Special Publication No. SP1991-003

Subsistence Uses of Fish and Wildlife in 15 Alutiiq Villages After the Exxon Valdez Oil Spill

by

James A. Fall

1991

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

Symbols and Abbreviations

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Measures (fisheries)

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

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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This document should be cited as:
Fall, J.A. 1991. Subsistence uses of fish and wildlife in 15 Alutiiq villages after the Exxon Valdez Oil Spill. Alaska Department of Fish and Game Division of Subsistence, Special Publication No. SP1991-003, Anchorage.

SUBSISTENCE USES OF FISH AND WILDLIFE IN 15 ALUTIIQ VILLAGES AFTER THE *EXXON VALDEZ* OIL SPILL

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Paper presennted at the 18th annual meeting of
the Alaska Anthropological Association, Anchorage, Alaska

March 23, 1991

ABSTRACT

The paper discusses some of the results of research on subsistence uses of fish and wildlife in 15 Alutiiq villages affected by the Exxon Valdez Oil Spill of March 1989. The research was conducted by the Division of Subsistence of the Alaska Department of Fish and Game. The study communities included Tatitlek and Chenega Bay in Prince William Sound; English Bay and Port Graham in lower Cook Inlet; Akhiok, Karluk, Larsen Bay, Old Harbor, Ouzinkie, and Port Lions in the Kodiak Island Borough; and Chignik, Chignik Lagoon, Chignik Lake, Ivanof Bay, and Perryville on the Alaska Peninsula. The primary data collection method was a systematic survey administered to representatives of 403 households. The research documented substantial declines in subsistence harvests and uses in 10 study communities in the year following the spill. For example, subsistence harvests at Tatitlek and Chenega Bay were down about 57 percent from pre-spill averages. The paper describes these changes and discuss reasons for the declines, especially concerns about hyrdocarbon contamination of resources harvested for subsistence use.

INTRODUCTION[1]

At last year's annual meeting of the Alaska Anthropological Association (aaa) in Fairbanks, I described the division's "oil spill response program" (Fall 1990a). Particularly, I focused on the issue of possible hydrocarbon contamination of subsistence foods, including the role of the Oil Spill Health Task Force and the subsistence resource collection and testing program. The division also presented another overview at the Conference on Hunting and Gathering Societies (CHAGS) in Fairbanks in May 1990 (cf. Smith 1991). As mentioned in those earlier presentations, another goal of the division's program was to understand changes to subsistence harvest and use patterns in the spill-affected communities. I presented preliminary findings of that aspect of our research at the annual meeting of the American Anthropological Association (AAA) in New Orleans last November (Fall 1990b). This present paper is an abridged version of the AAA paper and is, essentially, "part two" of my presentation at last year's aaa.[2]

As all of us well remember, two years ago tomorrow (March 24, 1989), the tanker Exxon Valdez ran around off Bligh Reef and dumped almost 11 million of gallons of crude oil into Prince William Sound. The currents and tides eventually carried oil, mousse, sheen, and tar balls more than 580 miles along Alaska's southern coast. Soon, images of oiled seabirds, dead and dying sea otters, and miles of ravaged coastline filled television screens and newspapers around the world.

As shown in Figure 1, the oil also fouled waters and beaches used for subsistence hunting, fishing, and gathering by 15 Alutiiq villages with about 2,200 people. For at least 7,000 years, Alaska Native people

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[1] Acknowledgements. This paper is based on research by the following Division of Subsistence staff: Janet Cohen, Philippa Coiley, Rita Miraglia, Craig Mishler, Deborah Robinson, Lisa Hutchinson-Scarbrough, Ron Stanek, and Lee Stratton. Data management support has been provided by Louis Brown, Gretchen Jennings, Cheryl Scott, Sandy Skaggs, Robert Walker, and Charles Utermohle of the Division of Subsistence. Carol Barnhill, Division of Habitat, prepared the maps. Assistance in research design and data analysis was provided by division research director Robert Wolfe. Also, 23 village residents were especially helpful in a variety of ways, including conducting interviews, translating, and introducing the project in their communities (see Fall 1990b). Especially, we thank the governments of each village for granting us permission to conduct this research in their communities and the hundreds of people who took the time to participate in the project.

[2] Another version of this paper was presented by Craig Mishler at the 50th Annual meeting of the Society for Applied Anthropology in Charleston, South Carolina, on March 16, 1991 (Fall and Mishler 1991).

have depended upon these lands and waters for survival (Clark 1984a, 1984b). This survival has also depended upon the people's knowledge about and observations of the natural world around them.

One of the first signs that people in Tatitlek, the community closest to Bligh Reef, used to warn them that something terrible might be happening to the fish and wildlife of Prince William Sound as a result of the spill was a report of a dead starfish that washed up on the beach near the village. Hundreds of miles away, news spread of a dead whale washed up at Cape Karluk, and everyone in Karluk suddenly stopped fishing (Craig Mishler, personal communication). Starfish are not eaten and whales are no longer hunted, but they, like other creatures, may act as signs or omens of unseen dangers throughout the ecosystem. Furthermore, as residents of these and the other villages traveled in their traditional harvest areas and worked on the spill clean-up, they experienced the spill's damages first-hand.

But, the effects of the spill were discontinuous. Some beaches were heavily oiled, other were not. Some animals, such as sea otters and sea ducks, were very vulnerable to oiling, but salmon and deer showed no outer signs of exposure to the oil. Thus, the major question for the villagers became: are our subsistence foods still safe to eat? If some beaches, waters, and animals were oiled, were <u>any</u> safe to use? Were there links between what the villagers could observe and what they could not see? Accordingly, when health officials advised villagers that if resources did not smell or taste oily, the were "almost certainly safe to eat" (ADHSS 1989), villagers responded with skepticism and disbelief. As the oil spread and wildlife died, anxiety over the safety of eating traditional foods grew to the point where subsistence harvests in some villages virtually ceased. As a village official at Ouzinkie put it in June 1989, "No one's eating anything out of the ocean anymore."

By August 1989, some preliminary findings from studies to test the safety of subsistence foods were available. In the following months, there were health bulletins, village meetings, newsletters, and videos reporting study findings, all with basically the same message. No fish tested were unsafe to eat. Most shellfish tested were also safe, but people should avoid using shellfish from oil contaminated beaches. Later tests on marine mammals, deer, and ducks, and additional testing of fish and shellfish in

1990, supported these conclusions.[3] Nevertheless, after months of observing the spill's effects first-hand, for many people, doubts remained.

The remainder of the paper will compare measures of subsistence harvests for the year after the spill with pre-spill measurements. It will then explore the assessments people themselves gave of subsistence harvests and the reasons they provided to explain differences. It will conclude with some observations about subsistence uses since our 1990 field interviews were completed.

DATA GATHERING METHODS

The primary method for gathering information about subsistence uses in the 15 Alutiiq oil spill villages was a household survey administered in person in each village. The questionnaire was modeled after other division survey instruments that had been administered at least once before in all 15 communities. For the 12 smaller communities, we tried to interview knowledgeable representatives of every household, while in the three larger villages of Port Lions, Old Harbor, and Ouzinkie, we chose 50 percent random samples. In total, from January to April 1990 we interviewed 403 households, for 88.2 percent rate of achievement of our goal (Table 1). Survey data were coded for computer entry and analysis with the SPSS program. Harvest quantities in numbers of animals or fish were converted into pounds edible weight using standard factors. Final study findings will be reported in a series of technical papers now in preparation (Fall et al. 1991; Mishler and Cohen 1991; Stanek 1991; Stratton and Coiley 1991).

SUBSISTENCE AFTER THE SPILL

As reported in Table 2 and Figure 2, the subsistence harvests in the study communities in the year after the spill ranged from a low of 89 pounds per person in Ouzinkie to a high of 490 pounds at Ivanof

[3] For summaries of these programs and findings see Fall (1990a, 1990b), Varanasi et al. 1990, Walker and Field 1991, and the newsletters produced by the division for the Oil Spill Health Task Force (ADF&G 1990).

Bay.[4] As shown in Figure 3, of the 10 study communities in Prince William Sound, lower Cook Inlet, and the Kodiak Island Borough, eight had lower harvest levels during the study year than in the closest previous year for which data are available. This includes all four Prince William Sound and Lower Cook Inlet villages, and four of the six in the Kodiak Island Borough. In contrast, four Alaska Peninsula villages showed higher harvests, while the other (Chignik Lagoon) was only slightly lower than the previous measurement.

Table 2 and Figure 4 compare the relative changes in subsistence harvests for each community across study years. Where two pre-spill measurements were available, they were averaged for this comparison. The comparison shows startling declines for all but the Alaska Peninsula villages. The Prince William Sound communities were down markedly in 1989-90, Chenega Bay by 56.9 perent and Tatitlek by 56.7 percent. The lower Cook Inlet communities also exhibited sharp declines of 51.3 percent for English Bay and 46.5 percent for Port Graham. Every Kodiak community also reported lower harvests in the study year compared to the average of previous measurements, ranging from 76.6 percent lower for Ouzinkie (the largest relative decline for any village) to 14.5 percent lower at Akhiok. With the exception of Karluk, the relative decline in harvests in the Kodiak Island Borough decreased as the community's distance from the source of the spill increased. Again in contrast, subsistence harvests in four of the five Alaska Peninsula communities were relatively stable. The exception was Chignik Lake, which showed a 60.1 percent increase in harvests compared to 1984. This community's harvest of 447.6 pounds per person was similar to that of Ivanof Bay, Perryville, and similar communities of the Alaska Peninsula such as Port Heiden, Pilot Point, and Egegik (Walker et al. 1988).

ASSESSMENT OF CHANGES AND REASONS FOR CHANGE

During household interviews, respondents were asked to compare their uses of particular categories of wild resources during the post-spill study year with those of previous years. If they noted a difference, they were asked for reasons why the differences had occurred. Assessments of change were

[4] Please note that these are preliminary data and will undergo minor changes before the final project reports are published.

requested for salmon, other fish, marine invertebrates, deer (Prince William Sound and Kodiak only), marine mammals, and waterfowl, as well as harvests overall.[5] As shown in Table 3 (cf. Figure 5), only 2 percent of the households reported higher levels of use in the year following the spill, while 61 percent of the households said uses were lower overall than in previous years. About a third of the households said that subsistence uses had stayed about the same.

There were notable differences in these assessments between subregions. For lower Cook Inlet and Prince William Sound, most respondents said that lower harvests had occurred (93 percent and 87 percent, respectively). Over half (56 percent) of the households from Kodiak Island Borough indicated lower harvests as well. This percentage was lowest among Alaska Peninsula households, 36 percent of all households. The communities with the largest percentage of households reporting lower harvests were English Bay (97 percent), Port Graham (90 percent), Chenega Bay (89 percent), Tatitlek (85 percent) and Ouzinkie (77 percent).

As also shown in Table 3 (cf. Figure 5), most respondents reported that lower subsistence uses during the study year were due to the effects of the Exxon Valdez oil spill. Overall, 80 percent of the households which reported lower harvests cited the spill as the cause of the decline, while 11 percent cited non-spill reasons. Respondents attributed lower levels of subsistence use to the spill in at least 97 percent of the households with declines in Prince William Sound, 91 percent in lower Cook Inlet, 71 percent in the Kodiak Island Borough, and 64 percent in the Alaska Peninsula,

More specifically, as reported in Table 4 (cf. Figure 5), fear of contamination of subsistence foods by the oil was the most common reason cited for lower levels of subsistence harvests. Of the 189 households which specified oil spill reasons for lower harvests, 68 percent said that fear of oil-contaminated foods reduced their harvests or uses.[6] This was a major concern in all the subregions, but highest in Prince William Sound (78 percent of households), followed by lower Cook Inlet (75 percent), Alaska Peninsula (61 percent), and the Kodiak Island Borough (58 percent).

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[5] The discussion here focuses on the overall assessment, but important differences between assessments for particular resource categories will be discussed in subsequent reports.

[6] Households could cite more than one reason for the change.

Here are some representative statements from survey respondents about their concerns about oil contamination of their traditional food supply.

> We saw too much oil, and we didn't want nothing to do with [fish]. I guess if you didn't see the oil you wouldn't mind. We don't want to eat them until we find out what's really going on.
>
> -- Chenega Bay, April 1990

> I didn't go to the same places [as usual] to hunt because of oil on the beach. I've seen deer eating kelp. I don't want to shoot [a] deer and then find out it has been eating oil.
>
> -- Tatitlek, April 1990

> There is still lots of oil on Elizabeth Island and Anderson Beach. In some places, there is lots of oil. I think people will wait a couple years before going out [to those places] again because they just don't trust it.
>
> -- English Bay, January 1990

> I can't go out and get what I want off my beach just to eat without worrying if it is contaminated or I'll get poisoned. . . That's why I don't eat nothing off the beach. I don't eat clams no more.
>
> -- Ouzinkie, January 1990

> We won't touch clams after that oil was floating around. Not our family anyway.
>
> --Chignik Lake, January 1990

The other major oil spill-related reasons for lower harvests were the time spent on oil spill clean up (at least 43 percent of the households), and the perception that less resources were available because of spill-induced mortality (at least 6 percent of the households). Regarding the latter, here are two statements from Tatitlek:

> There are usually hundreds of black ducks [scoters] around here, [but] this year there's not. [There's] nothing around to hunt. There are areas around here [usually] loaded with ducks. Last year, there were none.
>
> I've hunted seal for years and years. All my life. This year, [there's] none around. [It's a] poor year for seal. Some trips I go out, [there's] not a one.

FOLLOW-UP INTERVIEWS

As reported in another paper (Fall and Mishler 1991:8-9), between September 1990 and March 1991 the division conducted 88 follow-up interviews with household heads who had earlier reported decreased subsistence harvests because of concerns about hydrocarbon contamination. We found that the closer the community was to the origin of the spill, the higher the level of conern remained. This was especially clear regarding salmon and shellfish. For salmon, concern remained high at Chenega Bay and Tatitlek, but dropped off sharply past Ouzinkie. We found higher levels of concern remaining about oil-contaminated shellfish especially in communities such as Chenega Bay and English Bay. Overall, the follow-up interviews showed that for many households in some communities, especially those where the oil hit the hardest, questions remain about the damages that the spill might have caused to subsistence foods.

OBSERVATIONS AND CONCLUSIONS

This paper has provided an comparison overview of the size of subsistence harvests after the Exxon Valdez oil spill in 15 Alaska Native communities whose harvest areas were affected by the spill. The research found that in 10 of the communities, these harvests were substantially lower than in previous years. Especially, subsistence harvests in villages of Prince William Sound, lower Cook Inlet, and some in the Kodiak Island Borough showed stark declines. In contrast, subsistence production in five Alaska Peninsula villages was relatively similar to earlier measurements or higher.

When asked to assess differences in their subsistence uses in the study year compared with other years, most households confirmed that harvests were down (61 percent). In 80 percent of the cases, the oil spill was cited as the reason for the decline. The dominant oil spill-related reason for lower harvests was fear that subsistence foods had been contaminated by the oil. The majority of the households in most of 15 communities had direct contact with the effects of the spill through their employment on oil clean up jobs, as well as during other travel through their traditional use areas. They saw oil on the beaches, in the

water, and on certain animals and birds. Others suspected oiling when they inspected resources they had harvested or had been given. In addition, reports of dead wildlife and other signs warning of danger led many people to doubt that their traditional harvest areas were safe to use and traditional foods were safe to eat.

By the time reliable information based on tests of resources from specific traditional sites was available to these communities, all of the spring and most of the summer opportunities for subsistence harvesting in 1989 had passed. Furthermore, after months of observing the danger caused by the spill, many villagers were skeptical that foods could be safe. They demanded more tests from more places on a wider range of species. With oil still present, they argued that the tests should continue and be expanded.

Follow-up interviews suggested that responents in most communities had returned to eating fish again in 1990, but many still distrust the safety of shellfish and deer. Overall, those communities closest to the source of the spill are most likely to express continuing concerns about resource contamination.

Indeed, it appears that as long as residents of the Native communities of the areas affected by the *Exxon Valdez* oil spill believe that oil remains in their environment, many will continue to refrain from using subsistence foods. The following report appeared from Chenega Bay in October 1990, more than 18 months after the spill (Evanoff 1990). The report indicated that the people of the village

> Have eaten only a small fraction of the foods they ordinarily live on daily. They reported that indications from wildlife around them make the people very uncomfortable, and they are afraid to harvest subsistence food. An abnormal seal liver, ordinarily firm, was soft and runny. The arm of a starfish fell apart when pulled from the rocks. They have reported several dead eagles and sea gulls, a dead bear and a blind sea lion found during the past month, highly unusual occurrences prior to the spill.

In February 1991, several more dead and sick bald eagles were observed near Chenega Bay. The villagers captured one alive and turned it over to the U.S. Fish and Wildlife Service for treatment. In the same month, the villagers harvested chitons which, after cooking, were noticed to have strange white sores.

For a people whose survival has long relied upon their observations of the natural environment, such signs continue to warn of danger. And people have continued to respond in a culturally appropriate manner – with caution. Our analysis of data about subsistence uses in Alutiiq communities following the

Exxon Valdez oil spill suggests that while these signs have persisted, certain traditional foods have been avoided by many households. Until such signs disappear and people are able place confidence in their own abilities to again interpret and understand their environment, recovery from this disaster will likely remain incomplete.

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TABLE 1. SAMPLE SIZES, OIL SPILL AREA HARVEST SURVEY, 1990

Community	Number of Households			
	Target	Completed	Refusals	No contact
Prince William Sound Subarea				
Chenega Bay	21	18 (85.7%)	1	2
Tatitlek	28	22 (78.6%)	3	3
Subtotal	49	40 (81.6%)	4	5
Lower Cook Inlet Area				
English Bay	41	33 (80.5%)	6	2
Port Graham	61	48 (78.7%)	9	4
Subtotal	102	81 (79.4%)	15	6
Kodiak Island Borough				
Akhiok	13	10 (76.9%)	2	1
Karluk	17	14 (82.4%)	1	2
Larsen Bay	39	34 (87.2%)	4	1
Old Harbor	46 (50%)[a]	48 (104.3%)	2	NA
Ouzinkie	35 (50%)[a]	35 (100%)	5	NA
Port Lions	36 (50%)[a]	36 (100%)	5	NA
Subtotal	186	177 (95.2%)	19	4
Alaska Peninsula Area				
Chignik Bay	39	35 (89.7%)	2	2
Chignik Lagoon	15	15 (100%)	0	0
Chignik Lake	28	21 (75.0%)	0	7
Ivanof Bay	7	7 (100%)	0	0
Perryville	31	27 (87.1%)	2	2
Subtotal	120	105 (87.5%)	4	11
TOTAL	457	403 (88.2%)	42	26

[a] Target was a 50 percent random sample of year-round households.

TABLE 2. ANNUAL SUBSISTENCE HARVESTS, POUNDS USEABLE WEIGHT PER PERSON, STUDY COMMUNITIES AND PERCENT INCREASE OR DECREASE DURING THE YEAR FOLLOWING THE *EXXON VALDEZ* OIL SPILL

				Percentage of decrease/increase in harvests during the year of the spill	
Community	Year One	Year Two	Oil Spill Year[a]	Most recent previous year	Average of all previous years
Chenega Bay	308.8[b]	377.7	148.1	-60.8%	-56.9%
Tatitlek	351.7	641.5	214.8	-66.5%	-56.7%
English Bay	288.8		140.6	c	-51.3%
Port Graham	227.2		121.6	c	-46.5%
Akhlok	517.9[b]	158.2[b]	289.0	+82.7%	-14.5%
Karluk	832.1[b]	380.8[b]	250.7	-34.2%	-58.7%
Larsen Bay	388.3[b]	204.7[b]	212.1	+ 3.6%	-28.5%
Old Harbor	465.5[b]	419.0[b]	260.0	-37.9%	-41.2%
Ouzinkie	358.3[b]	401.1[b]	89.0	-77.8%	-76.6%
Port Lions	266.9[b]	323.0[b]	146.7	-54.6%	-50.3%
Chignik Bay	187.7		208.6	c	+11.1%
Chignik Lagoon	219.5		211.4	c	- 3.7%
Chignik Lake	279.6		447.6	c	+60.1%
Ivanof Bay	451.8		489.8	c	+ 8.4%
Perryville	390.4		394.2	c	+ 1.0%

[a] For Prince William Sound and Kodiak communities, two pre-spill measurements are available. Pre-spill study years are as follows: Tatitlek, 1987-88 and 1988-89; Chenega Bay, 1984-85 and 1985-86; English Bay and Port Graham, 1987; Kodiak Island Borough, 1983-83 and 1986; Alaska Peninsula, 1984. The "spill year" is 1989 for all communities but Chenega Bay and Tatitlek, for which it is April 1989 - March 1990.

[b] Factors for converting numbers of animals or fish to pounds useable weight were revised slightly for the current study. We are presently recalculating earlier per capita harvest estimates using the revised conversion factors so that the data are comparable. This recalculation is incomplete. Those figures noted with a "b" have not yet been recalculated.

[c] Only one previous measurement.

Please note that these data are preliminary and might change. Consult the final reports in the division's technical paper series for final data and analysis.

Table 3
Overall Assessement of Harvest/Use, Post-Spill Study Year

REGION Community	Households Surveyed*	CHANGE IN HARVEST/USE								REASONS FOR LESS					
		No Response		Higher		Same		Less		Non-Spill		Oil Spill		No Response	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
PRINCE WILLIAM SOUND	38	1	2.6%	0	0.0%	4	10.5%	33	86.8%	1	3.0%	32	97.0%	0	0.0%
Tatitlek	20	0	0.0%		0.0%	3	15.0%	17	85.0%	1	5.9%	16	94.1%	0	0.0%
Chenega Bay	18	1	5.6%		0.0%	1	5.6%	16	88.9%		0.0%	16	100.0%	0	0.0%
LOWER COOK INLET	81	1	1.2%	1	1.2%	4	4.9%	75	92.6%	7	9.3%	68	90.7%	0	0.0%
English Bay	33	0	0.0%		0.0%	1	3.0%	32	97.0%	2	6.3%	30	93.8%	0	0.0%
Port Graham	48	1	2.1%	1	2.1%	3	6.3%	43	89.6%	5	11.6%	38	88.4%	0	0.0%
KODIAK ISLAND	166	12	7.2%	6	3.6%	55	33.1%	93	56.0%	7	7.5%	66	71.0%	20	21.5%
Ouzinkie	31	2	6.5%		0.0%	5	16.1%	24	77.4%		0.0%	18	75.0%	6	25.0%
Port Lions	35	6	17.1%		0.0%	11	31.4%	18	51.4%	1	5.6%	15	83.3%	2	11.1%
Old Harbor	45	3	6.7%	2	4.4%	23	51.1%	17	37.8%	4	23.5%	8	47.1%	5	29.4%
Larsen Bay	31	1	3.2%	2	6.5%	7	22.6%	21	67.7%	1	4.8%	15	71.4%	5	23.8%
Karluk	14	0	0.0%	1	7.1%	4	28.6%	9	64.3%		0.0%	7	77.8%	2	22.2%
Akhiok	10	0	0.0%	1	10.0%	5	50.0%	4	40.0%	1	25.0%	3	75.0%	0	0.0%
ALASKA PENINSULA	101	1	1.0%	0	0.0%	64	63.4%	36	35.6%	12	33.3%	23	63.9%	1	2.8%
Chignik Bay	31	0	0.0%		0.0%	24	77.4%	7	22.6%	2	28.6%	5	71.4%	0	0.0%
Chignik Lagoon	15	0	0.0%		0.0%	7	46.7%	8	53.3%	1	12.5%	7	87.5%	0	0.0%
Chignik Lake	21	0	0.0%		0.0%	16	76.2%	5	23.8%	1	20.0%	4	80.0%	0	0.0%
Perryville	27	0	0.0%		0.0%	15	55.6%	12	44.4%	7	58.3%	4	33.3%	1	8.3%
Ivanof Bay	7	1	14.3%		0.0%	2	28.6%	4	57.1%	1	25.0%	3	75.0%	0	0.0%
TOTAL	386	15	3.9%	7	1.8%	127	32.9%	237	61.4%	27	11.4%	189	79.7%	21	8.9%

* Households not present during the pre-spill period were removed from analysis. These include two households from Tatitlek, three from Larsen Bay, three from Old Harbor, one from Port Lions, and four from Chignik Bay.

Table 4
Oil Spill-Related Reasons for Reduction in Overall Subsistence Harvest/Use, Post-Spill Study Year

REGION Community	Household Surveyed*	Households Specifying Spill-Related Reductions		Less Resources Around Due to Spill		Fear of Contamination		Too Busy Working to Obtain Sub. Food		Other Spill-Related Reasons		No Specific Reason Given	
		Number	Percent**	Number	Percent***	Number	Percent	Number	Percent	Number	Percent	Number	Percent
PRINCE WILLIAM SOUND	38	32	84.2%	4	12.5%	25	78.1%	4	12.5%	4	12.5%	5	15.6%
Tatitlek	20	16	80.0%	1	6.3%	13	81.3%	3	18.8%	2	12.5%	2	12.5%
Chenega Bay	18	16	88.9%	3	18.8%	12	75.0%	1	6.3%	2	12.5%	3	18.8%
LOWER COOK INLET	81	68	84.0%	0	0.0%	51	75.0%	49	72.1%	28	41.2%	0	0.0%
English Bay	33	30	90.9%		0.0%	22	73.3%	24	80.0%	14	46.7%		0.0%
Port Graham	48	38	79.2%		0.0%	29	76.3%	25	65.8%	14	36.8%		0.0%
KODIAK ISLAND	166	66	39.8%	0	0.0%	38	57.6%	25	37.9%	3	4.5%	11	16.7%
Ouzinkie	31	18	58.1%		0.0%	13	72.2%	3	16.7%	1	5.6%	3	16.7%
Port Lions	35	15	42.9%		0.0%	8	53.3%	6	40.0%		0.0%	4	26.7%
Old Harbor	45	8	17.8%		0.0%	4	50.0%	2	25.0%		0.0%	2	25.0%
Larsen Bay	31	15	48.4%		0.0%	9	60.0%	6	40.0%	2	13.3%	2	13.3%
Karluk	14	7	50.0%		0.0%	4	57.1%	5	71.4%		0.0%		0.0%
Akhiok	10	3	30.0%		0.0%		0.0%	3	100.0%		0.0%		0.0%
ALASKA PENINSULA	101	23	22.8%	7	30.4%	14	60.9%	4	17.4%	7	30.4%	0	0.0%
Chignik Bay	31	5	16.1%	2	40.0%	3	60.0%	1	20.0%	3	60.0%		0.0%
Chignik Lagoon	15	7	46.7%	2	28.6%	2	28.6%	2	28.6%	4	57.1%		0.0%
Chignik Lake	21	4	19.0%		0.0%	3	75.0%		0.0%		0.0%		0.0%
Perryville	27	4	14.8%	3	75.0%	3	75.0%	1	25.0%		0.0%		0.0%
Ivanof Bay	7	3	42.9%		0.0%	3	100.0%		0.0%		0.0%		0.0%
TOTAL	386	189	49.0%	11	5.8%	128	67.7%	82	43.4%	42	22.2%	16	8.5%

* Households not present during the pre-spill period were removed from analysis. These include two households from Tatitlek, three from Larsen Bay, three from Old Harbor, one from Port Lions, and four from Chignik Bay.

** Percentage based upon number of households surveyed.

*** Percentage based upon number of households specifying spill-related harvest reductions. As multiple responses are possible, percentages across reasons will not equal 100%.

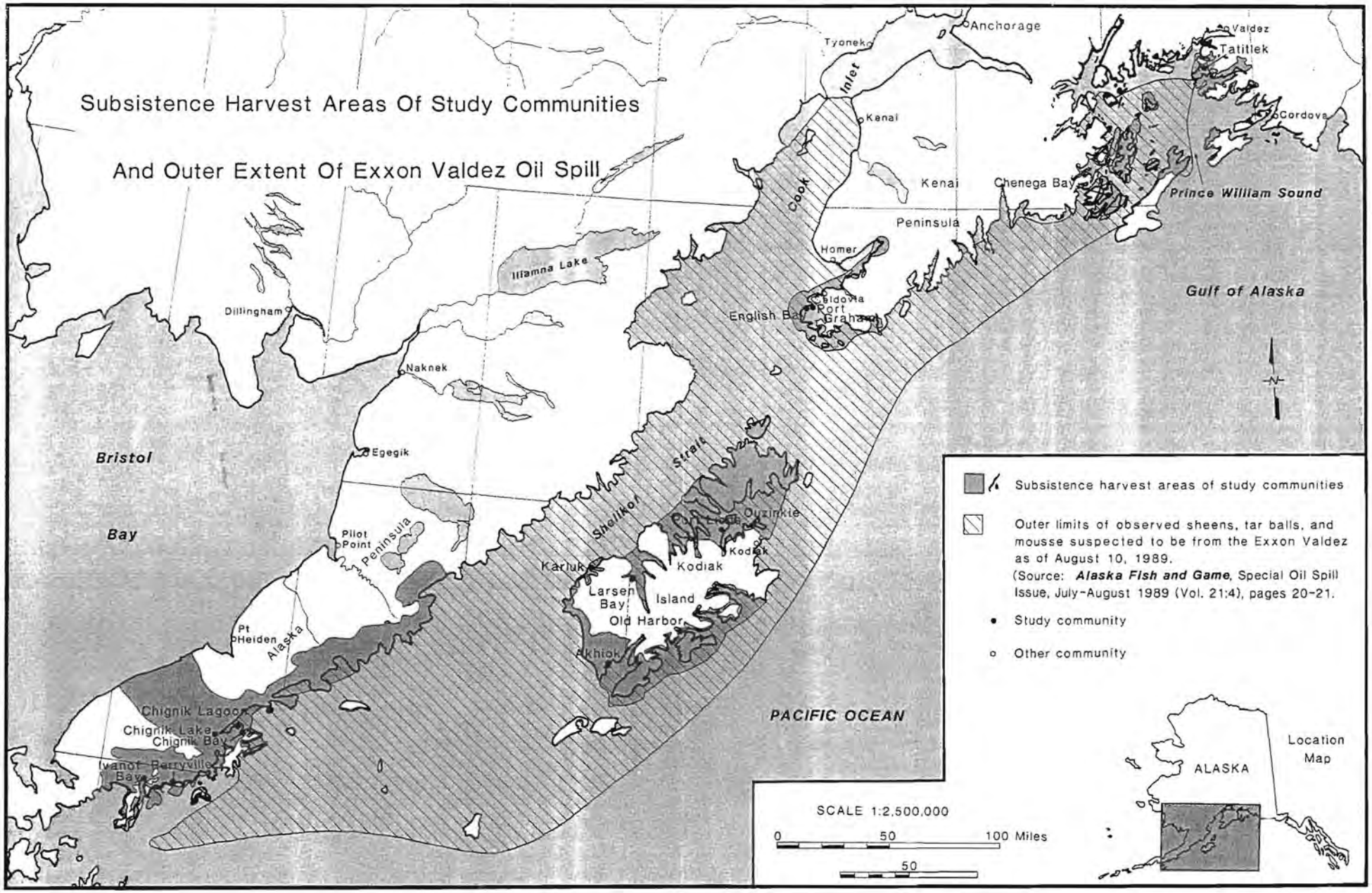

Subsistence Harvest Areas Of Study Communities
And Outer Extent Of Exxon Valdez Oil Spill
Anchorage
Tyonek
Inlet
Cook
Kenai
Valdez
Tatitlek
Cordova
Kenai
Chenega Bay
Peninsula
Prince William Sound
Homer
Gulf of Alaska
Iliamna Lake
Dillingham
Naknek
Bristol
Bay
Egegik
Pilot
Point
Peninsula
Shelikof
Strait
Ouzinkie
Kodiak
Karluk
Larsen
Bay
Island
Old Harbor
Akhiok
Pt
Heiden
Alaska
Chignik Lagoon
Chignik Lake
Chignik Bay
Ivanof Bay
Perryville
PACIFIC OCEAN
Subsistence harvest areas of study communities
Outer limits of observed sheens, tar balls, and mousse suspected to be from the Exxon Valdez as of August 10, 1989.
(Source: Alaska Fish and Game, Special Oil Spill Issue, July-August 1989 (Vol. 21:4), pages 20-21.
Study community
Other community
SCALE 1:2,500,000
0
50
100 Miles
50
Location Map
ALASKA

Figure 2. Per Capita Subsistence Harvests In the year following the EXXON VALDEZ oil spill

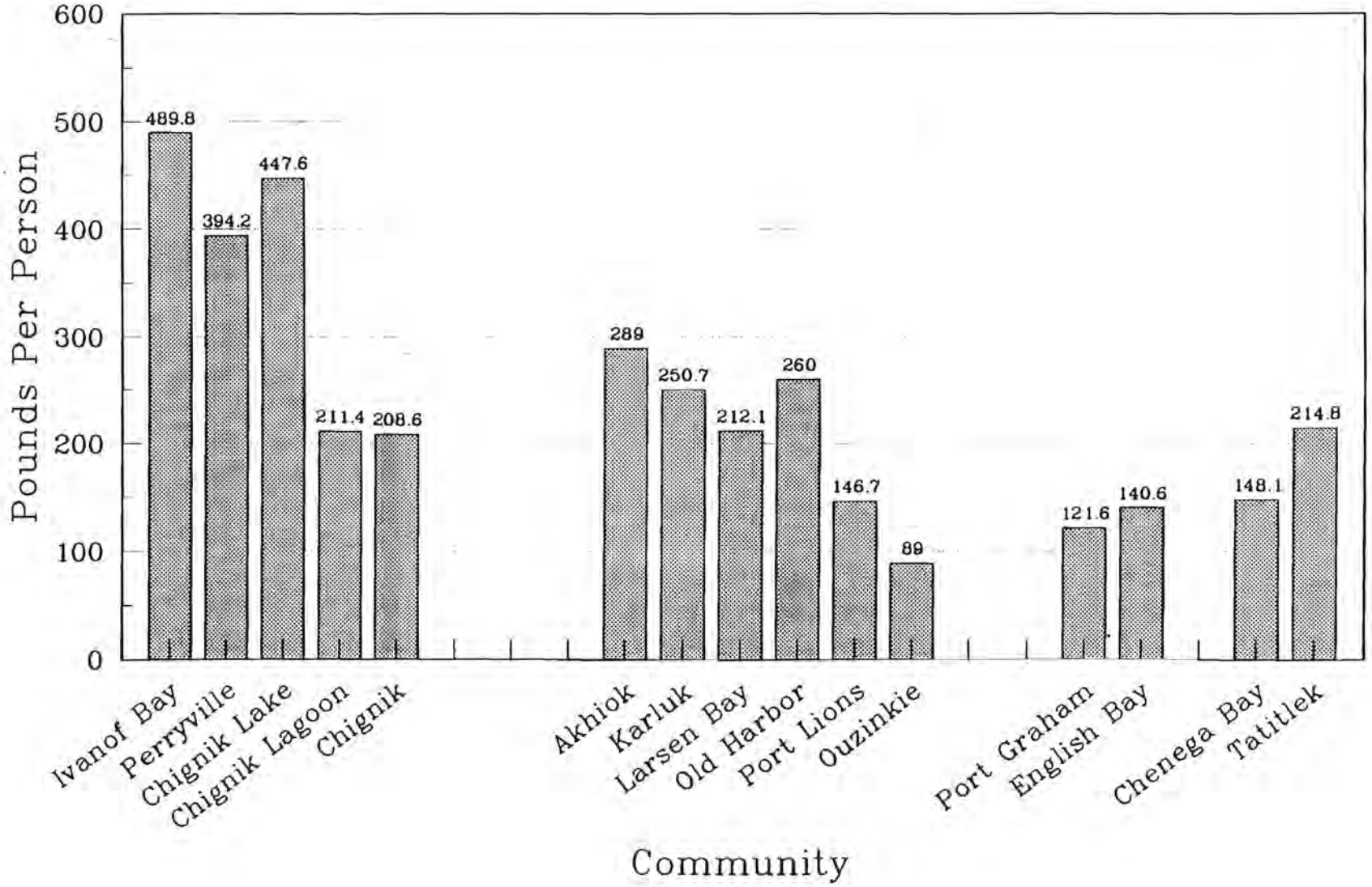
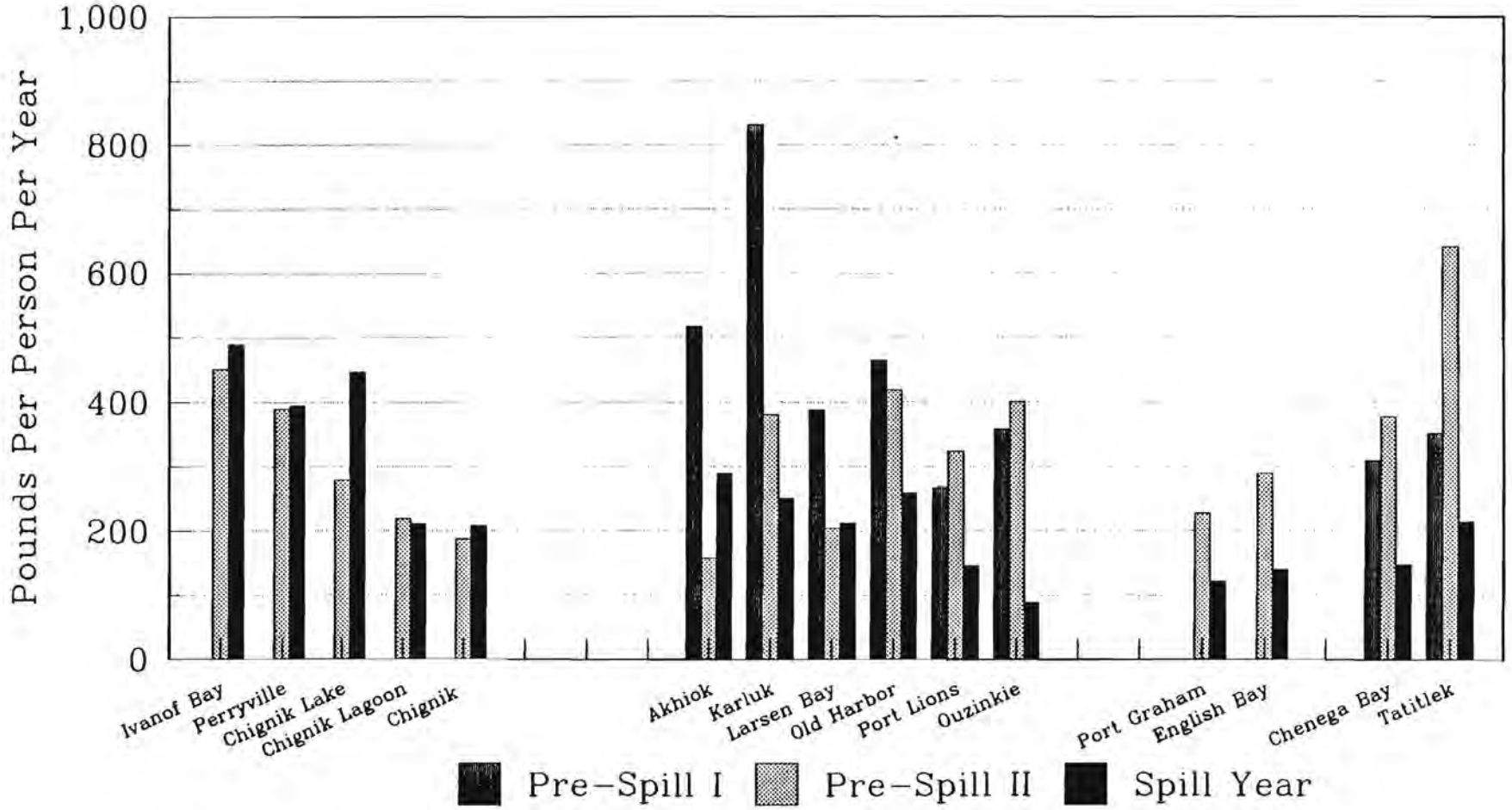


Figure 3. Per Capita Subsistence Harvests Oil Spill Study Communities, 1980's



Two previous study years exist for Kodiak and Prince Wm. Sound. One previous study year exists for AK. Peninsula and L. Cook Inlet

Figure 4. Comparison of Subsistence Harvests
Pounds per person, per year
Before and after the EXXON VALDEZ oil spill

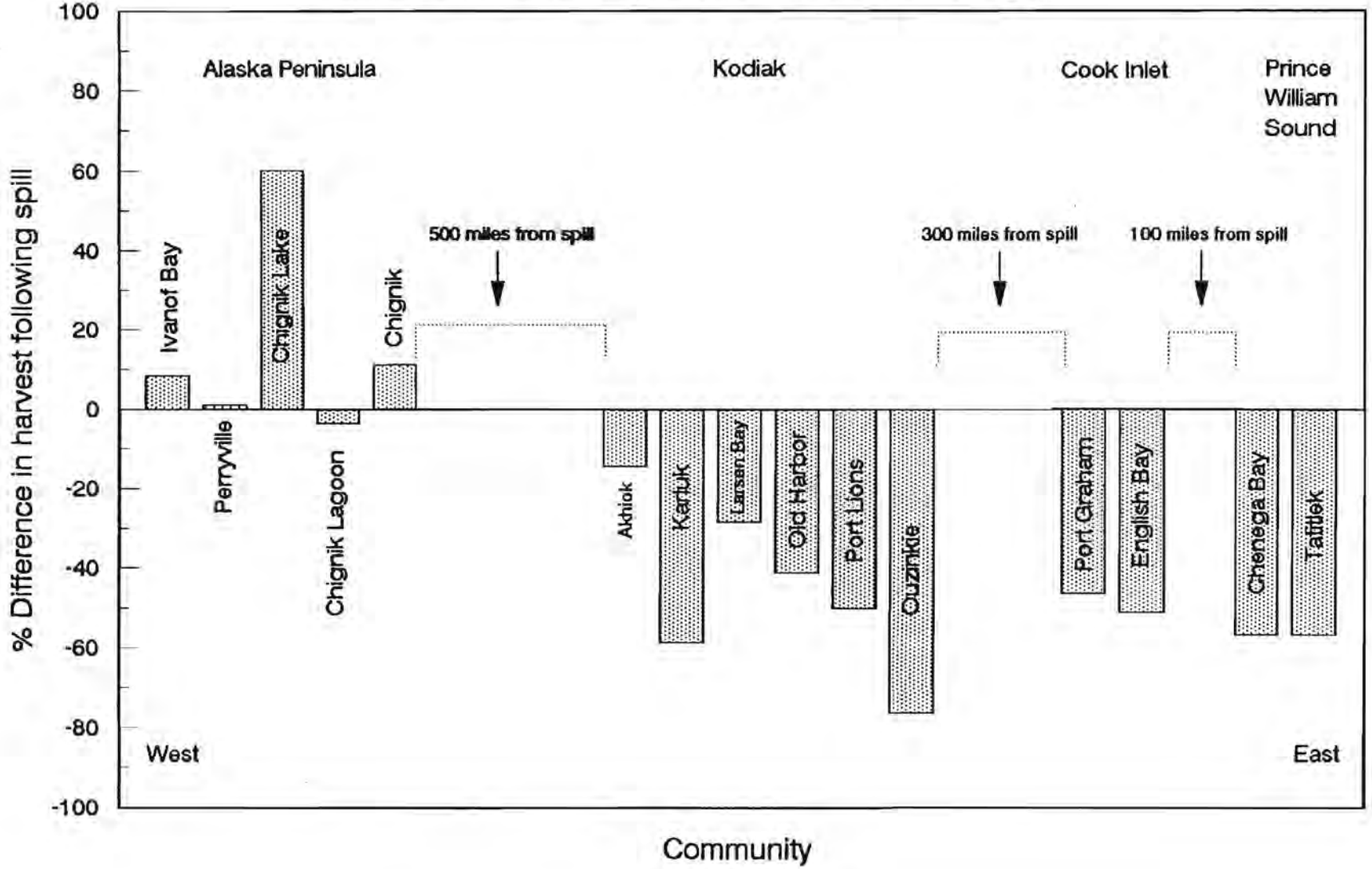


Figure 5. Assessments of Subsistence Harvests in the year following the EXXON VALDEZ Oil Spill