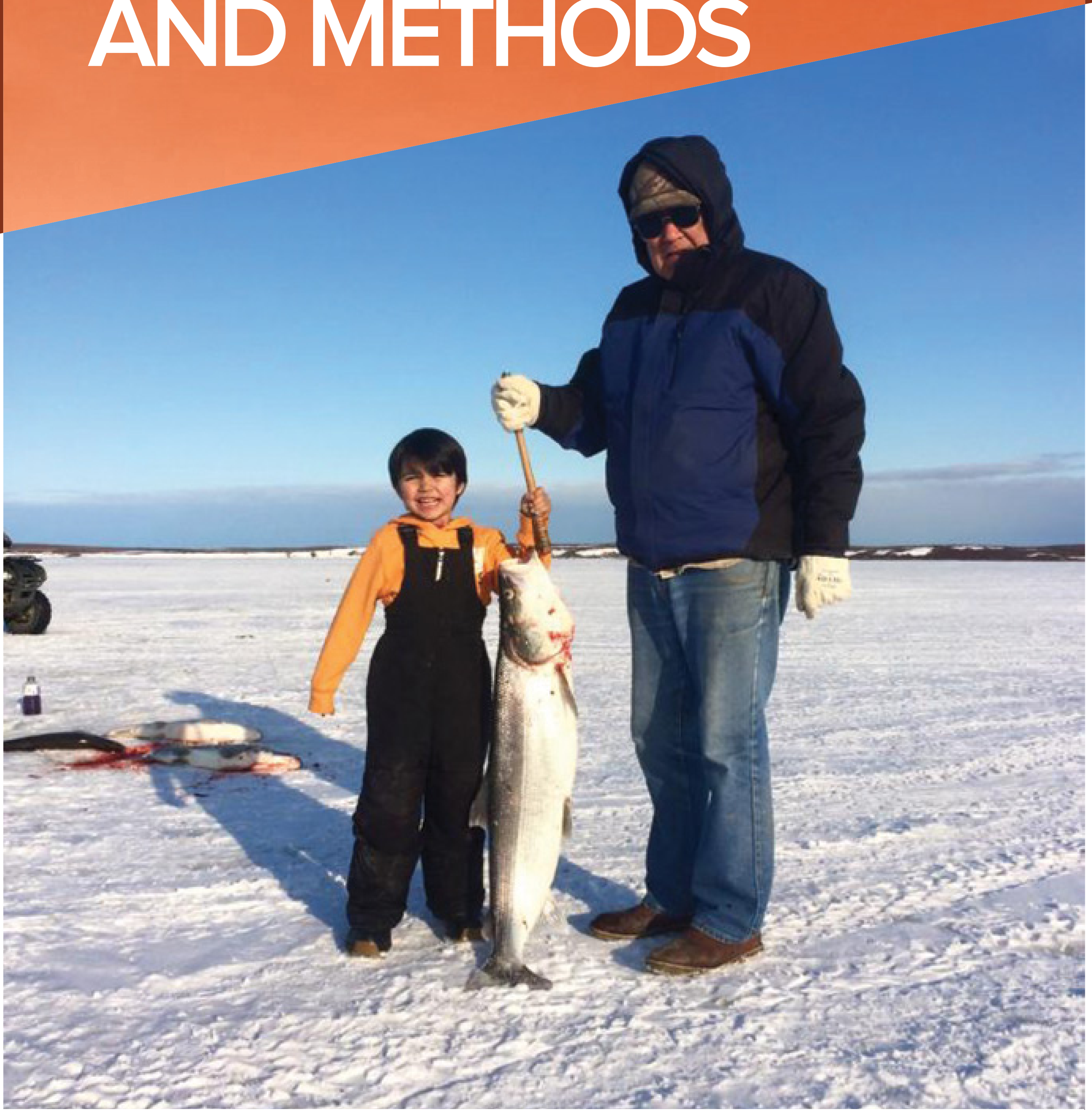
# CHAPTER 1: BACKGROUND AND METHODS



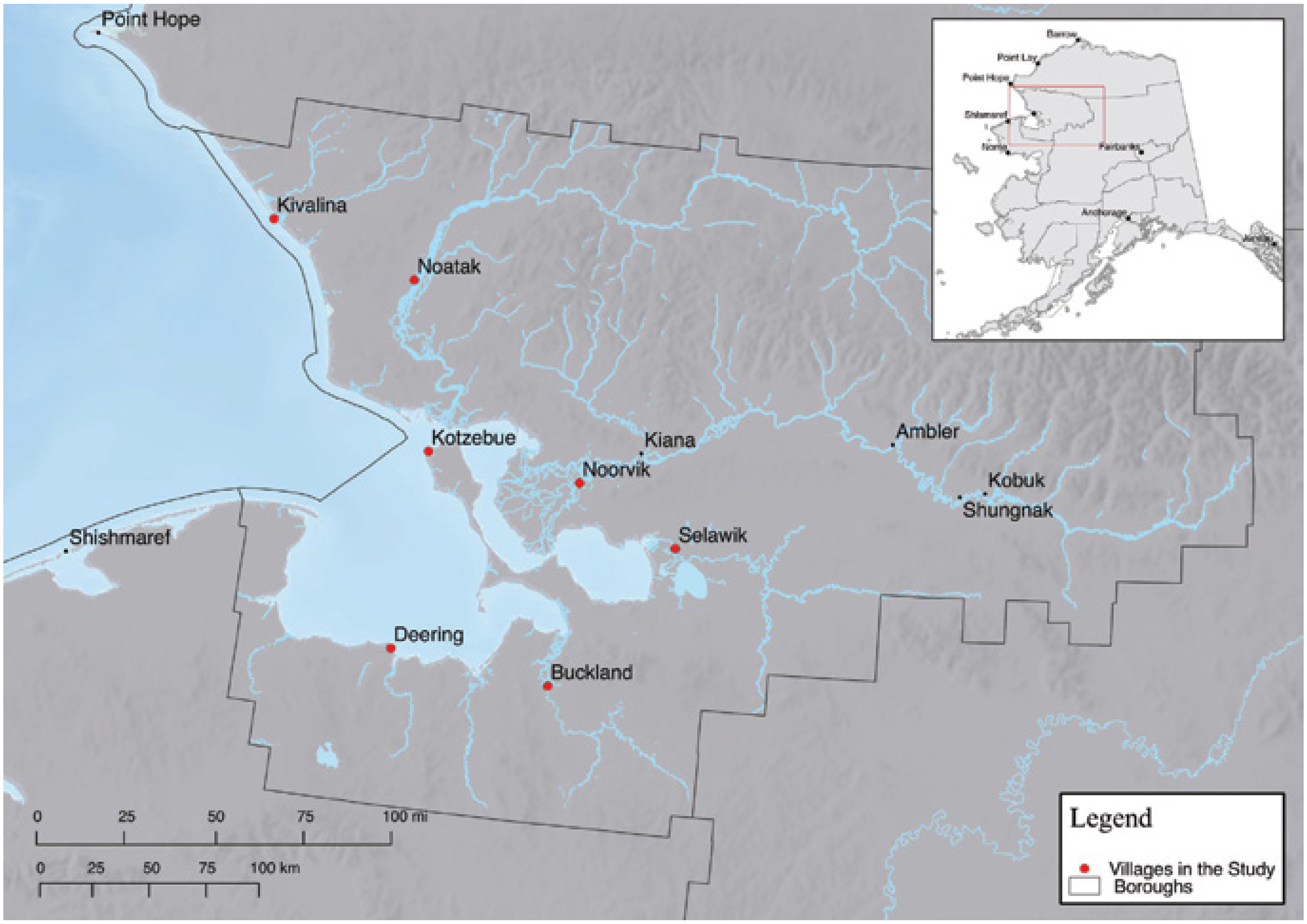
**Gage "Little Obbie" Pendergrass and Taata Frank "Obbie" Greene sheefishing near Kotzebue.**
Photo credit: Cathlynn Greene Pendergrass.

# CHAPTER 1: BACKGROUND AND METHODS



Photo credit: Sarah Betcher.

## NORTHWEST ARCTIC BOROUGH




# Introduction

For countless generations, the Iñupiat have occupied the places that today make up the Northwest Arctic Borough. In a long-undisturbed rhythm, the people shared the land, the waterways that thread through the land, and the oceans that bound the land with a seemingly eternal array of land animals, sea mammals, fish, birds, and plants. Seasons predictably transitioned from dark, to getting light, to always light; from ice, to ice going out, to flowing water and returning surf. From being inside, to going out to summer camp. From using up what had been stored, to putting up for the next ice-cold winter that was sure to come.

Before industrial harvesters from the outside world took most of the whale, before currency changed from meat to dollars, before stories were written down, before English and math were taught inside schoolhouses, before flour and sugar, the Iñupiat understood change. As northern peoples who depend on the land and the water resources and are well-acquainted with the organisms they share the land and the water with, the Iñupiat have acquired a deep understanding of change. Since long ago, all of the phases of the local cycle rolled around pretty much on time, but nothing ever returned exactly like it was before. Everything in nature changes all the time, including people and our economies. Anyone who listens carefully to an Iñupiaq elder or teenager talk about the Iñupiaq way of life—how it was in the past, how it is in the present, or how it might be in the future—can hear in the stories, in the tones of voices, this fact that resides among the core tenets of what is now called "traditional knowledge"—that change is always coming.

This atlas of traditional hunting, trapping, fishing, and gathering areas frequented by the residents of the Northwest Arctic Borough and the species they depend on—and the organisms those species depend on—aims to prepare residents of the Borough for the many changes everyone sees coming. This book has been designed to be read and referred to by a diverse audience of village residents, tribal and local, state, national, and international government policymakers, scientists, activists, and businesspeople. The purpose of this project is to produce an atlas of accurate maps showing where people in the Borough hunt, fish, and gather today and in what places the mammals, birds, and fish, and the organisms they need to thrive, can be found.

In this opening chapter, we provide background on the origin and purpose of the project and give an overview of

**The language of the Iñupiat is "Iñupiatun," though it is usually referred to as simply "Iñupiaq," the term we use in this atlas. Iñupiat is the plural form of Iñupiaq. In the Iñupiaq language, plurals usually end with a "t" (e.g., *umiaq/umiat*). There are places in this volume, however, where we use the more colloquial "s" ending (*umiaq/umiaqs*).**

methods our researchers devised and used to conduct this comprehensive study. The science presented in this atlas centers on human knowledge about the Borough's land and water, and the organisms that live on and in the land and water—knowledge that people who live in the area today are constantly gaining from personal experiences and observations and knowledge received in accounts passed along orally through generations. Later in this introductory chapter, we provide an overview of the methods that we employed to prepare the maps in this atlas. In the first methods section, we explain how we gathered local and traditional knowledge on *subsistence search areas* in the first phase of the study, which resulted in the maps in chapter 2. In the second methods section, we lay out the methodology we used to make the maps on *important areas for marine and coastal species* in chapter 4.

In chapter 2, we recount the histories of the seven villages whose residents participated in this study. The histories connect events of the past 150 years to changes in village locales, demographics, and economies, and trace the conditions through which villagers managed to continue the annual hunting, fishing, and gathering cycle. We then present findings on what kinds of traditional foods people in each village report harvesting and eating today and the relative number of search areas harvesters frequent to find particular foods. Next in chapter 2, we hear villagers describing, in their own voices, annual food gathering, preserving, and sharing routines. In these pieces, we also sometimes hear local views on village life as it is today and the changes and challenges people see coming to the villages and the Borough in the coming years.

Maps of villagers' search areas, organized by species and time of year, can be found at the end of each village section. Following the individual village sections, we then present study-area-wide maps that combine all of the search areas reported by village participants. These area-wide maps, which are based solely on villagers' input gathered in the first part of the study, complement the maps of important areas for species prepared for chapter 4, which incorporated outside data sources.

In chapter 3, we take a brief look at villagers' subsistence activities according to age, gender, and village characteristics and report the results of modeling conducted to predict what harvesting patterns may look like in the future. These findings add dimensions that, while not portrayed on the maps, we feel are interesting and belong among the data reported in this atlas.

Chapter 4 brings local and traditional knowledge together with results of other types of studies, including Audubon Alaska's bird analyses, aerial and boat surveys, satellite tracking studies conducted by local and outside scientists, and other research. Taking all of this information into account, our partner scientists at Oceana created maps showing where marine mammals, fish, birds, and invertebrates that local people rely on can be found in and around the Borough at different times of the year. After the maps were reviewed and adjusted by local experts in Kotzebue, Oceana mapped important areas for species, including subsistence harvesters. "Analysis" maps portray the relative importance of different areas along the coast and in the marine environment.

While it is well understood among the people of the North that change is a part of life, over the past 150 years, as recounted in the village histories and heard in the words of local residents in chapter 2, the people who live in this area have had to adapt to a lot of it. As everyone is aware, more change is coming. In chapter 5, we summarize various economic development projects that are underway or on the horizon. This atlas is just one tool the Northwest Arctic Borough is preparing to help people decide where, how, and when development should occur.

We hope this atlas, the product of a collaborative effort involving a variety of researchers and residents over many years, will be read and referred to by many people in the years to come. Whether opened by the hands of an elder in Buckland or clicked onto the computer screen of an oil company executive in Houston, it is our wish that all who access this atlas will find the Iñupiaq way of life reflected accurately here and make use of the compiled information to help protect it.

**A comprehensive summary of the Subsistence Mapping Project's activities and related publications is provided at Appendix K.**

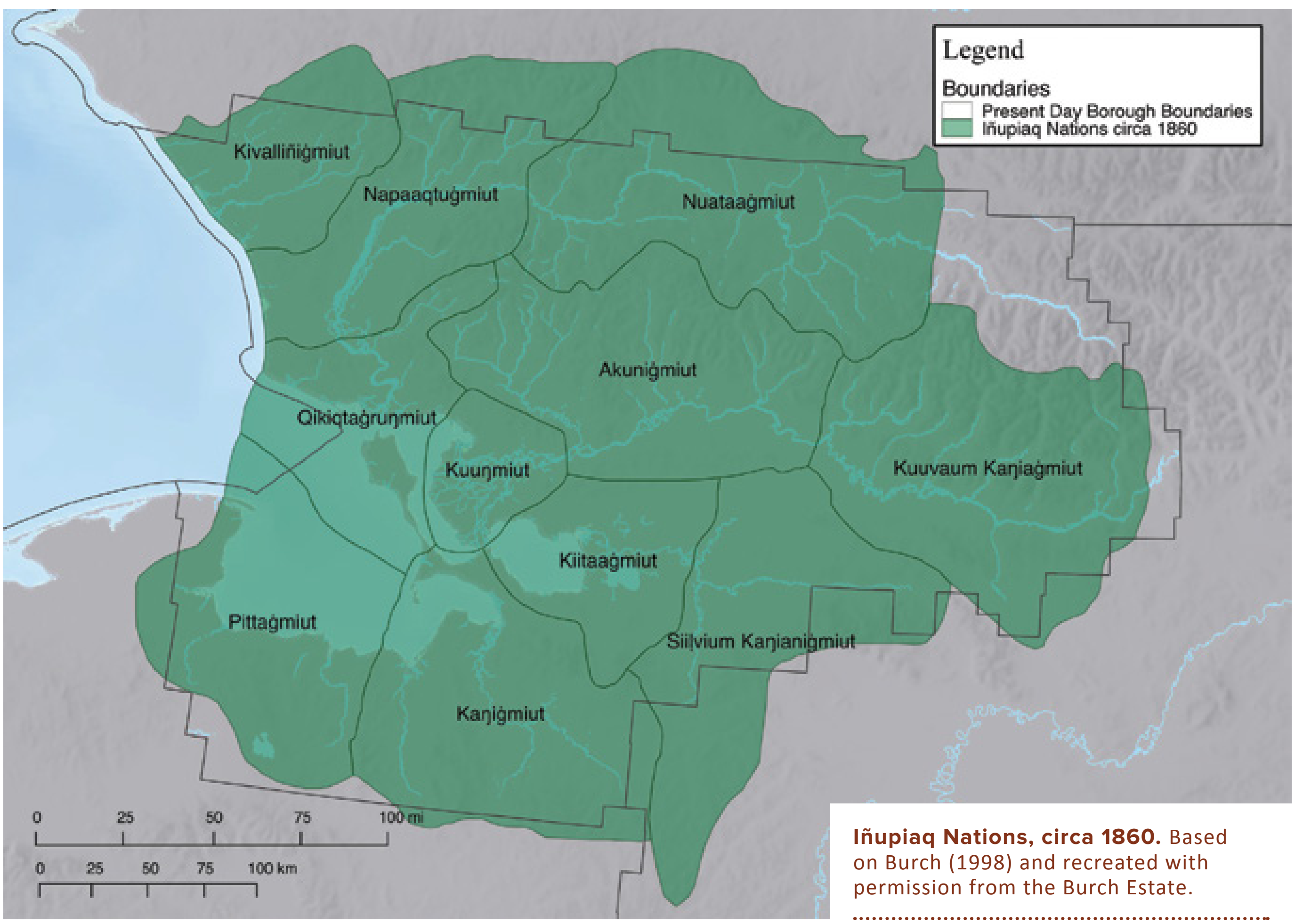
# The Northwest Arctic Borough and Its People

The Northwest Arctic Borough covers 40,749 square miles in northwestern Alaska—35,573 square miles of land and 5,176 square miles of water. The Borough is bordered on the north by the North Slope Borough, with the Yukon-Koyukuk region to the east, the Seward Peninsula-Norton Sound region to the south, and the Chukchi Sea to the west. Borough land nearer the coast is covered with tundra, with boreal forests growing farther inland,[1] as the elevation climbs from sea level to a maximum 8,760 feet at the summit of Mt. Igikpak in the Brooks Range at the eastern edge of the Borough.[2]

On the Alaska side of the Chukchi and Bering seas, Native people have traditionally lived on the lands of today's North Slope Borough, Northwest Arctic Borough, and Seward Peninsula.[3] It is believed that in earlier times 11 distinct Iñupiaq groups[4] resided on land now located within the Borough's boundaries: the Kivalliñiġmiut (present-day Kivalina area); the Napaaqtuġmiut (the lower Noatak River); the Nuataaġmiut (upper Noatak); the Qikiqtaġruŋmiut (Kotzebue Peninsula, and area surrounding the mouth of the Noatak); the Kuuŋmiut (the Kobuk River delta); the Akuniġmiut (central Kobuk River); the Kuuvaum Kaŋiaġmiut (upper Kobuk); the Kiitaġmiut (lower Selawik River); the Siiḷvium Kaŋianiġmiut (upper Selawik); the Kaŋiġmiut (Buckland area); and the Pittaġmiut (Goodhope Bay area).[5]

**2014 AFN Hunter/Gatherer Karmen Monigold and NAB subsistence officer Jaime Iqaak Lambert kavraking an *ugruk* at Camp Ivik.** Photo credit: Polly Aġruk Schaeffer.

When the most recent census was taken by the federal government in 2010, the Borough was home to 7,523 people. At the time, over 80% (6,121) were Alaska Natives, mostly Iñupiat. In recent years, small numbers of Yup'ik and Athabaskans have settled in the Borough, along with non-Natives, the majority of whom reside in Kotzebue.




**Iñupiaq Nations, circa 1860.** Based on Burch (1998) and recreated with permission from the Burch Estate.

## Study Area

Seven of the 11 Northwest Arctic Borough communities are included in this project: Buckland, Deering, Kivalina, Kotzebue, Noatak, Noorvik, and Selawik. The Borough plans to map subsistence resources in its other four communities, Kiana, Kobuk, Shungnak, and Ambler, in the near future.

Photo credit: Sarah Betcher.

## Consumption of Traditional Foods in Arctic Households Today

Foods acquired from hunting and trapping, fishing, and gathering plants and eggs from the areas around home villages contribute significantly to the diets of Arctic peoples and to the local economy. Recent studies have found that people in 92% of Arctic Alaskan households eat locally caught fish and people in 96% of the households eat wild game. Sixty-three percent of Arctic Alaskan homes have someone living there who actively hunts game and someone in 72% of the homes brings home fish.[6] The portion of each individual's diet that comes from traditional foods is not known for certain, but it has been estimated that individual communities in the region harvest anywhere from 375 to 1,544 pounds of traditional foods per person per year.[7] By comparison, the average down-south American consumes about 222 pounds of meat, fish, and poultry and a total of 1,370 pounds of all foods combined each year. Assuming people in the North eat about that much, it may be estimated that *at least* 27% of the food eaten in Alaska's Arctic villages every day comes from food the local people have hunted, fished, and gathered. For some households, the *majority* of their food still comes from the surrounding land and sea.

## Nutritional Values of Traditional Foods

It is estimated that traditional Native foods currently provide between 20 and 48% of the calories a body needs in the Arctic.[8] These foods are higher in important nutrients than store-bought foods, providing 46% to over 100% of daily protein needs, 83% of vitamin D, and approximately 35% of iron, zinc, and polyunsaturated fats, including over 90% of certain omega-3 fatty acids.[9] A study of diets in 16 Dene/Métis communities in Canada's Northwest Territory, where people collect and eat foods comparable to those consumed by borough residents, found Native foods to be significantly higher in potassium, zinc, and iron, and lower in sodium, fat, saturated fats, and sucrose than store-bought foods consumed in that same region.[10] In the villages of the Northwest Arctic Borough, store-bought food must be flown in, so it is expensive. Non-native foods travel a long way to get to a village, so quality and availability are unreliable.[11] At times, when weather conditions prevent cargo from arriving, shelves in the local store become empty. Low river levels in recent years brought on by changes in climate are making it hard for barges to get into upriver villages, resulting in increased use of expensive air transportation, which raises food prices, fuel and motor vehicle expenses, and villagers' overall cost of living.

**Herring ready for pickling.**
Photo credit: Jeanne Viveros.

**Sadie Ferguson with sheefish.** Photo credit: Claude Wilson.

## Purpose of the Project

In anticipation of coming economic development, the Borough's planning department conceived this project to 1) develop a baseline geospatial database of land and water used by residents in the seven coastal villages for traditional hunting, trapping, fishing, and gathering activities, based on villagers' reports; and 2) identify places of particular ecological importance to species harvested for subsistence, taking into account seasonal variations. These data are intended to serve as a decision-making tool to help guide future development in the Borough.

**Processing *ugruk* intestines at youth camp Piġaaq.** Photo credit: Lance Kramer.

# Methods, Part 1: Mapping Local Harvest Areas[12]

## Translating Local and Traditional Knowledge into Map Polygons

The maps in chapter 2 of this atlas portraying where people go to harvest traditional Iñupiaq foods illustrate visually a wealth of information provided to researchers over the course of three years, between 2011 and 2014, by residents of the Northwest Arctic Borough communities of Buckland, Deering, Kivalina, Kotzebue, Noatak, Noorvik, and Selawik.[13]

The main tool used to gather the vast amount of local and traditional knowledge reported by villagers in the first phase of the study involved a method researchers call "cognitive" or "mental" mapping—simply a process of asking someone to indicate on maps all of the places he or she goes to or travels through, or uses in other ways while engaged in hunting, fishing and gathering activities (e.g., trails, waterways, beaches, hills, or other landscape features).[14]

To map villagers' search areas for traditional resources, each person was asked to share any information that came to mind about the place and its significance. In this process, people conveyed knowledge not just about the hunting, fishing, or gathering they had done, but how they traveled there, what time of year they went, where their camp was located and how long it had been there, where they processed the fish or meat, etc.[15]

The gathering of this information in each of the seven communities followed the same basic two-part procedure. First, preliminary conversations took place in the form of one-on-one interviews in which a researcher from the mapping project would ask a participant about her or his patterns and traditional hunting, fishing, and gathering search areas.[16] The words spoken by village participants were considered property shared for the purpose of this study's accurate mapping of traditional use areas, and information has been aggregated to avoid identifying individual or family camps and other sites.

Accounts provided in the one-on-one conversations were then digitized and transferred to draft maps that were presented to advisory groups made up of seven people from each community. Members of this group were asked not about their own individual harvesting patterns but, rather, to review the information that had been gathered to determine whether participants' reported activities conveyed the traditional hunting and gathering patterns and areas of the community as a whole. Was the researcher getting an accurate and complete picture of community-wide subsistence activities? Committee members then provided additional information to refine and supplement the mapped findings. At each phase of activity, project leaders, researchers, and tribal and local government officials worked together to ensure the study achieved its purpose: to thoroughly and accurately map the land and water in and around the seven communities used for the harvesting of traditional subsistence resources.

## Convening Local Advisory Groups

At the project's outset, local advisory groups were brought together in each community to guide the work and review information provided to researchers in individual interviews. In addition, the Borough retained three village coordinators to help guide our work. Before inviting any advisors, we first explained the goals of the project to, and sought the permission of, tribal and city government officials in each community. After obtaining permission and bringing on village coordinators, we posted flyers in local public places and made announcements by VHF radio broadcast inviting people to contribute their experiences and knowledge to the project. Sometimes, potential participants would be recommended by a community leader, like an elder or a member of the tribal government. Often, someone who had agreed to participate would be asked if he or she knew of other locals who engaged in traditional hunting, trapping, fishing, and gathering who might like to contribute to this atlas.[17]

All advisory group candidates were asked to fill out a short questionnaire indicating their age, gender, and subsistence harvesting experience. This information allowed the research team to involve a variety of people (e.g., elders, fishers, hunters, gatherers) and to verify that an interested person had experiences that would contribute to the mapping project. The final advisory group for each community was then formed with the approval of the tribal and local government.

> **"Subsistence means that I am an independent man who will survive when faced with adverse conditions."**
> ***Joe Swan, Jr., Kivalina***

## Inviting Local Hunters, Fishers, and Gatherers to Participate

As with the advisory group members, permission to approach potential individuals for one-on-one interviews was obtained from each tribal and city government before anyone was invited to join the mapping project. In each community, this study's village coordinators, with the help and approval of local city and tribal leaders, compiled a list of people believed to hold knowledge relevant to the mapping project—individuals known to be the most experienced and knowledgeable hunters and gatherers in the community. We attempted to contact all of the local people on these lists to invite them to take part in the project. Those who wanted to contribute to the research filled out a questionnaire, supplying some demographic information and details about their personal subsistence harvesting experiences. (*see* Appendix B.)

## Men and Women, Young and Old

As we had done when convening advisory group members, individual participants were selected on the basis of their experience, with our researchers seeking to assemble a strong representative sample of various kinds of users,

**TABLE 1.**
LOCAL POPULATION, NUMBER OF INITIAL PARTICIPANTS AND VILLAGE'S PORTION OF STUDY'S TOTAL SEARCH AREAS

| COMMUNITY | POPULATION* | PARTICIPANTS | % OF STUDY'S TOTAL SEARCH AREAS |
|---|---|---|---|
| Buckland | 416 | 18 | 6.8 |
| Deering | 122 | 9 | 2.0 |
| Kivalina | 374 | 15 | 6.1 |
| Kotzebue | 3201 | **30** | 52.3 |
| Noatak | 514 | 18 | 8.4 |
| Noorvik | 668 | 24 | 10.9 |
| Selawik | 829 | 27 | 13.5 |
| **TOTAL** | **6124** | **141** | **100** |

**Source: 2010 U.S. Census*

**TABLE 2.**
GENDER AND AGE PERCENTAGES OF VILLAGE RESIDENTS ACCORDING TO THE 2010 U.S. CENSUS.

| VILLAGE | MALE (%) | FEMALE (%) | 18-34 (%) | 35-64 (%) | 65 and above (%) |
|---|---|---|---|---|---|
| Buckland | 56 | 44 | 29 | 24 | 4 |
| Deering | 55 | 45 | 24 | 39 | 8 |
| Kivalina | 48 | 52 | 29 | 29 | 5 |
| Kotzebue | 51 | 49 | 28 | 33 | 7 |
| Noatak | 52 | 48 | 24 | 29 | 6 |
| Noorvik | 56 | 44 | 24 | 29 | 6 |
| Selawik | 52 | 48 | 28 | 25 | 4 |

e.g., men, women, young people, elders, fishers, hunters, and gatherers. The number of people initially selected for one-on-one interviews differed according to the population of each community. Taking time and financial constraints into consideration, project leaders sought to have each community represented in proportion to its population and the age and gender make-up of the population.

Our goal was to gather knowledge from the most experienced subsistence practitioners, but we subdivided the practitioners into male and female, and three different age classes: young adults (18-34), middle-aged adults (35-64) and elders (65 and above), so that we could track whether each village's group of participants was representative of the community in terms of gender and age. Previous studies suggested, and local participants generally confirmed, that men and women engage in different subsistence practices (i.e., men do more hunting and trapping, whereas women do more gathering of plant resources). Similarly, because of technological changes, such as use of snow machines instead of dogsleds, and more recently, because of economic changes impacting costs of gasoline and other resources, we hypothesized that there might be differences in subsistence behaviors among age groups. Without making sure we had a representative group of men and women, young people, middle-aged people, and elders, we couldn't be sure we were getting good representative data.

i

**With the help of each community advisory group, we determined the areas and scales for the maps to be used in each of the seven villages. Oceana provided topographic and aerial satellite imagery maps of the study communities for each interview. A listing of all map sizes and scales is included as Appendix C.**

## The One-on-One Interview Process

The interviews were semi-directive.[18] This refers to an interview process in which key points are brought up by the researcher, but the study participant is permitted to talk freely about each topic and to wander to related topics. As there is no specified time limit or explicit questionnaire, the nature of the interview is much like that of a casual conversation, though the researcher may occasionally direct the conversation to make sure that all key points are addressed. This method has been used in other projects documenting traditional knowledge in the Arctic.[19] One of the helpful aspects of this method of data gathering is that it keeps interviewer interference at a minimum and allows participants to lead the way. A more directed approach might not get valid results. For example, an approach that uses a written survey might ask "Where do you search for ptarmigan eggs?" The question assumes the person searches for ptarmigan eggs, which may or may not be the case. In contrast, the interviews in this study were designed to identify important subsistence resources from things each villager told the researcher or showed the researcher on a map, in response to open-ended questions.

The interviews focused on the participant's subsistence search areas over his or her lifetime. If someone told us he was a hunter, we might begin with a general question such as

"What animals do you typically hunt in the fall?" Follow-up questions would then focus on such topics as the search area for those species identified, how frequently the person went to certain places, how he or she got there, and locations of camps and other food preparation locations. As discussed above, the interview was like a casual conversation, so the order and specific wording of questions was not prescribed. However, in order to fulfill the purposes of our grant, we did try to keep the conversation centered on places and species the participant normally makes use of in her or his traditional food harvesting cycle.

Interview meetings unfolded in the following sequence:

1. Prior to the participant's arrival, base maps and Mylar® (plastic) overlays were set up. Additional Mylar® overlays were kept nearby in case they would be needed.
2. Before starting the interview, a consent form was provided for the participant to sign. The researcher went over the form, and the participant was given an opportunity to ask questions and express concerns. (The consent form is provided in Appendix A.)
3. A brief questionnaire was provided to gather some demographic data about the participant (age, gender, time in village, etc., *see* Appendix B.)
4. After the forms had been completed, with the participant's consent, the audio recording began. Participants could refuse recording, if desired. Audio recordings began with the interviewer stating the date, location, and the coded value assigned to each participant.
5. The interview itself began with the researcher presenting an open question similar to the following:

    "For the purposes of this interview, I would like to ask you about your hunting, fishing, and gathering practices. Many interviewees find it easiest to go through the year season by season. If this works for you, we can begin with the fall and continue through the year. As you tell me about the different subsistence activities you have conducted, I will be taking notes. I will ask you to indicate on the map the areas in which you searched for different foods, and I will mark them."

6. As each subsistence activity was mentioned, more detailed follow-up questions would be asked, including, but not necessarily limited to, one or more of the following (listed in order of priority). Asterisks indicate responses usually marked on maps and coded accordingly.
    a. Search areas for each species*
    b. Months during which species were harvested, and ice conditions if relevant
    c. Camps and processing sites*
    d. Whether the camp is in an allotment or on other private property or if it is considered a community site
    e. Travel routes to those areas*
    f. Notes about important behaviors of species, such as:
        ◊ Migration routes*
        ◊ Breeding/Spawning grounds* and timing
        ◊ Variability in behaviors, and any observed seasonal trends or other changes.[20]
7. As appropriate, the researcher would follow up, asking more specifically about additional species in each taxonomic division. For example, "You mentioned that you hunted for snow hares in this region. Have you ever hunted for other fur-bearing mammals?" The additional questions often generated more detailed responses that led to additional questions.
8. Each activity was recorded as an object on the map and numbered. The researcher recorded the number in a notebook, along with all related information, such as activity, species, season, months, type of mapped object (point, line, or polygon), etc.
9. Upon completion of the interview, the Mylar® overlay was coded and marked up accordingly:
    a. Interview Session
    b. Location
    c. Interviewee (as a two-letter code to protect her or his identity)
    d. The map and scale used
    e. Mylar® overlay number (if more than one).

Additionally, a number of landmarks were marked on the map for alignment purposes to better preserve accuracy

### Interview Materials

- ☑ **Consent form**
- ☑ **Personal information survey**
- ☑ **Structured-material guide for interviews**
- ☑ **Maps**
- ☑ **Mylar® overlays**
- ☑ **Tape**
- ☑ **Wet-erase markers**
- ☑ **Digital recording device**
- ☑ **Field notebook**
- ☑ **Pens**

during the digitization process. The number of Mylar® overlays used during the interview was also recorded.

As mentioned on the previous page, the nature of the interview was more like that of a casual conversation than a series of questions asked in a predetermined order. Therefore, the order of the points listed above often varied. A person could respond that he or she searched locations *a*, *b*, and *c* for species *x*, *y*, and *z*, and then later follow up with the months that each was searched for. To keep track of the topics that had been covered, the researcher kept a list like the example provided at Appendix D, allowing him to check off different topics as they arose in the conversation and to note which topics needed to be followed up on. Once both the researcher and the village participant were content that the material was complete, the interview ended.

During the interview, the researcher was responsible for drawing polygons, lines, and points on transparencies as the village participant described areas and activities. Care was taken to ensure the level of detail was consistent across all interviews.[21] The village coordinator assisted the researcher in locating specific place names on the maps so that the researcher was sure to interpret the oral data correctly and mark the locations accurately. All interviews were conducted in English; although we asked all participants if they would like a translator, none requested one. Village coordinators sometimes gave the researcher common English names for less common species (we also had images of most birds and fish as another means of verification) and, on a few occasions when neither the interviewee nor the village coordinator knew the English name of a plant, the researcher recorded the Iñupiaq name and consulted references and experts later.

**Ray Schaeffer teaching his son Sterling how to pluck brant.** Photo credit: Leanne Schaeffer.

## Interim Analysis of the Scope and Sufficiency of Data

Upon completion of the first round of one-on-one interviews in the spring and summer of 2013, we performed analyses to evaluate both the sufficiency of the data and to ensure each village's group of study participants reflected the village's overall demographic make-up of regular subsistence practitioners. The findings from the interim analysis led researchers to go back and conduct more interviews in places where a representative sample had not yet been reached or where data remained insufficient to infer practices in each village. The methodology used for determining sufficiency and representativeness is presented in Appendix E.[22]

The analysis of sufficiency is based on the knowledge that local individuals use many of the same areas to harvest subsistence resources. Thus, as we interviewed more and more people, the areas each new person mentioned were increasingly likely to have been mentioned before by someone else from that village. As a result, "new" areas where the participant searched for food—places that none of the previous participants had mentioned—became smaller and smaller with each additional interview. For example, if the first 10 participants reported covering nearly all of the area surrounding their village, the 11th would not be able to provide much new area that had not already been covered. Using the methods described in Appendix E, we determined how many interviews would be necessary to get a sufficient representation of each village's subsistence activities.

**The late Kate Harris picking cranberries at Sisualik.** Photo credit: Maija Katak Lukin.

From the interim analysis, we learned it would be necessary to recruit more study participants as follows:

**Buckland**

| | |
|---|---|
| Interviews completed: | 17 |
| Total interviews needed for sufficiency: | 10 |
| Minimum add. demographic needs: | 1 (female 35-64) |
| Additional participants needed: | 1 (female 35-64) |

**Deering**

| | |
|---|---|
| Interviews completed: | 8 |
| Total interviews needed for sufficiency: | 8 |
| Minimum add. demographic needs: | None |
| Additional participants needed: | 0 |

**Kivalina**

| | |
|---|---|
| Interviews completed: | 12 |
| Total interviews needed for sufficiency: | 14 |
| Minimum add. demographic needs: | 1 (female 35-64) |
| Additional participants needed: | 2 (female 18-34, female 35-64)[23] |

**Kotzebue**

| | |
|---|---|
| Interviews completed: | 38 |
| Total interviews needed for sufficiency: | 38 |
| Minimum add. demographic needs: | None |
| Additional participants needed: | 0 |

**Noatak**

| | |
|---|---|
| Interviews completed: | 15 |
| Total interviews needed for sufficiency: | 12 |
| Minimum add. demographic needs: | 2 (male 18-34, female 18-34 |
| Additional participants needed: | 2 (male 18-34, female 18-34) |

**Noorvik**

| | |
|---|---|
| Interviews completed: | 21 |
| Total interviews needed for sufficiency: | 22 |
| Minimum add. demographic needs: | 2 (males 18-34) |
| Additional participants needed: | 2 (males 18-34) |

**Selawik**

| | |
|---|---|
| Interviews completed: | 25 |
| Total interviews needed for sufficiency: | 35 |
| Minimum add. demographic needs: | 7 (3 males 18-34, 4 females 18-34) |
| Additional participants needed: | 7 (3 males 18-34, 4 females 18-34) |

**Emma Thomas and Irene Armstrong working on Iñupiaq place names as part of this mapping project.** Photo credit: Jaime Lambert.

Looking at the above results of our sufficiency findings, it may strike some readers as surprising that the study sought nearly as many participants in Selawik as in Kotzebue, even though Kotzebue is a much bigger community. But, as explained above and in Appendix E, the number of participants needed for each village depended on the extent to which the search areas (described by participants up to the time this sufficiency check was run) overlapped. In Noatak, everyone's search efforts are concentrated along the river, which resulted in a very high degree of overlap on the map. (When people tend to frequent the same areas, fewer study participants are needed to paint a good picture of that village's subsistence use areas.) In Noorvik, by contrast, almost every family has their own little camp, and there is much less overlap, so we needed to interview more people in order to gain strong confidence that we were accurately mapping all of Noorvik's subsistence areas. Similarly, nearly as many interviews were necessary in Selawik as Kotzebue because they have similar amounts of overlapping search areas.

## Final Analysis of Demographic Representativeness and Data Sufficiency

A second round of interviews was conducted to obtain the data necessary to complete both the representativeness and completeness needs described above. The final group of study participants is summarized in Table 3. Note that these numbers were intended to be representative of the subsistence population in each village, not of the census distribution shown in Table 2. Even though there are roughly equal numbers of men and women in each of the villages in the study area, because more men engage in subsistence activities (*see* chapter 3), we included more men in our study sample.

**TABLE 3.**
DISTRIBUTION OF FINAL GROUP OF STUDY PARTICIPANTS CONTRIBUTING TO SUBSISTENCE MAPS.

| | YOUNG ADULTS (18-34) | | MIDDLE-AGED ADULTS (35-64) | | ELDERS (65+) | | |
|---|---|---|---|---|---|---|---|
| VILLAGE | MALE | FEMALE | MALE | FEMALE | MALE | FEMALE | **TOTALS** |
| Buckland | 4 | 1 | 13 | 1 | 0 | 0 | **19** |
| Deering | 2 | 1 | 4 | 1 | 2 | 1 | **11** |
| Kivalina | 4 | 2 | 5 | 1 | 2 | 1 | **15** |
| Kotzebue | 4 | 5 | 11 | 7 | 9 | 1 | **37** |
| Noatak | 1 | 1 | 10 | 2 | 3 | 1 | **18** |
| Noorvik | 2 | 1 | 9 | 10 | 2 | 1 | **25** |
| Selawik | 5 | 6 | 12 | 5 | 6 | 1 | **35** |
| **TOTALS** | **22** | **17** | **64** | **27** | **26** | **6** | **160** |

# Verifying the Accuracy of the Maps

## Buckland Test Exercise

Because study participants were present as we were marking the Mylar® overlays and constantly asked to comment on the accuracy of mapped objects, we expected a high level of accuracy between the digitized maps and the information provided by participating villagers. However, because some unintentional changes could have occurred during the digitization process, we wanted to present the digitized data, as it now appeared on maps, to participants to assess how accurately we'd managed to translate their oral descriptions into map form.

Using ArcMap mapping software,[24] we created an individual map for each study participant by overlaying the original base map used to collect data with the digitized search areas, lines, and points from each interview. The objects were labeled with species and season as well as the map ID in order to easily reference any changes to a particular object. To test the accuracy of the process of turning our interview results into mapped data, we went back and showed the individual maps to the Buckland participants, who were satisfied that mapped areas accurately conveyed the data each of them had provided. With this successful test, we were able to proceed, assured our methods would effectively transfer the interview data onto maps in the other communities.

## Local Advisory Group Review of Mapped Search Areas and Species

We included one final step in our data review process by asking the advisory group of seven subsistence practitioners in each participating village to comment on digitized maps that showed the data put together from all of the study participants in the community. The primary focus of this process was to allow the advisory group members to determine whether they thought the maps accurately portrayed the search areas frequented by hunters, trappers, fishers, and gatherers in their village. The maps were then updated to reflect additional information provided by advisory group members.

**Replogle "Reppie" Swan and Andrew Koenig review Kivalina maps.**
Photo credit: Damian Satterthwaite–Phillips.

Photo credit: Ray Schaeffer.

# Considerations

As explained throughout this atlas and illustrated on the maps, in this study we gathered quantifiable data on subsistence practices, including (1) the total area each individual covers when looking for food resources; (2) the number of unique locations the person frequents; and (3) the number of different species he or she harvests. While we have put all of these individual practices together to get a sense of the food gathering routines across the study area, when reviewing findings in each of these three categories, it is important for atlas users to keep in mind what may and may not be assumed from the reported findings.

## Considerations Regarding Total Area Searched

### *Covering more ground doesn't always mean coming home with more food.*

In considering the data on the total amount of area each individual covers in search of food resources, it's important to remember the many reasons someone may travel great distances. In general, we might expect that as an individual goes out on the land or water to hunt, fish, or gather, she or he will gradually cover more and more area over the course of her or his lifetime. In many areas, like up the river valley behind Deering, locals got to the same areas their ancestors did; in other parts of the Borough, where some of the old spots aren't as abundant today as they once were, it's not uncommon for people to look for food outside of the areas they grew up hearing were good places to go. These days, a hunter may spend hours on a snowmobile or in a boat searching and searching, only to come home empty-handed. Unaccompanied youngsters or other inexperienced individuals, in particular, may spend a lot of time out, covering much area with relatively little success. And, occasionally, people go a long way over several days not merely because they're actively hunting or gathering, but because they simply enjoy being out.

Variables like industrial development or changes in the weather might redirect species' patterns of movement, for example when terrestrial animals change their routes to avoid infrastructure. When species change their patterns, people have to look in new places to find them. The farther people then have to go to find what they need, the fewer people make it out there regularly. If people aren't being successful, fewer will bother to go out.

Since the internal combustion engine arrived in the Arctic, most people travel to harvesting areas in conveyances powered by motors—and motors need fuel. Today, a hunter who at one time knew right where to go and always had successful hunts might fall on hard economic times and not have the money for gas or to repair a snow machine or boat motor. It's not uncommon for experienced food gatherers to find themselves in the situation Lee Ballot, Sr., of Noorvik describes (*see* p. 70), where a full-time job is keeping him in the village during some of the best subsistence times of year. More experienced individuals like Lee, though, are likely to know precisely when and where to go to for the best results and can cover a smaller area and come home with a good supply of food.

For all of the above reasons, when applying this study's findings on area covered, it's good to keep in mind that when we report we found someone covers more ground, that should not be taken to assume the person is bringing home more food. At the same time, some people may not get a chance to search far and wide but are very successful in smaller search areas. When considering the effects on a person's knowledge, it is probably safe to assume that villagers who regularly range over large areas of land and water acquire not only information about more places where food can be found but also deeper insights into locations and behaviors of species across a wider selection of terrain types.

## Considerations Regarding Number of Unique Places Searched

### *Going many different places doesn't always mean finding more food.*

Some species, including most marine mammals, caribou, moose, and wolves, cover large areas in search of food or when migrating. As a result, their whereabouts can be hard to pin down, causing hunters to travel across a few large search areas to find them. This is easy to see on the maps for these species (*see, e.g.*, pp. 263, 321, 327, 346). Other species are more dependent on specific habitat, which keeps them in more predictable places: murres tend to favor rocky cliffs facing the ocean; migratory waterfowl like to stay in along the coast and those river or lake banks with good plant cover; snowshoe hare and lynx can usually be found in the brush along riverbeds; berries grow anywhere soil conditions are suitable. People who rely heavily on these foods don't have to go so far to achieve at least some success.

Looking at the tables in the Villages chapter that show what people are eating (*see, e.g.*, pp. 40, 69, 100), we see that

**Coltrane Chase with duck he caught.** Photo credit: Lance Kramer.

berries make up only 1 – 5% of most people's diet. Yet berry picking occurs in many distinct patches. So a person could have many unique search areas but primarily search for one thing at all of those different places. Still, the fact that so many villagers have committed to memory the precise locations of so many different patches to meet their berry-picking goals underscores the important role this traditional activity and food source plays in the cultural habits and diets of borough residents.

While the number of places a person goes to is not the same as the amount of food he or she brings back, it is probably safe to assume that someone who knows of more alternative areas to search when one place lacks abundance may have more overall success than someone who only searches in one or two places. It is also probably safe to assume that that person is bringing home a greater assortment of food and knows more about a broader array of species, including the habitats they prefer and different ways they behave. Villagers who frequent many different areas thus undoubtedly have much to contribute to local and traditional knowledge.

**Checking open lead for whales near Kivalina.**
Photo credit: Myra Wesley.

**"I remember walking past three mountains to hunt caribou, elementary days, walking back three days to haul our catch back to the boat, seining with uncles and aunts, camping out two weeks, making fish qauq nests."**
***Lizzie Hawley, Kivalina***

## Considerations Regarding Number of Unique Species Harvested

### *A good selection doesn't always mean a good supply (but it usually helps).*

The number of unique species that an individual harvests may be an indicator of the person's resilience—someone who can successfully find and harvest many different species will likely be more successful when one population crashes for a period or diverts its migration route out of the hunter's reach. However, similar to the other two study categories discussed above, a person's ability to get a greater variety of food does not automatically mean the person brings a greater quantity of traditional food to the table. Importantly, though, the villager who harvests a greater variety of species likely possesses a great breadth of traditional knowledge.

The kinds of considerations expressed above should be taken into account by policymakers and others when reviewing the study results reported in this atlas. Also, the data reported here are meant to be considered alongside other available data sets, such as the subsistence harvest surveys done by the Alaska Department of Fish and Game.

i

**What do we mean by "Search Area"?**

**When mapping the areas villagers told us they search for subsistence resources, researchers didn't just map the ground a person set foot on or drove a four-wheeler over. In this atlas, "area searched" includes the area a person surveys visually when out hunting, fishing, or gathering—as when standing on high ground looking out over an open valley.**

**The search area isn't always on dry land. In times of the year when lakes and rivers are frozen, caribou will cross the ice on parts of Kotzebue Sound, as well as on Selawik Lake and Kobuk Lake (Hotham Inlet). Ptarmigan and foxes, rabbits, and other furbearers can be found along frozen riverbeds. So, an area searched may frequently include contiguous land and frozen sea or river areas.**

**In addition, expanses of water and ice surveyed by a bird, seal, or whale hunter from a blind are considered part of the "search area" for a hunt.**

**Fishing search areas covered clusters of individual point locations that, in the minds of the participants, collectively delineated a place they like to go to.**

**Alan Sheldon of Noorvik hunting brant.** Photo credit: Rebecca Wesley.

**Tyler Kramer with his father's catch.** Photo credit: Lance Kramer.

# Methods, Part 2: Mapping Important Areas for Species

## Bringing Together Local Expert Knowledge and Tracking, Survey, and Other Data

In the second phase of this project, researchers met with local advisory groups to gather and document local and traditional knowledge on the locations of species that make up a significant part of villagers' diets in the seven communities. We prepared base maps for each community and put together lists of traditional food sources that make up 10% or more of the traditional foods consumed in each village. We then met with local advisory groups who indicated on maps where they knew different animals, fish, and birds to be during different seasons and the activities they observed the species involved in there (feeding, rearing, etc.)

As described above, in the first part of this study, we mapped harvesters' search areas and reports of species locations and seasonal behaviors based solely on villagers' local and traditional knowledge. In the second phase, researchers conducted a comprehensive literature review of available studies on species found in and around Kotzebue Sound and the U.S. southern Chukchi Sea. Findings from those studies were then compared to the wealth of local knowledge they had gathered from the hunters, fishers, and gatherers on the local advisory groups. All of the findings from all sources[25] were then digitized and a new set of maps prepared and brought before a group of local experts (a subgroup of the local advisory groups) in a two-day workshop in Kotzebue. At the workshop, the maps were once again refined based on local experts' input. The results of this process are reported in the narrative and maps in Chapter 4: Important Areas for Marine and Coastal Species.

The maps in chapter 4 portray the universe of information that was gathered during phase 2 of the study, including local and traditional knowledge of species locations and behaviors, aerial and boat surveys, satellite and radio tracking results, sampling data on benthic biomass and water column chlorophyll-*a* concentrations (an indicator of primary production), and other data. A more detailed description of the methods researchers used to evaluate and score specific map polygons so they could assess an area's importance to subsistence users and subsistence species in the study's marine areas is provided below and in Appendix H.

**What's an "IEA"?**

**Some places in the Borough today are not only abundant in one or several species, but contain organisms that those species need to thrive. These places are known by locals to be particularly precious. When, in this atlas, researchers use the term Important Ecological Area, or "IEA," they are referring to these locations.**

**We define an "important ecological area" as a geographical region that is important for the reproduction, rearing, feeding, migration, or general health of a given species"— the definition recommended by the project's Local Knowledge Specialist, Lance Kramer.**

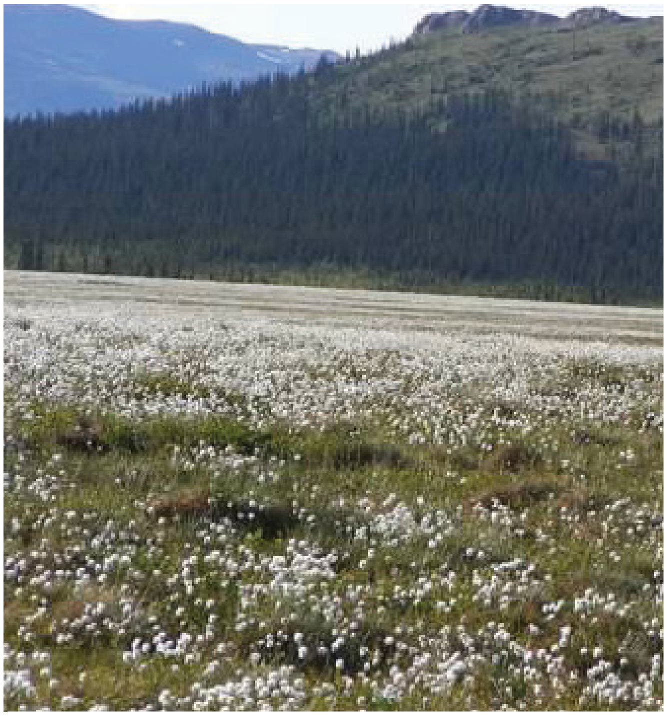
**By knowing where they are, decision makers will be better able to take care of these places when planning for future development.**

**"Subsistence means more than words can describe. It is not just how we eat, or how we put food on the table. It is a passion that is instilled in our way of living from the day we are born. It is a connection between our ancestors and who we are today. Traditional healing from inside out."**

***Josephine Howarth, Kotzebue***

## Identifying Importance

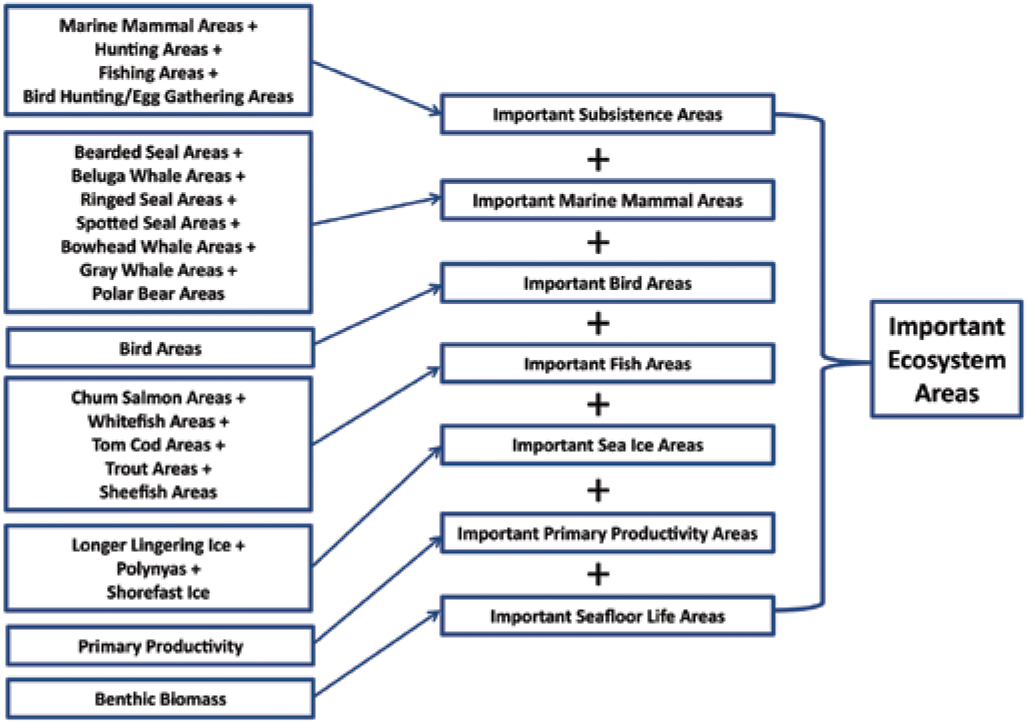
The local and traditional knowledge mapped in this project, considered alongside the publicly available information gathered during researchers' review of the literature, informed our understanding of the locations of important areas for subsistence harvesting and the various species and organisms that contribute to the seasonal subsistence cycle. We defined an important area for a species as "an area important for the reproduction, rearing, feeding, migration, or general health of a given species"—the definition recommended by the project's Local Knowledge Specialist, Lance Kramer.



**Schaeffer Camp Ivik.** Photo credit: Polly Aġruk Schaeffer.

# Identifying Important Areas: A Difficult but Necessary Process

Any effort to attach the label "important" to particular places, species, or organisms within a complex ecosystem will be framed by the context surrounding that effort. Here, we describe some of the considerations that framed our effort to prepare scientifically defensible maps of important areas for subsistence species that could help guide borough planners and others in making informed resource management decisions in the coming years.




## The Process Is Inherently Subjective and Requires Prioritizing

Deciding what is "important" necessarily requires a value judgment. Recognizing the essentially subjective nature of valuation, various stakeholder groups typically presume differing sets of assumptions as to what is important. While everyone who participated in this project believes the entire ocean is important, to stop there is to stop short of our task, which involves providing informed guidance to future decision makers faced with difficult resource management decisions. Spatial distributions of most species and ecological features, whether areas of primary productivity, places desirable for reproduction, migration corridors, or a host of other features, are neither random nor even, but vary considerably across the ocean. Prioritization is thus a fundamental part of any effort to identify important areas for species and other organisms.

## Scales of Space, Time, and Ecological Complexity Matter

Places, processes, and time frames deemed important on small scales may seem considerably less so on larger scales. Establishing scales at the outset of any analysis of important areas is fundamental. In this study, we thus had to identify (1) the spatial region under consideration; (2) the time frame within which ecological data, such as that on species populations and movements, would be considered relevant; and (3) the degree of precision—the level of detail concerning species behaviors, location in the food chain, and other factors that would constitute acceptable ecological complexity for purposes of evaluating and integrating data when scoring important areas for the chapter 4 analysis maps.

## Aggregation Plays a Central Role in Multiple Species and Ecosystem Important Areas

Correlation among distributions of marine species often arises from the widely varying distribution of primary productivity, the basis for marine food webs, and habitat. Regions of high primary productivity, such as upwelling zones, recurring fronts, and shallow shelves receiving a steady supply of nutrients, attract species on the higher rungs of the marine food ladder, resulting in regions of high abundance for many species and a diversity of species. Whether talking about seals looking for shellfish to eat or humans looking for seals to eat, biological entities gather where there is a good food supply and, when places that are good for reproduction, shelter, and other life-sustaining needs are found nearby to good feeding grounds, the result is a very rich area for all concerned. As a result, various organisms tend to *aggregate* in these locations. Much can be inferred about the environment by determining when and where species gather in this way. Identifying areas of such aggregation among a diverse array of species interacting within an intricate marine food web lies at the heart of identifying areas of importance—for subsistence harvesters, an array of species, and the ecosystem overall—and can sometimes help to fill data gaps.

### Determinations of Importance Are Constrained by the Limits of Available Knowledge

No matter what method is used for identifying an important area, it is all but certain that some very important places will be overlooked because of our rudimentary knowledge of marine ecosystem composition, functioning, and dynamics, often made worse by insufficient, inconsistent, or sporadic sampling or other gathering of knowledge across the vast area a particular species may occupy. Our effort to identify important areas for subsistence and species should therefore be explicitly viewed as our identifying areas we currently think are important, as opposed to our claiming definitive and absolute results. Recognition of this distinction allows for expansion of scientific assumptions about how to identify an important ecological area, while underlining the need for flexibility.

All of the above considerations influenced our identification of the important ecological areas shown on maps in chapter 4. The step-by-step process we used to score the relative importance of subsistence areas, marine multiple species important areas and ecosystem important areas is explained in detail in Appendix H.

In addition to identifying important areas for subsistence harvesters and individual subsistence species, we also identified areas important to multiple species ("multi-species IEAs") and important areas for invertebrates, algae, and primary production—organisms that play an essential role in the ecosystem. "Multi-species IEAs" are areas that are home to above-average densities of multiple species, and "ecosystem IEAs" are those areas that host above-average densities of ecosystem features (i.e., human subsistence users, marine mammals, seabirds, fish, seafloor life, primary production, and important habitat features).[26] At the ecosystem level, we wanted to identify the areas that contain a complex of supportive attributes, such as primary production hotspots that attract high densities of fish, seabirds, and marine mammals, because these areas likely contribute disproportionately to the overall health of the region's ecosystem.

**"Native communities' bank account is how much food you have stored.  Western culture's bank account is money oriented and Native communites' account is food oriented."**

***Leroy T. Adams, Kivalina***

**At the ecosystem level, we wanted to identify the areas that contain a complex of supportive attributes, such as primary production hotspots that attract high densities of fish, seabirds, and marine mammals, because these areas likely contribute disproportionately to the overall health of the region's ecosystem.**

**Selawik students pulling net.**
Photo credit: Norma Ballot.

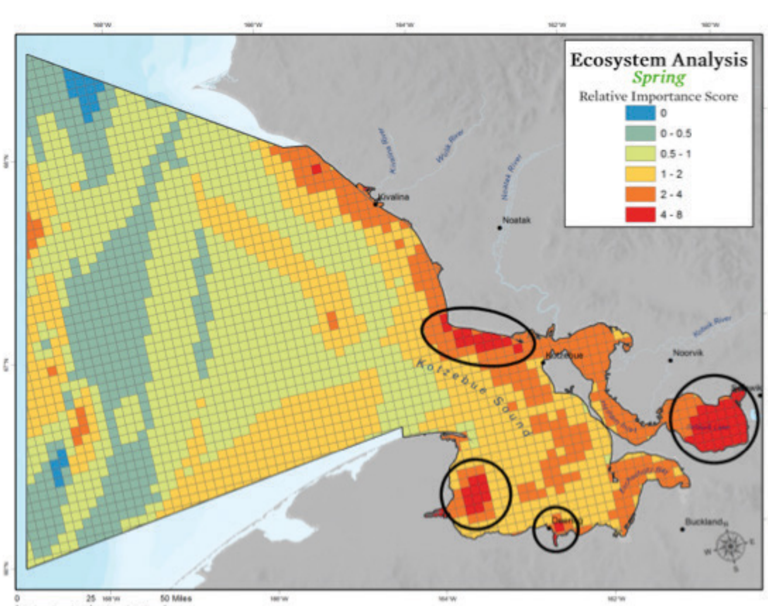
# Scoring of Importance on the Analysis Maps in Chapter 4

Maps of coastal and marine species in chapter 4 show locations of individual species based on available information from an array of sources, including local and traditional knowledge gathered from village participants, advisory group members, and experts at the Kotzebue workshops. To determine which areas hold particular importance for subsistence (IEAs), the data reflected on individual species maps were grouped (e.g., whales, seals, and polar bears were combined on the marine mammal IEA maps on pp. 459-463), and new "analysis" maps were made to show species densities in the coastal and marine environment in and around Kotzebue Sound and the southern Chukchi Sea.

The "Relative Importance Score" shown in the map legends for the analysis maps is based on the number of important areas for multiple species, or for the ecosystem overall, in a given location. More overlapping important ecological areas ("IEAs") result in a higher importance score. As explained in detail in Appendix H, we used an analysis to weight each species evenly. The scores for each grid cell correspond to the values from the analysis, resulting in a range of scores for every single grid cell in the study area. The score in a grid cell does not reflect the actual number of important areas in it. Rather, the number is a *relative measure* of important areas in one grid cell compared to another grid cell.

Taking the below-pictured Spring Ecosystem Analysis map from page 516 as an example, the red areas (circled) in and around Selawik Lake, Sisualik, Goodhope Bay, and Deering have the highest values, with scores between 4 and 8. This means that, in the spring time, these areas have the highest numbers of important areas for species of marine mammals and fish, subsistence activities, and other aspects of the ecosystem. Conversely, areas with a lower score have fewer overlapping important areas. The lower scores do not mean an area is unimportant. Rather, with the information available, looking at these areas on a relative scale, it means that fewer species, or places good for types of activities species engage in (feeding, mating, resting, etc.), are located in these areas when compared to other spring hotspots like Sisualik.

It should also be noted that, while the individual species maps (marine and terrestrial) cover areas around up-river villages in this study, the analysis maps focus on the marine environment, beginning near the coastline and extending out into Kotzebue Sound and the southern Chukchi Sea.




All of the analysis maps were reviewed and refined by local experts at the Kotzebue workshop in October of 2014.

# The Local Expert Workshop

At the two-day workshop held in Kotzebue in October 2014, local experts reviewed individual species maps and maps of important ecological areas (IEAs) that had been prepared using local and traditional knowledge documented in the villages, along with findings from other studies, as explained above. Representatives of all seven participating villages took part in the workshop. Over the two days, experts worked in three small groups to review and edit our seasonal maps of beluga, bearded seal, ringed seal, spotted seal, salmon, trout, tomcod, whitefish, and sea ice.

The experts were divided into three small groups, which reviewed and edited each of the numerous paper maps of species distributions and ice conditions. The goal of the review was to add important observations that were missing from the maps, as well as to identify any mapped information that didn't appear to the experts to be accurate. Adjustments were made on the maps themselves while all relevant information was recorded on mapping forms.

The images on the right show samples from the workshop.

**Fig. 1.1 shows a note-taking form on which researchers recorded information they received from local experts regarding whitefish locations.**

**Fig. 1.2 shows those changes drawn on a Mylar® map overlay.**

**Fig. 1.3 shows the whitefish spring migration map (*see* final map in chapter 4, at p. 481), with the experts' additions marked.**

After the workshop, project staff digitized the edits made to the maps by the local experts, consulting closely with the village coordinators and researchers who had recorded the information at the workshop, to ensure all map edits correctly portrayed the experts' input. Once approved, the changes and supporting information were stored in a database and used to produce the final maps in chapter 4.

*A list of Iñupiaq and scientific names for all studied species is provided at Appendix J.*

# A Closing Note on Scoring Importance

The maps resulting from the information gathered in this study reflect our analysis of currently relevant and available data. If an area does not score high on an analysis map in chapter 4, it simply means that the existing, often limited, data do not indicate the area is of high *relative* importance for a particular activity, species, ecological feature, or the overall ecosystem, according to study results. This is not the same as saying an area is unimportant.

**FIG. 1.1** NOTE TAKING FORM

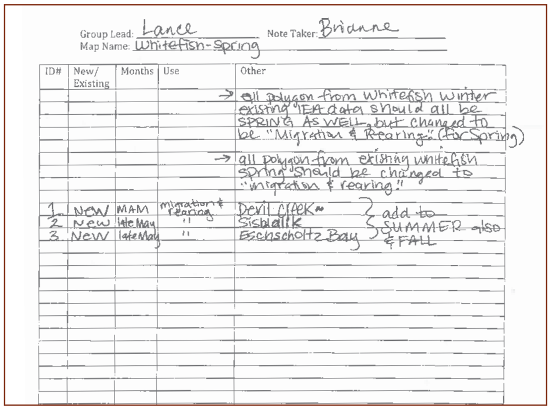



**FIG. 1.2** MYLAR® MAP OVERLAY

**FIG. 1.3** MAP WITH ADDITIONS MARKED

# Conclusion

The maps, along with the histories, local voices, and narrative discussions of data findings and analyses in this atlas, represent the efforts of over 200 borough residents who stepped forward to contribute their knowledge to this ambitious project. After many years of conceiving and designing innovative methods to transfer villagers' harvesting experiences and knowledge onto maps that could be referenced by stakeholders and planners as they craft a sustainable borough economy for the 21st century, an array of local experts, researchers, cartographers, ethnographers, photographers, videographers, writers, editors, and graphic designers from around the Borough and the state successfully executed this task.

Study methods employed to create this atlas included gathering oral evidence, transferring people's personal and cultural truths onto maps, and checking and re-checking the results to ensure accuracy. We then deployed assurance measures, ranging from running an array of sophisticated statistical models to sitting down to engage in long conversations with elders about what happens where in their world. Along the way, the maps integrated additional local and traditional knowledge. This multi-faceted review process proved extremely important in combining various outside studies done on species and other environmental elements with what people who live in the Borough see happening around them every day.

In designing the multi-dimensional methodology that led to the atlas you are reading, it may have been difficult for those involved at the outset to envision how all of the study's findings would be reported back to village participants and other interested parties. In the next chapter, we leave the world of study methods and statistical calculations to enter the histories and modern-day food gathering, preserving, and sharing routines of the people of the seven Iñupiaq villages whose lives are portrayed on the maps in this atlas.

i

**In the latest stages of this project, we have done our best to organize the study's complex methods and findings in a way that not only complements the maps but also respectfully relays the outcome of the hard work so many borough residents contributed. In trying to make this volume readable, we have moved the most technical discussions to notes and appendices, which we encourage the scientific community, planners, and policymakers to pay close attention to.**

**Beluga harvest near Kotzebue.** Photo credit: Wendie Schaeffer.

1. Nowacki, G. J., P. Spencer, T. Brock, M. Fleming, and T. Jorgenson. 2001. Ecoregions of Alaska and neighboring territories. U.S. Geological Survey Miscellaneous Investigations series I map.
2. U.S. Coast and Geodetic Survey, 1929. http://geodesy.noaa.gov/. Accessed 1 January 2015.
3. Archaeologists generally agree that human occupation on the American side of the Bering Strait dates back to at least 14,000 years ago. While this debate is beyond the scope of this atlas, we refer interested readers to a number of related research articles:

   Dixon, E. James. 1999. Bones, Boats and Bison: Archeology and the First Colonization of Western North America. University of New Mexico Press, Albuquerque.

   Dixon, E. James 2013. Arrows and Atl Atls: A Guide to the Archeology of Beringia. U.S. Dept. of the Interior, National Park Service.

   Elias, Scott A. 1995. The Ice-Age History of Alaska National Parks. Smithsonian Institution Press, Washington.

   Hoffecker, J.F. and S.A. Elias. 2007. Human Ecology of Beringia. Columbia University Press, New York.

   Holmes, Charles E., Richard VanderHoek, and Thomas E. Dilley. 1996. Swan point. American Beginnings: The Prehistory and Palaeoecology of Beringia 319-323. University of Chicago Press, Chicago.

   Larsen, Helge. l968. Trail Creek, final report of the excavations of two caves on Seward Peninsula. Acta Arctica, Fasc. XV, Copenhagen.

   O'Neill, Dan. 2004. The Last Giant of Beringia: The Mystery of the Bering Land Bridge. Westview Press, Boulder.
4. Burch, E. 1998. The Iñupiaq Eskimo Nations of Northwest Alaska. Fairbanks: University of Alaska Press.
5. Ibid.
6. Wolfe, R. J. 1996. Subsistence food harvests in rural Alaska, and food safety issues. Paper presented to the Institute of Medicine, National Academy of Sciences Committee on Environmental Justice. Spokane, WA. Aug. 13, 1996; Thériault, S., G. Otis, G. Duhaime, and C. Furgal. 2005. The legal protection of subsistence: a prerequisite of food security for the Inuit of Alaska. Alaska Law Review 22:35-87.
7. Wolfe, 1996; Magdanz, J. S., C. J. Utermohle, and R. J. Wolfe. 2002. The production and distribution of wild food in Wales and Deering, Alaska. Technical Paper 259. Division of Subsistence; Alaska Department of Fish and Game, Juneau.
8. Wolfe 1996; Johnson, J. S., E. D. Nobmann, E. Asay, and A. P. Lanier. 2009. Dietary intake of Alaska Native people in two regions and implications for health: the Alaska Native dietary and subsistence food assessment project. International Journal of Circumpolar Health 68:109-122.
9. Wolfe 1996, 10:5n-3 and 22:6n-3; Johnson et al. 2008.
10. Receveur, O., M. Boulay, and H. V. Kuhnlein. 1997. Decreasing traditional food use affects diet quality for adult Dene/Métis in 16 communities of the Canadian Northwest Territories. The Journal of Nutrition, 2179-2186.
11. Caulfield, R. 2002. Food security in Arctic Alaska: a preliminary assessment. Sustainable Food Security in the Arctic. State of Knowledge, 75-94; Thériault et al. 2005.
12. Methods for this study were first designed in 2011 by Brandon Chapman, PhD, who served as the project anthropologist for the first two years. Dr. Chapman's methods design was submitted for peer review to a panel of scientists all of whom had experience working in the Arctic: Henry Huntington, PhD (Science Director Arctic Projects, Pew Charitable Trusts); Susan Georgette (Selawik National Wildlife Refuge, U.S. Fish and Wildlife Service); Sveta Yamin-Pasternak, PhD (Department of Anthropology and Institute of Northern Engineering, University of Alaska Fairbanks and Resilience and Adaptive Management Group, University of Alaska Anchorage); Jim Magdanz (Alaska Department of Fish and Game, Division of Subsistence); and David Driscoll, PhD (Director, University of Alaska Anchorage, Institute for Circumpolar Health Studies and Associate Dean for Research at College of Health, University of Alaska Anchorage). Damian Satterthwaite-Phillips, PhD, who served as the project anthropologist for the final two years, synthesized revisions suggested by the panel and incorporated his own revisions to the methods design, and reviewers' feedback was again incorporated and another methods design draft was written and approved by both the research team and the peer reviewers in 2013. During the course of the project, as changes or amendments were made to the methods, these were also submitted to reviewers whenever time constraints allowed.
13. As noted earlier in the Introduction, these seven of the Borough's 11 communities were selected for this study because they are located nearest to the Chukchi Sea and have been defined as "coastal" by the U.S. Fish and Wildlife Service's Coastal Impact Assistance Program (CIAP), which provided funding for this project. Borough planners recognize that people who live in its four remaining villages participate in many of the traditional activities reported by residents in this volume and are anticipating many of the changes that the seven communities studied here see coming. While we hope this atlas will be useful and interesting to people in those communities, the Borough also recognizes the need to determine where and when people hunt, fish, and gather around the four remaining villages, and we hope to study and map these areas as well.
14. *See* Tobias, T. N. 2009. Living Proof: The Essential Data-Collection Guide for Indigenous Use and Occupancy Map Surveys. Vancouver, Canada: Ecotrust Canada & Union of BC Indian Chiefs; Braund 2011. Numerous studies of this kind have been done in various regions of the world (*see, e.g.*, Nietschmann 1994; Aldenderfer and Maschner 1996; Aswani and Lauer 2006 inter alia), including mapping of marine mammal, fish, and land mammal habitat areas across the North Slope of Alaska (Braund 2011) and identifying land use and harvest sites on First Nations' lands in Canada (Tobias 2000).
15. The subsistence maps in this atlas are based on reported search areas; while other details of individual subsistence patterns informed this study overall, they are not presented in detail in this volume.

16. Researchers in this study decided on one-on-one interviews as the preferred method for initial data gathering for a number of reasons. In group interviews, complicated group dynamics may arise that might influence individual openness and candor. For example, individuals may defer to community leaders or stay quiet in order not to publicly contradict another person. In one-on-one interviews, each informant had the opportunity to express his or her own views on each matter without interruption or influence of other community members. A secondary benefit of individual interviews is that they provided a measure of interpersonal variation in responses.
    Nevertheless, group interviews have benefits of their own. In particular, the process of open discussion can help access collective memory. As one person comments on a topic, other participants may be reminded of memories and events they may not have recalled on their own, resulting in a more comprehensive identification of important sites.
17. In a "snowball sampling" process, existing recruits are called on to recommend additional recruits (Bernard 2011).
18. Nakashima, D. J., and D. J. Murray. 1988. The common eider *(Somateria mollissima sedentaris)* of Eastern Hudson Bay: a survey of nest colonies and Inuit ecological knowledge. Ottawa, Canada: Environmental Studies Revolving Fund Report No. 102; Nakashima, D. J. 1990. Application of native knowledge in EIA: Inuit, eiders, and Hudson Bay oil. Ottawa, Canada: Canadian Environmental Assessment Research Council.
19. *See* Huntington, H. P. 1998. Observations on the utility of the semi-directive interview for documenting traditional ecological knowledge. Arctic 51:237-242.
20. For the subsistence interviews, these data were solicited only as the opportunity arose, i.e., when the interviewee mentioned them. In contrast, such matters as migration routes and breeding/spawning grounds were systematically documented in chapter 4, which discusses and presents maps showing important areas for species.
21. Following Tobias (2009), the researcher, rather than the study participant, actually marked the Mylar® overlays, using a system of lines, polygons, and points. These symbols played an important role in ensuring the data would be digitized accurately. While villagers were encouraged to study and point out information on the maps, individual marking of areas would have reflected personal systems of demarcation that would have been impossible to digitize uniformly for accurate mapping.
22. The methods for this part of the project are currently pending review for publication in a peer-reviewed scientific journal. In the meantime, the methods are available at the following URLs, which will be updated as the review process continues:
    http://www.nwabor.org/subsistence_mapping_project_methods_AppendixE.pdf
    http://www.nwabor.org/pdfs/subsistence_mapping_project_methods_Appendix_E.pdf
    http://www.phillips-research.com/pdfs/subsistence_mapping_project_methods_Appendix-E.pdf
23. The demographic make-up here is such that overall demographic representativeness is best preserved.
24. ArcGIS Desktop. 2014. v. 10.2.2. QGIS software was used to prepare the maps of search areas and species based on data collected in interviews with village participants and advisory groups in the first part of the study.
25. Some of the research reflected on the maps in this atlas was gathered in a cooperative effort between Audubon Alaska and Oceana and published in the Arctic Marine Synthesis. *See* Smith, M. A. 2010. Arctic Marine Synthesis: Atlas of the Chukchi and Beaufort Seas. Audubon Alaska and Oceana, Anchorage, Alaska. This volume also contains additional and newly available information gathered from ongoing or recently concluded studies, including Audubon Alaska's updated analysis of pelagic Important Bird Areas (*See* Smith, M., N. Walker, C. Free, M. Kirchhoff, N. Warnock, A. Weinstein, T. Distler, and I. Stenhouse. 2012. Marine Important Bird Areas in Alaska: Identifying Globally Significant Sites Using Colony and At-Sea Survey Data. Audubon Alaska, Anchorage, AK) as well as further reviews of other studies.
26. In some cases, the species maps in chapter 4 were created by extrapolating from or interpreting existing data, either by the original authors of the studies or by our scientists and researchers. Calculations for estimating areas of above average densities and areas important to the health of a species were, in some cases, such as benthic biomass or water column algae, carried out by extrapolating from point samples to the surrounding landscape with standard computer software mapping tools, such as inverse distance weighting, found in ArcMap 10.0. The extrapolation produces a continuous distribution of a variable (e.g., benthic biomass) across the landscape. We used the continuous distribution to estimate if areas were above or below average for a particular variable. *See* Appendix H for discussion of weighting methodology.