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MMS 91-0086

North Slope Subsistence Study
Barrow 1987, 1988, 1989

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BARROW, 1987, 1988 and 1989

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Alaska OCS Environmental Studies Program

North Slope Subsistence Study - Barrow, 1987, 1988 and 1989

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I. INTRODUCTION

The North Slope Subsistence Study, sponsored by the Minerals Management Service (MMS), is a three year study of Barrow and Wainwright residents' subsistence harvests. The major focus of the study was to collect harvest and location data for species used in these communities. This report is the third of three annual reports on the findings of the Barrow research. The first year of Barrow data collection began on April 1, 1987 and continued through March 31, 1988. Throughout the report, this time period is referred to as "Year One." The second year of Barrow data collection began on April 1, 1988 and continued through March 31, 1989, and is referred to as "Year Two." Year Three covered the time period from April 1, 1989 through March 31, 1990. In addition to presenting the Year Three data for the first time, this report contains the Year One and Year Two data. The current presentation of Year One and Year Two data contains some revisions to the data published in earlier reports based on new or corrected information gathered in the course of the Year Three data collection.

PURPOSE OF THE PROJECT

As conceived by the MMS, this study had two objectives. "First, to collect, analyze, and report harvest data by species for the North Slope communities of Barrow and Wainwright. A second objective is to provide comprehensive and accurate mapped subsistence ranges for these communities" during the study period (three years in Barrow and two years in Wainwright). The MMS's data collection goal was to gather "a reliable and accurate measure of yearly and seasonal subsistence harvests for each community by species and location." And, finally, the MMS envisioned "general use area" maps for each community. Thus, the MMS conceived of the mapping portion of this project as having "mapped subsistence ranges," subsistence harvest "locations," and mapped "general use areas."

Both of the terms "general use areas" and "subsistence ranges," used in their broader sense, could include the entire area hunted both successfully and unsuccessfully whereas subsistence harvest "location" refers to the more

specific area of a successful harvest. Although the most comprehensive mapping of Barrow and Wainwright subsistence would include general use areas/subsistence ranges (entire hunting/gathering area) and harvest locations, the study team did not have the resources to collect, digitize, and analyze both kinds of harvest data and had to focus on the geographic component that best fit into the overall study objectives (see Methodology for a more detailed discussion).

Thus, the study team, in concert with the MMS, chose "successful harvest locations" as the geographic unit of measurement for this study. As hunting and fishing activities that did not result in a harvest were not recorded, this study did not record "subsistence ranges" used in a broader sense to include the entire area hunted either successfully or unsuccessfully. This report presents the findings of the Barrow study covering the three year period from April 1, 1987 through March 31, 1990.

OVERVIEW OF BARROW REPORT

Rather than summarize the study findings, the purpose of this overview is to explain briefly the key topics that are addressed in this report and clarify what this report does not address. Many of these points are discussed more fully in appropriate sections of the report. The study did not attempt to measure hunting effort; only information on successful harvests was recorded. In this report, the term "harvest" refers to a successful harvest.

The study: (1) collected, analyzed and reported harvest data by species for Barrow and Wainwright; and (2) provided mapped subsistence harvest sites for Barrow and Wainwright. This report presents the findings of the Barrow study covering the three year period from April 1, 1987 through March 31, 1990.

The Barrow data are based on a disproportionate stratified probability sample of 101 households that remained in the study for the full three years. Harvest data from these 101 sample households have been generalized to estimate harvests for the entire community. A sample (i.e., subset of the Barrow households) was used because resources for the study did not allow for

including all 937 Barrow households in the study. The sample was stratified on the basis of a household's reported reliance on subsistence foods (reported in a census conducted by the North Slope Borough in 1985). Within each stratum, households were selected randomly for the study. The study team selected more households from the high subsistence strata and fewer households from the low subsistence strata. This concentration of effort on more subsistence-oriented households provided greater accuracy in our data than if we had sampled non-harvesters equally with major harvesters. Statistics accompany the harvest data (e.g., sampling error as a percent of mean), providing an analysis of how reliably a given harvest estimate was likely to reflect actual harvests.

Data were collected on subsistence harvests, including the species harvested, quantity harvested, location and date of harvest. (Additional information was collected about each harvest if available, such as the sex of the animal and the number of household members and non-household members participating in the harvest.) Harvest data were statistically processed to produce numeric output on several aspects of subsistence such as average household and per capita harvests per year and monthly harvests by species. These data are presented in tables and charts.

The mapped data were digitized and processed through the North Slope Borough's Geographic Information Systems (GIS) to produce harvest maps. These mapped data represent successful harvest sites only, not the total area hunted. Also, mapped data represent successful harvest sites of study households only, not all of Barrow. Geographic data collected from a subset of the total population could not be "weighted" to represent the entire community in the way that numeric data can be weighted. Hence, while the numeric harvest data (e.g., pounds per household and pounds per capita) collected from 101 sample households were weighted to represent the entire community of Barrow (937 households), mapped harvest sites only represent the successful harvests of the 101 households sampled in the study.

The study was intended to document subsistence harvests for the community of Barrow. Therefore, the major focus of the data is on subsistence harvests for Barrow as a whole (without reference to harvests by ethnicity). However, since subsistence is predominantly an Inupiat activity, the study team saw value in

providing data on Inupiat household harvests in addition to the data on harvests for all Barrow households. Such data are more useful for comparison with other studies of smaller, predominantly Native communities. In this report, an Inupiat household is defined as one in which the head of household or spouse is Inupiat.

The study presents data for three years only. Within the three year period, the study examines average harvests for the three years as well as variability between the three years. Although the study provides thorough and representative data on harvests for those three years, longer term trends are not captured. Environmental and/or economic factors can be major influences on the level of subsistence harvests in any given year. Harvest quantities and mapped harvests for these three years reflect environmental constraints on hunting that occurred during this period and thus may underrepresent some species with respect to their importance to Barrow residents in a broader time perspective. For example, had the study been conducted during a different three year period when sea ice conditions were more (or, alternatively, less) favorable for marine mammal hunting, the findings may have been quite different. Fluctuations in the populations of certain species, variations in their seasonal migrations, ice and storm conditions at sea, summer rainfall and winter snow cover on land are just a few examples of the kinds of environmental conditions that can influence significantly animal population levels, hunters' access to them, and consequently, the subsistence harvest levels of various species.

Constraints of employment and unemployment on hunters also can influence subsistence harvest levels. Modern Barrow subsistence hunters require some cash for subsistence equipment as well as time for pursuing subsistence activities. Thus, employment/unemployment is a variable in households' subsistence strategies and in their harvest levels. However, the study did not analyze the nature of the relationship between economics and subsistence.

Similarly, there are many sociocultural aspects of subsistence, such as the role of kinship in subsistence and the sharing of subsistence foods, that are culturally very important to the people of Barrow. However, the study's focus was on quantifiable harvest data and did not address the sociocultural aspects of subsistence in depth.

Although the data on number of animals harvested is presented, the study team also converted the harvests to pounds for the purpose of having a common unit of measurement by which harvest levels of multiple species can be compared and combined. The pounds data represent "usable" weight (rather than the "round" weight of the entire animal) and are based on standardized estimates of usable weight developed for each species by the Alaska Department of Fish and Game (ADF&G). The ADF&G Community Profile Database Catalog (1991:xxii) refers to this variable as "edible pounds" and defines it as follows:

> Edible Pounds is a measure of the portion of the kill brought into a household's kitchen for use, representing the usable pounds of the wild resources harvested (sometimes referred to as "usable weight" or "dressed weight"). In general, "edible pounds" is about 70-75 percent of round weight for fish, 60-65 percent of round weight for game, and 20-60 percent of round weight for marine mammals, and it includes bones for particular species. It is equivalent to the weights of domestic meat, fish, and poultry when purchased in a store.

The study team chose to use the same conversion weights as ADF&G where possible to achieve a high level of consistency between the large body of ADF&G research on community subsistence harvests (based on pounds of usable weight harvested) and this study. This study was not designed as a study of consumption, i.e., household reports of how much subsistence food they ate. However, in some cases a discrepancy exists between the amount of an animal that is usable and that which is actually eaten by the typical Barrow household. For example, the estimates of usable weight for bowhead whale and walrus include all the meat, the tongue, the *maktak* from bowheads (skin plus the attached one to two inches of blubber), all the blubber and some of the organs from these animals. Although the blubber is used in a variety of ways, it may not all be eaten by Barrow residents. Some of the blubber might be trimmed away on the ice. Additionally, in a successful whaling season, large quantities of blubber are sent by successful whaling captains and their crewmembers to Anaktuvuk Pass, Atqasuk, and other whaling communities on the North Slope that may not have had a successful whaling season. Also, Barrow residents share large amounts of blubber, meat and *maktak* by sending it to friends and relatives in many different communities, including Fairbanks and Anchorage.

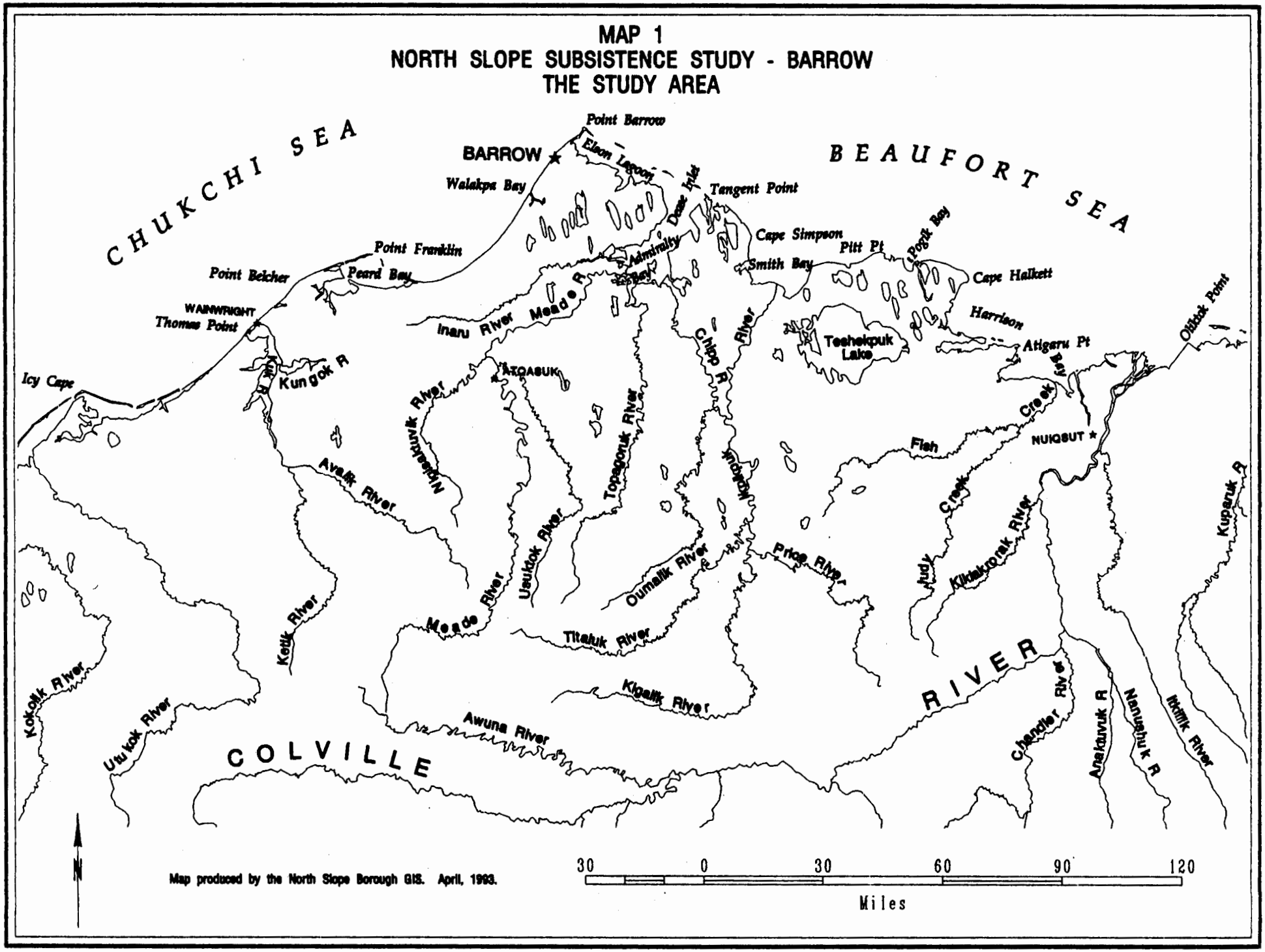
Hence, although our harvest data estimate the total amount of animal product potentially available to eat, in fact not all the product is eaten by Barrow

residents. In the case of these large animals that are widely shared beyond the community, the inclusion of all potentially usable weight has implications for the relative proportions they represent in the overall harvest, particularly when compared to the proportion that smaller species represent (e.g., fish and caribou) for which the usable weight more directly represents the amount actually eaten by Barrow residents (according to field discussions and observations). Had the study had as its focus Barrow consumption of subsistence foods, marine mammals (particularly bowhead and walrus) would represent a relatively smaller proportion of the total than is now the case, and terrestrial mammals, birds and fish would represent larger proportions of the total. Therefore, the reader must bear in mind that the harvest quantities presented in this report as usable pounds may not represent the quantities actually consumed by Barrow residents (mainly in the case of bowhead whale and walrus). This project collected harvest data, not consumption data.

SETTING

The community of Barrow is situated on the Chukchi Sea coast approximately 7.5 miles southwest of Point Barrow, the most northerly point in the United States (Map 1). In 1988 Barrow's population of 3,379 people lived in 1031 households (North Slope Borough Department of Planning and Community Services 1989). The unique marine and terrestrial environment surrounding Barrow provides local residents with excellent hunting opportunities for most of the mammals, birds, and fish that inhabit or migrate through the Arctic region. The mixing of the Chukchi and Beaufort seas in the vicinity of the point results in areas of open water almost year around, providing hunters with access to marine mammals. Even in mid-winter, ringed seals are usually available at open pools in close proximity to Barrow. Beginning in March or April, channels of open water -- open leads -- form within three to 10 miles from shore. Local residents hunt in this marine "river" rich in migrating resources: bowhead whales, beluga whales, walrus, bearded seal, ringed seal and eider ducks. During the arctic summer, onshore winds and shifting currents periodically bring the moving pack ice and the associated walrus, bearded seals and ringed seals to within hunting range of Barrow residents. Caribou move seasonally across the tundra and are available to Barrow hunters nearly year-round, while the elusive furbearing mammals such as fox, wolf and wolverine are more typically found in the

MAP 1
NORTH SLOPE SUBSISTENCE STUDY - BARROW
THE STUDY AREA



Map produced by the North Slope Borough GIS. April, 1993.

30 0 30 60 90 120

Miles

foothills to the south in late winter months. Thousands of birds arrive in the spring to nest in the coastal and tundra habitats, and most of the fish species can be found in the local rivers in summer and fall as they move toward their spawning areas.

The most significant characteristic of the study area to a community dependent on local food resources is the diversity of species that can be harvested. As this report details, fish, fowl, marine mammal and terrestrial mammal species are all available to local residents, with a variety of species available from each group. (Only in the case of terrestrial mammals is one species - caribou - the single major food source that is consistently harvested in large numbers.) Though most species are usually abundant at some period of the year, the presence of any one species during favorable harvest conditions is unpredictable. Successful harvests usually result from knowing where to intercept the resources as they migrate, and from being there at the right time. A few days delay in a hunting trip, adverse weather conditions, or equipment problems can mean missing the bulk of the migration and thus having a smaller harvest or missing out altogether. For some species like least cisco, geese, and walrus to name only a few, to miss the migration means a year-long wait until the next harvest opportunity.

As in all the North Slope villages, members of many of the Barrow families grew up out on the land away from village locations. These individuals have an intimate knowledge of areas where their parents taught them how to obtain the food they needed to survive. They continue to camp in these same traditional areas and teach their children and their grandchildren when, where, and how to successfully harvest the available resources. Some of that information pertaining to the Barrow area has been published in other reports and conveys a sense of what the land, ocean, and resources mean to the local residents (see for example: Arundale and Schneider 1987; Carnahan 1979; Hoffman, Libbey, and Spearman 1988; Ivie and Schneider 1988; Kisautaq (Leona Okakok) 1981; Nelson 1979; Nelson 1981; North Slope Borough 1980; Pedersen, Libbey, and Schneider 1979; Schneider and Libbey 1979; Schneider, Pedersen, and Libbey 1980).

STUDY APPROACH

Three essential elements of the Barrow study approach were the collection of data over a period of three consecutive years, the application of stratified sampling techniques, and the participation of the North Slope Borough.

The variability inherent in subsistence harvest patterns, both seasonally and annually, underscores the importance of the long-term approach. The areas used by Inupiat hunters vary seasonally according to resource distribution patterns and hunter access. Harvest patterns vary from year to year due to environmental conditions, population status of the resources, as well as social, economic and cultural influences. Three years of data collection were considered an adequate length of time to establish some general patterns and harvest levels and also to gain a sense of the year to year variability in Barrow subsistence harvests. However, three years is too short a period to capture the longer cycles associated with some animal populations and environmental conditions that can and do profoundly affect subsistence harvests. A longer study period would be more desirable in order to capture more fully the variation over time that is inherent in subsistence. To facilitate data collection, a full-time, on-site, field coordinator organized the collection of comprehensive subsistence data through repeated contacts with study households over the study period.

By applying stratified sampling techniques, the study team increased the representation of active hunters within the sample while ensuring that study results were representative of the community as a whole. Subsistence harvest patterns differ among families within the same community due to varying socioeconomic circumstances, the location of fixed camps, and the experience and knowledge of family members. The stratified sampling approach employed in this study captured most of the variation in harvest patterns by including a majority of the households that account for most of the community's harvest (see Appendix D, Methodology, for a detailed discussion of the Barrow data collection method).

During the first year of data collection, the North Slope Borough (NSB) provided both technical (e.g., Geographic Information Systems [GIS] mapping) and financial (e.g., local research assistants [RAs] were hired through the NSB

Mayor's Job Program) support for this project. During Years Two and Three, the NSB continued this support (except for the Mayor's Job Program which was phased out) and also provided supplemental funding for data collection and analysis. This additional funding made possible the continuous field presence in both Wainwright and Barrow, added to the scope of work SRB&A personnel were able to accomplish, and facilitated the data collection and analysis.

DIFFERENCES BETWEEN ANNUAL PROJECT REPORTS

The Year One report (Stephen R. Braund & Associates [SRB&A] and Institute of Social and Economic Research [ISER] 1988) presented results of the first year of data collection in the form of tables, figures, maps, and accompanying discussions. The report also described the basis for harvest estimates and provided an extensive description of the sampling and data collection methods used in this study. The Year Two report principally documented ongoing data collection efforts and supplied additional information (e.g., averages of Year One and Two harvests, differences by household in harvest levels, and the status of major faunal resources). As interim findings in a three year study, the Year Two report contained limited discussion of the data sets.

As the final product in this three year study of Barrow, this report does not focus only on presenting the Year Three data as a sequel to the Year One and Year Two reports, but rather presents Barrow subsistence in broader terms by emphasizing three year average annual harvests and variability in harvests between the three study years. Extensive use is made of maps, tables and graphics to supplement the discussion of the data. Since publication of the Year Two interim report (SRB&A & ISER 1989a), the Year One and Year Two data have been updated resulting in minor revisions. The updated data are presented in this report, and the data presented in the Year One and Year Two reports are no longer valid. The Year One (revised), Year Two (revised) and Year Three data are appended to this report in the form of tables, graphs and maps. Also included in each year's appendix is a narrative report (the Seasonal Round) describing the sequence of harvest activities and related environmental, cultural and economic events for that year. A fourth appendix presents the methodology used to conduct this study. Thus, the body of the report concentrates on Barrow subsistence from a three year perspective, while data on

the individual years and methodological documentation are presented in the appendices.

FORMAT OF THIS REPORT

Following this introduction, the second section of the report (Overview of Barrow Subsistence) describes the study area and summarizes the subsistence history and demographic characteristics of the community, the general annual cycle of harvest activities, a geographic overview of subsistence, as well as community and household harvest levels for the major resource categories. The third section (Barrow Subsistence Harvests by Species) presents average annual harvest data as well as an examination of year to year variability based on the Year One, Two and Three harvest data. These discussions are organized by major resource group and are species-specific. In the fourth section (Harvest Level Analysis), harvest levels are discussed with regard to socioeconomic characteristics of households. Next, Barrow and Wainwright harvests are briefly compared. In the last chapter of the report, Dr. Sam Stoker presents an analysis of the study's harvest estimates with regard to the sustainable yield of the major subsistence species populations. Finally, as stated previously, Appendix A contains Year One data, Appendix B contains Year Two data, Appendix C contains Year Three data, and Appendix D contains the methodology.

II. OVERVIEW OF BARROW SUBSISTENCE

This section presents a general overview of subsistence in Barrow through time, including summary level findings from the study and some information on the research methods employed. The basis for the harvest estimates is discussed below, followed by a description of historic Barrow subsistence practices and demographic trends. Presented next is a listing of species harvested in the Barrow area and a general description of the seasonal harvest patterns. The areal extent of Barrow hunting and fishing activities is presented, including a discussion of the use of cabins and traditional camps. Finally, summary harvest data are presented for the major subsistence resource groups (in tabular, figure and map form).

BASIS OF HARVEST ESTIMATES

As stated previously, the goal of this study was to obtain Barrow subsistence harvest and location data for the three year study period in a manner that accurately represented total community harvest amounts. Ideally, a study of this nature would observe the resource harvest activities of every village resident. This approach was not practical in Barrow, the home of over 3,000 people. Instead, the study team tracked the harvest activities for three years of a sample of 101 households that statistically represented all households in Barrow. The 101 households represent 11 percent of the 937 households enumerated in the 1985 NSB census, the most current census available at the time.

The study team chose to use a stratified sample design to increase the reliability of harvest estimates over what they would have been if simple random sampling procedures had been used. Households were stratified according to their reported level of subsistence harvest activity in a 1985 NSB census of borough residents (NSB Department of Planning and Community Services 1985) and according to common knowledge concerning the most highly active harvesting households. All households known to be highly active (including all households of whaling captains) were grouped in stratum one. The remaining households that reported in the 1985 census getting all of their food from hunting and fishing were grouped in stratum two. (Strata one and two were sampled separately in-

stead of being combined for reasons explained in the Methodology on page D-6.) Households that reported getting most of their food from subsistence activities were grouped in stratum three. Stratum four contained households reporting that half of their food came from hunting and fishing, stratum five contained households reporting that some of their food came from subsistence, stratum six contained households reporting that none of their food came from hunting and fishing, and stratum seven contained households not answering the 1985 census question. Within each stratum, sample households were selected randomly.

The reliability of harvest estimates is increased if those households accounting for the greatest harvest activity are given a higher chance of selection in the overall sample (i.e., compared to households in other strata that relied less on subsistence). For this reason, all households in stratum one were sampled. Sampling fractions for the remaining strata were 1:2, 1:4, 1:6, 1:12, 1:32, and 1:6, for strata two through seven respectively (see Table 1). The reason that households in some strata had a greater chance of selection than households in other strata was that, with limited resources, the study team wanted to concentrate more time on interviewing households that were active in subsistence and spend less time interviewing households that were inactive. Hence, we stratified the households and selected a greater number from the strata containing more active households.

The 1985 borough census question used to group households according to their level of subsistence harvest activity proved to be an imperfect measure. Some households reporting that all their food came from their "family's" harvest activities apparently interpreted the word family to include extended family members living in other households. Other households apparently experienced a change in household composition or circumstances that affected its level of harvest activity. As a result, some households were grouped for sampling purposes inappropriately. While such misclassification makes the sample less efficient in producing harvest estimates, it does not make the sample any less representative of all Barrow households. As long as the sample weight attached to all households in each sample stratum is the same, the requirements for a probability sample are met. Even if a household was misclassified, it is still possible to generalize to the entire community but it simply increases the sampling error. The sampling error is still lower, however, than what would

TABLE 1: SAMPLING CHARACTERISTICS - BARROW YEARS ONE, TWO & THREE

Strata (1)	Number of Households in Barrow (2)	Sampling Fraction (3)	Number of Households in Original Sample	Number of Households in Three Study Years	Year 1-3 Sample Weight (4)
1	48	1:1 or 1.00	48	40	1.20
2	45	1:2 or .50	22	13	3.46
3	67	1:4 or .25	17	14	4.79
4	85	1:6 or .17	14	7	12.14
5	222	1:12 or .08	19	12	18.50
6	360	1:32 or .03	11	5	72.00
7	110	1:6 or .17	18	10	11.00
Totals	937		149	101	

1) Households were assigned to sample strata based on their level of subsistence activity, with stratum one being the highest level of subsistence use and stratum six the lowest (stratum seven represents households with an unknown use level). Households in strata associated with a high level of activity had a greater chance of selection.

2) The total number of households in Barrow based on a 1985 North Slope Borough census (NSB Department of Planning and Community Services 1985).

3) Represents the probability of inclusion in the original sample for each sampling stratum (e.g., of the 67 households assigned to stratum three, 17 households, or 25 percent, were included in the original sample).

4) Sample weights are the inverse of the sample fraction. Stratum three, for example, had a sample fraction of 1:4 or .25. Had all households originally sampled in stratum three remained in the three year study, the appropriate sample weight for each household in this stratum would be the inverse of 1:4, or 4:1 (i.e., 4). Because some households dropped from the study, sample weights are based on the inverse of the ratio of the number of households in the final sample to the total number of Barrow households in the stratum (e.g., the inverse of 14:67 in stratum three). Thus, the sample weight for stratum three is derived by dividing the total number of Barrow households in this stratum (e.g., 67 households) by the final number of sample households in that stratum that participated in the study for the three study years (e.g., 14 households). Sixty-seven divided by 14 = 4.79 sample weight. These sample weights allow the data to be generalized to the whole community.

Source: Stephen R. Braund & Associates, 1993

have resulted if simple random sampling techniques had been used. Sampling error as a percentage of the mean is a statistic presented with each harvest estimate and serves as an indicator of the reliability of a specific piece of data. The lower the sampling error, the more reliable the data. This aspect of the sampling and data analysis is discussed more fully in the Methodology.

Any longitudinal study faces the problem of "sample mortality", or the loss of sample households from the study. In this case, the major reason households dropped from the sample was that they moved out of the community. Of the 149 households selected from the 1985 borough census records, 11 had moved from Barrow before the study began in 1987. During the course of the three year study, an additional 20 households moved from Barrow. Thus no data were available for 7.4 percent of the original sample, and only partial data were available for an additional 13.4 percent of the original sample. Of the remaining 118 households, 12 declined to participate at the outset of the study, and an additional five decided to drop from the study during the three years of data collection.

A decision had to be made as to whether to include households for which data were not available for the entire three year study period in the final report of community harvests over three years. One purpose of the study was to observe variations in harvest patterns and harvest levels over time. There were several possible sources for this variation: presence of wildlife, favorable environmental conditions for hunting and fishing, favorable personal circumstances for hunting and fishing (e.g., time, health, equipment, gas), and changes in the number of households in the community. One approach to the study design would have been to let all factors contributing to variations in harvest level vary. This means that households which harvested fish and game for only part of a year or for a subset of study years would contribute to study harvest estimates. The sample design would also have to identify and sample new households.

In fact, however, it proved impossible to reliably identify, stratify, and sample new households since they were few in number and dispersed throughout the community. To include part year households that left the community and not include new households would produce underestimates of community harvest levels

and mean household and per capita harvest levels. Since one interest in the multi-year study design is to observe the effects of environmental differences on harvest levels, it is best to hold the number of sample households constant over the three year period, and to report community harvest levels as if the population of the community remained constant. All study results reported are based on the same 101 households who participated in all three years of the study. These households represent 86 percent of all sample households present in Barrow for the three year period.

Since not all households had the same probability of selection, reports of community harvest levels must be based on weighted sample results. Sample weights are simply the inverse of the sample fraction. The original sample fractions were given above. Stratum two, for example, had a sample fraction of 1:2 or 0.5 (see Table 1). Had all households originally sampled in stratum two reported harvests for the three year period, the appropriate sample weight for each stratum two household would be the inverse of 1:2, or 2:1 (i.e., 2). In fact, however, as discussed above, household moves and refusals mean that the final sample of households in each stratum is somewhat different than the number originally selected. Our most reasonable assumption is that the harvest levels of households that dropped from the study are best represented by other households in the same sample stratum. For this reason, sample weights are based on the inverse of the ratio of the number of households in the final sample to the total number of households in the stratum. In the case of stratum two, for example, the effective sample fraction is 13:45, which expressed as a decimal is .289. The inverse of .289, 3.46, is the most appropriate sample weight for stratum two. Weights for households in each stratum are given in Table 1.

Through regular contacts with the study sample of Barrow households, data were collected on species harvested, harvest date, amount harvested, mapped location of the harvest, and other information for each harvest event. The harvest estimates presented in this report may vary from actual harvest amounts due to errors in reporting, errors in recording, and errors introduced with the use of average weights in the conversion of the number harvested to the amount of

usable pounds[1] harvested. Errors in reporting were minimized through repeated contacts with respondents over the course of the three years (see Key Informant Discussions in Appendix D for further detail on the method used to conduct and determine frequency of household contacts). Errors in recording were minimized with the application of rules and definitions by those persons collecting the data (i.e., the on-site field coordinator primarily, as well as trained research assistants in Years One and Two) and through a review of each report by the field coordinator. Additionally, data provided by one household were cross-checked with data provided by other study households that participated in the same harvest event. Finally, the conversion weights applied are predominantly those produced by the Alaska Department of Fish and Game (ADF&G) Division of Subsistence from data collected in Nuiqsut and Kaktovik, both North Slope villages (ADF&G n.d.). These weights were used to aid in comparisons between the data presented in this report and other ADF&G research. The weights are useful for comparing the relative amount of food contributed to the total community harvest by the different resources. These and other methodological issues are discussed in detail in Methodology (Appendix D). Despite these caveats, the data collected in Barrow are a comprehensive three-year record of harvest events for this North Slope community.

AN HISTORICAL PERSPECTIVE ON BARROW SUBSISTENCE AND DEMOGRAPHY

This section provides an overview of Barrow's history particularly with regard to resource use and settlement patterns. For more complete ethnohistoric and ethnographic information on Barrow, the reader is referred to Chance (1966, 1990), Murdoch (1891), Pedersen et al. (1979), Sonnenfeld (1956) and Spencer (1959, 1984).

The area around Point Barrow has been inhabited for approximately 5,000 years, with continuous habitation occurring for at least 1,300 years (Dumond 1977). Continuous occupation is associated with the Norton Tradition, a marine oriented culture connected to whaling and the growth of semi-permanent coastal

1. The term "usable pounds" is equivalent to ADF&G's term "edible pounds." See discussion and definition on page 5.

communities. About 900 A.D. the Norton Tradition was replaced by the Thule Tradition which is the direct antecedent of historic Barrow Inupiat culture first encountered by Europeans in 1826.

Historically, Barrow Inupiat were coastal dwellers who hunted sea mammals, including the bowhead whale, and lived in semi-permanent villages. In Inupiat they were *Tagiugmiut*, or "people of the sea" (Spencer 1984:323). Although primarily sea mammal hunters, Barrow people had a diversified economy that included harvesting inland resources, particularly caribou, and trading with the *Nunamuit* or "people of the land" who resided inland.

The first Europeans to encounter Barrow Inupiat were British explorers in search of a northwest passage. As part of this endeavor, two Englishmen, Sir John Franklin and Captain F.W. Beechey, were appointed by the British Admiralty to conduct explorations along the north Alaskan coast in 1826. In August of that year, members of Beechey's crew, led by Thomas Elson, reached Point Barrow. Elson received a hostile reception and withdrew after making a few astronomical observations (Bockstoce 1977). For approximately the next thirty years contact between Inupiat and Europeans was intermittent.

The first substantive account of Barrow Inupiat life comes from Dr. John Simpson, surgeon of the British ship *Plover*, who wintered in Barrow for two seasons (1852-1854) while searching for the Franklin Arctic expedition (Collins 1984:15). In 1852 the two primary villages in the vicinity of Point Barrow were Nuvuk, located directly on the point, and Utqiagvik located 11 miles south at Cape Smythe near the present town of Barrow (Spencer 1984:326). Nuvuk was described by Simpson:

> The assemblage of winter huts is placed on the expanded and more elevated extremity where there is a thin layer of grassy turf. It is called Nuwuk, or Noowook, which signifies emphatically 'the point.' No doubt the settlement owes its existence to the proximity of the deep sea, in which the whale can be successfully pursued in the summer and autumn, and to the great extent of shallow waters around, where seal may be taken at any season of the year (quoted in Pedersen et al. 1979:54).

According to Simpson, Nuvuk had a population in 1852 of 309 people living in 54 households, while Utqiagvik had a population of 250 people living in 40 houses (Simpson in Spencer 1984:326).

In 1854 commercial whaling ships in pursuit of bowhead whales began making regular stops at Point Barrow to trade firearms, ammunition and alcohol for baleen and furs. The presence of the "Yankee whalers" stimulated an already flourishing Native trade but apparently did not substantially alter Inupiat economic activity. According to John Murdoch, who spent the years 1881-1882 in Barrow, the Inupiat "have not changed the course or time of their journeys since Dr. Simpson's time..." (Murdoch 1891:54). "Of course," Murdoch went on to say "men who are rich in whalebone [baleen] now stay to trade with the ships, while those who have plenty of oil go east" (ibid), meaning to the mouth of the Colville River where they trade with inland Inupiat. Murdoch also wrote that Inupiat were "not absolutely dependent on the ships for anything except ammunition, and even during the short time the ships are with them they [the Inupiat] hardly neglect their own pursuits" (ibid).

Joseph Sonnenfeld, a geographer who conducted ethnohistorical and ethnographic research on Barrow subsistence in the early 1950s, agreed with this assessment. Sonnenfeld pointed out that trade with the whaling ships occurred during the late summer, a "slack subsistence period" (1956:229) when coastal Inupiat traditionally traded with inland people. He also wrote that the introduction of firearms had little effect on cooperative hunting (also cf. Murdoch 1891:53). Additionally, Sonnenfeld believed that any alcohol purchased by the Inupiat was immediately consumed on the spot thus having very little debilitating effect (1956:228-229). The depredation of the walrus herds by whalers that so affected Bering Straits Inupiat had perhaps less of an impact on Barrow people since, according to Sonnenfeld, Barrow people depended to a lesser extent on walrus (Sonnenfeld 1956:238). In summary, while Inupiat adapted some aspects of their economy to accommodate the presence of ship-based whalers, harvest patterns appear to have remained essentially stable between 1850 and 1880.

Harvest Patterns: 1850 - 1880

In describing Inupiat culture of the early 1880s, Murdoch wrote that the "staple food" was the "rough" or ringed seal with caribou next in importance. Bearded seal were less common but valued for their hides which made excellent covers for their *umiat* or skin boats. Harbor (spotted) and ribbon seal were known but uncommon, with the latter very rare (Murdoch 1891:56). Walrus,

bowhead and beluga whales were also hunted (Murdoch 1891:61). Larger birds, geese, ducks, gulls and grouse (probably meaning ptarmigan) along with bird eggs were also part of the diet. In addition, all kinds of fish were eaten. Furbearers were important essentially for their fur which was used in clothing. Furs were obtained most often in trade with inland people.

Sonnenfeld (1956:11) also considered ringed seal the staple food based on their quantity, general availability and desirability as food. Bowhead whales and walrus, on the other hand, were less significant because of their undependable quantity and/or variability (Sonnenfeld 1956:12). It should be noted, however, this system of classification does not reflect that of the Inupiat which held bowhead whales to be the preeminent resource and *maktak* (bowhead whale skin with a layer of attached blubber) to be the most esteemed food. As Sonnenfeld himself noted, the bowhead was the material, social and spiritual center of Inupiat life (1956:82).

While bowheads were prominent in the Inupiat conceptual system, the ringed seal provided not only skin, used for clothing, nets, dog harness, floats, and other articles, but meat and blubber rendered into oil for eating and used as a source of light and heat. They also provided sinew for thread, bones for fabricating implements, and intestines for waterproof clothing (Sonnenfeld 1956:31).

Traditionally seals were hunted in four ways, each technique being a particular adaptation to a seasonal variation or condition of the sea ice. The principal seal harvest began, according to Murdoch (1891:269), in October when the pack ice moved inshore. At this point seals came up to breathe in open pools of water that formed between ice floes. As they surfaced, the hunter shot and harpooned them. Once the pools iced over, usually in November, the seals pushed small breathing holes in the newly formed ice with their noses. The hunter then resorted to a method of hunting called *maupok* (or *nippaq*) in which he waited for the seal at the breathing hole. When the seal stuck its nose into the hole the hunter stabbed the animal with a harpoon. The most productive method of hunting seals was to set nets under the shorefast ice during the long winter nights (Sonnenfeld 1956:34). This method was effective until late May or early June when the sea ice became rotten and the seals hauled themselves out of the water to sleep in the sun. Then, using what the

Inupiat call the *utok* (or *auq*) method, the hunter stalked and shot the seal as it lay sleeping on the ice.

Of the whales, bowheads were the most significant since they provided vast quantities of meat, and blubber that could be used or rendered into oil for use as fuel in place of more valuable seal oil. As already mentioned, *maktak* was considered the greatest of delicacies. Baleen was important in the manufacture of a variety of objects as were the jaw bones and smaller ribs used in the construction of such things as sled runners (Murdoch 1891:272).

In aboriginal times, bowhead hunting took place in both the spring and fall (Murdoch 1891; Sonnenfeld 1956). The spring hunt began in late April or May and was conducted by boat crews in *umiat* under the leadership of a captain or *umialiq*. By the 1880s the fall bowhead hunt had been discontinued (Murdoch 1891:54). Sonnenfeld (1956:234) offered three reasons for this change. First, the presence of commercial whalers using shoulder and darting guns may have deterred Inupiat whalers. Second, the presence of American whaling ships meant trading opportunities which the Inupiat preferred over fall whaling, which was neither as productive or as ceremonially significant as spring whaling. Third, an abundance of rifles facilitated increased participation in the fall caribou hunt, so people went caribou hunting instead of whaling. The Barrow people resumed fall whaling in 1907 at the instigation of a non-Native whaler involved in one of the shore stations (Sonnenfeld 1956:276).

Upon completing the spring whale harvest, boat crews either disbanded or turned to walrus hunting (Spencer 1984:330). Less important than either seals or whales, walrus were taken in the summer during periods when the sea ice moved offshore forming relatively large areas of open water. Most of the meat (used primarily for dog food) as well as the ivory were divided equally among the crew (ibid). Because walrus hunting required optimal environmental conditions, success varied greatly (Sonnenfeld 1956:110).

If the crew disbanded before walrus hunting, individual families often moved inland to fishing sites located along rivers and lakes. Here the women fished while the men either returned to the coast to hunt walrus or moved further inland to hunt caribou (Spencer 1984:330). Fishing was a supplementary

activity practiced by the elders, women and children. The most productive areas for fishing were the inland lakes and rivers, particularly the Meade and Inaru rivers (Sonnenfeld 1956:149). Those species most commonly harvested were ling cod (burbot), whitefish and grayling, with salmon and trout less common (Sonnenfeld 1956:145). Birds were also hunted at this time but because of their variability were less significant than fish (Sonnenfeld 1956:153).

Of all inland animals, caribou were the most significant to the Inupiat economy of this period. Caribou provided vital skins for clothing used against winter cold (Sonnenfeld 1956:118). The meat was also a highly desirable food and the antlers and sinew were important raw materials. Caribou were hunted whenever the animals were available, but the major hunts were carried out in late winter and spring and again in late summer and fall (Murdoch 1891:266; Sonnenfeld 1956). During the 1880s, the spring hunt began in mid-January and lasted until mid-April when people returned to the coast for whaling. Meat was the primary focus of these late winter and early spring hunts, although the heavy winter skins were useful for such things as socks and sleeping bags (Sonnenfeld 1956: 119). In late May or June, during the whaling season, a second spring hunt was conducted by small groups of people who were after fawn skins used in the manufacture of clothing (Murdoch 1891:265). Murdoch (1891:266) noted that fall hunting, which he thought may have been an innovation begun after 1850, started around the first of October and ended toward the end of the month. Sonnenfeld, however, wrote that this hunt began in late summer and was important mainly for obtaining female fawn skins for clothing (Sonnenfeld 1956:119).

Four basic methods were used to hunt caribou: herding the animals into a corral, river, or lake; snaring the animals; digging traps or pits in the snow; and stalking (Sonnenfeld 1956:125). A major herding practice was to drive caribou into bodies of water and then kill them using a lance wielded from a kayak. This method was carried out spontaneously by small groups of Inupiat during the summer (Sonnenfeld 1956:126-127). A second herding technique required the use of permanently erected corrals built with long wings or drift fences that funneled the animals into the corral opening. This technique was a well-planned event requiring the cooperation of a number of individuals, including women and children. After siting a herd, runners chased the caribou into the wings, which, in some cases, extended as much as five or ten miles

from the corral opening. After the caribou entered the corral the opening was closed and the animals were killed (Sonnenfeld 1956:132). A third technique, carried out by individuals, was to dig a pit under the snow to within two or three inches of the surface leaving a small hole through which the snow was removed. After removing the snow, the hole was carefully covered over and a bait of reindeer moss was spread over the thin surface of the pit. As the caribou moved onto the thin crust of snow it collapsed and the animal fell into the pit (Murdoch 1891:268). A final method was to stalk individual or small groups of caribou and kill them with bow and arrow or rifle. This was carried out at all times of the year but especially in summer and fall (Sonnenfeld 1956:134).

In addition to hunting, an important aspect of the 19th century Inupiat economy was trade. Late in the summer the men stopped hunting to prepare for trading expeditions that would take them as far afield as the mouth of the Colville River, Barter Island, and the mouth of the Mackenzie River (Sonnenfeld 1956: 188). The aboriginal basis for this trade was the exchange of marine products, like seal and whale oil, for inland products, particularly caribou skins and furs. In the 18th century this trade was stimulated by the introduction of European goods that came from Siberian Chukchi peoples via a trade network that ran through the central Bering Straits and followed the Noatak and Colville rivers to the Arctic coast. This indigenous trade was further enhanced in the 19th century, first by the establishment of the Russian American Company in Alaska and the Hudson's Bay Company in western Canada and, second, by Yankee whalers who began trading directly at Point Barrow in 1854.

On completing their trade, the traders returned to their winter villages, stopping along the way to pick up their families at the fish camps. Winter subsistence activities were largely confined to the sea ice close to the village where individual men harpooned and netted seals under the ice (Spencer 1984:330). Winter village activities were devoted to a social and religious life that centered on the *kashim* (or *karigi*) or men's house, which was the heart of the community.

Shore-Based Whaling and the Herschel Island Whaling Grounds: 1884 - 1910

In the mid-1880s the harvest pattern described above was disrupted by the creation of permanent whaling stations at Barrow and Herschel Island, located near the mouth of the Mackenzie River. Both these stations, with year-round populations of non-Natives, resulted in more intensive and prolonged contacts which had a fourfold effect. First, Inupiat were introduced to wage employment and the concept of private property. Second, because of the economic opportunities presented by the whaling industry, Inupiat began to aggregate at certain spots along the coast. Third, the introduction of new diseases, along with the decline in caribou, had a devastating effect on the Inupiat population (Chance 1990). Fourth, opportunities for trade dramatically increased, not only altering old trade patterns but creating new desires (Sonnenfeld 1956).

In 1884, the Pacific Steam Whaling Company established the first shore station at Barrow. Within six years three additional independent operations, employing more than 400 people organized into fifty boat crews (10 non-Native crews and the rest Inupiat), were operating out of Barrow (Bockstoce 1986:236). In 1892 the Pacific Steam Whaling Company alone hired 100 Inupiat men, paying them not only an annual wage, but supporting their families, which totaled about 500 people (Bockstoce 1986:239). Such developments were the result of the high price of baleen which produced a demand for labor that could not be filled by the local indigenous population. As a consequence, Eskimos from as far away as the Siberian coast, St. Lawrence Island and interior Alaska made their way to Barrow to work in the whaling industry (Bockstoce 1986:241). In fact genealogical investigations indicate that many present day inhabitants of the Barrow area are descended from Inupiat who relocated from other areas, especially the Colville River, Beechey Point, Utukok, Wainwright, Noatak, and Shishmaref (Worl 1980:307).

In 1896, 12 years after establishing its shore-based station, the Pacific Steam Whaling Company discontinued shore-based operations at Barrow. At that point, Inupiat took control of the shore-based fishery and those who had worked for the company and accumulated enough capital went into business for themselves or entered into partnerships with non-Natives (Bockstoce 1986:252). By 1908, some of the more affluent Inupiat captains maintained six crews, paying each crew

member $200 worth of supplies, in addition to a furnished house and rations for the entire year (Stefansson in Sonnenfeld 1956:244).

Because of its commercial value, baleen became a currency used by Inupiat to purchase manufactured goods. Before that, baleen had been distributed equally among all the Inupiat boats that participated in the whale hunt. Once its commercial value was established, however, the distribution of baleen changed so that all of it was kept by the successful boat. The division among the crew depended upon whether individual crew members were paid wages or had "shipped" on shares, in which case they received one twenty-fifth of the catch payable in baleen at the end of the season (Bockstoce 1986:242). Once the price of baleen dropped, the Inupiat reverted back to sharing the baleen equally.

Increased contact with Euro-Americans not only created new economic opportunities for Inupiat but also brought new diseases such as measles, smallpox, and influenza. Regarding the population of Cape Smythe and Point Barrow, Charles Brower, a whaler who operated a whaling station at Barrow during the last decades of the 19th century, believed that in 1908 only half as many people lived along the coast as in 1889. Of those living along the coast in 1908, most came from either inland communities or farther south, as the coastal people were decimated by measles, pneumonia and consumption (Brower in Sonnenfeld 1956:296). In 1902, for example, more than 100 Barrow Inupiat died in a measles epidemic (Chance 1990:37). The arctic explorer, Stefansson, believed Utqiagvik would have disappeared as a village except for the Eskimos who relocated to Barrow for the prosperity offered by the whaling industry (Stefansson in Sonnenfeld 1956:296). These people were decimated as well. In 1900 more than 200 inland Inupiat, on a trading expedition to Point Barrow, died of influenza following the visit of a whaling ship (Chance 1990:37).

Native trade was affected by the increased commercial activity centered along the coast. As manufactured items became plentiful they decreased in value while the value of Native products, especially caribou meat and skins, increased (Sonnenfeld 1956:304-305). The increased value of caribou was due, in part, to the demand for meat created by the presence of whaling crews who began to overwinter at Herschel Island in 1889-90.

First successfully exploited in the summer of 1890, the development of the Herschel Island whaling grounds created another wave of intense contact between Inupiat and non-Natives. During the decade of 1890 to 1900, up to 15 ships annually spent the winter at Herschel Island which became a magnet for Inupiat wishing to sell caribou meat and skins for a wide variety of trade goods. In fact, the demand for fresh meat became so great that, in the winter of 1894-95, most of the Point Barrow Inupiat (Bockstoce 1986:274) along with Nunamiut and Athapaskan Indians from the interior visited Herschel Island to trade meat for a variety of goods. It was estimated that during the winters of 1894-95 and 1895-96 more than 2,000 caribou were consumed annually by the whalers (ibid).

There are differing interpretations as to the effect commercial hunting had on the caribou population. On the one hand, Sonnenfeld wrote the "major depredations" of the caribou herds began with commercial hunting (1956:287). Historian John Bockstoce, on the other hand, believed that commercial hunting had no affect on the caribou. Instead, Bockstoce (1980) points to data that indicate the disappearance of the caribou was related to a naturally "severe cyclical decline." Despite these differences, both Sonnenfeld and Bockstoce agree that the decline in caribou had a severe impact on Inupiat. Bockstoce (1986:241) reports that between 1890 and 1898 inland Inupiat abandoned their traditional areas in the Brooks Range and moved to the coast because of the lack of caribou. By 1907, the disappearance of the caribou had created a desperate situation for the Colville River Inupiat who were diseased and starving. Those remaining were forced either to rely on fish or move to Barrow which had become a year-round economic and social center as well as the primary place of residence for coastal Inupiat who had moved from the smaller settlements scattered along the coast (Sonnenfeld 1956:313). These demographic adjustments produced a diversified economy in Barrow. While coastal people continued their traditional reliance on sea mammals, inland people were more inclined to return inland to hunt caribou or fish on the inland rivers (Sonnenfeld 1956:314).

The Reindeer Industry and Inupiat Fur Trapping: 1897 - 1952

In 1897, six Yankee whaling ships were caught in the ice at Barrow and 275 men spent the winter living with the Inupiat. This event prompted the U.S. government to send 362 reindeer to Barrow, 125 of which became the nucleus of the Bar-

row herd which lasted until 1952 (Chance 1990:36). While the initial intention of the government was to provide food for the stranded whalers, government policy makers also wished to instill an entrepreneurial spirit in the Inupiat by providing them with domestic reindeer herds to manage. The Inupiat, however, viewed reindeer herding as an extension of their earlier subsistence practices (Chance 1990:41) and instead of herding the deer themselves hired other Inupiat to do this chore while they continued to hunt and trap (Sonnenfeld 1956:377). For their services the herders were paid one dollar a head and were provided with seal skins and blubber (Sonnenfeld 1956:378). Although the herd grew until it peaked at 30,000 animals in 1935, the U.S. depression of 1929 killed people's interest in the herds because there was no market for the meat. In 1930, the price of a dressed carcass fell from $5.00 to $2.00 (Spencer 1959: 365). By 1952 the Barrow herd had all but disappeared as the herds dispersed due to inattention, predation by wolves and assimilation into wild caribou herds. Sonnenfeld (1956:405) believed reindeer herding had little effect on Barrow subsistence practices but served to fill the void left by a depleted caribou stock and provided extra income when fur prices dropped in the 1920s.

The decline in the price of bowhead baleen after the turn of the century sounded the death knell for commercial whaling in the arctic. By 1908, the Herschel Island whaling grounds were empty of ships. In 1914, the Cape Smythe Whaling Company, begun in 1893 by Charles Brower, abandoned shore-based whaling and shifted its attention to the purchase of furs (Sonnenfeld 1956:322). For Inupiat who had relied on the whaling industry for cash, trapping became the major alternative. Incomes from fur harvests ranged from $3,000 to $4,000 annually, although some trappers made up to $7,000 (Chance 1990:44). The most important fur for the commercial trade was arctic fox while that of the local trade was wolverine and wolf, used to decorate Inupiat clothing. One wolverine skin was worth up to five fox skins (Sonnenfeld 1956:326). Other furs of significance were polar bear and lynx.

The fur trade produced demographic shifts in reverse of those created by commercial whaling. Employment opportunities offered by the whaling stations at Barrow had attracted Inupiat from the interior, as well as from settlements along the coast. This aggregation was reversed by the fur trade as trappers and their families left Barrow for winter trapping camps. Many of these camps were

located in the interior either to the east of Barrow (Sonnenfeld 1956:342) or to the south along the Meade River, which had been used historically for fishing and caribou hunting (Pedersen et al. 1979:54). These changes in demography are reflected in the Barrow census figures. In 1910, for example, at the end of the commercial whaling period, the total population of Barrow was 446, but by 1920 the population had declined to 322. For the next twenty years, the Barrow population was relatively static, increasing by only 41 people to a population of 363 in 1939 (ISER n.d.:17). During this period Inupiat stayed away in their trapping camps most of the year, returning to Barrow only on special occasions, if at all (Sonnenfeld 1956:457). While many Inupiat left Barrow to trap, the economic depression of the 1930s forced yet more Inupiat to leave for the greater security of the bush. In 1936, Fur Trade Review reported that:

> Most of the Eskimo population of Point Barrow abandoned the village and moved families and belongings about 150 miles into the interior. There deposits of oil soaked peat may be obtained as fuel, and reindeer herds, abundant ptarmigan, rabbits, and fresh water fish offer food ..." (quoted in Sonnenfeld 1956:344).

Trapping also cut into subsistence activity, as whaling had not (Sonnenfeld 1956:344). The major trapping seasons were November to December and April to May which were also the periods of early and mid-winter sealing and late winter and early spring caribou hunting. However, by dispersing into winter camps Inupiat subsistence became more diversified. More fish were available in inland rivers than at Barrow, as were caribou. Seals were also more plentiful along the coast east of Barrow than at Barrow proper (Sonnenfeld 1956:345).

Post World War II Development: 1946 - 1960

Following the depression of 1929-30, trapping became uneconomical and people returned to a basic dependence on sea mammals and "living off the land" (Spencer 1959:361). Cash was generated through the production of crafts, encouraged by the Bureau of Indian Affairs, as well as an assortment of government transfer payments including old age pensions, general relief and Aid for Dependent Children allotments (Chance 1990:45). In addition, employment became available to a handful of people through the school and U.S. post office in Barrow (ibid). Developments after World War II, however, provided a stimulus that created long-term wage employment for many Barrow Inupiat. In 1944, the U.S. Navy began exploring for oil in the Naval Petroleum Reserve IV (PET IV) north

of the Brooks Range. A construction camp was set up in the vicinity of Barrow in 1946 and 35 Inupiat were initially hired (Spencer 1959:363). From 1946 to 1952 an average of 75 to 80 Inupiat were seasonally employed in a variety of capacities earning salaries as high as $6,000 a year (Chance 1966:17). The availability of wage labor led to the development of several new services in Barrow, including a movie theater, coffee shops, and stores (Spencer 1959: 363). While wages went to support the new services, Inupiat also spent money on meat brought in by hunters not engaged in wage employment (Spencer 1959:358).

In the years following the Navy's exploration, several other government projects were begun in Barrow, including construction of the Naval Arctic Research Laboratory (NARL) and the Distant Early Warning site (DEW line), both of which employed Inupiat. Eskimos were also hired by the Federal Aviation Agency (FAA) and the Weather Bureau (Chance 1966:17). As a result of these employment opportunities large numbers of inland and coastal Inupiat were attracted to Barrow, decreasing the size of smaller communities like Atqasuk (Spencer 1959:4). As a consequence, the population of Barrow more than tripled from 336 in 1939 to 951 in 1950 (ISER n.d.:17). Smaller villages, like Atqasuk and Nuiqsut, continued to be used seasonally until after the passage of the Alaska Native Claims Settlement Act (ANCSA) when they were reinhabited.

Barrow Subsistence in the 1950s

Despite transformations created in Inupiat culture by their involvement in the entrepreneurially oriented enterprises of commercial whaling, fur trapping, reindeer herding and wage employment, Inupiat subsistence patterns were not greatly altered between the 1850s and the 1950s (Spencer 1959:358; Sonnenfeld 1956:417). In the 20th century, as in the 19th century, Inupiat subsistence activity was focused primarily on the harvest of sea mammals and secondarily on the harvest of land mammals, followed by fowl and fish.

As in the past, spring bowhead hunting was, without question, the major preoccupation (Spencer 1959:369). Whaling began in mid-April and lasted until June. After the first of June, some whaling crews cooperated in hunting seals, especially the *ugruk* or bearded seal which, when caught, were divided equally among the crew. Any smaller seals caught at this time were the

property of the individual hunter (Spencer 1959:366). Sealing usually continued through July. Seals remained important to the Inupiat economy but by the turn of the century the use of firearms had altered some hunting techniques. *Maupok* or breathing hole hunting was largely replaced by hunting for seals with rifles along open leads. The use of harpoons declined and was replaced by the rifle and retrieving hooks used to hook the dead seal. A floating retriever was used for hooking seals shot during the winter while a sinking variety was used for seal shot in the summer. Inupiat continued to net seals under the ice (Sonnenfeld 1956:425).

July was a period of diverse but intense activity and the subsistence patterns of individual families varied considerably. Some people left the village to fish or hunt ducks while others began hunting walrus or caribou which now appeared on their respective migrations. According to Spencer, individual families also varied their subsistence strategies from year to year. One year a family might concentrate solely on fishing, then the next year combine fishing with hunting, while the following year only hunt (Spencer 1959:368). In the late 1940s and early 1950s another variable was added as some people chose to remain in the village to take advantage of seasonal wage employment (Spencer 1959:366).

Sonnenfeld reported that the role of fishing had varied since the period of commercial whaling. In the 19th century, late summer trading excursions to the Colville River and Barter Island detracted from fall fishing as did fall caribou hunting, which became easier with the rifle. On the other hand, the use of the rifle for caribou hunting drew people into the interior where fishing was good. While the men were out hunting the women fished. People who stayed in the interior to trap also came to rely on fish, more than in aboriginal times (Sonnenfeld 1956:448-449).

Although fish varied in importance to the subsistence economy, in the 1950s they were used in large numbers. Sonnenfeld (1956:450) reported that in 1949 and again in 1950, 1,500 sheefish were flown from Kotzebue to Barrow. In 1952, 10,000 pounds of fish, mainly whitefish, were flown to Barrow from a fish camp on the Colville River. Spencer (1959:367) reported that in 1952 women frequently prepared 1,500 pounds of whitefish which they stored in Barrow.

As in the past, fishing continued to be the occupation of women and children (Spencer 1959:367). Similarly, duck hunting was conducted mainly by older men who could not endure the strenuousness of big game hunting. Both ducks and fish were valuable, not only for food but for trade and as a commodity. Fish, especially, were sold through the Native Store which acted as an agent and paid cash for fish and other game (Spencer 1959:368).

Whaling crews occasionally remained together to hunt walrus which arrived with the breakup of the ice pack. Sonnenfeld thought walrus harvests continued to be variable in the 1950s because of the need for optimum environmental conditions but walrus were probably more important than in aboriginal times (Sonnenfeld 1956:431). In 1951, about 100 walrus were taken by Barrow people while in 1952 the number was less than 10. Approximately 60 walrus were taken the following year (ibid).

Caribou decreased in importance around the turn of the century, in large part because the herds had declined. As the herds revived during the 1930s and early 1940s, their meat was very much in demand (Sonnenfeld 1956:436), and Spencer believed that maritime people intensified their caribou hunting in the 1950s (Spencer 1959:367). However, the old communal methods of hunting gradually disappeared soon after the introduction of the rifle. In the 1950s, caribou were hunted intensively using boats on inland rivers and along the coast. Hunters either shot the animals from boats, stalked them on land, or attempted to herd them into the water where they could be easily killed. While the caribou were close to water, the hunters attempted to kill as many animals as possible before they moved into the interior. Caribou carcasses were butchered on the spot and the meat and hides transported back to the village.

In late August the preparations for fall whaling began. The start of the season varied because of the weather. In 1926, for instance, whales were taken at Barrow in early August, but in the 1950s the community waited until September or even October to take a whale, because of the weather (Spencer 1959:368).

During the 1950s the major tasks of early winter were cutting ice for storage as drinking water. During the winter, concentrated activity came to an end, although many men were employed throughout the winter in the 1950s. While the

religious rituals of the past were no longer practiced, winter continued to be a period of intense social activity realized in dances, visiting, community sponsored events, and church related activities. Winter was the time for individuals to hunt seals on the sea ice close to town, either by looking for seal breathing holes or setting nets under the ice for smaller seals. In November men who had been inland trapping or hunting caribou returned home. A few families left the community during the winter to fish on the inland ice using nets stretched under the ice (Spencer 1959:370).

The development of Barrow as a regional center, with its attendant employment opportunities, has shaped the subsistence patterns of contemporary Barrow Inupiat. Access to cash has enabled them to purchase subsistence related equipment and services that have, in turn, enabled Inupiat to exploit large diverse harvest areas (Alaska Consultants, Inc. [ACI] et al. 1984:510-511) and deal with the time constraints imposed by wage labor. For instance, Barrow Inupiat use snowmachines and outboard motors to hunt a wide variety of animals and some people fly to and from inland fish camps. Additionally, because such innovations have made hunting and fishing more efficient and less time consuming, a few key hunters and fishermen can provide, through redistribution, a substantial amount of meat to the community (ACI and SRB&A 1984:161-162).

Barrow Demographic Patterns and Household Characteristics

As mentioned previously, in 1852, two villages existed in the vicinity of present day Barrow, Nuvuk and Utqiagvik. Located directly on the point, Nuvuk had a population of 309 people and was particularly suited to hunting whales and seals. Utqiagvik, located further down the coast near present day Barrow, had a population of 250. At the time Simpson believed the population was in decline, noting that in the previous year 40 people had died at as a result of influenza while 27 people died in 1853-54, mainly from starvation (Simpson in Spencer 1959:15). By 1882, the population of Nuvuk had declined to 150 while that of Utqiagvik had fallen to 130 (Spencer 1984:326) (Table 2).

While disease decimated the indigenous population, the development of shore based whaling at Point Barrow, in 1884, brought an influx of both Inupiat and Yu'pik speaking people from other areas of Alaska, as well as a number of

TABLE 2: BARROW POPULATION FIGURES, 1852–1990

	Native	Non–Native	Total	Source
1852	Information unavailable		559 \a	Simpson in Spencer (1984)
1853	Information unavailable		282 \b	Simpson in Spencer (1984)
1880	Information unavailable		200 \c	Petroff (1884)
1882	Information unavailable		280 \d	Ray in Spencer (1984)
1890	Information unavailable		398 \e	Porter (1893)
1910	Information unavailable		446 \e	U.S. Dept. of Commerce (1913)
1920	Information unavailable		322 \e	U.S. Dept. of Commerce (1921)
1930	Information unavailable		330 \e	U.S. Dept. of Commerce (1932)
1939	Information unavailable		363 \e	U.S. Dept. of Commerce (1942)
1950	Information unavailable		951 \e	U.S. Dept. of Commerce (1952)
1960	Information unavailable		1,314 \e	U.S. Dept. of Commerce (1961)
1970	1,901	199	2,104 \e	U.S. Dept. of Commerce (1972) and Worl & Smythe (1985)
1980	1,720	487	2,207 \e	U.S. Dept. of Commerce (1981)
1988	2,133	1,191	3,379 \e,g	N.S.B. Dept. of Planning and Community Services (1989)
1990	2,217	1,352	3,469 \e,h	Alaska Department of Labor (1991)

a. Represents the combined populations of Nuvuk and Utqiagvik.
b. Represents the population of Utqiagvik only.
c. Represents the combined population on Nuvuk and Utqiagvik.
d. Represents the combined population of Utqiagvik and Barrow.
e. Represents the population of Barrow.
f. Includes Inupiat, Other Alaska Natives and American Indian.
g. This total includes 44 missing observations, plus 11 not ascertained, none of which are included in the ethnic breakdowns.
h. 3,469 is the total given by the Alaska Department of Labor.

Source: Stephen R. Braund & Associates, 1993

permanent non-Native residents. As a result, in 1890 the combined population of Point Barrow (152) and Cape Smythe, or Utqiagvik (246), equaled 389 persons (Porter 1893). During the peak years of 1890 to 1900, 400 to 500 people were engaged in shore based whaling at Barrow (cf. Bockstoce 1986:236-239). By the end of the whaling boom in 1910, and despite a measles epidemic which killed 100 people in 1902, the population of Barrow was 446 inhabitants. At this point the demographic pattern was reversed.

When the demand for baleen stopped, the Inupiat turned from commercial whaling to commercial fur trapping. This required that trappers and their families leave Barrow for camps located in the interior. Under these circumstances the population of Barrow declined between 1910 and 1920 from 446 to 322 and remained basically static over the next two decades as Inupiat came to Barrow only occasionally. However, at the conclusion of World War II the demographic pattern again shifted as the government initiated defense related projects that provided employment and attracted Inupiat from outlying villages. As a consequence, between 1939 and 1950 the population of Barrow increased from 363 to 951 as the town became the regional center for the Arctic slope (Table 2).

Between 1970 and 1979 two processes occurred: the Inupiat population of Barrow declined, and the non-Inupiat population increased substantially (Worl and Smythe 1985:187). The decline in the Native population was a consequence of re-establishing the communities of Atqasuk, Nuiqsut and Point Lay which drew Inupiat away from Barrow (ibid). At the same time, economic opportunities created by the North Slope Borough and Arctic Slope Regional Corporation attracted non-Natives who often became permanent residents (ACI and SRB&A 1984:476; Worl and Smythe 1985:189). In addition, these new arrivals were of diverse ethnic backgrounds: Filipinos, Koreans, Mexicans, Yugoslavians (Worl and Smythe 1985:193). The 1988 NSB census indicated that out of a total population of 3,379 people, 2,048 or 61.4 percent, were Inupiat, 25 percent were Caucasian, 5.2 percent Filipino, 1.6 percent other Alaska Native, 1.4 percent Black, 0.9 percent Hispanic and 0.7 percent Orientals (Table 3).

In 1988, 34 percent of the Barrow population was under the age of 16. Both sexes were represented relatively evenly in the total Inupiat population. The

TABLE 3: ETHNIC COMPOSITION OF BARROW POPULATION, 1988

ETHNIC CATEGORY	POPULATION Male	Female	Total	Percent
Inupiat	1,007	1,041	2,048	61.4%
White	482	351	833	25.0%
Filipino	86	89	175	5.2%
Other AK Native	27	28	55	1.6%
Black	28	18	46	1.4%
American Indian	19	11	30	0.9%
Hispanic	18	13	31	0.9%
Oriental	8	16	24	0.7%
Other	50	32	82	2.5%
Not Ascertained	9	2	11	0.3%
TOTAL:	1,734	1,601	3,335	100.0%
PERCENT:	52.0%	48.0%	100.0%	
Number of Missing Observations:			44	
TOTAL POPULATION:			3,379	

Source: NSB Department of Planning & Community Services 1989
Stephen R. Braund & Associates, 1993

non-Inupiat population was disproportionately male (57 percent) and middle aged, with 27 percent of the population 26 to 39 years old (Table 4).

Of the 1,031 Barrow households in 1988, 557 were headed by an Inupiat or someone married to an Inupiat (Table 5). (This definition of an Inupiat household, i.e., one in which the head of household or spouse is Inupiat, is used throughout this report. The NSB also used this definition in its analysis of 1988 census data - NSB Department of Planning & Community Services 1989:II-2.) An average of almost four people (3.9) lived in each Inupiat household. Due to the larger size of most Inupiat households, non-Inupiat households constituted a larger proportion of all Barrow households (46 percent) than the non-Inupiat population constituted of the total Barrow population (39 percent).

Inupiat and non-Inupiat employment characteristics contrast similarly to Inupiat and non-Inupiat population characteristics. On average, Inupiat residents 16 years or older were employed 6.8 months annually compared with 10 months for non-Inupiat.

SPECIES HARVESTED IN THE BARROW AREA

People lived in this area long before commercial whaling or any other cash economy came to the region. Harvesting the local resources was the sole economy at one time. The establishment of a whaling station, trading post, schools and other subsequent institutions encouraged people to settle into a community, although seasonal migration to whaling camps, waterfowl hunting camps, and fish camps persisted, as did other subsistence pursuits. In the three years of this study, from 1987 to 1990, Barrow residents harvested at least 46 species of fish, birds, and marine and terrestrial mammals, as well as berries, greens, water and ice. While the people of Barrow were largely integrated into a cash economy by this time, the Barrow area offers an abundant diversity of resources and traditional subsistence activity remained a fundamental component of the local economy and the local Inupiat culture.

All the species harvested and recorded by this study in Years One, Two and Three are displayed in Table 6. It is possible that Barrow residents harvested additional resources during the study period that were not reported during

TABLE 4: BARROW POPULATION CHARACTERISTICS, 1988

AGE	INUPIAT Male	INUPIAT Female	INUPIAT Both	NON-INUPIAT Male	NON-INUPIAT Female	NON-INUPIAT Both	TOTAL	%
Under 4	132	141	273	59	42	101	374	12%
4-8	131	132	263	50	43	93	356	11%
9-15	109	117	226	64	48	112	338	11%
16-17	30	39	69	19	13	32	101	3%
18-25	137	130	267	58	69	127	394	12%
26-39	195	230	425	246	190	436	861	27%
40-59	138	126	264	186	127	313	577	18%
60-65	30	24	54	11	7	18	72	2%
66 and up	38	48	86	6	3	9	95	3%
Subtotal	940	987	1,927	699	542	1,241	3,168	100%
Number of Missing Observations:							211	
TOTAL POPULATION:							3,379	

Source: NSB Department of Planning & Community Services 1989
Stephen R. Braund & Associates, 1993

TABLE 5: BARROW HOUSEHOLD CHARACTERISTICS BY ETHNICITY, 1988

	Number of Households	Percentage of Households	Mean House-hold Size	Mean No. Months Employed Per Individual \1
Inupiat	557	54%	3.9	6.8
Non-Inupiat	474	46%	2.6	10.0
Overall	1,031	100%	3.3	8.2

1. Unpublished data provided to SRB&A by NSB Planning Department.

Source: NSB Department of Planning & Community Services 1989
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TABLE 6: SPECIES HARVESTED BY BARROW STUDY SAMPLE APRIL 1987 - MARCH 1990

Species	Inupiaq Name	Scientific Name
Marine Mammals		
Bearded seal	*Ugruk*	Erignathus barbatus
Ringed seal	*Natchiq*	Phoca hispida
Spotted seal	*Qasigiaq*	Phoca largha
Ribbon seal	*Qaigulik*	Phoca fasciata
Bowhead whale	*Agviq*	Balaena mysticetus
Polar bear	*Nanuq*	Ursus maritimus
Walrus	*Aiviq*	Odobenus rosmarus
Terrestrial Mammals		
Caribou	*Tuttu*	Rangifer tarandus
Moose	*Tuttuvak*	Alces alces
Brown bear	*Aklaq*	Ursus arctos
Dall sheep	*Imnaiq*	Ovis dalli
Arctic fox (Blue)	*Tigiganniaq*	Alopex lagopus
Red fox (Cross, Silver)	*Kayuqtuq*	Vulpes fulva
Porcupine	*Qinagluk*	Erethizon dorsatum
Ground squirrel	*Siksrik*	Spermophilus parryii
Wolverine	*Qavvik*	Gulo gulo
Fish		
Salmon (non-specified)		
Chum salmon	*Iqalugruaq*	Oncorhynchus keta
Pink (humpback) salmon	*Amaqtuuq*	Oncorhynchus gorbuscha
Silver (coho) salmon	*Iqalugruaq*	Oncorhynchus kisutch
King (chinook) salmon		Oncorhynchus tshawytscha
Whitefish (non-specified)	*Aanaakliq*	Coregonus sp.
Round whitefish	*Aanaakliq*	Prosopium cylindraceum
Broad whitefish	*Aanaakliq*	Coregonus nasus
River caught	*Aanaakliq*	Coregonus nasus
Lake caught	*Aanaakliq*	Coregonus nasus
Humpback whitefish	*Pikuktuuq*	Coregonus clupeaformis
Least cisco	*Iqalusaaq*	Coregonus sardinella
Bering, Arctic cisco	*Qaaktaq*	Coregonus autumnalis
Other Freshwater Fish		
Arctic grayling	*Sulukpaugaq*	Thymallus arcticus
Arctic char	*Iqalukpik*	Salvelinus alpinus
Burbot (Ling cod)	*Tittaaliq*	Lota lota
Lake trout	*Iqaluaqpak*	Salvelinus namaycush
Northern pike	*Siulik*	Esox lucius
Other Coastal Fish		
Capelin	*Pagmaksraq*	Mallotus villosus
Rainbow smelt	*Ilhuagniq*	Osmerus mordax
Arctic cod	*Iqalugaq*	Boreogadus saida
Tomcod	*Uugaq*	Eleginus gracilis

TABLE 6 (cont.): SPECIES HARVESTED BY BARROW STUDY SAMPLE, APRIL 1987 - MARCH 1990

Species	Inupiaq Name	Scientific Name
Birds		
Eider (non-specified)		
Common eider	*Amauligruaq*	Somateria mollissima
King eider	*Qinalik*	Somateria spectabilis
Spectacled eider	*Tuutalluk*	Somateria fischeri
Steller's eider	*Igniqauqtuq*	Polysticta stelleri
Other Ducks (non-specified)	*Qaugak*	
Oldsquaw	*Aaqhaaliq*	Clangula hyemalis
Surf scoter	*Aviluktuq*	Melanitta perspicillata
Red throated loon	*Qaqsraupiagruk*	Gavia stellata
Goose (non-specified)	*Nigliq*	
Brant	*Niglingaq*	Branta bernicla n.
White-fronted goose	*Niglivialuk*	Anser albifrons
Snow goose	*Kanuq*	Chen caerulescens
Canada goose	*Iqsragutilik*	Branta canadensis
Ptarmigan (non-specified)	*Aqargiq*	Lagopus sp.
Willow ptarmigan	*Nasaullik*	Lagopus lagopus
Other Resources		
Clams	*Imaniq*	
Berries (non-specified)		
Blueberry	*Asiaq*	Vaccinium uliginosum
Cranberry	*Kimminnaq*	Vaccinium vitis-idaea
Salmonberry	*Aqpik*	Rubus spectabilis
Bird Eggs (non-specified)	*Mannik*	
Eider eggs		
Greens/Roots (non-specified)		
Wild rhubarb	*Qunulliq*	Oxyric digyna
Wild chives	*Quagaq*	Allium schoenoprasum
Water		
Fresh water	*Imiq*	
Fresh water ice	*Sikutaq*	
Sea ice	*Siku*	

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harvest discussions. The study team has found in both Barrow and Wainwright that, particularly with "small" or incidental resources such as plants or bird eggs, or occasionally ducks, ptarmigan, or fish, respondents may have forgotten to report these harvests unless the interviewer asked about them specifically. A complete list of resources known to have been harvested historically by Barrow residents is found in Table D-4 (Appendix D).

In some instances, the researchers were not able to record each successful subsistence harvest by individual species. This problem occurred most commonly for those species harvested in mixed groups (e.g., various species of birds or fish). Thus, categories are included in the data tables for such non-specified reports, e.g., "non-specified duck" and "non-specified salmon." The recording of marine and terrestrial mammals, on the other hand, likely was more accurate. The harvest of larger animals was more memorable for most people, and respondents had no problem distinguishing one from the other. Further discussion of reporting and recording methods is found in the Methodology, Apppendix D.

Beluga whales have been harvested commonly in the past and reportedly a few belugas were harvested during the study period by Barrow residents. However, no beluga harvests were reported by Barrow study households. Wolves, one of the most desirable furbearers available to Barrow residents, reportedly have been scarce in the areas where they are usually hunted. Hunters scouting the foothills north of the Colville River reported a scarcity of tracks during the study. The study team learned of a few wolves being harvested by Barrow residents by households not in the study sample; however, no harvests were reported by participating households. Some of the smaller furbearers (e.g., marmot and ermine) were also absent from the harvest reports and were likely harvested in very small numbers if at all.

The fish species harvested include essentially all species available to Barrow residents except arctic flounder and blackfish. Arctic and Bering cisco are grouped together for this study and, in fact, differentiation of the two is often difficult without dissecting the fish.

A variety of bird species available to Barrow residents were not recorded in Year One or Year Two. Respondents often noted duck, eider, and geese harvests

at a generic level, e.g., "eiders" or "geese." Further probing sometimes led to a finer level of distinction between species, but often the species breakdown was a best guess. Of the six or more duck species (other than eiders), only oldsquaw and surf scoter were reported individually. All other duck species were reported generically as a "duck" harvest. Other unrecorded species included several loon species and owls.

Resources presented in Table 6 in the "other species" category elicited the least specific responses. Harvest of these species was often forgotten unless the researcher specifically asked about them. Greens, roots and berries were often harvested and consumed while at inland camps.

AREAL EXTENT OF SUBSISTENCE LAND USE

This section presents a brief introduction to the areal extent of Barrow subsistence during the three year study period. An overview of the methods used to map subsistence harvests and produce the maps is presented here (and also, in more detail, in the Methodology) so that the reader may better understand the maps included in the report. This overview of mapping methods is followed by a description of the general harvest area and a discussion of the community's use of cabins and camps in pursuit of wild resources.

Review of Map Collection Procedures

The data presented on all maps in this report only include the locations of successful harvests by the sample households and do not include the total area hunted nor the areas transited to reach hunting locations. During harvest discussions with study households, the hunter marked on a 1:250,000 scale map the location where each harvest occurred. Later, the NSB in Anchorage digitized (i.e., plotted) the mapped data points into the NSB's Geographic Information System (GIS), a computerized mapping system. The NSB GIS linked descriptive data to the mapped harvest points, allowing the NSB GIS to select and map a subset of digitized points based on the descriptive variable(s) selected. For example, by selecting only the species walrus and polar bear, and assigning a different symbol to represent each of those species, a map showing (and differentiating) all walrus and polar bear harvest locations can be produced. This

brief description greatly understates the amount of detailed work performed by NSB GIS staff in producing the many individual maps included in this report.

Map 2 illustrates Barrow harvest locations for the harvest of all species (undifferentiated) during Years One through Three combined. Barrow residents used a number of fixed camps for their harvest activities and visited scores of other areas in pursuit of mobile resources. The data presented on the maps are limited to the locations of successful harvests during Years One through Three; the data are also limited to the sample households. Thus, the maps do not illustrate the total area hunted. However, the study team's field experience indicates that the mapped harvests likely give a reasonable representation of the main harvest areas used in Years One through Three.

On most of the maps, individual harvest locations are depicted by a shaded circle. Each circle represents an actual harvest site surrounded by a two mile buffer. Overlapping circles form larger shaded areas. The two mile buffer serves three purposes. First, the depiction of harvest sites with a two mile buffer reflects an intent to include at least the immediate hunting area. Second, the use of a buffer also accounts for possible errors in reporting the exact location of harvest sites. Respondents reported the location of fish sites, for example, with certainty because those sites were identified easily by the geographic features of the lake or river. Other harvest sites with distinct geographic features were reported with a high degree of accuracy as well, evidenced by the respondent's ease and confidence in mapping the location. On the other hand, harvests of marine mammals or birds from boats offshore, for example, or of caribou out in the open tundra, were reported typically as an approximate location but recorded as one point on the map representing the respondent's best estimate of the exact harvest site. The lack of geographic landmarks reduced the precision with which the hunter could locate some harvest sites on a map. Third, the buffer is used to enhance the visual effectiveness of the data presented on the maps, particularly where distinct categories of data must be differentiated. Symbols as well as smaller buffers were tested as alternatives, but did not represent the data clearly, especially where harvests of multiple species overlapped (e.g., Map 4 on page 72).

MAP 2
NORTH SLOPE SUBSISTENCE STUDY - BARROW
SUBSISTENCE HARVEST SITES, YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study. Lifetime-community harvest areas, collected in the form of map biographies from 20 households (Pedersen 1979), are also illustrated.

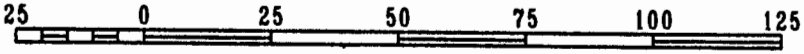
Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska.

LEGEND INFORMATION

Lifetime community land use (Pedersen 1979).

All Species Harvested

Seals, walrus, polar bear, bowhead whale, caribou, moose, brown bear, fox, wolverine, other terrestrial mammals, fish, geese, eiders, other ducks, loons, ptarmigan, cranes, swans, eggs, clams, berries, greens, water



Map Production: North Slope Borough GIS

Date: April 08, 1991

The maps indicate where one or more harvest event occurred. A harvest site may represent one harvest event during which one animal was harvested, or it could represent any number and variety of animals harvested on different dates and by different households, all in the same location. Hence, the sites as presented do not represent the number of harvest events or the pounds of usable resource product or number of animals harvested at each site. However, different species or species groups harvested in the same location would be indicated by one symbol (representing one species or species group) superimposed over another. (An example of a species group is eiders, which includes four individual species of eiders.)

The approach taken in reporting harvest location data differs from that of harvest amounts in three ways. First, map location data are reported for all sample households providing information in any study year. In contrast, community harvest amounts are based on reports only from households that participated in all three study years. In the course of collecting harvest data (i.e., location and amount) throughout the study year, field interviewers contacted all households in the study. At the end of the year, those households who were interviewed only part of the year (e.g., because they moved from Barrow) were dropped from the data base. However, their mapped harvest locations remained in the GIS system. Because of the large variability in harvest sites, the study team believed that maximum representation of harvest sites was desirable. Consequently, the number of households represented in the harvest maps is slightly larger in each year than the number of sample households upon which the community harvest amounts were based, as the Table 7 summarizes. The numbers of households listed below include both harvesters and non-harvesters.

TABLE 7: NUMBER OF HOUSEHOLDS REPRESENTED IN HARVEST DATA AND MAPPED DATA

	Number of Households Sampled for Weighted Numeric Data	Number of Households Represented in Maps
Year One	101	125
Year Two	101	117
Year Three	101	107
All Three Years Combined	101	125

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Second, map data are not weighted to take into account different probabilities of selection and different response rates as in the case of harvest amounts, whereas harvest data are weighted to represent the entire community. Third, map data for Years One, Two and Three have been combined as a cumulative total rather than as a cumulative average.

The basis for all three differences in the reporting of data on harvest locations and amounts is the greater variability in harvest locations. Individual harvesters, including those who harvest about the same amount, tend to hunt and fish in different locations. They become familiar with different areas and establish camp or cabin sites, returning to the same area year after year, thereby preserving differences in hunting and fishing locations.

The reliability of harvest location estimates is subject to the same principles of sampling theory as the reliability of harvest amount estimates. In both instances, reliability is a function of the variability in the characteristics (i.e., harvest location or harvest amount) and of the size of the sample. Since the location of harvest activities is more variable than the amount harvested, the reliability of harvest location data is lower. The research team therefore decided to restrict the reporting of map data to a graphic representation of the actual harvest sites reported by household contacts (i.e., the "raw" data) without using the sample weights to show that some harvest sites represent harvest patterns of more households than other harvest sites. The reader can easily draw interim conclusions about the areas most heavily used for harvest activities by visually identifying those areas with the highest concentration of reported harvest sites. Under contract with the NSB, SRB&A conducted a mapping project with active harvesters and other persons knowledgeable about subsistence including many active hunters not in the MMS study. The study team reviewed study maps of the three years' mapped harvest data with 21 active harvesters and other persons knowledgeable about subsistence. Seventeen of the 21 hunters were not in the MMS study. In that review process, people indicated that the data mapped from the sample households looked reasonably representative of the entire community's main harvest area for the three study years.

In combination with the harvest locations, many of the maps show a lifetime community land use perimeter line (Map 2). This line represents the aggregation

(along the outer limits reported) of map biographies collected from 20 Barrow individuals for the University of Alaska Fairbanks Cooperative Park Studies Unit and the NSB (Pedersen 1979). Pedersen noted that because the data are from a sample of hunters, the data understate land use for Barrow as a whole. However, he sought individuals who had been hunting a long time (i.e., older hunters) and who were known to range widely in their subsistence efforts to minimize the degree of understatement in the documentation of lifetime use areas. Although a nomadic way of life preceded the settlement of Inupiat families into villages, these maps represent village-centered use areas only; Pedersen excluded periods of nomadism from this database. He sought village participation in the development and review of the aggregated maps (Pedersen 1979). Based on the review process (showing the lifetime use area lines to a number of hunters who were not in the sample), Pedersen concluded that the line was representative of the normal maximum use area limit as of 1978 (S. Pedersen, personal communication). These lifetime use data are included to demonstrate how the areas hunted over several decades (up to 1978) may differ from the area of successful harvests in a three year period in the late 1980s.

Geographic features are not named on Maps 2 through 18 due to the need to present harvest data as clearly as possible. Geographic features can be identified by consulting Map 1 in combination with the harvest data maps.

Overview of Current Subsistence Land Use by Barrow Residents

As described in the Introduction, the Barrow area offers tremendous opportunities for local hunters. The following section discusses current geographic aspects of subsistence hunting and fishing in the Barrow area generalized from data collection and field observations during Years One, Two and Three of this study. The reader is referred to Maps 1 and 2 (pages 7 and 43 respectively) in conjunction with this section.

The Ocean Environment

The community of Barrow is situated on the Chukchi Sea coast approximately 7.5 miles southwest of Point Barrow, the most northerly point in the United States (Map 1). Point Barrow is the boundary between the Chukchi Sea to the west and

the Beaufort Sea to the east. With access to two seas, the unique marine environment near Barrow provides local residents with excellent hunting opportunities for most of the mammals, birds, and fish that inhabit or migrate through the Arctic region. The mixing of the Chukchi Sea and Beaufort Sea currents in the vicinity of the point results in frequent openings in the ice throughout the winter and spring, providing access to ringed seals in the middle of the winter. During field interviews, hunters indicated to the study team that after a strong wind blows from the east, they look for a channel of open water (an open lead) on the west side of the point where they will go to hunt ringed seals; conversely, a strong blow from the west can be expected to form an open lead on the east side of the point.

Beginning in March or April, an open lead forms within three to 10 miles from shore. At this time, whalers cut snowmachine trails to the lead edge on the Chukchi side of the point, where they make camp to await the migrating bowheads. During a lull in the bowhead migration, or if the ice closes up temporarily, the whalers also pursue eiders, ringed seals and the occasional bearded seal, walrus or beluga whale. Polar bears are commonly encountered out on the ice during whaling, and occasionally harvested.

Later, when the shorefast ice is gone (typically July through September or October), Barrow people travel by boat to the drifting ice floes where walrus, bearded seals and ringed seals feed and rest on the ice. The majority of the walrus and seals migrate past Barrow in the early part of the summer during the breakup of the ocean ice. Later, onshore winds and shifting currents periodically bring the moving pack ice and the associated walrus, bearded seals and ringed seals to within hunting range of Barrow residents. When the ice is not near Barrow, some people travel as far offshore as 60 miles in pursuit of marine mammals during the summer boating season (field interviews). Experienced ocean travelers typically ventured out from the coast to a distance of 25 to 30 miles, primarily in search of the bowhead whale during fall migration and while hunting walrus and bearded seal in the summer.

In September and October, whaling crews again assemble in an effort to intercept bowhead whales migrating south for the winter. The ocean is ice-free at this time and crews do not set up camps, but rather leave from Barrow or

Elson Lagoon by boat to search the Beaufort Sea. After the bowhead migration tapers off and the ocean begins to freeze up, ocean hunting diminishes considerably until spring bowhead whaling, with the exception of winter seal hunting at open leads in the ice.

The Coastal Environment

Hunters travel along the coast in either direction from Barrow, traditionally hunting as far as Wainwright to the southwest and the Colville River delta to the southeast (lifetime community land use area on Map 2). The majority of the travel during the study period, however, occurred between Peard Bay to the southwest and Admiralty Bay to the southeast. Barrow residents used the coastal environment extensively throughout the summer and fall and, to a lesser extent, in the winter and spring. In the summer, caribou can be found along the coast seeking escape from insects in the cool ocean breezes, and hunters often travel the coastline to hunt these animals. Boaters will travel the coast to reach a cabin or campsite, or sometimes they simply go out for the day to hunt or to picnic with the family.

From spring to fall, the coast provides an advantageous position for hunting migrating waterfowl. Likely the most important waterfowl hunting area for Barrow residents is *Pigniq*, also called the "shooting station." *Pigniq* is on the road to the point a few miles north of Barrow, and is situated on a narrow strip of land with the Chukchi Sea to the west and Elson Lagoon to the east. People have duck hunting blinds there, and some people also have cabins. *Pigniq* is accessible enough from Barrow by car or all terrain vehicle (ATV) that many hunters go there in the evenings after work to hunt birds or check their fishnets that they set in the lagoon.

In the late fall, people often find polar bears along the coast between Walakpa Bay and Point Barrow. Whether hunted specifically or encountered incidentally, several polar bears are usually taken each fall along this section of coast.

The Inland Environment

Barrow residents travel inland throughout all seasons in pursuit of a variety of subsistence resources. In the winter, hunters travel by snowmachine inland to hunt caribou and furbearing mammals such as wolf, wolverine and fox. During the study the most experienced hunters traveled over 150 miles to the headwaters of the Meade and Ikpikpuk rivers, and sometimes to the Colville River and points farther south, in search of furbearers inhabiting the more mountainous terrain (field interviews). In the spring, white-fronted geese along with brants, Canada and snow geese migrate overland to their summer nesting grounds. Hunters make special trips inland to cabins or camps where they hunt their year's supply of these birds in about a two week period. In the summer and fall, people boat up various river drainages, mainly the Inaru, Meade, Topagoruk, Chipp and Ikpikpuk rivers, to cabins and camps for hunting caribou, picking berries, and catching fish.

Four major rivers and numerous streams and lakes can be reached within four to eight hours by boat or snowmachine, providing access to the inland resources. For example, the Meade River is a four hour snowmachine or boat trip from Barrow. Peard Bay (an access point for inland travel), Atqasuk, the central portion of the Chipp and Ikpikpuk rivers, and Teshekpuk Lake can all be reached from Barrow in less than a day. Seasonal conditions can drastically alter travel times and an intimate knowledge of the environment is required to exploit the inland areas safely and successfully.

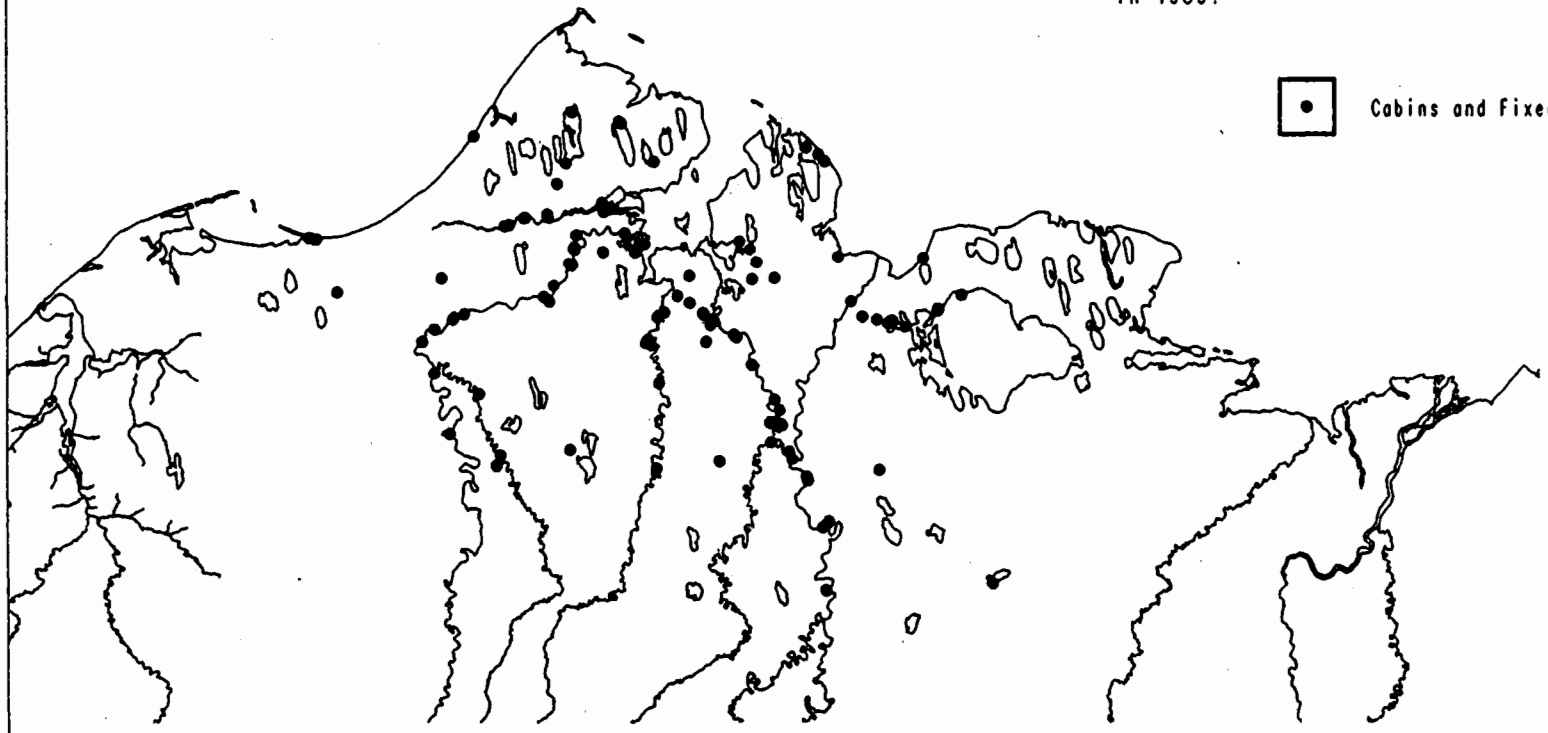
Fixed Cabins and Camps

The locations of most of the cabins owned by Barrow residents are shown on Map 3, Cabin and Fixed Camp Locations. These sites represent only those locations where a cabin is standing or which has a history of long-term use as a camping site (i.e., fixed camp locations), and by no means represent all the camping sites used by Barrow families. During the study period, Barrow residents' coastal cabins and camps were situated westerly to Peard Bay and easterly to Cape Simpson, Smith Bay, and the Teshekpuk Lake area. Most families visited their cabins each year and the area within the vicinity of the cabin was typically the focus of many of their subsistence activities. When viewed in

MAP 3
NORTH SLOPE SUBSISTENCE STUDY - BARROW
CABIN AND FIXED CAMP LOCATIONS

This map displays the locations of fixed hunting and fishing camps used by Barrow residents. The locations of many temporary subsistence camps are not shown.

Source: Data compiled by Worl and Smythe (1986) and updated by the North Slope Borough Planning Department in 1989.



Map Production: North Slope Borough GIS

Date: April 11, 1991

relation to Maps 2 through 5, the cabin locations closely correspond with most of the successful harvest locations.

Many of Barrow's older residents spent their younger years traveling to favored locations for harvesting subsistence resources. These early North Slope families constructed sod and driftwood shelters at the places they returned to year after year and used caribou skin tents in other locations. While some of these old camping sites and structures sit abandoned on the tundra, others now have plywood cabins built nearby or on top of the old site, an indicator that these locations continue to provide good access to plentiful fish and game. Thus, the traditionally used hunting area surrounding Barrow is dotted with small plywood cabins, usually occurring singly. Most of these cabins were built within the last 30 years to serve as permanent shelters on the camping or cabin sites traditionally used by the builder's parents and grandparents.

Although the cabins are scattered throughout the coastal and interior region around Barrow, those most heavily used lie in the central region between Peard Bay, Teshekpuk Lake, and the upper Ikpikpuk River drainage (Map 3). (Some of the more distant cabins were no longer used by Barrow residents because, according to some people, those cabins were too difficult to reach by boat in the summer due to shallow water. Also, the round trip consumed considerable fuel, thereby making the trip especially expensive.) The more distant cabins in the upper Chipp/Ikpikpuk drainage were used less often. One family used their cabin in this area for fall fishing by flying in and out, and sometimes during the winter as a base camp from which to launch their search for wolf, wolverine and fox. The use of cabins in this area tended to be limited to those traveling the tundra and foothills in search of furbearers, with the cabins serving as pre-determined nightly stopping points.

Generally, Barrow residents used their cabins throughout the year for a variety of purposes, including geese hunting, fishing, caribou hunting, berry picking and as bases for furbearer hunting trips. In some cases, the family cabin was well suited to harvesting fish, caribou and berries but not geese. Typically those who did not have a cabin near their preferred geese hunting location took a canvas wall tent to use during their annual geese hunting trips. In this

manner, traditional camping locations (or "fixed camps") have become established over time for pursuing resources not available at the cabin sites.

Families enjoyed spending time at their cabins, sometimes with an entire extended family staying together in a single cabin. For some families, their cabin was like a second home, and they spent up to seven months there with occasional trips back to town for additional supplies.

When a variety of age groups from a family participated in an extended camping trip, like with spring waterfowl hunting or summer and fall fishing and caribou hunting, a cabin helped to make the trip more comfortable and enjoyable by providing safe and convenient shelter. On these trips the cabin served as a focal point, with the hunting area used radiating outward. The cabins and fixed camping sites also served as a form of base camp from which hunters could access a larger area more easily than if they had to return to Barrow each night.

Most families had only one cabin, but some individuals had more than one. In these cases, one cabin was used more than the other, either due to the location's better subsistence productivity or its accessibility. For example, one family had a cabin on the lower portion of the Chipp River which they mostly used for fishing and for caribou and geese hunting, and another cabin located in the upper Chipp/Ikpikpuk river drainage which they also used for fishing and caribou hunting and as a base for furbearer hunting.

Although cabins were owned by an individual or a family, the use of the cabin generally was shared among members of the extended family. In addition, many people used friends' or relatives' cabins when out traveling around the country for extended periods when they would cover a lot of territory beyond the reach of their own cabin. Thus, while not all Barrow residents had a cabin, most had access to the use of one through some family or sharing connection. Finally, for the most part it remained acceptable to use anybody's cabin in the case of an emergency, as long as the supplies that were used were replenished.

A total of about 80 to 90 cabins belonged to Barrow families in 1990, although some of these cabins were no longer used. Now that the children of these families with cabins were getting older (e.g., in their 40s) and had their own

families with whom they wished to go camping, some new cabins were being built or at least planned. The process of building a new cabin was slow since all the building materials and supplies had to be hauled to the site either by boat or snowmachine, or by chartering a plane.

Both the old abandoned structures and the currently utilized cabins served as important navigational aides. The major snowmachine and river transportation routes went from cabin to cabin, with the cabins providing geographical landmarks and rest stops. Many hunters identified successful harvest locations and transportation routes in reference to whose cabin it was near. Cabins were especially important for navigation during furbearer hunting trips, which required traveling long distances over extended periods of time in open country with few geographic features or sheltered places. The cabins were an important network of support bases for those hunters covering an extensive area. Most of the cabins were well stocked with food, supplies, gear, fuel, generators, propane for stoves, and other basic necessities. With each trip, additional supplies for immediate use and consumption were brought along.

In short, cabins were an important element of the subsistence lifestyle for Barrow residents during this study. Cabins provided a base for better access to resources. Additionally, the act of leaving town and staying out on the land for several days or weeks allowed for uninterrupted concentration on subsistence harvests only. The use of cabins in productive habitats was a strong tradition stemming from the predominant lifestyle prior to the establishment of the town of Barrow, and continued to provide an important opportunity for children to learn and begin using subsistence skills.

THE SEASONAL ROUND

In the following section, a month by month description of subsistence activities documents Barrow resident's annual subsistence cycle. This general description of the yearly cycle or "seasonal round" emphasizes environmental, social, and cultural factors that can affect or are otherwise related to Barrow's subsistence harvest activities.

APRIL

During the spring, most subsistence activity is focused on hunting bowhead whales. In late March or early April, whaling crews begin preparations by checking their equipment and the condition of their *umiat* or skin boats. Provisions for the hunt are secured by the captain, or a member of the crew, who travels inland to retrieve dried caribou and fish stored at fish camp the previous year. In addition, hunters try and harvest one or two caribou for fresh meat.

To move their boats to open water, whaling crews build trails on the sea ice, chipping them out by hand when necessary. The length of these trails varies depending upon ice conditions and the location of an open lead. Once the trails are cleared, crew members establish camps at the edge of a lead and wait for the whales as they follow the open water in their northward migration. Whaling begins in earnest about mid-April.

MAY

Bowhead hunting can continue through the month of May depending on the condition of the lead or whether Barrow hunters have struck and killed their allotted quota set by the International Whaling Commission (IWC). According to tradition, the first spring whale is distributed among all whaling crews whether or not they have established their camp on the ice yet. All whales thereafter are only shared among the crews that are camped on the ice and that actively participate in the harvest, towing, or butchering of the whale. Each crew sends one or two crew members to a landed whale to help butcher and to claim their crew's portion. Once a whale is caught, the successful whaling crew holds an open house at the captain's home, serving whale to all guests. This event is called *nigipqi* and takes place the day after the harvest.

As they hunt whales, crew members also hunt a number of other marine mammals such as seals and polar bears. Geese hunting also begins in early to mid-May, depending on whether ice and weather conditions continue to be favorable for whaling. To hunt geese, hunters travel inland where they might also kill an

occasional caribou to provide meat for camp. Hunters, however, usually refrain from taking caribou this time of year because fawning is imminent.

By the end of May breakup usually occurs, often causing travel conditions to deteriorate hindering subsistence activities.

JUNE

When a successful crew finishes whaling for the season (usually early June), they hold a "bringing up the boat" celebration, or *apugautituq*, on the beach in front of town. The captain's and crew's families serve fermented whale meat or *mikigaq*, soup, cake and tea to anyone who comes down to the beach.

Once the whaling season is over, usually in late May or early June, subsistence activities become diverse. Some hunters turn their attention to hunting seals and polar bears along the shorefast ice while others go inland to fish or hunt for waterfowl and caribou. Even though there is considerable daylight this time of year, hunting continues to be affected by weather conditions. For instance, unexpected rain combined with snow and warm temperatures can cause rapid snow melt making inland trails inaccessible or dangerous for snowmachine travel.

In June, geese camp is often a family affair as children and grandchildren are out of school for the year. The more active geese hunters average about two weeks in camp. One household in an extended family usually stays the entire period while other households stay for weekends only. Geese hunting locations are scattered throughout the Barrow hunting range, with the heaviest concentrations along the Meade, Topagoruk and Inaru rivers. To supplement their camp larder, geese hunters often take caribou and ptarmigan. Those hunting along the coast typically also harvest eiders.

June is also the month for *Nalukataq*, the whaling festival. To prepare for this event, hunters intensify their harvest activities to provide adequate meat for the festivities. In addition, women sew new parkas, parka covers and

mukluks. Men sew the blanket for the blanket toss which is prepared from the boat skins of successful whaling crews.

JULY

The emphasis in July is either on sea mammal hunting by boat in the open waters of the Beaufort and Chukchi seas, or on moving inland to fish camps located along the rivers. Weather, especially prevailing winds, affect the timing and intensity of sea mammal hunting for two reasons. First, shorefast ice not blown out to sea prevents hunters from launching their boats. Second, the pack ice must remain close enough to shore in order for the hunters to hunt safely. The leading edge of the pack ice is considered to be within an acceptable distance when it is visible from shore and not more than forty-five minutes away by boat. In the open water around the ice, hunters take ringed, spotted and bearded seals, as well as walrus which is the preferred choice this time of year.

Walrus hunting is particularly affected by ice conditions as the animals are most often found among the moving ice floes, and the hunters use the ice as a platform to butcher the walrus since a sectioned walrus is much easier to transport than when whole. In addition, many hunters plan their route in search of walrus according to the prevailing ocean current. By heading south after leaving Barrow, hunters anticipate that while butchering their harvest on the ice, the current will carry the ice, boat and crew toward Barrow. This is both an economical and safe practice. The return trip is shorter, which saves time and fuel, and an inattentive crew will float toward Barrow rather than out to sea.

Once the ice goes out in Elson Lagoon and Admiralty Bay, fish camps located on the Meade, Ikpikpuk and Chipp river drainages become accessible. Fish nets set in the lagoon and rivers yield whitefish, char, salmon, cisco and grayling. At the shooting station, or *Pigniq*, located at the base of Point Barrow, activity increases significantly as people combine eider hunting with fishing in the lagoon. Additionally, families who have cabins at *Pigniq* move out from town and camp there all summer, commuting into Barrow for work. Some families just spend weekends at their *Pigniq* cabins. By the end of July,

eiders begin their post-breeding, southwesterly migration. Flocks ranging in size from 50 to 200 birds fly over Point Barrow at fairly regular intervals making easy targets for Barrow hunters.

Caribou are only occasionally harvested at this time of year since they are considered too lean. Those harvested are most often taken by people at inland fish camps.

AUGUST

Depending on the weather and ice conditions, marine mammals, eiders, fish and caribou are all harvested in August. Bearded seals are harvested principally for their blubber which is rendered into oil while ringed seals are harvested mainly for their meat. (Bearded seal meat is also highly enjoyed as a food.) Walrus are hunted if the pack ice moves within an acceptable distance to Barrow. Depending on the water levels in the local rivers, fishing may be more successful one year than the next. High water brings debris, such as grass, forcing people to pull their nets. Fish usually harvested in August include whitefish, grayling, salmon, and capelin. If the weather turns warm, caribou move to the coast to escape the heat and bugs inland and are easily harvested by boat.

Two resources harvested particularly in August and early September are moose and berries. Moose are found mainly on the Colville River while berries (including salmonberries, blueberries and cranberries) are picked along the Meade and Inaru rivers and around Atqasuk. Some non-Natives fly to outlying areas such as the Colville to hunt moose and Dall sheep. August marks the end of the family camping season as school begins at the end of the month and children, as well as adults employed by the school, leave their hunting camps.

Fall bowhead whaling sometimes begins as early as mid-August if ice conditions are favorable and the pack ice remains offshore. (Otherwise fall whaling begins in September.) Usually, fewer people participate in fall whaling compared to spring whaling. In the first place, spring whaling marks the beginning of the subsistence year and the return of the migrating animals. Secondly, those captains and crew members with full-time jobs have limited

leave time in a year and tend to spend it during spring whaling. Third, fall whaling is conducted in motorized aluminum skiffs, which hold fewer people and require smaller crews to operate than the traditional *umiaq*. Additionally, in contrast to spring whaling, which is organized around the participation of formally structured crews, fall whaling crews are organized less formally. Many people use their own boats to help tow the whale or individually participate in butchering, instead of being a member of a large crew. Because of the lower participation in fall whaling, whale shares tend to be larger and many crew members choose to go fall whaling independent of their registered crew.

SEPTEMBER

While some people continue to hunt whales in September when conditions are favorable, other Barrow residents travel inland to harvest eiders, caribou, and fish. Under the most favorable conditions, travel into the interior takes place after freeze-up in mid- to late September so the hunters can travel to their camps by snowmachine. However, conditions are so variable in September that many people prefer to fly to camp so not to get stranded without a means of transportation home. Camps are usually located at good fishing places where grayling and whitefish tend to school as they move to their spawning areas. During these fall excursions inland, Barrow hunters take caribou bulls before the rut makes their meat inedible.

As the weather stabilizes and the lakes and rivers freeze, usually in late September, fishing with nets under the ice begins. Freezing weather also marks the beginning of snowmachine travel into the interior.

OCTOBER

Whaling can continue into October if ice conditions remain good and Barrow whalers have not fulfilled their IWC quota. Subsistence activities focused inland include fishing and hunting caribou. By October, the ice has usually frozen thick enough to provide the proper environmental conditions for the schooling of fish and for setting nets under the ice. Each fisherman usually sets one to four nets and checks them daily until camp is struck or they catch enough fish. Those fish most often caught include broad and humpback white-

fish, least cisco, and some trout taken from nearby lakes. Once the nets are set, the men hunt caribou. At camp, people also jig for grayling and burbot.

Fall caribou are desirable because of their high fat content and thick coats. Since bull caribou come into rut about the middle of October and their meat becomes inedible, hunters prefer either young males or females.

Along the coast, good ice conditions might develop that allow access to seals close to town. By the end of October, Elson lagoon usually freezes and the elderly residents of Barrow sit around ice holes patiently jigging their hooks for cod.

NOVEMBER

Winter weather begins in November as the temperatures dip below zero. With the cold weather, the landfast sea ice freezes solid enabling hunters to drag small boats to the edge of the ice to hunt bearded seals and other seals open water.

People who have remained inland hunt caribou if the animals are easily accessible; otherwise, they concentrate on fishing for grayling and burbot. Ground squirrels and ptarmigan are hunted to provide variety in the diet. As the days shorten and temperatures drop, most families move back to Barrow. Thanksgiving holidays provide a brief interlude for those employed in full-time jobs to hunt seals near town if the conditions are right. Thanksgiving is also a time for the community distribution of subsistence foods at the church feast.

DECEMBER

On the whole, cold weather in December often keeps people close to town or indoors. However, people hunt seals and caribou if weather and ice conditions permit and the animals appear close to town. Another community-wide distribution of subsistence foods takes place during the Christmas feast at the local churches.

JANUARY

Often extreme cold weather prohibits hunters from leaving the village. When conditions allow, big ringed seals are hunted because seals rut in late January and hunters want to take large seals before the rut affects the taste of the meat.

The Messenger Feast or *Kivgiq* has been held in January and attracts residents from villages all over the North Slope. *Kivgiq* includes a community feast and exchange of goods as well as subsistence foods. According to Wooley and Okakok (1989:1),

> Kivgiq consists of three days of Inupiat dancing, singing, story and joke telling, trading, bartering and socializing, all of which reinforce North Slope Inupiat unity. Kivgiq brings North Slope villagers together in Barrow for the event, helping to strengthen kinship and partnerships. Kivgiq fosters traditional values such as sharing, spiritual guidance, storytelling, respect for elders and gratefulness for local game animals. Kivgiq promotes leadership qualities. Kivgiq is a celebration of living the Inupiaq way.

FEBRUARY

Storms tend to hold people in town this time of the year. If conditions are favorable, seal hunters venture onto the sea ice to hunt seals and polar bears. Those hunters involved in harvesting fox, wolverine and wolves may take extended trips into the interior. If caribou are known to be close to town, caribou hunting also occurs.

MARCH

In March, long periods of daylight and good snow cover frequently make traveling more comfortable and safer than the preceding months. Such conditions enable hunters to spend long hours hunting on the sea ice for seals and polar bears or traveling inland to hunt caribou. Expeditions into the interior for furbearers are also common in March. Those employed in full-time jobs take advantage of the three day Seward's Day weekend to travel to inland camps to retrieve stored supplies of caribou and fish for use during the upcoming whaling season. Whaling crews begin preparing for the upcoming season

by checking their *umiat* covers and employing elderly women to sew new ones when needed. Caribou skins, used for sleeping mats while at whale camp, are set out to dry and air out, new mukluks and hunting parkas are made for the hunters and ice cellars are cleaned and extra food given away.

In summary, with full-time employment a reality for many heads of households, subsistence activities were often coordinated to coincide with weekends, annual leave and holidays. Other local celebrations, such as *Nalukataq*, also affected subsistence activities. Successful whaling crews were especially active after spring whaling, expending extra effort hunting caribou, eiders, and geese to serve at the feast. By the week prior to *Nalukataq*, however, the crews and their families were no longer hunting but were occupied preparing food and dividing the whale for distribution at the celebration. Barrow families would also adjust their harvest patterns (e.g., return from their camps or delay departure) so that they might participate in events and holidays such as *Nalukataq*, Fourth of July games, and Thanksgiving.

Environmental conditions are possibly the most significant influence on subsistence activity. Ice conditions can greatly affect the success of marine mammal hunting, as can fog and bad weather. In turn, the length of the marine mammal hunting season can influence when people turn inland to begin their late summer caribou hunting and fishing. Fall freeze-up influences both fall whaling and access to the inland fall hunting and fishing areas, and the timing of fall ice fishing. Snow cover and weather influence the success of furbearer hunting in the winter, and breakup conditions affect access to spring geese hunting locations inland. A multitude of environmental variables can affect the subsistence harvest both negatively and positively.

HARVEST ESTIMATES FOR MAJOR RESOURCE CATEGORIES

This final component of the subsistence overview presents harvest estimates for the major resource categories and for all species combined. The major resource categories are marine mammals, terrestrial mammals, fish, birds and other resources. Discussion of these summary level data first addresses the harvest averages for the three years followed by a comparison of the three years' harvests. As Burch (1985) noted, anomalies are a part of the normal annual

cycle of subsistence harvesting in any Alaskan village. Extreme variations in harvest amounts can occur in any year and are a fact of life in the Arctic. In that sense, an "average harvest" for any North Slope village is an entity not nearly so stable as "average income" or "average age" for example. Therefore, average harvest amounts should be considered in conjunction with the range of observed actual harvest amounts, as well as in terms of the contextual information (e.g., weather, social and cultural activities, employment opportunities).

The main purpose of this section is to present data at the major resource category level as such data offers a useful "snapshot" overview. However, little explanatory discussion of trends accompanies this overview of the major resource categories; such trends usually are linked to one or two individual species and therefore are discussed more meaningfully in the subsequent sections that address individual species or species subgroups.

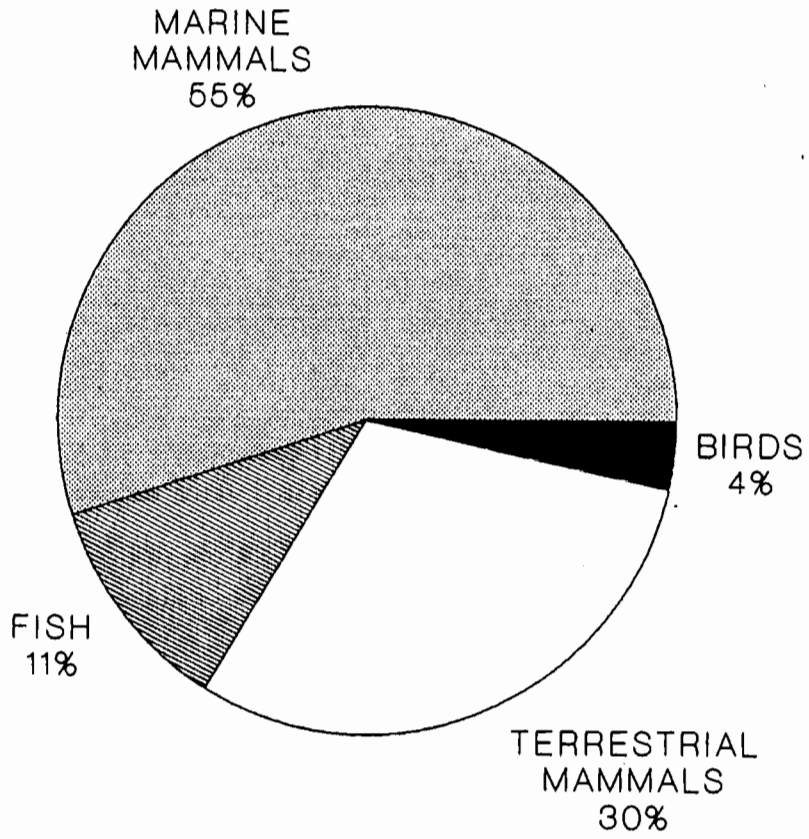
The data are presented in various analytical categories, e.g., total harvests, household means and harvests by month, to name a few, appearing mainly in tables and figures. Each of these data categories represents some level of synthesis of the raw data. To familiarize the reader with the data categories used repeatedly throughout the report, each category is introduced and explained as necessary in this section.

Average Harvests by Major Resource Category

As Figure 1 indicates, between 1987 and 1990, Barrow residents drew approximately 55 percent (by usable weight) of their subsistence foods from the sea in the form of marine mammals. The second most important resource group was terrestrial mammals, accounting for 30 percent of the total usable pounds harvested in Barrow over three years. Fish and birds constituted relatively small proportions of the total harvest at 11 and four percent respectively. The predominance of marine mammals stems primarily from the successful bowhead whale and walrus harvests in the three study years, and the large volume of usable product available from each of these animals.

Table 8 presents average subsistence resource harvest estimates for the community of Barrow. Neither the "conversion factor" nor "number harvested"

Figure 1: Estimated Harvest Percentages by Major Resource Category, Barrow
Years One, Two and Three Averaged



Based on usable pounds harvested.
Three years of study: 4/1/87 - 3/31/90
Source: Stephen R. Braund & Assoc., 1993

TABLE 8: TOTAL HARVEST ESTIMATES BY MAJOR RESOURCE CATEGORY - ALL BARROW HOUSEHOLDS, THREE YEAR AVERAGE (1,2)

RESOURCE	CONVERSION FACTOR (3) (Usable Weight Per Resource in lbs)	COMMUNITY TOTALS		AVERAGE POUNDS HARVESTED		PERCENT OF TOTAL USABLE POUNDS HARVESTED	PERCENT OF ALL BARROW HSEHOLDS HRVSTING RESRCE (4)	SAMPLING STATISTICS				
		NUMBER HARVESTED	USABLE POUNDS HARVESTED	PER HOUSEHOLD	PER CAPITA			STANDARD DEVIATION (lbs)	SAMPLING ERROR AT 95% (lbs)	LOW ESTIMATE (Mean lbs/ Household)	HIGH ESTIMATE (Mean lbs/ Household)	SAMPLING ERROR AS % OF MEAN
Marine Mammals (5)	n/a	n/a	386,153	412.1	128.0	55%	48%	18	36	376	448	9%
Terrestrial Mammals	n/a	n/a	211,861	226.1	70.2	30%	54%	31	61	166	287	27%
Fish	n/a	n/a	79,355	84.7	26.3	11%	41%	10	19	65	104	23%
Birds	n/a	n/a	24,720	26.4	8.2	4%	53%	4	8	18	34	30%
Other Resources	n/a	n/a	572	0.6	0.2	0%	7%	0	1	0	1	0%
Total (5)	n/a	n/a	702,660	749.9	233.0	100%	68%	50	99	651	848	13%

(1) Three years of study: April 1, 1987 - March 31, 1990.

(2) Estimated sampling errors do not include errors in reporting, recording, and in conversion to usable weight.

(3) See Table D-5 for sources of conversion factors.

(4) This percentage is a cumulative total for the three study years rather than an annual average.

(5) Bowhead harvest does not contribute to the sampling error for marine mammals since the bowhead harvest is based on a complete count.

** represents less than .1 percent

n/a means not applicable

Source: Stephen R. Braund & Associates, 1993

apply in Table 8 as each resource category includes more than one dissimilar species (e.g., marine mammals includes bowhead whales, walrus, various seals, and polar bear).

The first category of data presented is the estimated total usable pounds of each major resource category harvested by Barrow residents. These estimates are calculated by multiplying the number of animals harvested by the usable weight conversion for each individual species and adding the resulting total pounds per species together to get the total pounds per major resource category. Barrow residents harvested approximately 702,660 pounds of wild foods each year.

The average household harvest was derived by dividing the total harvest by 937 households, the number of households enumerated in the 1985 NSB census which served as the basis for this study's sampling design. The average household harvested about 750 usable pounds of subsistence resources. The next column presents the average pounds harvested per capita for the entire community; this figure was derived by dividing the total harvest by 3,016, the population of Barrow in the 1985 NSB census. Harvests averaged approximately 233 pounds per person, including 128 pounds of marine mammals, 70 pounds of terrestrial mammals, 26 pounds of fish, eight pounds of birds, and less than a pound of other resources per person.

The relative contribution of each major harvest category to the total Barrow harvest of subsistence resources is shown in the next column and is based on the total usable pounds harvested. (These data are the basis for Figure 1, summarized previously.) Next, the percentage of Barrow households that harvested each major resource category is shown. For example, 48 percent of Barrow households participated in the harvest of marine mammals sometime during this study. Sixty-eight percent participated in the harvest of at least one resource. (The percent participation presented on the three year tables represents the total for the three years rather than an annual average. For example, a household participated in the activity sometime during the three years of the study.)

Figure 2 is a bar chart showing the three year average usable pounds of resource product per Barrow household for each of the major resource categories, along with the average percentage of total household harvests. (These amounts generally are consistent with the data in Table 8, Average Pounds Harvested per Household column. However, quantities may vary slightly from one table or figure to the next due to software rounding.) The bar chart in Figure 2 shows the proportional value of each item. The figures and percentages presented in this bar chart restate figures and percentages presented in Table 8 and the percentages in Figure 1. However, these bar charts are included to give a clearer visual image of the relative contribution of each species or resource group than either the tables or pie charts offer.

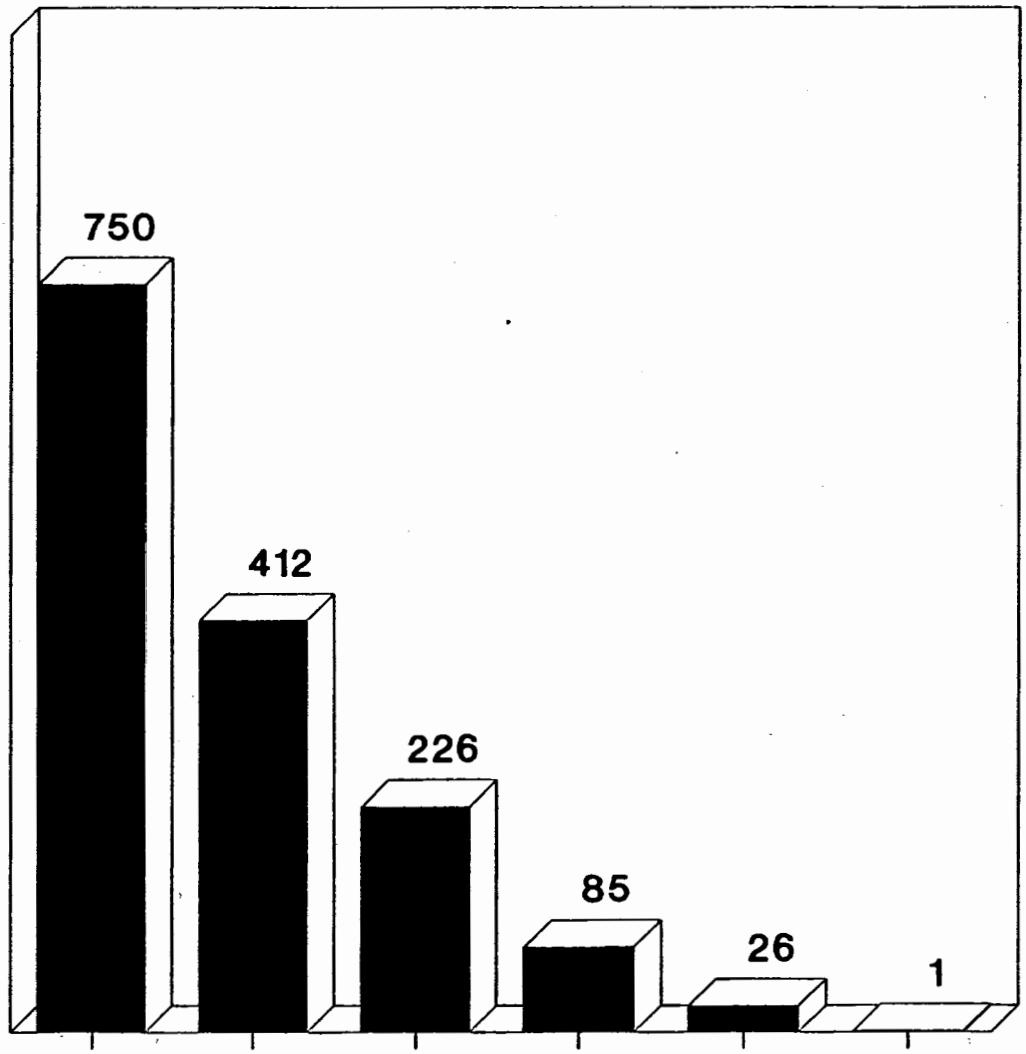
In considering the above estimates of the mean annual harvest by Barrow households, four cautions are noteworthy. First, the actual harvest in any given household varied depending on the level of harvest activity of household members, their hunting success, and their species preferences. Few households may actually harvest the amount exactly equal to the community mean, or harvest a particular resource at all.

Second, Figure 2 presents the relative importance of the major species categories in terms of usable pounds harvested per household. This figure (and the data presented in other tables and figures) does not necessarily indicate the relative cultural and nutritional importance of the resource categories, nor do they indicate what proportion of the amount shown is actually consumed or what proportion is given to other households or to people in other communities.

Third, household means for bowhead whale were calculated from the entire estimated usable weight of the whales harvested, rather than from the weight of the shares the households reported receiving. Thus, household means for bowhead (and marine mammals as an aggregate category including bowhead whale) subsume all usable portions of the whale, including: portions distributed at the community level at feasts and celebrations; the amount shared with other communities; and all the blubber.

Finally, these data pertain to just three years of harvest activity. While the relative importance of the resource categories may not change, the absolute

Figure 2: Harvest Estimates by Major Resource Category, Barrow
Years One, Two and Three Averaged
(Mean Usable Pounds Per Household)



Three years of study: 4/1/87 - 3/31/90
Source: Stephen R. Braund & Assoc., 1993

harvest levels may vary more widely from year to year over a period of several years than these three years of data reflect, due to biological trends within the harvest species, environmental shifts (e.g., weather and ice conditions) and socioeconomic and cultural shifts in Barrow.

Average Monthly Harvests by Major Resource Category

In the Barrow seasonal cycle over the three study years, approximately 94 percent of the harvesting occurred in the seven month period from April through October (Table 9). Only five to six percent of the total harvest was taken from November through March. Table 9 shows average monthly harvests by major resource group in usable pounds and the monthly percentage of the total yearly harvest for that resource category. October was the average high month in terms of usable pounds harvested, when 26 percent of the annual total was obtained (an average of 183,019 pounds). July was the second highest month on average, yielding 16 percent of the annual harvest (114,249 pounds); while May and August were nearly as high as July, with 107,281 and 105,029 pounds harvested, respectively, each month, representing 15 percent of the average yearly total. Thus, 72 percent of the total harvest typically was taken in May, July, August and October combined. These four months were high because they were the months in which the majority (72 percent) of the average year's marine mammals were taken, principally bowhead whale (May and October) and walrus (July). During August and October (combined), 51 percent of the terrestrial mammal harvest occurred and 65 percent of the annual fish harvest occurred. Figure 3 is a line graph showing monthly harvests for each major resource group, with the May, July and October marine mammal harvests standing out as the most significant harvest peaks of the year. Although this figure is somewhat difficult to interpret for detail, its purpose and value lie in illustrating general trends in seasonal harvests, and the relative contribution of different resource groups at different times of year.

Marine mammal harvests occurred almost exclusively in the seven month period from April through October. Most of the marine mammal species are highly migratory and therefore are available only during the more temperate months. Terrestrial mammals, on the other hand, were harvested steadily throughout the year, gradually peaking in August and October when over half (51 percent) of

TABLE 9: ESTIMATED MONTHLY HARVESTS BY MAJOR RESOURCE CATEGORY - BARROW, THREE YEAR AVERAGE (1)
(Pounds of Usable Resource Product)

TOTALS
******

1987-1990

MAJOR RESOURCE CATEGORY	April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Marine Mammals	26,393	86,103	23,948	68,541	29,522	46,923	94,097	1,502	1,652	769	2,796	3,963
Terrestrial Mammals	328	5,469	2,394	32,389	54,999	32,770	53,969	3,575	979	8,683	6,421	9,868
Fish	5	288	2,403	11,257	16,912	10,524	34,888	2,832	0	30	85	105
Birds	160	15,420	2,481	2,062	3,596	911	65	11	0	0	0	9
Total	26,885	107,281	31,226	114,249	105,029	91,127	183,019	7,920	2,631	9,481	9,302	13,945

PERCENTS
****

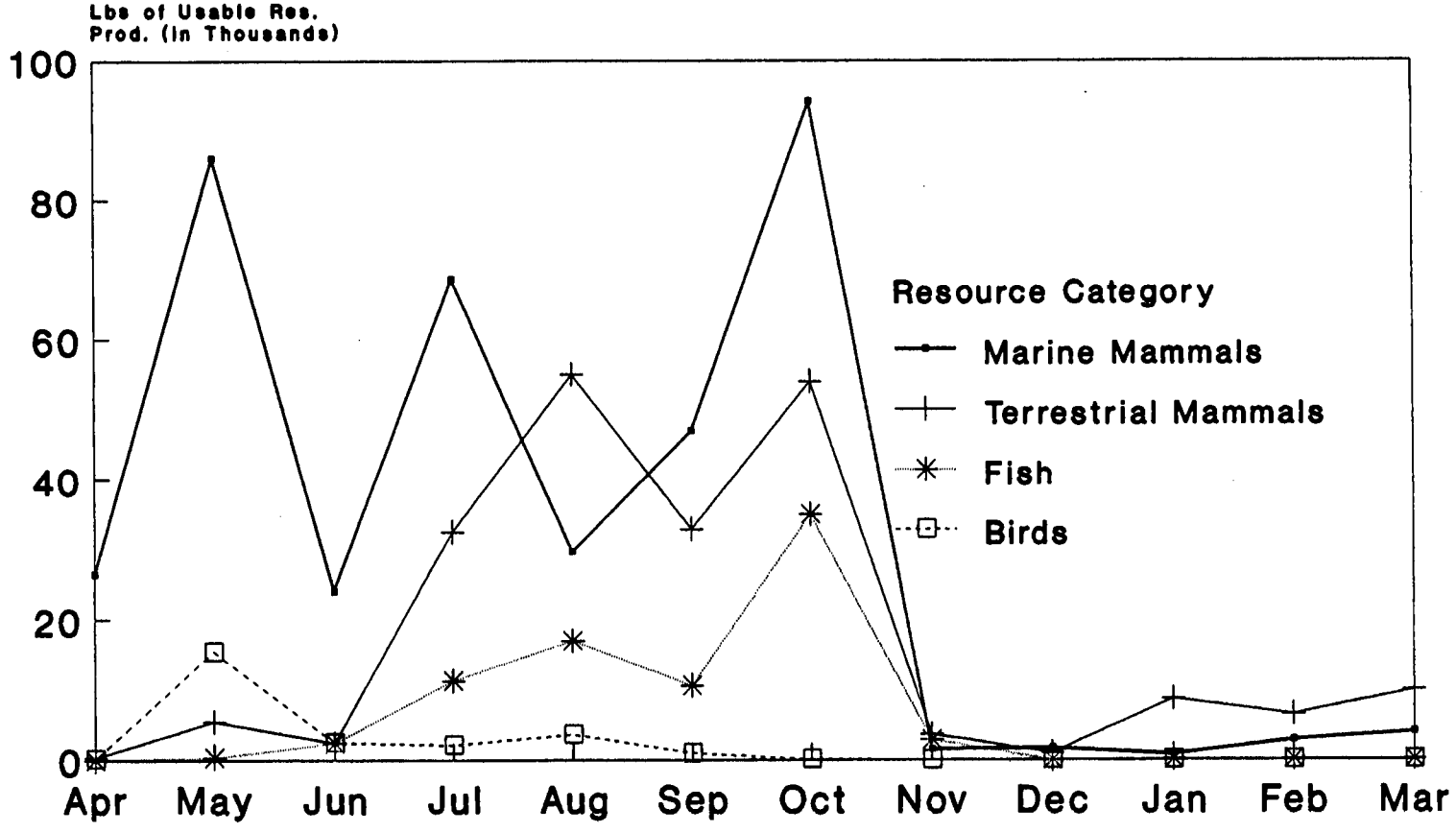
1987-1990

MAJOR RESOURCE CATEGORY	April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Marine Mammals	7%	22%	6%	18%	8%	12%	24%	0%	0%	0%	1%	1%
Terrestrial Mammals	0%	3%	1%	15%	26%	15%	25%	2%	0%	4%	3%	5%
Fish	0%	0%	3%	14%	21%	13%	44%	4%	0%	0%	0%	0%
Birds	1%	62%	10%	8%	15%	4%	0%	0%	0%	0%	0%	0%
All Resources Combined	4%	15%	4%	16%	15%	13%	26%	1%	0%	1%	1%	2%

(1) Three years of study: April 1, 1987 - March 31, 1990.

Source: Stephen R. Braund & Associates, 1993

Figure 3: Monthly Harvest Estimates by Major Resource Category, Barrow
Years One, Two & Three Averaged



Three years of study: 4/1/87 - 3/31/90
Source: Stephen R. Braund & Assoc., 1993

the average year's harvests occurred. The terrestrial mammal harvests consisted predominantly of caribou, which, during the three study years, were available to Barrow residents throughout most of the year. Fish harvests were similar, peaking in October when 44 percent of the average year's harvests occurred. The autumn period of heavy fish and terrestrial mammal harvests corresponds with the time when people traditionally went upriver to fish camp to hunt caribou and fish, as described previously in the Seasonal Round. Finally, bird harvests occurred primarily in the spring, with 62 percent of the average year's total taken in just one month: May. The significant bird species harvested by Barrow residents are highly migratory waterfowl. Consequently, this seasonal peak corresponds to bird migration patterns and residents' ability to intercept the migration either from whaling camps on the ice or from inland and coastal camps visited in the spring specifically to hunt birds.

Harvest Locations over Three Years

Almost all harvests mapped during the three study years are presented on Maps 2 and 4. (A few very remote sites are not represented within the bounds of these maps.) Map 4 shows the same harvest sites as Map 2 with the sites differentiated by major resource group. Generally, harvests over the three study years extended from Wainwright to the mouth of the Colville River along the coast with offshore harvests of birds and marine mammals concentrated on the Chukchi Sea between Point Franklin and Point Barrow. Inland harvests occurred along the several major drainages and bays, Teshekpuk Lake, and the land between these bodies of water, with scattered terrestrial mammal, fish and bird harvests throughout the inland region.

As Map 2 illustrates, Barrow harvest sites during this three year study fell, for the most part, within the lifetime community land use area documented by Pedersen. Although most harvests in the present study were concentrated within a certain area (a 50 to 75 mile radius from Barrow on land, and less at sea) some harvest sites extended beyond the outer limits of Pedersen's lifetime area (e.g., terrestrial mammals and fish to the south and marine mammals to the north). Residents indicated that they will harvest close to town when the animals are available; if the desired species, whether walrus or furbearer, is not available in the local area, hunters will travel considerable distance to

MAP 4
NORTH SLOPE SUBSISTENCE STUDY - BARROW
SUBSISTENCE HARVEST SITES BY MAJOR RESOURCE CATEGORY: YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska.

LEGEND INFORMATION

- Marine Mammals: Bowhead whale, seals, walrus, polar bear
- Terrestrial Mammals: Caribou, moose, brown bear, fox, wolverine, other terrestrial mammals
- Fish: Whitefish, other freshwater fish, salmon, other coastal fish
- Birds: Eiders, other ducks, geese, ptarmigan, loons, cranes, swans

Map Production: North Slope Borough GIS

Date: April 15, 1991

25 0 25 50 75 100 125

MILES

obtain the resource. Although during the study period hunters generally harvested within the traditional hunting area documented by the lifetime use line, people may travel farther in other years if the caribou, birds, furbearers or marine mammals are scarce in the local area.

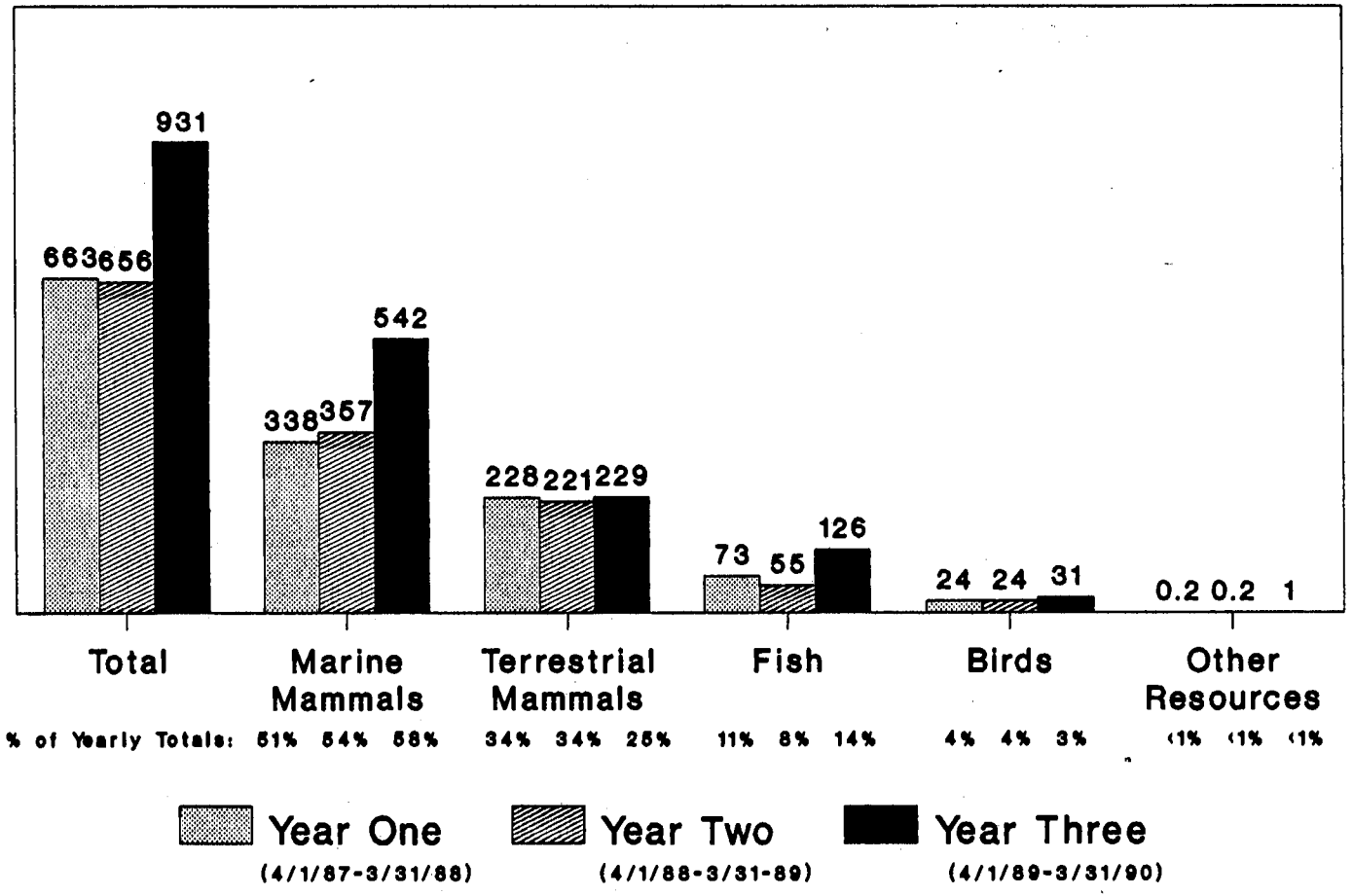
Year to Year Variability Among Major Resource Categories

The relative contribution of each major resource category to the overall harvest remained generally quite consistent across the three study years. The comparison shown in Figure 4 illustrates this consistency. Marine mammals represented 51 to 58 percent of the total harvest each year, terrestrial mammals represented 25 to 34 percent, fish represented eight to 14 percent, and birds represented three to four percent. Years One and Two were the most similar in terms of relative importance of the resource groups. In Year Three, marine mammal and fish proportions increased and terrestrial mammal proportions decreased. In terms of absolute numbers of usable pounds harvested, shown in Tables A-1, B-1 and C-1 (in the Year One, Two and Three appendices, respectively), the Year Three terrestrial mammal harvest was higher than Years One or Two. However, terrestrial mammal harvests did not increase as much as marine mammal or fish harvests, and thus decreased in terms of relative importance. Figure 4 compares household means for each year by major resource category.

Over the three years, as Tables A-1, B-1 and C-1 indicate, the total subsistence harvests by weight decreased from 621,055 usable pounds in Year One to 614,673 pounds in Year Two, then increased markedly to 872,109 pounds in Year Three. For every major resource category, Year Three harvests were the highest. Overall, Year Three was simply a very good year for subsistence. Although Barrow whalers landed one less whale in Year Three than Year Two, the whales landed in Year Three were much larger. Ice conditions were favorable for a very successful walrus harvest in Year Three, and fish harvests increased significantly, a result of favorable environmental conditions combined with apparently strong runs of various fish species.

Consistent with the trend in overall harvests from year to year, the percentage of households successfully harvesting wild resources decreased from Year One (58 percent) to Year Two (50 percent) and increased in Year Three (61 percent)

Figure 4: Comparison of Harvest Estimates by Major Resource Category
Barrow, Years One, Two & Three
Mean Usable Pounds Per Household



Source: Stephen R. Braund & Assoc., 1993

to the highest level of the three years. This pattern is seen within each major resource category: a decrease from Year One to Two, and a peak level of participation in Year Three - with one exception. Participation in fish harvests dropped from Year One (33 percent) to Year Two (18 percent) and increased from Year Two to Three (29 percent); however, Year Three's participation level was not the highest of the three years, as was the case in the other major resource categories.

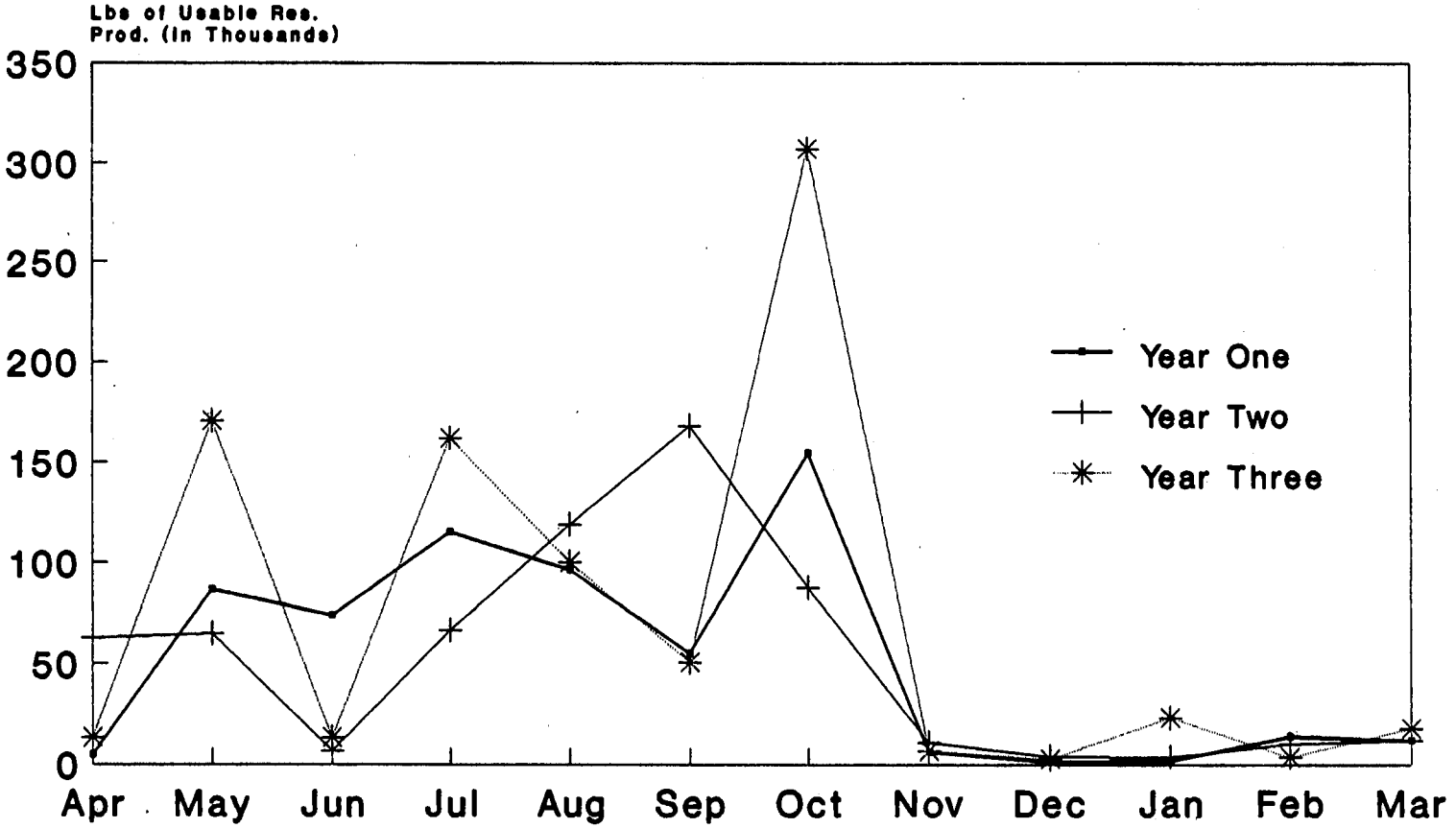
Three years of data offer some idea of how harvests can shift from year to year; however, longer term trends cannot be captured in just three years. Where possible, data from earlier studies are incorporated into subsequent species-level discussions in an effort to provide a broader time perspective on Barrow subsistence harvests.

Seasonal Variability from Year to Year among Major Resource Categories

Although the harvest timing of most major resource groups follows roughly the same schedule each year, some variation can occur from year to year due to environmental conditions, socioeconomic events, or biological trends affecting the resources. Figure 5 shows the total harvests for each month by study year and suggests considerable variation in the month to month trends each year. However, examination of Figures 6 through 9 indicates that the greatest variation occurred in the monthly harvests of marine mammals (Figure 6) which, being so large a proportion of the total harvest, influences the monthly totals of all the major resource categories combined (Figure 5). Compared to marine mammals, terrestrial mammals (Figure 7), fish (Figure 8) and birds (Figure 9) were relatively consistent from year to year in the timing of the harvests. (All of the above figures represent the data shown in Tables A-2, B-2 and C-2.)

The extreme highs and lows shown for marine mammals (Figure 6) were reflective primarily of the bowhead whale and walrus harvests. For example, the predominant marine mammal harvests in April or May are usually bowhead whales. Comparing those months across the three study years shows that May was the peak month for spring whaling in Years One and Three, whereas April was stronger than May in Year Two. Year Two was different from the other years in terms of the timing of fall whaling, also; Year Two fall whales were taken in September,

Figure 5: Comparison of Total Monthly Harvest Estimates
Barrow, Years One, Two and Three



Three year study period: 4/1/87-3/31/90
Source: Stephen R. Braund & Assoc., 1993

Figure 6: Comparison of Monthly Marine Mammal Harvest Estimates
Barrow, Years One, Two & Three

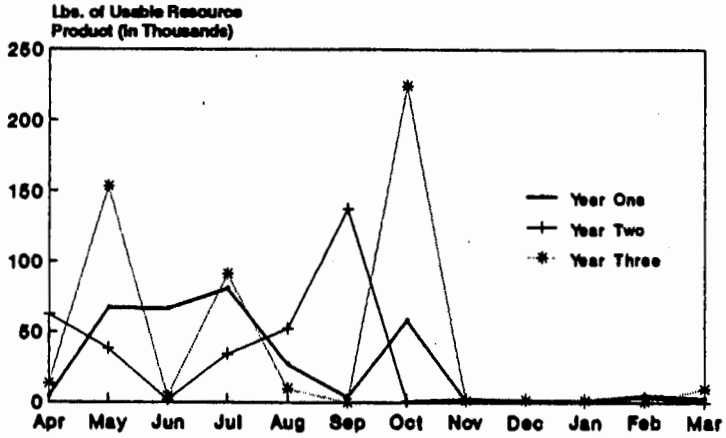


Figure 7: Comparison of Monthly Terrestrial Mammal Harvest Estimates
Barrow, Years One, Two & Three

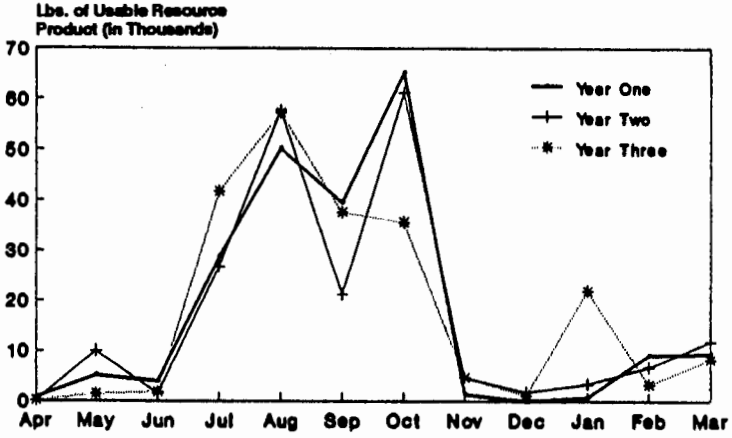
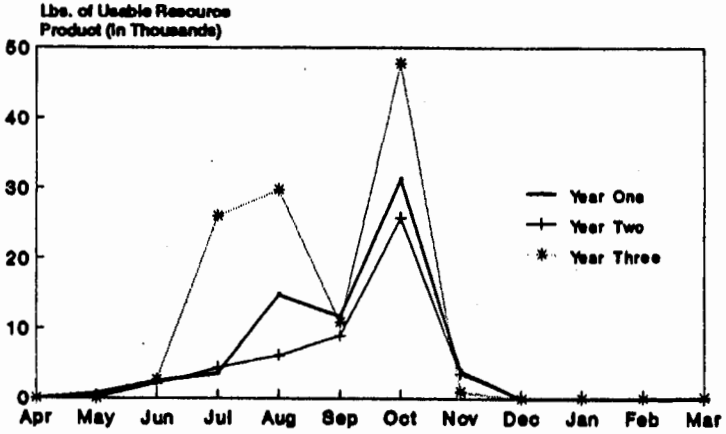
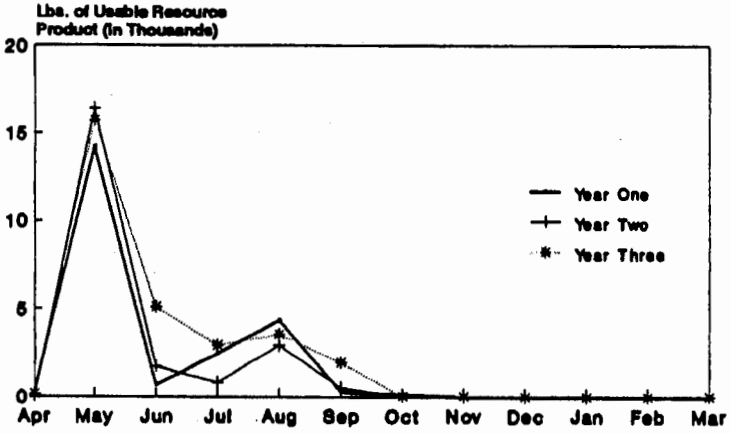


Figure 8: Comparison of Monthly Fish Harvest Estimates
Barrow, Years One, Two & Three



Three year study period: 4/1/87-3/31/90

Figure 9: Comparison of Monthly Bird Harvest Estimates
Barrow, Years One, Two & Three



Source: Stephen R. Braund & Associates, 1993

whereas fall whales were harvested in October of Years One and Three. In Year One, June marine mammal harvests were relatively high compared to Years Two and Three, when June harvests were very low. The reason for the difference is again attributable to whaling: Year One was the only study year in which bowheads were harvested in June.

Terrestrial mammal harvests (Figure 7) followed generally similar patterns in the three study years. Harvest levels were low in the spring, showing a significant increase in July and August, and tapering off slightly in September. October was the peak terrestrial mammal harvest month for Years One and Two. October harvests in Year Three, on the other hand, remained at the same level as September harvests. The relatively lower effort in October of Year Three likely was because people concentrated more effort than usual on whaling that month; Barrow got only three whales in the spring of Year Three due to poor spring ice conditions, and so whaled intensively in the fall, landing seven large bowheads in October.

The timing of fish harvests also was similar in all three years. Fish harvests began in June, increasing in July and August. September harvests were lower than August harvests in Years One and Three, and slightly higher than August in Year Two. October was the peak month for fishing in all three years. Following the October effort, harvests tapered off in November and were very low or non-existent December through May.

Bird harvests followed the same pattern in each of the three years. The peak harvest month was May, with lower harvests occurring through June and July. Harvests increased again in August to a smaller second peak and then tapered off until the following spring. Bird migration patterns are very consistent; hence, harvest timing during the study period reflected this consistency.

Variability from Year to Year in Harvest Sites of Major Resource Categories

Maps A-2, B-2 and C-2 differentiate harvest sites by major resource category in Years One, Two and Three respectively. As a comparison of these maps indicates, the areas of successful harvests in each of the three years were very consistent. One difference is that Year Three marine mammal harvests

ranged farther offshore to the east and west than in the other two years because unusually clear, calm weather allowed for more extensive travel in pursuit of walrus, bearded seal and fall bowheads. More harvests occurred along the lower Colville River (fish and terrestrial mammals) in Year One than in Years Two or Three. Finally, in Year Two a string of marine mammal harvest sites east of Point Barrow was unique among the three years. That year, ice blown against the Barrow coastline prevented residents from hunting marine mammals in the Chukchi Sea for a few weeks; hence, they hunted in the typically less productive Beaufort Sea and harvested several seals there. Other than these main differences, successful harvest sites overall were very consistent from year to year.

SUBSISTENCE HARVESTS BY BARROW INUPIAT

Table 10 presents average household and per capita harvests by Inupiat households of Barrow for the three year study period. (An Inupiat household, as an analytical variable in this study, was defined as any household in which the head of household or spouse was Inupiat.) Subsistence is an activity engaged in predominantly by Inupiat residents. A large percentage of the non-Inupiat residents do not interact socially with the Inupiat residents, nor do they take part in the cultural or subsistence activities of the community (R. Harcharek, personal communication). Of the households that harvested resources during the study period, 76 percent were Inupiat and 24 percent were non-Inupiat; conversely, of the non-harvesting households, 23 percent were Inupiat and 77 percent were non-Inupiat. As such, it is useful to examine Inupiat harvest estimates separately from total community estimates. Estimates of Barrow Inupiat harvests are more useful than the total community harvest estimates in terms of comparability with similar subsistence data from other communities, e.g., ADF&G harvest studies which tend to be focused on predominantly Native communities.

Inupiat households harvested an average of 1,171 usable pounds of wild foods each year compared to 750 pounds for the average Barrow household (i.e., Inupiat and non-Inupiat combined). Per capita harvests for Inupiat and all Barrow households are nearly equal: 245 pounds per capita for Inupiat and 233 pounds for all Barrow households. Inupiat per capita harvests differ from per

TABLE 10: HARVEST ESTIMATES FOR ALL SPECIES BY BARROW INUPIAT HOUSEHOLDS, YEARS ONE, TWO AND THREE AVERAGED (1)

MAJOR RESOURCE CATEGORY	WEIGHTED HOUSEHOLD MEANS: NUMBER HARVESTED	WEIGHTED HOUSEHOLD MEANS: USABLE POUNDS	WEIGHTED PER CAPITA MEANS(2): NUMBER HARVESTED	WEIGHTED PER CAPITA MEANS(2): USABLE POUNDS	% PARTICIPATION (OF ALL NATIVE HOUSEHOLDS)
Marine mammals	n/a	670.4	n/a	162.7	76%
Terrestrial Mammals	n/a	320.0	n/a	67.0	77%
Fish	n/a	141.5	n/a	29.6	60%
Birds	n/a	38.7	n/a	8.1	65%
Total	n/a	1,170.7	n/a	244.9	87%
MARINE MAMMALS					
Bowhead whale	0.02	476.1	**	122.1	75%
Walrus	0.13	103.7	0.03	21.7	29%
Bearded seals	0.27	48.2	0.06	10.1	46%
Ringed & spotted seals	0.70	29.4	0.15	6.2	27%
Polar bear	0.03	13.1	0.01	2.7	7%
TERRESTRIAL MAMMALS					
Caribou	2.59	303.6	0.54	63.5	77%
Moose	0.03	15.7	0.01	3.3	7%
Brown bear	**	0.1	**	*	0%
Dall sheep	0.01	0.6	**	0.1	3%
Wolverine (3)	**	n/a	**	n/a	1%
Fox (arctic and red) (3)	0.11	n/a	**	n/a	11%
FISH					
Whitefish	51.50	109.7	10.77	22.9	54%
Other freshwater fish	19.25	20.0	4.03	4.2	33%
Salmon	1.37	8.1	0.29	1.7	16%
Other coastal fish	18.71	3.8	3.91	0.8	23%
BIRDS					
Geese	5.69	24.4	1.19	5.1	40%
Eiders	8.62	12.9	1.80	2.7	52%
Other birds	**	*	**	*	1%
Ptarmigan	1.86	1.3	0.39	0.3	26%

(1) Based on a sample of Inupiat households weighted to represent all Inupiat households in Barrow.

(2) Per capita means are based on an estimated Inupiat household size of 4.8 persons per household, in contrast to total Barrow estimates which include Inupiat and non-Inupiat households (averaging 4 persons per household).

(3) Furbearers are not included in usable weight calculations.

** = less than 0.01

* = less than 0.1

Source: Stephen R. Braund & Associates 1993

capita means for the entire community by a much smaller factor than do household means (Inupiat compared to all Barrow). Inupiat household means, while higher in general than all Barrow household means, are being divided by a larger number of persons per household (4.78) to get per capita means than the Barrow means, which are divided by 4.02 (which includes 3.2 persons per non-Inupiat household). (These household size averages are from the study team's Year Three collection of selected household data.) Inupiat households harvested 670 pounds of marine mammals compared to 412 pounds per household for the entire community, and 320 pounds of terrestrial mammals compared to 226 pounds for the entire community. Inupiat household harvests of fish and birds were 142 and 39 usable pounds respectively compared to the entire community's household average of 85 pounds of fish and 26 pounds of birds.

SUMMARY

This subsistence overview has addressed, in general terms, demographic and ethnohistoric characteristics of Barrow, the hunting area, and the typical cycle of seasonal subsistence activities. Additionally, summary level data have been presented for Years One, Two and Three, showing that the average annual harvest for the three years was approximately 702,660 pounds of usable subsistence resources, or 750 pounds per household, 233 pounds per capita. The total ranged from 614,673 pounds (Year Two) to 872,109 pounds (Year Three). Despite slight differences in the relative contribution of each major resource group, marine mammals was the largest share of the harvest by weight each year, representing 51 to 58 percent of the harvest. Terrestrial mammal harvests represented 25 to 34 percent, followed by fish constituting eight to 14 percent, and birds which constituted three to four percent of each year's total harvest. Sixty-eight percent of all Barrow households successfully harvested subsistence resources during the study (88 percent of all Inupiat households and 40 percent of all non-Inupiat households).

III. BARROW SUBSISTENCE HARVESTS BY SPECIES

This portion of the report examines average harvests over the three study years and variability from year to year for all species first reviewing marine mammals in general and then examining findings at the level of individual species or species groups (e.g., four species of eiders comprise a species group). Total harvests, average household and per capita harvests, percentage of the total harvest, participation, seasonal trends, and harvest locations are discussed in terms of averages for the three years and also in terms of differences between the three years. The data are presented in tables, figures and maps comparable to those introduced in the previous section but with more detail at the species level.

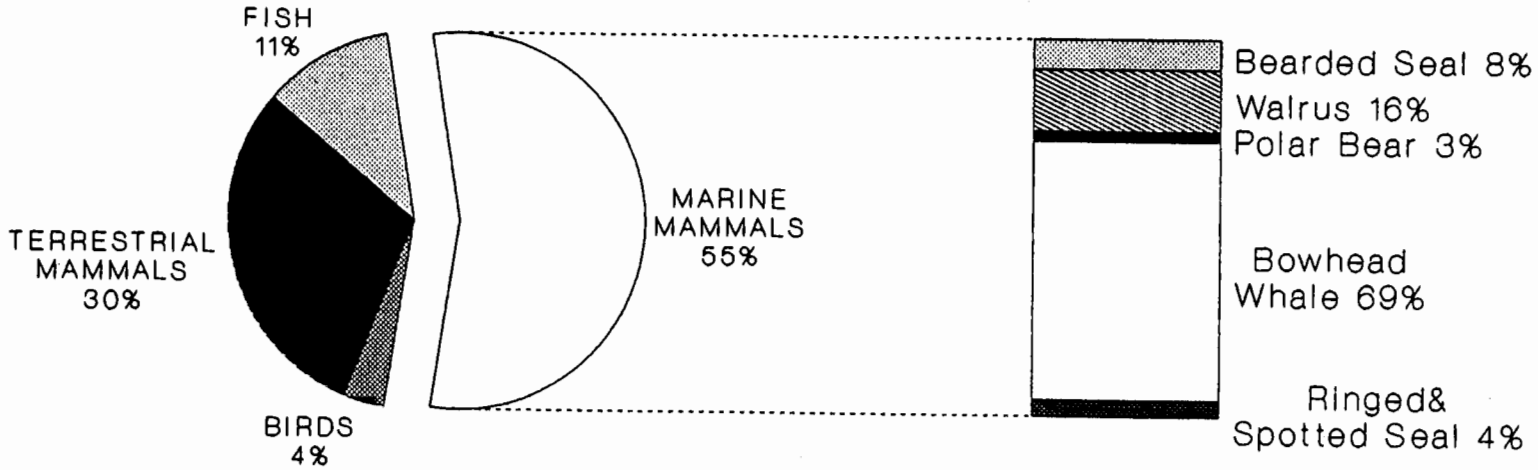
MARINE MAMMALS

Marine Mammals: Three Year Averages

As discussed previously, Barrow is a coastal community that gets much of its livelihood in the form of subsistence foods from the marine environment. In all three study years the total pounds of marine mammals harvested was greater than all the other major resource categories combined (Figure 10), providing an average of 56 percent of the total harvest by weight each year. The expertise required to extract marine mammals from the harsh Chukchi and Beaufort sea environments has been passed from generation to generation of Barrow hunters; over the three study years, an average of 48 percent of the households participated successfully in marine hunting (Table 11), providing an average of 412 pounds of usable meat per household (Figure 11) or 128 pounds per capita (Table 11). Marine mammals harvested by Barrow residents in the three study years included bowhead whale, walrus, bearded seal, polar bear, ringed seal and spotted seal. (A small number of beluga whales reportedly were harvested by Barrow residents during the study period. However, the hunters were not in this study and therefore beluga harvests do not appear in the harvest data.)

Table 12 shows average annual harvest amounts for each marine mammal species by month, with the equivalent monthly percentage of the year's harvest for each

Figure 10: Estimated Marine Mammal Harvest Percentages, Barrow
Years One, Two and Three Averaged
(Usable Pounds Harvested)



Three years of study: 4/1/87 - 3/31/90
Source: Stephen R. Braund & Assoc., 1993

TABLE 11: HARVEST ESTIMATES FOR MARINE MAMMALS - ALL BARROW HOUSEHOLDS, THREE YEAR AVERAGE (1,2)

RESOURCE	CONVERSION FACTOR (3) (Usable Weight Per Resource in lbs)	COMMUNITY TOTALS		AVERAGE POUNDS HARVESTED		PERCENT OF TOTAL USABLE POUNDS HARVESTED	PERCENT OF ALL BARROW HSEHOLDS HRVSTING RESRCE (4)	SAMPLING STATISTICS				
		NUMBER HARVESTED	USABLE POUNDS HARVESTED	PER HOUSEHOLD	PER CAPITA			STANDARD DEVIATION (lbs)	SAMPLING ERROR AT 95% (lbs)	LOW ESTIMATE (Mean lbs/ Household)	HIGH ESTIMATE (Mean lbs/ Household)	SAMPLING ERROR AS % OF MEAN
Total Marine Mammals	n/a	n/a	386,153	412.1	128.0	55.0%	48%	18	36	376.5	447.7	9%
Bowhead (5,6)	29,466.2	9	265,196	283.0	87.9	37.7%	46%	n/a	n/a	n/a	n/a	n/a
Walrus	772.0	81	63,285	67.5	21.0	9.0%	27%	9	18	49.7	85.4	26%
Bearded Seal	176.0	174	30,696	32.8	10.2	4.4%	29%	5	11	22.2	43.3	32%
Total Ring. & Spot. Seal	42.0	397	16,688	17.8	5.5	2.4%	19%	4	8	10.0	25.6	44%
Ringed Seal	42.0	394	16,557	17.7	5.5	2.4%	19%	4	8	9.9	25.5	44%
Spotted Seal	42.0	3	131	0.1	0.0	**	1%	0	0	0.1	0.2	37%
Polar Bear	496.0	21	10,288	11.0	3.4	1.5%	6%	4	7	3.8	18.2	66%

(1) Three years of study: April 1, 1987 - March 31, 1990.

(2) Estimated sampling errors do not include errors in reporting, recording, and in conversion to usable weight.

(3) See Table D-5 for sources of conversion factors.

(4) This percentage is a cumulative total for the three study years rather than an annual average.

(5) Bowhead harvest does not contribute to the sampling error for marine mammals since the bowhead harvest is based on a complete count.

(6) The percent of Barrow households harvesting bowhead represents the percent of Barrow households receiving crew member shares at the whale harvest site, as extrapolated from the sample households.

* represents less than .1 pound

** represents less than .1 percent

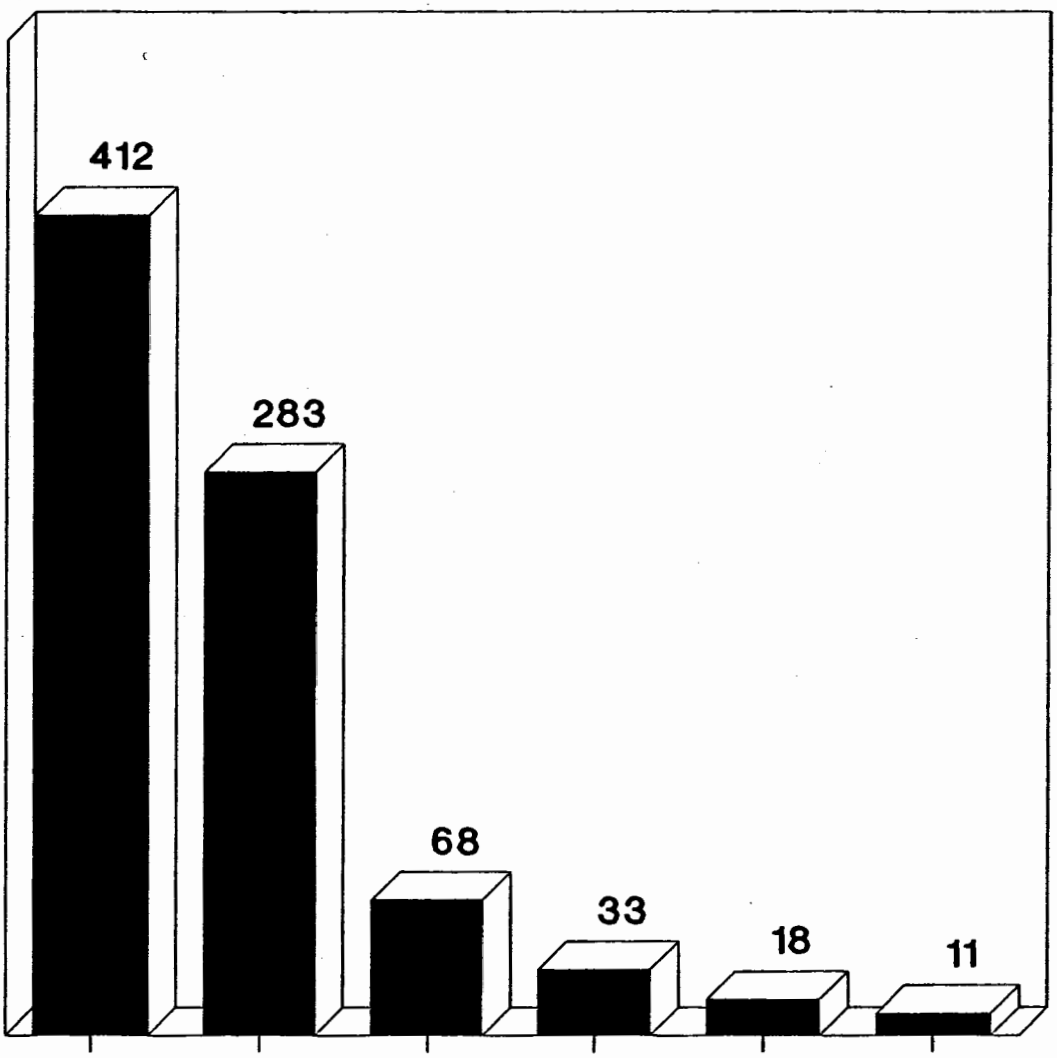
n/a means not applicable

Source: Stephen R. Braund & Associates, 1993

Figure 11: Marine Mammal Harvest Estimates, Barrow

Years One, Two and Three Averaged

(Mean Usable Pounds Per Household)



% of Marine Mammals:	100%	69%	16%	8%	4%	3%

Three years of study: 4/1/87 - 3/31/90

Source: Stephen R. Braund & Assoc., 1993

TABLE 12: MARINE MAMMAL HARVEST ESTIMATES BY SPECIES AND MONTH - BARROW, THREE YEAR AVERAGE (1)
(Pounds of Usable Resource Product)

1987-1990

TOTALS
******

SPECIES	April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Bowhead Whale	24,500	81,616	21,404	0	0	45,120	92,586	0	0	0	0	0
Walrus	0	0	0	40,906	20,365	1,081	937	0	0	0	0	0
Bearded Seal	0	282	612	21,094	8,096	106	356	14	141	0	0	0
Polar Bear	1,167	2,265	870	396	198	397	0	198	397	198	1,144	3,059
Total Ring. & Spot. Seal	725	1,941	1,062	6,145	862	220	218	1,290	1,115	570	1,652	904
Ringed Seal	725	1,924	1,062	6,094	812	203	218	1,290	1,115	570	1,652	904
Spotted Seal	0	17	0	50	50	17	0	0	0	0	0	0
All Marine Mammals	26,393	86,103	23,948	68,541	29,522	46,923	94,097	1,502	1,652	769	2,796	3,963

1987-1990

PERCENTS
****

SPECIES	April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Bowhead Whale	9%	31%	8%	0%	0%	17%	35%	0%	0%	0%	0%	0%
Walrus	0%	0%	0%	65%	32%	2%	1%	0%	0%	0%	0%	0%
Bearded Seal	0%	1%	2%	69%	26%	0%	1%	0%	0%	0%	0%	0%
Polar Bear	11%	22%	8%	4%	2%	4%	0%	2%	4%	2%	11%	30%
Total Ring. & Spot. Seal	4%	12%	6%	37%	5%	1%	1%	8%	7%	3%	10%	5%
Ringed Seal	4%	12%	6%	37%	5%	1%	1%	8%	7%	3%	10%	5%
Spotted Seal	0%	13%	0%	38%	38%	13%	0%	0%	0%	0%	0%	0%
All Marine Mammals	7%	22%	6%	18%	8%	12%	24%	0%	0%	0%	1%	1%

(1) Three years of study: April 1, 1987 - March 31, 1990.

Source: Stephen R. Braund & Associates, 1993

species shown below. With the ocean frozen much of the year, and the highly migratory nature of most marine mammals, Barrow hunters obtained an average of 97 percent of their marine mammal harvest in the seven month period between April and October. Forty-six percent of the marine mammal harvest typically occurred in the two months, May and October, when the majority of Barrow's bowhead whales were landed. Another 44 percent of the marine mammal harvest on average, occurred in the intervening four months, June through September, which were generally characterized by the summer drifting pack ice and associated seal and walrus hunting. Supplementing Table 12, Table 13 presents the average number of animals harvested each month by species and Figure 12 graphs the pounds (averaged for the three study years) presented in Table 12 for each species by month.

October was the month in which the highest marine mammal harvests typically occurred (24 percent of the year's marine mammals - Table 12) and this peak was due to the bowhead whale harvest. The second highest month for marine mammal harvests was May, when 22 percent of the average year's harvest was taken. As in October, the May harvest consisted mainly of bowhead whales.

Another peak in marine mammal harvests occurred in July, when 18 percent of the year's marine mammals were harvested. July was the peak month for walrus, bearded seal, and ringed seal harvests. Walrus harvests went from zero in April, May and June, to 65 percent in July. Another 32 percent were harvested in August. Thus, 97 percent of the average year's total walrus harvest was obtained in those two months. Bearded seal harvests followed a similar trend but began gradually in May and June (one and two percent respectively) and jumped to 69 percent in July followed by 26 percent in August. In the case of walrus in particular and bearded seal as well, harvests increased significantly with the arrival of the drifting summer pack ice and dropped sharply as soon as the ice left the general Barrow marine hunting area, typically in August.

In short, Barrow marine mammal hunters concentrated much effort on whaling in both the spring (April, May and June) and the fall (September and October), with the best results in October and May, and on harvesting walrus and seals in the summer, with the highest returns occurring in July. On average, 64 percent of the marine mammals (by weight) were harvested in these three months, May,

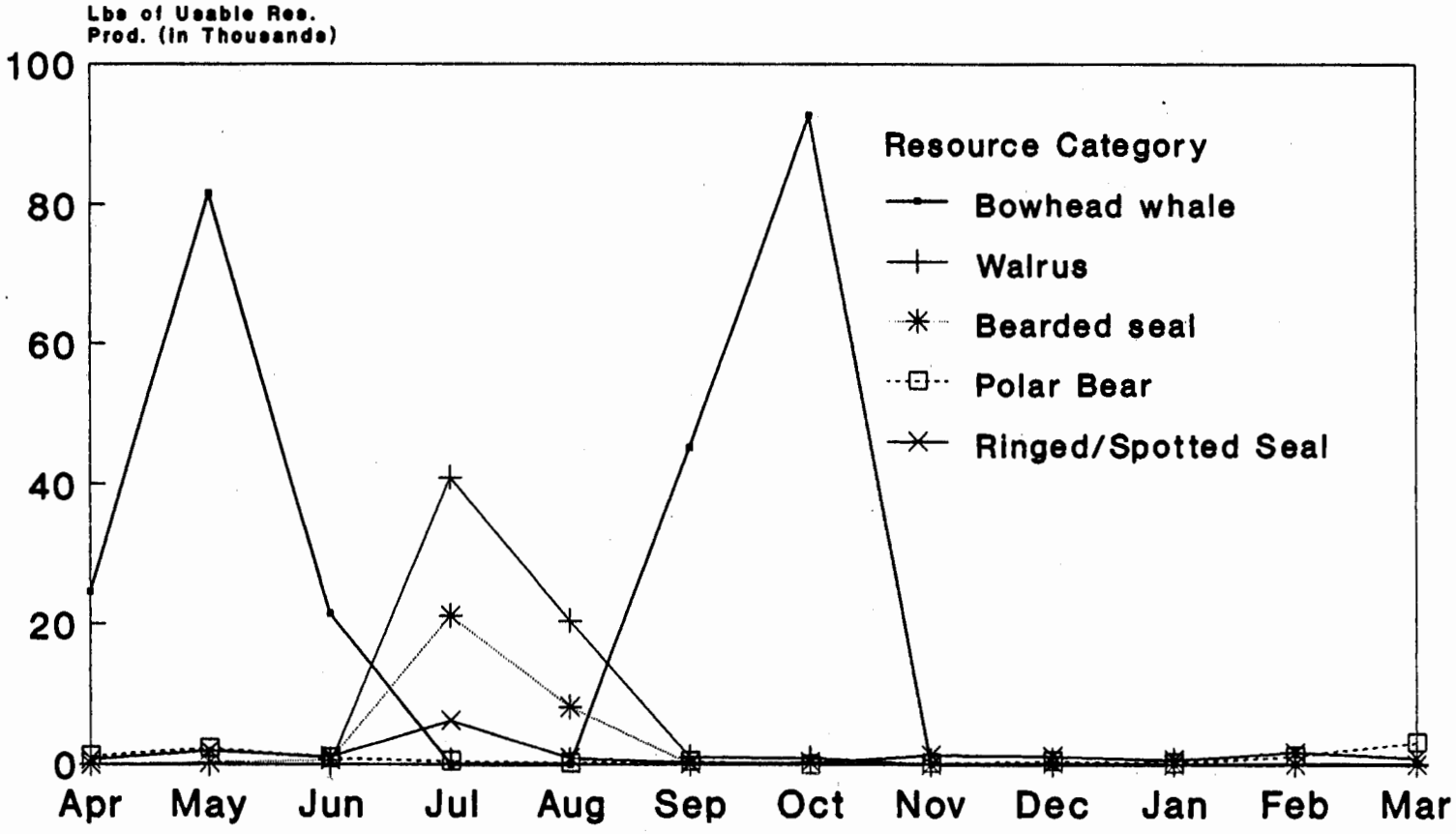
TABLE 13: MARINE MAMMAL HARVEST ESTIMATES BY SPECIES AND MONTH - BARROW, THREE YEAR AVERAGE (1)
(Number Harvested)

	1987-1990											
SPECIES	April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Bowhead Whale	2	3	0	0	0	1	3	0	0	0	0	0
Walrus	0	0	0	53	26	1	1	0	0	0	0	0
Bearded Seal	0	2	3	120	46	1	2	0	1	0	0	0
Polar Bear	2	5	2	1	0	1	0	0	1	0	2	6
Total Ring. & Spot. Seal	17	46	25	146	21	5	5	31	27	14	39	22
Ringed Seal	17	46	25	145	19	5	5	31	27	14	39	22
Spotted Seal	0	0	0	1	1	0	0	0	0	0	0	0

(1) Three years of study: April 1, 1987 - March 31, 1990.

Source: Stephen R. Braund & Associates, 1993

Figure 12: Monthly Marine Mammal Harvest Estimates, Barrow
Years One, Two & Three Averaged



Three years of study: 4/1/87 - 3/31/90
Source: Stephen R. Braund & Assoc., 1993

July and October. Because most of these species are migratory and also due to ice conditions, marine mammal harvests were negligible from November through March, accounting for only two percent of total marine mammal harvest (mainly polar bears and ringed seals). Figure 12 clearly illustrates the highly seasonal nature of marine mammal hunting.

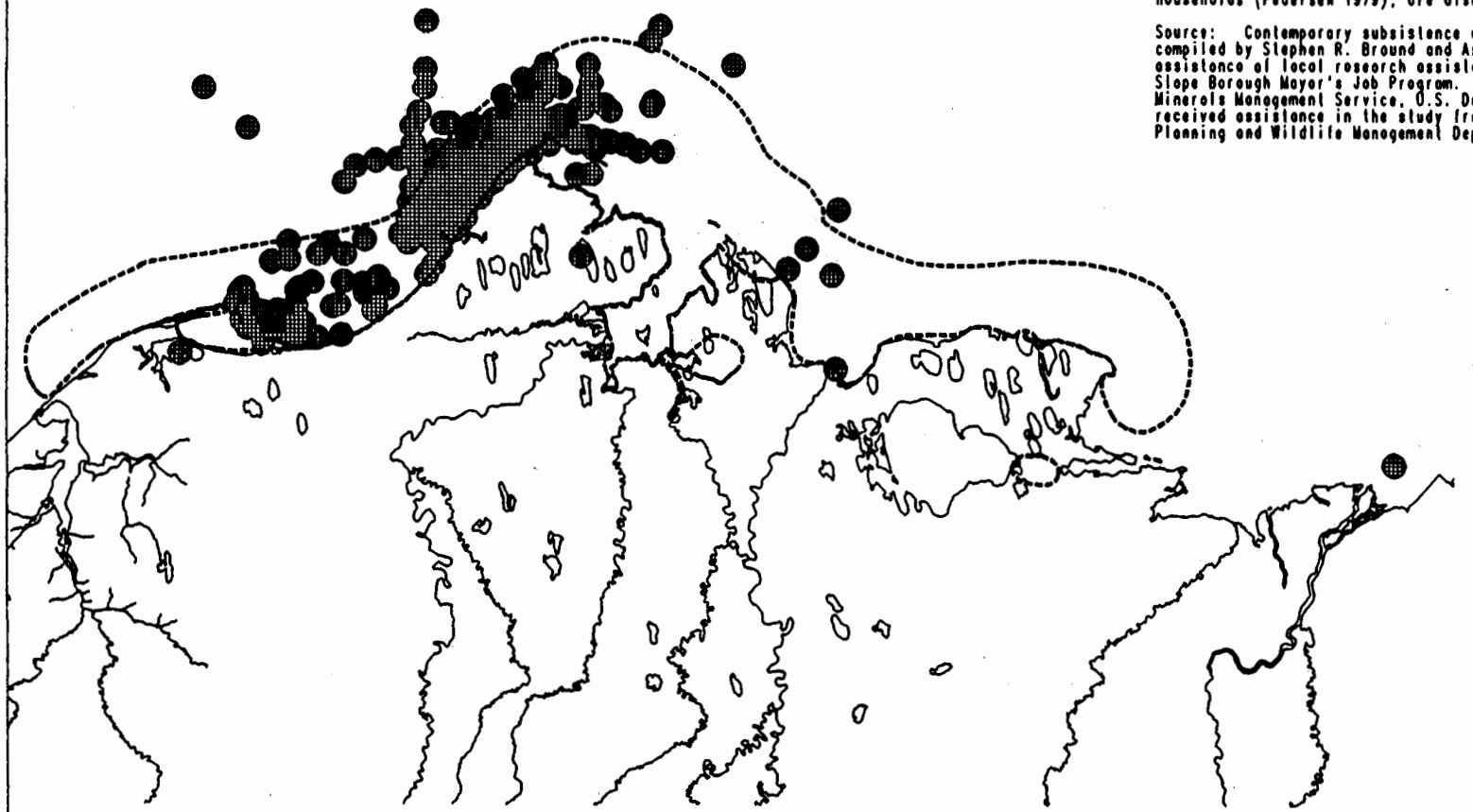
Map 5 depicts the locations of all successful marine mammal harvests in the three study years. As described earlier (in Harvest Locations Over Two Years, in Subsistence Overview), marine mammal harvests ranged from the mouth of the Colville River west to Kugrua Bay (inside Peard Bay) and well offshore. Compared to the lifetime use line, representing the areas used by 20 hunters over their lifetimes up to 1979 (Pederson 1979), harvests during the three study years were concentrated mainly within the lifetime community use area, but scattered distant harvests extended nearly twice as far offshore than occurred prior to 1979. One likely reason for the difference is that hunters now use more powerful motors that allow them to travel farther in pursuit of marine mammals (Braund and Burnham 1984). Technological improvements in boating equipment have progressively extended the range of area that hunters can utilize in their pursuit of marine mammals. In the 1940s, Wainwright residents began using outboard motors on their skin boats or *umiat* (Luton 1985, Milan 1964); it is likely that Barrow residents adopted the outboard motor around this time also. During this study period, skin boats were used only for spring whaling, and all other marine mammal hunting was conducted in aluminum or fiberglass boats with powerful outboard motors. Although hunters currently may travel farther to sea in pursuit of marine mammals, this more remote travel is largely an outward extension of the traditional hunting area, the offshore region between Peard Bay and Smith Bay.

Map 6 shows the harvest locations of walrus, bearded seals, and ringed and spotted seals. This map suggests that generally most of the seal harvests were concentrated within 12 miles of shore, while walrus harvests occurred in a broad area extending from near shore to over 50 miles offshore. Walrus harvests occurred almost exclusively amid the floating pack ice, which tends to remain offshore; in contrast, seal harvests may occur not only amid the pack ice but also in the waters closer to shore. In the spring during breakup, bearded seals with ringed seals could be found sunning themselves on the

MAP 5
NORTH SLOPE SUBSISTENCE STUDY - BARROW
MARINE MAMMAL HARVEST SITES - ALL SPECIES, YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study. Lifetime-community harvest areas, collected in the form of map biographies from 20 households (Pedersen 1979), are also illustrated.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska.



LEGEND INFORMATION

Lifetime community land use (Pedersen 1979).

Marine Mammals
- Bearded seal
- Ringed seal
- Spotted seal
- Ribbon seal
- Bowhead whale
- Walrus
- Polar bear

30 0 30 60 90

MILES

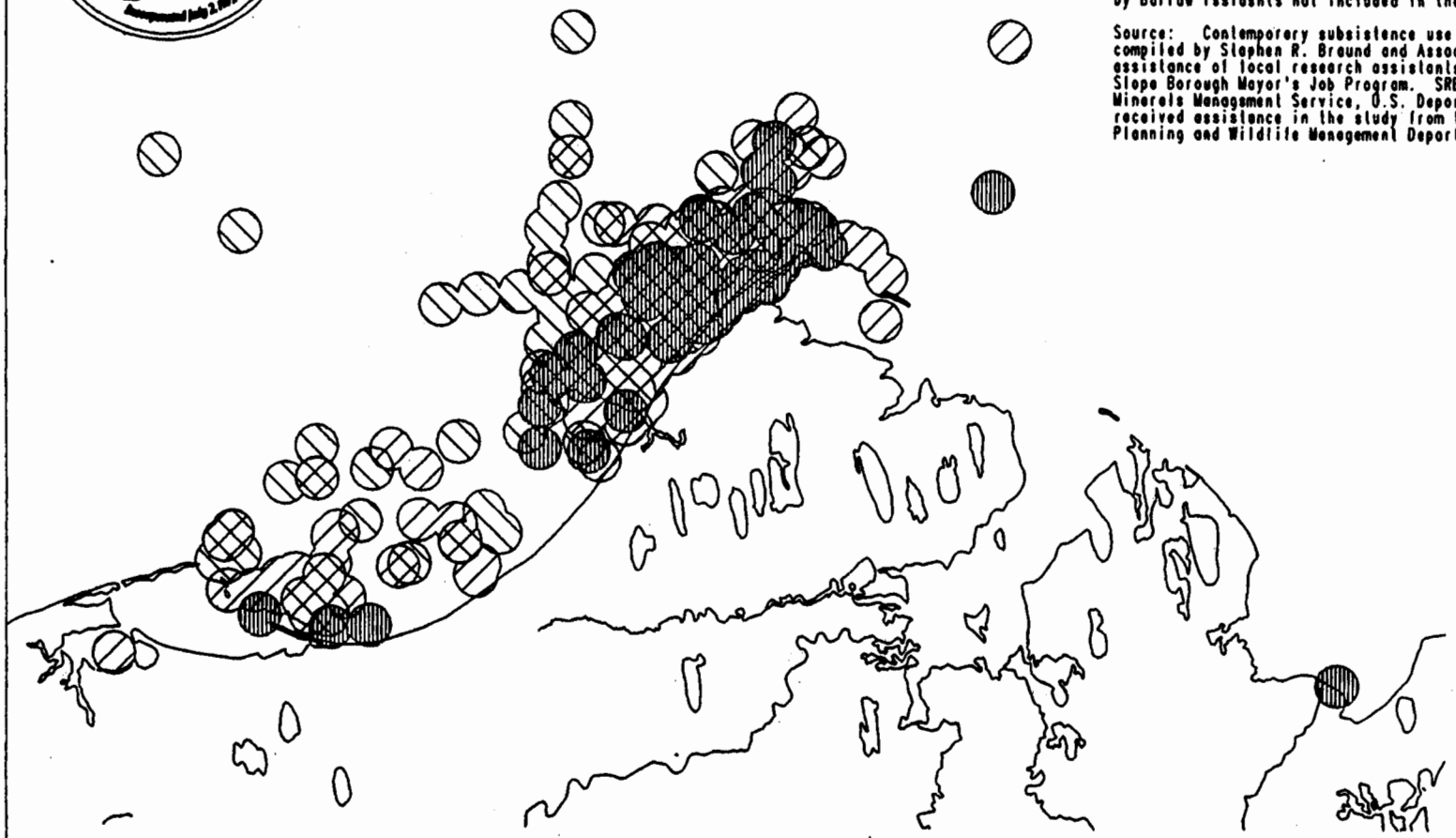
Map Production: North Slope Borough GIS

Date: April 11, 1991

MAP 6
NORTH SLOPE SUBSISTENCE STUDY - BARROW
MARINE MAMMAL HARVEST SITES BY SPECIES, YEARS ONE, TWO, AND THREE: WALRUS AND SEALS.

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska.



Map Production: North Slope Borough GIS

Date: April 11, 1991

shorefast ice. Spotted seals can be found quite predictably in Kugrua Bay (within Peard Bay) and also on Oarlock Island in Admiralty Bay. Bowhead whale and polar bear harvests are seen in Map 7. Polar bear and bowhead harvests occurred generally in the same vicinity as the marine mammals shown in Map 6, along Barrow's Chukchi coast and off Point Barrow, with additional locations scattered across a broader area reaching to Peard Bay to the west and Smith Bay to the east.

Map 8 shows the marine mammal harvest sites by the two "seasons" that affect the method of hunting. From June through October, people can usually launch their boats from Barrow and travel to open water (although in June they are mostly traveling through openings in the ice), allowing them to hunt over a broad area. November through May is the time when all hunting occurs on the ice, mainly at open leads. Because the leads typically form parallel to shore and offshore just a few miles, most harvests resulting from ice edge hunting took place closer to shore than the boat-based harvests.

Marine Mammals: Comparison of Years One, Two and Three

Total annual marine mammal harvests increased with each year of this study, from 316,229 usable pounds in Year One to 334,069 pounds in Year Two (a six percent increase), to 508,181 pounds in Year Three (Tables A-3, B-3 and C-3). Figure 13 compares the mean household harvests for marine mammals. Year Three marine mammal harvests represent a 52 percent increase from Year Two to Three, and a 61 percent net increase over the study period, from Year One to Year Three. The main reason for this tremendous increase is the successful Year Three harvest of bowhead whales in Year Three, a higher proportion of which were very large whales (compared to Years One and Two). Usable weight calculations for the bowhead harvest doubled from Year One to Year Three. Walrus harvests also showed a net increase over the study period, as did polar bear harvests. In spite of net decreases in the bearded and ringed seal harvests, the increases in pounds of bowhead harvested, combined with increases in walrus and polar bear harvests, resulted in the large overall increase in marine mammal harvests.

MAP 7
NORTH SLOPE SUBSISTENCE STUDY - BARROW
MARINE MAMMAL HARVEST SITES BY SPECIES, YEARS ONE, TWO, AND THREE: BOWHEAD WHALE AND POLAR BEAR

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska.

LEGEND INFORMATION

- Bowhead whale
- Polar bear

20 0 20 40

MILES

N

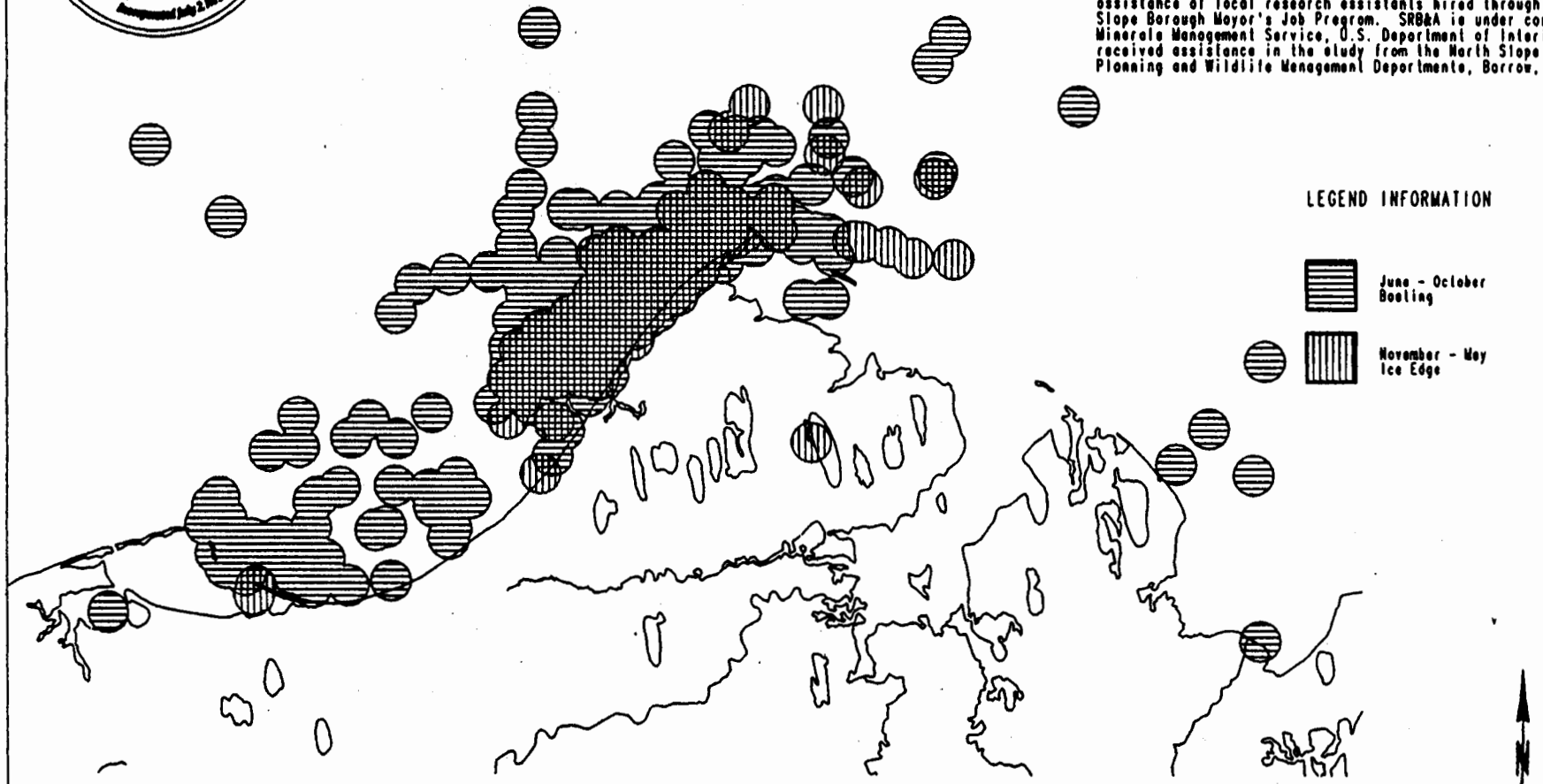
Map Production: North Slope Borough GIS

Date: April 11, 1991

MAP 8
NORTH SLOPE SUBSISTENCE STUDY - BARROW
MARINE MAMMAL HARVEST SITES BY SEASON, YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study.

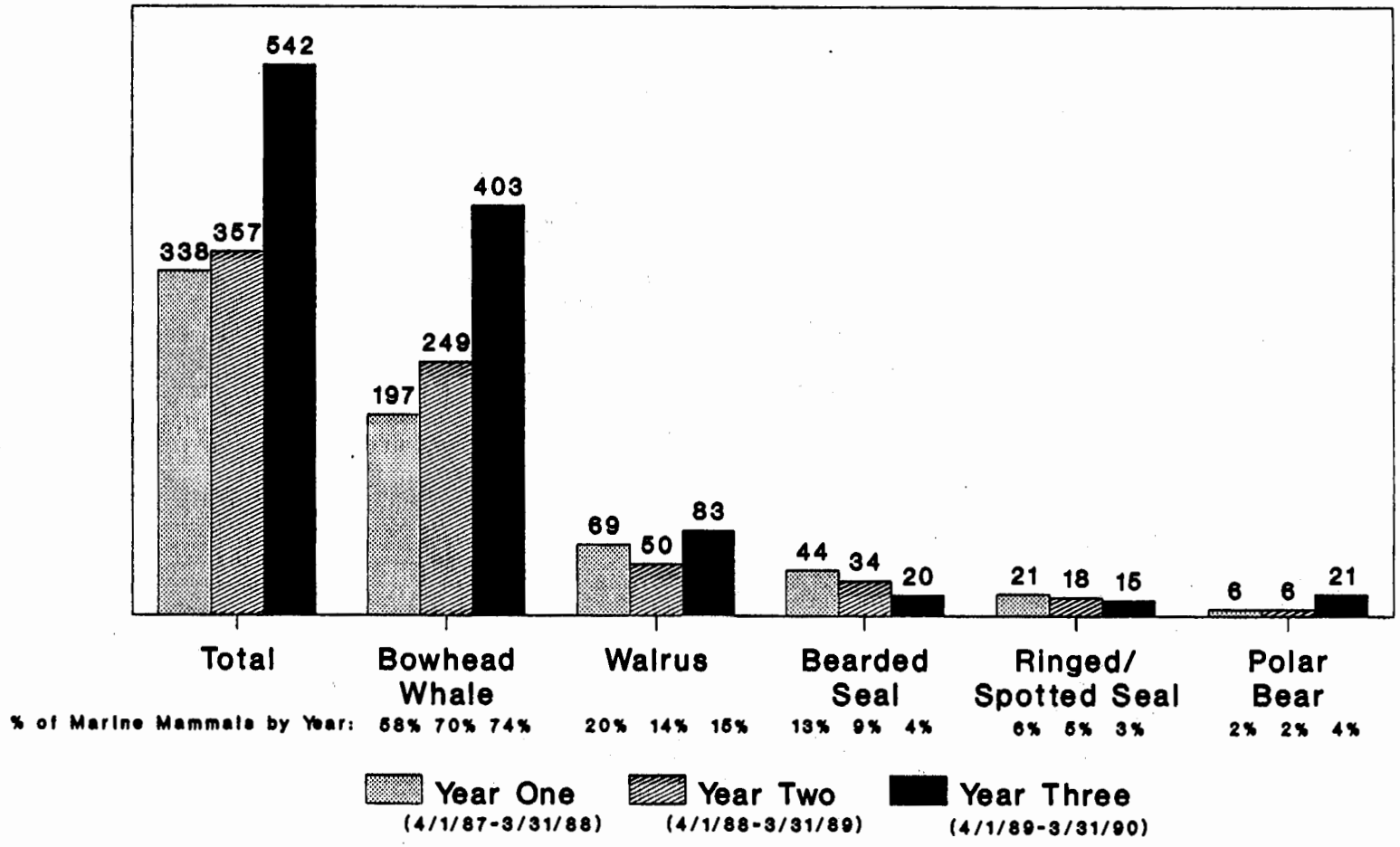
Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska.



Map Production: North Slope Borough GIS

Date: April 11, 1991

Figure 13: Marine Mammals Harvest Estimates, Barrow-Years One, Two & Three
(Mean Usable Pounds Per Household)



Source: Stephen R. Braund & Assoc., 1993

Successful participation in marine mammal harvests also increased over the three years, from 51 percent of all households in Year One to 54 percent in Year Two and 58 percent in Year Three. As with total pounds, the increase in participation appears to be a product mainly of participation in the bowhead harvests. The 10 whales landed in Year Three, many very large, required considerable labor to tow, land and butcher and thus provided ample opportunity (even necessity) for crews to participate and receive shares for their efforts.

Although most of the major marine mammal species follow distinct migratory patterns, limiting hunter access to specific seasons, a comparison of Tables A-4, B-4 and C-4 shows considerable variation in the overall distribution of pounds harvested across the months. Figure 5 graphically represents this variation, introduced previously in Seasonal Variability from Year to Year Among Major Resource Categories. In Year One, July was the peak month for marine mammal hunting (in terms of usable pounds harvested) with 25 percent of the year's marine mammal harvests by weight occurring that month. In Year Two, September was the peak month with 41 percent of that year's harvests. In Year Three, the high month was October when 44 percent of the year's marine mammal harvests occurred. These variations were driven principally by when the bowhead whales happened to be harvested, as well as the timing of the walrus and bearded seal seasons; and the timing of successful harvests of these species was largely a matter of when ice conditions were favorable. Thus, although the majority of marine mammal harvests typically occurred between April and October, considerable variation may occur from year to year as to the productivity of different months within that season.

The locations of successful marine mammal harvests varied little over the three study years. Maps A-3, B-3 and C-3 indicate that the main concentration of harvests took place along the Chukchi coast from Peard Bay to Point Barrow and offshore to about 15 miles (corresponding closely to the lifetime community land use perimeter in terms of distance offshore). Scattered harvests took place more than 15 miles offshore, the most distant harvests occurring in Year Three to the west of Barrow and in Years Two and Three to the northeast of Point Barrow. Year One's harvest area was smallest while Year Three harvests were the most extensive. Ice grounded against the Chukchi coast in July of Year Two caused seal hunters to range east and southeast of Point Barrow in the

Beaufort Sea more than usual. In contrast, good weather and ice conditions in the summer and fall of Year Three were conducive to traveling considerable distances in pursuit of walrus, seals and fall bowheads.

Bowhead Whale

Bowhead Whale: Three Year Averages

The majority of the marine mammal harvest consisted mainly of bowhead whale, averaging 265,196 pounds per year and amounting to a three year average of 38 percent of the total subsistence harvest (Table 11) and 69 percent of the marine mammal harvest each year (Figure 10). It is important to explain that the estimate of usable weight used in this report refers to potentially usable product. Usable weight includes those parts of the animal that are usable and does not include such parts as bones. This measurement contrasts with "round" weight, which is the weight of the animal with all its parts (i.e., before butchering or processing in any way). This report addresses only usable weights, most of which were developed by ADF&G (ADF&G n.d.); other usable weights (including bowhead weights) were developed by the study team or other sources. A complete list of usable weights used for the species harvested during the study period can be found in Table D-5 in Appendix D.

In the case of bowhead whale, the estimated usable portion includes the muscle or meat, tongue, the *maktak*, all the blubber and some of the organs. As discussed in Overview of Barrow Report, although the blubber is included in the estimates of usable pounds, half or less of the blubber was consumed in Barrow. Some of the blubber was trimmed away at the ice, some was made into *mikigaq*, and a considerable quantity was shared with residents from other communities. A large portion of the whale was divided up at the whaling feasts, *Nalukataq*, held in June following the spring whaling season and attended by families and individuals from all over Alaska. For the two days of celebration, portions of meat and *maktak* were given away. Everybody present, whether from Barrow or elsewhere, received a share of the meat and other parts of the whale that the successful whaling captains had set aside for distribution at *Nalukataq*. In addition, much of the blubber (and also meat and *maktak*) was sent by successful captains, crew members and other Barrow

residents to friends and relatives in other North Slope communities and beyond the North Slope, including Fairbanks and Anchorage.

This caveat is important to note in conjunction with the household and per capita means (Table 11, Figure 11), which include all usable weight regardless of whether it was trimmed at the ice, made into byproducts or eaten, and regardless of how much was consumed outside the community. The annual bowhead harvest averaged an estimated 283 pounds of bowhead per Barrow household, or 88 pounds per person per year for the three study years. The inclusion of all potentially usable weight for bowhead has implications for the relative proportion it represents in the overall harvest, particularly when compared to the proportion that smaller species represent, such as fish, for which the usable weight is more closely equivalent to the amount actually eaten in Barrow (field observations).

Alaska coastal Eskimos have been hunting the bowhead whale for centuries, and bowhead whaling continues to be an integral part of the subsistence cycle and community life in Barrow today. Alaska Eskimo bowhead whale harvests currently are regulated by the International Whaling Commission (IWC) which has determined an annual quota of strikes and landed whales that the whaling communities cannot exceed. The Alaska Eskimo Whaling Commission (AEWC), an association of the nine officially recognized Alaska Eskimo whaling communities (plus Little Diomede, which was accepted into the AEWC in 1988 but has not yet been recognized by the IWC as a whaling community), divides the quota of strikes among the nine whaling communities each year. (For a concise history of Alaska Eskimo bowhead whaling, the reader is referred to ACI & SRB&A 1984:23-31 and Braund et al. 1988:3-9.)

Much of Barrow Inupiat people's cultural identity derives from the residents' ability to harvest the bowhead whale. Whaling has been a virtual hallmark of Inupiat coastal culture (Spencer 1984) and its significance has been noted by numerous observers. For example, the ethnologist Murdoch, writing about Barrow in 1881, noted that,

> The pursuit of the "bowhead" whale, so valuable not only for the food furnished by its flesh and "blackskin" and the oil from its blubber, but for whalebone, which serves so many useful purposes in the arts of

> the Eskimo and besides the chief article of trade with ships, is carried on with great regularity and formality. (Murdoch 1891:272)

A similar observation was made 80 years later by the geographer Sonnenfeld (1956) who wrote that the bowhead was the material, social and spiritual center of Inupiat life. Today, the bowhead whaling complex continues to be the foundation of Inupiat culture and society (see Worl 1980).

In addition to untold cultural benefits, the bowhead whale provides Barrow and other residents on the North Slope valuable supplies of food essential, in their view, for their well-being. The Barrow three year average of nine bowhead whales per year during this study was the result of considerable time, effort, risk and cost on the part of many people, and ultimately was the species yielding the largest proportion of the community's total harvest in terms of usable weight. Residents value the bowhead whale in a manner distinct from other subsistence species. Harvesting the whale is a community effort to a degree surpassing any other harvest activity, and its harvest generates several community celebrations. Distribution of the whale is highly formalized and widespread.

As indicated above, bowhead whale was culturally the most important species harvested by Barrow residents. A 1984 whaling survey found that a majority of Barrow families interviewed (73 percent) preferred bowhead over all other subsistence foods (ACI and SRB&A 1984). Harvest data collected for this study found that bowhead whale also was the predominant species harvested in terms of usable weight. However, the 1984 whaling survey found that 71 percent of Barrow residents reported eating caribou most often of all subsistence foods, in contrast to nine percent who ate bowhead most often (ranking third as the most frequently eaten subsistence food after caribou and game birds [17 percent]).

Records of bowhead whales landed by Barrow crews between 1910 and 1987 show an average of 7.1 whales per year (based on 78 years of landed bowhead data from Braund et al. 1988, appendices 1 and 2). The range of landed whales during this 78 year period was from zero to 23 bowheads landed per year in Barrow. Thus, the harvests of seven, 11 and 10 whales in the study years appear to be slightly higher than historic harvest levels. During the study period, bowhead

represented over one-third (38 percent) of the total community harvest (Table 11) and over two-thirds (69 percent) of the Barrow marine mammal harvest (Figure 10).

During this study, 46 percent of Barrow households participated in the bowhead whale harvest, the second highest level of participation in the harvest of any species. (Participation in caribou harvests was highest at 54 percent - Table 14 on page 123.) Of the Inupiat households, 76 percent participated in successful bowhead harvests. While this high participation in bowhead harvesting was at least partially a function of the large numbers of people required to hunt and land this huge animal, the high participation also reflects the tremendous importance of whaling to the community.

As Table 12 indicates, Barrow hunters pursued bowheads in the spring and the fall when the large mammals migrated past Barrow to and from their summer feeding grounds in the Canadian Beaufort Sea. Barrow is unique in having access to the bowhead during two seasons; most other whaling villages hunt either in the fall or the spring. Over the three study years, whales were landed in April, May, June, September and October. The most successful months were May and October, however, when an average of three whales were taken in each of those months (Table 13). Generally during the study, the whales landed in the fall tended to be larger than those landed in the spring, as can be seen by comparing April's average harvest with September's, for example. Tables 12 and 13 show that in April an average of two whales were harvested, yielding only 24,500 usable pounds compared to an average of one whale landed in September, yielding 45,120 usable pounds. The timing of Barrow's fall whaling period coincides with the end of the fall whale migration. Since the smaller, younger whales lead the fall migration (according to the whalers), Barrow hunters more frequently land the larger whales that migrate last. The opposite is true in the spring. Spring whaling in Barrow coincides with the earlier stages of the migration and, as in the fall, the younger, smaller whales lead the migration through the nearshore leads where whalers are camped. Therefore, whales harvested in the spring are usually smaller than those harvested in the fall. (The spring migration is actually led by the oldest and largest whales migrating in the leads farther offshore, beyond the reach of Barrow whalers, according to Worl [1980]. The second "run" consists of younger whales in the

nearshore leads, followed by a run of cows and calves. Thus, the migration passing through the nearshore leads within reach of Barrow whalers was led by the smaller whales although it was actually the second of three runs in the overall migration.)

During the three study years, bowhead whale harvests occurred over a broad area spanning both the Chukchi and Beaufort seas (Map 7). Spring whaling took place at the lead that opened each year a few miles offshore on the Chukchi side of the point. There whaling crews set up camps between Point Barrow and Walakpa and watched for bowheads migrating through the lead. When a crew spotted a bowhead within a reasonable distance, they launched their skin boat from the ice edge and paddled in pursuit of the whale. The crews also had outboard motors which were used when a whale had been struck and the boats were towing it back to the ice edge where they would haul it up onto the ice. As Worl (1980:312) noted,

> According to the hunters, whales migrating through the ice are extremely sensitive to sound. That is the reason why outboard motors, recently introduced, are banned until a whale has been harpooned. In the fall season, commercial boats and motors are used since the whales are pursued through the ice-free ocean and they are not as sensitive to sound in the open water.

During this study, Barrow fall whaling was conducted mainly in aluminum or fiberglass motorized boats in open water. Whalers traveled the open seas in all directions (though mainly northeast and east of the point in the Beaufort Sea) searching for whales. Fewer crews participated in fall whaling than spring whaling mainly because the fall was the most important season for obtaining caribou and fish for the rest of the year; thus, many people who hunted bowheads in the spring instead hunted caribou and fished in the fall. Camps generally were not set up for fall whaling during the study period; rather, whalers left from Barrow in their boats and came home the same day if they did not get a whale. A shelter cabin situated at Point Barrow was used occasionally as a base for fall whalers during the study period, and residents explained that when the weather was good and lots of whales were "running," some people would camp on the islands just east of Point Barrow. However, the predominant pattern in fall whaling was to return to Barrow each night. ACI et al. (1984:544) observed,

> Traditionally, and currently, the fall whaling effort has been a land based activity; the hunters search for whales during the day and return to land-based camps at night. Historically these shore camps were located at the very tip of Point Barrow, but in the more recent past they have been situated on Cooper and Tapkaluk Islands, two of the islands which form Elson Lagoon.

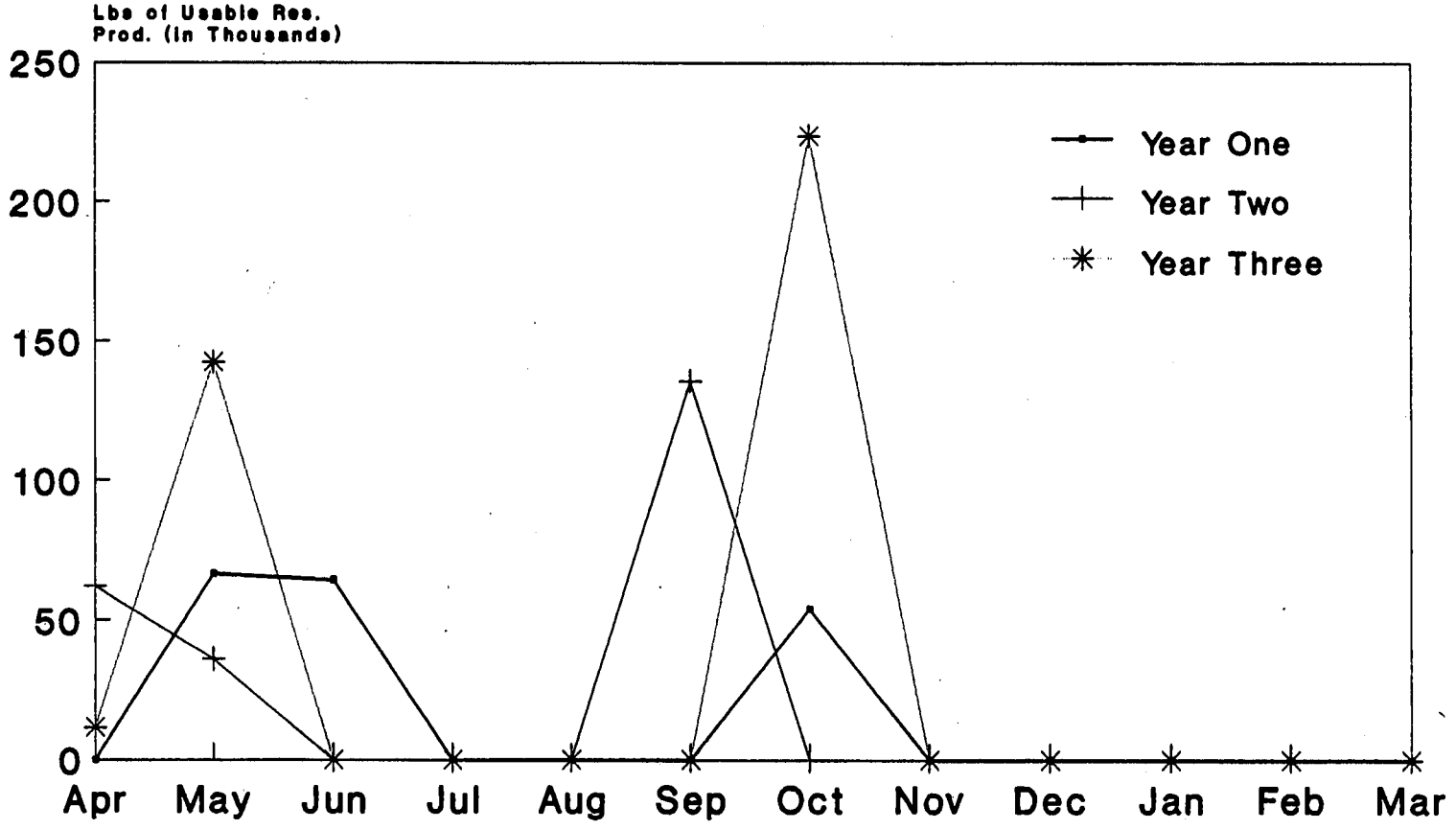
In short, spring and fall whaling were very different activities in terms of the type of boats, the ice/open water conditions, the areas hunted, and the use of camps.

Ideally, whalers preferred to harvest whales near camp (in the spring) or near Barrow (fall) so that they did not have to tow the whale very far before landing it. A long tow can result in spoiled meat. When whales are scarce, however, hunters will travel considerable distances in pursuit of bowheads. The four fall bowheads harvested near Cape Simpson (over 50 miles from Barrow) were taken in the fall of Year Three when whalers were concerned about the low bowhead harvest levels that year. They indicated that they would have preferred to have taken whales closer to Barrow but had not been successful and therefore ranged farther in their hunt.

Bowhead Whale: Comparison of Years One, Two and Three

In Year Three, 403 usable pounds per household of bowhead were harvested compared to 197 pounds in Year One and 249 pounds in Year Two (Tables A-3, B-3 and C-3 in appendices A, B and C). However, the number of whales harvested did not fluctuate as greatly. Seven whales were harvested in Year One, 11 whales in Year Two and 10 whales in Year Three. In Year Three, more whales were harvested in the fall and these fall whales were very large, contributing to the much higher yield of usable pounds in Year Three compared to the other study years (Figures 13 and 14; Tables A-4, B-4 and C-4). The poor spring ice conditions (no open lead for long periods of time) limited Barrow's spring whale harvest to three in Year Three. To make up for the poor spring whaling and in an attempt to reach their quota of 14 whales, hunters seriously pursued bowheads in the fall of Year Three. In spite of bad weather in September, the ocean did not freeze until early November, allowing whalers to hunt during most of October when they landed seven whales. In other years, spring whaling was

Figure 14: Comparison of Monthly Bowhead Whale Harvest Estimates
Barrow, Years One, Two & Three



Three year study period: 4/1/87-3/31/90
Source: Stephen R. Braund & Assoc., 1993

more productive (five in Year One and eight in Year Two), and fewer whales were harvested in the fall (two in Year One and three in Year Two).

Consistent with the increase in pounds of bowhead landed each year, the percentage that those pounds represented in the overall harvest also increased each year. Bowhead represented 30 percent of the total harvest in Year One, 38 percent in Year Two, and 43 percent in Year Three. The percent of Barrow households harvesting bowhead also increased steadily over the three study years. In Year One, 31 percent of all households participated in bowhead harvests; in Year Two, 35 percent participated and in Year Three, 45 percent participated.

A comparison of Maps A-4, B-5 and C-5 shows some variation in the bowhead harvest locations over the three study years. The seven whales taken in Year One were concentrated into the smallest area of the three years, an area extending offshore from Walakpa to just beyond Point Barrow. Though not differentiated by season, the Year Two bowhead sites illustrate the different areas used in spring and fall. The spring whales were concentrated along the Chukchi coast where the lead opened and camps were based, while the three fall whales were taken northeast of Point Barrow in the Beaufort Sea. In Year Three, only three whales were taken in the spring and those whales were harvested along the Chukchi coast just below Walakpa and up near Barrow. Two fall whales were also taken in that area, and the remaining five fall whales were taken northeast of Point Barrow (one) and southeast by Cape Simpson (four).

The four Year Three fall whales near Cape Simpson were struck farther than the whalers usually go in search of whales. One whaling captain said that the whales were late in coming around the point because a seismic exploration boat working north from Dease Inlet kept the whales from passing this area until well after the boat had ceased its activity. Therefore, he indicated that the whalers went to where they knew the whales would be instead of waiting any longer for the whales to come closer. The three whales harvested later in October were struck closer to town. The hunters traveled farther than usual that fall because the spring harvest had been so poor and whalers were concerned that the fall harvest might also be poor.

Walrus

Walrus: Three Year Averages

Walrus hunting was once a more important activity for North Slope Inupiat than is now the case. When dog sleds were the primary means of transportation, walrus were used primarily as food for the dog teams. Both Spencer (1984) and Sonnenfeld (1956) noted that walrus meat was not highly valued and that most of the meat, including large portions of the skin, was fed to dogs. Despite the low regard for walrus meat, Sonnenfeld (1956:111) believed that walrus hunting was the most important subsistence activity of the "open water season." He further noted that if the Inupiat of Barrow have a successful whaling season, walrus became important primarily for their ivory. However, with an unsuccessful bowhead season, walrus became significant for their meat and blubber.

Walrus are immense animals weighing up to 4,000 pounds and providing over 700 pounds of usable weight. During the three study years, Barrow had few dogteams and a portion of the potential usable food available from the walrus was not eaten (mainly some of the blubber). However, consistent with Sonnenfeld's observation in the 1950s, walrus could provide a sizeable source of needed food if the whaling or caribou seasons were bad. Thus, though not a preferred food like caribou or bowhead whale, walrus continued to provide an important source of food.

Barrow hunters harvested an average of 81 walrus each year during this study, equalling an estimated 63,285 usable pounds (Table 11). The harvest averaged 68 pounds per household and 21 pounds per person. Of all species in all resource groups, walrus was third (following bowhead and caribou) in terms of its contribution to the total harvest, representing nine percent of the total usable pounds (Table 11) and 16 percent of the marine mammal harvest (Figure 10). An estimated 27 percent of Barrow households participated in successful walrus harvests during the study period. Stoker (1984) reported that walrus harvests in Barrow between the years 1963 and 1979 averaged 52.4 per year. Given a range from seven to 165 for that same period, the average harvest of 81 walrus per year during this study was well within the historic range, though considerably higher than the 1963 to 1979 average harvest of 52 animals.

Because the season for hunting walrus is potentially very brief, hunting was conducted opportunistically. Walrus migrate north on the moving ice and usually remain in the Barrow area for several weeks during July and August. By early October, the animals typically begin to move back to their winter habitat in the Bering Sea. The walrus are found mainly along the southerly portions of the pack ice where the ice is broken up; there the animals can rest on the floes and feed in the surrounding waters. The walrus are generally concentrated in the Chukchi Sea in the summer; few go as far as the Beaufort Sea where food sources are scant (S. Stoker, personal communication). Any number of factors may inhibit hunters' ability to reach the walrus, however. Ice and weather conditions can and often do prevent hunters from seeking walrus; additionally, the ice on which the walrus are found must be within a reasonable boating range from land. Residents reported that in some years, conditions have conspired to prevent hunters from achieving desired harvest levels. Therefore, when conditions were favorable, hunters devoted considerable effort to locating and intensively harvesting walrus, realizing that the ice and/or weather could change in a matter of hours and conceivably close down the hunt for the rest of the season (i.e., until the next year).

The activity of walrus hunting (as with bowhead and, to a lesser extent, bearded seals) is inherently dangerous. Traveling across open water in open boats, working amid the ice floes, and dealing with large, powerful, and potentially dangerous animals requires a great amount of skill and knowledge and involves considerable risk. Consequently, walrus hunting generally was a cooperative effort undertaken in groups of at least two people per boat; occasionally, two or more crews in separate boats worked together. Big groups of walrus are unpredictable, especially if large numbers are in the water rather than on the ice. They have a tendency to thrash about and, with their long tusks, they can slash or puncture a boat. For reasons of safety and ease in approach, Inupiat hunters preferred to hunt among smaller groups of walrus lying on the ice (Sonnenfeld 1956; field observations). Also, because walruses will sink when shot in the water, hunters try to harvest walrus while the animals are resting on the ice. Animals on the ice but near the edge are avoided because they may slide off the ice once shot. In this manner, local hunters limit their loss. The ice also provides the hunters with an excellent butchering area. Many walrus hunters preferred to hunt walrus south and west

of Barrow; not only is this a good area for hunting walrus, but also the northeasterly current would carry the hunters back toward town while butchering the animals on the ice. In this manner, hunters saved both time and fuel.

As Tables 12 and 13 indicate, walrus hunting occurs in the shortest season of all marine mammals, being heavily concentrated in the months of July and August, followed by only incidental harvests in September and October. July was the peak month for walrus harvests, when 65 percent of the average year's harvest was obtained. Another 32 percent were taken in August, a combined total of 97 percent in those two months. The short season is due to the fact that walrus migration patterns bring them to the Barrow area for only a brief period each year. Walrus harvests increased significantly with the arrival of the drifting summer pack ice and dropped sharply as soon as the ice left the general Barrow marine hunting area, typically in August.

Map 6 shows the harvest locations of walrus, bearded seals, and ringed and spotted seals. This map suggests that generally most of the seal harvests were concentrated within 12 miles of shore, while walrus harvests occurred in a broad area extending from near shore to over 50 miles offshore. As mentioned above, walrus harvests occurred almost exclusively amid the floating pack ice, which tends to remain offshore.

Walrus: Comparison of Years One, Two and Three

As discussed previously, the summer walrus hunting season generally is brief and subject to environmental conditions that can eclipse the season at any point. Consequently, walrus harvests can vary a great deal from year to year. During the present study, Barrow residents obtained 84 walrus in Year One (Table A-3), 61 in Year Two (Table B-3), and 101 in Year Three (Table C-3). Sonnenfeld (1956) reported that Barrow hunters took 100 walrus in 1951 and less than 10 the next year, 1952. In 1953, approximately 60 walrus were harvested. Stoker (1984) reported that Barrow walrus harvests ranged from seven to 165 animals per year from 1963 to 1979, as noted previously. These wide ranges demonstrate the extreme variability in harvests from year to year, motivating hunters to hunt intensively when conditions allow.

In Year One, the majority of the 84 walrus harvested occurred in a five day period around mid-July and during a week that spanned late August and early September. For most of the season, high winds, heavy rains, grounded ice and/or remoteness of the pack ice limited walrus hunting. In Year Two, winds brought ice in against shore for most of July and early August, hampering boat travel. Hence, the second week of July and most of the month of August were the main opportunities for hunting walrus, and heavy fog often limited travel during those ice-free periods. Consequently, many people did not get any walrus until August. One resident indicated that his aged walrus meat did not acquire the right taste in 1988 because it was harvested too late (mid-August) to benefit from the warmer days of July. Year Two walrus harvests were lower than those of Years One and Three, with 61 walrus taken. Year Three, when 101 walrus were harvested, had more favorable conditions than the previous two years and also had, according to residents, a greater abundance of the resource. The ocean ice remained an easy distance from Barrow throughout July. Combined with lower winds and clearer, warmer weather than the previous two years, the walrus season was more successful than in Years One and Two. Most of the harvest occurred in the last two weeks of July. Despite some variation from year to year, Figure 15 illustrates the consistent pattern of walrus harvests each year, showing July and August as the peak months with virtually no harvests throughout the remainder of the year.

According to the NSB Department of Wildlife Management personnel, the coincident timing of the walrus migration, the ice opening up and ice floes remaining close to Barrow is a critical factor in the success of the walrus harvest. The timing of the migration is also influenced by the ice moving out of the Bering Sea. In Years One and Two, the bulk of the walrus migrated past Barrow while the ice was still in; hence, fewer walrus were around by the time summer boating commenced.

As with bowhead whale, Year One walrus harvests were concentrated into a smaller area than were Year Two and Year Three harvests (Maps A-4, B-4 and C-4). In Year One, walrus were taken between Peard Bay and Point Barrow, mainly within 20 to 25 miles of shore. The majority of Year Two harvests were in this same area, with a few harvests extending to about 30 miles offshore.

Figure 15: Comparison of Monthly Walrus Harvest Estimates
Barrow, Years One, Two & Three

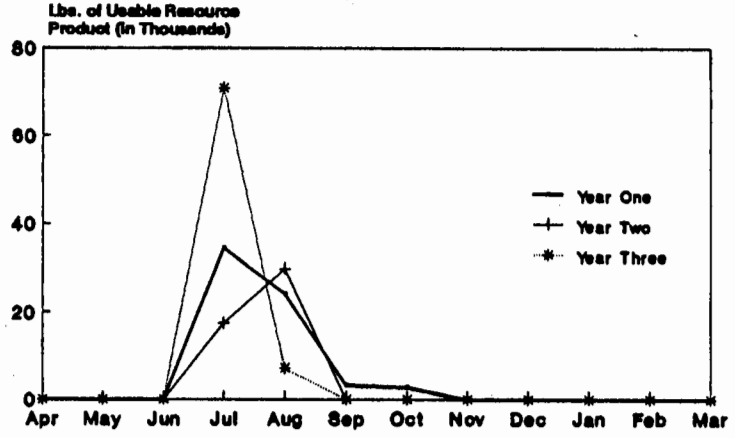


Figure 16: Comparison of Monthly Polar Bear Harvest Estimates
Barrow, Years One, Two & Three

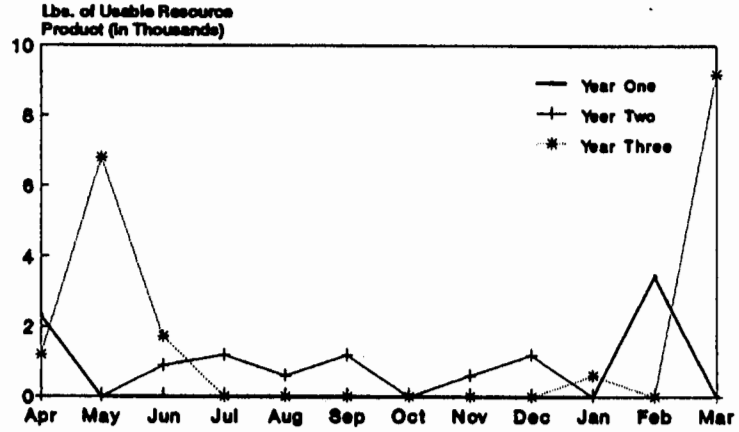
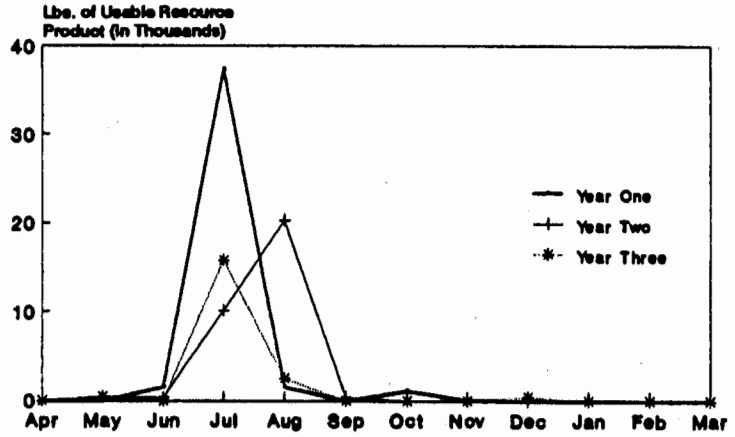
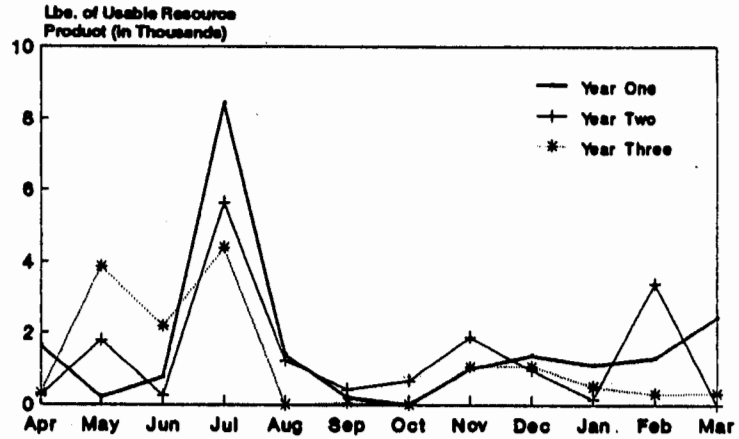


Figure 17: Comparison of Monthly Bearded Seal Harvest Estimates
Barrow, Years One, Two & Three



Three year study period: 4/1/87-3/31/90

Figure 18: Comparison of Monthly Ringed and Spotted Seal Harvest Estimates
Barrow, Years One, Two & Three



Source: Stephen R. Braund & Assoc., 1993

Year Three harvests extended yet farther offshore (over 50 miles). Generally, however, the main harvest area remained very consistent from year to year.

Bearded Seal

Bearded Seal: Three Year Averages

The average annual bearded seal harvest of 30,696 pounds (174 animals) represents approximately four percent of Barrow's total subsistence harvest (Table 11) and eight percent of the total marine mammal harvest (Figure 10). Twenty-nine percent of Barrow households successfully harvested bearded seal during this study, the fourth highest participation rate following caribou hunting, whaling, and eider (non-specified) hunting, and the same participation rate as harvesting broad whitefish. Bearded seal furnished approximately 32 usable pounds per household or 10 pounds per person each year.

Bearded seal was one of the primary marine mammals sought by Barrow hunters. Like bowhead whales and walrus, bearded seals were specifically pursued rather than being harvested incidentally. Most of the bearded seal population is migratory, coming north to the Chukchi Sea in the summer as the ice pack retreats and wintering in the central Bering Sea (Stoker 1984). Some bearded seals occasionally were seen in the Barrow area by whaling crews (May) but the main hunting season was July when the ice left shore, allowing hunters to launch their boats from town. Like other marine animals, harvesting bearded seal depended on ice conditions. Bearded seal, like walrus, inhabit the environment around the drifting ice pack. As long as ice floes remained in Barrow waters, chances of getting bearded seals were good. Thus, the timing and success of the bearded seal harvest in any given year was directly related to the ice conditions that year; a bad year of ice also meant a poor year for bearded seal harvests.

As the above discussion implies, the main method of hunting bearded seals was from one's boat during the summer. Barrow hunters traveled by boat to the drifting ice in July and August where concentrated numbers of the animals were found. Hunters shot the seals either from their boats or by landing on the ice and shooting the animal from the ice. A second and less common method of

hunting bearded seals was from the ice edge in the winter. As Stoker (1984) indicated, not all bearded seals migrate south for the winter; some overwinter in the Chukchi Sea. Ice edge hunting involves traveling to an open lead during the winter months and shooting seals that surface in the open water. Only a few Barrow hunters hunted seals in the winter at open leads during this study, and only a few bearded seals were harvested in this manner.

Bearded seals were one of the favorite foods during the three study years. In addition to consuming the meat (especially popular dried into a jerky), Barrow residents rendered the large quantity of blubber into oil and used it throughout the year as a condiment with other foods. However, the importance of the bearded seal harvest is not adequately measured in terms of usable pounds alone because their skins also play an important role in Barrow. One of the most important uses of the bearded seal in Barrow was to cover whaling boats with the skin. The bearded seal hide was always stored folded in a burlap sack in a cool, dark place. When the time came to re-cover the *umiaq*, or skin boat, the whaling captain and crew members stretched out the skins and sewed them to the *umiaq* frame. Bearded seal skins used on *umiat* (*umiat* is plural for *umiaq*) must be replaced every two to three years and are painted in the intervening years to help lengthen the durability of the skins. Field observations determined that about one-third of the 36 Barrow whaling crews re-covered their boats in Year One, with an average of five skins per boat. Bearded seal skins were shared and traded among hunters to ensure that those captains who needed fresh skins had enough. Whalers described their boat size in terms of how many bearded seal skins made up the covering of the boat, e.g., "my boat is an eight skin boat." Surplus skins were made into clothing (particularly soles of *mukluks*), sold or given to relatives or friends.

July was the peak month for bearded seal harvests. Table 12 shows bearded seal harvests beginning gradually in May and June (one and two percent respectively) and jumping to 69 percent in July followed by 26 percent in August. As with walrus, bearded seal harvests increased significantly with the arrival of the drifting summer pack ice and dropped sharply as soon as the ice left the general Barrow marine hunting area, typically in August.

The area in which Barrow hunters harvested bearded seals over the three study years generally extended slightly farther than the area where ringed seals were taken, but not quite as far to sea as the area in which walrus were harvested. Map 6 depicts the locations of all reported bearded seal harvests during the study period. The harvests ranged from Kugrua Bay (within Peard Bay) to the southwest, to nearly 30 miles northeast of Point Barrow, and around the point in Elson Lagoon. Along the coast between Point Barrow and Peard Bay, harvests extended up to 20 miles offshore.

Bearded Seal: Comparison of Years One, Two and Three

Barrow's harvest of bearded seals declined over the course of the three study years, from 236 bearded seals harvested in Year One to 179 in Year Two and 109 in Year Three. The decline in total seal harvests over the three study years may be related to variable environmental conditions, to how many *umiat* needed new bearded seal skins the following spring, or to an emphasis on harvesting walrus over bearded seal (following Year Two's poor walrus harvest).

Bearded seal hunting generally took place during the summer boating season. Most of the bearded seals were harvested while open water and ice floes were close to town, coinciding with the timing of walrus hunting. Year One and Three bearded seal harvests were similar in that 90 and 83 percent (respectively) of the harvests occurred in July, whereas in Year Two, the majority (65 percent) of the bearded seal harvests did not occur until August when the ice finally moved away from shore (Tables A-4, B-4 and C-4). Figure 17 shows that July and August were consistently the predominant months for bearded seal harvests, with little or no harvest occurring the rest of the year.

Bearded seal harvest locations varied only slightly over the three study years (Maps A-4, B-4 and C-4). Barrow hunters concentrated their harvests in the area between Point Barrow and Peard Bay and offshore to about 20 miles. In Year Two, several harvests occurred around Point Barrow in the Beaufort Sea because the grounded ice on the Chukchi side caused many hunters to hunt on the Beaufort Sea, which usually is less productive. In Year Three, one harvest occurred northeast of the point in the Beaufort Sea. Otherwise, harvest locations were very consistent throughout the study period.

Ringed and Spotted Seals

Ringed and Spotted Seals: Three Year Averages

Because of their quantity, general availability and desirability as food, ringed seals were historically the staple food for Barrow Inupiat (Murdoch 1891; Sonnenfeld 1956). According to Sonnenfeld (1956), seals (predominantly the ringed seal) provided not only skin (used for clothing, nets, dog harnesses, and various other items) but also meat, and blubber rendered into oil for eating and for a source of light and heat. Ringed seals also provided sinew for thread, bones for fabricating implements and intestines for waterproof clothing.

Ringed seals have declined in importance in Barrow's subsistence economy mainly due to the introduction of the snowmachine. When dog teams were the primary means of transportation, ringed seals were a primary source of dog food. The introduction of modern materials has obviated the need for the oil for heat and light, sinew and other byproducts of the animal. In terms of oil rendered to eat with other foods, field observations indicated that bearded seal oil clearly was preferred. During the study period, 19 percent of Barrow households harvested an average of 394 ringed seals annually, yielding a total of 16,557 usable pounds each year or about 18 pounds per household (Table 11). These small seals contributed approximately two percent of the total community harvest.

Though not one of the most preferred species overall (according to field interviews), ringed seals were hunted to supplement and provide variety in the diet. Ringed seals are only somewhat migratory, and therefore many of these animals reside near the Barrow shorefast ice through the winter (Stoker 1984), making them one of the few resources available to Barrow hunters during the winter. Consequently, ringed seals provided a source of fresh meat in the winter diet. Fresh seal in the winter and spring was considered a treat. Ringed seal was prepared as a special meal, usually baked, in contrast to the preferred way of fixing bearded seal as strips of dried jerky to be eaten plain or soaked in seal oil. Ringed seal was a heavily shared species. A few active seal hunters throughout the winter months provided fresh seal to the rest of

the community, especially to the elders (field observation). For the most part these animals were harvested incidentally rather than being sought out specially, except during the winter. Ringed seal was valued as a secondary resource for Barrow.

Ringed seals were hunted near Barrow throughout the year in accordance with open water conditions. In the winter, ringed seals were hunted from the ice edge any time an open lead formed within a few miles of Barrow. After high winds from the east, hunters sought an open lead on the west side of the point; conversely, after high winds from the west, a lead usually formed to the east of the point. The lead would freeze back over in a matter of days. During spring whaling, whalers hunted ringed seals when whales were not around. Ringed seals were also harvested on the ice when people went duck hunting along the coast in early June, and while hunting walrus and bearded seals amid the floating pack ice in June, July and August. As Table 12 indicates, 37 percent of the average year's ringed seal harvest occurred in July, the peak harvest month for this species. The second highest ringed seal harvests typically occurred in May (12 percent) when whaling crews were camped on the open lead. Another 10 percent were taken in February. Ringed seals were harvested throughout the year, being on of the few resources available year-round. (Caribou and ptarmigan are the only other resources with nearly year-round availability.)

Spotted seals were harvested in far fewer numbers than ringed seals. Over the three study years, residents reported an average of three spotted seals taken per year, equaling 131 pounds (less than half a pound of meat per household) and contributing less than a tenth of one percent of the year's total harvest. Spotted seal harvests during the study period were low for a few reasons. Most families did not eat spotted seal meat, though it was often used for dog food when dog teams were common in Barrow. Another factor in the low harvest numbers was that spotted seals were usually scarce in the area where most of the other marine mammal harvests took place. These seals were present in the Barrow area only in the summer and tended to concentrate in specific areas, such as Oarlock Island in Admiralty Bay and up the Kugrua River in Peard Bay. Most harvests occurred incidentally to other pursuits. More often, however, hunters who encountered spotted seals left them alone. Spotted seal skins were

desirable for crafts, as demonstrated in Year One by a study participant's excitement over her son's harvest of a "beautiful" spotted seal skin. Being migratory, spotted seals were harvested mainly in the summer months of July and August and to a lesser extent also in May and September (Table 12). Combined, ringed and spotted seals represented four percent of the total marine mammal harvest (Figure 10).

Though not shown on the tables, one ribbon seal was harvested in May of Year Three along with other seals during whaling. Ribbon seals are harvested infrequently in Barrow, typically occurring as an incidental catch while out hunting bearded or ringed seals.

Map 6 presents ringed and spotted seal harvest locations (undifferentiated) for the three study years. Successful harvests occurred mainly within a 15 mile wide band along the coast from just south of Walakpa to just beyond Point Barrow. Additional harvests occurred in the vicinity of Peard Bay, 20 miles northeast of Point Barrow, and by the mouth of the Ikpikpuk River in Smith Bay. Barrow hunters pursued these small seals at open leads, with great patience at their breathing holes or while the seals sunned themselves on the ice.

Ringed and Spotted Seals: Comparison of Years One, Two and Three

Ringed seal harvests declined steadily over the three study years. While 466 animals were taken in Year One, 388 were taken in Year Two and 328 were taken in Year Three. The decline in Year Two was in the summer harvests. With the coast ice bound much of the summer, seal harvests declined. In Year Three, the decline occurred in the winter. Winter seal harvests were considerably lower than in the two prior years because ice and weather conditions were not as favorable in Year Three as in Years One and Two. The percentage of the Barrow households harvesting these seals also declined, though not as steeply. In Year One, 14 percent of Barrow households harvested ringed seals successfully compared to 10 percent in Year Two and 11 percent in Year Three. Spotted seal harvests were consistently low at two to four per year.

Figure 18 compares the Year One, Two and Three monthly harvest levels for ringed and spotted seal harvests (combined). The annual seasonal pattern is

evident, showing generally low harvests throughout the year with a major increase during July. The years varied slightly, however, with strong harvests shown in May and June of Year Three and in February of Year Two. The higher harvests in May of Year Three were due to the poor ice conditions for whaling that month. With only small openings in the ice, hunters were unable to whale but had ample opportunity to pursue fresh seal meat both for consumption at whaling camp and for sending back to town.

Ringed seal harvests each year were clustered around the point and in the waters just off Barrow south almost to Walakpa. This main harvest area was consistent from year to year, as Maps A-4, B-4 and C-4 indicate. Additionally, a few harvests took place each year down the coast toward Peard Bay. In Year One, very few harvests occurred outside this area, while in Year Two, a series of harvests extended east from Point Barrow into the Beaufort Sea. As mentioned in the discussion of bearded seal harvests, these harvests in the Beaufort Sea occurred because the Chukchi side was closed in by grounded ice during most of July and early August. Consequently, Barrow residents hunted in the Beaufort Sea which is usually less productive than the Chukchi. In Year Three, one harvest occurred well offshore in the Beaufort Sea, and another seal was taken by the mouth of the Ikpikpuk River in Smith Bay. Generally, however, locations were highly consistent from year to year.

Polar Bear

Polar Bear: Three Year Averages

Barrow residents harvested an average of 21 polar bears each year during the study period, yielding an estimated 10,288 usable pounds of meat, or 11 pounds per household (Table 11). This harvest represented less than two percent of the total subsistence harvest (Table 11) and the same proportion of the marine mammal harvest (Figure 10). Six percent of Barrow households harvested polar bears during the study.

Although a few people hunted specifically for polar bears, most of these animals were harvested more or less spontaneously when a hunter encountered them incidentally (or heard of one's presence and pursued it). The rich meat of the

polar bear was commonly divided up and distributed beyond the hunter's family. Polar bear represented a secondary food source along with ringed seals and ptarmigan, for example. While use of these species may be sporadic and at a lesser volume than other resources, they remain of considerable value as a subsistence food. For some Inupiat individuals and households, some of these less common foods were valued and special treats. Elders in particular considered polar bear a delicacy. Polar bear meat was widely distributed when harvested (field observations).

Since passage of the Marine Mammal Protection Act in 1972, the sale of polar bear hides (once a popular commodity) has been prohibited. Consequently, people no longer had an economic motivation for hunting this animal. However, the hides can still be used in traditional means such as for clothing and handicrafts. Polar bear hides were used occasionally for clothing and some hides were also used to sleep on at whaling camp.

The few people who hunted polar bear specifically usually did so in the fall and winter months (October through March). However, as Tables 12 and 13 indicate, the four month period from February through May was when most of the polar bears were taken (74 percent). March was the peak month (with 30 percent of the average year's polar bear harvest) and the second highest month was May (22 percent). According to the North Slope Borough Department of Wildlife Management, polar bears follow the open lead, mostly staying on the moving pack ice in search of food, but also coming onto the shorefast ice and shore when the leads are closed. During whaling (and preparation for whaling, such as building trails to the lead), many people are out on the ice traveling to, from and between camps set along the open lead. Thus, the opportunity for a person to encounter a polar bear is much higher than during the rest of the year when fewer people (including polar bear hunters) are on the ice. Furthermore, the presence of whale carcasses may attract polar bears to these same areas where people concentrate for whaling. These factors likely resulted in the higher concentration of harvests in the period from February through May.

According to a Wainwright resident, people hunted polar bears in the late fall and winter months (before sale of the hides was prohibited) because the animal's fur was the whitest at that time. The coat turns more yellow in the

spring and summer, reportedly because of the whale and walrus blubber the polar bears consume (field interview).

Polar bears were harvested in roughly the same area as bowhead whales (Map 7). During the three study years, the main hunting area was between Point Barrow and Walakpa where walrus and whale carcasses tended to wash ashore in the fall, attracting polar bears. Hunters successfully obtained polar bears all along the coast from Point Barrow to Peard Bay, as well as several miles offshore to the northwest and northeast of Point Barrow. Residents always were concerned about human safety if a polar bear was known to be near town; thus, some of the harvests near Barrow were at least in part a matter of public safety.

Polar Bears: Comparison of Years One, Two and Three

As a comparison of Tables A-3, B-3 and C-3 indicates, the polar bear harvest increased significantly in Year Three, from 12 polar bears harvested in Year One and 11 in Year Two to 39 in Year Three. As mentioned above, polar bears generally follow the open leads in search of food. In Year Three, the lack of open water limited polar bears' access to food, causing polar bears to come toward shore and into town in search of food. Hungry (and usually underweight) polar bears that ventured into town were considered especially dangerous, and usually were shot immediately. Consequently, more bears were shot in self-defense in Year Three than in the previous study years (field observation). This increase in polar bears coming around human settlements, such as Barrow or whaling camps, combined with the whalers' extended wait at their spring whaling camps (due to Year Three's poor ice conditions), led to a higher than normal number of human/bear contacts, and thus to a higher number of bears being harvested in general, with 88 percent occurring in March, April and May (Table C-4). Thirty-five percent of the Year Three harvest occurred in May, when there was little open water and the whalers spent a lot of time waiting on the ice. In contrast, no polar bears were harvested in May of Years One or Two (Table A-4 and B-4). In Year Two, when the ocean ice grounded onshore in July, 21 percent of the polar bear harvests occurred, whereas no bears were harvested in July of Year Three when open water predominated. Thus, polar bear harvests often were related to ice conditions as well as to the volume of people spending time on the ice. The considerable variability in

monthly harvest levels can be seen in Figure 16, which compares monthly harvests for Years One, Two and Three.

Due to the unusually high polar bear harvest in 1989, the North Slope Borough Fish and Game Management Committee and Department of Wildlife Management have increased their efforts to inform hunters about the Polar Bear Management Agreement between Alaska and Canada. This agreement limits the allowable number of polar bears taken on both sides of the border with the goal of maintaining the polar bear population at a healthy level. During the winter of Year Three when this campaign of polar bear conservation had been renewed, one Barrow hunter mentioned seeing a mother bear with her cubs, but not shooting her because he knew that he was not supposed to hunt female bears with cubs (field interview).

Year One polar bear harvests mainly occurred within a few miles of Barrow, with an additional harvest offshore from Walakpa (Map A-4). In contrast, hunters in Year Two obtained polar bears well offshore (northwest of Barrow), down the coast by Peard Bay, inland by a lake southeast of Barrow, as well as in the vicinity of Barrow (Map B-5). Year Two harvests were the most dispersed geographically. In Year Three, polar bears were taken in an area corresponding closely to the spring leads, where, as mentioned above, whalers awaited opportunities to hunt bowheads and encountered numerous polar bears (Map C-5). The Year Three harvests extended past the spring whaling area into the Beaufort Sea, northeast of Point Barrow.

TERRESTRIAL MAMMALS

Terrestrial Mammals: Three Year Averages

Barrow's location has been a key variable in the community's adaptability as residents have good access to the resources of both the terrestrial and marine environments. The previous section documented the importance of the marine environment in the Barrow subsistence way of life. This section on terrestrial mammal harvests, in combination with the next three sections on fish, birds and other resources, will describe residents' use of the terrestrial environment. While the vast majority of the total harvests derive from marine environs, the

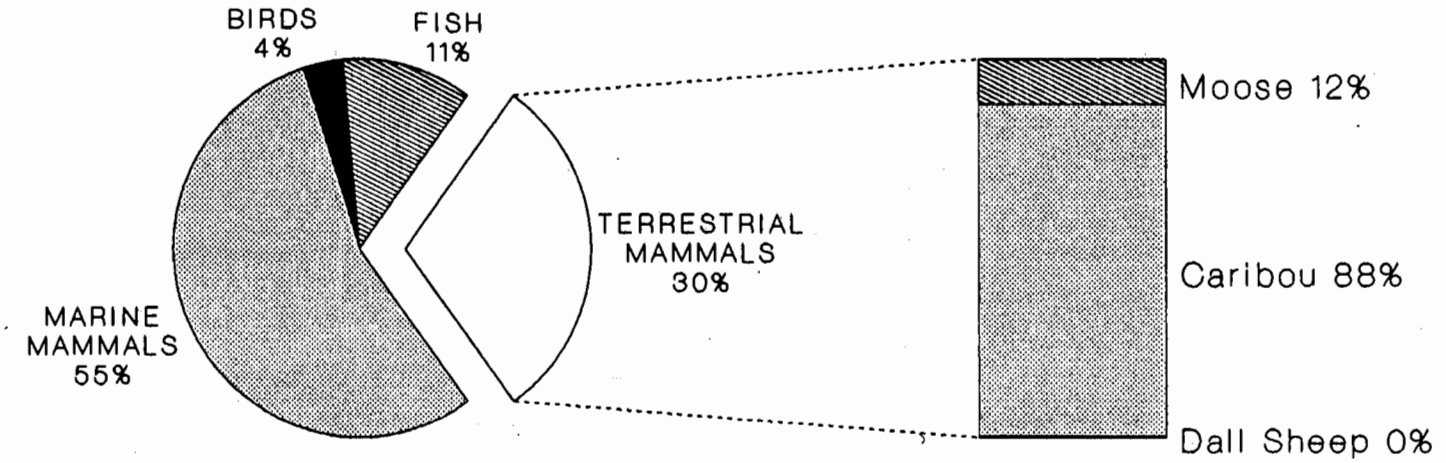
season for harvesting most marine resources is brief, and ice and weather conditions can severely impede hunters' success. The terrestrial environment, in contrast, yielded less in terms of usable pounds, but offered a more steady source of sustenance (namely caribou) throughout the year. In addition to caribou, other terrestrial mammals harvested during this study were brown bear, moose, Dall sheep, ground squirrel, and the furbearers, which included arctic and red fox and wolverine.

In Years One through Three, Barrow residents' harvest of terrestrial mammals for subsistence purposes averaged 226 pounds of usable meat per household, 88 percent of which came from caribou (Figure 19, Table 14, Figure 20). (Furbearers were not included in estimates of usable weight because they were harvested for their fur and not as food.) Fifty-four percent of the Barrow population participated in successful terrestrial mammal harvests, providing 30 percent of the total community subsistence harvest each year (Table 14). The majority of the terrestrial mammal harvest by weight (81 percent) was taken in the four months from July through October, as indicated in Table 15. Most all terrestrial mammal harvests peaked in the late summer/early fall months, with the exception of the furbearing mammals (Table 16), which were hunted and harvested mainly in winter, November through March. Figure 21 graphs the average pounds harvested each month by species. Map 9 shows terrestrial mammal harvest sites for the three study years. These harvests ranged widely, from the Peard Bay area east to the mouth of the Colville River and south to the upper Colville River, and were very densely clustered around Barrow and a large area to the south and east. The majority of the terrestrial mammal harvests fell within the lifetime community land use line. The southernmost harvests (shown mainly along the Colville River), however, extended beyond the historic use area. Discussions with furbearer hunters during this study indicated they hunted occasionally on the south side of the Colville River as well.

Terrestrial Mammals: Comparison of Years One, Two and Three

Terrestrial mammal harvests remained very constant from year to year (with regard to those species measured by their usable weight - i.e., not including furbearers since they are not harvested for food). Harvests totaled 213,834 pounds in Year One, 207,005 pounds in Year Two, and 214,683 pounds in Year

Figure 19: Estimated Terrestrial Mammal Harvest Percentages, Barrow
Years One, Two and Three Averaged
(Usable Pounds Harvested)



Three years of study: 4/1/87 - 3/31/90
Source: Stephen R. Braund & Assoc., 1993

TABLE 14: HARVEST ESTIMATES FOR TERRESTRIAL MAMMALS - ALL BARROW HOUSEHOLDS, THREE YEAR AVERAGE (1,2)

RESOURCE	CONVERSION FACTOR (3) (Usable Weight Per Resource in lbs)	COMMUNITY TOTALS		AVERAGE POUNDS HARVESTED		PERCENT OF TOTAL USABLE POUNDS HARVESTED	PERCENT OF ALL BARROW HSEHOLDS HRVSTING RESRCE (4)	SAMPLING STATISTICS				
		NUMBER HARVESTED	USABLE POUNDS HARVESTED	PER HOUSEHOLD	PER CAPITA			STANDARD DEVIATION (lbs)	SAMPLING ERROR AT 95% (lbs)	LOW ESTIMATE (Mean lbs/ Household)	HIGH ESTIMATE (Mean lbs/ Household)	SAMPLING ERROR AS % OF MEAN
Total Terrestrial Mammals	n/a	n/a	211,839	226.1	70.2	30.1%	54%	31	61	165.54	286.68	27%
Caribou	117.0	1,595	186,575	199.1	61.9	26.6%	54%	29	57	142.56	255.68	28%
Moose	500.0	48	24,053	25.7	8.0	3.4%	7%	14	27	0.00	52.93	106%
Brown Bear	100.0	1	84	0.1	*	**	**	0	0	0.04	0.14	53%
Dall Sheep	99.0	11	1,106	1.2	0.4	**	3%	1	2	0.00	2.90	146%
Other Terrestrial Mammals	n/a	15	21	0.0	*	**	1%	0	0	0.00	0.05	131%
Porcupine	10.0	2	16	0.0	*	**	1%	0	0	0.00	0.05	174%
Ground Squirrel	0.4	14	5	0.0	*	**	**	0	0	0.00	0.01	56%
Wolverine	n/a	2	n/a	n/a	n/a	n/a	1%	n/a	n/a	n/a	n/a	n/a
Arctic Fox (Blue)	n/a	129	n/a	n/a	n/a	n/a	5%	n/a	n/a	n/a	n/a	n/a
Red Fox (Cross, Silver)	n/a	5	n/a	n/a	n/a	n/a	**	n/a	n/a	n/a	n/a	n/a

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(1) Three years of study: April 1, 1987 - March 31, 1990.

(2) Estimated sampling errors do not include errors in reporting, recording, and in conversion to useble weight.

(3) See Table D-5 for sources of conversion factors.

(4) This percentage is a cumulative total for the three study years rather than an annual average.

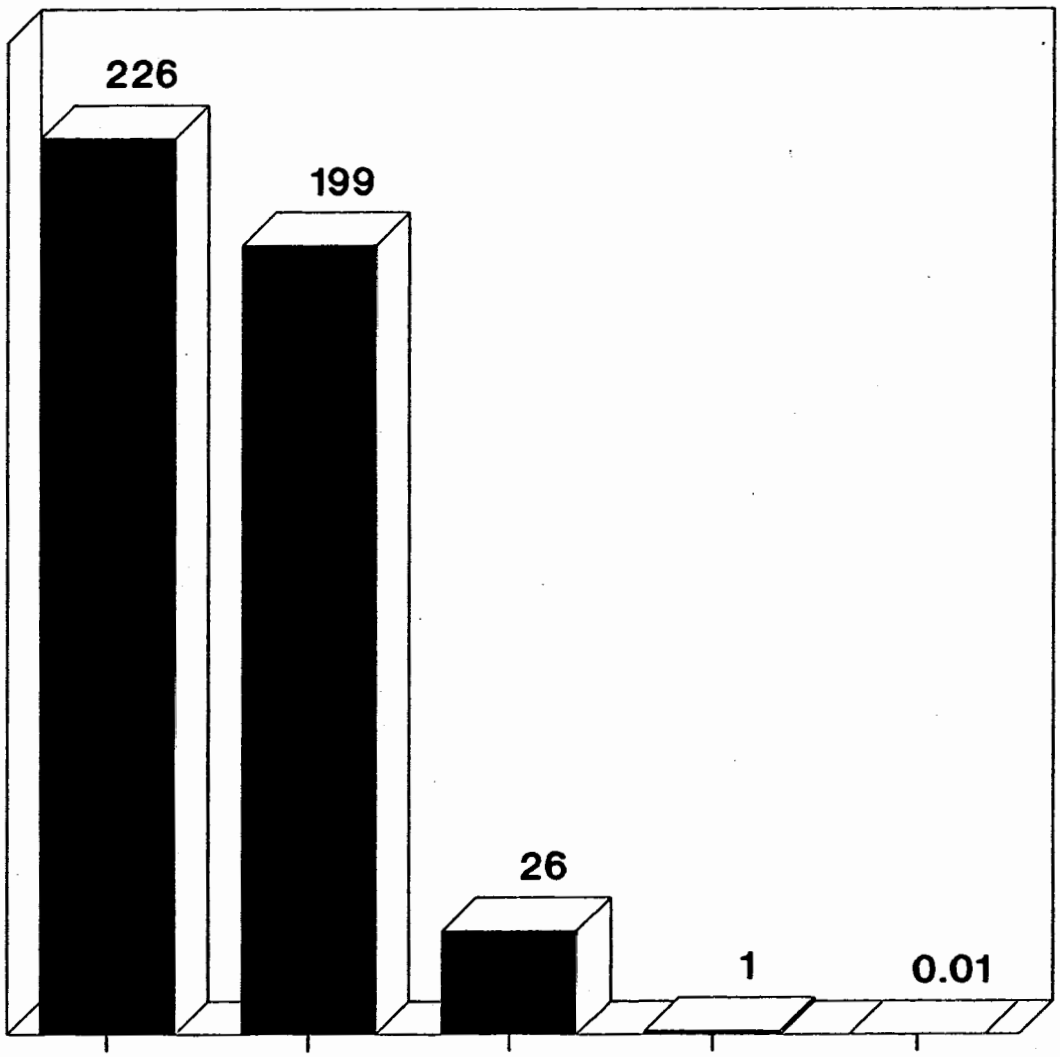
* represents less than .1 pound
** represeents less than .1 percent
n/a means not applicable

Source: Stephen R. Braund & Associates, 1993

Figure 20: Terrestrial Mammal Harvest Estimates, Barrow

Years One, Two and Three Averaged

(Mean Usable Pounds Per Household)



% of Terrestrial Mammals:	100%	88%	12%	<1%	<1%

Three years of study: 4/1/87 - 3/31/90

Source: Stephen R. Braund & Assoc., 1993

TABLE 15: TERRESTRIAL MAMMAL HARVEST ESTIMATES BY SPECIES AND MONTH - BARROW, THREE YEAR AVERAGE (1)
(Pounds of Usable Resource Product)

TOTALS

1987-1990 ******

SPECIES	April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Caribou	328	5,469	2,394	31,786	46,916	16,607	53,953	3,575	979	8,683	6,421	9,468
Moose	0	0	0	600	6,977	16,081	0	0	0	0	0	400
Brown Bear	0	0	0	0	0	80	0	0	0	0	0	0
Dall Sheep	0	0	0	0	1,106	0	0	0	0	0	0	0
Other Terrestrial Mammals	0	0	0	3	0	2	16	0	0	0	0	0
Porcupine	0	0	0	0	0	0	16	0	0	0	0	0
Ground Squirrel	0	0	0	3	0	2	0	0	0	0	0	0
All Terrestrial Mammals (excluding furbearers)	328	5,469	2,394	32,389	54,999	32,770	53,969	3,575	979	8,683	6,421	9,868

PERCENTS

1987-1990 ********

SPECIES	April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Caribou	0%	3%	1%	17%	25%	9%	29%	2%	1%	5%	3%	5%
Moose	0%	0%	0%	2%	29%	67%	0%	0%	0%	0%	0%	2%
Brown Bear	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%
Dall Sheep	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Other Terrestrial Mammals	0%	0%	0%	15%	0%	10%	75%	0%	0%	0%	0%	0%
Porcupine	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%
Ground Squirrel	0%	0%	0%	59%	0%	41%	0%	0%	0%	0%	0%	0%
All Terrestrial Mammals (excluding furbearers)	0%	3%	1%	15%	26%	15%	25%	2%	0%	4%	3%	5%

(1) Three years of study: April 1, 1987 - March 31, 1990.

Source: Stephen R. Braund & Associates, 1993

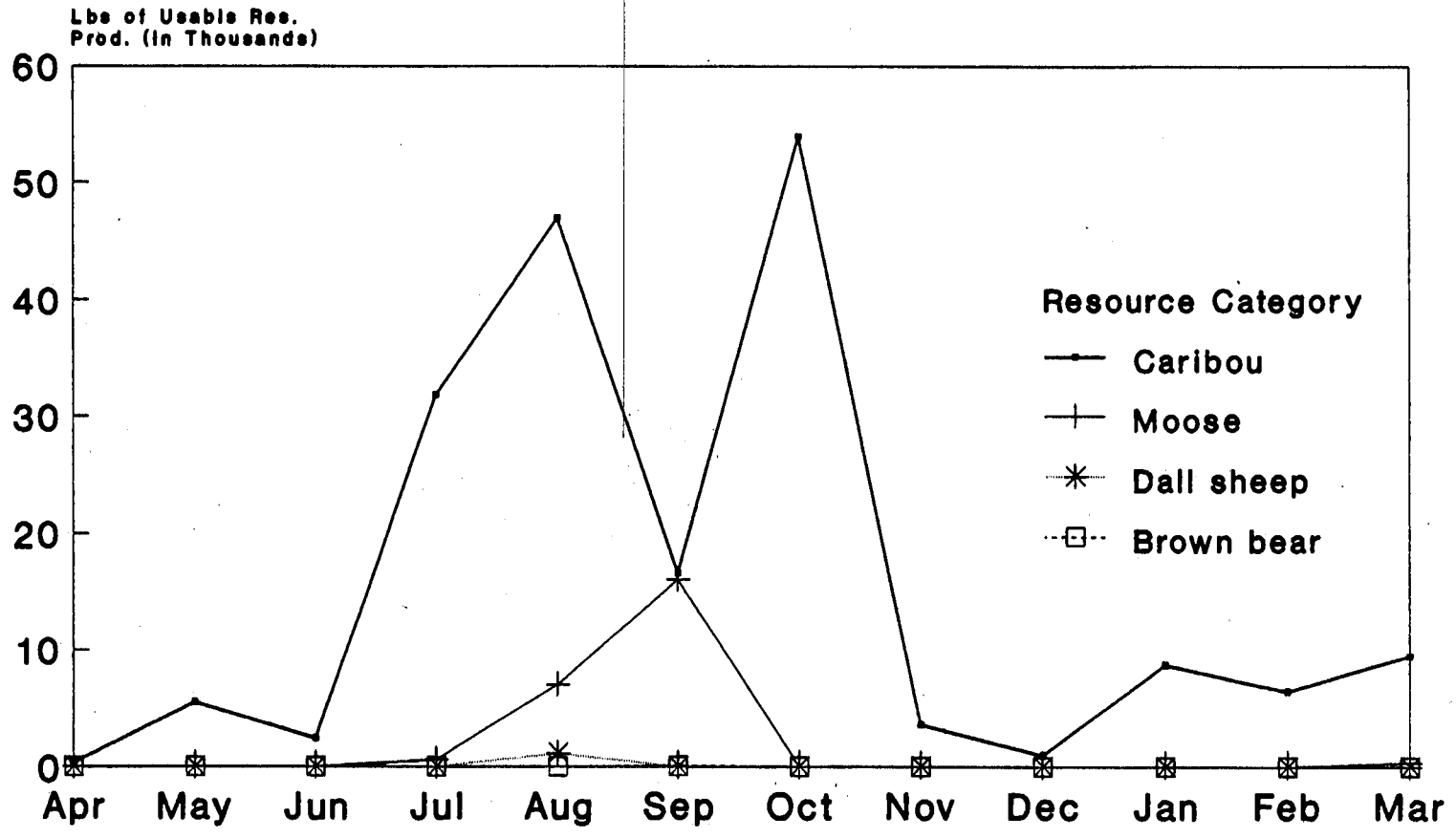
TABLE 16: TERRESTRIAL MAMMAL HARVEST ESTIMATES BY SPECIES AND MONTH - BARROW, THREE YEAR AVERAGE (1)
(Number Harvested)

SPECIES	1987-1990 TOTALS ****** April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Caribou	3	47	20	272	401	142	461	31	8	74	55	81
Moose	1	0	0	1	14	32	0	0	0	0	0	0
Brown Bear	0	0	0	0	0	1	0	0	0	0	0	0
Dall Sheep	0	0	0	0	11	0	0	0	0	0	0	0
Other Terrestrial Mammals	0	0	0	8	0	6	2	0	0	0	0	0
Porcupine	0	0	0	0	0	0	2	0	0	0	0	0
Ground Squirrel	0	0	0	8	0	6	0	0	0	0	0	0
Arctic Fox (Blue)	0	0	0	0	0	0	0	5	45	29	36	13
Red Fox (Cross, Silver)	0	0	0	0	0	0	0	0	0	0	0	4
Wolverine	0	0	0	0	0	0	0	0	0	0	1	1

(1) Three years of study: April 1, 1987 - March 31, 1990.

Source: Stephen R. Braund & Associates, 1993

Figure 21: Monthly Terrestrial Mammal Harvest Estimates, Barrow
Years One, Two & Three Averaged

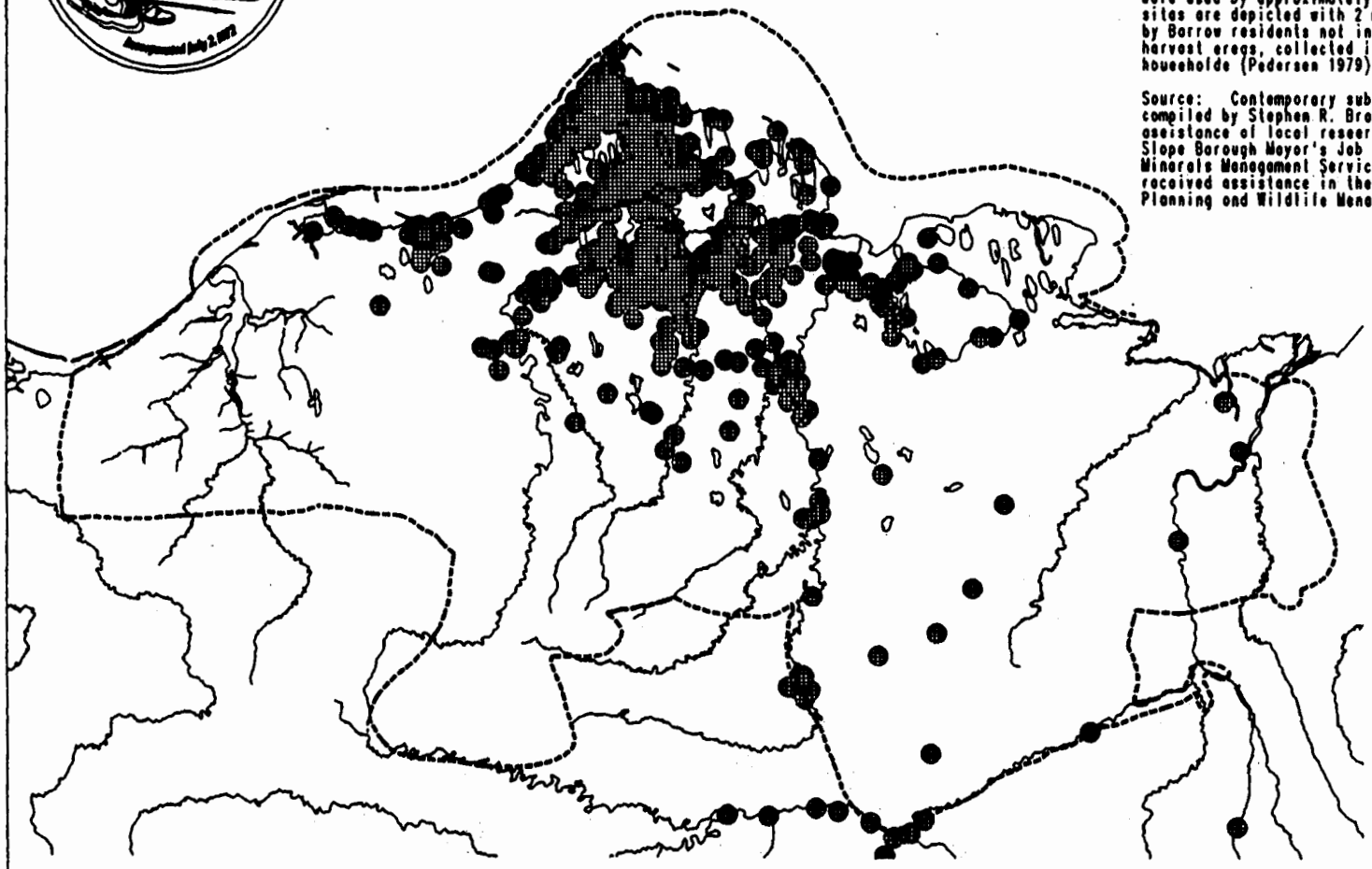


Three years of study: 4/1/87 - 3/31/90
Source: Stephen R. Braund & Assoc., 1993

MAP 9
NORTH SLOPE SUBSISTENCE STUDY - BARROW
TERRESTRIAL MAMMAL HARVEST SITES - ALL SPECIES, YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study. Lifetime-community harvest areas, collected in the form of map biographies from 20 households (Pedersen 1979), are also illustrated.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska.



LEGEND INFORMATION

Lifetime community land use (Pedersen 1979).

Terrestrial Mammals
- Caribou
- Moose
- Brown bear
- Fox
- Wolverine
- Ground squirrel
- Porcupine

Map Production: North Slope Borough GIS

Date: April 11, 1991

25 0 25 50 75 100 125

MILES

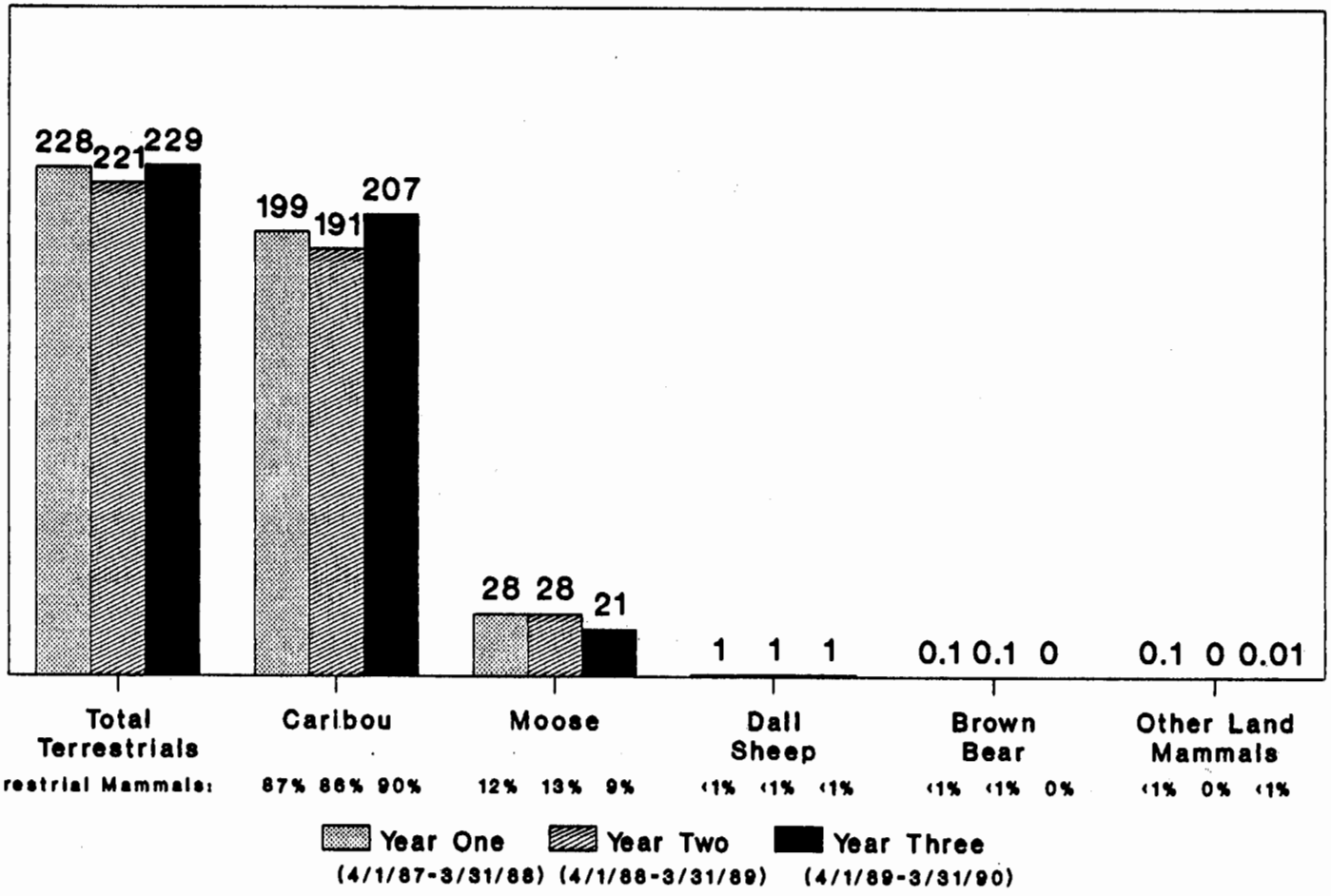
N

Three (Tables A-6, B-6 and C-6). A comparison of mean household harvests by year is shown in Figure 22. The percentage of households responsible for those harvests varied more, however, from 30 percent in Year One to 27 percent in Year Two and 43 percent in Year Three. The increase in Year Three participation was due mainly to the presence of caribou nearer to Barrow in the summer (July and August) and winter (January) of Year Three than in the previous two winters, enabling more people to harvest the animals easily.

The seasonality of the harvests was very consistent from year to year, as a comparison of Tables A-7, B-7 and C-7 indicates, along with Figures A-9, B-9 and C-9. The basic pattern was for harvests to be low in April, May and June, surging in July and August, dropping off a bit in September, and surging again in October. Harvests would again be very low from November through March. The main exception to this pattern occurred in Year Three, when 10 percent of that year's harvests occurred in January. This surge was related to the phenomenon mentioned above of more caribou being present near Barrow that month than in the previous two winters. Another variation in the typical pattern also occurred in Year Three. October harvests were nearly half in Year Three of the amounts harvested in October of Years One and Two. This decline was due in part to fall whaling. The poor spring whaling season in Year Three caused more hunters to concentrate on fall whaling in October rather than going upriver to their cabins and camps to hunt caribou. In addition, hunters observed that fewer caribou were seen in the vicinity of fall camps than usual. Finally, freeze-up in Year Three was late, causing a number of families to arrive at their camps after the caribou were already in rut.

Terrestrial mammal harvest locations for each study year, like total pounds and seasonal patterns, also appeared quite similar. Maps A-6, B-7 and C-7 illustrate this consistency from year to year in successful harvest sites. One difference was that in Year One, more harvests occurred along the lower Colville River (and a tributary) than in the other two years.

Figure 22: Terrestrial Mammal Harvest Estimates, Barrow
Years One, Two and Three
(Mean Usable Pounds Per Household)



Source: Stephen R. Braund & Assoc., 1993

Caribou

Caribou: Three Year Averages

The majority of the birds, fish and mammals in the Barrow area are migratory species that arrive in the spring and leave in the fall. Whales swim north in the spring, feeding on the rich ocean environment and leaving when the winter weather arrives and ice begins to form on the ocean. Ducks and geese migrate north in late spring to nest in the tundra wetlands, then head south in September and October for winter. The pinnipeds, for the most part, arrive around breakup and disappear during the winter, except for the occasional seals harvested when a lead opens in the winter ice. Fish are harvested mainly in the summer and fall. However, caribou offer residents of Barrow a relatively accessible year-round resource. If whaling was important for cultural needs, caribou was key for providing a relatively consistent source of fresh meat throughout the three study years. In terms of the historical importance of caribou, Sonnenfeld (1956) noted that, of all inland animals, caribou had been consistently the most significant to the Inupiat economy. Caribou provided meat that was a highly desirable alternative to that of sea mammals and fish, and, even as late as the 1950s, skins for winter clothing. More recently, a survey conducted in 1983 found that 34 percent of the respondents said they hunted caribou most often; 64 percent said that caribou was the largest source of wild meat for them. When asked what subsistence meat they ate most often, 71 percent of the respondents indicated caribou (ACI and SRB&A 1984). In each of those questions, caribou ranked the highest of all the species.

In modern Barrow's subsistence economy, caribou still has many uses. The meat typically is eaten dried, boiled, baked or raw and frozen (*quaq*), and the fat is used in a mixture with meat and fruit or berries called *akutuq* or "Eskimo ice cream." Caribou hides are used as sleeping mats when camping, as padding for passengers on freight sleds and for traditional *mukluks* and hunting clothing. One whaling captain in Year Three wore a pair of caribou skin pants at whaling camp that he had recently made for himself.

Field observations from this study confirmed that, as in the past, caribou remained one of the most important sources of everyday food in Barrow. An

indicator of the importance of caribou to Barrow residents was the high number of households participating in caribou harvests. Averaging 54 percent per year, more households participated in caribou harvests than in the harvest of any other species.

Over the three study years, residents harvested an average of 1,595 caribou per year, equivalent to 186,575 usable pounds (Table 14). Caribou represented over one-fourth (27 percent) of the total pounds harvested each year. This harvest averaged out to an estimated 199 pounds per household (Figure 20) or 62 pounds per person. Inupiat households harvested an average of 304 pounds of caribou per year (Table 10).

As mentioned above, caribou were harvested year-round. (Table 12, marine mammal harvests by month, shows that ringed seals were harvested every month of the year, when averaging the three study years. However, in no one year were ringed seals harvested each month. Rather, harvests occurred in 11 months of Years One and Two and in 10 months of Year Three. Caribou, on the other hand, were harvested every month of Years One and Three and in 11 months of Year Two.) Although people harvested caribou throughout the year, summer and fall were the main caribou hunting seasons. In the four month period from July through October, 80 percent of the average year's caribou harvest took place (Table 15). Once the summer boating season began, Barrow hunters not engaged in marine mammal hunting might travel along the coast and up the rivers in search of caribou. Caribou could be found along the coast mainly in the summer, when the intense insects of the summer tundra drove the caribou to the coast for the relief provided by the coastal breezes. While caribou generally were available year-round, Barrow residents made a concentrated effort to get much of their year's supply after the summer marine mammal hunting season ended. As the temperatures began to cool, the bugs died down and the caribou moved inland to fatten up for the winter on tundra vegetation. One of the most important subsistence events of the year occurred in the late summer and fall when families went inland to their cabins or camps to lay in the majority of their annual caribou, fish and berry supply. This time of year provided opportune circumstances for caribou hunting: marine mammal hunting had ended; caribou had begun to return inland from the coast; the caribou generally had fattened up for the winter so that their fur and their meat were at their

prime, but they had not yet gone into rut, which spoils the flavor of the meat; and the rivers were still open for travel by boat. Moreover, the timing of this hunt corresponded with the brief berry season and good fishing, both of which also took place upriver.

Maps 10 and 11 document reported caribou harvest locations during Years One, Two and Three combined. Map 10 shows the harvests by season. The darkly shaded harvests occurred during winter when travel was by snowmachine. Most of these harvests were during day trips from Barrow; the more distant harvests likely were incidental to extended furbearer hunting trips inland. July, August and September harvests are distinguished by a separate symbol and reflect the use of boats primarily, and all-terrain vehicles [ATVs] secondarily. Consequently, most of these harvests were located along the coast or inland waterways, or a short distance from Barrow or a cabin by ATV. Harvests in October and November occurred after freeze-up when many people would go to their cabins to do their late fall fishing (setting nets under the ice). These trips are made by snowmachine. Harvests, consequently, may occur anywhere. As Map 11 indicates, many of the mapped caribou harvests took place near Barrow residents' cabins or camps (in addition to occurring in the vicinity of Barrow).

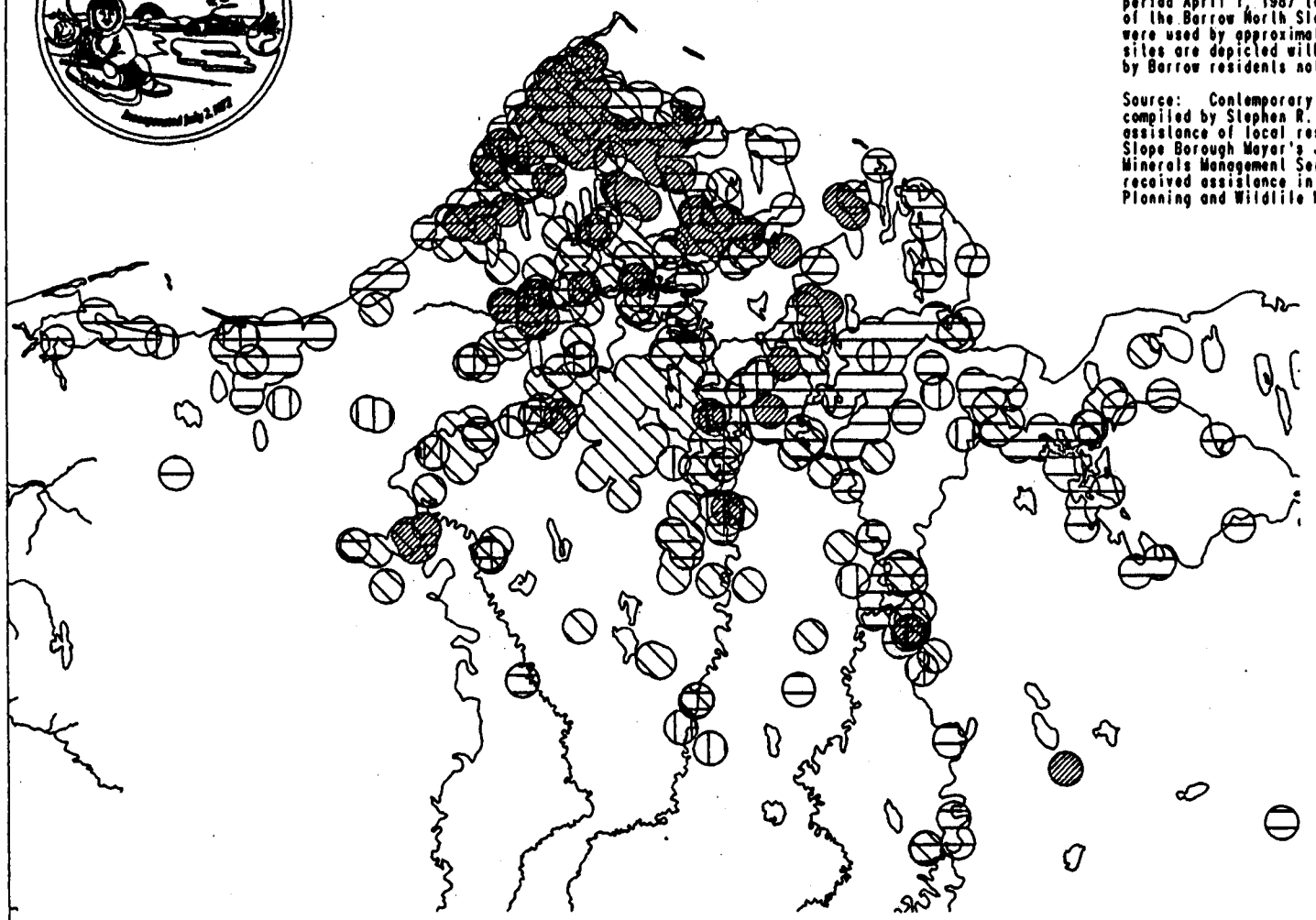
Caribou: Comparison of Years One, Two and Three

Barrow hunters took 1,595 caribou in Year One, 1,533 in Year Two and 1,656 in Year Three (Tables A-6, B-6 and C-6). In terms of usable pounds, harvests ranged from a low of 179,314 pounds to a high of 193,743 pounds. Household means ranged from 199 pounds (Year One) to 191 pounds (Year Two) to 207 usable pounds per household (Year Three). In Years One and Two, caribou represented 30 and 29 percent of the total harvest, respectively. However, in Year Three this percentage dropped to 22 percent because of the much higher bowhead harvest (by weight) in Year Three than in prior years, causing the relatively more consistent caribou harvests to decline proportionally in the overall harvest. Within just the terrestrial mammal harvest, however, caribou harvests consistently represented 87 to 90 percent of the total terrestrial harvest (Figures A-7, B-7 and C-7). Over the three study years, participation in successful caribou harvests increased from 26 percent in Year One to 27 percent in Year Two and 39 percent in Year Three. The large increase in participation

MAP 10
NORTH SLOPE SUBSISTENCE STUDY - BARROW
CARIBOU HARVEST SITES BY SEASON, YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska.



LEGEND INFORMATION

- April, May, June
- July, August, September
- October, November
- December, January February, March

20 0 20 40 60

MILES

N

Map Production: North Slope Borough GIS

Date: April 11, 1991

MAP 11
NORTH SLOPE SUBSISTENCE STUDY - BARROW
CABIN AND FIXED CAMP LOCATIONS AND CARIBOU HARVEST SITES, YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study. This map also displays the locations of fixed hunting and fishing camps used by Barrow residents. The locations of many temporary subsistence camps are not shown.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska. Camp and cabin location data compiled by Worl and Smythe (1986) and updated by the North Slope Borough Planning Department in 1989.

LEGEND INFORMATION

Caribou harvest sites

Fixed camps and cabins

20 0 20 40 60

MILES

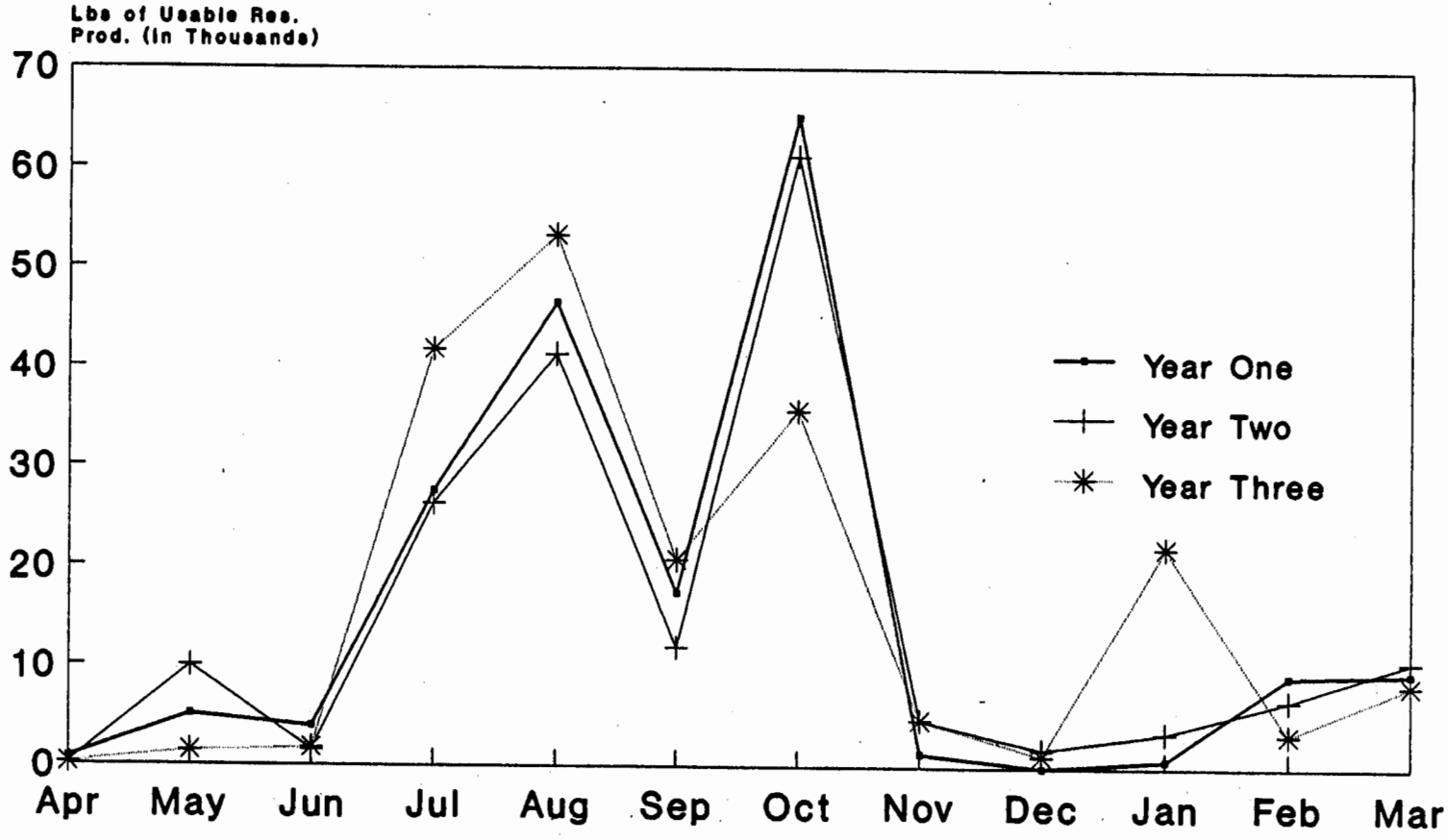
Map Production: North Slope Borough GIS

Date: April 11, 1991

in Year Three corresponds with the higher harvest amounts in Year Three and may be attributable to the following factors. As mentioned previously, harvests in January of Year Three were unusually high. During that month, good numbers of caribou were close to Barrow, allowing easy access by snowmachine and possibly contributing to the successful participation by more households than usual in harvesting caribou. A second factor could be related to the warm summer's impact on Barrow ice cellars. Many ice cellars thawed partially and leaked, causing the loss of stored meats. Field experience indicated that this problem stimulated more people to hunt caribou to make up for the loss. Third, residents indicated that the unusually warm summer was worse in terms of mosquitoes and drove more caribou than usual to the coast. Consequently, harvesting caribou along the beach by boat was easier and more households may have participated due to the easier access to the resource. A fourth factor was that the opportunity to harvest walrus and seals in the summer of Year Three occurred almost entirely in July. Most people obtained their desired amounts of walrus and seals earlier than in previous years (when considerable hunting continued into August); thus, people were able to shift their efforts to caribou hunting earlier in Year Three than in prior years, likely resulting in higher harvests and participation levels.

Seasonal variations in caribou harvest patterns from year to year were discussed earlier in the discussion of terrestrial mammals in general. As stated there, the seasonal cycle of caribou harvest patterns was very consistent across the three study years. Figure 23 illustrates this consistency, showing that July, August and October were the months in which the majority of the caribou were harvested. In July and August, people traveled along the coast and upriver by boat to hunt caribou. September harvests drop off because typically freeze-up occurs that month, limiting both boat and snowmachine travel. Usually by October, freeze-up has occurred and people travel to their camps by snowmachine to fish and hunt more caribou before the rut begins. As mentioned before, Year Three October harvests were lower than usual because of a late freeze-up (occurring in late October, after the animals went into rut), fall whaling, and fewer caribou present in the vicinity of the cabins and camps. The other anomaly in Year Three was the higher than usual

Figure 23: Comparison of Monthly Caribou Harvest Estimates
Barrow, Years One, Two & Three



Three year study period: 4/1/87-3/31/90
Source: Stephen R. Braund & Assoc., 1993

harvests in January, explained earlier as being due to the presence of many caribou near Barrow that month. July and August harvests were also higher than the previous two years, possibly due to the earlier end to marine mammal hunting and the presence of more caribou on the coast due to intense bugs inland.

Caribou harvest sites, shown on Maps A-8, B-9 and C-9, were very similar in the three study years. Harvests were more densely concentrated around the immediate Barrow and Point Barrow area in Years Two and Three than in Year One; in Year One, more harvest locations were mapped along the upper drainages than in Years Two and Three. The abundance of sites far upriver in Year One occurred mainly during the October-November fall ice fishing and caribou hunting season; apparently more people traveled farther in search of caribou before being successful that year than in the subsequent two years.

Other Terrestrial Mammals

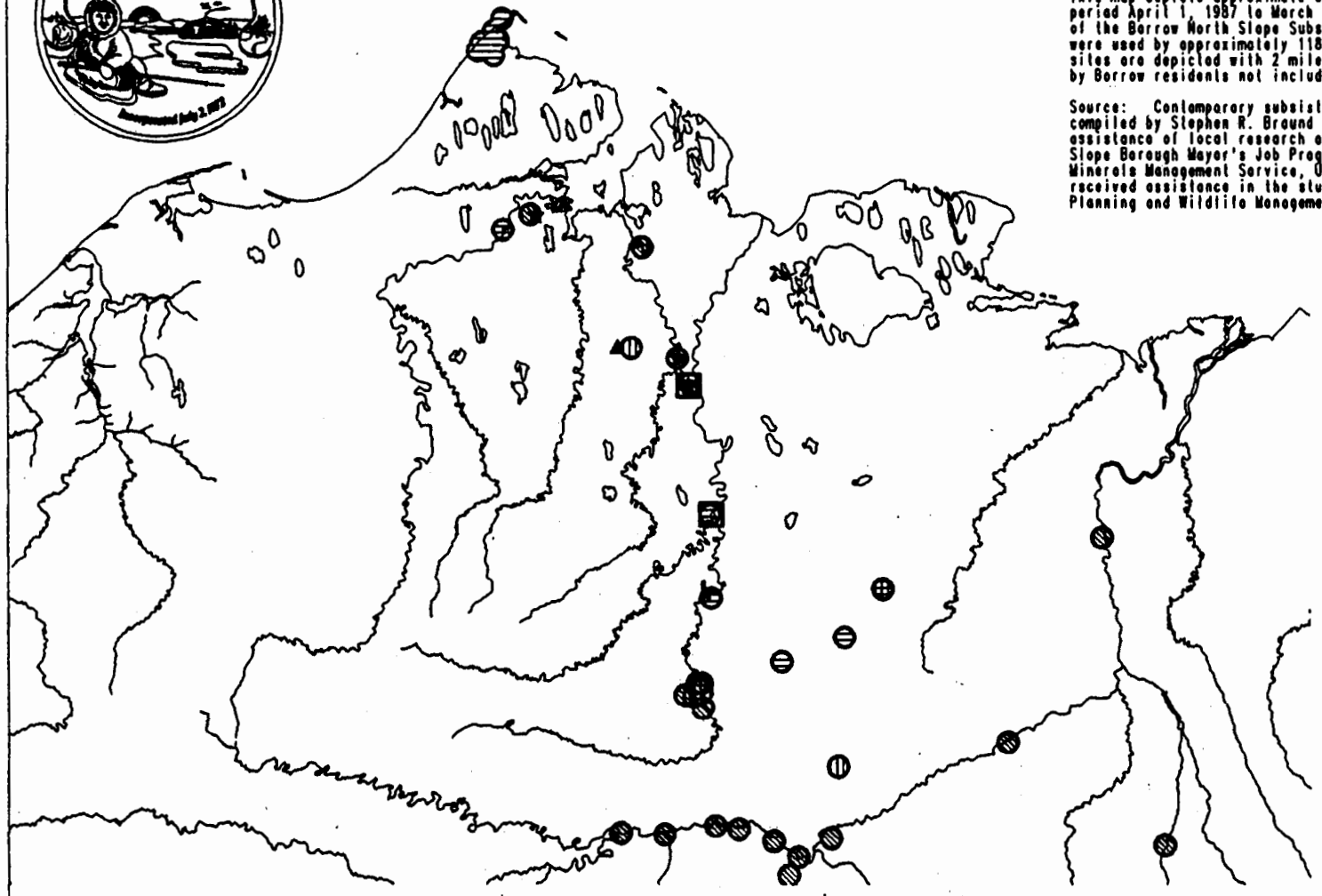
Other Terrestrial Mammals: Three Year Averages

Moose, Dall sheep and brown bear were the other major land mammals occasionally harvested for food by Barrow hunters. Following caribou, moose was the next most important terrestrial resource harvested (in terms of usable weight), providing an estimated 24,053 pounds of food per year, or 26 pounds per household. Moose harvests represented, on average, three percent of the total annual subsistence harvest (Table 14) and 12 percent of the total terrestrial mammal harvest (Figure 19). Seven percent of Barrow households harvested moose. The estimated Barrow harvest of 48 moose per year is considered by the study team to be a high estimate rather than an average. The high sampling error (as a percentage of the mean) for moose means that chance may play a large role in the observed moose harvest; another sample of households could have yielded a much different result. During the study period, moose were harvested in July, August, September and March, with two-thirds (67 percent) being taken in September. Map 12 shows that most of the moose were harvested along the Colville River, an area that Barrow hunters consider a reliable source of moose. Additional harvests occurred along the lower Chipp and Meade

MAP 12
NORTH SLOPE SUBSISTENCE STUDY - BARROW
TERRESTRIAL MAMMAL HARVEST SITES BY SPECIES (EXCLUDING CARIBOU), YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska.



Map Production: North Slope Borough GIS

Date: April 11, 1991

rivers, and high on the Ikpikpuk River. A few non-Native residents (who otherwise participated rarely if at all in subsistence activities) hunted moose, typically flying by small plane to the Colville River for this purpose (field observations).

Three percent of Barrow households harvested 11 Dall sheep, yielding 1,106 usable pounds. Dall sheep harvests all occurred in the month of August and generally were taken outside the normal Barrow harvest area. Some of the harvests occurred over 200 miles east of Barrow on the Canning River, its tributaries and other locations east of the Canning (accessed by small airplane) and are not shown on Map 12. As with moose, Dall sheep typically were harvested by non-Native households that otherwise participated rarely in subsistence activities.

An estimated average of one brown bear per year was harvested by Barrow residents. Brown bears generally were not actively sought but occasionally were taken when encountered. Brown bears were taken in September, typically when people were at their cabins and were concerned about a bear showing interest in the fish hanging up to dry, for example, or when the animals got into local ice cellars. The brown bears harvested by study households were taken mainly along the Ikpikpuk River. Approximately two porcupines and 14 ground squirrels were harvested each year, typically in the summer and fall months when families encountered them at their cabins. Ground squirrels used to be collected for use in parkas. That type of parka is rarely made anymore; most ground squirrels were shot by young people learning how to hunt. As with moose, the harvest of these other terrestrial mammals was so low and involved so few households that the estimate of the total amount is statistically less reliable (evident in the high sampling error as a percentage of the mean in Table 14) than the estimates for more heavily harvested species.

Furbearer hunting was undertaken by a small percentage of Barrow households because this activity generally requires extended snowmachine travel (e.g., one to two week long trips) into the backcountry in the winter when the animals' fur is thickest. March was a popular month for these extended trips because of the longer daylight hours and generally warmer temperatures. The most desired

species were wolf, wolverine and red fox, and these animals tend to be most abundant near or in the foothills of the Brooks Range, far inland from Barrow. These animals do not occur in abundance and generally are seen singly or in pairs. Consequently, hunting them requires considerable travel in pursuit of tracks that can lead the hunter to the animal. Snow cover must be adequate for snowmachine travel - not too bare, but not too deep and soft - and the weather must be such that tracks are preserved well enough to be followed by the hunter. Barrow hunters reported successful harvests mainly of arctic fox, averaging 129 animals per year (Table 14). These animals are found nearer to Barrow and the coast (even out on the ocean ice) than are the red fox; hence the relatively higher harvest success. One resident said, "White [arctic] foxes are all over. Wherever you put a trap you will get them, even by your house in Barrow." Some Barrow residents set traplines around the Barrow vicinity from December to March or April. Approximately five percent of Barrow households harvested arctic fox each year. An average of two wolverine were harvested by one percent of Barrow households and an average of five red fox were harvested by less than one percent of Barrow households each year. No wolves were harvested by study households during the study period. Wolverine and wolf harvests held particular esteem for community members. Of all the furbearing animals, the wolf and wolverine were the most prized for their fur.

As mentioned previously, because the furbearers were not used for food, none of the data tables or figures provide calculations of usable weight for these species. The number of animals harvested is shown on Tables 14 and 16 but comparison between species cannot be shown (e.g., bar charts, graphs, or percentages of total harvest) because such comparisons require that all species be converted to a common unit of measurement, such as pounds.

Furbearer harvests occurred exclusively in the winter and early spring months. Arctic fox harvests occurred November through April, while red fox were taken in March and wolverine were taken in February and March (Table 16). Numerous fox were harvested in the immediate Barrow area, while others occurred in scattered locations inland from Barrow (Map 10). Wolverines were taken high on the Ikpikpuk River and also between the upper Ikpikpuk and Fish Creek. Wolverine generally are found amid the willows along creeks, where they feed on

ptarmigan and other prey. According to one hunter, wolverine tend to come toward the coast in the spring in search of salt. The map shows only successful harvest locations and does not indicate the area traversed by the hunter before obtaining a harvest. In hunting furbearers, generally a large area is hunted before a single animal is located.

Other Terrestrial Mammals: Comparison of Years One, Two and Three

Moose harvests decreased over the study period, from an estimated 52 in Year One and 53 in Year Two to 40 in Year Three (Tables A-6, B-6 and C-6). The proportion of the total harvest represented by moose also declined from four in Years One and Two to two percent in Year Three. Typically, moose have been harvested by the same study households from year to year. Hunters took moose in July and August of all three years, as well as in September of Years One and Two. Two moose were harvested in March of Year Two (Tables A-8, B-8 and C-8). Locations of successful harvests appeared to shift away from Barrow over the three years (Maps A-7, B-8 and C-8). In Year One, moose harvests occurred near Admiralty Bay, within 40 to 55 miles (as the crow flies) of Barrow. Other harvests were on the upper Ikpikpuk and the Colville rivers. In Year Two, the nearest harvest was well south of the Year One Admiralty Bay harvests, occurring along the Chipp River about 75 miles from Barrow. As in Year One, other harvests occurred on the Ikpikpuk and Colville Rivers. In Year Three, the only mapped moose harvests occurred on the Colville, over 150 miles from Barrow.

Total Dall sheep harvests followed a similar pattern as moose, decreasing slightly from Year One and Two levels (12 Dall sheep each year) to Year Three (nine harvested). The seasonality of the harvests was identical each year, however. All Dall sheep harvests took place in August. Harvest of these animals typically was not mapped because the hunters flew east to hunt them, usually to the Canning River area, beyond the range of the report maps.

Brown bears were harvested only in Years One and Two. One bear was reported harvested each year, and in both cases the harvests were in September when the bears fatten up in preparation for the winter. Both of the bears were taken along the Ikpikpuk River, not far from cabins.

Wolverine harvests were consistently low, ranging from four taken in Year One to two in Year Two and one in Year Three. The winter of Year Three, according to Barrow residents, was a worse year in terms of adequate snow cover for snowmachine travel inland, compared to Years One and Two. Rough travel conditions reportedly kept some people from heading inland very far that year. Wolverine harvests were in October and February in Year One, March in Year Two, and April in Year Three (Tables A-8, B-8 and C-8). With the exception of the October harvest, all of these harvests took place within the usual furbearer hunting season, which is predominantly February through April. The one harvest in October was unusual and likely was the product of a chance encounter rather than a planned wolverine hunt.

Arctic fox harvests also declined in Year Three from higher Year One and Two levels. Barrow hunters obtained 192 arctic fox in Year One and 146 in Year Two, dropping to 48 in Year Three. The only month in which harvests occurred consistently in all three years was February. Year One harvests occurred December through March, with December being the month in which the most arctic fox were taken. The only October arctic fox harvest (one animal) also occurred in Year One. Year Two harvests spanned November through April; however, the peak month was January, and high harvests also occurred in December and February. Finally, in Year Three, most of the harvests occurred in February, with some also in March.

Red fox harvests decreased from eight animals in Year One, four in Year Two, to two in Year Three. March was the main month for red fox harvests. Year One and Two harvests occurred only in March, while Year Three harvests were split evenly between February and March. Year One fox harvests were mapped principally in the area of Barrow. In contrast, Year Two and Year Three harvests occurred not only in the Barrow vicinity but also up the Ikpikpuk River.

FISH

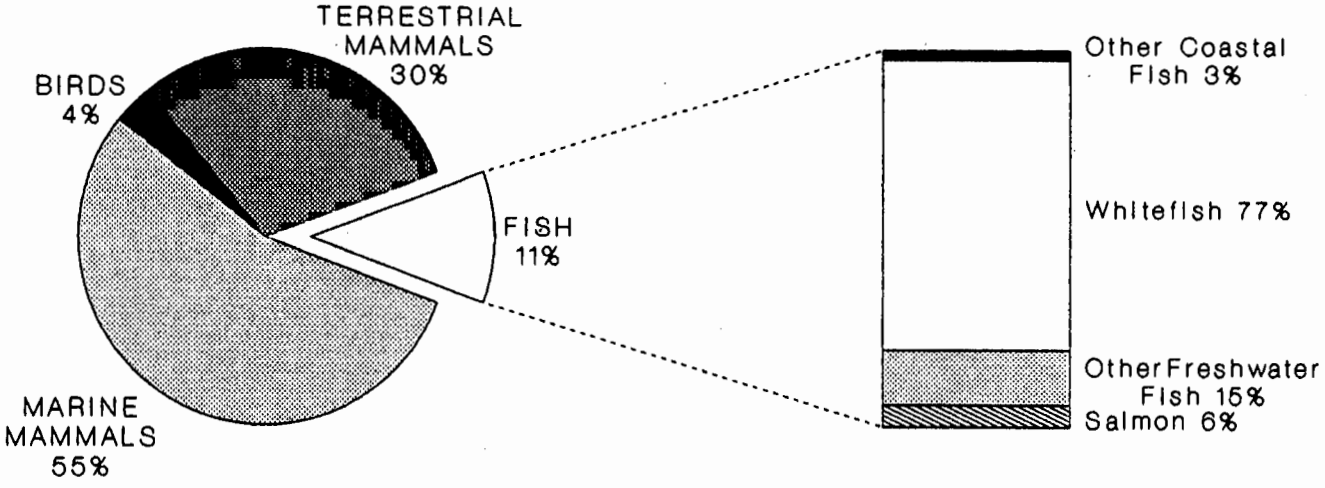
Fish: Three Year Averages

Historically, fish have been a secondary resource for Barrow Inupiaq. Although people valued and enjoyed fish as a subsistence food, they gave priority to harvesting marine mammals and caribou (Sonnenfeld 1956; Murdoch 1891; and Spencer 1959, 1984). This historical preference is reflected in harvest data collected over the three years of this study. Together the harvest of marine and terrestrial mammals provided 85 percent of the total harvest of usable foods while fish provided just 11 percent, a distant third among the four major resource categories in terms of total usable pounds (Figure 24). Even so, fish contributed, on average, over 79,000 usable pounds, or 85 pounds per household, of subsistence food to the community of Barrow (Table 17 and Figure 25). Barrow Inupiat households caught an average of 142 pounds of fish (Table 10).

Fish harvest data have been organized into four subgroups of fish species: whitefish (including two varieties of broad whitefish, humpback and round whitefish, plus least cisco and arctic or Bering cisco), other freshwater fish (consisting of arctic grayling, burbot or ling cod, arctic char, northern pike and lake trout), salmon (silver, chum, pink and king), and other coastal fish (including tomcod, arctic cod, rainbow smelt, capelin and sculpin). Of the four subgroups, whitefish comprised over three quarters of the total harvest (77 percent, Figure 24), averaged over the three study years. Second in importance were other freshwater fish (15 percent), followed by salmon (six percent) and other coastal fish (three percent). Of the individual fish species harvested during the three study years, the river variety of broad whitefish was the most significant fish in the Barrow subsistence economy contributing over 38,000 pounds (Table 17).

While harvest figures suggest that fish were a relatively insignificant component in the subsistence economy, several considerations must be kept in mind while assessing the importance of contemporary fish harvests in Barrow. First, participation levels over the three years of the study indicate that almost as many Barrow households harvested fish (41 percent) as harvested marine mammals (48 percent). Second, fish harvest estimates were recalled less accurately

Figure 24: Estimated Fish Harvest Percentages, Barrow
Years One, Two and Three Averaged
(Usable Pounds Harvested)



Three years of study: 4/1/87 - 3/31/90
Source: Stephen R. Braund & Assoc., 1993

TABLE 17: HARVEST ESTIMATES FOR FISH - ALL BARROW HOUSEHOLDS, THREE YEAR AVERAGE (1,2)

RESOURCE	CONVERSION FACTOR (3) (Usable Weight Per Resource in lbs)	COMMUNITY TOTALS		AVERAGE POUNDS HARVESTED		PERCENT OF TOTAL USABLE POUNDS HARVESTED	PERCENT OF ALL BARROW HSEHOLDS HRVSTING RESRCE (4)	SAMPLING STATISTICS				
		NUMBER HARVESTED	USABLE POUNDS HARVESTED	PER HOUSEHOLD	PER CAPITA			STANDARD DEVIATION (lbs)	SAMPLING ERROR AT 95% (lbs)	LOW ESTIMATE (Mean lbs/ Household)	HIGH ESTIMATE (Mean lbs/ Household)	SAMPLING ERROR AS % OF MEAN
Total Fish	n/a	n/a	79,355	84.7	26.3	11.3%	41%	10	19	65.32	104.06	23%
Total Whitefish		28,683	61,149	65.3	20.3	8.7%	34%	9	17	48.36	82.16	26%
Whitefish(non-specific)	2.5	1,760	3,523	3.8	1.2	0.5%	4%	1	2	2.16	5.36	43%
Round whitefish	1.0	953	956	1.0	0.3	0.1%	6%	0	1	0.49	1.55	52%
Broad whitefish (river)	2.5	15,234	38,089	40.7	12.6	5.4%	29%	5	10	30.29	51.01	25%
Broad whitefish (lake)	3.4	2,118	7,206	7.7	2.4	1.0%	6%	3	6	1.34	14.04	83%
Humpback whitefish	2.5	1,840	4,601	4.9	1.5	0.7%	15%	2	5	0.25	9.57	95%
Least cisco	1.0	5,819	5,819	6.2	1.9	0.8%	9%	1	2	3.87	8.55	38%
Bering, Arctic cisco	1.0	958	956	1.0	0.3	0.1%	4%	0	0	0.67	1.37	34%
Total Other Freshwater Fish		10,824	11,478	12.3	3.8	1.6%	23%	3	5	7.03	17.47	43%
Arctic grayling	0.8	9,914	7,936	8.5	2.6	1.1%	21%	2	4	4.81	12.13	43%
Arctic char	2.8	83	234	0.3	0.1	**	5%	0	0	0.03	0.47	88%
Burbot (Ling cod)	4.0	676	2,708	2.9	0.9	0.4%	10%	1	2	1.26	4.52	56%
Northern pike	2.3	4	9	0.0	*	**	1%	0	0	0.00	0.02	51%
Lake trout	4.0	147	590	0.6	0.2	0.1%	4%	0	1	0.11	1.15	82%
Total Salmon		788	4,638	5.0	1.5	0.7%	12%	2	3	1.47	8.43	70%
Salmon (non-specified)	6.1	169	1,031	1.1	0.3	0.1%	2%	1	2	0.00	2.83	158%
Chum (Dog) salmon	6.1	182	1,106	1.2	0.4	0.2%	6%	0	0	0.75	1.61	37%
Pink (Humpback) salmon	3.1	92	281	0.3	0.1	**	4%	0	0	0.13	0.47	55%
Silver (Coho) salmon	6.0	334	2,005	2.1	0.7	0.3%	4%	1	2	0.28	4.00	87%
King (Chinook) salmon	18.0	12	216	0.2	0.1	**	1%	0	0	0.12	0.34	50%
Total Other Coastal Fish		10,351	2,090	2.2	0.7	0.3%	14%	1	1	1.10	3.36	51%
Capelin	0.2	1,435	290	0.3	0.1	**	8%	0	1	0.00	0.81	161%
Rainbow smelt	0.2	526	66	0.1	*	**	2%	0	0	0.00	0.19	172%
Arctic cod	0.2	8,321	1,668	1.8	0.6	0.2%	2%	1	1	0.77	2.79	57%
Tomcod	1.0	65	66	0.1	*	**	1%	0	0	0.00	0.20	185%
Sculpin	0.6	4	2	0.0	*	**	**	0	0	0.00	0.00	n/a

(1) Three years of study: April 1, 1987 - March 31, 1990.

(2) Estimated sampling errors do not include errors in reporting, recording, and in conversion to usable weight.

(3) See Table D-5 for sources of conversion factors.

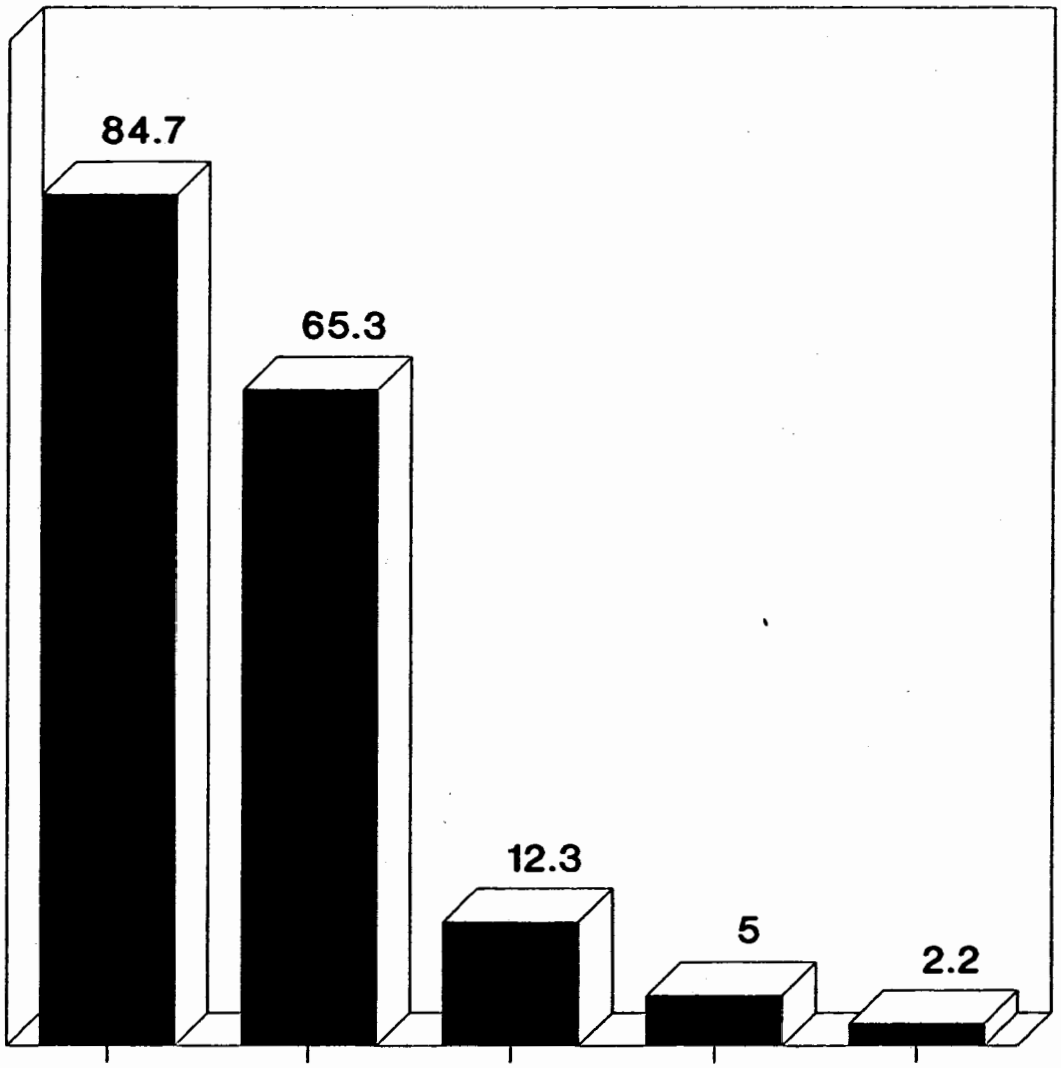
(4) This percentage is a cumulative total for the three study years rather than an annual average.

* represents less than .1 pound; ** represents less than .1 percent

n/a means not applicable

Source: Stephen R. Braund & Associates, 1993

Figure 25: Fish Harvest Estimates
Barrow, Years One, Two & Three Averaged
(Mean Usable Pounds Per Household)



Three years of study: 4/1/87 - 3/31/90
Source: Stephen R. Braund & Assoc., 1993

than the estimates for larger species such as caribou, seals, or even geese and ducks. Large numbers of fish were often harvested in a short period (e.g., a two week fall fishing trip in October) and a harvester's estimate of his catch was often a best guess. Moreover, the delineation of individual species was more difficult with fish. A single pull of the net in any of the local river systems could have yielded four or five different species, (e.g., broad whitefish, humpback whitefish, least cisco, and grayling).

Third, some of the most active fishermen were the least candid about the amount of fish they harvested. Fish harvests, unlike any other local food resource, involved the participation of local households which, year after year, were consistently major suppliers of the resource. Primarily five or six families, each with two or more camps spread out over the major river systems within the Barrow study area, attempted to catch enough fish to supply their extended families, to make generous contributions to the Thanksgiving and Christmas feasts, and to supply fish to those who desired them throughout the year. These families contributed a significant proportion of the total community fish harvest. Three of these highly productive fishing households participated in this study with differing degrees of enthusiasm. To the extent that any of these families underreported their fish harvests, data presented in this report are affected.

Fourth, over the three years that this research was conducted, the researchers and the study participants became more accurate in recording the study household's share of the harvest. This was especially true with fish and is evident in the large decrease in the number of fish in the non-specified whitefish category from Year One to Year Two and the lack of a non-specified whitefish category in Year Three. While Year Two and Three estimates are not necessarily closer to the "real" Barrow fish harvest, the distribution of catch between species is likely more accurate in Years Two and Three.

Finally, an unknown quantity of fish were imported from nearby North Slope villages: arctic cisco from Nuiqsut, rainbow smelt from Wainwright, and broad whitefish and burbot from Atqasuk. Although fish harvest data were recorded when a study household member traveled to a North Slope village and actually participated in fish harvests, fish obtained through sharing, gifting or barter

were not reflected in the harvest estimates. Field observations indicated that the latter means of obtaining fish were common during the three years of study.

Two species-specific considerations should be kept in mind about the fisheries data. First, for this study the researchers differentiated between broad whitefish caught from rivers and those caught from lakes. This was done both because of the size difference, with the lake-caught fish estimated to be at least 25 percent larger on the average, and because local people recognize them as being different both in size and flavor. Biologically, however, the lake and river varieties are a single species, broad whitefish.

Second, the identification of coho (silver) salmon and chum (dog) salmon was difficult during the harvest discussions since both species were often referred to locally as "silver salmon." Additionally, most of the salmon catch occurred very near the ocean, either in lagoons or near river mouths, at a time when sea-run chums and silvers still looked very similar. The approach of the researchers was to probe for an individual salmon species when the reported catch was "salmon." If "silver salmon" was the response the researcher asked the fisherman if the salmon were the coho or the chum species. The final response recorded would then be "silver," "chum" or "unspecified." Due to the local nomenclature, there was likely a tendency towards over-reporting of silver salmon and under-reporting of chums. However, the study team did not "second guess" fish reports and they are presented as reported. According to Craig and LGL (1987:10), along the coastline of the northeastern Chukchi Sea, "pink salmon are the most common species, accounting for 85 percent of all salmon caught in biological surveys from 1970 to 1984, followed by chum salmon (13 percent)." Participants in this study reported primarily silver and chum salmon harvests.

As illustrated by the monthly harvest data presented in Tables 18 and 19 and Figure 26, the prime month for fishing was October when an average of 44 percent of the fish harvests (by weight) took place. August was the next most important month with 21 percent. Together the months of July through November yielded a combined total of 96 percent of the average yearly fish harvests. August was a busy month for fishing because, after marine mammal hunting had ended, families typically traveled upriver by boat to hunt caribou, pick

TABLE 18: FISH HARVEST ESTIMATES BY SPECIES AND MONTH - BARROW, THREE YEAR AVERAGE (1)
(Pounds of Usable Resource Product)

SPECIES	1987-1990 TOTALS ****** April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Total Whitefish	0	140	2,285	8,329	13,885	7,747	26,395	2,357	0	0	0	0
Whitefish (non-specified)	0	0	80	355	1,312	754	955	64	0	0	0	0
Round Whitefish	0	40	280	46	142	169	276	0	0	0	0	0
Broad Whitefish (River)	0	100	1,916	6,935	8,500	5,775	13,279	1,582	0	0	0	0
Broad Whitefish (Lake)	0	0	0	592	2,505	462	3,012	630	0	0	0	0
Humpback whitefish	0	0	9	28	987	464	3,112	0	0	0	0	0
Least cisco	0	0	0	129	425	91	5,109	65	0	0	0	0
Bering, Arctic cisco	0	0	0	244	14	32	652	16	0	0	0	0
Total Other Freshwater Fish	5	136	94	477	616	2,754	7,032	196	0	0	55	101
Arctic grayling	0	0	89	177	562	2,164	4,936	3	0	0	0	0
Arctic char	0	17	0	34	28	95	1	56	0	0	0	0
Burbot (Ling cod)	5	118	0	2	6	470	1,815	131	0	0	55	101
Northern pike	0	0	0	0	1	6	3	1	0	0	0	0
Lake trout	0	0	5	264	19	19	276	5	0	0	0	0
Total Salmon	0	12	24	2,449	2,147	10	0	0	0	0	0	0
Salmon (non-specified)	0	0	0	17	1,016	0	0	0	0	0	0	0
Chum (Dog) salmon	0	0	0	588	510	10	0	0	0	0	0	0
Pink (Humpback) salmon	0	0	0	139	144	0	0	0	0	0	0	0
Silver (Coho) salmon	0	12	24	1,583	383	0	0	0	0	0	0	0
King (Chinook) salmon	0	0	0	122	94	0	0	0	0	0	0	0
Total Other Coastal Fish	0	0	0	1	264	13	1,461	279	0	30	30	4
Capelin	0	0	0	0	264	0	23	0	0	0	0	0
Rainbow smelt	0	0	0	0	0	0	0	0	0	30	30	4
Tomcod (Saffron Cod)	0	0	0	0	0	0	0	65	0	0	0	0
Arctic Cod	0	0	0	0	0	13	1,438	213	0	0	0	0
Sculpin	0	0	0	1	0	0	0	1	0	0	0	0
All Fish Species	5	288	2,403	11,257	16,912	10,524	34,888	2,832	0	30	85	105

(Continued on next page)

TABLE 18, CONTINUED: FISH HARVEST ESTIMATES BY SPECIES AND MONTH - BARROW, THREE YEAR AVERAGE (1)
(Pounds of Usable Resource Product)

SPECIES	1987-1990 PERCENTS ******** April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Total Whitefish	0%	0%	4%	14%	23%	13%	43%	4%	0%	0%	0%	0%
Whitefish (non-specified)	0%	0%	2%	10%	37%	21%	27%	2%	0%	0%	0%	0%
Round Whitefish	0%	4%	29%	5%	15%	18%	29%	0%	0%	0%	0%	0%
Broad Whitefish (River)	0%	0%	5%	18%	22%	15%	35%	4%	0%	0%	0%	0%
Broad Whitefish (Lake)	0%	0%	0%	8%	35%	6%	42%	9%	0%	0%	0%	0%
Humpback whitefish	0%	0%	0%	1%	21%	10%	68%	0%	0%	0%	0%	0%
Least cisco	0%	0%	0%	2%	7%	2%	88%	1%	0%	0%	0%	0%
Bering, Arctic cisco	0%	0%	0%	25%	1%	3%	68%	2%	0%	0%	0%	0%
Total Other Freshwater Fish	0%	1%	1%	4%	5%	24%	61%	2%	0%	0%	0%	1%
Arctic grayling	0%	0%	1%	2%	7%	27%	62%	0%	0%	0%	0%	0%
Arctic char	0%	7%	0%	15%	12%	41%	0%	24%	0%	0%	0%	0%
Burbot (Ling cod)	0%	4%	0%	0%	0%	17%	67%	5%	0%	0%	2%	4%
Northern pike	0%	0%	0%	0%	9%	52%	30%	9%	0%	0%	0%	0%
Lake trout	0%	0%	1%	45%	3%	3%	47%	1%	0%	0%	0%	0%
Total Salmon	0%	0%	1%	53%	46%	0%	0%	0%	0%	0%	0%	0%
Salmon (non-specified)	0%	0%	0%	2%	98%	0%	0%	0%	0%	0%	0%	0%
Chum (Dog) salmon	0%	0%	0%	53%	46%	1%	0%	0%	0%	0%	0%	0%
Pink (Humpback) salmon	0%	0%	0%	49%	51%	0%	0%	0%	0%	0%	0%	0%
Silver (Coho) salmon	0%	1%	1%	79%	19%	0%	0%	0%	0%	0%	0%	0%
King (Chinook) salmon	0%	0%	0%	57%	43%	0%	0%	0%	0%	0%	0%	0%
Total Other Coastal Fish	0%	0%	0%	0%	13%	1%	70%	13%	0%	1%	1%	0%
Capelin	0%	0%	0%	0%	92%	0%	8%	0%	0%	0%	0%	0%
Rainbow smelt	0%	0%	0%	0%	0%	0%	0%	0%	0%	47%	47%	6%
Tomcod (Saffron Cod)	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%
Arctic Cod	0%	0%	0%	0%	0%	1%	86%	13%	0%	0%	0%	0%
Sculpin	0%	0%	0%	56%	11%	0%	0%	33%	0%	0%	0%	0%
All Fish Species	0%	0%	3%	14%	21%	13%	44%	4%	0%	0%	0%	0%

(1) Three years of study: April 1, 1987 - March 31, 1990.
Source: Stephen R. Braund & Associates, 1993

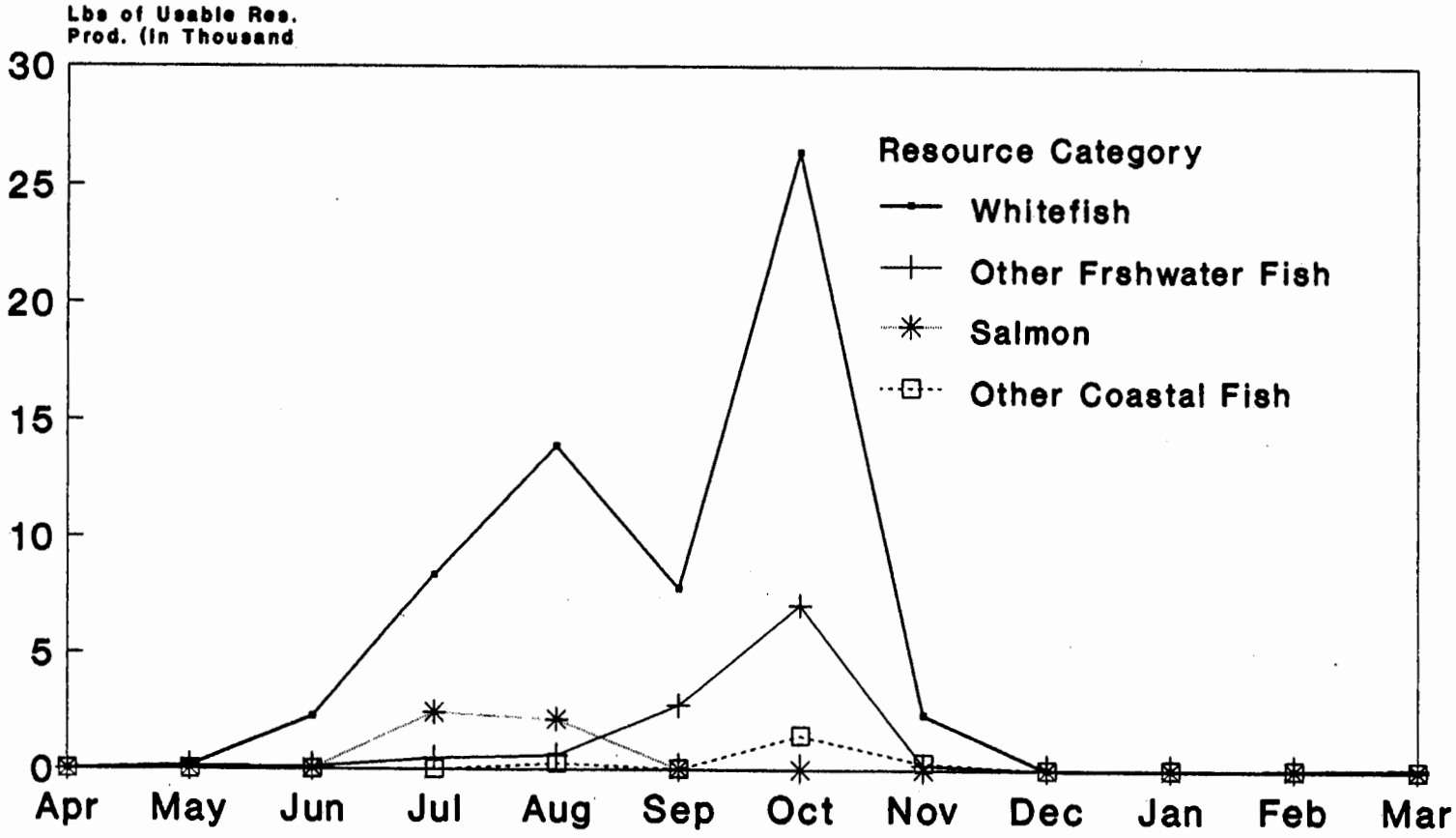
TABLE 19: FISH HARVEST ESTIMATES BY SPECIES AND MONTH - BARROW, THREE YEAR AVERAGE (1)
(Number Harvested)

SPECIES	1987-1990 April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Total Whitefish	0	80	1,090	3,556	5,768	3,301	13,957	931	0	0	0	0
Whitefish (non-specified)	0	0	40	178	656	377	478	32	0	0	0	0
Round Whitefish	0	40	280	46	142	169	276	0	0	0	0	0
Broad Whitefish (River)	0	40	766	2,774	3,406	2,310	5,311	633	0	0	0	0
Broad Whitefish (Lake)	0	0	0	174	737	136	886	185	0	0	0	0
Humpback whitefish	0	0	4	11	395	186	1,245	0	0	0	0	0
Least cisco	0	0	0	129	425	91	5,109	65	0	0	0	0
Bering, Arctic cisco	0	0	0	244	14	32	652	16	0	0	0	0
Total Other Freshwater Fish	1	36	112	300	719	2,864	6,694	58	0	0	14	25
Arctic grayling	0	0	111	221	702	2,705	6,170	4	0	0	0	0
Arctic char	0	6	0	12	10	34	0	20	0	0	0	0
Burbot (Ling cod)	1	30	0	0	2	117	454	33	0	0	14	25
Northern pike	0	0	0	0	0	2	1	0	0	0	0	0
Lake trout	0	0	1	66	5	5	69	1	0	0	0	0
Total Salmon	0	2	4	415	366	2	0	0	0	0	0	0
Salmon (non-specified)	0	0	0	3	167	0	0	0	0	0	0	0
Chum (Dog) salmon	0	0	0	96	84	2	0	0	0	0	0	0
Pink (Humpback) salmon	0	0	0	45	47	0	0	0	0	0	0	0
Silver (Coho) salmon	0	2	4	264	64	0	0	0	0	0	0	0
King (Chinook) salmon	0	0	0	7	5	0	0	0	0	0	0	0
Total Other Coastal Fish	0	0	0	2	1,320	64	7,306	1,133	0	247	247	32
Capelin	0	0	0	0	1,320	0	115	0	0	0	0	0
Rainbow smelt	0	0	0	0	0	0	0	0	0	247	247	32
Tomcod (Saffron Cod)	0	0	0	0	0	0	0	65	0	0	0	0
Arctic Cod	0	0	0	0	0	64	7,190	1,067	0	0	0	0
Sculpin	0	0	0	2	0	0	0	1	0	0	0	0

(1) Three years of study: April 1, 1987 - March 31, 1990.

Source: Stephen R. Braund & Associates, 1993

Figure 26: Monthly Fish Harvest Estimates, Barrow
Years One, Two and Three Averaged



Three years of study: 4/1/87 - 3/31/90
Source: Stephen R. Braund & Assoc., 1993

berries and fish. September harvests were lower generally because travel conditions were in transition and therefore unstable during that month; rivers, lakes and the tundra would go through several freeze-thaw cycles before finally freezing up for the winter, usually in October. Thus, in September, people did not want to travel upriver by boat only to become stranded there, yet snowmachine travel usually was not yet feasible. In October, families loaded their sleds and traveled by snowmachine to cabins and camps where they fished intensively, catching the majority of the year's supply. The fall fish harvest came mainly from nets set below the ice on the rivers at the time when large numbers of broad whitefish, grayling, and burbot made their annual fall migration, and the ice created the proper conditions for the schooling of fish in the deeper parts of the river. Usually one to four nets were set and checked daily until camp was struck or the fishermen caught enough fish. Those fish most often caught at fall fish camp included: broad and humpback whitefish, least cisco, and some trout taken from nearby lakes. People also jigged for grayling and burbot from fall fish camps. Additionally, by the end of October Elson Lagoon was usually frozen enough to jig for cod, an activity typically undertaken by elderly Barrow residents.

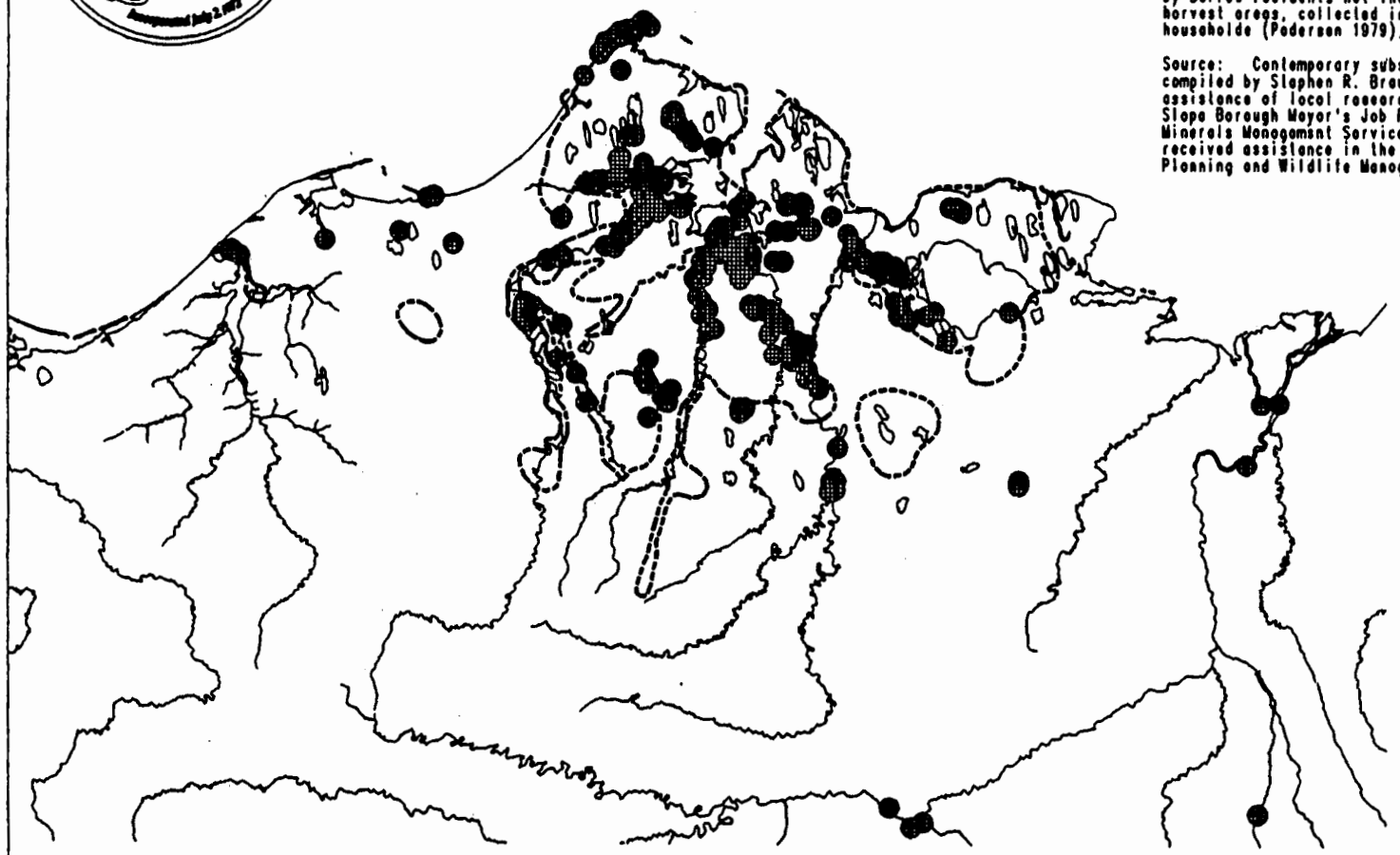
Map 13 shows harvest locations for all fish species (undifferentiated) as well as lifetime community fish harvest areas (based on Pedersen 1979). The map illustrates that Barrow residents harvested fish primarily along the inland river systems that feed into Admiralty Bay and Dease Inlet. In particular, harvests took place along the Inaru River, the lower and middle Meade River, the lower and middle Topagoruk River and the middle of the Chipp River, especially at its confluence with the Ikpikpuk River. Successful coastal fishing sites were few, primarily occurring in the vicinity of Barrow, in Elson Lagoon, at Peard Bay, and in Admiralty Bay. Lake harvests were associated with large lakes between Barrow and the Inaru River, and numerous small lakes often located near river-based fish sites. Harvest locations that do not appear to be near water were associated with small rivers and lakes not shown on the map.

Contemporary fish harvest locations are very similar to those recorded in the 1970s. Notable exceptions were the contemporary concentrated harvest areas southeast of Atqasuk, the Peard Bay and Wainwright areas, the upper and lower Colville River, and fish sites higher in the Ikpikpuk drainage than documented

MAP 13
NORTH SLOPE SUBSISTENCE STUDY - BARROW
FISH HARVEST SITES - ALL SPECIES, YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study. Lifetime-community harvest areas, collected in the form of map biographies from 20 households (Pedersen 1979), are also illustrated.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska.



LEGEND INFORMATION

Lifetime community land use (Pedersen 1979).

All Fish Species
- Whitefish
  Round whitefish, broad whitefish, humpback whitefish, least cisco, arctic cisco
- Other Freshwater Fish
  Grayling, arctic char, burbot, lake trout, northern pike
- Salmon
  Chum, pink, silver, king
- Other Coastal Fish
  Capelin, tomcod, arctic cod, sculpin rainbow smelt

N

25 0 25 50 75 100 125

MILES

Map Production: North Slope Borough GIS

Date: April 11, 1991

in the previous research. In addition, some of the use area "islands" defined from Pedersen's (1979) research were not successful harvest areas for the study households in Years One, Two, or Three. However, Barrow households not in this current study may have harvested fish in those areas during the last three years.

Map 14 differentiates the three years of fish harvest locations by subgroup of fish. Species caught in the ocean and adjacent bays and lagoons included species from all four major fish groups; however, salmon and other coastal fish were the primary species caught along the coast. Barrow fishermen caught whitefish and other freshwater fish all along the rivers, as well as salmon on the lower reaches of area rivers.

Map 15 illustrates the strong association between the cabin and camp sites in the Barrow area and the majority of fish harvest sites. Cabins and fish camps were often erected near a good fishing site for convenience. Nets set in close proximity to a cabin could be easily checked several times a day. Also, since fishing tended to be a family oriented activity, having nets set near a cabin enabled everyone in the family (regardless of age) to help with some aspect of the fishing. Nets set near a cabin also reduced the work involved in transporting loads of fish from the nets to the drying racks (field interviews). During the fall, nets set under the ice close to cabins reduced the time spent in the cold.

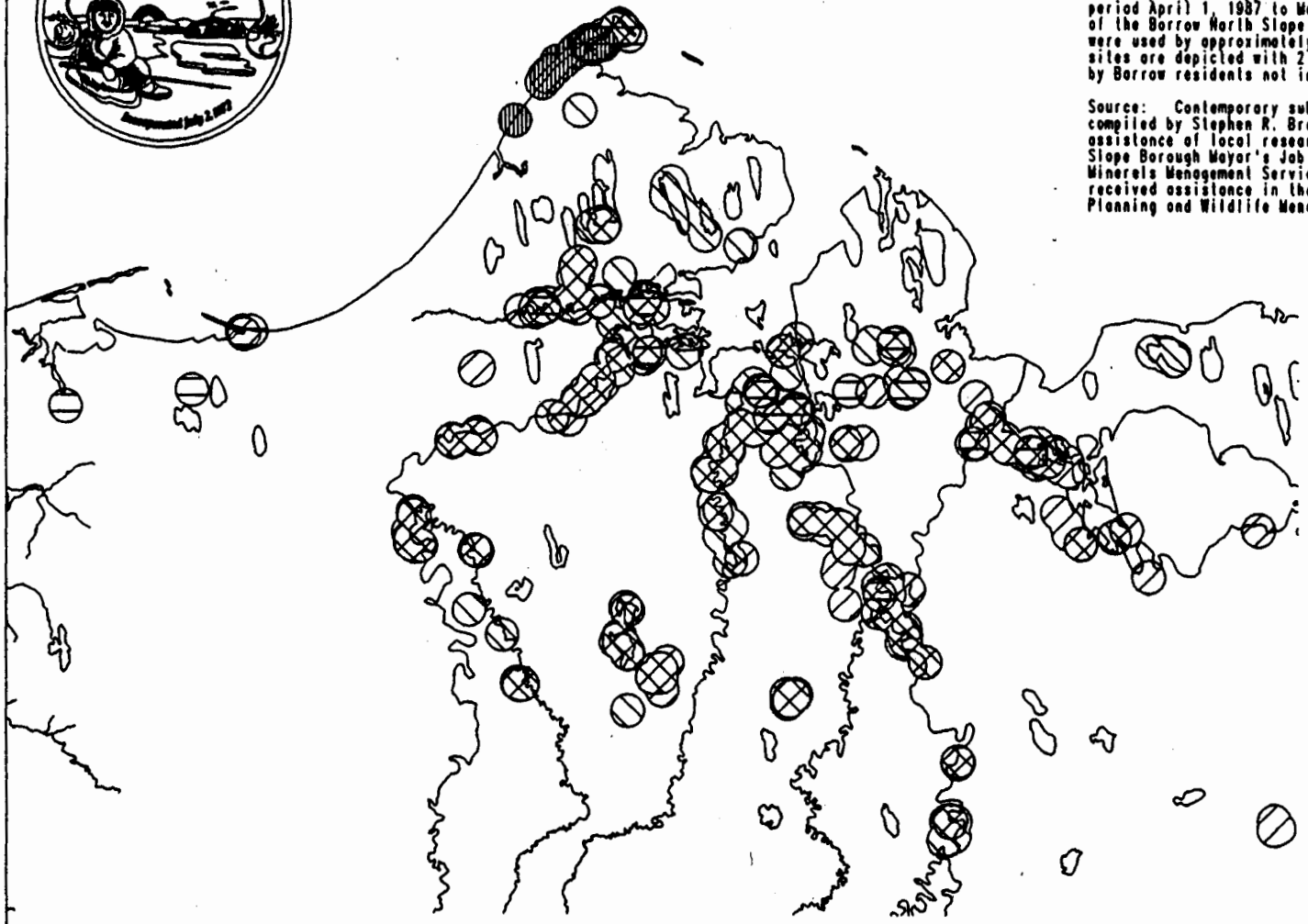
Fish: Comparison of Years One, Two and Three

During the three years this study was conducted, fish were consistently the third most important resource group in terms of total pounds harvested, yet fish harvests varied greatly. This variation is illustrated in Figure 27 which compares the mean usable pounds of fish harvested per household for all three years. During Year One a total of 74 pounds were harvested per household, while in Year Two the figure dipped to 55 pounds and then more than doubled to 126 pounds in Year Three. The total usable harvest for Year Three alone equaled the combined totals of Years One and Two. Despite strong variation in the absolute number of pounds harvested, the relative contribution fish made to the total pounds of subsistence resources was fairly consistent: 11 percent in

MAP 14
NORTH SLOPE SUBSISTENCE STUDY - BARROW
FISH HARVEST SITES BY SPECIES GROUPS, YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska.



LEGEND INFORMATION

- Whitefish: Round whitefish, broad whitefish, humpback whitefish, least cisco, arctic cisco
- Other Freshwater Fish: Greyling, arctic char, burbot, lake trout, northern pike
- Salmon: Chum, pink, silver, king
- Other Coastal Fish: Capelin, arctic cod, tomcod, sculpin, rainbow smelt

20 0 20 40 60

MILES

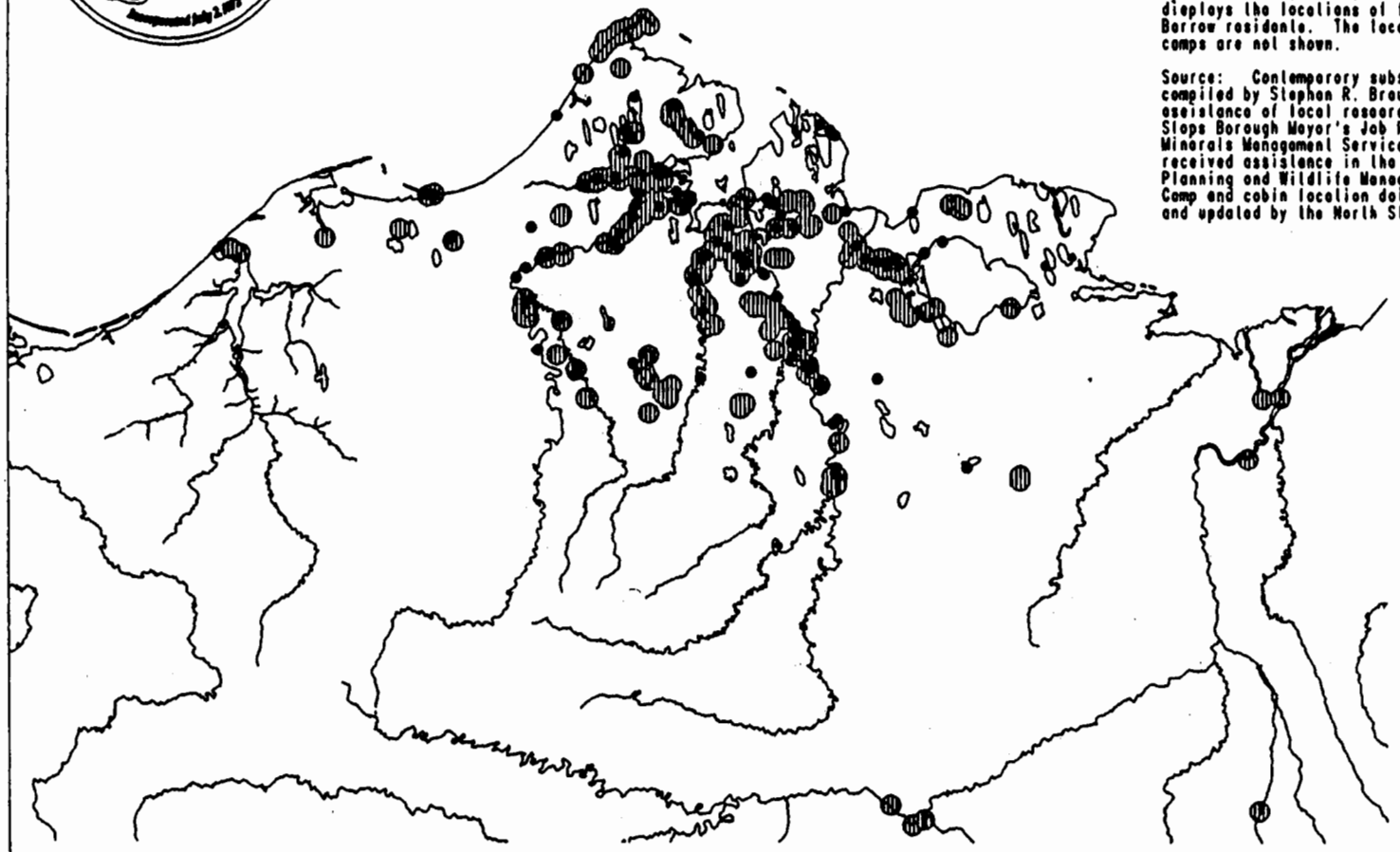
Map Production: North Slope Borough GIS

Date: April 11, 1991

MAP 15
NORTH SLOPE SUBSISTENCE STUDY - BARROW
CABIN AND FIXED CAMP LOCATIONS AND FISH HARVEST SITES, YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study. This map also displays the locations of fixed hunting and fishing camps used by Barrow residents. The locations of many temporary subsistence camps are not shown.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska. Camp and cabin location data compiled by Worl and Smythe (1986) and updated by the North Slope Borough Planning Department in 1989.



LEGEND INFORMATION

Fish harvest sites

Cabins and fixed camps

N

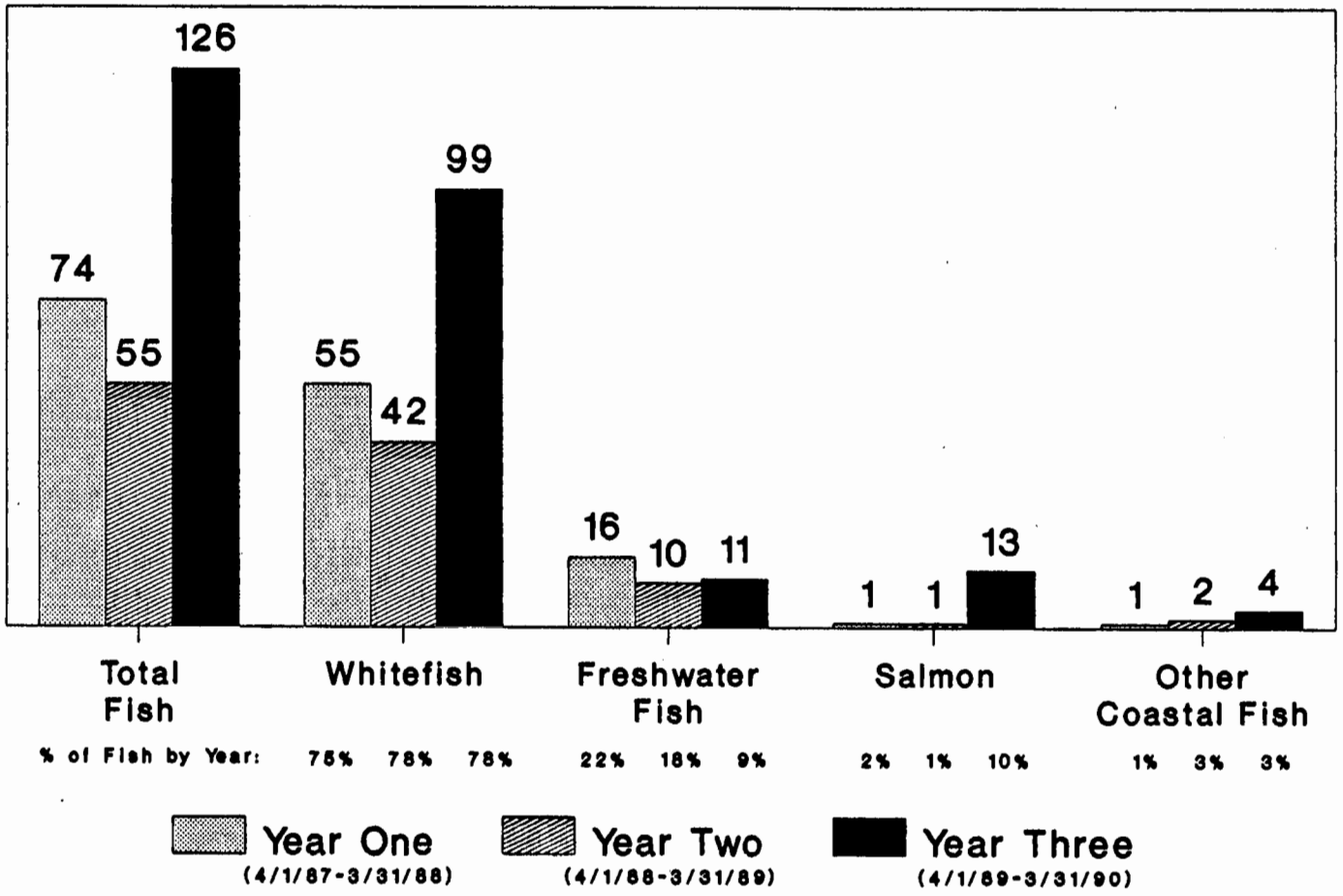
Map Production: North Slope Borough GIS

Date: April 11, 1991

25 0 25 50 75 100 125

MILES

Figure 27: Fish Harvest Estimates
Barrow, Years One, Two & Three
(Mean Usable Pounds Per Household)



Source: Stephen R. Braund & Assoc., 1993

in order of usable pounds harvested were the lake variety of broad whitefish, followed by least cisco, humpback whitefish, non-specified whitefish, round whitefish and Bering or arctic cisco. Thirty-four percent of all Barrow households harvested whitefish. (As mentioned previously, lake and river broad whitefish are biologically one species, broad whitefish. However, residents differentiated those caught in rivers and those caught in lakes due to differences in size and flavor.)

While whitefish harvests occurred from June through November, the majority of these fish were caught in October (43 percent) since people preferred fall whitefish for their taste, fatness, and eggs (field notes). Whitefish harvests consistently peaked in October over the three year study period (Figure 26). Table 18 shows that an average of 44 percent of all whitefish were caught in October. At the species level, harvests of river and lake-caught broad whitefish, humpback whitefish, least cisco, and arctic cisco all peaked in October. Non-specified whitefish harvests were highest in August, and the high months for round whitefish were June and October. The various species of whitefish were harvested only in the period May through November, with slight variations in the seasonality of each species within that time frame. Between December and April, the harvest of whitefish dropped to zero, rising slightly in May as people began to harvest round whitefish and the river variety of broad whitefish.

As indicated on Map 14, whitefish harvests were (along with other freshwater fish) geographically the most widespread of all the fish harvests. Barrow residents traveled considerable distances up the major rivers and also to various lakes to fish for these species, catching them in both the upper and lower reaches of the drainages.

Whitefish: Comparison of Years One, Two and Three

Although the harvest of whitefish remained proportionally consistent for all three years at 75 to 78 percent of the total fish harvest, the total pounds of whitefish harvested in Year Three increased significantly over the two previous years. In Year Three 99 pounds of whitefish were harvested per household compared to 55 pounds harvested in Year One and 42 pounds in Year Two (Tables

A-9, B-9 and C-9). The percentage of Barrow households harvesting whitefish also increased sizably in Year Three. In Year One, 21 percent of Barrow households caught whitefish, dropping to 13 percent in Year Two and rising to 28 percent in Year Three. As mentioned previously, the most prevalent whitefish species was the river caught broad whitefish. It should be noted that the amount of non-specified whitefish harvested has decreased over the three study years due to better reporting and identification from the harvesters. Non-specified whitefish were 21 percent of all whitefish in Year One, less than one percent in Year Two, and no non-specified whitefish harvests were reported in Year Three.

In all three years, whitefish harvests consistently peaked in October. As Figure 28 illustrates, whitefish harvests followed a pattern of increasing from low harvest levels in June to a peak harvest in October of each year. In Years One and Three, August harvests represented a major increase over the previous months' levels and was the second highest harvest month. September harvests dropped before the October peak because of freeze-up and unstable travel conditions. In Year Two, however, grounded ice in July had prevented people from hunting walrus and seals. When the ice moved out in early August, hunters availed themselves of their last opportunity to harvest these marine mammals; consequently, August whitefish harvests were relatively low (compared to August harvests in Years One and Three) as fewer people than usual went upriver to fish that month. Also in Year Two, fishing was considered slow in the latter half of August. High water in the rivers filled fish nets with grass, sticks and other debris, causing people to pull their nets.

In Years One and Two, harvest locations for whitefish were fairly evenly distributed along all the major rivers and inland lakes (Maps A-10, B-11 and C-11). In Year Three, however, whitefish harvests were concentrated along the lower portions of the major rivers, especially near the mouth of the Topagoruk and Chipp rivers.

Figure 28: Comparison of Monthly Whitefish Harvest Estimates
Barrow, Years One, Two & Three

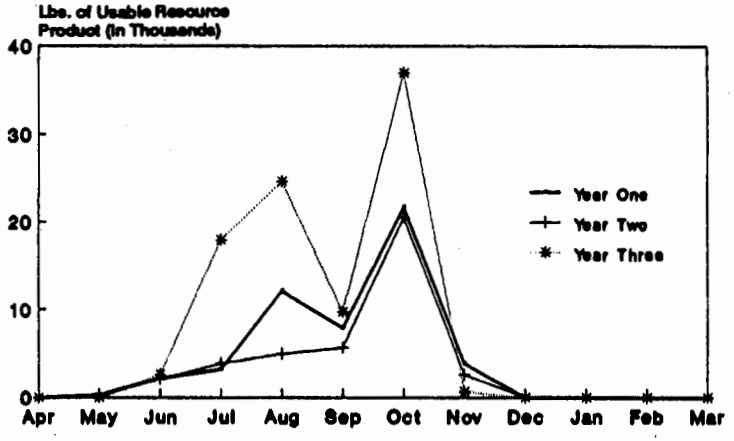


Figure 29: Comparison of Monthly Other Freshwater Fish Harvest Estimates
Barrow, Years One, Two & Three

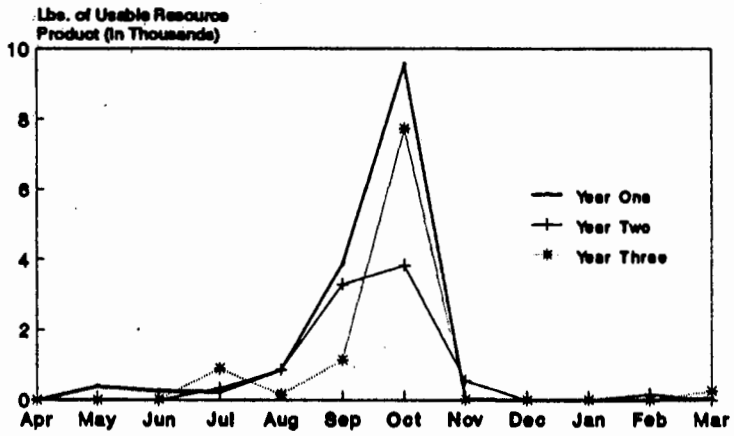
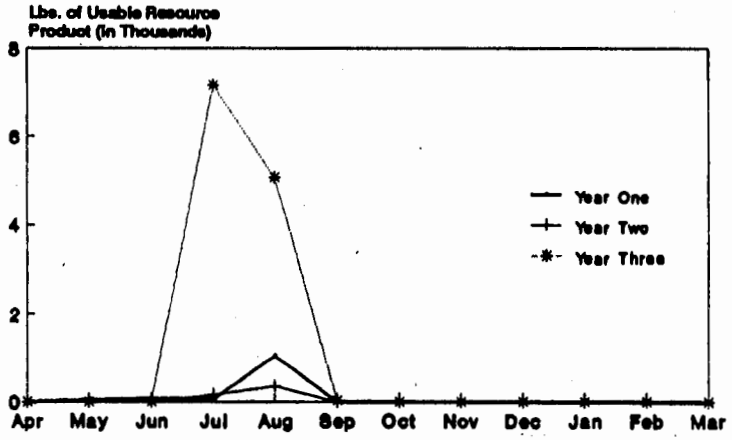
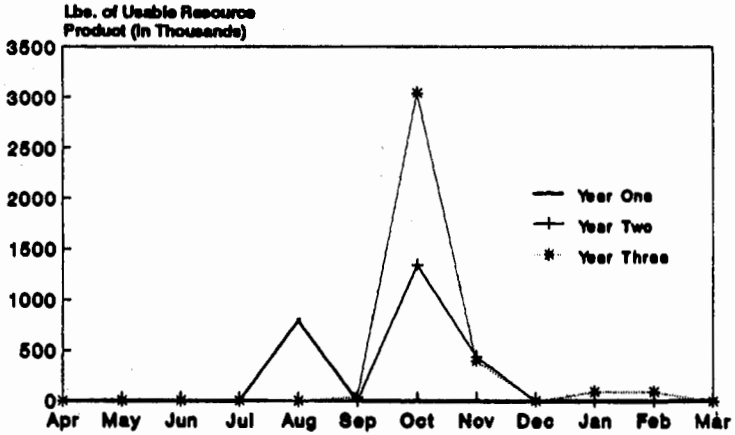


Figure 30: Comparison of Monthly Salmon Harvest Estimates
Barrow, Years One, Two & Three



Three year study period: 4/1/87-3/31/90

Figure 31: Comparison of Monthly Other Coastal Fish Harvest Estimates
Barrow, Years One, Two & Three



Source: Stephen R. Braund & Assoc., 1993

Other Freshwater Fish

Other Freshwater Fish: Three Year Averages

Second in importance following whitefish, other freshwater fish represented an average of 15 percent of the total fish harvest and less than two percent of the total Barrow subsistence harvest during the study period (Figure 24, Table 17). On average, 11,478 usable pounds of other freshwater fish were caught each year, equal to approximately 12 pounds per household. Among Barrow Inupiat households, other freshwater fish harvests averaged 20 pounds per household. Within this category of fish, arctic grayling was the major species harvested by a wide margin, contributing 7,936 pounds per year, followed by burbot (2,708 pounds), lake trout (590 pounds), arctic char (234 pounds), and northern pike (nine pounds).

The peak month for other freshwater fish harvests typically was October when an average of 61 percent of the year's harvest occurred (Table 18). In September, another 24 percent of these fish were harvested, for a total of 85 percent in September and October. Of all the fish species, only two were harvested outside the main harvest period from May through November, and one of those species was burbot. (The other was rainbow smelt in the other coastal fish category.) Burbot were taken in February, March and April, as well as May through November.

Barrow residents caught grayling, burbot and the other freshwater fish species throughout the same area as the whitefish (Map 14). Often, fishermen caught a mixture of whitefish and other freshwater fish (mainly grayling) in their nets. Whitefish and other freshwater fish shared the same habitat and, hence, the activity of fishing was not generally species-specific; one activity yielded a variety of fish. Most rod and reel fishing, however, was aimed at catching arctic grayling, while the winter harvests of burbot were generally the result of targeting that particular species by jigging. Other freshwater fish were caught along all the major drainages in the Barrow area and also on many of the lakes in the area.

Other Freshwater Fish: Comparison of Years One, Two and Three

Other freshwater fish differed from the other three fish subgroups in that Year One was the highest harvest year for other freshwater fish, whereas the highest harvests of whitefish, salmon and other coastal fish were recorded in Year Three. As shown in Figure 27, Barrow residents caught an average of 16 pounds of other freshwater fish in Year One, compared to 10 and 11 pounds per household in Years Two and Three (respectively). Consistent with this trend, the percentage of households harvesting other freshwater fish was highest in Year One at 16 percent, dropping to 12 percent in Year Two and 13 percent in Year Three (Tables A-9, B-9 and C-9). Grayling was the main species harvested each year, representing two-thirds or more of the other freshwater fish harvest each year. Burbot was consistently the second most important species by weight, followed by lake trout.

Although the harvest season for other freshwater fish varied somewhat from year to year, peak harvests consistently occurred in October of each year (Figure 29). In Year One, other freshwater fish were caught from May through November and also in March (burbot) (Tables A-10, B-10 and C-10). In Year Two, the season went from July through November, with additional burbot harvests in February, April and May. Year Three's harvests occurred in June through November, with added burbot harvests in March.

Throughout the study period, harvest sites for other freshwater fish remained consistently located along inland rivers and lakes (Maps A-10, B-11 and C-11). These harvests were as widely distributed as whitefish harvests, and were in most cases geographically coincident. As has been discussed previously with regard to fish in general and whitefish, the distribution of Year Three other freshwater fish harvest sites was also less widespread than in Years One and Two. Harvests were concentrated mainly along the lower drainages, with fewer successful sites along the upper sections of the rivers.

Salmon

Salmon: Three Year Averages

Over the three study years, an average of 4,638 pounds of salmon were harvested each year, representing six percent of the total fish harvest (Figure 24) and less than one percent of all species harvested (Table 17). An average of 12 percent of Barrow households harvested salmon each year, yielding approximately five pounds of salmon per Barrow household. Inupiat households harvested approximately eight pounds per household (Table 10). The predominant species harvested was reported to be silver salmon, followed by chum, pink and king salmon (in descending order of total pounds harvested per year). However, the caveat mentioned earlier in this section is important; distinguishing silvers from chums was difficult and people tended to refer to chums as silvers.

Salmon fishing was almost exclusively a summer activity. The season for catching salmon was concentrated in July and August, earlier than the main whitefish or other freshwater fish season. Fifty-three percent of the salmon harvests typically occurred in July and another 46 percent occurred in August, for a combined total of 99 percent of all salmon being caught in those two months (Table 18). (The remaining one percent occurred in June.) As seen in Map 14, salmon were caught near Point Barrow, in the Peard Bay area, and along the lower sections of the major rivers in the Barrow area.

Salmon: Comparison of Years One, Two and Three

Salmon harvests in Year Three were significantly greater than in either of the two previous years of the study. Barrow salmon harvests went from 1,190 pounds in Year One to 490 pounds in Year Two, rising dramatically to 12,247 usable pounds in Year Three (Tables A-9, B-9 and C-9). While salmon represented only two percent of the total fish harvest in the first two study years, salmon was 10 percent of the total fish harvest in Year Three (Figures A-10, B-10 and C-10). The percentage of Barrow households harvesting salmon followed a similar trend over the three years, going from three percent in Year One to one percent in Year Two and 10 percent in Year Three. Favorable ice conditions for setting nets along the coast likely was a factor in the high Year Three salmon

harvest (compared to Year Two when ice was grounded along the beach for most of July and early August). Another factor was that the salmon runs were simply stronger in Year Three than the previous years.

The seasonality of the salmon harvests varied slightly from year to year (Figure 30). Year One's season was the longest, beginning in May and lasting through August, with 87 percent of the year's harvest in August (Table A-10). In Years Two and Three, salmon were caught only in July and August (Tables B-10 and C-10). August was the peak month in Year Two, when 69 percent of the year's salmon were caught. However, in Year Three, July and August were both high months, and July harvests were the highest (58 percent). (Although August was the peak month in two of the three study years, the July peak in Year Three was so much higher that, when the three years were averaged, July was the average peak month.)

Harvest locations were very limited in Years One and Two, compared to the range and multiplicity of different locations in Year Three (Maps A-10, B-11 and C-11). Year One and Two harvests were mainly on the coast near Barrow. Two other sites were mapped in Year One near Admiralty Bay, and one near Peard Bay; only one other site (near Admiralty Bay) was mapped in Year Two. In Year Three, however, salmon were harvested not only near Barrow but also along most of the major drainages that Barrow fishermen use. Many more salmon harvest locations were reported in Year Three than in the previous two years. The harvest of salmon across a wider area is likely a reflection of the apparently stronger salmon runs in Year Three.

Other Coastal Fish

Other Coastal Fish: Three Year Averages

Other coastal fish harvests were the smallest proportion (three percent) of Barrow fish harvests during the study period. An average of 2,090 pounds of other coastal fish were caught each year, equalling less than one percent of the total Barrow subsistence harvest (Table 17). Other coastal fish consisted of capelin, rainbow smelt, arctic cod, tomcod and sculpin. All of the fish species in this category had a conversion weight of less than one usable pound

per fish. Consequently, despite lower total pounds harvested than salmon, Barrow residents caught more other coastal fish (788 salmon compared to 10,351 other coastal fish). Furthermore, participation was higher; 14 percent of Barrow households caught other coastal fish compared to the 12 percent who caught salmon.

Other coastal fish were harvested mainly between July and November (Table 18). The exception to this trend was rainbow smelt, which was harvested only in the winter beneath the ice at the Wainwright Inlet. Barrow residents went to Wainwright and caught smelt in January, February and March. Overall, however, October was the peak month for other coastal fish.

Harvests of other coastal fish occurred along the coastline north and south of Barrow and not more than 10 miles from town in either direction, with the exception of rainbow smelt (Map 14). Rainbow smelt were not harvested in Barrow, but were harvested by Barrow residents when in Wainwright. Therefore, the number of smelt harvested over the years was a reflection of Barrow residents visiting Wainwright and harvesting smelt at the same time. Although not represented in the tables, field observations indicated that because some Barrow residents had families in Wainwright who sent smelt to their Barrow kin, more smelt were available in Barrow than were actually harvested by Barrow residents.

Other Coastal Fish: Comparison of Years One, Two and Three

Although the contribution of other coastal fish to total fish harvests remained fairly consistent over the three study years at one to three percent (Figures A-10, B-10 and C-10), the composition of the other coastal fish category varied. In Year One, the other coastal fish category consisted almost exclusively of capelin (796 pounds), plus a small harvest of rainbow smelt (nine pounds). In Year Two, this category was predominantly arctic cod (1,593 pounds), supplemented by small amounts of tomcod (197 pounds) and sculpin (nine pounds). Arctic cod remained the most significant fish in this category in Year Three (3,401 pounds), followed by rainbow smelt (178 pounds) and capelin (66 pounds). Overall, other coastal fish harvests in Year Three were significantly higher than in the two previous years due to the large increase

in arctic cod harvests (Tables A-9, B-9 and C-9). However, the percentage of all Barrow households harvesting other coastal fish went from eight percent in Year One to two percent in Year Two to four percent in Year Three.

The large amount of arctic cod harvested in Year Three (3,401 pounds) as compared to Year Two (1,593 pounds) may have been the result of a mild fall after Elson Lagoon had already frozen. For about a week, the weather was nice for ice fishing. Because the ocean froze late, no one fished for cod on the ocean side; however, the lagoon froze up at a time when large schools of arctic cod were running.

The seasonality varied from year to year as well (Tables A-10, B-10 and C-10; Figure 31). In Year One, when capelin constituted virtually the entire harvest, the other coastal fish harvest peaked in August. August is the month when capelin are usually obtained; in years when fall storms create a heavy surf, capelin can be collected along the beach. In Years Two and Three, arctic cod was the predominant species caught, and the main season for arctic cod occurs in October and, to a lesser degree, November. Consequently, October was the peak harvest month for other coastal fish in Years Two and Three. All of the harvest sites for this category of fish were located along the coast near Barrow; however, in Year Three the locations extended farther along the coast south of Barrow than in Years One or Two (Maps A-10, B-11 and C-11). These more distant harvests were where residents collected capelin on the beach following a storm.

BIRDS

Birds: Three Year Averages

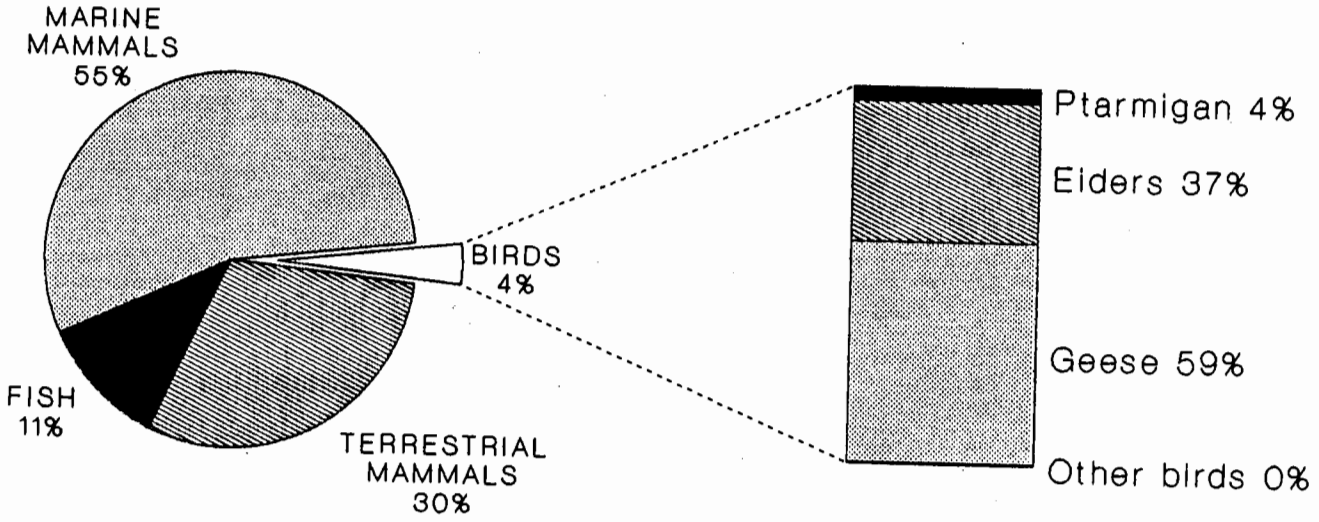
Harvesting birds was a major activity among Barrow residents, particularly in the spring. Barrow residents hunted several species of birds. In this report the bird harvest data have been organized into four subgroups: geese, eiders, other birds, and ptarmigan. Geese species include white-fronted, brant, Canada and snow geese, and eider species include king, common, spectacled, and Steller's eiders. The other birds category consists of red-throated loons, sandhill cranes, tundra swans, surf scoters, and oldsquaws. These three

categories of birds are migratory and constituted the major proportion (96 percent) of Barrow bird harvests. Geese were 59 percent, eiders were 37 percent, and other birds were less than one percent (Figure 32). In contrast, the non-migratory ptarmigan made up just four percent of the average annual Barrow bird harvest. All species of birds contributed an average of 24,720 usable pounds to the annual community subsistence harvest, equal to approximately 26 pounds per household annually (Table 20, Figure 33).

Eiders, geese and other waterfowl were among the first of the migratory subsistence species to return to the Barrow area each spring. As such, these birds were eagerly anticipated harbingers of the many migratory subsistence species soon returning, providing the first taste of the spring and summer harvests. Birds actually constituted a very small proportion of the total Barrow subsistence harvest, only four percent (Figure 32, Table 20). The significance of birds may be reflected more accurately in the fact that, despite relatively low overall harvest amounts, 53 percent of all Barrow households successfully harvested birds during this study (Table 20), a higher participation rate than that of fish (41 percent) or marine mammals (48 percent), and just slightly less than that of terrestrial mammals (54 percent). Additionally, birds were a fundamental part of most community feasts, along with bowhead whale. Moreover, white-fronted geese, brants and eiders (all species), which provided the bulk of the bird harvest, have specific migration routes and schedules which hunters must learn to be successful. The time and effort spent acquiring this knowledge and hunting these birds further imply that birds are a more important part of the subsistence economy than the harvest numbers suggest.

Migrating along the open leads, king and common eiders were the first waterfowl to arrive (late April) but usually were not harvested in significant quantities until May when hunters were able to get out on the ice during whaling. Sea birds, such as murres, guillemots and surf scoters, and other ducks (e.g., oldsquaws) also arrived in early spring. These birds were rarely harvested, however. The white-fronted geese and brants arrived next, along with occasional spectacled and Steller's eiders, snow geese, Canada geese, and sandhill cranes. White-fronted geese migrate over land, feeding and resting in marshy areas and tundra ponds. Brants, like eiders, follow the open water or, lacking open water, follow the flat ice just offshore in their flight path.

Figure 32: Estimated Bird Harvest Percentages, Barrow Years One, Two and Three Averaged (Usable Pounds Harvested)



Three years of study: 4/1/87 - 3/31/90
Source: Stephen R. Braund & Assoc., 1993

TABLE 20: HARVEST ESTIMATES FOR BIRDS - ALL BARROW HOUSEHOLDS, THREE YEAR AVERAGE (1,2)

RESOURCE	CONVERSION FACTOR (3) (Usable Weight Per Resource in lbs)	COMMUNITY TOTALS		AVERAGE POUNDS HARVESTED		PERCENT OF TOTAL USABLE POUNDS HARVESTED	PERCENT OF ALL BARROW HSEHOLDS HRVSTING RESRCE (4)	SAMPLING STATISTICS				
		NUMBER HARVESTED	USABLE POUNDS HARVESTED	PER HOUSEHOLD	PER CAPITA			STANDARD DEVIATION (lbs)	SAMPLING ERROR AT 95% (lbs)	LOW ESTIMATE (Mean lbs/ Household)	HIGH ESTIMATE (Mean lbs/ Household)	SAMPLING ERROR AS % OF MEAN
Total Birds	n/a	n/a	24,720	26.4	8.2	3.5%	53%	4	8	18.39	34.37	30%
Total Geese		3,384	14,561	15.5	4.8	2.1%	29%	3	5	10.39	20.69	33%
Geese (non-specified)	4.5	144	647	0.7	0.2	0.1%	3%	0	0	0.29	1.09	58%
Brant	3.0	440	1,321	1.4	0.4	0.2%	9%	1	1	0.04	2.78	97%
White-fronted geese	4.5	2,795	12,575	13.4	4.2	1.8%	27%	3	5	8.36	18.48	38%
Snow geese	4.5	4	19	0.0	*	**	1%	0	0	0.01	0.03	51%
Canada geese	4.5	1	4	0.0	*	**	**	0	0	0.00	0.00	n/a
Total Eider		6,087	9,136	9.8	3.0	1.3%	43%	3	5	4.79	14.71	51%
Eider (non-specified)	1.5	5,982	8,976	9.6	3.0	1.3%	42%	3	5	4.62	14.54	52%
Common eider	1.5	32	47	0.1	*	**	2%	0	0	0.00	0.11	111%
King eider	1.5	69	103	0.1	*	**	2%	0	0	0.07	0.15	35%
Stellar's eider	1.5	3	9	0.0	*	**	**	0	0	0.01	0.01	28%
Spectacled eider	1.5	1	1	0.0	*	**	**	0	0	0.00	0.00	n/a
Ptarmigan	0.7	1,378	965	1.0	0.3	0.1%	20%	0	0	0.57	1.49	44%
Other birds		30	58	0.1	*	**	1%	0	0	0.02	0.10	66%
Red-throated Loon	3.0	1	3	0.0	*	**	**	0	0	0.00	0.01	n/a
Sandhill Crane	10.0	1	9	0.0	*	**	**	0	0	0.01	0.01	48%
Tundra Swan	10.0	0.4	3	0.0	*	**	**	0	0	0.00	0.01	n/a
Other ducks (non-spec.)	1.5	26	40	0.0	*	**	**	0	0	0.04	0.04	n/a
Oldsquaw	1.5	1	1	0.0	*	**	**	0	0	0.00	0.00	n/a
Surf scoter	1.5	0.4	1	0.0	*	**	**	0	0	0.00	0.00	n/a

(1) Three years of study: April 1, 1987 - March 31, 1990.

(2) Estimated sampling errors do not include errors in reporting, recording, and in conversion to usable weight.

(3) See Table D-5 for sources of conversion factors.

(4) This percentage is a cumulative total for the three study years rather than an annual average.

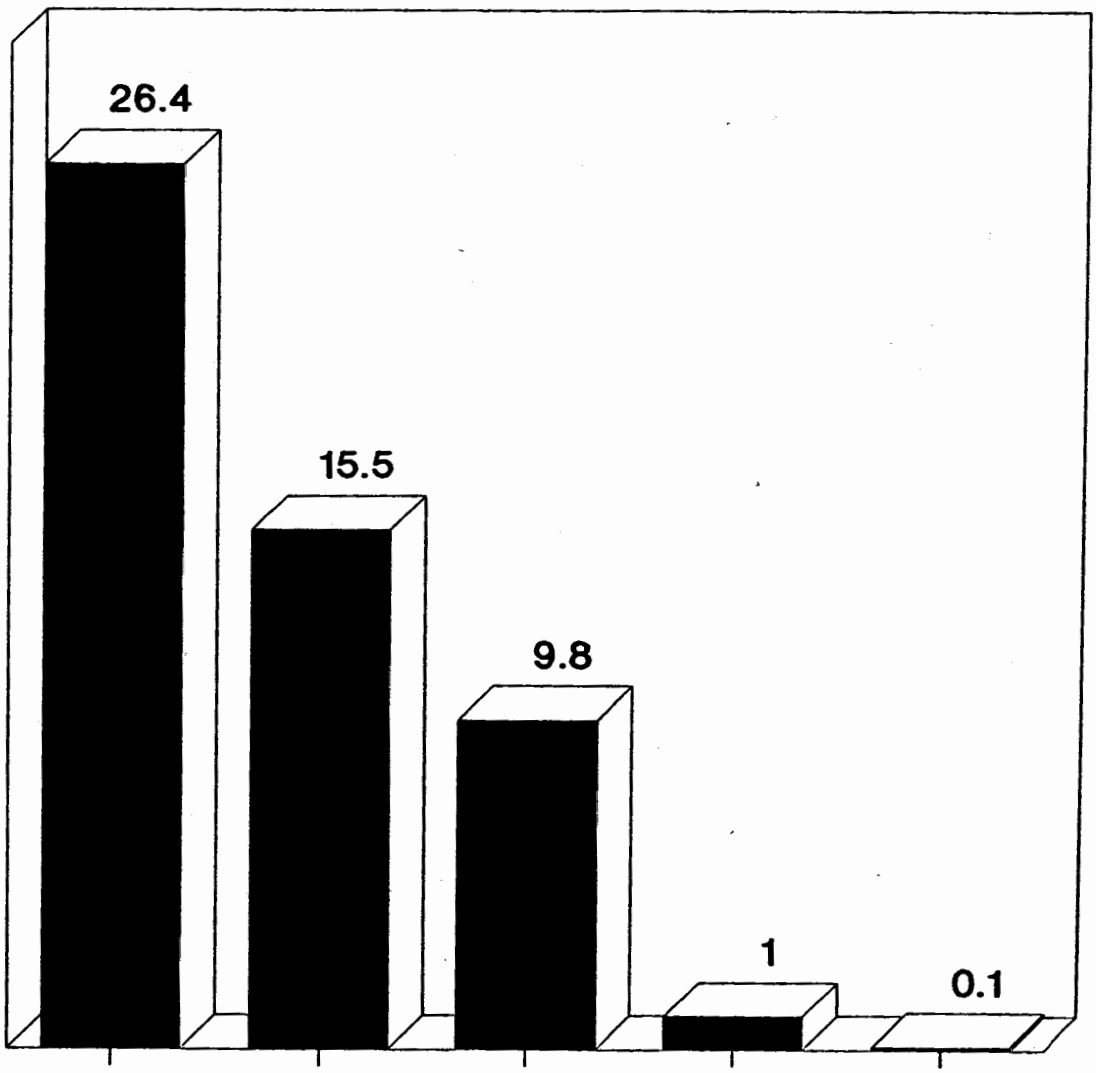
* represents less than .1 pound

** represents less than .1 percent

n/a means not applicable

Source: Stephen R. Braund & Associates, 1993

Figure 33: Bird Harvest Estimates
Barrow, Years One, Two & Three Averaged
(Mean Usable Pounds Per Household)



Three years of study: 4/1/87 - 3/31/90
Source: Stephen R. Braund & Assoc., 1993

Other bird species sometimes harvested or available include various loons, pintail ducks, mallards, mergansers, scaups, snowy owls, and the aforementioned tundra swans and ptarmigan.

Tables 21 and 22 show bird harvest data by species and by month, and Figure 34 graphs the pounds per month for each category of birds. As these tables and the graph show, a majority of bird harvests took place in a concentrated period from April through September, with over 60 percent of the harvest occurring in just one month: May. Eighty-four percent of all geese were taken in May as were 77 percent of all ptarmigan. The harvest of eiders, in contrast, was spread more evenly throughout the spring and summer, with the average peak harvest occurring usually in August. Similarly, most other birds were taken throughout the spring and summer with their average peak harvest occurring in July.

Map 16 shows harvest locations for all species of birds as well as lifetime community bird harvest areas (based on Pedersen 1979). This map illustrates that almost all of the bird harvest sites were located either along the major rivers or along the coast and nearshore waters from Point Barrow to about 30 miles south of Barrow. Map 17 differentiates Year One, Two and Three harvests (combined) by subgroup of birds. Geese and ptarmigan were taken almost exclusively on spring hunts along interior rivers while the harvest of eiders occurred either from the ice edge in May and June, from boats, or from the shooting station in August when the eiders were migrating westward. The harvest of other birds, particularly sandhill cranes and swans, were incidental takes associated with spring goose hunting trips. Map 18 illustrates the strong association between bird harvest sites and cabins and fixed camps.

Birds: Comparison of Years One, Two and Three

Bird harvests were very consistent from Year One (22,329 usable pounds) to Year Two (22,362 usable pounds); however, the total pounds of birds harvested in Year Three increased considerably to an estimated 29,456 usable pounds (Tables A-12, B-12 and C-12). As Figure 35 illustrates, the average household bird harvest was 24 pounds in Years One and Two, increasing to 31 pounds in Year Three. The number of households successfully hunting birds also increased in

TABLE 21: BIRD HARVEST ESTIMATES BY SPECIES AND MONTH - BARROW, THREE YEAR AVERAGE (1)
(Pounds of Usable Resource Product)

SPECIES	1987-1990 TOTALS ****** April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Total Geese	0	12,306	2,011	1	154	94	0	0	0	0	0	0
Geese (non-specified)	0	643	4	0	0	0	0	0	0	0	0	0
Brant	0	276	851	1	138	54	0	0	0	0	0	0
White-fronted geese	0	11,368	1,152	0	16	40	0	0	0	0	0	0
Snow geese	0	14	4	0	0	0	0	0	0	0	0	0
Canada geese	0	4	0	0	0	0	0	0	0	0	0	0
Total Eiders	160	2,357	413	1,997	3,392	797	13	0	0	0	0	0
Eider (non-specified)	160	2,305	379	1,948	3,372	794	13	0	0	0	0	0
Common eider	0	7	0	38	0	2	0	0	0	0	0	0
King eider	0	43	32	10	18	0	0	0	0	0	0	0
Spectacled eider	0	0	1	0	0	0	0	0	0	0	0	0
Stellar's eider	0	2	0	0	2	0	0	0	0	0	0	0
Ptarmigan	0	745	57	27	45	17	53	11	0	0	0	9
Other Birds	0	12	0	37	5	3	0	0	0	0	0	0
Red-throated loon	0	0	0	0	0	3	0	0	0	0	0	0
Sandhill crane	0	8	0	0	0	0	0	0	0	0	0	0
Tundra swan	0	4	0	0	0	0	0	0	0	0	0	0
Other ducks (non-specif.)	0	0	0	35	5	0	0	0	0	0	0	0
Oldsquaw	0	0	0	1	0	0	0	0	0	0	0	0
Surf scoter	0	0	0	1	0	0	0	0	0	0	0	0
All Bird Species	160	15,420	2,481	2,062	3,596	911	65	11	0	0	0	9

(continued on next page)

TABLE 21, CONTINUED: BIRD HARVEST ESTIMATES BY SPECIES AND MONTH - BARROW, THREE YEAR AVERAGE (1)
(Pounds of Usable Resource Product)

1987-1990

PERCENTS
****

SPECIES	April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Total Geese	0%	84%	14%	0%	1%	1%	0%	0%	0%	0%	0%	0%
Geese (non-specified)	0%	99%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Brant	0%	21%	64%	0%	10%	4%	0%	0%	0%	0%	0%	0%
White-fronted geese	0%	90%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Snow geese	0%	80%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Canada geese	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total Eiders	2%	26%	5%	22%	37%	9%	0%	0%	0%	0%	0%	0%
Eider (non-specified)	2%	26%	4%	22%	38%	9%	0%	0%	0%	0%	0%	0%
Common eider	0%	15%	0%	80%	0%	5%	0%	0%	0%	0%	0%	0%
King eider	0%	42%	31%	10%	17%	0%	0%	0%	0%	0%	0%	0%
Spectacled eider	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Stellar's eider	0%	77%	6%	3%	5%	2%	5%	1%	0%	0%	0%	1%
Ptarmigan	0%	77%	6%	3%	5%	2%	5%	1%	0%	0%	0%	1%
Other Birds	0%	21%	0%	64%	8%	6%	0%	0%	0%	0%	0%	0%
Red-throated loon	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%
Sandhill crane	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tundra swan	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Other ducks (non-specif.)	0%	0%	0%	88%	12%	0%	0%	0%	0%	0%	0%	0%
Oldsquaw	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%
Surf scoter	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%
All Bird Species	1%	62%	10%	8%	15%	4%	0%	0%	0%	0%	0%	0%

(1) Three years of study: April 1, 1987 - March 31, 1990.

Source: Stephen R. Braund & Associates, 1993

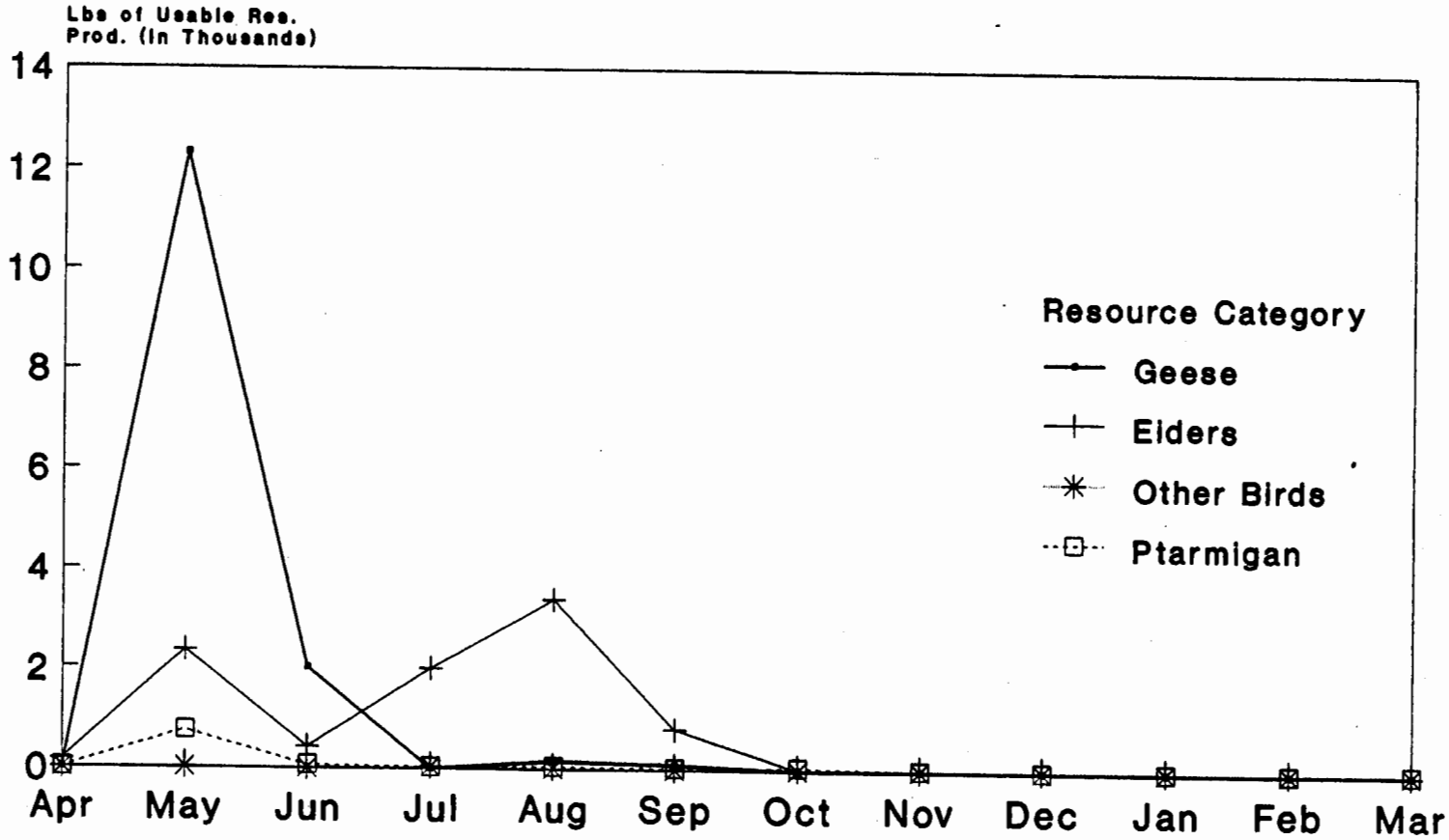
TABLE 22: BIRD HARVEST ESTIMATES BY SPECIES AND MONTH - BARROW, THREE YEAR AVERAGE (1)
(Number Harvested)

SPECIES	1987-1990 April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March
Total Geese	0	2,765	542	0	49	27	0	0	0	0	0	0
Geese (non-specified)	0	143	1	0	0	0	0	0	0	0	0	0
Brant	0	92	284	0	46	18	0	0	0	0	0	0
White-fronted geese	0	2,526	256	0	3	9	0	0	0	0	0	0
Snow geese	0	3	1	0	0	0	0	0	0	0	0	0
Canada geese	0	1	0	0	0	0	0	0	0	0	0	0
Total Eiders	107	1,572	275	1,331	2,262	531	8	0	0	0	0	0
Eider (non-specified)	107	1,536	253	1,299	2,248	529	8	0	0	0	0	0
Common eider	0	5	0	26	0	2	0	0	0	0	0	0
King eider	0	29	22	7	12	0	0	0	0	0	0	0
Spectacled eider	0	0	1	0	0	0	0	0	0	0	0	0
Stellar's eider	0	2	0	0	2	0	0	0	0	0	0	0
Ptarmigan	0	1,064	82	38	64	24	75	16	0	0	0	13
Other Birds	0	1	0	24	3	1	0	0	0	0	0	0
Red-throated loon	0	0	0	0	0	1	0	0	0	0	0	0
Sandhill crane	0	1	0	0	0	0	0	0	0	0	0	0
Tundra swan	0	0	0	0	0	0	0	0	0	0	0	0
Other ducks (non-specif.)	0	0	0	23	3	0	0	0	0	0	0	0
Oldsquaw	0	0	0	1	0	0	0	0	0	0	0	0
Surf scoter	0	0	0	0	0	0	0	0	0	0	0	0

(1) Three years of study: April 1, 1987 - March 31, 1990.

Source: Stephen R. Braund & Associates, 1993

Figure 34: Monthly Bird Harvest Estimates, Barrow
Years One, Two and Three Averaged



Three years of study: 4/1/87 - 3/31/90
Source: Stephen R. Braund & Assoc., 1993

MAP 16
NORTH SLOPE SUBSISTENCE STUDY - BARROW
BIRD HARVEST SITES - ALL SPECIES, YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study. Lifetime-community harvest areas, collected in the form of map biographies from 20 households (Pedersen 1979), are also illustrated.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska.

LEGEND INFORMATION

Lifetime community land use (Pedersen 1979).

Birds
- Eiders
  Common, king, spectacled, Steller's
- Other ducks
  Oldsquaw, surf scoter
- Geese
  White-fronted goose, black brant, lesser snow goose, Canada goose
- Ptarmigan
- Red throated loons
- Sandhill cranes
- Tundra (whistling) swans

N

30 0 30 60 90

MILES

Map Production: North Slope Borough GIS

Date: April 11, 1991

MAP 17
NORTH SLOPE SUBSISTENCE STUDY - BARROW
BIRD HARVEST SITES BY SPECIES, YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska.

LEGEND INFORMATION

- Sandhill cranes and tundra (whistling) swans
- Eiders
- Other ducks (includes loons)
- Geese
- Ptarmigan

N

30 0 30 60 90

MILES

Map Production: North Slope Borough GIS

Date: April 11, 1991

MAP 18
NORTH SLOPE SUBSISTENCE STUDY - BARROW
CABIN AND FIXED CAMP LOCATIONS AND BIRD HARVEST SITES, YEARS ONE, TWO, AND THREE

This map depicts approximate subsistence harvest sites for the time period April 1, 1987 to March 31, 1990: Years One, Two and Three of the Barrow North Slope Subsistence Study. Harvest sites shown were used by approximately 118 Barrow households. All harvest sites are depicted with 2 mile buffer. Additional areas were used by Barrow residents not included in the study. This map also displays the locations of fixed hunting and fishing camps used by Barrow residents. The locations of many temporary subsistence camps are not shown.

Source: Contemporary subsistence use information gathered and compiled by Stephen R. Braund and Associates (SRB&A) with the assistance of local research assistants hired through the North Slope Borough Mayor's Job Program. SRB&A is under contract to the Minerals Management Service, U.S. Department of Interior, and received assistance in the study from the North Slope Borough Planning and Wildlife Management Departments, Barrow, Alaska. Camp and cabin location data compiled by Worl and Smythe (1986) and updated by the North Slope Borough Planning Department in 1989.

LEGEND INFORMATION

Bird harvest sites

Fixed camps and cabins

N

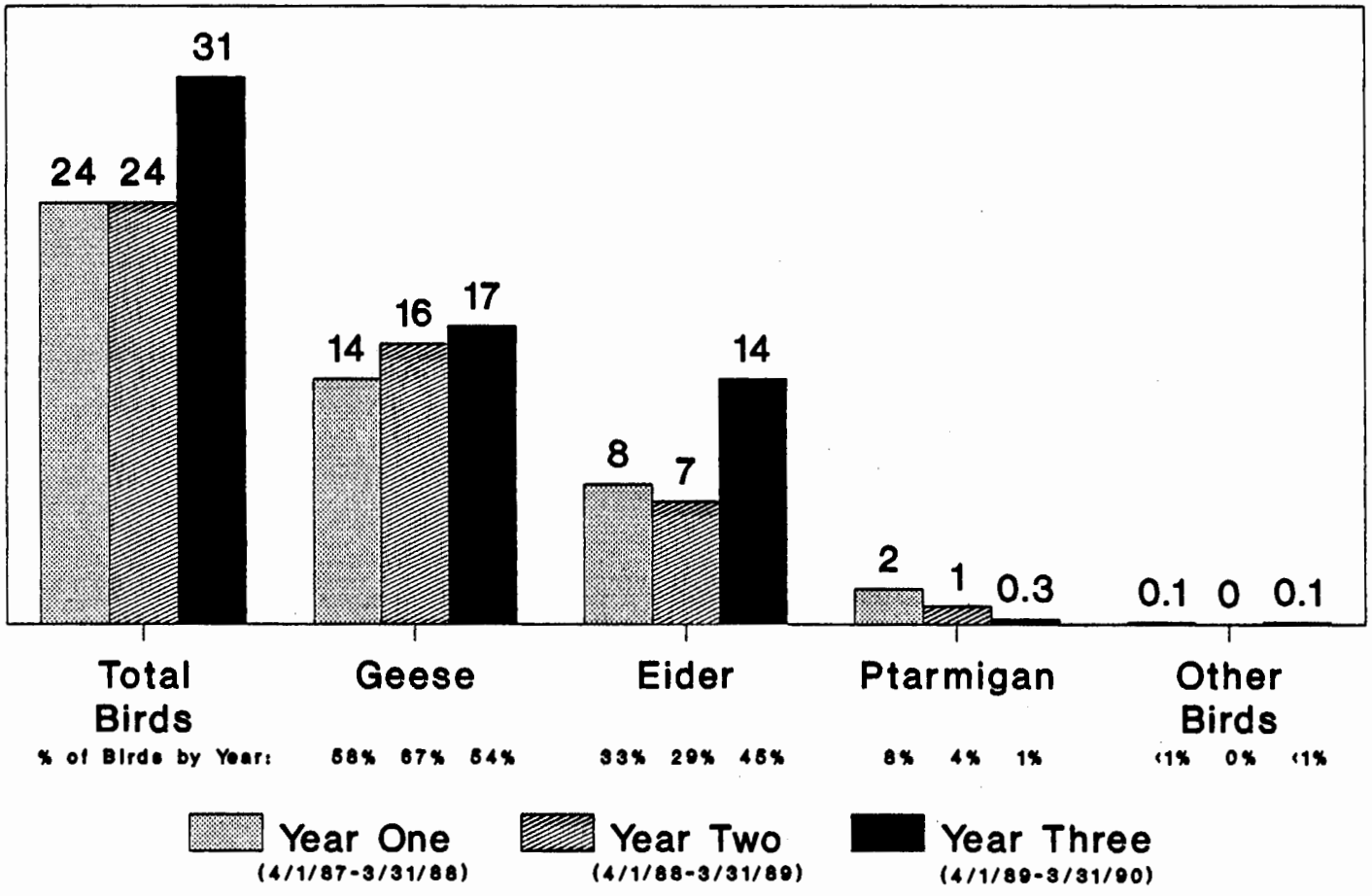
30 0 30 60 90

MILES

Map Production: North Slope Borough GIS

Date: April 11, 1991

Figure 35: Bird Harvest Estimates
Barrow, Years One, Two & Three
(Mean Usable Pounds Per Household)



Source: Stephen R. Braund & Assoc., 1993

Year Three; 36 percent of all Barrow households harvested birds in Year One, 34 percent harvested birds in Year Two, and 41 percent harvested birds in Year Three. The increase in participation during the third year likely was due to the good summer weather which provided hunters with more opportunity to hunt birds than in previous summers. Despite the Year Three increase, the proportion of the total subsistence harvest represented by bird harvests was very stable over the three study years, contributing just under four percent of the total harvest each year (Figures A-13, B-13 and C-13). May was the primary harvest month in all three years, with 53 to 73 percent of the year's harvest (by weight) taken that month (Tables A-13, B-13 and C-13). August was the second most productive bird hunting month in Years One and Two, compared to Year Three when June was the second highest month.

Maps A-11, B-12 and C-12 illustrate that the areal range of bird harvests was generally similar in all three years of the study. However, some variation occurred from year to year. In Years One and Three, for instance, offshore harvest sites near Barrow in the Chukchi Sea extended beyond the lifetime use line, whereas Year Two harvests were closer to the Chukchi coast and the lifetime use line. On the other hand, numerous Year Two harvests occurred along the Beaufort Sea coast, whereas Beaufort coastal harvests were unusual in Years One and Three. The higher harvests along the Beaufort Sea in Year Two resulted from the problem of grounded ice along the Chukchi coast that summer, causing more hunters to hunt in the Beaufort Sea than usual. The fact that Chukchi Sea harvests were closer to shore in Year Two than Years One and Three was a function not only of the grounded summer ice in Year Two, but also of the spring lead being closer to shore in Year Two than the other two years.

Geese

Geese: Three Year Averages

White-fronted geese and brants generally were hunted in different habitats and at different times, although overlap did occur. White-fronted geese were harvested in May and early June along interior rivers before the spring thaw made travel too dangerous. Some of the people who did not participate in whaling went inland to hunt geese, while many of the whalers would hurry inland

to hunt geese immediately after whaling if breakup had not already ensued. Inland geese hunting was dependent on ice and river conditions, but generally lasted from one to three weeks and usually provided families with their total white-fronted geese harvest for the year. The majority of the Barrow geese harvest was composed of white-fronted geese. An average of 2,795 white-fronted geese were harvested per year, or 12,575 usable pounds, with 27 percent of the households successfully harvesting this bird (Table 20). Barrow residents harvested an average of 13 pounds of white-fronted geese per household. Incidental to the inland white-fronted geese harvest, people also obtained a few snow geese and an occasional Canada goose. Ninety percent of the white-fronted geese harvest was in May with another nine percent taken in June; similarly, the incidental take of Canada and snow geese was also concentrated in May and June (Table 21). The brant harvest, on the other hand, was more evenly distributed over the spring and summer than were the harvests of other geese species. Most brants were harvested in June (64 percent), with another 21 percent taken in May, 10 percent in August, and four percent in September. Hunters intercepted brants on the bird's northward migration as well as its southward migration. Brant harvests were not only considerably smaller than white-fronted harvests, averaging 1,321 usable pounds or 440 birds per year, but fewer people (nine percent) participated successfully in the brant harvest. Geese harvest sites were located almost exclusively along interior rivers with a few sites being located along the coast and interior lakes.

Geese: Comparison of Years One, Two and Three

As a comparison of Tables A-12, B-12 and C-12 shows, geese harvests increased over the three study years (from 12,743 pounds in Year One to 16,291 pounds in Year Three) while participation in geese harvests decreased, most significantly between Years Two and Three. This paradox may be explained in part by the fact that in Year Three some hunters chose to stay out on the ice in hopes of harvesting another whale, and as a result did not take their annual waterfowl hunting trip. However, field observations indicated that while fewer and shorter hunts were undertaken than previously, more geese were in the area than in prior years; consequently, each hunter harvested more geese in a shorter period of time.

As Figure 36 shows, the timing of all geese harvests was virtually identical in each of the three study years. The one variation occurred in Year Three when higher June harvests were recorded than in the previous two years. White-fronted geese harvests were higher in June of Year Three, but the sharp increase in June geese was due mainly to brant: 801 birds compared to none harvested in June of Year One and 50 in June of Year Two. As explained by one Inupiat informant, the large June harvest of brants in Year Three was due in part to a change in the migration route of brants in such a way as to favor hunters. However, the unusually large increase in brant harvests was mainly a function of sample weighting. In Year Three, two households from stratum four each harvested numerous brants, having not done so in prior study years. Because of low sampling in their stratum, their harvests were weighted heavily, resulting in an apparently major increase in brant harvests. If Year Three was a more opportune year for hunting brants, it is possible that the participation of these two households accurately represents other households in their stratum. However, it is also possible that, in this case, the sample weighting overstates the actual harvests.

The geographic extent of geese harvests varied only slightly from year to year, with isolated distant harvests extending the range in one year compared to another (Maps A-12, B-13 and C-13). In general, however, geese harvests were located consistently along the major drainages. In Year Three, fewer harvests occurred along the upper Meade and Usuktuk rivers than in the other two study years. Additionally, Year Three harvests were concentrated closer to Barrow than in Years One and Two. This geographic shift in Year Three reflects the reduced amount of time families had for geese hunting because of the late whaling season and warm weather. Although some hunters harvested geese far inland, many hunters in Year Three had less time to travel as far as they usually go to hunt geese before break-up impaired inland travel.

Eiders

Eiders: Three Year Averages

Eiders were the second largest subgroup of birds harvested, constituting 37 percent of the annual average bird harvest (Figure 32). All of the eider

species - king, common, Steller's and spectacled eiders - were harvested in Barrow, in this order of importance. However, the majority of the eider harvests were reported as "non-specified" eiders (i.e., people reported "eiders" without indicating the species). Barrow residents harvested an average community total of 6,087 eiders or 9,136 usable pounds per year (Table 20). More people successfully hunted eiders (43 percent) in the three years than geese (29 percent). The higher participation was because people had better access to eiders (both geographically and temporally) than to geese; most geese were harvested as a result of a specific inland trip during a brief period of time, whereas eiders were available in and around Barrow during whaling, after whaling, throughout break-up and throughout most of the summer. Hunting eiders at *Pigniq* (the shooting station) was considered a family activity and an opportunity for boys to learn shooting skills. The shooting station also provided a hunting site for Barrow residents who worked during the day, and for older hunters who had difficulty with backcountry travel but could drive to *Pigniq*.

Eider harvests occurred in May and June as they migrated to their nesting grounds and in late July, August and September as these birds flocked up for their autumn migration. Peak eider harvests usually occurred in May (associated with whaling), when 26 percent of the harvest typically was taken, and again in August when 37 percent of the harvest occurred (Table 21). The "non-specified" eider category confounds the species-specific eider estimates somewhat, but from all indications most non-specified birds were either king or common eiders. (Spectacled and Steller's eiders are much less common.) As Table 21 indicates, king eider harvests were heaviest in May, tapering off during the summer and ending in September. Common eider harvests peaked in July.

Most eiders were taken in the immediate vicinity of Barrow although some harvest sites were located along the coast as far west as Peard Bay and as far east as Cape Simpson (Map 17). In the spring, eiders migrated from west to east following open water or flat ice that extended offshore. As the eiders followed the open leads they provided a source of fresh food for Barrow whalers camped on the ice. People also hunted eiders after whaling, stationing themselves at intervals along the coast or at *Pigniq*. Hunters continued to

get eiders well into the summer boating season although hunting ducks at this time was secondary to marine mammal hunting (walrus and bearded seals). The fall migration moved from east to west. People indicated they preferred the tender meat and flavor of young fall ducks (field interviews).

Eiders: Comparison of Years One, Two and Three

Between Years One and Two of the study, eider harvests decreased slightly, from 7,752 pounds to 6,746 pounds. However, between Years Two and Three, Barrow eider harvests nearly doubled to 12,879 pounds (Tables A-12, B-12 and C-12). Similarly, participation in the eider harvest increased from approximately 20 percent of Barrow households in Years One and Two to 37 percent in Year Three. Field observations indicate that the difference in harvest levels and participation were due to two factors. First, poor ice conditions hampered whaling activity in the spring of Year Three, giving whaling crew members more time to hunt eiders while out on the ice. This observation is generally supported by monthly harvest data on eiders gathered over the three years. Year One eider harvests were very modest in April, May and June, only reaching peak levels in July and August when over 5,000 birds were killed (Table A-13). In Year Two, however, May and August harvests were almost identical. By contrast the overall eider harvest of Year Three was higher, reaching a much higher peak in May than either of the two previous years and continuing at high levels through July, August and September (Figure 37). When these data are related to monthly harvest data on bowhead whales some correlations become apparent. In particular, when conditions for spring whaling were good, whalers did not hunt eiders for fear of scaring whales. When ice conditions were bad, however, whalers did hunt eiders.

In Year One conditions for whaling were good with Barrow whalers harvesting four whales in May and one in mid-June. Eider harvests for this period were low, as noted above. In Year Two whaling conditions were good during the first part of May and Barrow whalers filled their spring quota by May 6. A few crews remained on the ice, however, and Barrow eventually received an additional strike from Kivalina in mid-May. In the interim, whaling crews occupied their time hunting eiders, killing over 1,600 birds (Table B-14). In Year Three, ice conditions were unfavorable throughout most of May with a lead opening only

between the 12th and 16th and again around the 29th. With no leads open, whalers hunted eiders and killed over 2,500 birds (see Table C-14).

A second factor which contributed to the increase in Year Three eider harvests was good summer weather. At the end of July, eiders began their southwesterly migration. Flocks ranging in size from 50 to 200 birds began to fly over Point Barrow in fairly regular intervals and were easily harvested by Barrow hunters. When the wind was blowing from the east, the birds flew in even larger numbers and at least 30 to 40 families could be seen hunting eiders at *Pigniq*. In addition, the warm summer weather encouraged family duck hunting trips to *Pigniq* for a few hours in the evenings after work or on the weekend.

As can be seen from Maps A-12, B-13 and C-13 the overwhelming majority of eiders in all three years were hunted in the immediate vicinity of Barrow, both from the ice in the spring and along the coast. However, harvest sites did vary from year to year. In Year Two, eider harvests occurred along the Beaufort Sea coast east of Barrow nearly to Cape Simpson, in contrast to Year One and Three harvests which extended only a few miles east in Elson Lagoon. On the Chukchi side, Year Two harvests were much more confined to the shore area, compared to more extensive harvests offshore in Years One and Three. As has been discussed previously, this difference was a result of the spring lead system being nearer to shore in Year Two followed by grounded ice along that shore throughout most of the summer, causing people to hunt more on the Beaufort side.

Ptarmigan

Barrow residents harvested an average of 1,378 ptarmigan each year, yielding 965 pounds of usable meat (Table 20). This harvest was the third highest among the bird categories, yet constituted just four percent of the total bird harvest (Figure 32). Averaged across community households, ptarmigan provided about one pound per household. About 20 percent of Barrow households reported getting ptarmigan during this study. Generally, ptarmigan were harvested while people were camping and were incidental to another major hunting activity, or during short day trips around the Barrow area. Typically, the children in camp

did the bulk of the ptarmigan hunting. The majority of the ptarmigan harvest occurred in May in conjunction with the white-fronted goose harvest (Table 21). Additional harvests occurred throughout the summer, fall and spring, in the Barrow vicinity as well as in conjunction with inland caribou and furbearer hunting trips (Map 17).

Ptarmigan harvests declined over the course of the study period. Barrow hunters obtained 2,454 birds in Year One compared to 1,350 in Year Two and 329 in Year Three. Figure 38 graphs the pounds per month for ptarmigan harvests over all three years. As is shown on the graph, ptarmigan harvests peaked during May in all three years, but by decreasing amounts each year. In Year One, August and September harvests represented slight peaks, coinciding with harvests at upriver fish camps and while hunting caribou. The decline in the ptarmigan harvest was likely due to a reporting problem; an incidental species such as ptarmigan, often hunted by children, was more easily overlooked during a harvest discussion than the reporting of other species.

Other Birds

As with ptarmigan, the harvest of other birds, including red throated loons, sandhill cranes, tundra swans, and ducks, was usually incidental to the pursuit of other species rather than being sought out specifically. For instance, the cranes and swan were harvested during spring geese hunting and the loons, oldsquaws and surf scoter were harvested while summer duck hunting at *Pigniq*. On average, the other birds category yielded only 58 pounds of usable meat or less than one pound per household. Only one percent of Barrow households reported harvesting other birds. The reported harvest of other birds varied from 122 usable pounds in Year One to zero in Year Two and 52 pounds in Year Three. As Figure 39 indicates, the monthly harvest of other birds varied widely. In Year One July was the primary harvest month while in Year Three the largest harvest occurred in May with smaller harvests taking place in July and September. Because the harvests were so small and incidental, no consistent pattern is evident in terms of harvest timing, other than coinciding with the seasons when these migratory species were in the Barrow area.

OTHER RESOURCES

Other resources that residents reported harvesting included berries, other plants (greens), clams, eggs and water in its various forms (e.g., water, ice and snow). These resources were least likely to be recalled of all harvests because the majority of Barrow subsistence activity revolved around the hunting or fishing of various animal species, rather than the gathering of plants, clams, eggs and water. Consequently, respondents and the field coordinator focused mainly on the animal harvests. Hence, it is likely that the harvest amounts for these other resources were underreported during this study.

Weights reported for other resources include the weights of berries and plants in all three years, plus clams in Year Three. Water was measured in gallons and therefore is not included in the weight estimates of other resources. The large increase shown in other resources from Years One and Two (216 and 169 pounds respectively) to Year Three (1,312 pounds) was due to two environmental phenomena (field interviews). First, berries were more abundant in Year Three than they had been in the previous two years. Consequently harvests were much higher. People of all ages spent many hours on the tundra with bags and buckets picking blueberries, cranberries and salmonberries near their inland cabins. Second, the harvest of clams was reported in Year Three and not in the prior two years. A fall storm in Year Three, occurring before the ocean had frozen, washed thousands of clams onto the beach, and Barrow residents collected them while walking the beach. This kind of harvest occurs opportunistically and is not part of the annual seasonal round.

The harvest of vegetation such as wild chives, wild rhubarb and wild spinach were reported occasionally during the study. However, the harvest of such greens generally was very minor and infrequent.

Fresh water was collected by many Barrow households. Based on field observation, most fresh water was collected in the form of lake ice for drinking water. When lake ice was not available, snow was collected, or in the summer, fresh water. Occasionally people would encounter aged sea ice from which the salt had leached out, and they would collect this ice for fresh water.

IV. HARVEST LEVEL ANALYSIS

Thus far, this report has presented the Barrow Year One, Year Two and Year Three harvest data (averaged) in terms of community totals (by month and for the entire year) and household and per capita means. Preceding data tables have also shown the percentage of Barrow households participating in the harvest of each species. This section of the report expands upon that statistic as well as the household means in order to look more closely at the distribution of harvest activity across households and to look at selected characteristics of households grouped according to their level of annual harvest.

In an effort to divide Barrow households into meaningful harvest levels, the study team examined a distribution of the amount of pounds harvested by each household (weighted) to see if natural groupings emerged, and also to see if imposing a uniform structure on the distribution of household harvests would be useful (e.g., dividing the distribution into thirds or quarters). Neither of these approaches was adopted because, in the first approach, natural groups were not evident, and in the second approach, the thirds and quartiles produced categories too broad to be meaningful. The study team then examined an unweighted distribution of average annual household harvests and divided the sample into four comparably sized groups along reasonable breaking points between groups. The unweighted sample was used to define the categories because the reliability of any sample is a function of the unweighted sample size. Four harvest levels emerged from this exercise: households that harvested an average of zero pounds per year during the study; households harvesting one to 999 pounds; households harvesting 1,000 to 2,499 pounds; and households harvesting 2,500 pounds or more per year. When weighted, the groups became more divergent in size. Harvester Level 1 (zero pounds) contains 32 percent of Barrow households, Harvester Level 2 (one to 999 pounds) is the largest, containing 51 percent, while Harvester Levels 3 (1,000 to 2,499 pounds) and 4 (2,500 pounds or more) contain 11 and six percent of Barrow households respectively. The actual range in total pounds harvested by any one household was from zero pounds to one household that harvested 8,884 pounds. The total pounds per household upon which these breakdowns were based included only usable products and thus excluded furbearers and water.

The harvest data by harvester level are presented in two tables. Table 23 shows what percentage of the total community harvest of a species was obtained by each harvester level. Table 24 presents the average amount of each species harvested per household within each harvester level. The far right column of Table 24 shows mean harvests per household for the entire community. For most entries, this statistic corresponds to the column entitled "Average Pounds Harvested Per Household" in Tables 8, 11, 14, 17 and 20. These figures do not match for bowhead whale, and consequently for the total marine mammals and total mean household harvest. The calculations for bowhead in Tables 23 and 24 are different than those used in other tables in this report because the former reflect the number of crew member or village shares households reported receiving, multiplied by the estimated weight of such shares. In contrast, other tables in this report derive household means for bowhead from the total estimated usable weight from each whale, including all the blubber and shares set aside for community feasts, not just shares received and reported to this project by study households.

Table 23 shows that, in terms of all species combined, Level 4 harvested an average of 44 percent of the total annual community harvest. In other words, six percent of the households harvested close to half the total pounds harvested. Level 3 (11 percent of Barrow households) harvested about one-third (32 percent) of the total amount harvested. Combining Levels 3 and 4 reveals that 17 percent of the households harvested 76 percent of the total community harvest. Level 2 (51 percent of households) harvested 24 percent and Level 1 (32 percent, or one-third of Barrow households) harvested nothing at all.

In addition to allowing comparisons of harvest level means to the overall mean, Table 24 is also useful for scanning intra-level relationships. By looking down the Harvester Level 2 column, one observes that terrestrial mammals (specifically, caribou and moose) represent the largest share of their entire yearly harvest, followed by marine mammals (bowhead whale), fish (whitefish), and birds (eiders).

An examination of the columns for each of the harvester levels reveals an increasing variety of species harvested the higher the harvester level. Table 25 summarizes the number of species harvested by harvester level.

TABLE 23: PERCENTAGE OF ESTIMATED TOTAL POUNDS HARVESTED BY SPECIES AND BY HARVESTER LEVEL, BARROW YEARS ONE, TWO & THREE AVERAGED (1,2)

SPECIES HARVESTED	HARVESTER LEVEL 1 0 LBS (32% of HHs)	HARVESTER LEVEL 2 1-999 LBS (51% of HHs)	HARVESTER LEVEL 3 1000-2499 LBS (11% of HHs)	HARVESTER LEVEL 4 2500++ LBS (6% of HHs)	TOTAL
All Species	0.0%	23.7%	32.0%	44.4%	100%
Total Marine Mammals	0.0%	23.2%	37.5%	39.3%	100%
Bowhead		41.1%	39.2%	19.7%	100%
Walrus		10.2%	33.2%	56.6%	100%
Bearded Seal		18.7%	41.3%	39.9%	100%
Polar Bear		5.8%	54.4%	39.8%	100%
Total Ringed & Spotted Seal		13.2%	28.8%	58.0%	100%
Ringed Seal		13.3%	28.8%	57.9%	100%
Spotted Seal		0.0%	25.0%	75.0%	100%
Total Terrestrial Mammals (3	0.0%	28.1%	30.8%	41.1%	100%
Caribou		20.1%	33.7%	46.1%	100%
Moose		86.3%	9.5%	4.2%	100%
Dall sheep		100.0%	0.0%	0.0%	100%
Brown Bear		0.0%	0.0%	100.0%	100%
Ground Squirrel		0.0%	5.9%	94.1%	100%
Porcupine		0.0%	100.0%	0.0%	100%
Total Fish	0.0%	11.7%	18.9%	69.4%	100%
Total Whitefish		7.3%	21.5%	71.2%	100%
Whitefish (non-specified)		5.8%	10.2%	84.0%	100%
Round Whitefish		5.8%	27.6%	66.6%	100%
Broad whitefish (river)		7.2%	16.2%	76.5%	100%
Broad whitefish (lake)		0.0%	60.5%	39.5%	100%
Humpback whitefish		24.4%	2.4%	73.2%	100%
Least cisco		5.5%	28.6%	66.0%	100%
Bering, Arctic cisco		0.0%	21.7%	78.3%	100%
Total Other Freshwater Fish		18.0%	12.4%	69.6%	100%
Arctic grayling		15.4%	11.5%	73.1%	100%
Burbot (Ling cod)		18.1%	13.4%	68.5%	100%
Lake trout		41.9%	9.2%	48.9%	100%
Arctic char		45.2%	40.8%	14.0%	100%
Northern pike		0.0%	15.2%	84.8%	100%
Total Salmon		43.6%	8.3%	48.1%	100%
Salmon (non-specified)		83.6%	2.3%	14.1%	100%
Chum (Dog) salmon		11.1%	17.1%	71.8%	100%
Pink (Humpback) salmon		3.1%	8.3%	88.6%	100%
Silver (Coho) salmon		51.3%	4.9%	43.8%	100%
King (Chinook) salmon		0.0%	23.3%	76.7%	100%

(Continued next page)

TABLE 23 (continued): PERCENTAGE OF ESTIMATED TOTAL POUNDS HARVESTED BY SPECIES AND BY HARVESTER LEVEL, BARROW YEARS ONE, TWO & THREE AVERAGED

SPECIES HARVESTED	HARVESTER LEVEL 1 0 LBS (32% of HHs)	HARVESTER LEVEL 2 1-999 LBS (51% of HHs)	HARVESTER LEVEL 3 1000-2499 LBS (11% of HHs)	HARVESTER LEVEL 4 2500++ LBS (6% of HHs)	TOTAL
Total Other Coastal Fish		36.2%	0.6%	63.2%	100%
Rainbow smelt		93.8%	0.0%	6.2%	100%
Tomcod (Saffron Cod)		100.0%	0.0%	0.0%	100%
Sculpin		0.0%	0.0%	100.0%	100%
Capelin		83.6%	0.0%	16.4%	100%
Total Birds	0.0%	28.0%	40.7%	31.2%	100%
Total Geese		20.9%	44.7%	34.4%	100%
White-fronted goose		16.2%	49.6%	34.1%	100%
Brant		53.8%	11.4%	34.9%	100%
Goose (non-specified)		44.9%	18.9%	36.2%	100%
Lesser snow goose		29.2%	0.0%	70.8%	100%
Canada goose		0.0%	0.0%	100.0%	100%
Total Eiders		39.4%	33.9%	26.7%	100%
Eider (non-specified)		39.7%	33.6%	26.7%	100%
Common eider		60.2%	27.6%	12.3%	100%
King eider		5.8%	66.4%	27.8%	100%
Spectacled eider		0.0%	100.0%	0.0%	100%
Stellar's eider		0.0%	50.0%	50.0%	100%
Ptarmigan		25.7%	47.0%	27.3%	100%
Other birds		20.0%	23.2%	56.8%	100%
Oldsquaw		0.0%	0.0%	100.0%	100%
Surf scoter		0.0%	0.0%	100.0%	100%
Red throated loon		100.0%	0.0%	0.0%	100%
Tundra swan		0.0%	0.0%	100.0%	100%
Sandhill crane		0.0%	50.0%	50.0%	100%

(1) The percentages for bowhead in this table are based upon the number of crew member or village shares each household reported receiving, rather than on the entire usable whale weight divided by the number of Barrow households, as was done elsewhere in this report.

(2) Years One through Three = 4/1/87 through 3/31/90.

(3) Furbearers were not included in the calculation of harvester levels or amounts harvested per harvester level. They are not harvested for food and therefore are not measured in pounds, the unit upon which this analysis is based.

Source: Stephen R. Braund & Associates, 1993

TABLE 24: ESTIMATED MEAN USABLE POUNDS HARVESTED PER HOUSEHOLD BY HARVESTER LEVEL, BARROW YEARS ONE, TWO & THREE AVERAGED (1,2)

SPECIES HARVESTED	HARVESTER LEVEL 1 0 LBS (LBS.) (32% of HHs)	HARVESTER LEVEL 2 1-999 LBS (LBS.) (51% of HHs)	HARVESTER LEVEL 3 1000-2499 LBS (LBS.) (11% of HHs)	HARVESTER LEVEL 4 2500++ LBS (LBS.) (6% of HHs)	MEAN LBS. PER HOUSE-HOLD FOR ENTIRE COMMUNITY
All Species	0.0	254.2	1,536.1	3,896.6	543.5
Total Marine Mammals	0.0	94.5	684.3	1,311.9	206.4
Bowhead whale		62.8	268.2	245.7	77.3
Walrus		13.7	198.2	617.3	67.5
Bearded seal		12.1	119.7	211.4	32.8
Polar bear		1.3	52.8	70.6	11.0
Total Ringed & Spotted Seal		4.6	45.4	166.9	17.8
Ringed seal		4.6	45.0	165.2	17.7
Spotted seal		0.0	0.3	1.7	0.1
Total Terrestrial Mammals (3	0.0	125.4	615.6	1,502.2	226.1
Caribou		79.3	593.8	1,483.5	199.1
Moose		43.8	21.6	17.2	25.7
Dall sheep		2.3	0.0	0.0	1.2
Brown bear		0.0	0.0	1.4	0.1
Ground squirrel		0.0	*	0.1	0.0
Porcupine		0.0	0.2	0.0	0.0
Total Fish	0.0	19.6	141.2	949.4	84.7
Total Whitefish		9.4	124.0	750.6	65.2
Whitefish (non-specified)		0.4	3.4	51.0	3.8
Round whitefish		0.1	2.5	10.9	1.0
Broad whitefish (river)		5.8	58.4	502.5	40.6
Broad whitefish (lake)		0.0	41.1	49.1	7.7
Humpback whitefish		2.4	1.1	58.0	4.9
Least cisco		0.7	15.7	66.2	6.2
Bering, Arctic cisco		0.0	2.0	12.9	1.0
Total Other Freshwater Fish		4.4	13.4	137.6	12.2
Arctic grayling		2.6	8.6	100.0	8.5
Burbot (Ling cod)		1.0	3.4	31.9	2.9
Lake trout		0.5	0.5	5.0	0.6
Arctic char		0.2	0.9	0.6	0.2
Northern pike		0.0	*	0.2	0.0
Total Salmon		4.3	3.6	38.5	5.0
Salmon (non-specified)		1.8	0.2	2.5	1.1
Chum (Dog) salmon		0.3	1.8	13.7	1.2
Pink (Humpback) salmon		*	0.2	4.3	0.3
Silver (Coho) salmon		2.2	0.9	15.1	2.1
King (Chinook) salmon		0.0	0.5	2.9	0.2

(Continued next page)

TABLE 24, continued: ESTIMATED MEAN USABLE POUNDS HARVESTED PER HOUSEHOLD BY HARVESTER LEVEL, BARROW YEARS ONE, TWO & THREE AVERAGED

SPECIES HARVESTED	HARVESTER LEVEL 1 0 LBS (LBS.) (32% of HHs)	HARVESTER LEVEL 2 1-999 LBS (LBS.) (51% of HHs)	HARVESTER LEVEL 3 1000-2499 LBS (LBS.) (11% of HHs)	HARVESTER LEVEL 4 2500++ LBS (LBS.) (6% of HHs)	MEAN LBS. PER HOUSE-HOLD FOR ENTIRE COMMUNITY
Total Other Coastal Fish		1.6	0.1	22.7	2.2
Rainbow smelt		0.1	0.0	0.1	0.1
Tomcod (Saffron Cod)		0.1	0.0	0.0	0.1
Sculpin		0.0	0.0	*	0.0
Capelin		0.5	0.0	0.8	0.3
Total Birds	0.0	14.6	95.0	133.0	26.4
Total Geese		6.4	61.5	86.3	15.5
White-fronted goose		4.3	58.9	74.0	13.4
Brant		1.5	1.4	7.9	1.4
Goose (non-specified)		0.6	1.2	4.0	0.7
Lesser snow goose		*	0.0	0.2	0.0
Canada goose		0.0	0.0	0.1	0.0
Total Eiders		7.6	29.2	42.0	9.7
Eider (non-specified)		7.5	28.4	41.4	9.6
Common eider		0.1	0.1	0.1	0.1
King eider		*	0.7	0.5	0.1
Spectacled eider		0.0	*	0.0	0.0
Stellar's eider		0.0	*	*	0.0
Ptarmigan		0.5	4.3	4.5	1.0
Other birds		*	*	0.2	0.0
Oldsquaw		0.0	0.0	*	0.0
Surf scoter		0.0	0.0	*	0.0
Red throated loon		*	0.0	0.0	0.0
Tundra swan		0.0	0.0	0.1	0.0
Sandhill crane		0.0	*	0.1	0.0

* = Less than .1 pounds per household.

(1) The percentages for bowhead in this table are based upon the number of crew member or village shares each household reported receiving, rather than on the entire usable whale weight divided by the number of Barrow households, as was done elsewhere in this report.

(2) Years One through Three = 4/1/87 through 3/31/90.

(3) Furbearers were not included in the calculation of harvester levels or amounts harvested per harvester level. They are not harvested for food and therefore are not measured in pounds, the unit upon which this analysis is based.

Source: Stephen R. Braund & Associates, 1993

TABLE 25: NUMBER OF SPECIES HARVESTED BY HARVESTER LEVEL, BARROW YEARS ONE, TWO & THREE AVERAGED[1,2]

	HARVESTER LEVEL 1 0 LBS.	HARVESTER LEVEL 2 1-999 LBS.	HARVESTER LEVEL 3 1000-2499 LBS.	HARVESTER LEVEL 4 2500+ LBS.
Marine Mammals	0	5	6	6
Terrestrial Mammals	0	3	4	3
Fish	0	15	16	18
Whitefish	0	4	6	6
Other Freshwater Fish	0	4	5	5
Salmon	0	3	4	4
Other Coastal Fish	0	4	1	3
Birds	0	7	9	12
Geese	0	3	2	4
Eiders	0	2	4	3
Ptarmigan	0	1	1	1
Other Birds	0	1	2	4
TOTAL:	0	30	35	39

1. Harvests recorded as "non-specified" whitefish, salmon, geese or eiders were not included in this table.
2. Years One through Three = 4/1/87 through 3/31/90

Source: Stephen R. Braund & Associates, 1993

In Year Three of this project, the study team collected data from households on four descriptive socioeconomic characteristics: household size, ethnicity, income, and the number of person-months worked per year. Tables 26 and 27 present crosstabulations of these four variables with harvester levels and reflect the two different ways one might want to examine the data. Table 26 presents the data in such a way as to describe the characteristics of each harvester level. For example, this table shows the relative distribution of different household sizes across Level 1, in which 40 percent of the Level 1 households are single person households, 19 percent are two to three person households, 34 percent are four to five person households, and seven percent of the Level 1 households consist of six or more persons. In contrast, Table 27 presents the distribution of harvester levels across household sizes, ethnicity, income levels and months of employment. For example, of all the single person households in Barrow, 85 percent were in Level 1, three percent were in Levels 2 and 3 respectively, and nine percent were in Level 4. Both tables present means for each harvester level and for the entire community.

Continuing with household size, Table 26 indicates that the majority of the households who harvested nothing during the study (i.e., Harvester Level 1) were single person households. Average household size in Harvester Level 1 was 2.9 persons per household. Harvester Level 2 households averaged 4.6 persons per household. Harvester Level 3 households were the largest, containing 4.8 persons on average. This is the only harvester level in which the majority of the households fell in the category of six or more persons per household. Harvester Level 4 averaged 4.3 persons per household. Table 27 shows that 85 percent of Barrow's single person households were non-harvesting households (i.e., Harvester Level 1). The other three household size categories were dominated by Harvester Level 2 households.

Not only were Harvester Level 1 households predominantly single person households, but these non-harvesting households were also predominantly non-Inupiat (77 percent - Table 26). In contrast, 100 percent of the Harvester Level 4 households were Inupiat. (Inupiat households were defined for this study as those in which the head of household or spouse was Inupiat.) Looking across all harvester levels, one can see that the proportion of Inupiat households in each harvester level increases with the harvester level.

TABLE 26: DESCRIPTIVE CHARACTERISTICS OF HARVESTER LEVELS, BARROW YEARS ONE, TWO & THREE AVERAGED (1)

Household Size	Harvester Level 1 0 lbs. (32% of HHs)	Harvester Level 2 1-999 lbs. (51% of HHs)	Harvester Level 3 1,000-2,499 lbs (11% of HHs)	Harvester Level 4 2,500 lbs. & up (6% of HHs)	Entire Community (100% of HHs)
1	40 %	1 %	4 %	21 %	15 %
2,3	19 %	25 %	16 %	15 %	21 %
4,5	34 %	40 %	39 %	35 %	38 %
6+	7 %	34 %	41 %	29 %	26 %
	100 %	100 %	100 %	100 %	100 %
Mean household size:	2.9	4.6	4.8	4.3	4.1
Ethnicity					
Inupiat	23 %	71 %	83 %	100 %	59 %
Non-Inupiat	77 %	29 %	17 %	0 %	41 %
	100 %	100 %	100 %	100 %	100 %
Total Months Worked By Household Members					
0	3 %	2 %	0 %	23 %	3 %
1-12	42 %	24 %	35 %	18 %	31 %
13-24	55 %	49 %	22 %	41 %	47 %
25+	0 %	25 %	43 %	18 %	19 %
	100 %	100 %	100 %	100 %	100 %
Mean Person-Mos. Worked per Household:	15.9	20.6	21.1	13.8	18.8
Mean Household Income					
Under $4,999	1 %	2 %	0 %	21 %	3 %
$5,000-19,999	12 %	6 %	3 %	6 %	8 %
$20,000-$39,999	9 %	28 %	9 %	36 %	20 %
$40,000 plus	78 %	64 %	88 %	37 %	69 %
	100 %	100 %	100 %	100 %	100 %
Approximate Mean Income (scale: 1 to 10)*	8.5	8.0	8.6	6.5	8.1

*Incomes were reported as a code representing the ranges below; the mean incomes above represent an average of the responses (codes) reported. Based on ranges, the codes cannot be accurately converted to dollars.

* INCOME SCALE: 1 Under $4,999 4 $15,000-19,999 7 $30,000-39,999 10 $60,000 or more
2 $5,000-9,999 5 $20,000-24,999 8 $40,000-49,999
3 $10,000-14,999 6 $25,000-29,999 9 $50,000-59,999

(1) Years One through Three = 4/1/87 through 3/31/90.
Source: Stephen R. Braund & Associates, 1993

TABLE 27: SOCIOECONOMIC CHARACTERISTICS BROKEN DOWN BY HARVESTER LEVEL, BARROW YEARS ONE, TWO & THREE AVERAGED (1)

Household Size	Harvester Level 1 0 lbs. (32% of HHs)	Harvester Level 2 1-999 lbs. (51% of HHs)	Harvester Level 3 1,000-2,499 lbs (11% of HHs)	Harvester Level 4 2,500 lbs. & up (6% of HHs)	Entire Community (100% of HHs)
1	85 %	3 %	3 %	9 %	100 %
2,3	28 %	60 %	8 %	4 %	100 %
4,5	29 %	53 %	12 %	6 %	100 %
6+	9 %	66 %	18 %	7 %	100 %
Mean household size:	2.9	4.6	4.8	4.3	4.1
Ethnicity					
Inupiat	13 %	61 %	16 %	10 %	100 %
Non-Inupiat	60 %	35 %	5 %	0 %	100 %
Total Months Worked By Household Members					
0	25 %	30 %	0 %	45 %	100 %
1-12	41 %	41 %	14 %	4 %	100 %
13-24	35 %	54 %	6 %	5 %	100 %
25+	0 %	67 %	27 %	6 %	100 %
Mean Person-Mos. Worked per Household:	15.9	20.6	21.1	13.8	18.8
Mean Household Income					
Under $4,999	14 %	35 %	0 %	51 %	100 %
$5,000-19,999	47 %	43 %	5 %	5 %	100 %
$20,000-$39,999	14 %	70 %	5 %	11 %	100 %
$40,000 plus	36 %	46 %	15 %	3 %	100 %
Approximate Mean Income (scale: 1 to 10)*	8.5	8.0	8.6	6.5	8.1

*Incomes were reported as a code representing the ranges below; the mean incomes above represent an average of the responses (codes) reported. Based on ranges, the codes cannot be accurately converted to dollars.

*INCOME SCALE: 1 Under $4,999 4 $15,000-19,999 7 $30,000-39,999 10 $60,000 or more
2 $5,000-9,999 5 $20,000-24,999 8 $40,000-49,999
3 $10,000-14,999 6 $25,000-29,999 9 $50,000-59,999

(1) Years One through Three = 4/1/87 through 3/31/90.
Source: Stephen R. Braund & Associates, 1993

The information on person-months of employment was collected by asking households how many people in their household were employed each month over the three study years. (For example, a household with two people working full-time year-round would show 24 person-months of employment per year.) The totals for each year were averaged and crosstabulated with harvester levels. As shown in Table 26, 55 percent of the non-harvesting households had members who worked a combined total of 13 to 24 person-months per year. Level 1 households averaged 16 person-months of employment per year, and none of the Level 1 households (non-harvesters) worked 25 person-months or more. (The average household size for each harvester level should be taken into consideration in reviewing the months of employment; smaller households naturally had lower employment months.) Harvester Level 4 showed the lowest level of employment, with 23 percent of its households not in the labor force and an average of approximately 14 person-months of employment per year.

Income was reported as a range rather than as a specific amount. Table 26 indicates that in every harvest level (as in the community overall), the largest proportion of households fell in the $40,000 and over range. Table 27 shows that 51 percent of the lowest income households (earning less than $4,999 per year) were the highest harvesters, Level 4. Level 3 households showed the highest income, which is not surprising since this group also contained the largest households and the highest employment levels.

In summary, an examination of harvest amounts by harvester level indicates that six percent of the households harvested 44 percent of the total pounds harvested per year, while thirty-two percent of all households harvested nothing. The variety of species harvested increased with the harvester level. Non-harvesting households (Level 1) tended to be the smallest with an average of 2.9 persons per household. These households also were largely non-Inupiat (77 percent were non-Inupiat). Level 2 households averaged 4.6 persons and were predominantly (71 percent) Inupiat. Level 3 households were also mostly Inupiat (83 percent), and were the largest households, had the most employment, and had the highest income of all the harvester levels, on average. Level 4 households, those harvesting the most resources, were 100 percent Inupiat and showed the lowest employment and income levels of all the groups.

V. COMPARISON OF BARROW AND WAINWRIGHT SUBSISTENCE HARVESTS

As mentioned in the Introduction, the collection of Barrow harvest data was part of a larger project that also included two years of data collection in the smaller community of Wainwright, located approximately 100 miles to the southwest of Barrow. Subsistence harvest data were collected in Barrow for the three year period from April 1, 1987 through March 31, 1990 and comparable data were collected in Wainwright for two years, from April 1, 1988 through March 31, 1990. Thus, Years Two and Three of the Barrow effort were concurrent with Years One and Two of the Wainwright data collection effort. Conducting the same research in two different communities during the same time period provides a unique opportunity to compare the findings for each community. This comparison, not originally part of the study design, presents data in tables and briefly addresses salient points. A thorough presentation of the Wainwright study results is found in the MMS Technical Report No. 147 entitled North Slope Subsistence Study - Wainwright, 1988 and 1989 (SRB&A and ISER 1993).

Barrow and Wainwright are different in many ways. While Barrow is a community of over 3,000 people, the regional hub for most of the North Slope, Wainwright is a smaller community of around 500 residents. Barrow's population is about half Inupiat while Wainwright's population is almost entirely Inupiat. During this study, employment and income levels in Barrow were much higher than in Wainwright. Table 28 presents some background data on Barrow and Wainwright for comparison. The NSB conducted community censuses in Barrow and Wainwright in 1988. Most of the community characteristics reported in the 1988 census differ from those used or found by this study. For example, the Barrow sample was based on the 1985 NSB census which reported a population of 3,016 residents in 937 households. These figures were the basis for weighting the findings, even though the more recent census (1988) was performed during this study. Thus, demographic characteristics differ in part because of the difference in timing between the two censuses. In Wainwright, the NSB 1988 census counted everyone, including temporary construction workers, whereas this study counted only households present for the entire two years (thus excluding temporary construction workers and also seasonally resident schoolteachers). Data from the NSB 1988 census as well as from this study are both presented in Table 28.

TABLE 28: SOCIOECONOMIC CHARACTERISTICS OF BARROW AND WAINWRIGHT[1]

	Barrow	Wainwright
Basis for SRB&A harvest study estimates		
Study population	3,016[2]	411[3]
Ethnicity (Percent Inupiat)	59%[2]	98%
Number of households	937[2]	101
Average household size	4.0	4.1
Average person-months employment per household per year	18.8	12.1
Average household income (on a scale from 1 to 10[4])	8.1	5.2
NSB Census Data (1988)[5]		
Population	3,379	514[6]
Ethnicity (Percent Inupiat)	61%	90%
Number of households	1,031	131
Average household size	3.3	3.9
Average months employed per individual	8.2[7]	5.4[7]
Average months unemployed per individual	---	6.5[7]

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1. Barrow study period: 4/1/87 through 3/31/90;
   Wainwright study period: 4/1/88 through 3/31/90.

2. The NSB 1985 Barrow Census, Housing and Employment Survey was the source of these population and household figures for Barrow (NSB Dept. of Planning & Community Services 1985). These data were the basis for the original sampling design.

3. This Wainwright population reflects only those residents who were present in Wainwright for the full two study years. Thus, this figure does not include seasonally resident schoolteachers, temporary construction workers, or anyone else who was present only part of the two study years.

4. Income scale:

1	Under $4,999	6	$25,000 - $29,999
2	$5,000 - $9,000	7	$30,000 - $39,999
3	$10,000 - $14,999	8	$40,000 - $49,999
4	$15,000 - $19,999	9	$50,000 - $59,999
5	$20,000 - $24,999	10	$60,000 and above

5. Source: NSB Department of Planning and Community Services, 1989, unless otherwise noted.

6. This figure included anyone living in Wainwright at the time the census was conducted (e.g., temporary construction workers, schoolteachers, etc.)

7. Source: NSB Department of Planning and Community Services, personal communication, 1989.

Stephen R. Braund & Associates, 1993

Comparative harvest data are presented in subsequent tables. Table 29 shows mean household harvest levels for Barrow and Wainwright by species or species group, averaged for the study period. (The Barrow household means are subdivided into household means for Inupiat households and for all Barrow households.) The relative proportion that each species or species group represented in the overall subsistence harvest, averaged over the study period, is also presented in this table for each community. Finally, the percentage of households successfully participating in harvests of each species is presented for each community, with Barrow's participation rate shown both for the Inupiat households and for the entire Barrow community. In terms of total subsistence harvests, Wainwright households harvested an average of 2,624 usable pounds in contrast to Barrow Inupiat household harvests of 1,171 pounds and all Barrow households' harvests of 750 pounds. (These amounts work out to 638 pounds per capita for Wainwright, and 245 pounds per capita for Barrow Inupiat and 233 pounds per capita for all of Barrow.) In other words, the average Wainwright household harvested over twice the amount as Barrow Inupiat households, and 3.5 times as much as all Barrow households. Despite the large difference between Barrow and Wainwright in terms of total pounds harvested per household, the overall participation rate among Wainwright study households (98 percent Inupiat) and Barrow Inupiat households was nearly identical, 88 and 87 percent respectively. Participation among all Barrow households was 68 percent.

Comparison of the major resource categories in terms of the percentage of total harvest that each category contributed indicates that the order of importance was the same in each community; i.e., in both Barrow and Wainwright, marine mammals contributed the most to the total harvest, followed by terrestrial mammals, fish and birds. The relative proportions varied, however. Whereas marine mammals represented over half (55 percent) the total harvest in Barrow, this category represented over two-thirds (70 percent) of the total Wainwright harvest. Terrestrial mammals represented 30 percent in Barrow compared to 24 percent in Wainwright, fish represented 11 and 4.5 percent in Barrow and Wainwright respectively. Finally, birds were 3.5 percent of the total harvest in Barrow compared to two percent in Wainwright. In short, Wainwright's subsistence harvest was dominated by marine mammals; marine and terrestrial mammals combined constituted 94 percent of the total harvest. Marine mammals also dominated Barrow's subsistence harvest, but the harvest was more evenly

TABLE 29: AVERAGE ANNUAL HOUSEHOLD MEANS, PERCENTAGES AND PARTICIPATION BASED ON USABLE POUNDS HARVESTED, BARROW AND WAINWRIGHT (1)

	BARROW (WEIGHTED)					WAINWRIGHT		
	INUPIAT HH MEANS	ALL BRW HH MEANS	% OF TOTAL	% PARTICIPATION: INUPIAT	ALL BRW	HH MEANS	% OF TOTAL	% PARTICIPATION
All species	1,171	750	100.0%	87%	68%	2,624	100.0%	88%
Marine mammals	670	412	55.8%	76%	48%	1,795	69.6%	82%
Bowhead	476	283	38.3%	75%	46%	866	34.6%	75%
Walrus	104	68	9.1%	29%	27%	712	26.9%	29%
Bearded seal	48	33	4.4%	46%	29%	128	5.0%	35%
Ring.& spot. seal	29	18	2.4%	27%	19%	30	1.1%	26%
Polar bear	13	11	1.5%	7%	6%	45	1.5%	7%
Land mammals	320	226	30.1%	77%	54%	648	23.7%	62%
Caribou	304	199	26.6%	77%	54%	639	23.4%	62%
Moose	16	26	3.4%	7%	7%	8	0.2%	2%
Dall sheep	1	1	*	3%	3%	0	0.0%	0%
Fish	142	85	11.3%	60%	41%	121	4.5%	66%
Whitefish	110	65	8.7%	54%	34%	59	2.0%	23%
Other fresh-water fish	20	12	1.6%	33%	23%	24	0.8%	27%
Salmon	8	5	0.7%	16%	12%	5	0.2%	5%
Other coastal fish	4	2.2	0.3%	23%	14%	33	1.5%	54%
Birds	39	26	3.5%	65%	53%	61	2.2%	56%
Geese	24	16	2.1%	40%	29%	49	1.7%	45%
Eiders	13	10	1.3%	52%	43%	11	0.4%	40%
Ptarmigan	1	1	0.1%	26%	20%	0.9	*	15%
Other birds	*	*	*	1%	*	0.3	*	4%

(1) Barrow study period: 4/1/87 through 3/31/90
Wainwright study period: 4/1/88 through 3/31/90

* less than .1 or .1%

Source: Stephen R. Braund & Associates, 1993

distributed across the four major resource categories than occurred in Wainwright. The main reason for this difference was the high harvest of walrus in Wainwright during the study years. When comparing the percentage of total harvest that each of the major species represented (e.g., bowhead whale, walrus, bearded seal, other seals, caribou), the proportion of total harvest was similar (i.e., between Barrow and Wainwright) with the exception of walrus. Walrus provides a very large amount of potentially usable meat, yet residents typically did not eat all of the usable portions. Consequently, these animals appear to constitute a larger proportion of both Barrow and Wainwright residents' diet than was actually the case (particularly in Wainwright where the harvest was much higher). Consequently, the relative importance of caribou or fish, for example, (for which the usable weight more closely matches the amount actually eaten) appears underrepresented by comparison as a year round resource and everyday food.

The percentage of households participating in marine mammal harvests was very similar between Barrow Inupiat households and Wainwright households. Participation rates were identical in the case of bowhead whale, walrus and polar bear, and differed only by one percent between communities in their participation in ringed and spotted seal harvests. The main difference in participation occurred in bearded seal harvests, in which Barrow Inupiat participated at a rate of 46 percent compared to 35 percent in Wainwright. The higher involvement in this activity in Barrow likely was a reflection of the use of bearded seal skin boats in Barrow and resultant need for skins, which were not used for boats in Wainwright.

Barrow Inupiat participation was higher in terrestrial mammals and birds than Wainwright's level of participation. More Wainwright households harvested fish (66 percent), however, than did Barrow Inupiat households (60 percent). The high participation in Wainwright fish harvests was due mainly to the unique activity of rainbow smelt fishing. Wainwright residents fished smelt through the inlet ice in the winter months. Participation was high because smelt fishing was easily undertaken by a variety of age groups within a short distance from town, because the season did not conflict with other harvests, and because people considered smelt a delicacy. Although rainbow smelt fishing in Wainwright garnered an equal level of participation as whitefish harvests in

Barrow, an additional 12 percent of Wainwright households harvested other kinds of fish, whereas in Barrow only another six percent harvested other fish.

Barrow household means were higher than in Wainwright in the harvests of only two species groups: whitefish and ptarmigan. In the case of salmon, Barrow and Wainwright household means were identical. In all other species or species groups, Wainwright household means were higher than in Barrow.

Table 30 contains the number of animals harvested each study year by species for each community, as well as average annual harvest levels for each community. The level of detail in this table does not lend itself to discussion but serves as a source of data on absolute numbers harvested by species, by year and by community.

As in Barrow, the study team analyzed harvester levels in Wainwright. Tables showing harvester levels crosstabulated by socioeconomic characteristics follow. Table 31 describes Barrow harvester levels (and restates data presented in Table 26 in the previous section of this report) while Table 32 is taken from the Wainwright report (SRB&A and ISER 1993). Although the harvester levels were defined differently for each community, certain generalizations can be drawn from these tables. While 25 percent of Wainwright households harvested 2,500 pounds or more per year, only six percent of Barrow households harvested as much. Another 25 percent of Wainwright households harvested 1,060 to 2,499 pounds compared to 11 percent of Barrow households that harvested 1,000 to 2,499 pounds. In Wainwright, 50 percent of the households harvested 1,059 pounds or less whereas in Barrow 83 percent of the households harvested under 1,000 pounds per year. Thirty-two percent of Barrow households did not harvest anything during the study period compared to only five percent of Wainwright households who were non-harvesters. (The latter statistic for Wainwright is not shown on Table 32.)

Of the households harvesting 2,500 pounds or more (Harvester Level 4 in both communities), household size was slightly larger in Wainwright (4.7 persons per household compared to 4.3 in Barrow) and employment months were slightly higher than in Barrow (14.1 person months of employment compared to 13.8). However, income in this harvester level was lower in Wainwright than Barrow (5.6

TABLE 30: NUMBER OF ANIMALS HARVESTED, BARROW (1987-90) & WAINWRIGHT (1988-90)

	BARROW (weighted)				WAINWRIGHT		
	Year 1	Year 2	Year 3	3-yr.avg	Year 1	Year 2	2-yr.avg
Bowhead whale	7	11	10	9	4	2	3
Walrus	84	61	101	81	58	153	106
Bearded seal	236	179	109	174	97	74	85
Ringed seal	466	388	328	394	63	86	75
Spotted seal	2	4	4	3	5	12	9
Polar bear	12	11	39	21	7	12	10
Beluga whale	0	0	0	0	2	0	1
Caribou	1,595	1,533	1,656	1,595	505	711	608
Moose	52	53	40	48	3	0	2
Dall sheep	12	12	9	11	0	0	0
Brown bear	1	1	0	1	1	2	2
Porcupine	5	0	0	2	0	0	0
Ground Squirrel	24	0	17	14	3	7	5
Wolverine	4	2	1	2	20	7	14
Arctic fox	192	146	48	129	61	8	35
Red fox	8	4	2	5	26	22	24
Wolf	0	0	0	0	10	2	6
Ermine	0	0	0	0	2	9	6
Whitefish	27,366	20,628	38,053	28,683	5,037	7,102	6,070
Non-specified	5,108	173	0	1,760	4	0	2
Round	2,122	721	16	953	400	0	200
Broad-riv.&lake	10,579	11,431	30,047	17,352	0	0	0
Humpback	1,225	647	3,648	1,840	0	0	0
Least cisco	7,024	7,505	2,929	5,819	4,622	6,676	5,649
Arctic cisco	1,309	151	1,413	958	11	426	219
Grayling	12,664	8,684	8,392	9,914	2,894	3,006	2,950
Arctic char	38	76	135	83	0	0	0
Burbot	1,086	392	550	676	6	51	29
Lake trout	153	72	216	147	1	0	1
Northern pike	2	0	10	4	0	0	0
Salmon	196	80	2,089	788	11	180	96
Non-specified	66	3	439	169	2	0	1
Chum	11	5	529	182	3	68	36
Pink	12	1	261	92	6	52	29
Silver	103	70	828	334	0	51	26
King	4	1	31	12	0	9	5
Capelin	3,960	0	346	1,435	0	0	0
Rainbow smelt	97	0	1,480	526	20,194	54,083	37,139
Arctic cod	0	7,945	17,018	8,321	0	0	0
Arctic flounder	0	0	0	0	0	4	2
Tomcod	0	194	0	65	230	134	182
Sculpin	0	11	0	4	4	7	6
Geese	2,873	3,334	3,943	3,384	1,337	1,439	1,388
Non-specified	329	69	34	144	129	0	65
Brant	127	221	973	440	567	700	634
White-fronted	2,417	3,035	2,932	2,795	607	730	669
Snow	0	8	4	4	29	7	18
Canada	0	1	1	1	5	2	4
Eiders	5,173	4,499	8,590	6,087	560	1,097	828
Ptarmigan	2,454	1,350	329	1,378	135	196	166
Other birds	79	0	9	30	31	3	17

Source: Stephen R. Braund & Associates, 1993

TABLE 31: HOUSEHOLD CHARACTERISTICS BY HARVESTER LEVEL, BARROW YEARS ONE, TWO & THREE AVERAGED (1)

Household Size	Harvester Level 1 0 lbs. (32% of HHs)	Harvester Level 2 1-999 lbs. (51% of HHs)	Harvester Level 3 1,000-2,499 lbs (11% of HHs)	Harvester Level 4 2,500 lbs. & up (6% of HHs)	Entire Community (100% of HHs)
1	40 %	1 %	4 %	21 %	15 %
2,3	19 %	25 %	16 %	15 %	21 %
4,5	34 %	40 %	39 %	35 %	38 %
6+	7 %	34 %	41 %	29 %	26 %
	100 %	100 %	100 %	100 %	100 %
Mean household size:	2.9	4.6	4.8	4.3	4.1
Total Months Worked By Household Members					
0	3 %	2 %	0 %	23 %	3 %
1-12	42 %	24 %	35 %	18 %	31 %
13-24	55 %	49 %	22 %	41 %	47 %
25+	0 %	25 %	43 %	18 %	19 %
	100 %	100 %	100 %	100 %	100 %
Mean Person-Mos. Worked per Household:	15.9	20.6	21.1	13.8	18.8
Mean Household Income					
Under $4,999	1 %	2 %	0 %	21 %	3 %
$5,000-19,999	12 %	6 %	3 %	6 %	8 %
$20,000-$39,999	9 %	28 %	9 %	36 %	20 %
$40,000 plus	78 %	64 %	88 %	37 %	69 %
	100 %	100 %	100 %	100 %	100 %
Approximate Mean Income (scale: 1 to 10)*	8.5	8.0	8.6	6.5	8.1

*Incomes were reported as a code representing the ranges below; the mean incomes above represent an average of the responses (codes) reported. Based on ranges, the codes cannot be accurately converted to dollars.

*INCOME SCALE: 1 Under $4,999 4 $15,000-19,999 7 $30,000-39,999 10 $60,000 or more
2 $5,000-9,999 5 $20,000-24,999 8 $40,000-49,999
3 $10,000-14,999 6 $25,000-29,999 9 $50,000-59,999

(1) Years One through Three = 4/1/87 through 3/31/90.

Source: Stephen R. Braund & Associates, 1993

TABLE 32: CHARACTERISTICS OF HARVESTER LEVELS,
WAINWRIGHT YEARS ONE & TWO AVERAGED (1,2)

Household Size	Harvester Level 1 0-424 lbs. (25% of HHs)	Harvester Level 2 425-1,059 lbs. (25% of HHs)	Harvester Level 3 1,060-2,499 lbs (25% of HHs)	Harvester Level 4 2,500 lbs. & up (25% of HHs)	Entire Community (100% of HHs)
1	8 %	16 %	12 %	4 %	10 %
2,3	44 %	32 %	16 %	20 %	28 %
4,5	44 %	28 %	36 %	52 %	40 %
6+	4 %	24 %	36 %	24 %	22 %
	100 %	100 %	100 %	100 %	100 %
Mean household size:	3.2	3.8	4.7	4.7	4.1
Total Months Worked By Household Members					
0	28 %	13 %	9 %	4 %	14 %
1-12	40 %	71 %	48 %	52 %	53 %
13-24	32 %	13 %	39 %	28 %	28 %
25+	0 %	4 %	4 %	16 %	6 %
	100 %	100 %	100 %	100 %	100 %
Mean Person-Mos. Worked per Household:	10.3	10.9	13.3	14.1	12.1
Year Two Household Income					
Under $4,999	31 %	17 %	8 %	8 %	16 %
$5,000-19,999	9 %	29 %	21 %	24 %	21 %
$20,000-$39,999	44 %	42 %	46 %	44 %	44 %
$40,000 plus	17 %	13 %	25 %	24 %	20 %
	101 %	101 %	100 %	100 %	101 %
Approximate Mean Income (scale: 1 to 10)*	4.6	4.7	5.8	6.5	5.2

*Incomes were reported as a code representing the ranges below; the mean incomes above represent an average of the responses (codes) reported. Based on ranges, the codes cannot be accurately converted to dollars.

*INCOME SCALE: 1 Under $4,999 4 $15,000-19,999 7 $30,000-39,999 10 $60,000 or more
2 $5,000-9,999 5 $20,000-24,999 8 $40,000-49,999
3 $10,000-14,999 6 $25,000-29,999 9 $50,000-59,999

(1) Based on 100 core study households.
(2) Years One and Two = 4/1/88 through 3/31/90

Source: Stephen R. Braund & Associates, 1993

compared to 6.5 on a scale from one to 10). In the next highest group of households, Harvester Level 3, household size was nearly identical in the two communities but person-months worked and income were much higher in Barrow than in Wainwright. Harvester Level 3 households in Barrow averaged 21.1 person-months of employment and an income level of 8.6, in contrast to 13.3 person-months and an income level of 5.8 in Wainwright. Finally, among the households harvesting approximately 1,000 pounds or less (Harvester Levels 1 and 2), one can see that Wainwright households had significantly lower income and employment levels than Barrow households.

In summary, Barrow and Wainwright differed not only demographically but also in subsistence harvest levels. Wainwright subsistence harvests averaged 2,624 pounds per household (688 pounds per capita) compared to 750 pounds per household in Barrow (233 pounds per capita). Barrow Inupiat household harvests were closer to Wainwright household harvest levels at 1,171 pounds per household (Table 10), and participation of Barrow Inupiat households in subsistence harvests (87 percent) was nearly identical to Wainwright participation levels (88 percent). In each community, marine mammals provided the largest proportion of the subsistence harvest each year, followed by terrestrial mammals, fish and birds. In Wainwright, 25 percent of the households harvested 2,500 pounds or more per year, whereas in Barrow only six percent of the households conducted subsistence at that level. At the low end of the harvest scale, Barrow contained a higher proportion of non-harvesting households. Thirty-two percent of Barrow households harvested nothing during the study period compared to five percent of Wainwright household that were non-harvesting. Barrow households, on average, showed higher levels of income and employment and lower levels of subsistence harvests than Wainwright households.

VI. STATUS OF MAJOR FAUNAL RESOURCES

by Sam Stoker, PhD.
Beringia

The following section discusses recent population histories for major subsistence species harvested at Barrow and Wainwright, and presents estimates of current population size and trends, areal and temporal distribution, recruitment rates, sustainable yield levels, and impact of subsistence harvests on these populations.

When reviewing this information, it must be kept in mind that the numbers presented are best estimates only. In the case of marine mammals in particular, census work is costly and difficult and the results are always imprecise and subject to interpretation. Similar imprecision applies to recruitment rates and sustainable yield estimates for both marine and terrestrial resources. These figures are based primarily on the productivity (birth rate) of the population, age composition of the population, and natural mortality rates, all of which are poorly understood and documented for most species in question and are often subject to unpredictable environmental factors such as weather and ice conditions.

Reservations also pertain to estimates of subsistence harvest impacts on these populations. As noted above, population and sustainable yield levels for the resources themselves are subject to uncertainty, which makes it difficult to accurately assess effects on such populations resulting from subsistence harvests or other sources of impact. In addition, harvest figures themselves are in most cases incomplete and inadequate. For instance, good harvest data may exist for certain communities for specific years, but the application of such data to regional and usually migratory populations is of limited value without comparable information on a broader areal and temporal scale. For most species in question, such regional harvest information consists of estimates only, often extrapolated from a few locations during specific years. Such estimates are not without value, but at the same time must be viewed and applied with caution. As has been noted in other studies (Stoker 1984)

subsistence harvests tend to be extremely variable from location to location and from year to year in both magnitude and species composition.

Subsistence strategies are by nature flexible and opportunistic, with emphasis shifting from resource to resource depending not only on need but also on local abundance, weather, ice conditions, and timing of migrations. To extrapolate results from any one location or for any given year to the population as a whole is risky at best.

The following pages will discuss, in as much detail as is possible, population status, distribution, sustainable yield and subsistence harvest impact, by species or general taxa, for resources of major importance to Barrow and Wainwright. Current information suggests that such species or resources are (not necessarily in order of importance): bowhead whale, bearded seal, ringed seal, walrus, caribou, fish, and waterfowl.

BOWHEAD WHALE (Balaena mysticetus)

Population estimates for the western bowhead stock have increased rather dramatically over the past 10 years. In 1978 the population estimate, derived from shore counts near Barrow during the spring migration, was 1,783 to 2,864 animals, with 95 percent confidence limits. In subsequent years this estimate was increased conservatively to a 1988 mean of 7,800, with a 95 percent confidence range from about 5,400 to 10,200 (IWC 1988). Though the population itself is thought to be on the road to recovery after severe depletion by commercial interests during the latter 19th and early 20th centuries, the rapid increase indicated by these figures is almost certainly due more to improved census techniques than to population increase per se over that period of time.

Estimates of productivity, natural mortality, net recruitment and maximum sustainable yield rates for the western bowhead population are somewhat uncertain at present. For purposes of simulation models, the IWC currently employs a conservative annual natural mortality rate of five percent and an annual net recruitment range of 1.9 to 2.9 percent. Employing the currently accepted population mean of 7,800, this calculates to an annual population increase of from 148 to 226 animals, well in excess of the 41 landed or 54

struck annual quota approved by the IWC in 1991 for the nine communities currently participating in bowhead whaling.

The western bowhead stock is distinctly migratory, moving annually from winter grounds in the southern and central Bering Sea to summer feeding areas in the eastern Beaufort Sea. The population begins its northward migration about March, depending on weather and ice conditions, normally passes through Bering Strait in late March or early April and from there follows nearshore lead systems up the Chukchi coast, usually arriving in the vicinity of Barrow during May. From Barrow the whales continue their migration to the east, following offshore leads to the vicinity of Banks Island where they spend the summer months. The fall migration usually begins in September or early October with a nearshore movement from the eastern Beaufort to Point Barrow, then largely offshore from Barrow south through the Chukchi and northern Bering seas. Whaling is conducted primarily during the spring migration by residents of Bering Strait and the Chukchi coast, and during the fall by residents of the Beaufort. Barrow, and to some extent communities of the Bering Strait region, are able to take advantage of both spring and fall migrations, though the spring hunt is generally more productive.

Bowheads are baleen filter-feeders, obtaining their food from the water column in the form of zooplankton (krill) such as copopods, mysids, and euphausids.

WALRUS (Odobenus rosmarus divergens)

Like the bowhead whale, the walrus was subjected to major commercial exploitation in the last half of the nineteenth and first half of the twentieth centuries and suffered a consequently severe population decline. The initial, pre-commercial harvest population, estimated to be at least 200,000, was reduced to dangerously low levels by the mid-twentieth century. Over the past few decades, however, the Bering/Chukchi walrus stock has been under joint US-USSR management and protection, and populations have recovered to pre-exploitation levels. The most recent estimates, derived from joint US-USSR aerial surveys, place the population at about 233,000 (Gilbert 1989), down slightly from the 1980 estimate of 246,000.

The bulk of the walrus population, particularly the females, calves and young males, are distinctly migratory in nature. Most winter in the central and northwestern Bering Sea, then move northward into the Chukchi Sea in spring and summer (Fay 1982). Exceptions to this pattern are groups of adult males that summer at specific locations in Bristol Bay, Anadyr Gulf and Bering Strait. These groups move northward to mingle with the southward migrating females in the autumn, before the population settles on their wintering grounds (F.H. Fay and J.J. Burns, personal communication). Depending on weather and ice conditions, the bulk of the migratory population passes through Bering Strait in May and June and arrives in the vicinity of Barrow and Wrangel Island in July. By late September they are moving back southward, passing through Bering Strait again in October and November.

Walrus are limited for feeding purposes to continental shelf areas with water depths of 100 meters or less. Though they prey on a wide variety of benthic invertebrates, including clams, snails, crabs, shrimp, worms, tunicates, and other taxa, the majority of their diet seems to consist of a few genera of bivalve mollusks (Fay 1982, Fay and Stoker 1982). In addition to invertebrates they ingest small demersal fish on occasion, and are known to prey to some extent on seals.

There are indications that the walrus population may have been at or in excess of the carrying capacity of its environment (probably defined by food resources) by about 1980, and may have begun to decline since then. These indications include: greater diversity and smaller size of prey species found in stomachs, increasing average age of the population, reduced birth rate and calf survival, and decreased fat reserves observed from harvested animals (Fay and Stoker 1982, Fay et al. 1989). Recent calculations indicate that the current annual recruitment rate may be as low as one percent (Fay et al. 1989).

Concurrently, subsistence harvests have increased significantly in recent years on both the Alaskan and Soviet sides. Total retrieved Alaskan harvests have increased from about 1,500 to 2,000 per year in the 1960s and early 1970s to harvests exceeding 5,000 per year in the 1980s, while Soviet harvests have increased from about 1,000 to 4,000 per year. Factoring in a killed but lost ratio, current mortality from hunting may be 10,000 to 15,000 per year (Fay et

al. 1989), or four to six percent of the population. If the annual recruitment estimate of one percent is accurate, this current harvest level is probably in excess of sustainable yield, and will likely result in further population decline over the coming years. In addition to increased overall harvest levels, the percentages of adult females in this harvest have increased in recent years, compounding the effect.

Historically, the bulk (plus or minus 80 percent) of the Alaskan harvest takes place in the north Bering Sea and Bering Strait region in spring and summer. An additional seven to eight percent are taken between Point Hope and Barrow during summer, and the remaining 10 to 12 percent in the Bering Strait and north Bering Sea during fall and winter.

BEARDED SEAL (Erignathus barbatus)

Bearded seals are distributed over virtually all of the continental shelf waters of the northern Bering, Chukchi and Beaufort seas, with largest concentrations observed during late winter (January through April) in the northern Bering Sea (Burns 1981, Braham et al. 1984). The general population is somewhat migratory, shifting northward from the Bering and southern Chukchi toward the northern Chukchi and Beaufort in summer and back southward during winter months. The bulk of the northward movement usually begins in April, passes through Bering Strait sometime from early May to mid-June, and by June or July is in the vicinity of Barrow. This is a trend, however, as opposed to a distinct and predictable migration, with some animals remaining in the Bering Sea throughout the summer and others wintering in the Beaufort Sea. As for most marine mammals of the region, the fall movement, occurring from September through December, is even less concentrated and predictable than is the movement northward in the spring.

As a general rule bearded seals stay within the seasonal ice but avoid zones of unbroken shorefast ice or dense pack ice, preferring broken ice and areas with leads and polynas (Burns 1981). Bearded seal is the most widely distributed pinniped occurring in the drifting seasonal ice of the Bering and Chukchi seas (Burns and Frost 1979).

Bearded seals are opportunistic bottom feeders, utilizing a wide variety of prey including crabs, shrimp, mollusks and demersal fish (Lowry et al. 1982). They appear to be limited to continental shelf areas with feeding depths of 150 to 200 meters (Kelly 1988a, Burns et al. 1981), and as might be expected concentrate in relatively shallow waters with high benthic biomass such as occur in the northern Bering and southern and central Chukchi seas.

Population estimates for bearded seals are imprecise, deriving largely from fixed-wing aerial surveys of seals resting on the ice in spring and summer (Kelly 1988a). Available estimates for the Bering/Chukchi population range from 250,000 to 300,000 animals (U.S. Interagency Task Group Report 1976, Burns 1981, Popov 1976, Kelly 1988a).

Information regarding productivity, natural mortality, recruitment rates and sustainable yield levels for bearded seals is limited and incomplete. Gross annual productivity was estimated at about 24 percent for the Bering and Chukchi population during the 1960s and 1970s (Kelly 1988a). Reliable estimates of natural mortality and net recruitment to the population, however, not presently available. Total recommended harvest levels for Alaska range 3,000 retrieved seals per year (U.S. Federal Register 1979) to 9,000 d per year (U.S. Interagency Task Group Report 1976).

Data pertaining to total annual subsistence harvests of bearded seals in Alaska are also incomplete, particularly in recent years, and consist for the most part of general estimates based on harvest returns from a few locations in certain years. The total annual retrieved harvest for Alaska is estimated at 1,784 per year (with a standard deviation of 941) between 1966 and 1977 (Burns 1981, Kelly 1988a). There is some indication, however, that this number may be on the low side. During 1977 a retrieved harvest of 4,750 was recorded for Alaska, probably due to increased monitoring effort that year rather than to unusually high harvest levels (Lloyd Lowry, Alaska Department of Fish and Game, personal communication). An earlier report (Burns 1967) estimates the total kill of bearded seals in Alaska to be about 7,000 to 9,000 per year. If a killed but lost ratio of 50 percent is assumed, this would equate to an annual retrieved harvest of 3,500 to 4,500, more in accord with the 1977 return.

On the Soviet side, retrieved harvests in the Bering and Chukchi seas are estimated to range between 1,986 and 7,009 per year (mean 4,467 with standard deviation 1,974) for the period 1966 through 1970, declining to 1,150 to 2,053 per year (mean 1,448 with standard deviation 249) for 1971 through 1983 (Kelly 1988a).

Total US/USSR harvests, applying the conservative estimates of 1,784 and 1,448, calculate to 3,232 per year retrieved or approximately 6,500 killed using a killed but lost ratio of 50 percent. This would equate to two to three percent of the total population per year, presumably well within the range of maximum sustainable yield. This assumption is awkward, however, since the harvest estimates are for somewhat different sets of years and are probably conservative. Also, precise estimates are not available for recruitment and sustainable yield for this population on either a numbers or percentage basis, and population data are out of date and imprecise. Alaskan harvests do appear, however, to remain within levels recommended by federal agencies as described above.

RINGED SEAL (Phoca hispida)

The ringed seal is the most common and widely distributed arctic seal, occurring throughout the region. As with bearded seals, population estimates are based on aerial observations in the summer, when at least some seals are on the ice, and are imprecise and subject to variable interpretation. For Alaskan waters, the best guess seems to be one to 1.5 million (Kelly 1988b, Littlefield 1977), with annual sustainable yield estimated at eight to 11 percent (McLaren 1958). Again, however, it must be pointed out that these figures are based on incomplete information and are estimates only.

In Alaskan waters, ringed seals seem to be strongly reliant on ice as a substrate for hauling out, for molting, and for pupping, which occurs in subnivien dens in shorefast ice or within stable pack ice. And though they inhabit to some extent the ice-covered reaches of the Bering, Chukchi and Beaufort seas during all seasons, they are somewhat migratory. The bulk of the population shifts from north to south in the fall and winter and back during spring in response to ice conditions. In recent years the greatest numbers are taken in the Bering Strait vicinity from late April through June, arriving in

the Barrow vicinity in late June (Alaska Department of Fish and Game 1976). The population distribution at any one time or during any given year seems to vary depending on ice and weather conditions. It is estimated, for example, that from 1970 through 1977 the density of ringed seals declined by 50 percent in the Beaufort Sea and by 35 percent in the northern Chukchi Sea, presumably in response to severe ice conditions. At the same time a corresponding increase in population was observed in the southern Chukchi and northern Bering seas (U.S. Department of Commerce 1978). During mid-winter, ringed seals tend to concentrate inshore, replacing the larger bearded seals which move offshore to areas of flawed and moving ice (Burns 1967).

Ringed seals are opportunistic feeders, including items such as fish (primarily arctic and saffron cod), shrimp, mysids, and euphausids in their diet.

The subsistence harvest of ringed seals has declined significantly in Alaska in recent years, although the population of seals has not. From estimates of 10,000 to 20,000 ringed seals taken per year in the 1950s and 1960s, the the harvest has fallen to levels of 4,000 to 5,000 or lower in recent years (U.S. Department of Commerce 1978, Frost 1985, personal communication with John Burns). The recommended sustainable yield for Alaska is estimated at 20,000 per year, including killed but lost, significantly above the present harvest level (U.S. Federal Register 1979, U.S. Interagency Task Group Report 1976).

CARIBOU (Rangifer tarandus granti)

The Western Arctic caribou herd (WAH), the largest in the state and the one from which most of the Barrow and Wainwright harvest is taken, seems particularly prone to drastic population fluctuations. Though no numerical data are available, historical records indicate that caribou were "abundant" in the WAH region in the early 1800s and "scarce" by the late 1800s and early 1900s. By 1950, when the first aerial survey was undertaken, the population had recovered to an estimated 238,000. By the mid-1960s population estimates had increased to around 300,000 animals, but declined again to 242,000 in 1970. By 1975 this decline had accelerated (102,000 estimated), and by 1976 the WAH had reached a low of 77,000 to 82,000 (Davis et al. 1980). At that time major harvest restrictions were imposed by the state. Since 1976 the herd

has increased steadily to estimated levels of 113,000 in 1979, 165,000 in 1981, 239,000 in 1986, 311,000 as of 1988 (Davis and Valkenburg 1978, Jim Davis, personal communication), and 400,000 by the summer of 1990 (Pat Valkenburg, personal communication).

The other caribou herd from which harvests are taken by residents of Barrow is the Teshekpuk herd. Though figures for this herd are less available than for the Western Arctic herd, the Teshekpuk population also seems to be on the increase at present, with recent estimates at 11,000 animals in 1983 (Jim Davis, personal communication) and 16,500 in 1990 (Pat Valkenburg, personal communication).

For both herds, the annual recruitment rate is estimated at 11 to 14 percent. This calculates to an annual recruitment to the Western Arctic herd of about 44,000 to 56,000 animals, and 1,800 to 2,300 to the Teshekpuk herd. As of 1983, a conservative sustained yield estimate of five percent per year was derived for the Western Arctic herd (Jim Davis, personal communication), which would equate to about 20,000 per year for this herd and about 825 per year for the Teshekpuk herd at present population levels.

FISH (all species)

Various species of whitefish constitute the bulk of fish harvests at Barrow, followed by grayling, capelin, cod and salmon. The primary species taken at Wainwright is smelt (by number harvested, not by pounds harvested), followed by whitefish and grayling.

For the region as a whole, total annual fish harvests are estimated at about 210,000 pounds for the villages of Barrow, Wainwright, Point Lay, Atqasuk, Nuiqsut and Kaktovik (Craig 1989), consisting primarily of various species of whitefish, arctic char, Pacific herring, grayling, lake trout, burbot, rainbow smelt, arctic and saffron cod, arctic flounder, fourhorn sculpin, capelin and several species of salmon.

Little information is available concerning population or sustainable yield levels for any of these species in this region, so it is impossible to assess

the impact of present harvest levels other than to say that such harvest levels seem to be relatively stable over years for which data are available. The only population data available are for the Colville River arctic cisco fishery (Gallaway et al. 1989). This population seems to be somewhat variable from year to year, though it is thought that such variability is not due to fisheries impacts.

WATERFOWL

The most recent and most comprehensive estimates of waterfowl populations available to Barrow and Wainwright hunters are derived from aerial surveys of the Arctic coastal plain nesting grounds and the Teshekpuk Lake area. Results of these surveys calculate to a five year average (1986 to 1990) of about 824,000 nesting ducks on the Arctic coastal plain, with annual estimates ranging from about 622,000 in 1986 to 1,010,000 in 1989. Major species included in this estimate are oldsquaw (441,000), pintail (290,000) and scaup (46,000), followed by several other species of lesser numerical importance. Estimates of nesting white-fronted geese on the coastal plain averaged about 106,000 over the same five year period, ranging from 86,000 in 1990 to 145,000 in 1989, while brant estimates averaged roughly 9,000, with a range of from 3,500 in 1990 to 18,300 in 1989 (U.S. Fish and Wildlife Service [USFWS] survey data, 1991). Survey estimates indicate rather large population fluctuations from year to year, probably the result, for the most part, of displacement of birds from more southern nesting grounds due to varying environmental conditions rather than to actual population changes in the region itself (King and Cain 1987). There are also some indications that goose and, particularly, brant populations may have been adversely affected in recent years by poor nesting conditions in the Yukon delta region (King 1987).

In addition to the average estimates presented above, an average of 3,500 non-breeding white-fronted geese were counted in the Teshekpuk Lake region during the same five year period, and about 14,600 brant, bringing total five year estimates to 109,500 white-fronted geese and 23,600 brant (USFWS survey data, 1991). In addition, another 15,000 to 20,000 brant migrate past Barrow and Wainwright from the Herschel Island nesting grounds each year, raising the

average available brant population to the neighborhood of 39,000 to 44,000 (Rodney King, personal communication).

Eiders, one of the major species taken by both Barrow and Wainwright, were poorly sampled during the surveys quoted above due to somewhat different distributions (Rodney King, personal communication). Earlier surveys, however, estimated the fall migration of eiders past Point Barrow at about 800,000 to 1,000,000 (Johnson 1971, Barry 1968, Watson and Divoky 1974).

LOCAL IMPACT

For most species or resources discussed, the impact of local harvests on regional populations is minimal. This is certainly true regarding the impact of Barrow and Wainwright on walrus, and probably holds true for bowhead whales, bearded seals, ringed seals and most other species.

Combined bowhead landing by Barrow and Wainwright averaged 15 whales per year from 1987 through 1989. By all estimates, this number is well below the estimated rate of increase of the bowhead population, which range from about 148 to 226 animals per year with current harvest (quota) levels taken into account.

The combined retrieved harvest of walrus by Barrow and Wainwright for respective survey periods averaged 187 animals per year, constituting approximately three to four percent of the average total subsistence harvest for Alaska (Table 30). Present levels of subsistence harvest may pose some threat to the stability of the walrus population, but the major focus of that harvest is Bering Strait and the north Bering Sea, not the northeast Chukchi coast.

The combined average retrieved bearded seal harvest by Barrow and Wainwright for the same period was approximately 260 animals per year, about eight percent of the total combined US-Soviet take. So far as is known, the present harvest of bearded seals is well within sustainable limits, and there appears to be no immediate threat to this population.

Harvests of ringed seals by residents of Barrow and Wainwright during the survey averaged 469 retrieved seals per year, about 10 to 13 percent of the total for all Alaska. Ringed seal harvests have declined overall in recent years due to changing subsistence patterns, and are thought to be well below sustainable yield levels.

As discussed above, the Western Arctic caribou herd and the Teshekpuk herd seem to be healthy and are increasing at present. It is difficult to say how the harvest is divided between these two herds. It seems unlikely, however, that local harvests are sufficient to adversely affect either population at this time. A combined average of 2,203 caribou per year were taken by Barrow and Wainwright during the study period, amounting to about 0.5 percent of the current population estimate, or about 10 percent of the estimated sustainable yield.

As stated above, it is impossible to evaluate the effect of fish harvests on the various populations at this time. Harvests do seem to be relatively stable, however, which probably indicates that they are within sustainable yields and that populations are being maintained.

The combined average waterfowl harvest taken by residents of Barrow and Wainwright over the study period included 3,464 white-fronted geese, 1,074 brant, 209 non-specified geese, and 6,915 eiders per year. Applying five year average estimates derived from USFWS survey data, as discussed above, this harvest amounts to about three percent of the available white-fronted goose population, two to three percent of the available brant population, and less than one percent of the eider population. So far as is known, all of these harvests are well within sustainable yield limits for these populations.

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