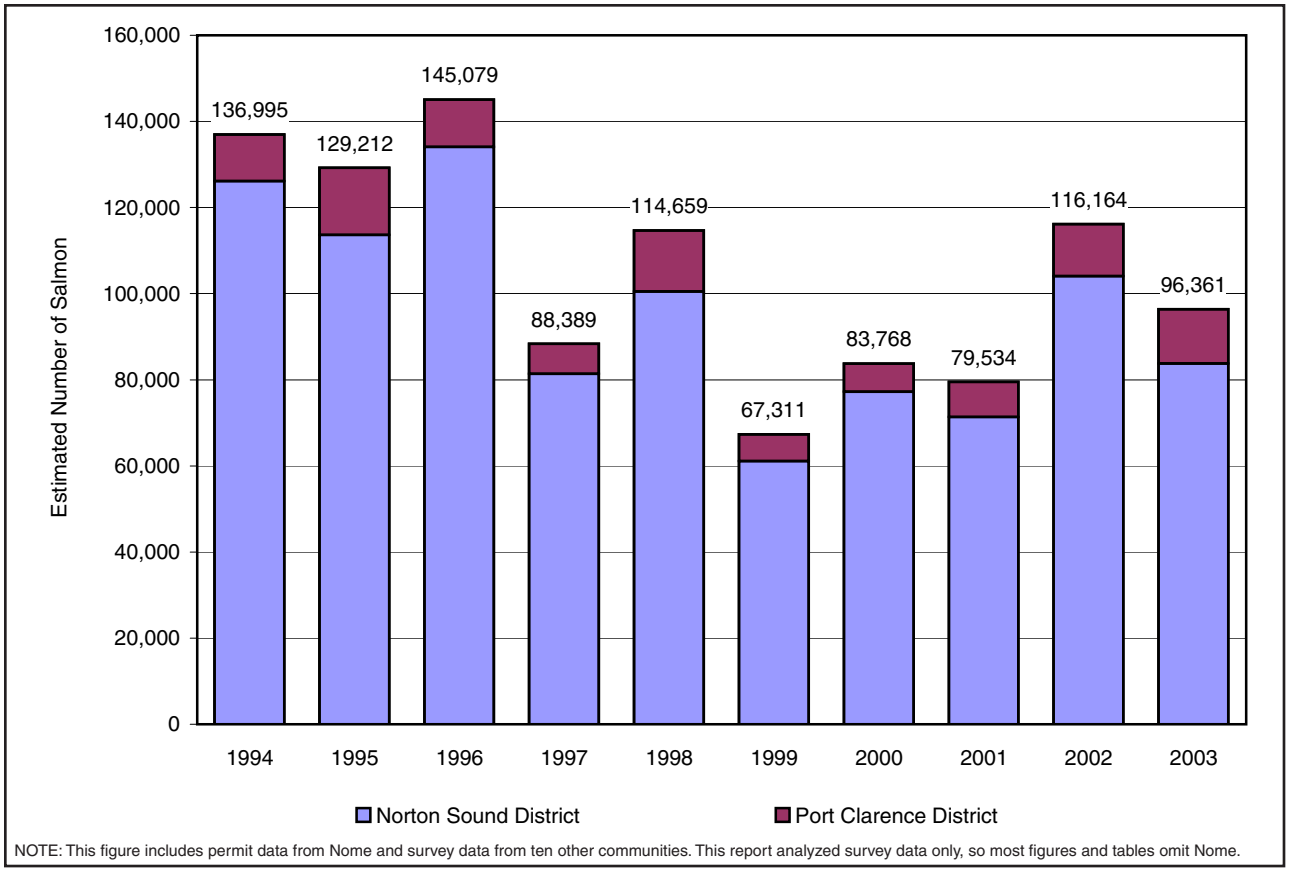

Figure 1-2. Estimated number of salmon harvested for subsistence in the Norton Sound and Port Clarence Districts, 1994-2003. During the decade, total harvests varied from a high of 145,070 salmon in 1996 to a low of 67,311 salmon in 1999. Total harvests were higher in the first three years of the study period than any any subsequent period. Harvest were especially low in 1999, 2000, and 2001. Northern Norton Sound communities suffered the largest declines in subsistence harvests. The declining trend in subsistence harvests may have ended in 1999, but harvests have not returned to the levels seen earlier in the decade.

- Households' wild food harvests vary widely and are not normally distributed. This makes it difficult to accurately estimate subsistence harvests with simple random samples.
- There is not enough time or money to survey every household in the North every year, even for a major species like salmon. Improving the accuracy of harvest estimates will require refinements in sampling and analysis methods.

Given these conditions, the problem becomes how to compensate for the limitations of the household as a unit of analysis.

One way to improve subsistence harvest estimates is use household characteristics to stratify populations. Examining survey data from widely dispersed rural Alaska communities, Wolfe found that the ages of household heads and subsistence production were significantly related (Wolfe 1987). In a study of two northwest Alaska communities, researchers identified five different harvesting strata based on household social type (Magdanz et al 2002:59-64). In a study of the economic practices of *Iñuit* in northern Canada, including wild food harvesting, Chabot stratified households based on the gender and employment status of household heads (Chabot 2002:21-22). The northwest salmon survey – which provided the harvest data for this analysis – employed a stratified approach, cal-

culating separate estimated harvests for households that "usually fished" and for households that "usually did not fish" (Georgette et al 2004).

Models that attempt to predict regional salmon harvests using stratified household harvests should be more reliable than models using unstratified household harvests or aggregated community harvests. If one wanted to predict future salmon harvests, it would be useful to know, for example, were some households consistent harvesters in all circumstances, and if so, which ones? Did declining commercial salmon fishing opportunities affect subsistence salmon harvests, and how? This kind of information could be used to refine harvest models.

Human populations of fishing communities are but one variable to consider, and may not be the most significant variable. As a step toward improving harvest models, this project attempted to identify and describe harvest patterns for groups of households in the communities of the northwest salmon survey project.

Presentation

Although this project was data intensive, the authors have attempted to explain findings in common English and to illustrate findings in charts that can be understood with a modest study. Most readers of this report will not be statisticians, and neither are the authors. Most of the findings, even those statistically derived, are not complex. Further discussion of the charts in this report can be found at the end of Chapter 2.

In this report, Chapter 2 describes the methodology, Chapter 3 describes the setting, Chapter 4 presents the findings, and Chapter 5 discusses the findings. For those interested in the details of the harvest survey project, Appendix 1 includes all the annual survey forms, Appendix 2 lists all the community researchers, and Appendix 3 includes the data verification and collection form used to gather additional household characteristics data in 2004. Appendix 4 lists all the variables in each of the annual data files and in the aggregated harvest data file.

2
Methods

The analyses in this report rely primarily on records gathered during ten annual salmon harvest assessment surveys in the Norton Sound-Port Clarence Area from 1994 through 2003, supplemented with additional information on household characteristics gathered in 2004. This chapter describes the annual survey, then describes how additional data were gathered and how analyses were conducted.

The Northwest Salmon Harvest Survey

The northwest salmon harvest survey project began in 1994 in response to chum salmon declines throughout western Alaska. The purpose was to provide reliable annual estimates of subsistence salmon harvests in Norton Sound, Port Clarence, and Kotzebue Sound for use in fisheries management. ADF&G's Division of Commercial Fisheries and the Bering Sea Fisherman's Association provided the funding. ADF&G's Division of Subsistence and the Natural Resource Department at Kawerak were responsible for the data collection, analyses, and reporting.

The results of the survey were published in a series of annual project reports (Georgette 1996a 1996b; Georgette and Utermohle 1997, 1998, 1999, 2000, 2001; Georgette et al 2003a, 2003b, 2004; Magdanz and Utermohle 1994) and summarized in annual management reports (Banducci et al 2003; Brennan et al 1999; Bue et al 1996a 1996b, 1997; Kohler et al 2004).

The two-page survey included a core question set that remained essentially unchanged from 1994 through 2003 (Appendix 1). The core questions collected the following data from each household:

- Name of household head.
- Number of people in household.
- Whether household *usually* fished for salmon for subsistence.
- Whether household fished for salmon for subsistence *this year*.
- Number of salmon harvested for subsistence.
- Number of salmon harvested with rods and reels.

- Types of gear used to harvest salmon for subsistence.
- Number of salmon harvested for dog food.
- Number of salmon retained from commercial harvests.

In addition to this core question set, other questions were included on the survey in some years. Several questions on cooperation among households were included in 1994, then dropped. A question exploring salmon harvests as a proportion of total harvests was removed in 1997. From 1998 through 2001, the entire survey was essentially unchanged. In 2002, questions on subsistence crabbing were added. In 2003, questions on fishing locations were added and form design changed substantially, but still the core question set was retained. Project supervisors (in particular, Georgette) sought to keep the survey simple and consistent so as to provide the highest degree of accuracy and comparability.

Survey procedures were the same each year. In October and November, after the salmon fishing season had ended, an ADF&G fisheries technician visited each village, and contacted one or more local researchers hired by Kawerak (Appendix 2). In each study community, the survey team reviewed a "tracking sheet" that listed all the occupied households. They deleted households that had moved away from the community or had consolidated with existing households, and added households that had moved into the community or had split from existing households. Once the tracking sheet had been updated, researchers attempted to administer a survey to each occupied household.

Because researchers attempted a census in each community each year, sampling rates usually were high (Table 2-1). In the ten communities included in this project, annual harvest survey samples ranged from 78 percent of occupied households in 1994, the first year of the project, to 94 percent in 2002. Over the ten-year duration of the project, the total sample was 88.1 percent of occupied households.

At the community level, survey samples included at least two thirds of every community in all instances except three: 15 percent in White Mountain in 1994, 60 percent in White Mountain in 1998, and 53 percent in Stebbins in 1994. In several instances, community samples approached 100 percent: 98 percent in Golovin in 1994, 99 percent in Koyuk in 1996, 99 percent in Unalakleet in 2002, and 98 percent in St. Michael in 1995.

After survey administration was complete, Kawerak and ADF&G project supervisors reviewed the completed surveys and the revised tracking sheets. ADF&G data analysts entered the surveys into computerized databases. A separate survey database was created

TABLE 2-1. SUMMARY OF HARVEST SURVEY SAMPLES, BY COMMUNITY AND BY YEAR, 1994-2003

	Year										
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
NORTON SOUND DISTRICT											
White Mountain											
N of Households	65	67	70	64	65	67	67	65	65	62	657
Household Surveyed	10	59	68	61	39	62	65	63	59	56	542
Sample Percentage	15%	88%	97%	95%	60%	93%	97%	97%	91%	90%	82%
Golovin											
N of Households	42	46	46	46	47	45	45	44	47	47	455
Household Surveyed	41	42	37	38	38	37	42	39	39	42	395
Sample Percentage	98%	91%	80%	83%	81%	82%	93%	89%	83%	89%	87%
Elim											
N of Households	74	74	73	77	76	78	84	80	82	81	779
Household Surveyed	64	61	61	72	70	72	80	69	76	71	696
Sample Percentage	86%	82%	84%	94%	92%	92%	95%	86%	93%	88%	89%
Koyuk											
N of Households	69	71	71	69	74	72	75	82	84	81	748
Household Surveyed	59	58	70	68	63	67	70	69	76	75	675
Sample Percentage	86%	82%	99%	99%	85%	93%	93%	84%	90%	93%	90%
Shaktoolik											
N of Households	49	54	54	54	53	57	56	60	59	62	558
Household Surveyed	46	50	49	45	50	55	54	51	57	58	515
Sample Percentage	94%	93%	91%	83%	94%	96%	96%	85%	97%	94%	92%
Unalakleet											
N of Households	233	234	226	219	216	228	206	205	225	220	2212
Household Surveyed	204	207	211	208	204	209	188	140	222	210	2003
Sample Percentage	88%	88%	93%	95%	94%	92%	91%	68%	99%	95%	91%
Saint Michael											
N of Households	76	89	88	84	89	101	85	90	93	94	889
Household Surveyed	70	74	79	82	70	83	80	74	90	85	787
Sample Percentage	92%	83%	90%	98%	79%	82%	94%	82%	97%	90%	89%
Stebbins											
N of Households	95	107	113	116	113	132	128	124	122	122	1172
Household Surveyed	50	90	99	108	95	111	111	107	108	98	977
Sample Percentage	53%	84%	88%	93%	84%	84%	87%	86%	89%	80%	83%
PORT CLARENCE DISTRICT											
Brevig Mission											
N of Households	63	59	59	70	70	70	69	68	71	74	673
Household Surveyed	57	53	56	61	64	63	57	55	67	66	599
Sample Percentage	90%	90%	95%	87%	91%	90%	83%	81%	94%	89%	89%
Teller											
N of Households	82	78	73	76	75	72	79	72	77	67	751
Household Surveyed	64	60	65	56	74	70	69	61	71	59	649
Sample Percentage	78%	77%	89%	74%	99%	97%	87%	85%	92%	88%	86%
ALL COMMUNITIES											
N of Households	848	879	873	875	878	922	894	890	925	910	8,894
Household Surveyed	665	754	795	799	767	829	816	728	865	820	7,838
Sample Percentage	78%	86%	91%	91%	87%	90%	91%	82%	94%	90%	88%

each year. The survey databases were used to produce annual harvest tables and annual reports, and then were archived.

In analysis, households were divided into two groups: "usually fish" and "usually do not fish," based on their responses to the survey question: "Does your household usually subsistence fish for salmon?" Harvest estimates were calculated for each group independently, then summed to estimate total community harvests. More details on estimation procedures can be found in the annual reports.

Data analysts also maintained a master "family file" that listed all the occupied households in each community. Each year, data analysts reviewed the tracking sheets as revised by the field workers, added new households to the master family file, and flagged households that had disappeared. Each household in the family file was assigned a unique number, the household ID. The household ID did not change during the survey period, as long as the household remained in the community every year. Each year, before surveys began, data analysts used the family file to generate new tracking sheets for each community, listing all occupied households and household IDs as they had existed at the end of the previous survey. Without this deliberate and consistent use of household IDs, the analyses in this project would not have been possible.

The researchers in this project were familiar with the survey project. Magdanz directed the survey project in 1994, its first year, and presented the survey results to the Alaska Board of Fisheries throughout the survey project. Tahbone, Trigg, and Ahmasuk directed harvest survey field work in Norton Sound and Port Clarence. They consulted with Susan Georgette, who administered the project from 1995 to 2003, and with Robert Walker and Dave Caylor, analyst-programmers who conducted the analyses for the annual summaries.

While this project depended on data gathered in the annual survey project, it was not a continuation of that project. After this project was funded by the AYK Sustainable Salmon Initiative, ADF&G discontinued funding for the northwest salmon survey project. That did not affect this project. All the necessary harvest data already had been collected. It did mean that the 10-year record of harvests was interrupted in 2004.

The Patterns and Trends Project

The ten archived annual survey databases and the family file from the northwest salmon survey project were the starting points for this project. The northwest salmon survey project included 15 to

20 northwest Alaska communities each year. This study explored harvest survey records from 10 communities: Brevig Mission, Teller, White Mountain, Golovin, Elim, Koyuk, Shaktoolik, Unalakleet, Stebbins, and St. Michael.

The study communities included all the permanent communities along the coast of Alaska in the Norton Sound – Port Clarence Area, except Nome. Salmon harvests in Nome were documented with permits, using a different method, and are not included in this analysis. The St. Lawrence Island communities of Savoonga and Gambell also are in the Norton Sound District, but were only surveyed twice during the 10-year survey period, and are not included in this analysis. Kotzebue Sound communities were outside of the area of interest for the AYK-SSI, which funded this project.

The study communities had participated in the harvest survey project since its inception in 1994, primarily by providing local research assistants to conduct the surveys. The project utilized some of those same research assistants to verify household lists and gather additional information on household characteristics.

Prior to conducting patterns and trends research in each study community, Kawerak sent a written letter to the local tribal government requesting permission to conduct the research. Each tribal council granted permission to conduct the research via tribal governing resolutions. The resolutions outlined the purpose, methodology, risks, benefits, and deliverables of the research project. Kawerak strove to ensure informed consent, respect for local traditions and language; protection of privacy, dignity, and confidentiality; acknowledgement of local contributions; and return of results to participating communities.

For the ten study communities, the household sample was the same as in the harvest survey project. In that project, the annual sample usually included about 90 percent of the occupied households in each community, an average of 784 households each year. The final aggregated 10-year harvest survey file included 8,894 household survey records, one for each occupied household in each community in each year (Table 2-1). All occupied households were included in the database regardless of whether the household was surveyed. Of the 8,894 records, 7,838 records contained harvest survey data (88.1 percent). The remaining records contained household identification data and stratification data for occupied but unsurveyed households.

In this study, researchers were interested in exploring possible relationships between harvest and household characteristics that were not gathered by the harvest surveys. Researchers also were aware that – in a minority of records – a single household appeared

in the database under two or more different household IDs. This usually happened when a household was absent from a study community for one or more years, or when one household split into two households. Researchers wanted to correct the household IDs so each household was identified by a single household ID in the database.

To do this, researchers developed a one-page data verification and collection sheet (Appendix 3). The first three sections of the form were used to correct household IDs and to flag households that moved in and out of the study communities. The next four sections of the form were used to record household characteristics, including commercial fishing permit holders, household head type, household social type, and household demographic changes.

Phase 1: Harvest Data Aggregation

The project was conducted in four phases. In the first phase of the project, researchers assembled and aggregated the annual data files. The household-level data sets from the northwest subsistence salmon harvest projects were stored in annual files, some in R-Base format and some in Microsoft Access format.

In the annual data files, variable names varied somewhat from year to year (see Appendix 4). Researchers reviewed the annual files for consistency in variable names and contents from year to year, renamed variables as necessary in the annual files, added a variable to identify the survey year, and then combined all the annual files into a single database. Each record in the database contains the survey information for a single household in a single year. The database was analyzed primarily with the Statistical Program for the Social Sciences(SPSS), but portions of the SPSS data file and SPSS output files were exported to Microsoft Excel to create tables and figures for this report. A complete list of the variables in the annual databases and in the final aggregated database can be found in Appendix 4.

As a check on the accuracy of the aggregated database, researchers compared it with the annual summary reports. There was an insignificant difference in 1995 (5 salmon, or 0.005 percent of the annual total). There was a larger difference in 2000 (2,590 salmon, or 3.6 percent of the annual total), and 19 additional houses were listed as responding to the survey. The most likely explanation for the differences was that mail-in surveys were added to the database after the reports were generated. In the other eight years, the aggregated data agreed with the annual summary reports for all salmon species in all communities.

TABLE 2-2. DATA COLLECTION SCHEDULE, BY COMMUNITY, 2004

Community	Resolution	Data Collection	Project Researchers	Community Researchers
Brevig Mission	Aug 31, 2004	Sep 8-9, 2004	Eric Trigg	Matilda Nayokpuk
Elim	Nov 4, 2004	Nov 9, 2004	Eric Trigg	Joel Saccheus
Golovin	Sep 16, 2004	Sep 20-21, 2004	Peter Nanouk Jr.	Jack Fagerstrom
Koyuk	Aug 17, 2004	Sept 25-26, 2004	Peter Nanouk Jr.	Abraham Anasogak Sr.
Shaktoolik	Aug 18, 2004	Oct 5-6, 2004	Peter Nanouk Jr.	Newman Savetilik
St. Michael	Sep 2, 2004	Sept 14-15, 2004	Eric Trigg	Ada Chemeeuk
Stebbins	Aug 31, 2004	Sep 19-21, 2004	Eric Trigg	Patrick Henry
Teller	Aug 19, 2004	Aug 23-24, 2004	Eric Trigg, Peter Nanouk Jr., James Magdanz	Sig Wein Omiak
Unalakleet	Sep 15, 2004	Sep 29-30, 2004	Peter Nanouk Jr., Eric Trigg	David Ivanoff
White Mountain	Aug 24, 2004	Sep 21-23, 2004	Peter Nanouk Jr.	Carl Brown

Phase 2: Verification and Characteristics

In the second phase of the project, researchers visited each study community to verify household identifiers and gather additional data about household characteristics to supplement each household's harvest data. The schedule of community data gathering trips and the personnel involved appears in Table 2-2. The verification and characteristics data were recorded on the one-page data verification and collection sheet (Appendix 3).

In preparation for each community trip, researchers printed two summary tables showing all the household IDs and household names used in each study community in each year. One table was sorted by household ID and the other table was sorted by last name. Researchers also printed tables listing all people in each community who had commercial fishing permits between 1994 and 2003. Finally researchers printed summary tables showing the age of every person who received an Alaska Permanent Fund Dividend in the year 2000. The PFD table also labeled each person in each year as "E" for elder (60 years old or older, "M" for mature (40 to 59 years old) or "Y" for young (16 to 39 years old). Children younger than 16 were not categorized.

With these four tables in hand, researchers reviewed the household ID table line by line with one or more key respondents in each study community. They verified that the same numerical household codes were used for the same household in each year. If a household was surveyed under different codes in different years (as often happened when a household left a community for more than one year and then returned), the case was flagged for correction.

In rare instances, a single household would be represented by two codes in the same year, in which case the records were flagged

for merger. This happened, for example, when members of two separate households married and moved into a single household. In the survey following the marriage, the vacated households might be shown as "no contact" rather than "moved away" and if that happened it would be retained in the sample. Such errors usually were not perpetuated for more than one year. When discovered during data verification in this project, the errant household record was removed from the dataset.

Using the printed table of commercial permits and working with key respondents, researchers also used the data verification and collection form to assign commercial fishing permits to the appropriate households. Using the printed table of PFD ages and categories, researchers characterized households as "elder," "mature," "young" or "teacher" in each study year, and identified household heads as "single male," "single female," or "couple." Finally, researchers flagged significant household changes: marriage, separation, or the death of either head.

At the end of this phase, researchers had one verification and characteristics form for each household in the sample. Data from these forms were entered in a series of Microsoft Access databases, one for each study community.

Phase 3: Data Merge

In phase 3, researchers merged the aggregated harvest database from phase 1 with the household characteristics data from phase 2. The first step was to correct household identifiers and merge duplicate records. Later analysis attempted to identify patterns and trends of household harvests; that would be confounded if a single household appeared in the record under two or three different identifiers.

Table 2-3 illustrates how researchers corrected household identifiers. The household identifiers in this example are from the database and the circumstances described are real, but the names are fictitious. In 1994 and 1995 the female head of this household, "Jane Williams," was surveyed as household 4. In 1995 "Robert Smith" moved into Jane's household, but Robert was surveyed as if he were in a separate household and given a new household identifier, 106. That error was discovered in 1996. From 1996 until 2000 and Robert Smythe and Jane Williams were surveyed as household 106. In 2000 Robert and Jane were surveyed separately again. That error was corrected in 2001. In 2002 Robert's name disappeared from the record, while Jane continued as household 4.

The harvest survey database made it appear that Robert and Jane were an on-again, off-again couple and that in some years Robert

TABLE 2-3. EXAMPLE OF HOUSEHOLD ID VERIFICATION

	Original Survey Records			Corrected Survey Record			
Year	ID	First Name	Last Name	ID	First Name	Last Name	Action Taken
1994	4	Jane	Williams	4	Jane	Williams	none
1995	4	Jane	Williams	4	Robert	Smythe & Jane Williams	Records Merged
	106	Robert	Smith				
1996	106	Robert	Smythe & Jane Williams	4	Robert	Smythe & Jane Williams	Household ID Corrected
1997	106	Robert	Smythe & Jane Williams	4	Robert	Smythe & Jane Williams	Household ID Corrected
1998	106	Robert	Smythe & Jane Williams	4	Robert	Smythe & Jane Williams	Household ID Corrected
1999	106	Robert	Smythe & Jane Williams	4	Robert	Smythe & Jane Williams	Household ID Corrected
2000	4	Jane	Willams & Susan Jones	4	Robert	Smythe, Jane Williams, & Susan Jones	Records Merged
	106	Robert	Smythe & Jane Williams				
2001	4	Jane	Williams, Susan Jones & Robert Smith	4	Jane	Williams, Susan Jones & Robert Smith	none
2002	4	Jane	Williams	4	Jane	Williams	none
2003	4	Jane	Williams	4	Jane	Williams	none

NOTE: Actual cases, fictitious names.

and Jane lived in two households and fished separately. The key respondent verified that Jane lived in a single household throughout the study period, was joined by Robert from 1995 forward, and that their relative Susan Jones had lived with them in some years. To correct these errors, data from household 106 was merged with household 4 for 1995 and for 2000, and the household 106 identifier was changed to household 4 from 1996 through 1999. The final data set included one survey from each year for household 4, and household 106 disappeared from the data set entirely.

This kind of error occurred in every community, and affected about 2 percent of the records. In Brevig Mission, for example, of 1,120 household harvest records, 24 household codes (2.1 percent) were corrected, and 4 household records (0.4 percent) were merged with another household's record.

Corrected household codes were stored in a new variable, so the original household codes were not lost. Mergers, however, could result in lost data. Researchers used the following guidelines for a group of households to be merged.

If only one household in a merge group was surveyed, *then* the surveyed household data were retained as the merged household's record.

If more than one household in a merge group was surveyed, *and* non-harvest responses (usually fish, household size, etc.) were the same, *and* only one household reported harvests, *then* the harvesting households' data were retained for the merged household record.

If more than one household in a merge group was surveyed *and* non-harvest responses (usually fish, household size, etc.) were different *or* more than one household reported harvests, *then* the surveyed households' data were reviewed to determine a course of action. There were ten such cases in the dataset (0.1 percent of all cases).

Researchers also added, when available, data characterizing the abundance of local salmon runs and the nature of the local commercial fishery. Table 2-4 lists new variables related to household characteristics and to ecological and economic conditions.

Phase 4: Data Analysis

In the fourth phase of the project, researchers reviewed the aggregated, expanded database to identify patterns of subsistence salmon harvesting. These patterns were used to further categorize households. For example, some households subsistence fished continuously during the 10-year period, while others subsistence fished intermittently. Some households' harvests varied little from year to year, other households' harvests varied widely. And, as Wolfe and others have demonstrated in the past, in every community in every year, a minority of the households accounted for a substantial majority of the salmon harvest.

Researchers tested the following hypotheses:

1 Hypothesis: Approximately 30 percent of a community's households harvest approximately 70 percent of that community's subsistence salmon (by weight). This was tested by ranking households in order of harvests and graphing cumulative harvests on Pareto charts. Researchers expected that specialization in harvesting would exist for each community; this analysis illustrated the degree of specialization in salmon harvesting.

2 Hypothesis: Continuously fishing households account for most of the variation in community salmon harvests. This was tested by comparing the harvests of households of different fishing types with community total harvests.

3 Hypothesis: Household social type is positively associated with the amount of salmon harvested (by weight). Wolfe's household development model categorizes households into five social types, based primarily on the age of the household heads. Households

TABLE 2-4. SUMMARY OF SELECTED VARIABLES IN AGGREGATED DATABASE

SOURCE: Variable	Type	Variable Contents
HARVEST SURVEY: Harvests		
Record Identification Data		
Year	Scale	Year of Survey
Community	Nominal	Community name
Household ID	Nominal	Household identifier code
Household Descriptive Data		
Household Size	Scale	Number of people in household
Harvest	Dichotomous	Was household surveyed for harvest information this year?
Fished?	Dichotomous	Did household fish for salmon for subsistence this year?
Usually Fish?	Dichotomous	Does household usually fish for salmon for subsistence?
Household Harvest Data		
Gear	Multiple Response	What type of fishing gear was used for subsistence salmon fishing?
Chinook, Chum, etc.	Scale	Number of salmon of each species harvested for subsistence
R&R Chinook, Chum, etc.	Scale	Number of salmon of each species harvested with rods and reels
CF Chinook, Chum, etc.	Scale	Number of salmon of each species retained from commercial fishing
DF Chinoook, Chum, etc.	Scale	Number of salmon of each species used for dog food
SUPPLEMENTAL SURVEY: Verifications and Characteristics		
ID verification and correction		
Correct Household ID	Dichotomous	Was household surveyed under multiple IDs?
Corrected Household ID	Nominal	In cases where household was surveyed under multiple IDs, the correct ID to use in analysis. Otherwise, the original Household ID.
Merge Household ID	Dichotomous	Should this household record be merged with another?
Merged Household ID	Nominal	In cases where two records existed for one household in the same year, the correct ID to use in analysis. If data existed in both records, data were reviewed before merger.
Household Characteristics		
Household Social Type	Categorical	Category: Inactive, developing, mature, active elder, or single person household
Household Change Type	Multiple Response	Change in household composition since previous year (death of head, marriage, dissolution)
FISHERY RECORDS: Ecological and Economic Conditions		
Commercial Fishing	Dichotomous	Did commercial fishing occur in this area this year?
Conversion Factor	Scale	Average weights of salmon harvested in commercial fisheries, used to compute edible pounds from number of salmon, by species.
Commercial Catch	Scale	Number of salmon caught in commercial fishery, by species.
Salmon Escapement	Ordinal	For species and areas where escapement goals exist, was escapement below, near, or above escapement goals?
CALCULATED VARIABLES		
Years Surveyed	Scale	Number of years household was surveyed between 1994 and 2003
Years Fished	Scale	Number of years household reported fishing between 1994 and 2003
Mean Chinook, Chum, etc.	Scale	Average number of salmon harvested of each species per year
Maximum Chinook, Chum, etc.	Scale	Maximum number of salmon harvested of each species per year
Minimum Chinook, Chum, etc.		Minimum number of salmon harvested of each species per year
Annual Rank Chinook, Chum, etc.	Ordinal	Household's harvest rank in the community this year, by species and for all salmon, by number of salmon and by edible pounds of salmon. Household with highest harvest in each community is ranked as "1."
HH Fishing Type	Dichotomous	Category: Intermittently or Continuously fishing household
HH Harvest Group	Ordinal	Category: High, Medium, or Low harvesting household
Chart Order	Ordinal	A ranking variable used to sequence the display of household data in charts. Unlike a pure rank, does not include "ties." Households with tied ranks are randomly distributed to sequential ranks before ranking process continues. Each rank includes only one household.

See Appendix 4 for a complete list of exact variable names in the harvest survey, year by year.

were categorized into Wolfe's categories, and harvests compared among social types. If the hypothesis was correct, active elder households would have higher harvests than developing or mature households.

4 Hypothesis: Households that fish intermittently are more likely to fish during years of greater salmon abundance. This was tested by comparing annual household harvests, by fishing type, with salmon abundance variables.

5 Hypothesis: Households that retained fewer salmon from commercial fishing caught more salmon for subsistence. This was tested by comparing number of salmon retained from commercial fisheries with subsistence harvests over time, for individual households, for communities, and for aggregations of households and communities.

Readers will find two kinds of harvest data in this report. To compare community harvests and to describe community harvest trends, researchers used *estimated* community harvest totals from Georgette's reports. Estimated totals account for variance in sampling fractions from year to year and from community to community, and provide the best basis for community-level comparison.

To compare harvest patterns at the household level and to test the hypotheses above, researchers relied on *reported* household harvests from the merged database. In other words, researchers did not weight cases or otherwise attempt to account for unsurveyed households. Reported harvests for a particular community or particular year always will be less than estimated harvests (because no samples included 100 percent of the households). If readers notice discrepancies between harvest totals in different sections of this report, the most likely explanation is that one instance is a household-level analysis using reported harvests, and the other instance is a community-level analysis using estimated harvests.

Data Presentation

Most readers of this report will not be statisticians, nor are the authors. Therefore, the authors have attempted to explain the findings in common English and present the results in graphs and charts rather than in tables and statistics. Two types of charts were particularly useful: Pareto charts and boxplots.

As an aid to readers unfamiliar with Pareto charts, two example Pareto charts appear in Figure 2-1. Pareto charts show which factors contribute the most to a particular result. In this report, Pareto charts are used to show which households harvested the most

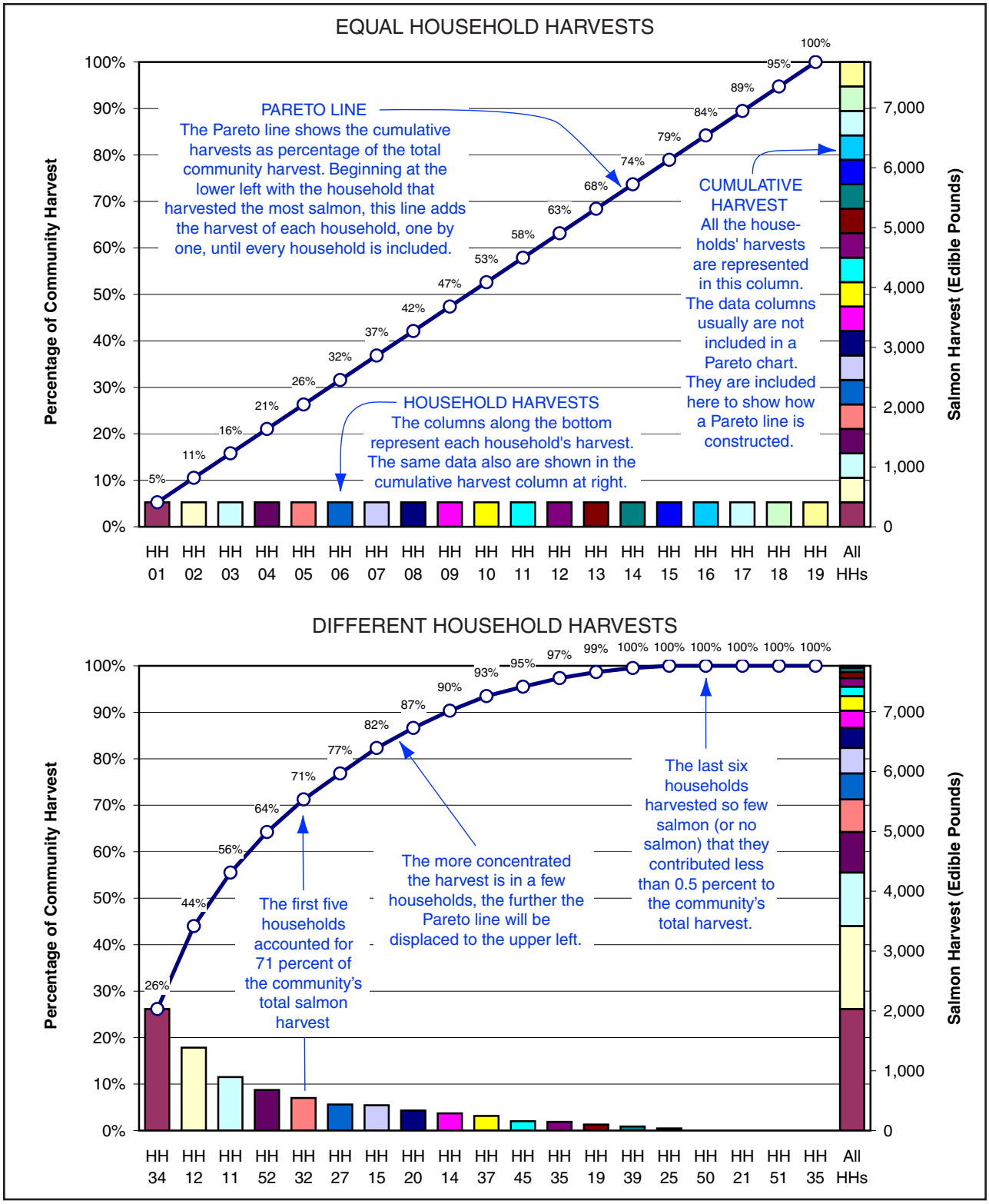

Figure 2-1. Pareto chart examples. In this report, Pareto charts are used to show whether a community's salmon harvest is produced by a few households or many households. If households all harvest exactly the same amount, top, the Pareto line will be straight. If households harvest different amounts, bottom, the Pareto line will be curved. As harvests become more concentrated in fewer households, the Pareto curve will steepen and move to the upper left. The columns of harvest data are shown here to illustrate how Pareto lines are constructed.

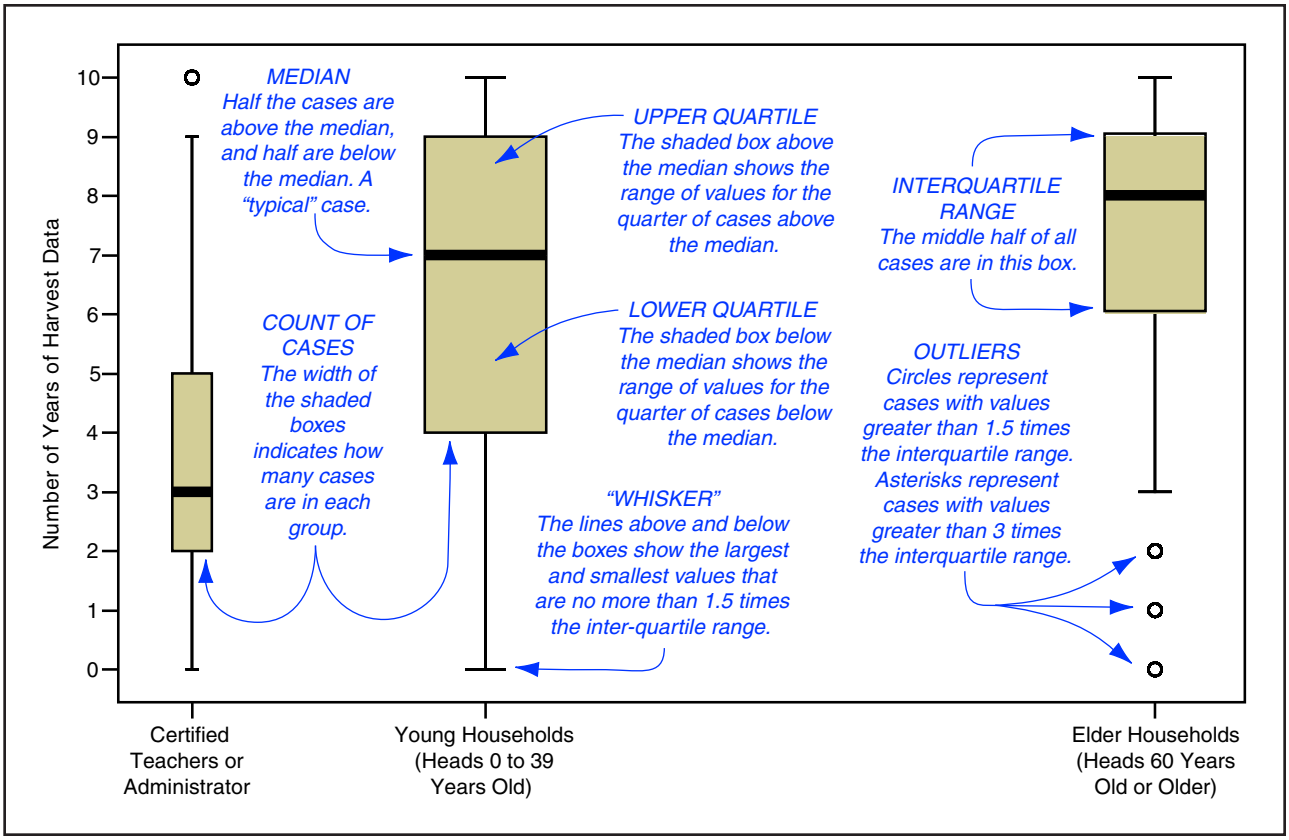

Figure 2-2. Boxplot example. A boxplot compares groups of cases (like households) with one another. This example boxplot compares the number of harvest records for three different types of households (see text).

salmon or, more precisely, the degree to which salmon harvests were concentrated in a few households. This is particularly useful to compare salmon harvest patterns among many years or among many communities, as in Supplemental Figures 3.

As an aid to readers unfamiliar with boxplots, an annotated boxplot appears as Figure 2-2. Boxplots show how values are distributed among different groups of cases. Boxplots are especially useful when one wants to compare groups of cases in a large dataset, such as the northwest salmon survey database.

Figure 2-2 compares the number of years of harvest data available in the dataset for three different types of households: teacher, young, and elder households. At a glance, Figure 2-2 shows that the typical (median, or middle) teacher household had fewer years of harvest data than young and elder households. The narrow teacher box indicates that there are fewer teacher cases in the dataset than young or elder households. The shorter elder box indicates that most elder households have a similar – and high – number of years of harvest data.

The data in these annotated Pareto charts and boxplot are for illustrative purposes only. Pareto charts and boxplots will be further described in the findings section of the report.

3
The Setting

The communities in this study are similar in many ways. They include all the small communities along the shores of Port Clarence and Norton Sound, beginning with Brevig Mission in the northwest and continuing clockwise to the east and south to Stebbins (Figure 3-1). The residents of all ten communities depend substantially on wild foods for subsistence, and salmon are a major component of that harvest.

The study communities also differ in significant ways. Some have had growing populations in the last decade, while others have had stable or declining populations. Some have commercial salmon fisheries; others do not. Sockeye and Chinook salmon are much

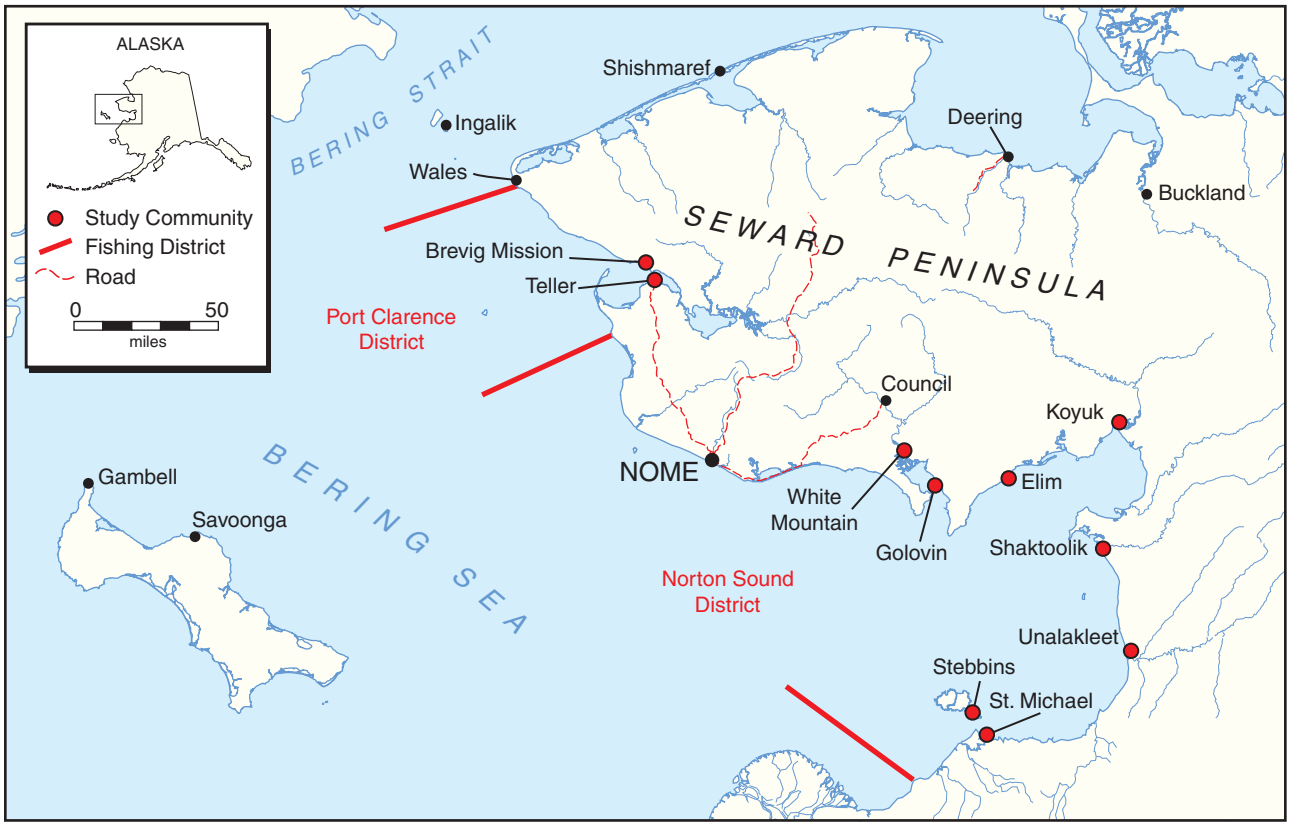

Figure 3-1. The study area. All ten study communities were on the Bering Sea coast, beginning with Brevig Mission and Teller in the north, then continuing around the shores of Norton Sound to Stebbins and St. Michael in the south. Nome salmon harvests are documented by permit, so Nome was not included in this study.

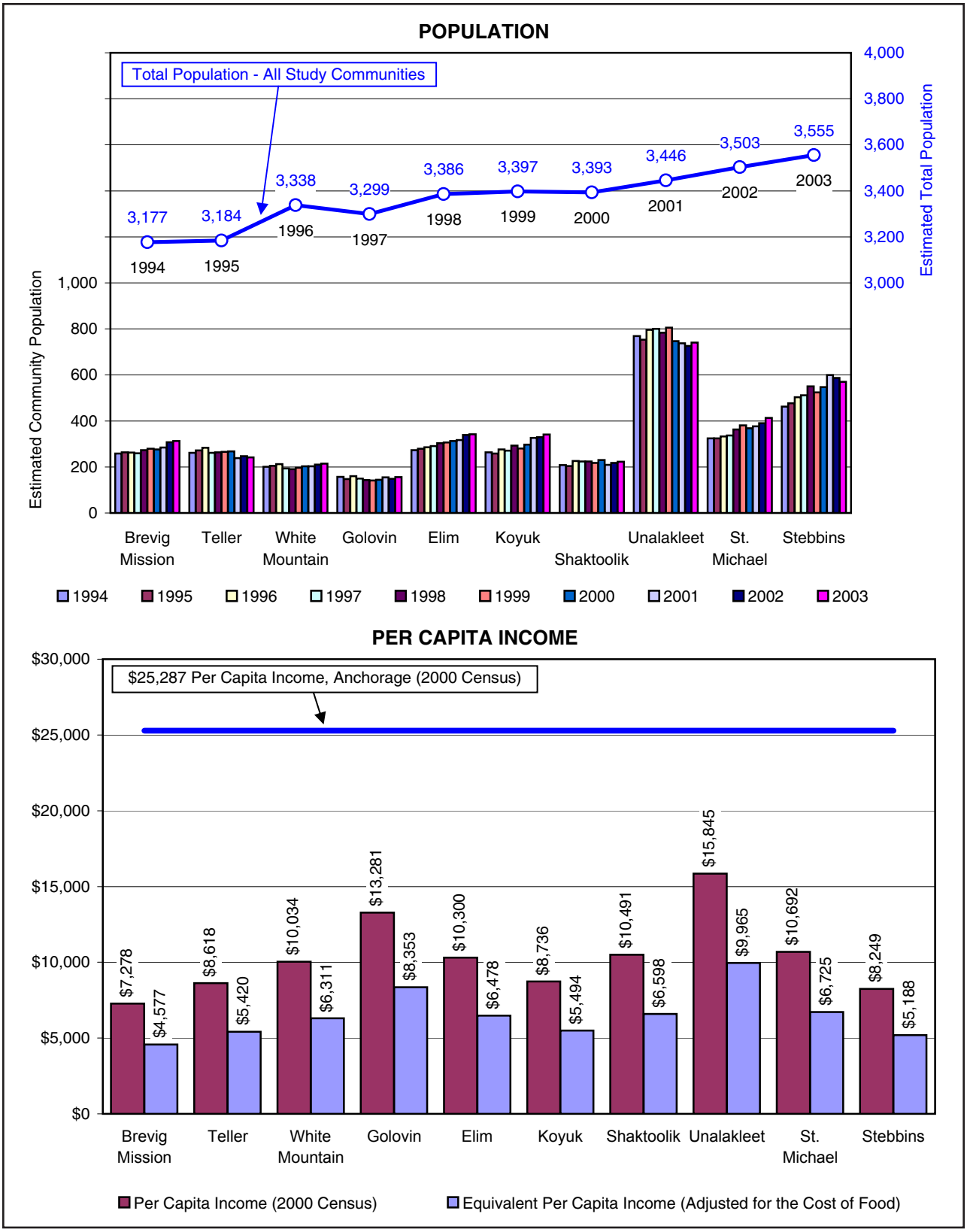

Figure 3-2. Community populations and incomes. The total population of the study communities (top) increased by 11.9 percent from 1994 to 2003, but community growth rates differed widely. Annual per capita incomes (bottom) averaged $10,841. Adjusted to Anchorage food costs, per capita incomes averaged about $6,800.

more available to some communities than to others. Pink salmon are extremely cyclical in some areas, but not in other areas. Salmon abundance has declined substantially in some areas (e.g. chum in White Mountain) but increased dramatically in other areas (e.g. sockeye in Port Clarence).

This chapter begins with a general discussion of the study communities from 1994-2003, including estimated populations, personal incomes, and the cost of living. The subsequent section discusses the role of wild foods in the local economy, comparing the data in the salmon surveys used for the analyses in this project with the results of other subsistence surveys and with the results of a diet survey.

Populations and Incomes

None of the communities had more than 1,000 residents. The typical (median) community population was 278 people. In 2003, they ranged in size from 156 people in Golovin to 741 people in Unalakleet (Figure 3-2). The average community population in 2003 was an estimated 337 people (Alaska Department of Labor 2005). The larger communities (Unalakleet, St. Michael, and Stebbins) all were located in eastern Norton Sound.

Approximately 90 percent of the communities' residents in 2000 were Alaska Native. Native proportions ranged from 86 percent Native (White Mountain) to 95 percent Native (Stebbins, Shaktoolik, and Elim). Elim, St. Michael, and Stebbins were Yup'ik Eskimo. Unalakleet included both Iñupiaq and Yup'ik Eskimo residents. The remaining study communities were Iñupiaq Eskimo. Except in Unalakleet, the largest community, the typical non-Native resident was a school teacher who remained for only a few years.

Between 1994 and 2003, the total population of the ten study communities increased from 3,177 people to 3,555 (11.9 percent). Five of the communities grew by more than 20 percent (Brevig Mission, Elim, Koyuk, St. Michael, and Stebbins). White Mountain and Shaktoolik grew by about 7 percent each, Golovin declined by 0.6 percent, while Unalakleet and Teller declined by 3 percent and 7 percent respectively.

There was no geographic pattern to the growth of community populations; northern communities were as likely to increase as southern communities. However, with the exception of Unalakleet, communities that began the decade with more than 250 people grew by more than 20 percent. And, except for Teller, communities that began the decade with 250 or fewer people grew by less than 10

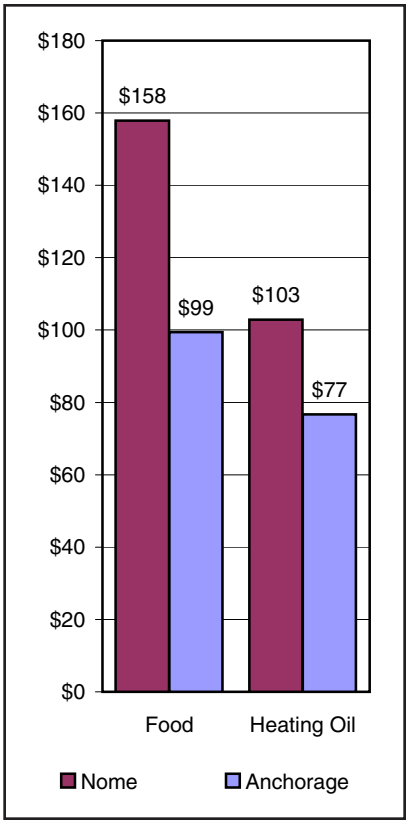

Figure 3-3. Cost of Food and Heating Oil in Nome and Anchorage. In March 2000, the University of Alaska estimated that food for a family of four cost about 59 percent more in Nome than in Anchorage. Fuel oil for heating cost 34 percent more. Food and oil costs in the study communities were substantially higher, but were not included in the University's survey.

percent or declined. In other words, larger communities accounted for most of the growth in the human population.

The 2000 census estimated the average income in the study communities was $10,841 per person per year, ranging from a low of $7,278 in Brevig Mission to a high of $15,845 in Unalakleet (Figure 3-2). For comparison, the average income in Anchorage was $25,287. About half the adults in the study communities were not employed (Alaska Department of Commerce and Economic Development 2005).

The cost of living was substantially higher in the study communities than in Anchorage. The University of Alaska surveys selected Alaska communities four times each year to estimate the cost of food at home; Nome is included in that survey. The March 2000 results (corresponding to the 2000 census) indicated that food for a family of four with children ages 6 to 11 cost 59 percent more in Nome than in Anchorage (Figure 3-3). Fuel oil in Nome cost 34 percent more than in Anchorage.

For purposes of comparison, Figure 3-2 includes an "equivalent per capita income" adjusted for the higher cost of food. Such comparisons can only be a general guide. "The study…assumes that the market basket consists of identical items in all of the communities even though the buying habits of residents in the different places may vary dramatically... Moreover, the local grocery list of base nutritional items also ignores the substitution of subsistence-harvested meats, fowl, fish, berries, and other foods for store-bought items" (Fried 2001:8).

The Role of Wild Foods

Salmon and other local wild foods were very important in the local diet. Several different surveys have estimated salmon harvests in Norton Sound and Port Clarence, producing similar results (Figure 3-4). Conger and Magdanz conducted comprehensive surveys in Golovin and Brevig Mission in 1989, and estimated the harvest of all types of wild foods to be 605 edible pounds per person per year in Golovin and 579 edible pounds per person per year in Brevig Mission. These were similar to estimates of total wild food harvests in other small northwest Alaska communities. Salmon contributed 161 pounds per person in Golovin and 118 pounds per person in Brevig Mission.

The ADF&G-Kawerak salmon survey data used in this project reported harvests as numbers of fish, rather than pounds. For purposes of comparison, researchers in this project calculated per capita estimates. Total edible pounds were computed using the average

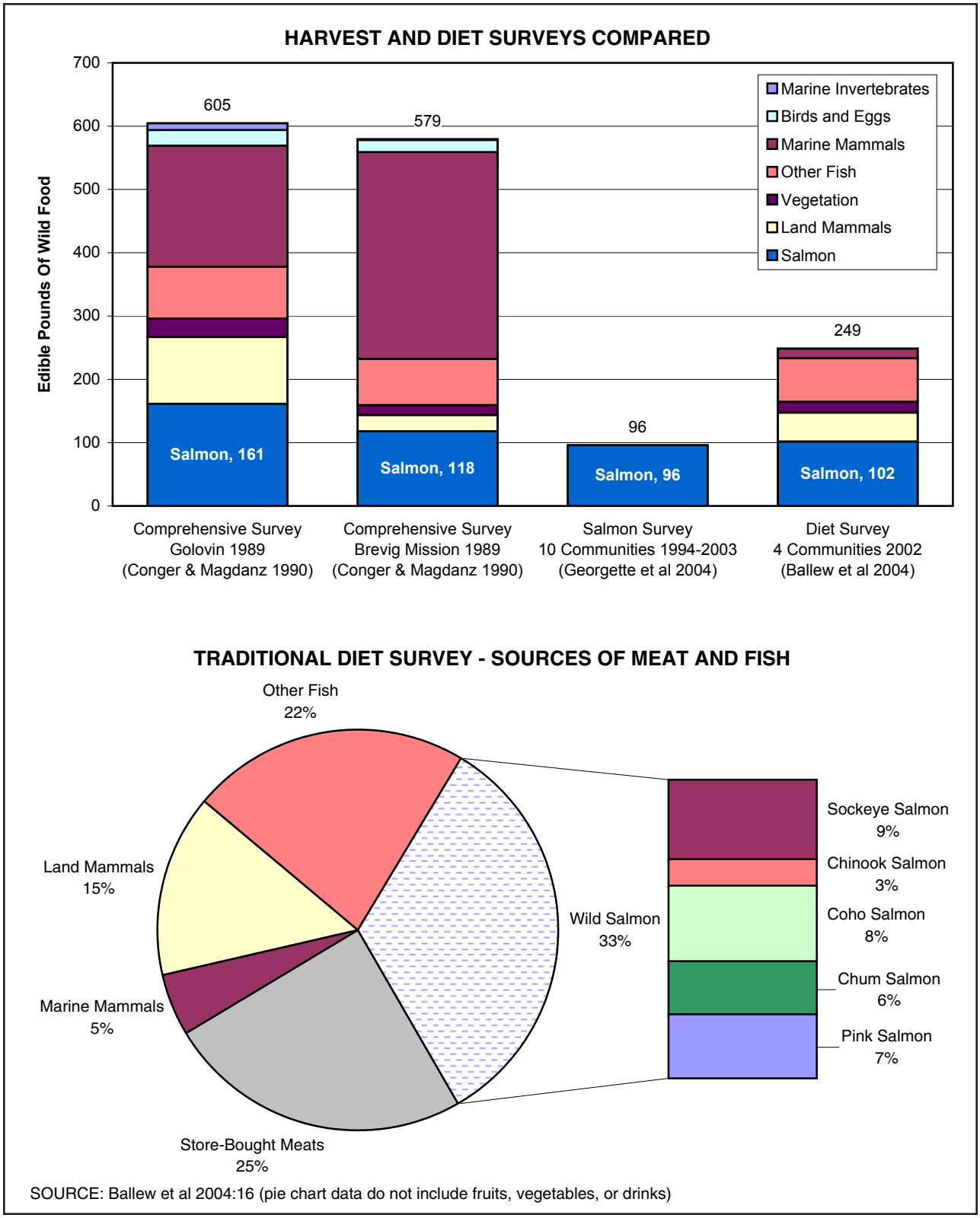

Figure 3-4. Survey estimates of wild food consumption, Norton Sound. Two different methods -- harvest surveys and diet surveys -- produced similar estimates of the subsistence use of salmon in Norton Sound (top). The diet survey estimated far lower use of marine mamals, which may be an sampling issue. The diet survey estimated that wild foods contributed 75 percent of the meat and fish, by weight, to the Norton Sound diet (bottom).

weight of salmon harvested in commercial fisheries in Norton Sound from 1994-2003. Pounds harvested per person were computed using Alaska Department of Labor population estimates for each study community in each year from 1994-2003. For all ten study communities from 1994-2003, the average salmon harvest was 96 edible pounds per person per year.

In 2002, the Alaska Native Health Board conducted a statewide diet survey, which included four communities in Norton Sound (Figure 3-4). In Norton Sound, 151 survey respondents reported consuming an annual total of 37,529 pounds of wild foods, including 15,356 pounds of salmon, 10,392 pounds of other fish, and 6,890 pounds of caribou and moose (Ballew et al 2004:16). Wild fish and meat accounted for 75 percent of all meat and fish consumed by the respondents. Salmon alone contributed 33 percent of the total. The per capita salmon harvest, calculated from data in the Alaska Traditional Diet Survey final report, was 102 pounds.

It was interesting that diet and harvest surveys, using very different methods, produced similar estimates for salmon, land mammals, and other fish, well within confidence intervals (Figure 3-4). However, the surveys disagree about the harvest and consumption of marine mammals, which may be a sampling issue.

In sum, demographic, economic, harvest, and diet data provide a consistent description. The study area includes primarily small Alaska Native communities with substantial dependence on wild foods. Employment is low, and consequently per capita incomes, when adjusted for the cost of food, are only 27 percent of the average per capita income in Anchorage. Residents of these small communities rely on wild foods for three fourths of the meat and fish in their diet (possibly more), and wild salmon are one of the largest contributors to the local diet.

4
Findings

This project explored patterns and trends in subsistence salmon harvests. The most basic trend in subsistence salmon harvests in the study area was a decline in harvests during the 1990s, followed by modest increases in some areas beginning in 2000.

This general trend has been widely discussed in many forums, was not a focus of this analysis, and will be explored only briefly below. Instead, researchers explored trends in harvests at the district and community levels. Declines were not uniform across the study communities. Harvest declines were substantial in some communities, and absent in other communities.

Patterns in subsistence harvests also have been described previously for other data sets, and were evident in the data here. For example, households with active elder heads usually have higher average subsistence harvests than households with younger heads, and larger households usually have higher average harvests than smaller households. As with trends, expected patterns were strongly evident in some communities, and absent in others.

The first section of this chapter explores trends in harvests at the district and community levels. The second section discusses harvest patterns, and explores a series of hypotheses that attempt to answer the general question: Which household characteristics (age of head, gender of head, retention from commercial fisheries, etc.) help explain differences in household salmon harvests?

When community harvests are presented in this chapter, they will be organized geographically, beginning with Brevig Mission and Teller in the northwest and working around Norton Sound to Stebbins in the southeast. In the harvest trends section, data are estimated totals. Expanding for unsurveyed households compensates for differences in sample sizes, and makes comparisons among communities more accurate. In the harvest patterns section, data are reported (unexpanded) harvests. In this section, groups of households are compared with one another, and the comparisons rely primarily on average (mean) harvests and typical (median) harvests. Expanding for unsurveyed households would not affect comparisons among households.

"Trend"
A statistically detectable change over time.

"Pattern"
A reliable sample of observable characteristics of a person, group, or institution.

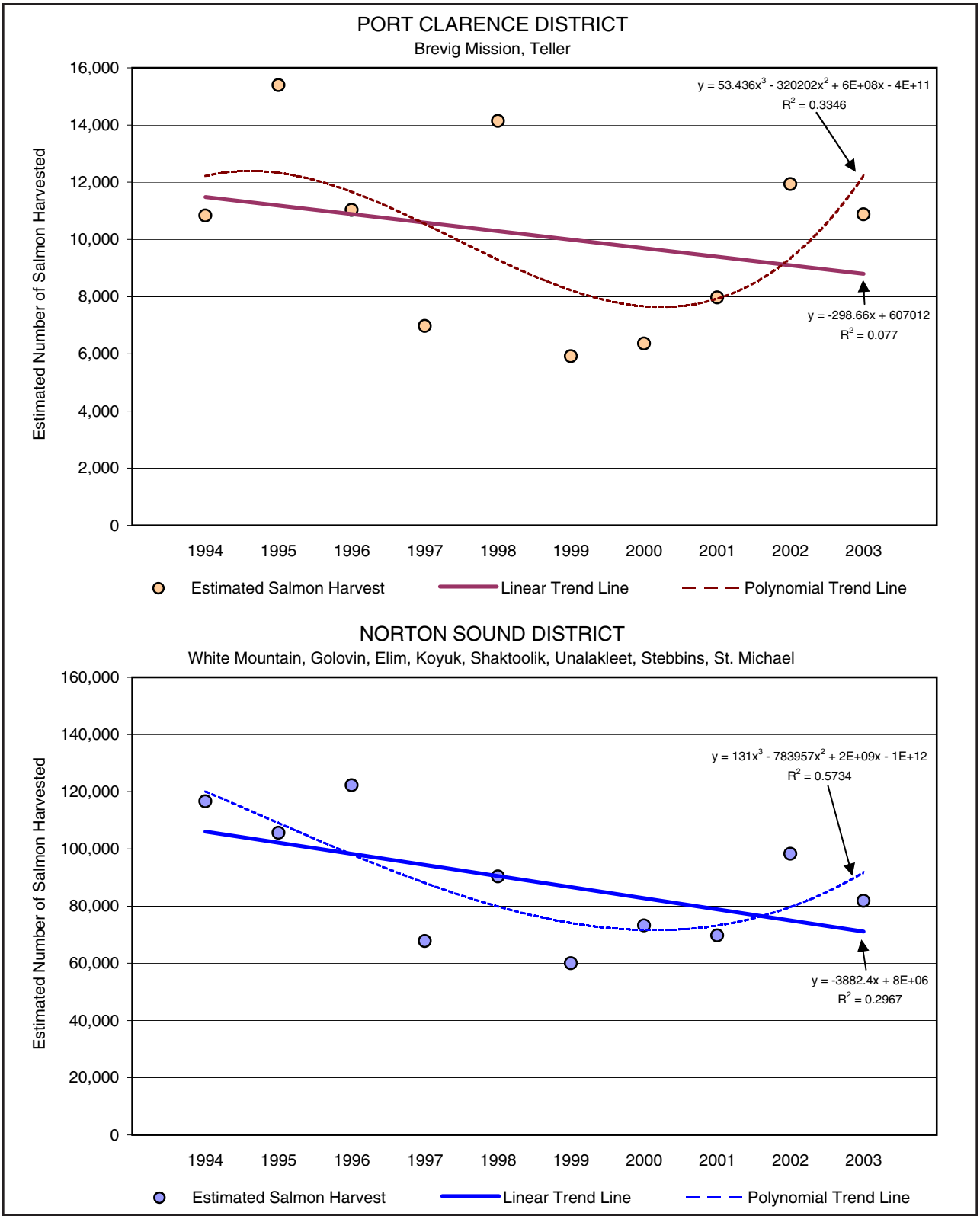

Figure 4-1. Salmon harvest trends in Port Clarence and Norton Sound, 1994-2003. Estimated total salmon harvests trended downward in both districts. In the Norton Sound District, two clusters of harvests appear, a cluster averaging 115,000 salmon from 1994-1996, and a cluster averaging 77,000 salmon from 1997-2003. The polynomial trend lines suggest the trends may have reversed themselves following the harvest lows in 1999.

Harvest Trends

Figure 4-1 includes the estimated total annual subsistence harvests of all salmon in the Norton Sound and Port Clarence Districts, as well as linear and polynomial trend lines for each district. The general declines are evident in the linear trend lines.

In the Port Clarence District, salmon harvests varied substantially from a high of 15,396 in 1995 to a low of 6,973 in 1999. The second highest harvest of the decade occurred in 1998, and was bracketed by the two lowest harvests of the decade. Harvests trended downward over the decade, declining by about 300 salmon each year, but a linear trend line was a weak fit (R^2=0.077).

In the Norton Sound District, the data suggested that there were two harvest regimes during the decade. During the first regime, from 1994 to 1996, harvests clustered around an average of about 115,000 salmon annually and never fell below 100,000 salmon. During the second regime, from 1997 through 2003, harvests on average were a third less, clustered around an average of about 77,000 salmon annually, and never exceeded 100,000. As in Port Clarence, the harvest in Norton Sound trended downward during the decade by about 4,000 salmon annually (R^2=0.297).

The lowest estimated harvests, 60,044 salmon in Norton Sound and 5,914 salmon in Port Clarence, occurred in 1999. Following the lows in 1999, salmon harvests began to increase in both districts. From 1999 through 2003, harvests increased by about 7,000 salmon annually in the Norton Sound District (R^2=0.568) and by about 1,500 salmon annually in the Port Clarence District (R^2=0.830), increases also evident in the polynomial trend lines.

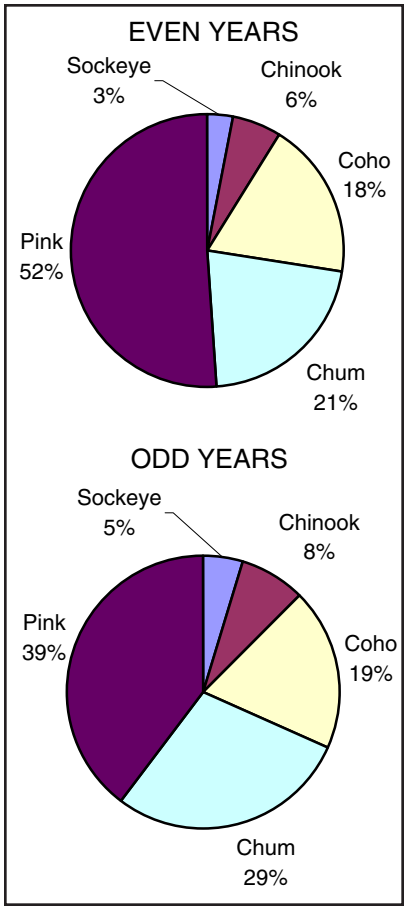

Figure 4-2. Species composition of subsistence harvests. Harvests reflect the abundance of pink salmon in even-numbered years.

Trends by Species

Subsistence harvests in the study area included five different salmon species. The proportion of each species in the subsistence harvest varied from year to year. Overall harvest trends could be driven by only one or two of the five species, and they could be confounded by cyclical patterns, especially of pink salmon.

Pink salmon runs were much stronger in even-numbered years (1994, 1996, etc.) than in odd-numbered years, and this was reflected in harvests (Figure 4-2). Even-year harvests in the ten study communities averaged 110,995 salmon, while odd-year harvests averaged 86,418 salmon, a difference of 24,576 salmon. Of that annual difference of 24,576 salmon, on average 22,576 were pink salmon (91.9 percent). Separating pink salmon harvests from the harvests

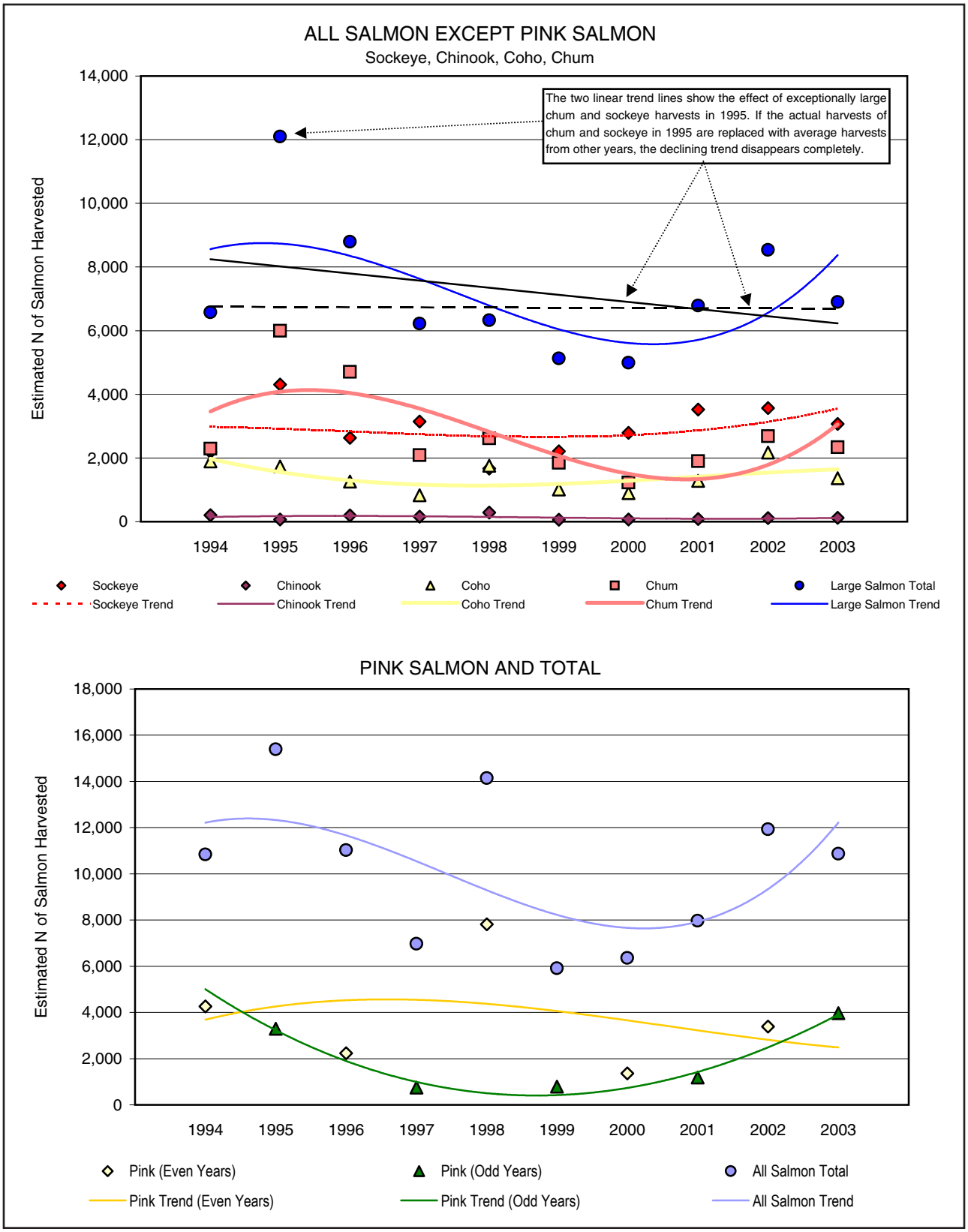

Figure 4-3. Estimated total subsistence harvests by species by year, Port Clarence, 1994-2003. Of the large salmon, chum and sockeye harvests in 1995 (top) had the most affect on the Port Clarence harvest trend. The 1998 pink harvest was exceptional, otherwise the odd-year pink trend captures the overall trend in pink harvests.

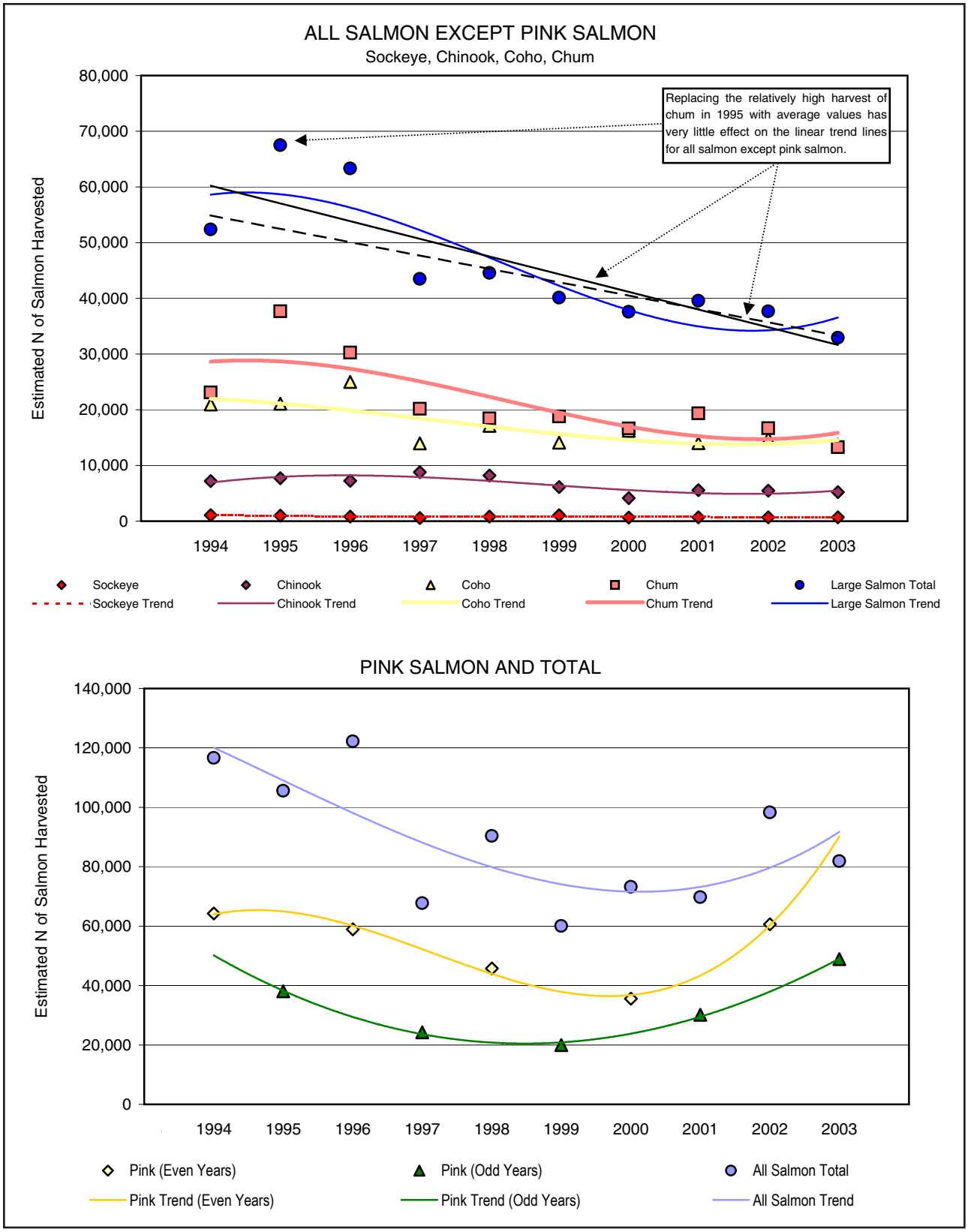

Figure 4-4. Estimated total subsistence harvests by species by year, Norton Sound, 1994-2003. Of the large salmon, chum and coho contributed the most to the harvest. Both species declined through the decade. From 1994 to 1997 large salmon harvests always exceeded 50,000; from 1998 forward they never exceeded 50,000.

of other, larger salmon species made it easier to see trends among the other species, particularly in the Norton Sound District.

Figure 4-3 includes the estimated total annual harvests of salmon by species in the Port Clarence District. Except for 1998, the cyclical harvests of pink salmon were not so pronounced in Port Clarence as in Norton Sound. The 1998 pink salmon harvest was anomalous, almost twice as large as any other year and 2.7 times as large as the average pink salmon harvest in Port Clarence. At the beginning of the study period, pink salmon harvests were about 4,000 annually. During the years from 1997 to 2001, pink salmon harvests were about 1,000 (except for 1998). In 2002 and 2003, pink harvests increased to the levels seen in 1994 and 1995. Overall, the trend in harvests of pink salmon in Port Clarence is well described by the odd-year trend line in Figure 4-3.

In Port Clarence, the declining trend in harvests of salmon other than pink salmon resulted entirely from unusually high chum and sockeye harvests in 1995 (Figure 4-3, top). If the exceptional chum and sockeye harvests in 1995 were replaced with the average of the other nine years, there would be no trend for salmon other than pink salmon. Coho and sockeye harvests declined slightly in the middle of the study period and then recovered (Figure 4-3, top). Interestingly, harvests of sockeye do not seem to have been much affected by the substantial increases in sockeye salmon escapement in the Kuzitrin-Pilgrim River system during the latter years of the survey project.

In the Norton Sound District, trends were different (Figure 4-4). Compared with Port Clarence, the Norton Sound odd-year pink harvests were predictably less than the even-year harvests, on average 39 percent less. In only one even year, 2000, was the pink harvest less than highest harvest in any other odd-year. Still, the patterns in pink harvest, especially odd-year pink harvests, resembled those in the Port Clarence, ending and beginning the decade at about twice the levels seen during the middle of the decade.

The most important trend in the Norton Sound District, though, was the trend in salmon other than pink salmon. Non-pink salmon harvests declined by about 3,200 salmon annually. The decline was attributable to declines in chum, coho, and chinook salmon harvests virtually across the decade. Sockeye were not widely available in the Norton Sound District, and contributed only 0.9 percent to the total salmon harvest from 1994-2203. To explore these declines further, the figures in the following section omit pink salmon, and focus on salmon other than pink (sockeye, chinook, coho, and chum).

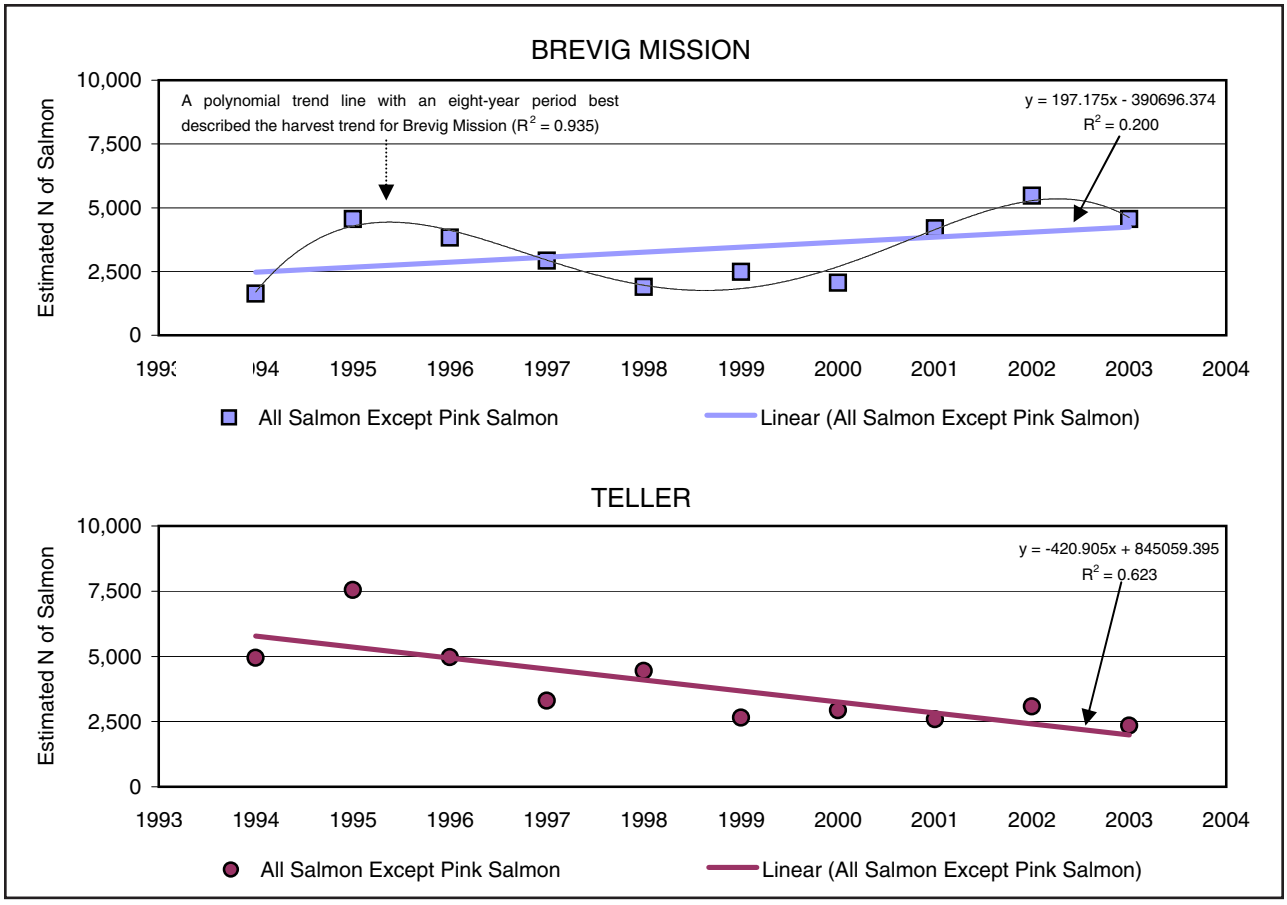

Figure 4-5. Large salmon harvest trends, Brevig Mission and Teller. From 1995 through 1999, salmon harvests (excluding pink) tended to decline in both Brevig Mission and Teller. After 2000, Brevig Mission harvests increased to meet and exceed earlier harvests, creating an overall increasing trend. Teller harvests changed little from 1999 through 2003, and for the decade as a whole, the trend was downward.

Trends by Community

In the previous discussion, the Port Clarence trend was seen to be different from the Norton Sound trend. Essentially no trend in large salmon species was apparent in Port Clarence. Nonetheless, trends were evident in the salmon harvests of the two surveyed communities in Port Clarence. Over the decade, harvests of large salmon (i.e. all salmon except pink) increased by about 200 salmon annually in Brevig Mission, and decreased by more than 400 salmon annually in Teller (Figure 4-5). If one removes the exceptionally low harvest in Brevig Mission in 1994, the trend line indicates that harvests increased by 300 salmon annually instead of 200 salmon. If one removes the exceptionally high harvest in Teller in 1995, the trend lines indicates that harvests decreased by about 300 salmon annually instead of 400 salmon.

The most likely explanation was that Brevig Mission's population increased by 21.3 percent during the decade, while Teller's population decreased by 7.3 percent (see Chapter 3).

But even controlling for the size of the human population, the difference between Brevig Mission and Teller persisted. From 1994 to 2000, Teller's average harvest ranged from 36.5 to 101.4 large

salmon per household, and was *always greater* than the average harvest per household in Brevig Mission. From 2001 to 2003, Teller's average harvest ranged from 32.5 to 38.4 large salmon per households, and was *always less than* Brevig Mission. Brevig Mission's average harvest ranged around 50.1 large salmon annually, and showed no significant trend during the study period.

Average harvests per person told the same story. In some years (1996, 1997, 2001, 2002, and 2003) harvests per person of large salmon were almost identical in Teller and Brevig Mission. But in the other years(1994, 1995, 1998, 1999, and 2000), which tended to fall earlier in the study decade, Teller's harvest per person of large salmon was two to six times as large as Brevig Mission's. The use of salmon for dog food doesn't explain the decline in Teller, either. The number of salmon used for dog food was almost identical (126 to 139 salmon) in four of the five years it was reported, and was reported more often in the later years than the early years.

The differences between Brevig Mission and Teller were an interesting observation. Located on the northern and southern shores of Port Clarence, respectively, the two communities fished the same salmon runs, and had a similar degree of access. Teller families were more likely to fish protected waters like Grantley Harbor, Tuksuk Channel, and Imuruk Basin where they would be less affected by rough weather, which might increase their success. Teller also was more easily accessible (by road) from Nome, increasing competition, which might decrease Teller's success.

There was another possible factor, which will be discussed in more detail in the hypothesis section, below. In most communities, elder households (heads 60 years old or older) tended to have the highest harvests, while young households (heads 39 years old or younger) usually harvested about half as much salmon as their elders. Moreover, in most communities, the number of elder and young households was similar. In Brevig Mission, neither condition was true. Not only were young households (N=206) much more numerous in Brevig Mission than elder households (N=133), young households harvested even more (355.7 salmon) than their elders (326.2 salmon). The presence of such a larger number of active, young households in Brevig Mission also was, no doubt, a factor in Brevig Mission's substantial population growth.

Moving to Norton Sound, trends were more consistent from community to community. There were no other communities in the study area which, like Brevig Mission, saw an increasing trend in the harvest of large salmon from 1994 to 2003. Harvests were declining in all eight of the Norton Sound communities, with the steepest declines in White Mountain, where large salmon harvests

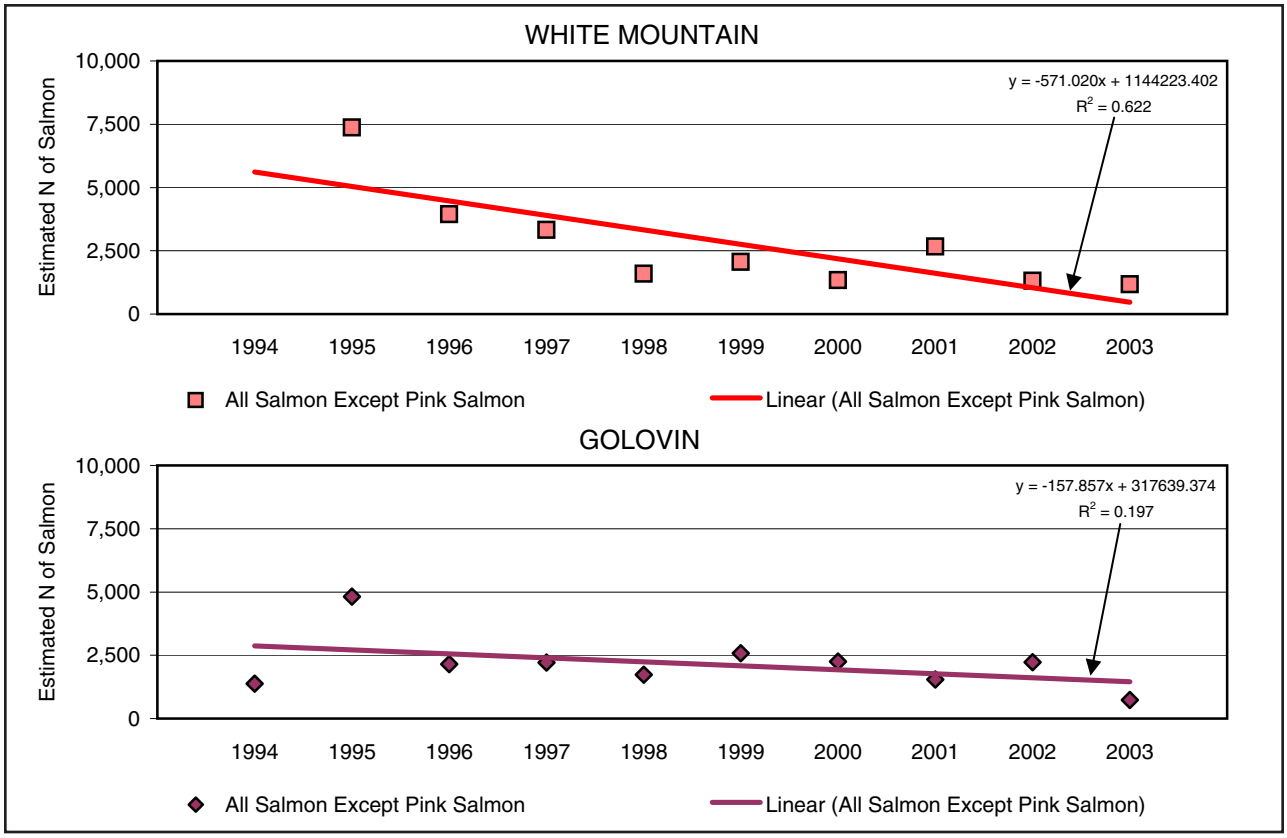

Figure 4-6. Large salmon harvest trends, White Mountain and Golovin.

declined by about 570 salmon annually, and St. Michael, where harvests declined by about 640 salmon annually.

White Mountain was one of a pair of adjacent communities that fished some of the same salmon stocks, like Brevig Mission and Teller. Golovin and White Mountain experienced similar declining trends in harvests, but the decline was substantial in White Mountain and modest in Golovin.

Because of an inadequate sample in 1994, the White Mountain data begin with 1995, when 7,368 large salmon were harvested. Harvest data from the 1980s (which are unexpanded, incomplete, and not strictly comparable) suggest that 1995 was a relatively high harvest for White Mountain (Figure 4-6, top). Even without the 1995 data, White Mountain's harvests still trended downward at a rate similar to most other Norton Sound communities, losing more than 300 salmon each year. More importantly, harvests in some other communities began to increase after 1999. That was not the case in White Mountain, where residents harvested a total of only 1,171 large salmon in 2003.

Golovin, which also saw a large harvest in 1995, fared better than White Mountain (Figure 4-6, bottom) Harvests trended downward, by about 157 salmon annually. If the large 1995 harvest is removed, the trend changes from -157 salmon annual to -39 salmon. Golovin's

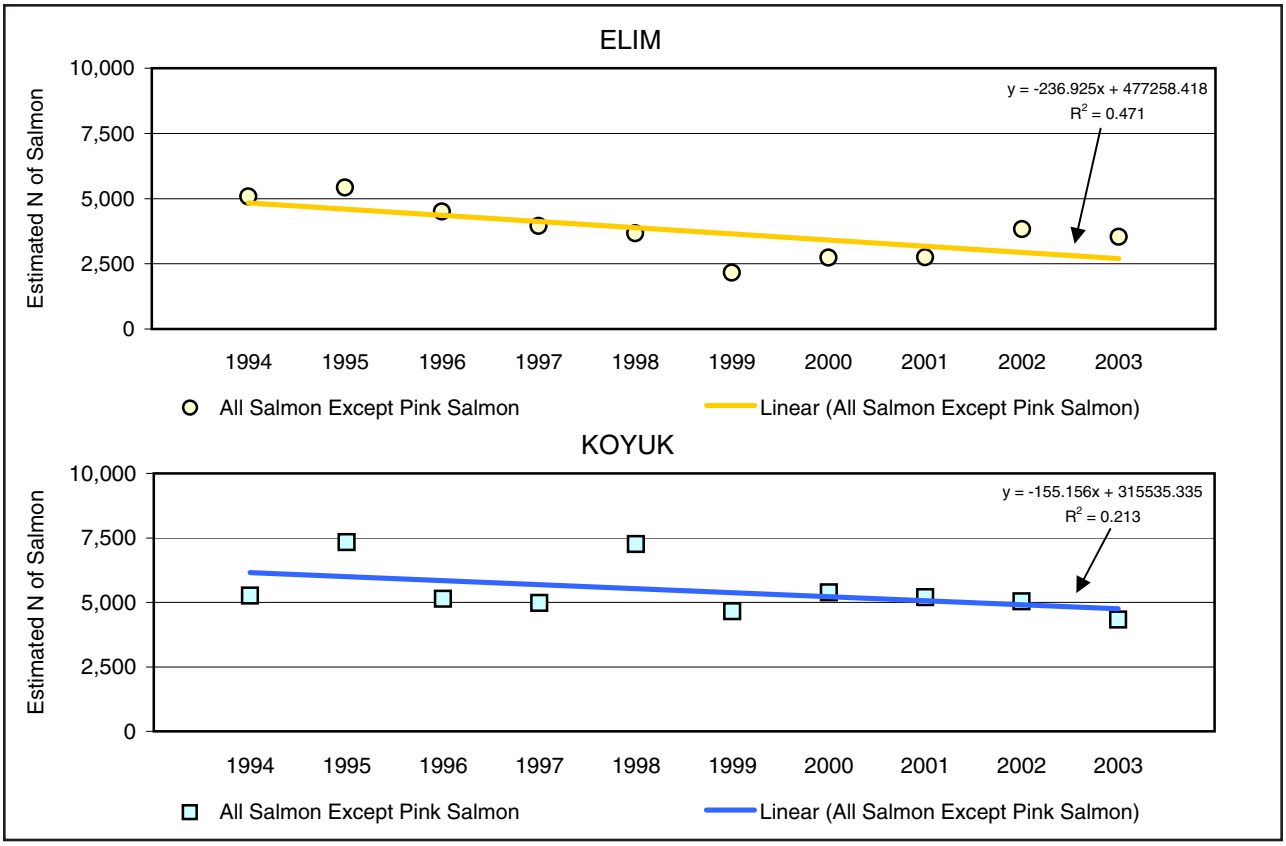

Figure 4-7. Large salmon harvest trends, Elim and Koyuk.

harvests in 1994 (1,379 large salmon), 2001 (1,538 large salmon), and in 2003 (734 large salmon) were especially low. Golovin depends in part on salmon runs in the Kachavik River, in Golovnin Lagoon, which is not fished by White Mountain.

In many communities, 1999 saw low harvests of large salmon, and Elim was no exception with only 2,156 chum, coho, chinook, and sockeye salmon harvested (Figure 4-7, top). After 1999, Elim saw a small but steady increase in harvests of large salmon, while other communities saw continued declines. Elim harvested 3,529 large salmon in 2003, less than the 5,428 harvested in 1995, but from 1999 forward harvests increased by almost 400 salmon annually. Both the early decline and the later increase were almost completely related to changes in chum harvests; there were no trends in the harvests of coho and chinook.

In Koyuk in most years, harvests of large salmon ranged around 5,000 (from 4,326 to 5,380 salmon), except for 1995 and 1998, when harvests exceeded 7,000 (Figure 4-7, bottom). These two higher, earlier harvests caused the trend line to decline by about 150 salmon annually. Without those two high years, the trend in harvests was almost flat, about -50 salmon annually. Chum comprised 83.3 percent of the harvest of large salmon in Koyuk, in some years

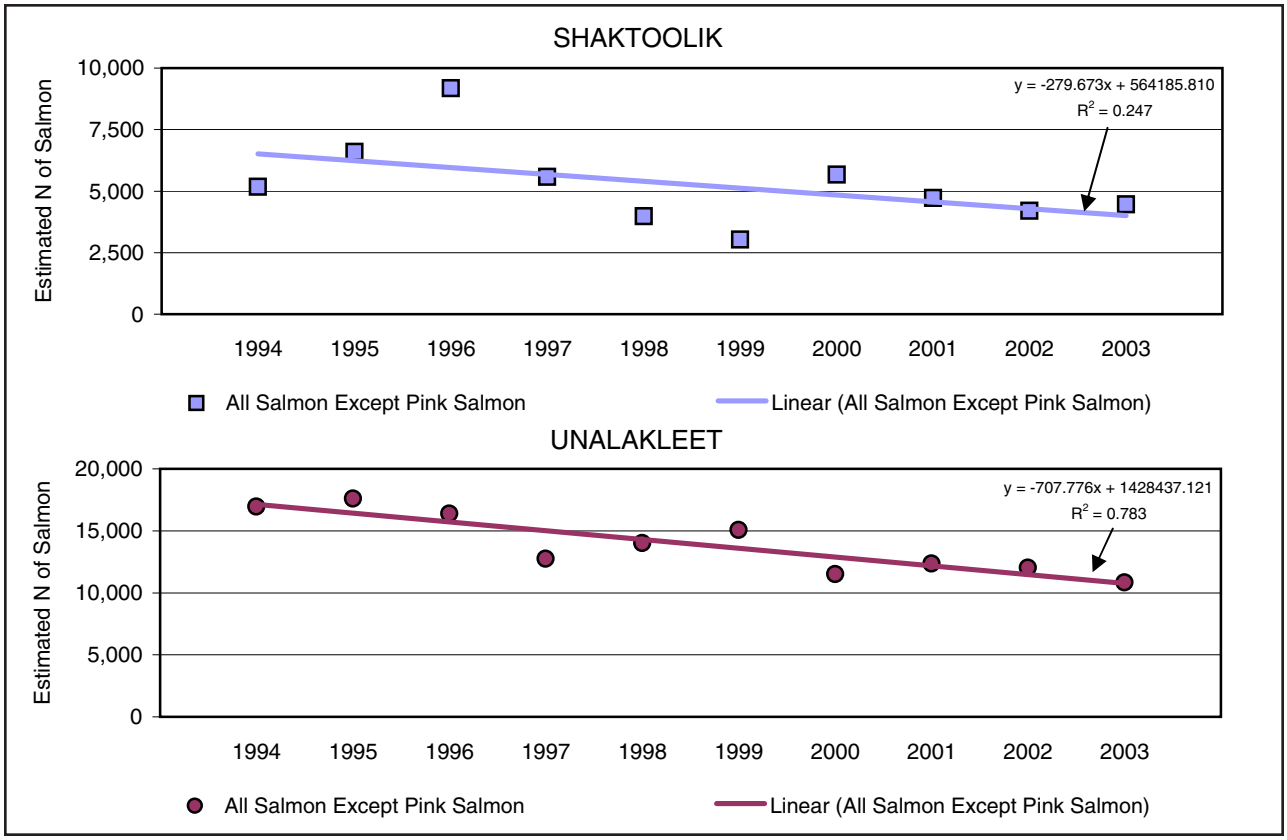

Figure 4-8. Large salmon harvest trends, Shaktoolik and Unalakleet.

almost 90 percent, so the trend of large salmon harvests in Koyuk is essentially the trend in chum.

Chum were not so dominant in Shaktoolik; 31.6 percent of the large salmon were chum while 48.0 percent were coho. Shaktoolik's subsistence harvests of large salmon varied more than in most communities, from 9,185 salmon in 1996 to only 3,024 in 1999 (Figure 4-8, top). Still, the overall trend in harvests was downward, about -275 salmon annually, driven primarily by declines in chum. In the latter four years, especially, chum contributed the most to the decline, harvests of coho were relatively stable.

Perhaps because it was a larger community and thus provided a larger sample of fishing households, inter-annual variation in subsistence harvests was less in Unalakleet than in other communities (Figure 4-8, bottom) The trend line was a relatively good fit (R^2=0.783), but steadily declining by about -700 salmon each year. Here, unlike Shaktoolik, the decline was in coho salmon rather than chum salmon. Over the decade, coho harvests were declining at the rate of about -585 coho salmon annually, while chum harvests were virtually unchanged (-17 chum salmon annually)

In St. Michael and Stebbins (Figure 4-9) chum harvests again were the driving factors in the overall decline in harvests of large salmon. As for Norton Sound as a whole, there appeared to be two

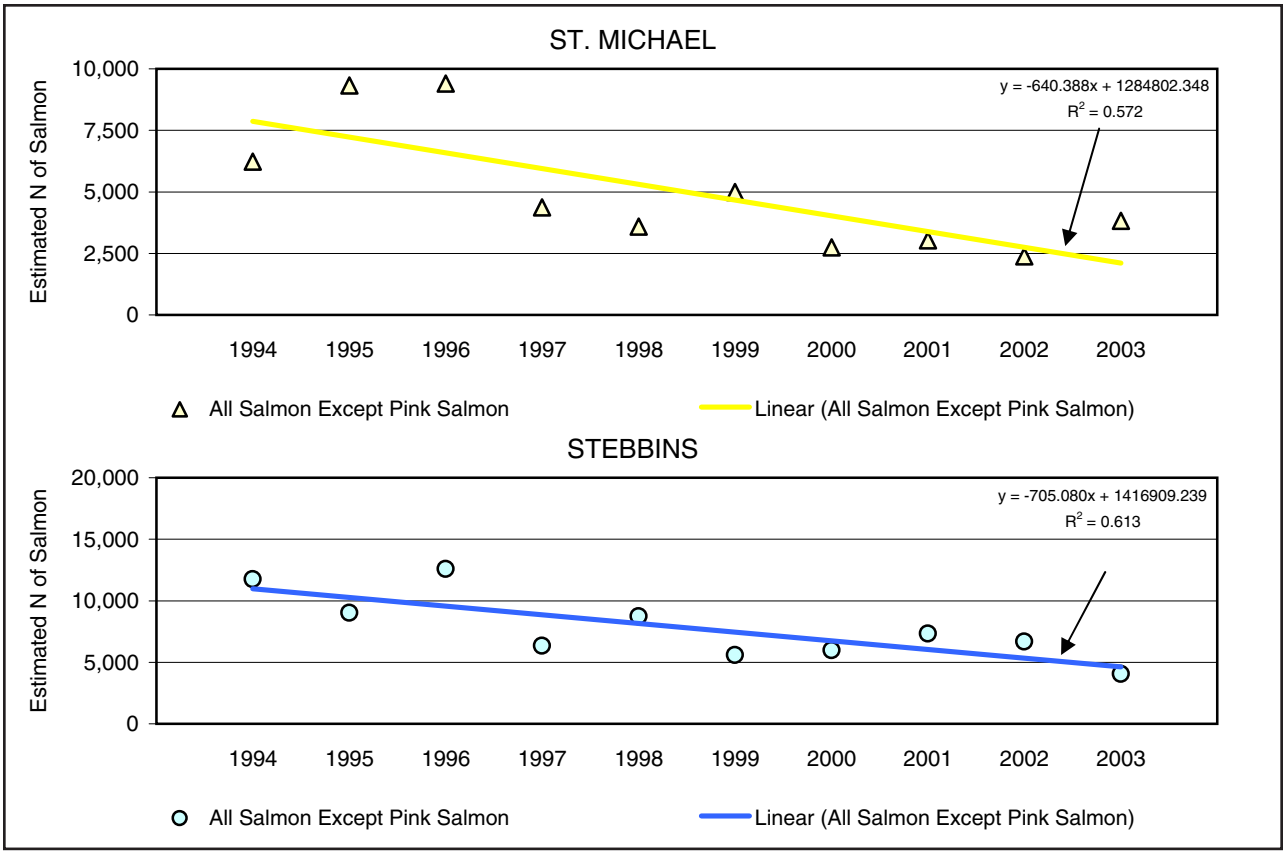

Figure 4-9. Large salmon harvest trends, St. Michael and Stebbins.

chum regimes. During first three years of the study period, 1994-1996, average chum harvests were more than twice as large as the average chum harvests during the last seven years.

In some other communities, declining chum harvests were mitigated in part by stable harvests of other species, but that was not so true in St. Michael and Stebbins. In Stebbins, coho harvests declined with the chum. In St. Michael, pink harvests declined with the chum. And in both communities, chinook harvests declined substantially. With chinook, the break occurred in 2000. Chinook harvests before 2000 averaged 1,092 per year; after 2000 chinook harvests averaged only 321 chinook per year.

Overall, St. Michael's subsistence harvest of large salmon declined by a factor of three, beginning the decade with three years of harvests that averaged 8,316 and ending the decade with four years of harvests that averaged 2,991. Stebbins harvests of large salmon fell by about half, averaging 11,127 during the first three years and 6,009 during the last four years.

Population, Effort, and Harvest

In Alaska subsistence debates, it is sometimes argued that growing rural populations inevitably result in growing demands for subsis-

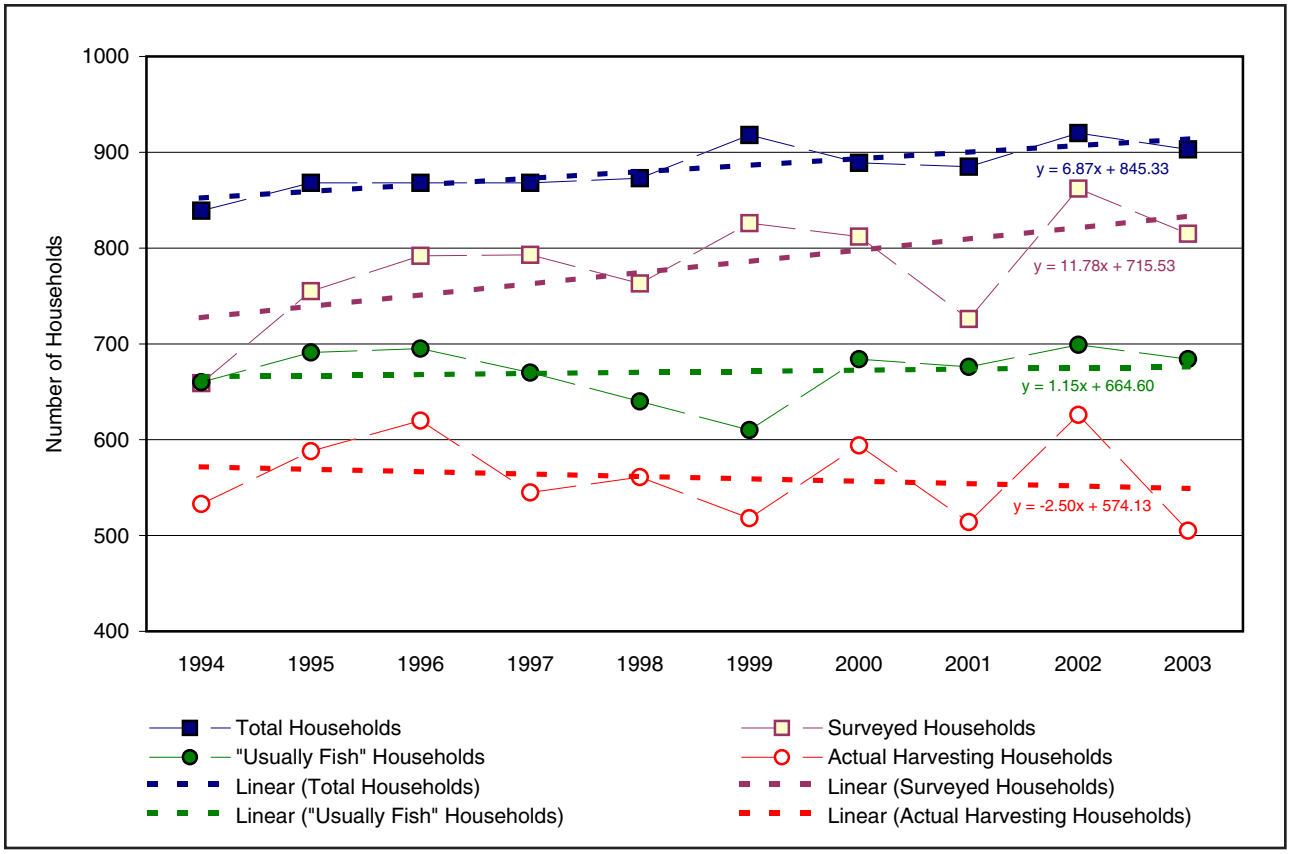

Figure 4-10. Numbers of total, surveyed, usually fish, and harvesting households in all communities, 1994-2003.

tence resources until there are no salmon or moose left over for non-subsistence users. Stated as a hypotheses: *For a community dependent upon local wild salmon for subsistence, salmon harvests will increase with increases in the human population.*

On their face, Norton Sound and Port Clarence data refute the rising-population-rising-consumption hypothesis. In the ten study communities, the human population increased by about one percent every year from 1994 to 2003. During the same period, salmon harvests decreased by about 6 percent every year. The problem is, the decline in salmon harvests is attributable primarily to declining salmon stocks. Nonetheless, time series are a logical choice for exploring the rising-population-rising-harvest hypothesis. With the caveat that northwest Alaska in the late 1990s was not the ideal situation to test this hypothesis, this section briefly explores relationships between human populations and salmon harvests.

To control the affects of salmon abundance, researchers employed two approaches. First, they compared the number of total households with fishing households. Second, they compared harvest trends between growing and shrinking communities.

Figure 4-10 compares the total number of households in the study communities with the number that "usually fished" for salmon and the number that actually caught salmon. From 1994 through 2003,

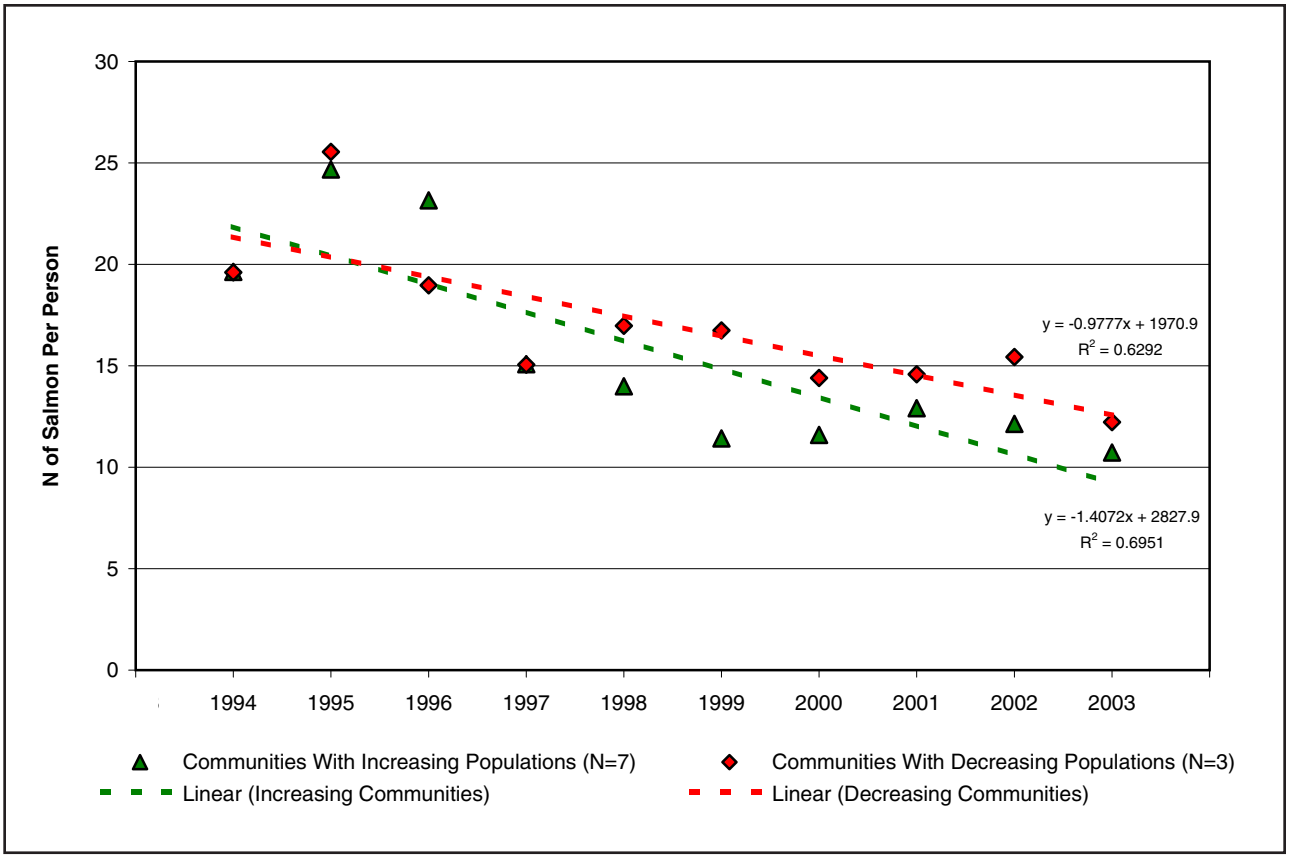

Figure 4-11. Per capita salmon harvests in growing and shrinking commmunities, 1994-2003.

the total number of households increased from 839 to 903, or about seven households per year. The number of surveyed households increased more rapidly, about 12 households per year, as the survey project matured. The number of households that "usually fished" increased by only 14 households during the decade, slightly more than one household a year. The number of households that actually *caught* a salmon declined by about two households a year from 1994 to 2003. So not only were households catching fewer salmon, fewer households caught even one salmon.

In Chapter 2, it was noted that from 1994 through 2003 the human population increased in seven communities: Brevig Mission, White Mountain, Elim, Koyuk, Shaktoolik, St. Michael, and Stebbins. Populations decreased in three communities: Teller, Golovin, and Unalakleet. Figure 4-11 compares per capita salmon harvests and trends in two categories of communities: growing and shrinking. Harvests in both categories declined in similar fashion, but the downward trend was more pronounced in growing communities.

Although confounded by many possible factors, especially declining salmon abundance, growing community populations do not necessarily result in growing subsistence harvests. If these same trends prevailed in times of stable or increasing salmon stocks, they would have a moderating effect on the demand for salmon.

Harvest Patterns

Several scholars have observed patterns in the subsistence harvests of wild foods. The basic observations are that some households harvest much more wild food than other households, and that the pattern of household harvests is similar for many different communities, even though they may utilize quite different species of wild foods. The pattern in most rural Alaska communities is for approximately 30 percent of a community's households to harvest 70 percent of that community's subsistence harvest (the "30-70 hypothesis").

From these basic observations come a series of research questions that seek to explain the variation in harvests from household to household. Wolfe categorized households into five social types based primarily on the age of household heads, and found that harvests were associated with household social type (Magdanz et al 2002:60-64). Chabot also categorized households into social types, based on the gender and employment status of the head of household, and also found associations between harvests and those factors (2003:24).

This section examines several hypotheses about factors which may be related to salmon harvests, and which may help explain harvest patterns. It begins with an exploration of the 30-70 hypothesis. Then it examines associations between salmon harvests and household social type, using categories similar to those employed by Wolfe and Chabot. It compares the annual contributions to the total harvest by households that always fish with those that do not fish every year. It looks for relationships between abundance and subsistence harvests, and between commercial fishing retention and subsistence harvest. Finally, it explores the affects of family changes (marriage, divorce, death) on household harvests.

In the previous section, community harvest totals did not include pink salmon because the highly cyclical abundance of pink salmon obscured the trends in other salmon harvests. In this section, pink salmon are included in harvest totals.

The 30-70 Hypothesis

Hypothesis: Approximately 30 percent of a community's households harvest approximately 70 percent of that community's subsistence salmon (by weight). The 30-70 hypothesis was first expressed by Wolfe (1987). The decision to evaluate cumulative harvests at 70 percent of the community total is somewhat arbitrary. In a community where 30 percent of the households take 70 percent of the

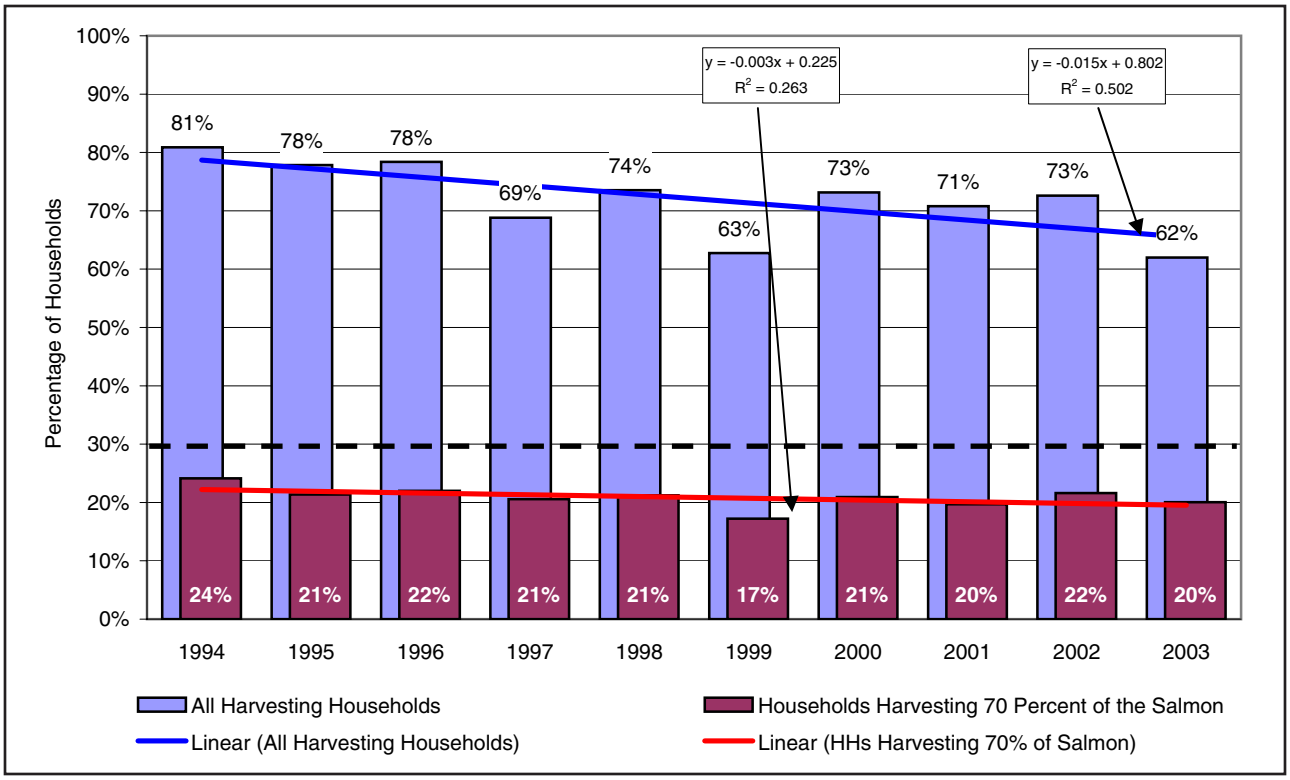

Figure 4-12. Concentration of salmon harvests by year. Harvests of salmon were more concentrated than predicted by the 30-70 hypothesis. On average, 23.4 percent of the households harvested 70 percent of the salmon (red columns). This did not change significantly during the decade. But the percentage of households harvesting at least one salmon declined from 81 percent in 1994 to only 62 percent in 2003. In other words, the proportion of households participating in the salmon fishery declined due to increasing populations, while the proportion of households that accounted for 70 percent of the harvest did not.

harvest, it may also be the case that 50 percent of the households take 90 percent of the harvest and 10 percent take 40 percent. The 30-70 point, though, is close to the midpoint of both households and harvests, and thus is more likely to describe the pattern. This can be seen in the Pareto charts which follow.

To test this hypothesis, households were ranked in order of edible pounds of salmon harvested. Cumulative totals were calculated for the number of households and for the edible pounds of salmon. When more than one year was included in an analysis, households' average annual harvests were used. In the following discussion, harvested are described as "more concentrated" when few households harvest most of the salmon and "less concentrated" when many households harvest similar amounts of salmon.

The analysis showed that, over all communities in all years, 23.4 percent of the surveyed households harvested 70 percent of the salmon (in edible pounds). This was more concentrated than 30:70, but not unexpected. Some households are more successful at fishing and others are more successful at hunting, so one would expect more concentrated harvests of individual species or species groups than for the all species combined.

The concentration of harvests varied from year to year (Figure 4-12, red columns). Harvests were *least* concentrated in 1994, when 24 percent of the households harvested 70 percent of the salmon, and *most* concentrated in 1999, when only 17 percent harvested 70

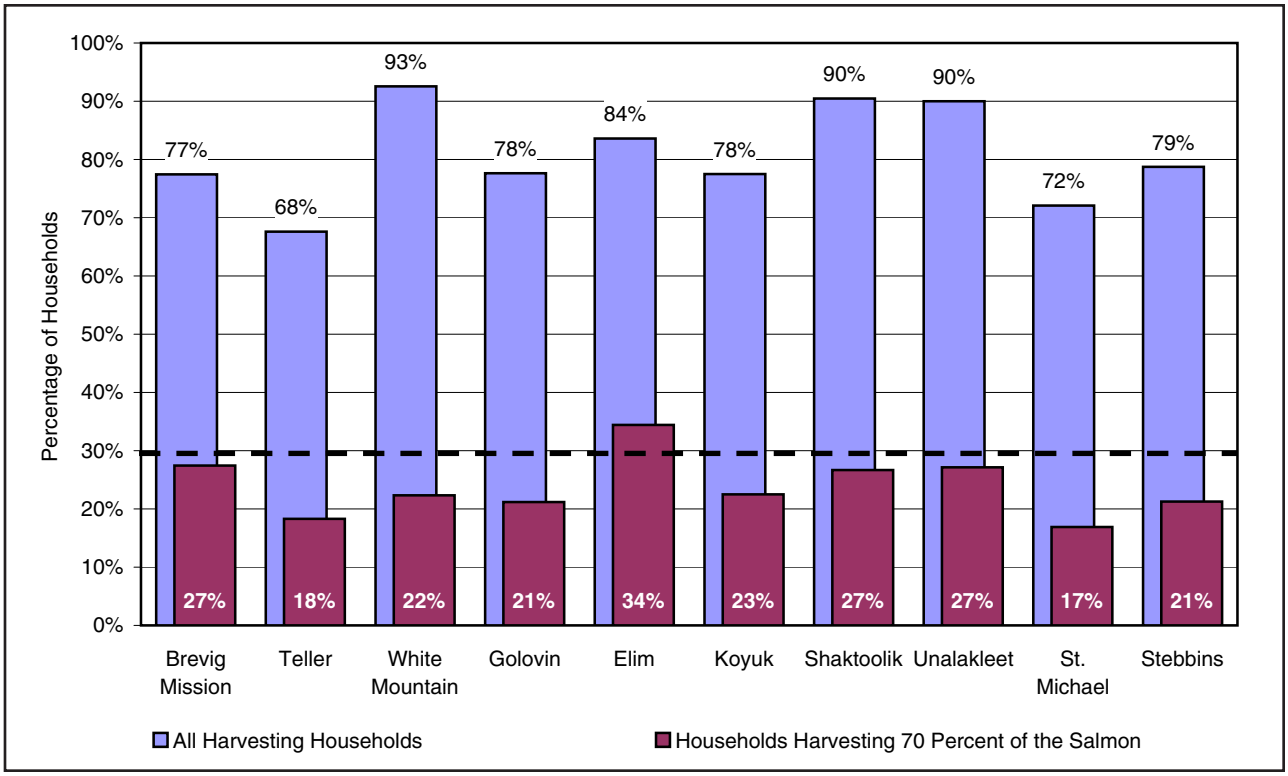

Figure 4-13. Concentration of salmon harvests by community. Harvests were least concentrated in Elim, where 34 percent of the households harvested 70 percent of the salmon (red column). In no other community did more than 27 percent of the households harvest 70 percent of the salmon. Participation in the salmon fishery (blue columns) varied from 68 percent in Teller to 93 percent in White Mountain.

percent of the salmon. Although the proportion of households that caught 70 percent of the salmon varied, there was no significant trend during the decade. However, from 1994 through 2004, the proportion of households that caught at least one salmon declined steadily, from 81 percent to 62 percent. Harvests tended to be less concentrated in even years when pink salmon were most abundant. In other words, the more salmon were available, the more households harvested for salmon, which is what one would expect.

The concentration of harvests varied from community to community (Figure 4-13). More households reported salmon harvests in White Mountain than in any other community; 92 of 99 White Mountain households (93 percent) reported harvesting at least one salmon during the decade (the blue column in Figure 4-13). Twenty two percent of the White Mountain households harvested 70 percent of the salmon (the red column in Figure 4-13). At the other end of the scale, only 96 of 142 Teller households (68 percent) reported harvesting at least one salmon during the decade, and 18 percent of the households harvested 70 percent of the salmon. Note that the percentage of households that harvested at least one salmon appears to be unrelated to the concentration of harvests.

To further explore the concentration of harvests, cumulative harvest totals were graphed in Pareto graphs, where the x-axis is the cumulative percentage of households in the community, and the y-axis is cumulative percentage of salmon harvested by those

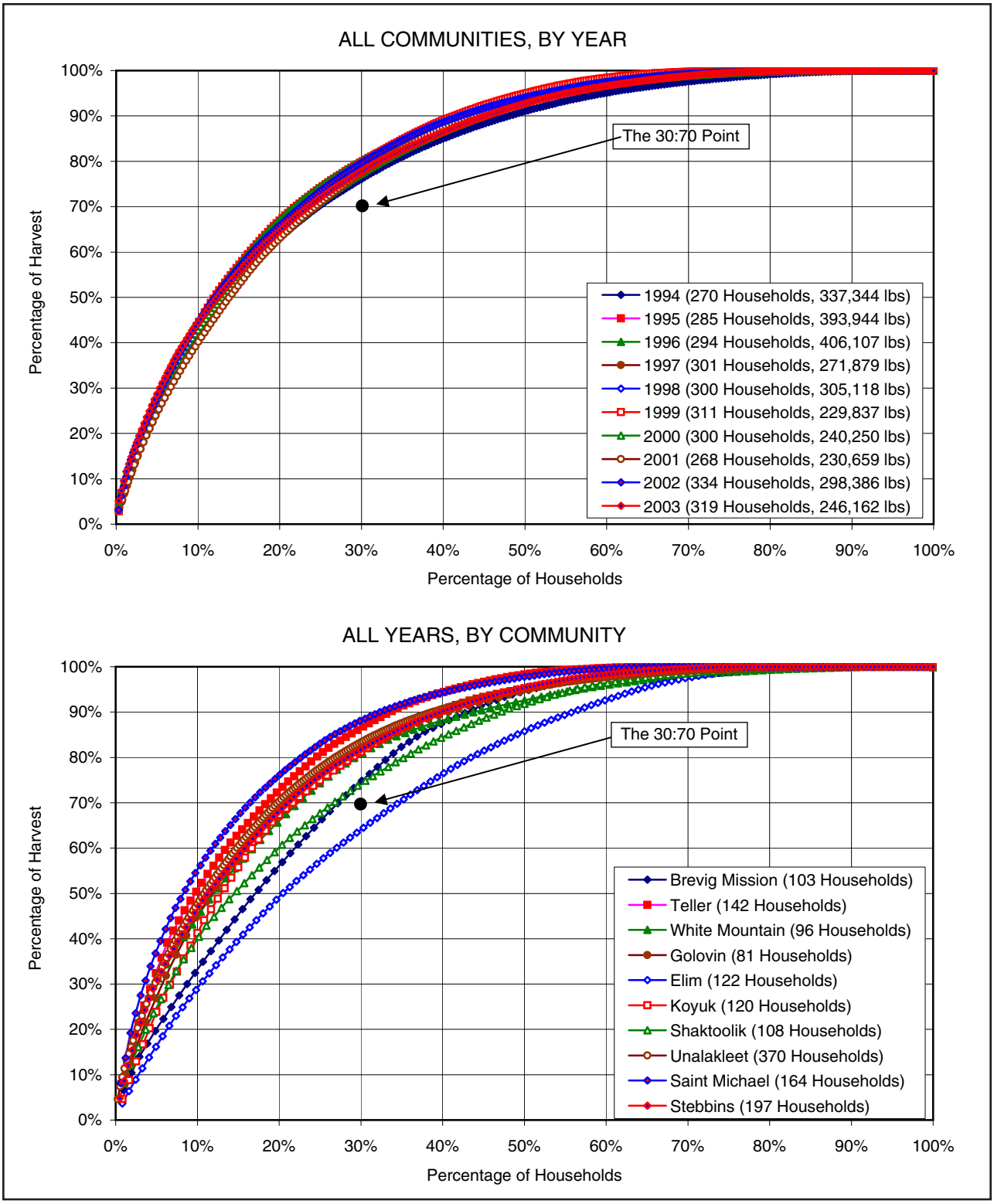

Figure 4-14. Pareto chart, all communities 1994-2003. A Pareto line that passed through the 30:70 point would exactly fit the 30:70 hypothesis. For all communities by year, 22 to 25 percent of the households reported 70 percent of the harvest (top). There was very little difference in the concentration of harvests from year to year, but harvest concentration did differ from community to community (bottom). During the decade from 1994 to 2003, Elim, Brevig Mission, Shaktoolik, and Unalakleet's harvest patterns most closely fit the 30-70 hypothesis.

households. At first, Pareto charts require some study. Once understood, they allow simple and easy comparisons of different harvest patterns. Additional explanations of Pareto charts can be found in the final section of the methodology chapter.

Figure 4-14 is drawn from the same data as Figures 4-12 and 4-13, but displays the cumulative contributions of individual households to the community total. Pareto lines that pass through the 30:70 point would exactly match the 30:70 hypothesis.

The concentration of harvest for all ten Norton Sound and Port Clarence study communities varied little from year to year (Figure 4-14, top). The concentration of harvests in each community, though, varied considerably (Figure 4-14, bottom).

Harvests were *least* concentrated in Elim, where 34 percent of the households harvested 70 percent of the salmon (the Elim Pareto line passes to the right of the 30:70 point). Brevig Mission, Shaktoolik, and Unalakleet – where 27 percent of the households harvested 70 percent of the salmon – came closest to the expected 30:70 pattern. Harvests were *most* concentrated in St. Michael and Teller, where only 17 percent and 18 percent of the households, respectively, harvested 70 percent of the salmon (these Pareto lines are farthest to the left of the 30:70 point).

In Figures 4-12 and 4-13, the percentage of households that harvested at least one salmon varied from 62 percent to 93 percent of all households. That would seem to be considerable variation. Yet that variation is not so apparent in Figure 4-14, because the households at the low end of the harvest spectrum contributed relatively little to the total community harvest. In every year and in every community, the Pareto lines approach 100 percent of the harvest with 80 percent of the households. When Pareto charts are drawn for a single year in a single community, the variation in Figures 4-12 and 4-13 is again evident; some of the Pareto lines approach 100 percent of the harvest with only 50 or 60 percent of the households.

Figures 4-15 and 4-16 include Pareto charts for each year for each community in the survey project, illustrating similarities and differences in the concentration of salmon harvests among the study communities. The small charts in the two figures are sorted. On the upper left are the communities with the least variation in annual harvest concentrations (Brevig Mission in Port Clarence and Unalakleet in Norton Sound). On the lower right are the communities with the most annual variation (Teller and White Mountain).

Several aspects of the harvest patterns can be seen in these charts. First, there are some communities like Brevig Mission, Unalakleet, Koyuk, and Elim where the concentration of harvests varied little from year to year. The Pareto lines for each year fall quite close

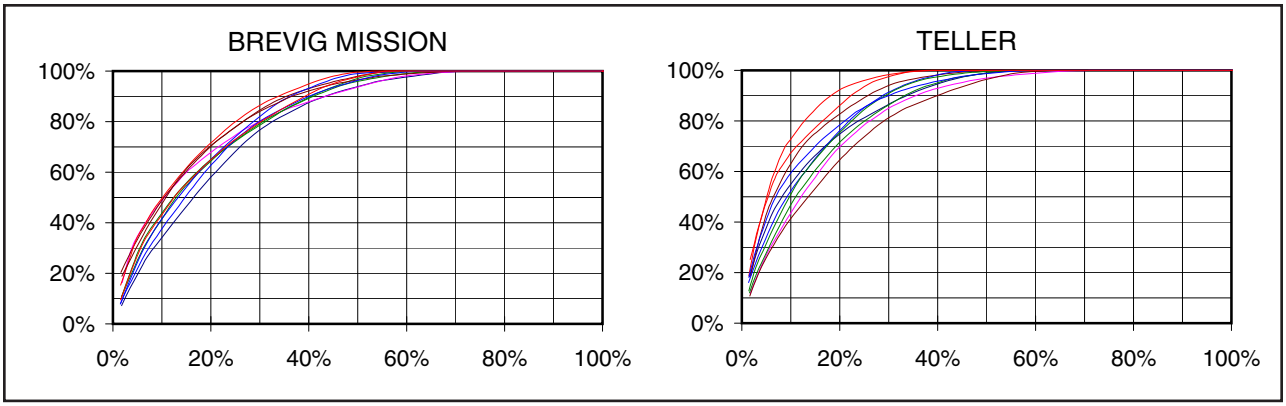

Figure 4-15. Pareto charts by year, Port Clarence communities. The concentration of harvests in Brevig Mission varied little from year to year, with 30 percent of the households harvesting between 76 and 87 percent of the salmon. In nearby Teller, harvests were concentrated in fewer households and there was more annual variation in the pattern. Thirty percent of the Teller households harvested between 80 and 98 percent of the salmon.

to one another, and are of the same general shape. This suggests a fairly predictable harvesting system.

Compare those communities' Pareto charts with the charts for Teller, St. Michael, or Golovin. In the latter communities, the concentration of harvests varies considerably from year to year. In St. Michael, for example, 23 households (29.7 percent) took 95.9 percent of the salmon in 1995, a consequence of unusually high harvests by six households. Those six households alone (8.1 percent of the population) harvested 72.2 percent of the salmon that year in St. Michael. That was a high-harvest year, the total harvest of 39,535 pounds was the second highest of the decade.

Another aspect of the harvest pattern evident in the Pareto chart is the degree of concentration. Lines that fall to the upper left, such as St. Michael's, indicate high degrees of harvest concentration. Lines that fall more towards the center, such as Elim's, indicate lower degrees of harvest concentration. In practical terms, St. Michael often depends on only a few households for most of its salmon, while Elim usually relies on many more households for its salmon.

Finally, the shape and location of the Pareto line also may be a indicator of bias in the sample. In 1994, the White Mountain sample was very small, only ten households instead of the usual 60 households. The 1994 sample appears to have been biased strongly towards high harvesting households, as is evident in the White Mountain Pareto line for 1994 (Figure 4-16). The 1998 sample in White Mountain also was smaller than usual, 39 households, but the 1998 Pareto line resembled other years suggesting that the 1998 sample was representative. The 1994 sample in Stebbins, with 50 households instead of the usual 100 households, appeared to be biased towards high harvesting households.

The salmon project attempted a census in every community in every year, so these kinds of biases were usually not an issue. They did illustrate the challenges of administering harvest surveys in villages. If the survey is attempting to estimate salmon harvests,

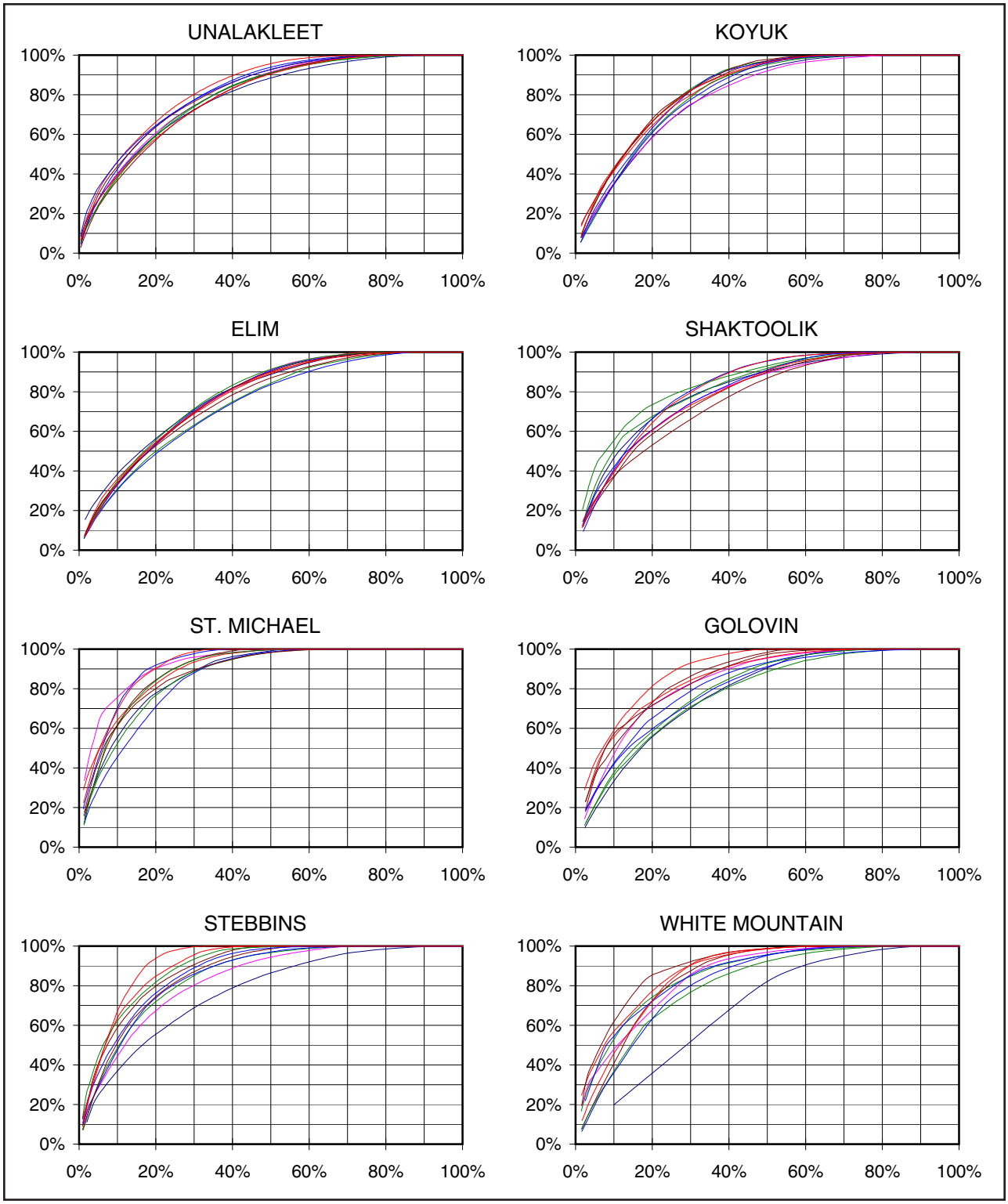

Figure 4-16. Pareto charts by year, Norton Sound communities. Salmon harvests in Elim fit the expected 30:70 pattern, that is about 30 percent of the households harvested about 70 percent of the salmon (in edible pounds). But in most communities in most years, harvests were more concentrated. Harvests in St. Michael were the most concentrated of all; in 2002 20 percent of the households harvested 92 percent of the salmon. The "outlier" lines in Stebbins and White Mountain resulted from small samples in 1994, and suggest that Pareto analyses could be used to explore possible bias in harvest survey samples.

untrained community surveyors often will assume that they should try especially hard to contact households they know to be high harvesters of salmon which, of course, biases the sample and inflates estimates. Fortunately, this appears to have occurred only once in 100 administrations of this salmon survey (10 communities for 10 years). The White Mountain sample of 10 households was not expanded because it was less than the minimum 30 households required for expansion by the analysis protocol.

The Pareto graphs clearly show that (1) a majority of the salmon harvest is concentrated in a minority of the households, and close to the hypothetical 30:70 pattern. The hypothesis is supported. In addition, (2) in some communities the degree of concentration changes little from year to year, (3) in other communities, the degree of concentration changes considerably from year to year, and (4) two community samples in 1994 appear to be biased towards high-harvest households. Given that harvests are concentrated in a few households, the next question is: "Which households?"

Household Social Type

Hypothesis: Household social type is positively associated with the amount of salmon harvested (by weight). This hypothesis follows Wolfe, whose household development model categorizes rural Alaska households into five social types, based on the age of the household heads, on household structure, and on harvests. Chabot, working in Canada, categorized households into four different categories, based on the gender and employment of the household head, and on harvests. Both categorization schemes require advance knowledge of individual household harvests for one of the categories, which limits their utility for predictive modeling.

For the following analysis, researchers categorized surveyed households into two categories that resembled Wolfe and Chabot. An age-based category followed Wolfe's household social type model. A household-head-type category followed Chabot model. Households were categorized year-by-year. Thus, a household with a 58-year-old head in 1994 would be categorized as "mature" household for in 1994 and 1995, then categorized as "elder" in 1996 when its head reached 60 years of age. It wasn't possible to determine, retroactively, the employment status of heads of households for 800 households in each of ten years, so the gender category only loosely follows Chabot. Researchers did not use *a priori* knowledge of harvests to construct any categories. Similar categories could be constructed from census data.

Figure 4-17 summarizes the results for all communities in all

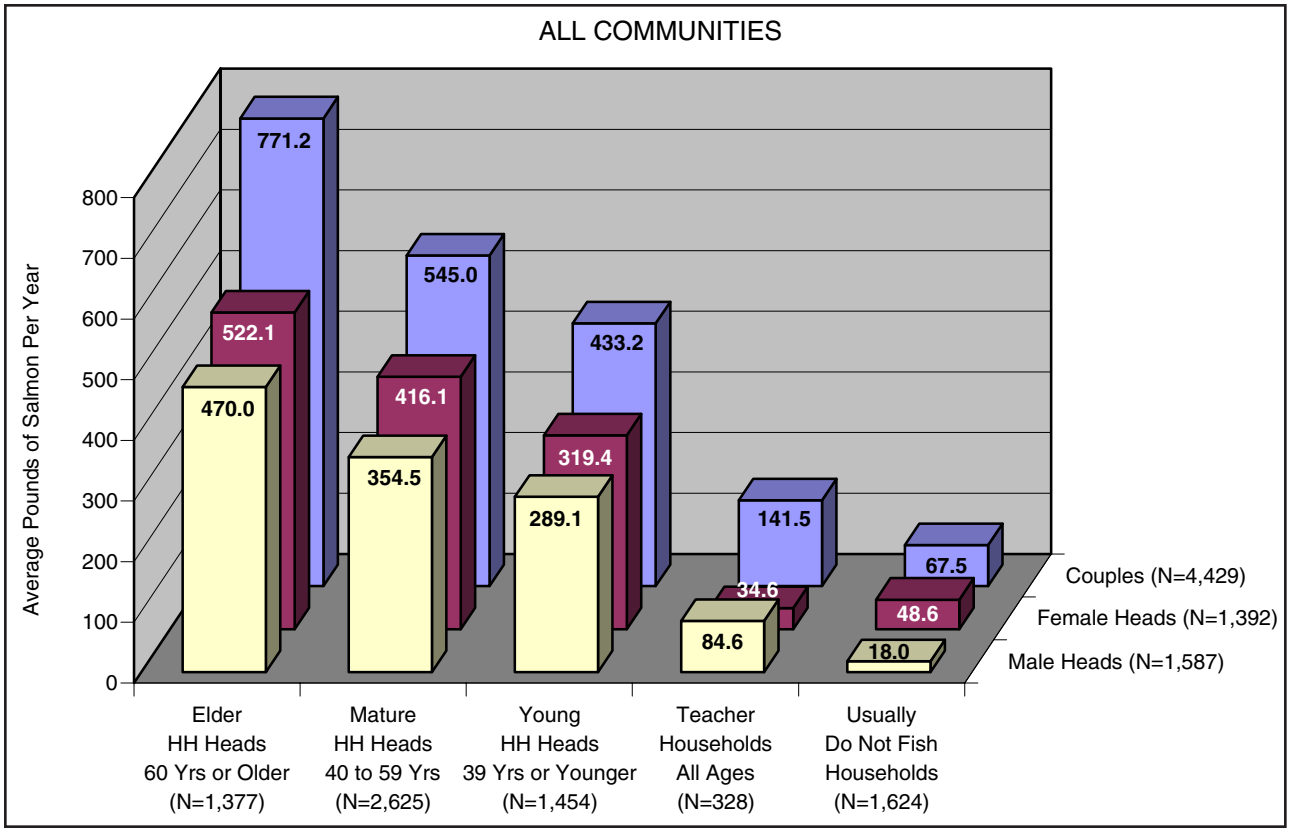

Figure 4-17. Average pounds of salmon harvested annually, by household type. The age and gender of household heads were significantly related to the harvest of salmon (in edible pounds). Among the households that usually fished, households headed by elders were the most productive regardless of whether the elders were a couple, a single man or a single woman. Couples were the most productive household structure, harvesting more salmon on average than households headed by single women or single men. The relationship between household structure was not as strong as with head age. Of the households that reported "usually" fishing, teacher households harvested the fewest salmon, on average.

years. Salmon harvests increased with the age of the household heads, as expected, and teacher households harvested less than other households, as predicted by Wolfe's model. Households headed by couples harvested more salmon than households headed by either single men or single women, as predicted by Chabot's model. With the exception of teacher households, these relationships held for the age and head-type categories together. That is, elder couple households harvested more than elder female households, who in turn harvested more than elder male households, etc.

However, these relationships were not consistent in the individual communities. Figure 4-18 compares the two Port Clarence communities, Brevig Mission and Teller. Among households headed by couples in Brevig Mission, the relationship between head age and harvest was the reverse of the region as a whole. In Brevig Mission, young and mature households harvested more than their elders. Among households headed by single women or single men, mature households harvested the most. In Teller, households headed by couples and single women followed the expected pattern. But among single men, the mature households were the most productive.

Figure 4-19 compares these same relationships for the eight Norton Sound communities. Households headed by elder couples were the highest harvesting category in seven of the eight commu-

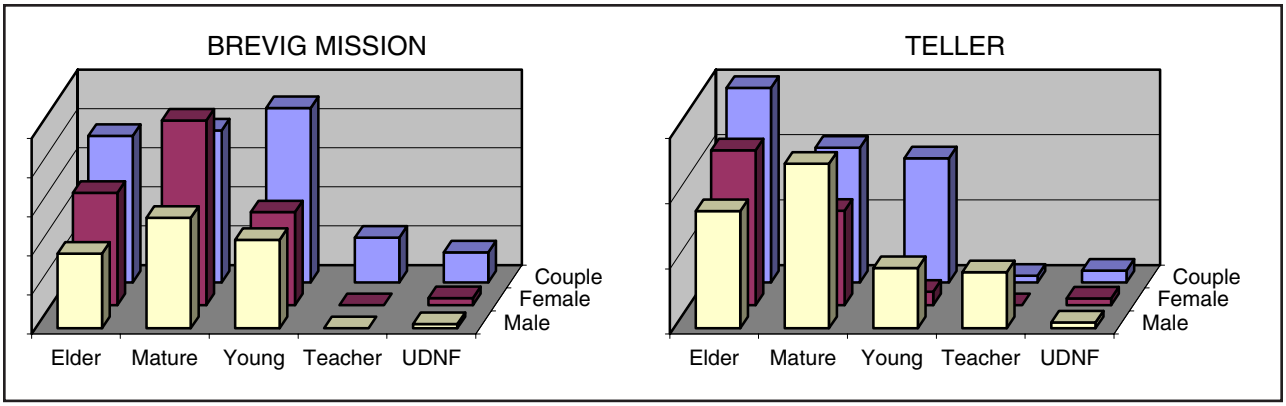

Figure 4-18. Average pounds of salmon harvested by household type, Port Clarence communities. Harvests by different household categories were different in Brevig Mission than in Teller, and both communities were different than the region as a whole. In Brevig Mission, harvests by couples decreased with the age of household heads, the reverse of the expected pattern.

nities, but otherwise relationships between head-age, head-type, and harvest quantities varied from community to community. This was partly because of the small number of samples in the single female head, single male head, and teacher categories. For example, in Golovin there were only two cases with single-female heads, an elder household and a mature household. In Unalakleet, where there were at least 30 cases in every category except single-female teacher (where n=16), the relationships among the variables were mostly as expected.

Consistent and Intermittent Fishing

Hypothesis: *Households that fish intermittently – that is, they fish in some years and not others – account for most of the variation in community salmon harvests.* Hypothesis: *Households that fish intermittently are more likely to fish during years of greater salmon abundance.* Like previous hypotheses, these hypotheses explore the contributions of different types of households to the communities' harvests. In each community a group of households were consistently active, that is, they reported harvesting salmon every year they were surveyed. It was reasonable to assume that this group included the minority of households that contributed 70 percent of the harvest, and to further assume that the harvests by these "fish-every-year" households would be as consistent as their effort. If those assumptions were true, then it was also reasonable to assume that the remainder of the households in the study communities – the "fish-some-year" households – would account for most of the variation in community salmon harvests. It was also reasonable to expect that the intermittent households might be more motivated to fish during years of greater salmon abundance.

To begin this exploration, households were categorized by two different variables, based on their reported fishing histories. One variable included three categories: "Harvest Salmon Every Year,"

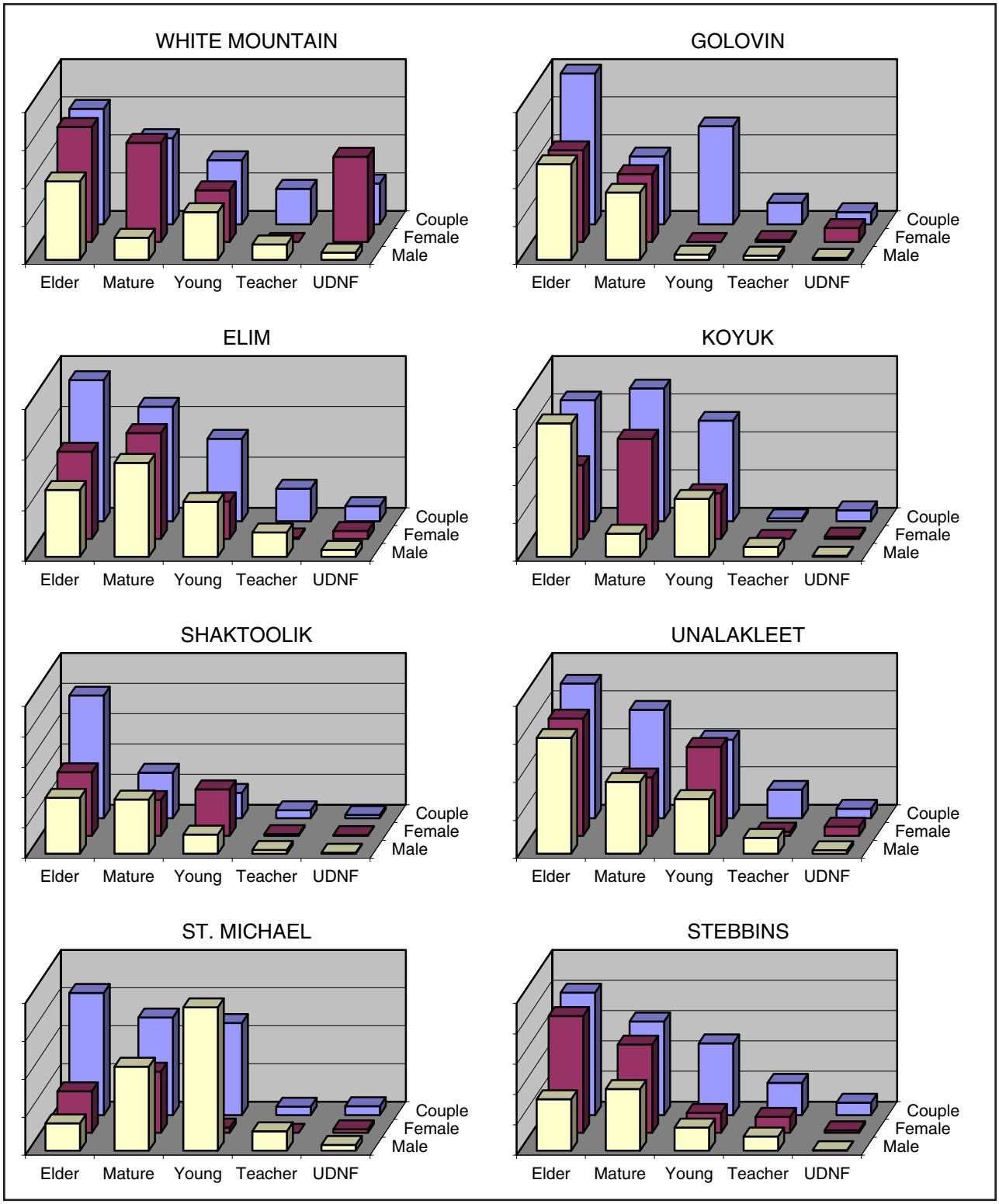

Figure 4-19. Average pounds of salmon harvested by household type, Norton Sound communities. No community exactly fit the expected pattern, which was partly a result of small samples in the single female, single male, and teacher categories. Elim, Golovin, Shaktoolik, Unalakleet, St. Michael all offered evidence of the important contribution of elder couples to community harvests. Elder couples were especially productive in Shaktoolik, where the elder couples' average harvest (2,018 pounds) was almost twice as large as any other category.

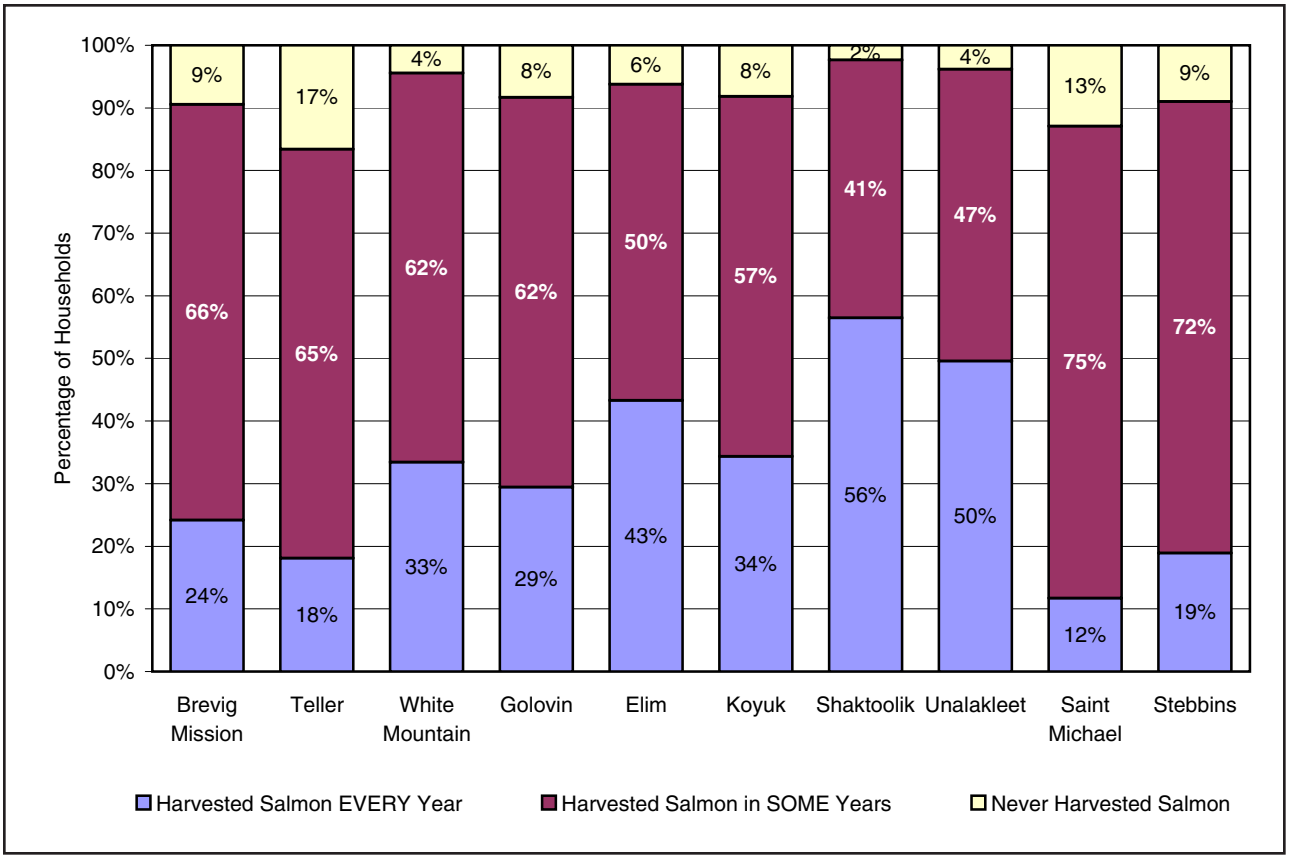

Figure 4-20. Consistent and intermittent fishing households, by community. The proportion of households that harvested salmon every year varied widely from community to community, from a low of 12 percent in St. Michael to a high of 56 percent in Shaktoolik. Within each community, though, the number of harvest-every-year households was usually stable over time.

"Harvest Salmon in Some Years," and "Never Harvest Salmon." Another variable further categorized the "harvest-some-years" households into three groups of more and less active households.

Figure 4-20 shows that the proportion of households in that harvested salmon every year varied considerably from community to community. In Shaktoolik, 56 percent of the households reported harvesting salmon every year they were surveyed, while in St. Michael only 12 percent of the households reported harvesting salmon every year. The proportion of fish-every-year households tended to increase from Brevig Mission eastward across Norton Sound to Unalakleet, except that Stebbins and St. Michael had fewer fish-every-year households than the other communities. In the region as a whole, 33.6 percent of the surveyed households harvested salmon every-year, 55.8 percent harvested salmon in some years, and 7.7 percent never harvested salmon.

Household harvests varied among communities and years, confounding attempts at comparisons among communities. To control for this variation, household harvest percentiles were calculated for each year's harvest in each community. Households at the first percentile in a particular year harvested more than any other household in their community that year, while households at the hundredth percentile harvested the least. This allowed comparisons

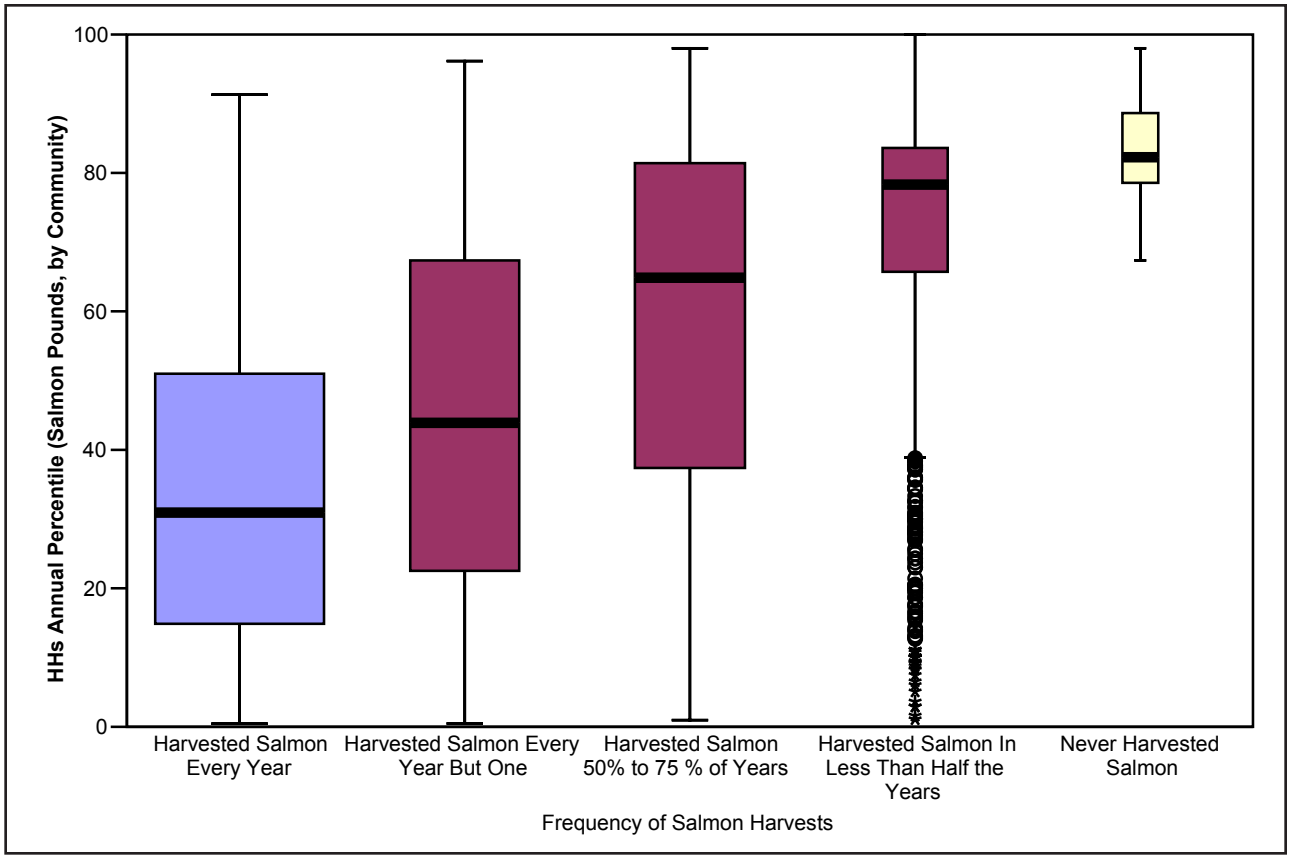

Figure 4-21. Annual percentile harvest rank by harvest category. Households that harvested salmon every year contributed more salmon to their communities than households that harvested intermittently. But in every category, some households ranked in the top and bottom percentiles. The range of percentile ranks in the "Never Harvested Salmon" occur because households that harvested nothing are sequentially ranked in the lowest harvest percentiles. (See Figure 2-2 on page 20 for an explanation of boxplots.)

of households' contributions to community harvests across years of various harvests and across communities of various sizes.

Figure 4-21 shows that, indeed, households that harvested salmon more frequently ranked among the higher harvesting households in their communities. Households that "Harvested Salmon Every Year" were typically at the 31st harvest percentile. Households that "Harvested Every Year But One" were typically at the 44th percentile. As the households' harvest frequencies declined, so did their median harvest ranks. However, in every category except "Never Harvest Salmon," there were some households that ranked near the top and the bottom percentiles. (In the boxplot, the overlapping circles in the "Harvest Salmon in Less Than Half the Years" category represent outliers).

In the region as a whole, and in each community as well, the number of harvest-every-year households was quite stable from year to year. For the region as a whole, the number of harvest-every-year households averaged 296 households annually. The line series in Figure 4-22 show that the number of harvest-every-year households ranged from 284 to 318 households; there was no trend. The harvest-some-year households averaged 519 households annually, and increased by about four households annually (0.8 percent). The never-harvest households averaged 68 households, and increased by

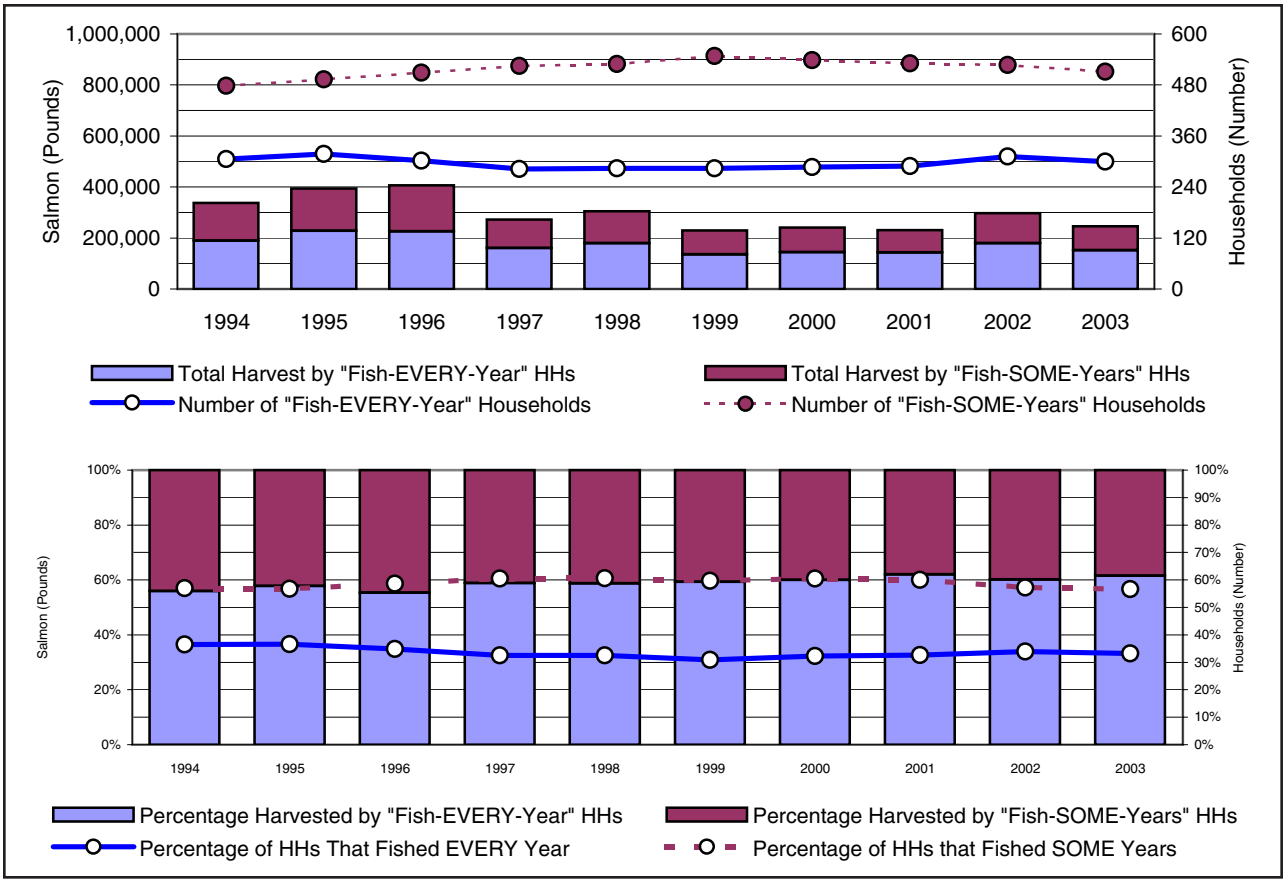

Figure 4-22. Contributions of consistent and intermitent fishing households. Although salmon harvests varied substantially from year to year (top), the contributions of consistent and intermitent fishing households changed little from year to year (bottom). The columns show the pounds of salmon harvested (top) and the percentage harvested (bottom) by each category of household (left axis). The lines show the number (top) and percentage (botttom) of all harvesting households (right axis).

about three households annually (5.1 percent). Primarily because of increasing populations in the study communities, the survey sample increased by about seven houses each year, from 839 in 1994 to 903 in 2003. Since the number of harvest-every-year households remained stable, the proportion of harvest-every-year households declined from 36.5 percent in 1994 to 33.2 in 2003.

To test the hypothesis that intermittent households accounted for most of the variation in community harvests, harvests (in edible pounds of salmon) were compared between consistent and intermittent households in each of the ten study years. The "never harvest" households were not relevant to the hypothesis since they contributed no salmon, so they were discarded.

The columns in Figure 4-22 shows the results of the comparison, with the pounds of salmon harvested by each category in the top chart and the percentage of total pounds harvested by each category in the bottom chart. The proportion of salmon harvested by the two categories of households was remarkably consistent through all regimes of harvest, from a high of 406,924 pounds in 1996 to a low of 229,266 pounds in 1999. The fish-every-year households harvested 58.6 percent of the total on average, ranging between 55.4

percent and 62.0 percent and trending upwards about 0.3 percent annually.

In other words, a similar number of fish-every-year households was becoming a smaller proportion of the community over time, and at the same time contributing a larger proportion of the salmon harvest (in edible pounds). Compared with the variation in the harvest, however, these trends were small. Harvests by the two categories of households contributed more or less equally to the total harvest of each. Although the intermittent households were cycling in and out of the fishery, their numbers and their combined contribution to the total harvests were similar from year to year. This was unexpected. These hypotheses were not supported.

Salmon Retained from Commercial Fishing

Hypothesis: *Households that retained fewer salmon from commercial fishing caught more salmon for subsistence.* This hypothesis was intended to explore a common feature of rural Alaska mixed economies: the interchangeability of commercial and subsistence fishing in meeting households' economic needs. Specifically, were retained commercial salmon a substitute for subsistence salmon? If so, then restrictions to commercial salmon fishing might increase demand for subsistence salmon.

There were many factors in play, especially markets. Higher salmon prices might discourage fishers from retaining commercial salmon for personal use. This analysis, however, looked only at the relationship between commercial retention and other local sources of salmon for households (i.e. subsistence nets, rods and reels).

Before exploring the hypothesis, some background may be useful. In Norton Sound, on the Yukon River, and on the Kuskokwim River, commercial and subsistence salmon fisheries were similar in many ways (there were no commercial salmon fisheries in Port Clarence). Most commercial salmon fishermen were local Alaska Natives, who used small open skiffs and set gillnets, and who fished close to their home communities (Kohler et al 2004:2).

Compared with some other Alaska salmon fisheries, the Norton Sound fishery was small. During the ten years 1994-2003, the Norton Sound commercial salmon catch averaged 311,916 salmon annually, of which 246,363 were pink salmon (Kohler et al 2004:105). By comparison, from 1993-2002 the Bristol Bay commercial salmon catch averaged 25,113,484 salmon annually, of which 24,270,531 were sockeye salmon (Weiland et al 2004:100, 95).

Pink salmon were less valuable than sockeye salmon. Consequently, the average annual ex-vessel value of the Norton Sound

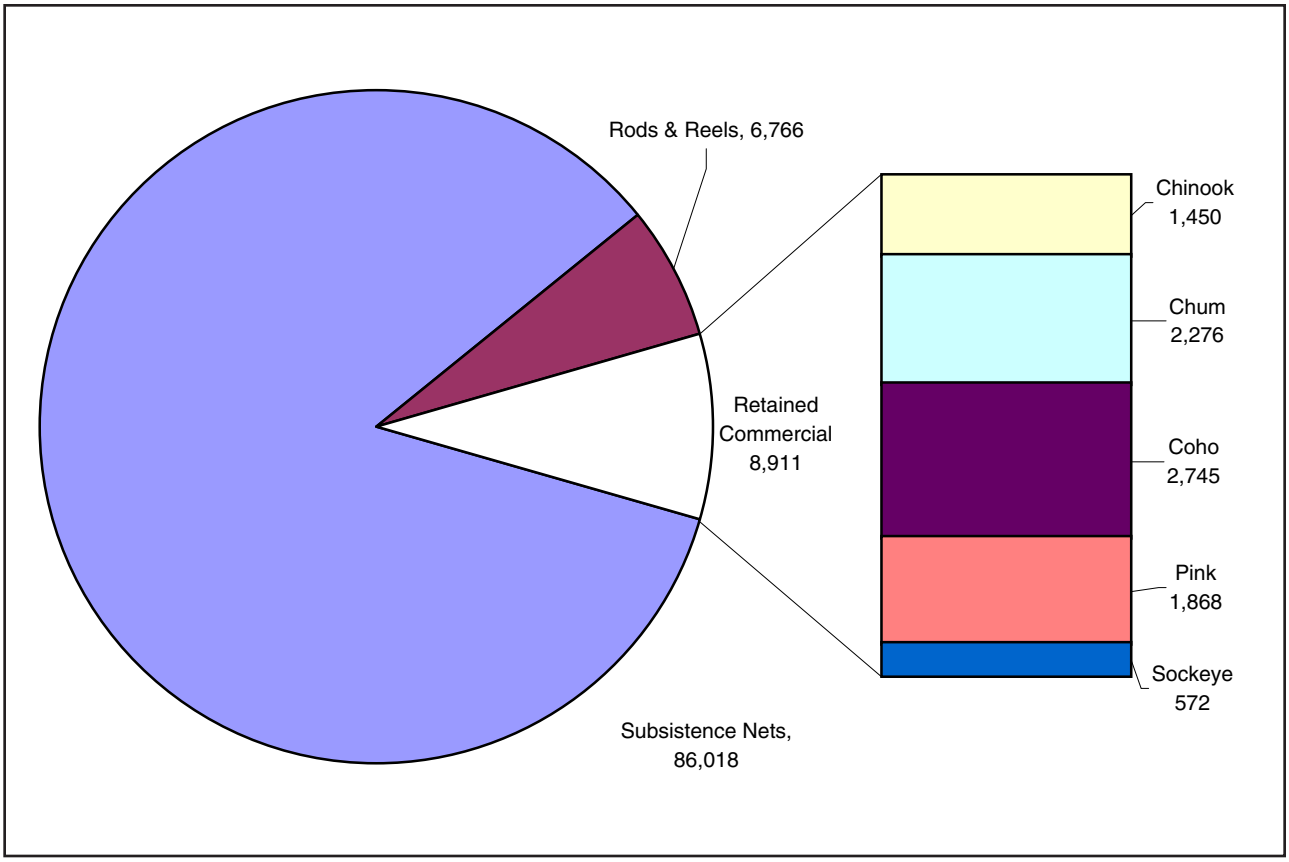

Figure 4-23. Salmon sources for commercial fishing households. The 581 commercial fishing cases in the survey sample retained 8,911 commercially-caught salmon for their personal use. Retained commercially caught salmon comprised about 9 percent of those cases' total salmon harvest of 101,685 salmon. Rod and reel harvests contributed about 7 percent.

catch from 1994 to 2003 was $284,436, while the average annual ex-vessel value of the Bristol Bay catch from 1993-2002 was almost $101 million (Kohler et al 2004:107, Weiland et al 2004:119).

Moreover, the study period was a period of deteriorating wild salmon markets throughout the world, as well as declining salmon abundance and increasing commercial restrictions in some areas of Norton Sound. Consequently, participation in commercial salmon in Norton Sound declined. The number of commercial salmon permit holders with Norton Sound addresses declined from 210 in 1994 to 149 in 2003. The number of commercial salmon permits fished in Norton Sound declined from 119 in 2003 to only 30 in 2003 (Kohler et al 2004:104).

Commercial fishermen in Norton Sound who stopped fishing commercially did not stop fishing altogether. They fished commercially during years when markets and prices made commercial effort worthwhile. In other years, they fished for subsistence. When engaged in commercial fishing, commercial fishermen were not allowed to subsistence fish (to prevent the sale of subsistence-caught salmon). Commercial fishermen were allowed to retain as many salmon as they wished from their commercial catch, and other members of the commercial fisherman's household were allowed

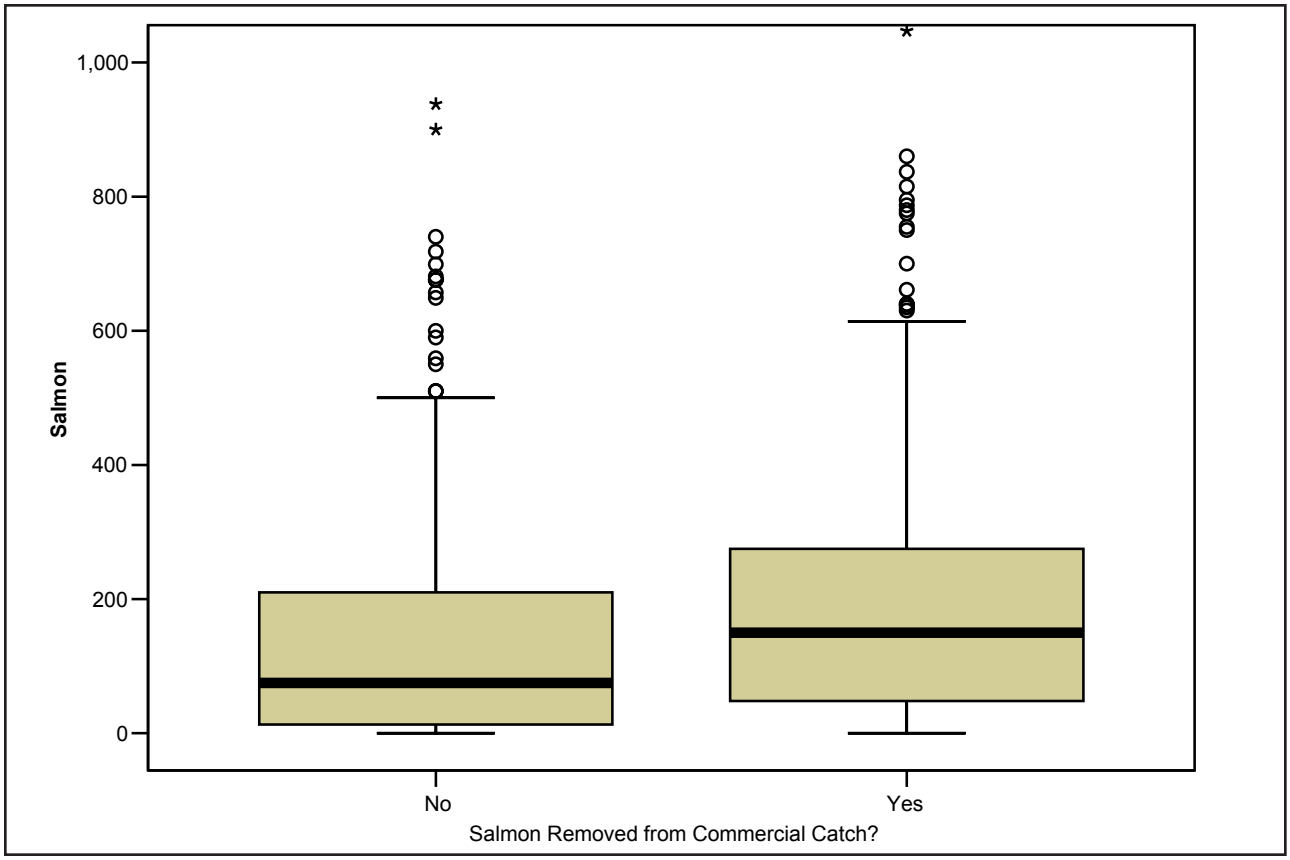

Figure 4-24. Total number of salmon reported by commercial fishing households. The boxplot compares total salmon harvests (i.e. subsistence nets, rods and reels, and retained commercial catch) for two categories of commercial fishing households. Households that did not remove salmon from their commercial catch (left) typically reported lower household salmon harvests than households which did retain salmon from their commercial catches (right). (The circles and asterisks represent outliers. See Figure 2-2 on page 20 for an explanation of boxplots.)

to fish in subsistence fisheries. This created a dynamic relationship between commercial and subsistence fishing.

From 1994 through 2003, 178 surveyed households reported that at least one member of the household fished for salmon commercially. Some households fished commercially in multiple years, so 581 surveys in the database reported commercial fishing. Of those, 255 cases (44 percent) reported retaining salmon from commercial catches. This analysis was limited to the 581 cases in which households reported commercial fishing.

Figure 4-23 shows the sources of salmon used by households who reported fishing commercially. Of a total 101,695 salmon reported in 581 cases, 86,018 came from subsistence nets (85 percent), 6,766 came from rods and reels (7 percent), 8,911 were retained from commercial catches (9 percent). Thus, commercial fishing operations were not a major source of salmon for Norton Sound families, even those involved in commercial fishing. Commercial fishing households that retained salmon from commercial harvests had higher total salmon harvests (subsistence, sport, and commercial) than commercial fishing households that did not retain salmon (Figure 4-24).

To return now to the hypothesis, the assumption was that if households retained commercially-caught salmon for their own use,

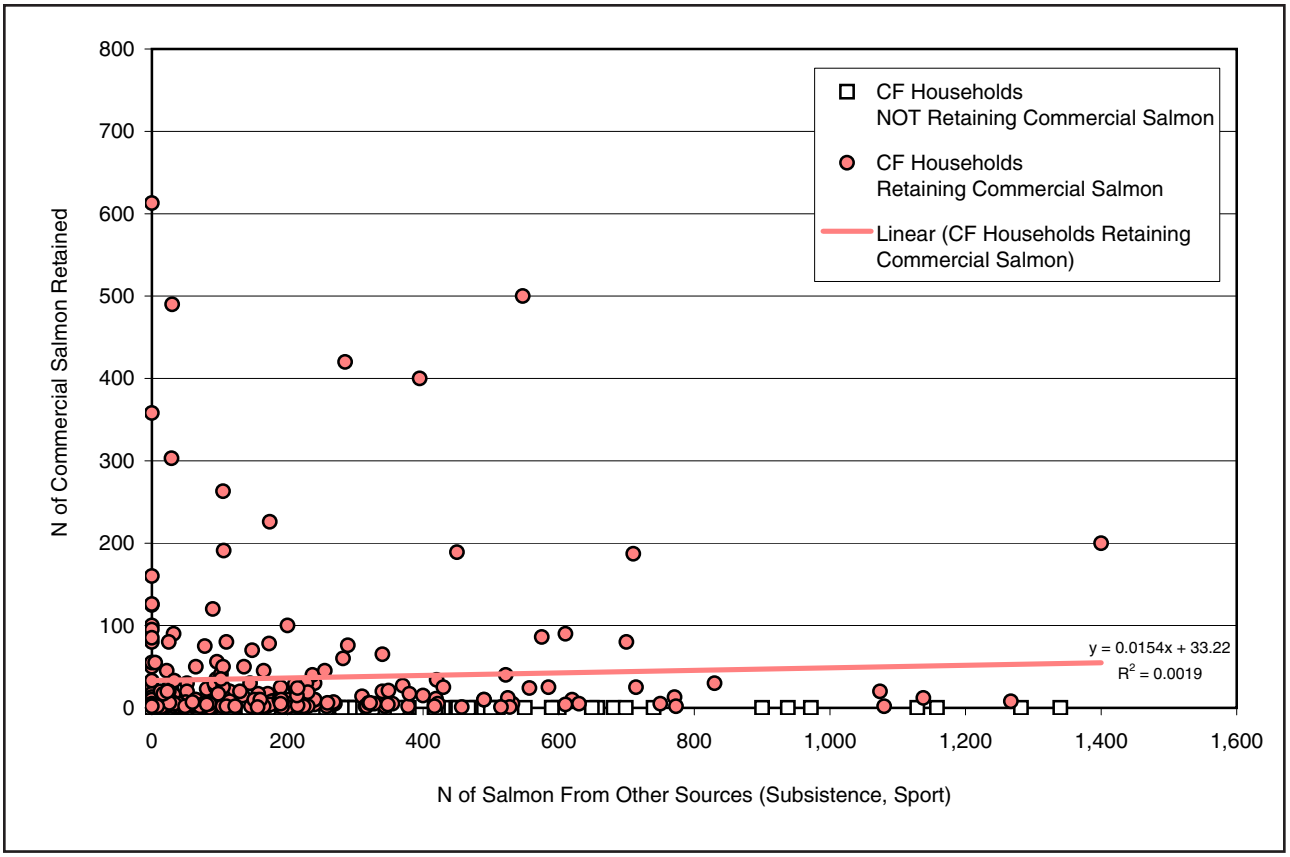

Figure 4-25. Scattergram, harvests by commercial fishing households. Chart compares the number of salmon retained from commercial havests (y-axis) with the number of salmon from other sources (x-axis). Fifty six percent of the commercial fishing households retained no commercial salmon for their own use (red circles on the x-axis). The other households retained between 1 and 613 salmon for their personal use. There was no signficant relationship between the number of salmon retained from commercial fisheries and the number of salmon obtained from subsistence and sport fisheries.

then those household would need fewer salmon from subsistence fisheries, and vice versa. If the hypothesis were true, there would be an inverse relationship between the two variables. As commercial retention decreased, other harvests should increase.

Among households that retained salmon from commercial fishing, the typical (median) amount retained was only 10 salmon. The average amount retained was 36 salmon, which was influenced by 15 households that retained more than 100 salmon. In 58 cases, commercial fishing households relied only on retained commercial salmon for their households' needs (that is, these households harvested no salmon in subsistence and sport fisheries). The remaining cases showed no discernable pattern.

Figure 4-25 compares the number of salmon retained from commercial fishing with the number of salmon obtained from subsistence and sport fishing, for each commercial fishing case. A trend line for households that retained salmon indicated that, for every 200 salmon harvested in subsistence and sport fisheries, 3 additional commercial salmon would be retained (slope = 0.015), but the relationship was weak. Thus the data did not support the hypothesis. The amount of salmon retained from commercial harvests was not significantly related to the amount of salmon harvested in other fisheries.

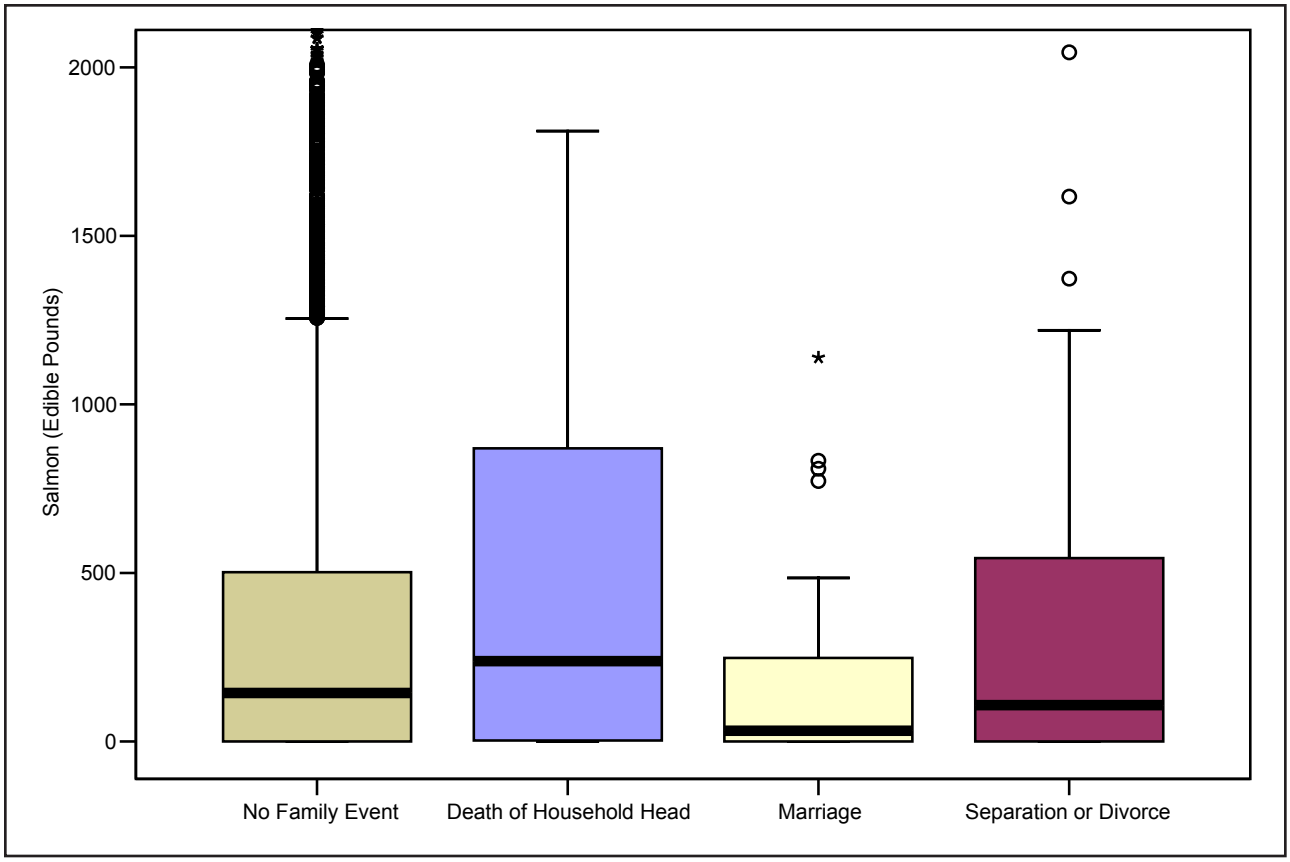

Figure 4-26. Pounds harvested by family event category. Unexpectedly, households in which a household head died reported higher than average salmon harvests in the year of the death. Households in which heads married reported lower than average harvests, perhaps because marriages occurred most frequently in younger, lower-harvesting households.

Family Events

Hypotheses: *Households that experience a major family event – death of household head, marriage, separation or divorce – harvest less during the year of the family event than households that do not experience a family event.* The assumption was that a family's resources were directed towards the family event, consequently fewer resources were available for harvesting salmon.

Data for testing this hypothesis were gathered retrospectively with the supplemental data collection and verification sheet in 2004. For each household, key respondents in each community flagged the years in which that household experienced a major family event. To test the hypothesis, cases were categorized by the type of event (or "no event"), then the amounts of edible salmon harvested by each category were compared.

Interestingly, the analysis showed that households that experienced a "family event" harvested 378 pounds of salmon, on average, compared with 387 pounds for "no-event" households, a statistically insignificant difference of about one salmon. But there were differences in the different categories of family events (Figure 4-26). Households that experienced the death of a head actually harvested more during the year of the death than "no event"

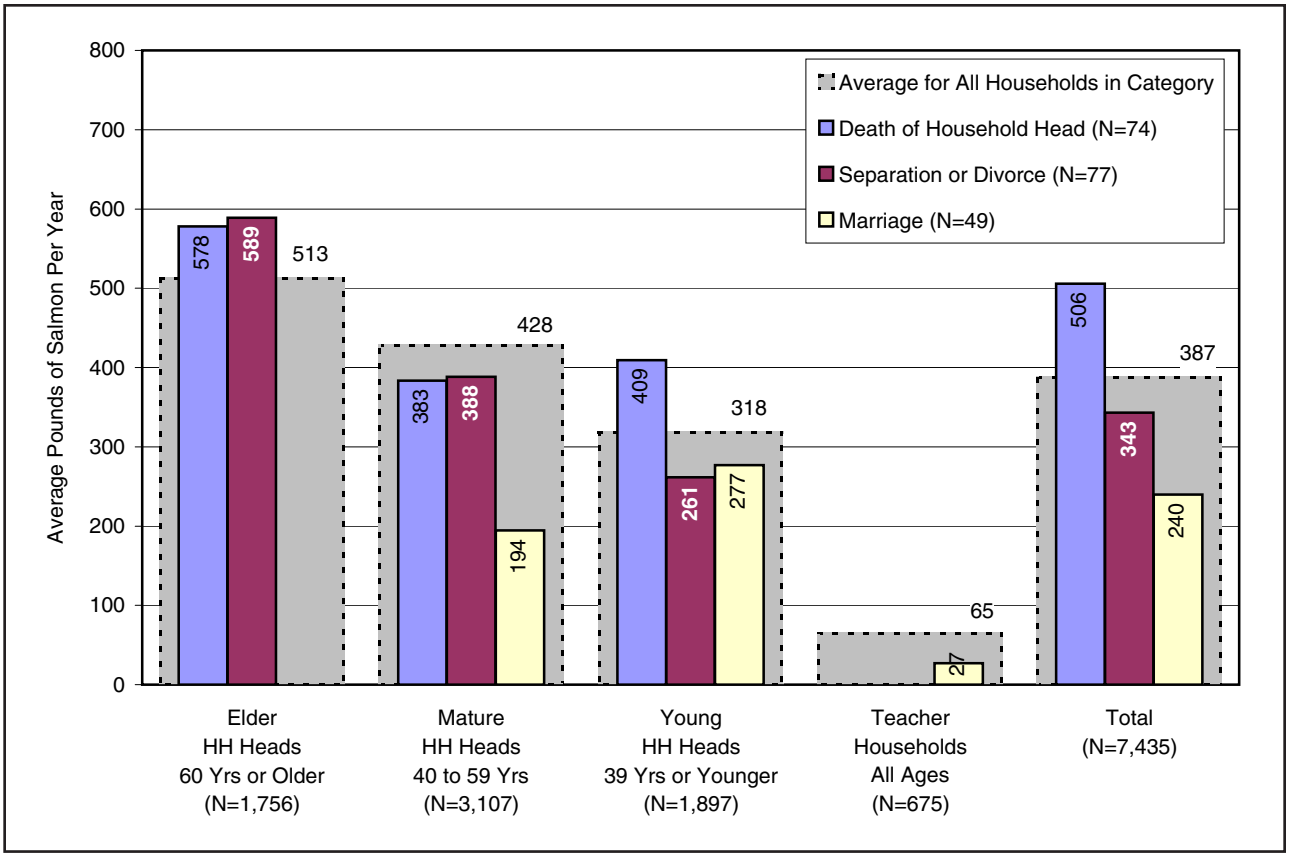

Figure 4-27. Pounds harvested by family event category and hosuehold type.

households. Households that experienced a separation or divorce harvested somewhat less than no-event households. Households that experienced a marriage harvested the least (of the three event-categories).

Because salmon harvests were associated with household type, as discussed previously, the analysis of the family events data was repeated, controlling for household type (Figure 4-27). The effects were different among the different age-categories. Negative effects of family events were most pronounced among middle-aged households (heads aged 40 to 59 years), where all three kinds of events resulted in lower harvests. On the other hand, among elder households, there was a small positive effect. Elder households actually harvested more salmon, on average, in the year of a family event (death, divorce, separation).

One can speculate about the effect of family events on elder households. The death of an ill or incapacitated elder could free up labor for salmon harvesting. An elder death might motivate survivors to reinvigorate traditional pursuits. An elder death might require additional salmon for funeral ceremonies, but in most northwest Alaska communities, residents cease all harvesting activities between a death and funeral so that would be an unlikely explanation.

Compared with the salmon harvest data gathered on the annual survey, the family event data gathered on the retrospective survey almost certainly were incomplete. Of the 7,803 cases available for analysis, only 200 were flagged for family events, an average of 20 per year for 800 households. Some of the household type sub-samples were too small to be useful; e.g. there were no elder marriages. Nonetheless, others were sufficient. There were 45 elder household death cases, 34 mature household separation-divorce cases, 31 young household marriage cases, and 37 young household separation-divorce cases.

The hypothesis was not supported by the data. Given the unexpected results, it would be worthwhile and prudent to explore the hypothesis with more complete family events data.

Roles of Individual Households

So far, these analyses of salmon harvest patterns have compared communities and categories of households with one another, but have not compared individual households' patterns. The following analysis explores, briefly, harvest patterns for individual households over the ten-year study period.

To review, in all communities a majority of the salmon were harvested by a minority of the households (the 30-70 hypothesis). In some communities, this concentration of harvest was very similar from year to year. In other communities, the concentration of harvests varied considerably. Although this was not true in every community, in general households with older heads harvested significantly more salmon than households with young heads, and households headed by couples harvested more salmon than households headed by single persons. Households that consistently harvested salmon also were among the high harvesting households in their communities. Neither commercial fishing retention nor family events seemed to affect harvest levels.

Given these patterns, it was reasonable to assume that in each community, there existed a stable core of high-harvest households that took the majority of the salmon year after year. Further, it was reasonable to assume that these were the *same* households year after year. But were they? That is the question explored below.

To compare households from year to year and to control for annual variations in harvest levels, researchers calculated an annual harvest rank for each household in each community. For each year, the highest harvesting household was ranked first for that year. The lowest harvesting household's rank was equal to the number of households surveyed in that year. A household that was surveyed

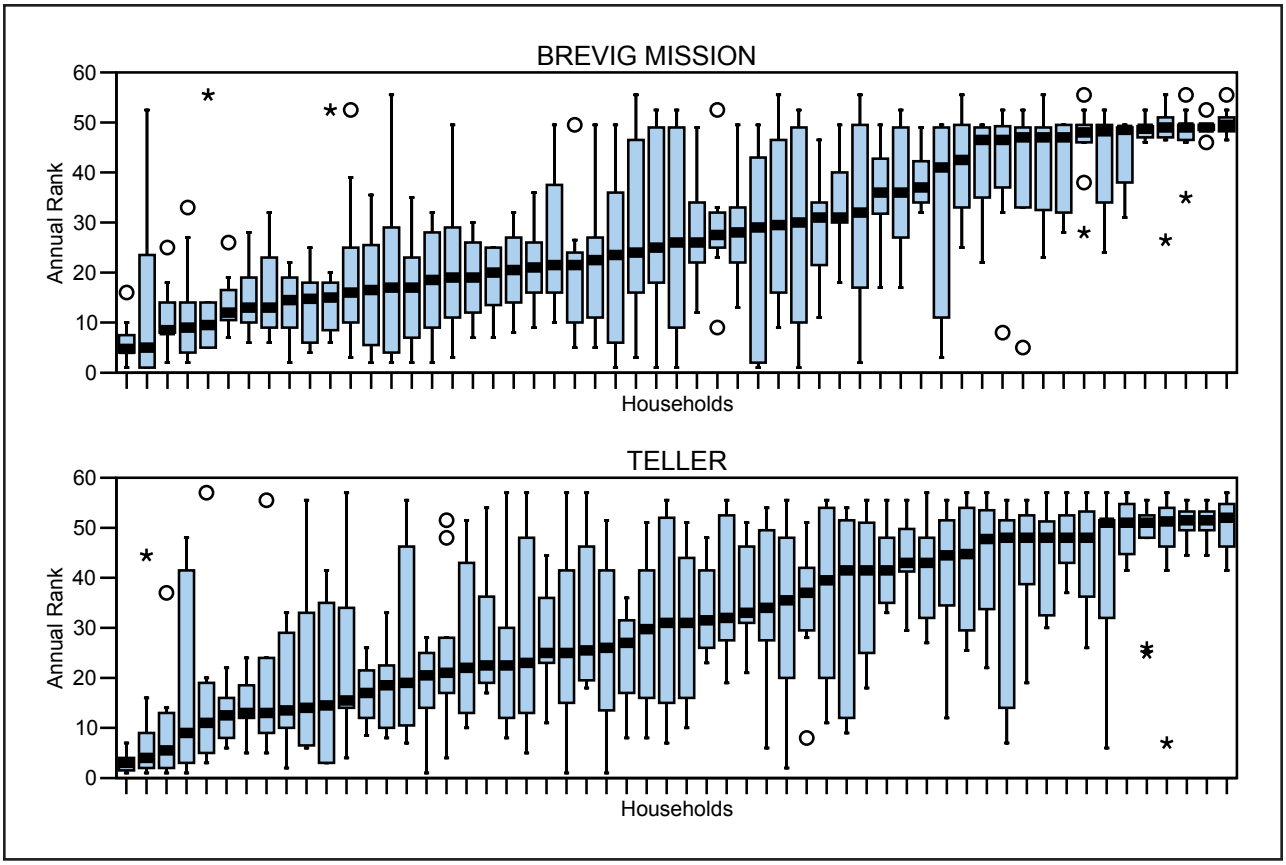

Figure 4-28. Annual harvest rank by household, Brevig Mission and Teller. Each vertical column represents one household with at least six years of harvest data. Households are ranked along the x-axis in order of their median (typical) harvest. The households that typically harvested the most appear to the left. The y-axis displays households' annual ranks among all harvesting households. The asterisks and circles represent outliers. Households whose ranks in the community harvest was about the same each year are represented by a short box. Households whose ranks varied widely from year to year are represented by a tall box.

every year from 1994 to 2003 would have 10 rank values ranging between 1 and N, one for each year. The rank was a measure of the relative contribution of a particular household to the total community harvest in any single year, regardless of whether the total community harvest was unusually large or unusually small.

Figure 4-28 includes two boxplots showing the ranks of households in Brevig Mission and Teller. The boxplots allow one to quickly assess the consistency of salmon harvesting by individual households in a particular community. First, though, an explanation of the data in the boxplots may be helpful.

The boxplots include only households with at least six years of harvest survey data. Each vertical box in the plot includes data for a single household, and illustrates the range of ranks for that household over the 10 years of the study. In the boxplots, households are sorted left to right based on their median rank in their community. The households that typically had the highest salmon harvests in the community appear on the left in each boxplot, while the lowest harvesting households appear on the right.

If a household contributed consistently to the community harvest, that household's rank would be similar from year to year. In the figures, that would be indicated by a short vertical box, by short

"whiskers" above and below the box, and by no outliers (the circles and asterisks). Inconsistent contributors will be indicated by a tall vertical box, and by long whiskers or outliers.

Looking at the Brevig Mission boxplot in Figure 4-28, the first household on the left had the highest median rank (the black horizontal bar) among all Brevig Mission households. Although its median rank was 4.75, in some years it ranked as high as first, and in other years it ranked as low as tenth. One year (the circle above the box, an outlier) it was ranked 16th. About half the time, it ranked between fifth and eighth. All in all, it *was* a consistently harvesting households, likely one of the "super-households" described by Wolfe (1987).

The second household from the left in the Brevig Mission boxplot also ranked fifth, just below the previous household. But this household's harvests were less consistent and consequently had a much greater range of ranks, from first to fifty-third. Half of the time, it ranked between first and twenty-fourth.

The next ten Brevig Mission households were more consistently high harvesters, similar to the first household, although none was as consistent as the first. From the twelfth household on, most household ranks varied considerably until, at the far right, a group of five households consistently ranked at the bottom of the community harvest scale.

Looking at the Teller boxplot, the first household on the left was *more* consistent than any other high harvesting household in Figure 4-28. The second and third households also were consistently ranked in the top 20, as was the fifth household. However, there was at least one outlier for the second, third, and fifth households, years in which they ranked about 45th, 36th, and 58th on the community harvest scale, respectively.

Other than the very highest and lowest harvesting households, though, consistently ranked households were the exception, not the rule. Even among the very highest harvesting households, there were one or more households that ranked near the top in one or more years and near the bottom in another year. There were two households in Teller and two households in Brevig that ranked first one year and last in another year. The same pattern existed for the lowest harvesting households. Although they typically harvested little; there were several who ranked among the highest harvesting households in one or two years.

Figure 4-29 and Figure 4-30 include box plots for the eight Norton Sound communities. In every community, a high proportion of households ranked first in at least one year. In Golovin and St. Michael, nine different households were ranked first during the

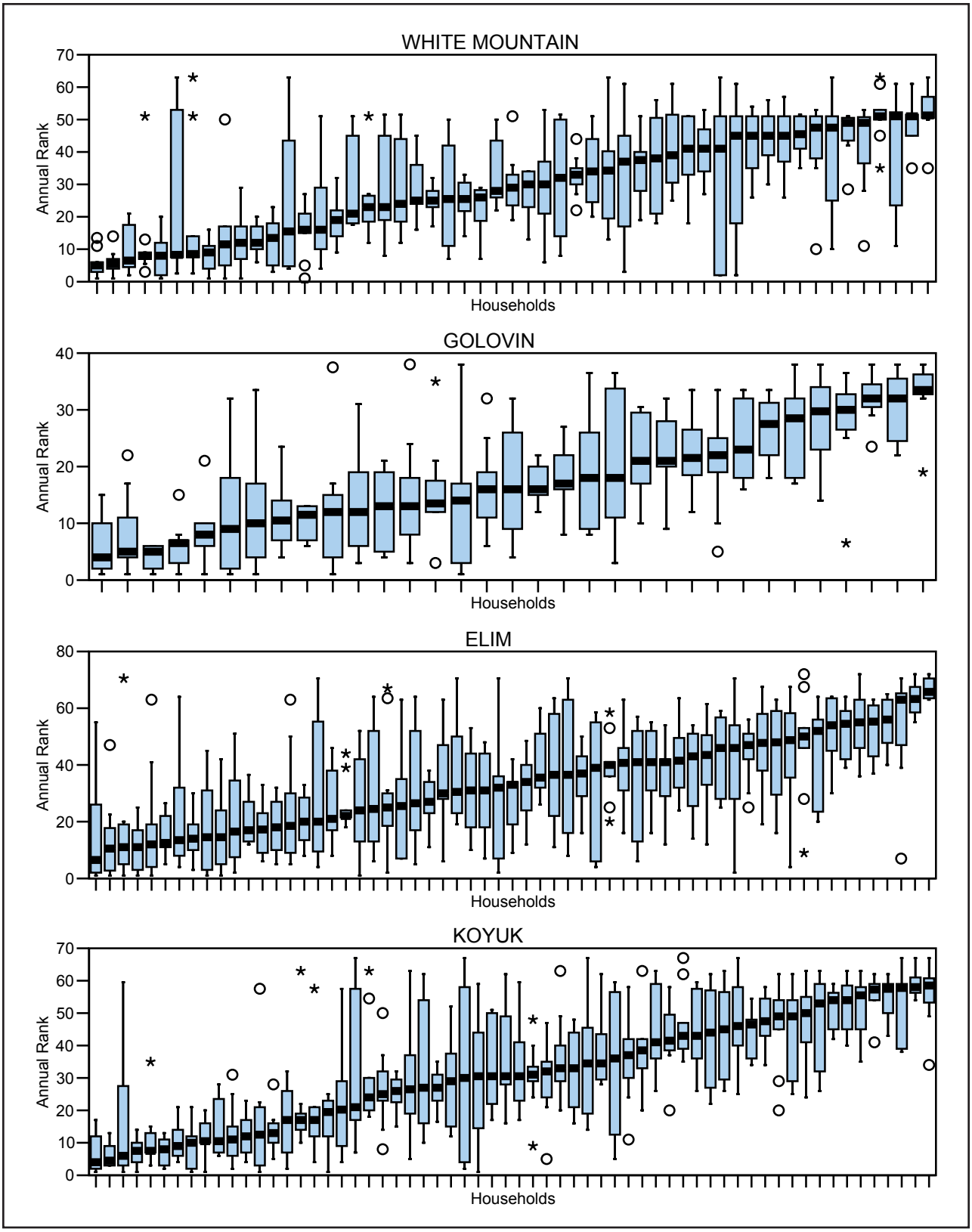

Figure 4-29. Annual harvest rank by household, White Mountain, Golovin, Elim and Koyuk. In every community at all ranks, there were households whose rank varied from near first to near last over the decade. The ranking of high harvesting households varied less in Koyuk than in Elim.

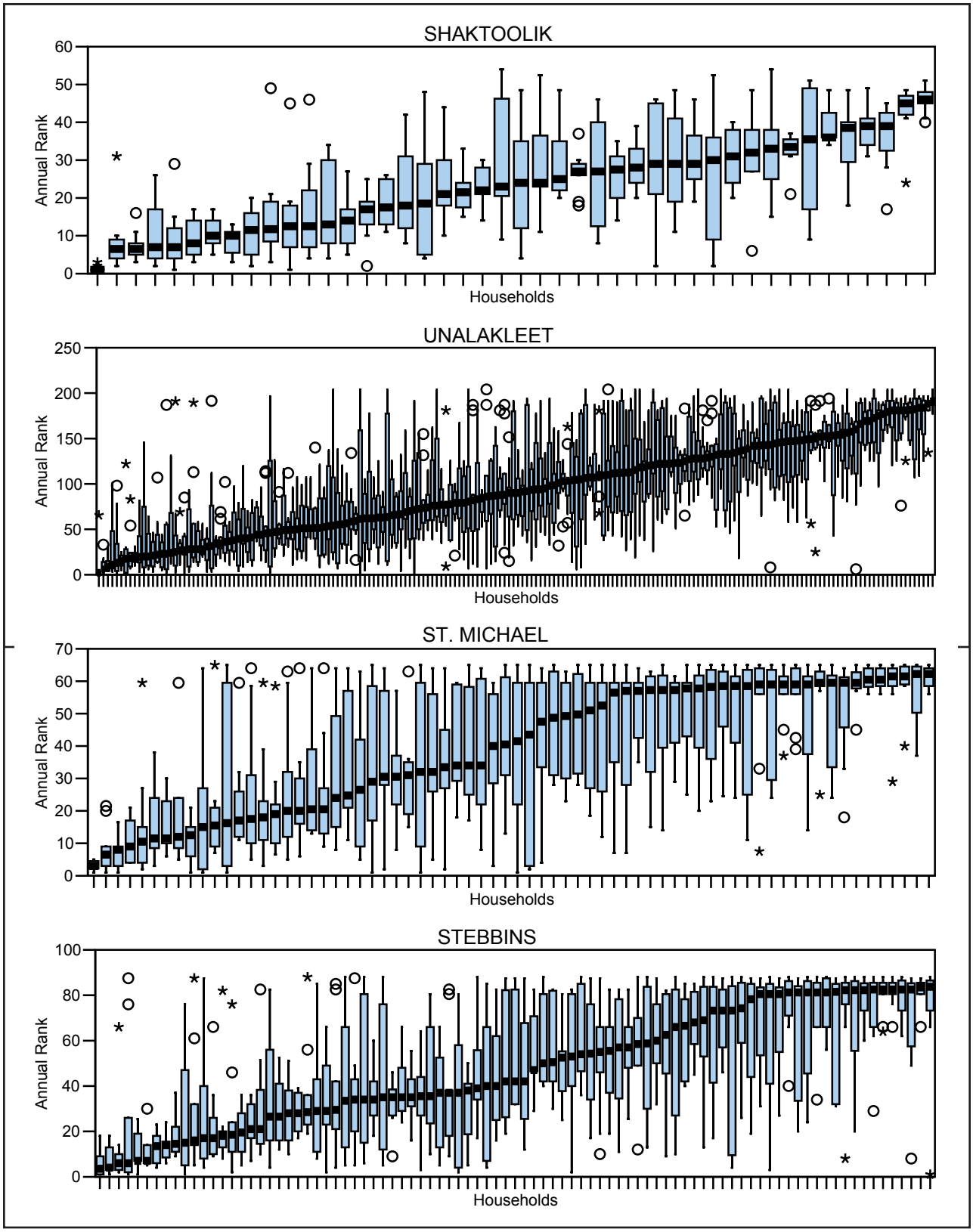

Figure 4-30. Annual harvest rank by household, Shaktoolik, Unalakleet, St. Michael, and Stebbins. Shaktoolik households were more consistently ranked than the other three communities. In particular, the highest ranked household in Shaktoolik never ranked lower than third of all households in the annual community harvest.

ten years of surveys. In White Mountain, Elim, and Koyuk, eight different households ranked first. The exception was Shaktoolik, were only three households consistently ranked first. Except for Shaktoolik, it would be difficult to predict the high harvesting household in any given year.

Deviation in ranks by households were least in Elim and Shaktoolik (visually, many household boxes were short). Deviations in ranks were the greatest in St. Michael and Stebbins (visually, many household boxes were tall).

To return to the question posed near the beginning of this analysis – were the *same* households responsible for a majority of the harvests year after year – it seems that some households did consistently contribute to the community harvest. But in every community, there were many unpredictable households. There were households that usually contributed much and then one year contributed little. There were households that usually contributed little and then in one year ranked among the highest harvesters in their community.

5
Summary and Discussion

Although the ten communities in this project shared a common geography and scale, within those confines each was different. Growing and shrinking, Iñupiaq and Yu'pik, coastal and inland, with and without commercial fishing, the communities varied in many ways. For most communities important salmon stocks were in decline, yet in Port Clarence sockeye stocks were increasing. Even between three pairs of communities that fished the same salmon stocks (Brevig Mission and Teller, Golovin and White Mountain, Stebbins and St. Michael), there were differences. For example, although Brevig Mission and Teller were separated by only five miles of water across Port Clarence, Brevig Mission had increasing harvests, while Teller had decreasing harvests.

This project explored salmon harvest data collected in the northwest salmon survey project from 1994 to 2003. This final chapter discusses some of the findings of this project. It begins with a discussion of methods, because the methods used to gather and store the data were essential to the completion of project. Then it discusses trends and patterns explored in the findings chapter.

Methodological Issues

The most important methodological factor in this project was the decision to use consistent household identification numbers across a series of annual harvest surveys, and a subsequent commitment to that goal by a series of researchers and analyst programmers. In retrospect, that may seem self-evident, but it was not easy to do. Most agency data sets known to these researchers are not so consistent. When key respondents in each of the study communities reviewed the identification codes for this study, they found only 287 cases (3.2 percent) that needed to be corrected, usually the consequence of a family leaving a community and returning a few years later. Thus the vast majority of codes did indeed track a single household during the study decade.

Another key to these analyses was a commitment by the project leaders to use the same survey form year after year. Although the

form did change over time, the core question set remained intact until 2003. A stable survey instrument meant that the underlying database also changed little from year to year. That made it possible to aggregate ten annual databases into one large database.

Even so, as researchers in this project were reminded, aggregating annual harvest survey data sets is a substantial undertaking. Minor errors and inconsistencies frustrated analyses throughout the project. For example:

- In some years, households' reports of zero harvests were left blank for variables like "Number of Chum Salmon Harvested." The missing values (which should have been zeroes) corrupted sum, median, and mean calculations.
- After household identification codes had been verified and household records had been corrected or merged when appropriate, sums of salmon harvested no longer agreed with sums of pre-corrected, pre-merged datasets. That led to the discovery of several cases of "unsurveyed" households with harvest data. A hand check of original tracking sheets showed the "unsurveyed" households had in fact been surveyed. Once the "surveyed" variable was corrected, the sums once again agreed.
- The use of string (alphabetic) variables led to variant entries for the same response, like "Unalakleet, Unk., Unk, and Unalakleet Subdistrict." Most string variables were recoded to numeric variables with labels (e.g. where 6 = "Unalakleet Subdistrict").

It is easy to underestimate the time and effort required to join and clean large data files. Errors may not become apparent until analyses are underway, and occasionally require repeating large sections of analyses. In this project, data inconsistencies required hours and sometimes days to locate and to correct. No doubt errors still remain in the aggregated data file. It is hoped they are minor.

There are a number of proposals to join many different kinds of ecological databases in Alaska. Such projects are considerable tasks in the best of circumstances.

Trends

For the ten study communities combined, estimated subsistence salmon harvests from 1994 through 2003 trended lower by 5.8 percent annually. Most of the declines occurred during the first five years (1994-1998), when harvests trended lower by about 8 percent annually. During the latter years (1999-2003), harvests trended lower by about 1 percent annually across all communities.

It would be reasonable to characterize harvest trends as declining

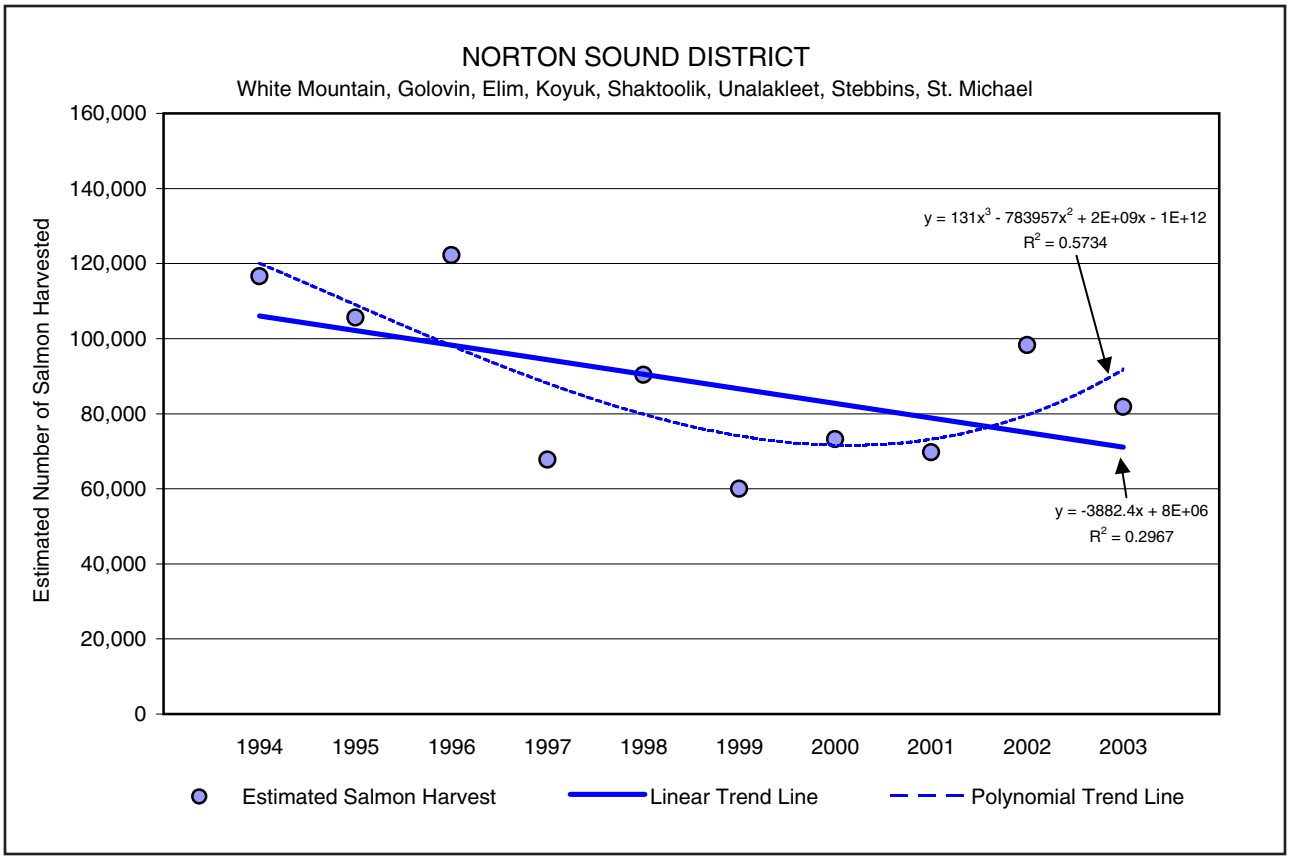

Figure 5-1. Salmon harvest trends in Norton Sound, 1994-2003. In the Norton Sound District, two clusters of harvests appear: a cluster averaging 115,000 salmon from 1994-1996, and a cluster averaging 77,000 salmon from 1997-2003. The polynomial trend line suggests harvest trends may have reversed following the harvest lows in 1999. However, half the communities experienced their lowest harvests in 2003.

for five years and then stable for five years with increases in some areas. For Norton Sound, it also would be reasonable to characterize harvests as occurring in two regimes. During the first regime, from 1994 to 1996, harvests clustered around an average of about 115,000 salmon annually. During the second regime, from 1997 through 2003, harvests on average were a third less, clustered around an average of about 77,000 salmon annually. Either interpretation is evident from the point data in Figure 5-1 (which also appears in this report as Figure 4-1).

Pink salmon runs were much stronger in even-numbered years than in odd-numbered years, and this was reflected in harvests. Separating pink salmon harvests from the harvests of other, larger salmon species made it easier to see trends among the other species, particularly in the Norton Sound District where odd-year pink harvests were on average 39 percent less than the even-year harvests.

In the Port Clarence District, the declining trend in harvests of salmon other than pink salmon was influenced by unusually high chum and sockeye harvests in 1995. If the exceptional chum and sockeye harvests in 1995 were replaced with the average of the other nine years, there would be no trend for salmon other than pink salmon. Coho and sockeye harvests declined slightly in the

middle of the study period and then recovered. Interestingly, harvests of sockeye in Port Clarence do not seem to have been much affected by substantial increases in sockeye salmon abundance in the Kuzitrin-Pilgrim River system during the latter years of the survey project.

In the Norton Sound District, the patterns in pink harvest, especially odd-year pink harvests, resembled those in the Port Clarence District, ending and beginning the decade at about twice the levels seen during the middle of the decade. For the other salmon species, trends in Norton Sound were different than in Port Clarence. In Norton Sound, harvests of salmon other than pink declined by about 3,200 salmon annually. The decline was attributable to declines in chum, coho, and chinook salmon harvests virtually across the decade. Sockeye were not widely available in the Norton Sound District, and contributed only 0.9 percent to the total salmon harvest from 1994-2003.

Community by community, harvest trends were worse than average in: Golovin (trend -11.4 percent annually), St. Michael (-10.3 percent), Teller (-8.5 percent), White Mountain (-7.8 percent), and Stebbins (-6.0 percent). Trends were better than average in: Shaktoolik (-5.4 percent), Koyuk (-2.9 percent), Elim (-4.7 percent), Unalakleet (-4.2 percent), Koyuk (-2.9 percent), and Brevig Mission (+12.1 percent). Brevig Mission was the only community with an increasing trend over the decade. The increasing trend in Brevig Mission occurred entirely in the latter period (1999-2003), when harvest trended upward by 46 percent annually. During first five years, harvests in Brevig Mission trended downward by about 7 percent annually.

It was interesting to explore possible relationships between community populations and community salmon harvests (Figure 5-2). During the decade, human populations increased in seven of the ten study communities, while salmon harvests declined in nine of the ten communities. The total number of households increased by about seven households per year, while the number of households that "usually fished" increased by only about one household a year. And the number of households that actually *caught* a salmon declined by about two households a year from 1994 to 2003. So not only were households catching fewer salmon, fewer households caught even one salmon.

Clearly growing community populations did not result in growing subsistence efforts or harvests. The downward trend in harvests was more pronounced in growing communities than in shrinking communities. If these same trends prevailed in times of stable or

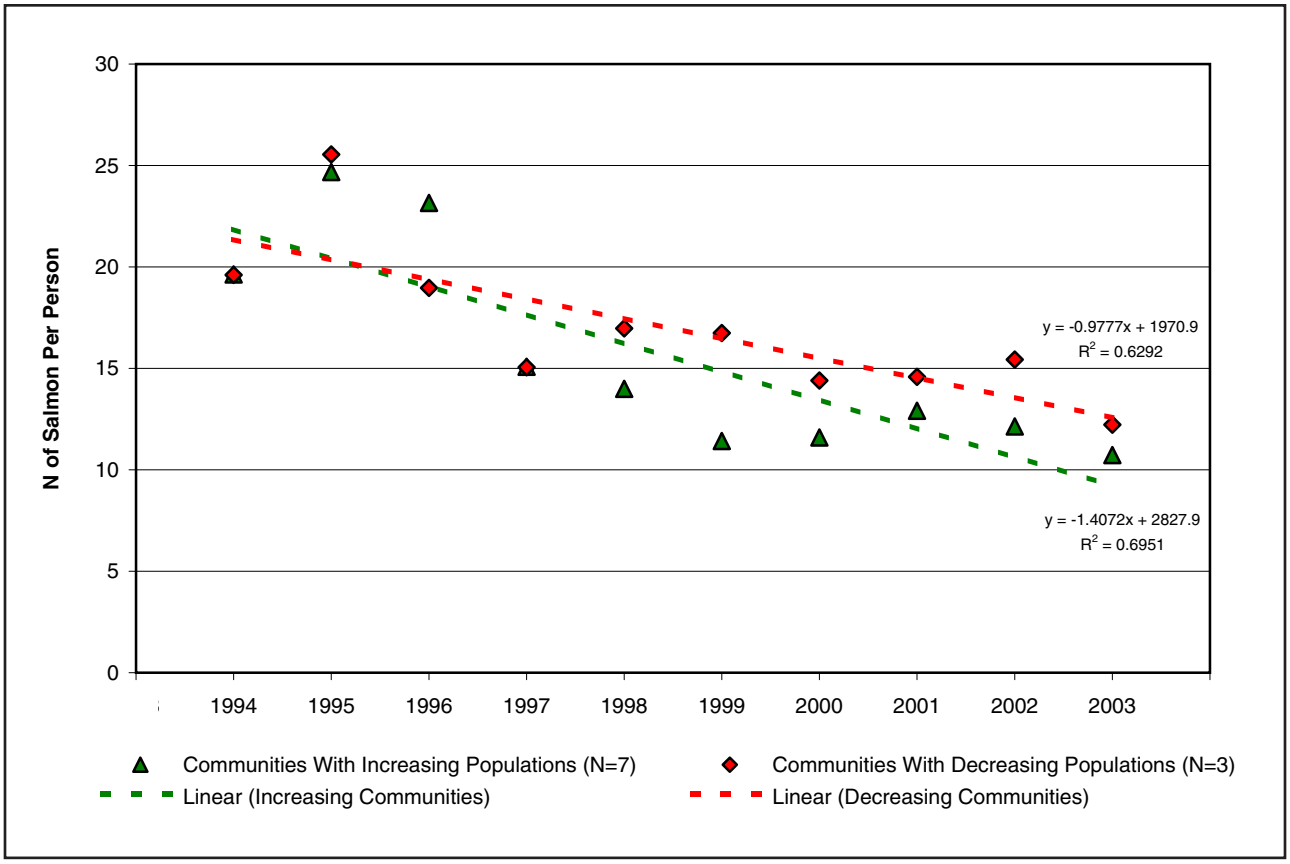

Figure 5-2. Per capita salmon harvests in growing and shrinking communities. The declining trend in salmon harvests was more pronounced in growing communities than in shrinking communities.

increasing salmon stocks, they would have a moderating effect on the demand for salmon.

In sum, while harvests appeared to have stabilized in the latter years, it would not be correct to characterize the overall situation as improving, at least through 2003. For half of the study communities (White Mountain, Golovin, Koyuk, Unalakleet, and Stebbins), the lowest estimated harvests of the decade occurred in 2003.

Patterns

In Norton Sound and Port Clarence, as elsewhere in Alaska, individual households' annual subsistence harvests of salmon varied widely, from zero to more than 5,000 salmon. Further, for a particular household from one year to the next, subsistence harvests also might vary from zero to thousands of salmon. At least in part, this is because salmon fishing in Alaska is an inherently unpredictable enterprise. Salmon runs fluctuate; pink salmon runs routinely fluctuate by an order of magnitude. Weather limits effort; weather frustrates attempts to process traditional dried salmon. Equipment fails; repair parts are difficult to obtain. But perhaps most important,

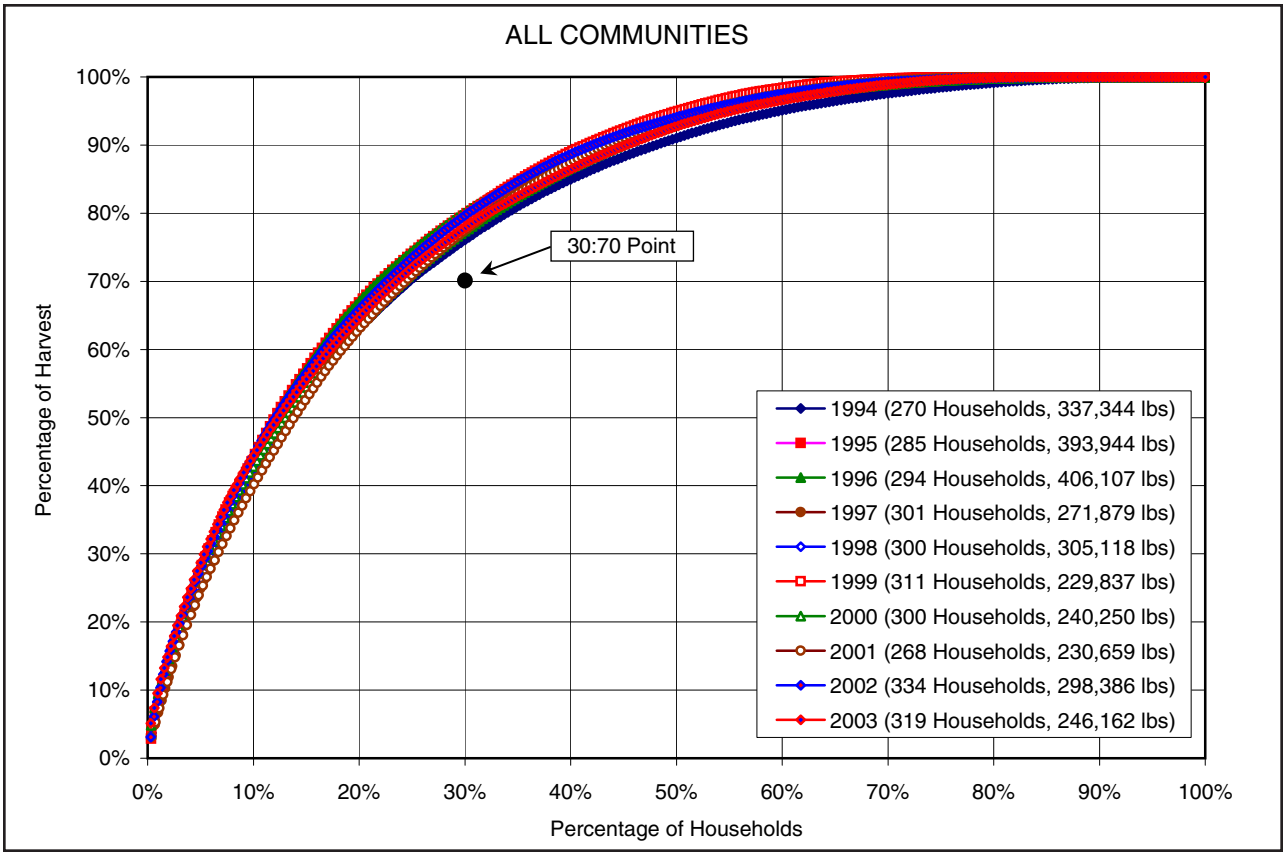

Figure 5-3. Pareto chart, all communities 1994-2003. A Pareto line that passed through the 30:70 point would exactly fit the 30:70 hypothesis. At the regional level, there was little difference in the pattern of harvests from year to year, even though the amounts harvested varied from 229,000 to 406,000 pounds.

different households have varying abilities to harvest salmon and different needs for salmon.

Despite all the variation in harvests, there still were predictable patterns, patterns that might be used to refine estimation and prediction. From year to year, through all harvest regimes, the concentration of harvests was very similar. This is evident in Figure 5-3, which is a series of ten Pareto lines, each line showing cumulative harvests of all households in the study communities for each year from 1994 to 2203. Through many different levels of abundance, through a decade of variable summer weather, with harvests ranging from 67,000 to 140,000 salmon, each year about 23 percent (range, 21.8 to 24.6 percent) of the households harvested 70 percent of the salmon, by weight.

Pareto charts were useful for comparing harvesting patterns over time or among communities. Pareto charts also have promise for exploring possible sample biases, especially when prior census data for the same species are available for comparison. A Pareto line that diverges substantially from a community's previous or subsequent patterns suggests, absent other factors, a biased sample like that obtained in White Mountain in 1994. A Pareto analysis could be used, for example, to explore whether household permit data were incomplete.

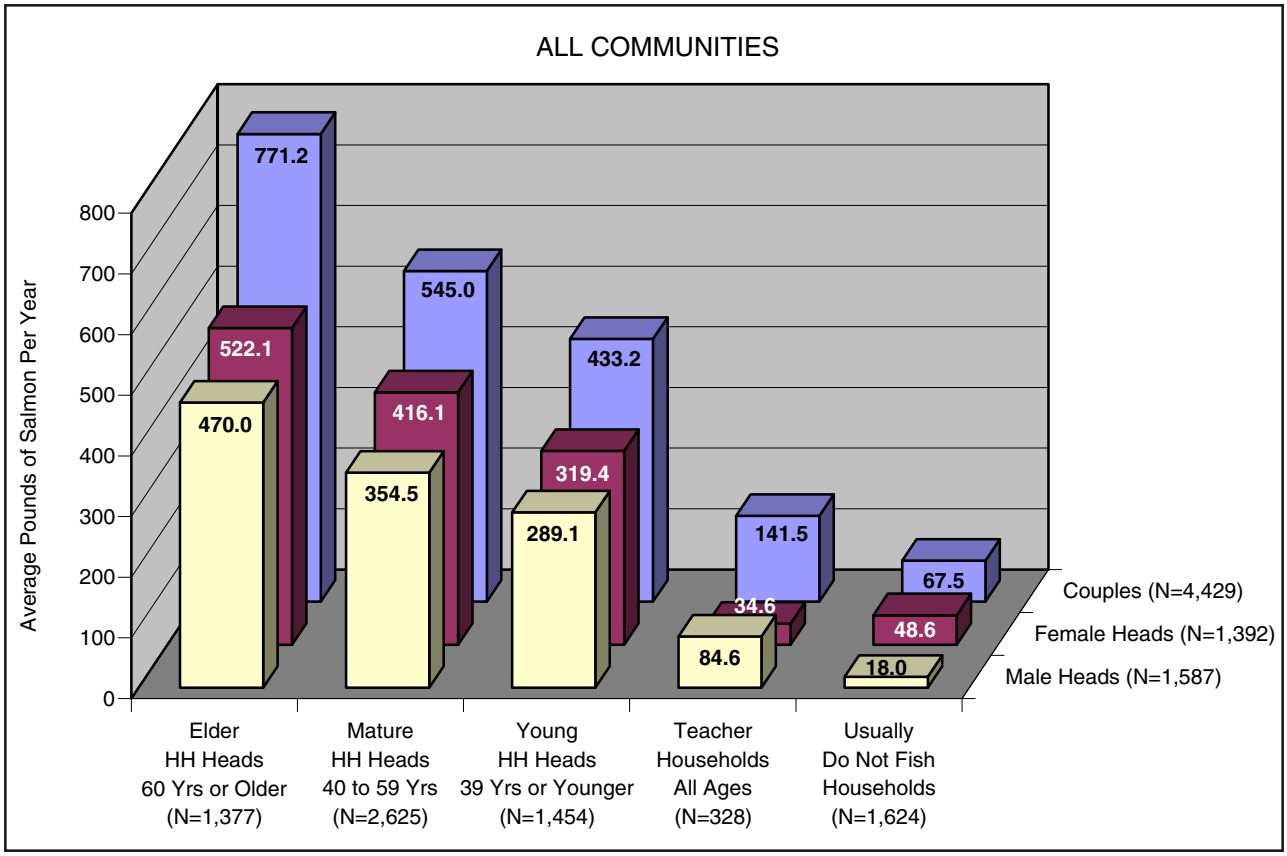

Figure 5-4. Average pounds of salmon harvested annually, by household type. The age and gender of household heads were significantly related to the harvest of salmon (in edible pounds).

Predictable patterns were also apparent in the harvests by the age and gender of household heads. Setting aside teacher households and households that usually did not fish, harvests increased with the age of the household heads, and decreased when household heads were single, especially single males. For all households in all communities in all years, the average harvest was about 398 edible pounds of salmon per household.

For elder couples (at least one head 60 years old), the average harvest was about 771 pounds per household, for elder single female households, 522 pounds, and for elder single male households, 470 pounds (Figure 5-4). Households headed by elder couples were the highest harvesting category in eight of the ten communities, but otherwise relationships between head-age, head-type, and harvest quantities varied from community to community. This was partly because of the small number of samples in the single female head, single male head, and teacher categories. In Unalakleet, where there were at least 30 cases in every category except single-female teacher (where n=16), the relationships among the variables were mostly as expected.

In each community a group of households were consistently active. That is, each year they were surveyed, they reported harvesting

salmon. It was reasonable to assume that this group included the minority of households that contributed 70 percent of the harvest and, further to assume that the harvests by these "fish-every-year" households would be as consistent as their effort. If those assumptions were true, then it was also reasonable to assume that the remainder of the households in the study communities – the "fish-some-year" households – would account for most of the variation in community salmon harvests. However, the latter assumption proved to be false.

The number of harvest-every-year households was quite stable from year to year, averaging 296 households annually. Because the number of harvest-every-year households remained stable while the population increased, the proportion of harvest-every-year households declined from 36.5 percent in 1994 to 33.2 in 2003. The proportion of salmon harvested by these consistently fishing households also was consistent through all regimes of harvest, from a high of 406,924 pounds in 1996 to a low of 229,266 pounds in 1999. The fish-every-year households harvested 58.6 percent of the total on average, ranging between 55.4 percent and 62.0 percent and trending upwards about 0.3 percent annually. Although intermittent households were cycling in and out of the fishery, their numbers and their contribution to annual harvests were similar from year to year.

In other words, a stable number of fish-every-year households was becoming a smaller proportion of the communities over time, while gradually contributing a larger proportion of the salmon harvest (in edible pounds).

One hypothesis explored whether retained commercially-caught salmon might substitute for subsistence salmon. The data showed that commercial fishing operations were not a major source of salmon for Norton Sound families, providing only about 9 percent of the total salmon reported for those households involved in commercial fishing.

The hypothesis assumed that if households retained commercially-caught salmon for their own use, then those household would need fewer salmon from subsistence fisheries, and vice versa. If the hypothesis were true, there would be an inverse relationship between the two variables. As commercial retention decreased, other harvests should increase. However, that proved false. For every 200 salmon harvested in subsistence and sport fisheries, 3 additional commercial salmon would be retained, but the relationship was weak. The amount of salmon retained from commercial harvests was not significantly related to the amount of salmon harvested in other fisheries.

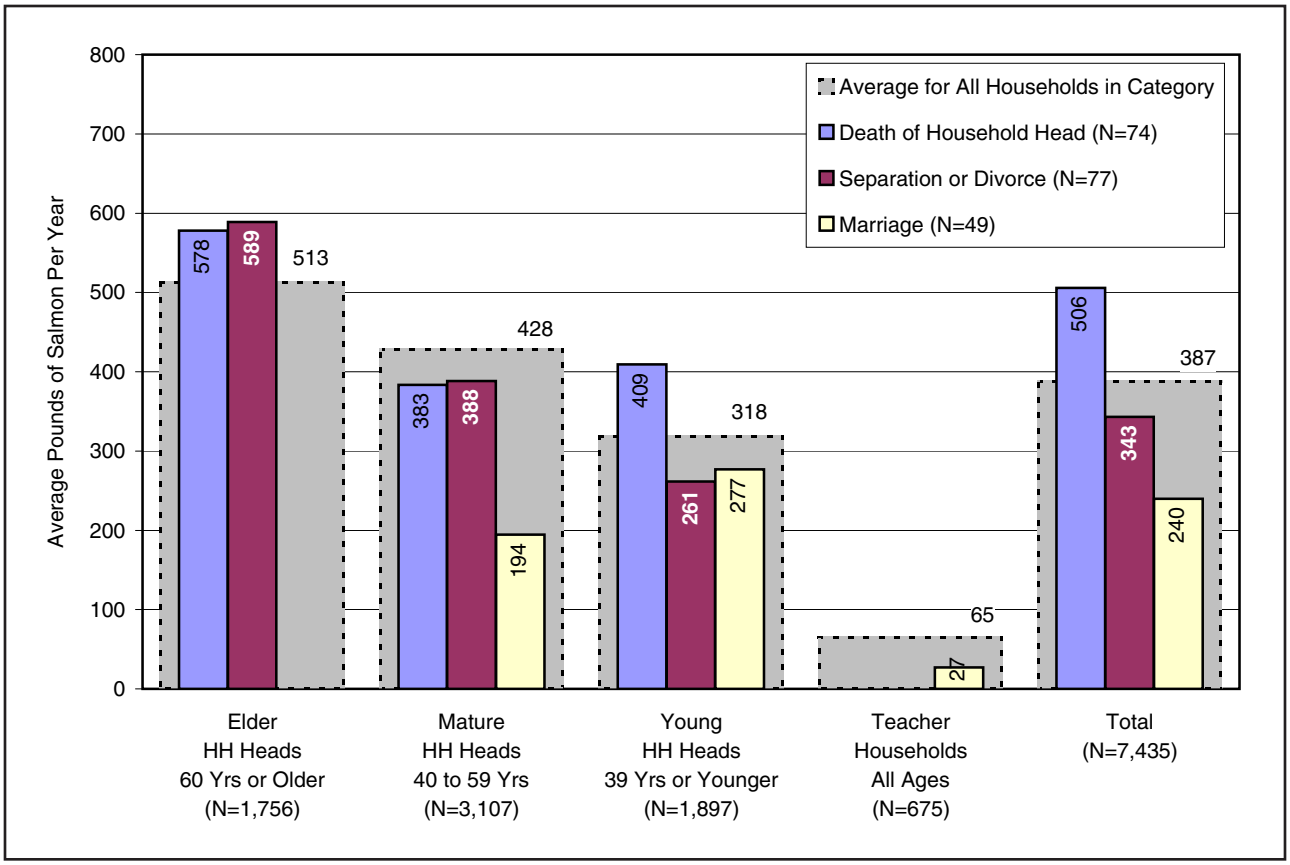

Figure 5-5. Pounds harvested by family event category and household type.

Researchers expected that households that experienced a major family event – death of household head, marriage, separation or divorce – would harvest less during the year of the family event than households that did not experience a family event. However, households that experienced a "family event" harvested only about one salmon less than "no-event" households, a statistically insignificant difference. Households that experienced the death of a head actually harvested more during the year of the death than "no event" households.

One can speculate about the effect of family events on elder households. The death of an ill or incapacitated elder could free up labor for salmon harvesting. An elder death might motivate survivors to reinvigorate traditional pursuits. In a mental health study involving two *Inupiaq* communities, "death" was the most frequent response to the question, "What makes you sad?" and "outdoor activities" was the most frequent response to the question, "What makes you happy?" (Minton and Soule 1990:11-12). A logical conclusion might be that people turn to outdoor activities, like subsistence fishing, to feel better after a death.

To review the patterns just discussed, in all communities a majority of the salmon were harvested by a minority of the households. In most communities, households with older heads harvested

significantly more salmon than households with young heads, and households headed by couples harvested more salmon than households headed by single persons. Households that consistently harvested salmon also were among the high harvesting households in their communities. Neither commercial fishing retention nor family events seemed to affect harvest levels.

Given these patterns, it was reasonable to assume that a stable core of the same high-harvest households took the majority of the salmon year after year. That turned out not to be the case for every community. Other than the very highest and lowest harvesting households, consistently ranked households were the exception, not the rule. Even among the very highest harvesting households, there were one or more households that ranked near the top in one or more years and near the bottom in another year (Shaktoolik was the lone exception). There were two households in Teller and two households in Brevig that ranked first one year and last in another year. The same was true of the lowest harvesting households. Although they typically harvested little, in most communities there were several who ranked among the highest harvesting households in one or two years.

In some communities (Koyuk and Unalakleet, for example) concentrations of harvests also were similar from year to year. In other communities (Teller and St. Michael, for example) harvests were more concentrated in some years than in other years. Not surprisingly, in communities where the concentration of harvests varied from year to year, individual household harvests also were more varied.

Figure 5-6 compares a community with a similar concentration in annual harvests – Koyuk – with a community with a varied concentration in annual harvests – Teller. In the Teller Pareto chart, the annual Pareto lines are splayed apart, showing harvests were concentrated in fewer households in some years than in others. In the Koyuk Pareto chart, the annual Pareto lines are close together, showing that harvests were concentrated to a similar degree in a similar number of households every year.

The boxplots for Teller and Koyuk tell the same story as the Pareto charts. In Teller, the second, third, fourth, and sixth highest harvesting households occasionally reported very low harvests. Indeed more than half the Teller households's harvests ranked near the top in at least one year and near the bottom in another year, as shown by the tall boxes and whiskers in the boxplot. In Koyuk, household's harvests were less varied. With the exception of the third ranked household, the high harvesting households were highly ranked in every survey year.

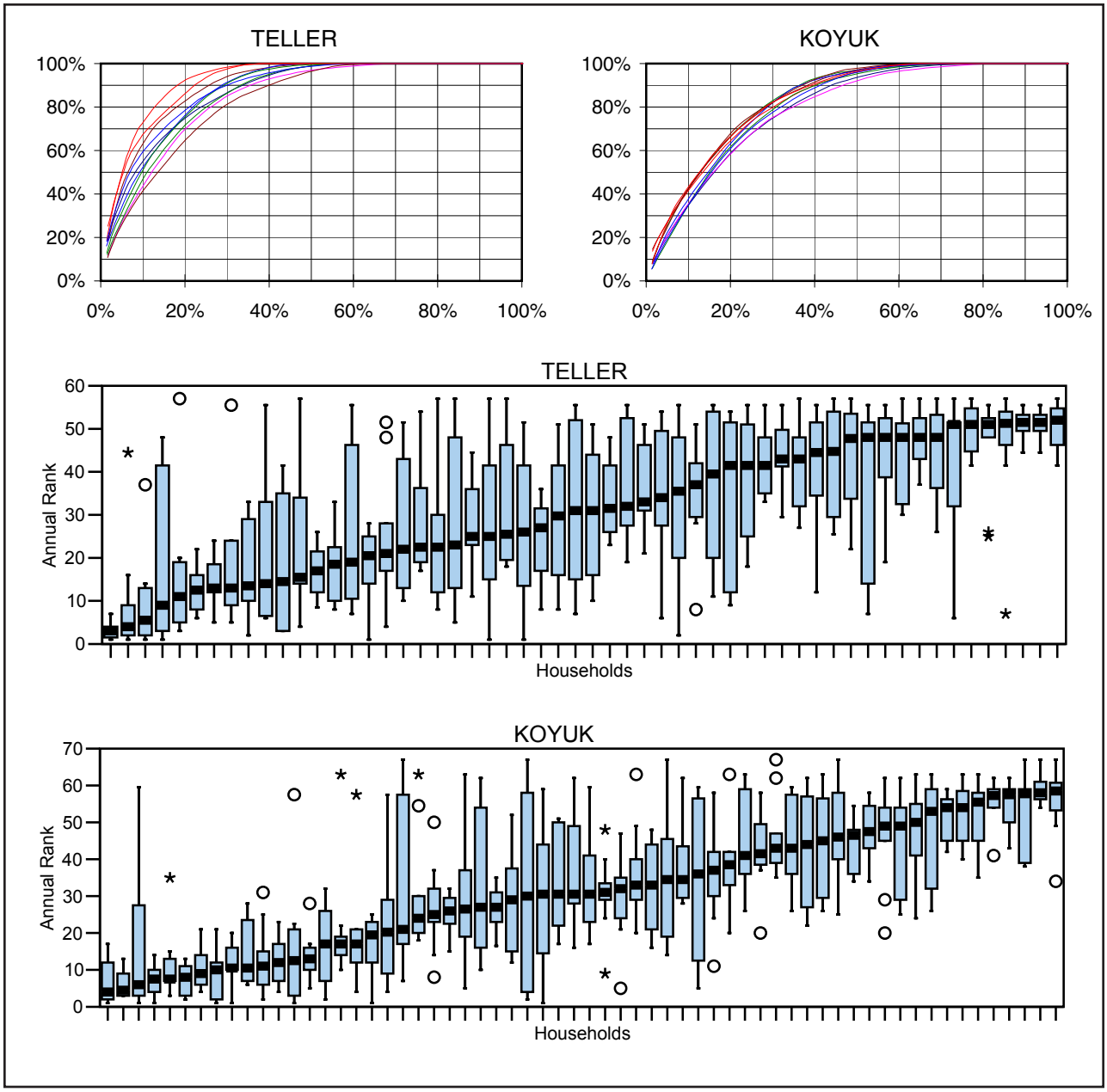

Figure 5-6. Variation in salmon harvests, Teller and Koyuk.

To return to the question posed earlier – were the *same* households responsible for a majority of the harvests year after year? – it seems some households did contribute consistently to the community harvest. But in every community, there were many unpredictable households. There were households that usually contributed much and then one year contributed little. There were households that usually contributed little and then in one year ranked among the highest harvesters in their community. This pattern was not apparent unless one tracked the harvests of individual households over time.

Use of Time-Series Data

In Alaska there is a large and growing body of time-series subsistence harvest data collected by government agencies like the Alaska Department of Fish and Game and by Native regional nonprofit corporations like Kawerak, Inc. These data have been used extensively during regulatory deliberations by the Alaska Board of Fisheries, the Alaska Board of Game, and the Federal Subsistence Board. But when the boards have adjourned and the annual management reports have been published, annual harvest survey data usually have been archived. State agencies, strapped for funding and focused on critical, immediate management tasks, have not had funding to remove confidential identifying information and clean data so it could be available to other researchers.

Most analyses in the subsistence literature rely upon comprehensive survey data, that is, harvest data for many species harvested by a single community in a single year. Comprehensive survey data usually have been collected for use by federal resource management agencies such as the National Park Service. Federal resource agencies have more funds, broader agendas, and long-term perspectives. In the subsistence arena, they have been willing to pay for more substantial data collection efforts and analyses than state agencies.

With the notable exception of some MMS studies related to oil development and oil spills, federal subsistence research projects have tended to be single-year efforts. Comprehensive survey samples often have been relatively small, for example, 150 households in three communities. By comparison, annual survey data sets often include thousands of cases from a dozen communities, or in the case of Yukon River salmon, tens of thousands of cases from two score communities.

There is a place for both kinds of survey data sets: the deep but narrow perspective of the comprehensive survey, and the broad but shallow perspective of the annual survey. For the most part, though, the potential to explore subsistence harvest patterns through the analysis of annual harvest survey data has been overlooked. That is unfortunate, because the temporal dimension of subsistence is a most interesting perspective, made even more pertinent by rapidly changing climactic conditions. Time-series data that could be used to explore some very interesting research questions remain in the agency archives.

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Appendix 1: Survey Instruments, 1994-2003

COMM. ID#_____

HHID#_____

1994 NORTON SOUND / SEWARD PENINSULA AREA
POST-SEASON SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY

*** (Questions marked with an asterisk are asked of all households interviewed)**

Community: _____ **Household Head Name:** _____

Survey Date: _____**, 1994** **Name of Person Interviewed:** _____

Interviewer: _____ **Household P.O. Box:** _____

*1. Does this household usually subsistence fish for salmon? **No**_____ **Yes**_____

*2. Did this household catch salmon for subsistence use this year? **No**_____ (go to 3) **Yes**_____ (go to 5)

HOUSEHOLD DIDN'T SUBSISTENCE FISH FOR SALMON **(Household did not help harvest/catch salmon)**

3. Did this household help another household process ("put up") salmon? **No** _____ **(go to 10)** **Yes** _____

If Yes, who? Name/HHID _____

4. Please estimate how many salmon were for your household only.

CHINOOK_____ ("kings") **CHUM**_____ ("dogs") **PINK**_____ ("humpies") **SOCKEYE** _____ ("reds") **COHO**_____ ("silvers") **Could not estimate**_____

(Go to Question 10).....

HOUSEHOLD SUBSISTENCE FISHED FOR SALMON

5. Did other households fish with you? **No** ____ **(go to 7)** **Yes** ____ **(If Yes, Name/HHID** _____**)**

6. Please estimate how many salmon all households together caught. **(Ask about salmon already eaten, frozen, given to other households, and dog food)**

CHINOOK_____ ("kings") **CHUM**_____ ("dogs") **PINK**_____ ("humpies") **SOCKEYE** _____ ("reds") **COHO**_____ ("silvers") **Could not estimate**_____

7. Please estimate how many salmon were caught for your household only.

CHINOOK_____ ("kings") **CHUM**_____ ("dogs") **PINK**_____ ("humpies") **SOCKEYE** _____ ("reds") **COHO**_____ ("silvers") **Could not estimate**_____

(Go to Question 8) .....

FISHING GEAR **(For subsistence fishing households only)**

8. What type(s) of fishing gear was used for catching subsistence salmon this year?

Drift net _____, **Set net** _____, **Seine** _____, **Rod-and-reel** _____,

Other (Identify)_____

9. What mesh size(s) do you use for catching salmon? **Kings**_____**(inches)** **Other**_____**(inches)**

HHID#_____

1994 NORTON SOUND / SEWARD PENINSULA AREA
POST-SEASON SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY

COMMERCIAL FISHING

*10. Does this household commercial fish for salmon? **No** _____ **(go to 14),** **Yes** _____

If yes, where ?_____

11. Were all of the salmon caught when commercial fishing sold or were some brought home to eat or processed for subsistence? **All were sold** _____ **(go to 14)** **Some were used for subsistence** _____

12. How many commercially caught salmon were used for subsistence?

CHINOOK_____ **CHUM**_____ **PINK**_____ **SOCKEYE**_____ **COHO**_____

13. Are those salmon included in the catch numbers you gave me? **No** _____ **Yes** _____

HOUSEHOLD SIZE

*14.How many people live in this household? _____

DOG FOOD **(For subsistence fishing households only)**

15. Did this household catch salmon for dog food?

No _____ **(go to 19)** **Only backbones/heads/guts/scraps** _____ **(go to 19)**

Yes _____

16. How many salmon? **CHINOOK** _____ ("kings") **CHUM**_____ ("dogs") **PINK**_____ ("humpies") **SOCKEYE** _____ ("reds") **COHO**_____ ("silvers")

17. Are the salmon caught for the dogs included in the estimates you gave me ? **No**_____ **Yes** _____

18. How many dogs does this household have? _____

19. **(For subsistence fishing households only)**

Were your household's subsistence salmon needs met this year? **No**_____ **Yes**_____

If no, why not?

How do you plan to meet those needs? **(other fish, game, food stamps, etc)**

20. In normal year, how much of your wild food harvest is salmon? **(circle)**

0 - 25%	26 - 50%	51-75%	76 - 100%
(some)	(about half)	(most)	(all)

21. This year, how much of your salmon catch did you give to other families? **(circle)**

0 - 25%	26 - 50%	51-75%	76 - 100%
(some)	(about half)	(most)	(all)

*22. Do you have any suggestions or comments?

THANK YOU FOR YOUR TIME AND FOR HELPING WITH THIS PROJECT.

A summary of the subsistence fishing survey will be sent out next spring (April).

COMM. ID#_____
HHID#_____

1995 NORTON SOUND / SEWARD PENINSULA AREA
POST-SEASON SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY

* Questions marked with an asterisk are asked of all households interviewed

Community: _____

Survey Date: _____

Interviewer:_____

Household Head Name: _____

Name of Person Interviewed: _____

Household P.O. Box: _____

***Household Size** _____

Was household in community last year? No ____Yes____

If no, where were you living? _____

***1. Did your household catch salmon for subsistence use this year?** No_____ Yes_____

***2. Does your household usually subsistence fish for salmon?** No_____ Yes_____

FISHING HOUSEHOLDS

3. Please estimate how many salmon your household caught for subsistence use this year (your share of the catch if fishing with others). Include salmon you caught and gave away or lost to spoilage.

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SPECIES_____

4. How much of your salmon catch did you give to other families this year? (circle)

NONE	SOME	ABOUT HALF	MOST	ALMOST ALL	ALL
(0%)	(1 -25%)	(26 - 50%)	(51 -75%)	(75 -99%)	(100%)

5. What type(s) of fishing gear did your household use for catching subsistence salmon this year?

DRIFT NET _____ SET NET _____ SEINE _____ ROD-AND-REEL _____

OTHER (IDENTIFY)_____

6. Did your household catch salmon for dog food?
No _____ (Go to #12) Only backbones/heads/guts/scraps/spoiled fish _____ (Go to #12) Yes _____

7. How many salmon? (Do **not** include fish lost to spoilage and fed to dogs.)
CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SPECIES_____

8. Were the salmon caught for dog food included in the estimates you already gave me? No_____ Yes _____

9. How many dogs does your household have? _____

HHID#_____

1995 NORTON SOUND / SEWARD PENINSULA AREA
POST-SEASON SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY (CON'T)

NON-FISHING HOUSEHOLDS (Household did not help harvest/catch salmon)

10. Did your household help another household process ("put up") salmon? No_____(Go to #12) Yes _____

11. Please estimate how many salmon you kept for your household only.

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SPECIES_____

(Go to #12)

COMMERCIAL FISHING

***12. Did your household commercial fish for salmon this year?** No _____ (Go to #16) Yes _____
If yes, where?_____

13. Were all of the salmon you caught when commercial fishing sold or were some brought home to eat or processed for subsistence? All sold _____ (Go to #16) Some used for subsistence _____

14. How many commercially caught salmon did your household use for subsistence?

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SPECIES_____

15. Are those salmon included in the estimates you already gave me? No _____ Yes _____

***16. Were your household's subsistence salmon needs met this year?** No_____ Yes_____(Go to #17)
If no, why not?

***17. Do you have any suggestions or comments?**

THANK YOU FOR YOUR TIME AND FOR HELPING WITH THIS PROJECT.
A summary of this subsistence fishing survey will be sent to you next spring (April).

COMM. ID#_____
HHID#_____

1996 NORTON SOUND / SEWARD PENINSULA AREA SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY

* Questions marked with an asterisk are asked of all households interviewed

Community: _____

Survey Date: _____

Interviewer:_____

Household Head Name: _____

Household P.O. Box: _____

***Household Size** _____

Was household in community last year? No ____Yes____

If no, where were you living? _____

***1. Did your household catch salmon for subsistence use or with a rod-and-reel this year?** No_____ Yes_____

***2. Does your household usually subsistence fish for salmon?** No_____ Yes_____

FISHING HOUSEHOLDS

3. Please estimate how many salmon your household caught for subsistence use or with a rod-and-reel this year (your share of the catch if fishing with others). Include salmon you caught and gave away or lost to spoilage.

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

4. How much of your salmon catch did you give to other families this year? (circle)

NONE	SOME	ABOUT HALF	MOST	ALMOST ALL	ALL
(0%)	(1 -25%)	(26 - 50%)	(51 -75%)	(75 -99%)	(100%)

5. What type(s) of fishing gear did your household use for catching subsistence salmon this year?

SET NET _____ DRIFT NET _____
SEINE _____ OTHER (IDENTIFY)_____
ROD-AND-REEL _____

How many salmon did your household catch and keep with rod-and-reel this year?

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS")

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

DOGS (CHUM):	__VERY GOOD	___AVERAGE	___POOR	IF POOR, WHY?_____
KINGS (CHINOOK):	__VERY GOOD	___AVERAGE	___POOR	IF POOR, WHY?_____
HUMPIES (PINK):	__VERY GOOD	___AVERAGE	___POOR	IF POOR, WHY?_____
REDS (SOCKEYE):	__VERY GOOD	___AVERAGE	___POOR	IF POOR, WHY?_____
SILVERS (COHO):	__VERY GOOD	___AVERAGE	___POOR	IF POOR, WHY?_____

7. Did your household catch salmon for dog food?

No ____ (Go to #13) Only backbones/heads/guts/scraps/spoiled fish ____ (Go to #13) Yes _____(Go to #8)

HHID#_____

1996 NORTON SOUND / SEWARD PENINSULA AREA
SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY (CON'T)

FISH FOR DOGS

8. How many salmon did your household catch for dog food? (Do **not** include fish lost to spoilage and fed to dogs.)

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

9. Were the salmon caught for dog food included in the estimates you already gave me? No_____ Yes _____

10. How many dogs does your household have? _____ (Go to #13)

NON-FISHING HOUSEHOLDS (Household did not harvest/catch salmon)

11. Did your household help another household cut or hang salmon or process it some other way? No_____(Go to #13)
Yes _____

12. Did you receive salmon in exchange for your help? Yes ____ No ____
If yes, please estimate how many salmon you received for your household.

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

(Go to #13)

COMMERCIAL FISHING

***13. Did your household commercial fish for salmon this year?** No _____ (Go to #17) Yes _____
If yes, where?_____

14. Were all of the salmon you caught when commercial fishing sold or were some brought home to eat or processed for subsistence? All sold _____ (Go to #17) Some used for subsistence _____

15. How many commercially caught salmon did your household use for subsistence?

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

16. Are those salmon included in the estimates you already gave me? No _____ Yes _____

***17. In your opinion, what could Fish and Game do to make subsistence salmon fishing better?**

***18. Do you have any other suggestions or comments?**

THANK YOU FOR YOUR TIME AND FOR HELPING WITH THIS PROJECT.
A summary of this subsistence fishing survey will be sent to you next spring (April).

COMM. ID# _____
HHID#_____

NORTON SOUND AND SEWARD PENINSULA AREA

1997 SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY

* Questions marked with an asterisk are asked of all households interviewed

Community: _____

Survey Date: _____

Interviewer:_____

Household Head Name: _____

***Household Size** _____

Was household in community last year? No ____Yes____

If no, where were you living? _____

Household P.O. Box (if new): _____

***1. Did your household catch salmon for subsistence use or with a rod-and-reel this year?**
No_____ Yes_____

***2. Does your household usually subsistence fish for salmon?** No_____ Yes_____

FISHING HOUSEHOLDS ("Yes" to #1)

3. Please estimate how many salmon your household caught for subsistence use or with a rod-and-reel this year (your share of the catch if fishing with others). Include salmon you gave away, ate fresh, lost to spoilage, or obtained from helping others process fish.

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

4. What type(s) of fishing gear did your household use for catching subsistence salmon this year?

SET GILL NET _____ SEINE _____
ROD-AND-REEL _____ DRIFT GILL NET _____

4a. How many salmon did your household catch and keep with rod-and-reel this year?

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS")

5. Did your household give salmon to other households this year? No _____ Yes _____

6. How was subsistence **chum** salmon fishing for your household this year?

____VERY GOOD _____AVERAGE _____POOR IF POOR, WHY?_____

7. Did your household catch salmon for dog food? (Using salmon for dog food is allowed by regulations.)

No ____ (Go to #13) Only backbones/heads/guts/scraps/spoiled fish ____ (Go to #13) Yes _____(Go to #8)

HH ID#_____

NORTON SOUND AND SEWARD PENINSULA AREA

1997 SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY (CON'T)

FISH FOR DOGS

8. How many salmon did your household catch for dog food? (Do not include fish lost to spoilage and fed to dogs.)

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

9. Were these salmon included in the estimates you already gave me? No_____ Yes _____

10. How many dogs does your household have? _____ (Go to #13)

NON-FISHING HOUSEHOLDS ("No" to #1)

11. Did your household help another household fish, cut or hang salmon, or process it some other way? No_____(Go to #13) Yes _____

12. Did you receive salmon in exchange for your help? No ____ Yes ____

If yes, please estimate how many salmon you received for your household. (Do not include fish from a F&G test net.)

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

(Go to #13)

COMMERCIAL FISHING

***13. Did your household commercially fish for salmon this year?** No _____ (Go to #17) Yes _____

If yes, where?_____

14. Were all of the salmon you caught when commercial fishing sold or were some brought home to eat or processed for subsistence? All sold _____ (Go to #17) Some used for subsistence _____

15. How many commercially caught salmon did your household use for subsistence?

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

16. Were these salmon included in the estimates you already gave me? No _____ Yes _____

***17. Do you have any suggestions or concerns about subsistence fishing?**

THANK YOU FOR YOUR TIME AND FOR HELPING WITH THIS PROJECT.

A summary of this subsistence fishing survey will be sent to you next spring (April).

COMMUNITY ID# _____
HHID#_____

NORTON SOUND AND SEWARD PENINSULA AREA

1998 SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY

* Questions marked with an asterisk are asked of all households interviewed

Community: _____

Survey Date: _____

Interviewer:_____

Household Head Name: _____

***Household Size** _____

Was household in community last year? No ____Yes____

If no, where were you living? _____

Household P.O. Box (if new): _____

***1. Did your household catch salmon for subsistence use or with a rod-and-reel this year?** No_____ Yes_____

***2. Does your household usually subsistence fish for salmon?** No_____ Yes_____

FISHING HOUSEHOLDS (“Yes” to #1)

3. Please estimate how many salmon your household caught for subsistence use or with a rod-and-reel this year (your share of the catch if fishing with others). Include salmon you gave away, ate fresh, lost to spoilage, or obtained from helping others process fish.

CHUM_____ ("DOGS”) CHINOOK_____ ("KINGS”) PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

4. What type(s) of fishing gear did your household use for catching subsistence salmon this year?

SET GILL NET _____ SEINE _____
ROD-AND-REEL _____ DRIFT GILL NET _____

4a. How many salmon did your household catch and keep with rod-and-reel this year?

CHUM_____ ("DOGS”) CHINOOK_____ ("KINGS”) PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS")

5. Did your household give salmon to other households this year? No _____ Yes _____

6. How was subsistence **chum** salmon fishing for your household this year?
____VERY GOOD _____AVERAGE _____POOR IF POOR, WHY?_____

7. Did your household catch salmon for dog food? (Using salmon for dog food is allowed by regulations.)
No ____ (Go to #13) Only backbones/heads/guts/scraps/spoiled fish ____ (Go to #13) Yes _____(Go to #8)

8. How many salmon did your household catch for dog food? (Do not include fish lost to spoilage and fed to dogs.)

CHUM_____ ("DOGS”) CHINOOK_____ ("KINGS”) PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

9. Were these salmon included in the estimates you already gave me? No_____ Yes _____

10. How many dogs does your household have? _____ (Go to #13)

HH ID#_____

NORTON SOUND AND SEWARD PENINSULA AREA

1998 SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY (CON'T)

NON-FISHING HOUSEHOLDS ("No" to #1)

11. Did your household help another household fish, cut or hang salmon, or process it some other way? No_____(Go to #13)
Yes _____

12. Did you receive salmon in exchange for your help? No ____ Yes ____

If yes, please estimate how many salmon you received for your household. (Do not include fish from a F&G test net.)

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

(Go to #13)

COMMERCIAL FISHING

***13. Did your household commercially fish for salmon this year?** No _____ (Go to #17) Yes _____

If yes, where?_____

14. Were all of the salmon you caught when commercial fishing sold or were some brought home to eat or processed for subsistence? All sold _____ (Go to #17) Some used for subsistence _____

15. How many commercially caught salmon did your household use for subsistence?

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

16. Were these salmon included in the estimates you already gave me? No _____ Yes _____

***17. Do you have any suggestions or concerns about subsistence fishing?**

THANK YOU FOR YOUR TIME AND FOR HELPING WITH THIS PROJECT.

A summary of this subsistence fishing survey will be sent to you next spring (April).

COMMUNITY ID# _____
HHID#_____

NORTON SOUND AND SEWARD PENINSULA AREA

1999 SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY

* Questions marked with an asterisk are asked of all households interviewed

Community: _____

Survey Date: _____

Interviewer:_____

Household Head Name: _____

***Household Size** _____

Was household in community last year? No ____Yes____

If no, where were you living? _____

Household P.O. Box (if new): _____

***1. Did your household catch salmon for subsistence use or with a rod-and-reel this year?** No_____ Yes_____

***2. Does your household usually subsistence fish for salmon?** No_____ Yes_____

FISHING HOUSEHOLDS ("Yes" to #1)

3. Please estimate how many salmon your household caught for subsistence use or with a rod-and-reel this year (your share of the catch if fishing with others). Include salmon you gave away, ate fresh, lost to spoilage, or obtained from helping others process fish.

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

4. What type(s) of fishing gear did your household use for catching subsistence salmon this year?

SET GILL NET _____ SEINE _____
ROD-AND-REEL _____ DRIFT GILL NET _____

4a. How many salmon did your household catch and keep with rod-and-reel this year?

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS")

5. Did your household give salmon to other households this year? No _____ Yes _____

6. How was subsistence chum salmon fishing for your household this year?
____VERY GOOD _____AVERAGE _____POOR IF POOR, WHY?_____

7. Did your household catch salmon specifically for dog food? (Using salmon for dog food is allowed by regulations.)
No ____ (Go to #13) Only backbones/heads/guts/scraps/spoiled fish ____ (Go to #13) Yes _____(Go to #8)

8. How many salmon did your household catch for dog food? (Do not include fish lost to spoilage and fed to dogs.)

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

9. Were these salmon included in the estimates you already gave me? No_____ Yes _____

10. How many dogs does your household have? _____ (Go to #13)

HH ID#_____

NORTON SOUND AND SEWARD PENINSULA AREA

1999 SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY (CON'T)

NON-FISHING HOUSEHOLDS ("No" to #1)

11. Did your household help another household fish, cut or hang salmon, or process it some other way? No_____(Go to #13)
Yes _____

12. Did you receive salmon in exchange for your help? No ____ Yes ____

If yes, please estimate how many salmon you received for your household. (Do not include fish from a F&G test net.)

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

(Go to #13)

COMMERCIAL FISHING

***13. Did your household commercially fish for salmon this year?** No _____ (Go to #17) Yes _____

If yes, where?_____

14. Were all of the salmon you caught when commercial fishing sold or were some brought home to eat or processed for subsistence? All sold _____ (Go to #17) Some used for subsistence _____

15. How many commercially caught salmon did your household use for subsistence?

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

16. Were these salmon included in the estimates you already gave me? No _____ Yes _____

***17. Do you have any suggestions or concerns about subsistence fishing?**

THANK YOU FOR YOUR TIME AND FOR HELPING WITH THIS PROJECT.

A summary of this subsistence fishing survey will be sent to you next spring (April).

COMMUNITY ID# _____
HHID#_____

NORTON SOUND AND SEWARD PENINSULA AREA

2000 SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY

* Questions marked with an asterisk are asked of all households interviewed

Community: _____

Survey Date: _____

Interviewer:_____

Household Head Name: _____

***Household Size** _____

If new household, where were you living last year? _____

_____

(If new household) P.O. Box: _____

***1. Did your household catch salmon for subsistence use or with a rod-and-reel this year?** No_____ Yes_____

***2. Does your household usually subsistence fish for salmon?** No_____ Yes_____

FISHING HOUSEHOLDS ("Yes" to #1)

3. Please estimate how many salmon your household caught for subsistence use or with a rod-and-reel this year (your share of the catch if fishing with others). Include salmon you gave away, ate fresh, lost to spoilage, or obtained from helping others process fish.

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

4. What type(s) of fishing gear did your household use for catching subsistence salmon this year?

SET GILL NET _____ SEINE _____
ROD-AND-REEL _____ DRIFT GILL NET _____

4a. (If rod-and- reel was used) How many salmon did your household catch and keep with rod-and-reel this year?

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS")

5. Did your household give salmon to other households this year? No _____ Yes _____

6. How was subsistence chum salmon fishing for your household this year?
____VERY GOOD _____AVERAGE _____POOR IF POOR, WHY?_____

7. Did your household catch salmon specifically for dog food? (Using salmon for dog food is allowed by regulations.)
No ____ (Go to #13) Only backbones/heads/guts/scraps/spoiled fish ____ (Go to #13) Yes _____(Go to #8)

If Household Fished for Dog Food:

8. How many salmon did your household catch for dog food? (Do not include fish lost to spoilage and fed to dogs.)
CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

9. Were these salmon included in the estimates you already gave me? No_____ Yes _____

10. How many dogs does your household have? _____ (Go to #13)

HH ID#_____

NORTON SOUND AND SEWARD PENINSULA AREA

2000 SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY (CON'T)

NON-FISHING HOUSEHOLDS ("No" to #1)

11. Did your household help another household fish, cut or hang salmon, or process it some other way? No_____(Go to #13)
Yes _____

12. Did you receive salmon in exchange for your help? No ____ Yes ____

If yes, please estimate how many salmon you received for your household. (Do not include fish from a F&G test net.)

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

(Go to #13)

COMMERCIAL FISHING

***13. Did your household commercially fish for salmon this year?** No _____ (Go to #17) Yes _____

If yes, where?_____

14. Were all of the salmon you caught when commercial fishing sold or were some brought home to eat or processed for subsistence? All sold _____ (Go to #17) Some used for subsistence _____

15. How many commercially caught salmon did your household use for subsistence?

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

16. Were these salmon included in the estimates you already gave me? No _____ Yes _____

***17. Do you have any suggestions or concerns about subsistence fishing?**

THANK YOU FOR YOUR TIME AND FOR HELPING WITH THIS PROJECT.

A summary of this subsistence fishing survey will be sent to you next spring (April).

COMMUNITY ID# _____
HHID#_____

NORTON SOUND AND SEWARD PENINSULA AREA

2001 SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY

* Questions marked with an asterisk are asked of all households interviewed

Community: _____

Survey Date: _____

Interviewer:_____

Household Head Name: _____

***Household Size** _____

If new household, where were you living last year? _____

_____

P.O. Box (if new)_____

***1. Did your household catch salmon for subsistence use this year (including with a rod-and-reel)?** No_____ Yes_____

***2. Does your household usually subsistence fish for salmon?** No_____ Yes_____

FISHING HOUSEHOLDS ("Yes" to #1)

3. Please estimate how many salmon your household caught for subsistence use this year , including with a rod-and-reel (your share of the catch if fishing with others). Include salmon you gave away, ate fresh, lost to spoilage, or obtained from helping others process fish.

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

4. What type(s) of fishing gear did your household use for catching subsistence salmon this year?

SET GILL NET _____ SEINE _____
ROD-AND-REEL _____ DRIFT GILL NET _____

4a. (If rod-and- reel was used) How many salmon did your household catch and keep with rod-and-reel this year?

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS")

5. Did your household give salmon to other households this year? No _____ Yes _____

6. How was subsistence chum salmon fishing for your household this year?
____VERY GOOD _____AVERAGE _____POOR IF POOR, WHY?_____

7. Did your household catch salmon specifically for dog food? (Using salmon for dog food is allowed by regulations.)
No ____ (Go to #13) Only backbones/heads/guts/scraps/spoiled fish ____ (Go to #13) Yes _____(Go to #8)

If Household Fished for Dog Food:

8. How many salmon did your household catch for dog food? (Do not include fish lost to spoilage and fed to dogs.)

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

9. Were these salmon included in the estimates you already gave me? No_____ Yes _____

10. How many dogs does your household have? _____ (Go to #13)

HH ID#_____

NORTON SOUND AND SEWARD PENINSULA AREA

2001 SUBSISTENCE SALMON HOUSEHOLD HARVEST SURVEY (CON'T)

NON-FISHING HOUSEHOLDS ("No" to #1)

11. Did your household help another household fish, cut or hang salmon, or process it some other way? No_____(Go to #13)
Yes _____

12. Did you receive salmon in exchange for your help? No ____ Yes ____

If yes, please estimate how many salmon you received for your household. (Do not include fish from a F&G test net.)

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

(Go to #13)

COMMERCIAL FISHING

***13. Did your household commercially fish for salmon this year?** No _____ (Go to #17) Yes _____

If yes, where?_____

14. Were all of the salmon you caught when commercial fishing sold or were some brought home to eat or processed for subsistence? All sold _____ (Go to #17) Some used for subsistence _____

15. How many commercially caught salmon did your household use for subsistence?

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

16. Were these salmon included in the estimates you already gave me? No _____ Yes _____

***17. Do you have any suggestions or concerns about subsistence fishing?**

THANK YOU FOR YOUR TIME AND FOR HELPING WITH THIS PROJECT.

A summary of this subsistence fishing survey will be sent to you next spring (April).

COMMUNITY ID# _____
HHID# _____

NORTON SOUND AND PORT CLARENCE AREA
2002 SUBSISTENCE SALMON HARVEST SURVEY

* Questions marked with an asterisk are asked of all households interviewed

Community: _____ ***Household Size** _____

Survey Date: _____ P.O. Box (if new household)_____

Interviewer:_____

***1. Did your household fish for salmon for subsistence use this year (including with a rod-and-reel)?**
YES ❑ (Go to #3) NO ❑ (Go to #11)

***2. Does your household usually subsistence fish for salmon?** YES ❑ NO ❑

FISHING HOUSEHOLDS (Only if "Yes" to #1)

3. Please estimate how many salmon your household caught for subsistence use this year , including with a rod-and-reel (your share of the catch if fishing with others). Include salmon you gave away, ate fresh, lost to spoilage, or obtained from helping others process fish.

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

4. What type(s) of fishing gear did your household use for catching subsistence salmon this year?

SET GILL NET ❑ SEINE ❑
ROD-AND-REEL ❑ DRIFT GILL NET ❑

4a. (If rod-and- reel was used) How many salmon did your household catch and keep with rod-and-reel this year?

CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS")

5. Did your household give salmon to other households this year? NO ❑ YES ❑

6. How was subsistence chum salmon fishing for your household this year?
VERY GOOD ❑ AVERAGE ❑ POOR ❑ IF POOR, WHY?_____

7. Did your household catch salmon specifically for dog food? (Using salmon for dog food is allowed by regulations.)
NO ❑ (Go to #13) Only backbones/heads/guts/scraps/spoiled fish ❑ (Go to #13) YES ❑ (Go to #8)

If Household Fished for Dog Food:

8. How many salmon did your household catch for dog food? (Do not include fish lost to spoilage and fed to dogs.)
CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

9. Were these salmon included in the harvest estimates you gave me in #3? NO ❑ YES ❑

10. How many dogs does your household have? _____ (Go to #13)

HH ID# _____

NORTON SOUND AND PORT CLARENCE AREA

2002 SUBSISTENCE SALMON HARVEST SURVEY (CON'T)

NON-FISHING HOUSEHOLDS (Only if "No" to #1)

11. Did your household help another household fish, cut or hang salmon, or process it some other way? NO ❑ (Go to #13) YES ❑

12. Did you receive salmon in exchange for your help? NO ❑ YES ❑
    If yes, please estimate how many salmon you received for your household. (Do not include fish from a F&G test net.)

    CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

    (Go to #13)

COMMERCIAL FISHING

***13. Did your household commercially fish for salmon this year?** NO ❑ (Go to #17) YES ❑
If yes, where?_____

14. Were all of the salmon you caught when commercial fishing sold or were some brought home to eat or processed for subsistence? All sold ❑ (Go to #17) Some used for subsistence ❑

15. How many commercially caught salmon did your household use for subsistence?

    CHUM_____ ("DOGS") CHINOOK_____ ("KINGS") PINK_____ ("HUMPIES") SOCKEYE _____ ("REDS") COHO_____ ("SILVERS") UNKNOWN SALMON_____

16. Were these salmon included in the harvest estimates you gave me in #3? NO ❑ YES ❑

CRABBING

***17. Did anyone in your household go crabbing for subsistence in the past 12 months?** NO ❑ YES ❑

18. If yes, please estimate how many crabs your household caught for subsistence use in the past 12 months. Include crab you gave away. NUMBER OF CRAB _____

19. How was subsistence crabbing this past year?

    VERY GOOD ❑ AVERAGE ❑ POOR ❑ IF POOR, WHY?_____

*** Do you have any suggestions or concerns about subsistence fishing?**

THANK YOU FOR YOUR TIME AND FOR HELPING WITH THIS PROJECT.
A summary of this subsistence fishing survey will be sent to you next spring (April).

Community ID#_____

HH ID#_____

NORTON SOUND AND PORT CLARENCE AREA 2003 SUBSISTENCE SALMON HARVEST SURVEY

Alaska Department of Fish and Game and Kawerak, Inc.

Community: _____

Survey Date: _____ **Household Size:** _____

Interviewer: _____ **(If new household) PO Box:** _____

Household participation is voluntary. Individual household data will not be released without permission of household head

1. Did your household fish for salmon for subsistence use this year (including with a rod and reel)? ☐ YES ☐ NO

2. Does your household usually subsistence fish for salmon? ☐ YES ☐ NO

FOR SALMON FISHING HOUSEHOLDS ONLY ("Yes" to #1)

3. Please estimate how many salmon your household caught for subsistence use this year, including with a rod and reel. It is important not to double count fish harvests. Report only your share of the catch if fishing with others. Include salmon you gave away, ate fresh, fed to dogs, lost to spoilage, or obtained from helping others process fish.

NUMBER OF SALMON YOUR HOUSEHOLD HARVESTED

SPECIES	SUBSISTENCE GILL NET or SEINE		ROD AND REEL		Salmon Kept From Commercial Fishing	Of your total harvest, how many salmon were caught specifically for dog food?
	Number(s) of fish	Location(s)	Number(s) of fish	Location(s)	(Number of fish)	
CHUM SALMON						
Dog						
CHINOOK SALMON						
King						
PINK SALMON						
Humpy						
SOCKEYE SALMON						
Red						
COHO SALMON						
Silver						

KEY TO HARVEST LOCATIONS

A. Agiapuk River
B. Pilgrim-Kuzitrin River
C. Niukluk R. (above tower)
D. Niukluk R. (below tower) & Fish R.
E. Kachavik Creek
F. Kwiniuk River
G. Tubutulik River
H. Koyuk River
I. Inglutalik River
J. Ungalik River
K. Shaktoolik River
L. Unalakleet R. (below Chiroskey)
M. Unalakleet R. (above Chiroskey)
N. North River
O. Golsovia River
P. Pikmiktalik River
Q. Marine waters
R. _____
S. _____

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

☐ Very Good ☐ Average ☐ Poor If poor, why? _____

5. Did your household give salmon to other households this year? ☐ YES ☐ NO

Sandy Tahbone, Kawerak, Inc. 443-4383

Susan Georgette, ADFG, 442-3420

Community ID# _____

2003 SUBSISTENCE SALMON HARVEST SURVEY (CON'T)

HH ID# _____

Based on your direct observations, the Kawerak Fisheries and Subsistence Programs would like your help identifying salmon fishery concerns. Your input is valuable and will assist staff with developing research projects to better enhance and manage the resource.

6. Please rate your level of concern regarding the following factors which may affect salmon harvest, and provide the harvest location on which you are basing your information:

	Level of Concern				Which River or Location?	Comments
	No Opinion	Low	Medium	High		
A) Beaver activity						
B) Disease/health of salmon						
C) River use/boat activity						
D) Non-local subsistence fishing						
E) Sportfishing						
F) Water level of river						
G) Water quality of river						
H) Spawning habitat						
I) Mining						
J) Other:						

7. Does anyone in your household trade or barter subsistence-caught fish with people in other households or communities?

☐ YES ☐ NO

8. Would you be willing to be interviewed by Kawerak staff to gather more information?

☐ YES ☐ NO

9. Do you have any further suggestions or concerns about subsistence fishing?

Appendix 2: Project Personnel, 1994-2003

APPENDIX TABLE 2-1. COMMUNITY SURVEY PERSONEL 1994-2003

Brevig Mission										
Michael Olanna	1994									
Roy Henry		1995								
Sarah Henry			1996	1997	1998	1999				
Marilyn "Janie" Goodhope							2000	2001		
Matilda Olanna									2002	2003
Elim										
Stanton Nakarak	1994									
Joel Saccheus[1]		1995	1996	1997			2000	2001	2002	2003
Amelia Amaktoolik					1998	1999				
Golovin										
Thomas Punguk	1994	1995								
Dora Smith			1996							
Isaac Larsen				1997						
Peter Amaktoolik						1999	2000			
Carl "Bones" Brown								2001		
Clarabelle Katchatag										2003
Koyuk										
Lloyd K. Kimoktoak	1994									
Dean Kimoktoak		1995								
Leslie Charles		1995					2000			
Ruby Nassuk			1996							2003
Fannie Nassuk				1997	1998					
Lane Douglas						1999				
Becky Anasogak								2001	2002	
Abigail Anasogak									2002	
Shaktoolik										
William Takak	1994									
Priscilla Savetilik		1995								
Carrie Takak			1996	1997					2002	2003
Karen Nashalook					1998	1999				
Ralph Takak							2000			
Myron Savetilik								2001		
St. Michael										
Pius Washington	1994									
Dora Lockwood		1995	1996	1997						
Harold Cheemuk		1995								
Vera Niksik			1996							
Steve Otten					1998					
Preston Otten						1999				
Stephanie Lockwood							2000	2001		
Paul Agibinik										2003

APPENDIX TABLE 2-1. COMMUNITY SURVEY PERSONEL 1994-2003

Stebbins										
Cornelius Dan	1994									
Ted Katcheak	1994									
Joseph Steve		1995		1997						
Robin Caudill (Unalakleet)		1995								
Tania Snowball			1996	1997	1998				2002	
Tom Kirk			1996							
Rennie Jack						1999	2000			
Patrick Katcheak								2001		
George Washington										2003
Teller										
Sam Komok	1994	1995								
Lillian Weyanna		1995								
Norman Menadelook			1996							
Etta Kugzruk			1996		1998	1999				
Karla Kugzruk				1997						
Tanya Noyakuk							2000	2001		
Carlson Tingook									2002	
Unalakleet										
Dawn Blankenship	1994				1998					
Warren Katchatag	1994									
Burkher Ivanoff		1995								
Robin Caudill		1995								
Gloria Johnson			1996	1997						
Nancy Rusin					1998					
Louisa Paniptchuk						1999				
Teri Paniptchuk						1999				
Carla Soxie							2000			
Carol Charles							2000			
Nixie Nick							2000			
Howard Slwooko							2000			
Karen Bradley								2001		
David Ivanoff									2002	2003
Nolene Katchatag									2002	
White Mountain										
Dean Lincoln		1995								
Carl "Bones" Brown[1]			1996	1997	1998	1999	2000	2001	2002	2003

[1] Also a seasonal employee of the Alaska Department of Fish and Game

Appendix 3: Supplemental Survey, 2004

Data Verification & Collection Sheet

Norton Sound Patterns & Trends
August-September 2004

Household ID _____
Community _____
Interviewer's Initials _____

Source of this data? *(circle one)* MEMBER OF THIS HOUSEHOLD KEY RESPONDENT (HH ID _____)

1. Was this household surveyed under different IDs? *(circle one)* YES NO

If YES, list the original survey numbers for EACH YEAR.
Leave corrected number blank for now.

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1a. Original Survey Number	*HH ID*										
1b. Corrected HH Number?	*HH ID*										
1c. Merge with another household…	*HH ID*										

2. Did this household first appear in the survey AFTER 1994? *(circle one)* YES NO

If YES, where did the household members come from?
Enter data in the first year they were surveyed. Leave other years blank.

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
2a. Another HH here?	*Previous HH ID*	X									
2b. Another Commmunity?	*Community*	X									
2c. Had HH members lived here before	*Y , N*	X									

3. Did this household disappear from the survey AFTER 1994? *(circle one)* YES NO

If YES, where did the household members go?
Enter data in the first year they were gone. That is, the first year they were NOT surveyed. Leave other years blank.

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
3a. Another HH here?	*New HH ID*	X									
3b. Another Commmunity?	*Community*	X									

4. In each year between 1994 & 2003, did a HEAD or MEMBER of this household have a COMMERCIAL fishing permit? *(circle one)* YES NO

Check list of permit holders, and mark each year that a permit was held for salmon, herring, or other species. Leave other years blank.

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Salmon	*H , M , H+M*										
Herring	*H , M , H+M*										
Other Species	*H , M , H+M*										

5. In each year between 1994 and 2003, was this household headed by a MALE, FEMALE, or COUPLE?

In each year, write "M" for a single male, "F" for a single female, or "2" for a couple in the table below, for every year.

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Male Head, Female Head, or Couple?	*M,F,2*										

6. Was the head of this household a YOUNG person, MATURE person, ELDER, or TEACHER?

Check PFD list. Mark ONE category for EACH year. If necessary, change category as the oldest head of household ages.

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
0 to 39 Years (Young Household)	*Y*										
40-59 Years (Mature Household)	*M*										
60 years or older (Elder Household)	*E*										
Teacher Household (Any Age)	*T*										

7. Between 1994 & 2003, did a head of this household pass away, get married, or get divorced? *(circle one)* YES NO

If YES, record changes in the year they happened. Leave other years blank.

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Household Head (M or F) Died?	*M , F*										
Household Head (M or F) Married?	*X*										
Heads Separated or Divorced	*X*										

Appendix 4: Variable Lists, 1994-2003

NW Salmon Project Variable Correspondence Table

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Aggregated
Record Identifcation Data										
	1 d_r	1 d_r	1 d_r	1 d_r	1 d_r	1 d_r				
	2 year	2 year	2 year	2 year	2 year	2 year	2 year	1 year		YEAR
88 year	59 year	67 year	85 year	84 year	84 year	84 year	102 year		57 year	X
80 sortnum	3 sortnum	3 sortnum	84 sortnum	83 sortnum	83 sortnum	83 sortnum	2 sortnum	3 sortnum	56 sortnum	X
			3 commcode	3 commcode	3 commcode	3 commcode	4 commcode	100 commcode	1 commcode	X
1 communty	51 communty	59 communty	5 communty	5 communty	5 communty	5 communty	5 communty			COMMUNTY
2 hhid	4 hhid	4 hhid	4 hhid	4 hhid	4 hhid	4 hhid	3 hhid	4 hhid	2 hhid	HHID
	2 uniqhhid	2 uniqhhid	2 uniqhhid	2 uniqhhid	2 uniqhhid	2 uniqhhid	1 uniqhhid	2 uniqhhid		UNIQHHID
Family Data (confidential)										
6 headlast			7 lastname	7 lastname	7 lastname	7 lastname	7 lastname	6 lastname	3 lastname	LASTNAME
4 headfirs			6 frstname	6 frstname	6 frstname	6 frstname	6 frstname	5 frstname	4 frstname	FRSTNAME
5 headmi										X
14 address			8 pobox	8 pobox	8 pobox	8 pobox	8 pobox	7 pobox	5 pobox	POBOX
			9 mailcomm	9 mailcomm	9 mailcomm	9 mailcomm	9 mailcomm	8 mailcomm	6 mailcomm	MAILCOMM
			10 zipcode	10 zipcode	10 zipcode	10 zipcode	10 zipcode	9 zipcode	7 zipcode	ZIPCODE
			11 phone	11 phone	11 phone	11 phone	11 phone	10 phone	8 phone	PHONE

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NW Salmon Project Variable Correspondence Table

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Aggregated
Household Data										
87 harvest	49 harvest	57 harvest	82 harvest	81 harvest	81 harvest	81 harvest	100 harvest	98 harvest	54 harvest	HARVEST
							23 refused	28 refused		REFUSED
							24 nocont	29 nocont		NOCONT
							25 moved	30 moved		MOVED
							26 othhh	31 othhh		OTHHH
							27 deceased	32 deceased		DECEASED
							21 note00	25 note00		NOTE2000
							22 note01	26 note01		NOTE2001
								27 note02		NOTE2002
			15 mailm97	15 mailm98	15 mailm99	15 mailm00	18 mailm01	21 mailm02		MAILM
			16 mailr97	16 mailr98	16 mailr99	16 mailr00	20 mailr01	24 mailr02		MAILR
							28 delete	33 delete		DELETE
			26 comyrago	24 comyrago	24 comyrago	24 comyrago	42 comyrago	35 comyrago		COMYRAGO
66 hhsize	38 people	38 people	25 hhsize	23 hhsize	23 hhsize	23 hhsize	41 hhsize	34 hhsize	15 hhsize	HHSIZE
16 hhcatch	5 subsft95	5 subsft96	13 subsft97	13 subsft98	13 subsft99	13 subsft00	14 subsft01	15 subsft02	11 subsft03	SFSHST
			17 sfmail97	17 sfmail98	17 sfmail99	17 sfmail	29 sfmail			SFMAIL
15 hhfish	6 uslyfish	6 uslyfish	12 uslyfish	12 uslyfish	12 uslyfish	12 uslyfish	12 uslyfish	11 uslyfish	9 uslyfish	USLYFISH
79 fish	14 uslyfiss	14 uslyfiss	28 uslyfiss	26 uslyfiss	26 uslyfiss	26 uslyfiss	44 uslyfiss	37 uslyfiss		X
									17 uslyfsrv	X
	50 fish	58 fish	83 fish	82 fish	82 fish	82 fish	101 fish	99 fish	55 fish	X
77 wildfood										WILDFOOD
								12 harv_gro		HARV_GRO
3 survey			14 surv97	14 surv98	14 surv99	14 surv00	16 surv01	18 surv02	10 surv03	X
							13 subsft00	13 subsft00		X
								14 subsft01		X
							15 surv00	16 surv00		X
								17 surv01		X
							17 mailm00	19 mailm00		X
								20 mailm01		X
							19 mailr00	22 mailr00		X
								23 mailr01		X
	7 sfshmt95	7 sfshmt96								X
	13 sfshst95	13 sfshst96								X
	47 subsff95	55 subsff96								X
	48 uslyfshf	56 uslyfshf								X
									12 subfns03	X
7 survdate			23 survdate						13 survdate	X
8 intfirst										X
9 intmi										X
10 intlast			24 intviewr						14 intinit	X
11 intvfirs										X
12 intvmi										X
13 intvlast										X
									16 subsalm	X
			27 sfshst97	25 sfshst98	25 sfshst99	25 sfshst	43 sfshst	36 sfshst		X
76 hhneed										X

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NW Salmon Project Variable Correspondence Table

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Aggregated
Harvest Data: Total Number of Salmon Caught by Household for Subsistence Use OR With Rod and Reel										
38 hhidchum	21 chinthis	21 chinthis	30 chinthis	28 chinthis	28 chinthis	28 chinthis	46 chinthis	39 chinthis		CHINTHIS
37 hhidking	22 chumthis	22 chumthis	29 chumthis	27 chumthis	27 chumthis	27 chumthis	45 chumthis	38 chumthis		CHUMTHIS
41 hhidcoho	25 cohothis	25 cohothis	33 cohothis	31 cohothis	31 cohothis	31 cohothis	49 cohothis	42 cohothis		COHOTHIS
39 hhidpink	24 pinkthis	24 pinkthis	31 pinkthis	29 pinkthis	29 pinkthis	29 pinkthis	47 pinkthis	40 pinkthis		PINKTHIS
40 hhidred	23 sockthis	23 sockthis	32 sockthis	30 sockthis	30 sockthis	30 sockthis	48 sockthis	41 sockthis		SOCKTHIS
42 hhidunk										UNKTHIS
									18 chumnet	
									19 chinnet	
									20 pinknet	
									21 socknet	
									22 cohonet	
									23 unknet	
30 allking										X
31 allchum										X
32 allpink										X
33 allred										X
34 allcoho										X
35 allunk										X
36 allshee										X
Gear Data: Gear Used for Catching Salmon for Subsistence										
45 setnet			34 setnet	32 setnet	32 setnet	32 setnet	50 setnet	43 setnet		SETNET
47 rodreel			35 rodnreel	33 rodnreel	33 rodnreel	33 rodnreel	51 rodnreel	44 rodnreel		SEINE
46 seine			36 seine	34 seine	34 seine	34 seine	52 seine	45 seine		RODNREEL
44 driftnet			37 driftnet	35 driftnet	35 driftnet	35 driftnet	53 driftnet	46 driftnet		DRIFTNET
				36 dipnet	36 dipnet	36 dipnet	54 dipnet	47 dipnet		DIPNET
48 unkgear										UNKGEAR
49 kingsize										X
50 chumsize										X
51 pinksize										X
52 redsize										X
53 cohosize										X
54 unksize										X
55 sheesize										X
Harvest Data: Salmon Caught With Rod and Reel										
		43 chumrr	38 chumrr	37 chumrr	37 chumrr	37 chumrr	55 chumrr	48 chumrr	24 chumrr	CHINRR
		44 chinrr	39 chinrr	38 chinrr	38 chinrr	38 chinrr	56 chinrr	49 chinrr	25 chinrr	CHUMRR
		45 pinkrr	40 pinkrr	39 pinkrr	39 pinkrr	39 pinkrr	57 pinkrr	50 pinkrr	26 pinkrr	COHORR
		46 sockrr	41 sockrr	40 sockrr	40 sockrr	40 sockrr	58 sockrr	51 sockrr	27 sockrr	PINKRR
		47 cohorr	42 cohorr	41 cohorr	41 cohorr	41 cohorr	59 cohorr	52 cohorr	28 cohorr	SOCKRR
78 foodgive			43 salmgive	42 salmgive	42 salmgive	42 salmgive	60 salmgive	53 salmgive	41 salmgive	SALMGIVE
			44 chumstat	43 chumstat	43 chumstat	43 chumstat	61 chumstat	54 chumstat	39 chumstat	CHUMSTAT
									40 chummemo	CHUMEMO

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NW Salmon Project Variable Correspondence Table

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Aggregated
Harvest Data: Salmon Caught for Dogfood										
67 hhdog			45 salmdogf	44 salmdogf	44 salmdogf	44 salmdogf	62 salmdogf	55 salmdogf		SALMDOGF
68 dogking	26 chindogf	26 chindogf	47 chindogf	46 chindogf	46 chindogf	46 chindogf	64 chindogf	57 chindogf	35 chinDogf	CHINDOGF
69 dogchum	27 chumdogf	27 chumdogf	46 chumdogf	45 chumdogf	45 chumdogf	45 chumdogf	63 chumdogf	56 chumdogf	34 chumdogf	CHUMDOGF
72 dogcoho	30 cohodogf	30 cohodogf	50 cohodogf	49 cohodogf	49 cohodogf	49 cohodogf	67 cohodogf	60 cohodogf	38 cohodogf	COHODOGF
70 dogpink	28 pinkdogf	28 pinkdogf	48 pinkdogf	47 pinkdogf	47 pinkdogf	47 pinkdogf	65 pinkdogf	58 pinkdogf	36 pinkdogf	PINKDOGF
71 dogred	29 sockdogf	29 sockdogf	49 sockdogf	48 sockdogf	48 sockdogf	48 sockdogf	66 sockdogf	59 sockdogf	37 sockdogf	SOCKDOGF
73 dogunk										UNKDOG
75 dogsize			52 dogs	51 dogs	51 dogs	51 dogs	69 dogs	62 dogs		DOGS
74 incdog	31 dogfcal	31 dogfcal	51 dogfcal	50 dogfcal	50 dogfcal	50 dogfcal	68 dogfcal	61 dogfcal		DOGFCAL
Distribution Data: Salmon Received by Non-Fishing Households for Helping Other Households										
17 hhprocce	15 helpsalm	15 helpsalm	53 helpsalm	52 helpsalm	52 helpsalm	52 helpsalm	70 helpsalm	63 helpsalm		HELPSALM
			54 recsalm	53 recsalm	53 recsalm	53 recsalm	71 recsalm	64 recsalm		RECSALM
	16 chinget	16 chinget	56 chinget	55 chinget	55 chinget	55 chinget	73 chinget	66 chinget		CHINGET
	17 chumget	17 chumget	55 chumget	54 chumget	54 chumget	54 chumget	72 chumget	65 chumget		CHUMGET
	20 cohoget	20 cohoget	59 cohoget	58 cohoget	58 cohoget	58 cohoget	76 cohoget	69 cohoget		COHOGET
	19 sockget	19 sockget	57 pinkget	56 pinkget	56 pinkget	56 pinkget	74 pinkget	67 pinkget		PINKGET
	18 pinkget	18 pinkget	58 sockget	57 sockget	57 sockget	57 sockget	75 sockget	68 sockget		SOCKGET
										SALMGET
20 procking										X
21 procchum										X
22 procpink										X
23 procred										X
24 proccoho										X
25 procunk										X
26 procshee										X
Harvest Data: Salmon Retained from Commercial Catches										
56 hhidcomm			60 commfish	59 commfish	59 commfish	59 commfish	77 commfish	70 commfish		COMMFISH
57 location							78 cfwhere	71 cfwhere		CFWHERE
58 commsold			61 cfkeep	60 cfkeep	60 cfkeep	60 cfkeep	79 cfkeep	72 cfkeep		CFKEEP
59 commking	32 chincf	32 chincf	63 chincf	62 chincf	62 chincf	62 chincf	81 chincf	74 chincf	30 chincf	CHINCF
60 commchum	33 chumcf	33 chumcf	62 chumcf	61 chumcf	61 chumcf	61 chumcf	80 chumcf	73 chumcf	29 chumcf	CHUMCF
63 commcoho	36 cohocf	36 cohocf	66 cohocf	65 cohocf	65 cohocf	65 cohocf	84 cohocf	77 cohocf	33 cohocf	COHOCF
61 commpink	35 pinkcf	35 pinkcf	64 pinkcf	63 pinkcf	63 pinkcf	63 pinkcf	82 pinkcf	75 pinkcf	31 pinkcf	PINKCF
62 commred	34 sockcf	34 sockcf	65 sockcf	64 sockcf	64 sockcf	64 sockcf	83 sockcf	76 sockcf	32 sockcf	SOCKCF
64 communk										UNKCF
65 inccomm	37 salmcfc	37 salmcfc	67 salmcfc	66 salmcfc	66 salmcfc	66 salmcfc	85 salmcfc	78 salmcfc		SALMCFC

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NW Salmon Project Variable Correspondence Table

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Aggregated
Harvest Data: Harvests Reports Mailed To ADF&G After the Survey (by Unsurveyed Households)										
	9 chummail	9 chummail	18 chummail	18 chummail	18 chummail	18 chummail	30 chummail			CHUMMAIL
	8 chinmail	8 chinmail	19 chinmail	19 chinmail	19 chinmail	19 chinmail	31 chinmail			CHINMAIL
	10 pinkmail	10 pinkmail	20 pinkmail	20 pinkmail	20 pinkmail	20 pinkmail	32 pinkmail			COHOMAIL
	11 sockmail	11 sockmail	21 sockmail	21 sockmail	21 sockmail	21 sockmail	33 sockmail			PINKMAIL
	12 cohomail	12 cohomail	22 cohomail	22 cohomail	22 cohomail	22 cohomail	34 cohomail			SOCKMAIL
							35 setnetm			
							36 rnrm			
							37 seinem			
							38 otherm			
							39 chumst			
							40 chummem			
Harvest Data: Non-Salmon Species										
								79 crab		
								80 crabharv		
								81 crabstat		
									42 sfsfwfch	
	39 subshee	39 subshee	68 subshee	67 subshee	67 subshee	67 subshee	86 subshee	82 subshee	43 subshee	SUBSHEE
43 hhidshee	40 sheethis	40 sheethis	69 sheethis	68 sheethis	68 sheethis	68 sheethis	87 sheethis	83 sheethis		SHEETHIS
			70 subwhit	69 subwhit	69 subwhit	69 subwhit	88 subwhit	84 subwhit	44 subwhit	SUBWHIT
			71 whitthis	70 whitthis	70 whitthis	70 whitthis	89 whitthis	85 whitthis		WHITTHIS
		41 subchar	72 subchar	71 subchar	71 subchar	71 subchar	90 subchar	86 subchar	45 subchar	SUBCHAR
		42 charthis	73 charthis	72 charthis	72 charthis	72 charthis	91 charthis	87 charthis		CHARTHIS
								88 subchwh		X
Harvest Data: Combined and Adjusted Total Harvest for All Species, All Sources, All Gear Types										
	41 chinfinl	48 chinfinl								X
	42 chumfinl	49 chumfinl								X
	43 pinkfinl	50 pinkfinl								X
	44 sockfinl	51 sockfinl								X
	45 cohofinl	52 cohofinl								X
	46 sheefinl	53 sheefinl								X
		54 charfinl								X
81 chin	52 chin	60 chin	74 chin	73 chin	73 chin	73 chin	92 chin	89 chin	47 chin	CHIN
82 chum	53 chum	61 chum	75 chum	74 chum	74 chum	74 chum	93 chum	90 chum	46 chum	CHUM
85 coho	56 coho	64 coho	78 coho	77 coho	77 coho	77 coho	96 coho	93 coho	50 coho	COHO
83 pink	54 pink	62 pink	76 pink	75 pink	75 pink	75 pink	94 pink	91 pink	48 pink	PINK
84 sock	55 sock	63 sock	77 sock	76 sock	76 sock	76 sock	95 sock	92 sock	49 sock	SOCK
								94 crab2		X
86 shee	57 shee	65 shee	79 shee	78 shee	78 shee	78 shee	97 shee	95 shee	51 shee	SHEE
			81 whit	80 whit	80 whit	80 whit	99 whit	97 whit	52 whit	WHIT
	58 char	66 char	80 char	79 char	79 char	79 char	98 char	96 char	53 char	CHAR

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NW Salmon Project Variable Correspondence Table

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Aggregated
Network Data: Cooperation Among Households in Harvesting and Processing Salmon										
27 othhhid										OTHHHID
29 allhhid										ALLHHID
19 prochhid										PROCHHID
28 allname										ALLNAME
18 procname										PROCNAME

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