

**SUBSISTENCE HERRING FISHING IN THE
NELSON ISLAND AND NUNIVAK ISLAND
DISTRICTS, 1991**

by
Mary C. Pete

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ABSTRACT

This report summarizes results of subsistence herring harvest surveys conducted in five communities in the Nelson Island and Nunivak Island districts in 1991. Results are compared with four years of survey data, 1986-88 and 1990. Surveys in the 1980s were initiated to document the subsistence herring fishery on Nelson Island when commercialization on those stocks was introduced. The 1990 and 1991 surveys were prompted by poor herring returns to both the Nelson Island and Nunivak Island districts and a concern for adequate subsistence opportunities.

In 1991, a total of 74 short tons of herring was harvested by all five communities which participated in the survey. By all accounts, the 1991 subsistence herring fishery was disastrous for Nelson Island families. The Nelson Island harvest of 70.1 short tons was the lowest ever recorded since 1986, roughly 50 percent less than in other survey years. Per capita harvests of 123 pounds of herring were produced in 1991, which is approximately one-third of the per capita production in 1986, a year considered to have been a satisfactory season for most fishing families. The Nunivak Island harvests in 1991 were lower than that recorded in 1990: 3.9 tons were harvested in 1991 compared to 4.5 tons in 1990.

According to Nelson Island subsistence fishing families declines in herring stocks in the past two years are similar to declines in the 1960s and 1970s. Those were difficult years for residents of these communities in terms of food procurement. As during those times of shortage, many families have made adjustments during the past two years by increasing herring fishing time and by shifting production efforts to other fish and wildlife species.

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INTRODUCTION

This report describes findings of subsistence herring harvest surveys conducted in summer 1991 in four Nelson Island area communities (Newtok, Tununak, Toksook Bay, and Nightmute), and Mekoryuk on Nunivak Island (Fig. 1). The 1991 season was the second consecutive year with poor herring returns and low subsistence harvest levels, particularly in the Nelson Island district. Comparisons are made of 1991 findings with survey results conducted in 1986-88 and 1990 in most of the communities.

Communities in the Nelson Island region of western Alaska have produced the highest total and per capita harvests of herring for subsistence use in the state (Pete and Kreher 1986; Pete, Albrecht, and Kreher 1987; Pete 1991a; Pete 1991b). In the past several decades, quality and quantity of herring returning to the Nelson Island and Nunivak Island areas have varied extensively with concomitant fluctuations in subsistence herring harvests. These fluctuations have significantly impacted the local subsistence economy (Hemming, Harrison, and Braund 1978; Lenz 1980; Pete 1984; Pete 1991a; Pete 1991b). With herring declines in the 1960s and 1970s which were attributed to foreign offshore overfishing, area residents were wary of commercialization of local herring stocks in the 1980s (Pete 1984). Commercialization occurred in 1985 and local residents requested that detailed surveys be conducted in 1986-88 to document subsistence herring harvests and uses by Nelson Island communities. The commercial herring sac-roe fishery expanded the role of herring in the economy of the communities; it became an important local source of monetary income where few opportunities to generate income exist. Projected low returns of herring compelled resumption of subsistence surveys in 1990 and 1991 (Pete 1991b). Local experiences with and observations of reduced herring returns support biological management concerns.

Projections of herring returns to both the Nelson Island and Nunivak Island districts were below allowable commercial harvest thresholds in 1990 and 1991 (Hamner 1989; Alaska Department of Fish and Game 1990). Herring returns to the Nelson Island district in 1990 were slightly above threshold, but no herring were sold because no buyers registered for the district in anticipation of the

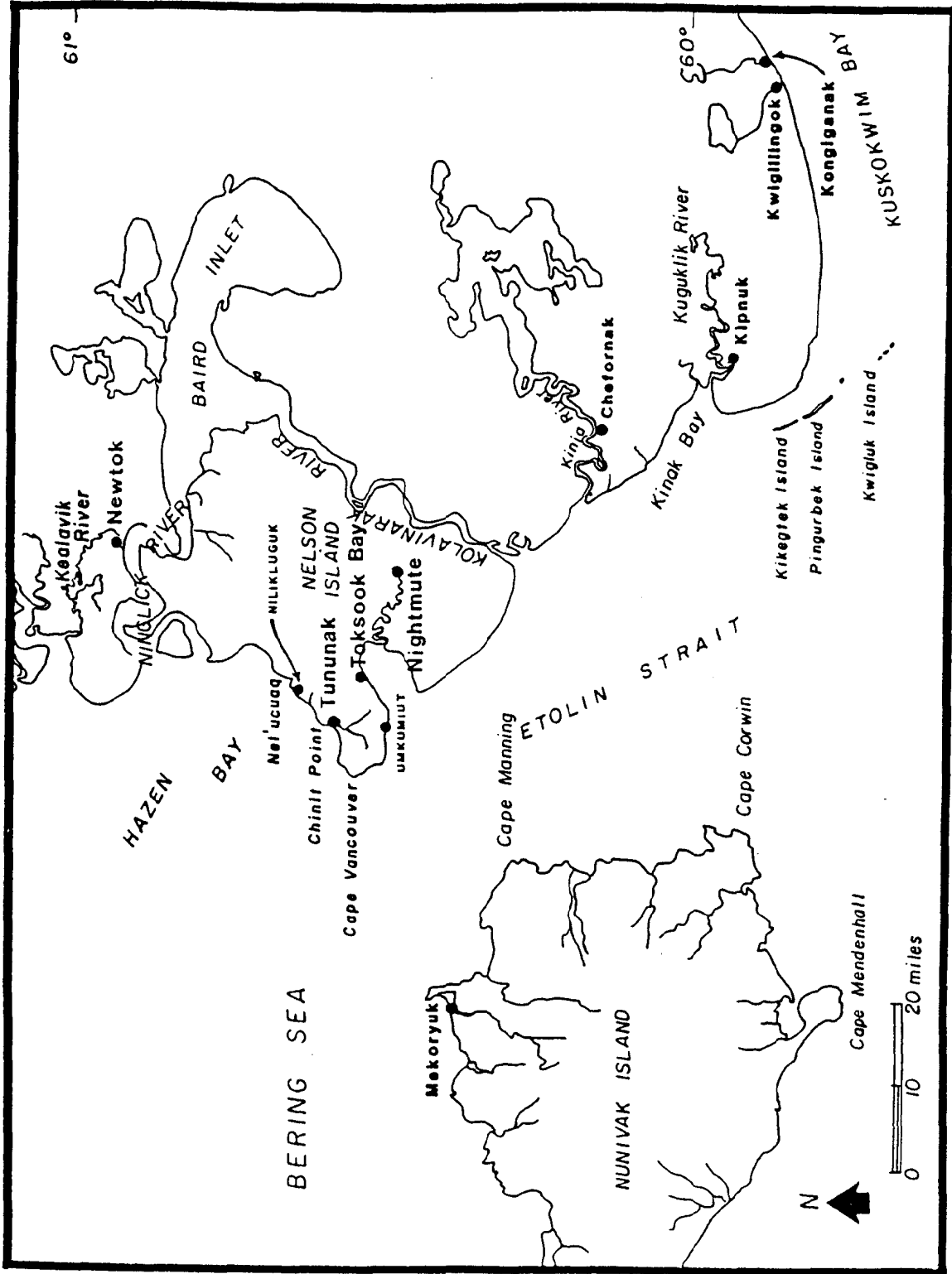


Fig. 1. Location of communities on Nelson and Nunivak islands.

low returns. In 1990, Nunivak Island herring numbers were approximately one-third of the amount needed to allow a commercial harvest. In 1991, herring returns were the inverse of that observed in 1990. Commercial quantities of herring were observed in the Nunivak Island district, but not in the Nelson Island district. However, the commercial harvests in the Nunivak Island district resulted in more bait-quality rather than commercial roe-quality herring being sold (Alaska Department of Fish and Game 1991). Herring declines have resulted in losses for subsistence and commercial fisheries in the Nelson Island and Nunivak Island districts.

METHODOLOGY

The surveys in all the communities were administered using the same method as in previous years since 1986 (Pete and Kreher 1986; Pete, *et al.* 1987; Pete 1991a; Pete 1991b). Letters were sent to community officials in late May requesting permission to administer surveys and recommendations for local assistants. All communities agreed to participate. Nightmute officials agreed to allow the survey because they felt that the 1990 estimates misrepresented their harvests. They did not believe they had as productive a season as portrayed by averages generated from existing data. Contact with key respondents was maintained by telephone to schedule surveys when harvesting had essentially ceased and all processed herring were hung on drying racks. As described below, the relative lateness of the surveys allowed some data collection on rates of spoilage of "fatty" herring (*ullipengayit*) for several fishing families. Households censuses were updated with community officials or local assistants upon arrival. Harvest information collected was similar to that recorded in previous surveys; harvest estimates were generated from direct observation of herring on drying racks. Detailed information on herring fishing sites, timing of harvest, specific personnel involvement, spawn-on-kelp harvest levels, and gear used was collected from several key respondents in each community. Participation in subsistence herring production by every household was noted.

This was the second consecutive year that the survey had been administered in Mekoryuk (Pete 1991b). Again, a complete (100 percent) sample of Mekoryuk herring fishing households was

surveyed. In addition to household participation, harvest levels, and methods of herring processing, harvest timing, areas fished, harvest methods and gear used, more detailed information on subsistence harvest levels of herring spawn-on-kelp was collected.

COMMUNITY CHARACTERISTICS, 1991

Relatively detailed descriptions of the Nelson Island area communities and Mekoryuk were included in previous survey reports (Pete and Kreher 1986; Pete *et al.* 1987; Pete 1991b). In summary, each island is occupied by its own Yup'ik society, of which there traditionally were approximately 20 in the Yukon-Kuskokwim Delta region. The societal name for the Nelson Island society is *Qaluyaarmiut* (from *Qaluyaat*, the place name for Nelson Island proper), and for the Nunivak Island society it is *Nunivaarmiut* (also, from *Nunivaaq*, the place name for Nunivak Island). Each society was bound by a network of kinship ties, generally married within the group, spoke a distinctive dialect, and had specialized and essentially self-sustained use patterns of a specific area (Lantis 1946; Fienup-Riordan 1983; Shinkwin and Pete 1984; Andrews 1989). The *Qaluyaarmiut*, especially, are considered to be relatively traditional in many ways, with most children still learning Yup'ik Eskimo as their primary language and many middle and older age people speaking only the Yup'ik Eskimo language.

The 1991 population and demographic features of the communities remained similar to what they had been in 1990. The total population and the number of households on both islands increased by one percent over the previous year for a total of 1,343 persons in 275 households in 1991 (Table 1) (Pete 1991b). Most (97 percent) were Yup'ik Eskimo. As in 1990, there was some inter-village migration among all communities due to marriage, as well as some, but less, movement for jobs to Anchorage or Bethel, the regional trade and transportation center. In the Nelson Island communities, most of the increase was due to natural growth, except for Toksook Bay where in-migration accounted primarily for the increase, as it did in Mekoryuk. Three households in Nightmute moved to Toksook Bay after deaths in the family or for job opportunities; three households as well as several individuals moved back to Mekoryuk from Bethel or Anchorage. Average household sizes were typically large in

Nelson Island communities, ranging between 4.8 to 6.8 persons per household, in contrast to smaller households in Mekoryuk (3.4 persons) (Table 1).

TABLE 1. NELSON ISLAND AND NUNIVAK ISLAND POPULATION AND HOUSEHOLD PARTICIPATION IN SUBSISTENCE HERRING PRODUCTION, 1991

Community	Population	Total number of households	Average household size	Number of participating households		Number of fishing families
<u>Nelson Island</u>						
Newtok	205	39	5.3	12	(31%)	6
Tununak	321	67	4.8	49	(73%)	32
Toksook Bay	449	83	5.4	57	(69%)	37
Nightmute	163	24	6.8	16	(67%)	10
Subtotals	1,138	213	5.3	134	(63%)	85
<u>Nunivak Island</u>						
Mekoryuk	205	62	3.4	30	(48%)	20
Totals	1,343	275	4.9	164	(60%)	105

The communities continue to rely on local wild resources, the most stable basis of the local economy in many rural communities (Wolfe and Walker 1987). Over 90 local species of fish, game and plants are harvested and used for subsistence by residents of these communities (Pete 1991a). Seasonal employment, commercial fishing, and cottage industries provide the major opportunities for monetary income; permanent year-round jobs are few. Cost of living is high, in part, due to the

expense of importing goods and services. Reductions in and/or the eventual lack of a commercial herring sac-roe fishery in recent years were expressed as a loss of an important source of income in all communities. In particular, many respondents in Mekoryuk complained about time and gear conflicts with the commercial herring fishery along the east shore of Nunivak Island. Boats, nets and personnel were committed to the marginally successful commercial sac-roe fishery and away from the subsistence fishery in 1991.

SUBSISTENCE HERRING FISHING, 1991

Nelson Island District

Methods and patterns of harvest and production of herring for subsistence use by area residents have been described in detail in previous reports (Pete and Kreher 1986; Pete *et al.* 1987; Pete 1991a; Pete 1991b). The subsistence fishery was executed in generally the same manner in 1991 with similar adjustments to the low herring numbers as had been made in 1990. Gear used and areas fished were similar to those reported earlier. Briefly, boats used were locally made wooden or purchased aluminum skiffs 14 to 28 feet in length; gill nets with 2 to 2-3/4 inch mesh and 60 to 300 feet long were set; and areas fished were traditionally productive sites located near communities.

Production activities were organized and managed usually by a couple in charge of extended-family-based work groups. Generally, men oversee and engage in fishing and women take charge of processing and storage. Extended families involving members of more than one household and many individuals with a wide age range cooperated in production activities.

In Tununak, gill nets were usually set as soon as the adjacent shoreline was ice free and herring were present in appreciable numbers in traditional fishing areas, a time span from mid May to early June. The other communities waited until rivers were clear of ice (Newtok and Nightmute) or subsequent runs of herring, noted for lower oil content, arrived (Toksook Bay). Thus, fishing generally occurred from mid May through mid June around Nelson Island.

The 1991 subsistence herring season was similar to the 1990 season in that it was considered to be unusual. According to local families, herring numbers were never considerable throughout the entire season, unlike the 1990 season when they were relatively plentiful early in the season and then decreased dramatically in mid June. Herring were consistently few throughout the 1991 season resulting in more labor-intensive harvesting activities. In further contrast to 1990, herring along the north shore of Nelson Island essentially disappeared after the first week of June. This resulted in a very difficult season for Tununak and Newtok families, who fished longer than usual and still yielded lower harvests.

In 1991, Tununak families fished from late May through the middle of June, about one week later than usual. Fishing activities by Toksook Bay, Newtok, and Nightmute families extended from early June through late June. Many families continued to fish later to increase their low harvests as well as to target herring with lower oil content. These determined efforts by families in Toksook Bay and Nightmute resulted in relatively better harvests, but the quality of herring caught later when the weather is less conducive to drying may not improve their winter stores of herring due to increased spoilage.

As in 1990, many more herring were unusually fat compared to the late 1980s. Each year fishermen and processors make note of the oil content of herring as it affects spoilage. Spoilage is of particular concern in late June when weather is generally more sunny and windless and interspersed with drizzling rain, especially along the south shore of Nelson Island. Because of later administration of the survey, the surveyor observed several families in Toksook Bay and Newtok culling their drying racks of herring that had spoiled. In Toksook Bay, 40 percent of one family's and 60 percent of another family's processed catch were rotten and had to be thrown out. A family in Newtok discarded about one-third of their processed catch, with unwelcome prospects of more rotten fish if the sunny, windless weather continued after weeks of rain. The spoiled herring fell off of the strings as they were being turned. A post-survey telephone report in early August from another Newtok family indicated that 90 percent of their processed catch was unsuitable for human food; they planned to chop the oily mass to mix with dog food throughout the winter.

Understandably, an even greater proportion of strings of herring (*piirat*) was processed as *ullipengayiit* (plural; *ullipengayaq*, singular; means "those that are cut and exposed to the air") in 1991 than in 1990 which indicated the high oil content of herring caught for subsistence (Table 2). This means that more herring were subject to spoilage if suitable weather did not prevail. In the 1991 season, 35.7 percent of all strings of herring were processed as *ullipengayiit* on Nelson Island, compared to regional averages of 11.0 to 19.7 percent of all strings in 1986-88 and 25 percent in 1990 (Table 2). In Tununak and Newtok, nearly one-half of the 1991 catch was processed as *ullipengayiit* (Table 2).

After an initial, brief showing of predominantly large, fat herring in 1991, herring sizes were highly variable in all runs, as they had been in 1990. Large and small herring, or different age-classes, were mixed together. Generally, younger herring are smaller and less oily, so fishermen targeting these set nets of smaller mesh size -- usually 2-inch stretched mesh. In 1990 and 1991, even the 2-inch mesh nets caught mostly small, oily herring. As mentioned above, Newtok and Tununak families had a particularly difficult fishing season. In 1991, in one striking example, a Tununak family got a total of four herring in an overnight set, whereas they usually got over a ton with the same net in the same spot. A 4-inch mesh net they had set for cisco got more herring in the same amount of time. After experimenting with different mesh sizes, some families suspended fishing until later in hopes of getting more and/or leaner herring. However, large numbers of less oily herring never arrived.

Several families who usually fish for herring did not fish at all, resulting in the lowest overall household involvement in herring production in the years of the survey. Instead, they diverted efforts to increase smelt, halibut, Pacific cod, salmon, pike, and cisco harvests, filling drying racks and freezers with these welcome, but less-preferred, alternatives. In 1991, harvested halibut were smaller than normal and salmon runs were late, making local residents more apprehensive about the possibility of supplementing low herring harvests. In Newtok, the community with the most drastic decrease in harvest of herring, many men were spending several days away from the community to harvest pike to dry, rather than overnight trips to nearby pike set net sites. In that community, many more pike and whitefish were observed hanging on drying racks than during previous surveys. Restating important comments from the 1990 survey report, local residents do not consider halibut or Pacific cod adequate,

TABLE 2. TOTAL STRINGS OF HERRING PRODUCED FOR SUBSISTENCE USE AND PERCENTAGE OF TOTAL STRINGS PROCESSED AS *ULLIPENGAYIIT* BY NELSON ISLAND COMMUNITIES, 1986-88 AND 1990-91^a

Community	1986		1987		1988		1990		1991	
	Total No. of Strings	Percent <i>ullipe-ngayitit</i>	Total No. of Strings	Percent <i>ullipe-ngayitit</i>	Total No. of Strings	Percent <i>ullipe-ngayitit</i>	Total No. of Strings	Percent <i>ullipe-ngayitit</i>	Total No. of Strings	Percent <i>ullipe-ngayitit</i>
Newtok	503	7.2%	463	8.3%	618	18.3%	351	16.2%	42	45.4%
Tununak	2,615	17.2	2,331	17.4	2,537	27.2	2,441	28.0	1,121	48.4
Toksook Bay	2,779	7.2	2,348	9.4	2,998	14.6	2,040	23.0	2,000	29.6
Nightmute	1,032	7.2	758	4.4	906	16.9		no data	371	29.2
Totals	6,929	11.0	5,900	12.0	7,059	19.7	4,832	25.0	3,536	35.7

^aTotal numbers of strings vary slightly for some communities from previous reports (Pete and Kreher 1986; Pete *et al.* 1987; Pete 1991b). The numbers reported here are the final adjusted figures and percentages.

or even improved, substitutes for herring, as non-local people may, but these species certainly are preferred by Nelson Island families to non-local, imported foods. Herring is the traditional winter food for Nelson Island families. Changing subsistence fishing strategies often means purchasing new gear and more gasoline, adjusting processing and drying facilities, investing more time fishing for other species, and altering subsistence production roles in the family.

Many respondents interpreted the unusual characteristics of the 1990 and 1991 herring seasons as indications of dramatically decreasing stocks. Some of these disturbing signs had been observed previously in herring stock reductions during the 1960s and 1970s, such as an abundance of fatty herring, shorter duration of runs, and localization and concentration of spawning schools along Cape Vancouver and the north shore of Nelson Island (Pete 1991a). However, there were some differences. Respondents viewed the recent trends with more alarm. Nelson Island herring stocks may have not experienced full recovery from earlier shortages before current relapses. In earlier times of shortage, herring were uniformly large one year, and then decreased in size the next year. The mixed sizes and high oil content of herring throughout the 1990 and 1991 seasons were believed to show that herring numbers may be in a more drastic decline in comparison to the declines in the 1960s and 1970s. Different-sized herring, indicative of age-classes, were thought by local residents to be mixing because there were too few numbers to sustain large enough schools for normal spawning saturation as discrete age-classes. Fewer herring with less competition for the abundant food have become uniformly fat (Pete 1991b). Consequently, in 1990 and 1991 the subsistence herring fishing seasons were distinctly stressful and unusual.

Harvest Levels

By all accounts, the 1991 subsistence herring season was a disaster for Nelson Island area residents. The total 1991 subsistence herring harvest by Nelson Island communities was an estimated 70.1 short tons (Table 3), the lowest recorded total harvest since 1986 and roughly 50 percent less than in other survey years (Fig. 2) (Pete 1991b). The 1991 harvest produced the lowest per capita pounds of

TABLE 3. ESTIMATED NELSON ISLAND AND NUNIVAK ISLAND SUBSISTENCE HERRING HARVEST LEVELS (IN SHORT TONS) AND PERCENTAGE OF TOTAL HOUSEHOLDS INVOLVED IN PRODUCTION, 1986-88 AND 1990-91

Community	1986		1987		1988		1990		1991	
	Short tons involved	Percentage of house-holds involved	Short tons involved	Percentage of house-holds involved	Short tons involved	Percentage of house-holds involved	Short tons involved	Percentage of house-holds involved	Short tons involved	Percentage of house-holds involved
<u>Nelson Island</u>										
Newtok	12.6	46%	10.0	56%	12.5	68%	7.9	51%	0.9	31
Tununak	63.3	86	48.0	85	49.3	86	54.0	81	20.9	73
Toksook Bay	69.5	83	51.0	83	58.5	84	46.3	73	40.0	69
Nightmute	21.4	64	15.0	65	16.0	74	17.5 ^a	67	8.3	67
Subtotals	166.8	75	124.0	76	136.3	80	125.7	72	70.1	63
<u>Nunivak Island</u>										
Mekoryuk ^b	no data		no data		no data		4.5	59	3.9	48
Totals							130.2	69	74.0	60

^a Figures for Nightmute were derived from a combination of methods, rather than interviews with families in Nightmute or direct observation of all herring they processed.

^b Herring harvest data from 1986 for Mekoryuk are incomplete and have been omitted (Pete 1991b).

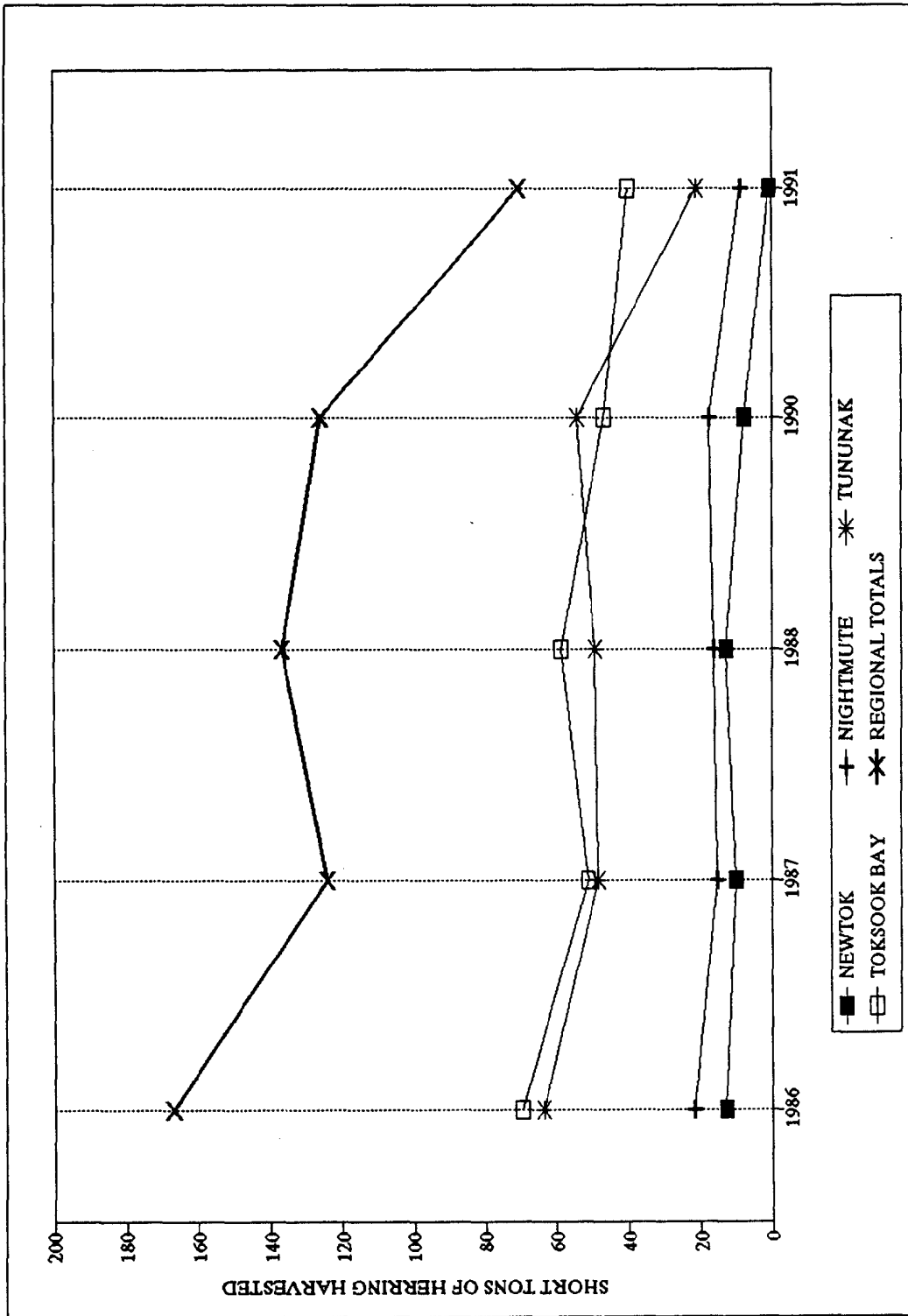


Fig. 2. Short tons of herring harvested for subsistence by four Nelson Island communities, 1986-88, and 1990-91.

herring for each community (Fig. 3) as well as the entire regional population -- approximately 123 pounds per capita (Fig. 4). This is merely one-third of the 1986 harvest, a season considered satisfactory. Regional per capita pounds of herring harvested for subsistence ranged from 227 to 308 pounds in 1986-88 (Fig. 4).

Tununak and Newtok, the communities which fish along the north shore of Nelson Island were the most affected; Tununak's 1991 harvest was 60 percent less than the 1990 harvest. Newtok harvest levels were the lowest documented, with barely one ton harvested in 1991, compared to a range of 10.0 to 12.6 short tons in 1986-88 (Table 3) (Pete 1991b). As mentioned, Newtok families were trying to replace the extremely low herring harvests by increasing pike harvests.

Household participation rates for all communities were, likewise, the lowest recorded since 1986: 63 percent of all households were involved in fishing and processing of herring for subsistence use, compared to a regional average of 79 percent in 1986-88 and 72 percent in 1990 (Table 3). The most substantial decrease in involvement this season occurred in Newtok where only 31 percent of all households fished or processed herring for subsistence use (Table 3).

The annual range of harvest by subsistence herring production units (multi-household extended families) by community is represented in Table 4. The highest upper ranges of harvest occurred in the 1986 season, the most productive season in terms of total harvest. Although there were fluctuations throughout the years in both the lower and upper limits of harvest, the lowest harvest ranges were found in 1991. The lower range of harvest dropped dramatically in Newtok and Tununak in 1991, with the lowest amount totaling six pounds of herring for one Newtok family, barely one meal (Table 4). Most fishing family harvests declined in all communities. Further, fewer fishing families sustained harvests in the higher end in 1991. In each community except Toksook Bay, for families that fished in both years, all but one family's harvest decreased between 1990 and 1991. Sixty-two percent of the production units' harvests declined in Toksook Bay between 1990 and 1991. For many families, reductions in production level were considerable (11 to 89 percent reduction with most between 20 and 60 percent less), with mostly slight increases (range of 3 to 83 percent with most between 3 and 44 percent more).

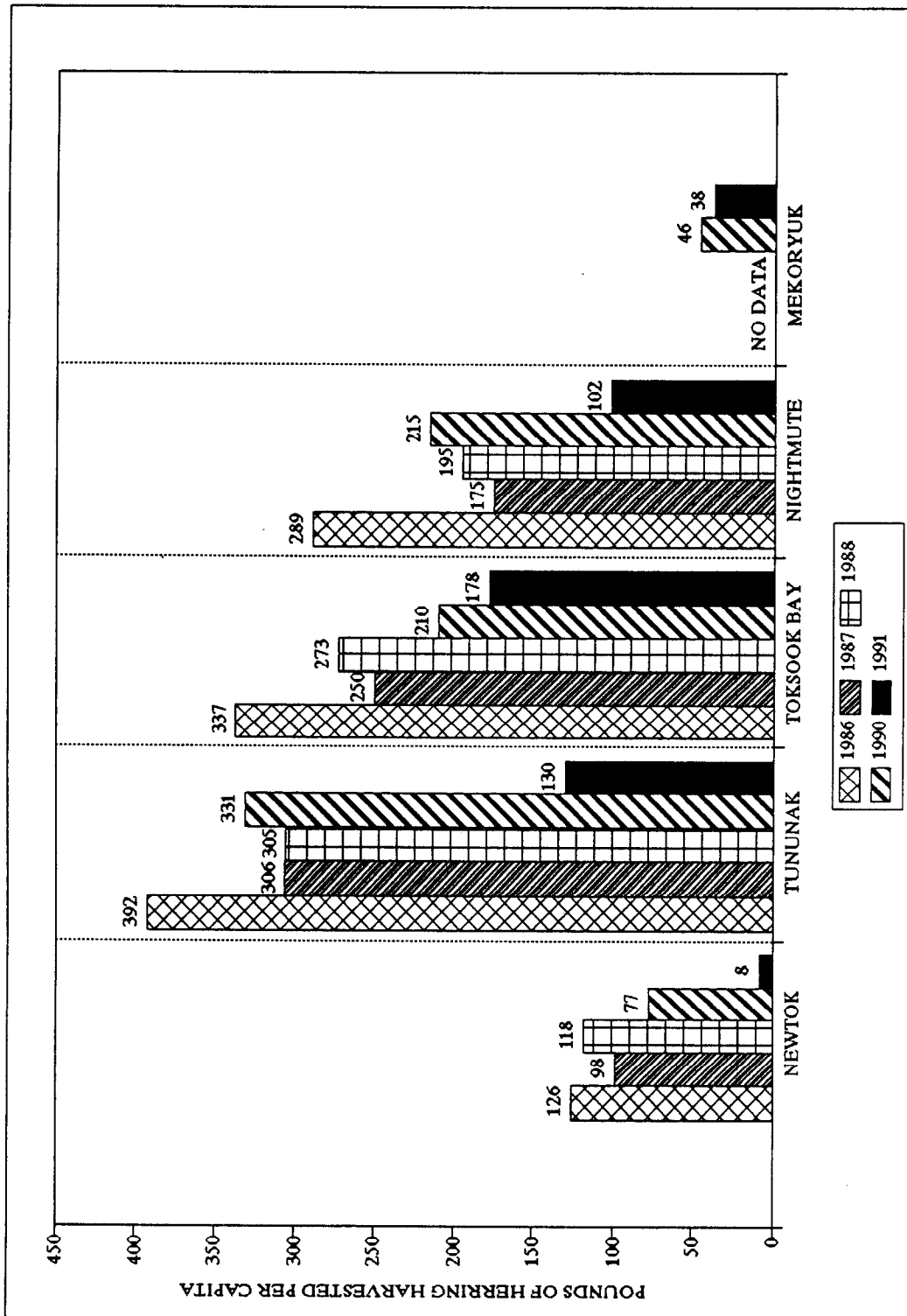


Fig. 3. Pounds of herring harvested per capita for subsistence use by Nelson Island and Nunivak Island communities, 1986-88, and 1990-91.

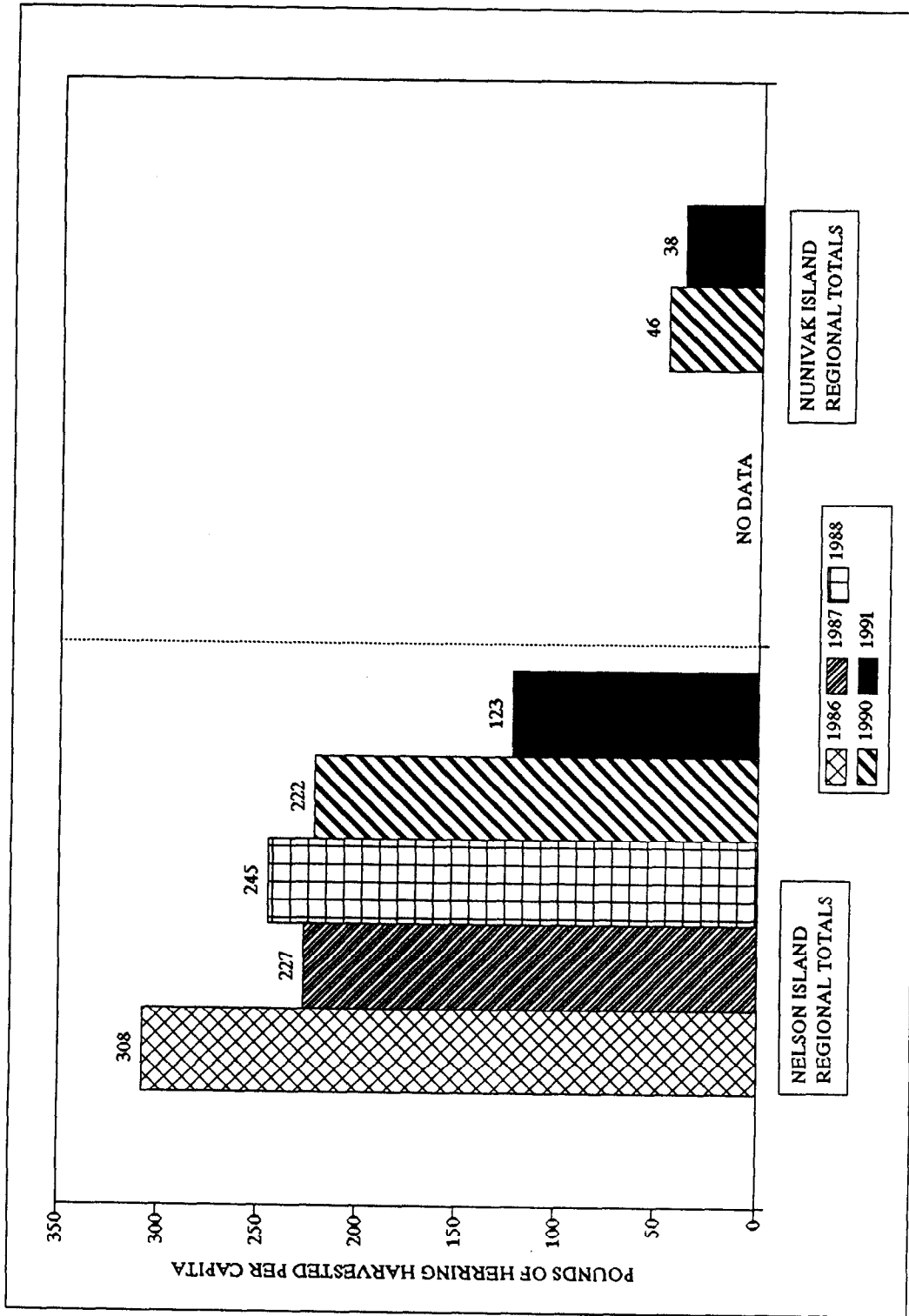


Fig. 4. Regional totals of pounds of herring harvested per capita for subsistence use in the Nelson Island and Nunivak Island districts, 1986-88 and 1990-91.

Between 1990 and 1991, the number of fishing families (multi-household production units) dropped by 50 percent in Newtok; 30 percent in Nightmute; 14 percent in Tununak; and 3 percent in Toksook Bay. The riverine communities (Newtok and Nightmute) appear to have more opportunities and possibilities to find productive alternatives for reduced herring harvests with easier access to more species of freshwater fish. This probably contributed to less effort for and decreased harvest levels of herring by Newtok and Nightmute families. The households and production units not involved in subsistence herring production focused efforts on other species. As mentioned, they chose to put their time and effort into catching and processing other types of fish for their subsistence. Tununak and Toksook Bay families spent more time subsistence herring fishing, combined with diversified efforts for other fish species. Even with less reliable returns per effort, a substantial percentage of total households continued to be involved in subsistence herring production in 1991 (Table 3). This underscores the importance of herring as a subsistence resource to Nelson Island families.

TABLE 4. RANGE OF HARVEST IN POUNDS OF HERRING FOR SUBSISTENCE USE BY PRODUCTION UNITS IN COMMUNITIES IN THE NELSON ISLAND AND NUNIVAK ISLAND DISTRICTS, 1986-88 AND 1990-91

<u>Range of harvest in pounds by subsistence herring production units</u>					
Year	Newtok	Tununak	Toksook Bay	Nightmute	Mekoryuk
1986	573 - 5,189	1,248 - 6,258	1,381 - 7,236	1,156 - 7,137	no data
1987	651 - 3,450	1,192 - 5,587	644 - 5,516	689 - 3,845	no data
1988	466 - 3,428	507 - 5,404	852 - 6,186	318 - 4,033	no data
1990	265 - 2,390	227 - 5,214	799 - 4,734	626 - 3,998	35 - 900
1991	6 - 582	19 - 2,832	459 - 3,967	480 - 2,746	52 - 700

Nunivak Island District

Patterns of subsistence herring production by residents of Mekoryuk were described in detail in the 1990 survey report and much of the description here was summarized from that report (Pete 1991b). Timing and processing methods of subsistence herring on Nunivak Island are similar to those reported for Nelson Island. Herring are harvested from mid May to mid June. Harvesting methods differ somewhat from Nelson Island. More commonly, gill nets were set or "drifted" for herring with skiffs similar in size to that described for Nelson Island. Other methods of harvest included using dipnets, picking herring by hand from tidal pools or throwing home-made "toss nets," approximately six feet in diameter, over spawning schools and pulling them closed and ashore with the "purse" full of herring. Because the commercial herring fishery occurred at the same time herring were near Mekoryuk, and considerable gear and personnel were directed to commercial efforts, many more families reported picking herring by hand in 1991 than in 1990.

Set and drift net fishing areas commonly used extended east and south from Mekoryuk to Cape Corwin (Fig. 1). Herring spawn-on-kelp was collected from the same areas. In 1991, most collection areas were near the community of Mekoryuk. As in 1990, one family traveled by boat across Etolin Strait to the area west of Umkumiut on Nelson Island to get herring because they missed the unusually short window of harvest opportunity near Nunivak Island.

Although herring is harvested from camps along the eastern shore of Nunivak Island, all herring is brought to Mekoryuk to be processed. Herring caught around Nunivak Island are noted to be consistently large and fat every year, requiring processing as *ullipengayiit*, or filleted fish. After braiding into relatively short strings of 15 to 40 herring each, the strings of herring were dipped in tubs of sea water to wash off slime and to add salt for taste and better drying. These strings were hung up to dry on racks with other fish or sea mammal meat. When dry, the strings were moved into smokehouses and smoked with green willow and driftwood, a step rarely taken by Nelson Island herring fishing families. Smoking prevents the fat from turning rancid, increasing sustained palatability

and storage life. The strings of herring were stored along with other dried products in caches for the winter.

Key respondents noted the labor-intensive process as one of the reasons Nunivak Island people did not specialize in subsistence herring production and use. Smoking of herring is viewed as an extra, but necessary, step in subsistence herring processing. Precious wood has to be gathered and cut (Nunivak Island is treeless tundra). The smoke has to be tended for several days to over one week. Other fish, even salmon, are rarely smoked, because they are generally not fat (salmon are caught primarily near spawning grounds). Halibut, Pacific cod, and salmon can be dried at fish camps without smoking. A few individuals thought that eating too much smoked products reduced endurance, a desired condition for walking throughout Nunivak Island to pursue subsistence activities.

As in Nelson Island, production of herring for subsistence use was a kin-based operation in Mekoryuk, with members of extended families, generally a couple and their adult children in separate households, working together. Five former Nunivak Island families now living in Bethel customarily return to the island to produce herring for subsistence, as they had in 1990 and 1991. Only three of the five families were successful at harvesting herring in 1991.

The majority of harvesters were men, but relatively more women fished for herring than was documented in Nelson Island communities. Women generally helped their husbands or picked herring from tidal pools near Mekoryuk. As in 1990, most people (90 percent) involved in subsistence-herring production were between 25 and 70 years of age; no one under 18 years of age was involved in 1991.

More detailed harvest levels of herring spawn-on-kelp were collected in 1991. Gathering areas coincided with herring fishing areas. Areas near Mekoryuk have been the most frequently used to gather herring spawn-on-kelp, especially since the development of the commercial sac-roe fishery. Respondents noted also, that women and children have become the most productive collectors, since many men were occupied with the commercial fishery.

Collection and use of herring spawn-on-kelp were primarily by household, rather than fishing family; a household generally consumed or stored the spawn-on-kelp they harvested. Respondents reported some trade of spawn-on-kelp primarily for dried salmon from families along the Kuskokwim

River. However, with recent declines in herring numbers and difficulties in the subsistence and commercial herring fisheries, that activity was thought to be at much reduced levels than in the past. Most spawn-on-kelp collected was eaten relatively quickly; the remainder was frozen, and less frequently dried, to be reconstituted for use later.

Mekoryuk respondents concur with their neighbors in Nelson Island. According to their observations, herring numbers have been decreasing since the mid-1980s. Each season, there seems to be a progressively shorter time span when herring stay in waters off of Nunivak Island, decreasing the effective fishing time (Pete 1991b). These changes have made herring a less reliable resource than it has been in the past. As in 1990, two families that usually fish for herring for food did not do so in 1991. Instead, they concentrated on halibut and Pacific cod fishing.

Harvest Levels

In 1991, 20 fishing families comprised of 30 households produced 3.9 short tons of herring for subsistence use (Table 3). Similar to Nelson Island, effort was less in 1991 than in 1990; 48 percent of Mekoryuk households were involved in subsistence-herring production in 1991 compared to 59 percent in 1990 (Table 3). Per capita pounds produced were also lower, at an estimated 38 pounds in 1991 compared to 46 pounds in 1990 (Fig. 3). In 1991, fishing family harvests ranged from 52 to 700 pounds (Table 4) for an average of 325 pounds of herring per fishing family.

Approximately 600 pounds of processed herring were destined for Bethel, to be taken by three families who moved to Bethel from Nunivak Island. Families estimated amounts for herring to be taken to Bethel, based on past patterns, as well as the current harvest. Bethel-based families conducted fishing and processing activities out of Mekoryuk or camps along the east shore of Nunivak Island, in some cases, using local relatives' facilities. Thus, approximately 3.6 short tons were harvested for Mekoryuk families in 1991.

Subsistence harvest of herring spawn-on-kelp by 33 Mekoryuk households totaled approximately 3,400 pounds in 1991 for an average household harvest of approximately 103 pounds. As

mentioned, the harvest and use of herring spawn-on-kelp is confined to a high degree to households; each household was responsible for collection and use. Approximately one-half of the 30 households involved in herring fishing reported that they also usually collected spawn-on-kelp. Fourteen households only collected spawn-on-kelp; they did not fish for herring in 1991 and reported that they usually did not fish for herring. Members of several of these households did help relatives residing in other households with herring processing. The majority of the households who only gathered herring spawn-on-kelp were relatively new households, without the full compliment of equipment and facilities to produce dried fish products.

SUMMARY

All past surveys have demonstrated the significance of herring harvest levels in the economy of Nelson Island and Nunivak Island communities. The declining returns of herring to the area have affected subsistence harvests, with the 1991 season reflecting the most drastic reductions in harvest levels since 1986. Approximately 70.1 short tons were harvested in the Nelson Island district -- which is 58 percent below the 1986 harvest of 166.8 short tons. The 1991 season produced the lowest harvests for all communities, especially Newtok and Tununak. Furthermore, the 1991 harvest produced the lowest per capita harvest of all survey years, at 123 pounds per capita of herring for subsistence uses compared to 308 pounds per capita in 1986 and 222 pounds in 1990 (Fig. 4). The per capita production for both Nelson and Nunivak districts combined was 110 pounds in 1991 or approximately 40 percent less than the per capita production in 1990 of 196 pounds. This was the second complete herring harvest survey of Mekoryuk households. They obtained an estimated 3.9 short tons. Even with these low production rates, household participation rates in subsistence herring production were substantial in all communities, ranging from 31 percent in Newtok to 69 percent in Tununak (Table 1).

This summer and in 1990, many local observations of herring runs paralleled those made of decreasing herring stocks in the 1960s and 1970s. However, there were observable distinctions in the 1990 and 1991 seasons which local residents believe signal more radical declines in local herring stocks.

Herring schools in 1990 and 1991 were of mixed sizes and herring with high oil content in sustained numbers occurred throughout the entire season. There were the most alarming characteristics to local residents of the 1990 and 1991 seasons.

Declining numbers of herring and proportionately greater numbers of oily herring throughout the entire season affected fishing activities. Approximately 20 percent of all families that usually fish for herring on both Nelson and Nunivak islands did not fish for herring this year due to a prevalence of "fatty" herring, perceived declines in herring numbers, and variable productivity when fishing. These families concentrated efforts for winter food on increased harvests of smelt, halibut, salmon, pike, whitefish, and Pacific cod. Augmenting harvests of other fish species was a strategy used in previous herring shortages during the 1960s and 1970s (Pete 1991a; Pete 1991b).

This was the first season surveyors were able to observe processed, oily herring discarded because of weather-induced spoilage. Between 40 and 90 percent of herring hung up to dry were thrown out or reduced to dog food by four families in Newtok and Toksook Bay. Since these observations occurred relatively early in the drying season, it is very likely that more herring would spoil and have to be discarded.

There is widespread local concern for the Nelson Island and Nunivak Island herring resources, especially among Nelson Island families, whose main winter food is dried herring. The importance of herring as a source of income in the Nelson Island and Nunivak Island districts developed with its commercialization, because opportunities for wage employment are few and cost of living is high. These recent decreases in herring stocks, and particularly the low subsistence production in 1991, remind Nelson Island people of past shortages and associated difficulties, which they hope can be avoided. They want to see management policies in place and action taken to ameliorate the situation soon before more drastic declines in herring abundance create further hardships.

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