

SUBSISTENCE HERRING FISHING IN
THE NELSON ISLAND DISTRICT 1986

Mary C. Pete
and
Ronald E. Kreher

Technical Paper No. 144

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

December 1986

TECHNICAL PAPER #144

ERRATA

- p.9 Last paragraph, first sentence should read "...177 permit holders of a total of 435 permit holders or 41 percent were from one of the four communities surveyed in this study. Sixty-three percent of the Nelson Island permits were used in 1986 (Table 2)."
- p.10 Table 2, fifth column, under "Percentage of Total Permits Used," the first number should be "17%."
- p.43 Table 5, sixth column, under "Total Number of Strings," the second, third, fourth, and fifth numbers should be as follows: "503; 2,223; 848; and 6,189."

ABSTRACT

This report presents results of research in 1986 on subsistence herring production by residents of four communities and one seasonal camp in the Nelson Island region of Western Alaska. Fieldwork was conducted by four researchers and spanned all phases of the production of subsistence herring, from fishing through processing, to storing of the dried product. Current household censuses were completed in all four communities. A survey was administered to all households who participated in the fishery to record harvest levels, facilities, gear, timing, persons involved, and areas used to fish for herring and collect roe-on-kelp and beach grass for braiding herring.

Each community fished for herring from their respective traditional use areas which are relatively discrete. Most used between 18 to 22-foot aluminum or locally-made wooden skiffs with set gill nets less than 25 fathoms. Participation in the subsistence fishery was high with approximately 75 percent of all households contributing at least one member as a fisherman or processor. Production units composed of extended families cooperated to produce dried herring for their own consumption.

Processing herring into the dried, storable, winter food is time-consuming and labor-intensive. In addition to the nets, boats, and personnel required for harvesting herring, fishing families need beach grass for braiding herring into strings, as well as holding and storage facilities and drying racks. Herring requires intensive measures to protect it from extreme weather as it dries.

The estimated 1986 subsistence harvest for the four communities totals 166.8 short tons with a range of 12.6 to 69.5 short tons per community. Including all permanent residents of the four communities, the per capita harvest was 308 pounds of herring for subsistence use.

TABLE OF CONTENTS

	<u>Page</u>
Abstract.....	ii
Table of Contents.....	iv
List of Figures.....	vi
List of Tables.....	vii
Acknowledgments.....	viii
INTRODUCTION.....	1
PURPOSE.....	1
METHODOLOGY.....	3
COMMUNITY CHARACTERISTICS.....	5
SUBSISTENCE HERRING ACTIVITIES, 1986.....	13
Geographic Use Areas.....	13
Tununak.....	15
Newtok.....	17
Toksook Bay.....	20
Nightmute.....	23
Umkumiut.....	23
Herring Harvest Activities.....	26
Tununak.....	26
Newtok.....	28
Toksook Bay.....	29
Nightmute.....	30
Umkumiut.....	31
Roe-on-Kelp Collecting.....	31

	<u>Page</u>
Beach Grass Collecting.....	32
Gear.....	33
Processing and Storage	36
Herring and Sac-roe.....	36
Roe-on-kelp.....	41
HARVEST LEVELS.....	42
THE PRODUCTION OF HERRING FOR SUBSISTENCE USE.....	45
Tununak.....	48
Newtok.....	50
Toksook Bay.....	52
Nightmute.....	55
Umkumiut.....	56
DISCUSSION.....	57
REFERENCES.....	60
APPENDIX.....	62

LIST OF FIGURES

Figure 1.	Location of Communities in the Nelson Island area.....	2
Figure 2.	Areas used by Nelson Island residents for herring fishing and roe-on-kelp and beach grass collecting in 1986	14
Figure 3.	Areas used by Tununak residents for herring fishing and roe-on-kelp and beach grass collecting in 1986.....	16
Figure 4.	Areas used by Newtok residents for herring fishing and roe-on-kelp and beach grass collecting in 1986.....	18
Figure 5.	Areas used by Toksook Bay residents for herring fishing and roe-on-kelp and beach grass collecting in 1986.....	21
Figure 6.	Distribution of herring drying racks in Toksook Bay, 1986.....	22
Figure 7.	Areas used by Nightmute residents for herring fishing and beach grass collecting in 1986.....	24
Figure 8.	Areas used by Umkumiut residents for herring fishing and beach grass collecting areas in 1986.....	25

LIST OF TABLES

	<u>Page</u>
Table 1. 1986 Population and Household Size of Nelson Island Communities.....	7
Table 2. Number of Persons Holding and Using Nelson Island and Nunivak Island Commercial Herring Roe Fishing Permits by Village in 1986.....	10
Table 3. 1978, 1979, and 1982 Income Data by Community.....	12
Table 4. Fishing Effort by Community, Nelson Island Subsistence Herring Fishery, 1986.....	27
Table 5. Estimated 1986 Subsistence Herring Harvest Levels by Community.....	43
Table 6. Production of Herring for Subsistence Use in Nelson Island by Community, 1986.....	46

ACKNOWLEDGEMENTS

Researchers involved in this project would like to express their gratitude to the residents of Tununak, Newtok, Toksook Bay, Nightmute, and Umkumiut, without whose cooperation project would not have been possible. Their willingness to teach us and to allow us to "be in the way" as we counted their herring is most appreciated. Many people in those communities made special contributions to us as researcher and key respondents. Some we will mention here. Thanks are in order to Richard Lawrence for Yup'ik place-names and historical information, to Dick Anthony for delicious food; to Theresa Waska, Moses and Marie Carl, and Susie and Mike Angaiak for room and board; and to Marie Brite for all her help, even after the field season was over. Susan Alexander from Anchorage volunteered her time and good humor in the field.

Review and editing of this report was patiently done by Elizabeth Andrews and Bob Wolfe. Ruth Southern typed several drafts and Gary Nichols and Betsy Strum drafted the figures.

INTRODUCTION

The importance of herring (iqalluarpak, singular, iqalluarpiit, plural) as a food source to communities in the Nelson Island region has been well documented (Fienup-Riordan 1983; Hemming, Harrison, and Braund 1978; Lenz 1980; Pete 1984). Its significance was underscored when a commercial herring fishery was established for the area in 1984 (Alaska Board of Fisheries 1985). Local concern over the establishment of the commercial fishery, which targets a valuable subsistence species, prompted the need to determine the level of subsistence utilization of herring for area communities.

Three communities on Nelson Island--Tununak, Toksook Bay, and Nightmute--and the nearby community of Newtok, and Umkumiut, a major seasonal camp on Kangirivak Bay (Fig. 1) were surveyed for harvest levels and related subsistence herring fishing information. The information provided in this report is a summary of that survey of the herring fishery which occurred between May and July 1986.

PURPOSE

The potential for conflict between a developing commercial herring fishery and a long-term subsistence fishery necessitates the collection of base-line information on the subsistence herring fishery focusing on harvest levels and the interrelationships with the commercial fishery. Information obtained from this research is intended to provide insights about the local subsistence fishery so informed decisions regarding that

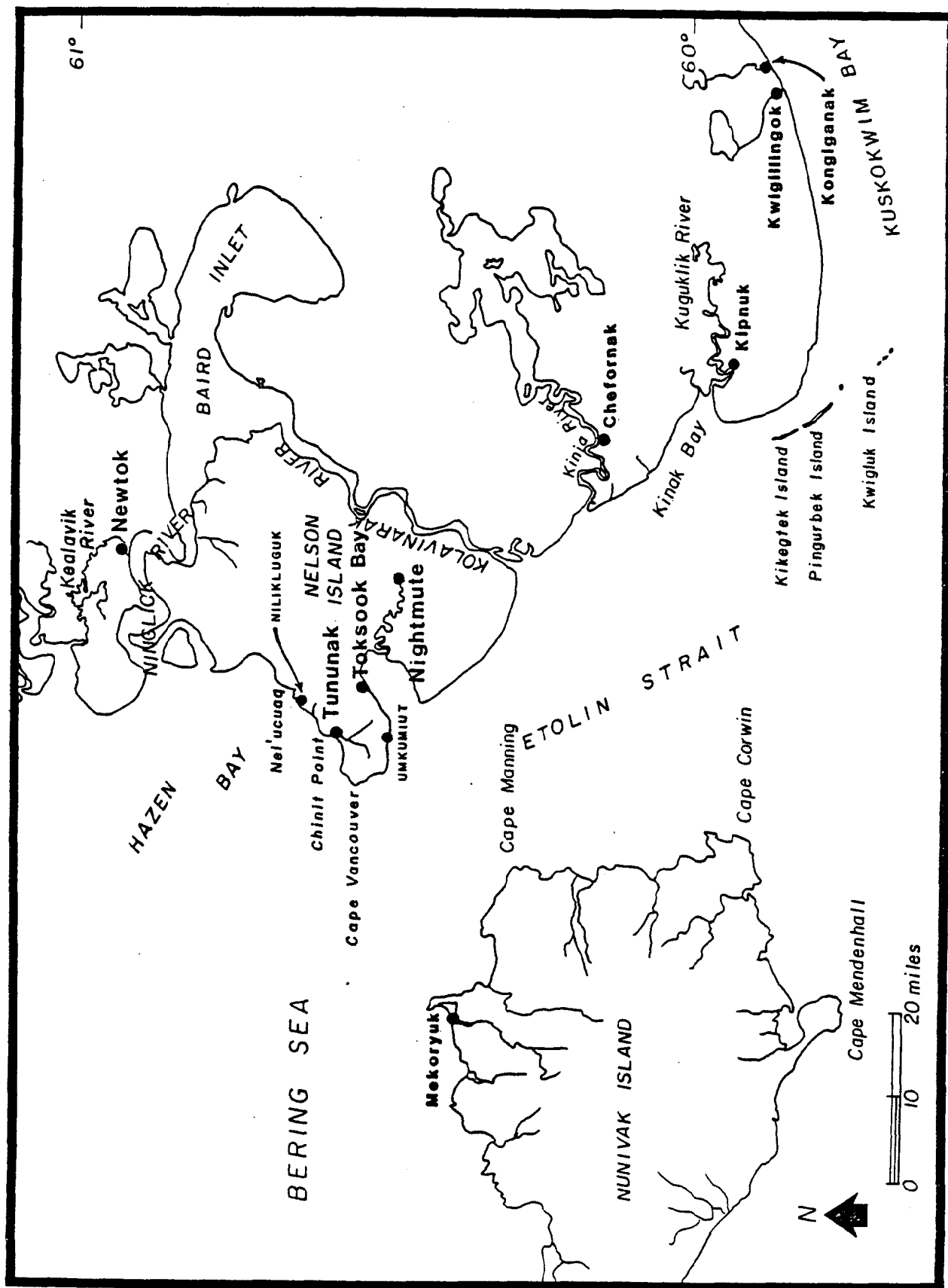


Fig. 1. Location of communities in the Nelson Island area.

fishery can be formulated while providing for the successful development of a commercial herring industry.

METHODOLOGY

This research employed several data gathering methods consisting of a systematic survey, selective mapping sessions, topically-focused interviews, formal (i.e., meeting-setting) and informal discussions, participant observation, and a literature review. Fieldwork, conducted by four researchers, occurred through all phases of the subsistence fishery, from harvesting, through processing and drying, to the early stages of the storing of dried herring within a time span of over one month.

A letter introducing and asking permission to conduct the research was sent to village officials in Nightmute, Newtok, and Toksook Bay in early April 1986. Follow-up telephone calls to village officials to invite questions and input or to schedule informational village meetings, if necessary, were made in late April and early May. Tununak is the subject of a study of wider scope in which the herring fishery research is a component. The community was already informed about this phase of the project and approved it. Telephone contact with Tununak officials was maintained to provide current information on ice conditions and movements and the commercial and subsistence herring fishing activities. They helped to contribute to logistical planning for the research team.

The four researchers (one Subsistence Resource Specialist II, two Fish and Game Technician IIIs, and one College Intern) separated into teams of two, one team responsible for data gathering in Tununak and the

other in Toksook Bay and Umkumiut. One researcher in each team is bilingual in English and Yup'ik Eskimo. Additionally, local bilingual assistants were employed as needed for the non-Yup'ik speaking researchers. All four researchers cooperated in data-gathering in Newtok and Nightmute.

The initial task in each community was the compilation of a current household census, existing censuses in the city or tribal council offices or health clinics were updated with residents of each community. A survey instrument was used to record harvest levels, timing, gear, role in production of dried herring, facilities used, effort in harvest of roe-on-kelp, and areas used to harvest herring (see Appendix). The survey was administered to members of every household that was designated as a "rack manager" of the production units in each community resulting in a complete (100 percent) sample of targeted households. Subsistence herring harvest estimates were calculated by sampling the longest, shortest, and medium-sized strings of drying herring on every rack to arrive at an average estimate for each string and then each rack. Each herring was counted on every "teepee-style" rack since each of the teepees were a different size and it was difficult to determine average string lengths because strings are tied together in a spiral around the teepee rack.

Sections of maps (1:63,360 scale) depicting areas around each community were attached to survey forms. The maps were used to accurately record herring fishing, roe-on-kelp and beach grass collecting areas during each survey interview session. Current aerial photographs made by the Department of Community and Regional Affairs were obtained from the city offices and were utilized as base maps on which herring drying racks and processing facilities were delineated and assigned to their

respective owners. The Tununak photograph did not include critical areas of the beach on which the drying racks were constructed, so the map of its herring facilities was drafted relative to structures in the photograph. As there was no photograph of Umkumiut, all structures in that camp were sketched from ground observations. The length and height of log racks and the height and breadth of the base of "teepee-style" racks was measured.

All researchers directly observed and, for limited time periods, participated in herring fishing and processing. Discussions at these times provided important information to the understanding of the subsistence herring fishery. For example, researchers learned the method of distinguishing between "fatty" and non-"fatty" herring while helping with processing.

The survey data were compiled and entered into the computer using Lotus 1-2-3 software for data analysis. The Subsistence Resource Specialist II and the College Intern wrote this report.

COMMUNITY CHARACTERISTICS

In the Nelson Island region, the communities of Tununak and Newtok historically have formed a cohesive group with a shared land-use area oriented to the northern half of Nelson Island and the mainland to the east. Nightmute and Chefnak maintained a similar relationship with their land use directed to the island's southern half and contiguous mainland and the area around present-day Chefnak. The overlap in land use by and intermarriage between the two communities of the two areas

increased in the past century with the demographic decrease and upheaval resulting from various epidemics (cf. Wolfe 1982) and relocations in response to outside church and educational impositions. More recently, people from Nightmute established Toksook Bay in 1964 as a year-round settlement (it had been their spring and summer camp), creating a closer contact point for Tununak and Newtok. Several Newtok families relocated to Toksook Bay near that time, also. Currently, a broad network of kinship ties extends through the four villages and Chefornek (cf. Fienup-Riordan 1983), although each community still emphasizes their respective traditional land use areas.

Umkumiut is located four miles southwest of Toksook Bay, and is a seasonal camp traditionally used by the people of Nightmute, and also more recently Toksook Bay. Prior to the settlement of Toksook Bay in 1964 by residents of Nightmute, the majority of Nightmute's subsistence herring harvest was taken and processed at Umkumiut. Since then, use of the area for processing herring has diminished. Umkumiut, however, is still used by several families from both Nightmute and Toksook Bay who harvest a full range of available spring and summer marine food resources, including sea mammals (particularly seals), marine invertebrates, halibut, codfish, capelin, birds, and plants. The site of Umkumiut is also important as a local source for beach grass, used in processing and storing herring.

According to our censuses, in June 1986, the four villages had a combined permanent resident population of 1,082 persons in 209 households, an overall average household size of 5.2 persons with a range of 1 to 11 persons per household (Table 1). More than one-half (58 percent) of the households range in size of 5 to 11 persons. Toksook Bay, the largest

TABLE 1. 1986 POPULATION AND HOUSEHOLD
SIZE OF NELSON ISLAND COMMUNITIES

Village	Population	Number of Households	Average Household Size
Tununak	323	65	5.0
Newtok	199	39	5.1
Toksook Bay	412	77	5.4
Nightmute	148	28	5.3
Total	1,082	209	5.2

village in terms of population, also has the largest average household size (Table 1). The riverine villages of Newtok and Nightmute have smaller populations in that order, relative to the coastal communities. Close to ninety-nine percent of the permanent residents are Alaska Native, primarily Yup'ik Eskimo, and most, including children, speak Central Yup'ik as their first language. Many elders do not understand English.

Each village is incorporated under state law as a second class city and has a federally-recognized tribal council, however, only Tununak is incorporated under the Indian Reorganization Act. The three other communities are organized as traditional councils. Umkumiut, the seasonal camp, also has a traditional council, based in Nightmute but its status as a fully recognized tribal entity with eligibility for the full spectrum of federal programs and services is not well-defined (Case 1984). Additionally, the four communities and Umkumiut are organized as profit-making village corporations under the provisions of the Alaska Native Claims Settlement Act (ANCSA). Each of the various governing or profit-making entities have similar responsibilities in their respective villages. The state municipal councils and their employees maintain garbage pick-up in all communities, the showers and laundromat in Tununak (a similar system was being installed in Newtok in summer 1986), the watering station system in Tununak, Newtok, and Nightmute, and the water and sewer system in Toksook Bay. Additionally, Toksook Bay and Tununak administer the Village Public Safety Officers (VPSO) program with the regional non-profit corporation, Association of Village Council Presidents (AVCP), while the cities of Newtok and Nightmute hire and pay their own village police.

The profit-making village corporations maintain specialty or general retail stores and heating fuel and gasoline outlets in each village. There is one non-locally owned general store in Tununak and there are small family-owned businesses in all four communities offering some groceries and general merchandise.

The Lower Kuskokwim School District with its central office in Bethel administers the elementary and secondary educational programs in all four villages. Tununak manages its own pre-school program through municipal funds; Toksook Bay has a Headstart (pre-school) program funded through RuralCap.

All villages receive almost daily air transportation and flight service from five separate Bethel-based air taxi businesses, barring inclement weather, which can last several days in the Nelson Island region. Barge lines also offer freight service in the summer and early fall from Seattle, Anchorage, and Bethel and other points. Multi-channel television and telephone service to each house is available. Citizen's band and VHF radios are more common than telephones, due to the cost of maintaining a telephone.

In 1986, which was the second year of existence for the commercial herring fishery in the Nelson and Nunivak Island Districts, 177 permit holders of a total of 435 permit holders or 63 percent were from one of the four communities surveyed in this study (Table 2). Of the 177 local permits, 65 percent (115 permits) were used in 1986. Toksook Bay had the highest participation rate (82 percent of its permit holders sold herring) and Newtok the lowest (Table 2). Ice conditions limited the participation of Tununak and Newtok commercial fishermen in 1986 as the north

TABLE 2. NUMBER OF PERSONS HOLDING AND USING NELSON AND NUNIVAK
ISLAND DISTRICT COMMERCIAL HERRING ROE FISHING PERMITS BY VILLAGE
IN 1986^a

VILLAGE	TOTAL PERMIT HOLDERS	NUMBER PERMITS USED ^b	PERCENTAGE OF TOTAL VILLAGE PERMITS USED	PERCENTAGE OF TOTAL PERMITS USED	AVERAGE NUMBER OF PERMITS PER HOUSEHOLD
Tununak	55	31	56%	7%	.85
Toksook Bay	71	58	82	32	.92
Nightmute	31	19	61	10	1.11
Newtok	20	7	35	4	.51
Total for 4 Villages	177	115	65	63	.84
All other Places	258	68	26	37	
Total	435	183	42	100	

a. Source: Commercial Fisheries Entry Commission (CFEC).

b. Source: Alaska Department of Fish and Game, Division of Commercial Fisheries.

side of the island was iced in until the last four-hour opening of the commercial fishery.

Residents from the four villages are also heavily involved in the local commercial halibut fishery, but are less involved in other area and species commercial fisheries. In 1984, the four communities had 127 commercial halibut and 34 salmon and/or herring permit holders (Pete 1984).

The above-mentioned agencies, businesses, and industries provide employment and income for some residents, although like most other wage-employment in the region's villages, most opportunities are intermittent and not year-round. For example, commercial fishing, like most wage employment is seasonal; jobs associated with the educational system last up to ten months a year. For those jobs that are year-round, many of them are part-time (e.g. air service agents, fee-agents, and many other jobs offer six hours per day or less of work). Other income generating activities which some residents engage in are cottage industries (basket making, ivory carving, and fur sewing) and selling locally trapped furs.

Income levels are quite restricted in the four communities. Data derived from Department of Revenue tax returns show an increase in income and number of returns in the four villages between 1978 and 1982 (Table 3). This information includes returns from some two-income families and non-Natives, many of whom are relatively high-salaried school teachers. To offer a comparison, the 1979 census-based per capita income data includes only those which are from Native households in the villages. The income statistics show a marked disparity between the villages and

TABLE 3. 1978, 1979, AND 1982 INCOME DATA BY COMMUNITY

Community	1978 ^a Average Taxable Income	(Number of Returns)	1979 ^b Per Capita Income	1982 ^a Average Taxable Income	(Number of Returns)
Anchorage	\$18,255	(63,602)	\$11,341	\$23,590	(81,042)
Bethel	14,250	(1,436)	8,217	18,796	(1,795)
Tununak	4,575	(93)	2,925	6,942	(118)
Toksook Bay	6,541	(109)	2,859	8,019	(117)
Newtok	4,178	(33)	1,691	6,097	(46)
Nightmute	4,387	(35)	2,955	7,564	(40)

a. Source: Alaska Department of Revenue 1985

b. Source: U.S. Bureau of Census 1980

places like Bethel and Anchorage. Cost of living in Bethel is reported to be twice the national average (University of Alaska, Cooperative Extension Service 1986) and the average cost of food, fuel and other products and services in the four villages is higher than it is in Bethel.

SUBSISTENCE HERRING ACTIVITIES, 1986

Geographic Use Areas

In the recent past herring fishing areas for the four communities as a group included a continuous area along the coast from Nel'ucuaq on the north to just south and west of the inlet of the Toksook River on the south (Fig. 2). In 1986, the harvest areas for herring reflected more discrete and consistently productive areas for each respective village and the Toksook Bay and Nightmute families who fish from Umkumiut which will be described below. Newtok herring fishermen concentrated on the Nilikluguk (Nel'ulugaq) area with several harvesting herring from areas closer to the village. Tununak residents set nets or drifted for herring from the north side of Chinit Point to Talurarevak Point. Toksook Bay, Umkumiut and Nightmute fishermen used overlapping areas which were located from west of Umkumiut eastward to the mouth of the Toksook River.

Summer 1986 was not a highly productive year for roe-on-kelp production. A relatively high level of harvest participation by Tununak households yielded comparatively low harvest levels. It is thought that wave action from storms caused siltiness of the ocean water in the vicinity of the kelp beds which consequently inhibited production of roe-on-

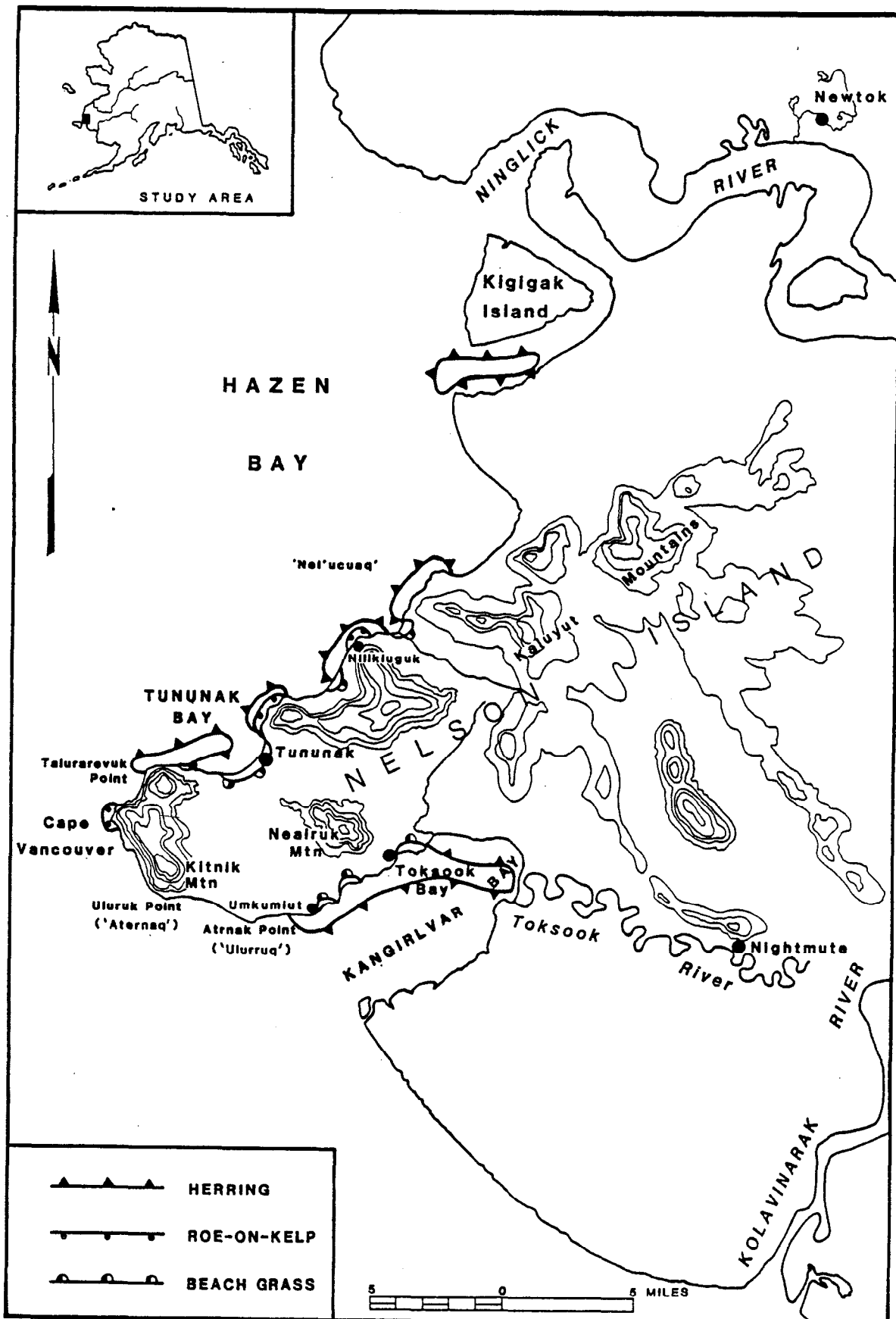


Fig. 2. Areas used by Nelson Island residents for herring fishing and roe-on-kelp and beach grass collecting in 1986.

kelp. The 1986 roe-on-kelp harvest areas included Nilikluguk, Chinit Point, and Cape Vancouver (Fig. 2).

Tununak

The primary herring harvest area for Tununak residents during 1986 were the waters around Chinit Point, locally referred to as Uyaquruag (literally "pretend neck") (Figs. 2 and 3). Three miles north of Tununak, the Chinit Point area is preferred by local fishermen for subsistence fishing but fishermen did not limit themselves to this one area. Several boats also fished for herring in the waters between Tununak Bay and Talurarevuk Point (Talurarivik) (Fig. 3).

Roe-on-kelp (elquat) is harvested in several areas (Fig. 3). During 1986, harvests occurred along the coastline north of Tununak, extending from the bluffs just north of the community to Chinit Point. Most roe-on-kelp was harvested near Igvaq (meaning "to come into a view"), a point approximately one mile south of Chinit Point. People who collected roe-on-kelp at Chinit Point and elsewhere also collected it at Igvaq.

The sandy spit formed by Tununak River deposits provides perfect conditions for taperrnat or Lyme grass (Elymus arearius L.) which is used to "braid" herring into strings for drying and to make open-weave baskets used for storage of the dried product. Much of the grass collected by Tununak residents for these purposes is harvested from this spit or in the immediate vicinity (Fig. 3).

Recently constructed housing units dominate the slope of a ridge which is at the northeast end of the community, while below the ridge,

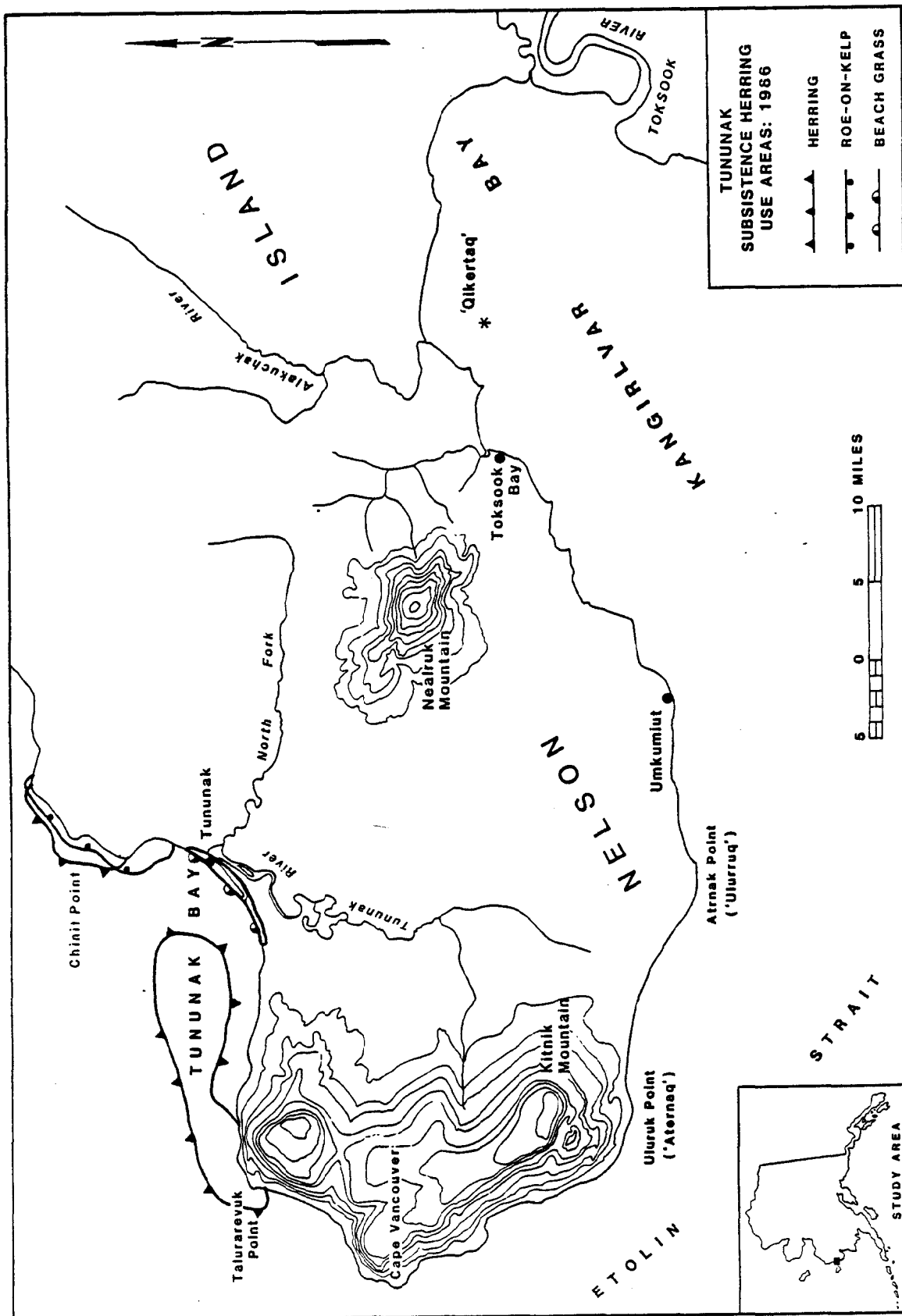


Fig. 3. Areas used by Tununak residents for herring fishing and roe-on-kelp and beach grass collecting in 1986.

the older residential section of Tununak consists of several rows of houses and other buildings extending along a spit formed by the river and Tununak Bay. Processing facilities such as herring drying racks and processing pits parallel the beach for almost one-half mile, separating the dwellings in the older section from the waterfront. Almost all racks are set perpendicular to the beach and have at least one nearby storage pit (ellivik, singular, elliviit, plural, meaning "underground temporary storage place"). Other wild food storage and drying facilities are often associated with a family's set of racks. Prior to construction of the new housing units family dwellings were, for the most part, close to family racks. Currently, there is not a direct correlation between racks and residence locations.

Newtok

As mentioned earlier, the communities of Newtok and Tununak have close social and geographic ties because of their proximity and history of shared land use relative to the rest of the area's communities. In addition to use of the Nilikluguk seasonal camp, some Newtok families fished for and processed their herring at Tununak, either independently or as a part of a Tununak production unit. This occurred as recently as 1985.

Newtok's general geographic use areas for subsistence herring related activities coincide with those of Tununak (Figs. 2, 4). Most Newtok residents focus on areas north of Tununak, especially those areas in the vicinity of Nilikluguk. Up until about 1968 people from Newtok

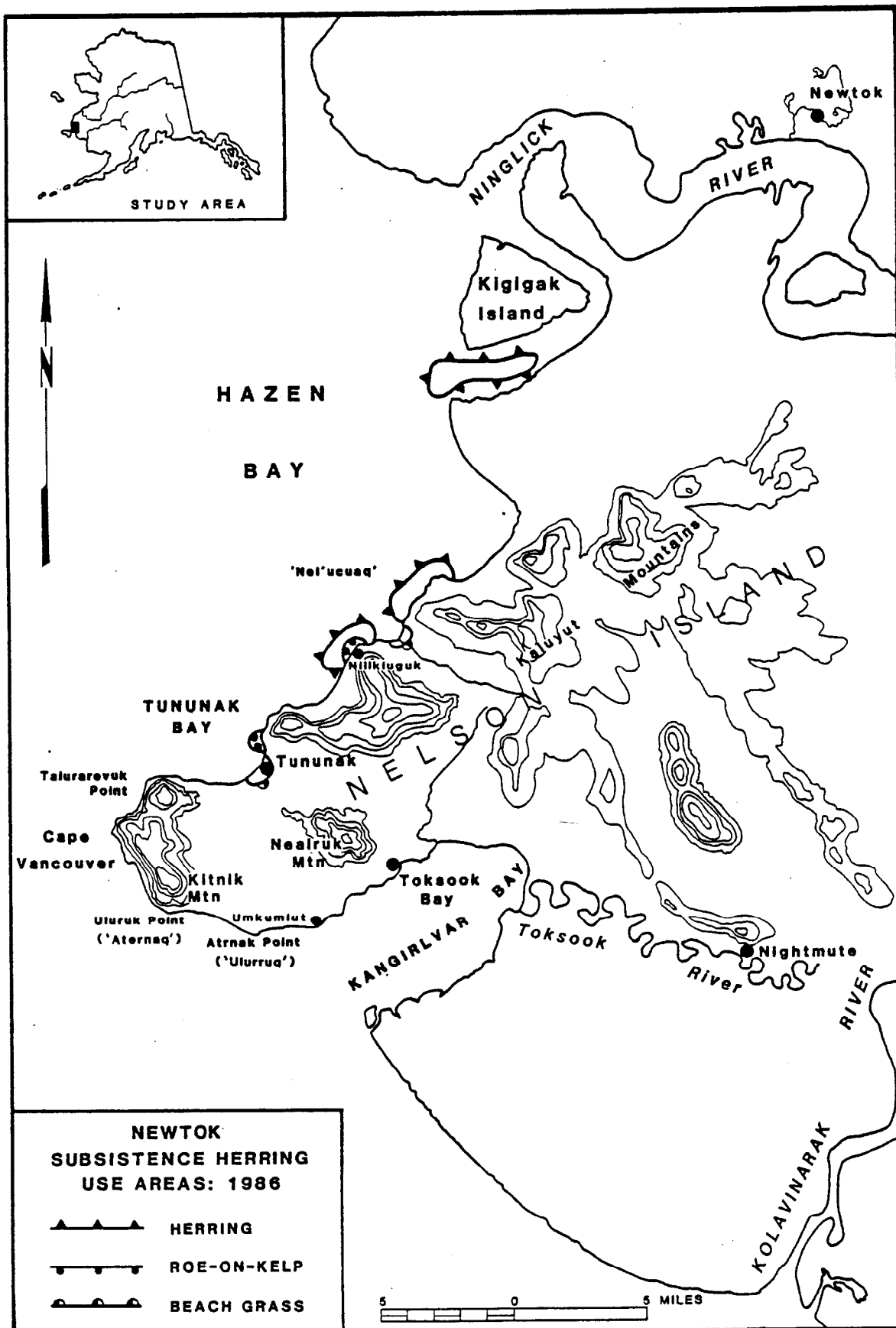


Fig. 4. Areas used by Newtok residents for herring fishing and roe-on-kelp and beach grass collecting in 1986.

maintained a seasonal camp at Nilikluguk, located approximately six miles north of Tununak and 25 air miles southwest of Newtok. Massive landslides buried the camp area and changed the shoreline enough to alter the seasonal movements of herring along that stretch of coast. Subsequently, Newtok residents abandoned the area as a fish camp, but still use the site as a spring sea bird and seal hunting camp.

In 1986, all but one of the Newtok herring fishermen fished in the waters off Nilikluguk fish camp (Fig. 4). One fished off Nel'ucuaq, a point about 4 miles north of Nilikluguk, and the same person fished at the southern mouth of the Ninglick River, approximately 10 miles north of Nilikluguk.

Three families collected roe-on-kelp at Igyaq near Chinit Point, where most Tununak people also collected roe-on-kelp and at Nilikluguk. Taperrnat, or beach grass, was collected on the spit at Tununak and some people received it from relatives in Tununak. Other areas are used also and at least one individual reported that she usually collects grass from Toksook Bay.

Newtok is a community situated in a wet-tundra environment along the Kealavik River (Fig. 1). Dwellings and processing facilities are necessarily located on the little high ground available. Most processing facilities (67 percent of the 15 rack sets) are closely associated with the rack owner's residence. The rest of the racks and processing facilities are near the river bank, most often directly below the owners' residence. Poor drainage restricts the use of subterranean storage pits (elliviit), like those used in Tununak, so above-ground cribs are used to age the herring.

Toksook Bay

Fishermen from Toksook Bay fished along the north shore of Kangirlvar Bay, from the vicinity of a small island locally referred to as Qikertaq, meaning "island," approximately two miles east of town west to the area near Ngelumiut, an abandoned prehistoric and historic village site about three miles southwest of the village of Toksook Bay (Fig. 5).

For both Toksook Bay and Nightmute residents, the greater travelling distance to areas for harvesting roe-on-kelp somewhat limits local exploitation of that resource. The favored area is along the coast from Uluruk Point north to Talurarevuk Point on the western end of Nelson Island (Fig. 5). A smaller spawning area is located around a small point less than one mile east of Toksook Bay. In this location, however, the shallow, silty waters of Kangirlvar Bay can quickly cover the roe with sand.

Beach grass was collected at Umkumiut, at Ngelumiut, and in the immediate vicinity of Toksook Bay (Fig. 5). Several people reported receiving grass from relatives in Tununak, and one woman purchased grass from residents of Mekoryuk on Nunivak Island.

Figure 6 shows the locations of processing facilities in Toksook Bay. Some dwellings are closely situated near the household's herring racks, whereas the remainder of the residences are located along the roads. Storage pits or cribs are associated with each rack complex. Racks are scattered throughout the community, and, with few exceptions, racks have no association with owners' residences. Some racks, particularly those east of the small stream which marks the eastern edge of

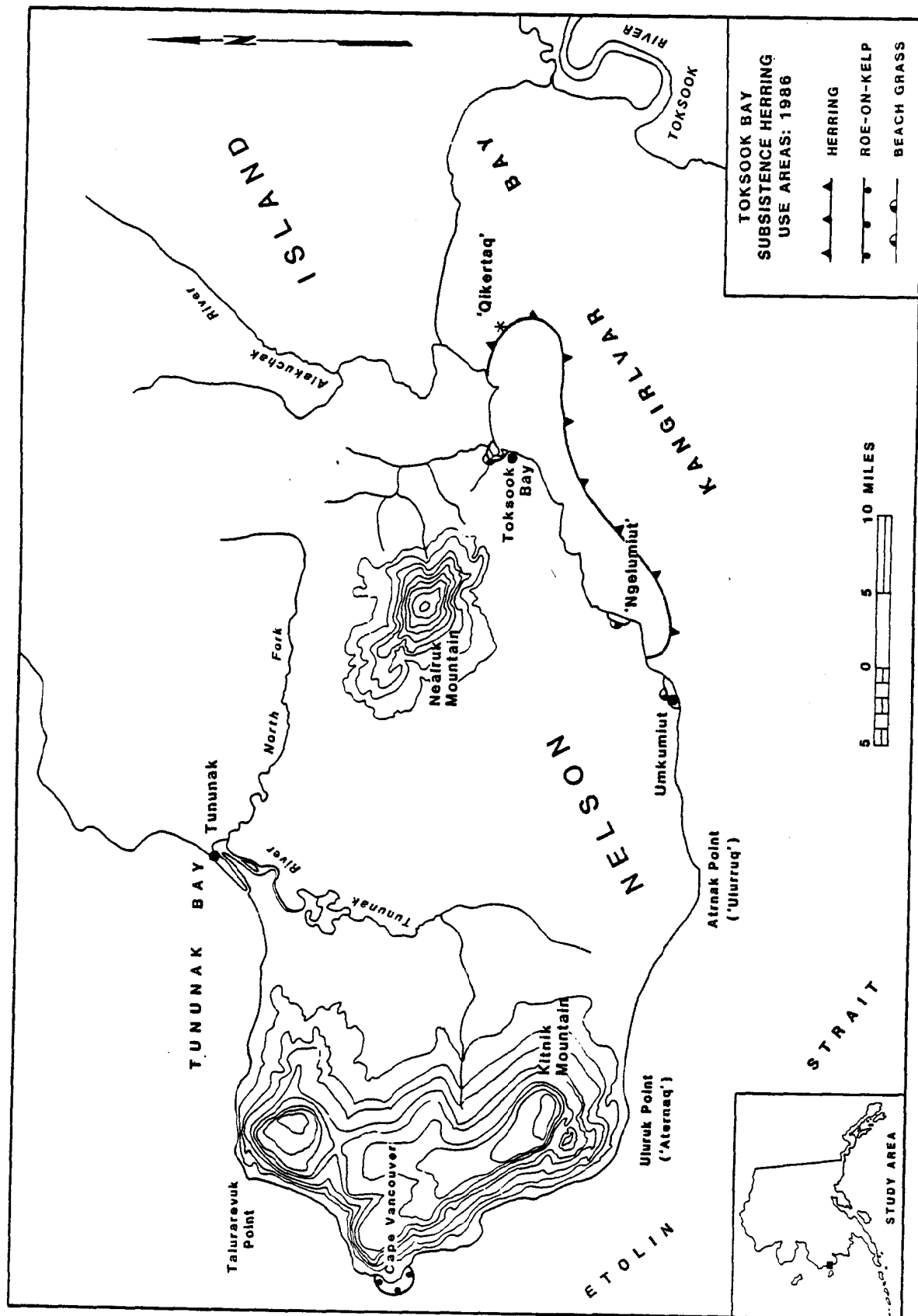


Fig. 5. Areas used by Toksook Bay residents for herring fishing and roe-on-kelp and beach grass collecting in 1986.

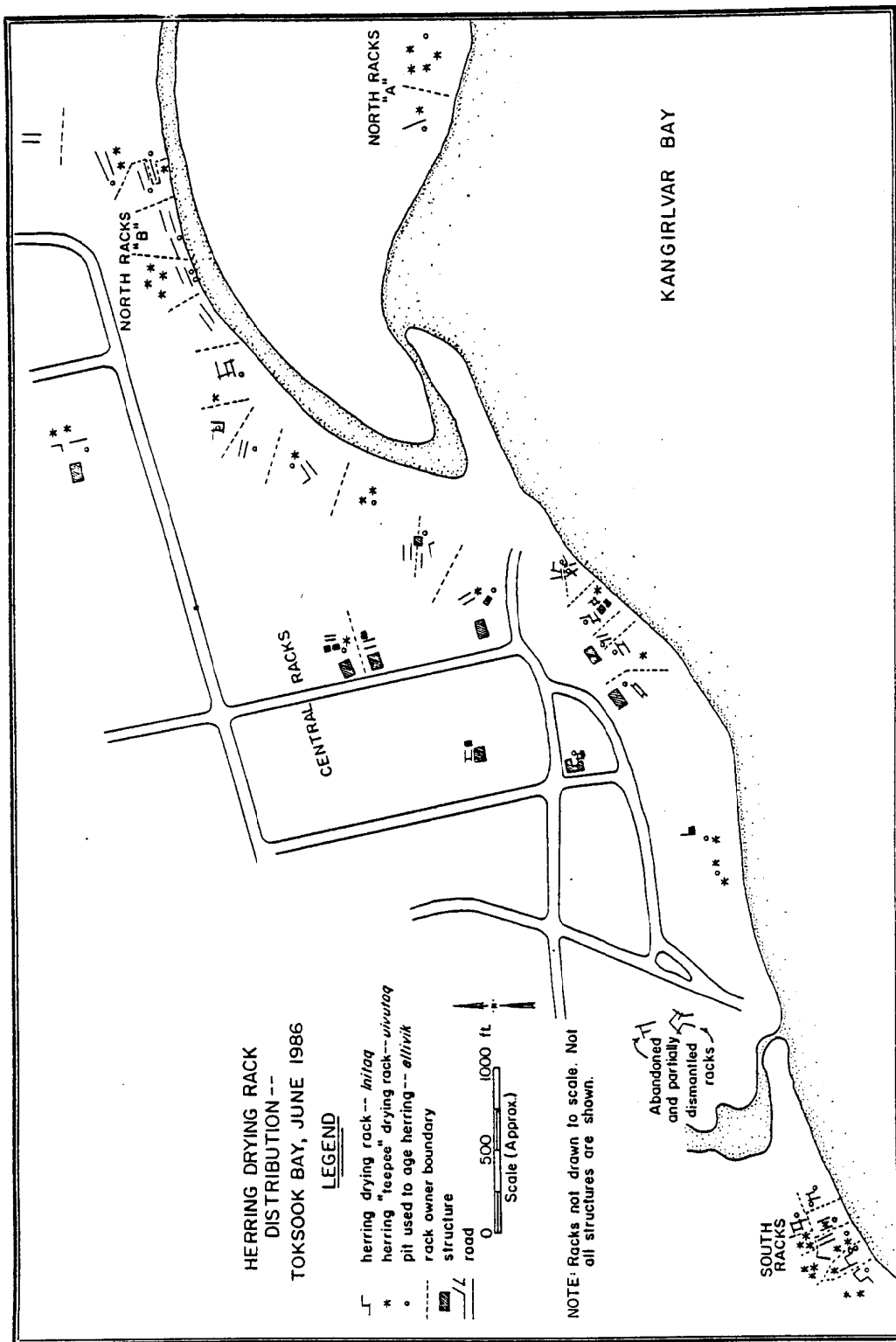


Fig. 6. Distribution of herring drying racks in Toksook Bay, 1986.

town, are completely removed from the community residences and buildings (Fig. 6).

Nightmute

Subsistence fishing for herring by Nightmute residents occurred either at the mouth of the Toksook River or in the same general area used by Toksook Bay fishermen (Figs. 5, 7). Umkumiut and Ngelumiut were the preferred areas for harvesting beach grass. Roe-on-kelp was not collected by Nightmute residents in 1986. Processing facilities tend to be closely associated with family residences. One Nightmute family maintained racks in Toksook Bay and fished from that community.

Umkumiut

In 1986, three households from Toksook Bay and six from Nightmute fished for herring from Umkumiut. Subsistence fishing families from Nightmute moved to Umkumiut about a month before herring season started to hunt sea birds and seals. Fishing for herring took place within one mile of the Umkumiut seasonal camp (Fig. 8). Beach grass was collected in season from the camp. Umkumiut families did not report collecting any roe-on-kelp in 1986.

At Umkumiut herring drying racks tend to be located close to the owner's dwelling. They extend the length of the camp and are situated between the dwellings and the beach.

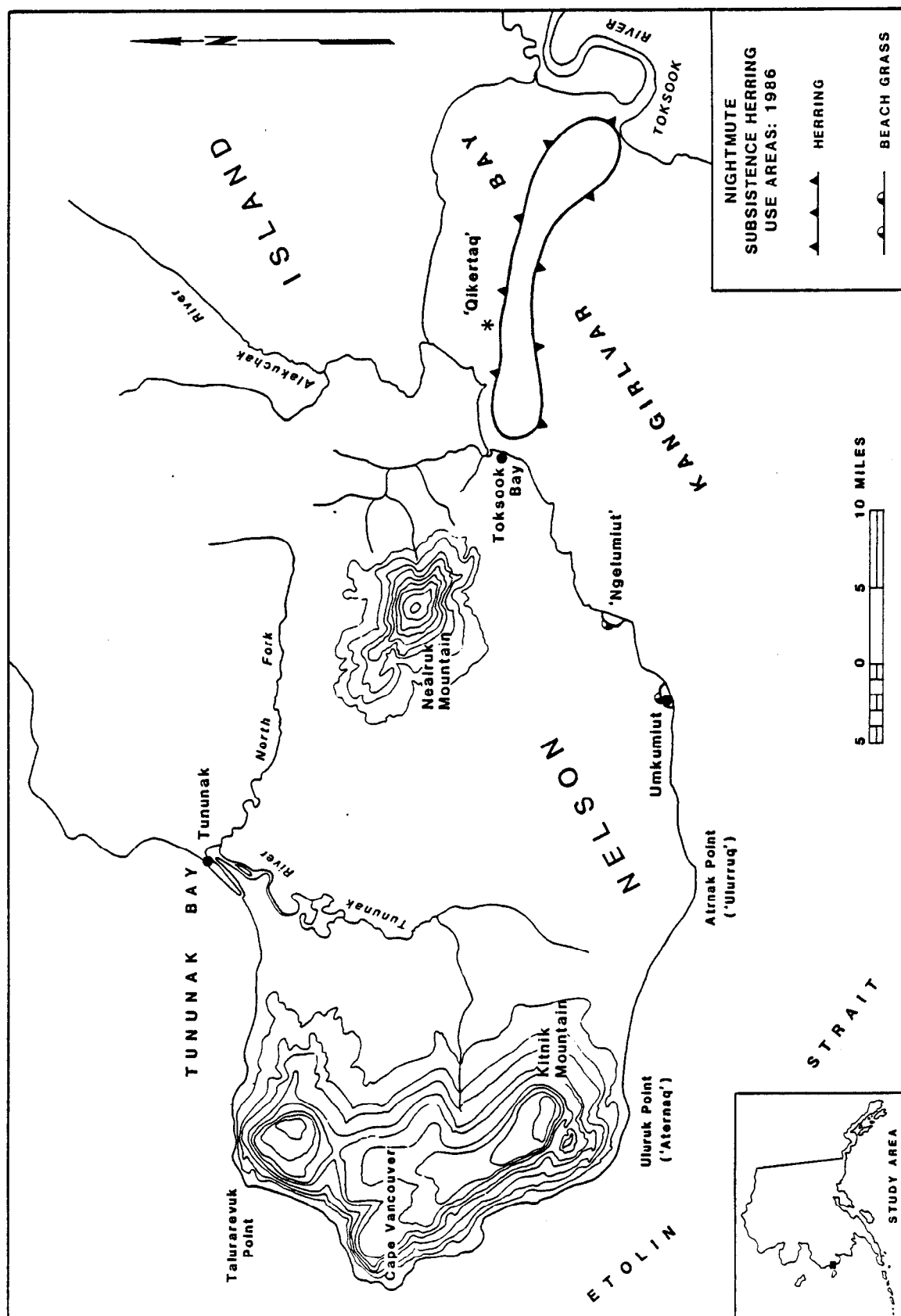


Fig. 7. Areas used by Nightmute residents for herring fishing and beach grass collecting in 1986.

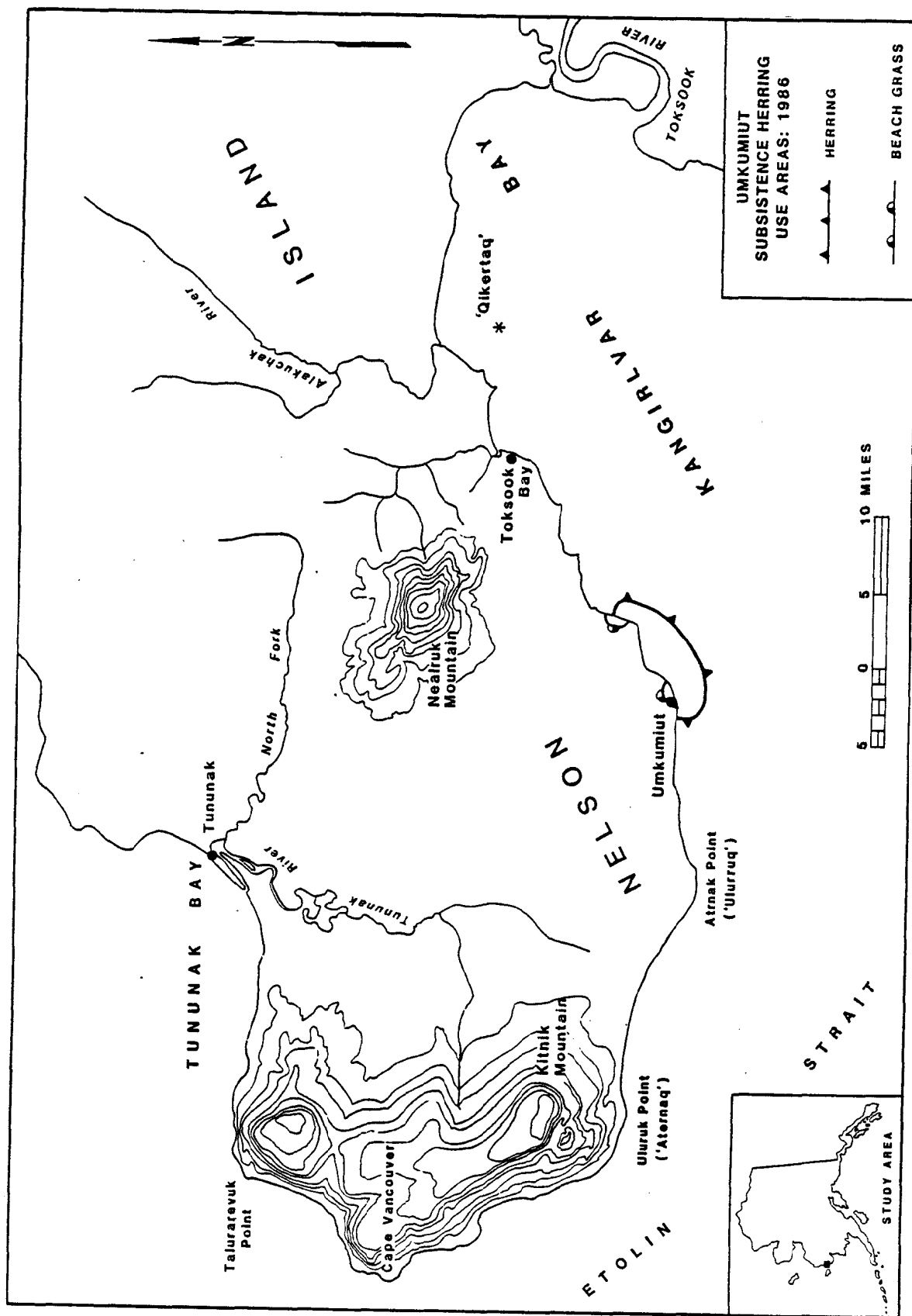


Fig. 8. Areas used by Umiukmiut residents for herring fishing and beach grass collecting in 1986.

Herring Harvest Activities

Timing of subsistence herring harvests depends on the quality of the herring, local weather conditions, and the presence of sea ice. Local residents recognize several "runs" of herring available during early spring and summer at Nelson Island. The early herring runs usually are not greatly utilized because the high fat content of these fish makes them difficult to dry in this maritime climate. Sea ice which hinders fishing often is still present during the earliest run, which is referred to as aciirtutet, meaning "those under (the ice)," further decreasing the likelihood of harvesting early run herring.

Tununak

In Tununak the major effort in subsistence herring fishing in 1986 occurred between May 28 and May 31 (Table 4). Tununak fishermen began fishing immediately after the closure of the commercial herring fishery. The 1986 commercial herring season in the Nelson Island District began on May 23 and closed on May 28, when the quota was reached. There were a total of six openings lasting between 4 to 12 hours with four of the openings lasting six hours. The final commercial opening on May 28, which occurred from 4 pm to 8 pm was immediately followed by the start of the subsistence fishery. Within three days most of the herring for subsistence had been harvested. Onshore winds intensified through the three-day duration, which helped keep the schools of herring close to shore and aided the harvest effort.

TABLE 4. FISHING EFFORT BY COMMUNITY, NELSON ISLAND
SUBSISTENCE HERRING FISHERY, 1986

Village	Timing of Major Effort	Total Fishing Days	Number of Production Units	Average Fishing Days Per Production Unit	Number of Households Providing Harvester
Tununak	May 28 - May 31	72	37	1.9	44
Newtok	June 4 - June 12	18	15	1.2	15
Toksook Bay	June 5 - June 12 June 18 - June 21	72	35	2.1	49
Nightmute	June 3 - June 10	27	14	1.8	15
(Umkumiut*	June 3 - June 11	11	9	1.2	7)

*The figures for Umkumiut harvesters (3 Toksook Bay and 6 Nightmute households) are also included in their respective communities, but are broken out here for comparison.

The extensive tidal flats offshore of Tununak necessitate that fishing be coincident with high or rising tides, regardless of the time of day. Fishing crews leave the community on a rising or high tide and may fish until the next flood provides enough water to cross the mudflats to return with the catch. When conditions are optimal (relatively calm weather and plentiful numbers of herring) people intensify their effort, with fishermen making several trips during a tide, tending and picking their nets and returning with the fish. For each day a net is set, the actual time spent fishing is difficult to measure but ranges from several hours to the whole day depending on weather conditions and the length of the net being used.

Forty-four of the 56 households which participated in one of the 37 extended-family production units provided fishermen. The 37 production units set their nets for an average of 2 days per production unit or a total of 72 days for the entire community (Table 4). Individual families fished between one and three and one-half days. However, to associate days of effort to a standard 8-hour work day would be misleading, as the actual hours of effort are dependent on highly variable factors such as weather, the presence of ice, and size of the schools of herring (Pete 1984).

Newtok

Subsistence herring fishing by Newtok fishermen occurred between June 4 and 12, 1986. Fifteen of the 18 households involved in one of 15 production units had a member that fished. The 15 production units

fished an average of 1.2 net-days, for a total of 18 fishing days for the production of herring for subsistence use (Table 4). Most families fished for one day, while two fished for two days and one fished over a three day period.

Because Newtok fishermen must navigate the tidally-influenced Ninglick River consisting of extensive mudflats and sandbars in order to reach fishing spots, the timing of the harvest is a function of when rising or high tides occur, as in Tununak. Transporting the catch back to the community for processing is easiest at high water. It generally requires about two hours to navigate the 30 ocean and river miles to the village.

Toksook Bay

In 1986, subsistence herring fishing was delayed at Toksook Bay due to persistent easterly winds which, according to local fishermen, kept the fish away from the shore. The easterlies cause turbulent, silt-filled waters in Kangirlvar Bay which herring apparently avoid. One fishermen indicated that northerly (offshore) winds were best for herring fishing in Kangirlvar Bay. During the end of May and the first week of June a few families were given herring caught in the Department of Fish and Game's test fishing nets at Toksook Bay. At least two families were able to begin processing herring prior to the end of the commercial season because of this.

When the wind decreased and shifted to the southeast, herring harvests commenced on June 5. The majority of the fishermen fished between

June 6 and June 12 when most people had completed their initial harvest. Weather conditions were ideal during most of this time and people were able to make several trips between the set nets and the processing facilities on shore.

A second fishing period occurred later in the month. Poor drying conditions resulted in the loss of some of the initial fish, particularly the "fatty" herring. Also, a local preference for smaller-sized herring prompted at least six families to fish again between June 18 and 21. Unlike Tununak where herring fishing was intense for a brief period of time, Toksook Bay residents spread their effort out over a longer period of time, essentially as long as the herring were present.

Forty-nine households (including three households which fished from Umkumiut) of the 64 involved in one of the 35 production units provided fishermen. The 35 production units fished for a total of 72 fishing days for an average of 2 fishing days per production unit (Table 4). Individual harvesters fished from one to four days during the first season. Fishermen who fished during the second period fished only one day.

Nightmute

The 14 Nightmute production units had fishermen from 15 of 18 households, including the six that fished from Umkumiut. Nightmute residents began fishing around June 3. The peak harvest occurred between June 6 and June 10. Herring fishermen fished from one to six days, averaging 2 fishing days per production unit with a total of 27 fishing days (Table 4). The one family based in Toksook Bay made a second harvest on June 20.

Umkumiut

Harvest activities of the three Toksook Bay and Nightmute six households which fished from Umkumiut were described in the previous sections. When viewed as a single unit, however, the herring fishing activities at Umkumiut closely paralleled those in Toksook Bay and Nightmute. All fishermen set nets close to the fish camp and fished for one or two days during the first two weeks of June for 11 fishing days (Table 4).

Roe-on-Kelp Collecting

Harvest of roe-on-kelp (elquat) begins as soon as spawning activity is intense enough to produce thick deposits of roe on the kelp (Fucus sp.) beds. It is usually handpicked at low tide and may be gathered in conjunction with tending nets. People continue to harvest roe-on-kelp as long as it is free from accumulations of sand and mud, caused by storms and tidal action, or until the roe has matured to the point it is no longer considered edible. Roe-on-kelp collecting techniques are common to all Nelson Island communities; however, the degree of effort for collecting roe-on-kelp varies between communities and between years.

Roe-on-kelp collection was greatest at Tununak in 1986. Most Tununak households (31 out of 56) involved in the production of herring for subsistence use attempted to harvest roe-on-kelp in 1986. The collecting of roe-on-kelp by Tununak residents coincided with herring fishing. Low tide was the preferred time although at higher tides rakes and other long-handled tools can be used in deep water to scrape the kelp off the

substrate. A few individuals used all-terrain vehicles, while most walked, to reach areas where roe-on-kelp was collected.

Three Newtok households collected roe-on-kelp in 1986. Most roe-on-kelp was soiled by deposits of silt and sand by the time Newtok residents began fishing activities and may account for the low level of participation. At Toksook Bay, one person harvested roe-on-kelp before the start of subsistence herring fishing and another household picked roe-on-kelp at Cape Vancouver during the peak of subsistence herring harvests. No one reported harvesting roe-on-kelp from Nightmute or Umkumiut in 1986, but several households were given enough for a couple of meals from relatives in Toksook Bay.

Beach Grass Collecting

As mentioned earlier, one of many uses for beach grass (taperrnat) is to "braid" herring into the long strings or garlands that are tied and circulated around the log racks or spiralled around the "teepee" racks to dry herring. Beach grass grows on well-drained coastal gravel and beach ridges and women gather it primarily by cutting the stalks at their base with an uluaq, the women's semilunar knife. Beach grass can be picked any time after it has died (turned brown). It is most commonly collected in the fall, rather than spring. The weight of the winter snow on the grass can make its quality less desirable for its other uses besides "braiding" herring (i.e. the shorter, straighter blades are used primarily to make baskets). After harvesting, it is tied into bundles and stored until used the following spring. Before being used, the grass is

soaked in sea water to make it more pliable and less likely to cut or scratch the hands of the processors.

Beach grass cut and stored at Umkumiut and Ngelumiut (Fig. 5) the previous fall was collected and brought into the owner's herring processing area during the days just preceding the start of fishing activities. A few families gathered grass in season close to town when their supply ran out. Researchers were asked to transport grass from Tununak to the giver's niece in Toksook Bay who had run out of grass. One woman reported purchasing grass collected by someone from Mekoryuk on Nunivak Island. She stated it was superior to work with and she is too old to harvest it herself locally. Some people incorporated strips of cloth into their braids, either for additional strength or to conserve their supply of grass.

Gear

Vessels used for the subsistence herring fishery ranged from 18 to 29 feet in length and were either commercially-manufactured aluminum boats or locally-constructed wooden skiffs. The use of wooden skiffs is more prominent in Tununak than any of the other Nelson Island communities. Fifty-seven percent of the fishermen in Tununak used a wooden boat. In Newtok, eleven aluminum skiffs, from 16 to 22 feet long, were used for subsistence herring fishing in 1986. Three locally-constructed wooden boats, ranging in length from 24 to 26 feet, were used also.

A 29-foot long fiberglass boat with hydraulic gear for pulling nets was the largest vessel used in the subsistence fishery. It was owned by a

resident of Toksook Bay. The smallest boat used in 1986 was a 14-foot aluminum skiff, used to pick a net that was set right off shore from Toksook Bay. The majority of Toksook Bay boats (74 percent) used were 18-foot aluminum skiffs. Only one wooden boat, 20 feet long, was used at Toksook Bay.

At Nightmute, fishing boats were from 18 to 22 feet long. Most (90 percent) were 18-foot aluminum skiffs, but two were made of wood. Like Nightmute, most Umkumiut boats used for subsistence herring fishing ranged from 18 to 22 feet in length. Two 20-foot boats were made of wood and the remainder were aluminum skiffs.

Gill nets made from cotton twine are commonly used by Tununak fishermen who prefer them because they are less likely than monofilament net to cut or otherwise damage the fish. Use of multi-filament nets (cotton twine with a nylon core or multi-filament nylon) is not widespread, but did occur. At Tununak nets ranged in length from 25 feet to 300 feet. The majority of nets used were between 30 and 60 feet long. Some individuals with the longer nets rolled up and tied portions of the net reducing the amount of effective gear in the water. Limiting the effective length of the net makes it easier to handle and also reduces the possibility of inadvertently harvesting more fish than the family can use. Nets over 150 feet in length most often were used for both commercial fishing and subsistence fishing. In some instances a part of a net once used for commercial fishing was used solely for subsistence fishing. Stretched mesh sizes ranged from 2 to 2-3/4 inches. The majority of the nets used in Tununak had a mesh of 2 to 2-1/2 inches. Meshes greater than 2-5/8 inches were common for nets used for commercial fishing.

At Newtok gill nets ranged from 25 to 300 feet in length, although only two nets exceeded 60 feet in length. Stretched mesh sizes were between 2-1/4 and 2-3/4 inches. Six of 14 nets used had a mesh size of 2-3/4 inches. This may indicate that these nets were portions of nets used for commercial fishing and probably made of monofilament. At least one fishermen used a net made of cotton twine.

Monofilament gill nets 300 feet long and with mesh sizes between 2-3/4 and 2-5/8 inches were most commonly used by Toksook Bay fishermen. Nets over 100 feet long comprised 77 percent of the nets used. Only eight people used nets 50 feet or less in length. Stretched mesh sizes for these smaller nets was 2 or 2-1/2 inches.

Nets used by Nightmute fishermen ranged from 50 to 300 feet in length and had mesh sizes from 2 to 2-3/4 inches. Thirteen of the nets exceeded 100 feet in length and 11 had mesh sizes of 2-3/4 inches or greater.

At Umkumiut, all nets used were 100 feet in length or longer. Most were 300-foot nets used also for commercial fishing. Mesh sizes were from 2 to 2-3/4 inches.

During 1986 most subsistence herring fishing by Tununak fishermen was done using set nets. All fishermen reported that they set their gear in the immediate vicinity of Chinit Point (Fig. 3). The lee side of the point is preferred for setting nets. Three fishermen also drifted for herring between Tununak Bay and Talurarevuk Point.

Eight Newtok fishermen set nets for subsistence herring in the vicinity of Nilikluguk. Five fishermen drifted in the same area. One fisherman drifted off Nel'ucuaq and another also drifted near the mouth

of the Ninglick River.

All of the harvesters from Toksook Bay used set nets in 1986. Two crews also drifted for herring. Both drifted within about one mile east of town. Set net sites were concentrated in the waters just east of the community within two miles of town (Fig. 5). A second concentration of set net sites was located near the first large point south of town approximately one mile distant. One fishermen fished just north of Ngelumiut (Fig. 5).

Set nets were used by 11 Nightmute fishermen. Most set net activity occurred on the Toksook Bay side of Kangirllvar Bay, while one fishermen set a net near the mouth of the Toksook River. Three fishermen drifted for herring at the mouth of the Toksook River. One of these men also set a net for herring.

Processing and Storage

Herring and Sac-Roe

The most critical part of the production of herring for subsistence use is the processing. It is the most time-consuming and labor-intensive aspect of the subsistence fishery. Not only must the harvest, which may exceed 5,000 pounds of herring, be prepared for drying, but once the fish are on the drying racks they must be turned or rotated to ensure they dry evenly. Dry, windy days provide ideal drying conditions. The total processing time required to produce dried herring for subsistence use can be as long as two months or longer if conditions are not optimum. The

drying fish must be protected from rain and intense sun and heat. Prolonged hot, dry or wet weather can result in an unsuable harvest. Intense heat from the sun can "cook" or burn the herring such that the flesh becomes rancid, peals and falls from the skin. Wet weather which prohibits drying can also make the flesh rancid, sour, and rotten. Additionally, long thin logs, milled lumber, or thick rope must be threaded through the braided strings of herring in extremely windy weather so the strings do not become tangled or break.

As soon as spring day-time temperatures are high enough to produce melting to reveal the outlines of the pits, Tununak, Umkumiut, and some Toksook Bay residents begin maintaining and preparing the elliviit (singular: ellivik) or subterranean storage pits. Tununak, Umkumiut, and limited areas around Toksook Bay are the only places that adequate soil drainage allows use of elliviit. In these places, each set of racks has a large pit associated with it. Pits may be as deep as 5 feet, and 6 feet square or in diameter. Any melt water or remaining snow is removed from the pit, and for several days each pit is bailed dry until water seepage no longer occurs. Once it is free of excess moisture the pit is lined with bunches of grass or woven grass mats, cardboard and/or plastic sheeting. Once the harvest has been hung to dry, the pit lining is dried and then burned on the beach. Herring are placed in above ground "cribs" in Newtok, Nightmute, and most areas in Toksook Bay, where poor soil drainage prohibits use of elliviit. The "cribs" are made with logs or scrap lumber placed into, usually, a square-shaped enclosure.

Aside from the use of storage pits in Tununak, Umkumiut, and some areas in Toksook Bay, much of the processing, drying, and storage tech-

niques are essentially similar among all the communities. Women hold the primary responsibilities for processing herring and ensuring that processing facilities are properly maintained. In some circumstances, such as widowers, men do assume these responsibilities. Including the several days to one week that the herring are aging in the storage pit, it may take up to two weeks to gut, slime, and braid the herring onto strings of grass for drying. Processing must take place regardless of the weather so temporary wind breaks or shelters are constructed to protect workers. If the production unit has a limited number of processors it may take longer. First the fish must be properly aged. In Tununak, Umkumiut, and parts of Toksook Bay this is accomplished by placing the herring in the elliviit, or pits, which are covered with grass mats or tarps. In Newtok, Nightmute, and most of Toksook Bay, canvas or visqueen tops protect the herring in above-ground "cribs." Aging allows the ventral wall of the fish to become more tender, making them easier to gut. Aging also hardens the carcass so the fish are easier to handle during processing. Further, aging lets the sac-roes harden enough so the skeins can be removed in one piece. Sac-roes taken from the herring is further aged until the skeins are firm. It is spread on a flat surface to dry and must be turned periodically to promote even drying.

As the herring are gutted and the sac-roes is set aside, the processors watch for "fatty" herring, which have striking whitish flesh along the spine and ribs, and has very light colored flesh when opened. The fatty herring receive special treatment because they are most vulnerable to spoilage from too hot or wet weather. They are filleted, either by running the thumb along both sides of the spine to remove the vertebrae

or by using a paring knife or homemade ulligcissuun ("a device for cutting fish for drying"), which is a piece of bone or ivory, sharpened and pointed on one end with the other end wrapped in cloth, and string or twine to form a comfortable handle. The processed "fatty" herring, called ullipengayiit (plural), which means "those that are cut and exposed to the air," are laid, flesh up, on flat surfaces to bead or "sweat" their oil. In contrast, processed non-fatty herring are called tamalkuryat, meaning "those that are whole (i.e. not exposed to air)." Tununak residents string up all the fatty herring, in contrast to the other villages, where most of them are left on the flat surface to dry as "blankets."

Herring are "braided" with beach grass as soon as the pile of gutted herring becomes large enough to produce several strings. Given ideal conditions it may take a month to dry the herring. Sac-roë dries much quicker, but may still take several weeks to dry completely. Some fish either individually or in whole strings are removed prior to being completely dried; either to be immediately eaten boiled (as egamaarrluk) or frozen for later use. Most of the fish are left hanging until completely dry. Fish are removed as they dry from the strings throughout the drying process. They are twisted from the strings leaving the head in place and the headless fish are placed in large open-weave baskets, called tut'at, for storage. Initially, within the baskets a pocket is formed in the middle of the loose mound of herring to allow the air to circulate and the door to the storage cache is kept ajar for a week to insure adequate ventilation and to retard mildew. The bulky baskets of fish are placed in corners of the family's storehouse. Some of the "fatty" herring are stored in seal-skin pokes with seal oil.

The sac-roë (called imlaucuaq) is dried into a product resembling golden chips. The dried roë is placed in containers and stored in the cache. It is usually soaked in water prior to eating but is also eaten dried. All sac-roë from subsistence caught herring was processed in all communities.

In Tununak herring processing began about the first of June. Within 16 days most processors had emptied their pits, gutted and braided the herring, and filled their racks. "Fatty" herring requires additional drying prior to being braided so some fish were not on drying racks until the third week in June. As soon as the fish begin to appear desiccated the strings of fish are turned to assure even drying by pulling the string around the rack crosspiece. During this time it is essential to protect the fish from bad weather. In the past, the racks were covered with grass mats, but today the primary materials include canvas and nylon tarps as well as sheets of plastic. In Tununak it is not uncommon for people to cover their fish each night as protection against dew as well as unexpected rain squalls. Tununak people had moved their herring into storage by the third week of July, seven weeks after the start of processing.

In Newtok, the community's herring harvest had already been hung to dry by the time the researchers arrived on June 18. The cleaning and braiding of herring for Newtok families took anywhere from one to two weeks to complete. Methods are similar to those found elsewhere on Nelson Island. Presumably herring were placed into storage by the third week of July.

The processing of herring in Toksook Bay was under way when re-

searchers arrived on May 30. Several families were processing fish they were unable to sell before the commercial fishery ended, or that they received from the Alaska Department of Fish and Game's commercial test fishery. One family fished for herring for subsistence use at the end of the commercial fishery. The last herring harvested from the second harvest period were on the racks by June 27, although most processors had finished hanging their herring to dry by June 18.

The timing of processing for Nightmute coincided with that of Toksook Bay. When researchers arrived in Nightmute on June 26 all herring were on racks and in the final stages of drying. Sac-roes had already been put into storage.

At Umkumiut, processing activities are similar in timing and method to those described for Toksook Bay and Nightmute, with two exceptions. Umkumiut is located on low sandy beach ridges which allows subterranean storage pits to be used. Each set of racks used there had an associated pit. Once the herring was dried it was transported to final storage areas in Nightmute or Toksook Bay.

Roe-on-Kelp

Much of the roe-on-kelp is consumed soon after it is harvested, but a portion of the harvest is preserved in seal-skin pokes filled with seal oil. It is difficult to quantify the amount of roe-on-kelp collected in a given year. Individuals use different sized containers for collection and storage which hinders efforts to gauge harvest levels. People report taking less roe-on-kelp than normal in 1986 because of poor harvest

conditions. High winds and turbulent seas stirred up sand and silt which coated the sticky roe making it inedible. Local community concern over maintaining viable herring stocks may have had some influence on limiting collection of roe-on-kelp. Some individuals reported that local kelp beds appear to be diminishing in size during the past two decades. Current local harvest levels of roe-on-kelp, while insufficiently documented, do not appear to be very large. What factors are associated with the perceived declines of kelp beds are as yet undetermined.

HARVEST LEVELS

The four communities harvested an estimated total of 166.8 short tons of herring for subsistence use in 1986 (Table 5). As described above, this harvest estimate was derived from calculations from direct observations of all herring while they were still on the drying racks. This study included a complete sample of fishing families in all four communities so the per capita harvest calculations were made with all community residents rather than with just the members of the actual fishing families. The overall per capita harvest for all communities was 308 pounds of herring for subsistence (Table 5).

In Tununak a total of 126,515 pounds, equivalent to 63.3 short tons or 57.5 metric tons of herring were harvested and processed in 1986 with an overall per capita harvest of 392 pounds (Table 5). On the average, each production unit in Tununak produced 1.7 short tons of herring, however, production ranged from .6 to 3.1 short tons.

Of the 2,615 strings of herring, 465 (17 percent) strings were

TABLE 5. ESTIMATED 1986 NELSON ISLAND SUBSISTENCE HERRING HARVEST LEVELS BY COMMUNITY*

Community	Total Pounds	Total Short/Metric Tons	Average Pounds Per Production Unit	Average Short/Metric Tons Per Production Unit	Total Number of Strings	Percentage of Strings as Ullipeng- ayitt	Pounds Per Capita
Tununak	126,515	63.3/57.5	3,419	1.7/1.6	2,615	17%	392
Newtok	25,097	12.6/11.4	1,673	.84/.76	2,223	7	126
Toksook Bay	139,026	69.5/63.2	3,972	2.0/1.8	826	6	337
Nightmute	42,806	21.4/19.5	2,852	1.4/1.3	503	7	289
Total	333,444	166.8/151.6	3,334	1.7/1.5	6,167	11	308

*Unkumiut seasonal camp harvests (23,410 pounds) included in the totals for Nightmute (17,285 pounds) and Toksook Bay (6,125 pounds).

"fatty" herring processed as ullipengayiit, which is the highest proportion of "fatty" herring for the four communities. As mentioned earlier, "fatty" herring are most susceptible to weather-caused spoilage. The large proportion of ullipengayiit present reflects the early timing of harvest by residents of Tununak.

The community of Newtok harvested 25,097 pounds of herring, equivalent to 12.6 short tons or 11.4 metric tons. This equals an average of 1,673 pounds of fish per production unit and 126 pounds per capita (Table 5). Harvest levels per production unit ranged from .3 to 2.3 short tons. An estimated 7 percent of their strings of herring were processed as ullipengayiit.

In Toksook Bay a total of 2,223 strings of herring were dried. Approximately 6 percent of these were ullipengayiit. The community harvested 139,026 pounds, equivalent to 69.5 short tons or 63.2 metric tons of herring (Table 5). This equals an average of 2 short tons with a range of .7 to 3.3 short tons per production unit and 337 pounds per capita.

The community of Nightmute processed 42,806 pounds of herring into 826 strings, of which 6 percent were ullipengayiit. This is equivalent to 21.4 short tons or 19.5 metric tons. The average number of short tons of herring processed by Nightmute production units was 1.4 ranging between .6 to 3.7 short tons with a per capita average of 289 pounds (Table 5). Production units at Umkumiut contributed 23,410 pounds of fish to their community totals. The three families from Toksook Bay that fished from Umkumiut harvested a total of 6,125 pounds of herring. The remainder (17,285) pounds went to Nightmute (Table 5).

THE PRODUCTION OF HERRING FOR SUBSISTENCE USE

The recruitment of persons into production units for harvesting and drying herring is kinship-based in all four Nelson Island communities. Kinship is the regulating principle for many social, economic, and political aspects of Yup'ik culture (cf. Fienup-Riordan 1983; Lantis 1946; Shinkwin and Pete 1984). In this study, involvement in the subsistence herring fishery was determined for discrete households (i.e. residential units). The unit of data collection, and ultimately of analysis, was the production unit or that group of individuals who converged on a set of racks to produce dried herring for that unit.

Each production unit had a "rack managing couple," typically a married couple or a widow(er) and her or his eldest son or daughter. The married couple or widow(er) are commonly the head of an extended family unit comprising one or several households. Within this "rack managing couple," one person (usually the male) oversees harvesting of herring while the other (always female, at least in the 1986 season) manages processing. Although it was infrequent, "rack managers" may not actually harvest or process herring, but they direct the activities of the members of the production unit, such as deciding where gill nets are to be set, who checks them and when, and when they are to be pulled from the water. The managing couple jointly decide when the harvest amount is adequate for the production unit. In most cases, the "rack managers" or members of their household owned the equipment needed for herring fishing, such as the nets, boat, and outboard motor. They are obligated to make sure that gasoline, motor oil, and beach grass is provided for

the relatives who fish for and process the herring for that unit. They are responsible for the maintenance and preparation of the processing and storage facilities. The production unit collectively owns their racks, although the products on the racks are referred to as belonging to the woman in the managing couple who oversees processing. The herring are most often stored in facilities of the managers' household, however, all members of the production unit can take herring as they need it throughout the winter. Most often, production units contained more than the designated "rack-managing" couple's household; the overall average number of households per production unit included 2.3 households in 1986 (Table 6).

Usually, the children of the "managing" couple or the widow(er) (often living in other households or communities) helped in harvesting and processing herring. All other possible categories of relatives from the perspective of the "rack managers" were involved in production units in 1986, but not as frequently as their children and children's spouses. The actual make-up of the production unit from year to year is not always the same or certain at the start of the season, as there is a pool of kin from which can be drawn the personnel to assure that herring are harvested and dried for that production unit. If some of one's usual set of kin are not available, for example due to health reasons another, may be called upon for that season, or those already active in another production unit may do "double-duty." The managers for each set of racks, known community-wide, "manages" the members of his or her kin group each year to get herring on the racks.

In sum, the production unit is a multiple household, kin-based

TABLE 6. PRODUCTION OF HERRING FOR SUBSISTENCE
USE IN NELSON ISLAND BY COMMUNITY, 1986

	TUNUNAK	NEWTOK	TOKSOOK BAY	NIGHTMUTE
Community Population	323	199	412	148
Total Households in Community	65	39	77	28
Number of Community Households Involved	56 (86%)	18 (46%)	64 (83%)	18 (64%)
Number of Herring Production Units	37	15	35	14
Average Number of Households Per Production Unit (Range)	2.4 (1-6)	2 (1-3)	2.7 (1-6)	1.5 (1-3)
Range of the Number of Persons Per Production Unit	2-9	3-6	2-9	3-8
Number of Fishermen	91	32	108	32
Average Number of Fishermen Per Production Unit (Range)	2.5 (1-4)	2.3 (1-4)	3.1 (1-5)	2.1 (1-3)
Number of Processors	96	34	116	39
Average Number of Processors Per Production Unit (Range)	2.6 (1-5)	2.4 (1-5)	3.3 (1-7)	2.6 (1-6)
Total Number of Persons Involved	160	56	190	60
Number from Local Community	141 (88%)	52 (93%)	178 (94%)	54 (90%)