NORTON SOUND-BERING STRAIT

SUBSISTENCE KING CRAB FISHERY UPDATE

By

Jim Magdanz and Annie Olanna

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ABSTRACT

This study is a continuation of the Division of Subsistence's efforts to document the Norton Sound and Bering Strait subsistence king crab fishery. After the area was opened to commercial fishing in 1977, subsistence harvests declined sharply. The division has conducted house-to-house surveys in Nome and area villages for four consecutive years, collecting information about harvests, crabbing conditions, and gear. Data are presented in two parts; the first for villages in the Norton Sound Section, and the second for villages in the General Section of the Northern District of Statistical Area Q (Bering Sea). In the Norton Sound Section, Nome harvests in 1983 were the highest since 1978. ELim, Golovin and White Mountain harvests, however, remain depressed negating a modest increase observed in Golovin in 1982. One reason for Nome's considerable success is a transformation of gear. A predominantly handline fishery has become a predominantly pot fishery. In the General Section, harvest trends are not so evident. Savoonga experienced two years of poor success in 1980 and 1981. In 1983 harvests were moderate at both Savoonga and Gambell. Of more concern in the General District is the sudden and unexpected change in the level and timing of commercial activity. More crab were harvested commercially around St. Lawrence Island in 1983 than in the previous six years combined (although harvests were low by comparison with other fisheries). And the fishery occurred later than usual, interferring with the subsistence seal hunting by residents of Gambell. As a result, Gambell and Savoonga people petitioned the governor for closure of the

fishery and have submitted several proposals to change the season, the harvest strategy and the closed waters in the General Section.

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INTRODUCTION

Since May 1980, the Nome office of the Division of Subsistence has been documenting the harvest and use of king crab in the Norton Sound and Bering Strait area. In March 1981, the Division published the results of an extensive survey of area villages in a report titled "Norton Sound-Bering Strait Subsistence King Crab Fishery." In March 1982 and March 1983, the Division published updates to that report, containing the findings of similar surveys in a sample of area villages and comparisons with the previous data. This update repeats the survey and extends the baseline of harvest and use data for Norton Sound and Bering Strait king crab. In consideration of the changes in membership of the Board of Fisheries, this update will describe in detail the research problem and the methodologies for the update. More discussion can be found in the initial report (Thomas 1981) and the earlier updates (Magdanz 1982, 1983), which are available upon request from the Division of Subsistence.

THE RESEARCH PROBLEM

King crab have been a part of winter diets in Norton Sound and Bering Strait villages for as long as elders can remember. Crabbing occurs in the harsh environment of the sea ice in late winter or early spring. It is not often observed by outsiders, and may be overshadowed by concurrent subsistence activities, such as whaling at Southwest Cape on St. Lawrence Island. Before 1977, no one competed with villagers for king crab and no commercial or regulatory studies had been conducted.

When the initial surveys and interviews were conducted in 1980 and 1981 (Thomas 1981), it was discovered that crabs have long been taken and still are being taken throughout the area, from Little Diomede Island in the north, to Shaktoolik in the south and to St. Lawrence Island in the west. Harvest data for king crab prior to 1970 are sketchy. Until these surveys, no data existed for the villages. Based on the recollections of elders who talk of sled loads of crab they caught themselves, harvests were substantial (Thomas 1981:50). Permit data, although incomplete, exist for Nome beginning in 1978.

In 1976, in anticipation of federal oil and gas lease sales on the outer continental shelf, the National Oceanic and Atmospheric Administration (NOAA) conducted an extensive trawl survey in northwestern Alaskan waters. Among their findings was the presence of an abundance of king crab and tanner crab (Wolotira et al, 1977:217-238). Red king crab were concentrated in Norton Sound, especially in the waters just offshore from Nome. Blue king crab were found to the west near the Strait, around King Island and north of St. Lawrence Island. Tanner crab (opilio) were found in Norton Sound and to the north in Kotzebue Sound. At about the same time, there was an interest in developing a commercial crab fishery. Crab fishermen requested a commercial crab fishery in the northern Bering Sea. In April 1977, the Board of Fisheries initiated a red and blue king crab fishery in the Northern District of Statistical Area Q (Bering Sea). The fishery was opened by emergency order on June 7, 1977. At the following board meeting, in December 1977, the Board passed additional regulations to allow a winter commercial fishery through the ice in Norton Sound.

Current regulations divide the Norton Sound and Bering Strait area into two sections for the purpose of king crab management: the Norton Sound Section and the General Section. The Norton Sound Section includes all waters east of 168 degrees West longitude, north of the latitude of Cape Romanzof, and south of the latitude of Cape Prince of Wales. Nome and the coastal villages of Norton Sound are in the Norton Sound Section. Red king crab are the predominant species. Management is handled through department offices in Nome. The General Section includes all waters north of the latitude of Cape Newenham, except for the waters of the Norton Sound Section. St. Matthew Island, St. Lawrence Island, King Island, and Little Diomede Island are in the General Section. Blue king crab are the predominant species. Management is handled through Dutch Harbor. Maps of these management sections appear in Chapter 2 of this report, along with village crab harvest reports.

Since 1977, viable commercial fisheries have developed near Nome and near St. Matthew Island. With the results of the 1976 NOAA trawl survey as a "road map," the commercial fleet targeted on red king crab just offshore from Nome. They also ranged throughout Norton Sound, dropping pots near Golovin, near Little Diomede Island, and around St. Lawrence Island. St. Matthew Island, though, has been far and away the most productive fishery in the Northern District.

Commercial harvests in the Norton Sound Section increased dramatically during the first three years (Figure 1), but then declined. The largest catch occured in 1979, when 2,931,672 pounds (970,962 crab) were harvested. Harvests in 1980 and 1981 were only a third of that in 1979, and harvests in 1982 and 1983 were about a tenth of 1979. The

commercial harvest in the summer of 1983 was 368,032 pounds (132,205 crab). Since 1977, the commercial fleet has harvested 8,703,983 pounds (2,759,494 crab) in the Norton Sound Section.

Commercial harvests in the General Section have concentrated near uninhabited St. Matthew Island, outside of the Norton Sound - Bering Strait area. A relative handful of boats harvested blue king crab around St. Lawrence Island; 9,000 pounds (2,500 crab) were taken in 1978, 22,200 pounds (6,341 crab) were taken in 1979, and 3,290 pounds (914 crab) were taken in 1981. No commercial harvests were reported north of Cape Romanzof in 1977, 1980, or 1982. In 1983, managers closed General Section waters after the harvest guideline had been reached, then reopened waters around St. Lawrence Island. No other crab fishery was open at the same time, so boats converged on St. Lawrence and harvested 47,600 (10,847 crab) in ten days. This more than doubled the total commercial harvest of blue king crab from St. Lawrence Island waters in the past seven years.

As these fisheries have developed, they have attracted crabbers from Dutch Harbor, Kodiak, and as far away as Seattle. Although northern waters are not as productive as southern waters, seasons in the Norton Sound Section and the General Section do not coincide with any other crab seasons. This has concentrated commercial effort in northern waters. Nome interests were surprised at the magnitude of the summer commercial fishery that developed in their own backyard. No boats from Nome were equipped to compete successfully. The winter commercial fishery -- limited by market and ice conditions -- has never approached the magnitude of the summer commercial fishery.

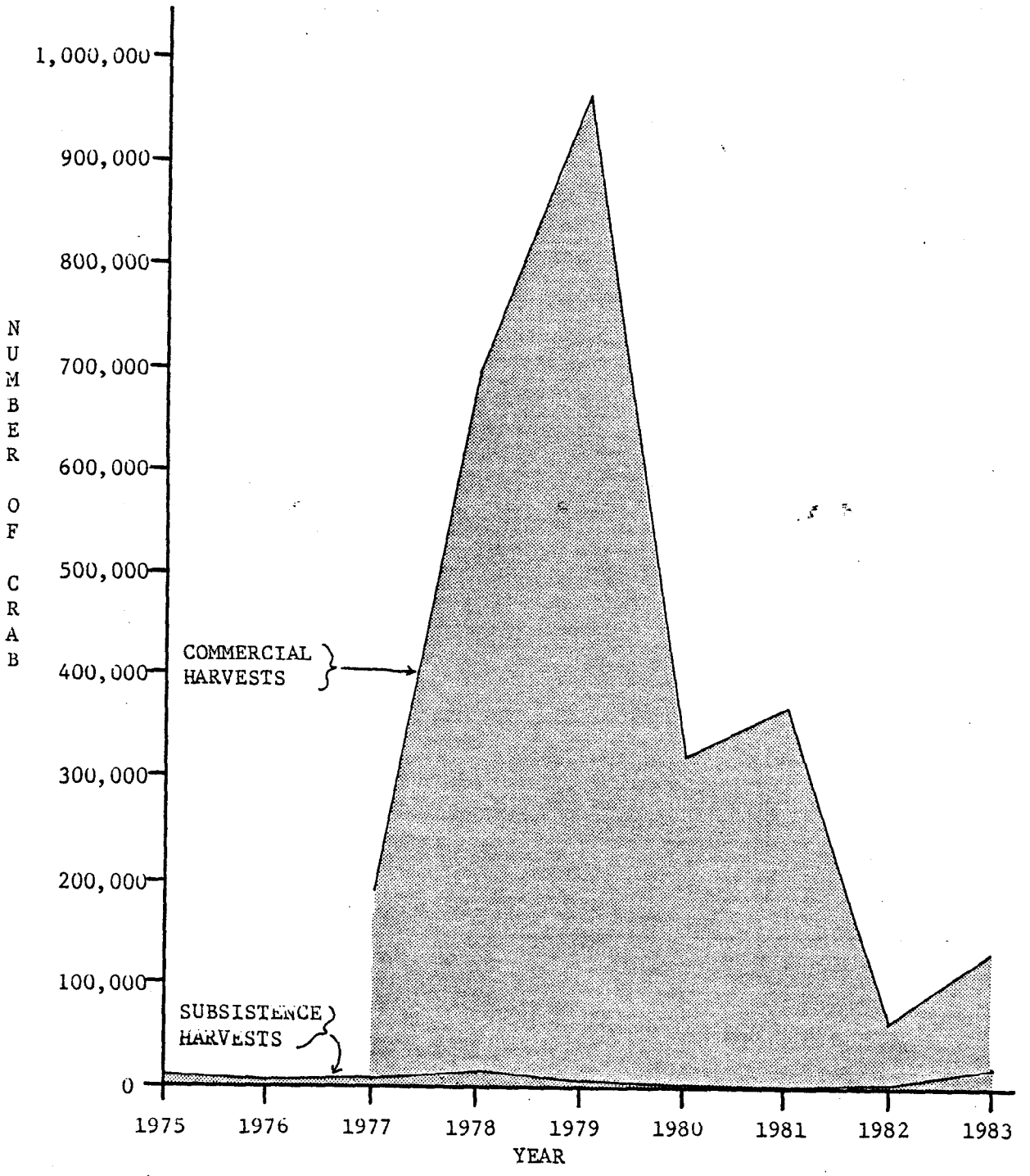

Fig. 1. Commercial and subsistence harvests of red king crab in the Norton Sound Section of the Northern District of Statistical Area Q (Bering Sea). A graph shows magnitude of summer commercial harvests compared with winter subsistence harvests by villagers in Elim, Golovin, Nome, and White Mountain. See Appendix 3 for an explanation of the subsistence harvest totals for 1981 and 1982, when not all villages in Norton Sound were surveyed.

As the commercial harvests were accumulating, villagers began to notice their subsistence harvests were shrinking. Permit data from Nome showed that the annual household catch of crab decreased from 125 in 1978 to 16.9 crab in 1981 (Magdanz 1982:12). Golovin crabbers, who had enjoyed an average annual household catch of between 25 and 50 crab until 1980 (Thomas 1981:52), averaged only 1 crab per household in 1981 (Magdanz 1982:14). Savoonga crabbers who crabbed on the northside of St. Lawrence Island in the mid-1970s averaged between 10 and 60 crab per household per year, but caught only 1.6 crab per household in 1980 (Thomas 1981:93) and only 0.14 crab per household in 1981 (Magdanz 1982:20).

A number of explanations have been advanced for the decline in subsistence harvests, such as changes in the ocean environment, natural fluctuations in crab populations, decline in effort by subsistence crabbers, changes in the ice conditions, and alteration of crab distribution patterns. But residents of Norton Sound and Bering Strait villages are convinced that the opening of the commercial crab fishery is directly responsible for the decline in subsistence harvests.

Out of concern for the viability of the Norton Sound crab stocks, as well as for their continued use of crab as a food source, area residents presented the Board with a series of regulation proposals. The first was a proposal for closure of the commercial fishery in the Norton Sound Section in 1981. A closure proposal was presented again in 1982, this time with the endorsement of the newly created Arctic Regional Council, and again in 1983. There are no local proposals affecting the Norton Sound Section this year. There are several proposals, however, that would change commercial king crab regulations in the General Section.

All originate from St. Lawrence Island; one was drafted by the St. Lawrence Island Advisory Committee. The proposals would change the season, the harvest strategies, and the closed waters in the General Section of the Northern District north of Cape Romanzof.

In the past the Board has responded to the problem of declining subsistence harvests in essentially two ways. In 1981 it created a near-shore closure of the waters within approximately 15 miles of the mainland and in 1982 created a near-shore closure of the waters within 3 miles of St. Lawrence Island, Little Diomede Island, and King Island. Commercial boats were not allowed to set pots in these waters. Second, in 1982 the board reduced the optimum yield for the Norton Sound Section from 40 per cent of the harvestable male king crab to 20 per cent. The Board adopted a new harvest strategy for king crab in 1983. But it retained the protection for subsistence crabbing by setting the exploitation rate in Norton Sound at half the exploitation rate for other sections (see 5 AAC 34.080 and 5 AAC 34.915). (Before the subsistence harvest declines were documented, the Board lowered the minimum size of legal crab in the Norton Sound Section from 5" to 4 3/4". This substantially increased the allowable commercial harvest. The 4 3/4" minimum is still in effect.)

When the fishery is in progress, the area biologist has management authority. In 1981 the Division of Commercial Fisheries closed four areas (about 15 per cent of the Norton Sound Section) to commerical crabbers to distribute effort to areas where little or no effort had occured. In 1982 the Division relaxed the 15 mile near-shore closure by five miles when it became apparent that the boats were not going to meet

the harvest guideline while fishing outside the closed waters. These actions were consistent with Board directives.

Because the 1983 survey showed that subsistence harvests in the area contiued to be depressed, the Division of Subsistence continued to monitor the situation. The Division's purpose since 1980 has been to document the history of use, the tools and techniques of the fishery, the locations of effort, the timing of effort, the preparation, storage and distribution of the catch, and other facets of the fishery. Thomas (1981) presented detailed information on these topics. The updates do not repeat his information. Thomas also documented the levels of harvest, year by year, in area villages. These data will be used in this update to compare current harvests. (The data in this, the 1984 update, comes from the 1983 harvest. The harvest was continuing as this update was being prepared. March and April are very productive months for most subsistence crabbers, so it would be premature and possibly misleading to present any conclusions now about the 1984 subsistence harvest.) The purpose of this update is to extend the baseline of harvest data for a selected sample of area villages and to note changes in tools and techniques, in the location of effort, in the timing of effort, and in other features of the Norton Sound-Bering Strait king crab subsistence fishery during the 1983 season. The objective is to provide comparable harvest data, which can be graphed with data from previous years to show harvest trends in the subsistence fishery.

Three limitations apply to the harvest statistics. First, the statistics for Nome may be incomplete because they are based on permits. Not all crabbers obtain or return permits. If the number of permits issued is any indication, compliance is increasing. Second, information

from village crabbers derive from interviews administered in the villages after crabbing season is complete. These statistics are based on recall. (For a protocol of the questions used in the survey, see Appendix 1). To minimize the affects of variable sample size, the statistics are analyzed by computing the average annual catch per house and the average daily catch per house (catch per unit effort or CPUE). Third, Thomas' 1980 survey asked for harvest ranges instead of exact harvests. When he totalled his data, he used midpoints (see Thomas 1981:9-12). For example, people who reported catching 1-5 crab were counted as having caught 3 crab. People who reported catching 25-50 crab were counted as having caught 38 crab. But when people reported catching more than 75 crab (Thomas' highest range), there was no way to compute a midpoint. These cases were counted as having caught only 75 crab, although this understated both harvest totals and harvest averages. Thomas noted this limitation in his report. Since subsequent surveys asked for actual harvests instead of harvest ranges, this limitation has been eliminated.

Data in this update do not always agree with data in the Division of Commercial Fisheries reports. Permit design has varied from year to year, incomplete or ambiguous permits have been returned, and different methods have been used for tabulating the data. See the 1978 Annual Management Report (Kuhlmann 1978:129) for details on the "expansion" of the 1978 data. This researcher obtained the original permits and tabulated them using the same procedures year-by-year, as explained in the methodology section.

Each year brings refinements in the statistical data gathering techniques and the reliability of the harvest total should increase with

time. These limitations are unique to the statistical data gathering techniques and the reliability of the harvest total should increase with time. These limitations are unique to the statistical portions of the study. They do not apply to information about tools and techniques, location of effort, and other topics discussed in the report and updates.

METHODOLOGY

From the Division's information about the area and from local informants, Thomas identified villages where crabbing regularly occurred. A survey on crabbing effort, locations, harvests and gear for 1979 and 1980, and about harvests for 1970 and 1975-78 was administered in person to residents of Golovin, White Mountain, Elim, Shaktoolik, Gambell, Savoonga and Diomede (Thomas 1981:7). The survey was administered by mail to all post office box holders in Nome. A nearly 100 per cent sample was obtained in Golovin, White Mountain, Elim, and Diomede, and a 30 per cent sample in Savoonga and Gambell. In addition to the survey, interviews were conducted with selected, knowledgeable informants about historical harvest, traditional methods, and other topics. Thomas intended that an abridged version of his initial survey be administered in subsequent years to extend his baseline data. The updates fulfill that intent.

For the 1982 and 1983 updates, only selected villages were surveyed. Personnel, time, and budgets are limited, and Thomas' findings support such a selective approach. As Golovin and White Mountain crab at the same location, a place near Rocky Point known as

Ipnatchuaq, only Golovin was surveyed in 1982 and 1983 to represent that area. Similarly, as Savoonga and Gambell crab at Southwest Cape during the whaling season, only Savoonga was surveyed in 1982 and 1983. Shaktoolik was judged by Thomas to be less active in crabbing than the other villages surveyed (Thomas 1981:71-72). Shaktoolik was not surveyed for the update. Ingalik on Little Diomede Island is a very active crabbing village, but unlike other villages had not experienced a decline when Thomas did his survey (Thomas 1981:125). In summary, all heavily used crabbing areas Thomas documented in the Norton Sound Section and two of the four areas documented in the General Section are represented in the 1982 and 1983 updates.

Within the selected villages, the same houses were contacted and the same identifying codes were used each year. Thus comparisons can be made of individual cases between Thomas' 1981 report and each of the updates (see Appendix 2). The sample size has grown in two villages. In 1981, the reported harvest in Golovin was so low that a concerted effort was made to locate individuals who had been unavailable when Thomas did his survey. Those individuals' houses were added to Thomas' sample and contacted again in 1982. In 1982, the reported harvest in Elim was so low that again a concerted effort was made to locate individuals who had been unavailable in 1980 and 1981. These individuals' houses were added to Thomas' sample and were contacted again in 1983. In other villages, the sample has remained the same. For Nome data, Thomas relied on his survey, because not everyone obtained or returned permits. The 1982 update compared survey and permit data and found that, while catch totals might not agree, average catches per house were similar with both kinds of data. The Division of

Commercial Fisheries is emphasizing compliance with the permit system, and to avoid duplication and confusion, the Division of Subsistence is not administering crab surveys in Nome. The updates rely on permit data for Nome.

Village harvest data for this update were gathered during house to house visits by researchers in Elim, Golovin, White Mounatin, Gambell and Savoonga. Researchers were guided by a protocol of questions (see Appendix 1) and recorded answers in field notes. Respondents who did not crab were asked only two questions and the sessions might be relatively brief. The entire protocol was used with respondents who had fished both handlines and pots for several months. In Savoonga, where crabbers use two locations, the protocol was repeated for each location. Some interviews went beyond simple recitation of harvests. When these interviews provided data pertinent to the study, that data will be included in the findings below.

The survey was expanded this year to include two villages that had not been surveyed since Thomas did his work in 1980 and 1981. White Mountain and Gambell residents were asked not only about their harvests in 1983, but also about harvests in 1982 and 1981. It was deemed important to add these villages for 1983 because staff and funding are being shifted to other projects in fiscal 1985 and will not be available to conduct surveys. Researchers wanted the final survey to be as complete as possible. In addition, St. Lawrence Island residents were especially concerned after an intensive (by comparison to previous local fisheries) commercial fishery developed in September. Gambell and Savoonga's crab fisheries have received much less attention from the staff than Norton Sound village fisheries.

Analysis of the survey data was relatively simple. Totals were calculated for the harvest for each gear type, the number of houses using each gear type, and the number of days reported for each gear type. Data from houses that could not remember either harvest or number of days were temporarily set aside. The following statistics were computed:

1. The total harvest for handlines was divided by the number of houses using handlines, to obtain the average annual catch per house for handlines.

2. The total harvest for pots was divided by the number of houses using pots to obtain the average annual catch per house for pots.

3. The total harvest reported for both pots and handlines was divided by the number of houses that crabbed to obtain the average annual catch per house. This statistic was graphed for each village in the findings section.

4. The total harvest for handlines was divided by the number of days reported by handline users, to obtain the average daily catch per house for handlines.

5. The total harvest for pots was divided by the number of days reported by pot users, to obtain the average daily catch per house for pots.

6. The total harvest for both pots and handlines was divided by the number of days reported to obtain the average daily catch per house. This statistic was graphed for each village in the findings section.

After these statistics were computed, the harvest totals were adjusted by adding data from houses that could not remember their harvest or the number of days they crabbed. In cases where the harvest was supplied, but not the days, the harvest for their case was divided by the average daily catch for other crabbers in that village, and the result was added to the village's "days" total. In cases where the response to a query about days or harvest was "a few", the value "2" was substituted. The value "3" was substituted for "several". Adjusted totals were then figured. The extrapolations are used only to compute adjusted harvest and effort totals, not to compute the average catch per house statistics.

Findings are arranged by village, and the presentation will be the same for each village. The narrative will describe the 1983 harvest totals, participation (number of houses crabbing) effort (number of days crabbed) the statistical averages and comments villagers had about crabbing, ice conditions, weather, regulations, or other features of crabbing. The narrative will offer comparisons between 1983 and previous years.

CHAPTER TWO

VILLAGE CRAB HARVESTS IN 1983
NORTON SOUND SECTION

Four villages along the northern coast of Norton Sound have traditionally crabbed intensively in the winter and spring (Figure 2). Elim, Golovin and Nome crab harvests have been reported regularly in these updates since 1982. White Mountain data has been added to this year's update. All these villages have experienced declines in crabbing success in the past five years. Nome -- but none of the villages -- shows signs of recovery.

Elim

Elim data come from a survey conducted between September 5 and September 9, 1983. Forty one houses were contacted.

The southernmost village surveyed, Elim's crab harvest was among the lowest reported in 1983. Crabbers caught 11 crab in 1983, compared with seven in 1982, 99 in 1981, and 86 in 1980. Despite the low harvest, participation was normal; 15 houses reported crabbing, compared with 13 in 1982, 11 in 1981, and 14 in 1980. Effort was down compared to 1982, but on par with earlier years. Sixty-three days were spent crabbing in 1983, compared with 157 days in 1982, 75 in 1981, and 52 in 1980. Considering that over half the effort reported in 1982 was attributed to one crabber's 90 day pot soak, effort in 1983 was normal.

Consequently, the annual average catch per house and the average daily catch per house were again very low. In 1983, the average annual catch per house was 0.8 crab, compared with 0.5 in 1982, 9.0 in 1981,

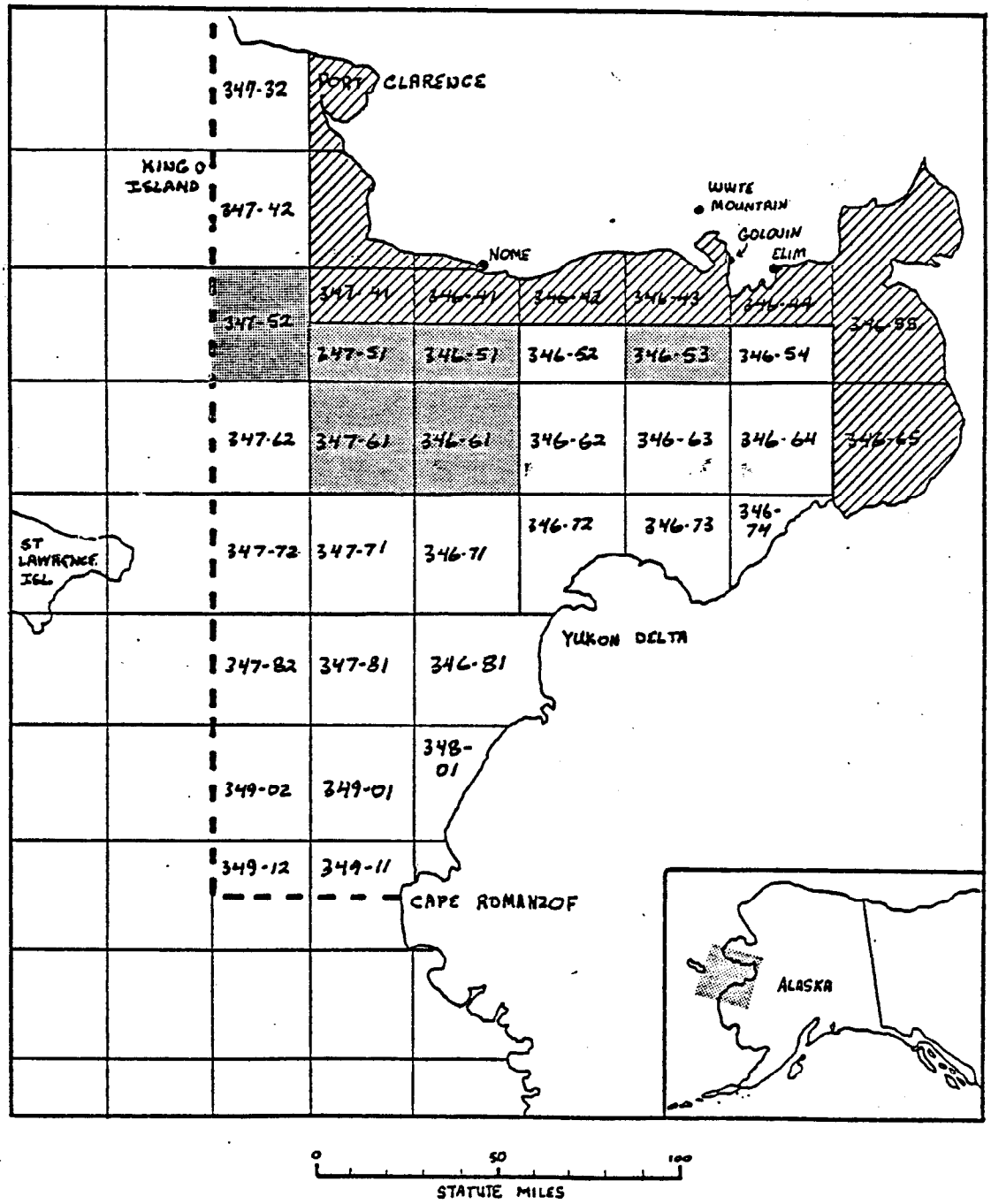

Figure 2. Norton sound Section of the Northern District of Statistical Area Q (bering Sea). Shaded statistical areas outside the closed waters indicate locations of the summer 1983 commercial king crab harvests. Almost 90 percent of the harvest came from statistical area 347-51.

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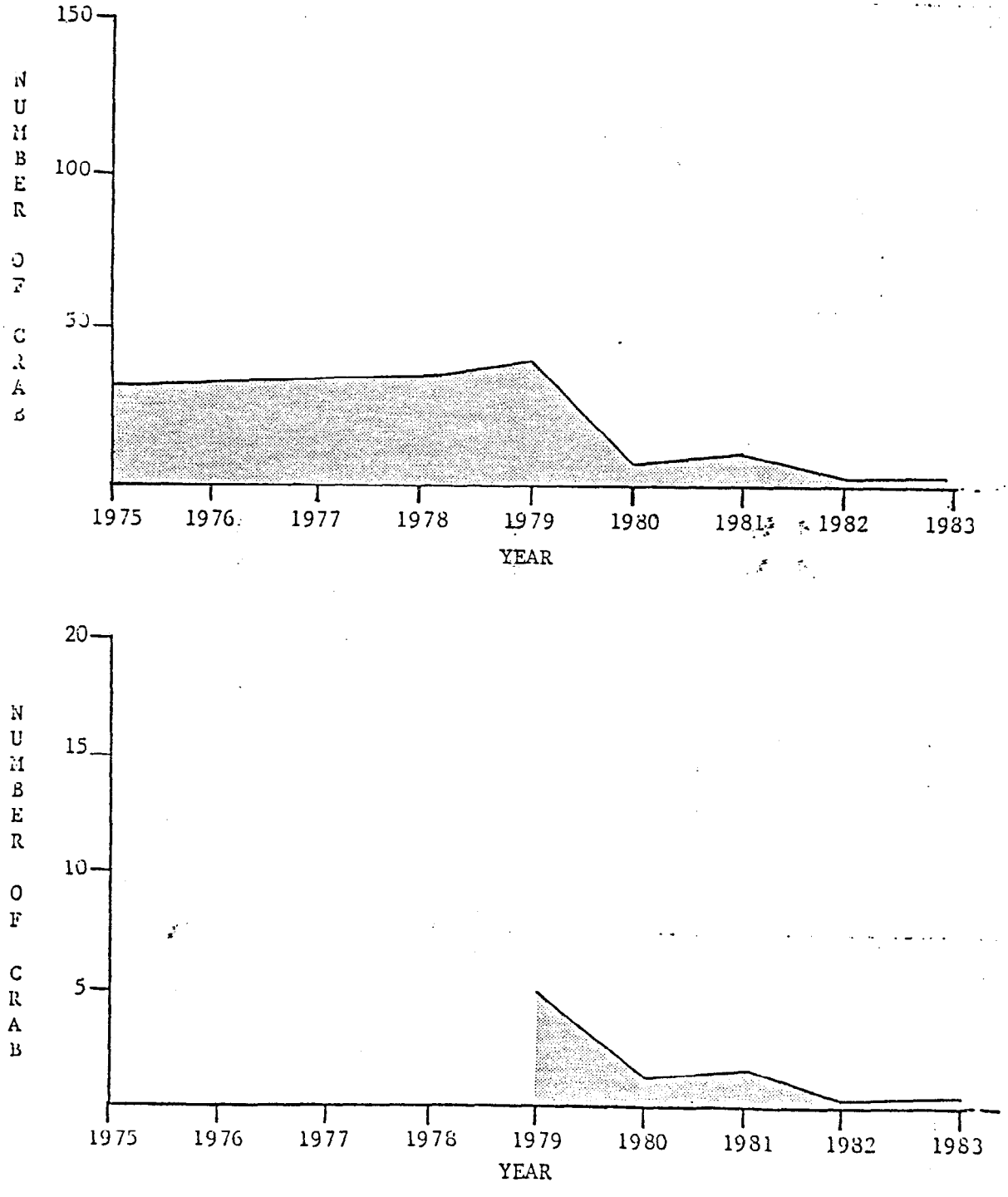

Figure 3. Average annual catch per household (top) and average daily catch per household (bottom) in Elim from 1975 to 1983. Total harvest reported by 41 households in 1983 was 13 crab.

and 6.1 in 1980 (Figure 3). The average daily catch per house in 1983 was 0.2 crab, compared to 0.04 in 1982, 1.3 in 1981, and 1.2 in 1980.

The ice went out earlier than usual in 1983, several villagers reported. Several families traveled to Golovin to catch crabs after crabbing near Elim (an overland trip of about 30 miles by snowmachine). During the commercial salmon fishing season, several people said they saw many small crabs near the Moses Point (15 miles east of Elim in Norton Bay). One woman said that was the first time she had seen so many crabs. That is the only encouraging sign. Crabbers seem discouraged about their lack of success, and implied the commercial fishery was responsible.

Golovin

Golovin data come from a house-to-house survey in May, 1983, done in conjunction with other research in that village. Only 11 households were contacted, compared with 21 in 1982 and 19 in 1981. Usually, surveys are conducted in the fall and winter, six months after the crabbing season. Because of the other work to be done in Golovin, this survey was conducted immediately after crabbing season. But because springtime is a busy time for hunting, fishing and travelling, it was more difficult to contact crabbers. The fall and winter surveys, even though they come well after crabbing time, seem to be more successful.

Golovin crab harvests continue to be depressed, after hopeful signs of an improvemnet in 1982. The 1983 harvest reported was 15 crab, compared with 164 in 1982, 4 in 1981, and 201 crab in 1980. Five of the eleven households contacted reported crabbing in 1983, compared with 14

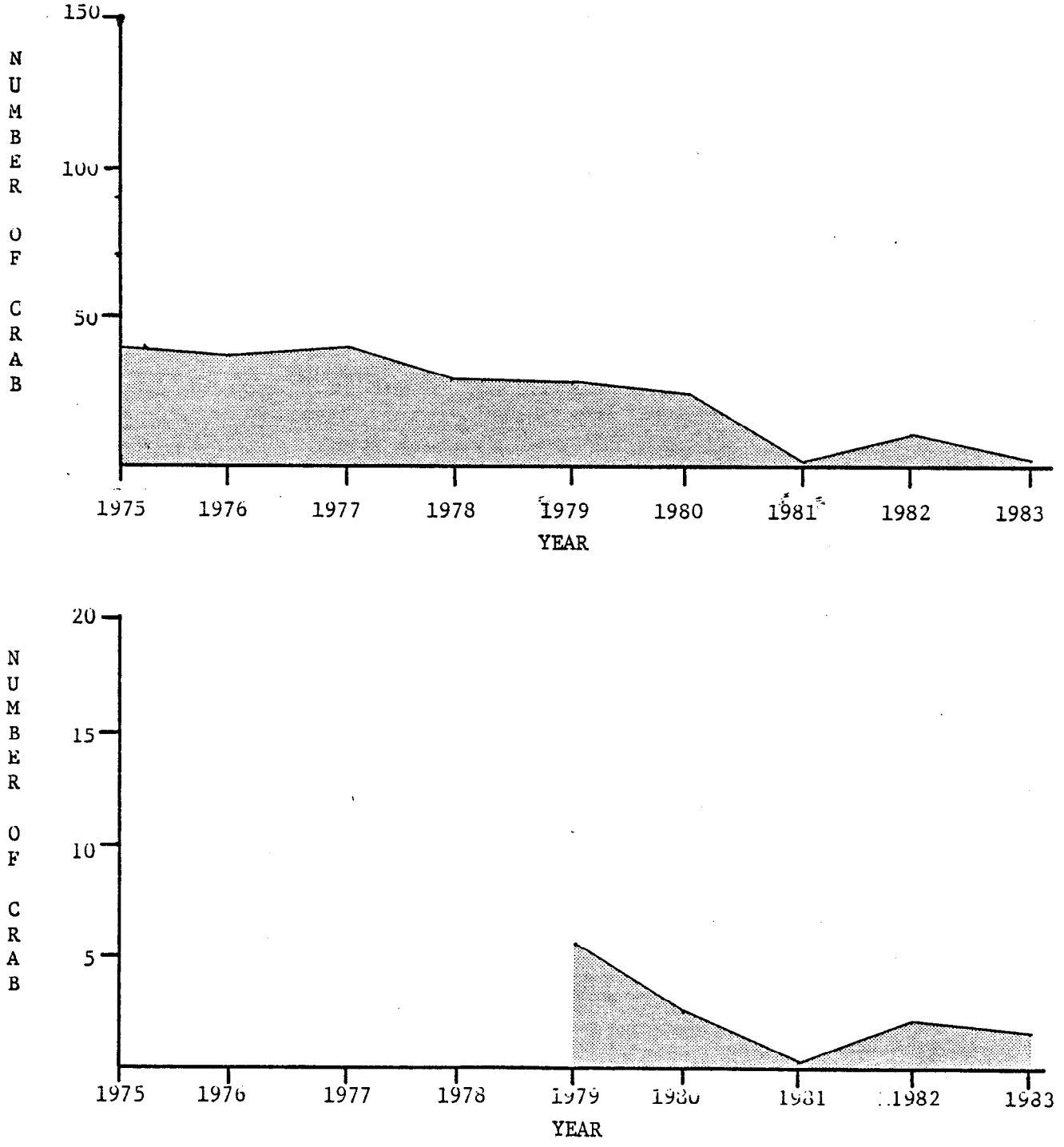

Figure 4. Average annual catch per household (top) and average daily catch per household (bottom) in Golovin from 1975 to 1983. Total harvest reported by 11 households in 1983 was 15 crab.

houses in 1982, 4 houses in 1981, and 8 in 1980. Crabbers reported 50 days spent crabbing in 1982, compared with 33 in 1982, 34 in 1981, and 55 in 1980. But 42 of those 50 days represent one pot crabber, and 8 represent handline crabbers.

The average annual catch per house and the average daily catch are both significantly lower in 1983 than in 1982, but not so low as in 1981. The average annual catch in 1983 was 3 crab per house, compared with 11.7 crab in 1982, 1 crab in 1981, and 25.1 crab in 1980 (Figure 4). The average daily catch was 0.3 crab in 1983, compared with 3.1 crab in 1982, 0.1 crab in 1981, and 3.7 crab in 1980. The average daily catch statistic is strongly influenced by the long soak time of the lone pot crabber (42 days, 6 crab). The handliners as a group caught an average of 1 crab per day in 1983.

Golovin crabbers crab west of Rocky Point, at Ipnatchuaq. Ice conditions there in 1983 were not as good as they were in 1982, and this was one reason for the lower effort. The crabber fishing with pots lost one pot in piled ice in February. He returned in April and fished two pots. He caught his six crab during April. The Golovin residents who did crab did not have much luck, and this probably discouraged other residents from crabbing during 1983.

Nome

Nome data come from subsistence crabbing permits issued by the Division of Commercial Fisheries in Nome between November 30, 1982 and May 24, 1983. The Division of Subsistence administered a survey of Nome

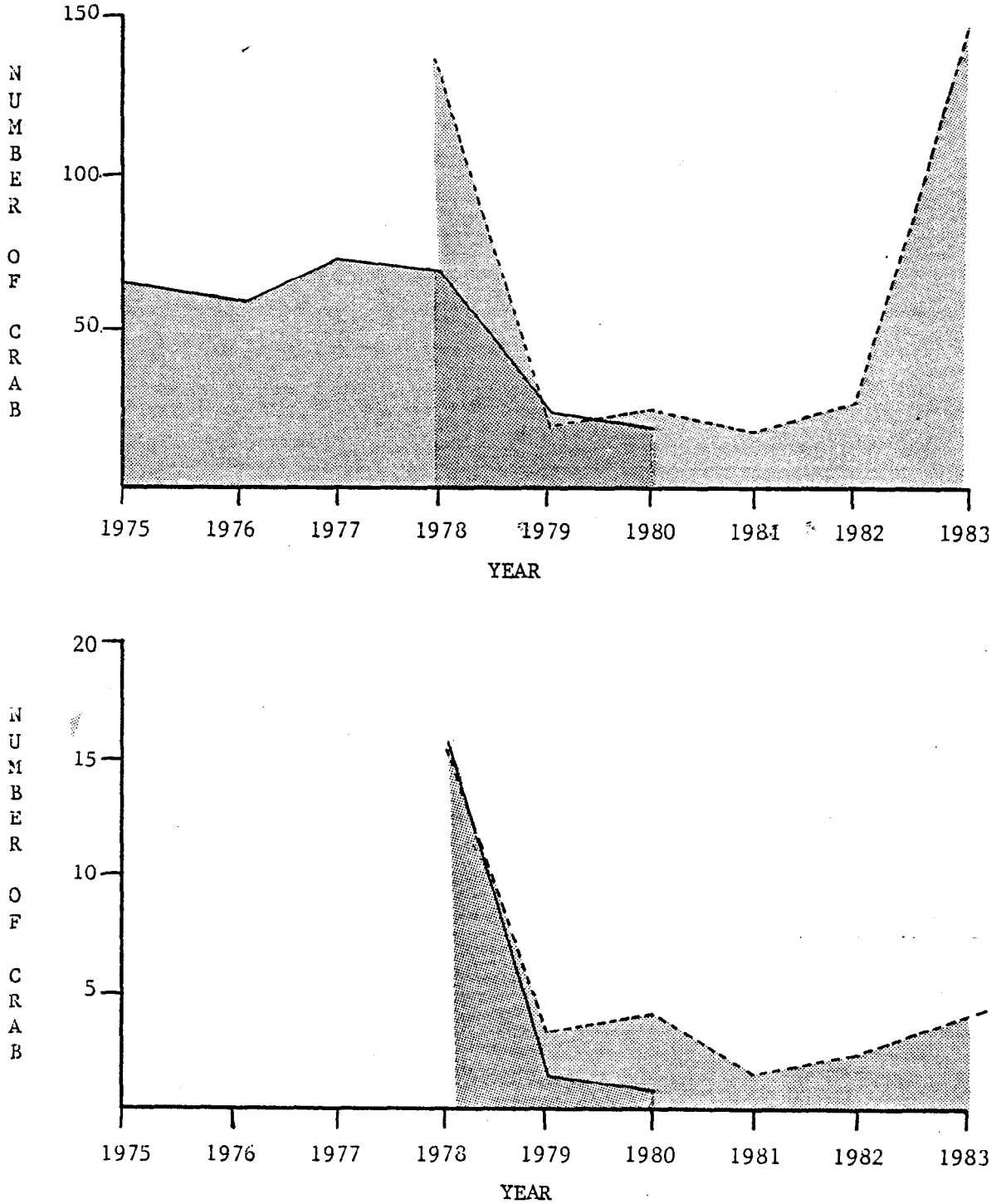

Figure 5. Average annual catch per permit (top) and average daily catch per permit (bottom) in Nome from 1975 to 1983. Solid lines represent data from Division of Subsistence survey. Dotted lines represent data from Division of Commercial Fisheries permits. Total harvest reported by 106 permit holders in 1983 was 9,968 crab.

boxholders in 1980. Data from both the 1980 survey and 1978-1983 permits are presented in Figure 2, for purposes of comparison.

Subsistence crab harvests increased substantially in 1983, following a modest increase in 1982. Permits show 9,968 crab were caught in 1983, compared with 1,288 in 1982, 371 in 1981, and 213 in 1980. One hundred seventy two permits were issued; 105 were returned and 80 permit holders reported crabbing. This is also an increase; in 1982 there were 51 crabbers, in 1981, 22, and in 1980, 9. (Not all crabbers obtain or return permits. More than nine people probably crabbed in 1980). Effort increased sharply; 2,229 days were spent crabbing in 1983, compared with 541 in 1982, 198 in 1981, and 50 in 1980.

The increase in effort and the increase in number of crabbers was more than outweighed by the abundant harvest. So the average annual catch per permit and the average daily catch per permit both increased. Average annual catch increased by a factor of five, to 126.6 crab/permit, compared to 25.3 in 1982, 16.9 in 1981 and 23.7 in 1980 (see Figure 5). This average is the highest annual average reported since permitting began in 1978. The average daily catch per permit also increased, but not so much. The average daily catch was 4.5 crab per day, compared with 2.4 crab in 1982, 1.8 crab in 1981, and 4.3 crab in 1980. In summary, crabbers harvested many more crab than any year since 1978, on the average, but they did so by increasing their effort substantially.

There is a perception among some Nome crabbers that "the crab are back." It is interesting that crab population estimates from NOAA and the Division of Commercial Fisheries are relatively low (Schwarz 1984).

Several factors may account for the high harvest even though abundance may be low. Environmental conditions during the winter of 1982-83 were excellent for crabbing. Sea ice formed on schedule, without excessive storm action. So it offered a smooth and stable surface from which to crab. Unlike 1982 and 1984, in 1983 the ice did not fracture and move out to sea. Pot and handline holes set in early winter remained accessible throughout the crabbing season.

Possibly more significant than weather and ice conditions, however, has been the transformation of the subsistence fishery from a handline fishery to a pot fishery. The early permits are ambigious about gear types. But recent permits and researchers' observations suggest that pots are the predominant gear today, while handlines were used almost exclusively five years ago. In 1983, almost half (38) of the crabbers used pots exclusively. One fourth (21) used both pots and handlines. Only one fourth (21) used handlines exclusively (see Figure 6). This is the first year when more than half the crabbers used pots.

One reason for the transformation may be the considerable success of the Commercial Fish biologists, who used pots in their study (see Schwarz 1983). Subsistence crabbers frequently asked department personnel about the study project. They took note of catches of 30, 40, or 50 crab per pot on two-and three-day soaks. At the same time, ice conditions cooperated with the fishers. So crabbers who tried pots for the first time in 1983 were able to keep pots fishing throughout the season. The extended soak time, more than any other factor, accounts for the high total harvest in 1983 and the high average annual catch per house.

It will be interesting to see if this trend continues. In February 1984, with perhaps 100 pots set through the sea ice near Nome, the ice

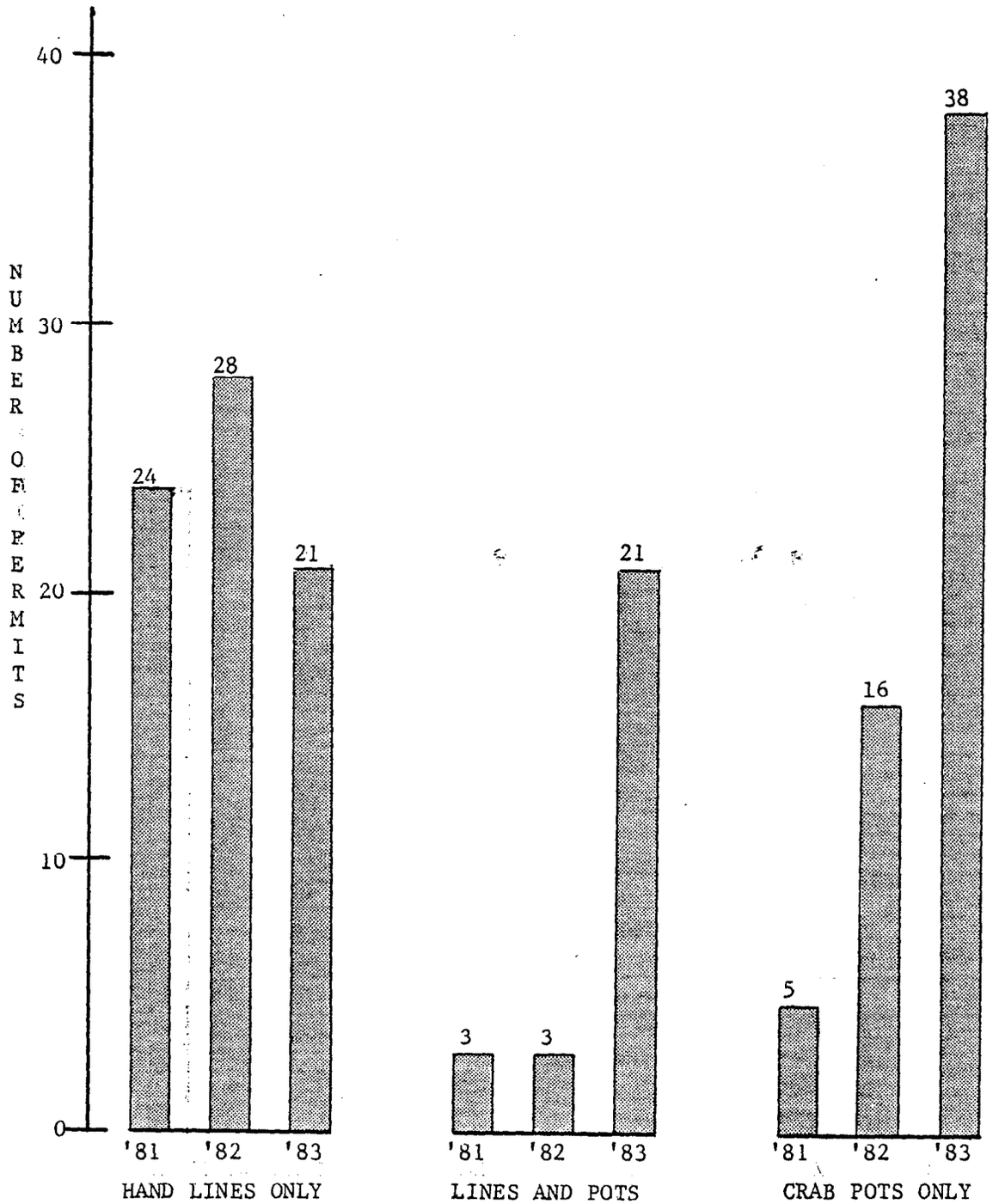

Figure 6. Gear selection among subsistence crabbers in Nome. Since 1981, Nome subsistence crab permit holders have increased their use of pots nearly eight-fold. Only five crabbers in 1981 used pots exclusively, while three used pots and hand lines in combination. In 1983, 38 crabbers used pots exclusively and 21 used pots and hand lines. Ice conditions in 1983, were especially conductive to pot crabbing (see text). Nome is the only village in the Norton Sound and Bering Strait area where crabbers are using pots so extensively.

fractured and moved offshore. Scores of pots were lost, including three Commercial Fisheries study pots. Three weeks later, after the ice had formed an apparently stable shelf again, biologists set three more research pots. Within 12 hours, these pots floated out to sea as well. Biologists set pots again; the ice took them too. The Division of Commercial Fisheries can afford to lose half a dozen pots a year. But will subsistence crabbers continue to build new crab pots and expend the extra effort to set them, knowing the ice may take them away any day? Permit data from the current year, 1984, should be interesting.

The transformation from handlines to pots and handlines, incidentally, has not occurred in any of the villages surveyed. Ice around Rocky Point, Cape Darby and St. Lawrence Island is much less stable than ice around Nome. The few who have tried pots in these locations in recent years have usually lost them, sometimes on the same day they were set.

White Mountain

White Mountain data come from a house-to-house survey conducted between November 8 and November 11, 1983. White Mountain residents had not been surveyed about crabbing harvests since Thomas' initial survey of 1980 harvests. Since White Mountain and Golovin crabbers usually crab in the same location, Golovin harvests were used as indicators of crabbing success for both villages. For this update, White Mountain was surveyed again. Residents were asked not only about 1983 harvests, but also about 1982 and 1981 harvests. Thirty one households were contacted.

White Mountain reported poor crabbing in 1983. The total village harvest was only three crab, compared with 23 crab in 1982, 15 in 1981, and 111 in 1980. Participation was average; five houses reported crabbing in 1983, compared with nine in 1982, six in 1981 and six in 1980. Effort decreased to 11 days in 1983, compared with 31 in 1982, 14 in 1981, and 27 in 1980. White Mountain residents -- like Golovin residents -- were more successful in 1982 than in 1983 or 1981.

The average annual catch per household in 1983 was 0.6 crab, compared with 2.6 in 1982, 2.5 in 1981, and 18.5 in 1980 (Figure 7). The average daily catch per household in 1983 was 0.3 crab compared with 0.7 crab in 1982, 1.1. crab in 1981, and 3.9 crab in 1980.

White Mountain crabbers travelled a considerable distance to crab, since they are located inland on the Fish River, about 15 miles from the ocean. Most crabbed near Rocky Point, but some ranged as far as Cape Darby and Cape Denbigh to the south (30 miles and 60 miles, respectively), and Topkok Head to the west (18 miles). Crabbers commented on the decreasing harvests; some blamed them on the commercial crab fishery, as have villagers elsewhere. Some villagers wanted the commercial fishery -- if there is to be one -- to be locally operated like the salmon fishery. "All they do is just take all our crabs and leave," said one. Other crabbers said changing tide conditions and the "cycle" crabs go through may also be factors in decreasing harvests. Whatever the reason, crabbing success is clearly poor. An elder who has been crabbing since the 1930s said, "We didn't have to stay out long (before), not like now. Now you have to stay out longer and catch few."

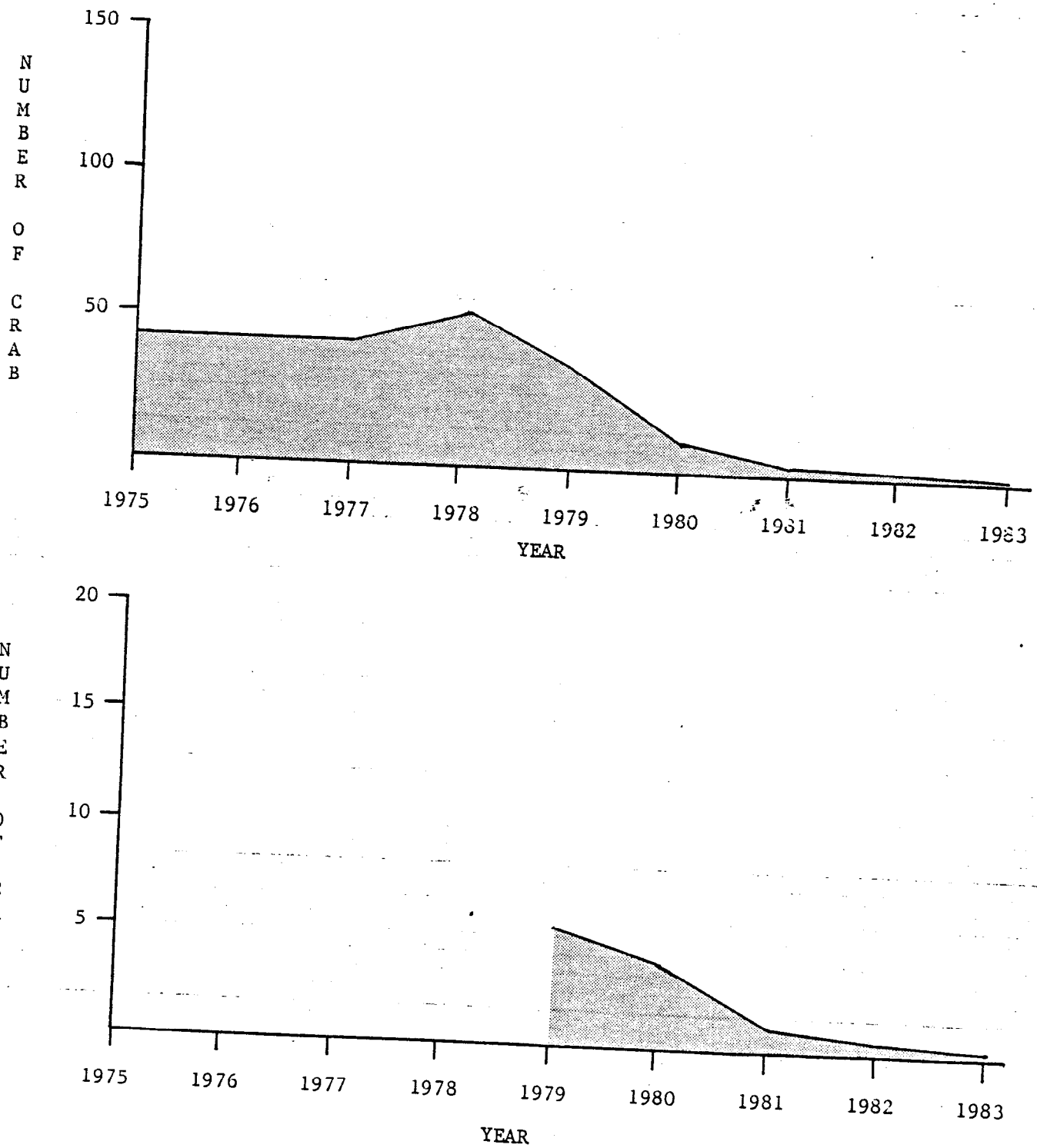

Figure 7. Average annual catch per household (top) and average daily catch per household (bottom) in White Mountain from 1975 to 1983. Total harvest reported by 31 households in 1983 was 3 crab.

GENERAL SECTION

Four villages in the Bering Strait area have traditionally crabbed (Figure 8). Thomas reported on crabbing at Savoonga, Gambell, and Little Diomede Island in 1981. King Island residents crab principally from Nome today. Savoonga data has been included in annual updates in 1982 and 1983. This year, Gambell crabbing data has been added. Little Diomede was scheduled for inclusion also, but poor ice conditions made the village inaccessible during the survey period.

Gambell

Gambell was surveyed by Thomas for his 1981 report, but was not surveyed for the 1982 and 1983 updates. Instead, Savoonga data were used as indicators of crabbing success on St. Lawrence Island. For this update, Gambell residents were surveyed between October 25 and October 29, 1983. They were asked not only about crabbing effort and harvest in 1983, but also about 1982 and 1981.

Compared with residents of other villages, Gambell residents had difficulty recalling how many days they crabbed in 1982 and 1981. Only three houses were unable to remember how many days they crabbed in 1983, but ten houses were unable to recall effort in 1982 and fifteen were unable to recall effort in 1981. By comparison, in White Mountain only one house was unable to remember effort in the same three-year period. Gambell residents did remember, however, the number of crab caught. All houses could recall 1983 catches and all but four could recall 1982 catches. But fourteen houses could not recall 1981 catches. Therefore,

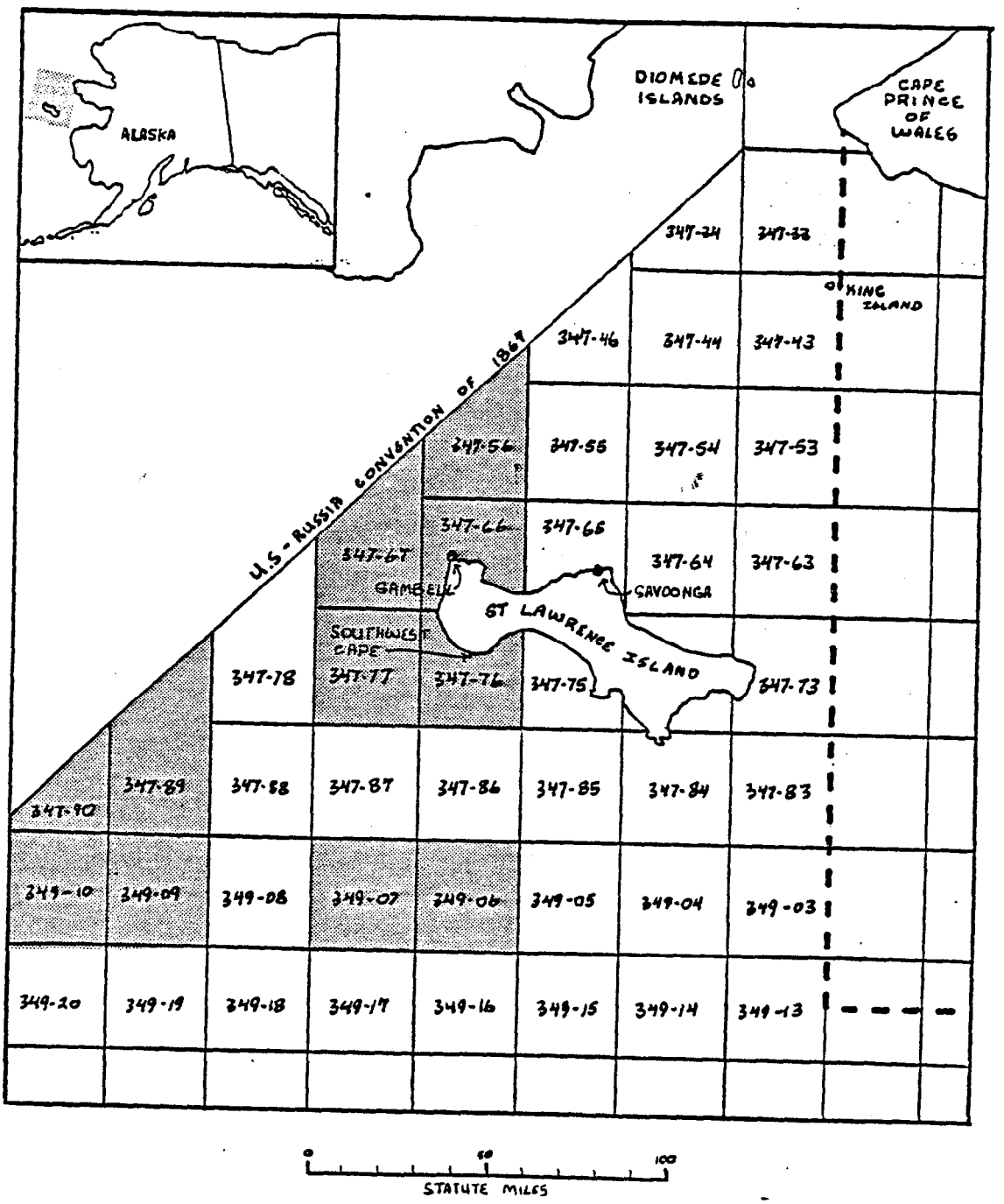

Figure 8. A portion of the General Section of the Northern District of Statistical Area Q (Bering Sea). Shaded statistical areas indicate the locations of the summer 1983 commercial king crab harvest.

the 1981 data should be considered only minimally reliable, based on only three of eighteen crabbing houses. The 1982 and 1983 data are more complete. In Appendix 2 are detailed extrapolations used to compute total effort and harvest levels for 1981 and 1982. These methods were used in the previous updates, but were never applied to so many cases within one village.

Gambell residents reported catching more than 448 crab in 1983, compared with more than 387 crab in 1982, more than 542 in 1981, and more than 687 in 1980. About the same number of houses crabbed during those years, ranging from 15 to 18 houses within the sample of 30.

The number of days spent crabbing declined considerably from 1980. Thomas reported 337 days crabbing in 1980. In 1983, Gambell residents reported 103 days crabbing. Data for 1982 (50 days) and 1981 (42 days) is probably not reliable, for the reason explained above.

The average catch per house in Gambell in 1983 was 29.33 crab compared with 9.2 crab in 1982, 29.5 in 1981, and 38.2 crab in 1980 (Figure 9). The 1982 figure of 9.2 crab is probably low, because several houses with large catches couldn't remember their effort and were not included when statistical averages were computed. If the average catch is calculated from the extrapolated figures for 1982, the result is 24.9 crab per house. The average catch per day per house in 1983 was 4.22 crab, compared with 2.87 in 1982, 12.64 in 1981, 2.0 in 1980 and 2.7 in 1979. Again, the 1982 and 1981 numbers are suspect because of the low number of houses used to calculate these averages.

As in other villages, the range of harvests reported by Gambell crabbers in 1983 was great, from 0 crab to 150 crab. Three houses account for 260 of the 448 crab reported by the sample. As Thomas

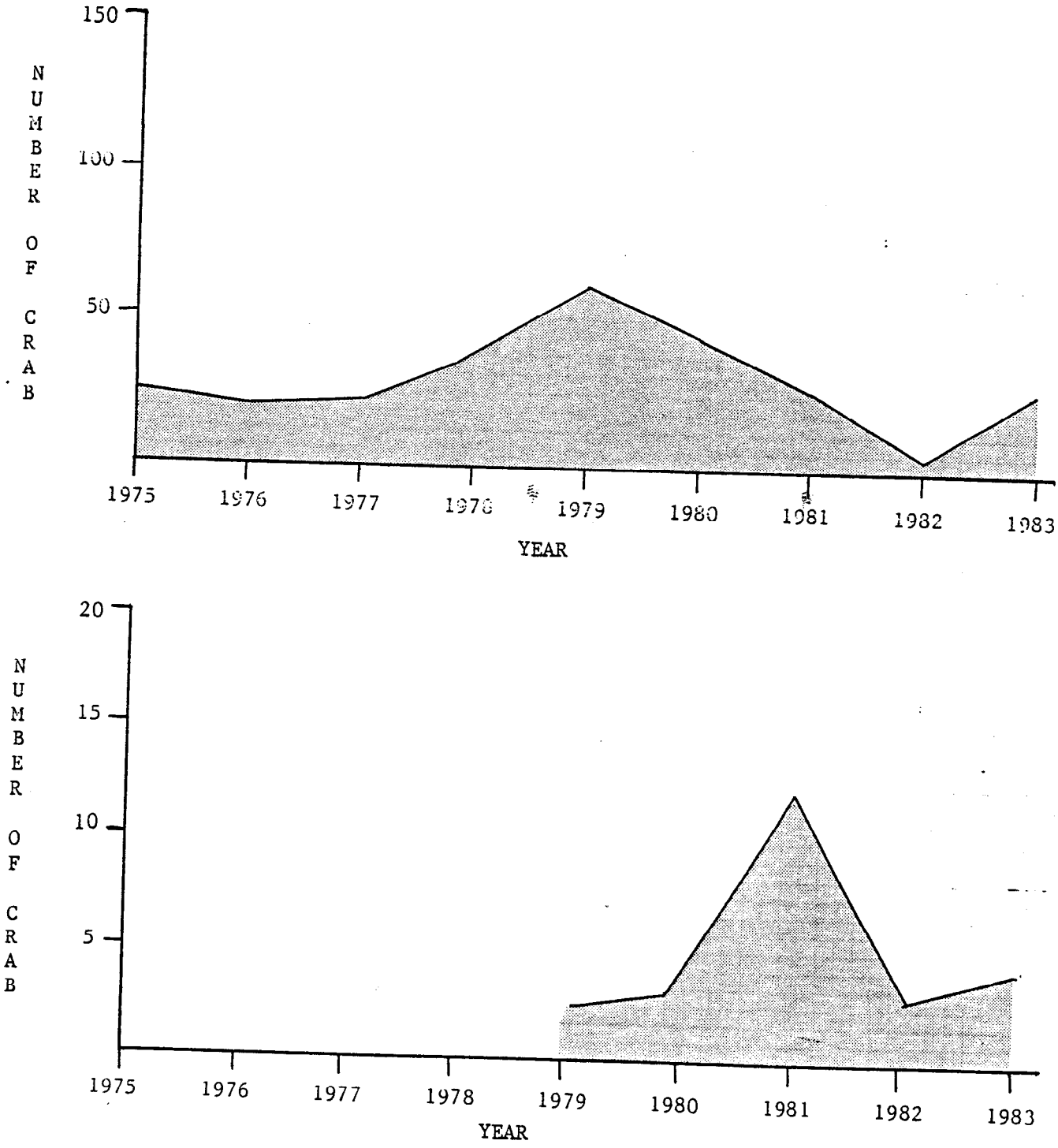

Figure 9. Average annual catch per household (top) and average daily catch per household (bottom) in Gambell from 1975 to 1983. Total harvest reported by 25 households in 1983 was more than 448 crab.

documented and informants confirmed during the 1983 survey, these prolific crabbers usually distribute their catch to others in the village and beyond. One crabber in Gambell reported catching 36 crab in one day in 1983, which was as many as 15 other households reported for the entire year. He is, not surprisingly, known in Gambell as an excellent crabber. He characterized 1983 crabbing as "real good." He limits himself, he said, "It's lots of fun to crab, but we don't want to get too much. Just have to give them away. This year, I limit it. When I get 30 or so, I stay here (at home) and carve." He usually crabs with a handline, but has crabbed with a frame, baited, on which the crab crawl, and are hauled up through the ice. He reports that crabs in 1983 were big, and the females had full clutches of eggs.

His information was confirmed by other crabbers, saying that females almost always had full egg clutches. One other crabber agreed with him that 1983 was the best of the three years just past. Other houses reported catches slightly higher or about the same in 1983 as in previous years, except for house No. 17, which reported catching 80 crab in 1981, compared to 25 and 16 in 1982 and 1983.

Thomas reported in 1981 that four houses had crabbed at Southwest Cape, in addition to crabbing near the village of Gambell. No houses contacted in 1983 reported crabbing at Southwest Cape in the previous three years. One house did report crabbing -- in the summer -- at Dovelawik Bay (south and east of Gambell about 5 miles). The informant's son caught 10 crab by hooking them with a long pole in shallow water. The next day, his son returned with a wet suit and caught six more. He could have taken more, but he had no gloves and the sharp points on the shell were cutting his hands. This informant has

seen three or four grasping male-female pairs in Dovelawik Bay. Grasping pairs were reported by another house in shallow water near Southwest Cape, in the 1950s. There were hundreds and hundreds of crab, so many they could have "filled a skin boat full." (A skin boat is about 30 feet long by eight feet wide).

This same individual reported catching crab in 1981 in a 150' x 12' salmon gill net set one mile from shore, in 50-60 feet of water. He caught no salmon, as he had expected, but a number (he couldn't remember how many) of crab got tangled in the net. They were near the top of the net, tangled by the float line. He said that crab float in the water, near the surface, and move with the current, after they molt.

Several houses reported gathering live crab from the beach in the summer and fall, either when they come close to shore to mate or when a storm blows them ashore. One man reported taking crab this way in the summer of 1983 at Dovelawik Bay. Several houses reported taking large numbers of crab (about 200) after a storm in 1982. These were mostly female, mostly smaller crab. This inflates the catch statistics for 1982. It was considered an unusual, but not rare, situation.

The 1983 survey was conducted about one month after the commercial crab season closed around the Island. Gambell people had signed a petition calling for an end to commercial crabbing, and complained to their elected representatives and to the governors' office about crabbing. They were, however, quite cooperative during the survey, and appreciated information researchers were able to provide about the effort, location of harvest, and amount of harvest by the commercial fleet around the Island. Although most people were concerned that the commercial crabbers would deplete the crab population, criticism of the

fleet centered more on its disruption of seal hunting than on its depletion of the crab population. Virtually every hunter contacted for information about crabbing complained that the seal hunt this fall had been singularly unproductive. Houses that typically take 20-30 seals during September and October had taken only 2 or 3 seals this fall. Many felt that the intense light and constant noise of the commercial fleet was a factor in their low success. It was "enough to light up the whole Bering Sea," said one. "I hardly see any seals," said another. "Every time I go to hunt seals, I'd hear those motors."

Not only did the commercial fleet scare seals, local people said, but it frightened the people themselves. The fleet arrived two months after the Greenpeace "invasion" of Siberia and a few weeks after the Korean airliner incident. "We got a scare one night," said one crabber. "Three lights were coming in from the West. That was right after that airliner. We thought the Russians were coming." This individual and several others complained that they were given no notice that the crab fleet was coming. They chastised the state for its insensitivity to their situation on the international border in these troubled times.

Savoonga

Savoonga data come from a survey conducted between October 10 and October 14, 1983. Twenty-four households were contacted. Data for Savoonga is presented in two parts: "north side" and "Southwest Cape." Savoonga crabbers crab on the north side of St. Lawrence Islands (usually near Kookoolik) in January, February and March. Then crabbers move to the south side of the Island and set up whaling camp at

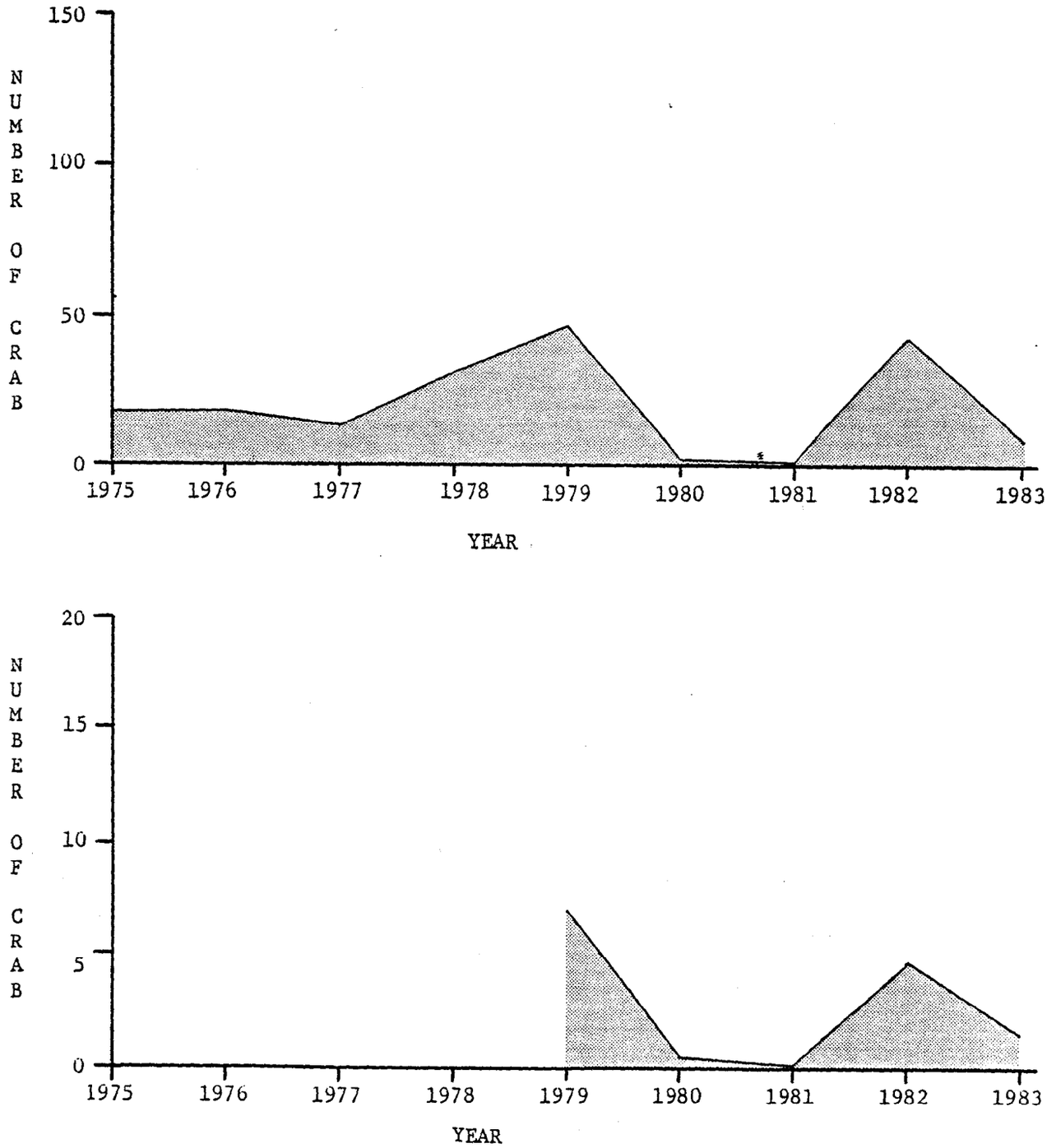

Figure 10. Average annual catch per household (top) and average daily catch per household (bottom) on the north side of St. Lawrence Island by Savoonga crabbers from 1975 to 1983. Only three households reported crabbing on the north side in 1983 due to poor ice conditions. Total harvest was 23 crab.

Southwest Cape. They crab through the ice there, while waiting for the bowheads. Because crabbing harvests and environmental conditions often are quite different at the two locations, the data are considered seperately below.

Ice conditions on the north side of the St. Lawrence Island hampered crabbing in 1983. Crabbers reported harvesting 23 crab there in 1983, compared with 823 crab in 1982, one crab in 1981, and 16 crab in 1980. Only three houses reported crabbing on the northside, compared with 21 houses in 1982, 7 in 1981 and 10 in 1980. Effort in 1983 totaled 32 days, compared with 179 days in 1982, 24 days in 1981, and 62 days in 1980.

The average harvests on the north side have varied widely over the past five years, from a high of 55.6 crab per house per year (in 1979) to 0.14 crab per house per year (in 1981). In 1983, the average annual catch per house was 7.7 crab, compared to 41.2 in 1982, and 1.6 crab in 1980 (Figure 10). The average catch per day in 1983 was 1.4 crab, compared with 4.6 crab in 1982, 0.04 crab in 1981, and 0.3 crab in 1980.

To compensate for their poor success in 1983, crabbers tried different areas along the northside of the Island. One man tried crabbing with a baleen device, instead of the usual crab line. His gear consisted of four cross baleen strips with notches on the end, and a sinker in the middle. He had no luck.

Crabbers were more successful at Southwest Cape than on the north side in 1983. They reported harvesting 96 crab there in 1983, compared with 2 in 1982, 298 in 1981, and more than 332 in 1980. Five houses reported crabbing, compared with 2 in 1982, 13 in 1981, and 11 in 1980.

Effort in 1983 totaled 47 days, compared with 2 in 1982, 40 in 1981, and 47 in 1980.

The average annual catch per house in 1983 was 19.2 crab, compared with 1.0 crab in 1982, 22.9 in 1981, and more than 30.2 crab in 1980 (Figure 11). The average daily catch per house at Southwest Cape in 1983 was 2.0 crab, compared with 1.0 in 1982, 7.5 in 1981, and more than 7.1 crab in 1980.

Savoonga crabbers -- like Gambell crabbers -- were concerned about the continued commercial activity around the Island. Commercial effort in 1983 was concentrated at the western end of the Island, and thus impacted Gambell's subsistence activities more directly than Savoonga's. But commercial crabbers did set pots near Southwest Cape; that may have some effect on future crabbing success there.

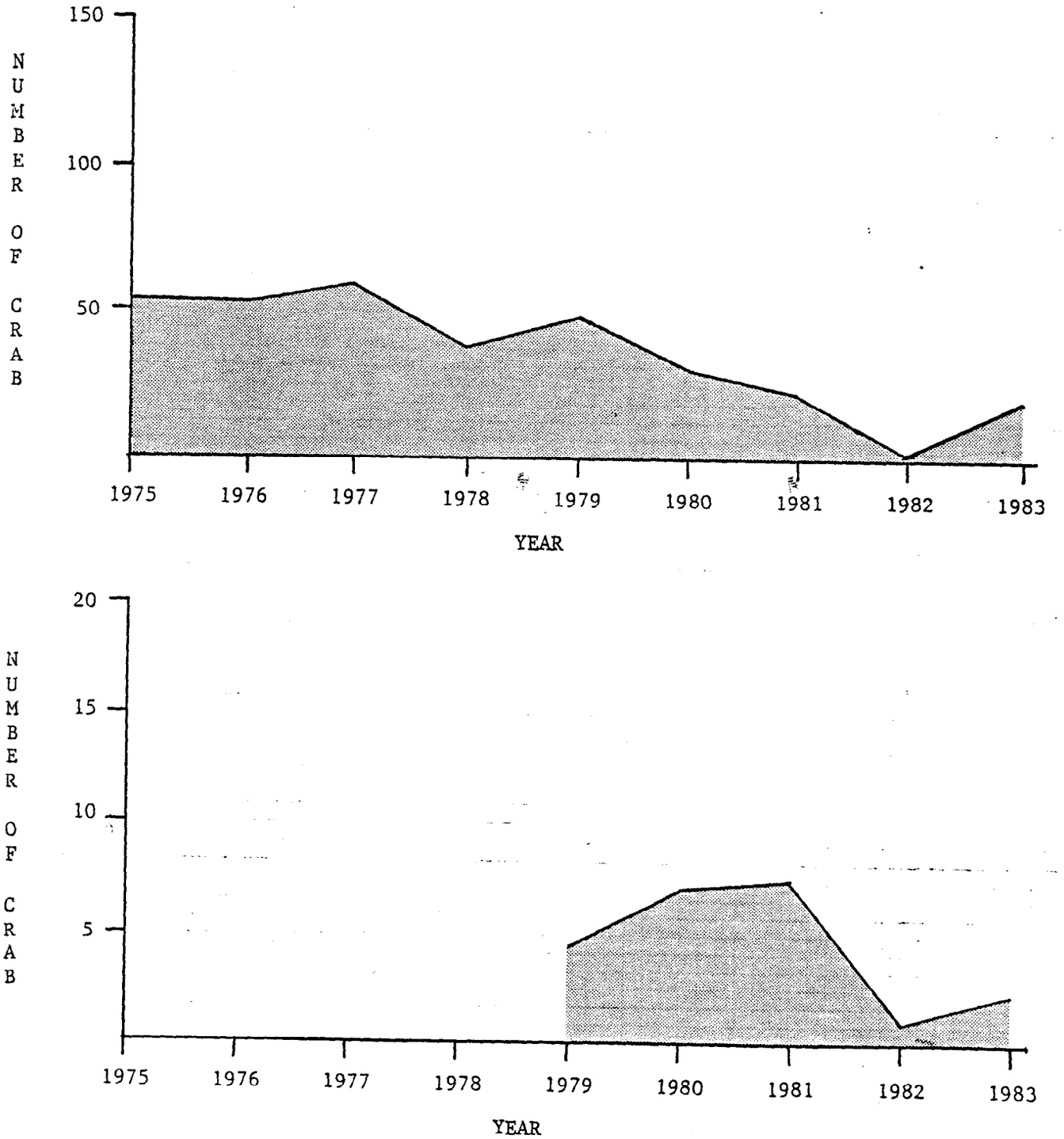

Figure 11. Average annual catch per household (top) and average daily catch per household (bottom) at Southwest Cape on St. Lawrence Island by Savoonga crabbers from 1975 through 1983. Total harvest reported by 5 households in 1983 was 96 crab.

CHAPTER THREE

SUMMARY AND CONCLUSIONS

Crabbers in Nome apparently are enjoying a resurgance of crabbing after four poor years. The 1983 harvest of nearly 10,000 crab was exceeded only by the 1978 harvest of 12,506 crab. Perhaps because of crabbing successes, there are no proposals from the local public or local advisory committee to change commercial crabbing regulations for the Norton Sound Section. Some local people feel that the Board's near-shore closure and the reduced commercial quotas are protecting subsistence crabbing.

It is a puzzle, however, why subsistence harvests are so high when the crab population estimates are still relatively low. There are two possible explanations. First, the effort and participation in the fishery have increased significantly. The number of permits issued has approximately doubled each year since 1980. The effort has nearly tripled each year, from 50 days in 1980 to 2,229 days in 1983. So more people are crabbing (or at least more people are reporting their crabbing) and they are crabbing longer. The second possible explanation is the transformation of the fishery from predominantly handlines to predominantly pots. In 1983, handline crabbers accounted for only 12 per cent of the harvest; pot crabbers took the rest. More crabbers are using more efficient gear, driving harvest totals upward.

The average daily catch per permit is probably a more accurate guide to crabbing conditions than the total harvest. This statistic accounts for changes in participation and effort, if not for changes in gear. This daily average has risen more slowly the past three years,

from 1.8 crab per day in 1981, to 2.4 crab per day in 1982, to 4.5 crab per day in 1983. This gradual increase in daily catches more closely follows the gradual increase in the estimated total population.

It is important to note that the villages other than Nome in the Norton Sound Section have not experienced improved crabbing success. Elim, Golovin, and White Mountain crabbers all report continued depressed harvests. Some crabbers have been ranging considerable distances in an attempt to locate crab, but with little success. It appeared in 1982 that crabbing at Golovin was improving, but 1983 catches were poor. Elim has not had a productive year since 1979, and crabbers are worried. Reports of small crab east of the village are encouraging, but it will be several years before those crab are harvestable, assuming they survive in the area. Attempts by individual crabbers in these villages to use pots -- as the Nome crabbers are doing -- have been notably unsuccessful.

In the General Section of the Northern District, around St. Lawrence Island, subsistence crabbing success has been somewhat random. Ice conditions limited crabbing on the north side near Savoonga in 1983. A boating accident limited crabbing at Southwest Cape in 1982. Currently, crabbing at Savoonga seems to be somewhat depressed from pre-1981 levels, but not as depressed as in 1981. Gambell data is sketchy for 1981 and 1982; 1983 crabbing seems to compare favorably with levels and in 1979 and 1980.

Although St. Lawrence Island crabbers were concerned about impact of commercial crabbing on crab populations, they were at least equally concerned about the fleet's impact on other subsistence activities. This was especially true in Gambell, where seal hunters found the

presence of the fleet during the September seal hunt disruptive. The proposal submitted by the St. Lawrence Island Advisory Committee this year is intended -- in part -- to keep the commercial crab fleet far enough offshore that seal hunting is undisturbed.

Several Gambell crabbers were also concerned about the conduct of the state in managing the commercial fishery. They appreciated a visit from the Wolstad in August, but they did not appreciate having the fleet descend on them unannounced several weeks later. Gambell crabbers observed that no biologists have been studying their crab. They wondered how the state could be managing adequately. They asked questions about the local crab population and reproduction; researchers admitted they did not really know. Some crabbers indicated they would welcome biological studies at St. Lawrence Island to learn about crab populations and reproduction. In the meantime, they remain concerned.

APPENDIX 1

PROTOCOL FOR VILLAGE CRAB SURVEY

The following protocol of questions was used in conducting the village crab surveys for the 1983 season. The questions were preceeded by a general introduction of the researcher and the project.

1. "Did you go crabbing last winter?

   (IF "NO", GO TO QUESTION 13)

2. "Where did you crab?
3. "What kind of gear did you use?

(ASK HANDLINE USERS)

4. "What months did you crab with handlines?
5. "How many trips did you make in (month 1, month 2, etc.)?
6. "How many crab did you catch in (month 1, month 2, etc.)?
7. "How many hours did you usually stay out when you crabbed?

(ASK POT USERS)

8. "What months did you set your pots?
9. "How many days were your pots set in (month 1, month 2, etc.)?
10. "How many crab did your pots catch in (month 1, month 2, etc.)?

(ASK ALL CRABBERS)

11. "Were your crab larger, smaller or about the same as before?
12. "Did you catch any females? Many eggs?

(ASK ALL RESPONDENTS)

13. "Do you have any comments about crabbing in general?"

APPENDIX 2

1983 SUBSISTENCE HARVESTS -- RAW DATA

Elim

Elim data come from a house-to-house survey administered by Olanna between September 5 and September 9, 1983. Thomas contacted 23 houses in 1980, 24 were contacted in 1981, 29 were contacted in 1982, and 41 were contacted in 1983. Of the 41 houses contacted, 15 reported crabbing.

HOUSE	HL DAYS	HL CRAB	HOURS/DAY	POT DAYS	POT CRAB	#POT
01 did not crab						
02 did not crab						
03 did not crab						
04 did not crab						
05 not available						
06 did not crab						
07 did not crab						
08	1	0	6			
09 did not crab						
10 did not crab						
11 did not crab						
12 did not crab						
13 did not crab						
14 not available						
15 did not crab						
16 did not crab						
17 not available						
18 did not crab						
19 not available						
20	3	0	3			
21	3-4	0	3-4			

22				1	0	1
23	not available					
24				14	0	
25	3-4	0	5-6	16	0	2
26	2	0	36			
27	not available					
28	did not crab					
29	4	0	20	4	0	5
30	did not crab					
31	1	0	6			
32	not available					
33	did not crab					
34	did not crab					
35	2	2-3	4-5			
36	2-3	1-2	12	1	1-2	1
37	did not crab					
38	1	0	6			
39	did not crab					
40	1	0	5-7			
41	did not crab					
42	did not crab					
43	did not crab					
44	1	4	1			
45	did not crab					
46	did not crab					
47	3	2	24			
TOTALS	27	11		36	2	

Golovin

Golovin data come from a survey administered by Magdanz in May, 1983, concurrent with other research in Golovin. Thomas contacted 23 households in 1980; 11 households were contacted in 1983. Six of the original contacts have died or have moved from Golovin; others were out of town or otherwise unavailable. Of the 11 households, five reported crabbing.

HOUSE	HL DAYS	HL CRAB	POT DAYS	POT CRAB	# OF POTS
01	1	0			
02	3	9			
03 Did not crab					
04 Did not crab					
05 Did not crab					
06 Did not crab					
07 Not available					
08 Not available					
09 Not available					
10 Not available					
11 Not available					
12 Not available					
13 Did not crab					
14	"Several"	1-2			
15 Not available					
16 Did not crab					
17 Not available					
18 Not available					
19 Not available					
20 Did not crab					
21	?	1			
22 Not available					
23	4	5			
24 Not available					
25 Not available					

TOTALS	8	14-15	42	6

House 14 reported crabbing "several" days and was assigned a value of 3 days (see methodology). House 21 could not remember how many days were spent crabbing, and was assigned the average effort for Golovin households, 3 days.

Nome

Nome data come from permits issued by the Division of Commercial Fisheries between November 30, 1982 and May 24, 1983. Permits included a day-by-day calendar on which crabbers listed the number of crab caught, the hours fished, and the number of pots or handlines used. Permits were to be returned at the end of the crabbing season. One hundred seventy two permits were issued; 106 were returned. Of those 106, 80 permit holders reported crabbing. In the table below, missing permit numbers were not returned or not issued (thus the highest permit number is 203, although only 172 permits were actually issued).

	HANDLINES			POTS		
PERMIT #	Days	Crab	Hours/Day	Days	Crab	# Pots
1	19	124	4	54	328	1
2	9	25	6			
4				10	84	2
6 did not crab						
7 did not crab						
8	1	40	10	10	246	2
9 did not crab						
10	9	161	4			
11				?	3-4	?
14	2	11	2			
15 did not crab						
19	5	13	7			
20	2	3	5	9	126	1
21	1		?	72	138	1
22 did not crab						
23	2		3	74	229	1-2
24	7	39	?	46	269	1
25	7	42	4	?	33	1

HANDLINES				POTS		
PERMIT #	Days	Crab	Hours/Day	Day	Crab	# Pots
26	1	1	3	3	1	1
28				29	60	1
30	2	12	4	32	82	1-2
31	1	5	5	26	75	1
32				59	248	1-2
33	3	26	2	6	26	1
36	1	2	1.5	97	153	1
38				18	56	1
39	5	31	?			
41				63	532	1
43				89	763	1-3
44	1	2	3	73	156	1
45 did not crab						
48				?	45	?
49	2	8	9			
50				71	372	2-4
51				2	2	1
52 did not crab						
53				9	59	2
54				67	372	1-2
56	?	25	?			
57				4	8	1
58	8	12	8	66	127	1
61	2	8	9			
62				54	97	1
63				21	18	1
64	3	9	13	48	113	1
65				80	90	2-3
66				2	6	1
68 did not crab						

	HANDLINES			POTS		
PERMIT #	Days	Crab	Hours/Day	Days	Crab	# Pots
69						
72	4	8	2	23	26	1
73				1	6	1
75 did not crab				?	1	2
81 did not crab						
82						
84 did not crab				6	25	1
85	2	4	?			
87	1	1	1			
89	3	35	9.5 hrs.			
90 did not crab						
93	5	88	4			
97	8	55	4	62	157	2
99	13	63	5			
100						
101	?	30	?	1	10	1
103	6	27	6			
106	4	30	7			
114				47	54	1
115	3	27	17	9	23	1
117	3	18	12	1	3	1
118						
119				46	94	1
120 did not crab				10	20	1
121	1	2	3	42	65	
122 did not crab						
124 did not crab						
128 did not crab						

	HANDLINES			POTS		
Permit #	Days	Crab	Hours/Day	Days	Crab	# Pots
129				60	102	1
130	7	5	?			
134				82	522	2
136 did not crab						
137				28	133	1-2
139 did not crab						
140				71	66	1
142				12	31	1
143	1	1	8			
145	12	122	6	2		1
147 did not crab						
154 did not crab						
155	13	52	6			
156	1		1			
157				66	784	2
164				62	407	1-2
165				69	400	2-4
167 did not crab						
168	1	3	3			
170 did not crab						
171				28	49	1
172 did not crab						
174				21	163	1-2
179				?	549	2
183				43	12	1
185				35	100	2
203				27	77	1
TOTAL	181	1170 CRAB		2048	8798 CRAB	

White Mountain

White Mountain data come from a house-to-house survey conducted by Olanna between November 8 and November 11, 1983. Thomas contacted 18 houses in 1980; 31 houses were contacted in 1983. White Mountain had not been surveyed in 1981 and 1982, so the 1983 survey asked about harvests in previous years.

1983

HOUSE	DAYS	CRAB	HOURS/DAY
01 Did not crab			
02 Did not crab			
03	2	0	4
04 Not available			
05 Did not crab			
06 Did not crab			
07 Did not crab			
08 Did not crab			
09 Did not crab			
10 Did not crab			
11 Did not crab			
12 Not available			
13 Not available			
14	3	0	3
15 Not available			
16 Not available			
17 Did not crab			
18 Not available			
19	2	0	8
20 Did not crab			
21 Not available			
22 Did not crab			
23 Did not crab			
24 Did not crab			
25 Did not crab			

HOUSE	DAYS	CRAB	HOURS/DAY
26 Did not crab			
27 Did not crab			
28 Did not crab			
29 Did not crab			
30 Did not crab			
31 Did not crab			
32 Did not crab			
33	1	3	4
34	3	0	3-4
35 Did not crab			
36 Did not crab			
37 Not available			
38 Not available			
39 Not available			
40 Did not crab			
41 Did not crab			
42 Not available			
43 Not available			
44 Not available			
	11 DAYS	3 CRAB	

1982

HOUSE	DAYS	CRAB	HOURS/DAY
01 Did not crab			
02	1	0	8
03	6	4	6
04 Not available			
05 Did not crab			

HOUSE	DAYS	CRAB	HOURS/DAY
06	Did not crab		
07	1	6	6
08	Did not crab		
09	Did not crab		
10	7	0	3
11	4	0	8
12	Not available		
13	Not available		
14	Did not crab		
15	Not available		
16	Not available		
17	Did not crab		
18	Not available		
19	4-5	2	8
20	Did not crab		
21	Not available		
22	Did not crab		
23	Did not crab		
24	Did not crab		
25	Did not crab		
26	2	0	8
27	Did not crab		
28	Did not crab		
29	Did not crab		
30	Did not crab		
31	Did not crab		
32	Did not crab		
33	3	7-10	4-5
34	2	2	?
35	Did not crab		
36	Did not crab		
37	Not available		

38 Not available

39 Not available

40 Did not crab

41 Did not crab

42 Not available

43 Not available

44 Not available

30-31 DAYS 21-23 CRAB

1981

HOUSE	DAYS	CRAB	HOURS/DAY
01 Did not crab			
02	1	0	8
03	4	10	8
04 Not available			
05 Did not crab			
06 Did not crab			
07 Did not crab			
08 Did not crab			
09 Did not crab			
10	4-5	4-5	3
11	2	0	8
12 Not available			
13 Not available			
14 Did not crab			
15 Not available			
16 Not available			
17 Did not crab			
18 Not available			
19 Did not crab			
20 Did not crab			

HOUSE	DAYS	CRAB	HOURS/DAY
21 Not available			
22 Did not crab			
23 Did not crab			
24 Did not crab			
25 Did not crab			
26 Did not crab			
27	1	0	1/2
28 Did not crab			
29 Did not crab			
30 Did not crab			
31	1	0	4
32 Did not crab			
33 Did not crab			
34 Did not crab			
35 Did not crab			
36 Did not crab			
37 Not available			
38 Not available			
39 Not available			
40 Did not crab			
41 Did not crab			
42 Not available			
43 Not available			
44 Not available			
TOTAL	13-14 DAYS	14-15 CRAB	

Gambell

Gambell data come from a house-to-house survey conducted by Magdanz between October 25 and October 29, 1983. Thomas contacted 30 houses in 1980; 25 houses were contacted in 1983. Gambell had not been surveyed in 1981 and 1982, so the 1983 survey asked about harvests in previous years. Six houses that Thomas contacted in 1980 were not identified in his notes (apparently due to problems with translation), and could not be contacted again. Those houses are labeled "unidentified" in the tables that follow. An attempt was made to contact six additional houses to replace the unidentified houses; because of time constraints only three additional houses were contacted.

1983

HOUSE	DAYS	CRAB	HRS/DAYS
01 did not crab			
02 did not crab			
03 did not crab			
04	15	150	
05	1	0	
06 did not crab			
07 unidentified			
08	30	60	
09	4-5	15	
10 did not crab			
11 unidentified			
12 unidentified			
13 unidentified			
14	3-4	20 +	
15 did not crab			
16 did not crab			
17	?	16	
18	6	16-19	

19	4-6	20-30
20	2-3	8-15
21 not available		
22	5-6	20
23 did not crab		
24 did not crab		
25 not available		
26 did not crab		
27	1-2	2
28 unidentified		
29 unidentified		
30	?	50
31	7	30
32	?	30
33	2	1
TOTALS	80-87 DAYS	342-362 + CRAB
ADJ TOT	103 DAYS	448 + CRAB

Houses 17, 30, and 32 could not remember how many days they crabbed. After the average catch per house and the average catch per day were figured, these three houses were assigned the average effort (6.9 days) for the village as a whole, and added to the other houses to arrive at an adjusted total, above. Midpoints of ranges were used in figuring the adjusted totals.

1982

HOUSE	DAYS	CRAB	HRS/DAY
01 did not crab			
02 did not crab			
03	2	5-6	
04	?	200	
05	4	5-6	
06 did not crab			
07 unidentified			
08	2-3	0	
09	?	6-7	
10 did not crab			
11 unidentified			
12 unidentified			
13 unidentified			
14 did not crab			
15 did not crab			
16	2	15	
17	?	25	
18	?	?	
19	?	?	
20	2	?	
21 not available			
22	5-6	20	
23 did not crab			
24 did not crab			
25 not available			
26 did not crab			
27	?	30 +	
28 unidentified			
29 unidentified			
30 did not crab		40 +	
31	?	"Fair"	
32	?		
33	Under 7	1-2	
TOTALS	15-17 DAYS	45-47 CRAB	
ADJ TOT	50 DAYS	387 CRAB	

Only five houses could remember both the number of days crabbed and the number of crab caught during 1982. Average annual catch and average daily catch were computed using only these five houses. Then adjusted totals were computed as follows.

Five houses reported crabbing 15-17 days, midpoint was...	16	
House 20 reported crabbing 2 days.....	2	
Ten houses assigned average effort (3.2 days/house).....	32	
	50	DAYS

Five houses reported catching 45-47 crab, midpoint was...	46	
House 04.....	200	
House 09 reported catching 6-7 crab, midpoint was.....	7	
House 17.....	25	
House 27.....	30+	
House 30.....	40+	
House 33 reported catching 1-2 crab, midpoint was.....	2	
Four houses assigned average catch (9.2 crab/house).....	37	
	387	CRAB

1981

HOUSE	DAYS	CRAB	HRS/DAY
01 did not crab			
02 did not crab			
03 did not crab			
04	?	"Fair"	
05	4	6-7	
06 did not crab			
07 unidentified			
08	?		
09	?		
10 did not crab			
11 unidentified			
12 unidentified			
13 unidentified			
14	?		
15	1	2	
16	?		
17	2	80	
18	?		
19	?		
20	?		
21 not available			
22	?		
23 did not crab			
24 did not crab			
25 not available			

1981

HOUSE	DAYS	CRAB	HRS/DAY
26	?		
27	?		
28 unidentified			
29 unidentified			
30		40 +	
31	?	Fair	
32	?		
33	?		
TOTALS	7 DAYS	88-89 CRAB	
ADJ TOT	42 DAYS	542 CRAB	

Only three Gambell houses could remember both the number of days crabbed and the number of crab caught during 1981. Average annual catch and average daily catch were computed using only these three houses. Then adjusted totals were computed as follows:

Three houses reported crabbing 7 days.....	7	
15 houses assigned average effort (2.3 days/house).....	35	
	42	DAYS
Three houses reported catching 88-89 crab, midpoint was...	89	
House 30.....	40+	
14 houses assigned average catch (29.5 crab/house).....	413	
	542	CRAB

Savoonga

Savoonga data come from a survey conducted by Olanna between October 10 and October 14, 1983. Thirty houses were contacted in previous surveys (approximately one-third of the village). The same houses were contacted each year. In 1983, 24 of the 30 houses were available when the survey was conducted; 10 reported crabbing. In the tables below, data from two crabbing locations are presented.

HOUSE	ES DAYS	ES CRAB	HOURS/DAY	SW DAYS	SW CRAB
01	3	3	14	12	6
02	5-6	8	60		
03	did not crab				
04	14	20	10		
05	6	4	10		
06	did not crab				
07	4	0			
08	not available				
09	did not crab				
10	did not crab				
11	not available				
12	did not crab				
13	8	3	10		
14	did not crab				
15	did not crab				
16	did not crab				
17	did not crab				
18	did not crab				
19					
20					
21	25	20			
22	did not crab				
23	not available				
24	not available				
25	not available				
26	did not crab				
27	did not crab				
28	did not crab				
29					
30	not available				
TOTALS	32 DAYS	23 CRAB	47 DAYS	96 CRAB	

APPENDIX 3

NOTES OF FIGURE 1

Because only sample villages were surveyed for 1981 and 1982 harvests, it is not possible to simply add the survey totals to get a total for the Norton Sound Section. Thomas' data were analyzed to determine if each village usually harvests a similar percentage of the total section harvests each year. It was discovered that these percentages were remarkably stable from year to year, with the exception of 1979. That year, Nome crabbers did poorly, while certain village crabbers did better than usual. For example, except for 1979, Nome crabbers harvested an average of 76.2 per cent of the section total, with a range of 74-79 per cent. Golovin crabbers harvested an average of 8.6 per cent, with a range of 6-11 per cent.

Therefore, to construct an approximate total subsistence harvest for 1981 and 1982, the village totals from Elim and Golovin were divided by the average percentage of the total harvest taken in Elim and Golovin. The same procedure was applied to Nome's harvest total. In 1981 these two procedures gave an extrapolated harvest of 547 (based on Elim and Golovin) and 486 (based on Nome). The 1981 harvest was assumed to be about 500 for the entire Norton Sound Section. In 1982, these two procedures gave an extrapolated harvest of 894 (based on Elim and Golovin) and 1,694 (based on Nome). Since it it known that the harvest totalled at <u>least</u> 1,458 (Nome + Golovin + Elim), the extrapolated harvest for the Norton Sound Section should not be less than 1,500. This is the figure that is used to construct Figure 1. The scale of the graph is so large that these extrapolations should be well within the margin of error.

Data on the commercial harvests in Figure 1 come from information published by the Division of Commercial Fisheries, and is based on delivery records.

Savoonga, Gambell, and Little Diomede are not represented in Figure 1 because they are in the General Section. A more detailed explanation of these extrapolations can be found in the 1981 update (Appendix 2).

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