Seismic Survey Mitigation Measures: Arctic Ocean

The mitigation measures which follow are: (1) consistent with environmental policy as required by the National Environmental Policy Act (NEPA), Endangered Species Act (ESA), and Marine Mammal Protection Act (MMPA); and (2) comply with 40 CFR 1500.2(f) regarding the requirements for Federal agencies to avoid or minimize any possible adverse effects of their actions upon the quality of the human environment. The mitigation measures also fulfill Minerals Management Service's (MMS) statutory mission and responsibilities, i.e., to permit and authorize seismic surveys that are technically safe and environmentally sound while considering environmental, technical, and economic factors.

The following mitigation measures (in concert with applicable MMS's standard stipulations, http://www.mms.gov/alaska/re/permits/stips1-5.htm) are to be implemented:

- No solid or liquid explosives shall be used without specific approval.
- Permittee operations shall be conducted in a manner to ensure that they will not cause pollution, cause undue harm to aquatic life, create hazardous or unsafe conditions, or unreasonably interfere with other uses of the area. Any difficulty encountered with other uses of the area or any conditions that cause undue harm to aquatic life, pollution, or could create a hazardous or unsafe condition as a result of the operations under this permit shall be reported to the Regional Supervisor/Resource Evaluation. Serious or emergency conditions shall be reported without delay.
- Permittee operations shall maintain a minimum spacing of 15 miles between the seismic-source vessels for separate operations. The MMS must be notified by means of the weekly report whenever a shut down of operations occurs in order to maintain this minimum distance.
- Permittee operators shall use the lowest sound levels feasible to accomplish their data-collection needs.
- Vessels and aircraft shall avoid concentrations or groups of whales. Permittee operators shall, at all times, conduct their activities at a maximum distance from such concentrations of whales. Under no circumstances, other than an emergency, shall aircraft be operated at an altitude lower than 1,000 feet above sea level (ASL) when within 1,500 lateral feet of groups of whales. Helicopters shall not hover or circle above such areas or within 1,500 lateral feet of such areas.
- When weather conditions do not allow a 1,000-foot ASL flying altitude, such as during severe storms or when cloud cover is low, aircraft may be operated below the 1,000-foot ASL altitude stipulated above. However, when aircraft are operated at altitudes below 1,000 feet ASL because of weather conditions, the operator must avoid known whale-concentration areas and should take precautions to avoid flying directly over or within 1,500 feet of groups of whales.
- When the Permittee operates a vessel near a concentration of whales, every effort and precaution shall be taken to avoid harassment of these animals. Therefore, vessels shall reduce speed when within 900 feet of whales and those vessels capable of steering around such groups should do so. Vessels shall not be operated in such a way as to separate members of a group of whales from other members of the group.
- Vessel operators shall avoid multiple changes in direction and speed when within 900 feet of whales. In addition, operators shall check the waters immediately adjacent to a vessel to ensure that no whales will be injured when the vessel's propellers (or screws) are engaged.
- Small boats shall not be operated at such a speed as to make collisions with whales likely. When weather conditions require, such as when visibility drops, vessels shall adjust speed accordingly to avoid the likelihood of injury to whales.
- When any operator becomes aware of the potentially harassing effects of operations on whales, or when any operator is unsure of the best course of action to avoid harassment of whales, every measure to avoid further harassment shall be taken until the National Marine Fisheries Service

(NMFS) is consulted for instructions or directions. However, human safety shall take precedence at all times over the guidelines and distances recommended herein for the avoidance of disturbance and harassment of whales.

- The Permittee shall notify MMS, NMFS, and U.S. Fish and Wildlife Service (FWS) in the event of any loss of cable, streamer, or other equipment that could pose a danger to marine mammals and other wildlife resources.
- Seismic cables and airgun arrays shall not be towed in the vicinity of fragile biocenoses (e.g., the Boulder Patch, kelp beds), unless MMS determines the proposed operations can be conducted without damage to the fragile biocenoses. Seismic-survey and support vessels shall not anchor in the vicinity of fragile biocenoses as identified by MMS or may be discovered by the operator during the course of their operations, unless there is an emergency situation involving human safety and there are no other feasible sites in which to anchor at the time. The Permittee shall report to MMS any damage to fragile biocenoses as a result of their operations.
- To help avoid causing bird collisions with seismic survey and support vessels, seismic and surface support vessels will minimize the use of high-intensity work lights, especially within the 20-meter-bathymetric contour. High-intensity lights will be used only as necessary to illuminate active, on-deck work areas during periods of darkness or inclement weather (such as rain or fog), otherwise they shall be turned off. Deck lights, interior lights, and lights used during navigation could remain on for safety.[1]
- All bird collisions (with vessels and aircraft) shall be documented and reported within 3 days to MMS. Minimum information shall include species, date/time, location, weather, identification of the vessel or aircraft involved and its operational status when the strike occurred. Bird photographs are not required, but would be helpful in verifying species. Permittees/operators are advised that the FWS does not recommend recovery or transport of dead or injured birds due to avian influenza concerns.

The following monitoring and mitigation measures are related to the requirements of the MMPA and ESA. However, final mitigation and monitoring requirements defined in any NMFS (the Federal agency having MMPA management authority for cetaceans and pinnipeds, less Pacific walrus) and FWS (the Federal agency in having MMPA management authority for Pacific walrus, polar bear, and sea otter) ITA and/or Letters of Authorization (LOA) obtained by the seismic survey operator will have precedence over any related measures listed below:

- **Exclusion Zone** – A 180/190 dB isopleth exclusion zone from the seismic-survey sound source shall be free of marine mammals before the survey can begin and must remain free of marine mammals during the survey. The purpose of the exclusion zone is to protect marine mammals from Level A harassment (injury).The 180 dB applies to cetaceans and the Pacific walrus, and the 190 dB applies to pinnipeds other than the Pacific walrus. The exclusion zones specified in ITAs and/or LOAs will take precedence over the MMS-identified exclusion zones.
- **Monitoring of the Exclusion Zone** – Individuals (marine mammal biologists or trained observers) shall monitor the area around the survey for the presence of marine mammals to maintain a marine mammal-free exclusion zone and monitor for avoidance or take behaviors. Visual observers monitor the exclusion zone to ensure that marine mammals do not enter the exclusion zone for at least 30 minutes prior to ramp up, during the conduct of the survey, or before resuming seismic-survey work after shut down. The NMFS will set specific requirements for the marine mammal monitoring program and observers.

[1] Nothing in this mitigation measure is intended to reduce personnel safety or prevent compliance with other regulatory requirements (e.g., U.S. Coast Guard or Occupational Safety and Health Administration) for marking or lighting of equipment and work areas.

- **Shut Down/Power Down** – A seismic survey shall be suspended until the exclusion zone is free of marine mammals. All observers shall have the authority to, and will, instruct the vessel operators to immediately stop or de-energize the airgun array whenever a marine mammal is seen within the exclusion zone or to power down to a sound level where the marine mammal in no longer in the exclusion zone. If the airgun array is completely powered down for any reason during nighttime or poor sighting conditions, it shall not be re-energized until daylight or whenever sighting conditions allow for the exclusion zone to be effectively monitored from the source vessel and/or through other passive acoustic, aerial, or vessel-based monitoring.
- **Ramp Up** – Ramp up is the gradual introduction of sound to deter marine mammals from potentially damaging sound intensities and from approaching the exclusion zone. This technique involves the gradual increase (usually 5-6 dB per 5-minute increment) in emitted sound levels, beginning with firing a single airgun and gradually adding airguns over a period of 20-to-40 minutes, until the desired operating level of the full array is obtained. Ramp-up procedures may begin after observers ensure the absence of marine mammals for at least 30 minutes. Ramp-up procedures shall not be initiated when monitoring the exclusion zone is not possible. A single airgun operating at a minimum source level can be maintained for routine activities, such as making a turn between line transects, for maintenance needs or during periods of impaired visibility (e.g., darkness, fog, high sea states), and does not require a 30-minute clearance of the exclusion zone before the airgun array is again ramped up to full output.
- **Field Verification** – Before conducting the survey, the operator shall verify the radii of the exclusion zones within real-time conditions in the field. This provides for more accurate exclusion-zone radii rather than solely relying on modeling techniques before entering the field. When moving a seismic-survey operation into a new area, the operator shall verify the new radii of the exclusion zones by applying a sound-propagation series.
- **Reporting Requirements** – Operators must report immediately any shut downs/power downs due to a marine mammal entering the exclusion zones and provide the regulating agencies and MMS with information on the frequency of occurrence and the types and behaviors of marine mammals (if possible to ascertain) entering the exclusion zones.
- **Spring Lead System** – In order to provide bowhead whale and walrus cow/calf pairs additional protection, and unless authorized under the MMPA by NMFS and FWS, seismic surveys shall not occur in the Chukchi Sea spring lead system – as defined by NMFS – before July 1.
- **Ledyard Bay Critical Habitat Unit (Unit)** – Except for emergencies or human/navigation safety, surface vessels associated with seismic survey operations shall avoid travel within the Unit between July 1 and November 15. To the maximum extent practicable, aircraft supporting seismic survey operations shall avoid operating below 1,500 feet ASL over the Unit between July 1 and November 15. Vessel travel within the Unit and altitude deviations by aircraft over the Unit for emergencies or human safety shall be reported within 24 hours to MMS.
- **Walrus-** Vessels and aircraft should avoid concentrations or groups of walruses. Operators should, at all times, conduct their activities at a maximum distance from such aggregations. Seismic-survey and associated support vessels shall observe a 0.5-mile safety radius around Pacific walrus groups hauled out onto land or ice. Under no circumstances, other than an emergency, should aircraft be operated at an altitude lower than 1,500 feet ASL when within 0.5-mile of walrus groups. Helicopters may not hover or circle above such areas or within 2,500 lateral feet of such areas.
- **Polar Bear –** Seismic survey operators shall adhere to any mitigation measures identified by the FWS to protect polar bears from being harassed and/or injured.

The following mitigation measures may reduce further the potential for adverse environmental impacts. The specific measures identified in NMFS and FWS ITA's will apply, where applicable, including protocols for monitoring programs.

- A 120-dB monitoring (safety) zone for bowhead whales in the **Beaufort Sea** will be established and monitored, once 4 or more bowhead whale cow/calf pairs are observed at the surface during an aerial monitoring program within the area to be seismically surveyed during the next 24 hours. No seismic surveying shall occur within the 120-dB safety zone around the area where the whales were observed until two consecutive surveys (aerial or vessel) indicate they are no longer present within the 120-dB safety zone of seismic surveying operations.
- A 120-dB aerial monitoring zone for bowhead whales in the **Chukchi Sea** will be established and monitored: (1) once 4 or more migrating bowhead whale cow/calf pairs are observed at the surface during the vessel research monitoring program; (2) once Barrow whalers notify NMFS or MMS that bowhead whale cow/calf pairs are passing Barrow, or (3) on September 25th, whichever is earliest. Once notified by NMFS or MMS, a daily aerial survey will occur (weather permitting) within the area to be seismically surveyed during the next 24 hours. Whenever 4 or more migrating bowhead whale cow/calf pairs are observed at the surface during an aerial monitoring program, no seismic surveying shall occur within the 120-dB monitoring zone around the area where the whales were observed by aircraft until two consecutive surveys (aerial or vessel) indicate they are no longer present within the 120-dB safety zone of seismic surveying operations.
- A 160-dB vessel monitoring zone for bowhead and gray whales will be established and monitored in the **Chukchi Sea** during all seismic surveys. Whenever an aggregation of bowhead whales or gray whales (12 or more whales of any age/sex class that appear to be engaged in a non-migratory, significant biological behavior (e.g. feeding, socializing) are observed during an aerial or vessel monitoring program within the 160-dB safety zone around the seismic activity, the seismic operation will not commence or will shut down immediately until two consecutive surveys indicate such whales are no longer present within the 160-dB safety zone of the seismic-surveying operations.
- Dedicated aerial and/or vessel surveys, if determined by NMFS to be appropriate and necessary, shall be conducted in the **Beaufort and Chukchi seas**, during the fall bowhead whale-migration period to detect bowhead whale cow/calf pairs, and to detect aggregations of feeding bowhead and gray whales. The protocols for these aerial and vessel monitoring programs will be specified in the MMPA authorizations granted by NMFS.
- Survey information, especially information about bowhead whale cow/calf pairs or feeding bowhead or gray whales, shall be provided to NMFS as required in ITA's and will form the basis for NMFS determining whether additional mitigating measures, if any, will be required over a given time period.
- To avoid significant additive and synergistic effects from simultaneous seismic-survey operations that might hinder the migration of bowhead whales, NMFS and MMS will review the seismic-survey plans and may require special restrictions, such as additional temporal or spatial separations.

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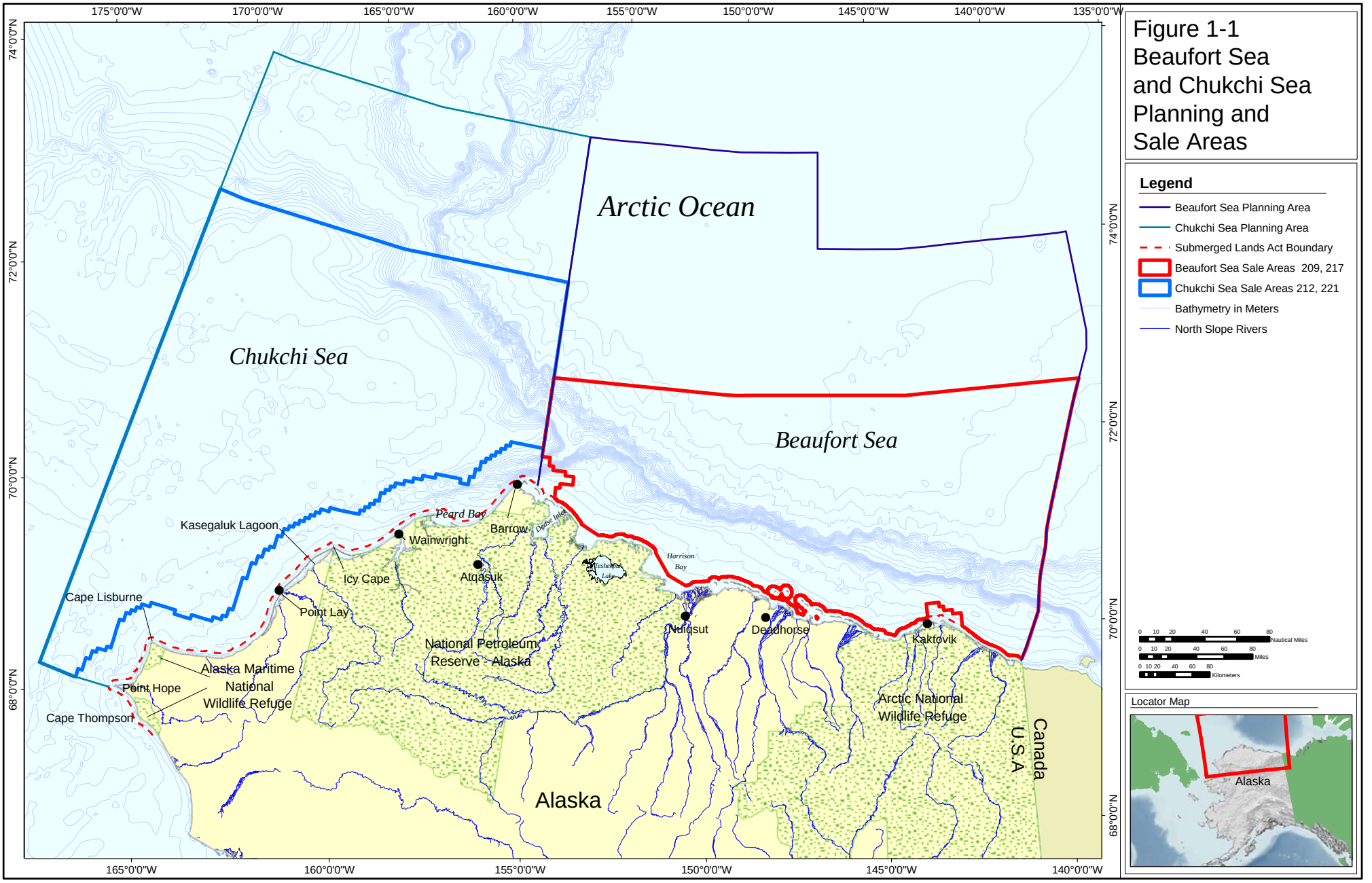
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Peard Bay
Barrow
Wainwright
Icy Cape
Atqasuk
Point Lay
Cape Lisburne
Point Hope
Cape Thompson
Alaska Maritime
National
Wildlife Refuge
National Petroleum
Reserve - Alaska
Nuiqsut
Deadhorse
Kaktovik
Arctic National
Wildlife Refuge
Harrison
Bay
175°0'0"W
170°0'0"W
165°0'0"W
160°0'0"W
155°0'0"W
150°0'0"W
145°0'0"W
140°0'0"W
135°0'0"W
74°0'0"N
72°0'0"N
70°0'0"N
68°0'0"N

Figure 2-1
Beaufort Sea
Program Area

Legend

- Cross Island Deferral Alternative
- Program Area Boundary
- East of Kaktovic Deferral Alternative
- Barrow Deferral Alternative
- Deep Water Deferral Alternative
- Rivers Greater Than 100 Km in Length
- Submerged Lands Act Boundary
- Official Protraction Diagram

0 3.5 7 14 21 28 Nautical Miles

0 3.5 7 14 21 28 Miles

0 10 20 40 60 80 Kilometers

Locator Map

155°W 150°W 145°W 140°W

72°N

70°N

NS04-06 NS05-05 NS05-06 NS06-05 NS06-06 NS07-05 NS07-06 NS08-05

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NS05-07 NS05-08 NS06-07 NS06-08 NS07-07 NS07-08

Beaufort Sea

NR04-02

NR05-01 NR05-02 NR06-01 NR06-02 NR07-01 NR07-02

Prudhoe Bay

Teshekpuk Lake

Harrison Bay

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Nuiqsut

Deadhorse

Point Thompson

Kaktovik

National Petroleum Reserve - Alaska

NR06-05 NR07-06

NR06-06 NR07-05

Arctic National Wildlife Refuge

Alaska

Canada

170°W
165°W
160°W
155°W
72°N
70°N
68°N
N
Chukchi Sea
Peard Bay
Barrow
Wainwright
Atqasuk
Icy Cape
Point Lay
Kasegaluk Lagoon
Cape Lisburne
Alaska Maritime National Wildlife Refuge
Point Hope

Figure 2-2
Deferral Areas
Chukchi Sea
Program Area

0 2.5 5 10 15 20 Nautical Miles
0 2.5 5 10 15 20 Miles
0 5 10 20 30 40 Kilometers

Legend

- Program Area Boundary
- Submerged Lands Act Boundary
- Coastal Deferral Alternative
- Deep Water Deferral Alternative
- Hanna Shoal Deferral Alternative
- Ledyard Bay Deferral Alternative

Locator Map

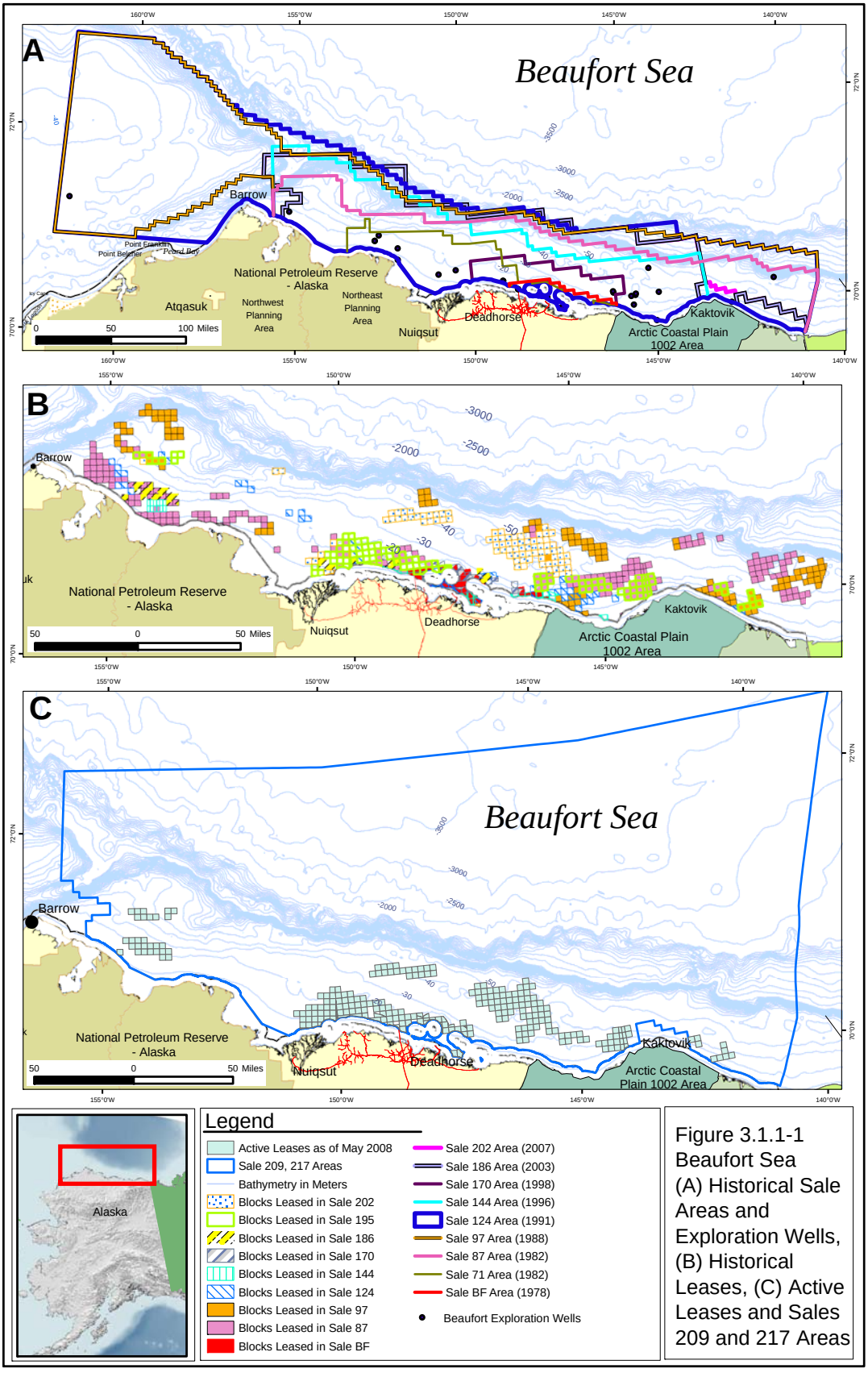
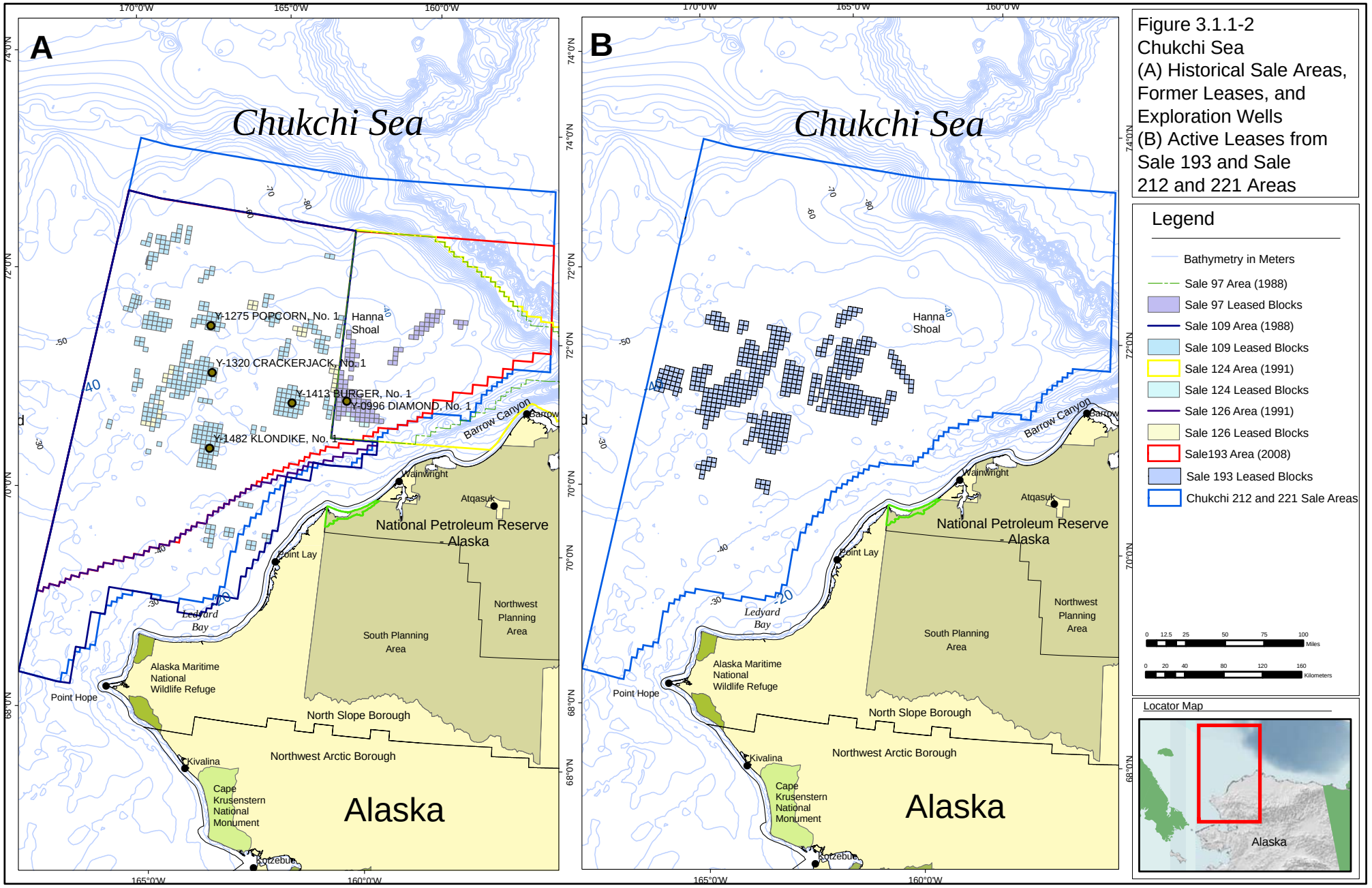


Figure 3.1.1-1
Beaufort Sea
(A) Historical Sale Areas and Exploration Wells, (B) Historical Leases, (C) Active Leases and Sales 209 and 217 Areas


A
Chukchi Sea
Y-1275 POPCORN, No. 1
Hanna Shoal
Y-1320 CRACKERJACK, No. 1
Y-1413 BURGER, No. 1
Y-0996 DIAMOND, No. 1
Y-1482 KLONDIKE, No. 1
Barrow Canyon
Barrow
Wainwright
Atqasuk
National Petroleum Reserve - Alaska
Point Lay
Ledyard Bay
Northwest Planning Area
South Planning Area
Alaska Maritime National Wildlife Refuge
Point Hope
North Slope Borough
Northwest Arctic Borough
Kivalina
Cape Krusenstern National Monument
Kotzebue
Alaska
B
Chukchi Sea
Hanna Shoal
Barrow Canyon
Barrow
Wainwright
Atqasuk
National Petroleum Reserve - Alaska
Point Lay
Ledyard Bay
Northwest Planning Area
South Planning Area
Alaska Maritime National Wildlife Refuge
Point Hope
North Slope Borough
Northwest Arctic Borough
Kivalina
Cape Krusenstern National Monument
Kotzebue
Alaska
170°0'W
165°0'W
160°0'W
74°0'N
72°0'N
70°0'N
68°0'N
Figure 3.1.1-2
Chukchi Sea
(A) Historical Sale Areas, Former Leases, and Exploration Wells
(B) Active Leases from Sale 193 and Sale 212 and 221 Areas
Legend
Bathymetry in Meters
Sale 97 Area (1988)
Sale 97 Leased Blocks
Sale 109 Area (1988)
Sale 109 Leased Blocks
Sale 124 Area (1991)
Sale 124 Leased Blocks
Sale 126 Area (1991)
Sale 126 Leased Blocks
Sale193 Area (2008)
Sale 193 Leased Blocks
Chukchi 212 and 221 Sale Areas
0 12.5 25 50 75 100 Miles
0 20 40 80 120 160 Kilometers
Locator Map
Alaska

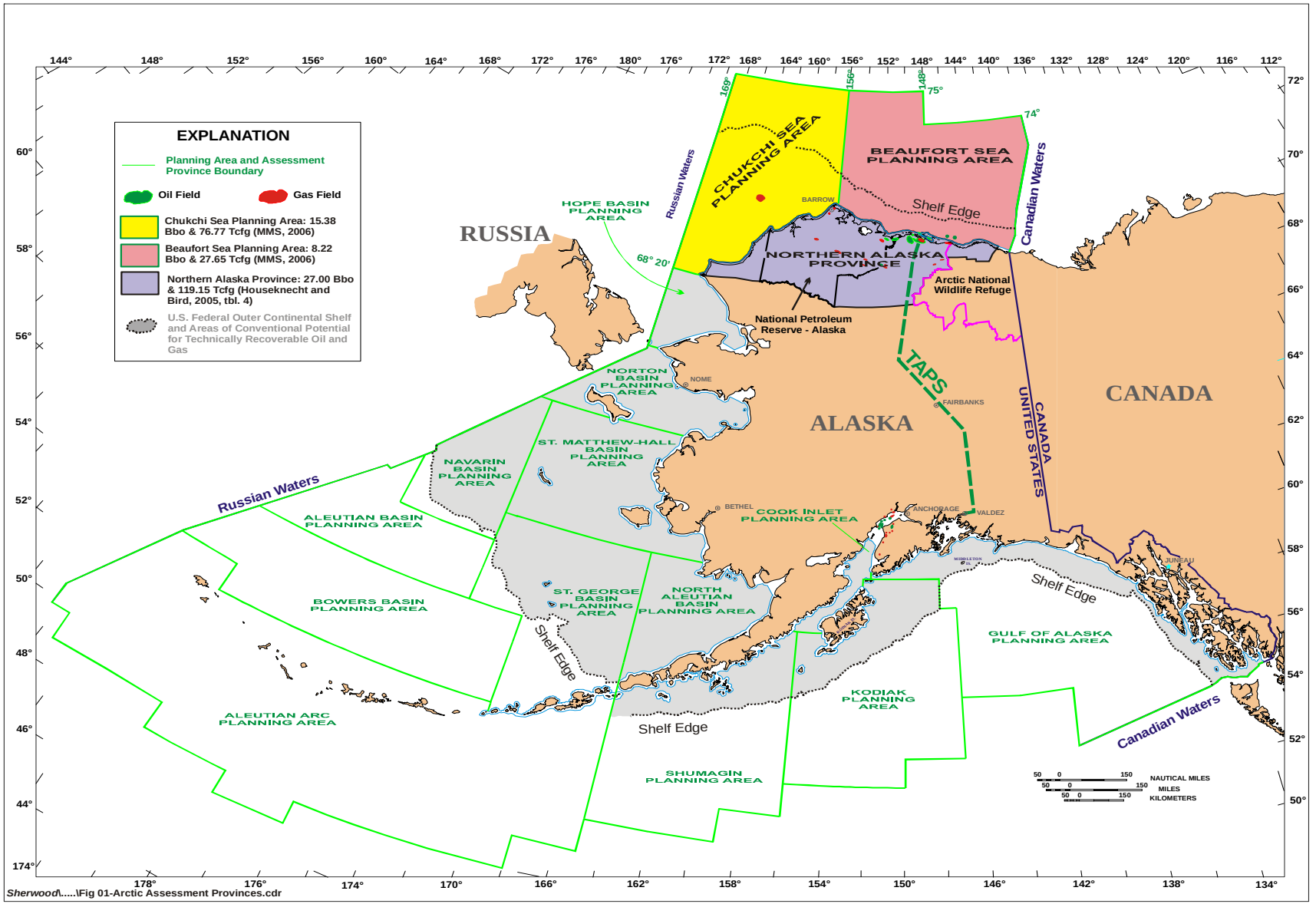


Figure 3.2.1-1 The Three Components of the Arctic Alaska Petroleum Province: (1) the Northern Alaska (onshore) Province; (2) the Chukchi Sea Planning Area; and (3) the Beaufort Sea Planning Area. The Alaska Federal OCS Planning Areas Also Are Shown.

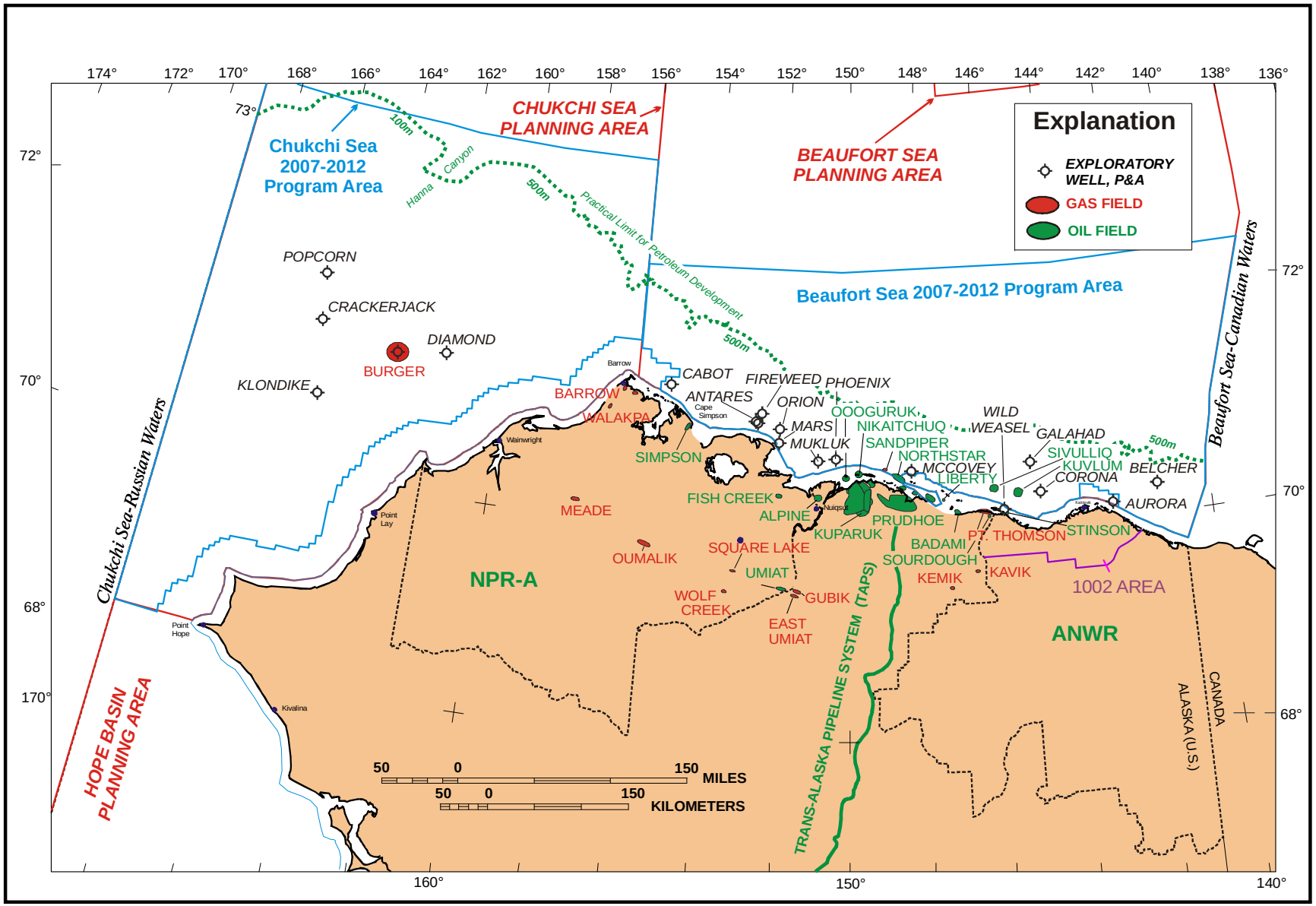


Figure 3.2.1-2 Oil and Gas Fields and Offshore Wells in the Beaufort Sea and Chukchi Sea Planning Areas. The 2007-2012 Five-Year Program Areas Are Subareas Within the Larger Planning Areas.

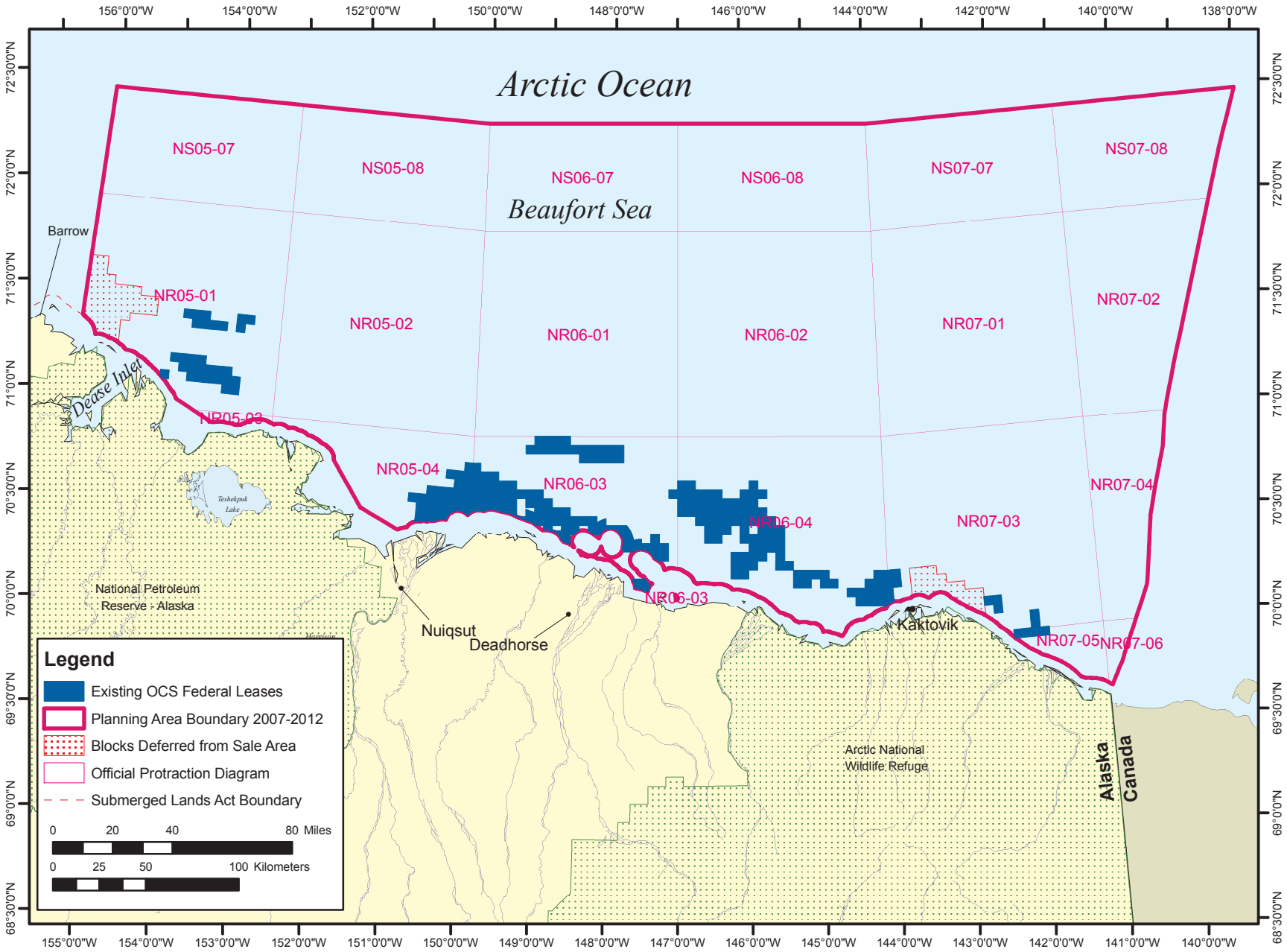


Figure 3.2.1-3 The 261 Active Leases in the Beaufort Sea Planning Area (as of November 2007). The original file of this map is available for download in pdf format at http://www.mms.gov/alaska/Maps/bf_leases.pdf.

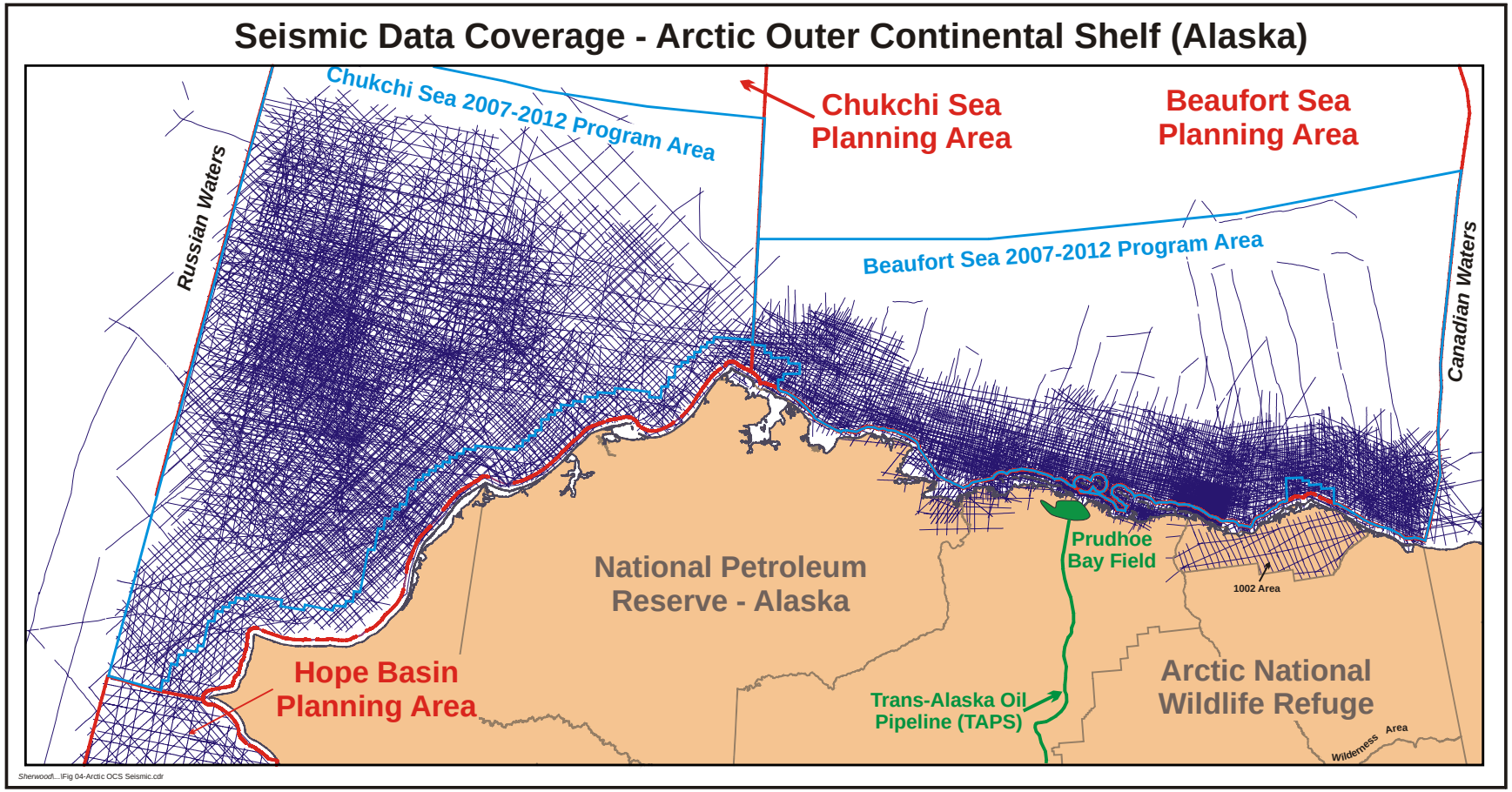


Figure 3.2.1-4 Coverage of 2D Seismic Data in the Beaufort Sea and Chukchi Sea Planning Areas. Only “speculative” (shot by geophysical companies and then offered on the open market) surveys are shown. The locations of 3D seismic surveys conducted in both planning areas are not shown.

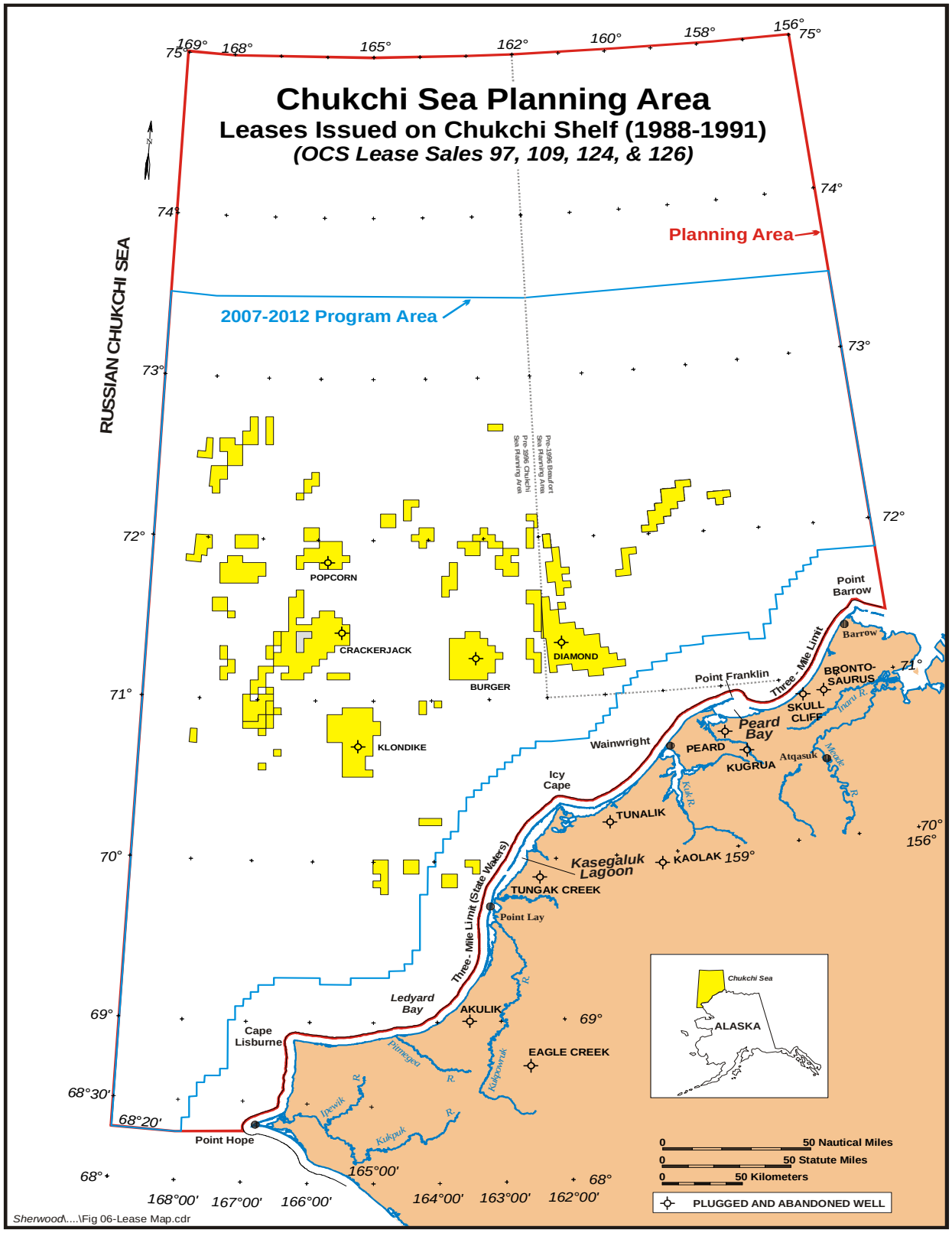


Figure 3.2.1-5 Chukchi Sea Planning Area, Leases Issued on Chukchi Shelf, 1988-1991, OCS Lease Sales 97, 109, 124, and 126. Locations of 483 leases issued (total high bids 512 million dollars) in 1988 and 1991 lease sales in modern Chukchi Sea Planning Area. The pre-1996 boundary between the Beaufort and Chukchi Sea Planning Areas is shown as a dotted line. No lease were active (all relinquished) as of November 2007.

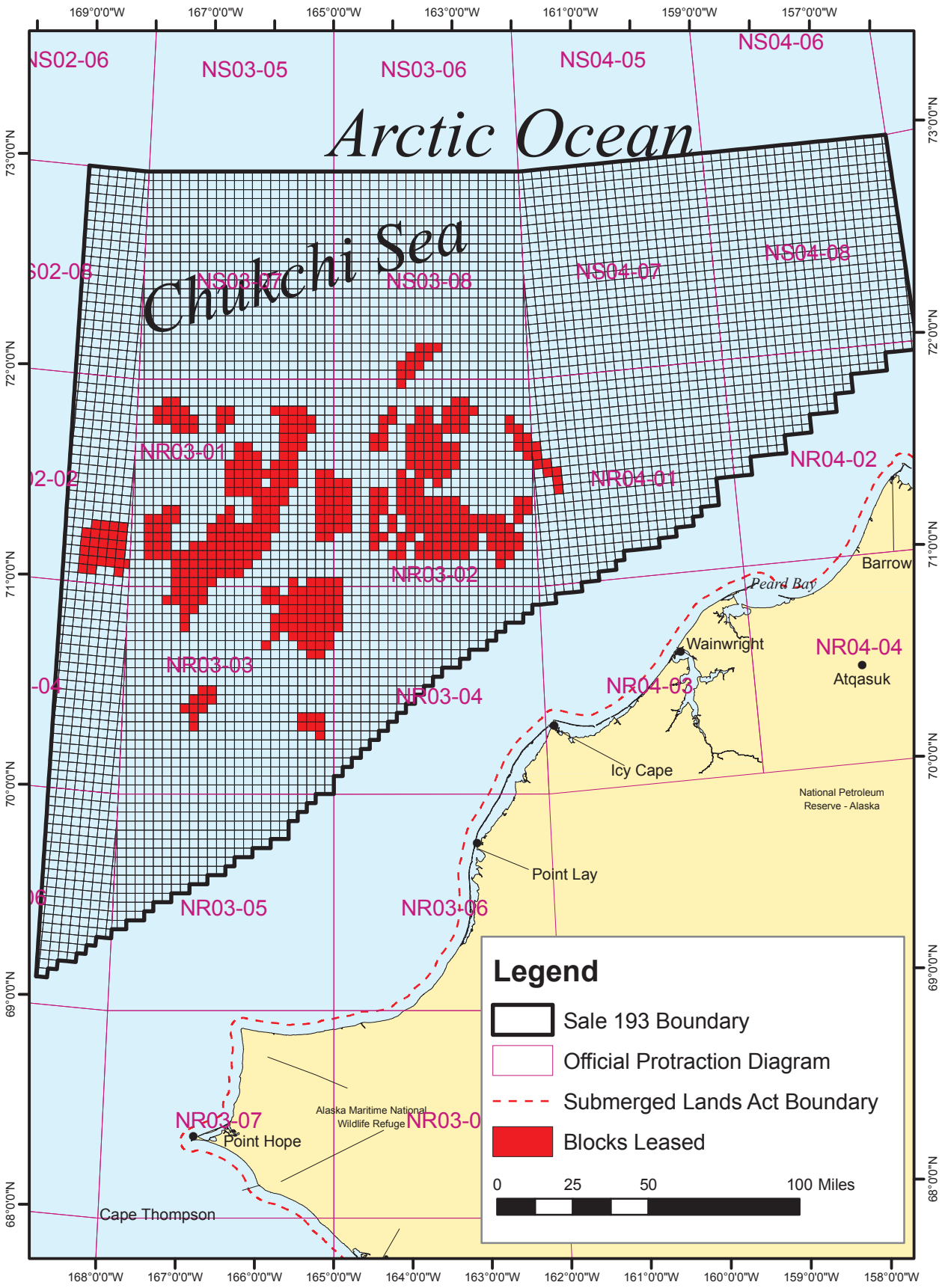


Figure 3.2.1-6 Blocks Leased in Chukchi Sea Sale 193 (February 6, 2008). Adaped from original file of map available for download in pdf format at http://www.mms.gov/alaska/cproject/Chukchi193/193Saleday/Sale_193_blx.pdf

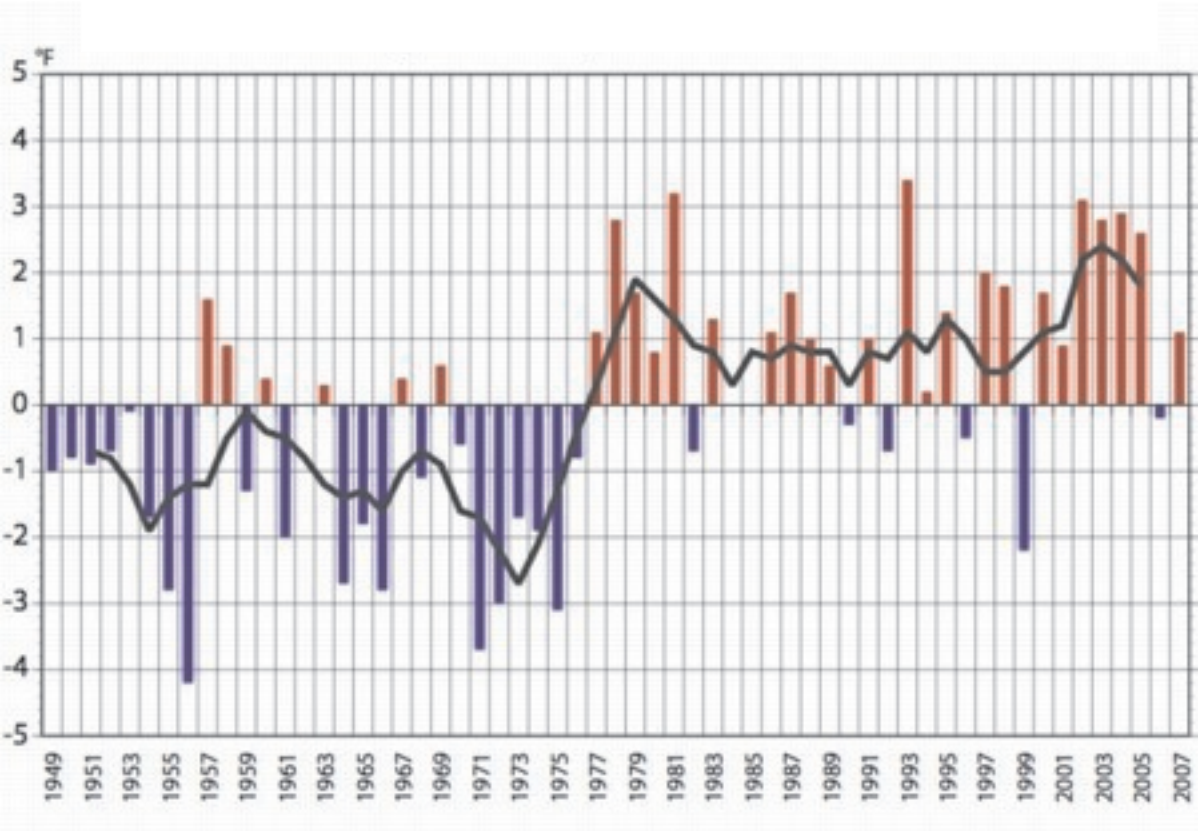


Figure 3.2.2-1 Mean Annual Temperature Departure for Alaska (°F), 1949-2007

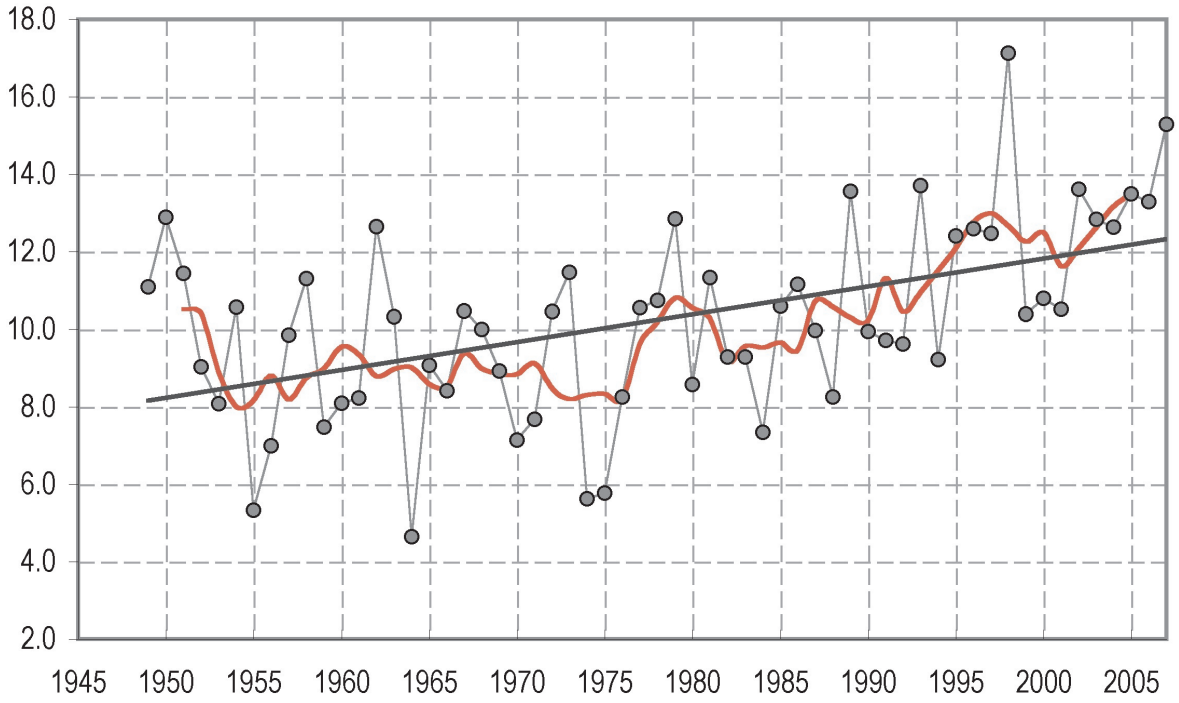


Figure 3.2.2-2 Barrow Mean Annual Temperature (˚F)

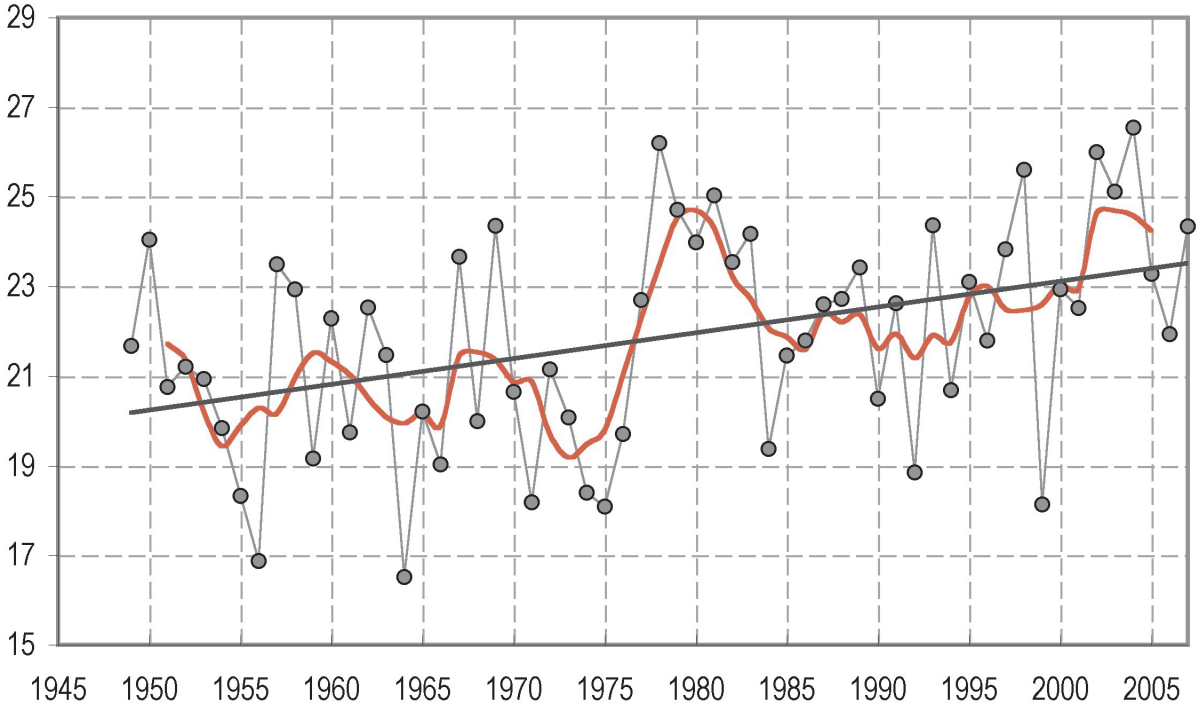


Figure 3.2.2-3 Kotzebue Mean Annual Temperature (˚F)

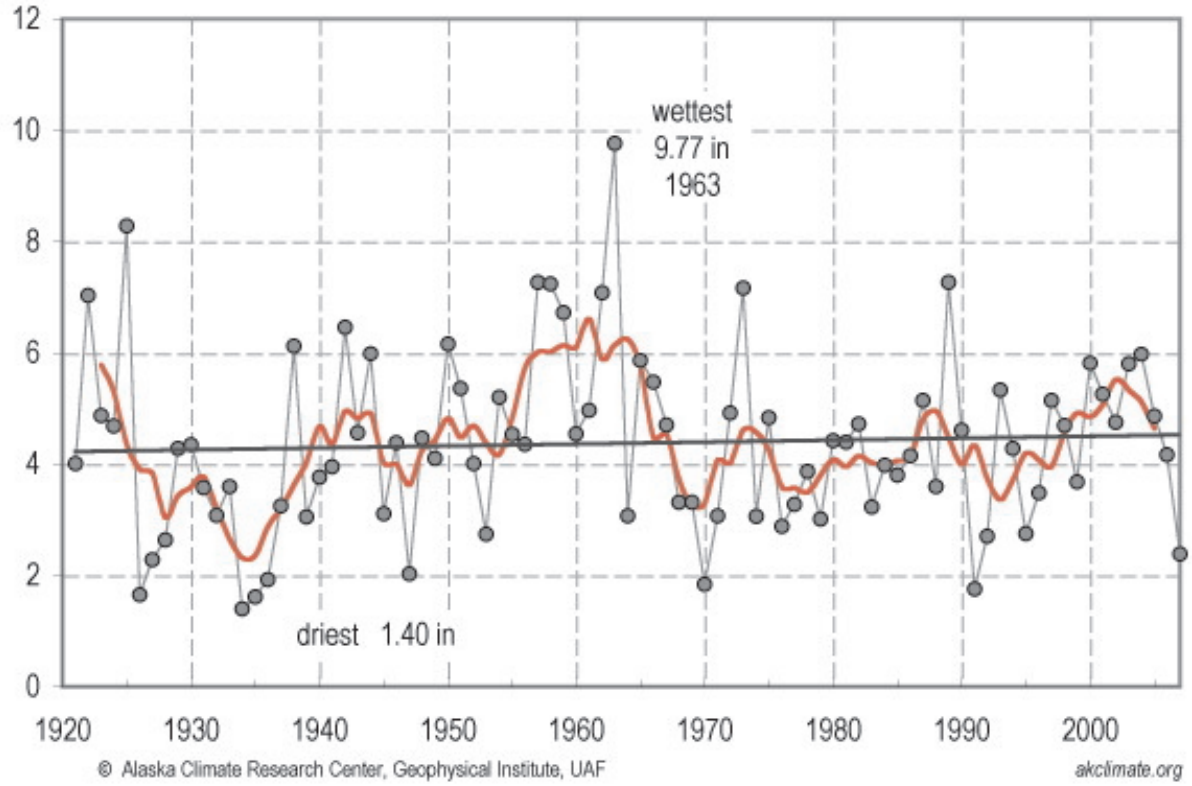


Figure 3.2.2-4 Barrow Total Annual Precipitation (inches)

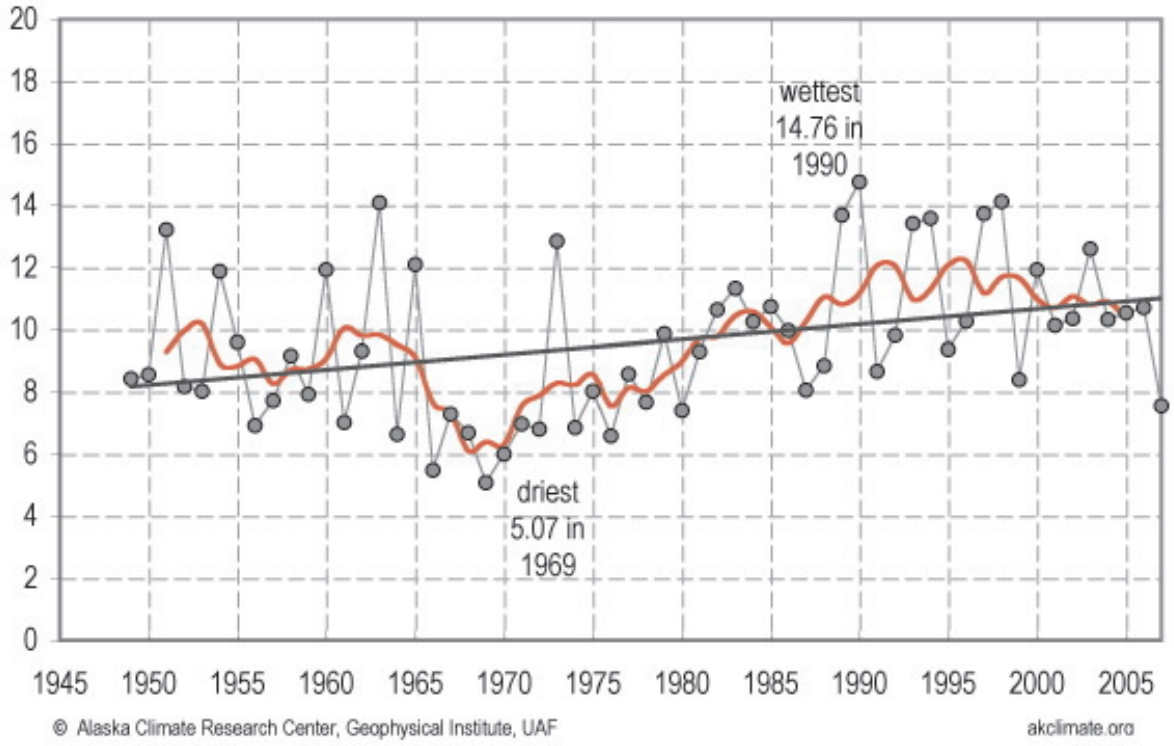


Figure 3.2.2-5 Kotzebue Total Annual Precipitation (inches)

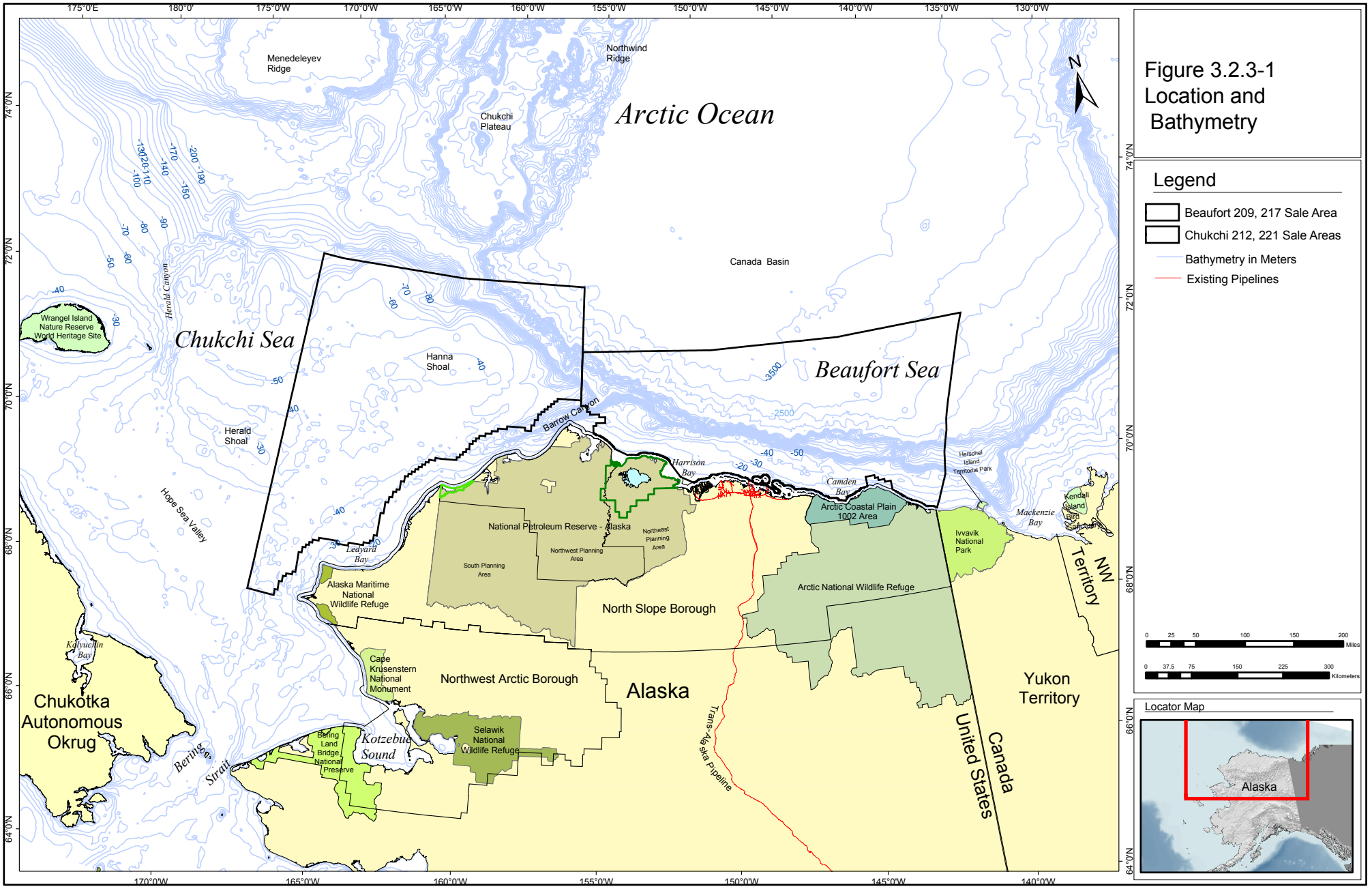


Figure 3.2.3-1
Location and
Bathymetry
Legend
Beaufort 209, 217 Sale Area
Chukchi 212, 221 Sale Areas
Bathymetry in Meters
Existing Pipelines
Arctic Ocean
Chukchi Sea
Beaufort Sea
Canada Basin
Menedeleyev Ridge
Northwind Ridge
Chukchi Plateau
Herald Canyon
Hanna Shoal
Herald Shoal
Barrow Canyon
Hope Sea Valley
Wrangel Island Nature Reserve World Heritage Site
Harrison Bay
Camden Bay
Mackenzie Bay
Ledyard Bay
National Petroleum Reserve - Alaska
Northeast Planning Area
Northwest Planning Area
South Planning Area
Arctic Coastal Plain 1002 Area
Arctic National Wildlife Refuge
Ivvavik National Park
Herschel Island Territorial Park
Kendall Island Bird Sanctuary
NW Territory
Alaska Maritime National Wildlife Refuge
North Slope Borough
Cape Krusenstern National Monument
Northwest Arctic Borough
Alaska
Yukon Territory
Kotzebue Sound
Selawik National Wildlife Refuge
Bering Land Bridge National Preserve
Kolyuchin Bay
Chukotka Autonomous Okrug
Bering Strait
Trans-Alaska Pipeline
United States
Canada
Locator Map
Alaska
Miles
Kilometers

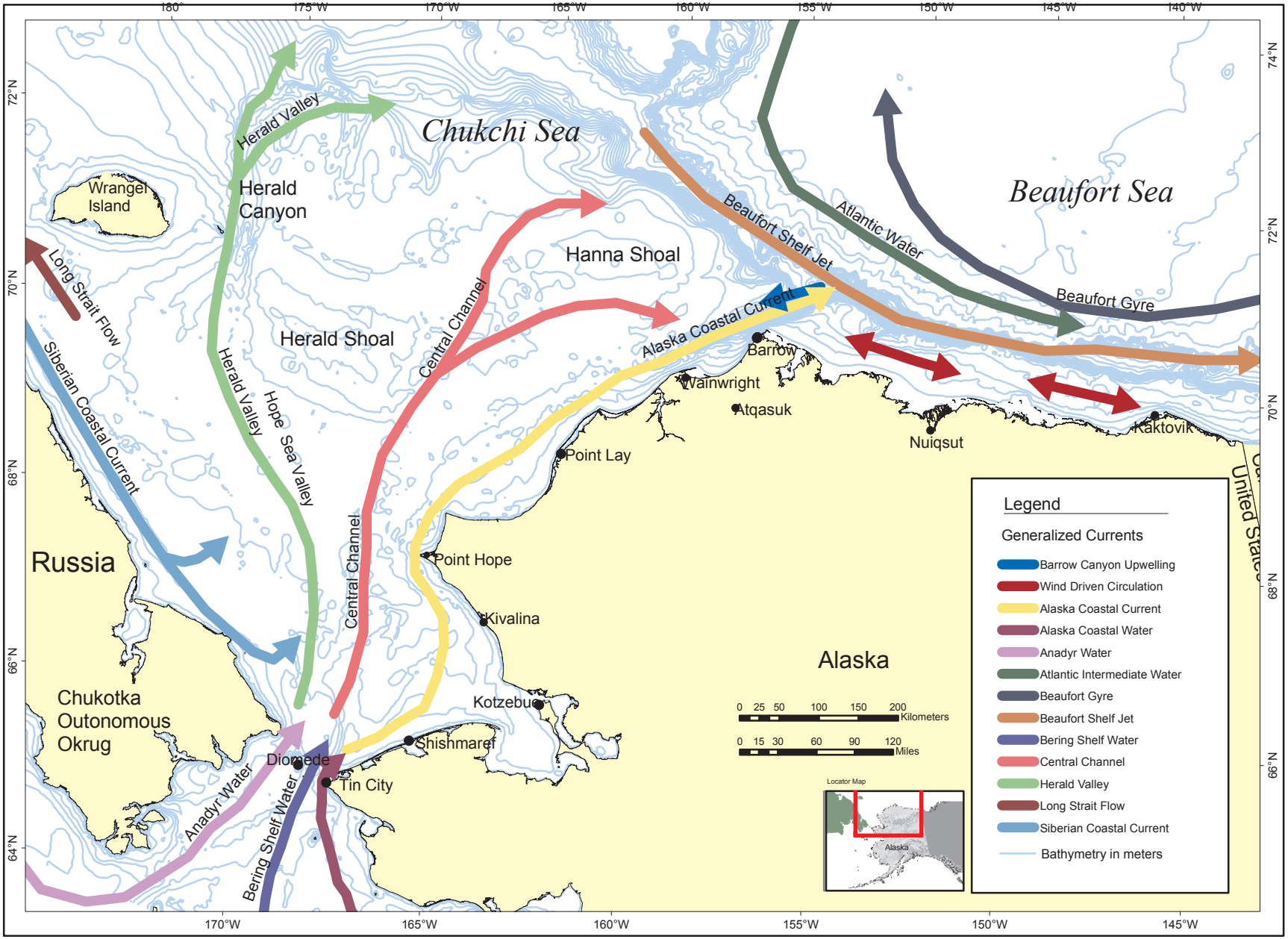
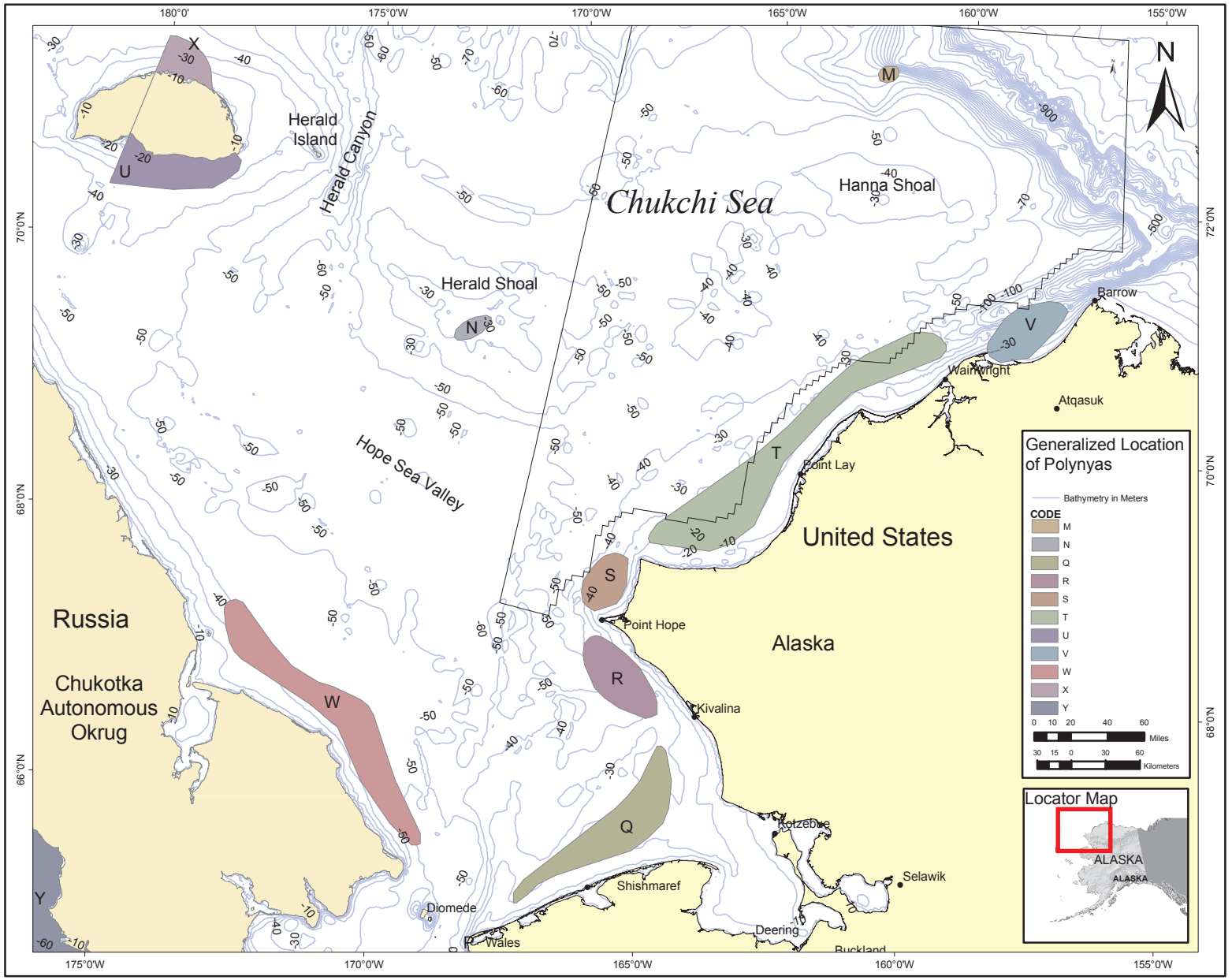
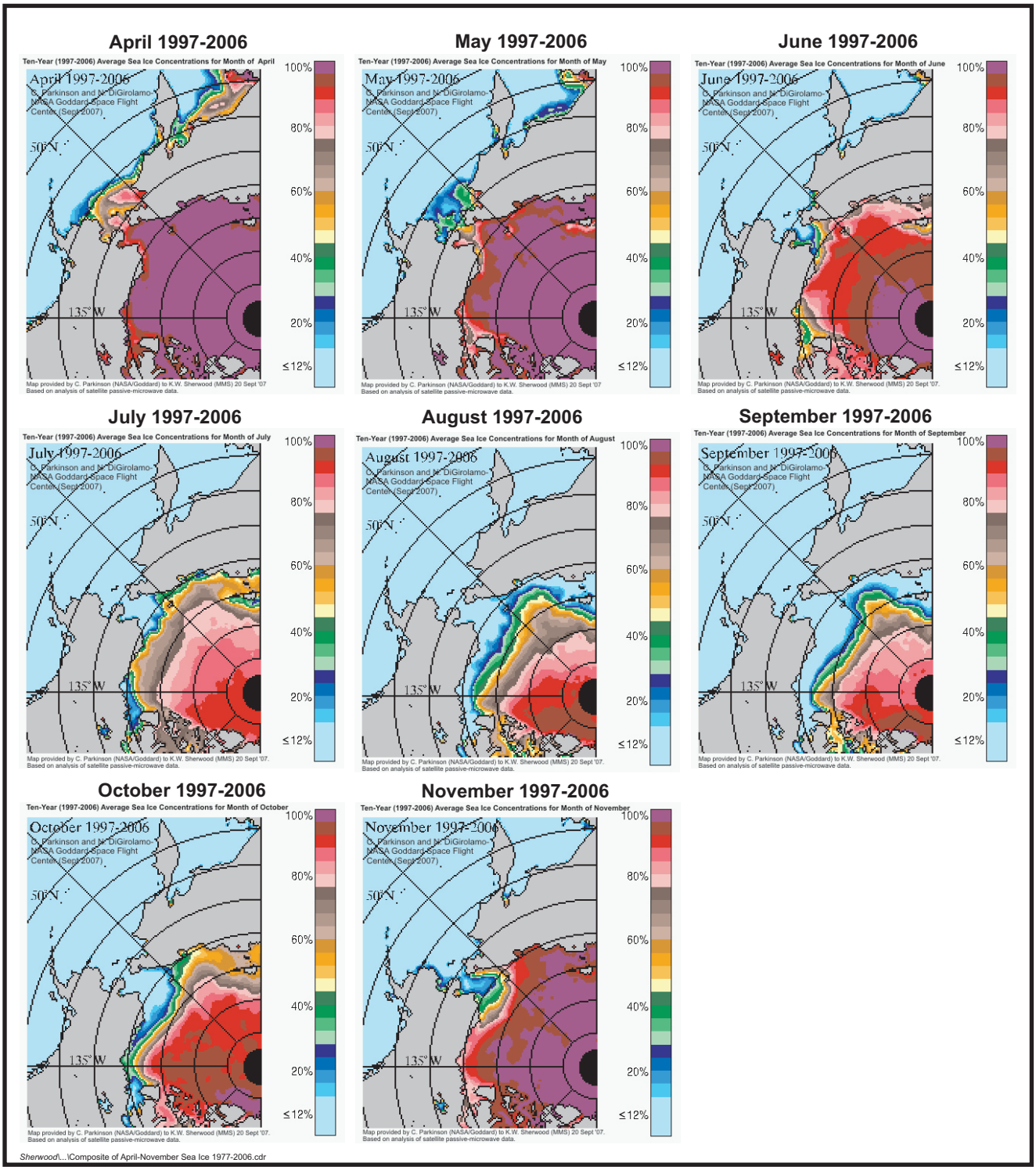


Figure 3.2.3-2 Generalized Circulation over the Chukchi and Beaufort Seas.



Source: Stringer et al. 1991.

Figure 3.2.4-1. Generalized Location of Chukchi Polynyas



Source: Parkinson, 2007

Figure 3.2.4-2 Ten-Year (1997-2006) Average Sea Ice Concentration for the Months April - November

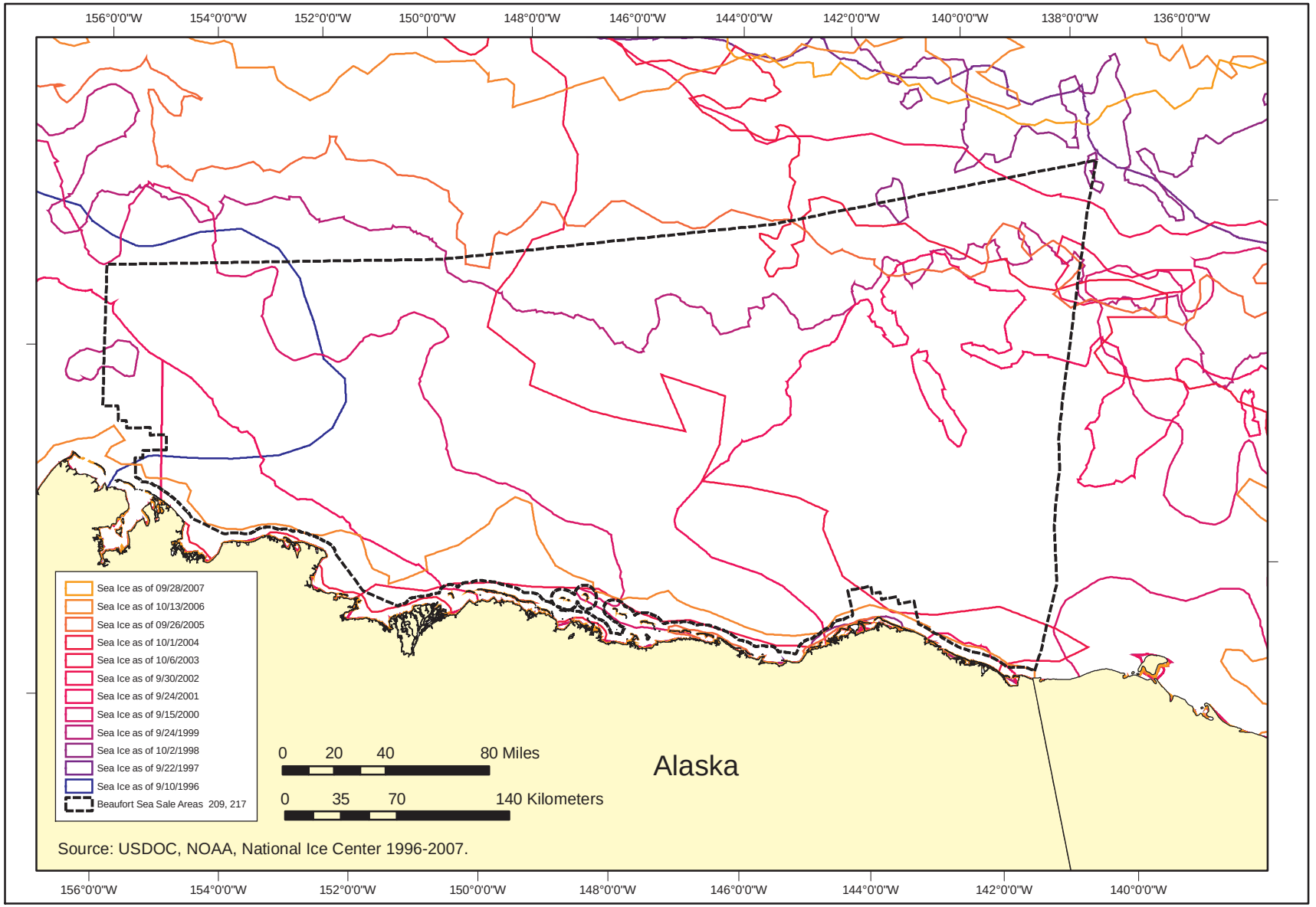


Figure 3.2.4-3. Beaufort Sea Generalized Maximum Retreat of Sea Ice 1996-2007.

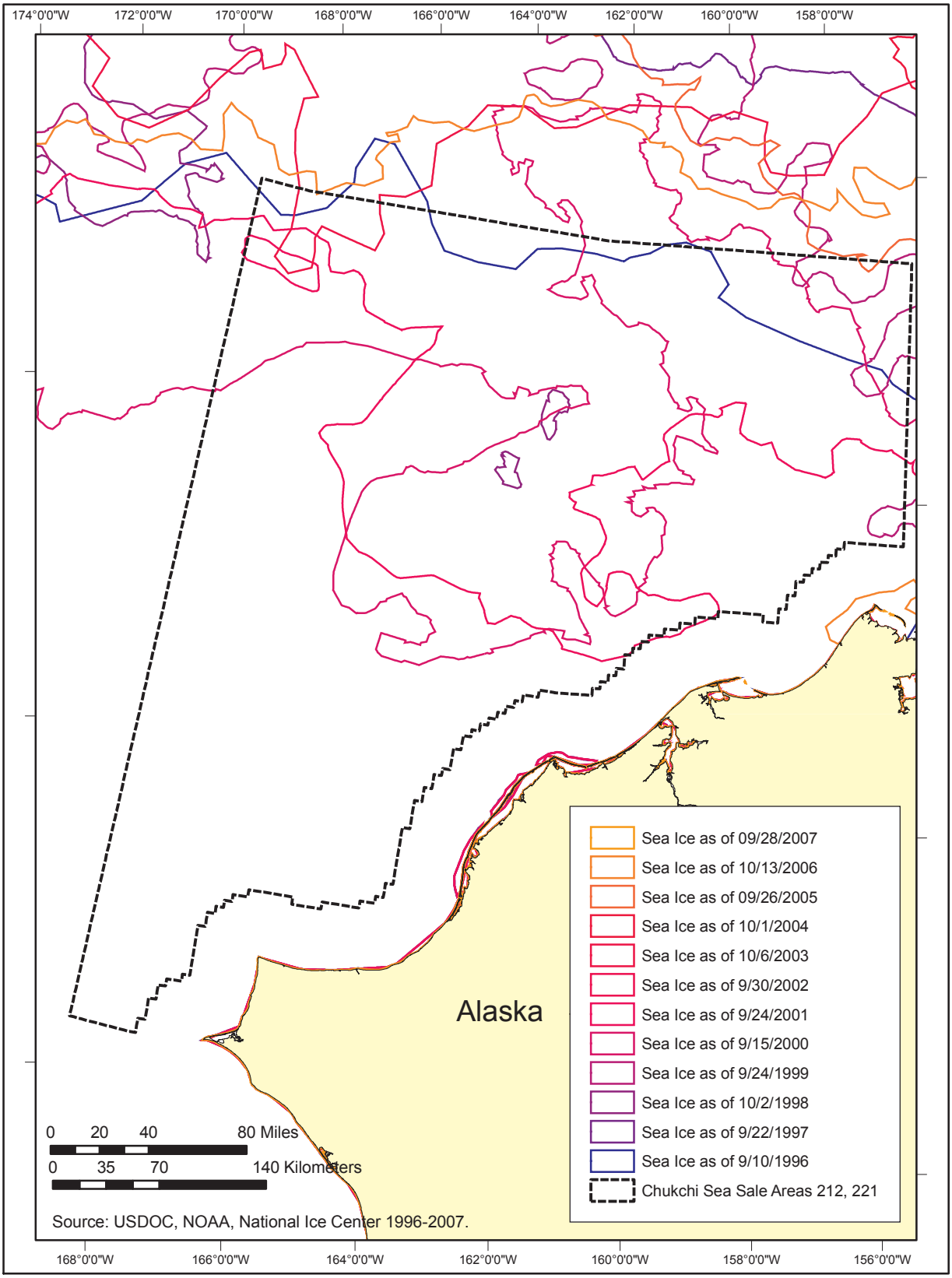


Figure 3.2.4-4. Chukchi Sea Generalized Maximum Retreat of Sea Ice 1996-2007.

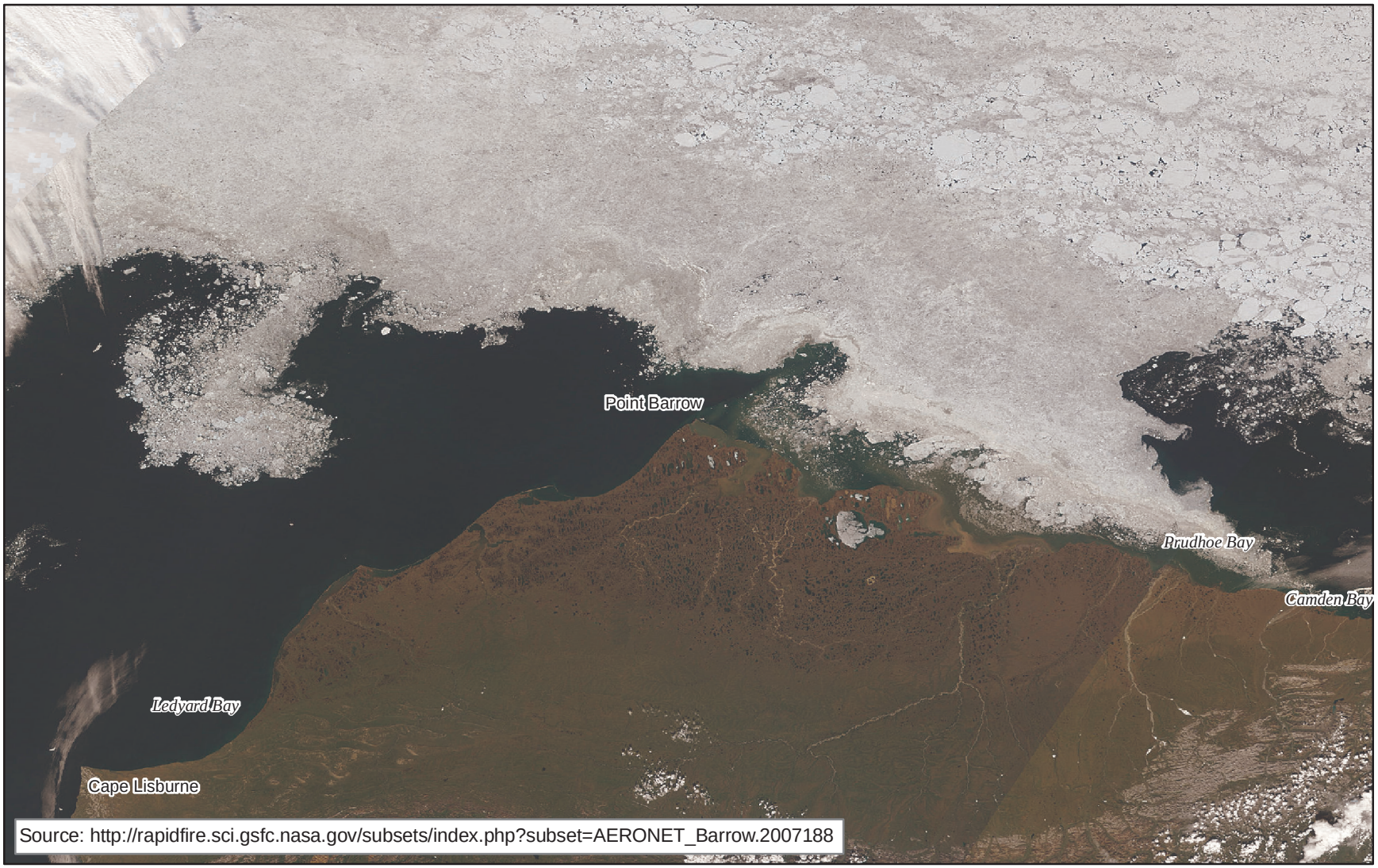


Figure 3.3.1-1 Early summer sea ice and coastal production in part of the proposed lease areas. Some locations in the satellite photograph are Cape Lisburne and Ledyard Bay in the Chukchi Sea on the left, Point Barrow in the center, and Camden Bay in the Beaufort Sea on the right edge. The apparent line of color on shore in the lower right is the result of merging adjacent satellite paths, but the line intersects the coast at Prudhoe Bay. This image, taken on July 7, 2007, reflects the slight reduction in the sea-ice cover during Spring, although climate warming has diminished it greatly during Autumn. An intense phytoplankton bloom has turned the surface water slightly green between the ice cover and shore just to the east of Pt. Barrow.

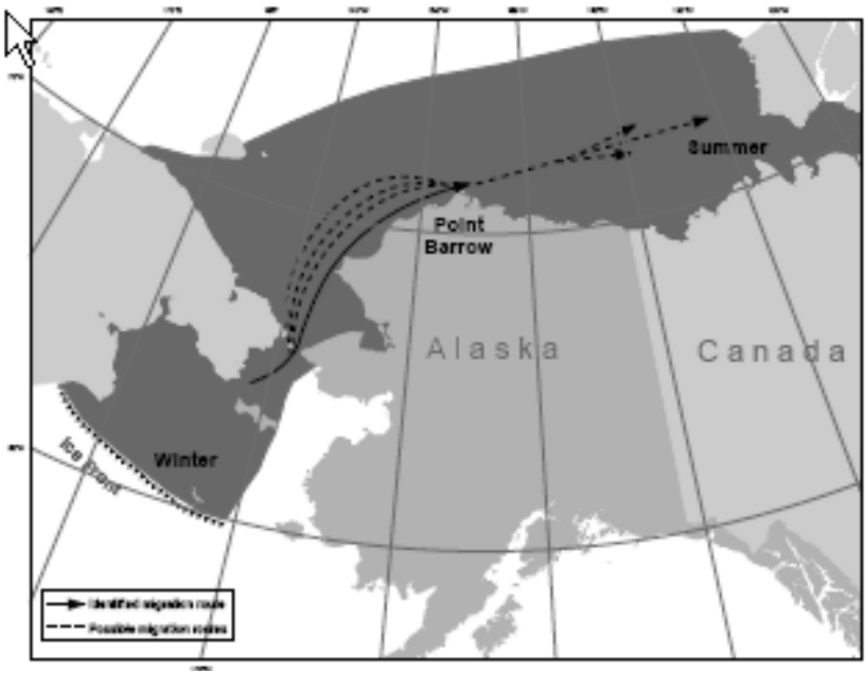


Figure 3.3.4.1-1. Bowhead Whale Distribution and Spring Migration Routes, Shaded area depicts the approximate distribution of Arctic stock bowhead whales. Spring migration is noted by lines and arrows following a route from the Bering Sea wintering areas to the Beaufort Sea summering area. Reproduced from Figure 42 of Angliss and Outlaw Rev. 03/03/07.

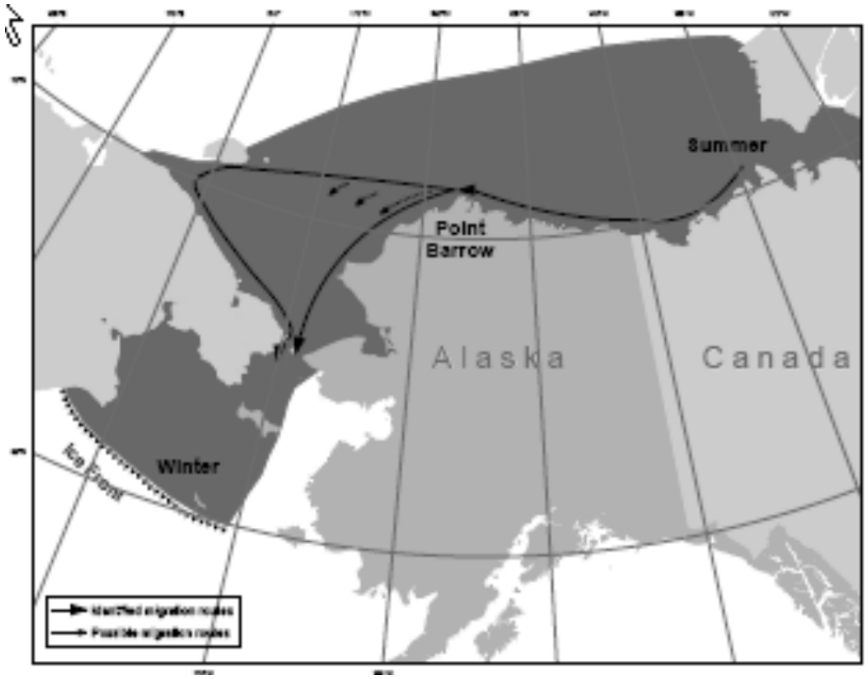


Figure 3.3.4.1-2. Bowhead Whale Distribution and Fall Migration Routes, Shaded area depicts the approximate distribution of Arctic stock bowhead whales. Fall migration is noted by lines and arrows following a route from the Beaufort Sea summering areas to the Bering Sea wintering areas. Reproduced from Figure 40 of Angliss and Outlaw Rev. 03/03/07.

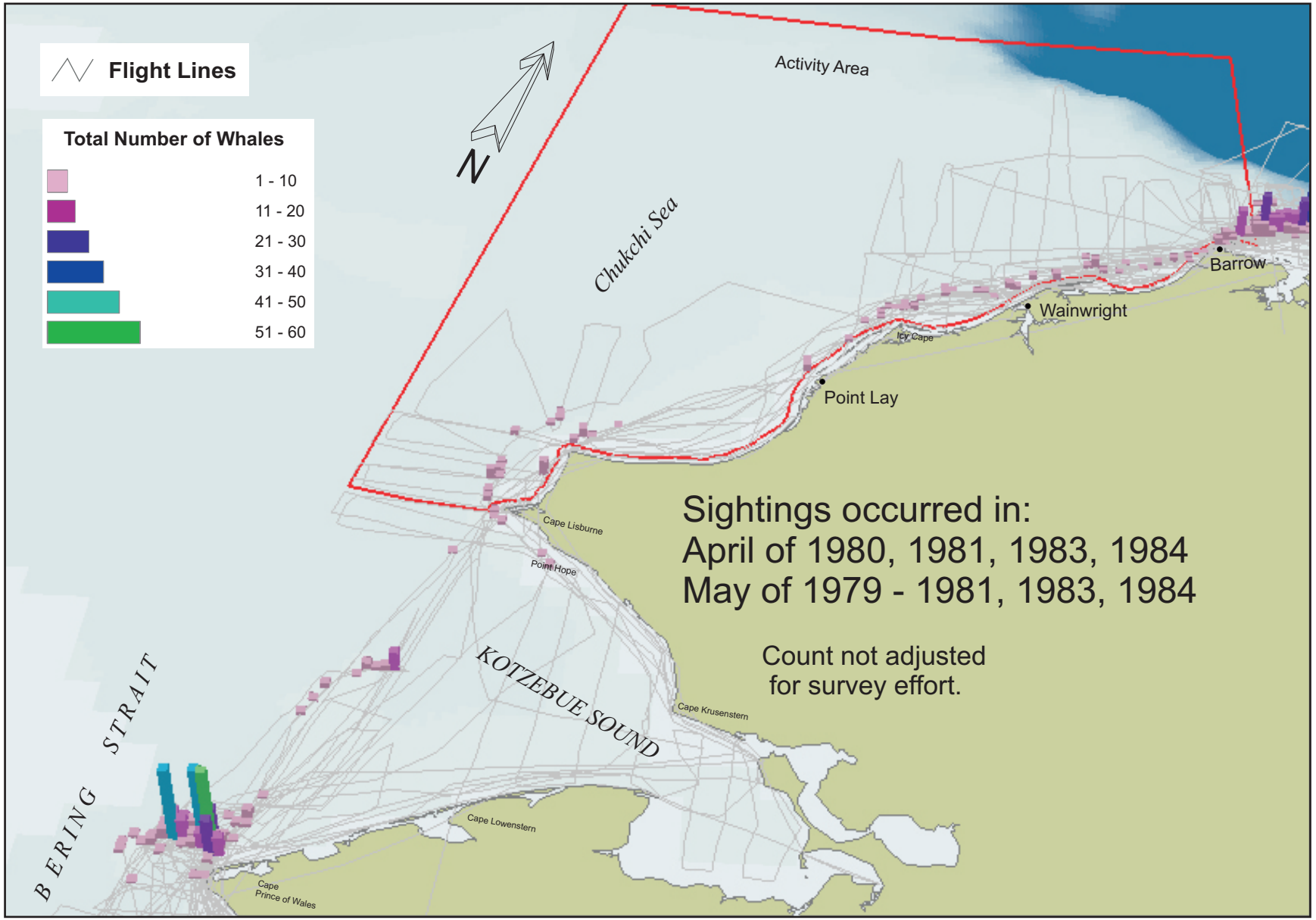


Figure 3.3.4.1-3 Counts of Bowhead Whales in April -May in the Chukchi Sea taken by the MMS (Alaska OCS Region) Bowhead Whale Aerial Survey Project. (Counts are aggregated on a 5-km grid).

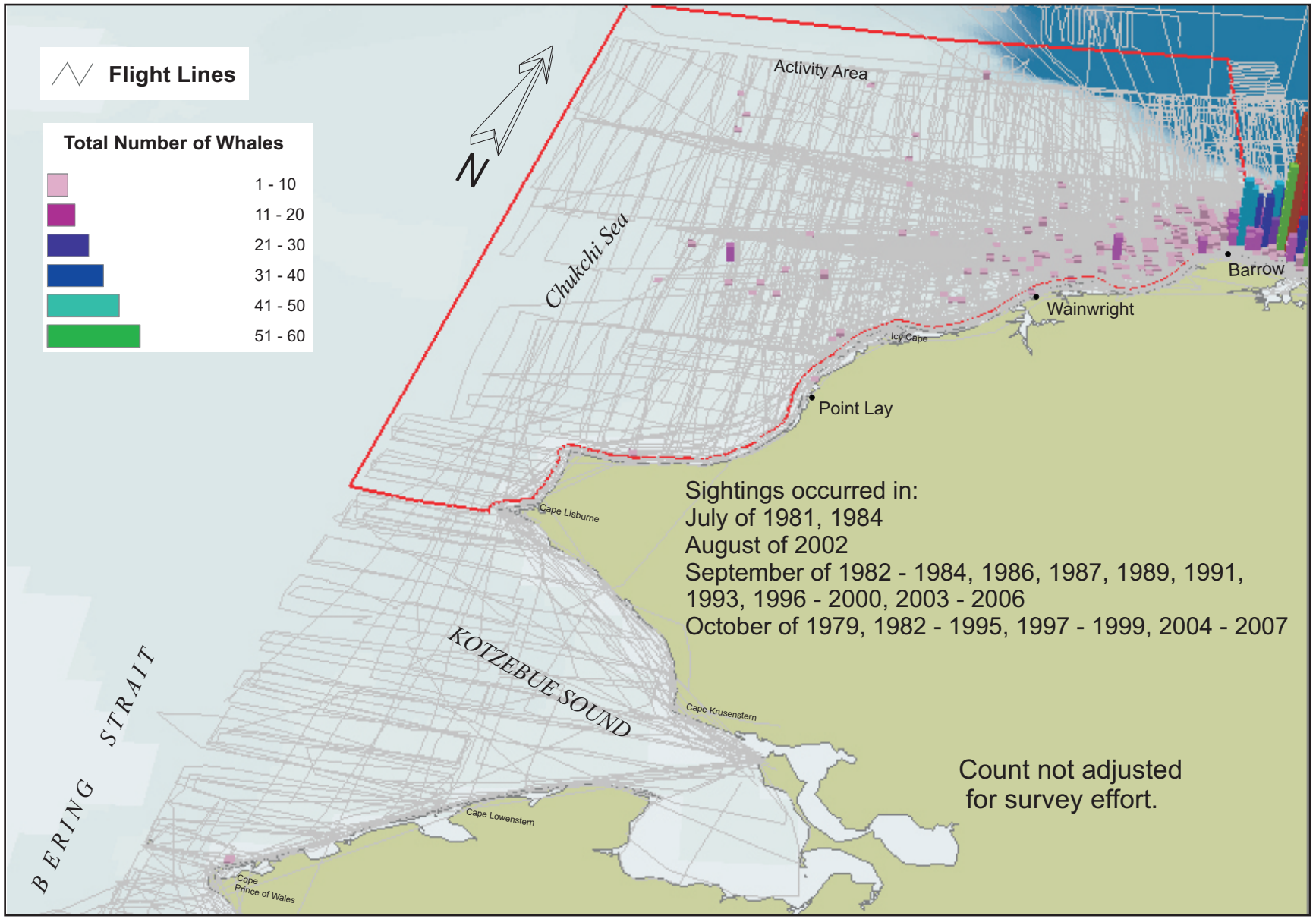


Figure 3.3.4.1-4 Counts of Bowhead Whales in July - November in the Chukchi Sea taken by the MMS (Alaska OCS Region) Bowhead Whale Aerial Survey Project. (Counts are aggregated on a 5-km grid).

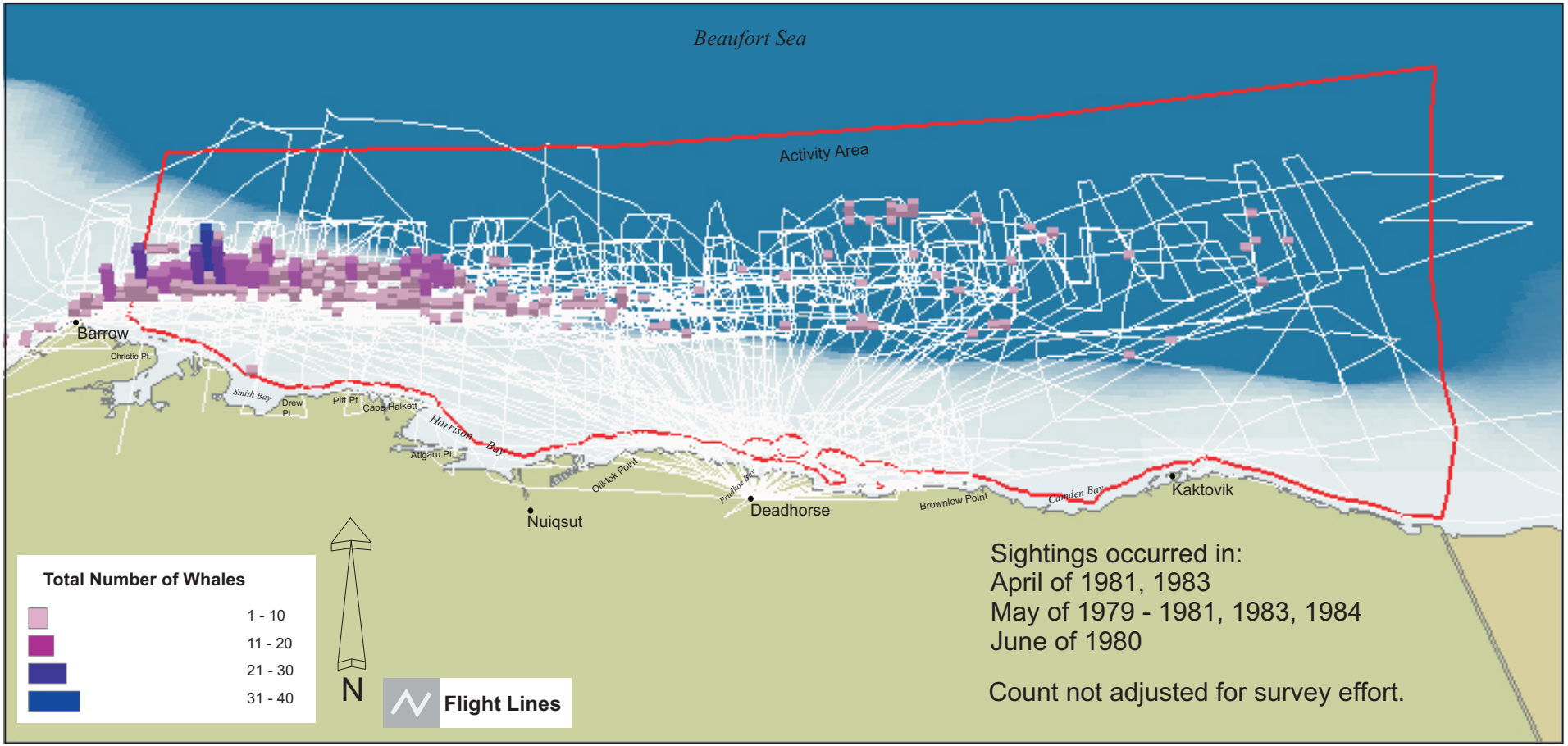


Figure 3.3.4.1-5 Counts of Bowhead Whales in April - June in the Beaufort Sea taken by the MMS (Alaska OCS Region) Bowhead Whale Aerial Survey Project. (Counts are aggregated on a 5-km grid).

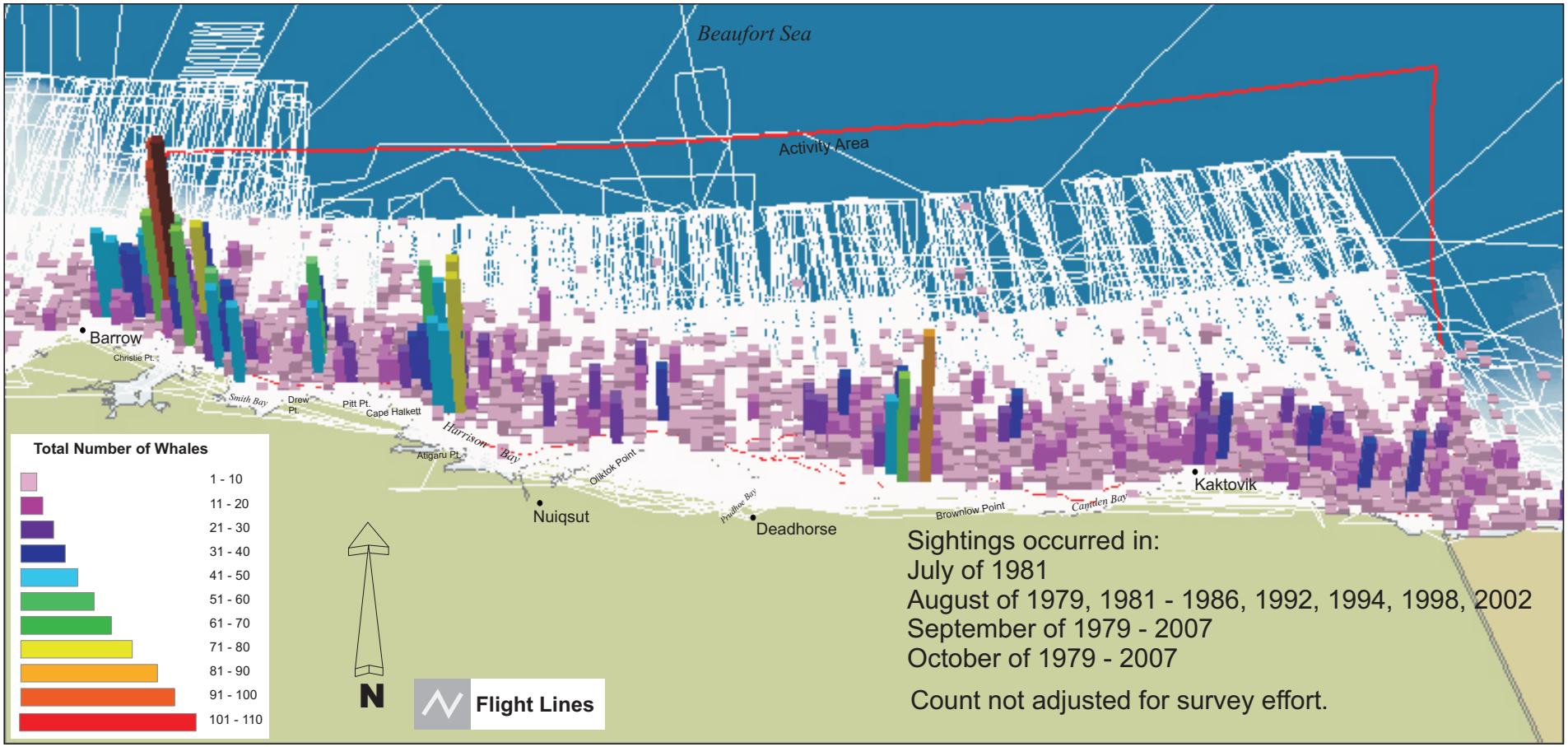


Figure 3.3.4.1-6 Counts of Bowhead Whales in July -October in the Beaufort Sea taken by the MMS (Alaska OCS Region) Bowhead Whale Aerial Survey Project. (Counts are aggregated on a 5-km grid).

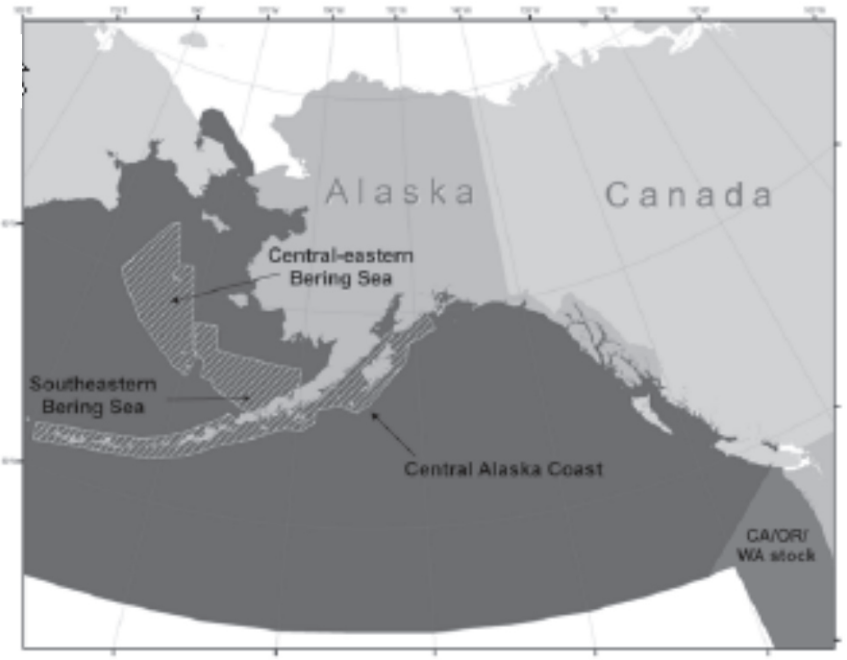


Figure 3.3.4.1-7. Approximate Distribution of Fin Whales in the Eastern North pacific (shaded area). Striped areas indicate where vessel surveys occurred in 1999-2000 (Moore et al. 2002) and 2001-2003 (Zebrini et al. 2006). Reproduced from Figure 40 of Angliss and Outlaw Rev. 03/03/07.

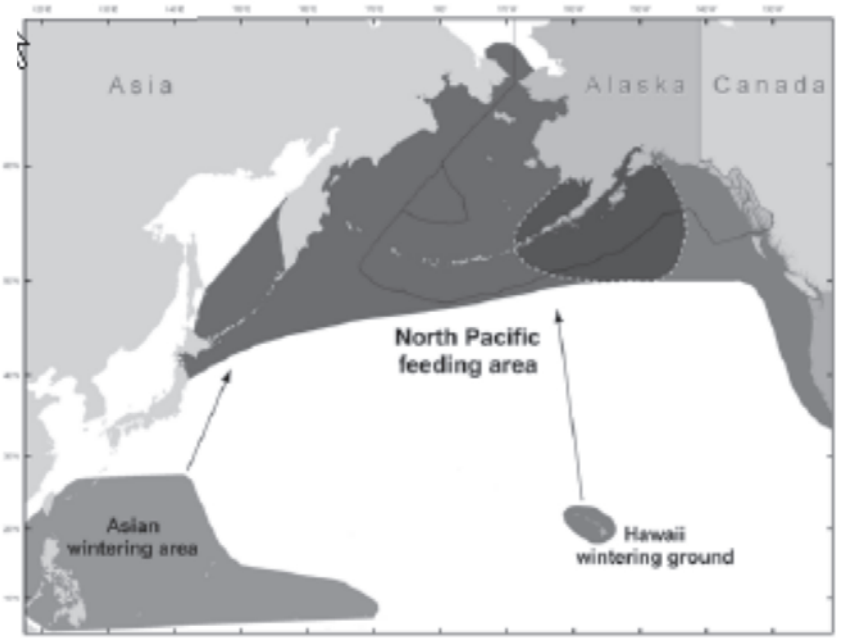
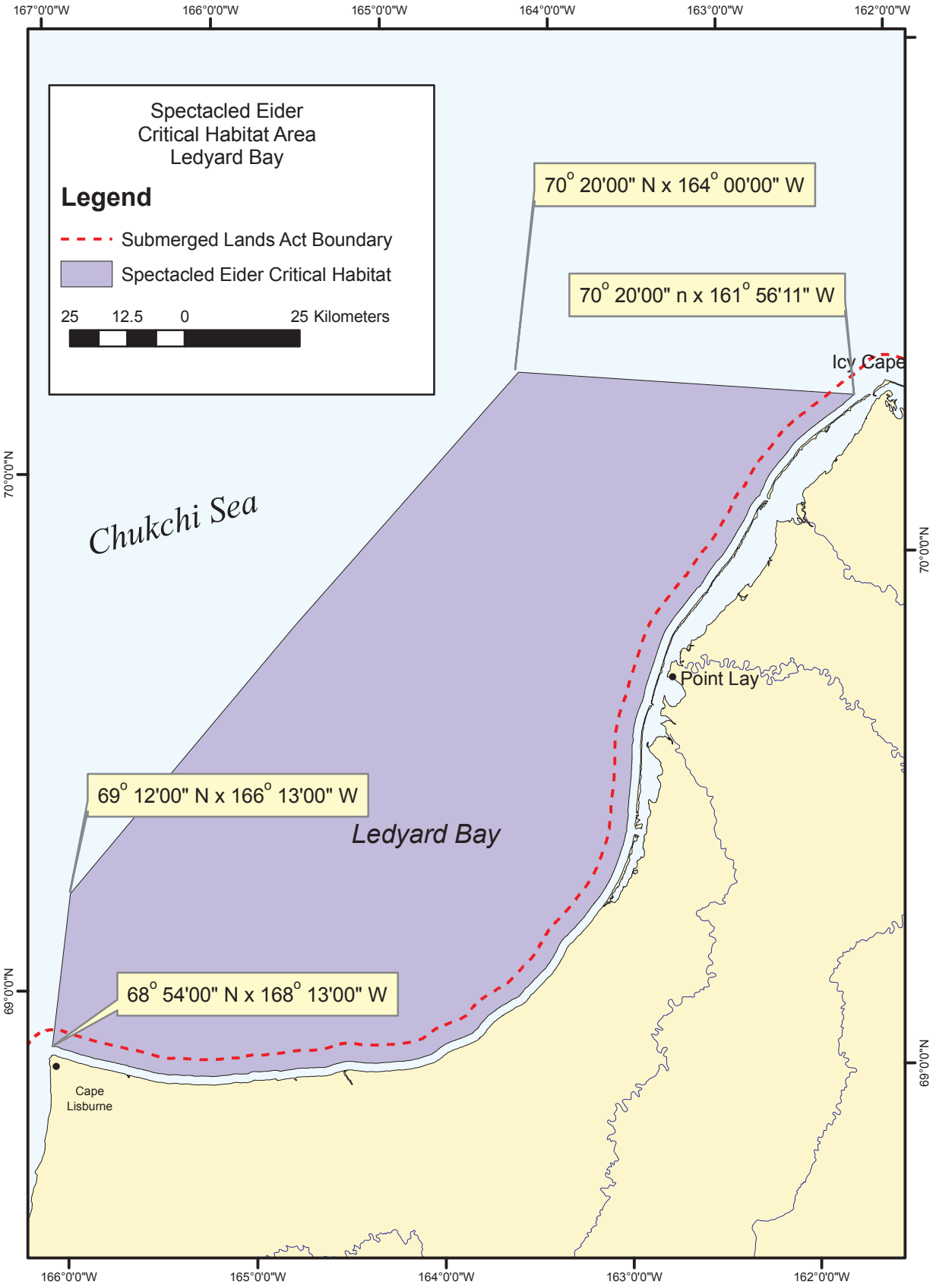


Figure 3.3.4.1-8. Approximate distribution of humpback whales in the Western North Pacific (shaded areas). Feeding and wintering grounds are presented. The dark shading within the dotted line is known to be an area of overlap of the Central North Pacific stock. Reproduced from Figure 38 of Angliss and Outlaw Rev. 03/03/07.



Source: USDOI, FWS (2001b)

Figure 3.3.4.2-1 Location of Ledyard Bay Spectacled Eider Critical Habitat Area

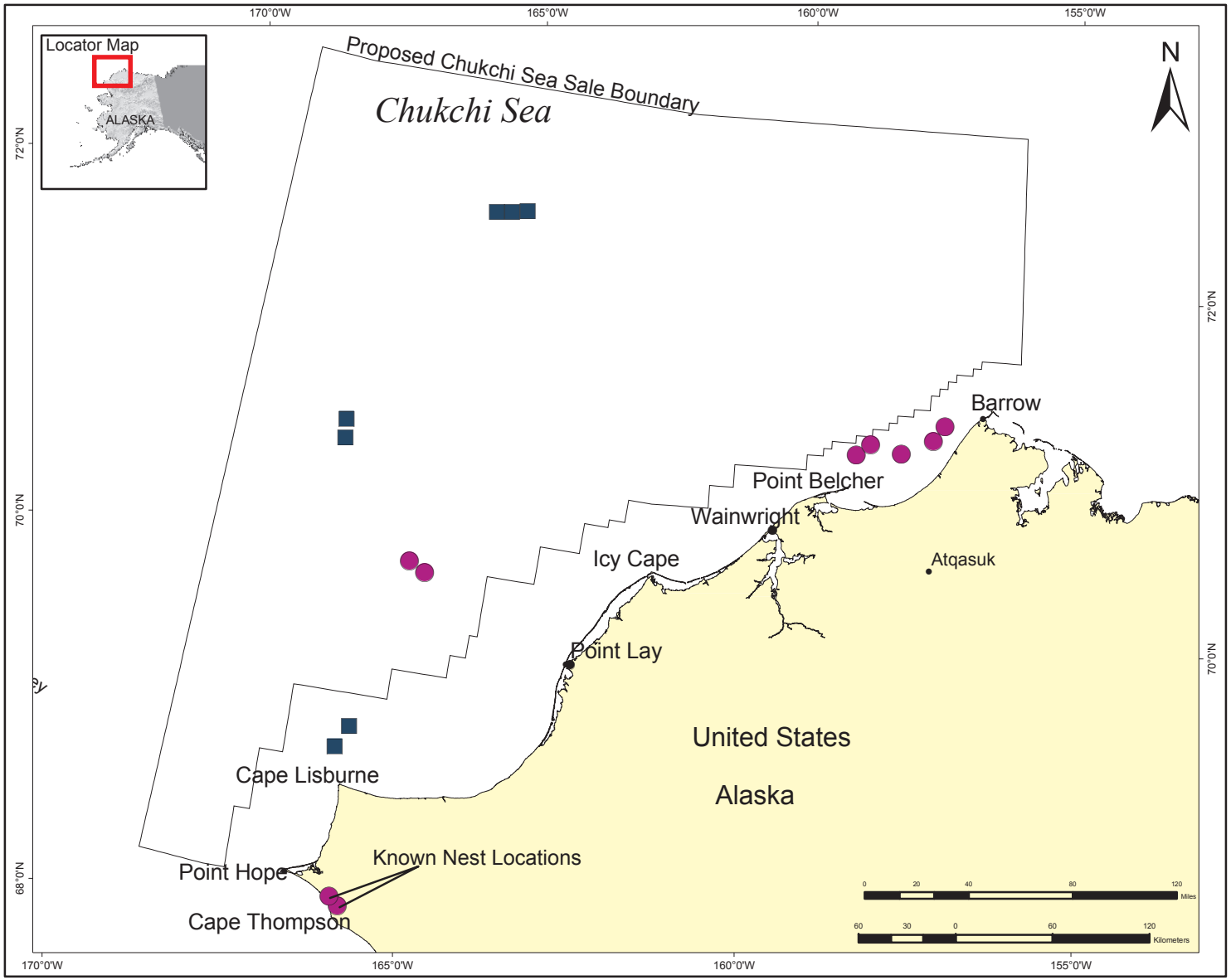
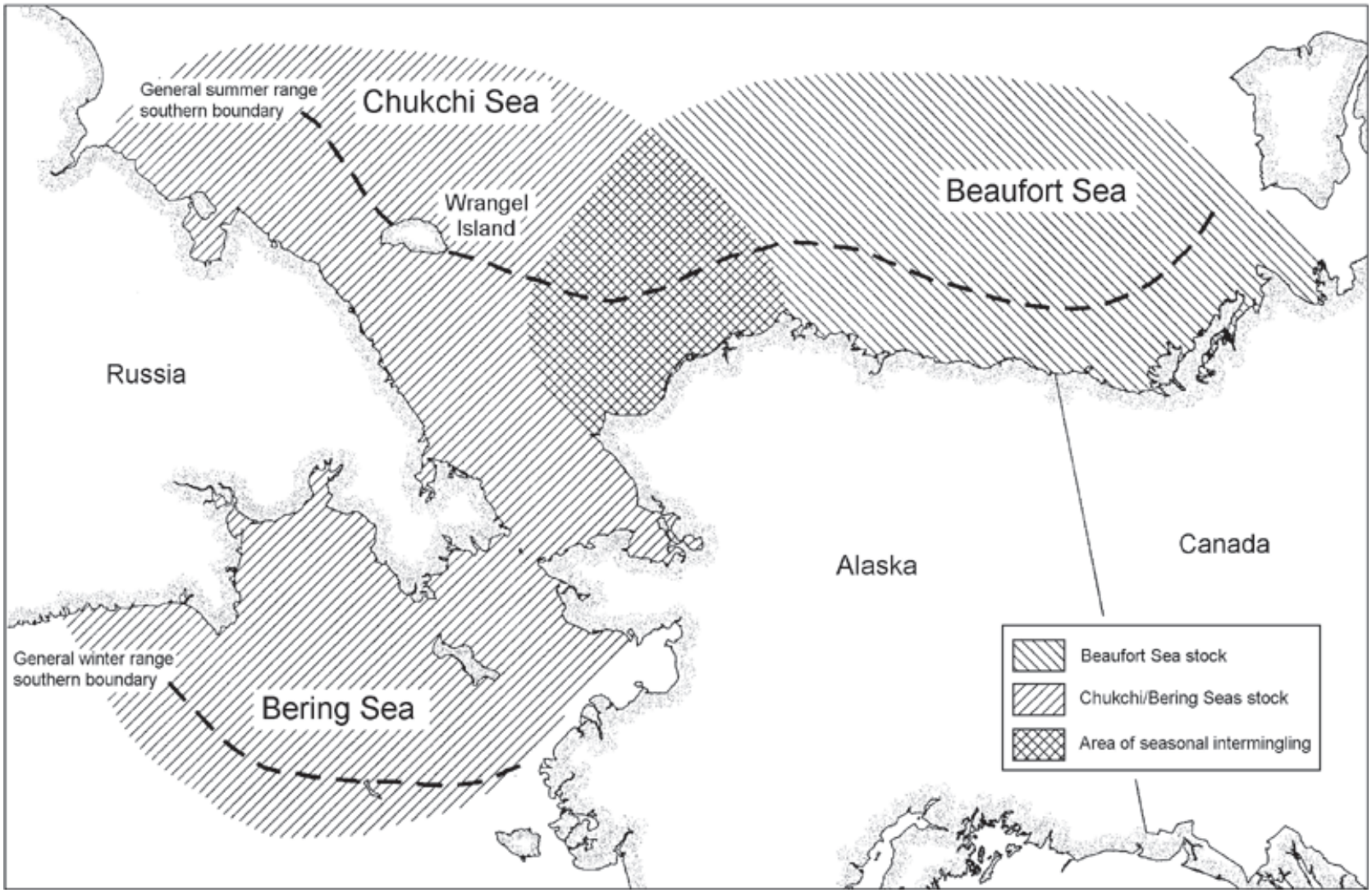
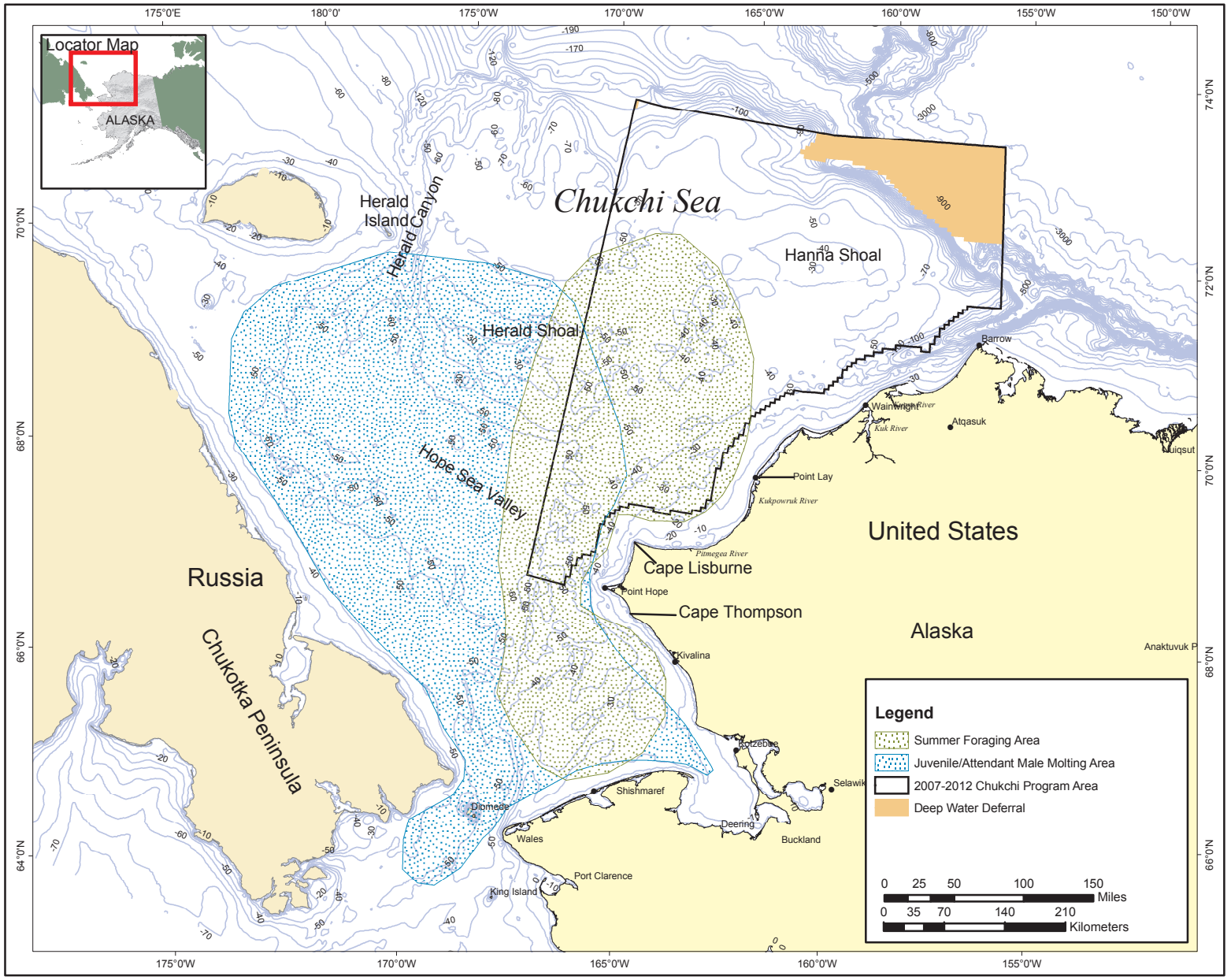


Figure 3.3.4.2-2 Kittlitz's Murrelet Offshore Observations and Nesting Information. Potential nesting area based on Day et al. (1990). Nest locations based on USDOI (2004). Offshore observations are designated as blocks (24 Aug-22 September) and dots (22 September-17 October) (Divoky 1987).



Source: USDOI, FWS, Region 7 (www.r7.fws.gov/fisheries/mmm/polarbear)

Figure 3.3.4.3-1 Distribution of the Chukchi/Bering Sea and Southern Beaufort Sea stocks of polar bear, from USFWS 2008.



Source: Hatch et al., (2000).

Figure 3.3.5-1 Approximate Areas used by Common and Thick-Billed Murres from the Cape Lisburne and Cape Thompson Colonies when Foraging in Summer and by the Juvenile and Attendant Males during the Postnesting Molting Period (late August through mid-November).

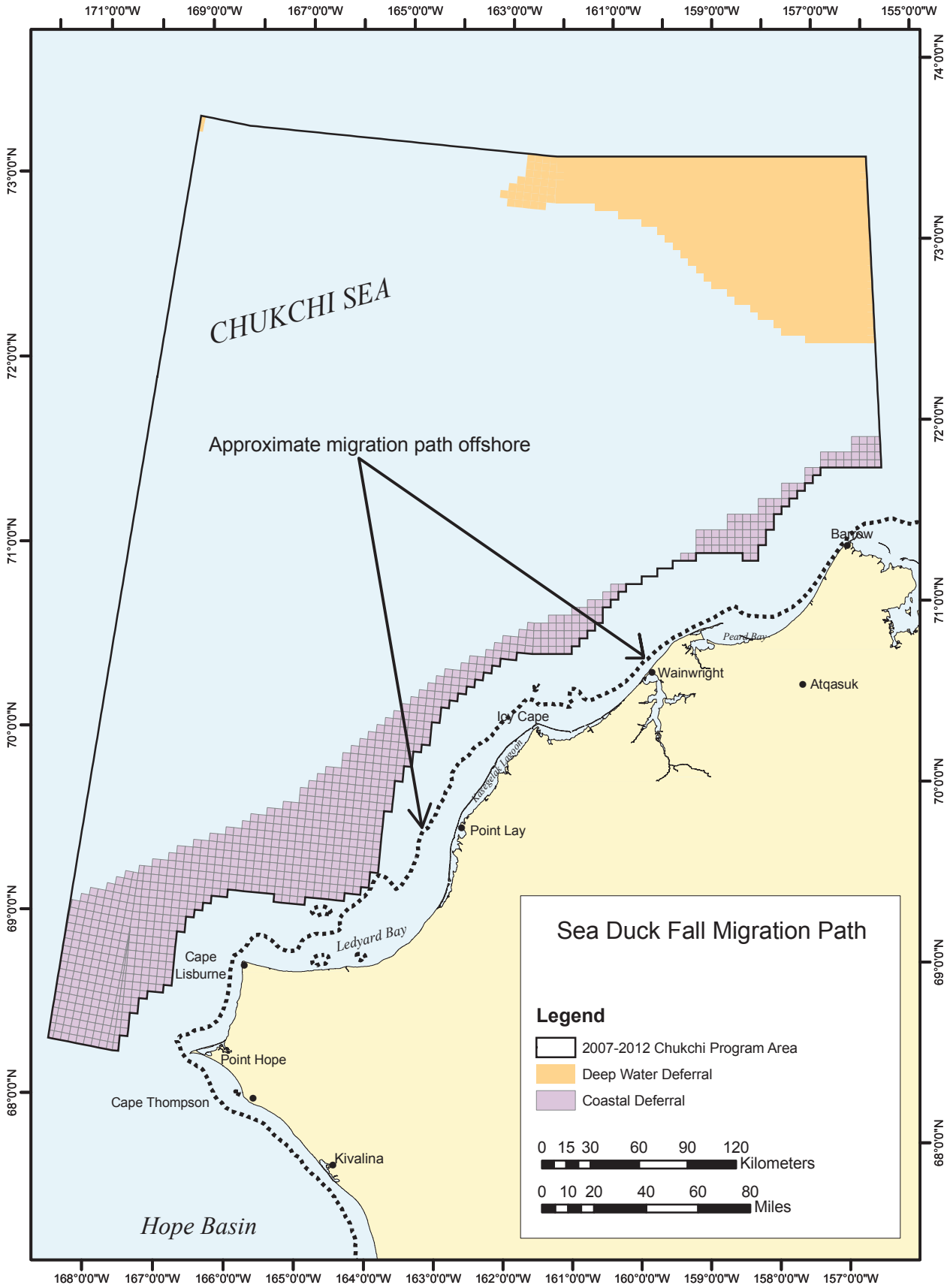
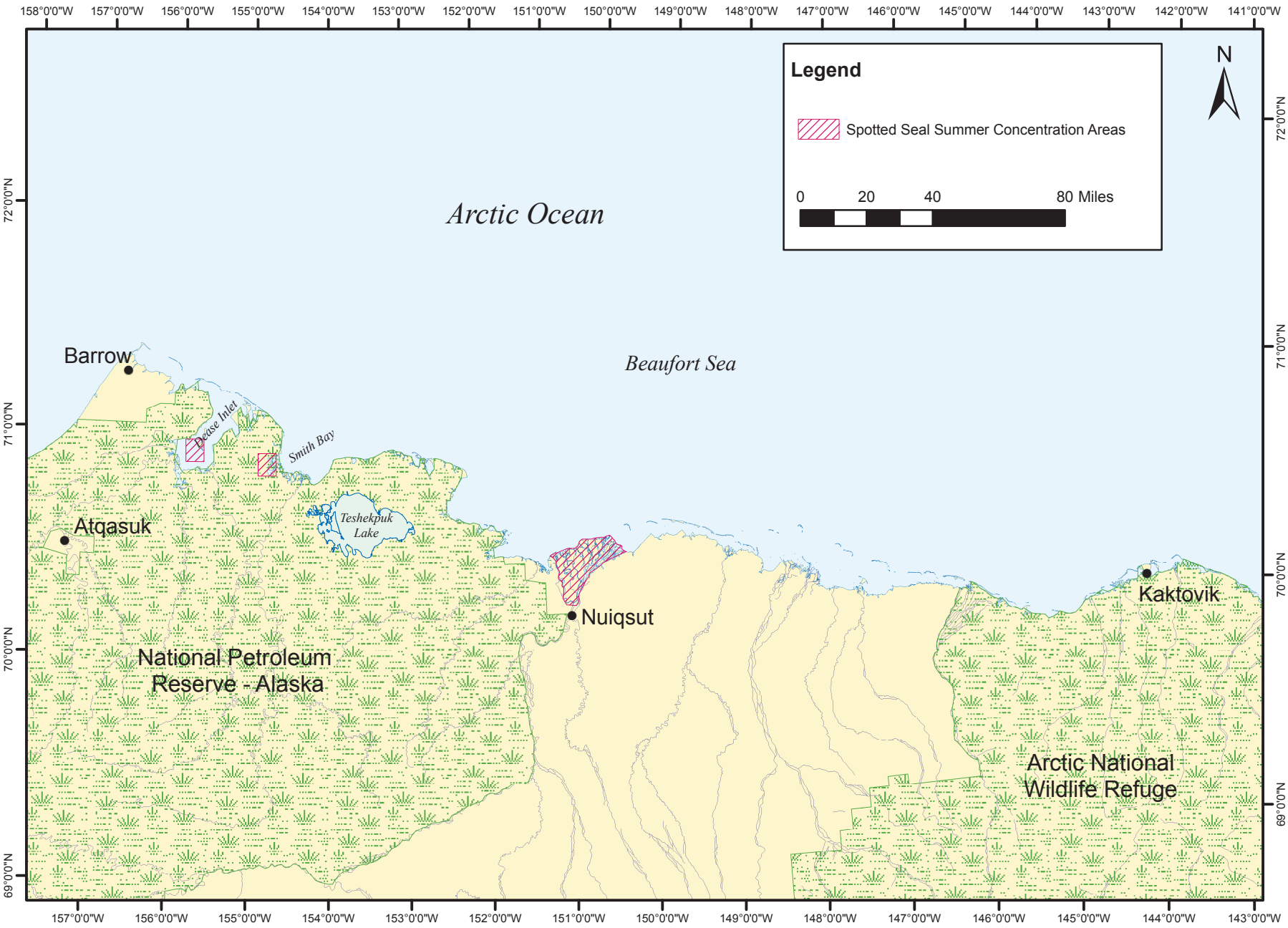


Figure 3.3.5-2 Approximate Migration Distances from Shore for King Eiders, Common Eiders, and Long-Tailed Ducks In Fall (these species tend to migrate along the 20-meter isobath).



Source: USDOI, BLM and MMS (1999)

Figure 3.3.6-1 Spotted Seal Summer Concentration Areas

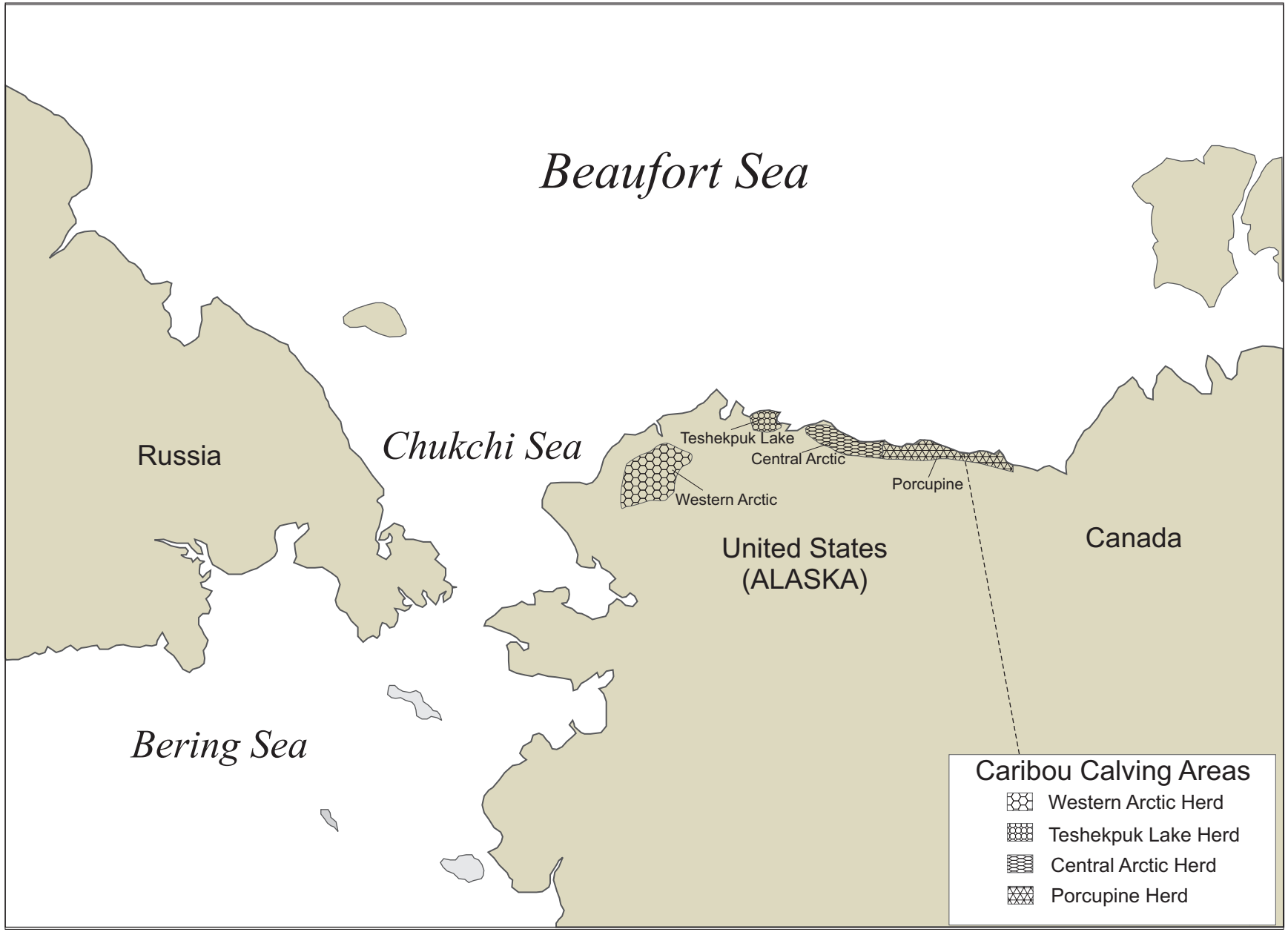


Figure 3.3.7.1-1 Caribou Calving Areas

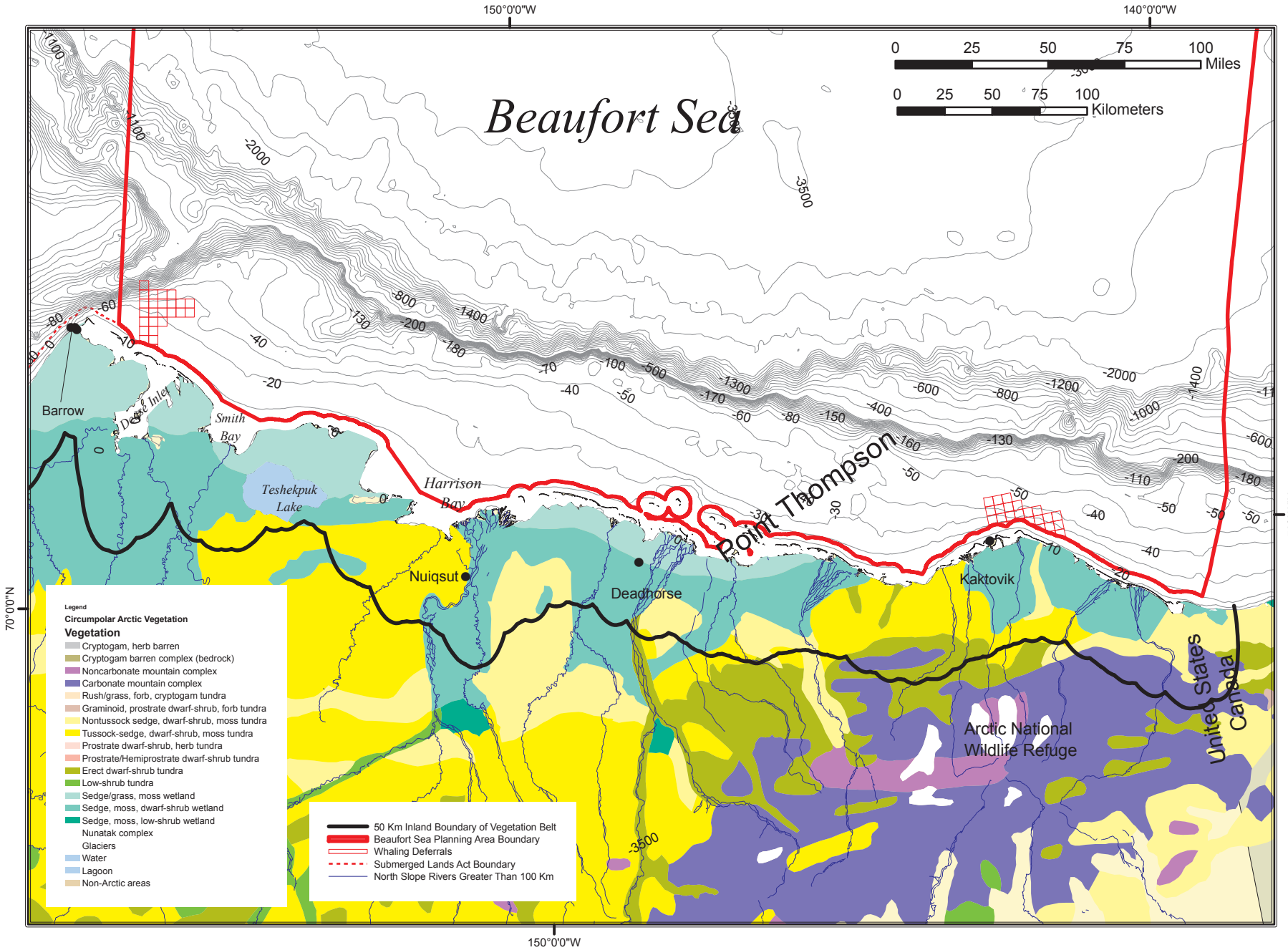


Figure 3.3.8-1 Vegetation and Wetlands within a 50-km belt from the Beaufort Shoreline.

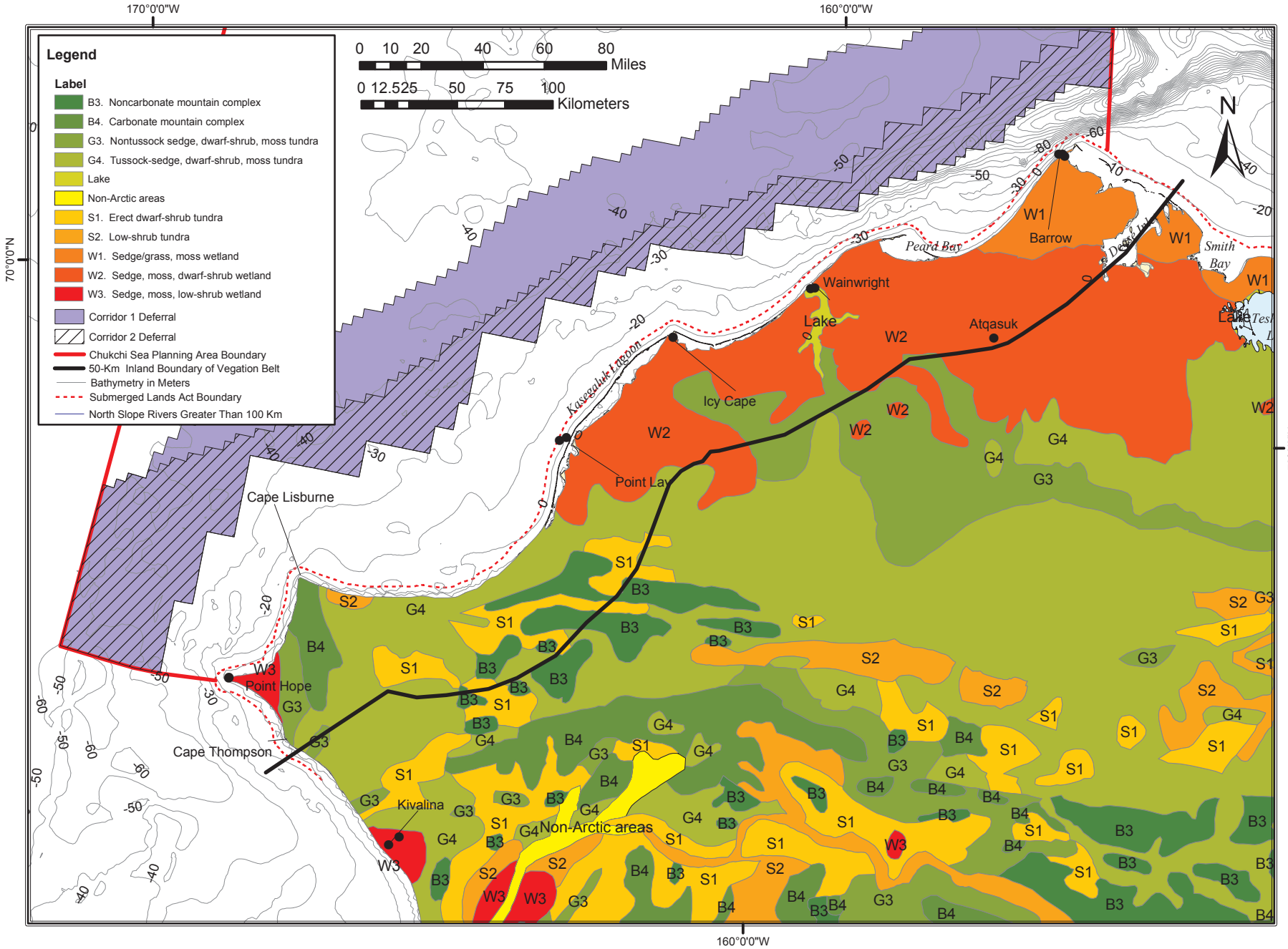
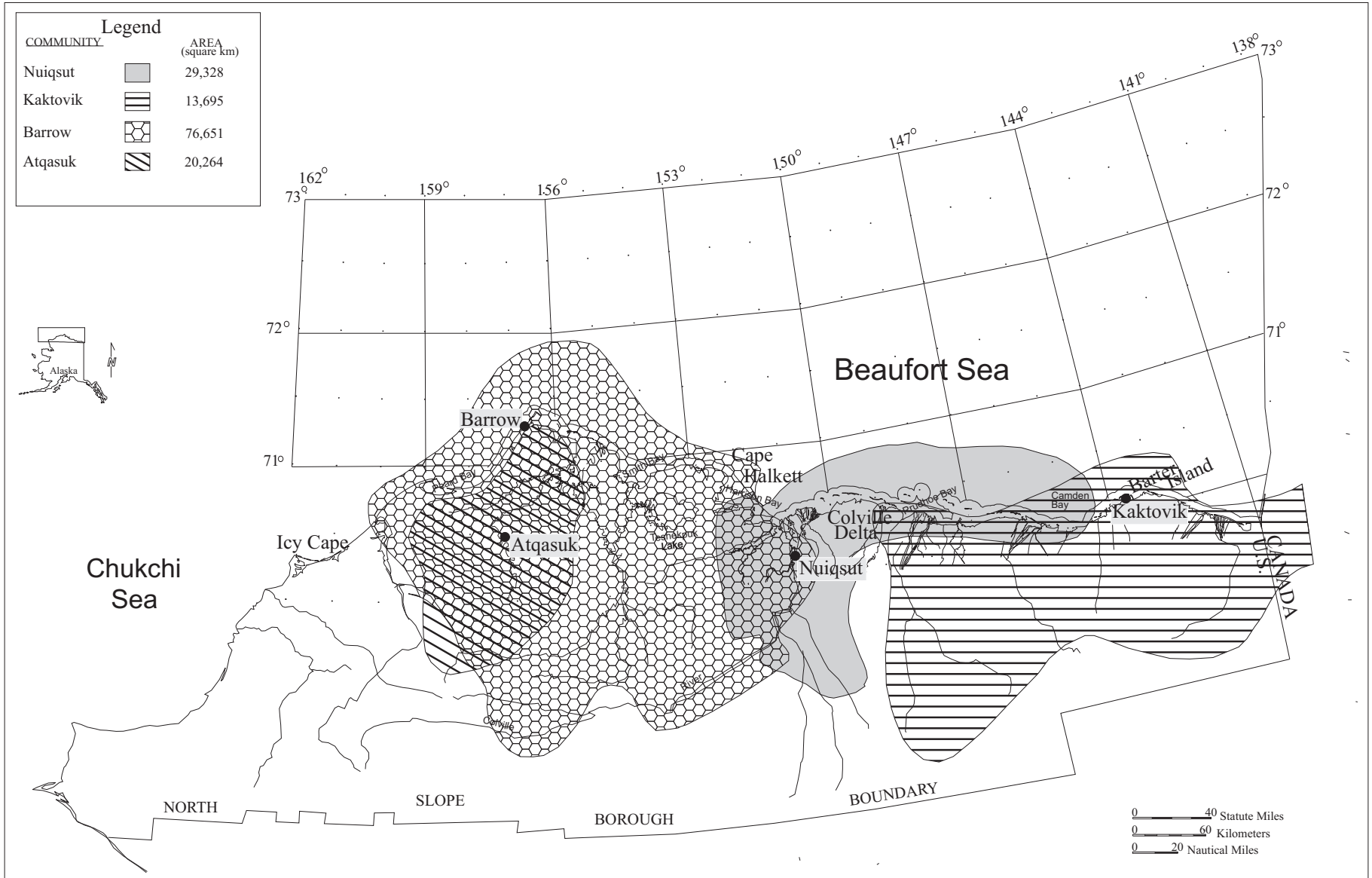


Figure 3.3.8-2 Vegetation and Wetlands within a 50-km belt from the Chukchi Shoreline.



Source: Impact Assessment Inc. (1990a and b) (Nuiqsut and Kaktovik); and Braund (1989a and b) (Barrow).

Figure 3.4.2-1 Subsistence-Harvest Areas for Beaufort Sea Communities of Barrow, Atqasuk, Nuiqsut, and Kaktovik

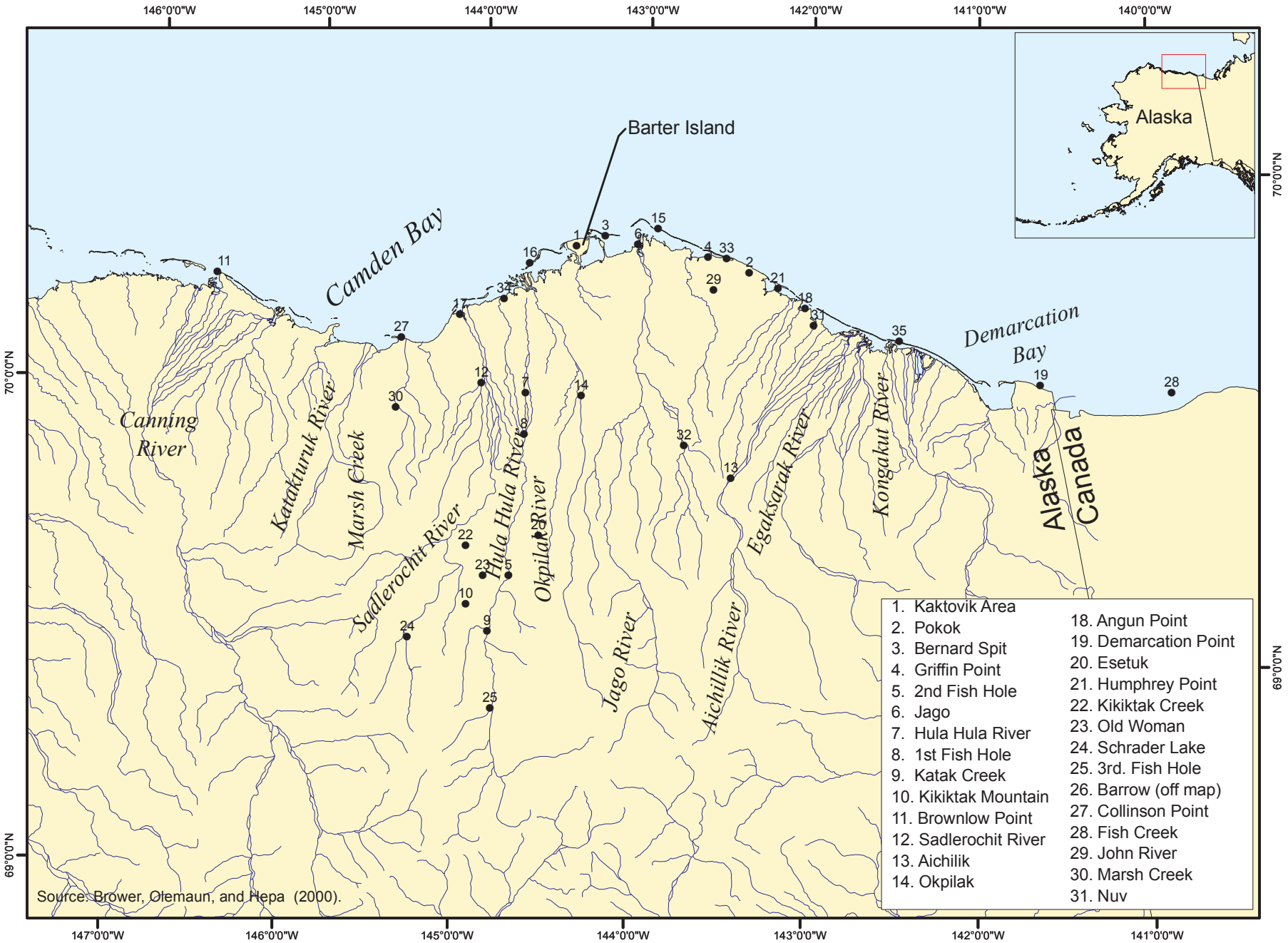


Figure 3.4.2-2 Kaktovik Subsistence Harvest Place Names, July 1994 to June 1995.

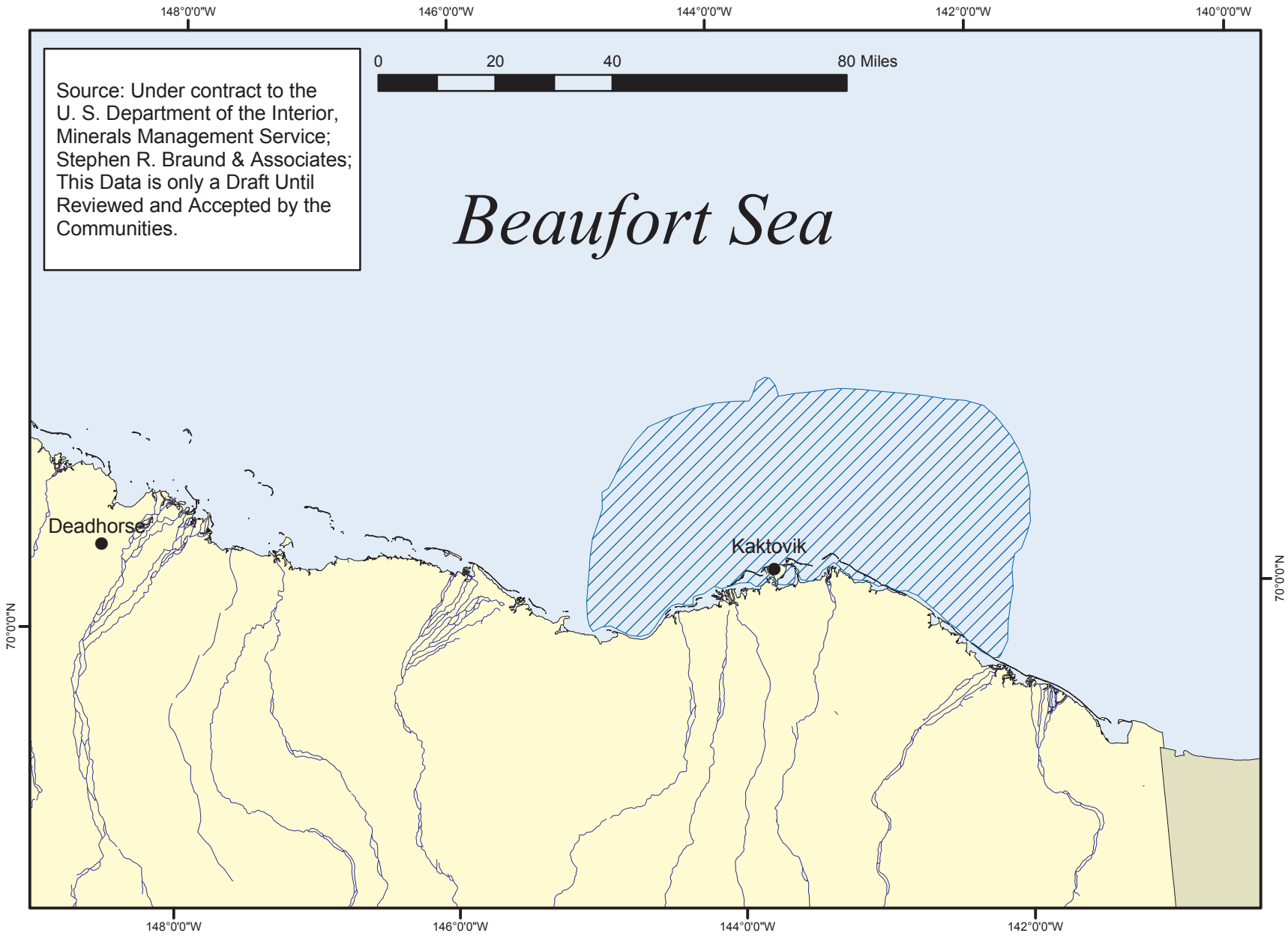


Figure 3.4.2-3 Kaktovik Subsistence-Use Areas, Bowhead Whale, 1996-2006

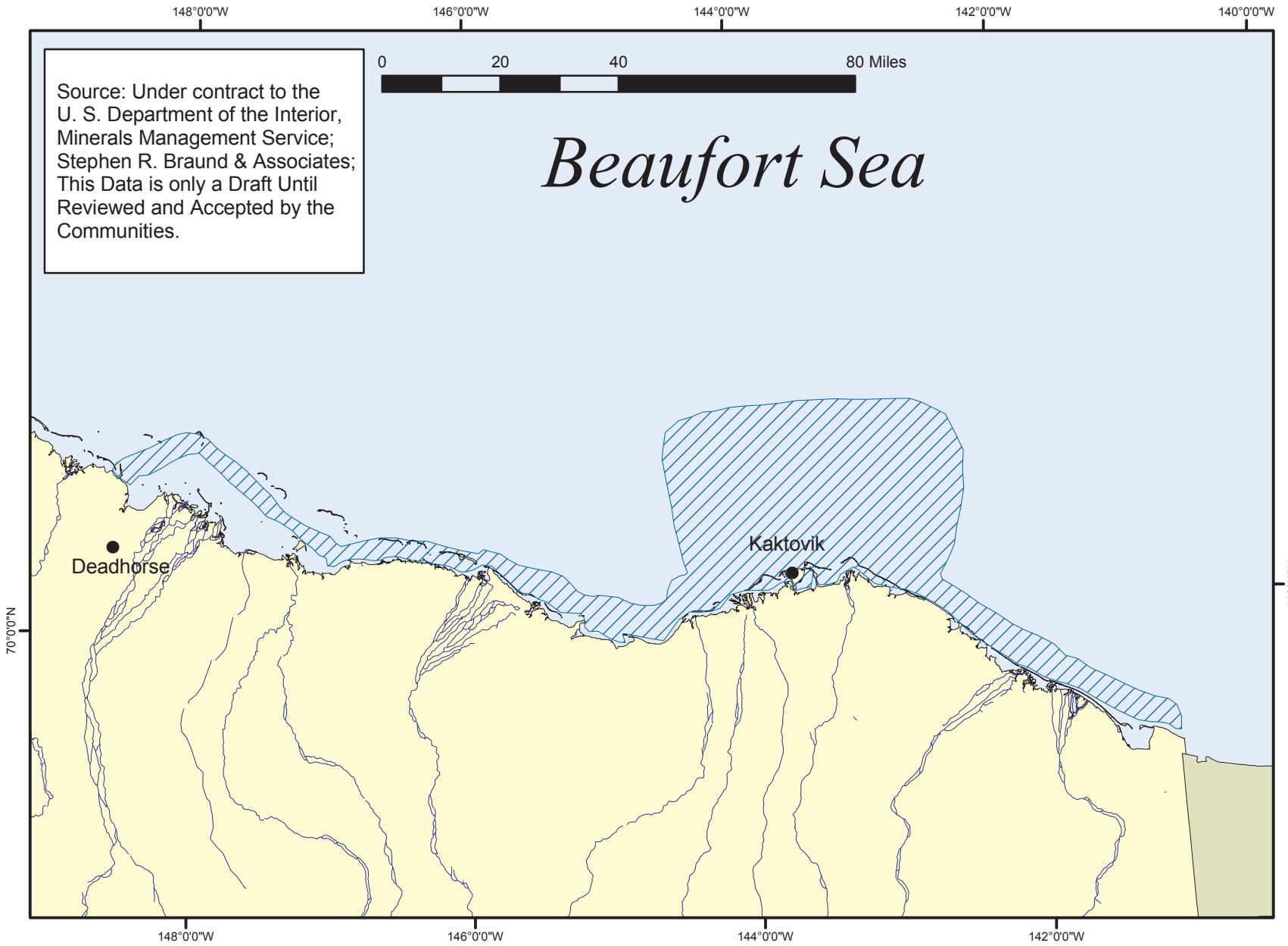


Figure 3.4.2-4 Kaktovik Subsistence-Use Areas, Ringed Seal, 1996-2006

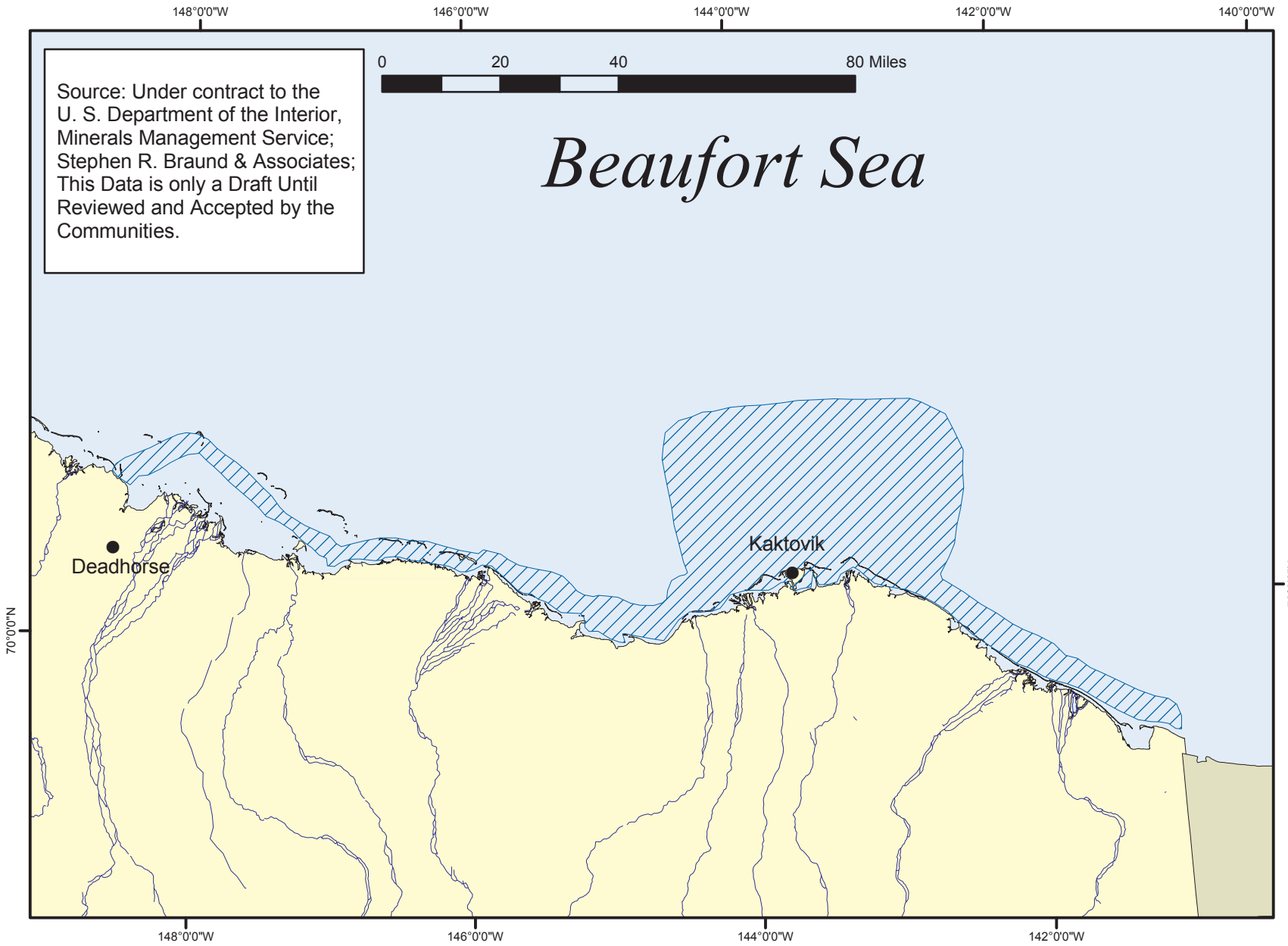


Figure 3.4.2-5 Kaktovik Subsistence-Use Areas, Bearded Seal, 1996-2006

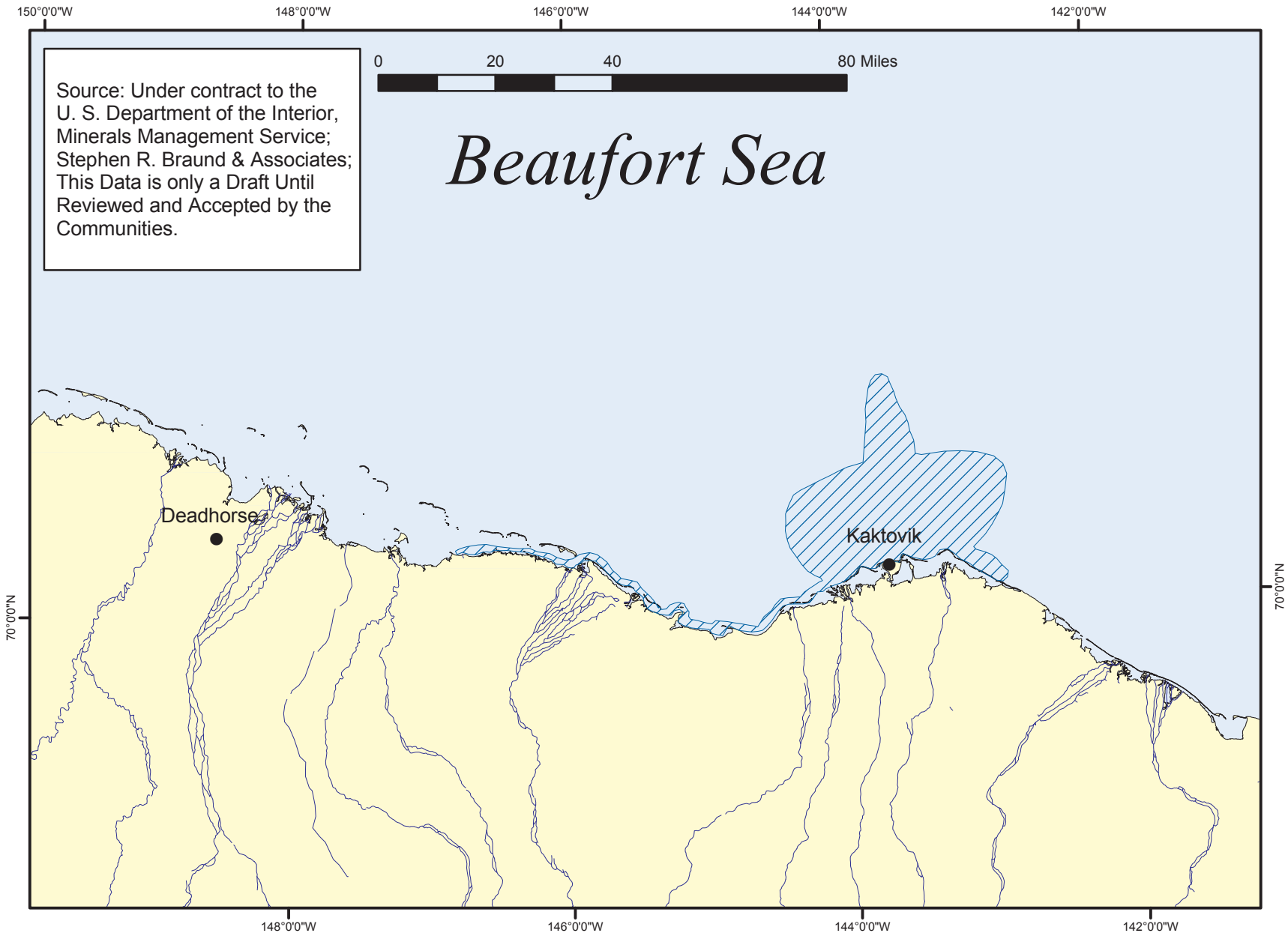
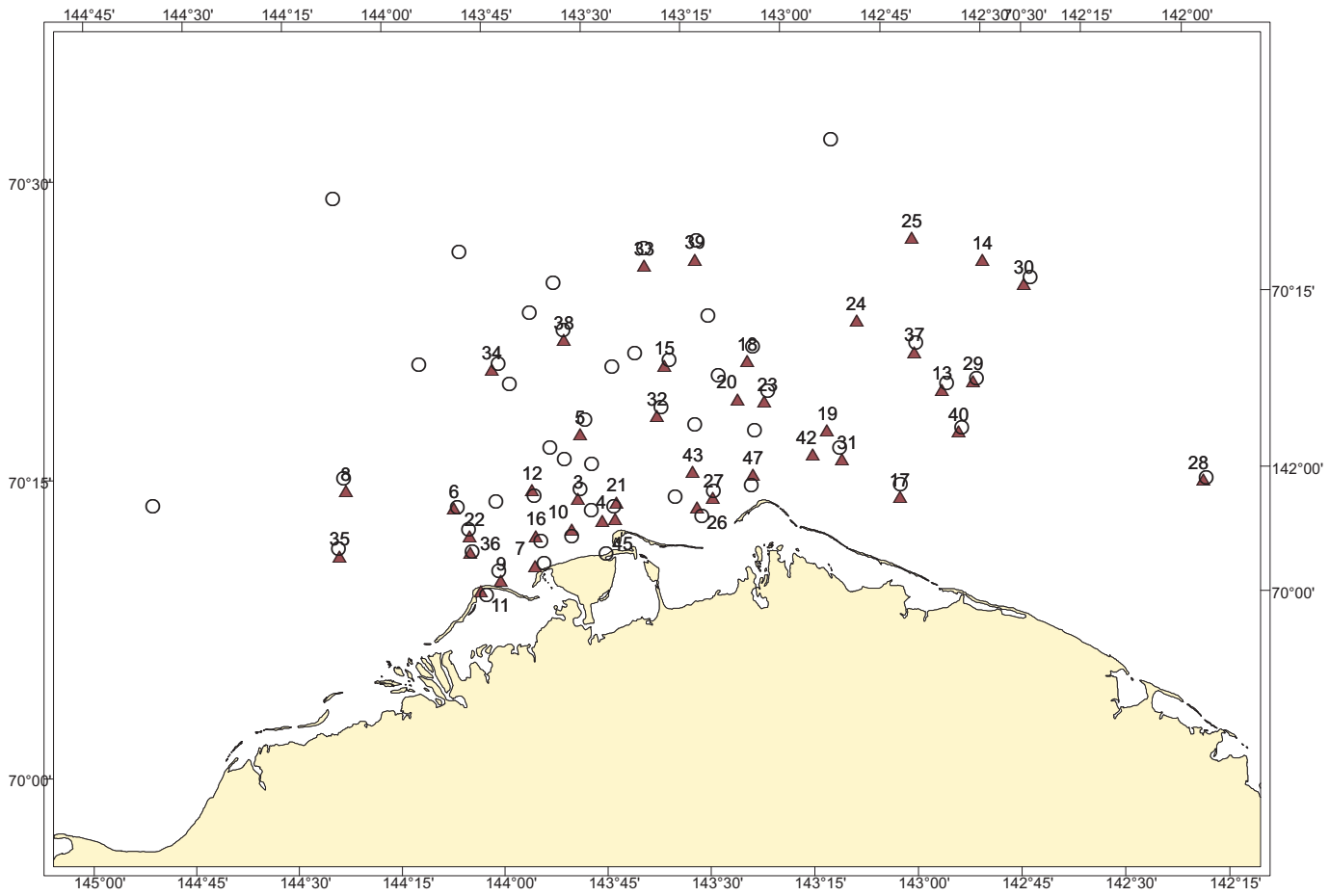


Figure 3.4.2-6 Kaktovik Subsistence-Use Areas, Walrus, 1996-2006



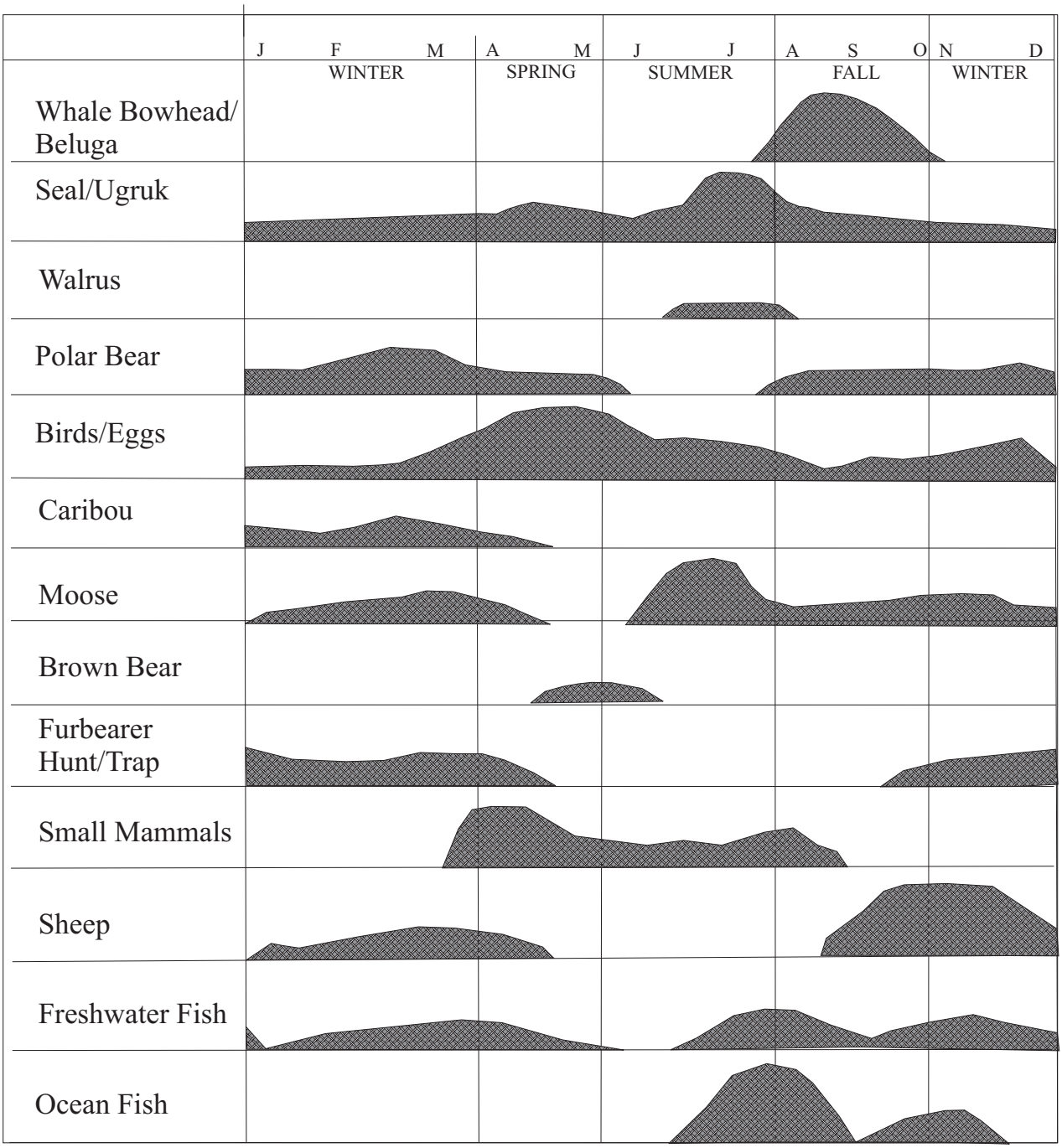
▲ Bowhead Strikes 1988-1995

○ North Slope Borough Bowhead Strikes 1989-2001

Location	Harvest Date	Location	Harvest Date
1	9/17/1988	22	9/26/1992
2	10/2/1989	23	10/8/1992
3	10/2/1989	24	10/5/1993
4	10/2/1989	25	10/7/1993
5	10/2/1989	26	10/13/1993
6	9/27/1991	27	10/18/1993
7	9/28/1991	28	10/19/1993
8	10/2/1991	29	10/20/1993
9	10/4/1991	30	10/13/1993
10	8/31/1992	31	10/1/1994
11	9/1/1992	32	9/5/1995
12	9/2/1992	33	9/6/1995
13	9/2/1992	34	9/11/1995
14	9/2/1992	35	9/16/1995
15	9/3/1992	36	9/16/1995
16	9/12/1992	37	9/18/1995
17	9/17/1992	38	9/20/1995
18	9/19/1992	39	9/20/1995
19	9/23/1992	40	10/16/1995
20	9/24/1992	41	10/17/1995
21	9/26/1992	42	10/17/1995

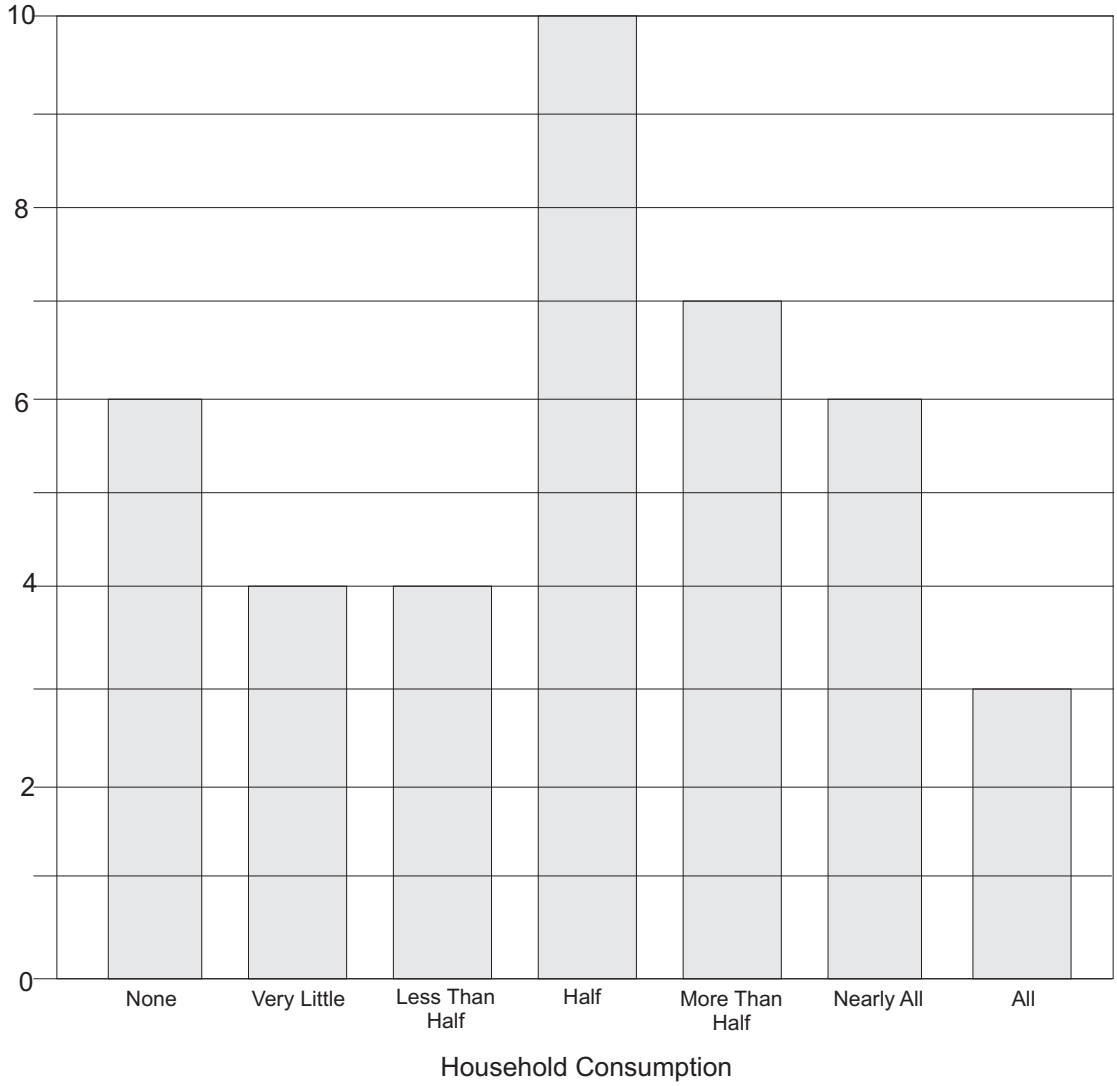
Sources: Kaleak (1996); North Slope Borough Planning Dept. (1993); North Slope Borough (2001)

Figure 3.4.2-7 Bowhead Whale Harvest Locations Near Kaktovik 1988 - 2001



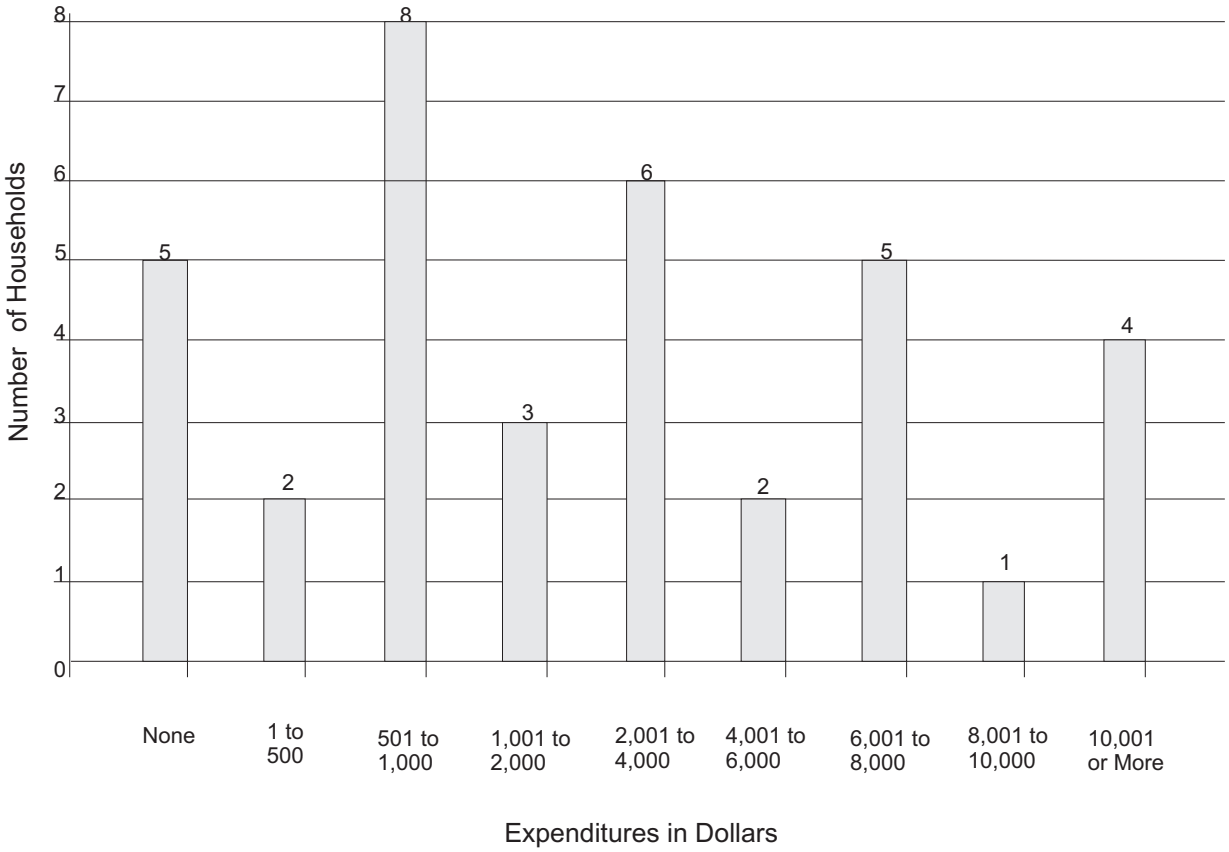
Source: North Slope Borough Contract Staff (1979)

Figure 3.4.2-8 Kaktovik Annual Subsistence Cycle



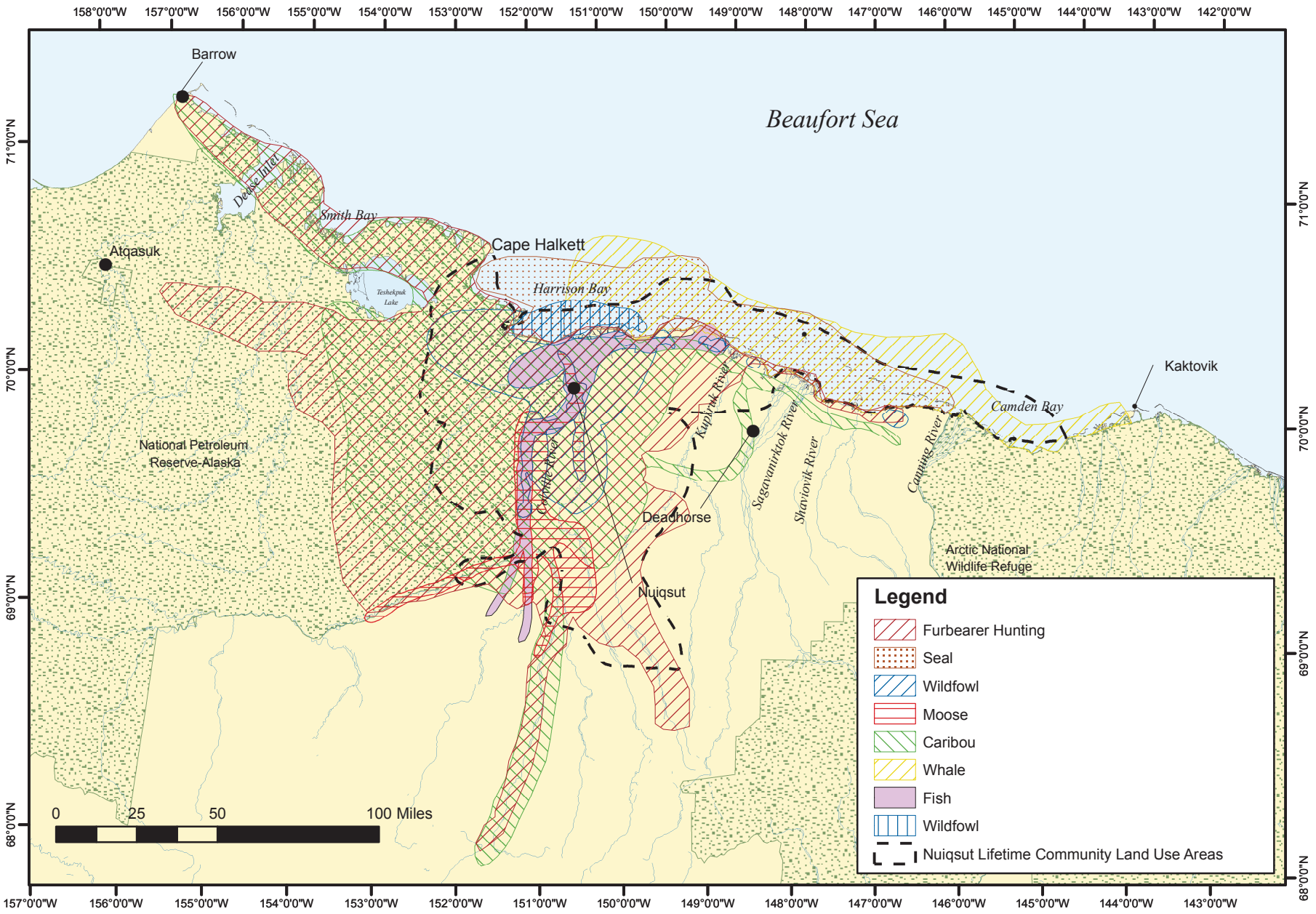
Source: Harcharek (1995).

Figure 3.4.2-9 Kaktovik Household Consumption of Meat, Fish, and Birds, from Subsistence Activities
(Household results include only those households that participated in the study.)



Source: Harcharek (1995)

Figure 3.4.2-10 Kaktovik Household Expenditures on Subsistence Activities.



Source: Braund & Associates (2004)

Figure 3.4.2-11 Nuiqsut Subsistence Land Use 1973-1986

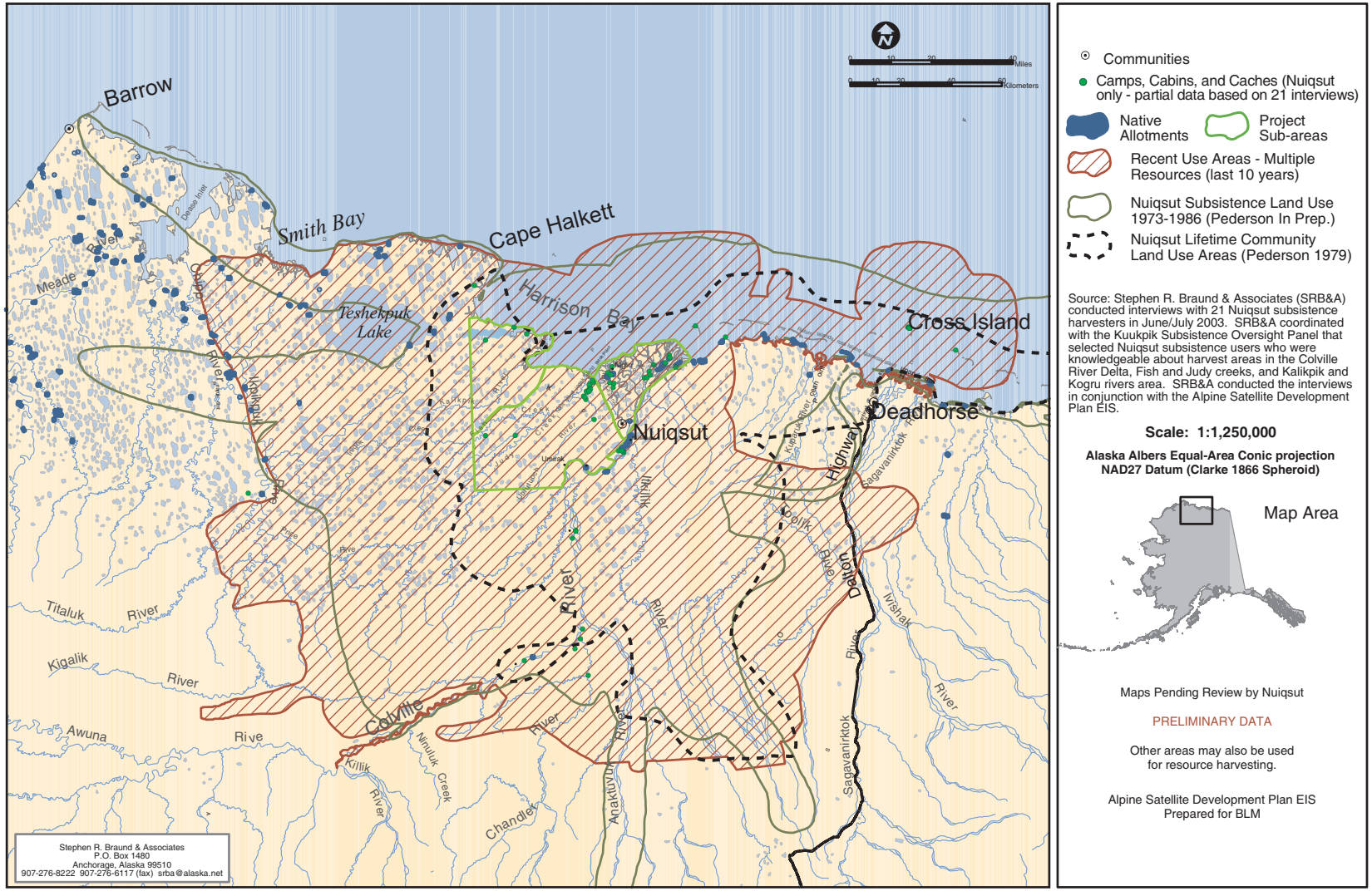
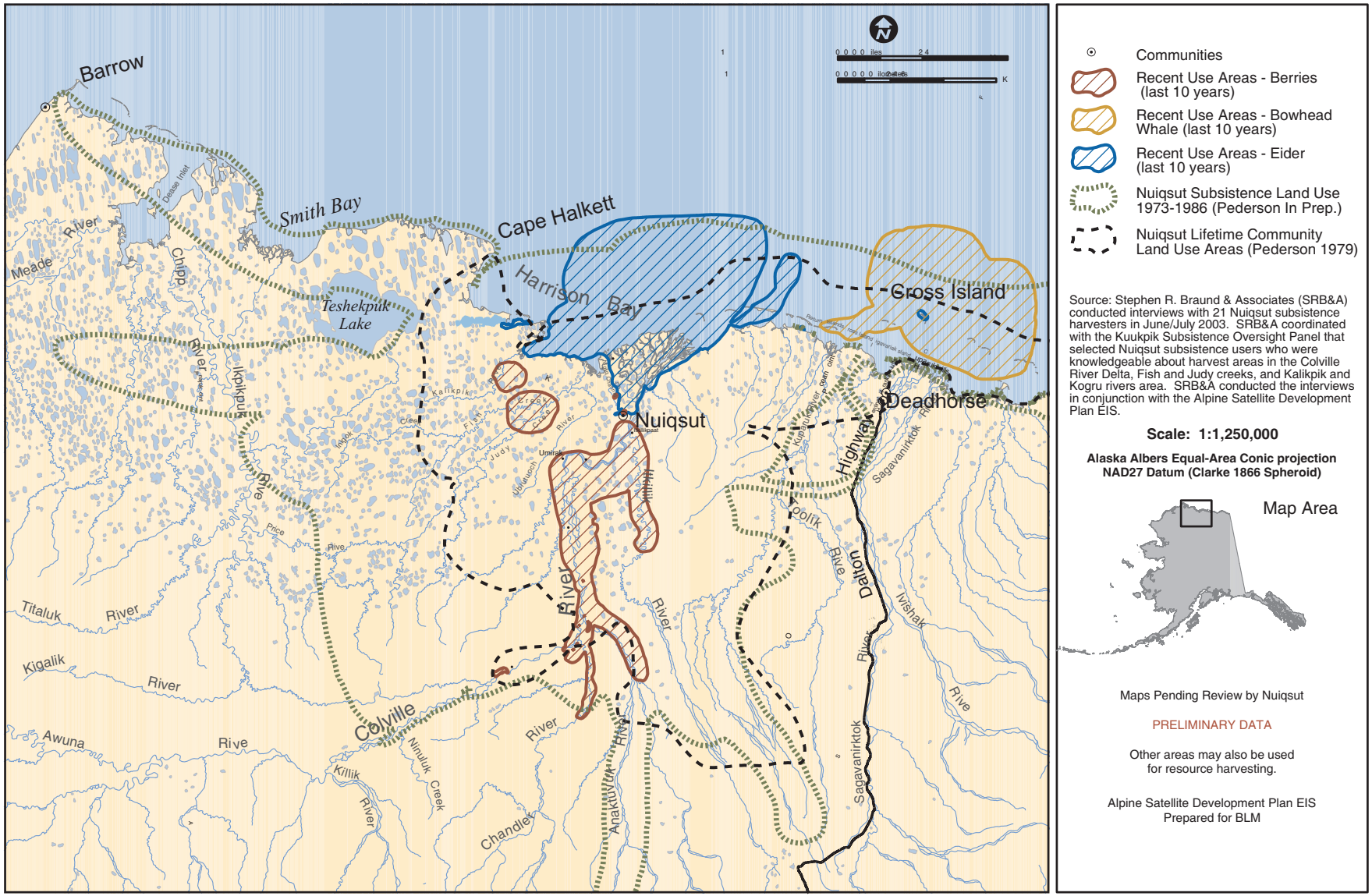
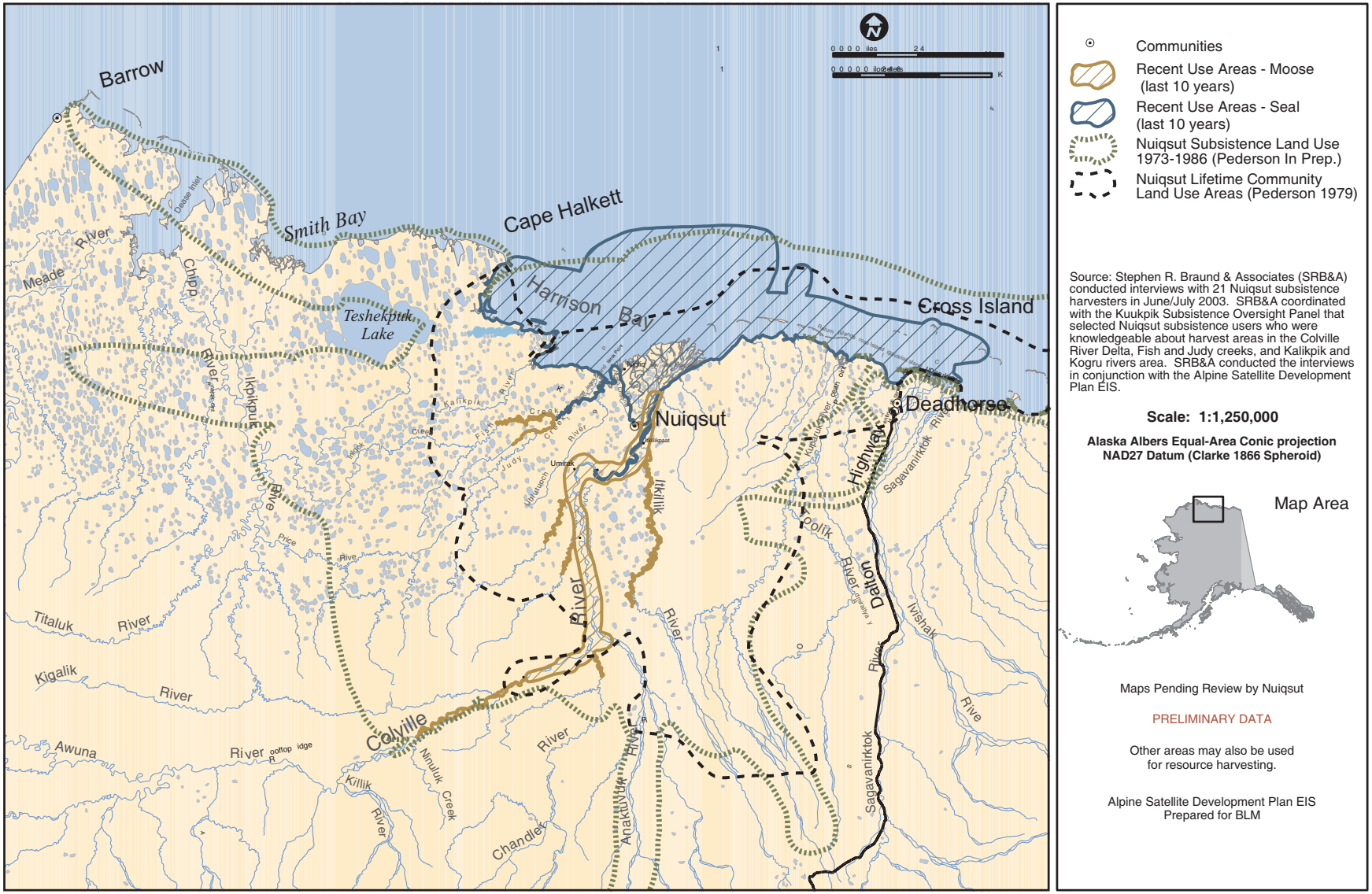


Figure 3.4.2-12 Nuiqsut Camps, Cabins, and Caches



Source: Braund & Associates (2004)

Figure 3.4.2-13 Nuiqsut Partial Subsistence Use Areas for Berries, Bowhead Whale, and Eider, 2003



Source: Braund & Associates (2004)

Figure 3.4.2-14 Nuiqsut Partial Subsistence-Use Areas for Moose and Seal, 2003

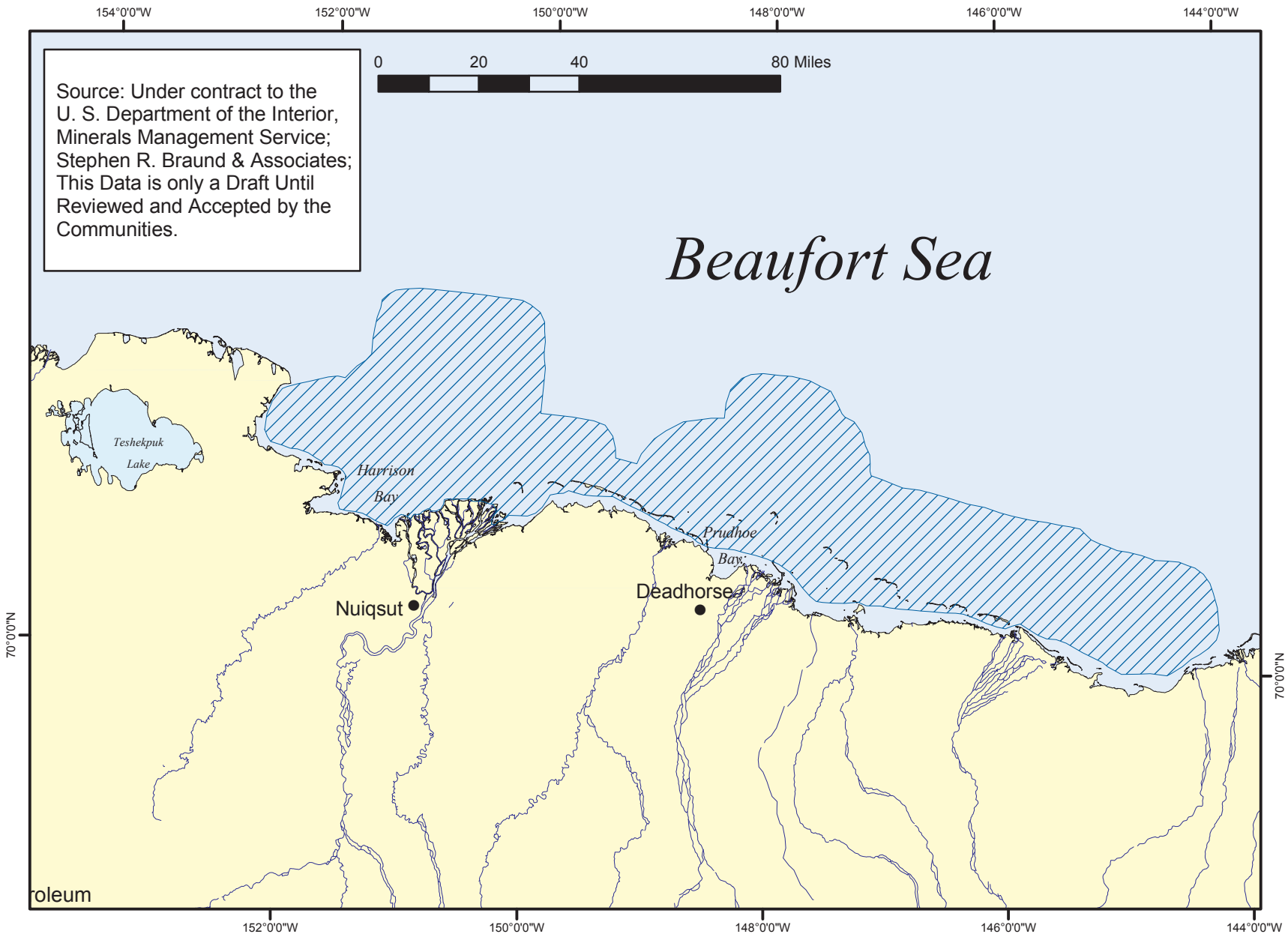


Figure 3.4.2-15 Nuiqsut Subsistence-Use Areas, Ringed Seal, 1996-2006

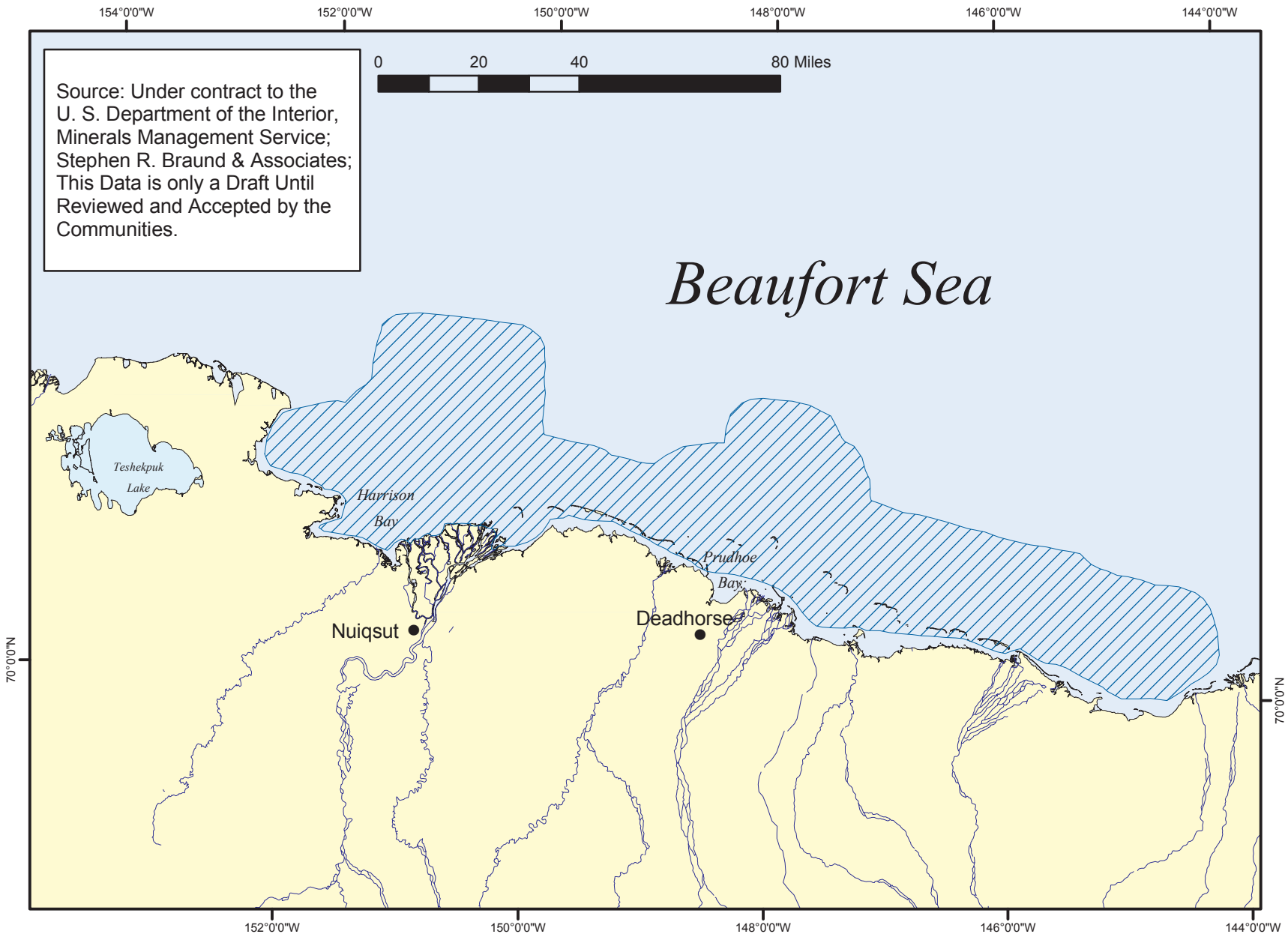
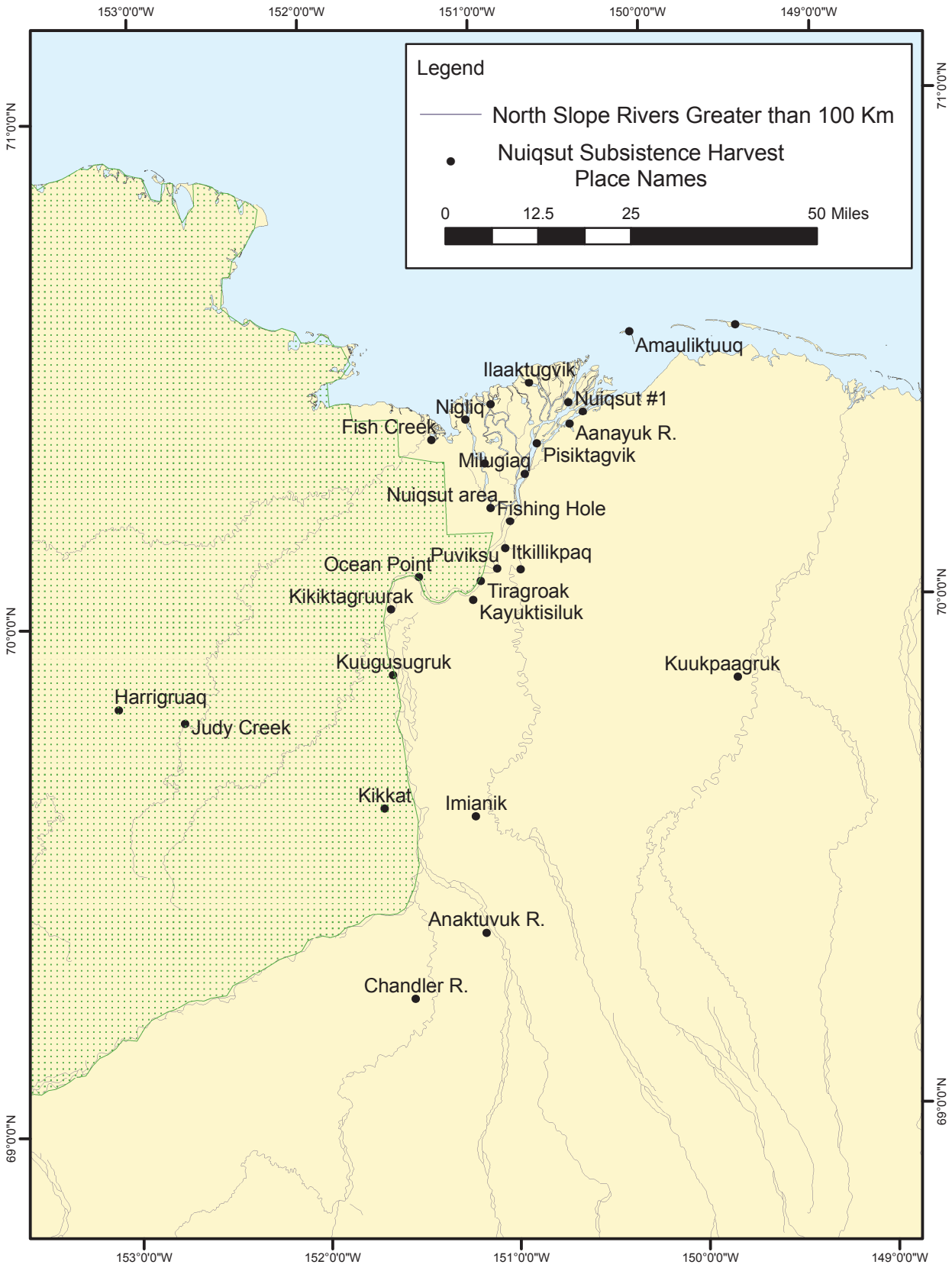


Figure 3.4.2-16 Nuiqsut Subsistence-Use Areas, Bearded Seal, 1996-2006



Source: Brower and Opie (1997)

Figure 3.4.2-17 Nuiqsut Subsistence-Harvest Place Names, July 1994 to June 1995

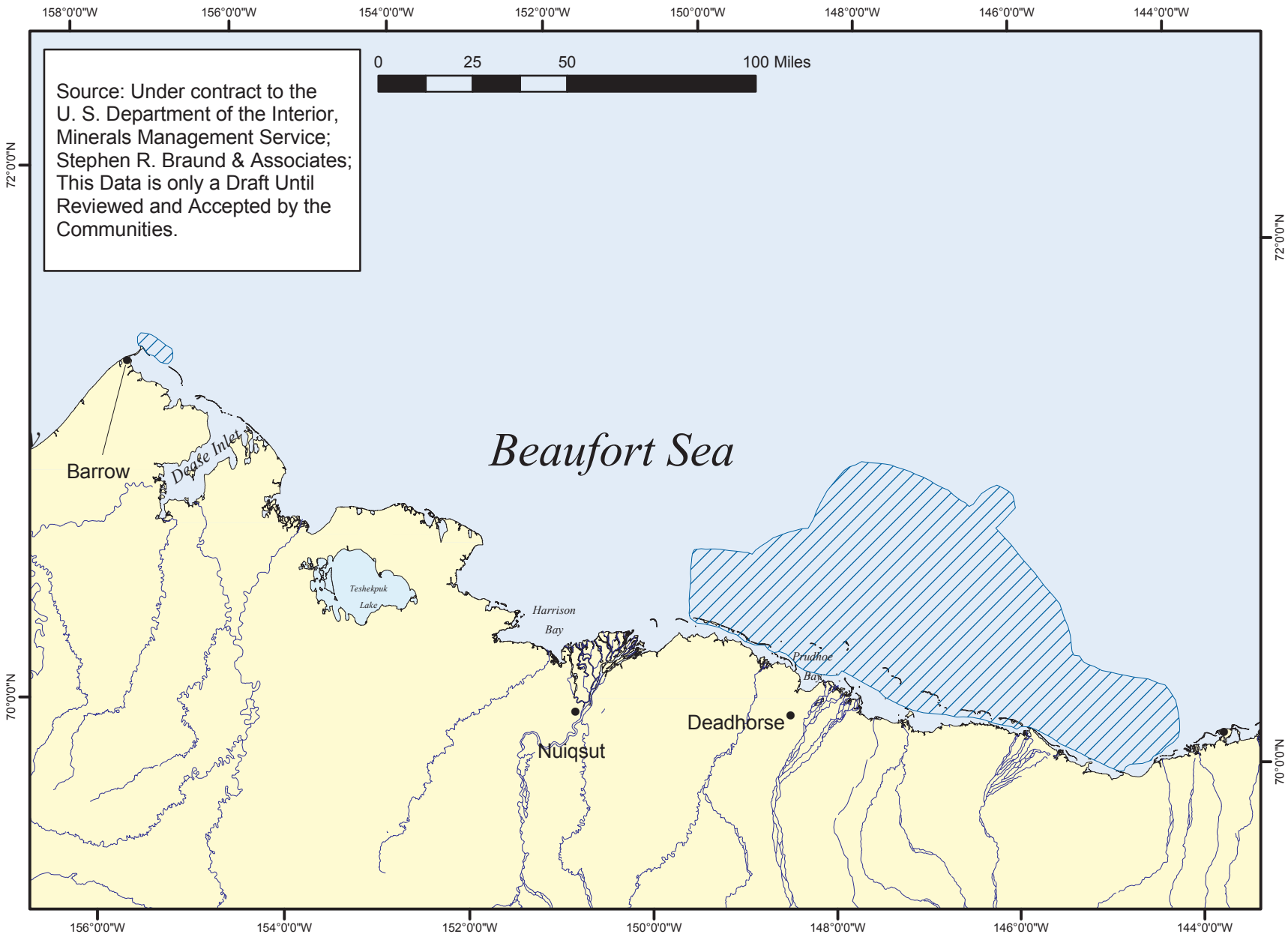
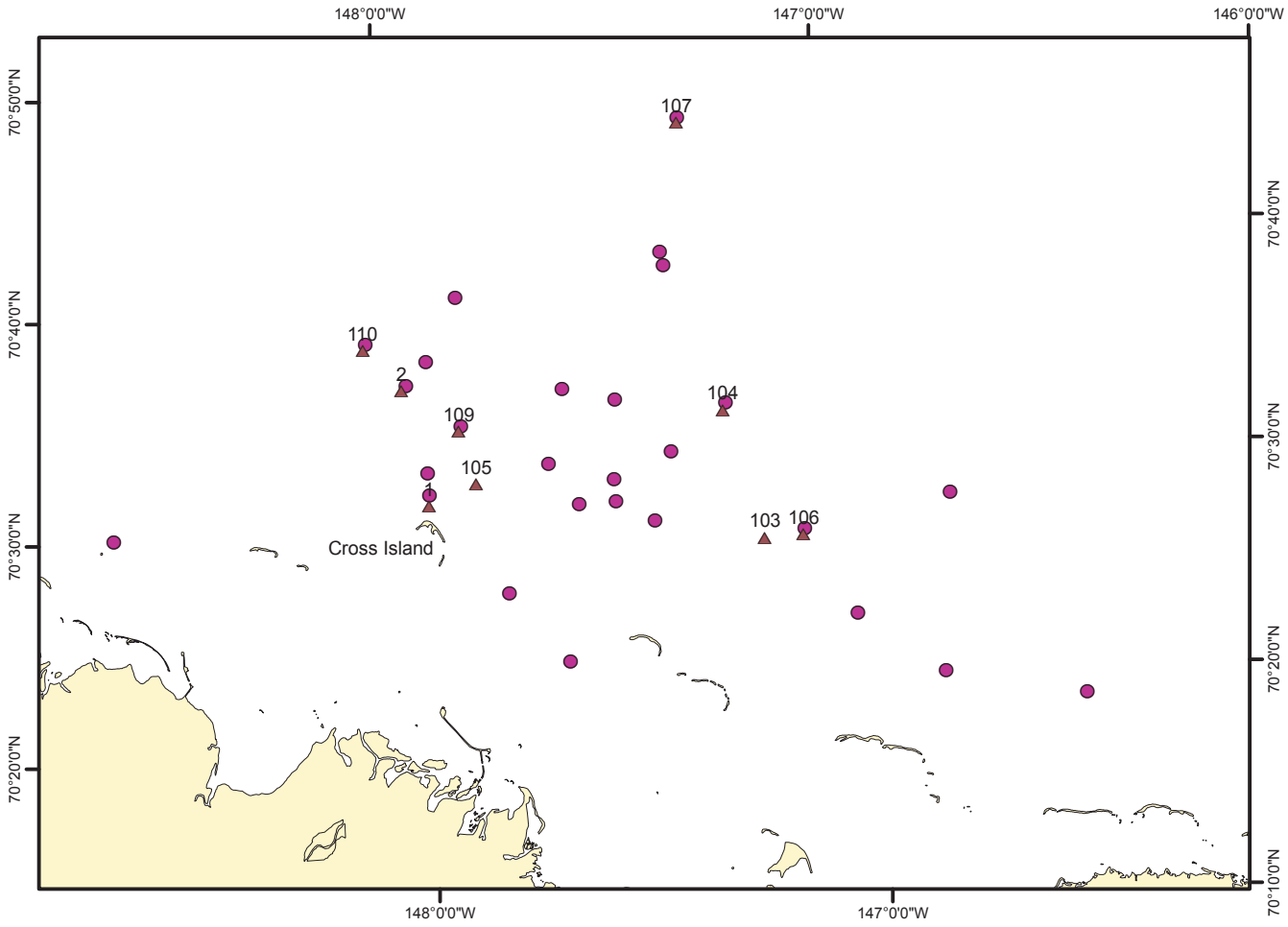


Figure 3.4.2-18 Nuiqsut Subsistence-Use Areas, Bowhead Whale, 1996-2006

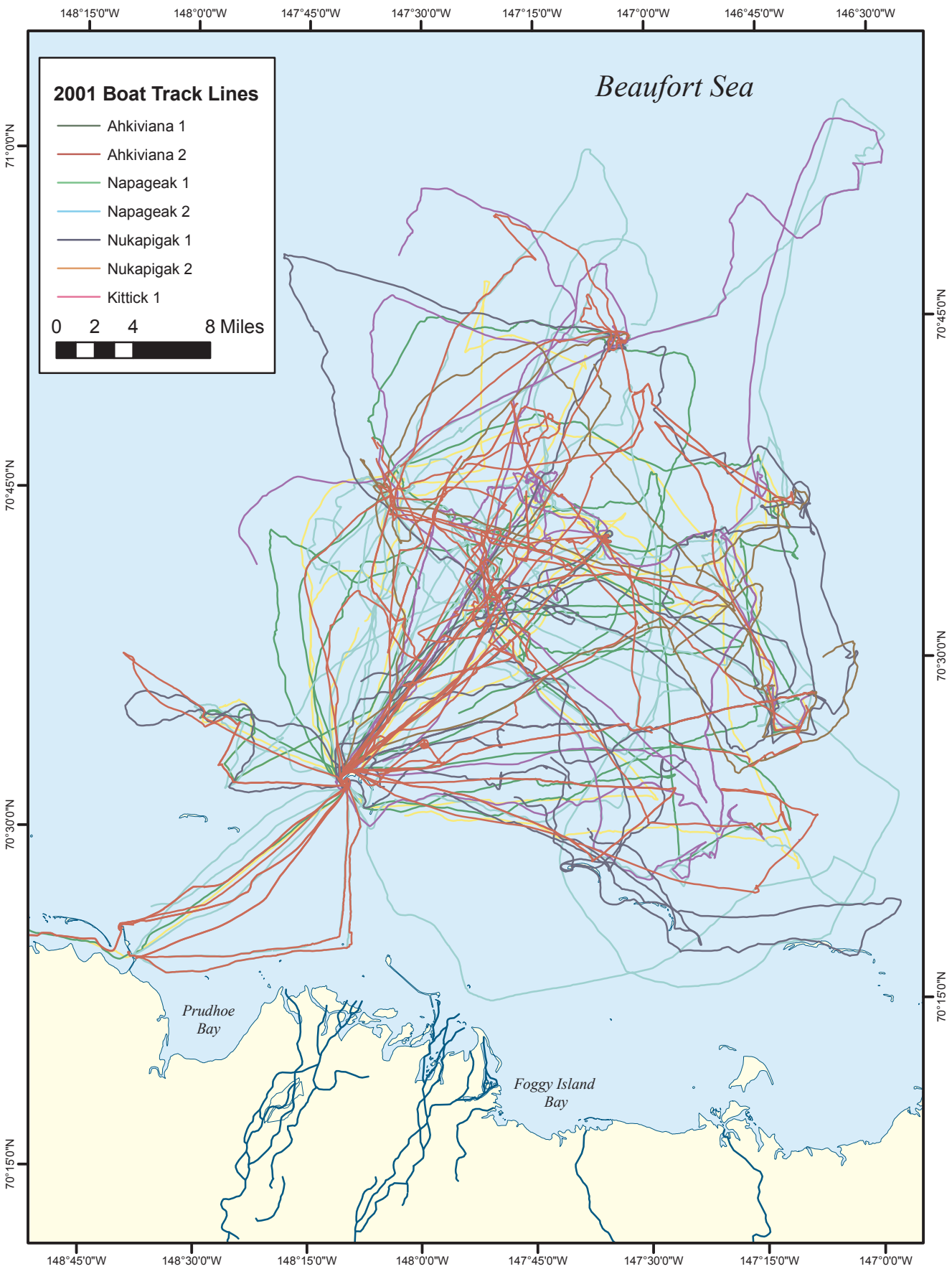


▲ Bowhead Whale Strikes 1937-1992
● Historic Bowhead Strikes 1937-2001

Location Id	Year
1	1937
2	1940
103	1983
104	1985
105	1986
106	1990
107	1991
109	1992
110	1992

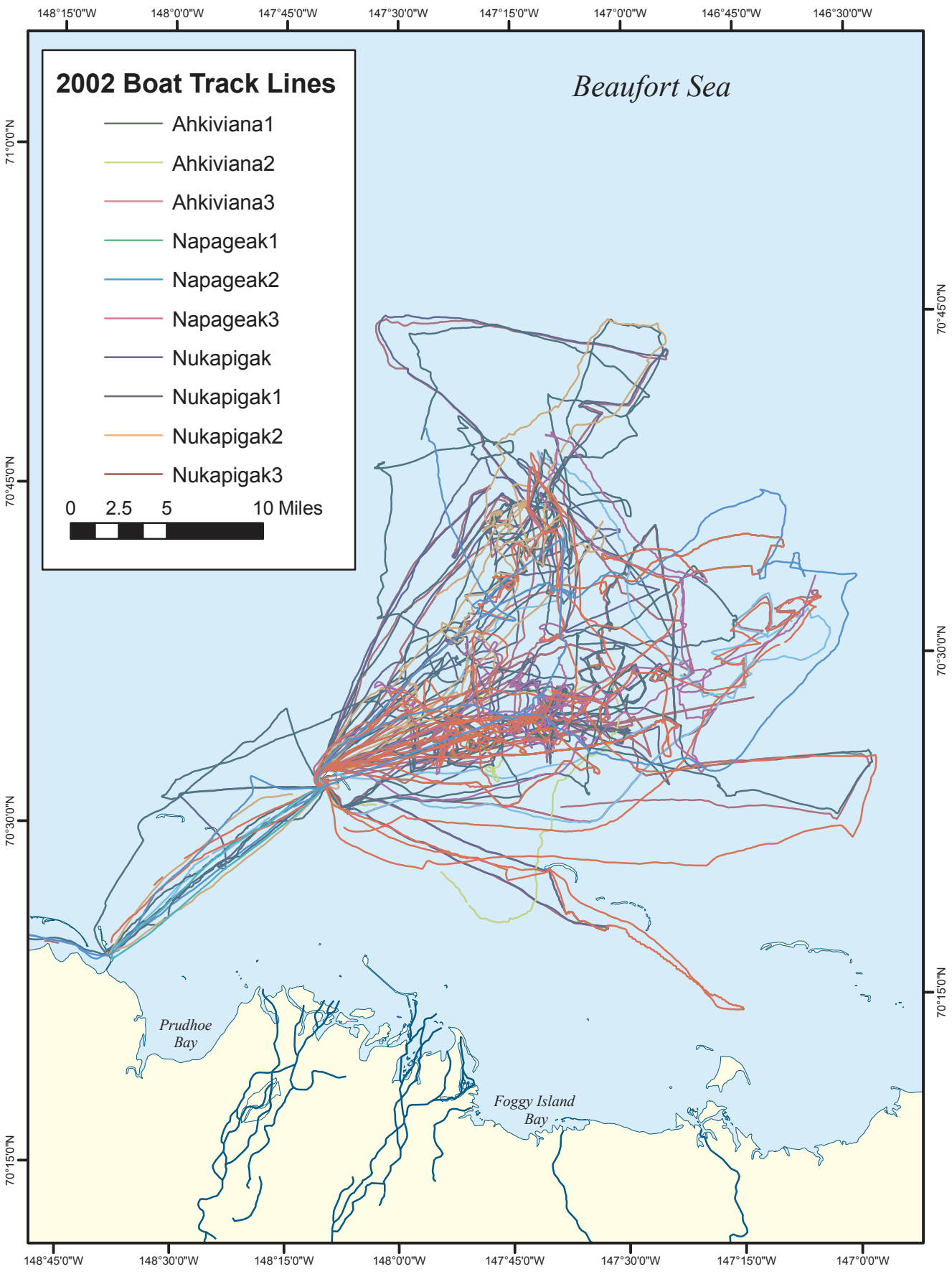
Sources: Long (1996); North Slope Borough Planning Dept. (1993); Bowhead Strikes 1937-2001

Figure 3.4.2-19 Bowhead Whale Harvest Locations Near Cross Island, 1937 - 2001



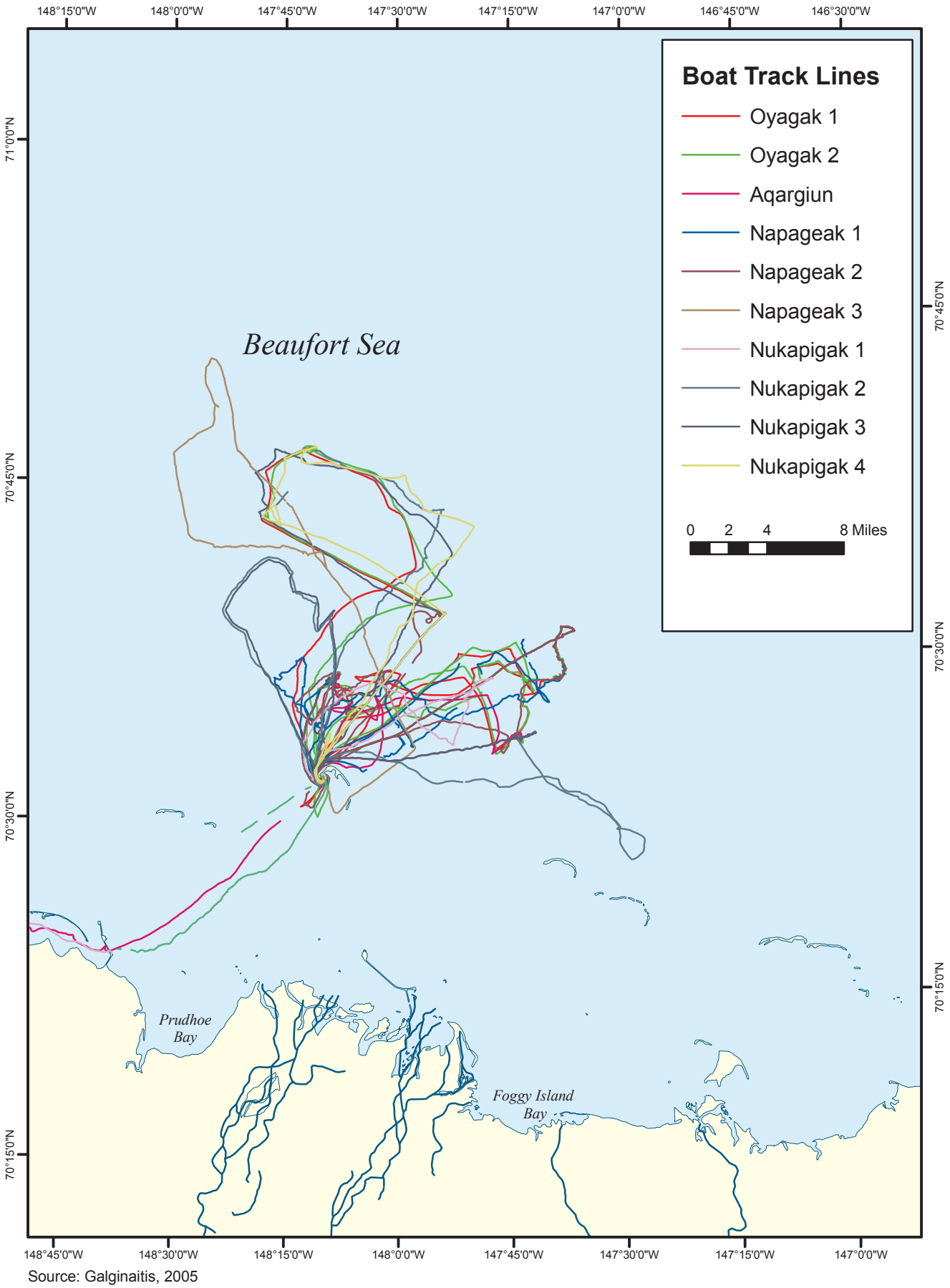
Source: Galginaitis, 2004

Figure 3.4.2-20 Composite GPS Tracks for All Whaling Trips for All Boats, 2001 Cross Island Whaling Season



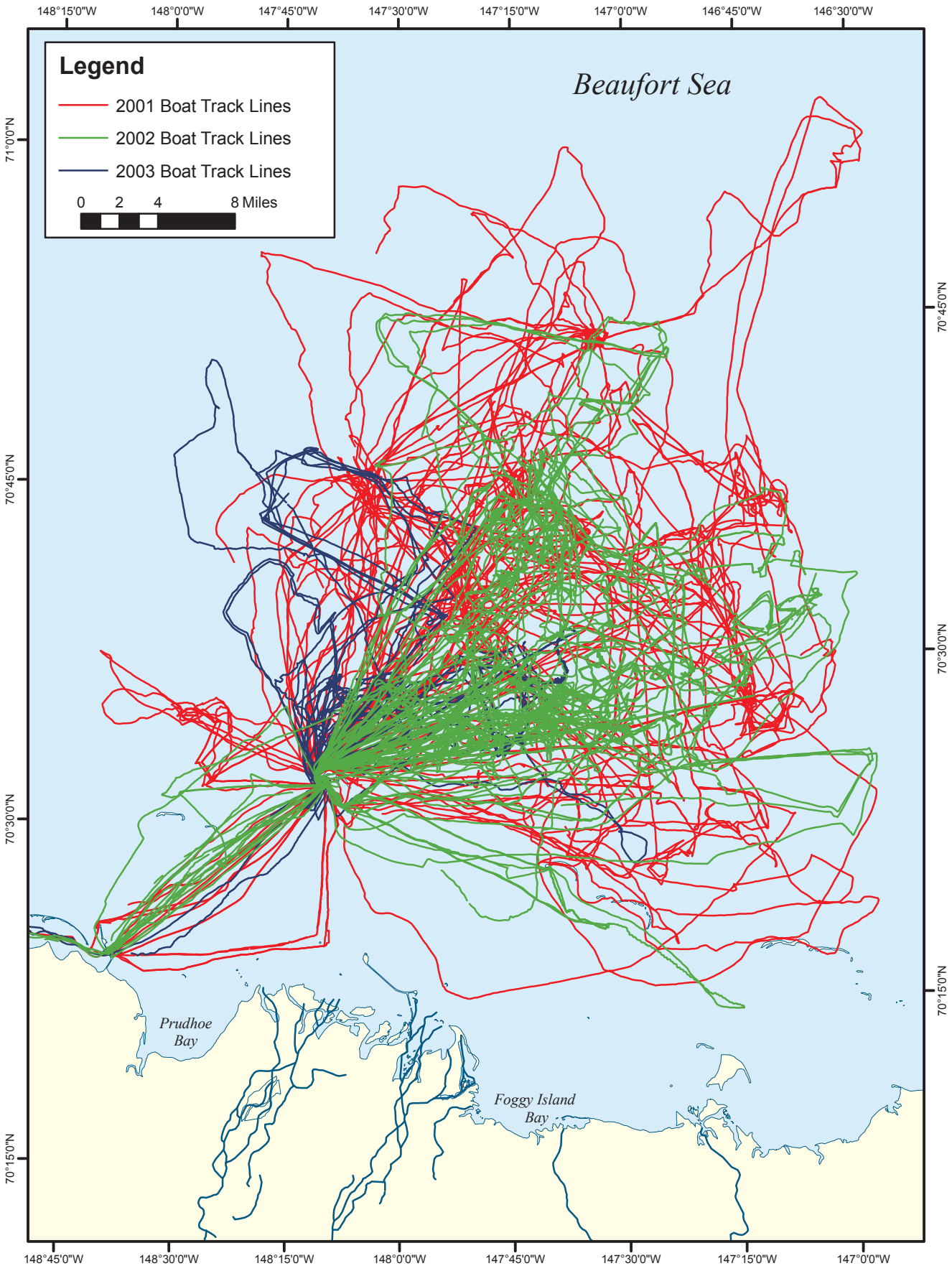
Source: Galginaitis, 2004

Figure 3.4.2-21 Composite GPS Tracks for All Whaling Trips for All Boats, 2002 Cross island Whaling Season



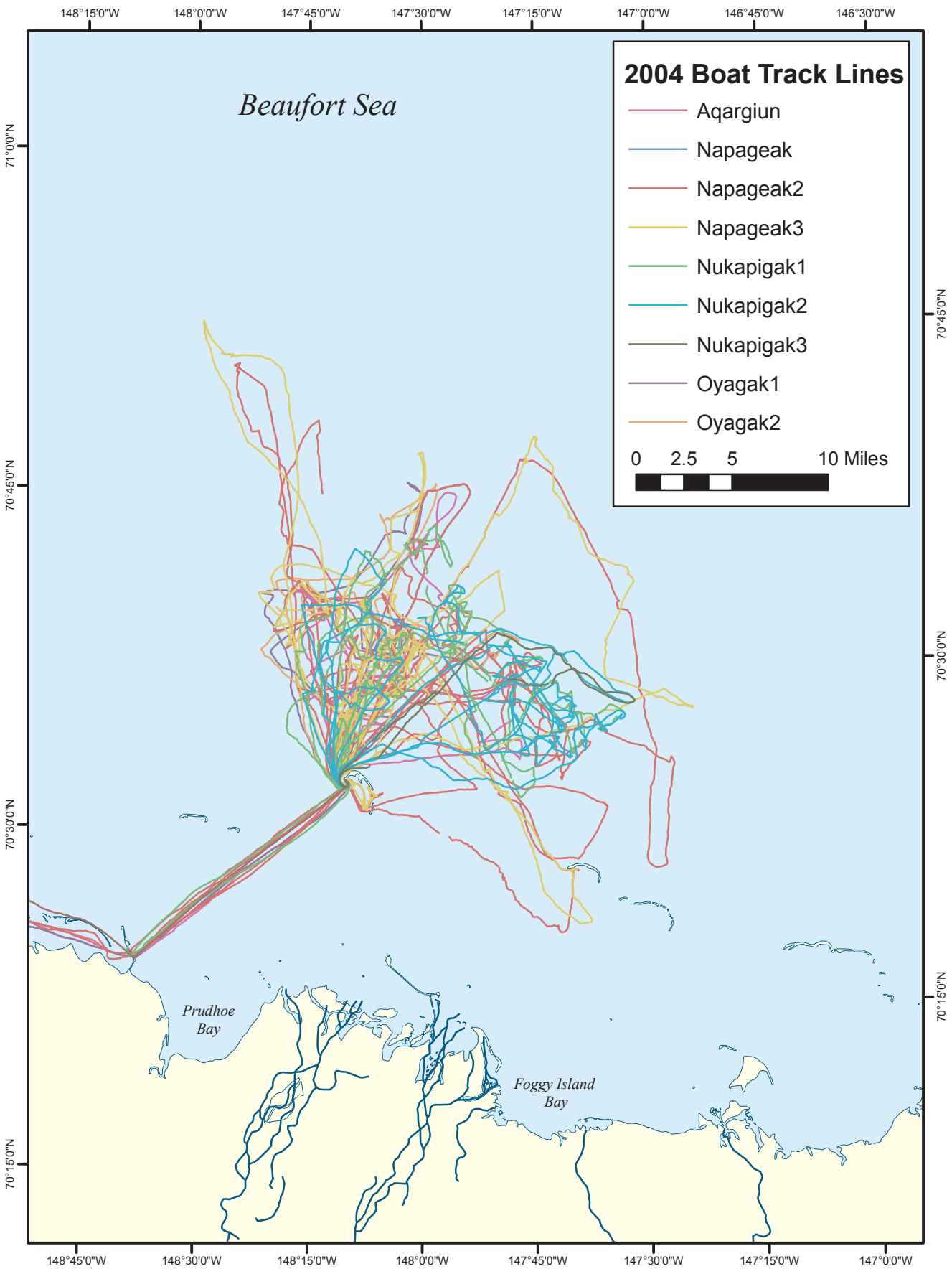
Source: Galginaitis, 2005

Figure 3.4.2-22 Composite GPS Tracks for All Whaling Trips for All Boats, 2003 Cross Island Whaling Season



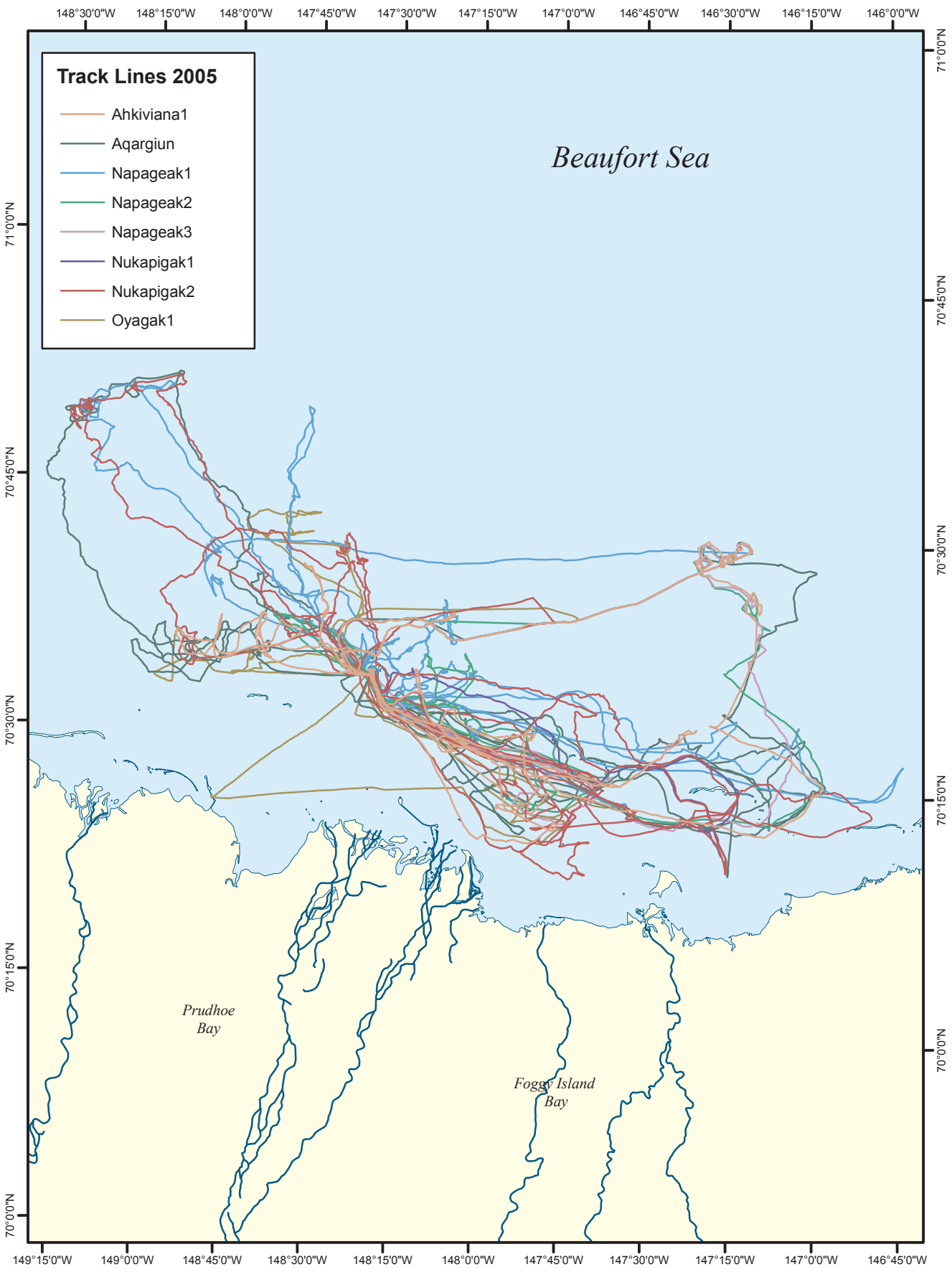
Source: Galginaitis, 2005

Figure 3.4.2-23 Comparison of Composite GPS Tracks for 2001, 2002, and 2003 Cross Island Whaling Seasons



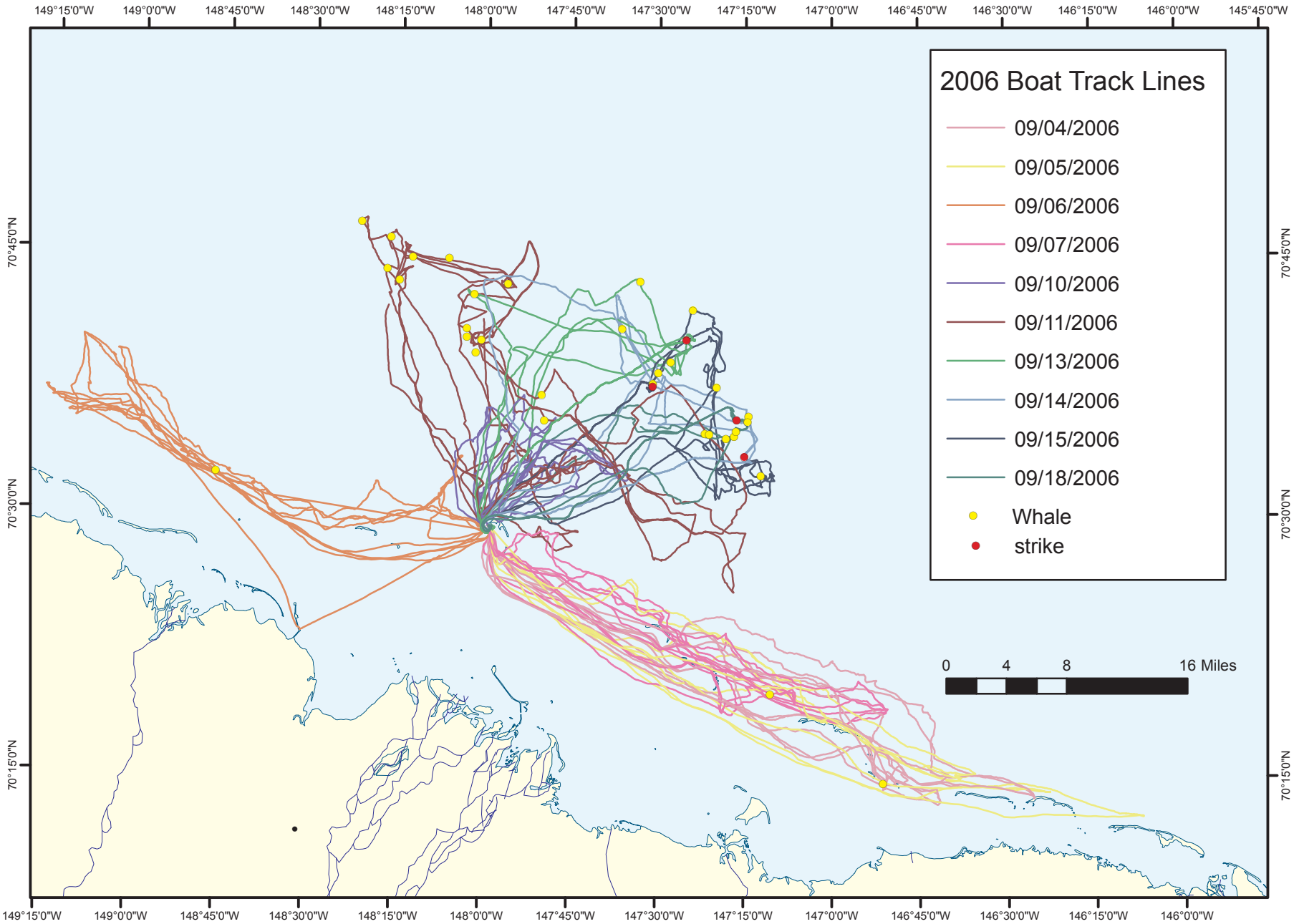
Source: Galginaitis and Funk, 2006a

Figure 3.4.2-24 Composite GPS Tracks for All Whaling Trips for All Boats, 2004 Cross Island Whaling Season



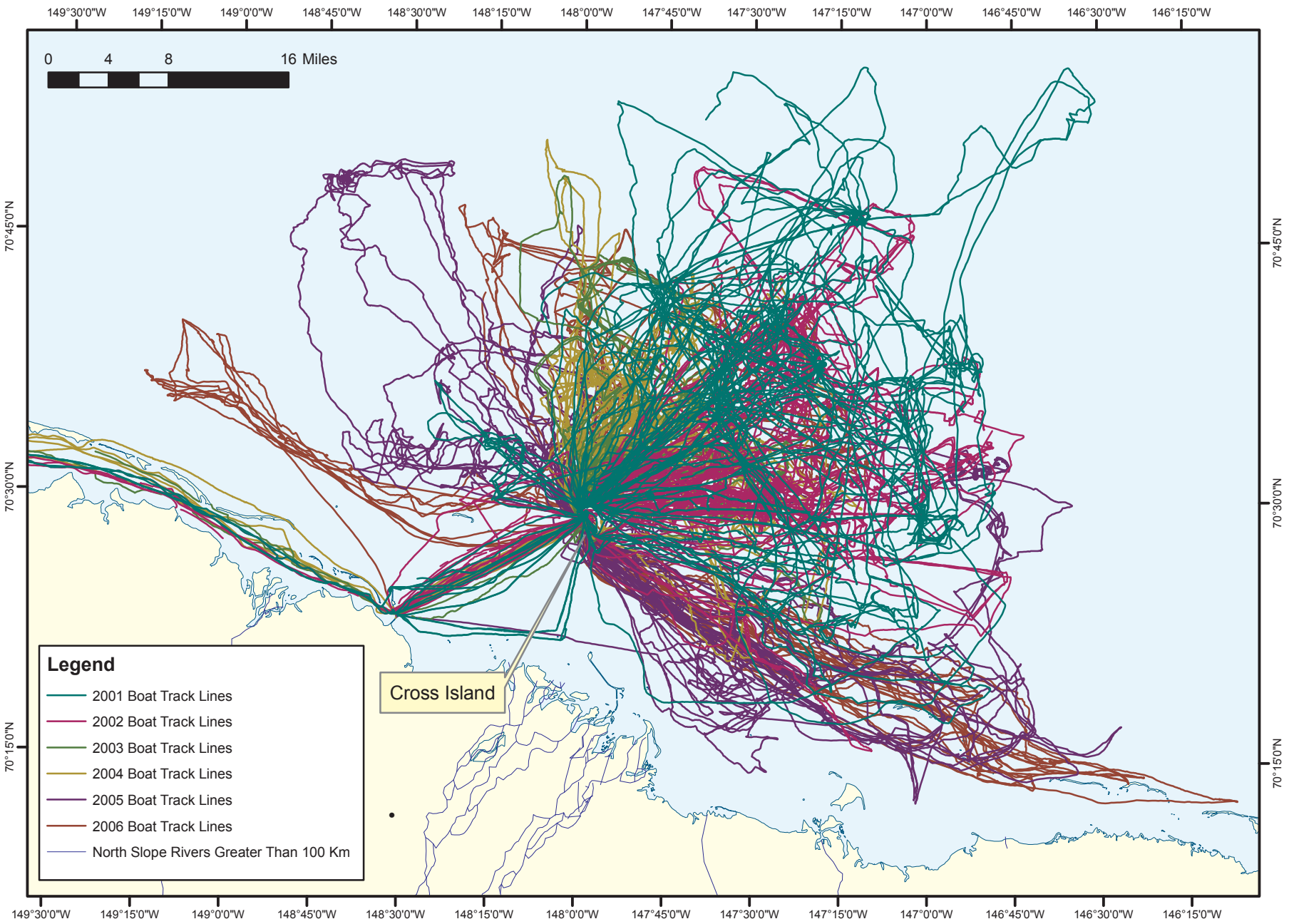
Source: Galginaitis and Funk 2006b

Figure 3.4.2-25 Composite GPS Tracks for All Whaling Trips for All Boats, 2005 Cross Island Whaling Season



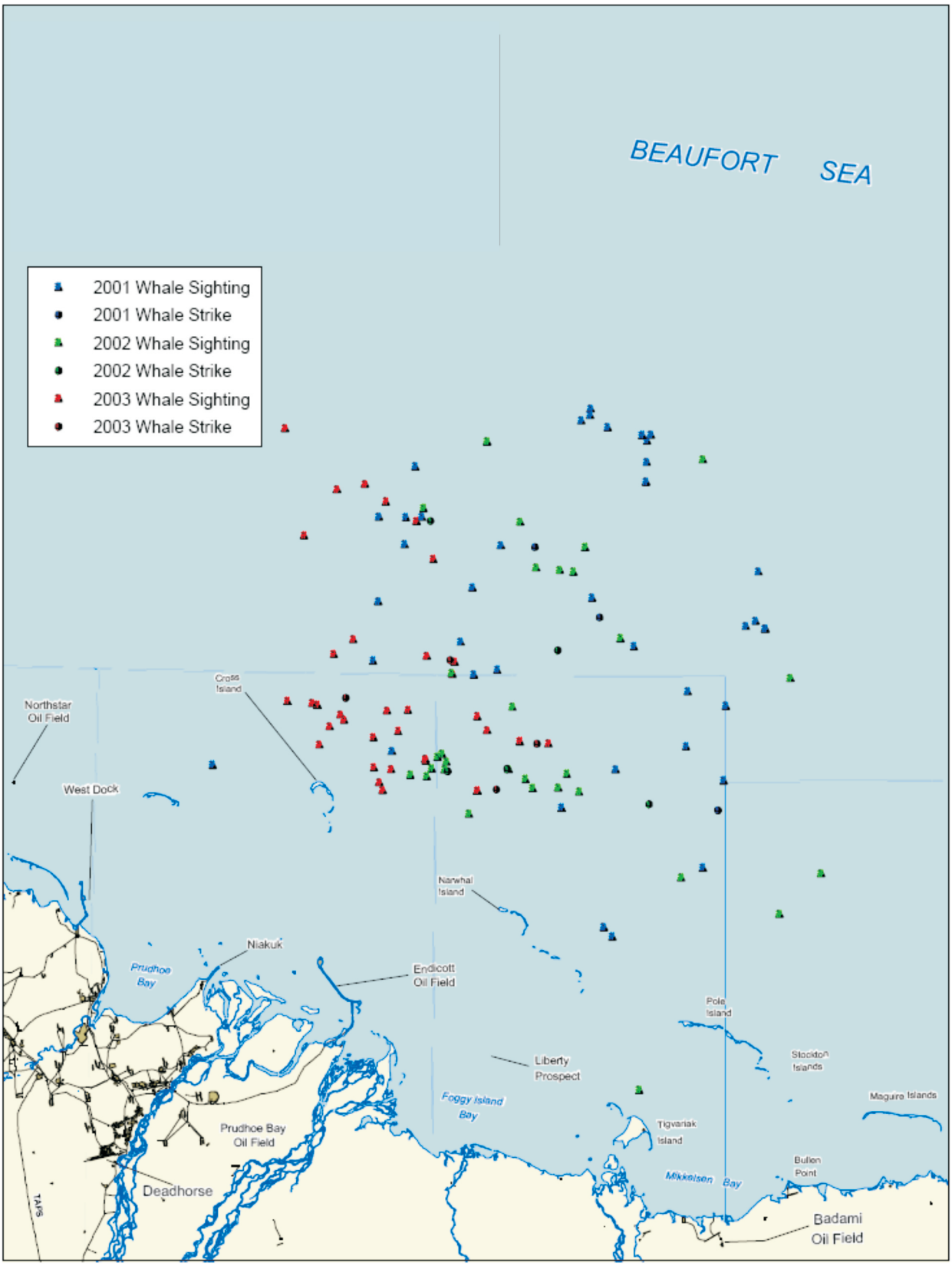
Source: Galginaitis and Funk, 2007

Figure 3.4.2-26a GPS Tracks for 2006 Cross Island Whaling Season By Day



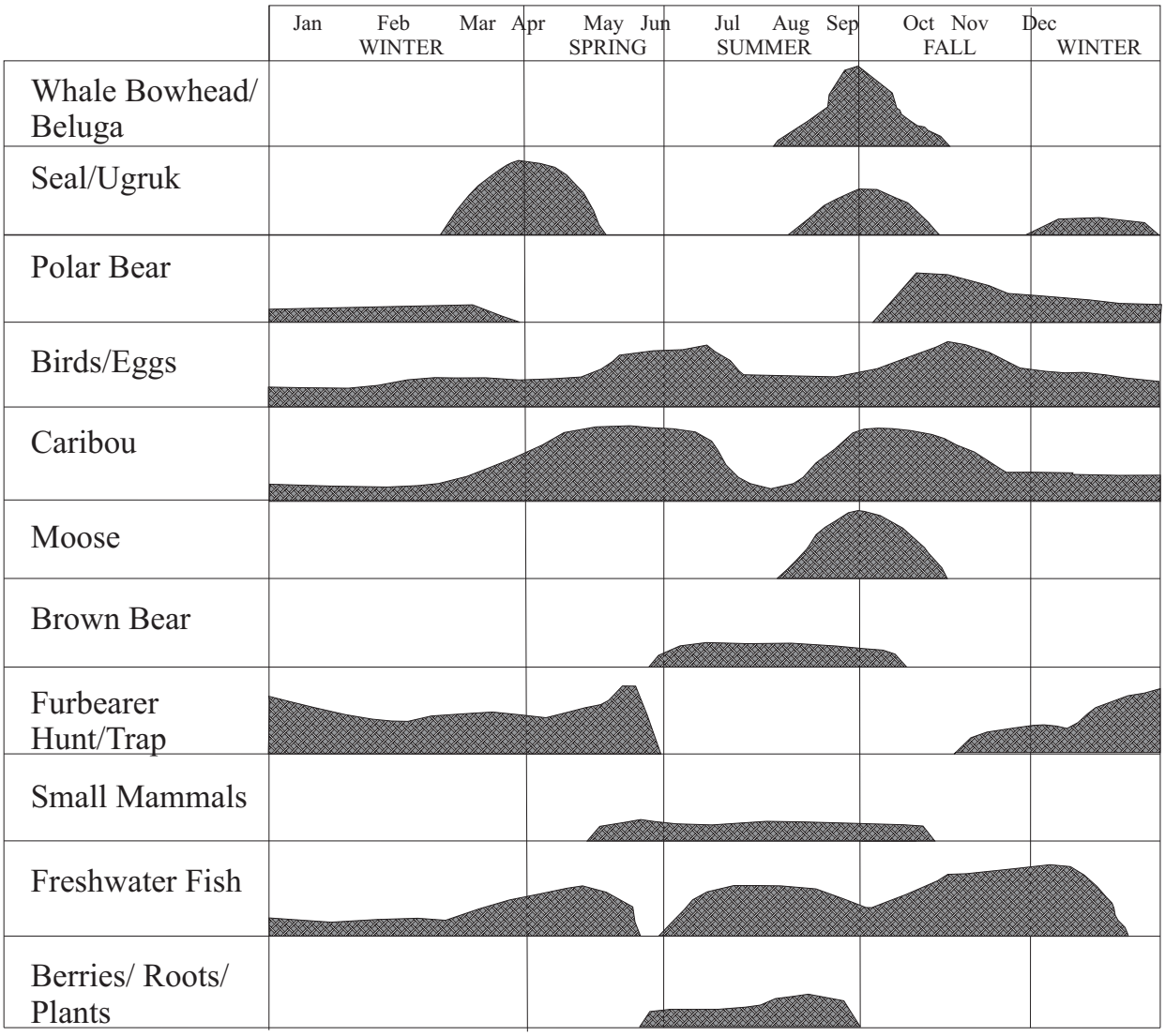
Source: Galginaitis and Funk, 2007

Figure 3.4.2-26b Composite GPS Tracks for Cross Island Whaling Trips, 2001-2006



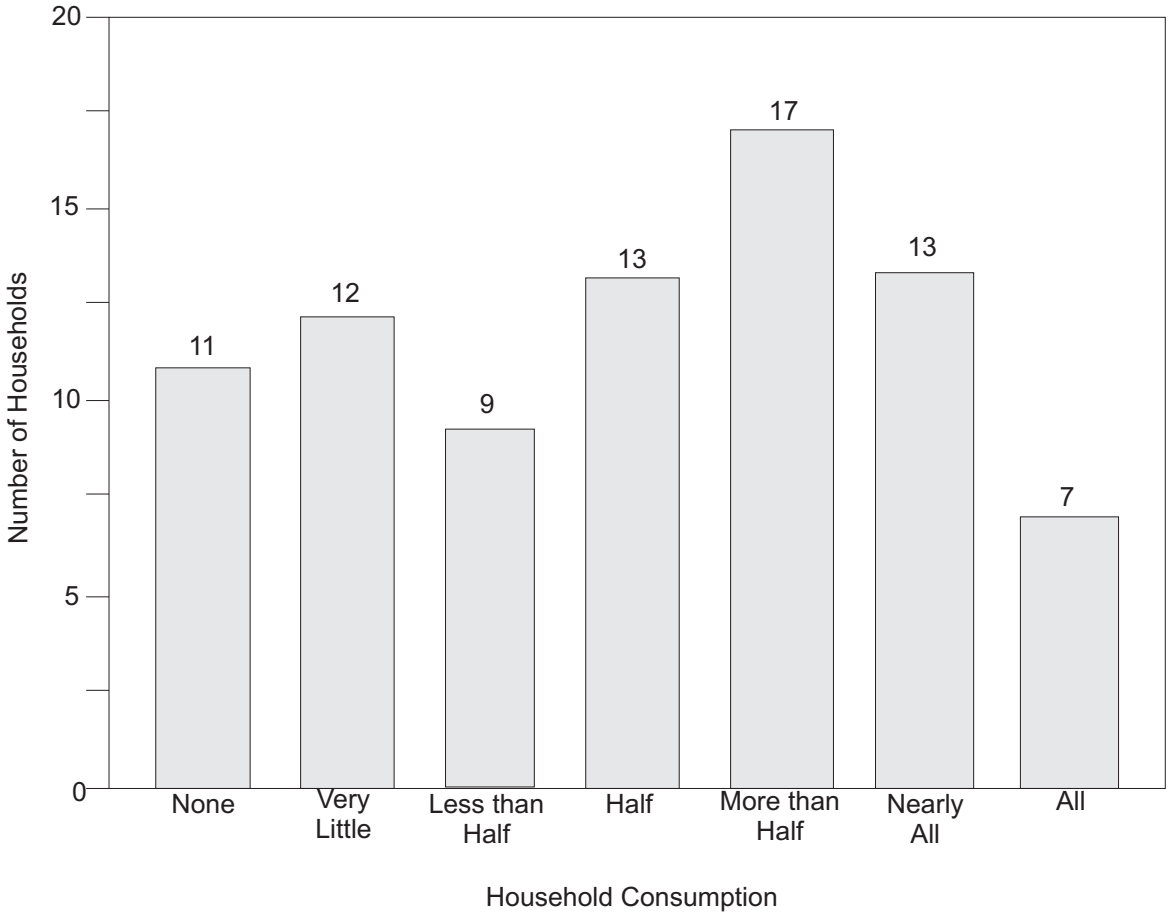
Source: Galginaitis and Funk, 2005

Figure 3.4.2-27 Comparison of Whale Sightings by Nuiqsut Whalers for 2001, 2002, and 2003



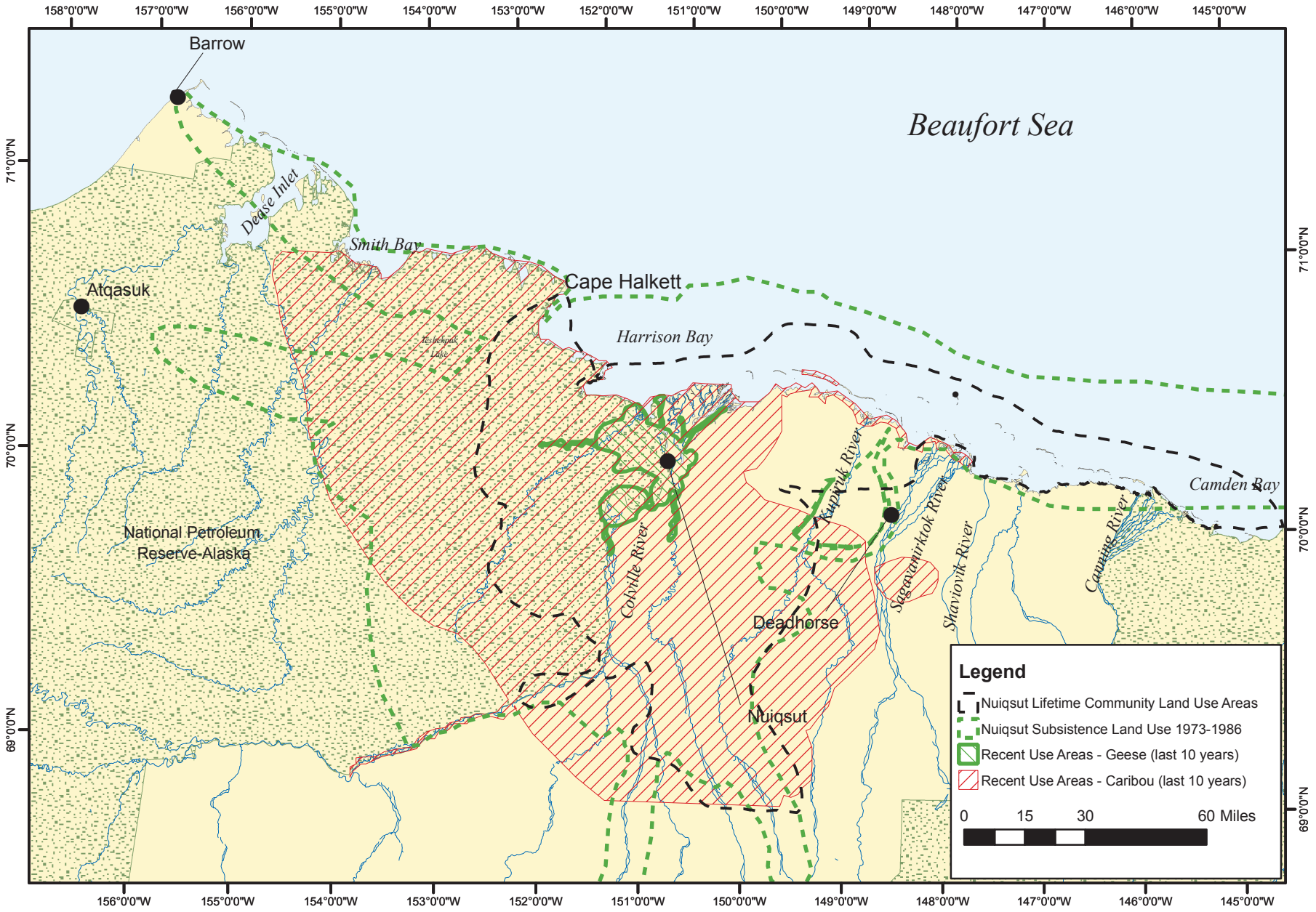
Source: North Slope Borough Contract Staff (1979)

Figure 3.4.2-28 Nuiqsut Annual Subsistence Cycle. Patterns indicate desired periods for pursuit of each species based upon the relationship of abundance, hunter access, seasonal needs, and desirability. Peaks represent optimal periods of pursuit of subsistence resources.



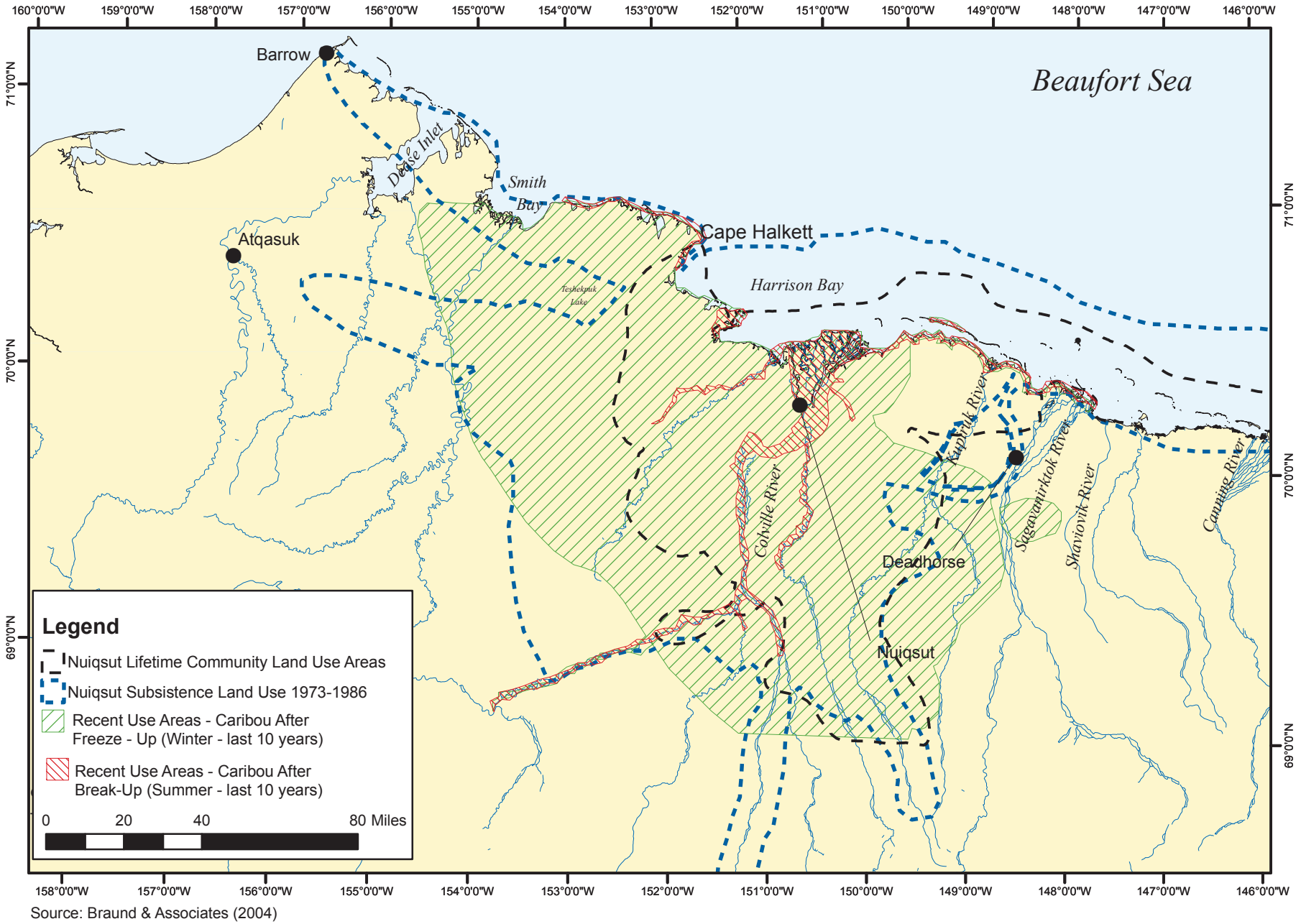
Source: Harcharek (1995)

Figure 3.4.2-29 Nuiqsut Household Consumption of Meat, Fish, and Birds from Subsistence Activities



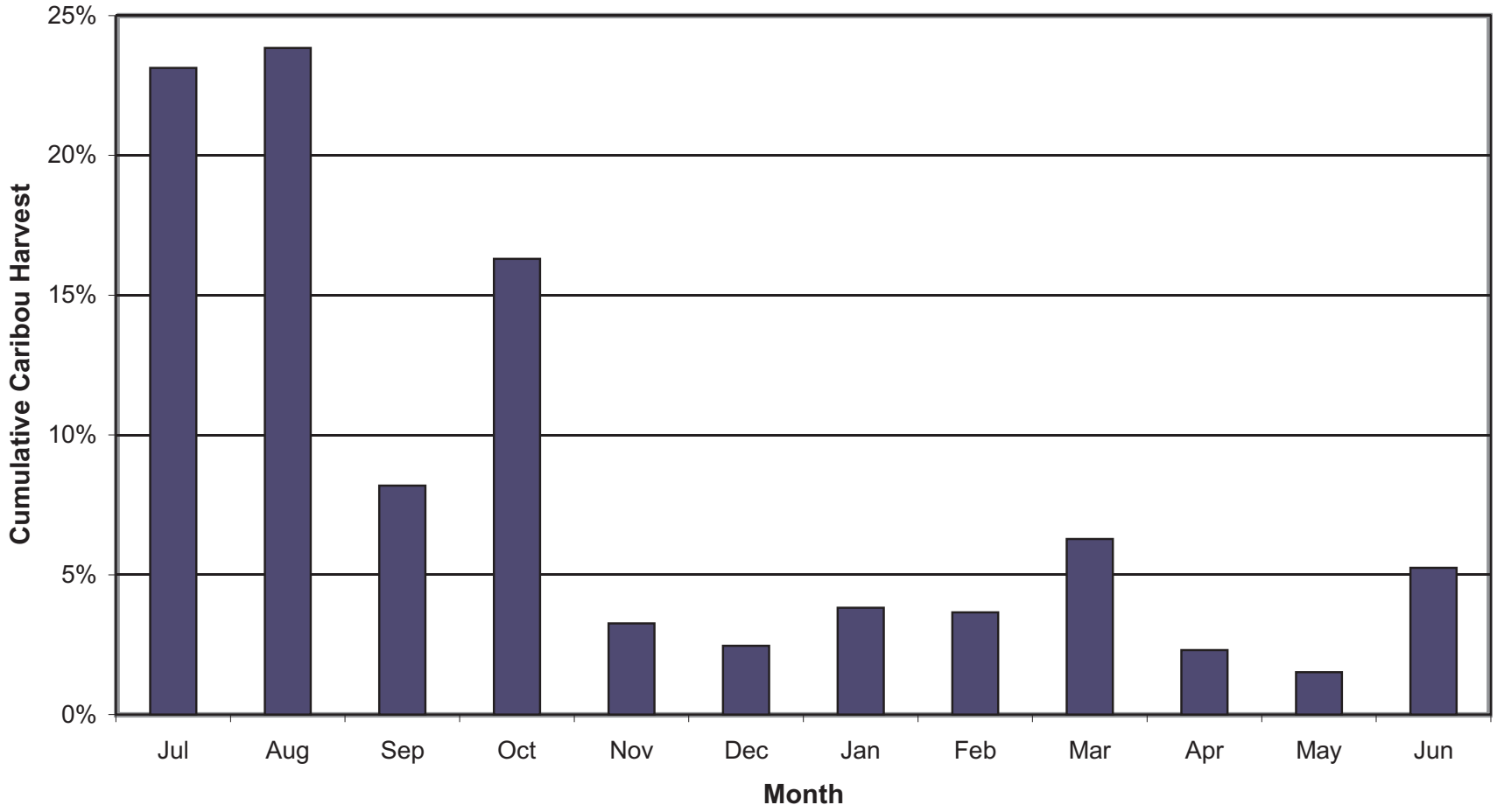
Source: Braund & Associates (2004)

Figure 3.4.2-30 Nuiqsut Partial Subsistence-Use Areas for Caribou (All Seasons) and Geese, 2003



Source: Braund & Associates (2004)

Figure 3.4.2-31 Nuiqsut Partial Subsistence-Use Areas for Caribou by Season, 2003

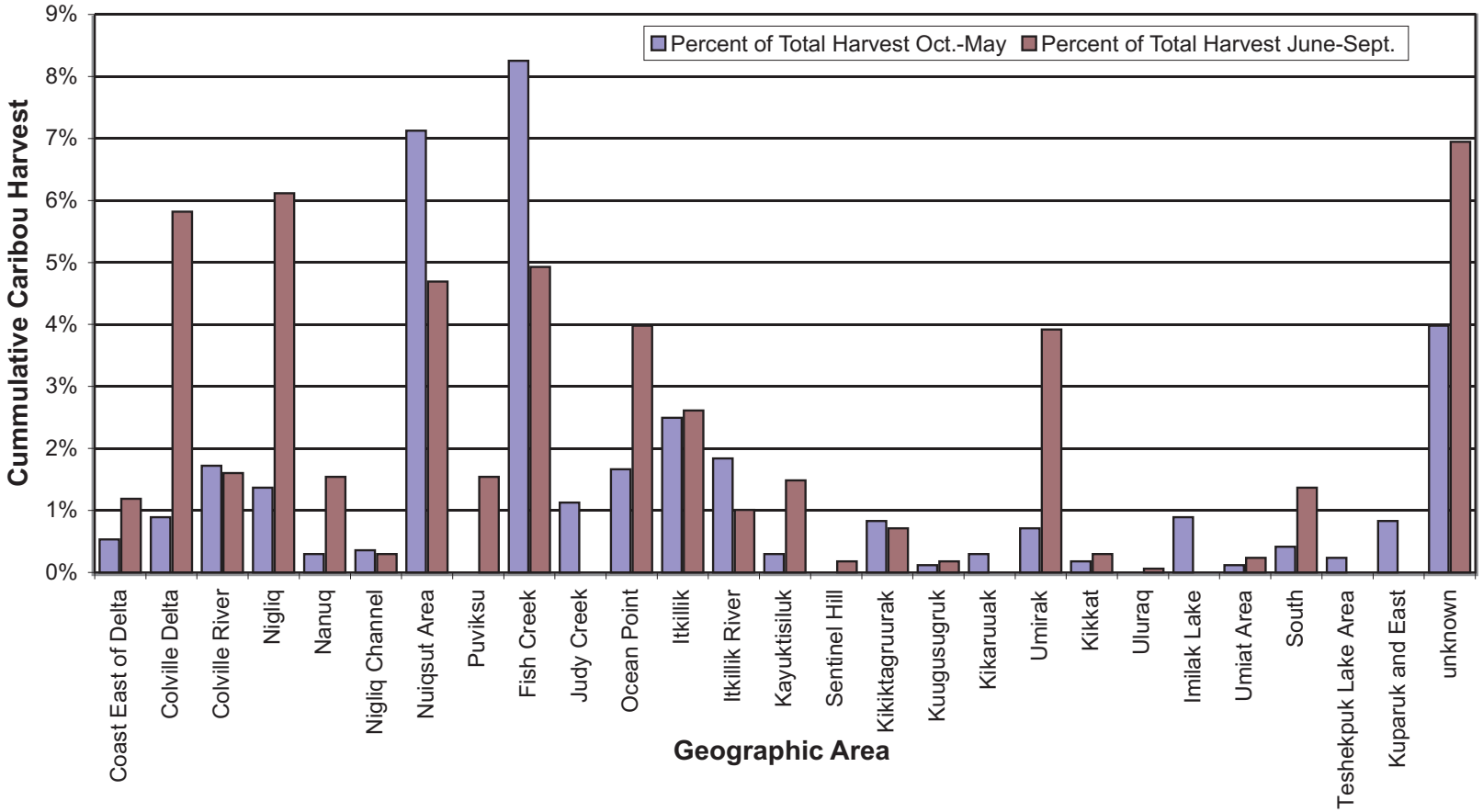


Note: Data for the study years of 1994-1995, 2000 and 2001 is raw, uncorrected data, and the figure does not represent total harvest numbers

Source: Alaska Department of Fish and Game, Division of Subsistence, 2003 (unpublished Nuiqsut data, 1993)
North Slope Borough Department of Wildlife Management, 2003 (unpublished Nuiqsut data, 1994-1995, 2000, 2001)

Stephen R. Braund & Associates, 2003

Figure 3.4.2-32 Nuiqsut Cumulative Caribou Harvest by Month, 1993, 1994-1995, 2000 and 2001

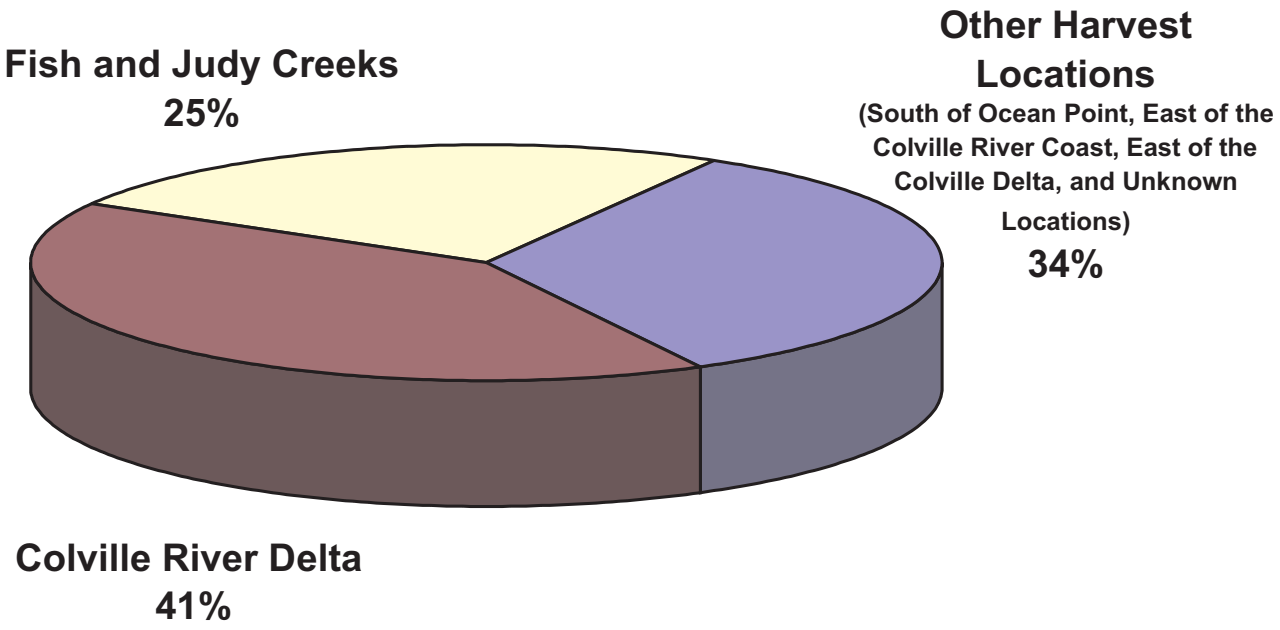


Note: Data for the study years of 1994-1995, 2000 and 2001 is raw, uncorrected data, and the figure does not represent total harvest numbers

Source: Alaska Department of Fish and Game, Division of Subsistence, 2003 (unpublished Nuiqsut data, 1993)
North Slope Borough Department of Wildlife Management, 2003 (unpublished Nuiqsut data, 1994-1995, 2000, 2001)

Stephen R. Braund & Associates, 2003

Figure 3.4.2-33 Nuiqsut Cumulative Caribou Harvest by Season and Location, 1993, 1994-1995, 2000 and 2001

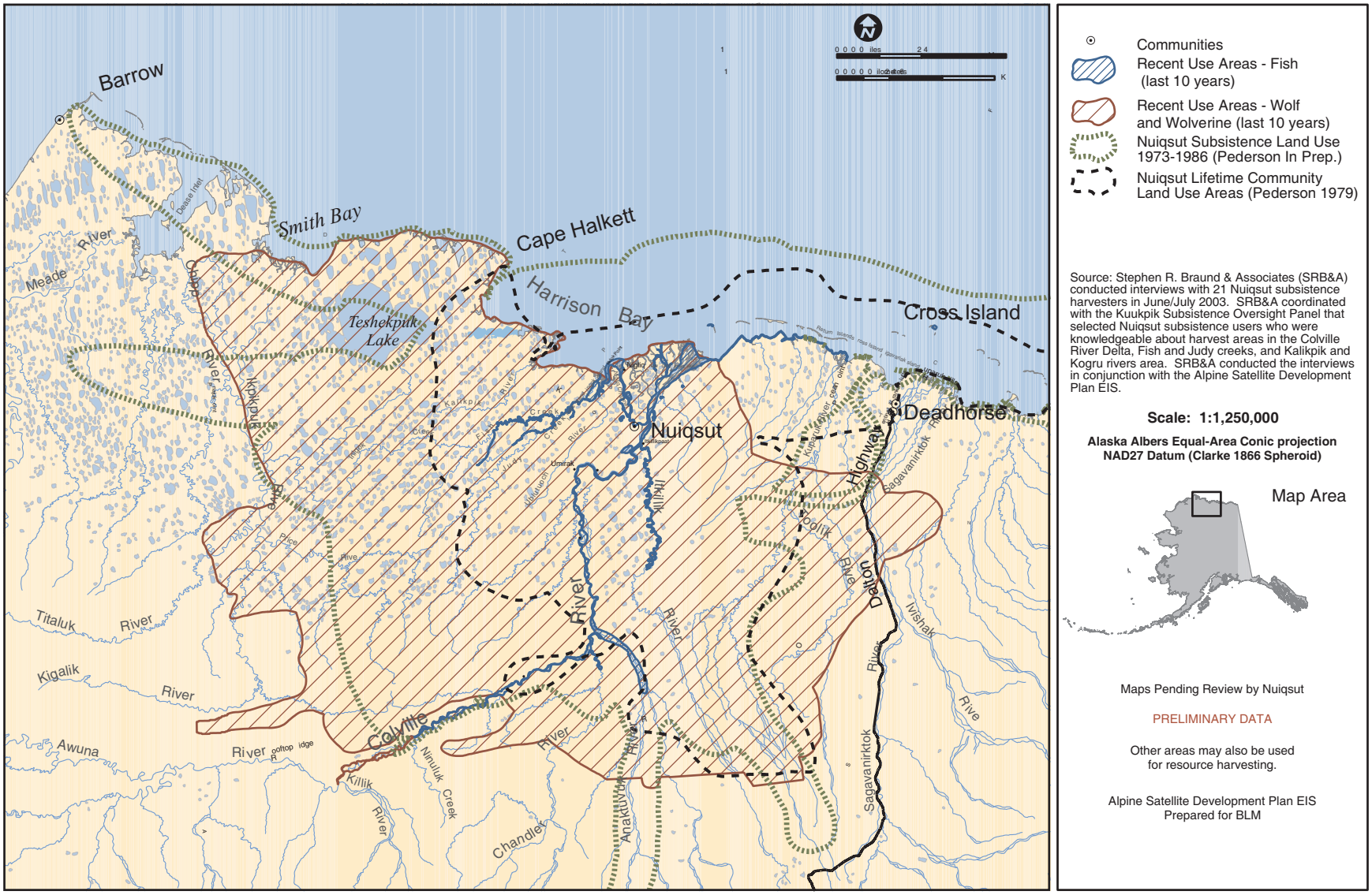


Note: Data for the study years of 1994-1995, 2000 and 2001 is raw, uncorrected data, and the figure does not represent total harvest numbers

Source: Alaska Department of Fish and Game, Division of Subsistence, 2003 (unpublished Nuiqsut data, 1993)
North Slope Borough Department of Wildlife Management, 2003 (unpublished Nuiqsut data, 1994-1995, 2000, 2001)

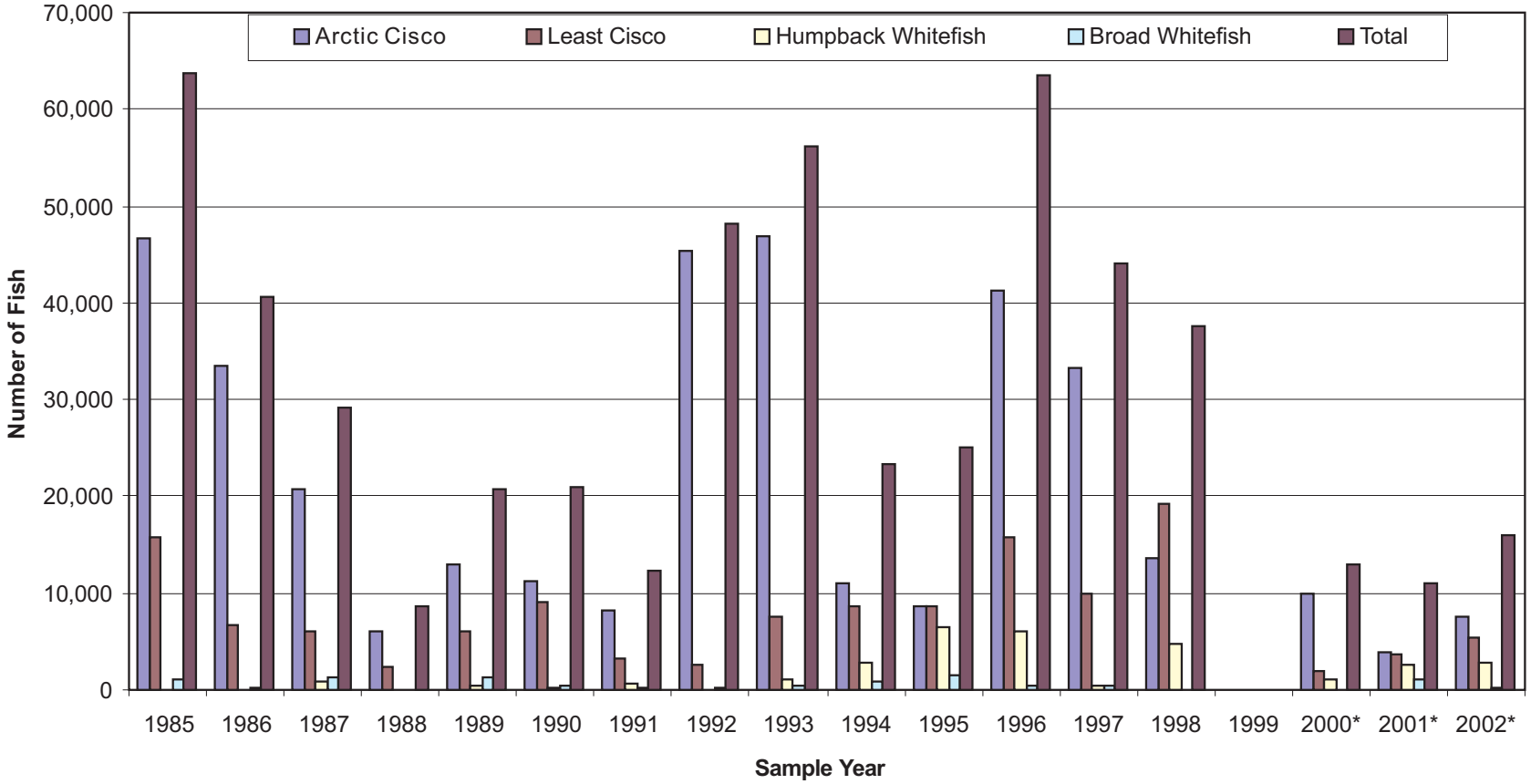
Stephen R. Braund & Associates, 2003

Figure 3.4.2-34 Nuiqsut Cumulative Caribou Harvest by Area, 1993, 1994-1995, 2000 and 2001



Source: Braund and Associates (2004)

Figure 3.4.2-35 Nuiqsut Partial Subsistence-Use Areas for Fish and Wolf/Wolverine, 2003

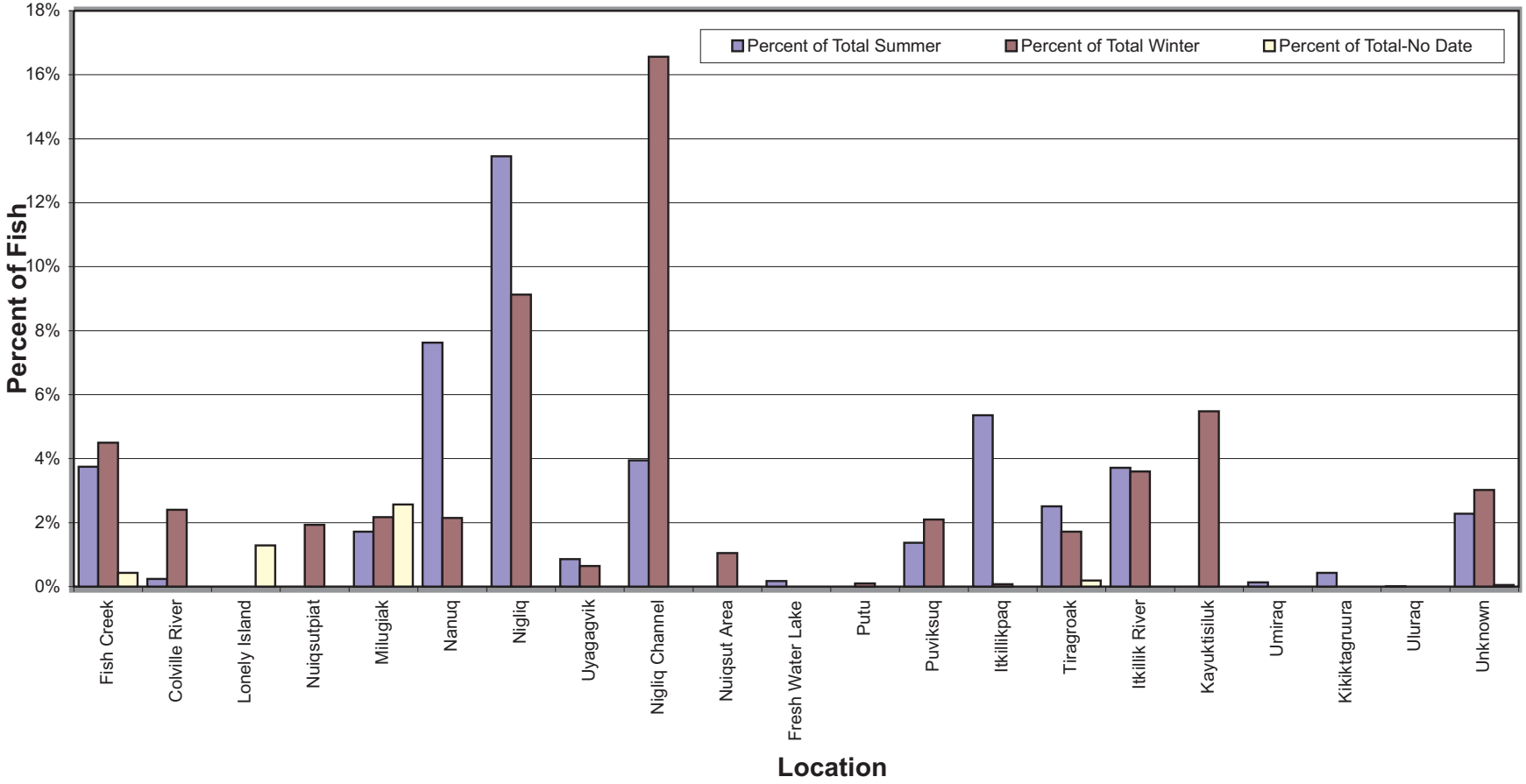


* Harvest numbers represent only the Nigliq Channel Harvest

Source: Moulton, 2002: Table 6

Stephen R. Braund & Associates, 2003

Figure 3.4.2-36 Estimated Whitefish Harvests for the Colville River Delta Fall Subsistence Fishery, 1985-2002

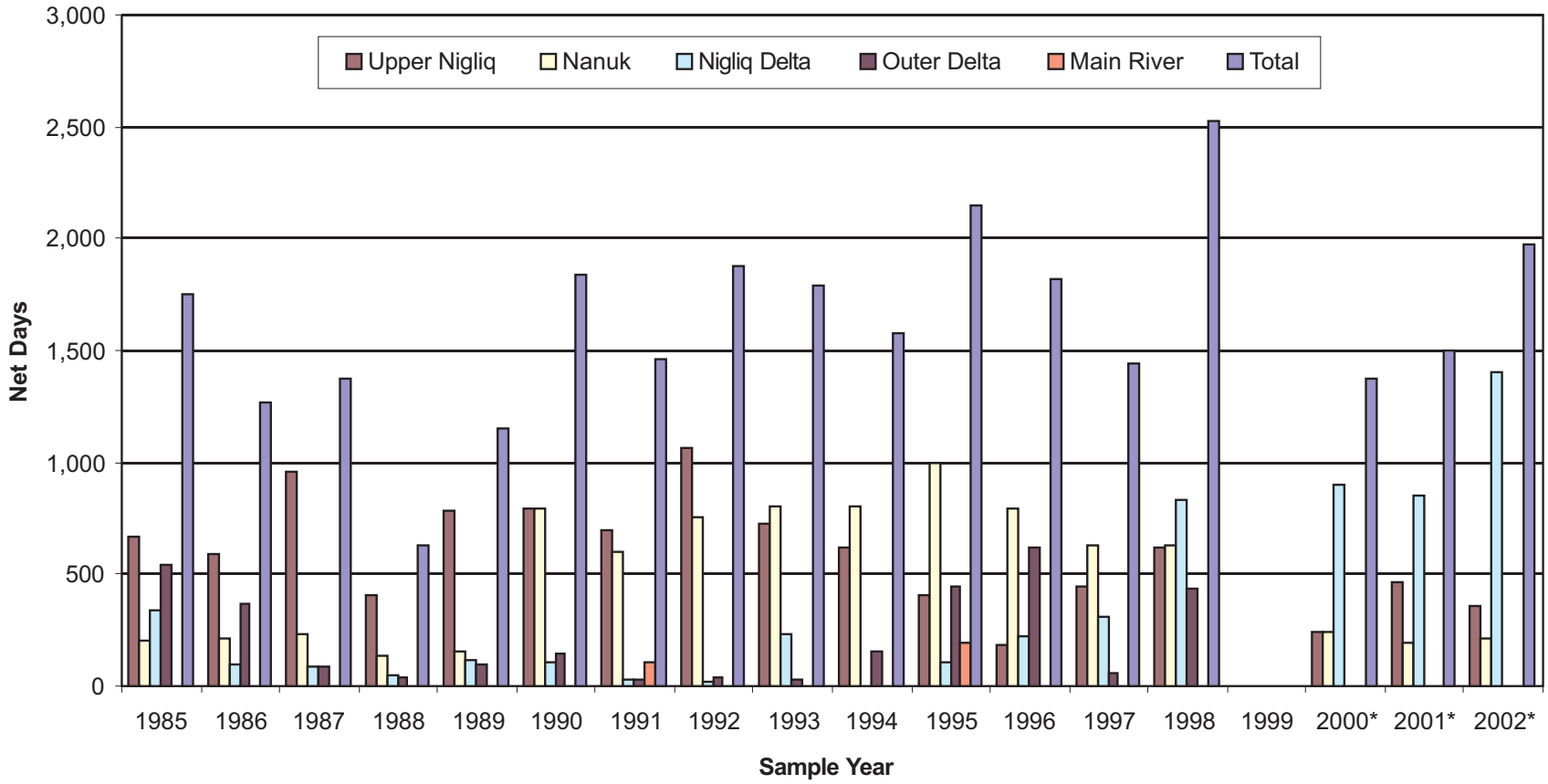


Notes:
1)This Figure is based on raw, uncorrected data and does not represent total harvest numbers.
2) The Arctic Cisco is excluded in this figure.

Source: North Slope Borough Department of Wildlife Management, 2003
(Unpublished Nuiqsut Harvest Data 1994-1995, 2000 and 2001)

Stephen R. Braund & Associates, 2003

Figure 3.4.2-37 Nuiqsut Cumulative Subsistence Fish Harvest (excluding arctic cisco) by Location, 1994-1995, 2000, and 2001

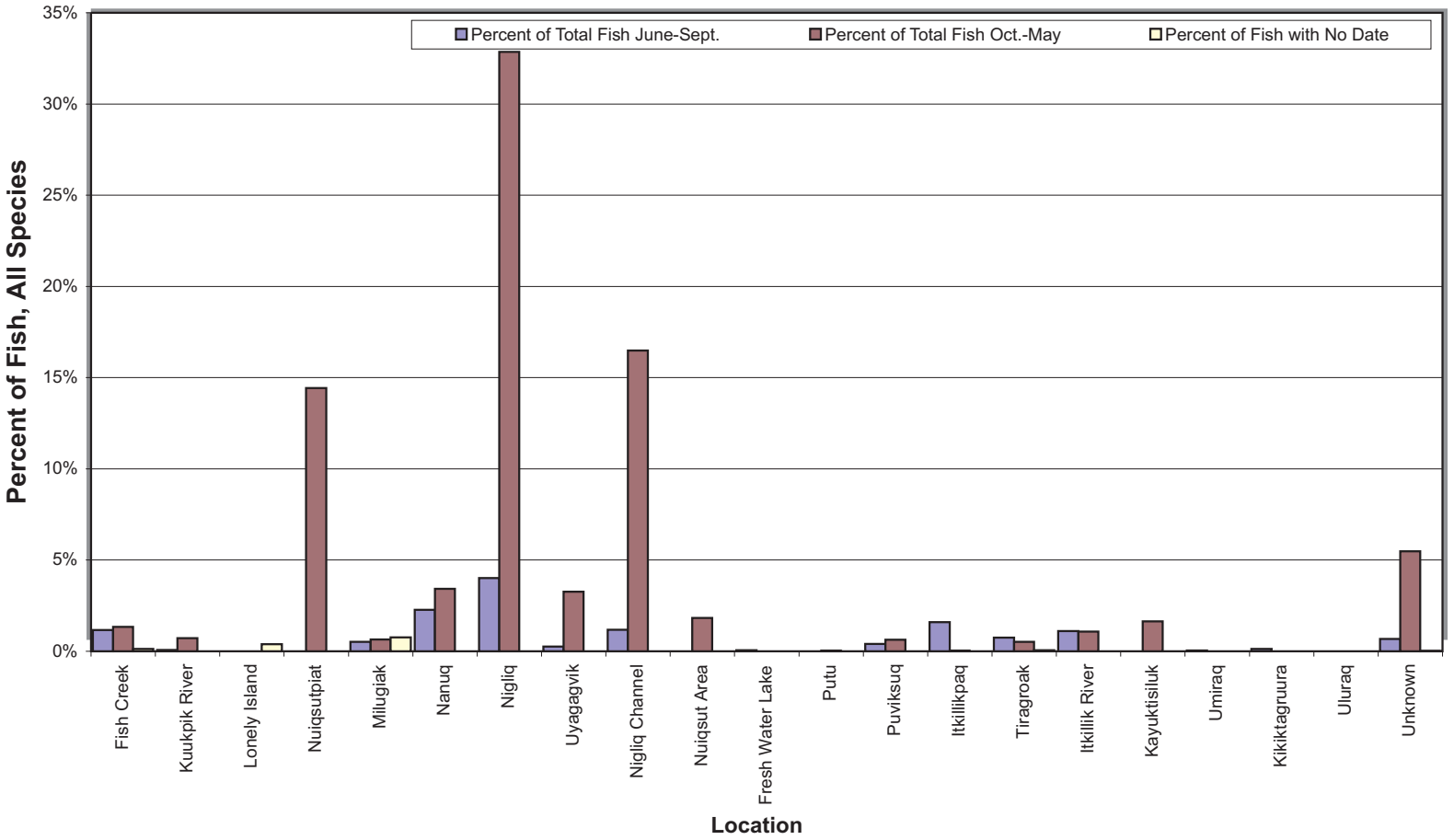


* Harvest numbers represent only the Nigliq Channel Harvest

Source: Moulton, 2002: Appendix Table 1

Stephen R. Braund & Associates, 2003

Figure 3.4.2-38 Estimated Fishing Effort in the Colville River Delta Fall Subsistence Fishery in Net Days, 1985-2002



Note: This Figure is based on raw, uncorrected data and does not represent total harvest numbers

Source: North Slope Borough Department of Wildlife Management, 2003
(Unpublished Nuiqsut Harvest Data 1994-1995, 2000 and 2001)

Stephen R. Braund & Associates, 2003

Figure 3.4.2-39 Nuiqsut Cumulative Subsistence Fish Harvest by Location, 1994-1995, 2000, and 2001

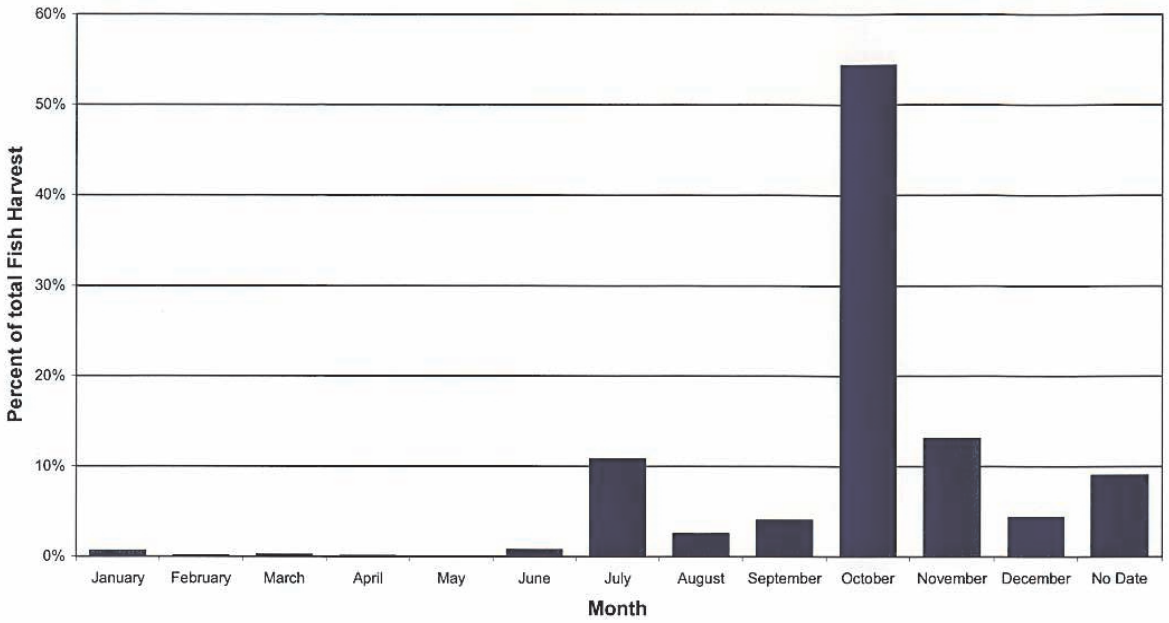
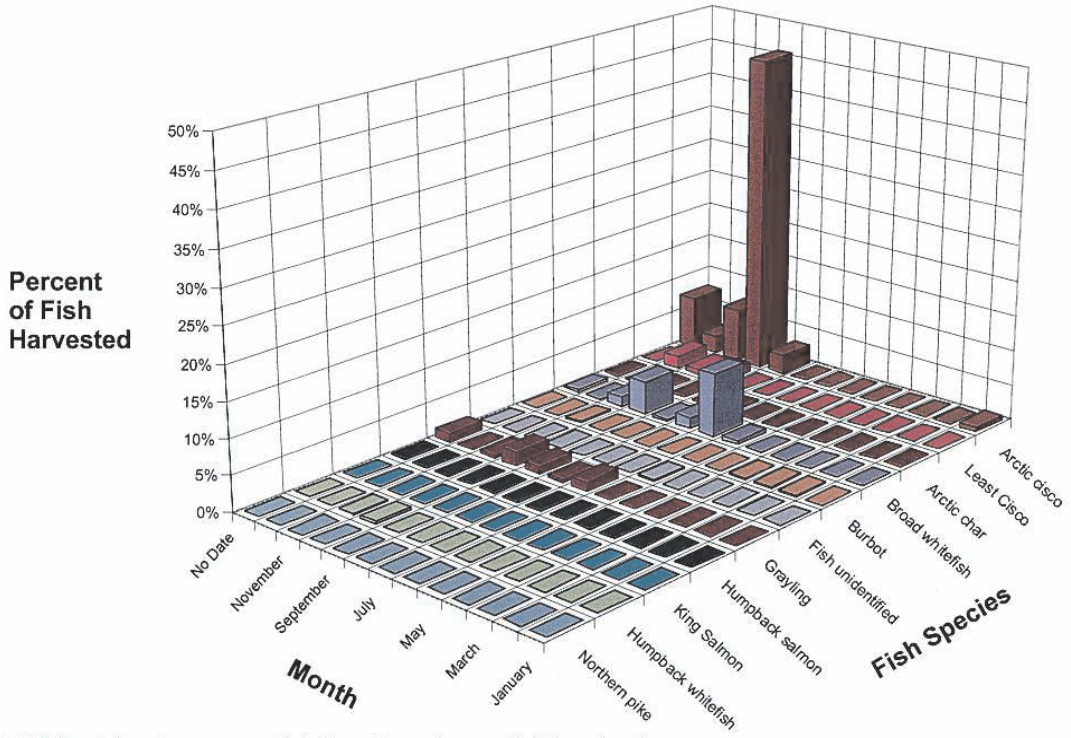


Figure 3.4.2-40 Nuiqsut Fish Harvest by Month, 1994, 2000, and 2001

Note : This figure is based on raw, uncorrected data and does not represent total harvest numbers

Source: North Slope Borough Department of Wildlife Management, 2003 (Unpublished Nuiqsut Harvest Data 1994-1995, 2000 and 2001)

Stephen R. Braund & Associates, 2003

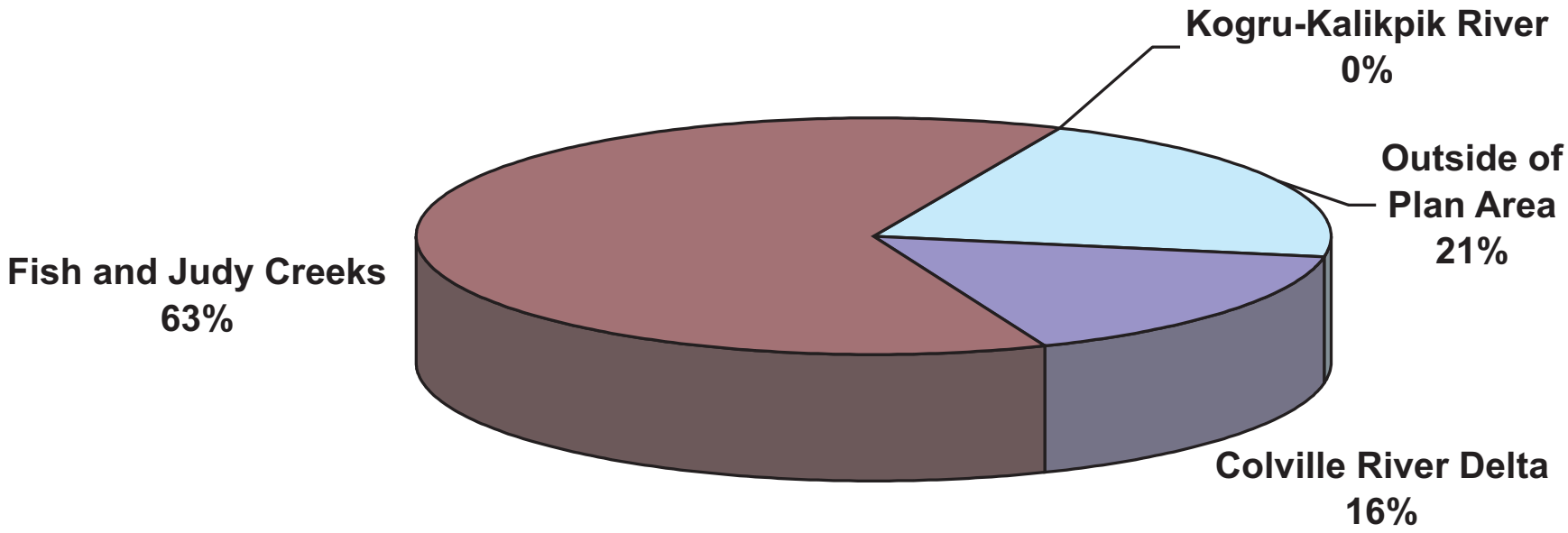


Note: This figure is based on raw, uncorrected data and does not represent total harvest numbers

Source: North Slope Borough Department of Wildlife Management, 2003 (Unpublished Nuiqsut Harvest Data 1994-1995, 2000, 2001)

Stephen R. Braund & Associates, 2003

Figure 3.4.2-41 Nuiqsut Subsistence Fish Harvests by Month and Species, 1994-1995, 2000, and 2001

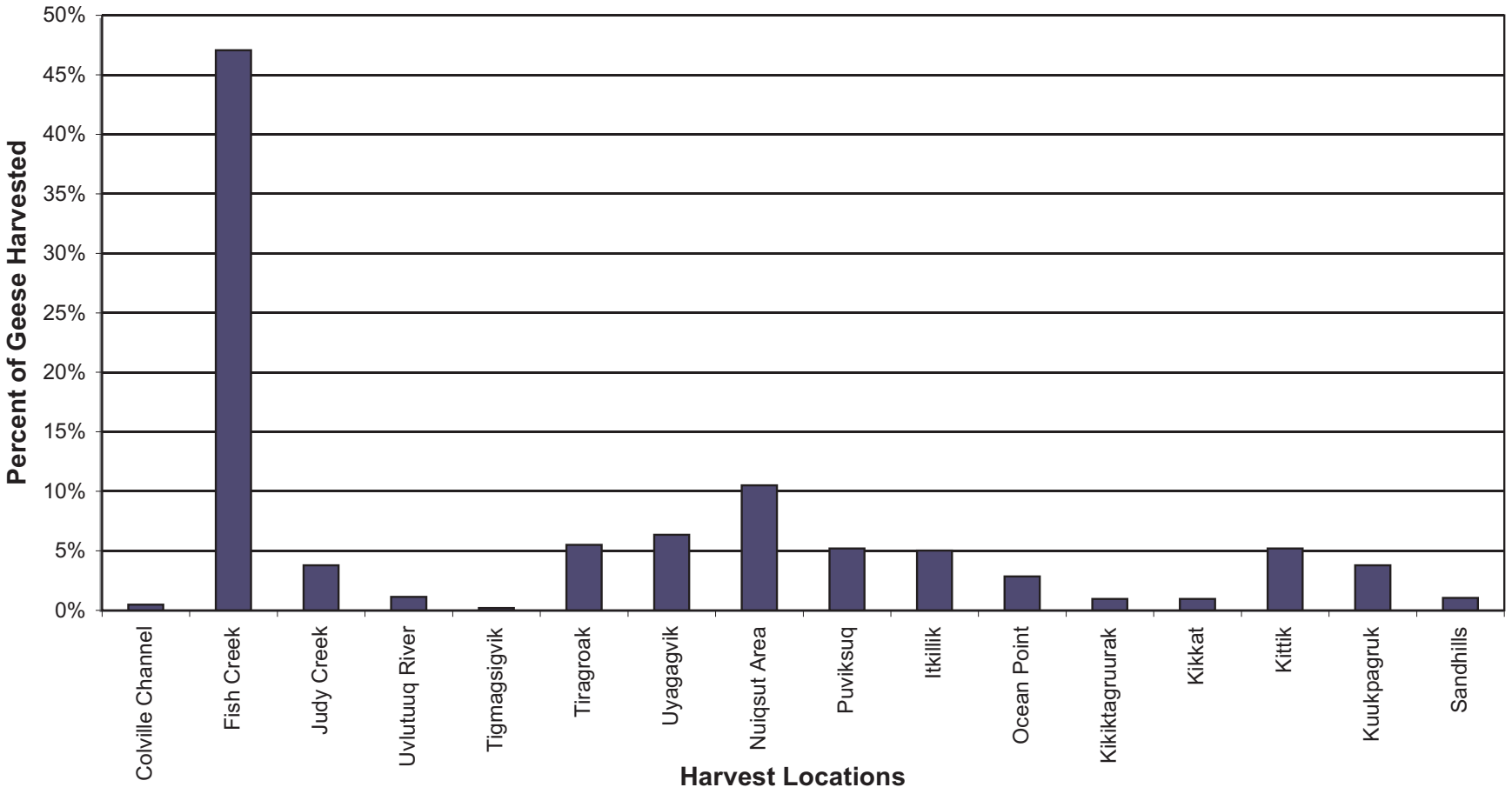


Note: This figure is based on raw, uncorrected data and does not represent total harvest numbers

Source: North Slope Borough Department of Wildlife Management, 2003 (Unpublished Nuiqsut Harvest Data 1994-1995, 2000 and 2001)

Stephen R. Braund & Associates, 2003

Figure 3.4.2-42 Nuiqsut Subsistence Geese Harvest by Area, 1994-1995, 2000, and 2001



Note: This figure is based on raw, uncorrected data and does not represent total harvest numbers

Source: North Slope Burough Department of Wildlife Management, 2003 (Unpublished Nuiqsut Harvest Data 1994-1995, 2000 and 2001)

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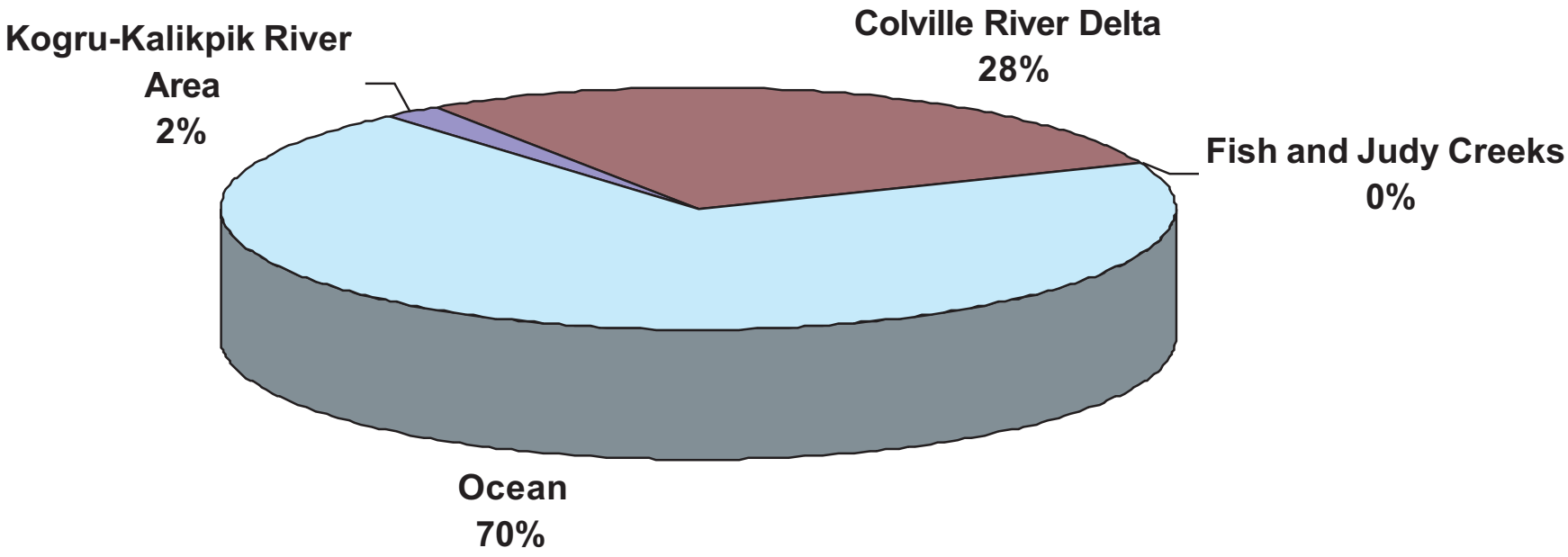
Figure 3.4.2-43 Nuiqsut Harvest Locations for All Species of Geese, 1994-1995, 2000, and 2001



Note: This figure is based on raw, uncorrected data and does not represent total harvest numbers

Source: North Slope Burough Department of Wildlife Management, 2003 (Unpublished Nuiqsut Harvest Data 1994-1995, 2000 and 2001)

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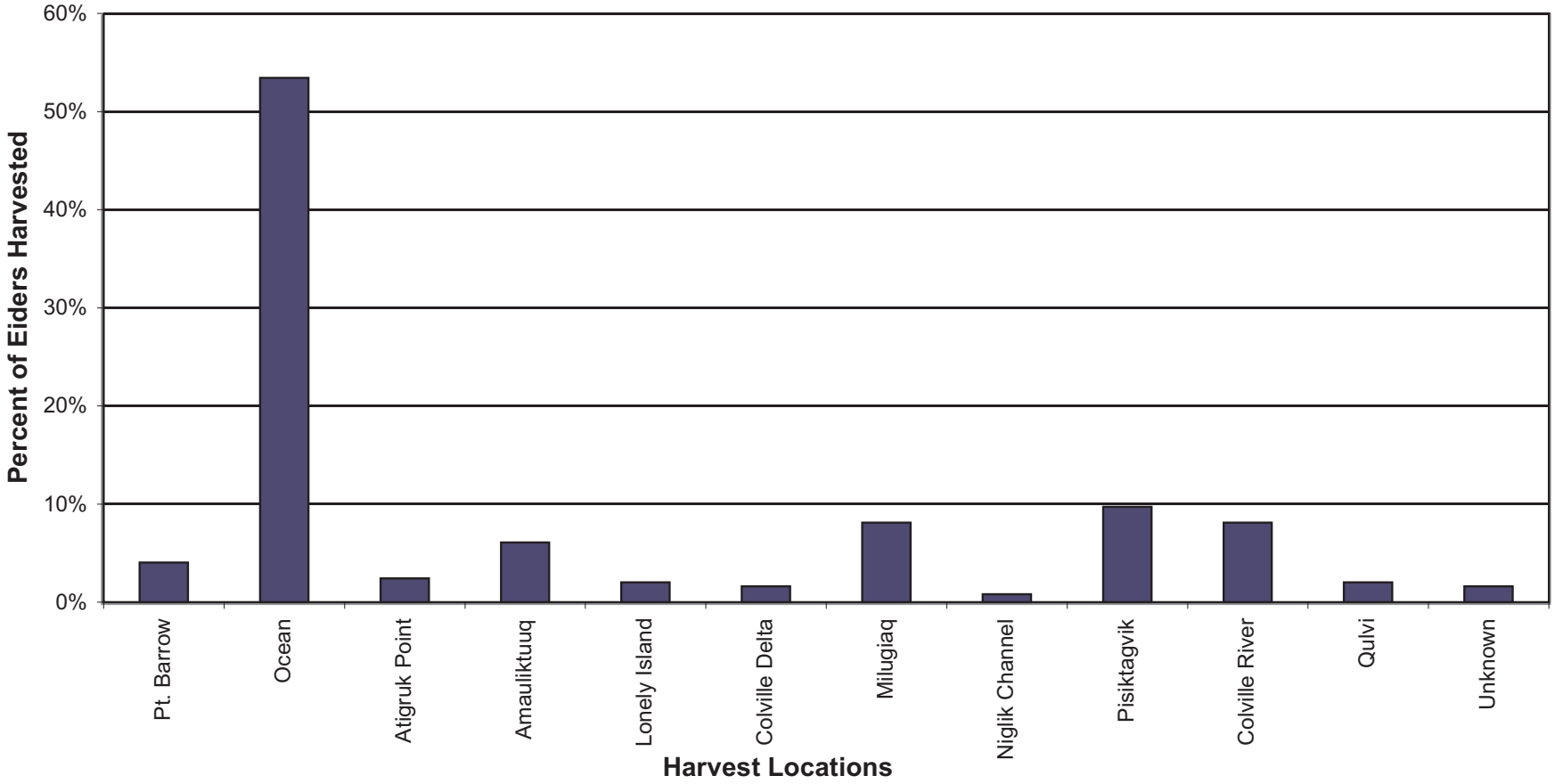
Figure 3.4.2-44 Nuiqsut Cumulative Harvest Locations of Eiders, 1994-1995, 2000, and 2001

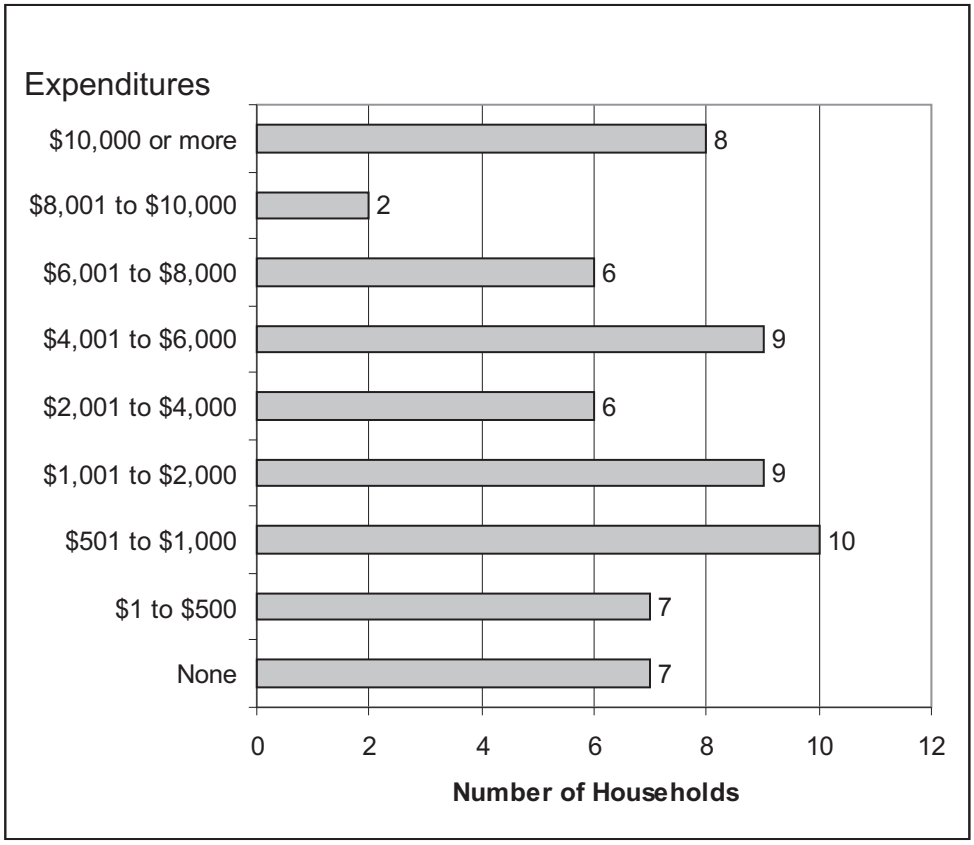


Notes:
1) This figure is based on raw, uncorrected data and does not represent total harvest numbers.
2) The King Eider is included in this figure.

Source: North Slope Borough Department of Wildlife Management, 2003
(Unpublished Nuiqsut Harvest Data 1994-1995, 2000 and 2001)

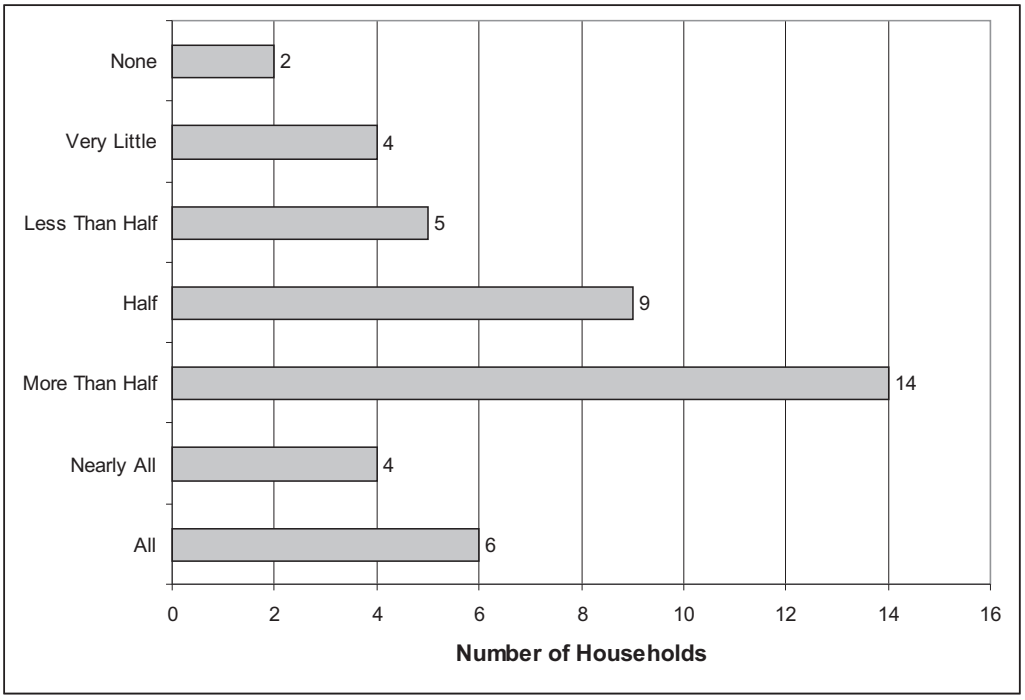
Stephen R. Braund & Associates, 2003

Figure 3.4.2-45 Nuiqsut Subsistence Harvest Locations for Eiders, 1994-1995, 2000, and 2001



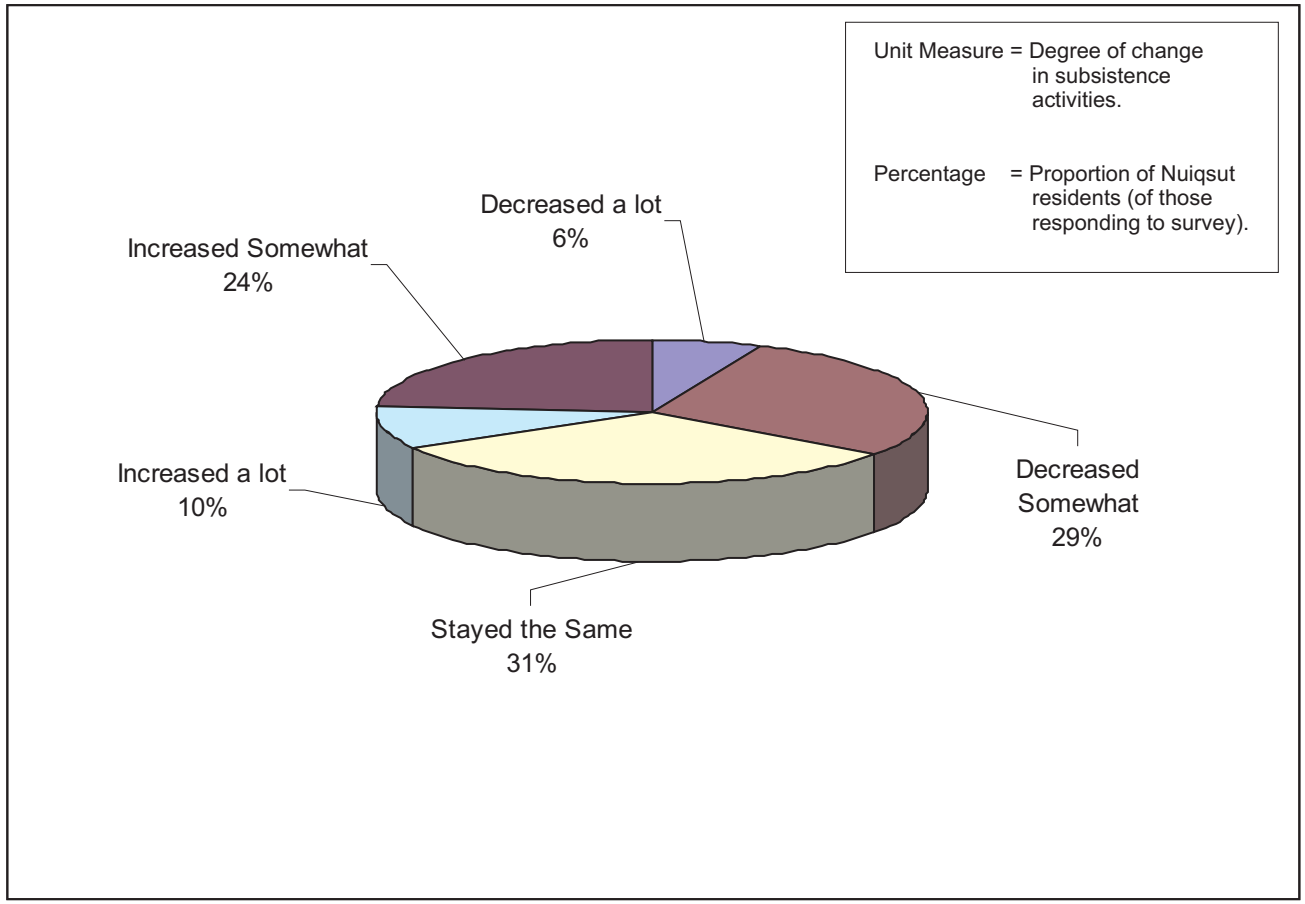
Source: North Slope Borough, 1999.

Figure 3.4.2-46 Nuiqsut Expenditures on Subsistence Activities, 1998-1999.



Source: North Slope Borough, 1999.

Figure 3.4.2-47 Nuiqsut Household Consumption of Subsistence Foods, 1998-1999.



Source: North Slope Borough, 1999.

Figure 3.4.2-48 Nuiqsut Changes in Subsistence Activity, 1998-1999.

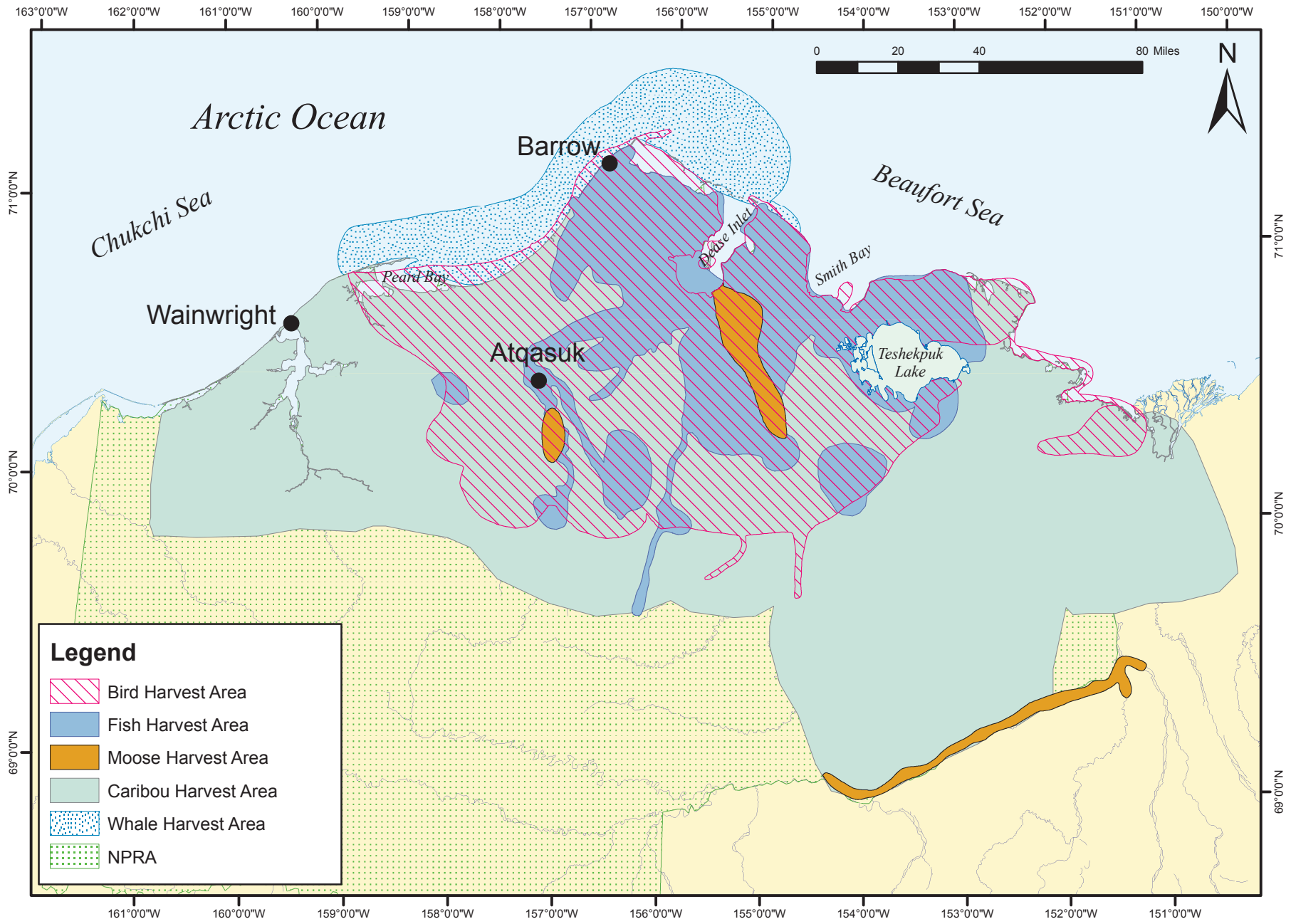


Figure 3.4.2-49 Barrow Subsistence Areas

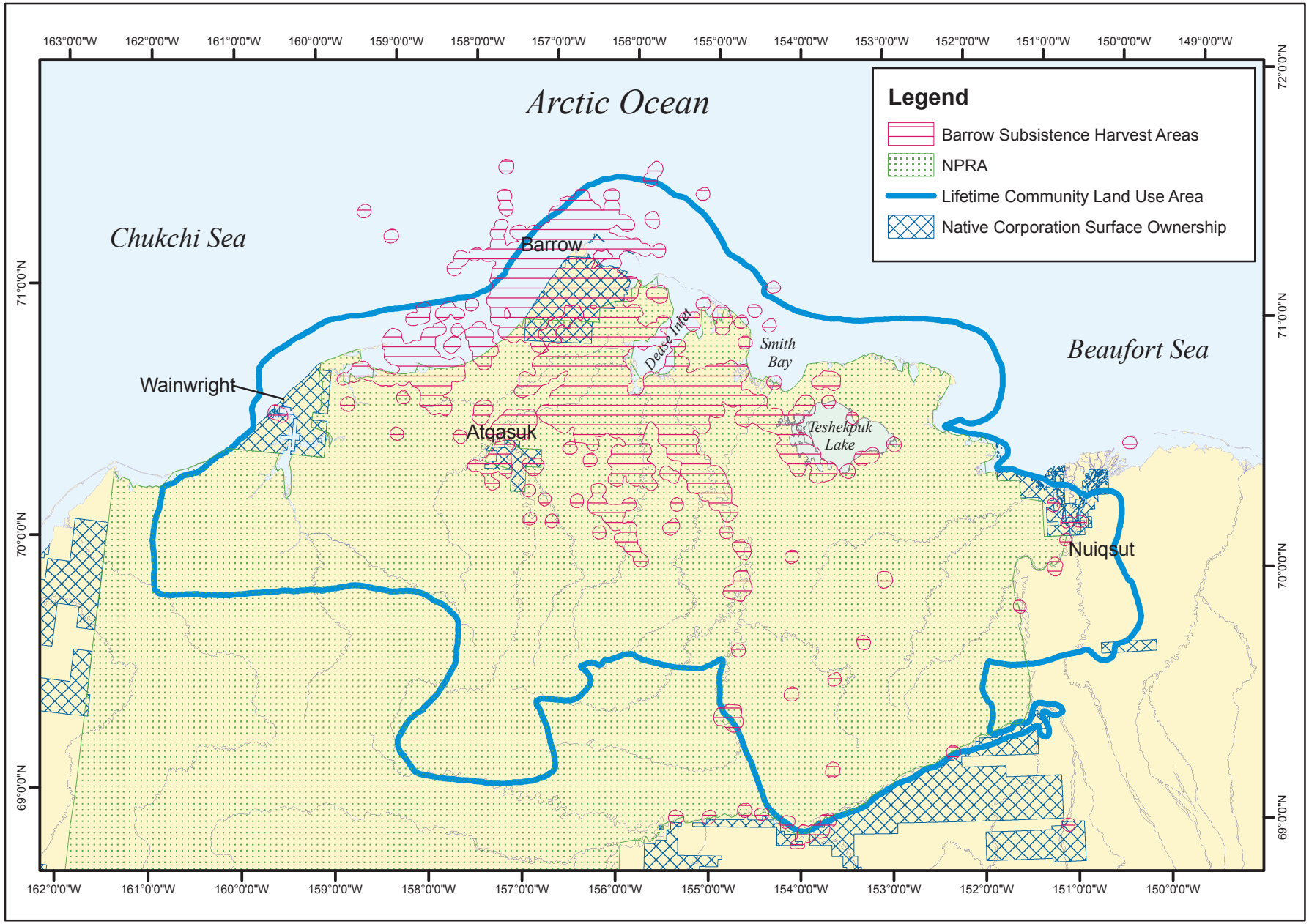


Figure 3.4.2-50 Barrow Subsistence-Harvest Sites for All Resources, April 1987 to March 1990

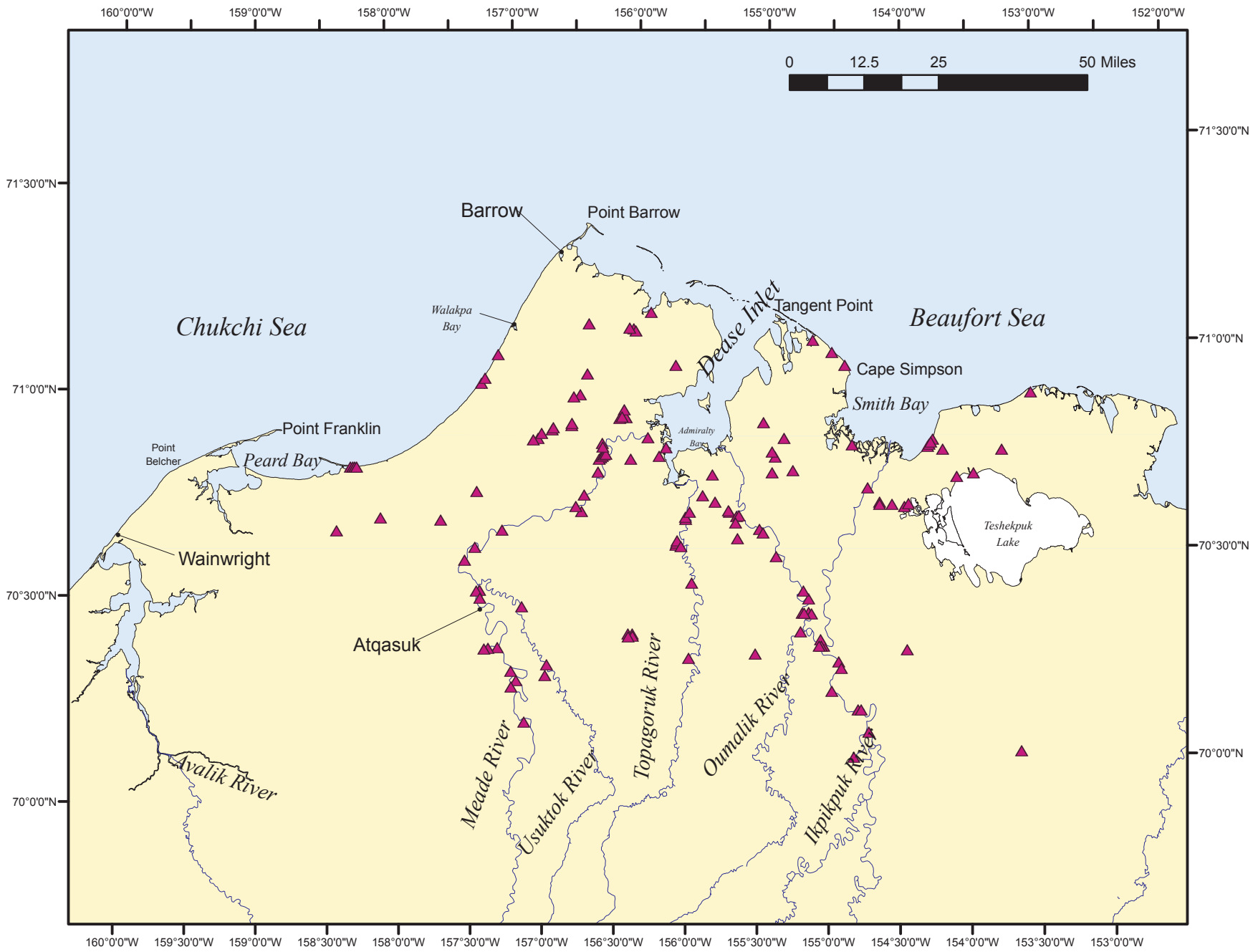


Figure 3.4.2-51 Locations of Barrow Fixed Hunting and Fishing Camps and Cabins.

Species	Winter					Spring		Summer			Fall	
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Fish												
Birds												
Berries												
Furbearers												
Caribou												
Polar Bear												
Moose												
Seals												
Walrus												
Bowhead												

	No to Very Low Levels of Subsistence
	Low to Medium Levels of Subsistence
	High Levels of Subsistence Activity

Sources: SRBA and ISER (1993) and SRBA (2003a).

Figure 3.4.2-52 Barrow Annual Subsistence Cycle

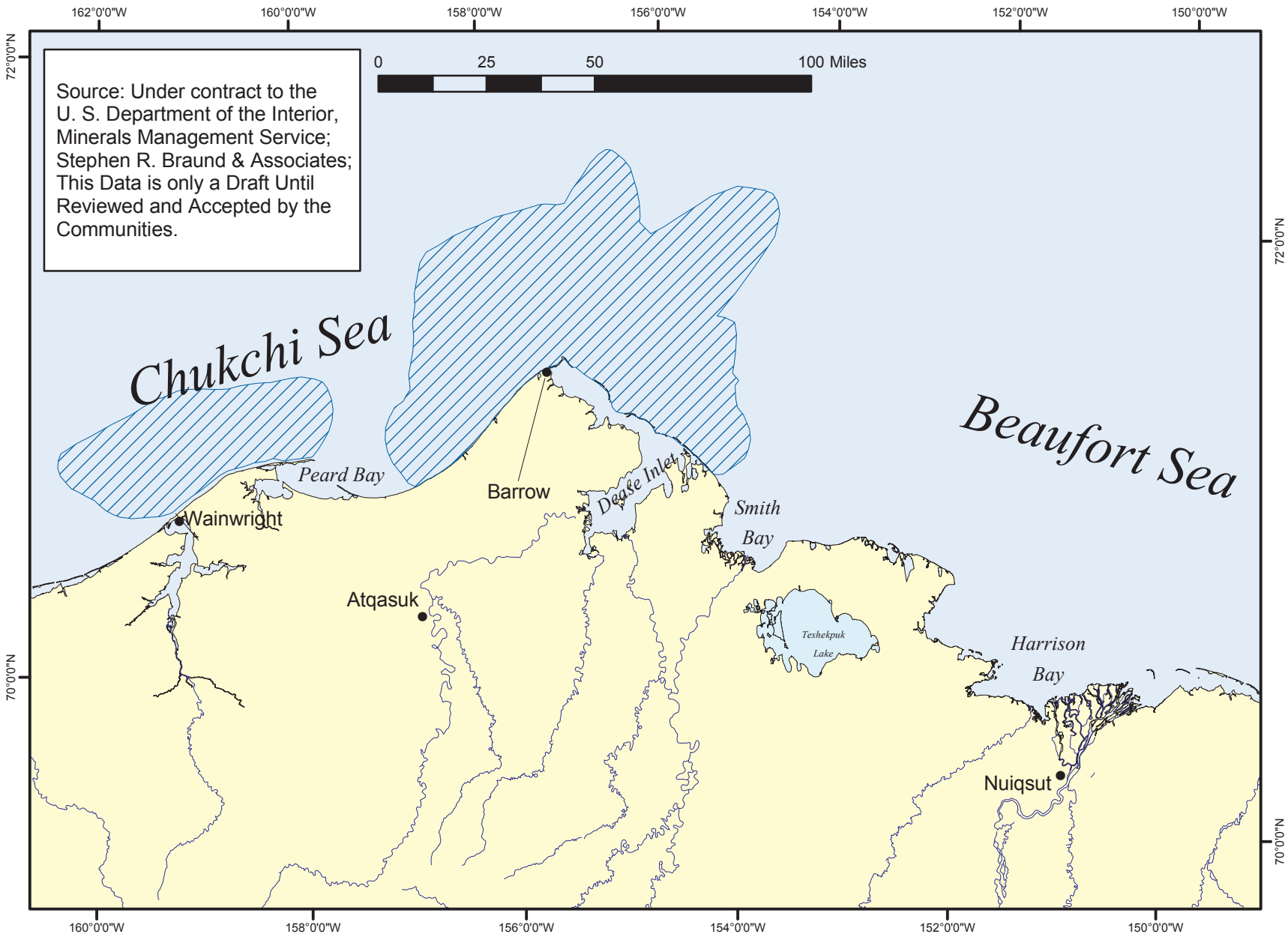
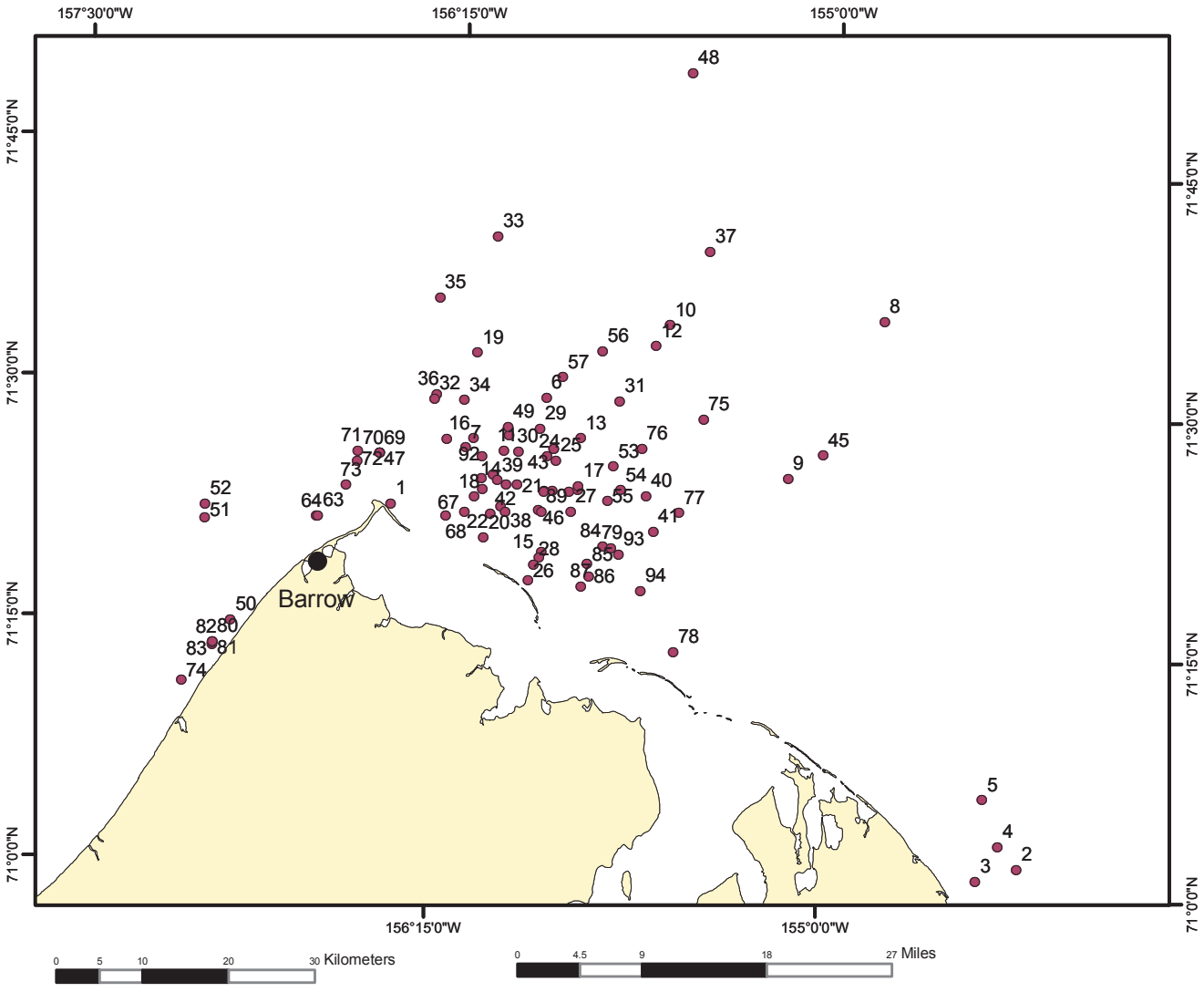


Figure 3.4.2-53 Barrow Subsistence-Use Areas, Bowhead Whale, 1996-2006



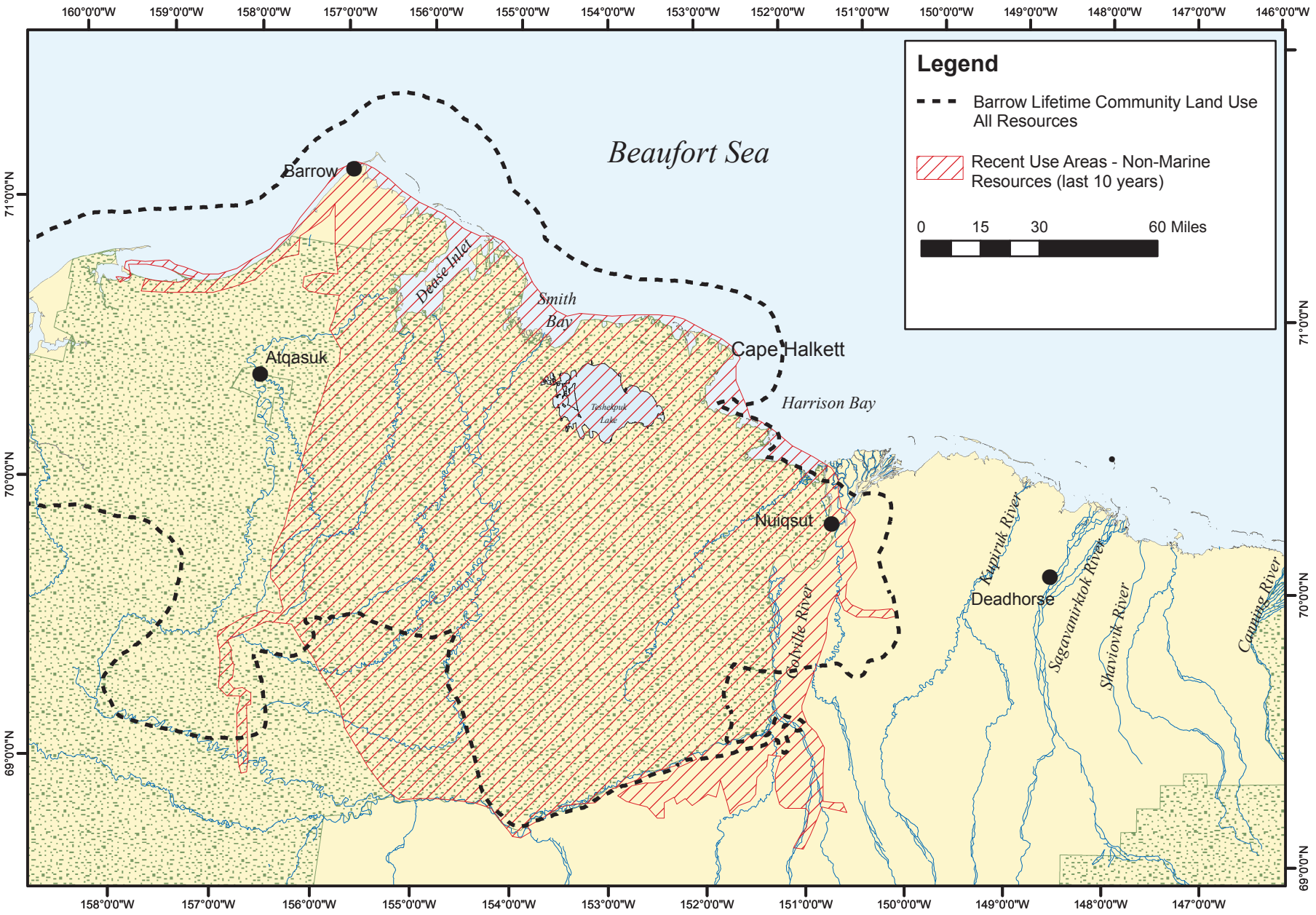
NUMBER	ID	YEAR
1	88B11	1988
2	89B7	1989
3	89B5	1989
4	89B6	1989
5	89B4	1989
6	91B10	1991
7	91B9	1991
8	91B11	1991
9	91B12	1991
10	92B16	1992
11	92B15	1992
12	92B14	1992
13	92B13	1992
14	92B12	1992
15	92B17	1992
16	92B11	1992
17	92B10	1992
18	92B08	1992
19	92B07	1992
20	92B06	1992
21	92B05	1992
22	92B04	1992
23	92B03	1992
24	93B18	1993
25	93B19	1993
26	93B21	1993
27	93B22	1993
28	93B23	1993
29	93B20	1993
30	93B17	1993
31	94	1994

NUMBER	ID	YEAR
33	95B15	1995
34	95B14	1995
35	95B18	1995
36	95B17	1995
37	95B16*	1995
38	95B10	1995
39	95B9	1995
40	95B13	1995
41	95B12	1995
42	95B11	1995
43	97B16	1997
44	97B28	1997
45	97B31	1997
46	97B13	1997
47	97B7	1997
48	97B30	1997
49	97B18	1997
50	97B10	1997
51	97B6	1997
52	97B3	1997
53	97B24	1997
54	97B12	1997
55	97B11	1997
56	97B26	1997
57	97B19	1997
58	97B15	1997
59	97B23	1997
60	97B25	1997
61	97B14	1997
62	97B27	1997
63	97B5	1997

NUMBER	ID	YEAR
64	97B4	1997
65	97B17	1997
66	97B23	1997
67	97B20	1997
68	97B21	1997
69	97B8	1997
70	97B5	1997
71	97B1	1997
72	97B4	1997
73	98B1	1998
74	98B3	1998
75	98B18	1998
76	98B17	1998
77	98B98	1998
78	98B11	1998
79	98B20	1998
80	98B6	1998
81	98B7	1998
82	98B9	1998
83	98B8	1998
84	98B12	1998
85	98B14	1998
86	98B15	1998
87	98B16	1998
88	98B99	1998
89	98B25	1998
90	98B22	1998
91	98B23	1998
92	98B24	1998
93	98B21	1998
94	98B19	1998

Sources: Iong, 1996: North Slope Borough Planning Dept., 1993; Bowhead Strikes 1937-2001

Figure 3.4.2-54 Bowhead Whale Harvest Locations Near Barrow, 1988-1998



Source: Braund & Associates (2004)

Figure 3.4.2-55 Barrow Partial Subsistence-Use Areas for Non-Marine Resources, 2003

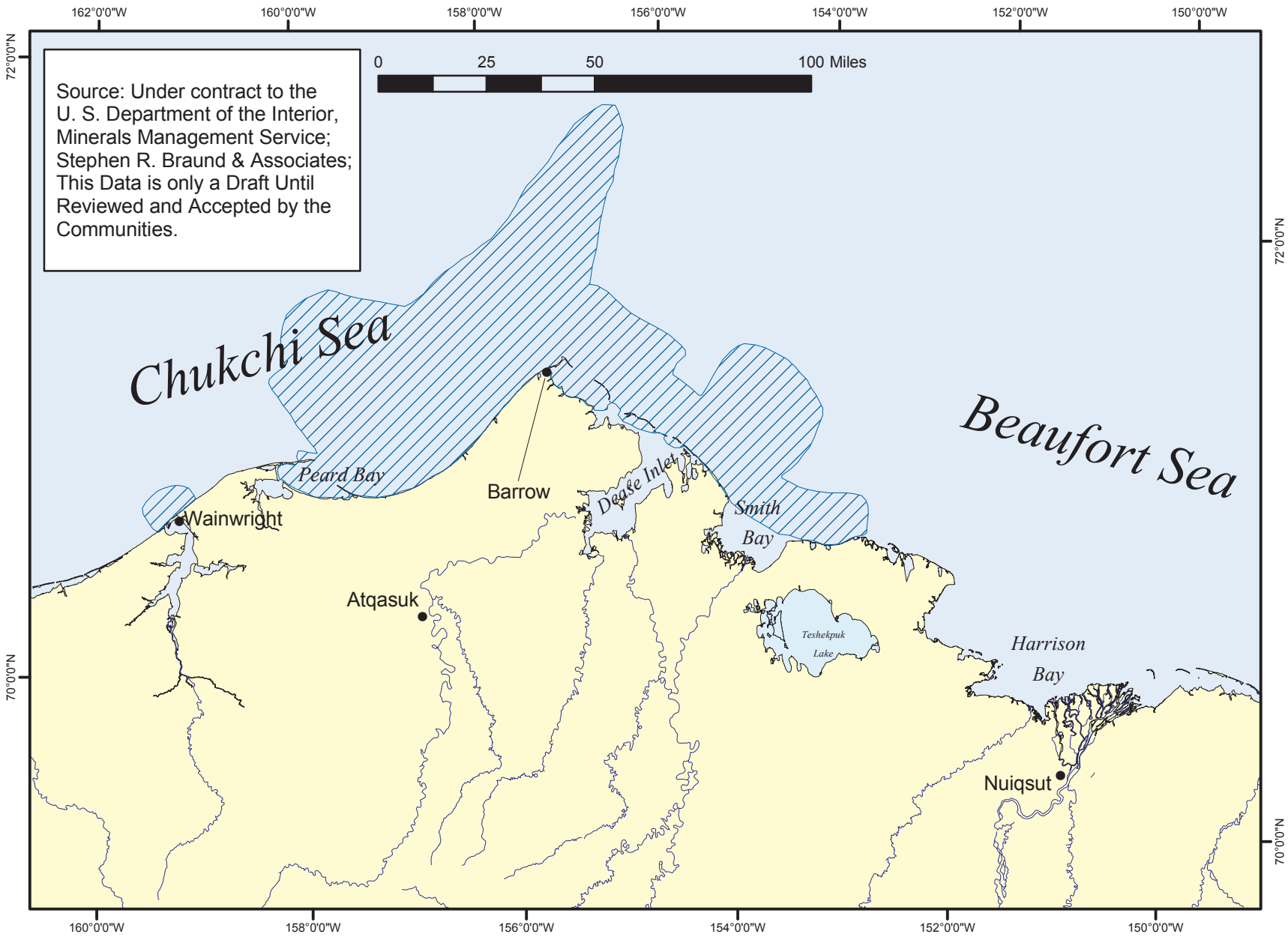


Figure 3.4.2-56 Barrow Subsistence-Use Areas, Ringed Seal, 1996-2006

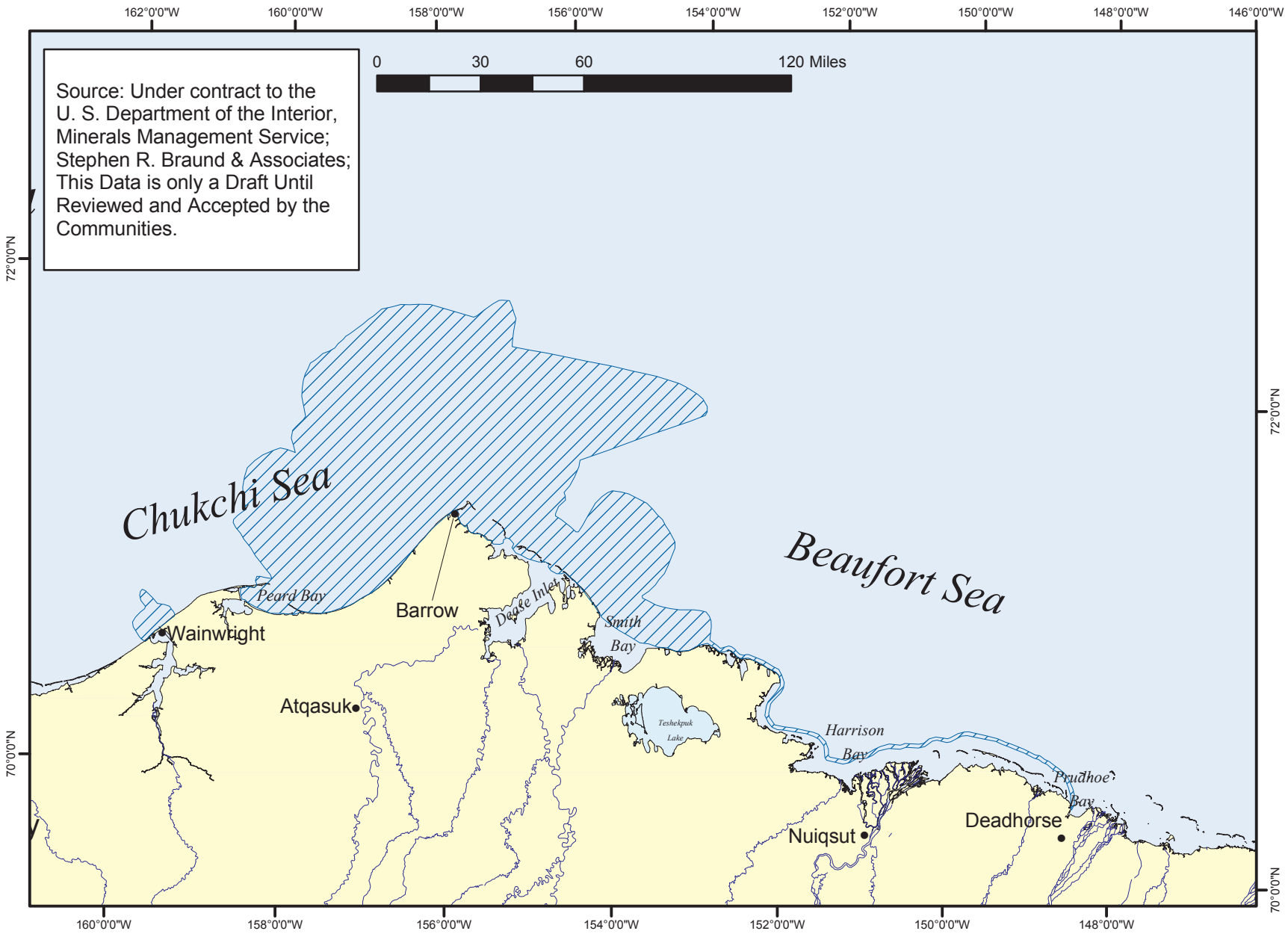


Figure 3.4.2-57 Barrow Subsistence-Use Areas, Bearded Seal, 1996-2006

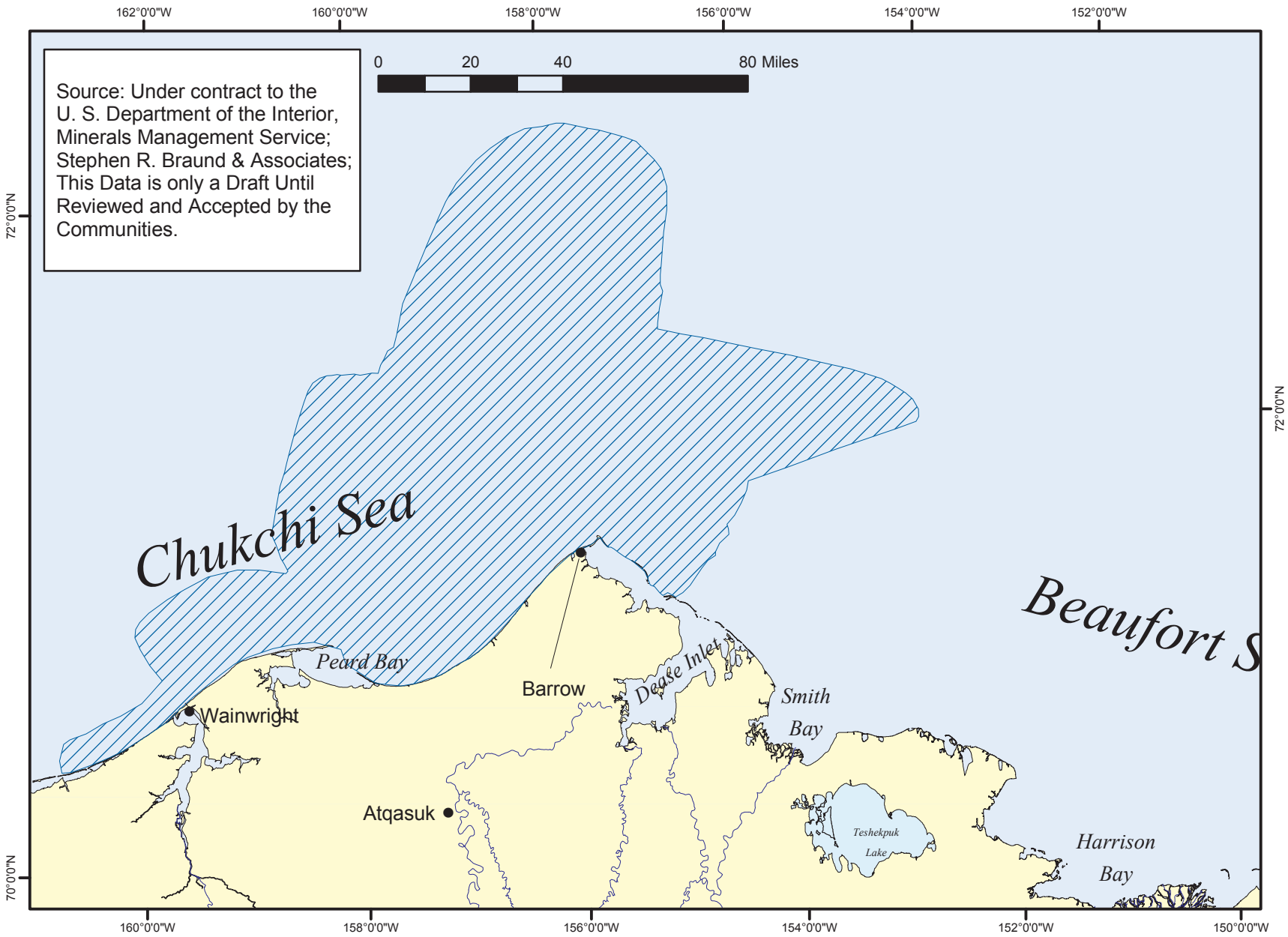


Figure 3.4.2-58 Barrow Subsistence-Use Areas, Walrus, 1996-2006

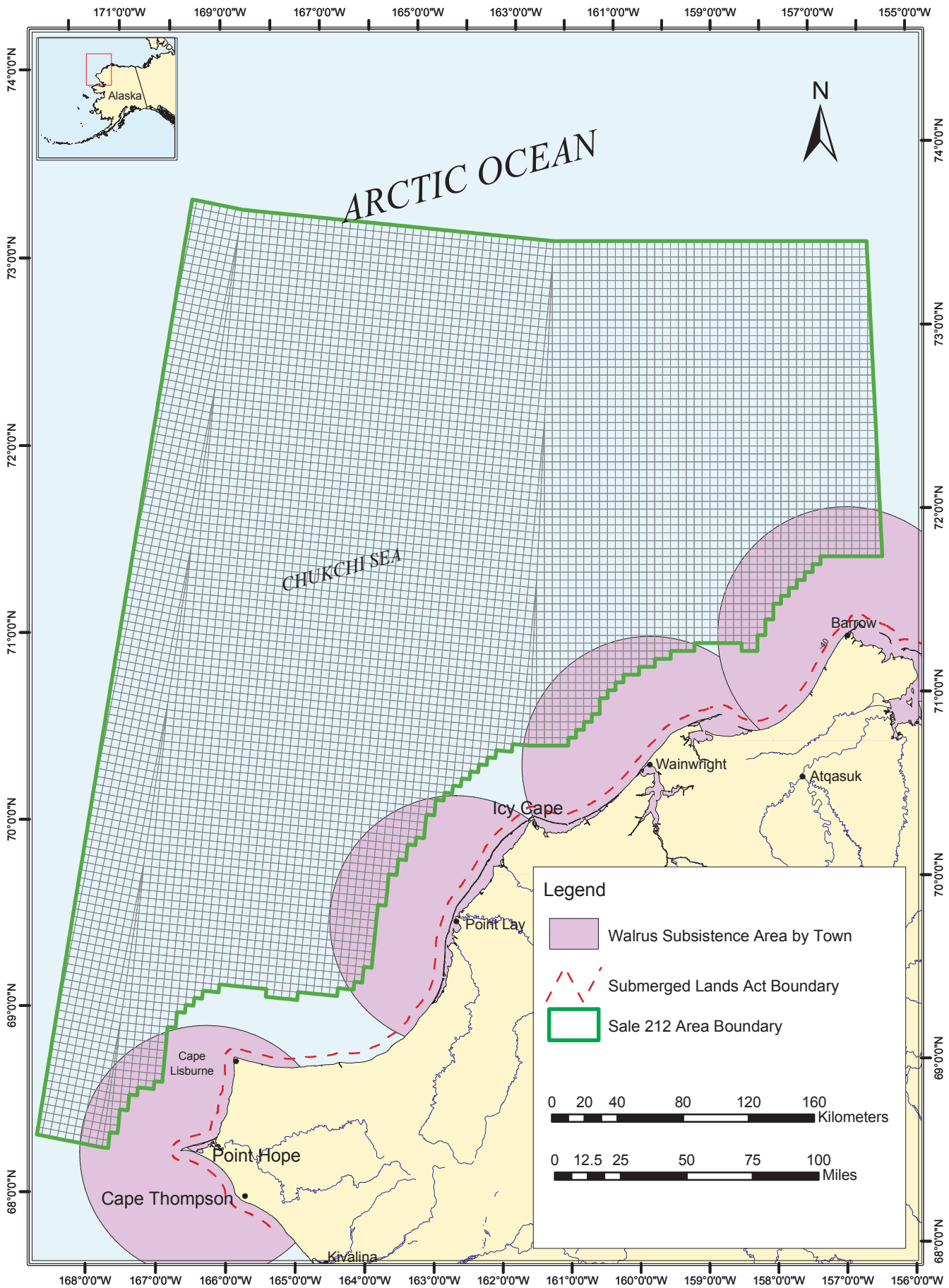
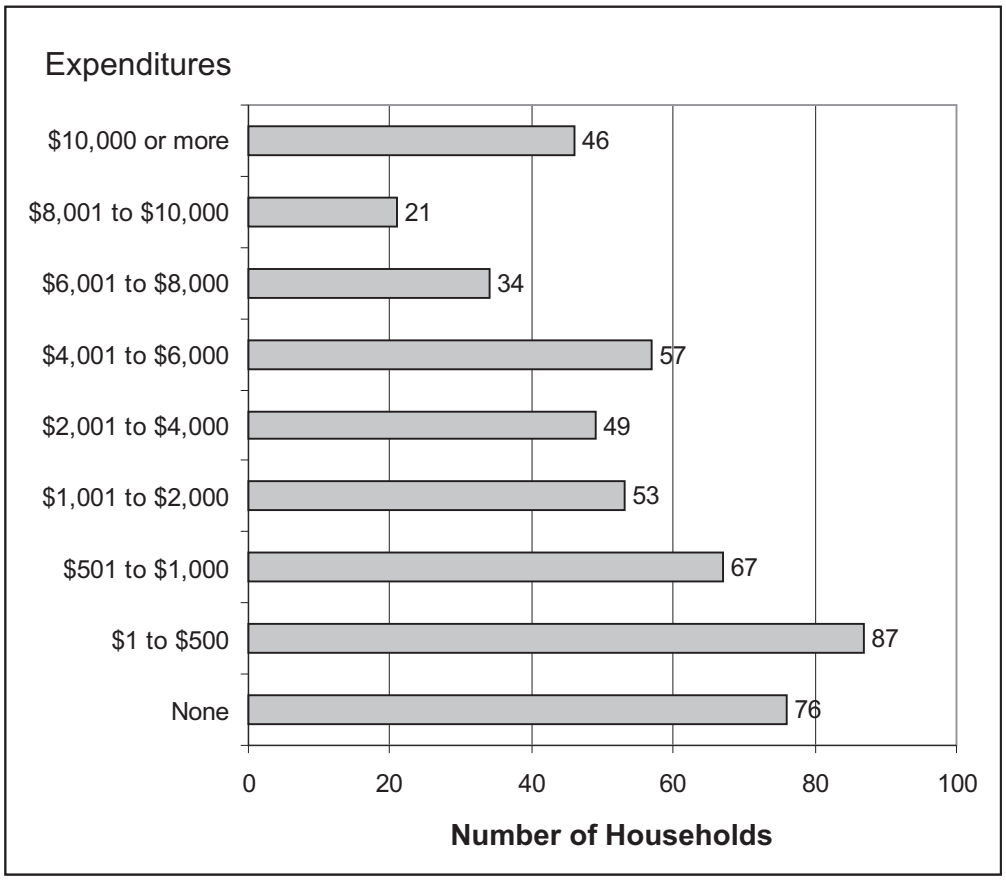
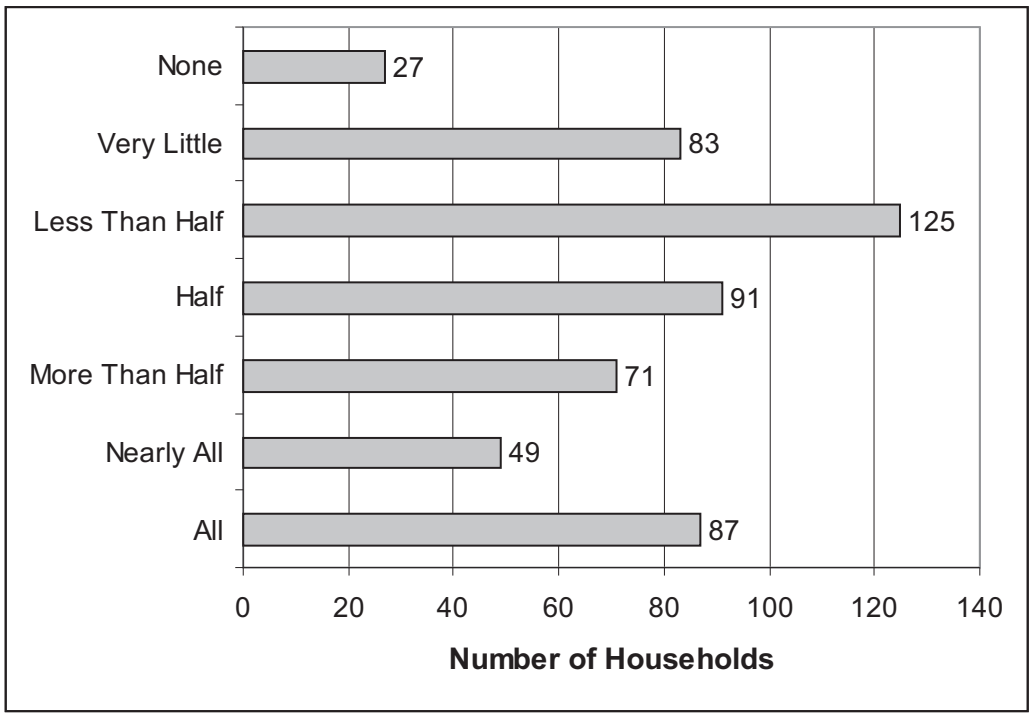


Figure 3.4.2-59 Walrus Subsistence Areas (Chukchi)



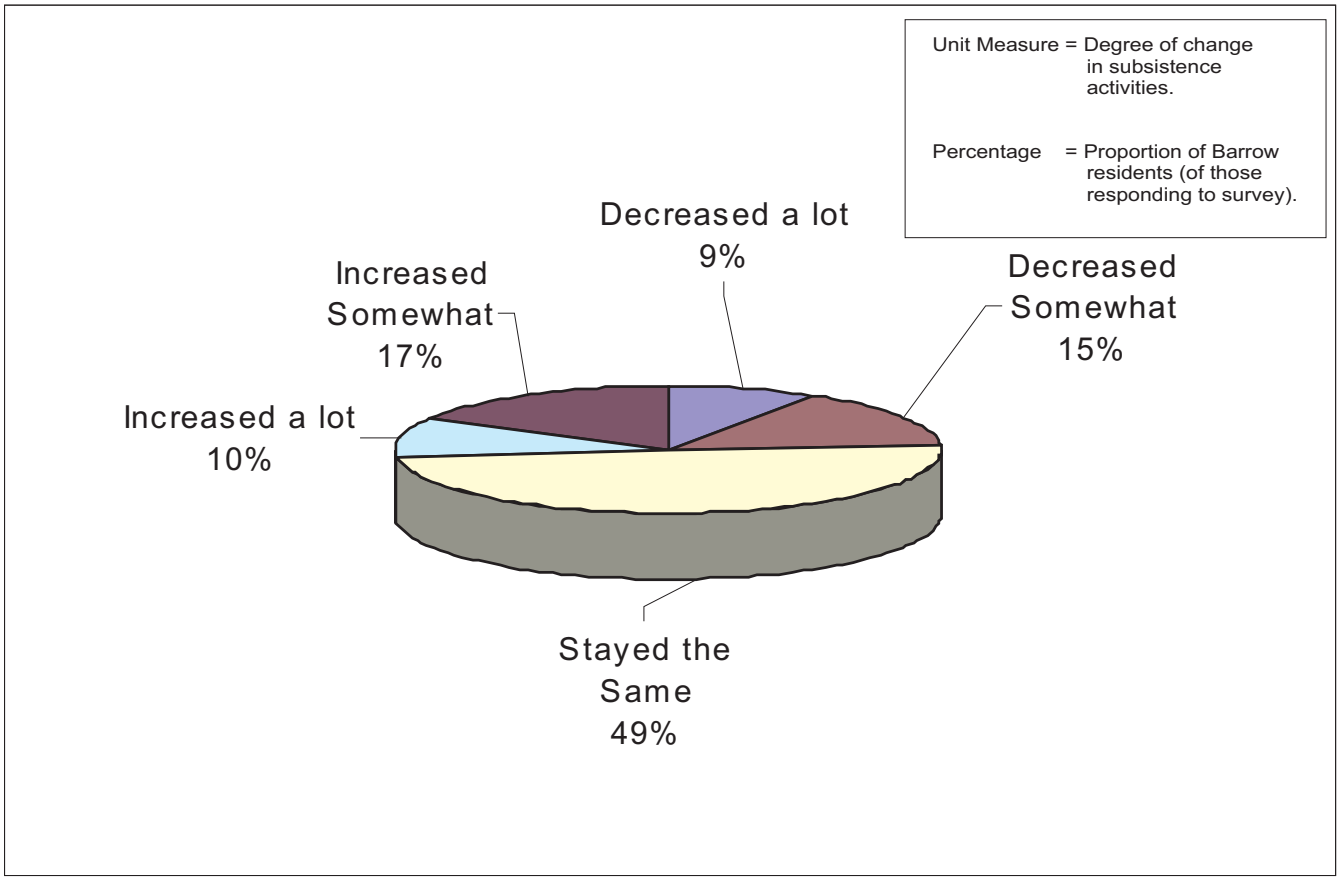
Source: North Slope Borough,1999.

Figure 3.4.2-60 Barrow Expenditures on Subsistence Activities, 1998-1999



Source: North Slope Borough,1999.

Figure 3.4.2-61 Barrow Household Consumption of Subsistence Foods, 1998-1999.



Source: North Slope Borough,1999.

Figure 3.4.2-62 Barrow Changes in Subsistence Activity, 1998-1999

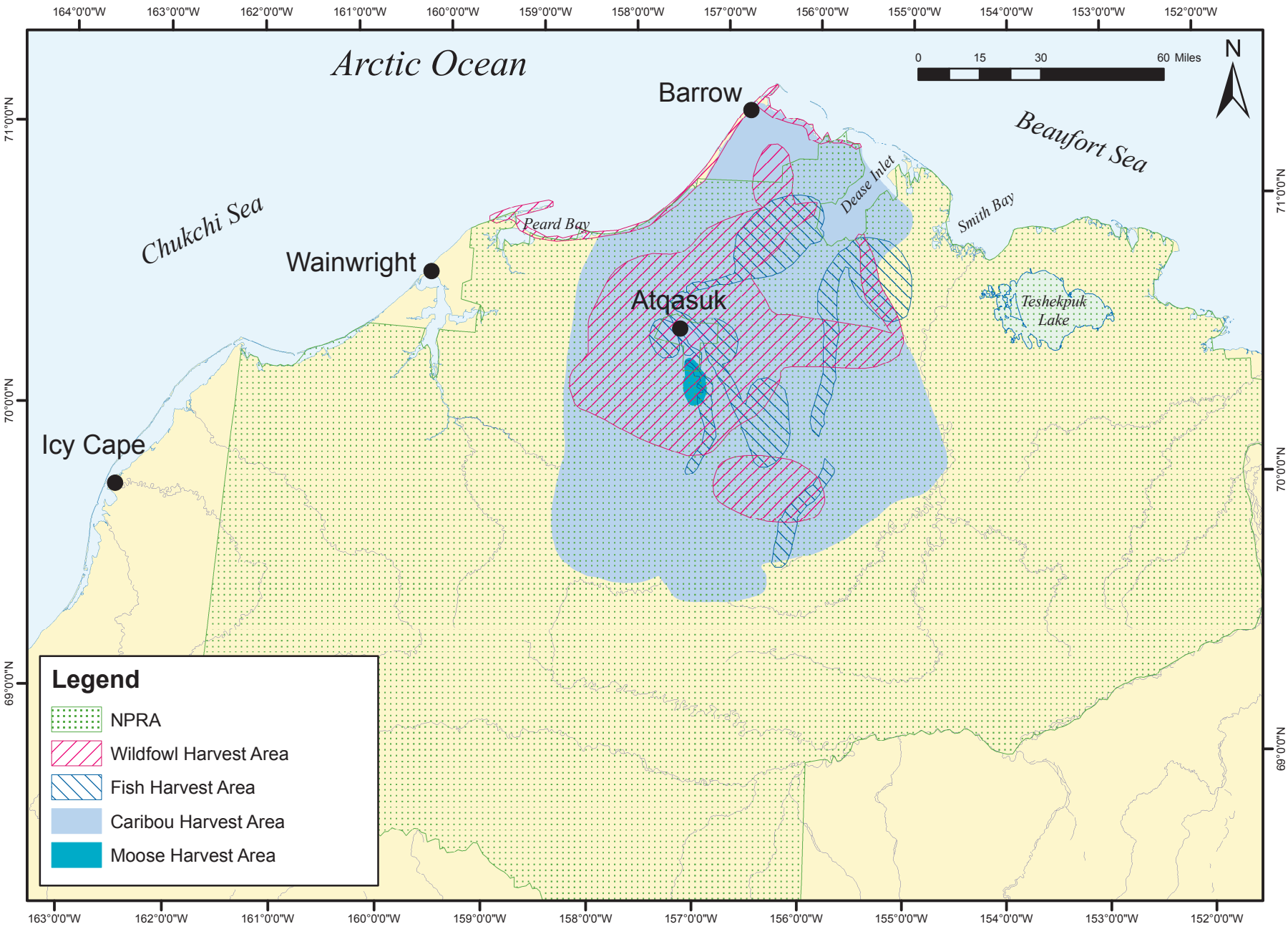
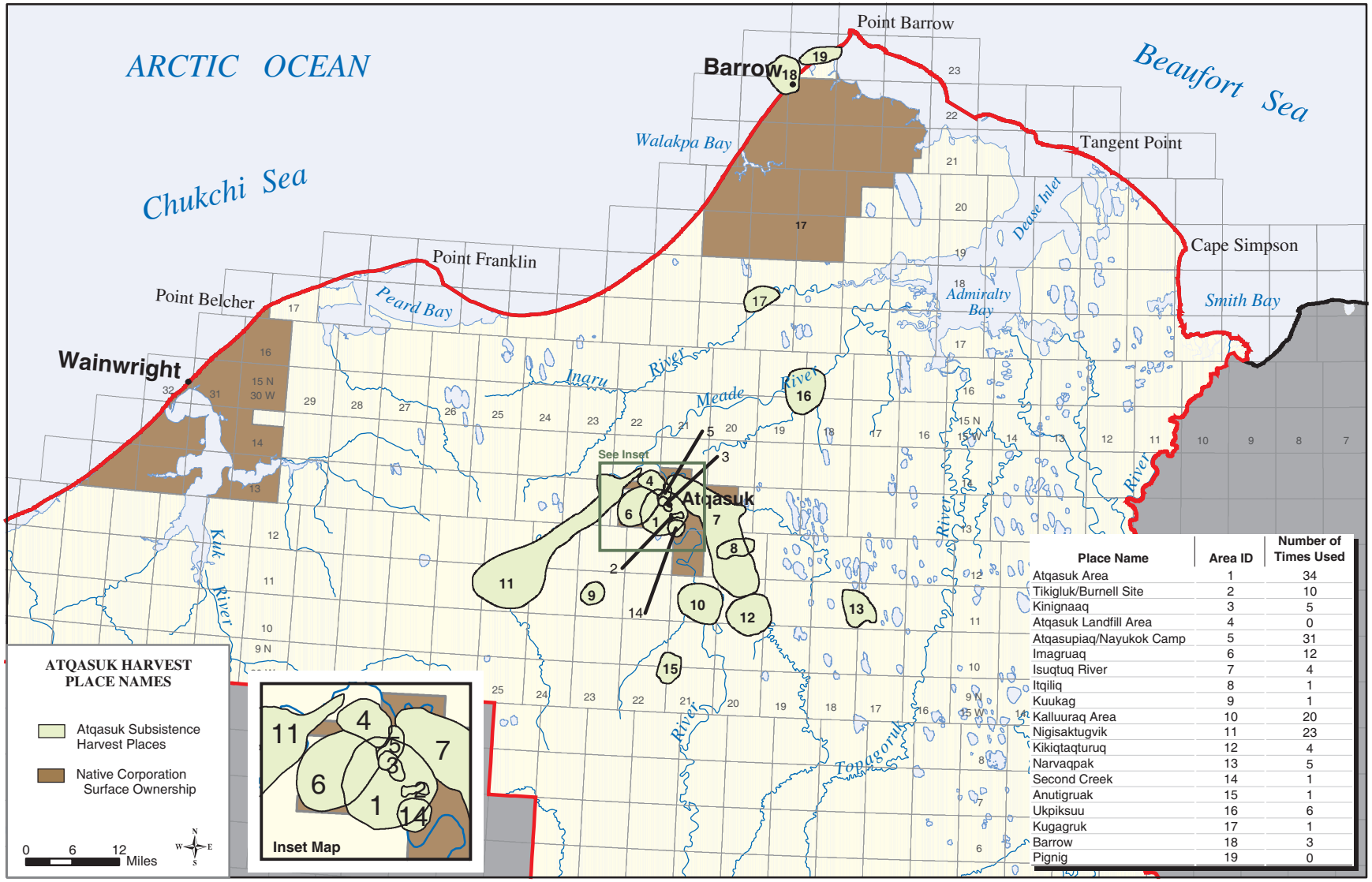


Figure 3.4.2-63 Atqasuk Subsistence-Use Areas



Place Name	Area ID	Number of Times Used
Atqasuk Area	1	34
Tikigluk/Burnell Site	2	10
Kinignaaq	3	5
Atqasuk Landfill Area	4	0
Atqasupiaq/Nayukok Camp	5	31
Imagruaq	6	12
Isuqtuq River	7	4
Itqiliq	8	1
Kuukag	9	1
Kalluuraq Area	10	20
Nigisaktugvik	11	23
Kikiqtaqturuq	12	4
Narvaqpak	13	5
Second Creek	14	1
Anutigruak	15	1
Ukpiksuu	16	6
Kugagruk	17	1
Barrow	18	3
Pignig	19	0

Source: Opie, Brower, and Bates, 1997

Figure 3.4.2-64 Atqasuk Subsistence Harvest Place Names and Frequency of Harvest Area Use, July 1994 to July 1995

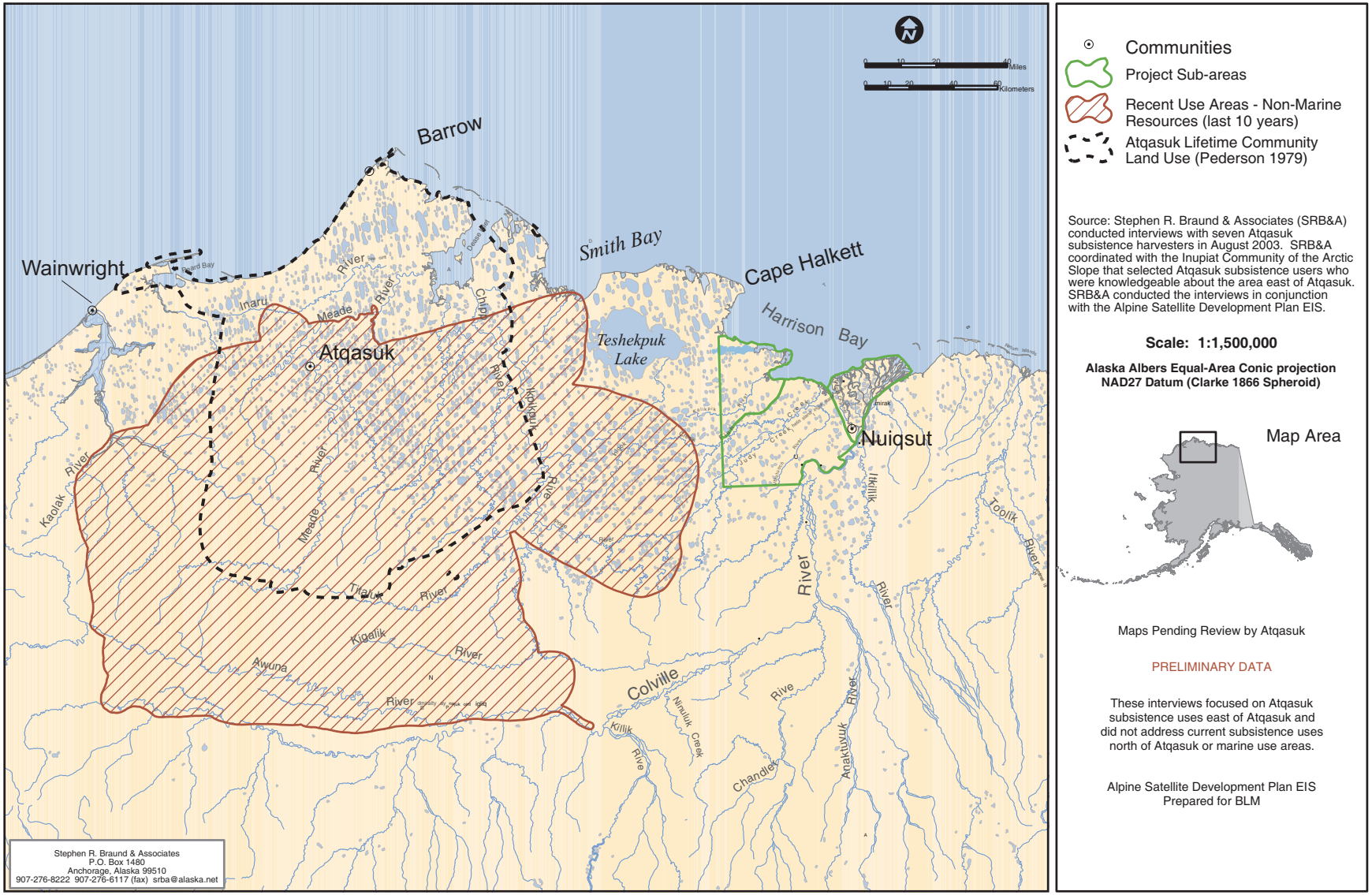
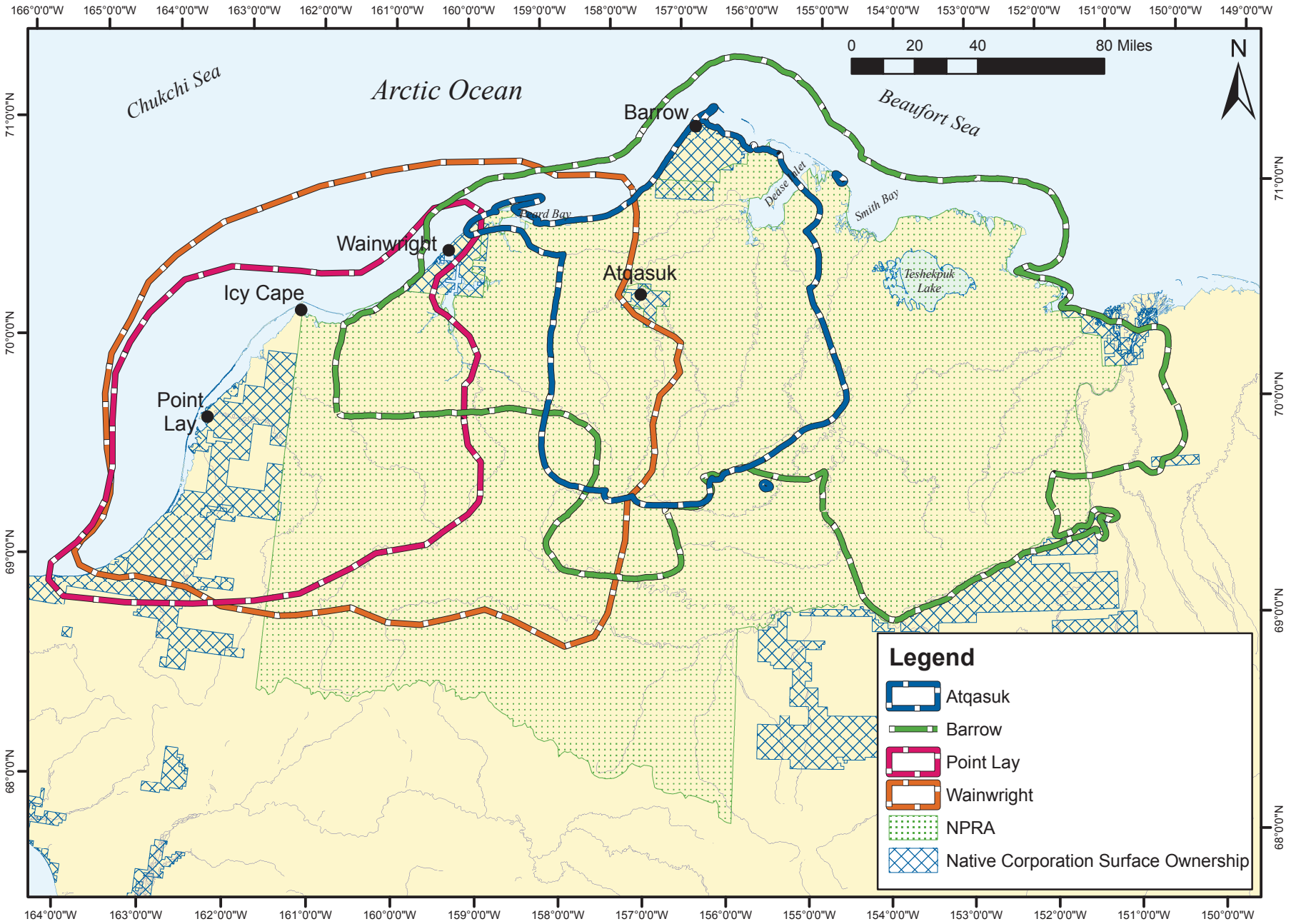


Figure 3.4.2-65 Atqasuk Partial Subsistence-Use Areas for Non-Marine Resources, 2003



Source: Pedersen, 1979; North Slope Borough, 1979 and 1993; Alaska Department of Fish and Game, 1986; Hoffman, Libbey, and Spearman, 1988; Braund, 1989a

Figure 3.4.2-66 Atqasuk, Barrow, Point Lay, and Wainwright Community Subsistence Areas, 1979

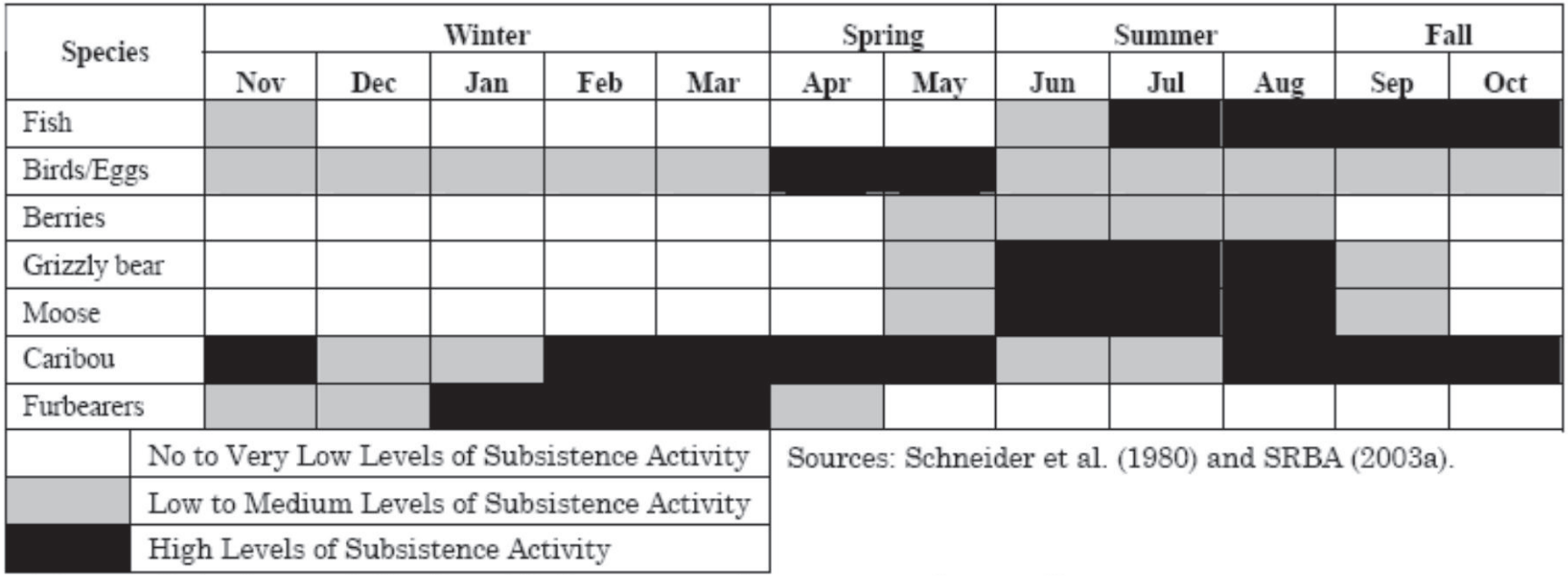
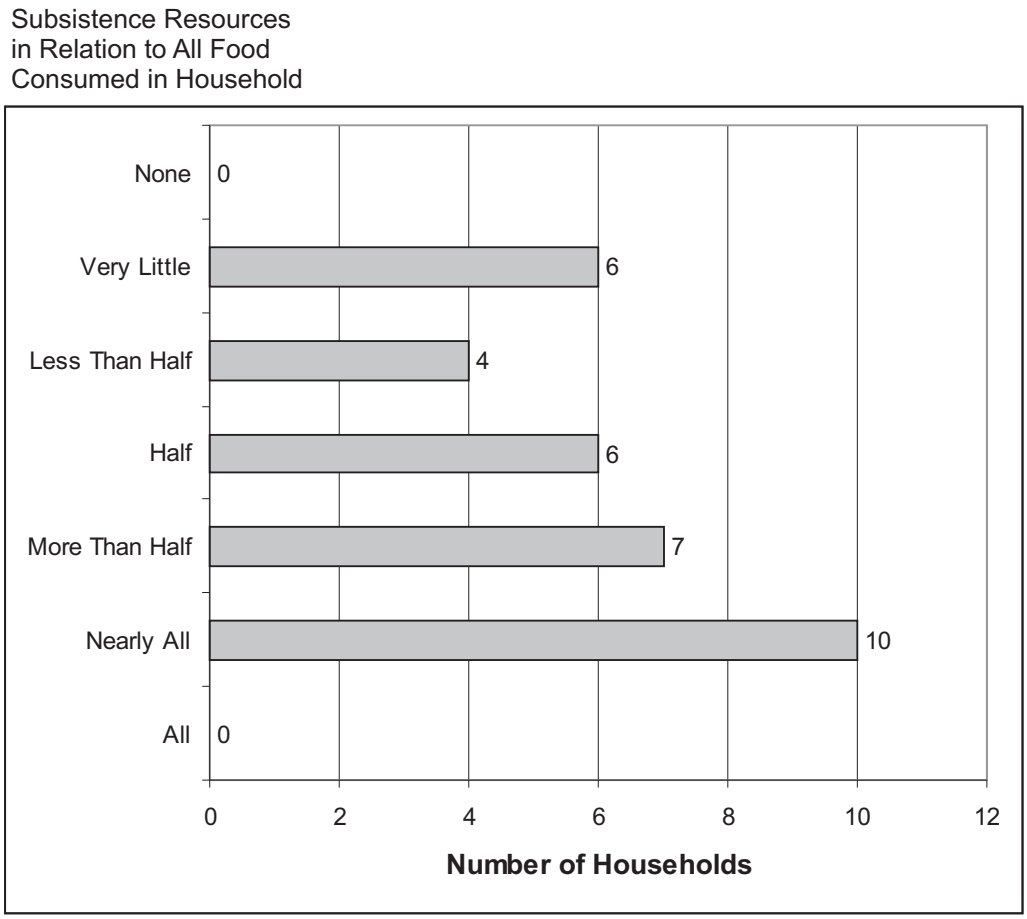
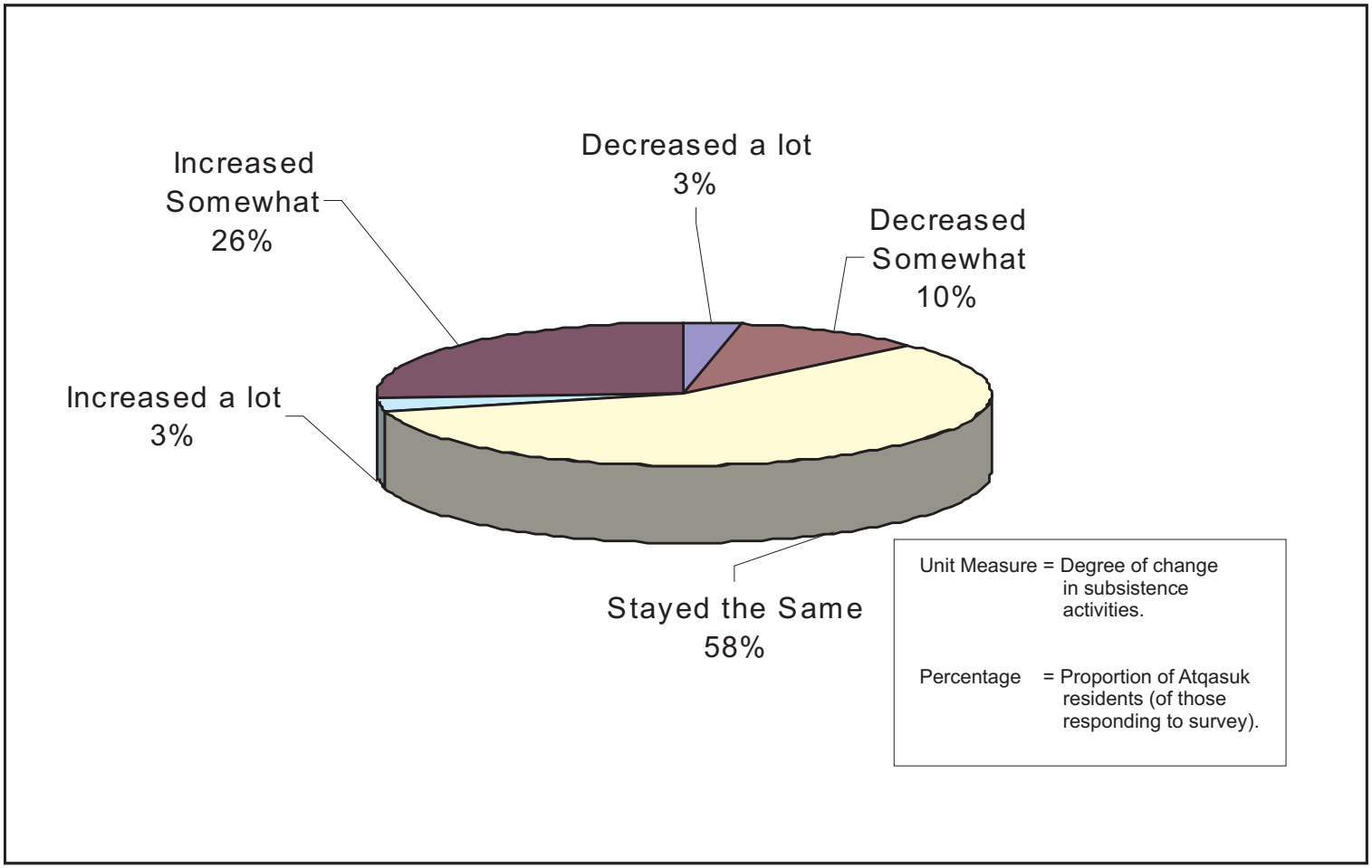


Figure 3.4.3-67 Atqasuk Annual Subsistence Cycle



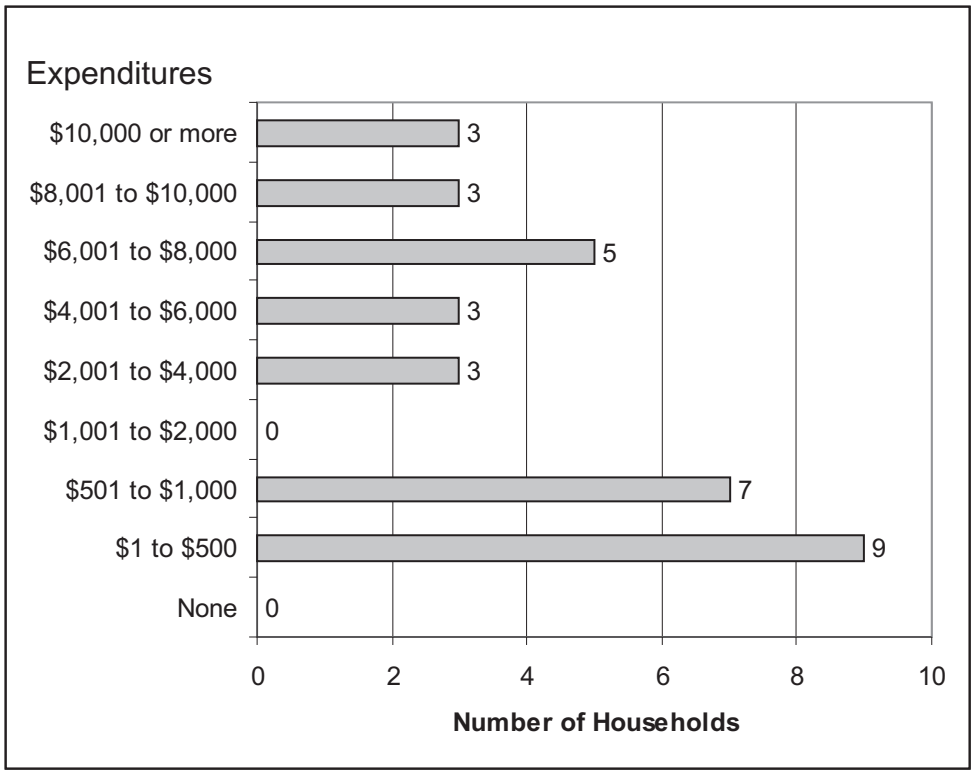
Source: North Slope Borough,1999.

Figure 3.4.2-68 Atqasuk Household Consumption of Subsistence Foods, 1998-1999



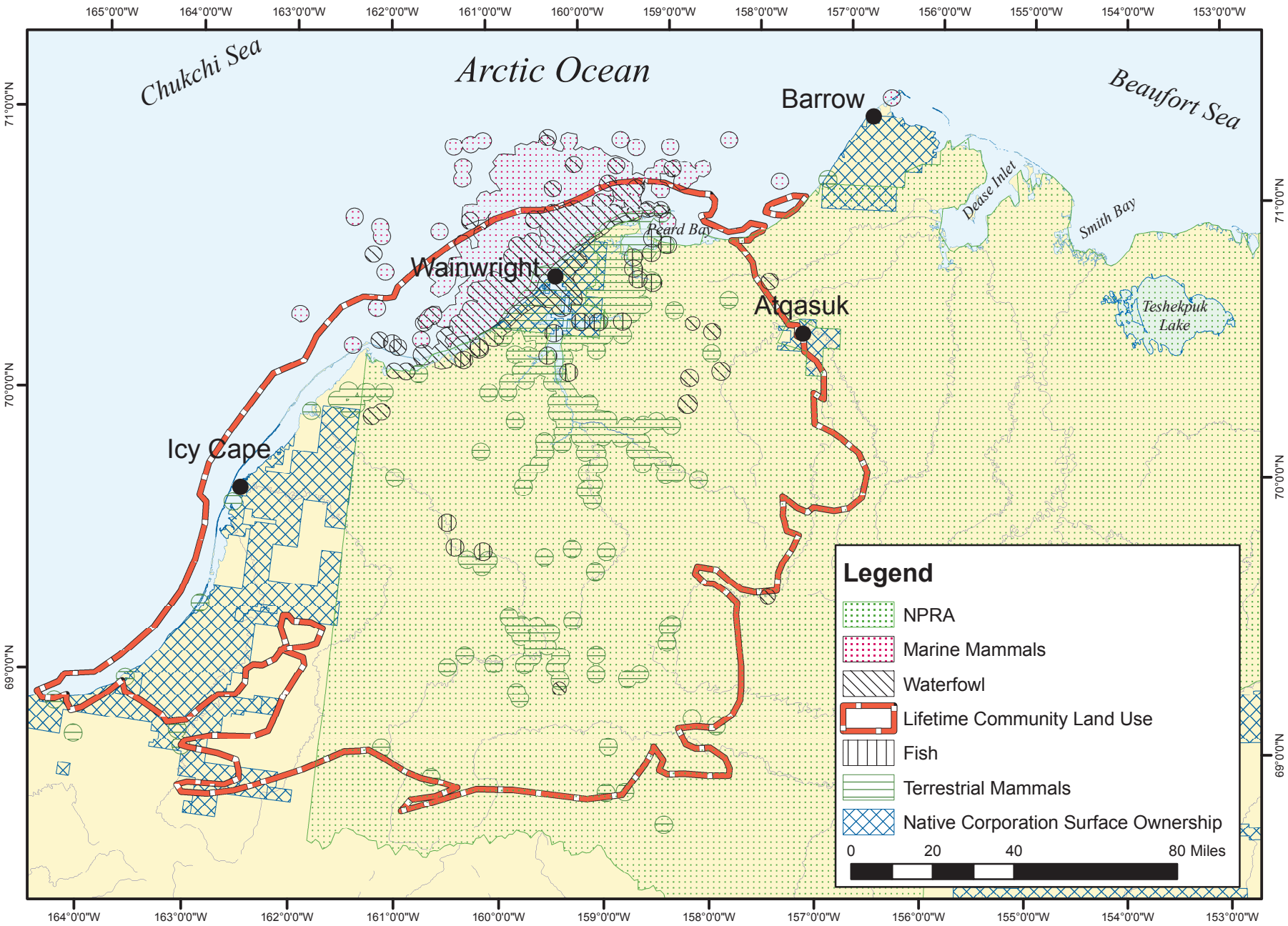
Source: North Slope Borough,1999.

Figure 3.4.2-69 Atqasuk Changes in Subsistence Activity, 1998-1999



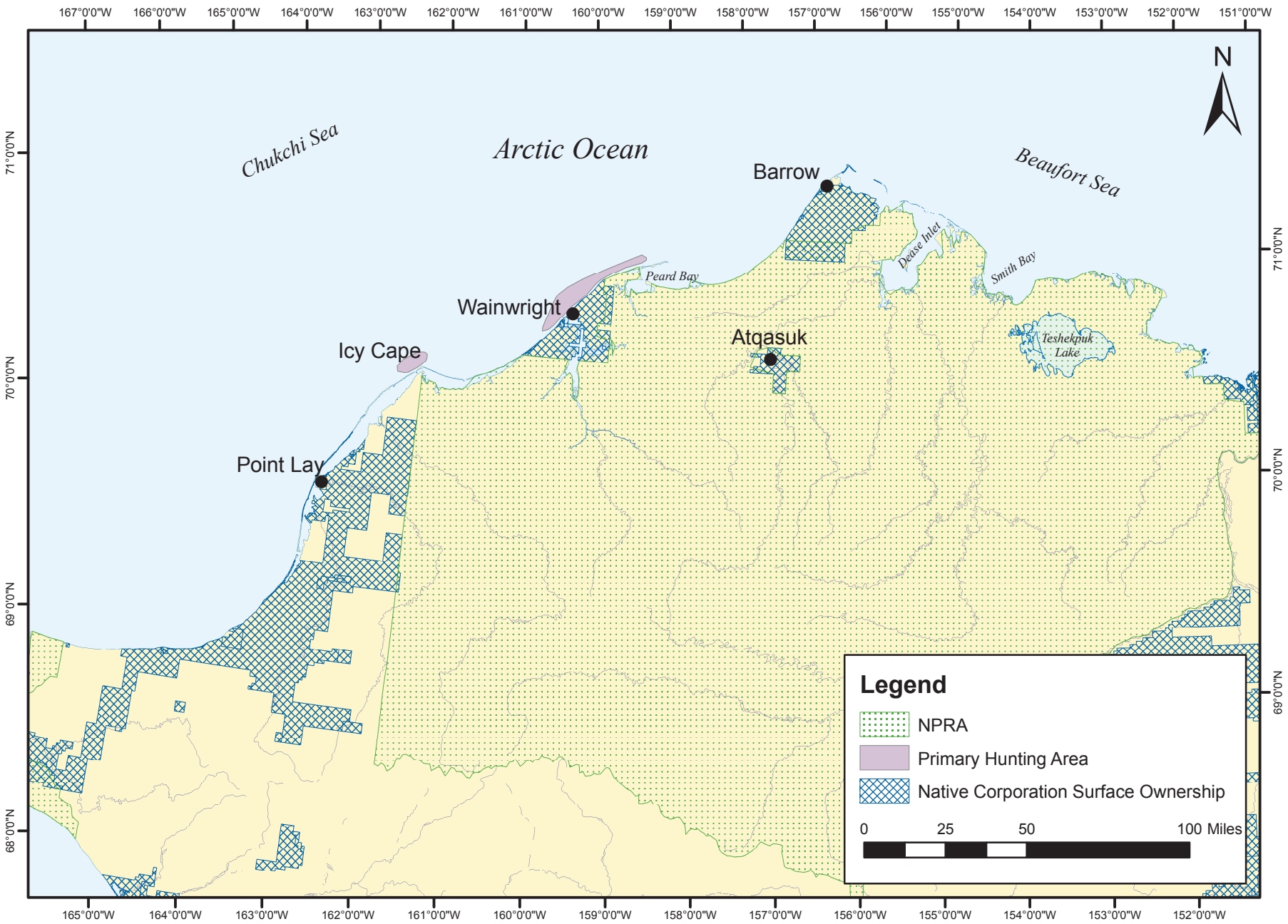
Source: North Slope Borough,1999.

Figure 3.4.2-70 Atqasuk Expenditures on Subsistence Activities, 1998-1999



Source: S. R. Braund and Associates and UAA ISER, 1991

Figure 3.4.2-71 Wainwright Subsistence Harvest Areas for Fish, Birds, and Terrestrial and Marine Mammals



Source: Braund and Burnham, 1984

Figure 3.4.2-72 Wainwright Subsistence-Use Areas for Bowhead Whales

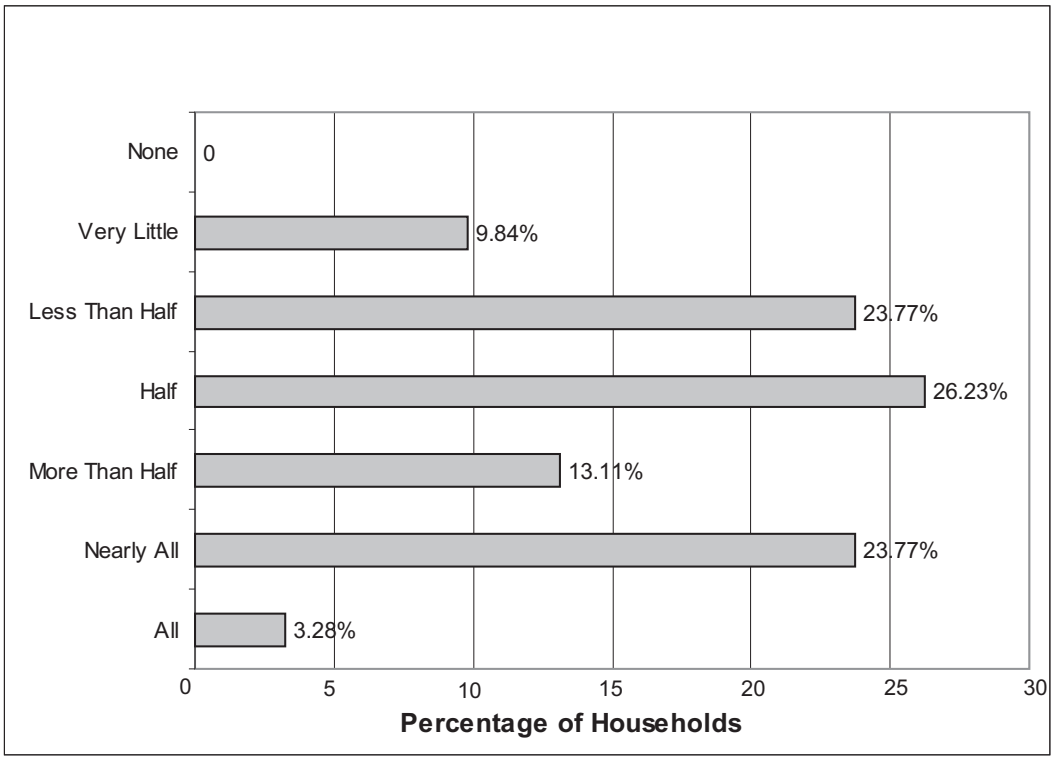
Species	Winter					Spring		Summer			Fall	
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Fish												
Birds/Eg												
Berries												
Caribou												
Furbeare												
Seals												
Walrus												
Whales												

	No to Very Low Levels of Subsistence Activity
	Low to Medium Levels of Subsistence Activity
	High Levels of Subsistence Activity

Source: Kassam 2001

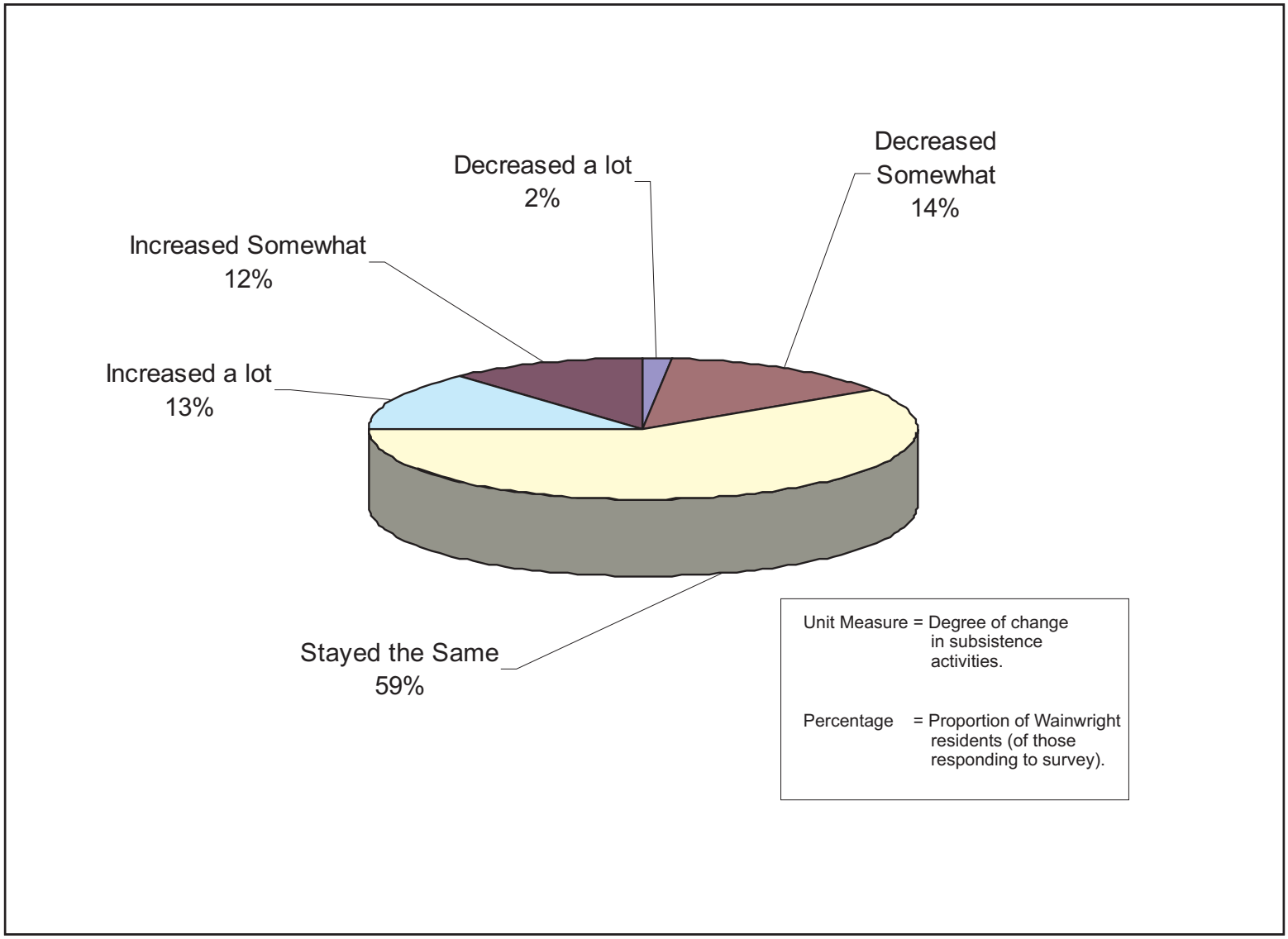
Figure 3.4.2-73 Wainwright Annual Subsistence Cycle

Subsistence Resources
in Relation to all food
Consumed in Households



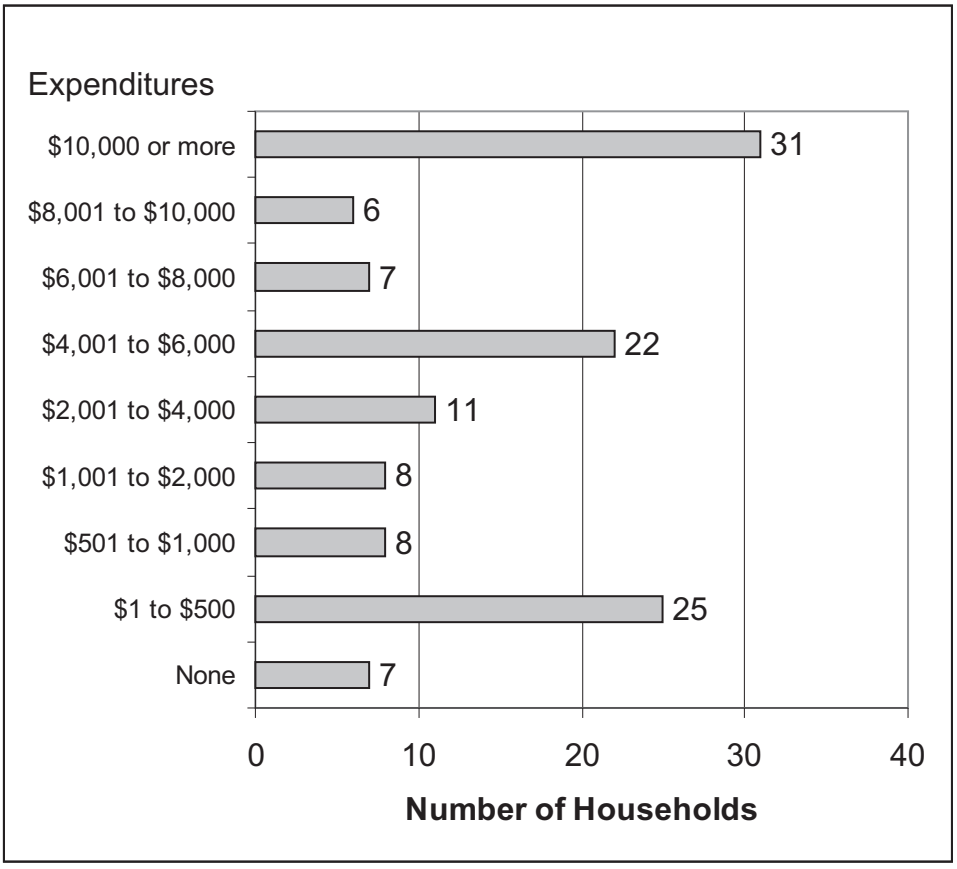
Source: North Slope Borough, 1999.

Figure 3.4.2-74 Wainwright Household Consumption of Subsistence Resources, 1998-1999



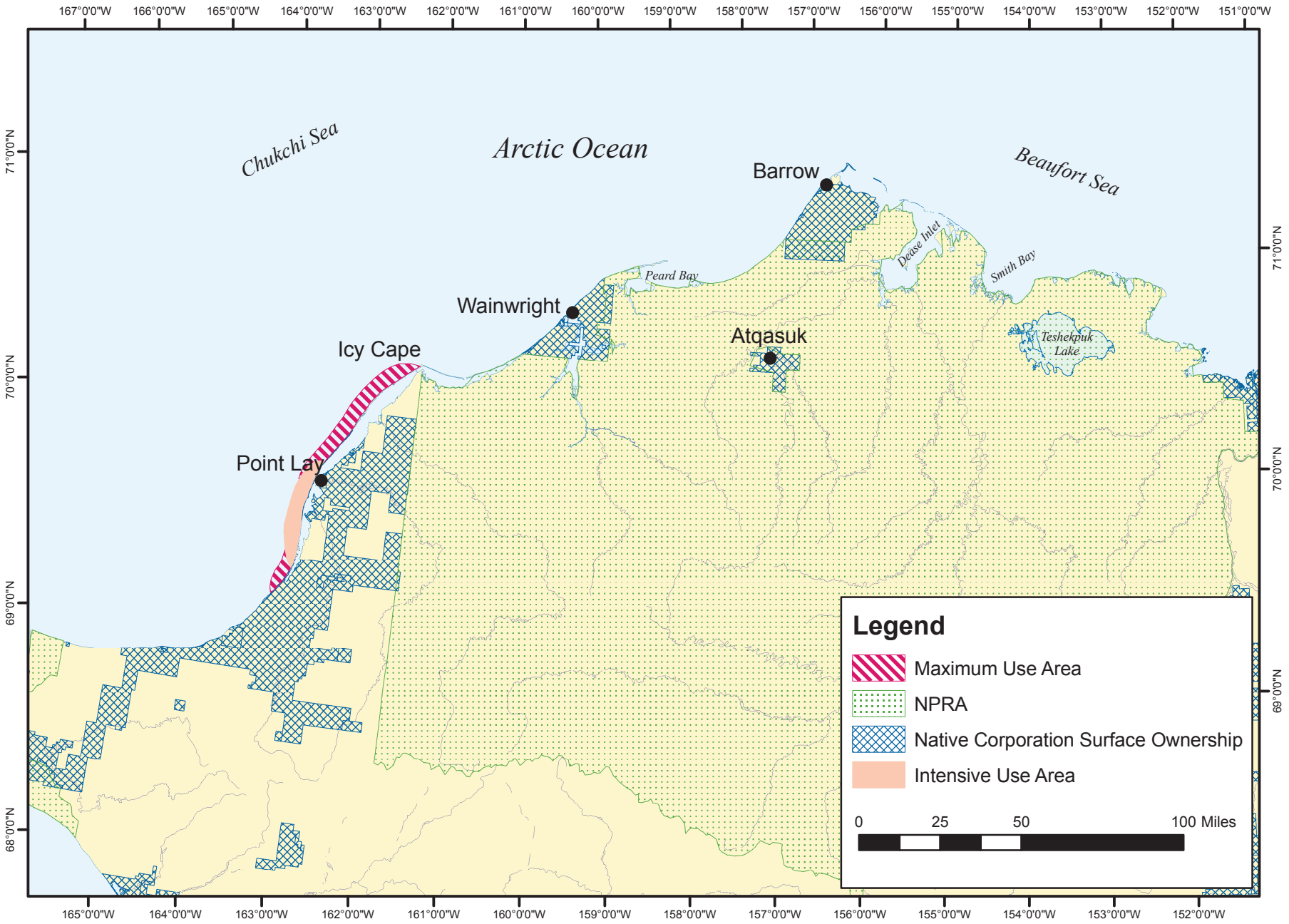
Source: North Slope Borough,1999.

Figure 3.4.2-75 Wainwright Changes in Subsistence Activity, 1998-1999



Source: North Slope Borough,1999.

Figure 3.4.2-76 Wainwright Expenditures on Subsistence Activities, 1998-1999



Source: Braund and Burnham, 1984

Figure 3.4.2-77 Point Lay Subsistence-Use Areas for Beluga Whales

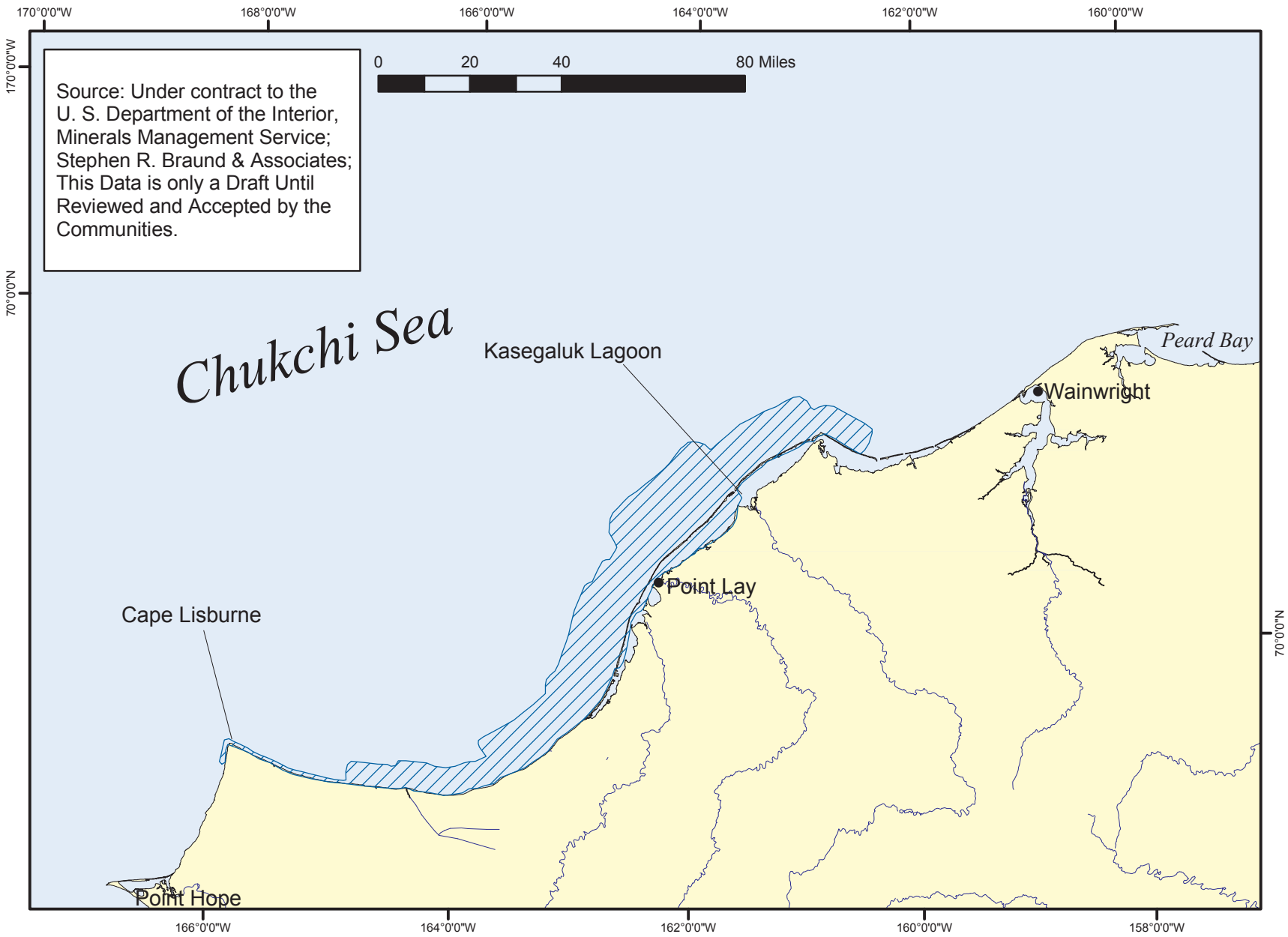
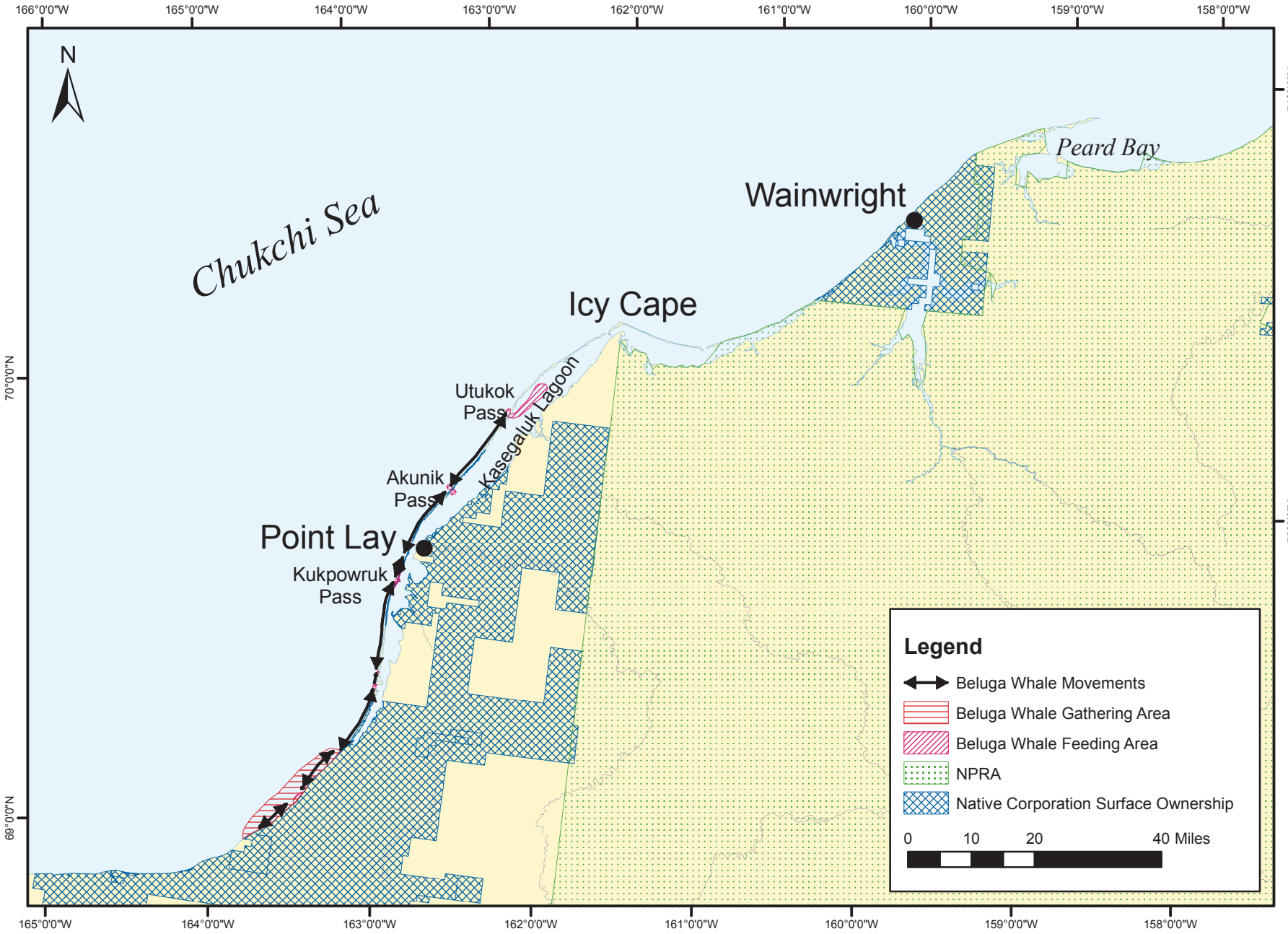


Figure 3.4.2-78 Point Lay Subsistence-Use Areas, Beluga Whale, 1997-2006



Source: Huntington and Mymrin, 1996

Figure 3.4.2-79 Beluga Whale Feeding and Calving Areas and Coastal Movements Based on Point Lay Traditional Knowledge

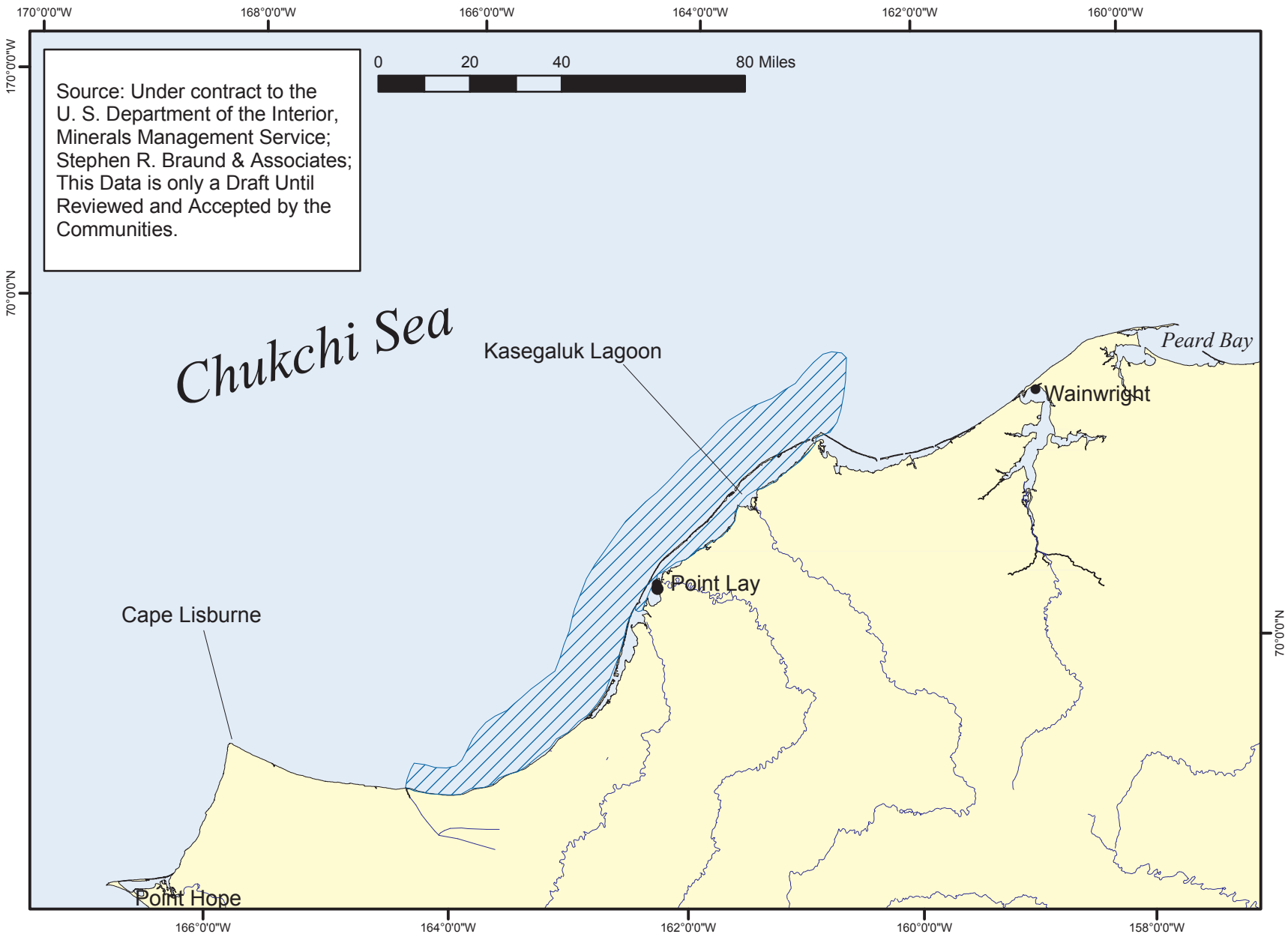


Figure 3.4.2-80 Point Lay Subsistence-Use Areas, Ringed Seal, 1997-2006

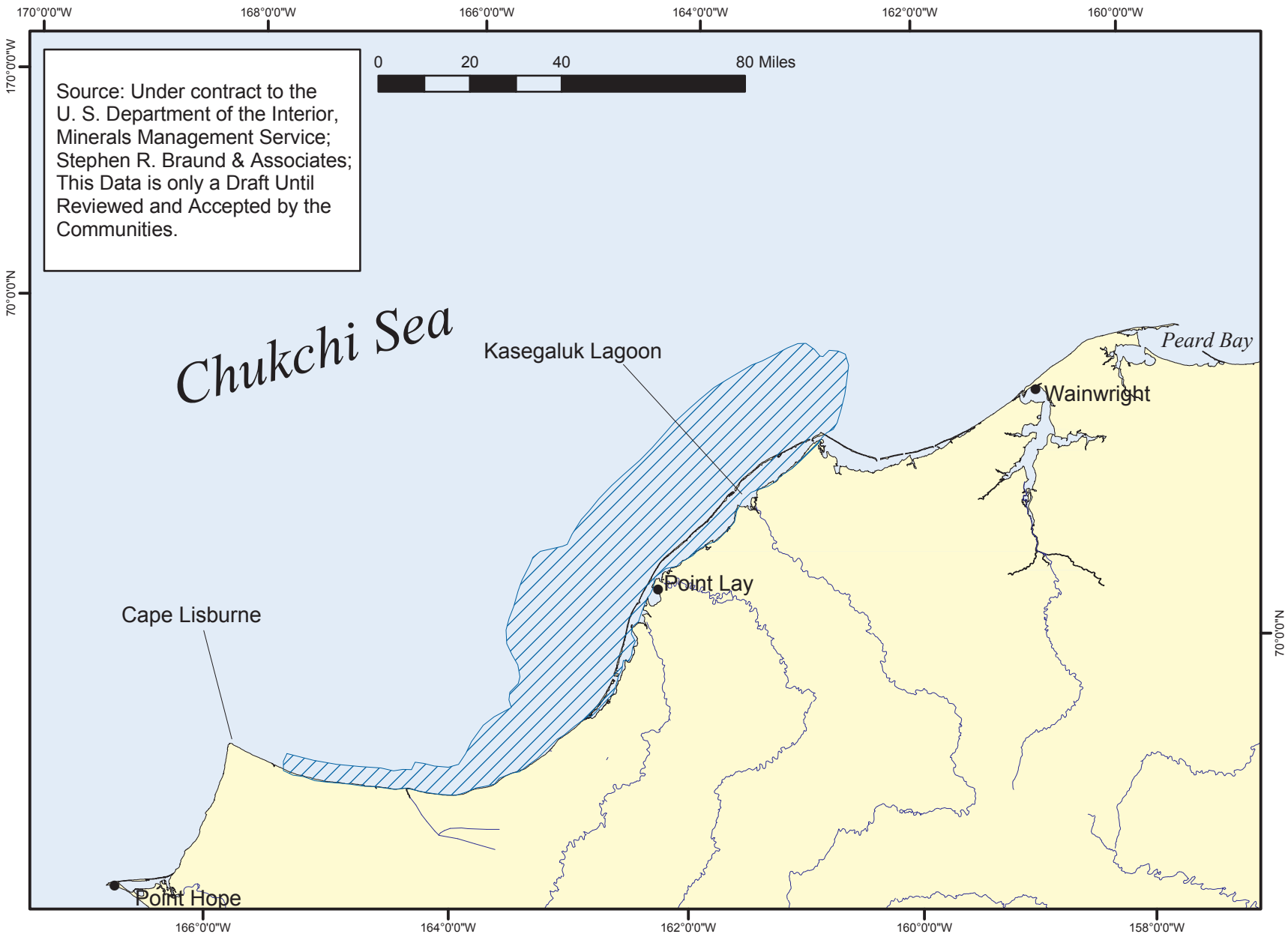


Figure 3.4.2-81 Point Lay Subsistence-Use Areas, Bearded Seal, 1997-2006

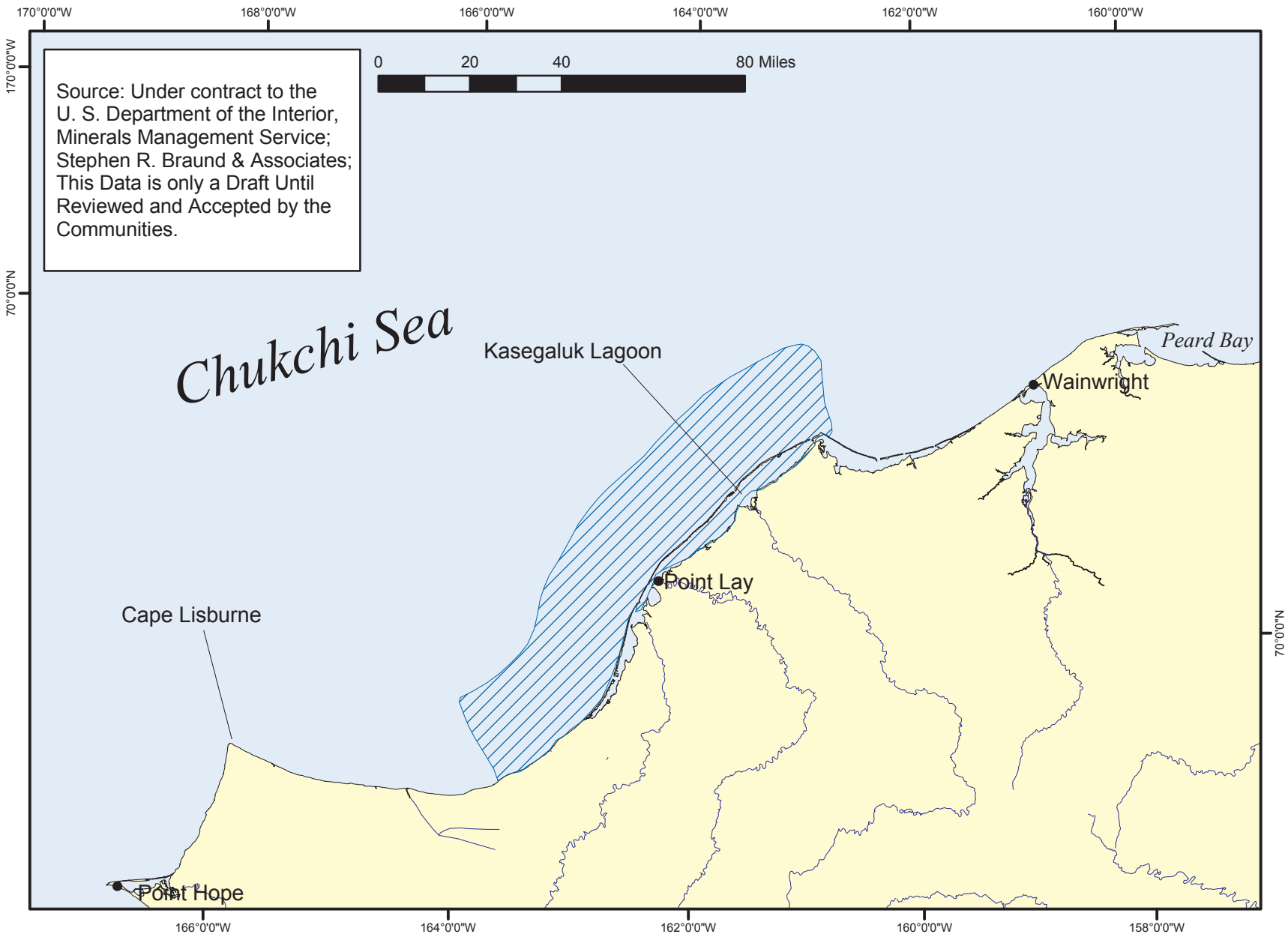
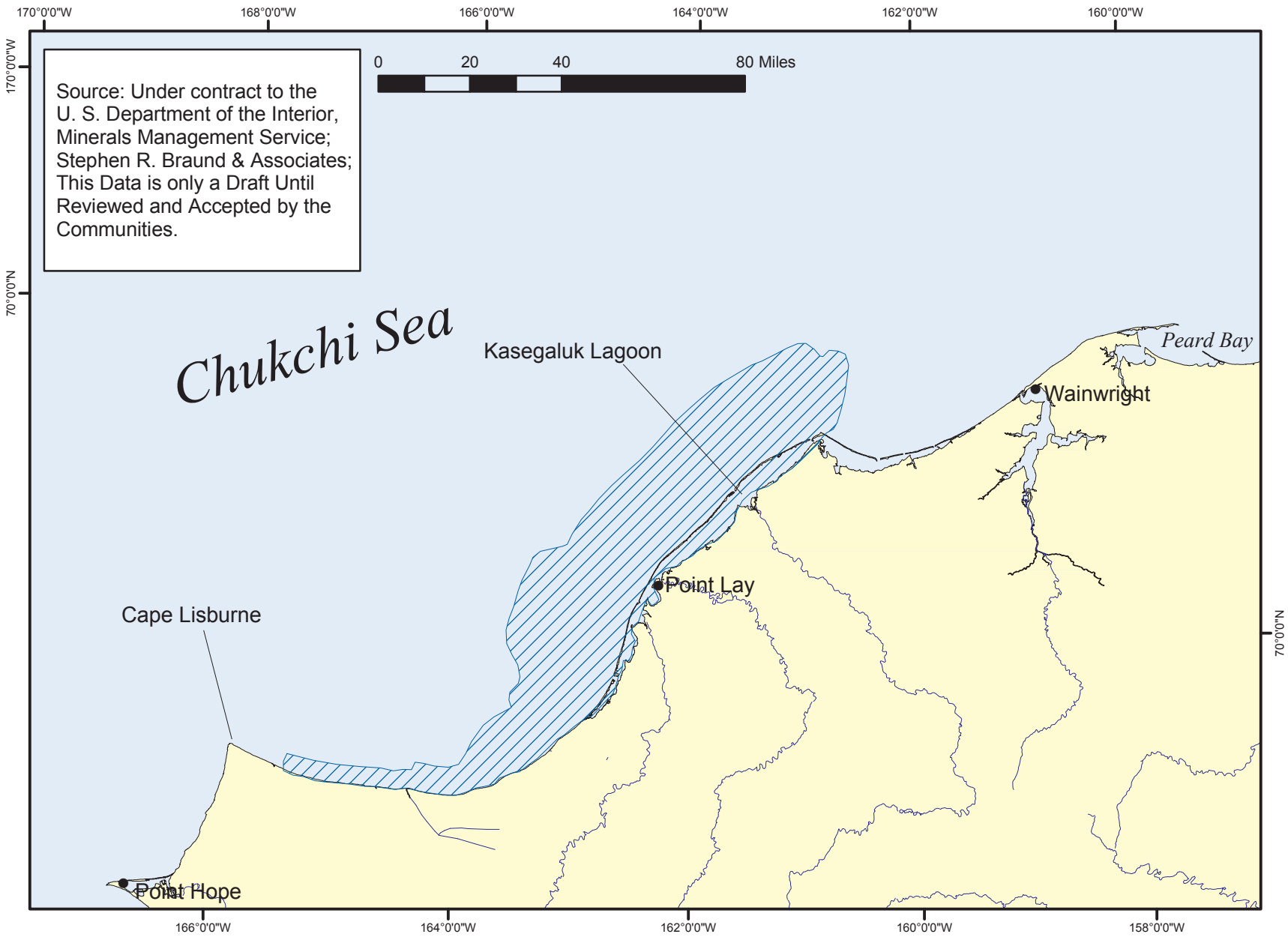


Figure 3.4.2-82 Point Lay Subsistence-Use Areas, Walrus, 1997-2006



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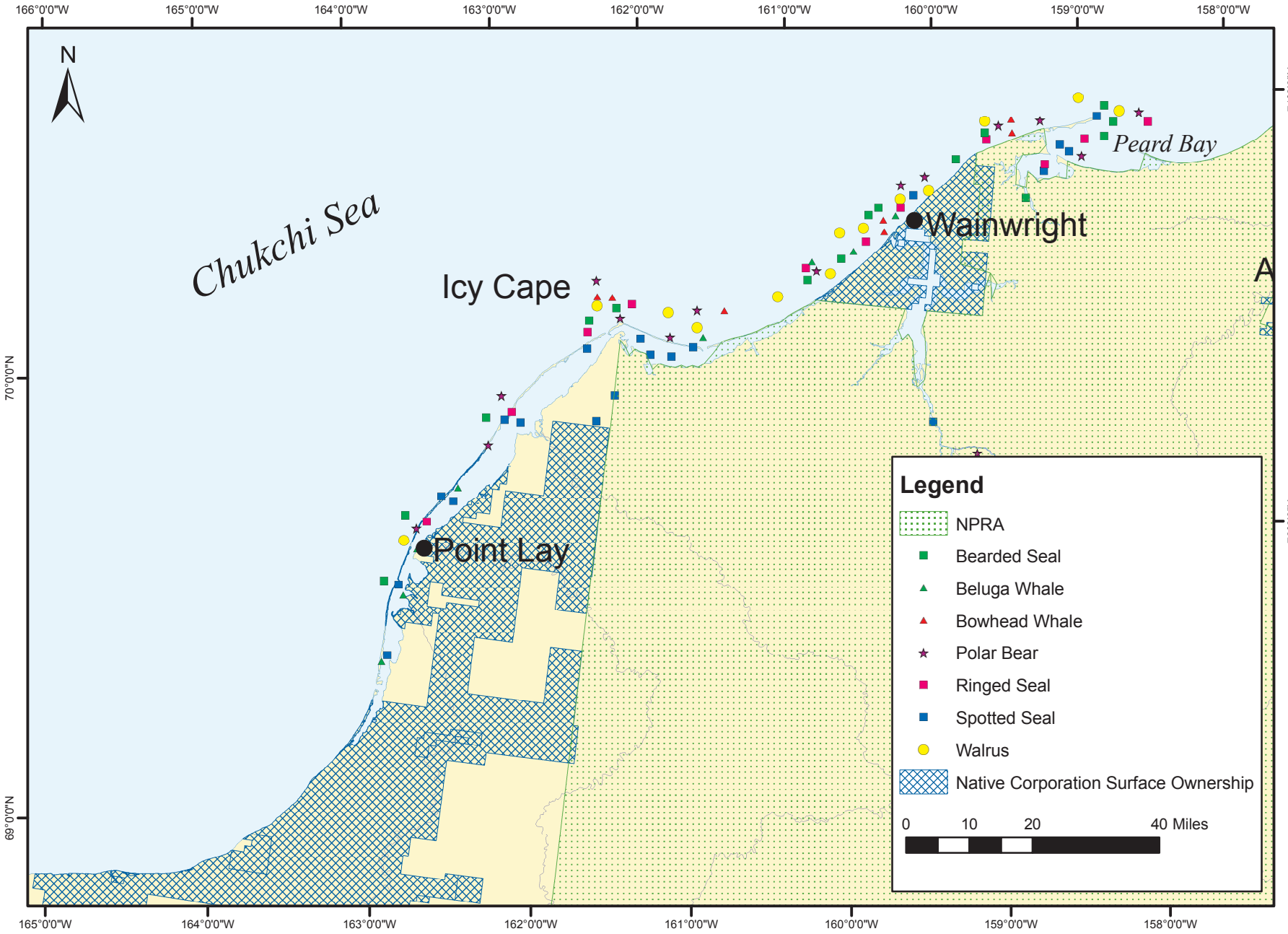

Source: Huntington and Mymrin, 1996; Kassam and Wainwright Traditional Council, 2001

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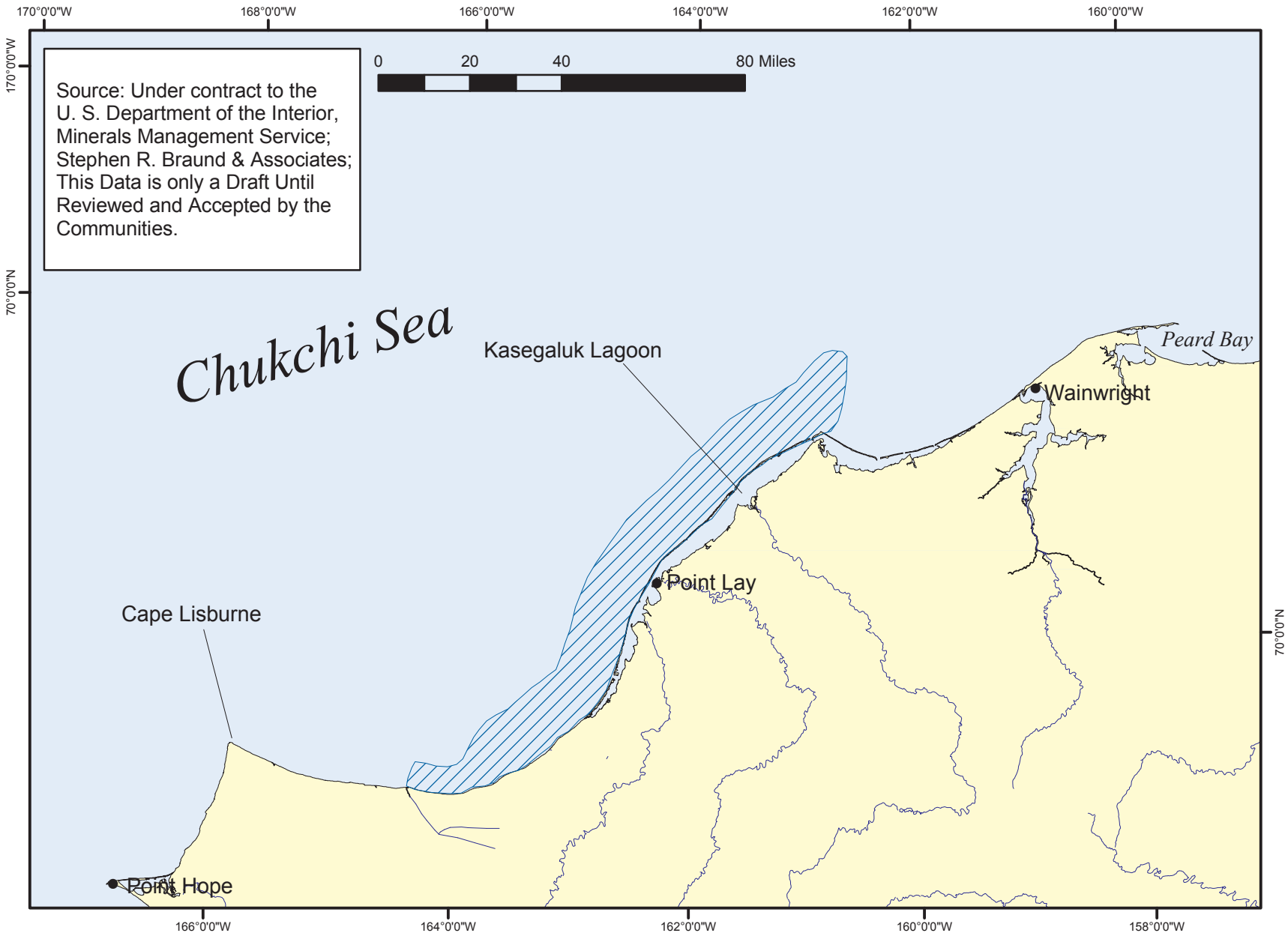

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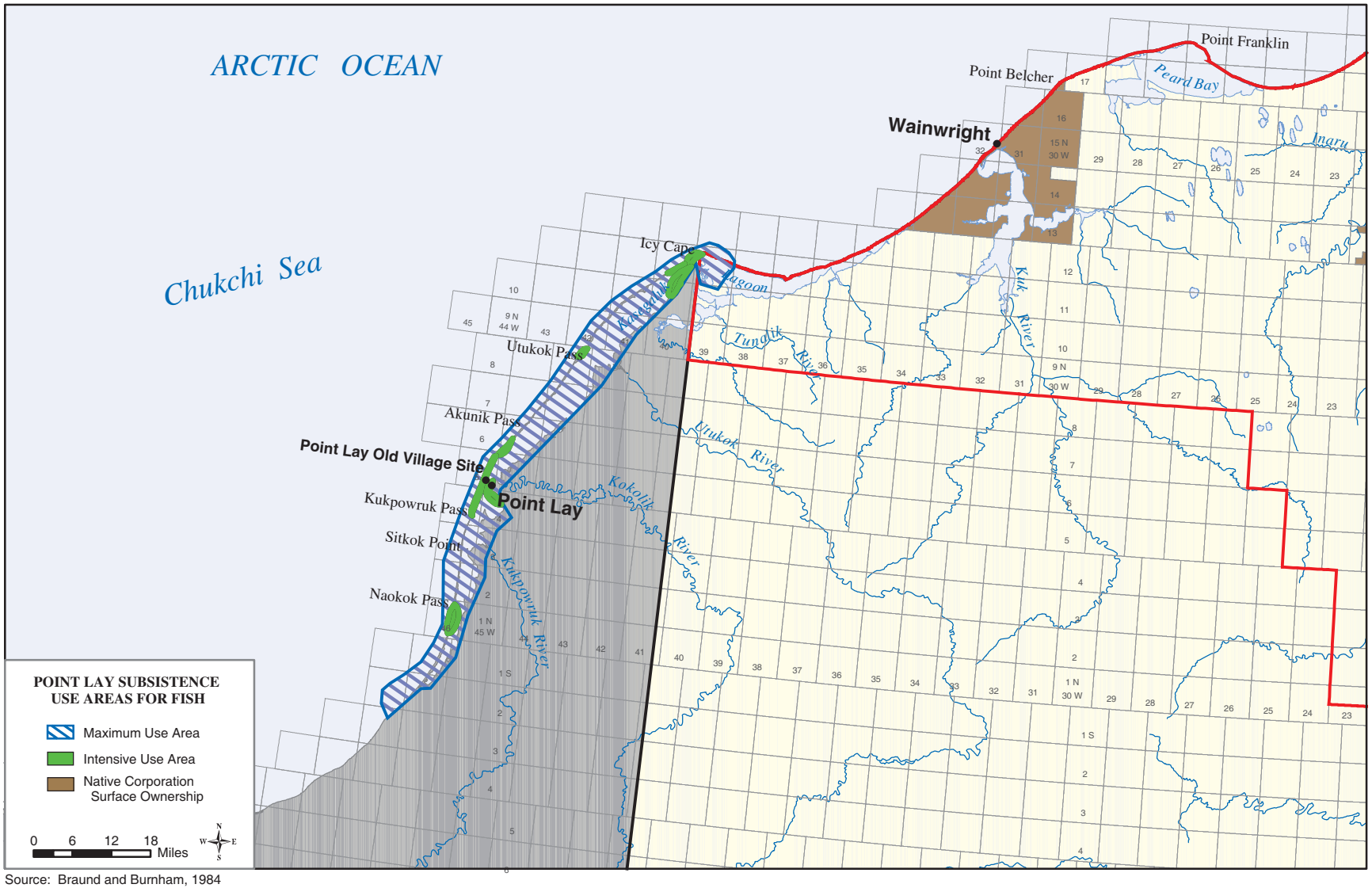

Source: Braund and Burnham, 1984

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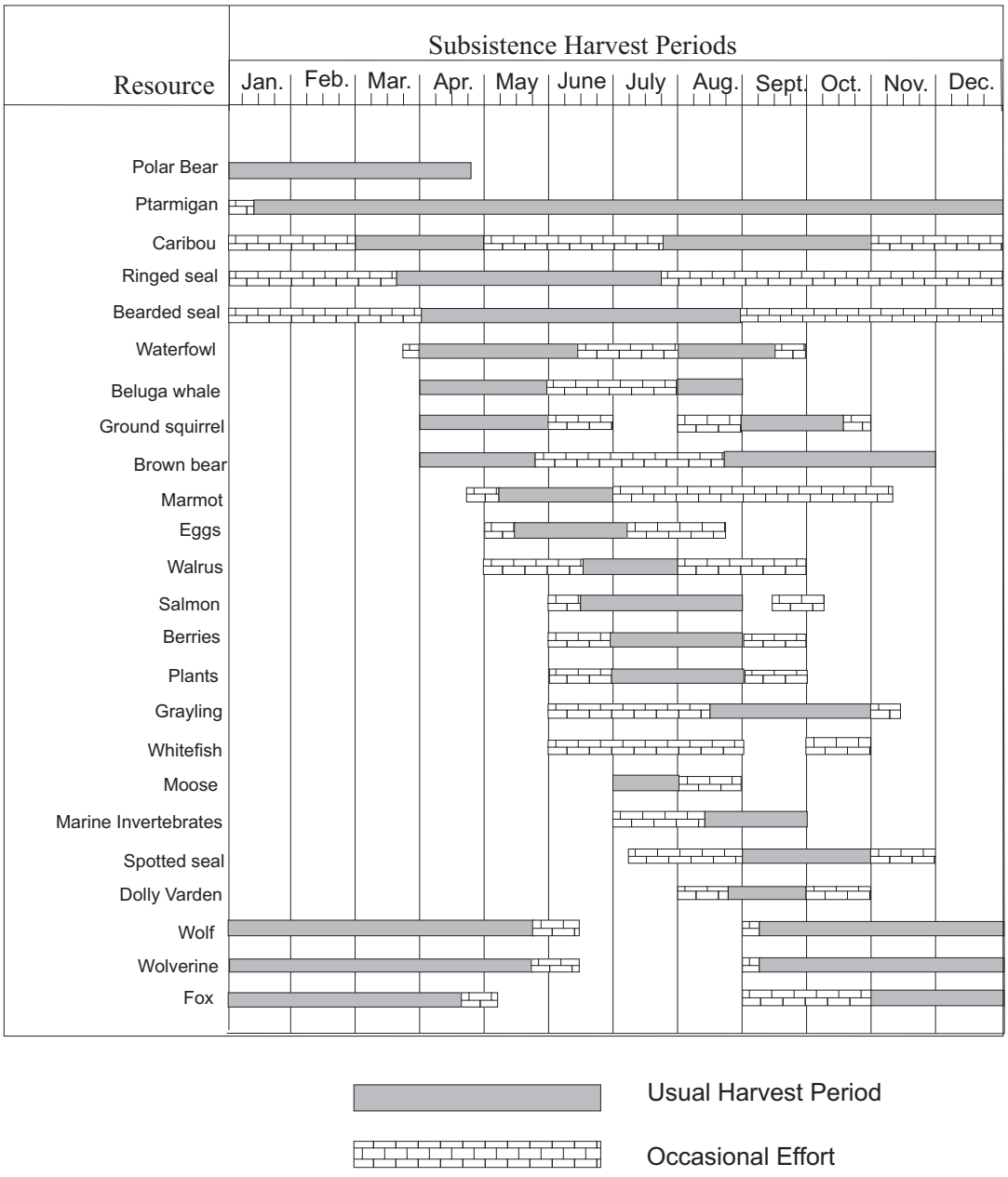

Source: Pedersen (1979) and North Slope Borough Contract Staff (1979)

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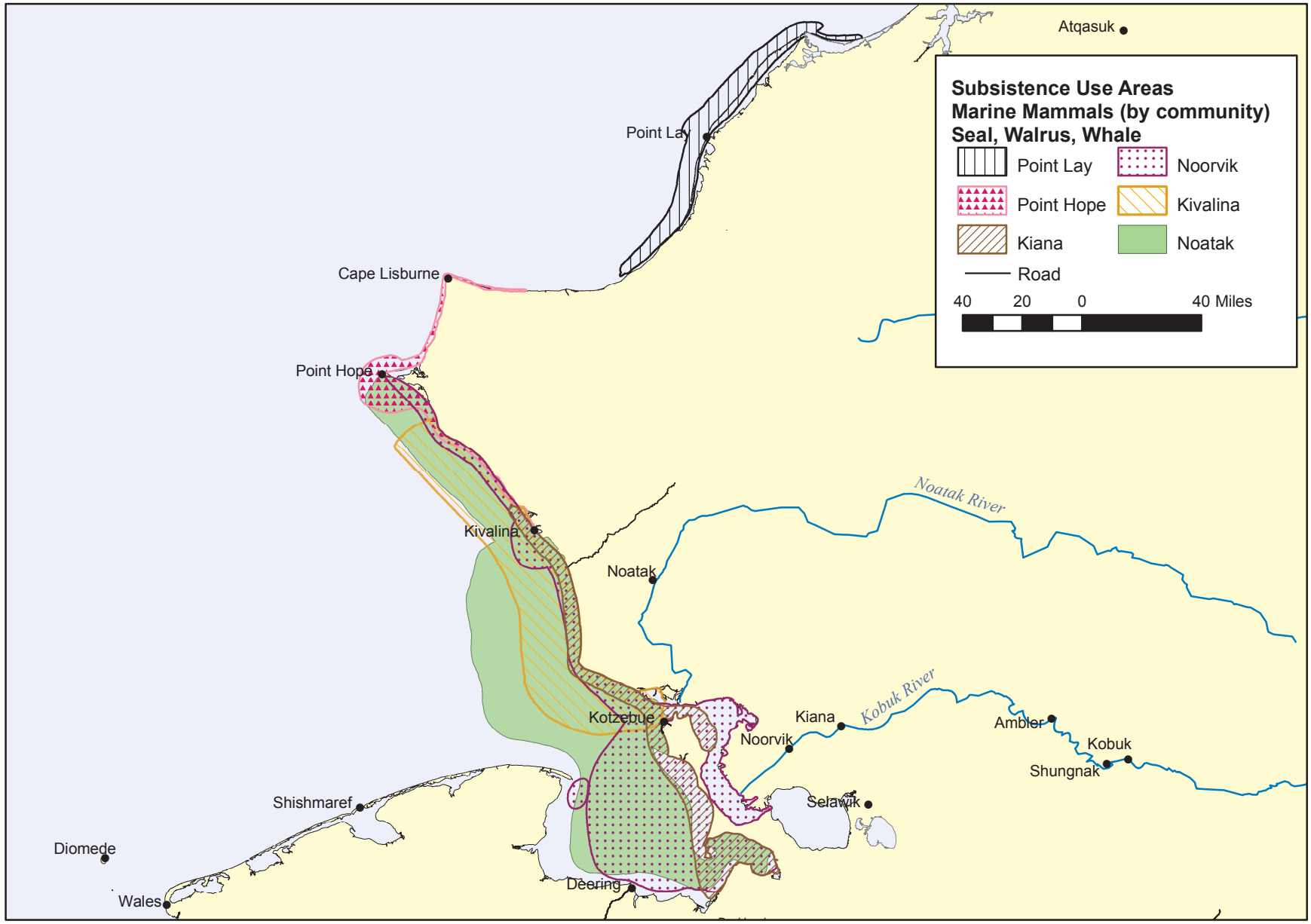

Source: State of Alaska - ADF&G, 1987; Kobuk-Seward Peninsula Proposed RMP/Final EIS, Bureau of Land Management - Alaska

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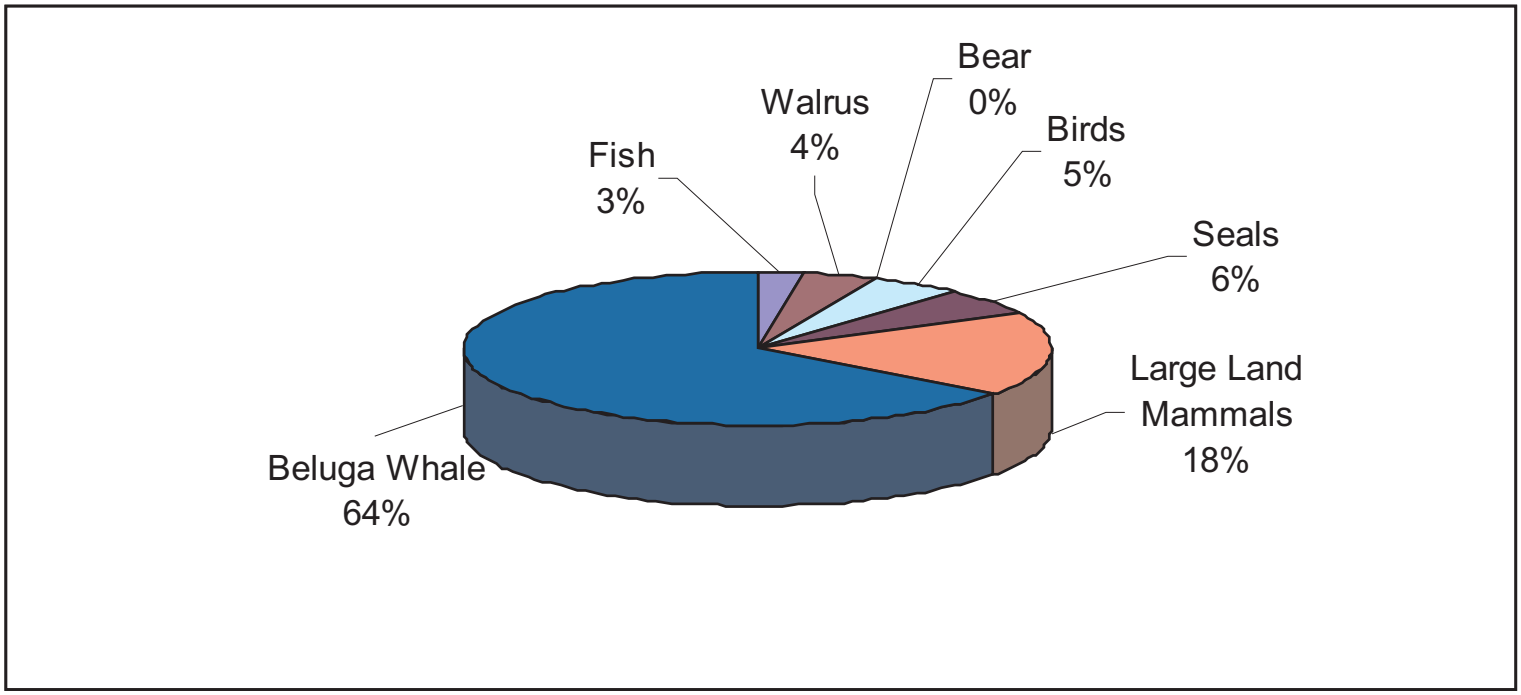

Source: Impact Assessment, Inc. (1989c)

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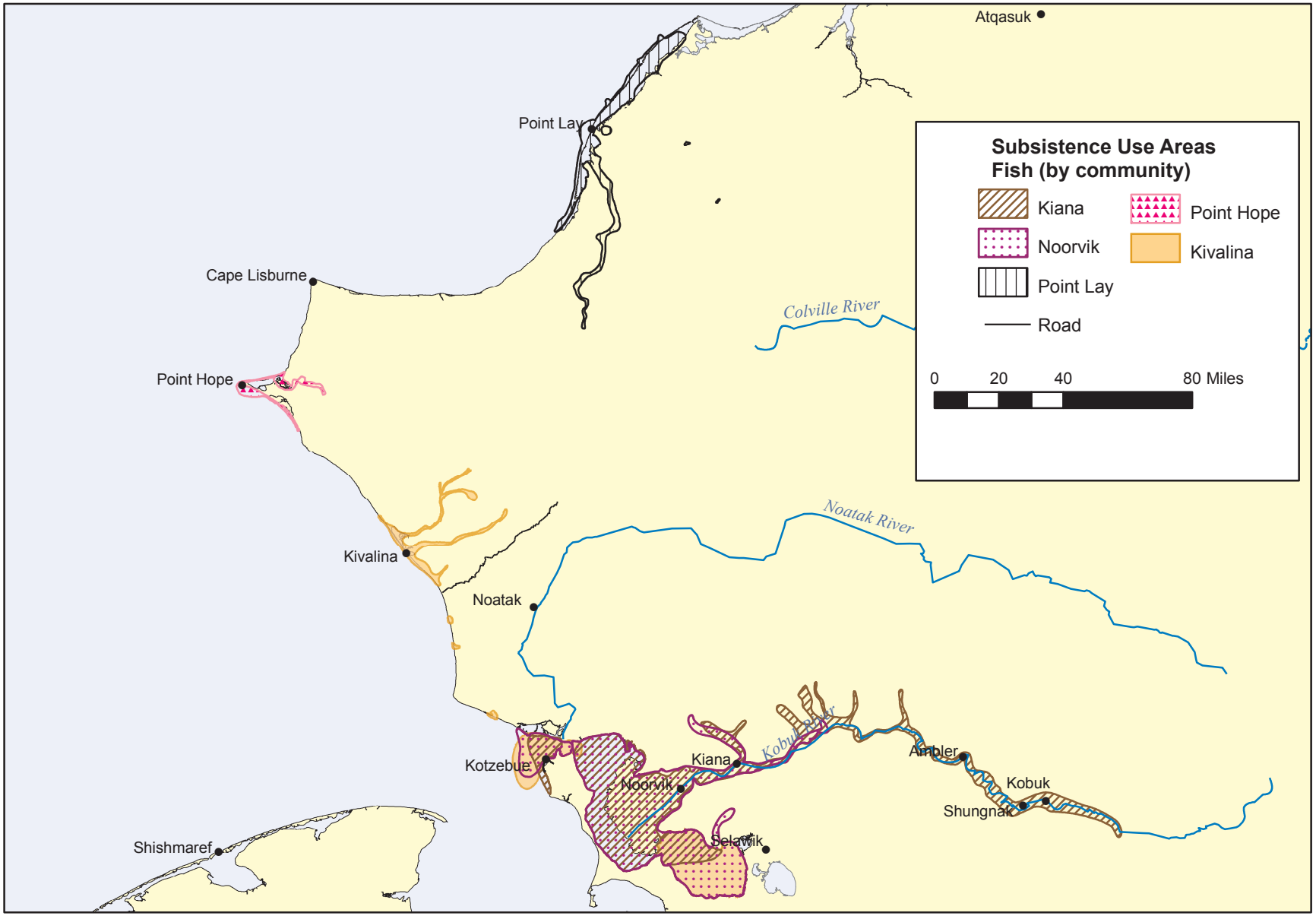

Source: State of Alaska - ADF&G,1987; Kobuk-Seward Peninsula Proposed RMP/Final EIS, Bureau of Land Management - Alaska

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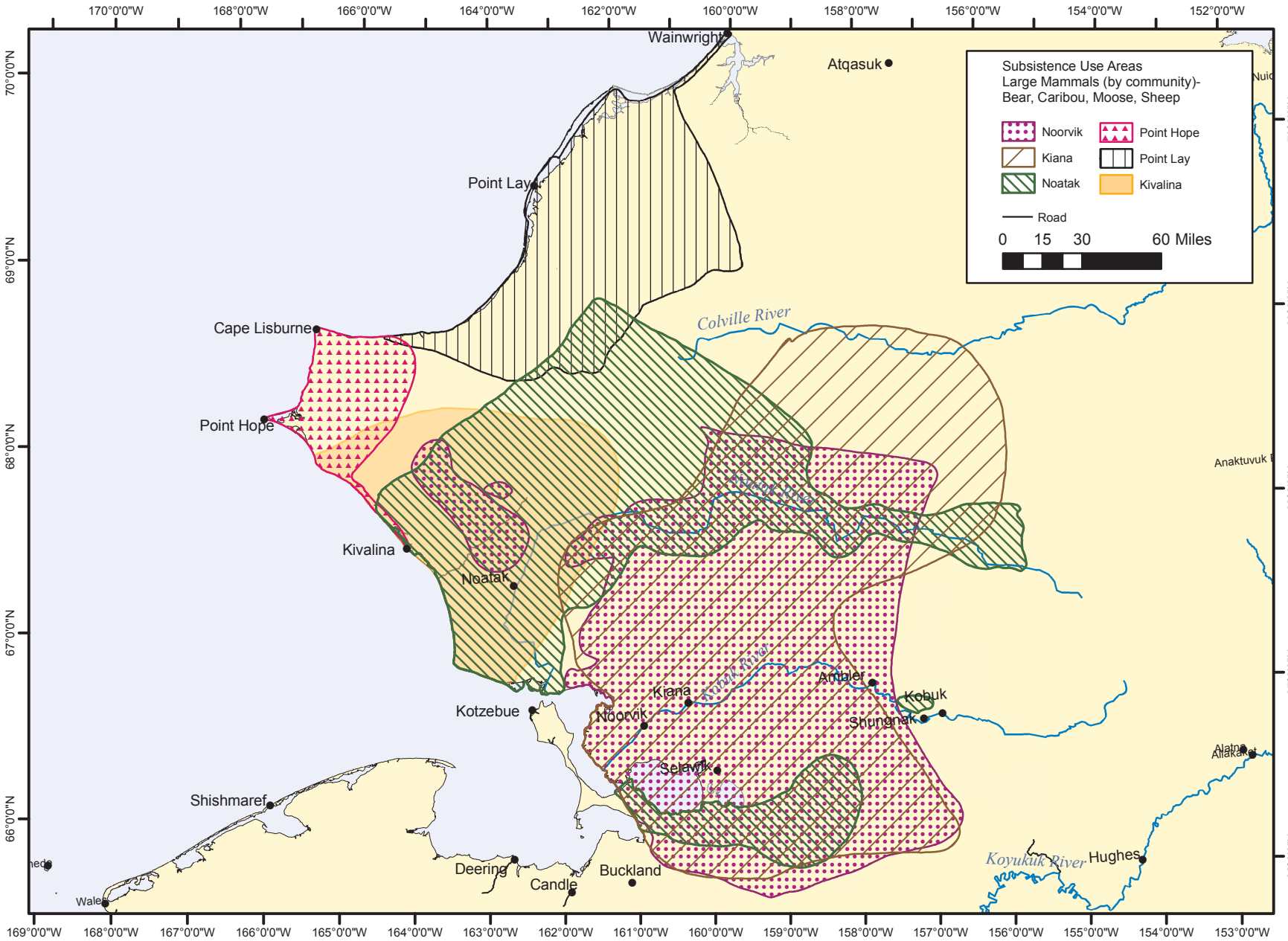

Source: State of Alaska- ADF&G,1987; Bureau of Land Management - Alaska Kobuk-Seward Peninsula Proposed RMP/Final EIS

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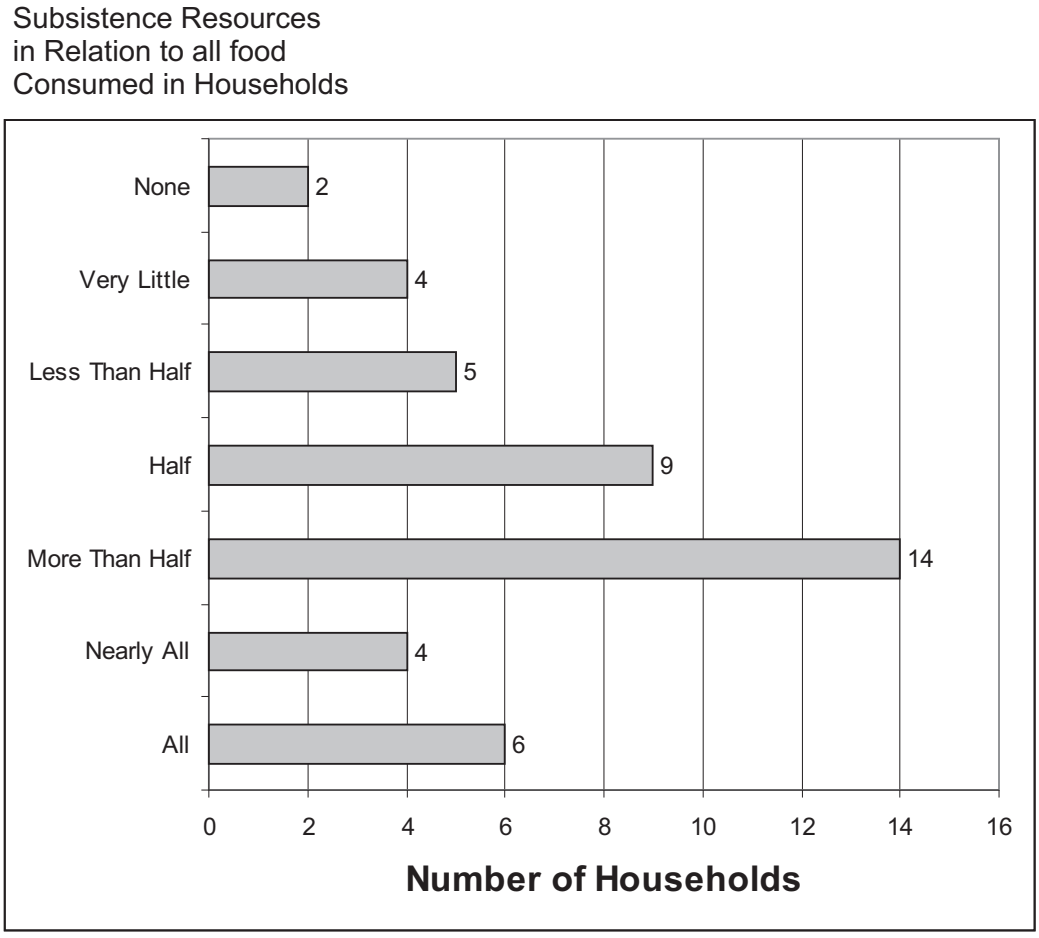

Source: North Slope Borough, 1999

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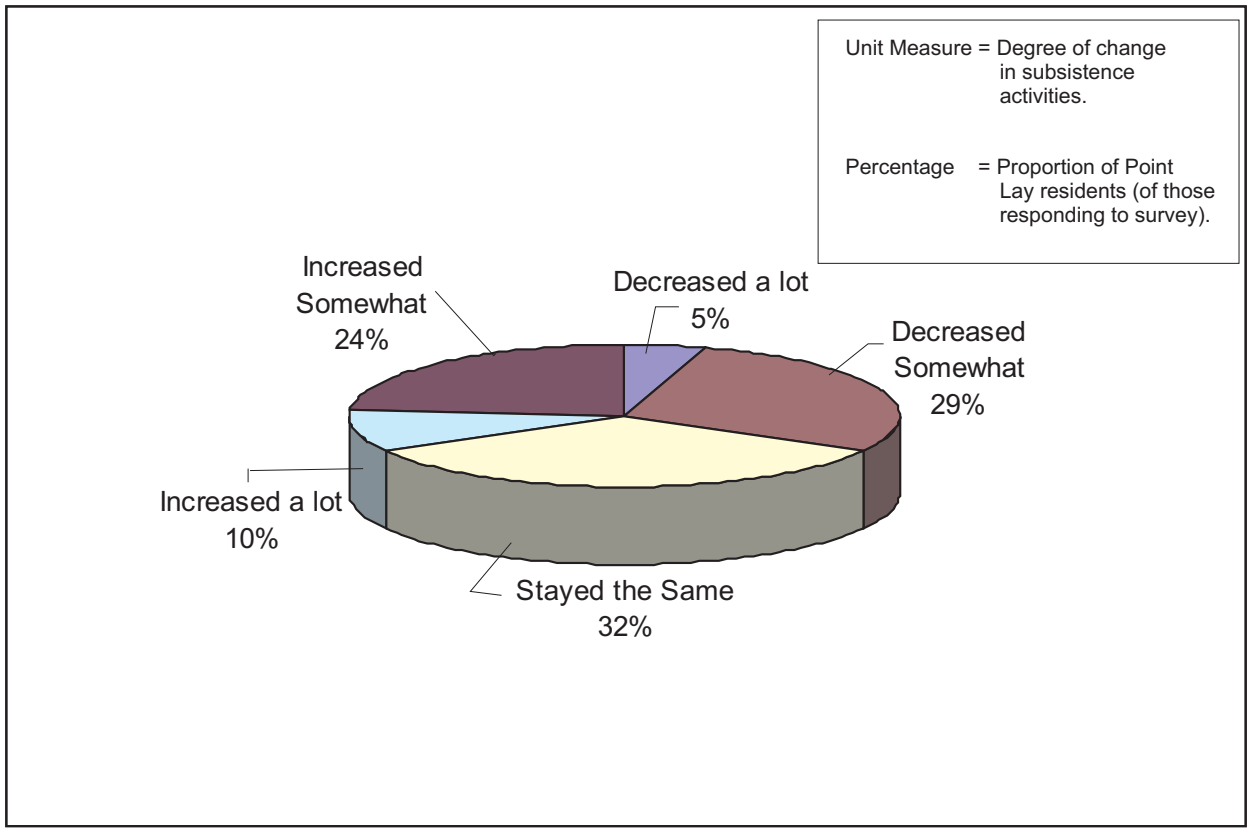

Source: North Slope Borough,1999

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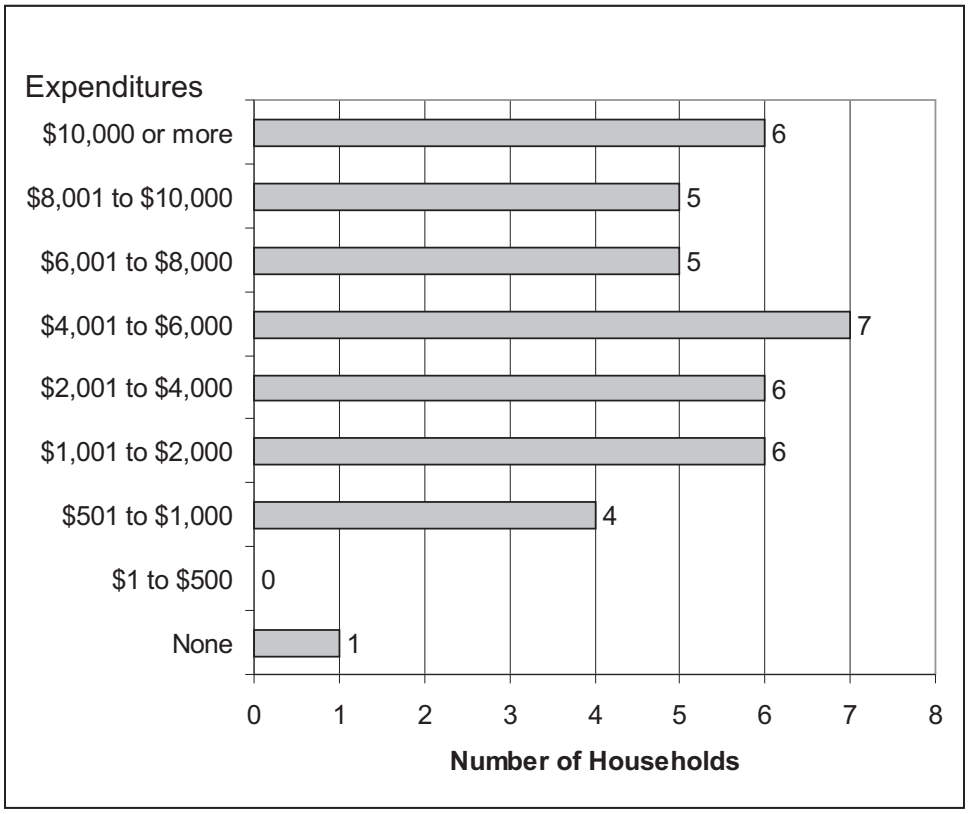

Source: North Slope Borough,1999.

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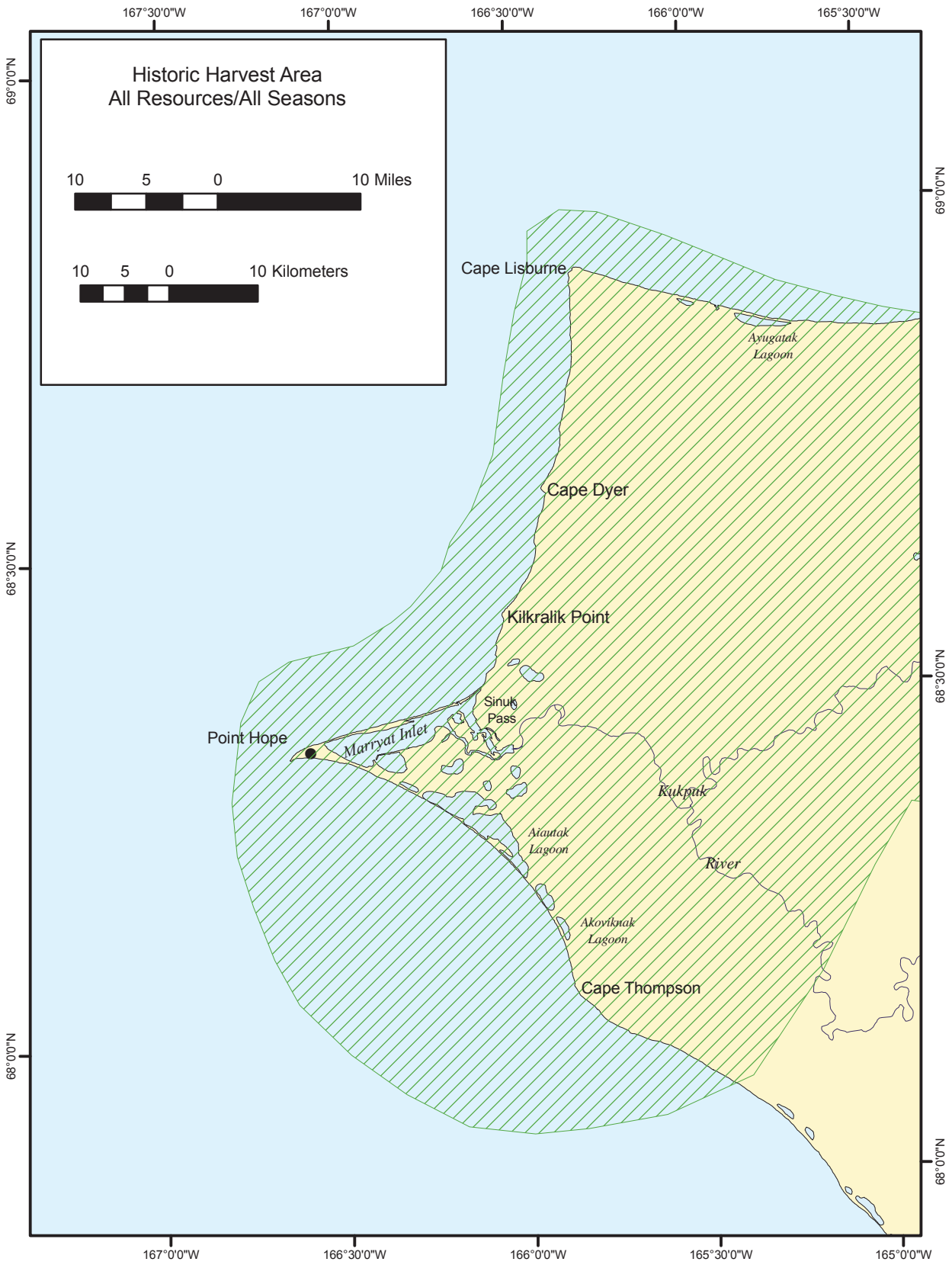

Sources: From Braund & Burnham (1984); Pedersen (1977)

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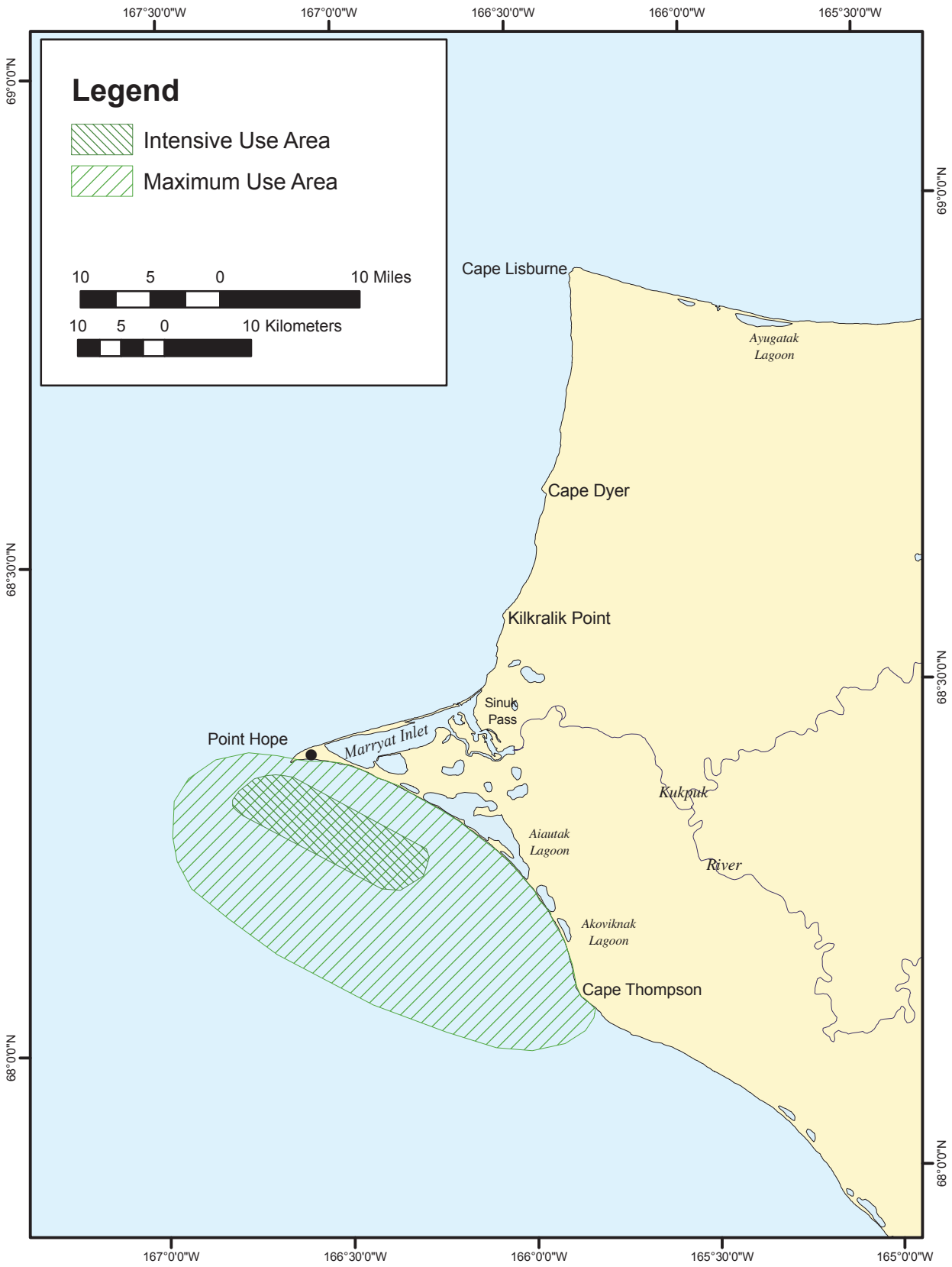

Source: From Braund & Burnham (1984)

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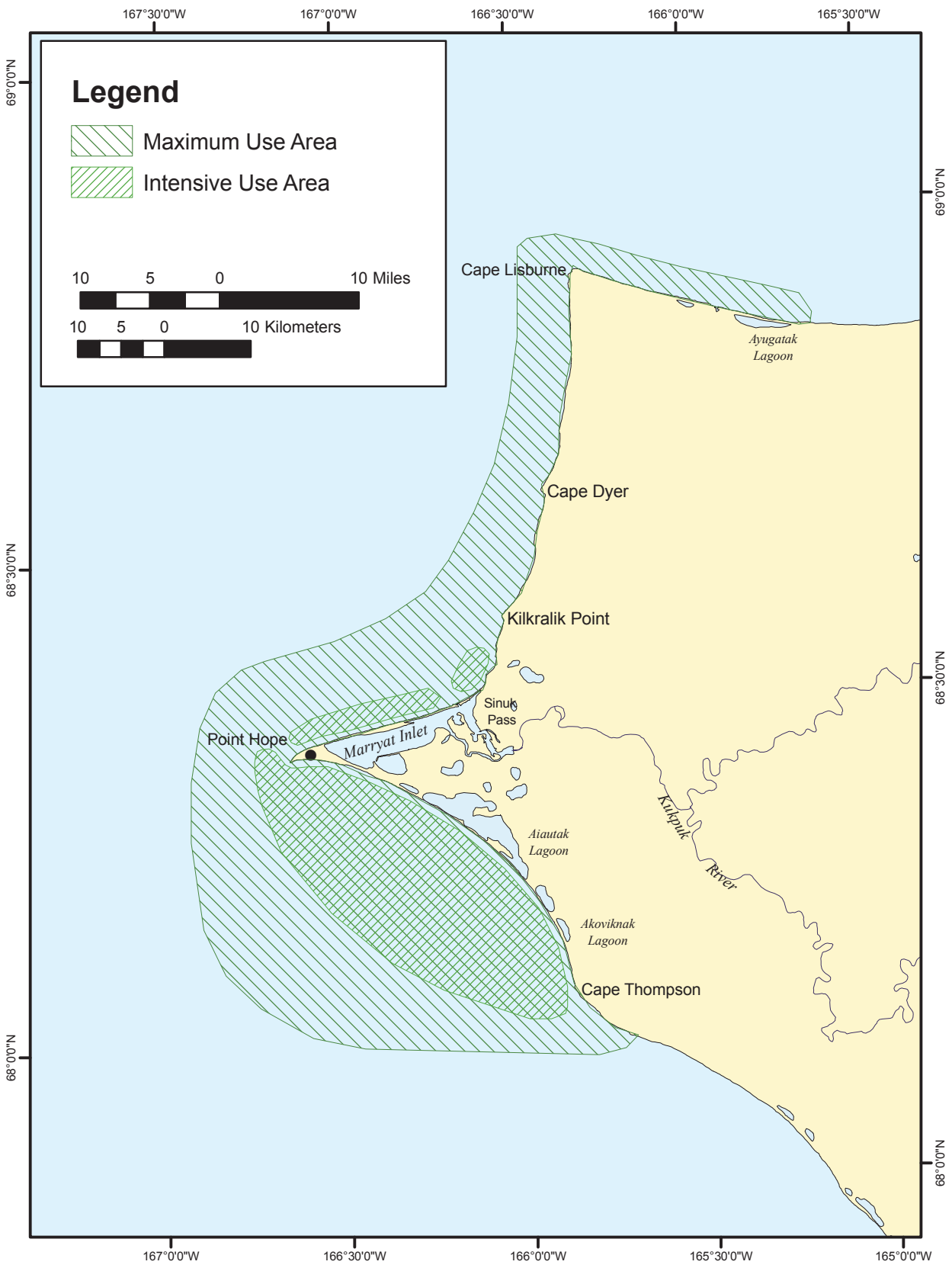
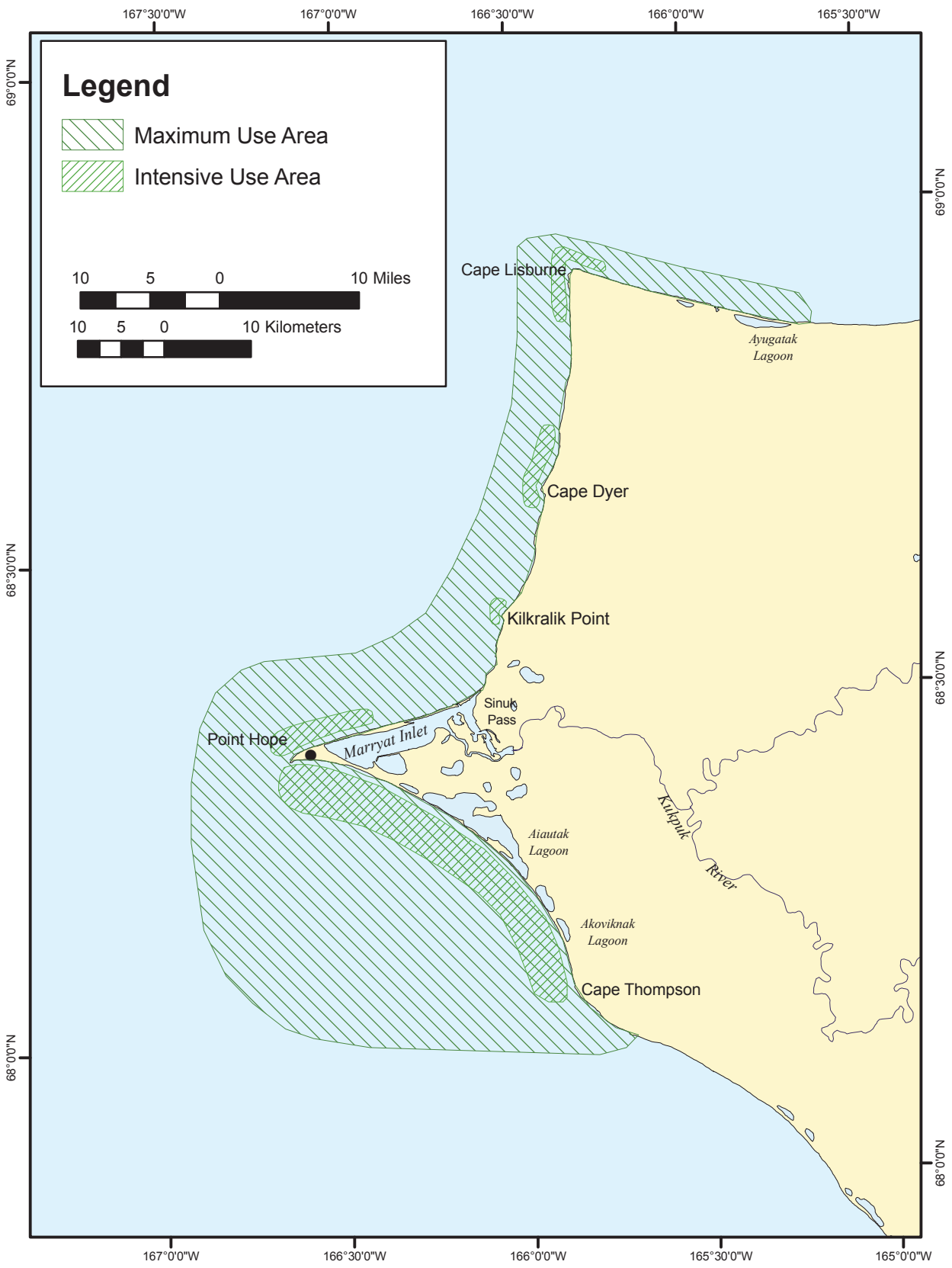


Source: From Braund & Burnham (1984)

Figure 3.4.2-97 Point Hope Subsistence-Use Areas for Seals



Source: From Braund & Burnham (1984)

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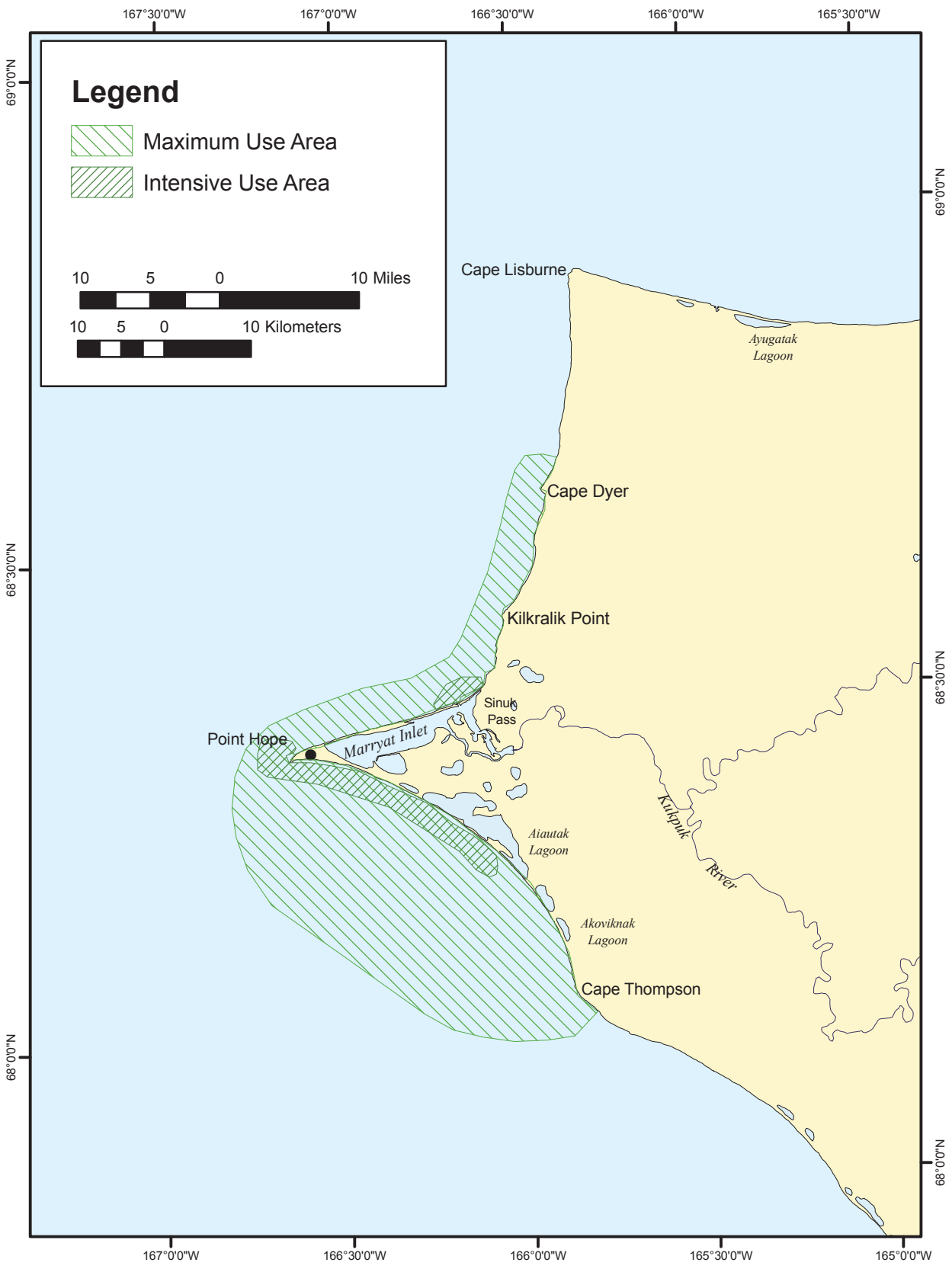
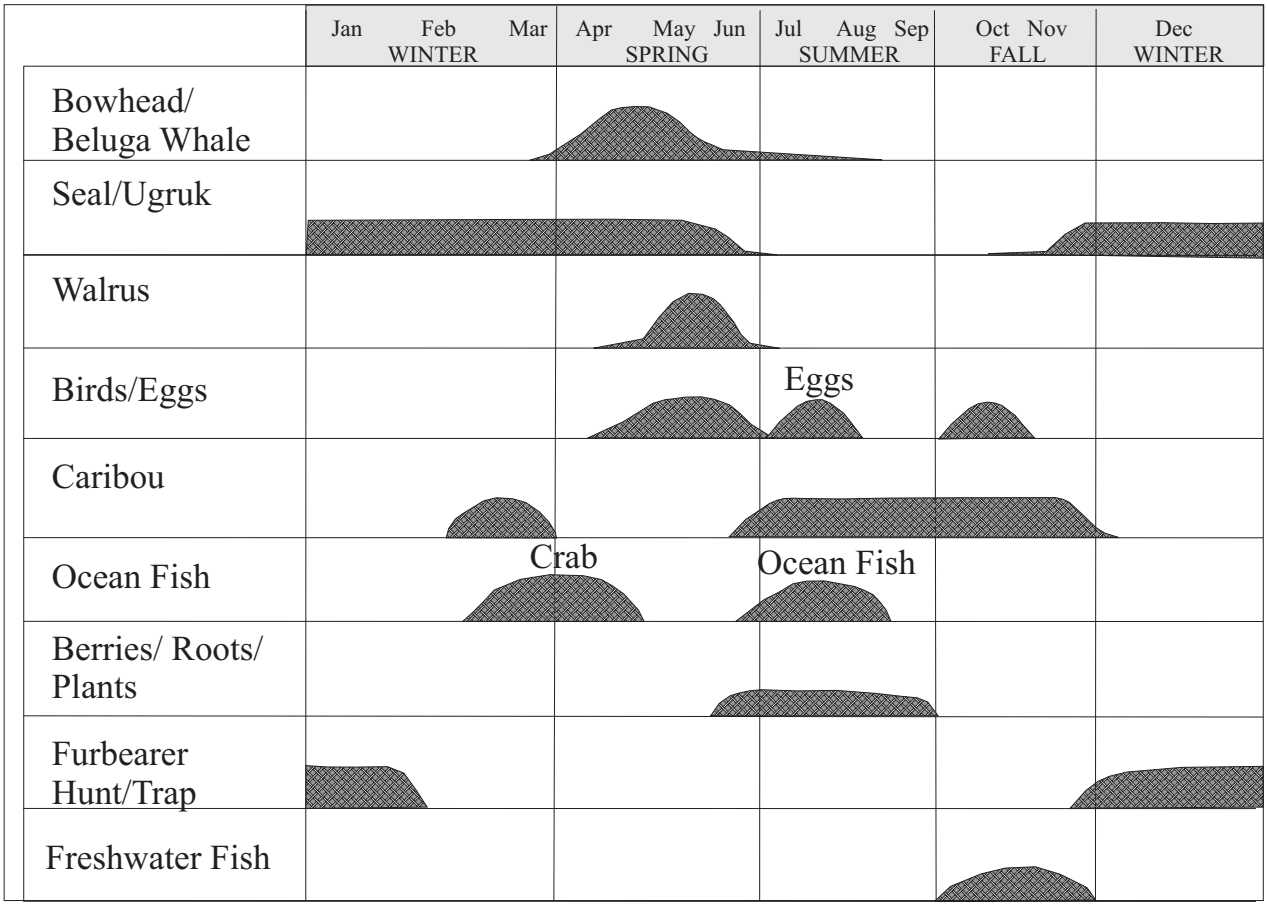


Source: From Braund & Burnham (1984)

Figure 3.4.2-99 Point Hope Subsistence-Use Areas for Beluga Whales



Source: Pedersen (1977)

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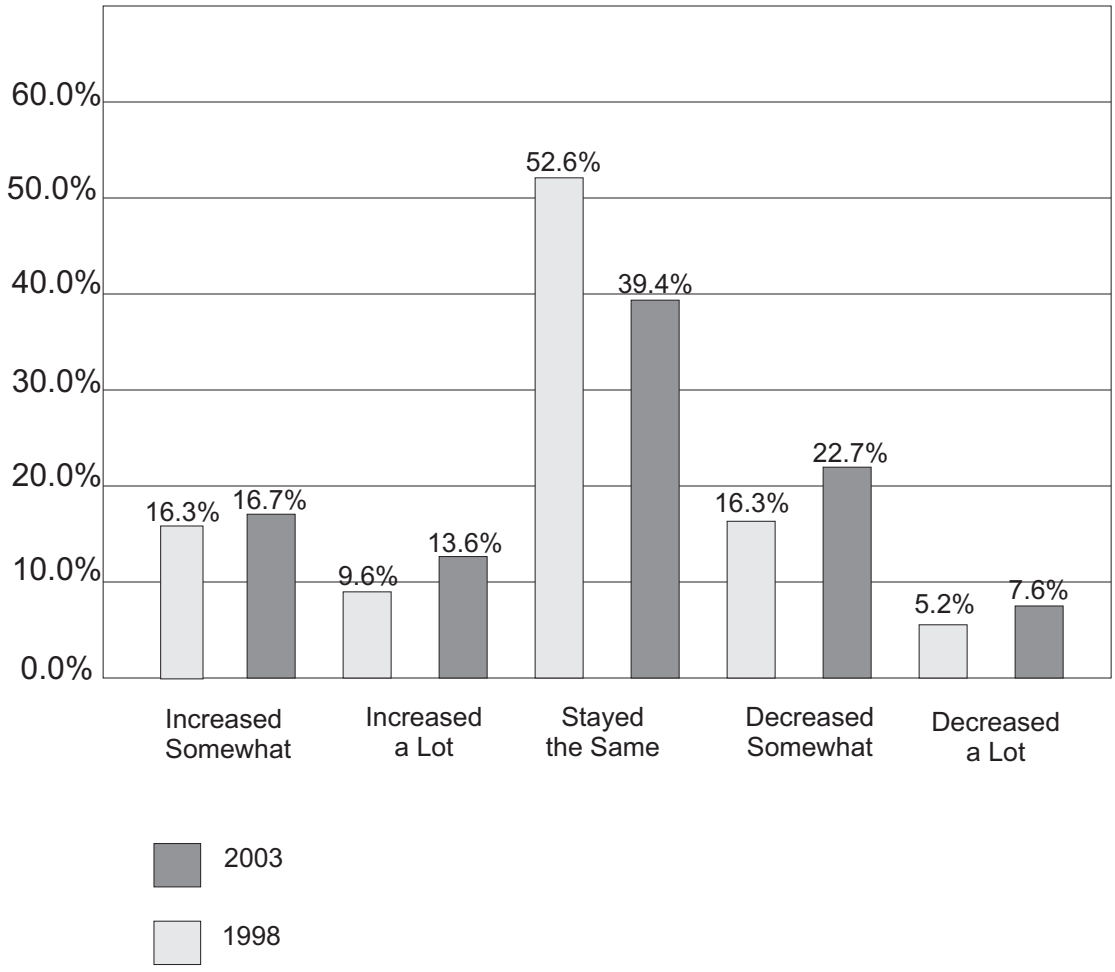

Source: Fuller and George (1997); North Slope Borough (2004)

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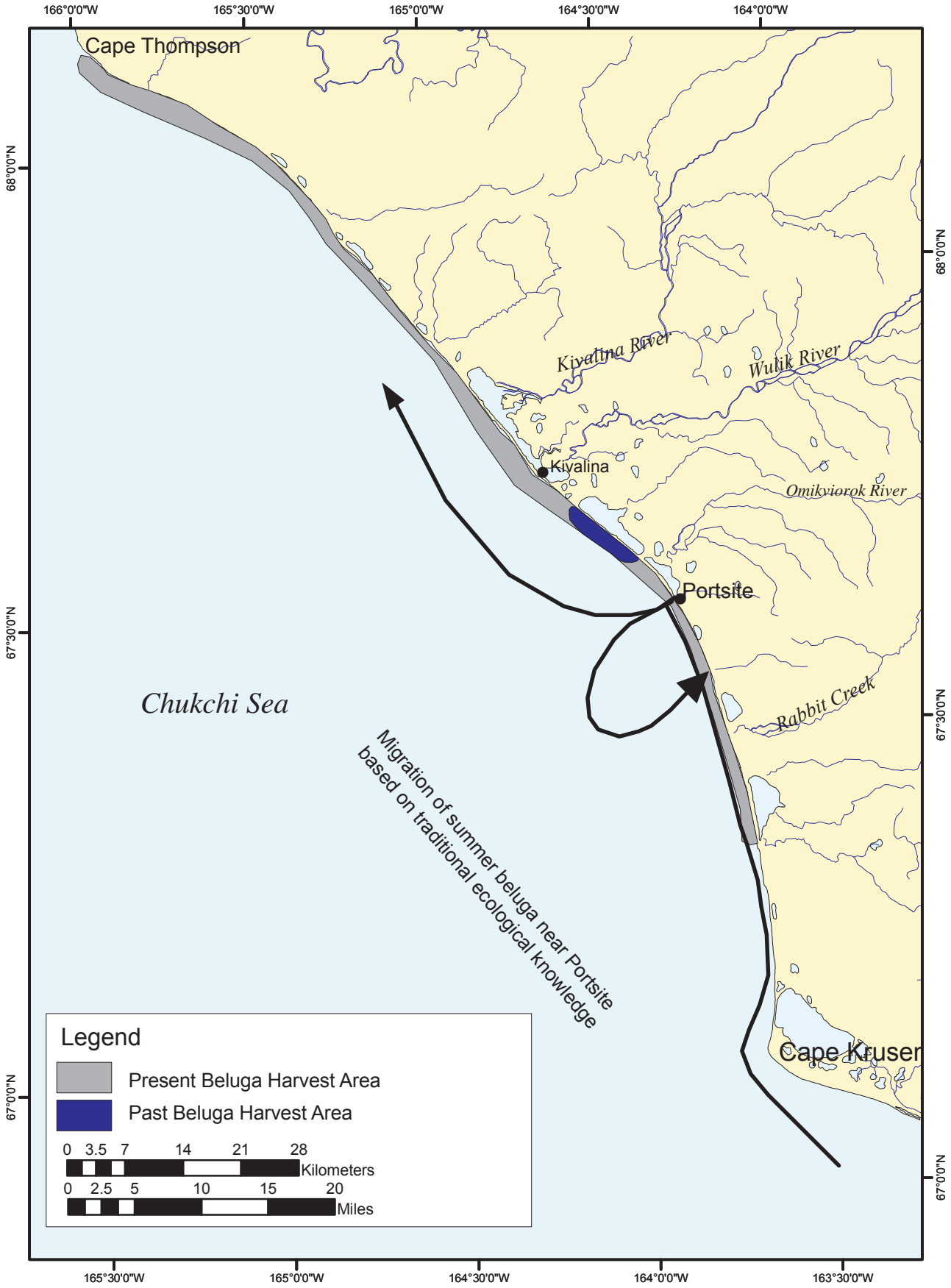

Source: Braund (2000)

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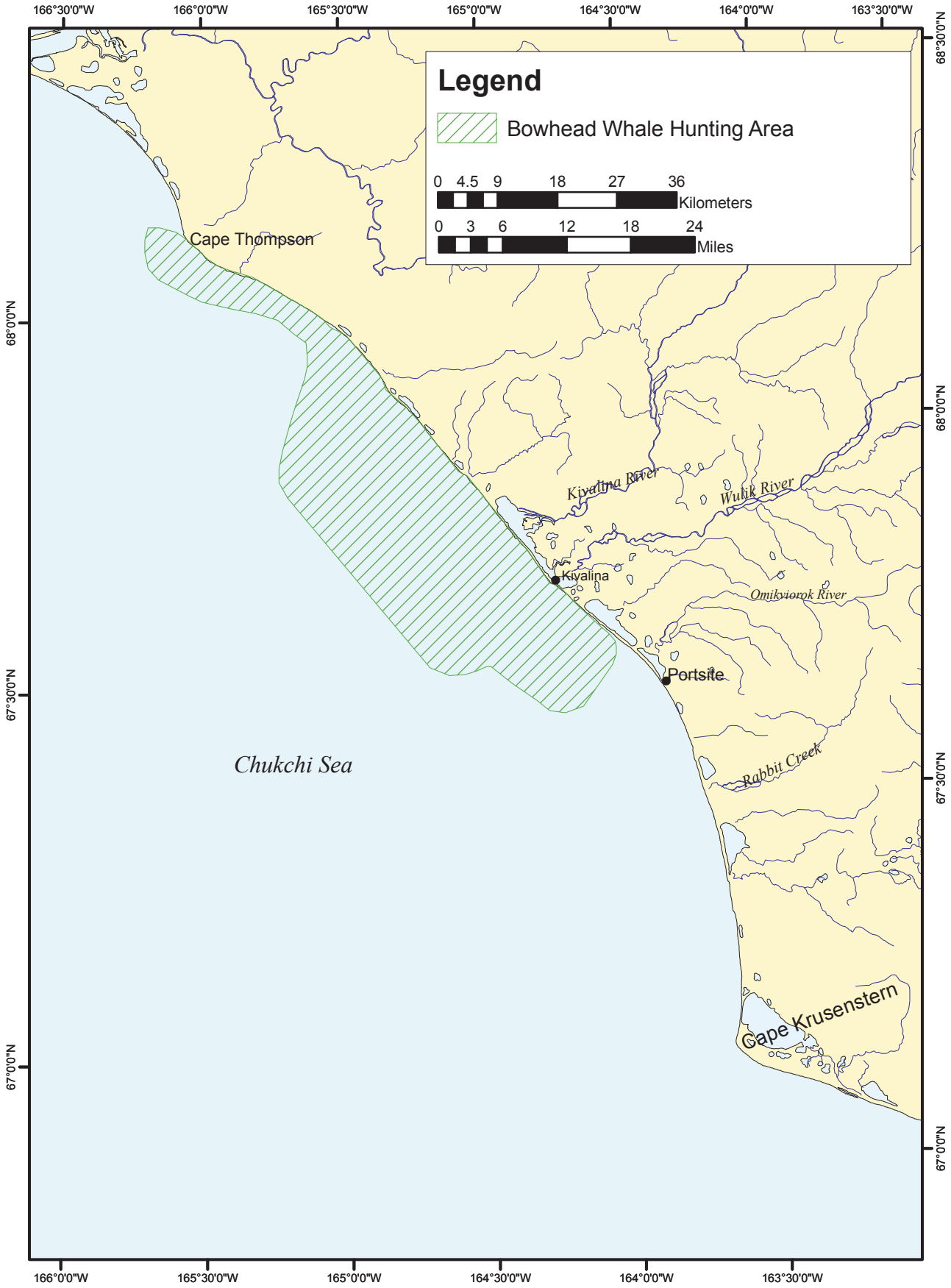

Source: Braund (2000)

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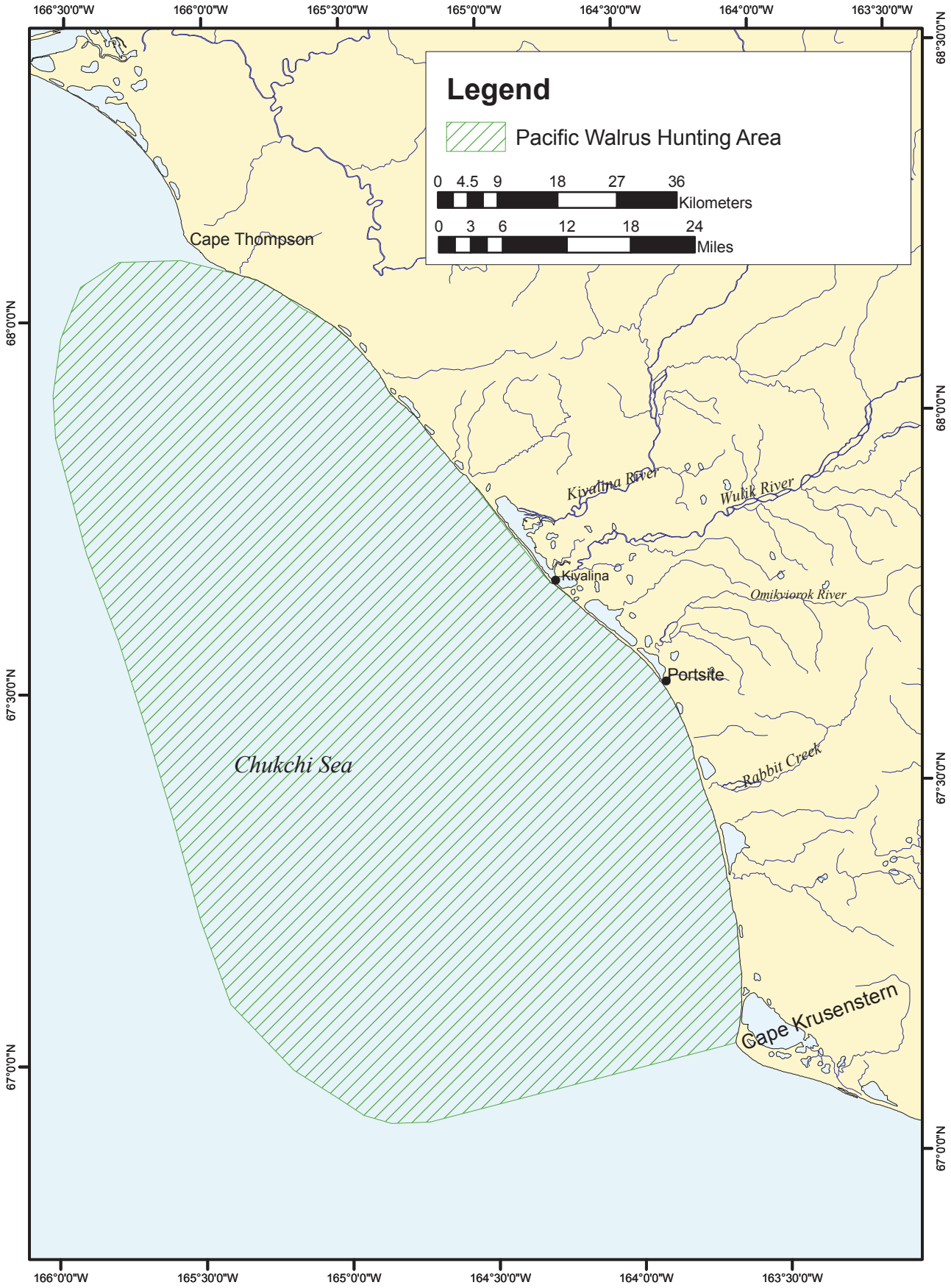

Source: Braund (2000)

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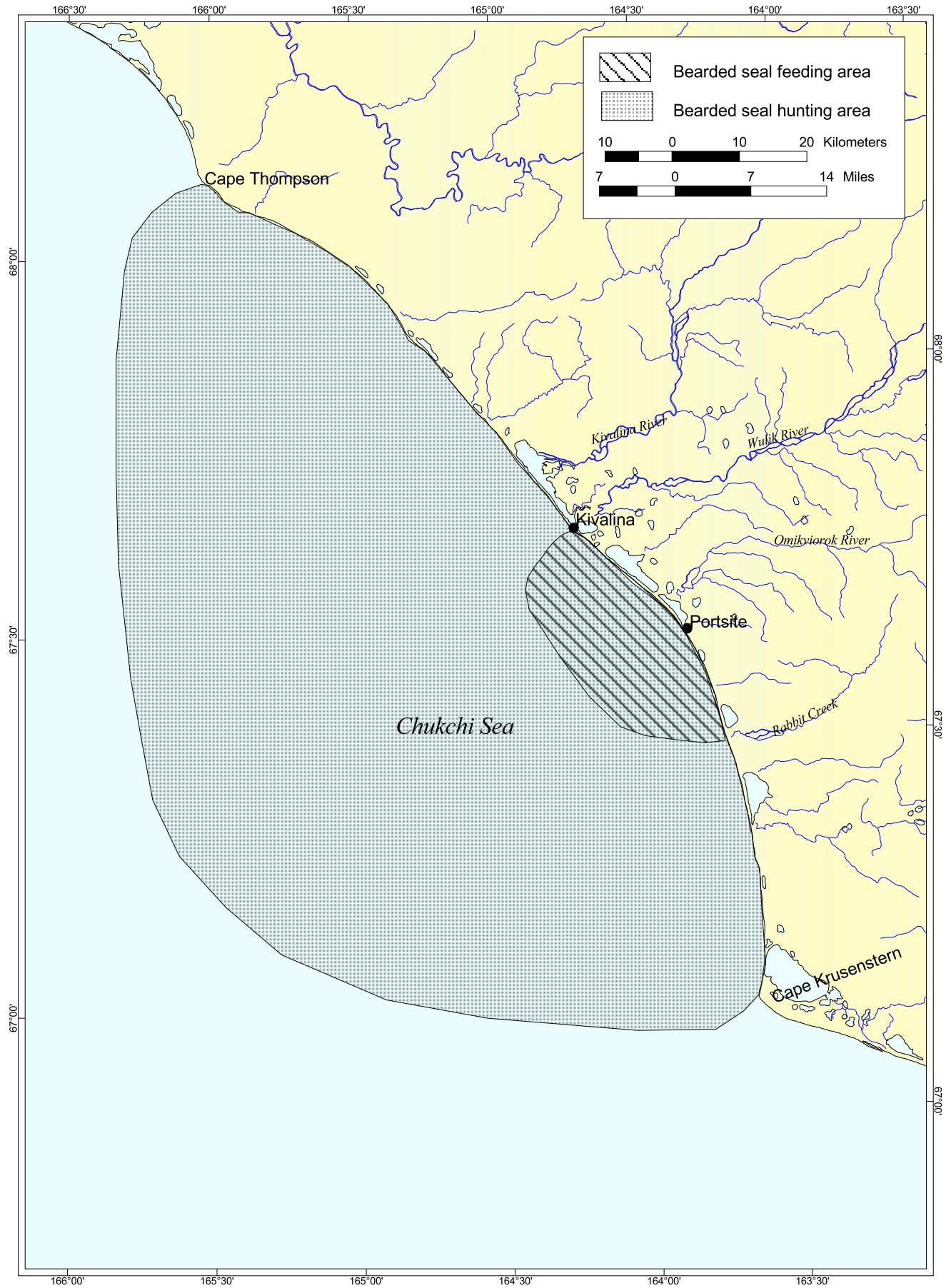
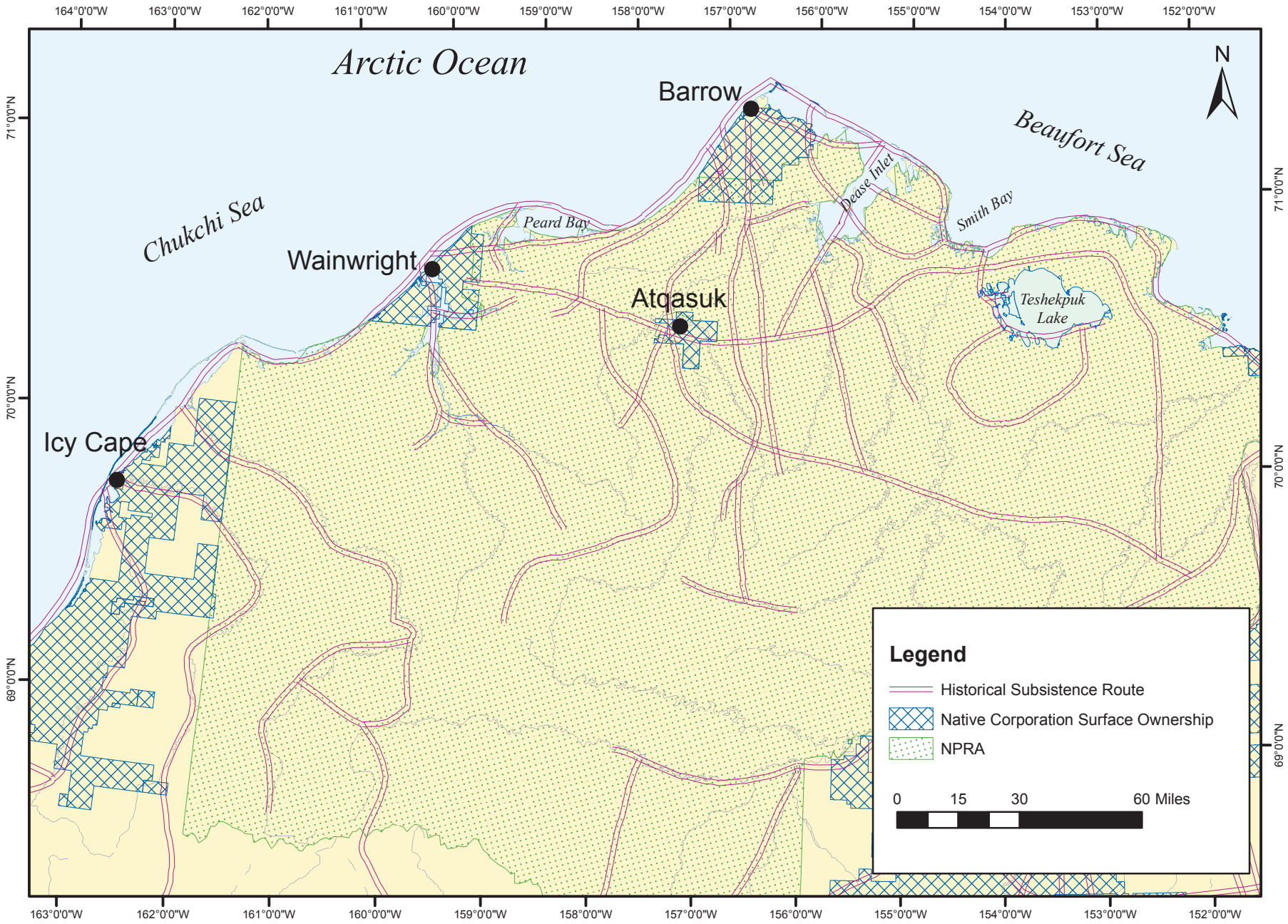


Source: Braund (2000)

Figure 3.4.2-105 Kivalina Hunting and Feeding Area of Bearded Seals



Source: University of Alaska, AEIDC and Arctic Slope Regional Corporation, 1974; Tremont, 1987 (OCS Report MMS 87-0010)

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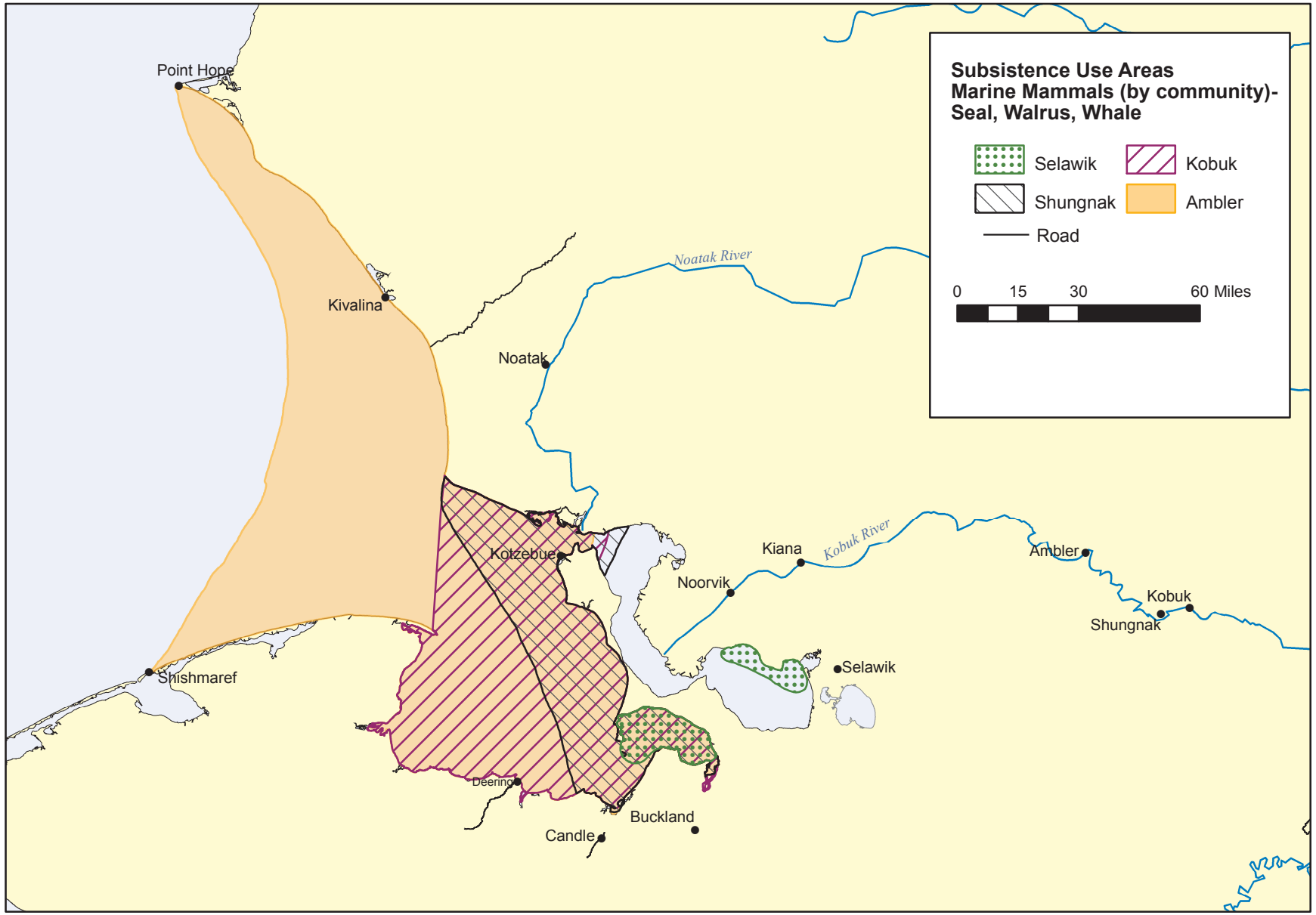

Source: State of Alaska - ADF&G, 1987; Kobuk-Seward Peninsula Proposed RMP/Final EIS, Bureau of Land Management - Alaska

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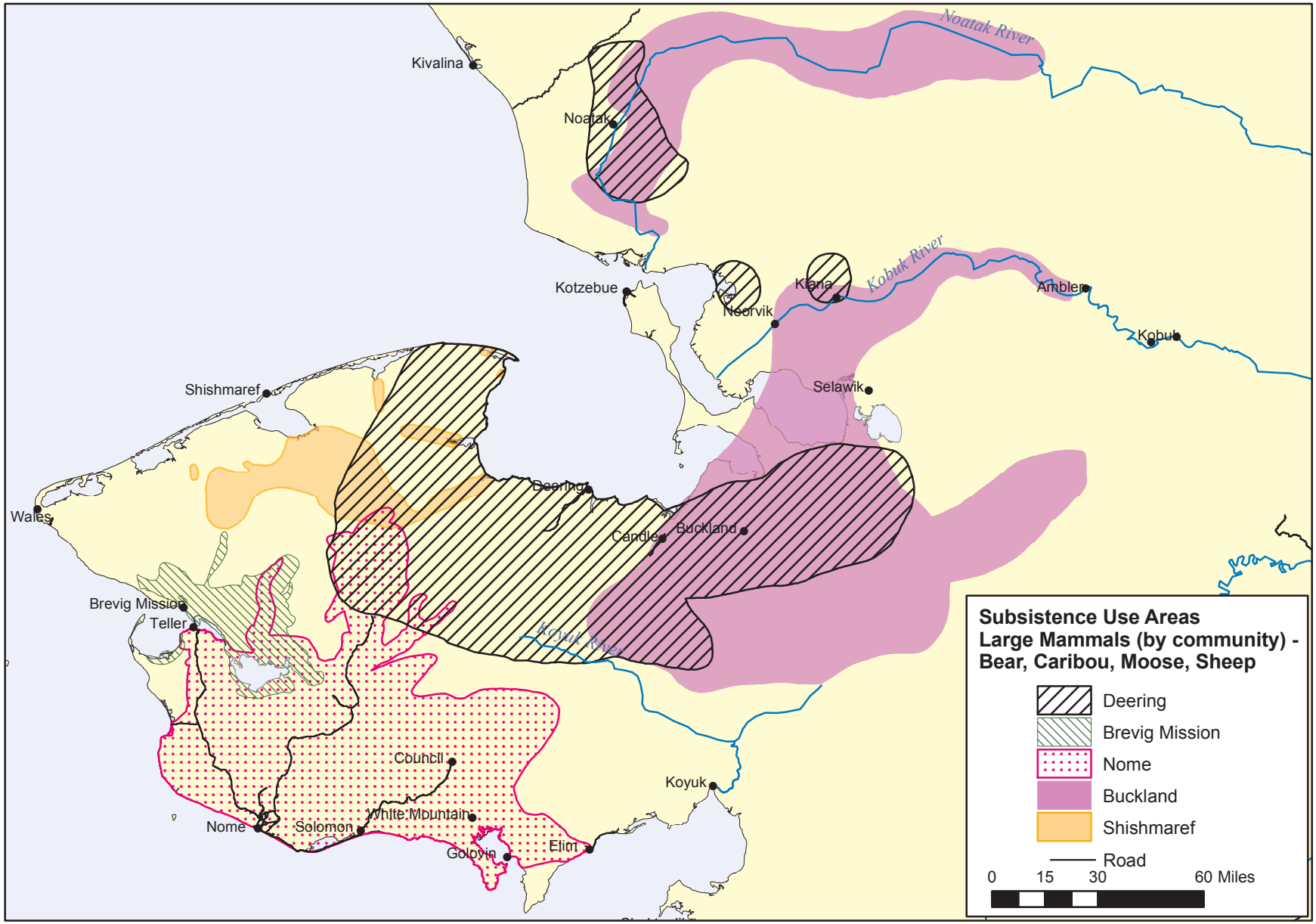
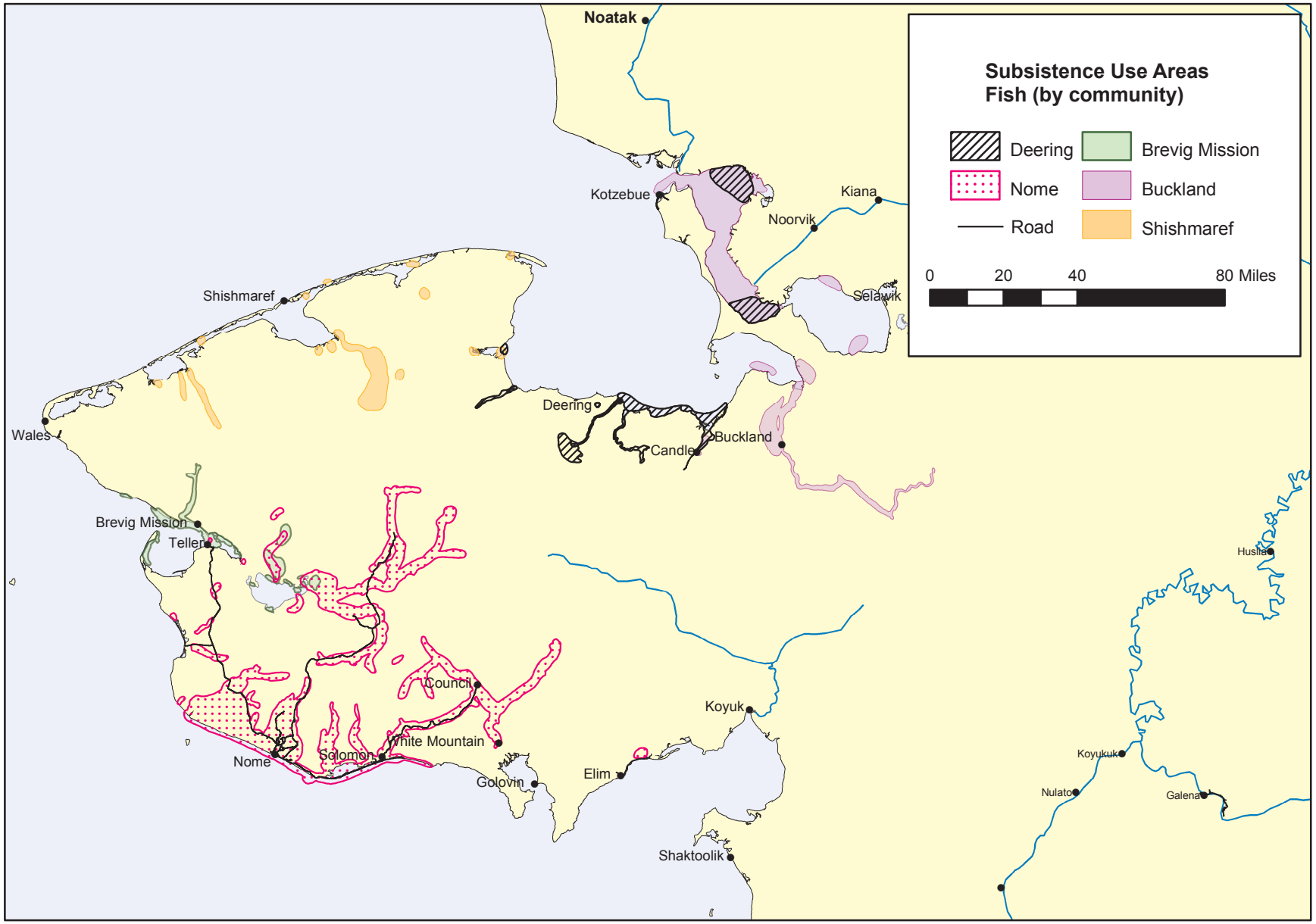


Source: State of Alaska - ADF&G, 1987; Kobuk-Seward Peninsula Proposed RMP/Final EIS, Bureau of Land Management - Alaska

Figure 3.4.2-107 Subsistence-Use Areas, Mammals (Buckland, Deering, Shishmaref)



Source: State of Alaska - ADF&G, 1987; Kobuk-Seward Peninsula Proposed RMP/Final EIS, Bureau of Land Management - Alaska

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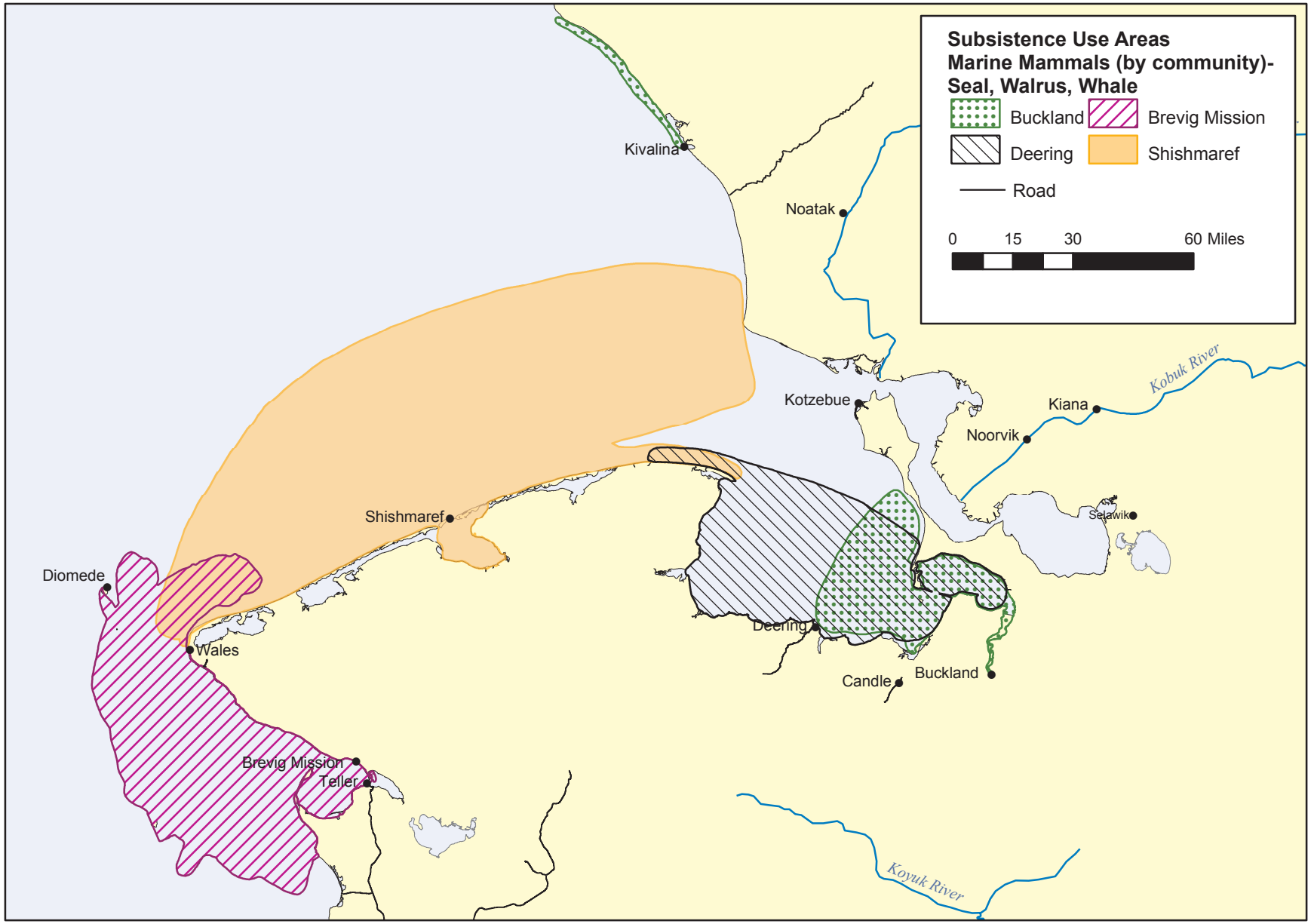

Source: State of Alaska- ADF&G, 1987; Kobuk-Seward Peninsula Proposed RMP/Final EIS, Bureau of Land Management - Alaska

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Figure 3.4.4-1
Archaeology Blocks and General Location of Shipwrecks in the Beaufort Sea Planning Area

Legend

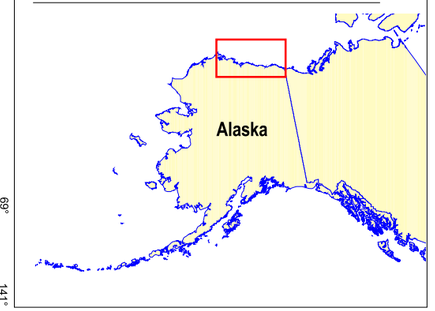
- 10-20 Meter Bathymetry Line
- Shipwreck Sites
- Beaufort Sales 209 and 217 Lease Blocks
- Blocks Within 20 Meter Depth Zone

30 0 30 60 Kilometers

20 0 20 40 Miles

USDOI, MMS, May 2008

Locator Map



Arctic Ocean

Beaufort Sea

National Petroleum Reserve - Alaska

1002 Arctic Coastal Plain Area

Arctic National Wildlife Refuge

Teshekpuk Lake

Prudhoe Bay

Deadhorse

Nuiqsut

Kaktovik

Topagoruk River

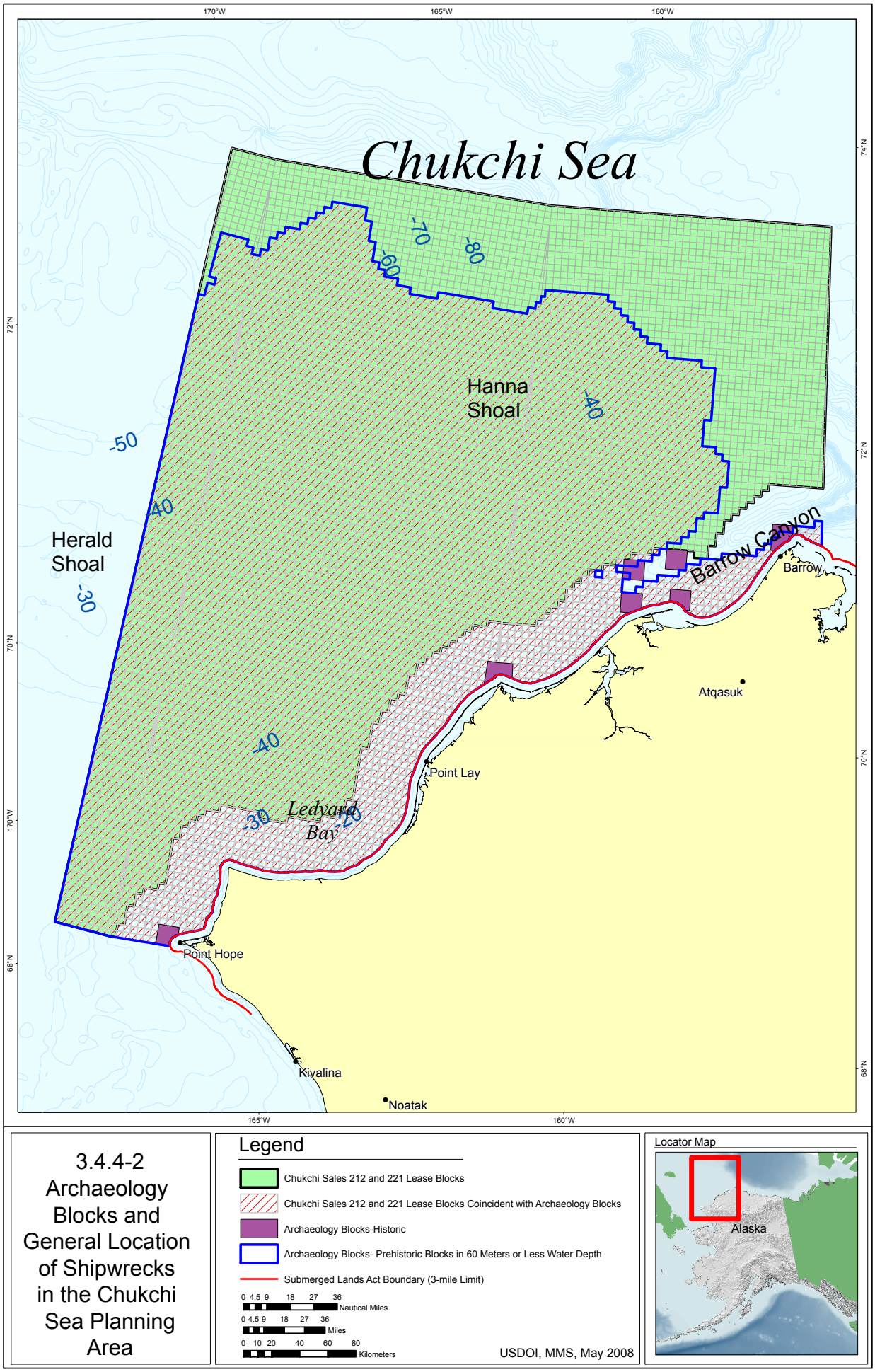
Colville River

Kuparuk River

Canning River

Sadlerochit River

Archillik River



3.4.4-2 Archaeology Blocks and General Location of Shipwrecks in the Chukchi Sea Planning Area

Legend

- Chukchi Sales 212 and 221 Lease Blocks
- Chukchi Sales 212 and 221 Lease Blocks Coincident with Archaeology Blocks
- Archaeology Blocks-Historic
- Archaeology Blocks- Prehistoric Blocks in 60 Meters or Less Water Depth
- Submerged Lands Act Boundary (3-mile Limit)

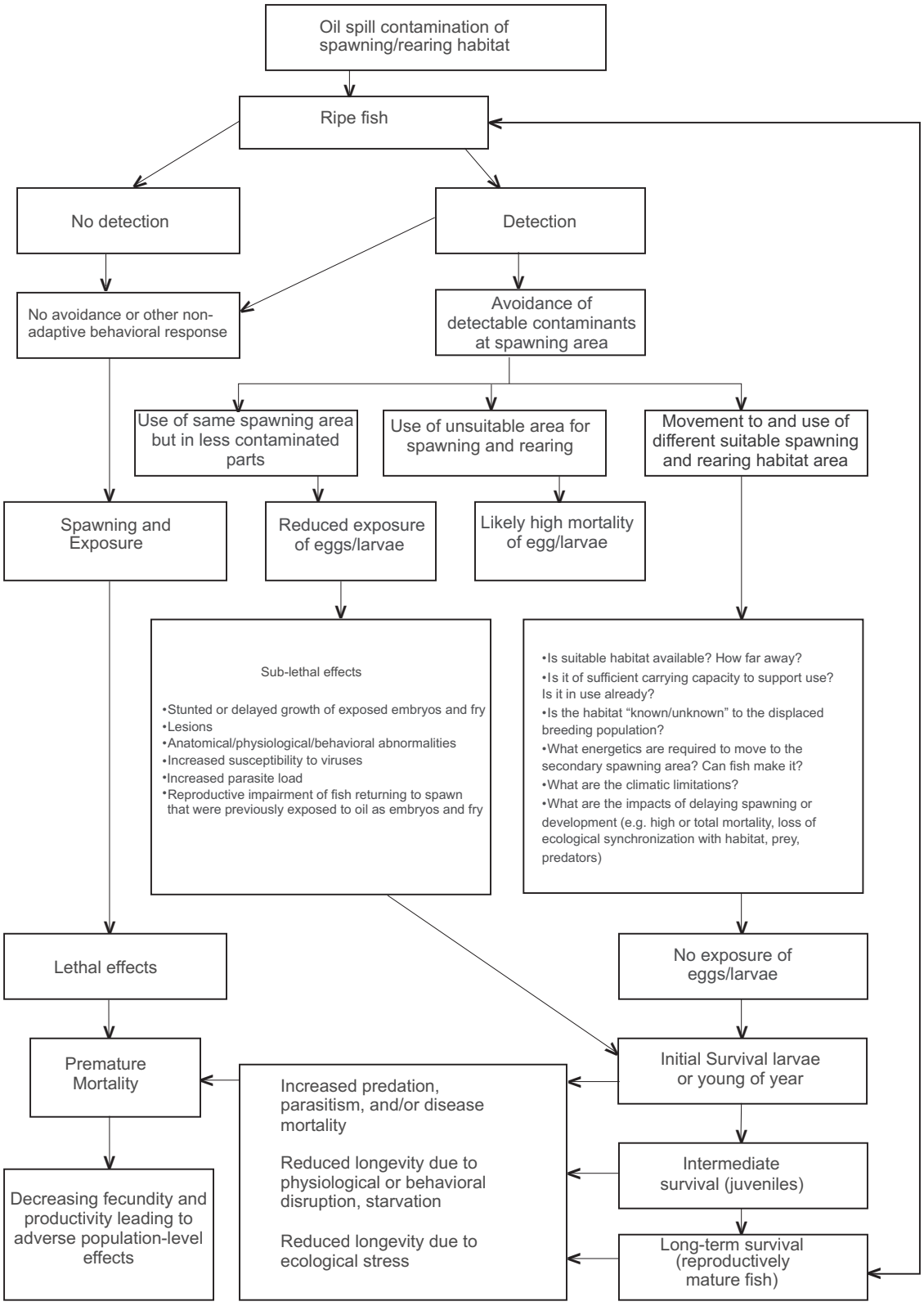
0 4.5 9 18 27 36 Nautical Miles

0 4.5 9 18 27 36 Miles

0 10 20 40 60 80 Kilometers

USDOI, MMS, May 2008

Locator Map



Source: USDOI, MMS

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4.5.2.6.3-1. Summer Conditional Probabilities (Expressed As Percent Chance) That A Large Spill Starting At Launch Areas 1-15 Or Pipeline Segments 1-11 Will Contact Certain Important Fall Feeding And Denning Areas For Polar Bears In The Chukchi Sea Within 30 Or 360 Days
4.5.2.6.3-2. Winter Conditional Probabilities (Expressed As Percent Chance) That A Large Spill Starting At Launch Areas 1-15 Or Pipeline Segments 1-11 Will Contact Certain Important Fall Feeding And Denning Areas For Polar Bears In The Chukchi Sea Within 30 Or 360 Days

Table 3.1.1-1 Alaska North Slope Oil and Gas Discoveries as of May 2008

	Name	Location of Field or Pool	Production Oil, Gas	Location of Production Facility	Discovery	Production Began	Category	Ranking Criteria
Past Development And Production								
1	South Barrow	Onshore	Gas	Onshore	1949	1950	Field	**When Production Began**
2	Prudhoe Bay	Onshore	Oil	Onshore	1967	1977	Field	
3	Lisburne	Onshore	Oil	Onshore	1967	1981	Field	
4	Kuparuk	Onshore	Oil	Onshore	1969	1981	Field	
5	East Barrow	Onshore	Gas	Onshore	1974	1981	Field	
6	Milne Point	Onshore	Oil	Onshore	1969	1985	Field	
7	Endicott	Offshore	Oil	Offshore	1978	1986	Field	
8	Sag Delta	Offshore	Oil	Onshore	1976	1989	Field	
9	Sag Delta North	Offshore	Oil	Offshore	1982	1989	Satellite[1]	
10	Schrader Bluff	Onshore	Oil	Onshore	1969	1991	Satellite[2]	
11	Walakpa	Onshore	Gas	Onshore	1980	1992	Field	
12	Point McIntyre	Offshore	Oil	Onshore	1988	1993	Field	
13	North Prudhoe Bay	Onshore	Oil	Onshore	1970	1993	Field	
14	Niakuk	Offshore	Oil	Onshore	1985	1994	Field	
15	Sag River	Onshore	Oil	Onshore	1969	1994	Satellite[3]	
16	West Beach	Onshore	Oil	Onshore	1976	1994	Field	
17	Cascade	Onshore	Oil	Onshore	1993	1996	Field	
18	West Sak	Onshore	Oil	Onshore	1969	1997	Satellite[2]	
19	Badami	Offshore	Oil	Onshore	1990	1998	Field	
20	Eider	Offshore	Oil	Offshore	1998	1998	Satellite[1]	
21	Tarn	Onshore	Oil	Onshore	1991	1998	Field	
22	Tabasco	Onshore	Oil	Onshore	1992	1998	Satellite[2]	
23	Midnight Sun	Onshore	Oil	Onshore	1998	1999	Satellite[4]	
24	Alpine	Onshore	Oil	Onshore	1994	2000	Field	
25	Northstar	Offshore	Oil	Offshore	1984	2001	Field	
26	Aurora	Onshore	Oil	Onshore	1999	2001	Satellite[4]	
27	NW Eileen/Borealis	Onshore	Oil	Onshore	1999	2001	Field	
28	Polaris	Onshore	Oil	Onshore	1999	2001	Satellite	
29	Meltwater	Onshore	Oil	Onshore	2000	2001	Pool	
30	Palm	Onshore	Oil	Onshore	2001	2002	Pool	
31	Orion	Onshore	Oil	Onshore	2000	2003	Satellite	
32	Raven	Onshore	Oil	Onshore	?	2006	Pool	
33	Fiord (CD 3)	Onshore	Oil	Onshore	1992	2006	Pool	
34	Nanuq (CD 4)	Onshore	Oil	Onshore	1996	2006	Pool	
35	Oooguruk	Offshore	Oil	Offshore	2003	**(2008)**	Pool	
Present Development								
36	Nikaitchuq	Offshore	Oil	Offshore & Onshore	2004	**(2009)**	Pool	**When Production Is Expected**
37	Alpine West (CD 5)	Onshore	Oil	Onshore	1998	**(2010)**	Pool	
38	Liberty	Offshore	Oil	Offshore	1983	**(2011)**	Pool	
Reasonably Foreseeable Future Development								
39	Lookout (CD 6)	Onshore	Oil	Onshore	2001	**(2013)**	Pool	
40	Sivuliiq (Hammerhead)	Offshore	Oil	Offshore	1985	—	Pool	
41	Tuvaaq	Offshore	Oil	Offshore	2005	—	Prospect	
42	Spark (CD 7)	Onshore	Gas & Oil	Onshore	2000	—	Pool	
43	Carbon	Onshore	Oil & Gas	Onshore	2004	—	Prospect	
44	Moose's Tooth	Onshore	Gas & Oil	Onshore	2001	—	Prospect	
45	Rendezvous	Onshore	Gas & Oil	Onshore	2000	—	Pool	
46	Kalubik	Offshore	Oil	Onshore	1992	—	Prospect	
47	Thetis Island	Offshore	Oil	Offshore	1993	—	Prospect	
48	Sikulik	Onshore	Gas	Onshore	1988	—	Pool	
49	Gwydyr Bay	Offshore	Oil	Onshore	1969	—	Pool	
50	Point Thomson	Onshore	Gas & Oil	Onshore	1977		Pool	
51	Pete's Wicked	Onshore	Oil	Onshore	1997	—	Prospect	
52	Sandpiper	Offshore	Gas & Oil	Offshore	1986	—	Pool	
53	Mikkelson	Onshore	Oil	Onshore	1978	—	Prospect	
54	Sourdough	Onshore	Oil	Onshore	1994	—	Show	

Table 3.1.1-1 Alaska North Slope Oil and Gas Discoveries as of May 2008 (cont'd)

	Name	Location of Field or Pool	Production Oil, Gas	Location of Production Facility	Discovery	Production Began	Category	Ranking Criteria
Reasonably Foreseeable Future Development (Continued)								
55	Yukon Gold	Onshore	Oil	Onshore	1994	—	Show	
56	Flaxman Island	Offshore	Oil	Offshore	1975	—	Prospect	
57	Stinson	Offshore	Oil	Offshore	1990	—	Prospect	
58	Kuvlum	Offshore	Oil	Offshore	1987	—	Prospect	
Speculative Future Development								
59	Paktoa	Offshore	Oil	Offshore	2006	—	Prospect	
60	Klondike	Offshore	Oil	Offshore	1990	—	Prospect	
61	Burger	Offshore	Gas & Oil	Offshore	1990	—	Prospect	
62	Hemi Springs	Onshore	Oil	Onshore	1984	—	Pool	
63	Ugnu	Onshore	Oil	Onshore	1984	—	Pool	
64	Umiat	Onshore	Oil	Onshore	1946	—	Pool	
65	Fish Creek	Onshore	Oil	Onshore	1949	—	Show	
66	Simpson	Onshore	Oil	Onshore	1950	—	Prospect	
67	East Kurupa	Onshore	Gas	Onshore	1976	—	Show	**Insufficient Information to Estimate Chance of Development**
68	Meade	Onshore	Gas	Onshore	1950	—	Prospect	
69	Wolf Creek	Onshore	Gas	Onshore	1951	—	Show	
70	Gubik	Onshore	Gas	Onshore	1951	—	Pool	
71	Square Lake	Onshore	Gas	Onshore	1952	—	Show	
73	East Umiat	Onshore	Gas	Onshore	1964	—	Prospect	
74	Kavik	Onshore	Gas	Onshore	1969	—	Show	
75	Kemik	Onshore	Gas	Onshore	1972	—	Show	

Notes:
Field information is taken from State of Alaska, Dept. of Natural Resources Annual Report December 2004 and Petroleum News
Footnotes for Satellites identify the associated production unit:
[1]Duck Island Unit;
[2]Kuparuk River Unit;
[3]Milne Point Unit;
[4]Prudhoe Bay Unit.
Parentheses indicate when production startup is expected.
Definitions:

Field—infrastructure (pads/wells/facilities) installed to produce one or more pools.
Satellite—a pool developed from an existing pad.
Pool—petroleum accumulation with defined limits.
Prospect—a discovery tested by several wells.
Show—a one-well discovery with poorly defined limits and production capacity.

Table 3.1.1-2 Present Development: Estimated Reserve Data

Unit or Area	Field	Type (Oil, Gas)	Discovery	Status	Oil Reserves (MMbbl)
Nikaitchuq	Nikaitchuq	Oil	2004	Present Development	70-180
Colville River	Alpine West CD 5	Oil	2002?	Present Development	50
Endicott	Liberty	Oil	1983	Present Development	105
Total for All Units or Areas		–	–	–	225-335

Source: Anchorage Daily News (2007); USDOI, MMS, (2007a); ENI (2008)

Table 3.1.1-3 Future Lease Sales

Sale	Proposed Sale Date(s)	Area/Description	Resources or Hydrocarbon Potential
Federal			
2007-2012 Beaufort Sea OCS Sales 209 and 217	2009 and 2011, respectively		0.5-1.0 Bbbl
2007-2012 Chukchi Sea OCS Sales 212, and 221	2010 and 2012, respectively		1.0 Bbbl
Northeast NPR-A	Fall 2008		2.0-4.05 Bbbl
Northwest NPR-A	Fall 2008		
State Of Alaska			
North Slope Areawide	October 2008-2012	As much as 5,100,000 acres of State-owned lands between the Canning and Colville rivers and north of the Umiat Baseline (about 69° 20' N.).	Moderate to High
Beaufort Sea Areawide	October 2008-2012	Unleased State-owned tide- and submerged lands between the Canadian border and Point Barrow and some coastal uplands acreage located along the Beaufort Sea between the Canning and Colville rivers. The gross proposed sale area is in excess of 2,000,000 acres and is divided into 576 tracts.	Moderate to High
North Slope Foothills Areawide	February 2008-2012	State-owned lands lying between the National Petroleum Reserve-Alaska and the Arctic National Wildlife Refuge south of the Umiat Baseline and north of the Gates of the Arctic National Park and Preserve. The gross proposed sale area is in excess of 7,000,000 acres.	Moderate
Canada			
Beaufort Sea and Central Mackenzie Valley	June 2008	One (1) parcel of land are located in the Central Mackenzie Valley region of the Northwest Territories and five (5) in the Beaufort Sea / Mackenzie Delta. The parcels in the Central Mackenzie Valley cover 82,100 hectares, more or less. The parcels located in the Beaufort Sea / Mackenzie Delta covers 849,194 hectares.	

Source: ADNR (2008) 2007-2012 5-Year Oil and Gas Leasing Program; USDOI, MMS (2007c)

Table 3.1.1-4 Past Development: 2007 Production and Reserve Data

					Produced			Reserves[2]	
Unit or *Area*	Field	Type (Oil or Gas)	Discovery	Began	Gas (Bcf)	2007 Oil (MMbbl)[1]	Production to	Oil (MMbbl)[1]	Gas (Bcf)
Duck Island									
—	Endicott	O	1973	1987	–	466.240308	Endicott	–	–
—	Sag Delta North[2]	O	1989	1989	–	"	Endicott	–	–
—	Sag Delta[2]	O	1976	1989	–	"	Endicott	–	–
—	Eider	O	1998	1998	–	2.753886	Endicott	–	–
—	Ivishak	O	–	–	–	8.178075	Endicott	"l	"l
Duck Isl. Unit	–	–	–	–	–	–	–	120	843
Prudhoe Bay									
	Prudhoe Bay	O	1967	1977	–	11,003.663154	Prudhoe	2,240	23,000
—	Lisburne	O	1968	1981	–	149.716030	Lisburne	71	1,000
—	Niakuk	O	1985	1994	–	86.248596	Lisburne	15	26
—	West Beach	O	1976	1994	–	3.361555	Lisburne	–	–
—	N. Prudhoe Bay	O	1970	1993	–	1.985,858	Lisburne		
—	Point McIntyre	O	1988	1993	–	404,422,480	Lisburne	164	500
—	Prudhoe Bay IPA's	O	–	–	–	–	–		
—	Midnight Sun	O	1998	1999	–	16,611,817	Prudhoe	15	–
—	Aurora	O	1999	2001	–	22,124,009	Prudhoe	43	–
	NW Eileen/Borealis	O	1999	2001	–		Prudhoe	117	–
—	Polaris	O	1999	2001	–	6,526,597	Prudhoe	91	–
—	Orion	O	1968	2003	–	11,374,804.00	Prudhoe	232	–
—	P. Bay Satellites	O	–	–	–	– "	Prudhoe	504	–
Kuparuk River									
—	Kuparuk River	O	1969	1981	–	2113.536142	Kuparuk	799	1,000
—	Tabasco	O	1992	1998	–	13.746126	Kuparuk	8	–
—	Tarn	O	1992	1998	–	86.031076	Kuparuk	41	50
—	West Sak	O	1969	1998	–	32.732285	Kuparuk	403	100
—	Meltwater	O	—	2001	–	12.238532	Kuparuk	–	–
—	Palm	O	—	2002		–	Kuparuk	–	–
Milne Point									
—	Milne Point	O	1969	1985	–	16.746	Milne Point	–	–
—	Cascade4	O	1993	1996	–	–	Milne Point	–	–
—	Schrader Bluff	O	1969	1991	–	53.3039580	Milne Point	–	–
—	Sag River	O	1968	1994	–		Milne Point	–	–
Milne Point Unit	–	–	–	–	–	–	–	331	14
Badami	Badami	O&G	1990	1998	–	5.198420	TAPS	2	-
Colville River	Alpine	O	1994	2000	–	274.431633	Kuparuk	252	400
	Nanuq			2006				203	
	Fiord			2006					
Northstar	Northstar	O	1984	2001	–	122.390552	TAPS	97	450
NPR-A[1]	East Barrow	G	1974	1981	0.081	–	Barrow	–	5
—	South Barrow	G	1949	1950	0.2.25	–	Barrow	–	4
—	Walakpa	G	1980	1993	1.5167	–	Barrow	–	25
All Units or Areas Total		–	–	–	–	15,129.288761	–	**5.9**	**35**

Notes:
[1] Production information is from State of Alaska, Oil and Gas Conservation Commission (December 2007). Production includes oil and NGLs. Oil and Gas Reserves are from State of Alaska, DNR (2007)
[2] Reserves were estimated by subtracting 2005 production in State of Alaska, Oil and Gas Conservation Commission (2005) from the Reserve Data in ADNR (2006a).
[3] Endicott includes Endicott, Sag Delta, and Sag Delta North. Prudhoe Bay satellites include Midnight Sun, Aurora, Borealis, Polaris, and Orion
[4] Cascade is included in Milne Point.

Table 3.2.1-1 Undiscovered Oil and Gas Resources of Arctic Alaska Petroleum Province*

Assessment Area	Total Energy Endowment (billions of barrels equivalent)	Oil and Natural Gas Liquids (billions of barrels)	Natural Gas (trillions of cubic feet)	Percentage (energy-equivalent basis)
Chukchi Sea Planning Area[1]	29.04	15.38	76.77	32
Beaufort Sea Planning Area[1]	13.14	8.22	27.64	15
Northern Alaska Province[2]	48.20	27.00	119.15	53
Totals	**90.38**	**50.60**	**223.57**	**100**

Notes:
*Mean, risked, undiscovered, technically recoverable oil and gas resources, Chukchi Sea and Beaufort Sea Planning Areas and Northern Alaska Province

Sources: [1]USDOI, MMS (2006), Arctic Offshore Planning Areas; [2]Houseknecht and Bird (20-5:Table 4, p. 9); BOE calculated by author (Sherwood) using 5,620 cubic feet of gas = 1 barrel oil-equivalent

Table 3.2.1-2 Arctic Alaska Developed Oil and Gas Fields, Remaining Reserves, Production, and Original Reserves[1]

Unit or Area (Developed Fields)	Oil Reserves as of 1/2007 (MMbbl)	Gas Reserves as of 1/2007 (Bcfg)	Oil Production (Net) as of 12/2006	Gas Production (Net) as of 12/2006[2]	Original Oil Reserves (MMbbl)	Original Gas Reserves (Bcfg)
Badami Unit	2	0	4.828	7.811	6.828	7.811
Barrow						
East Barrow	Nr[6]	5	nr	8.181	nr	13.181
South Barrow	nr	4	nr	22.640	nr	26.640
Walakpa	nr	25	nr	16.411	nr	41.411
Total Barrow	nr	34	nr	47.232	nr	81.232
Colville River Unit						
Alpine	252	nr	226.407	62.311	478.407	nr
CRU Satellites	203	nr	2.553	1.630	205.553	nr
Total CRU	455	400	228.960	63.941	683.960	463.941
Duck Island Unit	120	843	471.743	250.228	591.743	1093.228
Kuparuk River Unit						
Kuparuk	799	1000	2070.510	526.059	2869.510	1526.059
West Sak	403	100	26.428	10.892	429.428	110.892
Tabasco	8	nr	12.682	2.009	20.682	nr
Tarn	41	50	80.226	-20.189	121.226	29.811
Meltwater	6	nr	11.146	-7.600	17.146	nr
Other KRU Satellites	nr	nr	nr	nr		
Total KRU	1256	1150	2200.992	511.171	3456.992	1661.171
Milne Point Unit	331	14	249.294	52.673	580.294	66.673
Northstar[3]	97	450	108.517	-120.770	205.517	570.770
Prudhoe Bay Unit						
Prudhoe IPA[4]	2240	23000	11381.435	4516.341	13621.435	27516.341
PBU Satellites[5]	504	nr	91.776	131.688	595.776	nr
Lisburne	71	1000	160.682	15.553	231.682	1015.553
Niakuk	15	26	85.675	72.183	100.675	98.183
North Prudhoe Bay	nr	nr	2.071	6.652	nr	nr
West Beach	nr	nr	3.641	17.424	nr	nr
Point McIntyre	164	500	404.871	125.048	568.871	625.048
Total PBU	2995	24526	12130.152	4884.889	15125.152	29410.889
Totals	**5256**	**27417**	**15394.485**	**5697.175**	**20644.773**	**33205.542**

Notes:
[1]Data for onshore unitized and developed fields and Point Thomson area from State of Alaska (2007).
[2]A negative entry indicates that greater amounts were injected than produced.
[3]Northstar field extends from State of Alaska waters into Federal OCS waters. As of November 2007, 17.840% of Northstar reserves are considered to underlie Federal OCS leases (http://www.mms.gov/alaska/fo/North_Star/Northstar_production_table.pdf).
[4]Prudhoe Bay Initial Participating Area includes the main Ivishak oil pool, gas, gas liquids, gas cap gas, and injected gas.
[5]Includes Aurora, Borealis, Orion, Polaris, Midnight Sun, and Raven pools.
[6]nr = not reported

Table 3.2.1-3 Arctic Alaska Undeveloped Oil and Gas Discoveries and Estimated Resources

Unit or Area	Oil Resources as of 1/2007 (MMbbl*)	Gas Resources as of 1/2007 (Bcfg)*	Oil Production (Net) as of 12/2006	Gas Production (Net) as of 12/2006	Original Oil Resources (MMbbl)	Original Gas Resources (Bcfg)
Undeveloped Fields – Onshore and State of Alaska Waters						
East Kurupa	nr*	nr	0	0	nr	nr
East Umiat[1]	nr	4	0	0	nr	4
Fish Creek (NPRA)	nr	nr	0	0	nr	nr
Gubik[1]	nr	600	0	0	nr	600
Gwydyr Bay[1]	30-60	nr	0	0	30-60	nr
Hemi Springs	nr	nr	0	0	nr	nr
Kavik[2]	nr	95-173	0	0	nr	95-173
Kemik	nr	nr	0	0	nr	nr
Lookout (NPRA)	nr	nr	0	0	nr	nr
Meade (NPRA)[1]	nr	20	0	0	nr	20
Mikkelsen	nr	nr	0	0	nr	nr
Moose's Tooth (NPRA)	nr	nr	0	0	nr	nr
Nikaitchuq	nr	nr	0	0	nr	nr
Oooguruk[3]	70-90	nr	0	0	70-90	nr
Point Thomson Area[4]	295	8,000	0	0	295	8,000
Rendezvous (NPRA)	nr	nr	0	0	nr	nr
Sikulik (Barrow area)	nr	nr	0	0	nr	nr
Simpson (NPRA)	nr	nr	0	0	nr	nr
Spark (NPRA)	nr	nr	0	0	nr	nr
Square Lake (NPRA)	nr	58	0	0	nr	58
Stinson	nr	nr	0	0	nr	nr
Sourdough[5]	100?	nr	0	0	100?	nr
Umiat (NPRA)[6]	70	nr	0	0	70	nr
Wolf Creek (NPRA)	nr	nr	0	0	nr	nr
Undeveloped Fields – Federal Offshore (OCS)						
Liberty (Beaufort Sea)[7]	105	nr	0	0	105	nr
Sivulliq/Hammerhead (Beaufort Sea)[8]	100-200	nr	0	0	100-200	nr
Kuvlum (Beaufort Sea)[8]	160-300	nr	0	0	160-300	nr
Sandpiper (Beaufort Sea)[9]	47	nr	0	0	47	nr
Burger (Chukchi Sea)[10]	107-3,370	2,400-63,200	0	0	107-3,370	2,400-63,200

Sources: [1]Thomas et al. (1991); [2]Verma et al. (2006); [3]Petroleum News Alaska (2007); [4]ADNR, Div. Oil and Gas (2007d);Estimate includes the "Flaxman" pool; [5]Alaska Report (1997); [6]Molenaar (1982); [7]BPXA (2007); [8]Petroleum News Alaska (2003);[9]Petroleum News Alaska (1998); [10]Estimates of discovered resources by MMS based on limited well date. http://www.mms.gov/alaska/re/Burger/Resources/Burger%20Fact%20Sheet.pdf. Most likely gas resource = 14038 Bcf; most likely liquids resource = 724 MMbbl condensate.
*nr = not reported

Table 3.2.2-1 Temperature Trend for Barrow and Kotzebue (1949-2007)

Station Location	Total Change, ˚F (1949-2007)				
	Annual	Winter	Spring	Summer	Autumn
Barrow	4.2	6.3	4.3	2.9	3.0
Kotzebue	3.3	7.0	1.8	2.7	1.8

Notes: Barrow is located at 71°17' N., 156°46' W. at an elevation of 30.8 feet. Kotzebue is located at 66°53' N., 162°32' W. at an elevation of 9.8 feet.

Source: http://climate.gi.alaska.edu/ClimTrends/Change/TempChange.html

Table 3.2.3-1 Average Monthly Discharge in the Beaufort Sea from Gauged Rivers

River Name	Jan.	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Record Length
Colville River at Umiat AK	16	3.6	0.21	0.00	16,400	51,000	17,500	22,400	10,900	4,420	414	83	2003-2007
Colville River near Nuiqsut, Alaska	--	--	--	--	--	21,600	22,500	14,800	--	--	--	--	1977
Ikpikpuk River, Fry Creek	0.00	0.00	0.00	0.00	445	5,670	449	784	138	86	2.7	0.00	2005-2007
Judy Creek near Nuiqsut, Alaska	0.00	0.00	0.00	0.00	11	1,350	167	75 54	34	2.4	0.00		2005-2007
Kuparuk River near Deadhorse, Alaska	0.87	0.83	0.83	0.83	1,700	10,200	1,200	1,700	1,530	291	27	3	1971-2007
Meade River At Atkasuk, Alaska	0.00	0.00	0.00	0.00	780	4,180	896	1,450	270	154	5.3	0.00	1977, 2005-2007
Miguakiak River near Teshekpuk Lake near Lonely, Alaska						120	980	724					1977
Nunavak Creek near Barrow, Alaska	0.00	0.00	0.00	0.00	0.26	8.6	2.1	0.89	1.0	0.03	0.00	0.00	1972-2004
Putuligayuk River near Deadhorse, Alaska	0.00	0.00	0.00	0.00	4.1	451	21	9.4	15	1.8	0.00	0.00	1971-1986
Sagavanirktok River near Pump Station 3, Alaska	54	37	31	30	1,250	5,700	4,780	3,960	1,820	626	235	99	1982-2007
Mackenzie River at Arctic Red River	3,886	3,480	3,241	3488	13,633	20,457	17,140	13,767	11,286.07	8997.5	4,525	3,481	1973-2000

Notes: **-- =** No Data, Peak flow indicated in grey.
Source: USGS (2008) and R-ArcticNet (2008)

Table 3.2.4-1 Mean Occurrence Dates (1996-2004) for Landfast Ice Conditions

		Mahoney et al., 2007; Eicken et al., 2006				Barry, Moritz, and Rogers, 1979		
		Zone 1 Wainwright to Pt. Barrow	Zone 2 Pt Barrow to Barter Isl.	Zone 3 Barter Isl to Herschel Isl.	Zone 4 Mackenzie Delta	Central Chukchi Sea	Central Beaufort Sea	
First Ice*	**Mean**	Dec 01	Oct 25	Nov 04	Nov 9	Early November	Mid-October	First continuous fast ice
	σ'	31.8	9.6	11.4	17.5			
Stable Ice	**Mean**	Feb 23	Jan 22	Jan 28	Jan 27	February	January February	Stable ice inside of 15-m isobath
	σ'	41.9	30.1	32.6	34.9			
Breakup	**Mean**	Jun 04	Jun 11	Jun 04	May 26	June 10	June 30	First openings and movement
	σ'	13.9	14.2	13.7	12.6			
Ice Free	**Mean**	Jun 18	Jun 24	Jun 24	Jun 06	July 05	August 01	Nearshore largely free of fast ice
	σ'	12.7	8.4	12.6	10.2			

	Oasis and D.F. Dickins Associates Ltd., 2006						
	Pt Barrow to Drew Pt	Drew Pt to Cape Halkett	Cape Halkett to Oliktok	Oliktok to Bullen Pt	Bullen Pt to Brownlow Pt	Brownlow Pt. to Barter Isl.	Barter Isl to Demarcation Pt.
Median Freezeup	Oct 4-22	Oct 4-22	Oct 4-22	Oct 4-15	Oct 4-15	Oct 8-1 5	Oct 8-1 5
Ice 30-46cm	Nov 3	Oct 30	Oct 30	Oct 30	Oct 30	Nov 3	Nov 3
Ice 46-76 cm	Nov 19-Dec 2	Dec2–Dec 20	Nov 15-22	Nov 15-22	Dec 5	Dec 5	Nov 27-Dec 9
Overflood	May 25	NA	Ma 27-28	May 27-29	Jun 11	May 23-Jul 2	NA
Start Breakup	Jun 21-Jul 1	Jun 20–Jul 4	Jun 12–Jul 6	Jun 12-Jun 25	Jun 25-Jul 2	Jun 2-Jul 2	Jul 1-9
End Breakup	Jul 9-Aug 30	Jul 23-Aug 27	Jun 25-Aug 29	Jun 25-Aug 29	Jul 16- Aug 15	Jul 16-Aug 15	Aug 1-13

Sources: Oasis Environmental and D.F. Dickins Associates Ltd. (2006); Mahoney et al. (2007); Eicken et al. (2006); Barry, Moritz, and Rogers (1979).

Table 3.2.6-1 Ambient Air Quality Standards Relevant to the Chukchi Sea Planning Area

Ambient Air Quality Standards				
Pollutant	**Averaging Period[1]**	**Alaska Standards**	**National Standards[2]**	**Standard Type**
Carbon Monoxide	8-hour	10 mg/m^3	9 ppm (10 mg/m^3)	Primary
	1-hour	40 mg/m^3	35 ppm(40 mg/m^3)	Primary
Nitrogen Dioxide	Annual	100 µg/m^3	.053 ppm (100 µg/m^3)	Primary & Secondary
Ozone	1-hour	235 µg/m^3	—	—
	8-hour	—	.08 ppm (157 µg/m^3)	Primary & Secondary
Lead	Quarterly	1.5 µg/m^3	1.5 µg/m^3	Primary & Secondary
Particulate Matter (PM_{10})	Annual	50 µg/m^3	50 µg/m^3	Primary & Secondary
	24-hour	150 µg/m^3	150 µg/m^3	Primary & Secondary
Particulate Matter ($PM_{2.5}$)	Annual	—	15 µg/m^3	Primary & Secondary
	24-hour	—	65 µg/m^3	Primary & Secondary
Sulfur Dioxide	Annual	80 µg/m^3	.03 ppm (80 µg/m^3)	Primary
	24-hour	365 µg/m^3	.014 ppm (365 µg/m^3)	Primary
	3-hour	1300 µg/m^3	.5 ppm (1300 µg/m^3)	Secondary
Reduced Sulfur Compounds	30-minute	50 µg/m^3	—	—
Ammonia	8-hour	2.1 µg/m^3	—	—

Notes:
(a dash [—] indicates that no standards have been established)
mg/m^3 = milligrams per cubic meter
µg/m^3 = micrograms per cubic meter

Footnotes:
[1]National standards (other than ozone, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth high 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m^3 is ≤1. For $PM_{2.5}$, the 24-hour standard is attained when 98% of the daily concentrations, averaged over 3 years, are equal to or less than the standard.
[2]Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25 °C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25 °C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

Source: ADEC (2005), 18 AAC 50.010; Environmental Protection Agency (40 CFR Part 50)

Table 3.2.6-2 Measured Air Pollutant Concentrations at Prudhoe Bay, Alaska 1990-1996[1]

Pollutant	Monitor Sites					NAAQS[2]	Class II Increments
	CPF-1	DS1F	CCP	WPA	GC1		
O_3							
Max 1-hr	0.05-0.06	0.05	0.04-0.06	0.05-0.09	0.04-0.05	0.075	--
NO_2							
Annual	13-16	4-5	16-26	8-12	16-20	100	25
PM_{10}							
Annual	--	--	--	--	--	--	17
Max 24-hr	--	--	12-29	--	55-155	150	30
SO_2							
Annual	4-5	3	3	--	3-4	80	20
Max 24-hr	16-26	5-13	8-10	--	8-39	365	91
Max 3-hr	29-44	13-55	10-13	--	21-101	1,300	512

Notes:
[1]O_3 concentrations are in parts per million (ppm); all others are in micrograms per cubic meter
[2]The NAAQS for O_3 is based on an 8-hour average concentration; it is not directly comparable to the measured values; the 8-hour average concentrations will be lower than the 1-hour average values
CPF-1 Central Compressor Plant
DS1F Drill Site 1F
CCP Central Compressor Plant
WPA Well Pad A
GC1 Gathering Center 1

Table 3.2.7-1 A Comparison of Most Common Sound Levels from Various Sources

Source	Activity	Decibels at Source
Vessel Activity		
	Tug Pulling Barge	171
	Fishing Boat	151-158
	Zodiac (outboard)	156
	Supply Ship	181
	Tanker	169-180
	Freighter	172
Icebreaking		
	Ice Management	171-191
	Icebreaking	193
Dredging		
	Clamshell Dredge	150-162
	Aquarius (cutter-suction dredge)	185
	Beaver Mackenzie Dredge	172
Drilling		
	Kulluk (conical drillship)	185
	Explorer II (drillship)	174
	Gravel Island	125
	Ice Island (in shallow water)	86
Seismic and Acoustics		
	Airgun Array	235-259
	Single Airgun	216-232
	Vibroseis	187-210
	Water Gun	217-245
	Sparker	221
	Boomer	212
	Depth Sounder	180
	Sub-Bottom Profiler	200-230
	Side-Scan Sonar	220-230
	Military	200-230
Ambient Noise		
	Ambient Noise	65-133

Source: Reprinted from USDOI, MMS, 2007d

Table 3.4.1-1 Estimated Number of Jobs by Sector, North Slope Borough Residents Only

	1980	1988	1993	1998	2003
Federal Government	100	83	37	39	61
State Government	12	20	25	35	26
City Government	—	71	61	57	66
NSB Government	642	1,087	893	989	777
NSB School District	—	419	345	289	409
Private Construction	201	95	21	66	43
Regional/Village Corporation		311	304	407	383
Transportation	107	122	45	43	53
Oil Industry	30	46	21	16	23
Service	71	84	53	83	108
Other	176	168	138	368	242
Total	1,689	2,506	1,943	2,392	2,191

Sources: 1980 Data from Alaska Consultants, Inc. (1981); remaining data from North Slope Borough Economic Profile and Census Reports.

Table 3.4.1-2 Employment of Residents by Sector, North Slope Communities, 2003

Sector	Anaktuvuk Pass	Atqasuk	Barrow	Kaktovik	Nuiqsut	Pt. Hope	Pt. Lay	Wainwright
Federal Gov't.	1	0	45	1	0	10	2	2
State Gov't.	2	0	22	0	1	0	1	0
City. Gov't.	12	1	21	3	5	14	2	8
NSB Gov't.	51	20	464	27	29	44	24	48
NSB School District	30	20	194	21	27	62	29	44
NSB CIP	0	0	4	0	2	0	1	3
Oil Industry	3	0	14	1	3	2	0	0
Private Construction	4	0	23	5	3	1	4	4
ASRC	3	0	60	5	3	1	4	3
Village Corp.	19	27	87	18	37	60	9	38
Finance	0	0	5	0	0	0	1	0
Transportation	0	0	48	0	1	3	1	1
Communication	0	0	8	0	0	0	0	0
Trade	0	1	27	0	0	2	0	1
Service	4	0	103	0	0	0	1	0
Ilkisagvik College	0	0	58	0	0	2	1	1
Other	2	3	132	3	10	25	5	18
Total	131	72	1,334	83	121	226	85	170

Notes: NSB = North Slope Borough; CIP = Capital Improvements Project; ASRC = Arctic Slope Regional Corp.

Source: NSB, Dept. of Planning and Community Service (2003)

Table 3.4.1-3 Employment Estimates (in thousands) (nonagricultural wage and salary employment)

	1995	1996	1997	1998	1999	2000	2005
Anchorage-MatSu Region	131	132	135	141	144	148	157
Kenai Peninsula Borough	16	16	16	17	17	17	16
Fairbanks North Star Borough	31	31	32	33	33	34	36
Total for three areas	176	179	183	191	194	189	209
Alaska Total	**261**	**262**	**269**	**275**	**278**	**284**	**292**

Source: State of Alaska, Dept. of Labor and Workforce Dev., Research and Analysis Section

Table 3.4.2-1 Subsistence Resources Used in Point Lay, Wainwright, Barrow, Atqasuk, and Nuiqsut (English, Inupiaq, and Scientific Names)

Resource	Inupiaq Name	Scientific Name	PL[1]	W[2]	B[3]	K[4]	N[5]
Marine Mammals							
Bearded seal	Ugruk	*Erignathus barbatus*	X	X	X	X	X
Ringed seal	Natchiq	*Phoca hispida*	X	X	X	X	X
Spotted seal	Qasigiaq	*Phoca largha*	X	X	X	X	X
Ribbon seal	Qaigulik	*Phoca fasciata*	X	X	X	X	—
Beluga whale	Quilalugaq	*Delphinapterus leucas*	X	X	X	X	—
Bowhead whale	Agviq	*Balaena mysticetus*	X	X	X	X	X
Polar bear	Nanuq	*Ursus maritimus*	X	X	X	X	X
Walrus	Aiviq	*Odobenus rosmarus*	X	X	X	X	—
Terrestrial Mammals							
Caribou	Tuttu	*Rangifer tarandus*	X	X	X	X	X
Moose	Tuttuvak	*Alces alces*	—	X	X	X	X
Brown bear	Aklaq	*Ursus arctos*	X	X	X	X	X
Dall sheep	Imnaiq	*Ovis dalli*	—	X	X	X	X
Muskox	Uminmaq	*Ovibus moschatus*	—	X	—	X	X
Arctic fox (blue)	Tigiganniaq	*Alopex lagopus*	X	X	X	X	X
Red fox[6]	Kayuqtuq	*Vulpes fulva*	X	X	X	X	X
Porcupine	Qinagluk	*Erethizon dorsatum*	—	X	X	—	—
Ground squirrel	Siksrik	*Spermophilus parryii*	X	X	X	X	X
Wolverine	Qavvik	*Gulo gulo*	X	X	X	X	X
Weasel	Itigiaq	*Mustela erminea*	—	X	—	X	X
Wolf	Amaguk	*Canis lupus*	X	X	X	X	X
Marmot	Siksrikpak	*Marmota broweri*	X	X	—	X	X
Fish							
Salmon (ns)	——	——	X	X	X	X	X
Chum	Iqalugruaq	*Oncorhynchus keta*	X	X	X		X
Pink (humpback)	Amaqtuuq	*O. gorbuscha*	—	X	X	X	X
Silver (coho)	Iqalugruaq	*O. kisutch*	—	—	—	—[7]	—
King (chinook)		*O. tshawytscha*	—	—	—	—	—
Sockeye (red)		*O. nerka*	—	—	—	—	—
Whitefish (ns)	Aanaakliq	*Coregonus sp.*	—	X	X	X	—
Round whitefish	Aanaakliq	*Prosopium cylindraceum*	—	X	X	—	—
Broad whitefish	Aanaakliq	*Coregonus nasus*	—	X	X	X	X
Humpbackwhitefish	Pikuktuuq	*C. clupeaformis*	—	X	X	X	X
Least cisco	Iqalusaaq	*C. sardinella*	—	X	X	X	X
Bering Arctic cisco	Qaaktaq	*C. autumnalis*	X	X	X	X	X
Other Freshwater Fish							
Arctic grayling	Sulukpaugaq	*Thymallus arcticus*	X	X	X	X	X
Arctic char	Iqalukpik	*Salvelinus alpinus*	X	X	X	X	X
Burbot (ling cod)	Tittaaliq	*Lota lota*	—	X	X	X	X
Lake trout	Iqaluaqpak	*Salvelinus namaycush*	—	X	X	X	X
Northern pike	Siulik	*Esox lucius*	—	X	X	—	—
Other coastal fish	——	——	—	—	—	—	—
Capelin	Pagmaksraq	*Mallotus villosus*	—	—	—	—	—
Rainbow smelt	Ilhuagniq	*Osmerus mordax*	X	X	X	—	X
Arctic cod	Iqalugaq	*Boreogadus saida*	—	X	X	X	X
Tomcod	Uugaq	*Eleginus gracilis*	X	X	X	X	—
Flounder	Nataagnaq	*Liopsetta glacialis*	—	—	—	—	—

Table 3.4.2-1 Subsistence Resources Used in Point Lay, Wainwright, Barrow, Atqasuk, and Nuiqsut (English, Inupiaq, and Scientific Names) (cont'd.)

Resource	Inupiaq Name	Scientific Name					
			PL[1]	W[2]	B[3]	K[4]	N[5]
Birds							
Snowy owl	Ukpik	*Nyctea scandiaca*	—	X	—	—	X
Red-throated loon	Qaqsraupiagruk	*Gavia stellata*	X	X	X	—	—
Tundra swan	Qugruk	*Cygnus columbianus*	—	X	—	X	X
Eider	——	——	—	—	—	—	—
Common eider	Amauligruaq	*Somateria mollissima*	X	X	X	X	X
King eider	Qinalik	*Somateria spectabilis*	X	X	X	X	X
Spectacled eider	Tuutalluk	*Somateria fischeri*	X	X	X	—	—
Steller's eider	Igniqauqtuq	*Polysticta stelleri*	X	X	X	—	—
Other ducks (ns)	Qaugak	——	—	X	X	X	—
Pintail	Kurugaq	*Anas acuta*	X	X	—	X	—
Long-tailed duck	Aaqhaaliq	*Clangula hyemalis*	X	X	X	X	—
Surf scoter	Aviluktuk	*Melanitta perspicillata*	—	X	X	—	—
Geese	——	——	—	—	—	—	—
Brant	Niglingaq	*Branta bernicla n.*	X	X	X	X	X
White-fronted goose	Niglivialuk	*Anser albifrons*	X	X	X	X	X
Snow goose	Kanuq	*Chen caerulescens*	X	X	X	X	X
Canada goose	Iqsragutilik	*Branta canadensis*	X	X	X	X	X
Ptarmigan (ns)	Aqargiq	*Lagopus sp.*	—	X	X	X	X
Willow ptarmigan	Nasaullik	*L. lagopus*	X	X	X	—	—
Other Resources							
Berries (ns)	——	——	X	X	X	X	X
Blueberry	Asiaq	*Vaccinium uliginosum*	X	X	X	—	—
Cranberry	Kimminnaq	*V. vitisidaea*	—	X	X	—	—
Salmonberry	Aqpik	*Rubus spectabilis*	—	X	X	—	—
Bird eggs (ns)	Mannik	——	X	X	X	X	—
Gull eggs	——	——	—	X	—	X	—
Goose eggs	——	——	—	X	—	X	—
Eider eggs	——	——	—	X	X	X	—
Greens/roots (ns)	——	——	—	X	X	X	X
Wild rhubarb	Qunulliq	*Oxyric digyna*	—	X	X	—	—
Wild chives	Quagaq	*Allium schoenoprasum*	—	X	X	—	—
Clams	Imaniq	——	X	X	X	—	—
Crab	Puyyugiaq	——	X	X	—	X	X
Wood	——	——	—	—	—	X	X
Freshwater	Imiq	——	—	X	X	—	—
Freshwater Ice	Sikutaq	——	—	X	X	—	—
Sea ice	Siku	——	—	X	X	—	—

Notes:
[1]Point Lay resources used, 1987;
[2]Wainwright resources used, 1987-1990
[3]Barrow resources used, 1987-1990
[4]Atqasuk resources used, 1992-1993
[5]Nuiqsut resources used, 1993
[6]Red fox (Cross, Silver)
[7]Harvest of silver, king, and sockeye salmon is rare

ns. = onspecified
— = not available or not applicable

An unchecked box might mean a resource was not used or, especially in the case of "Other Resources," the resource might have been used but use was reported as "berries" rather than "blueberries," for example.
Sources: S.R. Braund and Assocs. and UAA, ISER (1993a,b); Pedersen (1995a); S.R. Braund and Assocs. (1996)

Table 3.4.2-2 Proportion of Iñupiat Household Food Obtained from Subsistence Activities, 1977, 1988, 1993, 1998

All Surveyed Households in the North Slope Borough				
Proportion	**1977**	**1988**	**1993**	**1988**
None	13	20	18	2
Less than half	42	31	25	29
Half	15	14	15	22
More than half	30	35	42	47

Source: North Slope Borough (1999)

Table 3.4.2-3 Kaktovik 1992 Subsistence-Harvest Summary for Marine Mammals, Terrestrial Mammals, Fish, and Birds

	Edible Pounds Harvested			
	Total Number Harvested	Total	Household Harvest Mean	Per Capita
Marine Mammals				
Total marine mammals	—	115,645	1,835.64	599.13
Bowhead whale	—	108,160	1,716.82	560.35
Beluga whale	0	0	0.00	0.00
Walrus	47*	52	0.81	0.27
Polar bear	3	1,330	21.10	6.89
Bearded seal	24*	4,246	67.40	22.00
Ringed seal	42	1,689	26.80	8.75
Spotted seal	4*	169	2.68	0.88
Terrestrial Mammals				
Total large land mammals	212	28,705	455.63	148.71
Brown bear	0	0	0.00	0.00
Caribou	158	19,136	303.74	99.14
Moose	4	2,011	31.91	10.42
Muskox	5	3,179	50.46	16.47
Dall sheep	44	4,379	69.51	22.69
Total small land mammals/furbearers	213	162	2.56	0.84
Arctic fox	36**	0	0.00	0.00
Red fox	11**	0	0.00	0.00
Marmot	21	107	1.70	0.55
Mink	0	0	0.00	0.00
Parka squirrel	133	54	0.86	0.28
Weasel	0	0	0.00	0.00
Wolf	3**	0	0.00	0.00
Wolverine	9**	0	0.00	0.00
Fish				
Total fish	18,468	22,952	364.32	118.91
Total salmon	50	105	1.66	0.54
Total nonsalmon	18,415	22,847	362.65	118.37
Smelt	—	—	—	—
Cod	3,673	300	4.76	1.55
Burbot	—	—	—	—
Char	5.741	16.337	259.31	84.64
Grayling	176	158	2.50	0.82
Total Whitefish	8,823	6,051	96.04	31.35
Cisco	8,809	6,027	95.66	31.22
Bering cisco	8,103	5,672	90.03	29.39
Least cisco	697	349	5.53	1.81
Birds				
Total birds and eggs	1,796	3,249	51.56	16.83
Total Migratory birds	970	2,702	42.88	14.00
Ducks	369	553	8.77	2.86
Eiders	248	372	5.90	1.93
Long-tailed ducks	106	159	2.52	0.82
Geese	601	2,135	33.89	11.06
Brant	378	1,134	18.00	5.87
Canada Goose	164	736	11.68	3.81
White-fronted goose	50	223	3.54	1.16
Swan	1	13	0.21	0.07
Ptarmigan	769	539	8.54	2.79
Bird eggs	56	8	0.13	0.04

Notes: Of 91 households, 62 participated in the survey.
Source: ADF&G (1995b) **Footnotes:** *some not eaten; **not eaten

Table 3.4.2-4 Number of Surveyed Households in Kaktovik in Each of Four Seasons, December 1994 to November 1995

Activity Code Reported	Number of Surveyed Households in Each Surveyed Season			
	Winter	Spring	Summer	Fall
	12/1/94-3/31/95	4/1/95-6/30/95	7/1/95-9/30/95	10/1/95-11/30/95
Harvest	17	22	42	13
Attempted Harvest but Not Successful	7	3	2	13
Did Not Attempt to Harvest	48	40	24	41
Out Hunting	0	0	1	0
Out of Town	1	7	2	3
Could Not Contact	0	0	1	0
Did Not Want to be Interviewed	0	0	0	0
Other (any activity not mentioned above)	0	1	1	0
Total	73	73	73	70

Source: ADF&G (1995b)

Table 3.4.2-5 Kaktovik Subsistence Harvest by Month (total number taken), December 1994 to November 1995*

	1994	1995												Reported for All Survey Sessions
	Fall	Winter			Spring			Summer			Fall			
Harvest Items	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Unk.*	
Dolly Varden	100	0	0	2	160	0	16	708	748	0	7	124	10	1,875
Arctic cisco	0	0	0	0	0	0	0	1,128	1,230	0	0	0	0	2,358
Arctic cod	0	0	0	0	0	0	0	40	0	0	0	0	0	40
Arctic flounder	0	0	0	0	0	0	0	13	0	0	0	0	0	13
Chum salmon	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Grayling	2	0	0	0	1	0	0	0	0	0	0	1	0	4
Sculpin	0	0	0	0	0	0	0	60	75	0	0	0	0	135
Bowhead whale	0	0	0	0	0	0	0	0	0	3	0	0	0	3
Beluga whale	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Polar bear	1	0	0	0	0	1	0	0	0	0	0	0	0	2
Bearded seal	0	0	0	0	0	0	0	18	3	0	0	0	0	21
Ringed seal	0	0	0	0	0	5	3	5	1	2	0	0	0	16
Spotted seal	0	0	0	0	0	0	0	0	2	1	0	0	0	3
Brown bear	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Moose	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Muskox	0	0	0	4	0	0	0	0	0	0	4	1	0	9
Caribou	9	5	1	0	2	0	0	50	5	3	3	0	0	78
Dall sheep	7	0	5	3	0	0	0	0	0	0	0	11	0	30
Wolf	1	1	1	2	2	0	0	0	0	0	0	1	0	8
Wolverine	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Arctic fox	0	0	0	0	0	0	0	0	0	0	0	0	5	5
Ground squirrel	0	0	0	0	30	0	0	0	0	0	0	0	15	45
Goose unidentified	0	0	0	0	0	1	8	0	4	0	0	0	0	13
Canada goose	0	0	0	0	0	0	18	0	0	1	0	0	0	19
Snow goose	0	0	0	0	0	0	1	1	0	0	0	0	0	2
Brant	0	0	0	0	0	0	207	3	29	0	0	0	0	239
King eider	0	0	0	0	0	0	39	2	6	0	0	0	0	47
Common eider	0	0	0	0	0	0	21	27	10	0	0	0	0	64
Common loon	0	0	0	0	0	0	1	1	0	0	0	0	0	2
Long-tailed duck	0	0	0	0	0	0	10	2	13	0	0	0	0	25
Ptarmigan	25	25	0	0	20	0	15	0	0	10	14	10	0	119
Grand Total	146	31	8	11	216	13	339	2,058	2,127	21	32	148	30	5,180

Note:
*During this 12-month period, 31 different harvest items were taken. **Unk = unknown month (included in total).

Source: Brower, Olemaun, and Hepa (2000)

Table 3.4.2-6 Annual Polar Bear Harvest for Barrow, Nuiqsut, Wainwright, Point Lay, Point Hope, and Kivalina, 1983-2005

Harvest Season*	Number of Bears					
	Barrow	Nuiqsut	Wainwright	Point Lay	Point Hope	Kivalina
1983/1984	27	0	34	8	30	3
1984/1985	33	1	18	0	18	3
1985/1986	14	4	8	6	17	2
1986/1987	18	2	13	4	13	1
1987/1988	15	4	9	2	9	5
1988/1989	29	4	14	2	9	1
1989/1990	14	0	9	1	23	5
1990/1991	14	0	6	3	18	3
1991/1992	22	2	3	0	9	2
1992/1993	26	0	8	3	17	1
1993/1994	30	4	19	1	8	1
1994/1995	11	1	7	1	20	2
1995/1996	18	1	14	1	7	0
1996/1997	40	0	9	6	14	0
1997/1998	18	2	6	3	12	0
1998/1999**	16	3	2	0	18	3
1999/2000	17	7	5	4	10	0
2000/2001	28	5	10	1	15	1
2001/2002	25	3	2	1	9	0
2002/2003	20	3	5	1	12	1
2003/2004	10	2	13	3	10	0
2004/2005	2	2	5	4	9	2

Notes:
*Harvest runs from July 1 to June 20.
**Atqasuk harvested 2 bears during the 1988-1989 season.

Sources: Amstrup and Garner (1995); Schliebe (2006).

Table 3.4.2-7 Nuiqsut 1993 Subsistence-Harvest Summary

	Edible Pounds Harvested			
	Total Number Harvested	Total	Household Harvest Mean	Per Capita
Marine Mammals				
Total Marine Mammals	113	85,216	936.44	236.01
Bowhead whale	3	76,906	845.12	213.00
Polar bear	1*	0	0.00	0.00
Bearded seal	6	1,033	11.35	2.88
Ringed seal	98	7,277	79.96	20.15
Spotted seal	4*	0	0.00	0.00
Terrestrial Mammals				
Total Large Land Mammals	691	87,306	959.40	241.80
Brown bear	10*	734	8.06	2.03
Caribou	672	82,169	902.95	227.57
Moose	9	4,403	48.38	12.19
Muskox	0	0	0.00	0.00
Dall sheep	0	0	0.00	0.00
Total Small Land Mammals/Furbearers	599**	84	0.92	0.23
Arctic fox	203	0	0.00	0.00
Red fox	63	0	0.00	0.00
Marmot	0	0	0.00	0.00
Mink	0	0	0.00	0.00
Parka squirrel	336	84	0.92	0.23
Weasel	10	0	0.00	0.00
Wolf	31	0	0.00	0.00
Wolverine	19	0	0.00	0.00
Fishes				
Total Fish	71,897	90,490	994.39	250.62
Total Salmon	272	1,009	11.08	2.79
Total Nonsalmon	71,626	89,481	983.30	247.83
Smelt	304	42	0.46	0.12
Cod	62	7	0.07	0.02
Burbot	1,416	5,949	65.37	16.48
Char	618	1,748	19.20	4,84
Grayling	4,515	4,063	44.65	``.15
Total Whitefish	64,711	77,671	853.53	215.12
Cisco	51,791	34,943	383.98	96.78
Arctic cisco	45,237	31,666	347.97	87.70
Least cisco	6,553	3,277	36.00	9.08
Birds				
Total Birds and Eggs	3,558	4,325	47.53	11.98
Total Migratory Birds	2,238	3,540	38.90	9.80
Ducks	772	1,152	12.66	3.19
Eiders	662	1,059	11.63	2.93
Geese	1,459	2,314	25.43	6.41
Brant	296	356	3.91	0.99
Canada goose	691	830	9.11	2.30
White-fronted goose	455	1,092	12.00	3.02
Swan	7	73	0.80	0.20
Ptarmigan	973	681	7.48	1.89

Notes:
*not eaten
**some not eaten
Of 91 households, 62 participated in the survey.

Source: ADF&G (1995b)

Table 3.4.2-8 Nuiqsut Subsistence Harvest by Month, July 1994 to June 1995

Item	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Total 71 HHs	Est. Total 83 HHs
Arctic char	0	8	0	0	0	0	0	0	0	0	0	0	8	8
Arctic cisco*	0	0	37	5,737	2,400	1,050	262	0	0	0	0	0	9,486	9,842
Broad whitefish	1,535	25	75	855	500	0	0	0	0	0	0	130	3,210	3,237
Burbot	0	0	0	9	76	3	0	0	0	0	0	0	88	91
Fish Unidentified	0	0	0	0	0	0	0	0	0	0	0	75	75	78
Grayling	0	24	225	110	84	0	0	0	0	0	0	2	445	462
Humpback salmon	10	0	0	0	0	0	0	0	0	0	0	0	10	10
Humpback whitefish*	0	0	0	150	25	0	0	0	0	0	0	0	175	182
Least cisco	0	0	0	0	0	750	0	0	0	0	0	0	750	778
Northern pike	0	0	0	0	0	0	0	0	0	0	0	18	18	19
Whitefish unidentified	0	0	0	50	425	0	0	0	0	0	0	0	475	493
Caribou	63	32	6	80	13	4	9	5	13	7	2	15	249	258
Moose	1	1	1	1	0	0	1	0	0	0	0	0	5	5
Wolf	0	0	0	0	1	1	3	0	12	1	0	0	18	19
Wolverine	0	0	0	0	1	1	2	1	1	2	0	0	8	8
Arctic fox	0	0	0	0	0	1	1	1	3	0	0	0	6	6
Fox unidentified	0	0	0	0	4	0	0	0	0	0	0	0	4	4
Red fox	0	0	0	0	0	1	1	1	1	1	0	0	5	5
Polar bear	0	0	0	0	1	0	0	0	0	0	0	0	1	1
Tundra swan	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Goose unidentified	0	0	0	0	0	0	0	0	0	0	409	48	457	474
Eider unidentified	0	0	0	0	0	0	0	0	0	0	50	40	90	93
Ptarmigan	0	0	0	0	0	0	0	0	0	33	23	0	56	58
Sandhill crane	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Ringed seal	2	10	0	0	0	0	0	0	0	6	0	5	23	24
Salmonberries**	0	9	0	0	0	0	0	0	0	0	0	0	9	9
Cranberries*	0	0.5		0	0	0	0	0	0	0	0	0	0.5	1
Blueberries*	0	2.5		0	0	0	0	0	0	0	0	0	2.5	1
Blackberries*	0	0.5		0	0	0	0	0	0	0	0	0	0.5	1

Notes:
HH = households
*The harvest of arctic cisco and humpback whitefish is under-represented; one household provided evidence of a significant but unquantifiable harvest by saying that “sled loads” were harvested “every couple of days during October and November.”
**gallons

Sources: Brower and Opie (1997); Brower and Hepa (1998)

Table 3.4.2-9 Annual Bowhead Whale Subsistence Harvest for Beaufort and Chukchi Sea Villages 1982-2005 (Kaktovik, Nuiqsut, Barrow, Wainwright, Point Hope, Kivalina)

Year	Kaktovik	Nuiqsut	Barrow	Wainwright	Point Hope	Kivalina
1982	1	1	0	2	1	0
1983	1	0	2	2	1	0
1984	1	0	4	2	2	1
1985	0	0	5	2	1	0
1986	3	1	8	3	2	0
1987	0	1	7	4	5	1
1988	1	0	11	4	5	0
1989	3	2	10	2	0	0
1990	2	0	11	5	3	0
1991	2	1	12	4	6	1
1992	3	2	22	0	2	1
1993	3	3	23	5	2	0
1994	3	0	16	4	5	2
1995	4	4	19	5	1	1
1996	1	2	24	3	3	0
1997	4	3	30	3	4	0
1998	3	4	25	3	3	0
1999	3	3	24	5	2	0
2000	3	4	18	5	3	0
2001	4	3	27	6	4	0
2002	3	4	22	1	0	0
2003	3	4	16	5	4	0
2004	3	3	21	4	3	0
2005	3	1	29	3	7	0

Sources: S.R. Braund and Assocs. (1984, 2002); Stoker and Krupnik (1993); AEWC (1993, 1995); Philo et al. (1994); Suydam et al. (1995); S.R. Braund and Assocs. and North Slope Borough (2006)

Table 3.4.2-10 Annual Beluga Whale Harvest for Barrow, Wainwright, Point Lay, Point Hope, and Kivalina, 1980-2006

Year	Number of Whales				
	Barrow	Wainwright	Point Lay	Point Hope	Kivalina
1980	0	0	15-16	23-35	3-5
1981	5	0	29-38	4-7	10-15
1982	3-5	0	28-33	17	4-5
1983	3	0	18	20-31	24
1984	0	0	0	30	27
1985	0	0	18	30	120-200
1986	0	5	33	30	7
1987	0	47	22-35	40	4
1988	0	3	40	59	6
1989	1	0	16	17	0
1990	0	0	62	16	1
1991	1	5	35	39	1
1992	0	20	24	15	10
1993	2	0	77	79	3
1994	5	0	56	53	3
1995	0	0	31	40	3
1996	2	0	41	15	7
1997	8	4	3	32	1
1998	1	38	48	52	0
1999	1	3	47	33	1
2000	1	0	0	16	44
2001	1	23	34	24	0
2002	1	37	47	23	3
2003	2	38	36	34	0
2004	1	0	53	29	1
2006	7	1	41	?	2

Sources: Alaska Beluga Whale Committee (2002, 2006); Fuller and George (1997); Lowry, Burns, and Frost (1989); Burns and Frost (1989); Impact Assessment, Inc. (1989); Burns and Seaman (1986); Braund and Burnham (1984)

Table 3.4.2-11 Annual Walrus Harvest for Barrow, Wainwright, Point Lay, Point Hope, and Kivalina 1985-2005

Harvest Season	Number of Walruses				
	Barrow	Wainwright	Point Lay	Point Hope	Kivalina
1985	—	—	—	—	—
1986	—	—	—		—
1987	54	—	6	—	—
1988	1-62	0-59	0	—	—
1989	14	43	0	2	46
1990	7	0	0	5	0
1991	23	32	0	0	0
1992	26	48	0	5	1
1993	27	44	1	5	12
1994	16	68	1	6	16
1995	12	83	4	0	38
1996	13	24	4	0	13
1997	48	50	0	3	2
1998	24	69	7	5	0
1999	17	48	8	5	0
2000	19	36	6	6	0
2001	37	94	3	2	0
2002	39	119	11	16	0
2003	51	29	9	12	0
2004	52	47	5	20	0
2005	5	21	5	0	4

Sources: USDOI, FWS (1997, 2002, Tagging Database, 1989-2005); Braund (1993); Braund and Burnham (1984); ADF&G (1996); Fuller and George (1997)

Table 3.4.2-12 Species Harvested by Barrow Residents, 1987-1990

Species	Year 1	Year 2	Year 3	3-Year Average
Bowhead whale	7	11	10	9
Walrus	84	61	101	81
Bearded seal	236	179	109	174
Ringed seal	466	388	328	394
Spotted seal	2	4	4	3
Polar bear	12	11	39	21
Beluga whale	0	0	0	0
Caribou	1,595	1,533	1,656	1,595
Moose	52	53	40	48
Dall sheep	12	12	9	11
Brown bear	1	1	0	1
Porcupine	5	0	0	2
Ground squirrel	24	0	17	14
Wolverine	4	2	1	2
Arctic fox	192	146	48	129
Red fox	8	4	2	5
Wolf	0	0	0	0
Ermine	0	0	0	0
Whitefish	27,366	20,628	38,053	28,683
Nonspecified	5,108	173	0	1,760
Round	2,122	721	16	953
Broad-river and lake	10,579	11,431	30,047	17,352
Humpback	1,225	647	3,648	1,840
Least cisco	7,024	7,505	2,929	5,819
Arctic cisco	1,309	151	1,413	958
Grayling	12,664	8,684	8,392	9,914
Arctic char	38	76	135	83
Burbot	1,086	392	550	676
Lake trout	153	72	216	147
Northern pike	2	0	10	4
Salmon	196	80	2,089	788
Nonspecified	66	3	439	169
Chum	11	5	529	182
Pink	12	1	261	92
Silver	103	70	828	334
King	4	1	31	12
Capelin	3,960	0	346	1,435
Rainbow smelt	97	0	1,480	526
Arctic cod	0	7,945	17,018	8,321
Arctic flounder	0	0	0	0
Tomcod	0	194	0	65
Sculpin	0	11	0	4
Geese	2,873	3,334	3,943	3,384
Nonspecified	329	69	34	144
Brant	127	221	973	440
White-fronted	2,417	3,035	2,932	2,795
Snow	0	8	4	4
Canada	0	1	1	1
Eiders	5,173	4,499	8,590	6,087
Ptarmigan	2,454	1,350	329	1,378
Other birds	79	0	9	30

Source: Adapted from S.R. Braund and Assocs. (1993)

Table 3.4.2-13 Barrow 1989 Subsistence-Harvest Summary for Marine Mammals, Terrestrial Mammals, Fish, and Birds

	Edible Pounds Harvested				
	Total Number Harvested	Total	Household Harvest Mean	Per Capita	Household Percent Participation
Marine Mammals					
Total Marine Mammals	591	508,181	542.35	168.5	45.0
Bowhead whale	10	377,647	403.04	125.21	45.0
Beluga whale	0	0	0.00	0.00	0.0
Walrus	101	77,987	83.23	25.86	13.0
Polar bear	39	19,471	20.78	6.46	4.0
Bearded seal	109	19,152	20.44	6.35	11.0
Ringed seal	328	13,774	14.70	4.57	11.0
Spotted seal	4	151	0.16	0.05	*
Terrestrial Mammals					
Total Large Land Mammals	1,705	214,676	229.11	71.18	39.0
Brown bear	0	0	0.00	0.00	0.0
Caribou	1,656	193,744	206.77	64.24	39.0
Moose	40	20,014	21.36	6.64	6.0
Muskox	0	0	0.00	0.00	0.0
Dall sheep	9	918	0.98	0.30	2.0
Total Small Land Mammals/Furbearers	68	7	0.01	0.00	2.0
Arctic fox	48**	0	0.00	0.00	*
Red fox	2**	0	0.0	0.00	*
Marmot	0	0	0.00	0.00	0.0
Mink	0	0	0.00	0.00	0.0
Parka squirrel	17	7	0.01	0.00	*
Weasel	0	0	0.00	0.00	0.0
Wolf	0	0	0.00	0.00	0.0
Wolverine	1	0	0.00	0.00	*
Fish					
Total fish	68,287	118,471	126.44	39.28	61,0
Total salmon	2,088	12,244	13.07	4.06	10.0
Total nonsalmon	66,199	106,226	113.37	35.22	13.0
Smelt	1,825	247	0.26	0.08	2.0
Cod	17,018	3,404	3.63	1.13	5.0
Burbot	550	2,202	2.35	0.73	7.0
Char	350	1,239	1.32	0.41	5.0
Grayling	8,393	6,714	7.17	2.23	9.0
Total whitefish	38,054	92,399	98.61	30.64	18.0
Broad whitefish	30,047	78,921	84.23	26.17	—
Cisco	2,929	2,929	3.13	0.97	3.0
Humpback whitefish	3,648	9,119	9.73	3.02	10.0
Birds					
Total birds and eggs	12,869	29,446	31.43	9.76	41.0
Migratory birds	12,539	29,215	31.18	9.69	37.0
Ducks	8,589	12,883	13.75	4.27	37.0
Eiders	8,585	12,877	13.74	4.27	37.0
Geese	3,944	16,289	17.38	5.40	13.0
Brant	973	2,920	3.12	0.97	4.0
Snow goose	4	19	0.02	0.01	0.0
White-fronted goose	2,932	13,193	14.08	4.37	12.0
Seabirds and loons	3	9	0.01	0.00	*
Ptarmigan	329	231	0.25	0.08	5.0
Bird eggs	——	——	——	——	——

Notes: Of 937 households, 101 participated in the survey
Footnotes: *percent harvested less than 0.1%
**not eaten
Source: ADF&G (1995b)

Table 3.4.2-14 Atqasuk 1988 Subsistence Participation Levels by Household[1]

Household Ethnicity and Household Harvest	Level of Subsistence Participation[2]			
	Minimal	Moderate	Active	All Households
Inupiat	26,250	17,500	30,556	——
Non-Inupiat	85,000	57,500	45,000	——
All households	43,529	27,500	32,000	36,431
Cases	17	4	20	41
Average Household Size (number of persons per household)				
Inupiat	4.2	4.5	4.8	——
Non-Inupiat	3.2	2.0	2.0	——
All households	3.9	4.0	4.6	4.3
Cases	17	5	23	45
Average Meat and Fish Consumption from Own Household Subsistence (by percent)				
Inupiat	13.8	35.0	78.1	——
Non-Inupiat	6.0	25.0	75.0	——
All households	11.5	33.0	77.8	47.8
Cases	17	5	23	45
Average Meat and Fish Consumption from Other Household Subsistence (by percent)				
Inupiat	12.9	5.0	17.7	——
Non-Inupiat	0.0	0.0	0.0	——
All households	9.1	4.0	20.5	14.4
Cases	17	5	23	45
Average Meat and Fish Harvested and Given Away (by percent)				
Inupiat	5.4	10.0	18.3	——
Non-Inupiat	2.0	0.0	34.0	——
All households	4.4	8.0	20.7	13.1
Cases	17	5	23	45
Average Proportion of Household Income in Village (by percent)				
Inupiat	77.5	62.5	82.6	——
Non-Inupiat	13.0	25.0	65.0	——
All households	58.5	55.0	81.1	69.7
Cases	17	5	23	45

Notes:
[1]Total available households = 55
[2]Degree of subsistence participation based on how much meat and fish consumed from own household subsistence activity. Levels of subsistence defined as:
Minimal = under 20% meat and fish from own household subsistence
Moderate = 20-40% meat and fish from own household subsistence
Active = over 40% meat and fish from own household subsistence

Source: Adapted from Impact Assessment, Inc. (1990b)

Table 3.4.2-15 Atqasuk Subsistence Harvest by Month, July 1994 to June 1995

Subsistence Resource	Numbers of Animals Harvested												Total	Est. Total
	1994						1995							
	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	51 HHs	56 HHs
Arcti-c char	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Arctic cisco	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Broad whitefish	0	100	1,050	130	0	0	0	0	0	0	0	350	1,630	1,790
Burbot	0	0	10	130	22	0	0	0	0	0	0	0	163	175
Rainbow trout	0	0	0	15	0	0	0	0	0	0	0	0	15	16
Grayling	100	850	2,078	2,463	225	0	0	0	0	0	0	0	5,716	6,276
Silver salmon	0	0	0	10	0	0	0	0	0	0	0	0	10	11
Humpback whitefish	0	13	150	1122	150	0	0	0	0	0	0	75	500	549
Least cisco	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Northern pike	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Whitefish unidentified	0	88	100	1,087	125	0	0	0	0	0	0	0	1,400	1,537
Caribou	31	43	43	25	22	7	1	9	2	0	3	1	187	205
Moose	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Wolf	0	0	0	1	0	0	0	0	1	0	0	0	2	2
Wolverine	0	0	0	0	3	0	0	4	3	0	0	0	19	11
Arctic fox	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Geese unidentified	0	0	0	0	0	0	0	0	0	0	168	0	168	184
Eider unidentified	0	0	0	0	0	0	0	0	0	0	12	0	12	13
White-fronted goose	0	0	0	0	0	0	00	0	0	0	76	0	76	83
Canada goose	0	0	0	0	0	0	0	0	0	0	2	0	2	2
Brant	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Ptarmigan	0	0	0	0	0	0	0	0	0	0	16	0	16	18
Ringed seal	4	0	0	0	0	0	0	0	0	0	0	0	4	4
Bearded seal	40	0	0	0	0	0	0	0	0	0	0	0	4	4
Salmonberries*	0	72	0	0	0	0	0	0	0	0	0	0	72	79
Cranberries*	0	0	0	0	0	0	0	0	0	0	0	0	—	—
Blueberries*	2	0	10	0	0	0	0	0	0	0	0	0	12	13

Notes: *in gallons
Source: Opie, Brower, and Bates (1997)

Table 3.4.2-16 Wainwright 1989 Subsistence-Harvest Summary for Marine Mammals, Terrestrial Mammals, Fish, and Birds

Subsistence Resource	Total Number Harvested	Edible Pounds Harvested			Household Participation [1]by Percent
		Total (in pounds)	Household Harvest (Mean Pounds)	Per Capita (In Pounds)	
Marine Mammals					
Total marine mammals	——[2]	243,595	2,047.01	520.50	78.0
Bowhead whale	2	102,132	858.25	218.23	66.0
Pacific walrus	153	118,370	994.71	252.93	37.0
Polar bear	12	5,952	50.02	12.72	8.0
Bearded seal	74	13,025	109.45	27.83	34.0
Ringed seal	86	3,612	30.35	7.72	28.0
Spotted seal	12	505	4.24	1.08	6.0
Terrestrial Mammals					
Total Large land mammals	713	83,387	700.73	178.18	66.0
Brown bear	2	200	1.68	0.43	2.0
Caribou	711	83,387	699.05	177.75	66.0
Total Small land mammals/furbearers	47	2	0.02	0.00	——
Arctic fox	8[3]	0	0.00	0.00	6.0
Red fox	22[3]	0	0.00	0.00	2.0
Land otter	1[3]	0	0.00	0.00	1.0
Parka squirrel	7	2	0.02	0.00	1.0
Weasel	9[3]	0	0.00	0.00	4
Wolf	2[3]	0	0.00	0.00	2.0
Wolverine	7[3]	0	0.00	0.00	2.0
Fish					
Total fish	64,567	17,385	146.09	37.15	62.0
Total salmon	180	1,044	8.77	2.23	7.0
Chum salmon	68	415	3.49	0.89	4.0
Chum salmon (other gear)	51	306	2.57	0.65	5.0
Chinook salmon	9	162	1.36	0.35	4.0
Pink salmon	52	161	1.35	0.34	4.0
Total nonsalmon	64,387	16,341	137.32	34.92	——
Rainbow smelt	54,083	6,490	54.54	13.87	53.0
Pacific tomcod	134	134	1.13	0.29	1.0
Flounder	4	2	0.02	0.00	3.0
Sculpin	7	5	0.04	0.01	2.0
Burbot	51	203	2.35	0.73	10.0
Grayling	3,006	2,405	20.21	5.14	28.0
Total whitefish	7,102	7,102	59.68	15.18	23.0
Cisco	7,102	7.102	59.68	15.18	——
Bering cisco	426	426	3.58	0.91	3.0
Least cisco	6,676	6,676	56.10	14.26	22.0
Birds					
Total birds and eggs	2,735	7,211	60.60	15.41	57.0
Migratory birds	2,539	7,075	59.45	15.12	——
Ducks	1,099	1,648	13.85	3.52	48.0
Eider	1,097	1,646	13.83	3.52	48.0
Common eider	29	44	1.37	0.09	7.0
King eider	816	1,225	10.29	2.62	36.0
Spectacled eider	246	369	3.10	0.79	26.0
Steller's eider	3	5	0.04	0.01	3.0
Unknown eider	3	5	0.04	0.01	1.0

Table 3.4.2-16 Wainwright 1989 Subsistence-Harvest Summary for Marine Mammals, Terrestrial Mammals, Fish, and Birds (cont'd.)

Subsistence Resource	Total Number Harvested	Edible Pounds Harvested			Household Participation (by percent)
		Total (in pounds)	Household Harvest (mean pounds)	Per Capita (in pounds)	
Long-tailed duck	2	4	0.03	0.01	1.0
Geese	1,439	5,425	45.59	11.59	45.0
Brant	700	2,100	17.65	4.49	36.0
Canada goose	2	10	0.08	0.02	1.0
Snow goose	7	31	0.26	0.07	4.0
White-fronted goose	730	3,286	27.61	7.02	29.0
Seabirds and loons	1	4	0.03	0.01	1.0
Ptarmigan	196	137	1.15	0.29	15.0

Notes:
[1]Percentage of households participating in subsistence harvest
[2]Not calculated in report
[3]Not eaten
All 119 households in the community participated in the survey.
—— = Data not available

Source: ADF&G (1995b, 1996)

Table 3.4.2-17 Point Lay 1997 Subsistence-Harvest Summary for Marine Mammals, Terrestrial Mammals, Fish, and Birds

Subsistence Resource	Number Harvested	Edible Pounds Harvested			Household Participation (by percent)[2]
		Total (in pounds)[1]	Household Harvest (mean pounds)	Per Capita (in pounds)	
Marine Mammals					
Total marine mammals	——[3]	76,853	1,787.27	637.41	79.6
Beluga whale	——	64,929[4]	1,509.98	538.52	74.0
Pacific walrus	6	4,603	107.04	38.18	19.0
Polar bear	1	661	15.38	5.48	3.1
Bearded seal	13	2,341	54.44	19.42	26.7
Ringed seal	49	2,078	48.32	17.23	27.0
Spotted seal	53	2,241	52.12	18.59	29.2
Terrestrial Mammals					
Total Large Land mammals	167	21,309	495.56	176.74	71.9
Brown bear4	4	4.27	9.92	3.54	9;9
Caribou	157	18,418	428.33	152.76	71.8
Moose	5	2,464	57.31	20.44	15.6
Small Land Mammals/Furbearers					
Arctic fox	0	0	0.00	0.00	0.0
Red fox	0	0	0.00	0.00	0.0
Marmot	0	0	0.00	0.00	0.0
Parka squirrel	285	117	2.72	0.97	22.7
Weasel	0	0	0.00	0.00	0.0
Wolf	0	0	0.00	0.00	0.0
Wolverine	7[4]	0	0.00	0.00	6.5
Fish					
Total Fish	2,807	2,983	69.38	24.74	49.1
Total Salmon	147	425	9.88	3.52	26.4
Chum salmon	40	242	5.64	2.01	19.5
Pink salmon	107	182	4.24	1.51	16.4
Total nonsalmon	2,660	2,559	59.50	21.22	49.1
Herring	27	5	0.11	0.04	3.1
Smelt	265	37	0.86	0.31	6.8
Flounder	192	96	2.35	0.73	7.0
Arctic char	167	552	12.83	4.58	23.3
Grayling	1,985	1,786	41.54	14.81	36.6
Broad whitefish	24	83	1.92	0.69	5.6
Birds					
Total Birds and Eggs	3,531	5,836	135.73	48.40	77.4
Migratory Birds	1,871	5,327	123.88	44.18	77.4
Ducks	933	1,399	32.54	11.60	65.2
Eider	702	1,054	24.50	8.74	65.2
Long-tailed duck	221	331	7.69	2.75	19.3
Pintail	10	15	0.34	0.12	5.6

Table 3.4.2-17 Point Lay 1997 Subsistence-Harvest Summary for Marine Mammals, Terrestrial Mammals, Fish, and Birds (cont'd.)

Subsistence Resource	Number Harvested	Edible Pounds Harvested			Household Participation (in percent)[2]
		Total (in pounds)[1]	Household Harvest (mean pounds)	Per Capita (in pounds)	
Geese	3,944	15,289	17.38	5.40	13.0
Brant	499	2,096	48.73	17.38	55.9
Canada goose	435	1,826	42.46	15.14	52.8
Seabirds and loons	4	7	0.15	0.06	3.4
Murre	4	7	0.15	0.06	3.4
Ptarmigan	473	331	7.70	2.75	51.6
Eggs	1,188	178	4.14	1.48	54.2

Notes:
[1]Household harvests were unknown but were estimated from the known community harvest. This Introduces an artificially high variance into the total pounds statistics.
[2]Percentage of households participating in subsistence harvest.
[3]Not calculated in the report.
[4]Not eaten
—— = Data not available.
Of 43 households, 25 participated in the survey.

Source: ADF&G (1995b, 1996)

Table 3.4.2-18 Point Lay 1992 Subsistence Participation Rates and Resources*

Activity	Number of Households				Percentage of Households			
	Often	Sometimes	Vacation	Not At All	Often	Sometimes	Vacation	Not At All
Fall whaling	2	2	0	36	5	5	0	90
Fish	23	13	0	4	58	33	0	1
Helped whaling crew	9	5	0	26	23	13	0	65
Hunt caribou	31	5	0	4	78	13	0	10
Hunt moose, bear, or sheep	6	13	1	20	15	33	3	50
Hunt seal	24	6	0	10	60	15	0	25
Hunt walrus	19	11	0	10	48	28	0	25
Hunt waterfowl and eggs	25	10	0	5	63	25	0	13
Make sleds or boats	12	18	0	10	30	45	0	25
Pick berries	14	11	0	15	35	28	0	63
Sew skins, make parkas	7	8	0	25	18	20	0	63
Spring whaling	7	4	0	29	18	10	0	73
Trap	4	7	0	29	10	18	0	73

Note:
*Of 58 households, 40 participated in the survey.

Source: Fuller and George (1992)

Table 3.4.2-19 Point Hope 1992 Breakdown of Total Harvest by Subsistence-Harvest Category

Subsistence-Harvest Category	Total Weight	Pounds Per Household	Pounds Per Capita
Birds	9,429	60	13
Fish	30,589	196	44
Invertebrates	88	1	0
Marine Mammals	262,009	1,680	375
Plants	2,720	17	4
Terrestrial Mammals	35,548	228	51
TOTAL	340,383	2,182	487

Source: Fuller and George (1997)

Table 3.4.2-20 Point Hope 1992 Top Five Species Harvested

Species	Edible Pounds Harvested	Number Harvested	Pounds per Household	Pounds Per Capita	Percent of Total Harvest
Beluga whale	137,172	98	879	196	40.3
Walrus	55,797	72	358	80	16.4
Bearded seal	28,242	160	181	40	8.3
Caribou	26,303	225	169	38	7.7
Bowhead whale	23,365	3	150	33	6.9

Source: Fuller and George (1997)

Table 3.4.2-21 Point Hope 1992 Participation in Subsistence-Harvest Activities*

	Number of Households				Percentage of Households			
Activity	Often	Sometimes	Vacation	Not At All	Often	Sometimes	Vacation	Not At All
Fall whaling	4	5	0	133	3	4	0	94
Fish	86	29	1	26	61	20	1	18
Helped whaling crew	92	27	2	21	65	19	1	15
Hunt caribou	71	27	1	43	50	19	1	30
Hunt moose, bear, or sheep	35	27	2	78	25	19	1	23
Hunt seal	78	29	0	35	55	20	0	25
Hunt walrus	70	33	0	39	49	23	0	27
Hunt waterfowl and eggs	81	27	1	33	57	19	1	23
Make sleds or boats	53	26	0	63	37	18	0	44
Pick berries	81	39	1	21	57	27	1	15
Sew skins, make parkas	49	35	0	58	35	25	0	41
Spring whaling	98	16	4	24	69	11	3	17
Trap	14	22	0	106	10	15	0	75

Note:
*Of 156 households, 142 participated in the survey.

Source: Fuller and George (1997)

Table 3.4.2-22 Point Hope Amount of Subsistence Food Consumed that is Harvested from Local Sources*

Amount	1998		2003	
	Number	Percent	Number	Percent
None	4	2.9	10	7.0
Very little	11	8.2	16	11.3
Less than half	23	17.2	23	16.2
Half	34	25.4	28	19.7
More than half	34	25.4	30	21.1
Nearly all	19	14.2	15	10.6
All	9	6.7	20	14.1
Total	134	100	142	100

Note:
*Results include only those households responding to the census survey and the query about the amount of subsistence harvested by the household.

Source: Fuller and George (1997)

Table 3.4.2-23 Point Hope Money Spent on Subsistence Activities*

Amount	Number	Percent
$0 to $100	27	22.5
$200 to $400	9	7.5
$500 to $700	10	8.3
$800 to $1,200	11	9.2
$1,200 to $3,000	22	18.3
$3,100 to $9,500	18	15.1
$9,600 to $20,000	1	0.8
Total	120	100%

Note:
*Results include only those households responding to the census survey and the questions.

Source: Fuller and George (1997)

Table 3.4.2-24 Kivalina Subsistence Harvests for 1964-1965, 1965-1966, 1982-1983, 1983-1984, and 1991-1992

Resource	Number Taken				
	1964-1965	1965-1966	1982-1983	1983-1984	1991-1992
Marine Mammals					
Bearded seal	153	119	134	60	139
Spotted seal	4	1	1	1	30
Ringed seal	908	467	172	109	110
Ribbon seal	NR	NR	1	NR	8
Walrus	0	3	51	4	28
Beluga	6	12	27	28	10
Bowhead whale*	0	0	0	1	1
Gray whale	0	0	0	part of carcass	0
Polar bear	NR	1	NR	2	8
Terrestrial Mammals					
Large Land Mammals					
Caribou	256	1,010	346	564	351
Moose	NR	4	6	6	17
Grizzly bear	1	2	NR	2	3
Small Land Mammals					
Fox	6	19	47	58	21
Sheep	NR	NR	2	NR	U
Wolf	1	1	NR	1	9
Wolverine	17	21	12	10	23
Lynx	NR	6	1	NR	0
Porcupine	1	1	1	NR	0
Mink	NR	1	NR	NR	2
Otter	NR	NR	1	NR	2
Hare	NR	NR	NR	NR	0
Squirrel	NR	NR	3	53	10
Fish					
Char	93,995	28,140	69,059	68,467	69,792
Cod	NR	6,955	9	4,299	6,095
Burbot	NR	2	2	2	516
Grayling	NR	40	290	968	644
Salmon	1,425	116	464	2,107	5,081
Whitefish	2,500	13	100	1,608	4,662
Sculpin	ND	ND	9	9	ND
Smelt	ND	ND	ND	20	22
Birds					
Geese	ND	ND	215	387	944
Ducks	ND	ND	134	210	609
Ptarmigan	ND	16	46	242	637
Cranes	ND	ND	4	4	12
Snowy owl	ND	ND	15	26	29
Swan	ND	ND	1	NR	0
Murres	ND	10	ND	18	ND

Notes:
*Two additional bowhead whales were taken in 1994.
NR = None reported.
ND = No data collected.

Source: NANA Regional Strategy, Community Service (1978) as cited in U.S. Army Corps of Engineers (1984a,b)

Table 3.4.2-25 Importance of Subsistence Foods to Households in the NANA Region

Response	Kivalina	Noatak	Kotzebue
"All of our food"	5.6%	——	5.6%
"Most of our food"	16.7%	57.1%	14.9%
"Half of our food"	38.9%	28.6%	16.1%
"Some of our food"	38.9%	14.3%	49.1%
"None of our food"	——	——	14.3%
Total	100.0%	100.0%	100.0%

Source: NANA Regional Strategy, Community Service (1978) as cited in U.S. Army Corps of Engineers (1984a,b)

Table 3.4.4-1 Shipwrecks in the Beaufort Sea Planning Area

Vessel Name	Type of Vessel	Tons	Date of Wreck	Location	Cause of Wreck
St. George	Whaling ship	392	8/27/1876	Between Pt. Barrow and Pt. Tangent	Caught in ice and abandoned.
Acors Barnes	Whaling bark	296	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned; later burned by Inupiaq Eskimos.
Camilla	Whaling bark	328	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
Cornelius Howland	Whaling ship	333	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
Desmond	Whaling bark	301	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
Java 2nd	Whaling bark	290	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
Marengo	Whaling ship	478	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
Onward	Whaling bark	339	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
James Allen	Whaling ship	349	9/5/1876`	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
Young Phoenix	Whaling bark	355	8/3/1888	30 mi E of Point Barrow	Lost in ice and gale; crew picked up by steam bark *Beluga* and rescued later by steamer *Bear*, 3/9/1888. Still drifting in ice 1 year later.
Reindeer	Whaling bark	340	8/4/1894	On Reindeer Island, Midway Islands	Ice came in very quickly, and ship was forced ashore. Reindeer Island (westernmost of Midway Islands) was named after this vessel. All hands were saved.
Duchess of Bedford	Expedition schooner	60	4/11/1907	Off Flaxman Island	Caught in ice and crushed.
Elvira	Gas schooner	109	9/23/1913	5 mi offshore of Humphrey Point, E of Barter Island, off Icy Reef	Crushed in ice, then lost in an autumn gale. Crew wintered aboard the whaler *Belvedere*. Capt. Pedersen walked 400 mi to Fairbanks, then traveled to San Francisco to take charge of the *Herman* for the 1914 whaling season.
Duxbury	Gas trading schooner	38	6/5/1925	½ mi NE of Cape Halkett	Caught in icefloe and crushed.
Baychimo	Trading/supply steamer	1,322	11/24/1931	Just S of Point Barrow	Caught in ice and abandoned. Vessel drifted for years in arctic ice, was sighted and was even boarded a number of times, but finally disappeared. It was officially listed as lost in 1934. After a number of years, the cargo of furs was recovered by Leslie Melvin, who sighted the hulk while traveling by dogsled. Sightings in the Beaufort Sea as late as the 1960s were reported by local Inupiat.
Unnamed	Native whaling boat	?	9/11/1988	30 mi N of Cross Island	Boat lost while whaling. Seventy people began searching. The two whalers, Burton Rexford and his son Mike, managed to make their way to a barge underway off Barrow.
Unnamed	Native whaling boat	?	9/13/1988	Off Kaktovik	Aluminum whaling boat struck ice while whaling off the village of Kaktovik in the Beaufort Sea. One crewman, Simon Tagarook, Jr., suffered head injuries and died; two others were injured.
Unnamed	Native whaling boat	?	9/28/1991	30 mi N. of Cross Island	Nuiqsut whaling captain Eli Nukapigak and his crew of four lost their whaling boat after a bowhead whale they had struck pulled their 18-foot boat underwater. The men were hauled aboard whaling boat of Nuiqsut whaling captain Frank Long, which was following close behind. No one was lost.
Unnamed	Native whaling boat	?	9/28/1991	25 mi NE of Cross Island	Captain Archie Ahkiviana and crew lost a whale and their whaling boat in rough seas while towing the whale back to Cross Island. Ahkiviana and his crew were rescued by another whaling boat in the vicinity. No one was lost.

Table 3.4.4-2 Shipwrecks in the Chukchi Sea Planning Area

Vessel Name	Type	Tons	Date Wrecked	Location	Cause of Wreck
Caulaincourt	French whaling ship	657	9/5/1861	At Point Belcher	Stove by ice; was quickly full of water and lost.
Henry Kneeland	Whaling ship	304	6/22/1864	In the Chukchi Sea	Struck an ice cake, filled instantly and lost.
Gratitude	Whaling bark	337	7/2/1865	40 mi from Cape Lisburne	Stove by ice and sank while trying to escape the C.S.S. *Shenandoah* and get into the protection of grounded ice.
Ontario	Whaling bark	489	9/27/1866	In the Chukchi Sea	Abandoned after colliding with the *Helen Mar* in a gale on 9/27/1866. With the vessel in damaged condition, the crew refused duty, and she was abandoned with 1,050 barrels of whale oil aboard.
Hae Hawaii	Whaling bark	368	9/22/1868	In the Seahorse Islands off Point Franklin	Anchors dragged in a gale; the vessel went ashore and was lost.
Eagle	Whaling bark	336	9/30/1869	On Seahorse Shoal off Point Franklin	Grounded and lost; crew rescued by the vessel *John Carver*.
Almira	Whaling ship	310	8/26/1870	Near Point Barrow	Stove by ice and lost.
Hiernia	Whaling ship	256	8/28/1870	About 2 mi SW of Point Barrow	Ice stove hole in bow and vessel ran aground. Sold at auction for $150.
Comet	Whaling brig	255	9/2/1871	Between Pooint Franklin and Seahorse Islands	Crushed between grounded floe and moving pack ice and lost.
Roman	Whaling bark	358	9/7/1871	In the Seahorse Islands off Point Franklin	Crushed between grounded floe and moving pack ice. Vessel sank less than an hour after being carried off by the ice. Crew escaped over the ice.
Awashonks	Whaling bark	380	9/8/1871	S of Wainwright Inlet	Crushed and lost after being pushed partly onto the ice. Wreck was still visible in 1872.
Julian	Whaling ship	356	9/8/1871	S of Wainwright Inlet	Crushed in ice and abandoned.
Kohola	Whaling brig	270	9/8/1871	2 mi NE of Wainwright Inlet	Abandoned after being trapped in ice. In 1872, found high and dry S of Point Belcher.
Carlotta	Whaling bark	480	9/12/1871	Point Belcher near Wainwright Inlet	Abandoned after being trapped in ice.
Fanny	Whaling bark	391	9/13/1871	6 mi S of Point Belcher, ¼ mi from shore	Abandoned after being trapped in ice and crushed.
Monticello	Whaling bark	356	9/13/1871	4 mi S of Point Belcher	Trapped in ice and abandoned. In 1872, vessel's hull was identified; bow and stern were ½ mi apart.
Champion	Whaling ship	367	9/14/1871	Point Belcher near Wainwright Inlet	Abandoned after being trapped in ice.
Concordia	Whaling bark	368	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice, abandoned, burned by Inupiaq Eskimos.
Contest	Whaling bark	341	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice and abandoned.
Elizabeth Swift	Whaling bark	327	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice and abandoned.

Table 3.4.4-2 Shipwrecks in the Chukchi Sea Planning Area (cont'd.)

Vessel Name	Type	Tons	Date Wrecked	Location	Cause of Wreck
Emily Morgan	Whaling bark	365	9/14/1871	1 mi N of Point Belcher	Abandoned after being trapped in ice and crushed. By 1872, wreck had drifted 1 mi N of Point Belcher, and in 1873, wreck was still visible.
Eugenia	Whaling bark	315	9/14/1871	Point Belcher near Wainwright Inlet	Ice snapped rudder; vessel was abandoned after it became trapped in ice. It was later crushed.
Florida	Whaling ship	470	9/14/1871	In the Seahorse Islands off Point Franklin	Abandoned after being trapped and forced ashore by ice. In 1872, the vessel was found ashore at Seahorse Islands and was burned to water's edge by Inupiaq Eskimos. Some accounts have the vessel drifting N to Barrow.
Gay Head	Whaling ship	300	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice and abandoned. In 1872, vessel was found burned by Inupiaq Eskimos.
George	Whaling bark	259	9/14/1871	Point Belcher near Wainwright Inlet	Abandoned after being trapped in ice and crushed.
George Howland	Whaling bark	361	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice and abandoned.
Henry Taber	Whaling bark	296	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice and abandoned.
James D. Thompson	Whaling bark	432	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice and abandoned.
John Wells	Whaling bark	357	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice and abandoned.
Mary	Whaling ship	373	9/14/1871	S of Wainwright Inlet	Trapped in ice, crushed, and abandoned.
Massachusetts	Whaling bark	356	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice and abandoned. In 1872, hull had been carried around Point Barrow by ice.
Navy	Whaling bark	385	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice and abandoned.
Oliver Crocker	Whaling bark	305	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice and abandoned.

Table 3.4.4-2 Shipwrecks in the Chukchi Sea Planning Area (cont'd.)

Vessel Name	Type	Tons	Date Wrecked	Location	Cause of Wreck
Palea	Whaling bark	386	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice and abandoned.
Reindeer	Whaling ship	332	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice and abandoned. In 1872, found 5 mi S of Point Belcher.
Seneca	Whaling bark	328	9/14/1871	Point Belcher near Wainwright Inlet	Trapped in ice and abandoned. Vessel survived the crush of 1871 and was taken by tow by the bark *Florence* in July 1872. Later, it was cut adrift in bad weather, ran aground, and was lost.
Thomas Dickason	Whaling bark	461	9/14/1871	N of Wainwright Inlet	Trapped in ice; abandoned and lost. In 1872, vessel was found 2 mi N of Wainwright Inlet with water flowing in and out of her.
Victoria	Trading brig	149	9/14/1871	S of Wainwright Inlet	Trapped in ice; abandoned and lost.
William Rotch	Whaling ship	290	9/14/1871	S of Wainwright Inlet	Forced ashore by ice and abandoned.
Roscoe	Whaling bark	313	8/19/1872	Off Point Barrow	Stove while at anchor and abandoned.
Arctic	Whaling bark	431	7/7/1876	18 mi from the "Bend" (Point Belcher)	Crushed in ice and abandoned. Crew reached shore and was rescued by the vessel Onward.
Three Brothers	Whaling bark	357	9/11/1877	Off Point Barrow	Abandoned in ice and lost; whale catch saved.
W.A. Farnsworth	Whaling bark	432	9/15/1877	Near Point Barrow	Stove by ice, filled with water, capsized, sank
William H. Allen	Trading brig	157	8/2/1878	Off Cape Smyth	Stove by ice and sank.
Florence	Whaling bark	245	8/8/1878	4 mi S of Point Barrow	Stove by ice and sank.
Daniel Webster	Whaling bark	327	7/12/1881	5 mi S of Point Barrow	Crushed by ice and sank rapidly. Crew escaped to Point Barrow, and some walked to Icy Cape and sailed in the bark Coral.
North Star	Steam whaling bark	489	7/8/1882	Off Point Barrow 2-1/2 mi from shore	Crushed by ice on maiden voyage under command of L.C. Owen, and the "force of ice was so great that the cracking of her timbers could be heard on shore." Crew made its way over ice to U.S. Army Signal Service Station.
John Howland	Whaling bark	384	7/17/1883	S of Point Hope	Stove by ice and condemned. Ship burned on July 20 and sank on July 21.
Cyane	Whaling bark	295	8/23/1883	S of Point Hope	Vessel stranded in fog and heavy SW gale and went to pieces.
Louisa	Whaling bark	304	8/23/1883	Off Point Hope	Struck ice in a gale and sank.

Table 3.4.4-2 Shipwrecks in the Chukchi Sea Planning Area (cont'd.)

Vessel	Type	Tons	Date Wrecked	Location	Cause of Wreck
Bowhead	Steam whaling bark	533	8/11/1884	Blossom Shoals near Icy Cape	Made fast to grounded ice to clean boilers. She was struck and holed by a piece of drifting ice and sank quickly. Crew was rescued by the nearby steam whalers *Narwhal* and *Balaena*.
George and Susan	Whaling bark	343	8/10/1885	9 mi N of Wainwright Inlet	Driven ashore and wrecked in SW gale after parting anchor chain and colliding with the bark *Mabel*. All crew but 3 rescued by the revenue cutter *Corwin*.
Mabel	Whaling bark	199	8/10/1885	At Wainwright Inlet	After being fouled by the whaler George and Susan in a gale, the vessel went ashore and was stranded. It became a total wreck. The revenue cutter *Corwin* tried to get a hawser on board, but failed. The *Corwin* was able to rescue the crews. Hulk still on beach in 1886.
Clara Light	Whaling schooner/tender	179	8/31/1886	15 mi N of Point Franklin	Abandoned in ice and lost.
Fleetwing	Whaling bark	328	8/3/1888	1 mi NE of Point Barrow	Chain cable parted in heavy SW gale, and vessel went ashore on shoal. Ship was abandoned by crew, sold at auction, and gear salvaged. Remains were burned by Inupiaq Eskimos on Aug. 15.
Mary and Susan	Whaling bark	327	8/3/1888	4 mi S of Point Barrow	Lost on outlying reef in a gale. Crew rescued by the cutter *Bear* the same day. Vessel burned on Aug. 4.
Ino	Schooner	98	8/8/1888	At Cape Smyth	Driven ashore in sudden SW gale and stranded when anchors dragged.
Ohio	Whaling bark	206	10/3/1888	At Point Hope	Ship was driven onto the beach in a heavy gale and snowstorm and grounded. The vessel broke up and was a total loss. After 8 months, some of the crew were rescued; 25 were lost.
Thomas Pope	Whaling bark/tender	226	7/28/1890	Off Point Hope	Masts were cut away in a gale. Vessel was stove by ice and stranded. Crew and cargo were taken off by steamer *William Lewis* and brig *F.A. Barstow*.
Spy	Sloop	17	11/25/1890	At Point Barrow	Caught in ice and crushed while heading for winter quarters.
William Lewis	Steam bark	463	10/3/1891	At Point Barrow	Ran ashore in gale and snowstorm and piled up on a snow-covered sand spit when captain mistook it for slush ice. Crew and cargo were rescued by steamer *Nararch*. On 3/20/1892, the wreck was accidentally burned by salvagers.

Table 3.4.4-2 Shipwrecks in the Chukchi Sea Planning Area (cont'd.)

Vessel	Type	Tons	Date Wrecked	Location	Cause of Wreck
Emily Schroeder	Schooner	?	10/13/1893	Marryatt Inlet, Point Hope Lagoon	Cragged anchor and driven ashore in storm. Seen hard aground as late as 1896.
Hidalgo	Brig	174	7/24/1896	8 mi W of Cape Thompson within 1 mi of Jabbertown	Forced ashore by ice and broken up by sea and ice. Cutter *Bear* took crew to Unalaska.
Navarch	Steam whaling bark	494	8/12/1997	Off Blossom Shoals near Icy Cape	Lost off Blossom Shoals but later drifted in ice to Point Barrow
Orca	Steam whaling bark	628	9/21/1897	N of Seahorse Islands off Point Franklin	Ice tore away propeller and rudder, and part of the stern was crushed between two immense icefloes. At the time, the *Orca* was the world's largest steam whaler. The steam whaler *Belvedere* rescued all hands, and the crew later walked 100 mi to Barrow to overwinter.
Jessie H. Freeman	Steam whaling bark	516	9/22/1897	No of Seahorse Islands off Point Franklin	Crushed in ice and abandoned on 9/24. Vessel was later burned accidentally by Inupiaq Eskimos and sank. The crew escaped to the steam whaler *Belvedere* and later walked to Point Barrow to overwinter.
Rosario	Schooner	141	7/2/1898	3/4 mi SW of Point Barrow	Crushed in pack ice near Point Barrow. Crew rescued by the revenue cutter *Bear*.
Grampus	Steam whaling bark	326	7/18/1901	Point Barrow	Nipped in ice. Vessel was beached and condemned. All hands were saved.
Laura Madsen	Whaling schooner	345	10/14/1905	At anchorage off Point Barrow	Caught in ice and crushed.
Ivy	Schooner	142	9/1/1908	At Point Barrow	Driven ashore by pack ice. Crew took passage to Seattle on schooner *Volente*. Vessel was salvaged but sank the next year near Barrow.
Helen Johnson	Gas schooner	39	7/29/1910	7 mi E of Point Hope	Pounded to pieces by ice in a strong SE gale. Crew was rescued by the cutter *Bear*.
Transit	Schooner	547	8/25/1913	5 mi SW of Cape Smyth	Wrecked when ice pushed it ashore. On 7/20/1914, vessel was located on the beach 10 mi S of Cape Smyth. Captain and crew escaped over ice to Barrow and returned S on the schooner *Hetty B*.
Arctic	Auxiliary gas schooner	669	8/10/1924	16 mi S of Point Barrow	Crushed in ice while on a trading and whaling voyage. Crew was rescued by the vessel *Boxer*. The *Arctic* was the former *H.D. Bendixsen*.
Lady Kindersly	Canadian power schooner	?	8/31/1924	Off Point Barrow	Caught in ice and crushed. Crew rescued by vessel *Boxer*. The ship carried cargo of machinery and stores for northern outposts.

Table 3.4.4-2 Shipwrecks in the Chukchi Sea Planning Area (cont'd.)

Vessel	Type	Tons	Date Wrecked	Location	Cause of Wreck
Lettie	Gas screw	33	9/9/1924	½ mi NE of Wainwright Inlet and ½ mi from shore	Vessel got out of channel, stranded, and was lost.
Baychimo	Canadian trading/supple steamer	1,322	11/24/1931	Just S of Point Barrow	Caught in ice and abandoned. Vessel drifted for years in arctic ice, was sighted and even boarded a number of times. It finally disappeared and considered a ghost ship. It was officially listed as lost in 1934.
Arnold Liebes	Gas boat	?	1/1/1934	Off Point Barrow	Wrecked.
C.B. Brower	Gas boat	?	1/1/1934	Off Point Barrow	Wrecked.
Eli-Yuk	Oil screw	35	9/2/1963	Off Wainwright	Foundered.
Basiil	Diesel boat	28	9/7/1950	At Cape Lisburne	Stranded on the beach and lost.

Source: USDOI, MMS, Alaska OCS Region (2007, Alaska shipwreck database)

Table 3.4.5-1 Ethnic Composition of Kaktovik, Nuiqsut, Barrow, Atqasuk, Wainwright, Point Lay, and Point Hope – Percent by Race

	Total	Hispanic or Latino	Not Hispanic or Latino	Population of One Race	White	Black or African American	American Indian or Alaskan Native	Asian	Native Hawaiian and Pacific Islander	Some Other Race	Two or More Races
State of Alaska											
Population	626,932	25,852	601,080	570,626	423,788	21,073	96,505	24,741	3,181	1,388	30,454
Percent		4.1	95.9	91.0	67.6	3.4	15.4	3.9	0.5	0.2	4.9
Kaktovik											
Population	293	0	293	267	43	0	221	1	0	2	26
Percent		0.0	100.0	91.1	14.7	0.0	75.4	0.3	0.0	0.7	8.9
Nuiqsut											
Population	433	1	432	429	44	1	382	2	0	0	4
Percent		0.2	99.8	99.1	10.2	0.2	88.2	0.5	0.0	0.0	0.9
Barrow											
Population	4,681	153	4,428	4,063	972	44	2,558	429	59	1	365
Percent		3.3	96.7	88.7	21.2	1.0	55.8	9.4	1.3	0.0	8.0
Atqasuk											
Population	228	0	228	227	11	0	215	1	0	0	1
Percent		0.0	100.0	99.6	4.8	0.0	94.3	0.4	0.0	0.0	0.4
Wainwright											
Population	546	0	546	531	37	1	493	0	0	0	15
Percent		0.0	100.0	97.2	6.7	0.2	90.2	0.0	0.0	0.0	2.7
Point Lay											
Population	247	6	241	233	28	0	204	1	0	0	14
Percent		2.4	97.5	94.3	11.3	0.0	82.5	0.4	9.9	0.0	5.6
Point Hope											
Population	757	13	744	728	66	1	659	1	0	1	29
Percent		1.7	98.2	96.1	8.7	0.1	87.0	0.1	0.0	0.1	3.8

Source: Census Table SF-1 http://146.63.75.45/census2000/Census_1v2.asp

Table 3.4.5-2 Median Household, Median Family, Per-Capita Incomes; Number of People in Poverty; Percent of the Total Borough or Native Subsistence-based Community Population

Community	Median Household Income	Median Family Income	Per-Capita Income	Number of People in Poverty (Percent of Community Population)
North Slope Borough	$63,173	$63,810	$20,540	663 (9.1%)
Kaktovik	55,625	60,417	22,031	18 (6.6)
Nuiqsut	48,036	46,875	14,876	10 (2.4)
Barrow	67,097	68,203	22,902	390 (8.6)
Wainwright	54,722	58,125	16,710	70 (12.5)
Point Lay	68,750	75,833	18,003	18 (7.4)
Point Hope	63,125	66,250	16,641	112 (14.8)
Northwest Arctic Borough	45,796	45,230	15,286	1,243 (17.4)
Kivalina	30,833	30,179	8,360	99 (26.4)
Kotzebue	57,163	58,068	18,289	401 (13.1)
Noorvik	51,964	52,708	12,020	51 (7.6)
Buckland	38,333	40,000	9,624	49 (11.9)
Deering	33,333	43,438	11,000	8 (5.8)
Nome Census Area	41,250	44,189	15,476	1,569 (17.4)
Diomede	23,750	24,583	9,944	56 (35.4)
Shishmaref	30,714	29,306	10,487	89 (16.3)
Wales	33,333	39,583	14,877	28 (18.3)

Source:
USDOC, Bureau of the Census, (2000).

Table 3.4.5-3 Summary of Available Socioeconomic Indicators Relevant to Public Health

Indicator	Alaska	NSB	Barrow	Point Hope	Point Lay	Wainwright	Nuiqsut	Kaktovik
Economic								
Below poverty line[a]	6.7%	8.6%	11.6%	15.1%	11.1%	15.6%	6.4%	6.6%
Per capita income[a]	$22,600	$20,540	$22,902	$16,641	$18,003	$16,710	$14,876	$22,031
Dependency ratio[b]			0.67	0.90	0.94	0.78	0.94	0.70
Income inequality								
Unemployment rate (2003)[c]	8		19%	18%	16%	19%	17%	16%
Average household expenditure on subsistence[d]			$3,787 (median 925)	(range <$200-20,000)	(30% spent $500, 40% spent $3100-9,500	$4,504	$6,700	$4,788
Economically Distressed?	N/A	N/A	No	Yes	No	No	No	No
2. Education								
Graduation rate (average of last 5 years)	61% (3-year average)	55%	55%	66%	49%	57%	33%	86%
School failure 2005-6 (grades 7-12 dropout rate)	5.8%	5.9%	7.0%	5.0%	3.1%	3.2%	15.7%	0.0%
Reading: proficient or advanced 2007[c] (composite of all grades unless specified)	Grade 10: 85%	Grade 10: 62%	Grades 9-10: 77%	56%	42%	56%	57%	69%
Writing: proficient or advanced 2007 (all grades) (composite of all grades unless specified)	Grade 10: 63%	Grade 10: 61”%	Grades 9-10: 63%	47%	39%	42%	38%	62%
Math: Proficient or advanced 2007 (all grades) (composite of all grades unless specified)	Grade 10: 69%	Grade 10: 46%	Grades 9-10: 55%	54%	33%	52%	51%	64%
3. Access to Health Care								
Health Professional Shortage Area designation[b]	N/A	13/25* - mental health 16/25* - primary care	N/A	N/A	N/A	N/A	N/A	N/A
Medically underserved[b]	N/A	56/100**	N/A	N/A	N/A	N/A	N/A	N/A
Geographic Isolation Score[b]***	N/A	N/A	3	1	1	1	1	1
4. Cultural Continuity								
Households participating in subsistence activities[d]			91	93	77	92	81	93
“Language other than English”		49%	N/A	N/A	N/A	N/A	N/A	N/A

Table 3.4.5-3 Summary of Available Socioeconomic Indicators Relevant to Public Health (cont'd.)

Indicator	Alaska	NSB	Barrow	Point Hope	Point Lay	**Wainwright**	**Nuiqsut**	**Kaktovik**
Ability to speak indigenous language very or relatively well[f]	44%[g]							
Ability to Understand indigenous language very or relatively well[f]	54%[g]	54% (excluding Barrow)	64%					
Households participating in artisan crafts sales			N/A	21%	20%	More than 20%	23%	19%

Notes:
[a]Data from USDOC, Bureau of the Census (2002); updated figures available for regions but not villages.
[b]Reported in Alaska Health Care Data Book (2007)
[c]State of Alaska, Dept. of Education Report Cards to the Public: Standards Based Assessment. Results are aggregated for all grades for small village schools due to small numbers of students. All-grade aggregate results are not available for district and State levels.
[d]North Slope Borough (2003a); Shepro and Maas, from NSB Comprehensive Plan Village Profiles (http://www.north-slope.org/NSB/CompPLAN/PtLayVillageProfile06.pdf)
[e]Denali Commission
[f]SLiCA
gAreas surveyed in Alaska include North Slope, NANA, and Bering Straits regions only.
*A score of 25 indicates the most severe shortage.
**A score of 100 indicates the most severe shortage.
***A score of 1 indicates the most medically isolated communities.

Table 3.4.5-4 Social and Psychological Health Problems, North Slope Borough

Indicator	U.S.	Alaska	NSB	Pt. Hope	Pt. Lay	Wainwright	Nuiqsut	Kaktovik	Barrow
Health Determinants (see also Health Determinants in Table 3.4.6-5)									
Village school policy	N/A	N/A	N/A	Dry	Dry	Dry	Dry	Dry	Damp
Village police staffing (# of officers)	N/A	N/A	N/A	1	1	1	1	1	
Village access	N/A	N/A	N/A	Air	Air	Air	Air, ice road	Air	Air
Health Outcomes									
Reports of domestic violence 2003[a] (per 1,000 population	N/A	3	19.6	31.7	28.3*	16.4*	39.2*	13.6*	20
Protective orders issued 2003[a] (per 1,000 population)	N/A	10	9						
OCS reports 2003[b] (per 1,000 population)	N/A	22	28						
DV/sexual assault incidents 2006[c] (per 1,000 population)	N/A	11.9	97.7						
2004 rape rate (per 100,000 women)[b]	62	173	332						
2004 rate of assaults per 100,00 women)[b]	279	465	557						
2005-6 (2-year average) violent crime rate[d] (per 100,000 population)	472	660	886						
2005-6 (2-year average) property crime rate[d] (per 100,000 population)	3,383	3,608	2,203						

Notes:
[a]Domestic Violence Impact and Needs in North Slope Borough Communities Report: January to December 2003. Denominator based on 2000 Census. Not age adjusted.
[b]U.S. Dept. of Health and Human Services: Office on Women's Health Quick Health Data Online.
[c]Alaska Council on Domestic Violence and Sexual Assault: Annual Report Fiscal Year 2006.
[d]U.S. Dept. of Justice: 2006 Crime in the United States. Rates are not age adjusted. Caution must be taken in making comparisons in rates, given demographic differences and community size.
*Rates based on fewer than 20 incidents; rates are, therefore, less reliable.

Table 3.4.5-5 Summary of Available Indicators on Food, Nutrition, and Physical Activity

Indicator	Alaska	NSB	Barrow	Pt. Hope	Pt. Lay	Wainwright	Nuiqsut	Kaktovik
Health Determinants								
Weekly food cost, family of 4 (children 6-11)[a]	$186[b]	N/A	$289	N/A	N/A	N/A	N/A	N/A
Subsistence food harvest per capita[c] (in pounds per person)	N/A	434	289	N/A	890	751	742	886
Households reporting at least half of calories from subsistence resources[d]	N/A	N/A	66%	66%	75%	73% (83% of Iñupiat)	63%	68%
Food sharing networks: receiving traditional food from others	92%[e]	91% (excluding Barrow	94%					
Population's calories from subsistence resources[c]	N/A	40%						
Very or somewhat satisfied with amount of fish and game available locally[f]	76%[e]	87%						
Adults experiencing food insecurity (with or without hunger) 2006	11% (20% in rural Alaska							
Children experiencing food insecurity (with or without hunger) 2006	15% (24% in rural Alaska							

Notes:
[a]Luick (2008)
[b]Average of 19 Alaskan cities surveyed.
[c]from Alaska Dept. of Fish and Game, Subsistence Div.
[d] North Slope Borough (2003a); Shepro and Maas, from NSB Comprehensive Plan Village Profiles (http://www.north-slope.org/NSB/CompPLAN/PtLayVillageProfile06.pdf)
[e]Areas surveyed in Alaska include NSB, NANA, and Bering Straits regions only.
[f]SLiCA

Table 3.4.5-6 Summary of Available indicators of Maternal Child Health

Indicator	Alaska	North Slope Borough	NWAB*
Health Determinants			
Self-reported drinking	2.1%	3.9%	3.8%
Self-reported smoking	15.5%	43%	42.3%
Less than 12 years education	14.4%	26.7%	36.2%
Inadequate prenatal care	16.6%	32.3%	28.4%
Breastfeeding at 4 weeks	79.6%	69.5%*	69.5%*
Health Outcomes			
Less than 15 teen pregnancy rate	0.1%	0.8%	0.4%
Low birth rate	6.0%	6.2%	5.9%
Premature deliveries	10.9%	15.5%	9.4%
Unintented pregnancy	45.4%	54.0%	N/A
Infant mortality	6.2/1,000	10.2/1,000**	12.5/1,000

Source: State of Alaska, Dept. of Health and Human Services (2008)
*Perham-Hester, Wiens, and Schoellhorn (2005)
**Based on less than 10 events and, therefore, the calculated rate is less reliable.

Table 3.4.5-7 Number of North Slope Borough Households with Piped Water and Flush Toilets

Indicator	Pt. Hope	Pt. Lay	Wainwright	Nuiqsut	Kaktovik	Barrow
Houses with piped water	N/A	60% (40% 250-gallon holding tank)	94%	88%	90%	92%
Households with flush toilets	90%	No data	93%	90%	90%	Approx. 90%

Source: North Slope Borough (2005)

Table 3.4.5-8 North Slope Borough Region Emission Summary

				Potential to Emit (PTE)*						
Permitted	Facility	Date Issued	Total PTE	NO_x[1]	CO[2]	PM_{10}[3]	SO_2[4]	VOC[5]	HAPs[6]	Notes
AIC	Deadhorse Soil Remediation Unit	9/24/2002	314	107	25	14	163	6	0	
APSC[7]	TAP* Pump Station No. 1	11/22/2002	1,501	NP**	NP	NP	NP	NP	NP	Only total emissions reported
APSC	TAP Pump Station No. 2	11/22/2002	1,465	NP	NP	NP	NP	NP	NP	Only total emissions reported
APSC	TAP Pump Station No. 3	10/22/2007	1,426	695	526	108	83	14	NP	
APSC	Tap Pump Station No. 4	11/22/2002	1,256	571	495	97	79	14	NP	
BPXA[8]	Crude Oil Topping Unit	7/29/2002	456	118	132	139	56	11	NP	
BPXA	Prudhoe Bay Operating Center/Main Construction Camp	10/4/2002	498	231	151	46	52	19	NP	
BPXA	Prudhoe Bay, Grind and Eject Facility	12/2/2002	33	16	13	1	2	1	NP	
BPXA	Prudhoe Bay, Central Power Station	1/7/2003	7,672	6,110	1,165	150	63	184	20	
BPXA	Milne Point, C-Pad	1/21/2003	227	90	75	4	8	50	5	
BPXA	Prudhoe Bay, Flow Station No. 3	3/31/2003	5,564	4,235	1.171	100	42	16	NP	
BPXA	Prudhoe Bay, Flow Station No. 1	3/31/2003	3,910	2,872	889	84	35	30	18	
BPXA	Milne Point Production Facility	4/14/2003	1,481	707	448	36	77	213	NP	
BPXA	Prudhoe Bay, Seawater Treatment Plant	7/22/2003	763	395	280	35	28	25	13	
BPXA	Prudhoe Bay, Central Compressor Plant	8/4/2003	16,446	14,238	1,630	347	147	84	54	
BPXA	Prudhoe Bay, Central Gas Facility	8/4/2003	13,265	10,968	1,779	305	125	88	59	
BPXA	Lisburne Production Center	1/11/2007	3,421	2,280	776	58	265	41	13	
BPXA	Endicott Production Facility	10/14/2003	5,243	3,756	972	120	346	49	18	
BPXA	Prudhoe Bay, Gathering Center No. 1	10/20/2003	6,485	4,912	1,374	107	48	44	22	
BPXA	Prudhoe Bay, Gathering Center No. 2	12/29/2006	3,239	2,389	688	86	33	43	15	
BPXA	Prudhoe Bay, Flow Station No. 2	10/20/2003	4,974	3,663	1,108	91	83	29	15	
BPXA	Badami Development Facility	11/10/2003	822	278	382	12	67	83	NP	
BPXA	Prudhoe Bay, Base Operations Center	10/27/2003	1,674	1,165	266	37	171	35	<1	
BPXA	Prudhoe Bay, Gathering Center No. 3	11/28/2003	3,779	2,873	778	69	33	226	15	
BPXA	Prudhoe Bay, Seawater Injection Plant East	10/27/2003	2,740	2,175	494	42	20	9	8	
BPXA	Transportable Drilling Rigs, unaggregated well pads	11/17/2003	3,420	2,376	600	96	252	96	<25	12 concurrent drill rigs authorized
BPXA	Northstar Production Facility	Proposed 4/2008	2,253	562	1,153	331	57	150	9	
CPAI[9]	Kuparuk, Central Production Facility No. 2	11/25/2002	3,986	2,777	907	86	185	31	NP	

Table 3.4.5-8 North Slope Borough Region Emission Summary (cont'd.)

				Potential to Emit (PTE)*						
Permitted	**Facility**	**Date Issued**	**Total PTE**	**NO_x[1]**	**CO[2]**	**PM_{10}[3]**	**SO_2[4]**	**VOC[5]**	**HAPs[6]**	**Notes**
CPAI	Kuparuk, Central Production Facility No. 3	12/2/2002	3,355	2,340	758	72	167	18	NP	
CPAI	Kuparuk, Central Production Facility No. 1	4/28/2003	5,385	3,529	1,232	146	324	154	32	
CPAI	Alpine, Central Processing Facility	7/1/2003	3,692	2,732	614	56	202	88	23	
CPAI	Transportable Drilling Rigs, Kuparuk River Unit	11/30/2007	4,588	2,772	835	46	298	637	18	
CPAI	Kuparuk, Seawater Treatment Plant	Proposed 4/2008	527	292	157	20	50	8	7	
Eni	Nikaitchuq Development	5/5/2006	703	225	225	8	84	161	NP	
Halliburton	Deadhorse Facility (Halliburton)	5/11/2006	314	249	59	2	2	2	NP	
Pioneer	Oooguruk Development Project	12/4/2006	634	240	237	33	72	52	NP	
NSB[10]	Service Area 10 Incinerator	10/23/2001	145	36	39	23	33	14	NP	
NSB	Barrow Utilities	9/2/2005	532	NP	NP	NP	NP	NP	NP	Only total emissions reported
NSB	Thermal Oxidation System	7/22/2005	79	30	15	15	18	1	11	
TDX NS Generating	Deadhorse Power Plant	12/6/2005	611	243	240	14	10	104	NP	
Subtotals			**118,875**	**83,248**	**22,687**	**3,034**	**3,778**	**2,630**	**400**	

Notes:
Table compiled by North Slope Borough using Alaska Dept. of Environmental Conservation data records available on State website; updated August 2008.
[1]nitrous oxide; [2]carbon monoxide; [3]particulate matter less than 10 microns in diameter; [5]volatile organic compound; [6]hazardous air pollutant; [7]Alyeska Pipeline Service Co.; [8]BP Exploration (Alaska), Inc.; [9]ConocoPhillips Alaska, Inc.; [10]North Slope Borough.
*This is the estimated maximum emissions used for permitting a facility; actual emissions should be less than PTE.
**HAP emission estimates were not provided in permitting documentation for many sources; therefore, HAP emissions likely are underestimated.

Table 3.4.5-8 North Slope Borough Region Emission Summary (cont'd).

In addition to the large emission sources listed above, other smaller permitted sources of emissions on the North Slope include:

ACS	Various locations on the North Slope	Open Burn Permit
BPXA	GPB T-Pad Fire Training Grounds	Open Burn Permit
BPXA	Prudhoe Bay Eastern Operating Area Fire Training	Open Burn Permit
BPXA	Badami Development Area Fire Training	Open Burn Permit
BPXA	Milne Point Fire Training Site at D-Pad	Open Burn Permit
CPAI	Alpine Oil Field Drill Site CD1	Open Burn Permit
NSB	Anaktuvuk Pass Power	Fuel use of up to 330,000 gallons
NSB	Atqasuk Power Plant	Fuel use of up to 330,000 gallons
NSB	Kaktovik Power Plant	Fuel use of up to 330,000 gallons
NSB	Point Lay Power Plant	Fuel use of up to 330,000 gallons
NSB	Nuiqsut Power Plant	Operating under Fuel Limited Diesel Electric Generating Facilities General Permit
NSB	Point Hope Power Plant	Operating under Fuel Limited Diesel Electric Generating Facilities General Permit
NSB	Wainwright Power Plant	Operating under Fuel Limited Diesel Electric Generating Facilities General Permit

Notes:

1. Mobile Sources of Emissions, such as seismic units, trucks, cranes, vessels and other construction and maintenance equipment are not included in this emission estimate, and are significant sources of air pollution in the North Slope Borough.
2. Hazardous Air Pollutants are not quantified for some facilities, and test data and verification is limited. These numbers are estimates only and require additional work to verify accuracy.
3. Exploratory Mining Operation, emission sources are not included in this summary. Coal exploration is ongoing in the western North Slope Borough region.
4. Exploratory Drilling Operations, emissions sources for operators other than BPXA or CPAI are not included in this summary; additional emissions may occur as projects are proposed by other operators.

Table 4.3.2-1 Beaufort Sea Cumulative Oil-Spill-Occurrence Estimates ≥500 Barrels or ≥1,000 Barrels Resulting from Oil Development over the Assumed 20-Year Production Life of Sale 209 or 217

Category	Crude Oil Spills					
	Reserves and Resources (Bbbl)	**Spill Rate (spills/Bbbl)**	**Size Category (bbl)**	**Assumed Size (bbl)**	**Mean Number of Spills**	**Assumed Number of Spills for Analysis**
Offshore						
Past, Present, and Reasonably Foreseeable	0.96	0.58	≥1,000		0.56	0
Alternatives for Sale 209 or 217	0.50	0.58	≥1,000		0.3	0
Total	**1.46**	**0.58**	**≥1,000**		**0.85**	**0**
Onshore						
Past, Present, and Reasonably Foreseeable	8.4	0.61	≥500	675	5.1	5
Alternatives for Sale 209 of 217	0.5	0.17	≥500	675	0.09	0
Total	**8.9**	**0.17**	**≥500**	**675**	**5.2**	**5**
TAPS Pipeline						
Past, Present, and Reasonably Foreseeable	9.4	0.11	≥500	4,600	1.03	1
Alternatives for Sale 209 or 217	0.5	0.11	≥500	4,600	0.06	0
Total	**9.9**	**0.11**	**≥500**	**4,600**	**1.09**	**1**

Source: USDOI, MMS, Alaska OCS Region (2008)

Table 4.3.2-2 Chukchi Sea Cumulative Oil-Spill-Occurrence Estimates ≥500 Barrels or ≥1,000 Barrels Resulting from Oil Development over the Assumed 25-Year Production Life of Sale 212 or 221

Category	Crude Oil Spill					
	Reserves and Resources (Bbbl)	**Spill Rate (spills/Bbbl)**	**Size Category (bbl)**	**Assumed Size (bbl)**	**Mean Number of Spills**	**Assumed Number of Spills for Analysis**
Offshore						
Past, Present, and Reasonably Foreseeable	0.96	0.51	≥1,000		0.48	0
Alternatives for Sale 212 or 221	1.0	0.51	≥1,000		0.51	0
Total	**1.96**		**≥1,000**		**0.99**	**0**
Onshore						
Past, Present, and Reasonably Foreseeable	8.4	0.61	≥500	675	5.1	5
Alternatives for Sale 212 or 221	1.0	0.17	≥500	675	0.17	0
Total	**9.4**	**0.17**	**≥500**	**675**	**5.27**	**5**
TAPS Pipeline						
Past, Present, and Reasonably Foreseeable	9.4	0.11	≥500	4,600	1.03	1
Alternatives for Sale 212 or 221	1.0	0.11	≥500	0	0.11	0
Total	**10.4**	**0.11**	**≥500**	**4,600**	**1.14**	**1**

Source: USDOI, MMS (2008)

Notes: Assumed spill sizes are median spill size in that size category.

Table 4.3.3-1 Oil Spill Response Organization (OSRO) Classifications

Classifications	M and W1	W2 and W3
	Only resources located at equipment sites capable of being mobilized and en route to the scene of a spill within 2 hours of notification are counted toward M and W1 classifications. Because of the potential for nondedicated resources to be committed to other functions, only dedicated resources are presumed to be able to mobilize within these time requirements.	Any type resource owned or contracted, dedicated or nondedicated, is allowed for W2 and W3 classification.

Response Times. In addition to resource quantities, OSROs are required to meet certain response times (33 CFR 154.1045(d)-(f) and 33 CFR 155.1050(a)-(h)). The response times for classifications were derived from the regulations and standardized for classification through a series of workshops.

Response Times in Hours for Boom, EDRC and TSC Resources

Operating Area	M	W1	W2	W3
Nearshore	12	12	36	60
Offshore	12	12	36	60
Open Ocean	12	12	36	60

Notes; **EDRC**. Effective Daily Recovery Capacity **TSC**. Temporary Storage Capacity

Source: Guidelines for U.S. Coast Guard Oil Spill Removal Organization Program

To receive an M, W1, W2, or W3 classification, an OSRO must meet all boom, EDRC, and TSC amounts to obtain a single classification and each classification is determined independently for each operating area (Tables A, B, and C below).

A. Boom Amounts in Feet for OSRO Classifications

Area	Configuration	M	W1	W2	W3
Rivers/Canals	Protective	4,000	25,000	25,000	25,000
Great Lakes	Protective	6,000	30,000	30,000	30,000
Inland	Protective	6,000	30,000	30,000	30,000
Nearshore	Protective	8,000	30,000	30,000	30,000
Offshore	Protective	8,000	15,000	15,000	15,000
Open Ocean	Protective	0	0	0	0

B. EDRC Amounts in Barrels per Day for OSRO Classifications

Area		M	W1	W2	W3
Rivers/Canals		1,200	1,875	3,750	7,500
Great Lakes		1,200	6,250	12,500	25,000
Inland		1,200	12,500	25,000	50,000
Nearshore		1,200	12,500	25,000	50,000
Offshore		1,200	12,500	25,000	50,000
Open Ocean		1,200	12,500	25,000	50,000

C. TSC Amounts in Barrels for OSRO Classifications

Area		M	W1	W2	W3
Rivers/Canals		2,400	3,750	7,500	15,000
Great Lakes		2,400	12,500	25,000	50,000
Inland		2,400	25,000	50,000	100,000
Nearshore		2,400	25,000	50,000	100,000
Offshore		2,400	25,000	50,000	100,000
Open Ocean		2,400	25,000	50,000	100,000

Table 4.3.3-2 Travel Times to Deadhorse, Alaska in Hours

Coming From	Heavy Transport Fixed-Wing Aircraft (300 mph*)	Light Transport Fixed-Wing Aircraft (150 mph)	Helicopter (100 mph)	Vehicle (35 mph)
Anchorage	2.1	4.3	6.4	23.9
Fairbanks	1.3	2.7	4.0	13.7
Kenai	2.4	4.8	7.2	28.2
Valdez	2.2	4.3	—	24.1
Seattle, Washington	7.0	14.0	—	—

Source: Alaska Clean Seas Technical Manual, Vol. I

Table 4.4.1.10-1 Estimated Areal Extent of Direct and Indirect Effects on Tundra Vegetation during Potential Development of Oil Resources on Existing Beaufort Sea OCS Leases

Facility	Gravel Footprint	
	Km^2*	Acres
Staging Area	0.20	50
Shore Base	0.20	50
Road/Pipeline Corridor (o.03 km x 0 km)	2.45	606
Gravel-Extraction Sites (2 at 0.2km^2 each)	0.40	99
Pump Station	0.16	40
Total	3.41	845

Notes: *square kilometers
Source: USDOI, MMS, Alaska OCS Region

Table 4.4.2.2-1 Estimated Air Emissions from OCS Activities from a Lease Sale in the Beaufort Sea (Sale 209 or 217

Activity	Pollutant (tons/year)				
	NO_x	SO_2	$PM_{10}/PM_{2.5}$	CO	VOC
Exploration Wells	735-980	53-71	21-28	144-192	35-47
Platform Construction/Removal	821	66	58	184	65
Pipelaying Vessels	149-223	13-84	11-71	34-227	12-77
Production Well Drilling	292-584	17-35	2-5	48-95	2-4
Production Platforms	631-2,828	20-87	28-121	244-1,025	98-399
Support Vessels	46-69	8-12	1-2	6-9	1
Helicopters	0.4-11	0-1	0.1-1	1.6-48	0.6-18
Total	2,675-5,507	177-354	121-285	661-1,736	213-595

Note: Emissions for each activity are for the year of peak activity in that category; total emissions for all activities in any given year would be lower.

Table 4.4.2.2-2 Projected Greenhouse Gas Emissions from Proposed Beaufort Sea and Chukchi Sea Lease Sales

Greenhouse Gas	Million Metric Tons $C0_2$ Equivalent	Total 2005 U.S. Emissions, Million Metric Tons $C0_2$ Equivalent	Arctic Multiple-Sale Program as Percentage of Total U.S. Emissions
Beaufort Sea			
$C0_2$	0.344-1.276	6,089	0.006-0.02
CH_4	0.0006-0.003	539	0.0001-0.0005
$CO_2 + CH_4$	0.345-1.278	6,628	0.005-0.02
Chukchi Sea			
CO_2	o.341-0.482	6,089	0.006-0.008
CH_4	0.0006-0.0020	539	0.0001-0.0004
$CO_2 + CH_4$	0.342-0.484	6,628	0.005-0.007

Estimates of emissions from the 2007-2012 5-Year Leasing Program (USDOI, MMS, 2006d) were not made for these compounds, but they are assumed to be very small.

Table 4.4.2.6.2-1 Estimated Areal Extent of Direct and Indirect Effects on Eider Nesting Habitats and Associated Incidental Take of Spectacled and Steller's Eiders during Potential Development of Oil Resources on Existing Beaufort Sea OCS Leases

	Gravel Footprint		200-M Influence Zone		Total Area	
Facility	Square kilometers	Acres	Square kilometers	Acres	Square Kilometers	Acres
Staging area	0.20	50	0.51	126	0.71	175
Shore base	0.20	50	0.51	126	0.l71	175
Road/pipeline corridor (0.3 km x 80 km)	2.45	606	32.20	7,957	35.00	8,566
Gravel extraction sites (2 at 0.2 km^2 each)	0.40	99	N/A - Winter operation		0.40	99
Pump station	0.16	40	0.48	118	0.64	158
Total Area	3.41	845	32.68	8,327	37.46	9,173
Spectacled eiders affected at 1.1/km^2	4		36		42	
Steller's eiders affected at 1.1/km^2	1		2		3	

Source: USDOI, MMS, Alaska OCS Region, 2003

Table 4.4.2.6.2-2 Combined Probabilities (Expressed As Percent Chance) Of One Or More Spills Greater Than Or Equal To 1,000 Barrels Originating in the Beaufort Sea Occurring And Contacting The Two Most Important Environmental Resource Areas For ESA-Listed Birds (See Maps In Appendix A) Over the Assumed Production Life Of The Sale Area Within Varying Time Periods, Beaufort Sea Sales 209, 217.

Environmental Resource Area	3 Days	10 Days	30 Days	60 Days	180 Days	360 Days
ERA 10 Ledyard Bay Critical Habitat Area	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ERA 19 Spring Lead system	<0.5	<0.5	<0.5	<0.5	<0.5	1

Source: Appendix A, Table A2-157

Table 4.4.2.6.3-1 Summer Conditional Probabilities (Expressed As Percent Chance) That A Large Spill Starting At Launch Areas 1-25 Or Pipeline Segments 1-17 Will Contact Certain Important Fall Feeding And Denning Areas For Polar Bears In The Beaufort Sea Within 30 Or 360 Days.

ERA ID	ERA Name	30 Days LAs 1-25	30 Days PLs 1-17	360 Days LAs 1-25	360 Days PLs 1-17
55	Pt. Barrow, Plover area	<0.5-38%	<0.5-29%	<0.5-40%	<0.5-32%
92	Thetis, Jones, Cottle, and Return Islands	<0.5-11%	<0.5-11%	<0.5-12%	<0.5-12%
93	Cross and No Name Islands	<0.5-6%	<0.5-7%	<0.5-7%	<0.5-7%
94	Maguire, Flaxman, and Barrier Islands	<0.5-6%	<0.5-9%	<0.5-7%	<0.5-10%
95	Arey and Barter, and Bernard Spit	<0.5-5%	<0.5-3%	<0.5-5%	<0.5-3%

Source: Appendix A, Tables A.2-65, A.2-66, A.2-71 and A.2-72.

Table 4.4.2.6.3-2 Winter Conditional Probabilities (Expressed As Percent Chance) That A Large Spill Starting At Launch Areas 1-25 Or Pipeline Segments 1-17 Will Contact Certain Important Fall Feeding And Denning Areas For Polar Bears In The Beaufort Sea Within 30 Or 360 Days.

ERA ID	ERA Name	30 Days LAs 1-25	30 Days PLs 1-17	360 Days LAs 1-25	360 Days PLs 1-17
55	Pt. Barrow, Plover area	<0.5-4%	<0.5-3%	<0.5-4%	<0.5-4%
92	Thetis, Jones, Cottle, and Return Islands	<0.5-3%	<0.5-3%	<0.5-14%	<0.5-11%
93	Cross and No Name Islands	<0.5-1%	<0.5-1%	<0.5-1%	<0.5-1%
94	Maguire, Flaxman, and Barrier Islands	<0.5-2%	<0.5-3%	<0.5-9%	<0.5-10%
95	Arey, Barter, and Bernard Spit	<0.5%	<0.5%	<0.5-1%	<0.5-1%

Source: Appendix A, Tables A.2-65, A.2-66, A.2-71 and A.2-72.

Table 4.4.2.11-1 Chukchi Employment and Personal Income Effects

Area of Residence/Phase of OCS Activity	Employment Annual Average Jobs			Total Personal Income Annual Average in Millions of Constant 2006 $		
	Direct	Indirect and Induced	Total	For Direct Workers	For Indirect and Induced Workers	Total
North Slope Borough (a)						
Exploration	5	2	7	.7	.3	1
Development	10	3	13	1.3	.4	1.7
Production	7	2	9	.9	.3	1.2
South Central Alaska and Fairbanks (b)						
Exploration	440	220	660	59	30	89
Development	960	480	1,440	111	55	166
Production	520	260	780	70	35	105

Source: Jack Faucett Associates, Inc. (2000).

Table 4.4.2.11-2 Beaufort Employment and Personal Income Effects

Area of Residence// Phase of OCS Activity	Employment Annual Average Jobs			Total Personal Income Annual Average in Millions of Constant 2006 $		
	Direct	Indirect and Induced	Total	For Direct Workers	For Indirect and Induced Workers	Total
North Slope Borough (a)						
Exploration	7	3	10	.9	.4	1.3
Development	12	6	18	1.6	.8	2.4
Production	9	4	13	1.2	.6	1.8
South Central Alaska and Fairbanks (b)						
Exploration	600	300	900	81	40	121
Development	1,140	670	1,810	131	65	196
Production	700	350	1,050	95	48	143

Source: Jack Faucett Associates, Inc. (2000).

Table 4.5.1.6.2-1 Estimated Areal Extent of Direct and Indirect Effects on Eider Nesting Habitats and Associated Incidental Take of Spectacled and Steller's Eiders during Development of Oil Resources following Lease-Sale 193.

Facility	Gravel Footprint		200-Meter Influence Zone		Total Area	
	Km^2	Acres	Km^2	Acres	Km^2	acres
Staging Area	0.20	50	0.51	126	0.71	175
Shore Base	0.20	50	0.51	236	0.71	175
Road/Pipeline Corridor (0.03 km x 483 km)	14.72	3,636	193.20	47,740	208.00	51,397
Gravel Extraction Sites (8 at 0.2 km^2 ea)	1.60	395	N/A Winter Operation		1.60	395
Pump Stations (4 at 40 acres ea)	0.65	160	1.91	472	2.56	632
Total	**17.37**	**4,291**	**196.13**	**48,464**	**213.58**	**52,774**
Spectacled Eiders Affected at 1.1/km^2	19		216		235	
Steller's Eiders Affected at 0.06/km^2	1		12		13	

Source: USDOI, MMS (2007)

Table 4.5.2.2-1 Estimated Air Emissions from OCS Activities from a Lease Sale in the Chukchi Sea (Sale 212 or 221)

Activity	Pollutant (tons/year)				
	NO_x	So_2	$PM_{10}/PM_{2.5}$	CO	VOC
Exploration Wells	490-735	35-53	14-21	96-144	24-35
Platform Construction/Removal	821	66	58	184	65
Pipelaying Vessels	298-298	25	21	68	23
Production Well Drilling	328-511	20-31	3-4	54-83	2-4
Production Platforms	1,099-1,994	31-57	43-80	320-607	109-213
Support Vessels	92-138	16-23	2-3	12-18	2-3
Helicopters	0.4-11	0-1	0.1-1	1.6-48	0.6-18
Total	3,128-4,498	192-255	142-188	736-1,110	225-344

Note: Emissions for each activity are for the year of peak activity in that category. Total emissions for all activities in any given year would be lower than total of peak year emissions for all activities.

Table 4.5.2.6.2-1 Combined Probabilities (expressed as percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels Originating in the Chukchi Sea Occurring and Contacting the Two Most Important Environmental Resource Areas for ESA-Listed Birds (see maps, Appendix A) over the Assumed Production Life of the Lease-Sale Area with Varying Time Periods, Chukchi Sea.

Environmental Resource Area	3 Days	10 Days	30 Days	60 Days	180 Days	360 Days
ERA 10 Ledyard Bay Critical Habitat Area	3	4	5	6	6	6
ERA 19 Spring Lead System	2	3	5	6	7	7

Source: Appendix A, Table A3-79

Table 4.5.2.6.3-1. Summer Conditional Probabilities (Expressed As Percent Chance) That A Large Spill Starting At Launch Areas 1-15 Or Pipeline Segments 1-11 Will Contact Certain Important Fall Feeding And Denning Areas For Polar Bears In The Chukchi Sea Within 30 Or 360 Days.

ERA ID	ERA Name	30 Days LAs 1-15	30 Days PLs 1-11	360 Days LAs 1-15	360 Days PLs 1-11
ERA 11	Wrangel Island with 12 NM Buffer	<0.5-2	<0.5-2	<0.5-2	<0.5-2
ERA 19	Chukchi Sea spring lead System	<0.5-9	<0.5-14	<0.5-10	<0.5-14
ERA 39	Pt. Lay/ Chukchi Sea polynya area	<0.5-16	<0.5-41	<0.5-19	<0.5-44
ERA 40	Wainwright/ Chukchi Sea polynya area	<0.5-19	<0.5-51	<0.5-26	<0.5-57
ERA 55	Pt. Barrow, Plover Islands	<0.5-3	<0.5-1	<0.5-7	<0.5-3
ERA 58	Chukchi Sea polynya area offshore	1-84	4-82	2-85	6-82
ERA 59	Ostrov Kolyuchin	<0.5-2	<0.5-2	<0.5-2	<0.5-2
ERA 66	Herald island	<0.5-1	<0.5-1	<0.5-1	<0.5-1
LS 85	Barrow, Browerville, Elson Lagoon	<0.5-8	<0.5-4	<0.5-13	<0.5-8
GLS 142[1]	Russian Chukchi Sea coastline	<0.5-20	<0.5-20	1-20	<0.5-20
GLS 143[1]	U. S. Chukchi Sea coastline	<0.5-22	<0.5-35	1-31	3-43
GLS 144[1]	U. S. Beaufort Sea coastline	<0.5-10	<0.5-5	<0.5-23	<0.5-13

Note[1]: Most contacts to GLS 143 occur to LSs 64-85 (Pt. Hope to Barrow). We use GLS 142, 143 and 144 as a proxy to represent potentially available coastal denning habitat.

Source: Appendix A, Tables A.3-33, A.3-36, A.3-39, A.3-42, A.3-45 and A.3-48.

Table 4.5.2.6.3-2. Winter Conditional Probabilities (Expressed As Percent Chance) That A Large Spill Starting At Launch Areas 1-15 Or Pipeline Segments 1-11 Will Contact Certain Important Fall Feeding And Denning Areas For Polar Bears In The Chukchi Sea Within 30 Or 360 Days.

ERA ID	ERA Name	30 Days LAs 1-15	30 Days PLs 1-11	360 Days LAs 1-15	360 Days PLs 1-11
ERA 11	Wrangel Island with 12 NM Buffer	<0.5	<0.5	<0.5	<0.5
ERA 19	Chukchi Sea spring lead System	<0.5-16	<0.5-23	<0.5-26	<0.5-35
ERA 39	Pt. Lay/ Chukchi Sea polynya area	<0.5-16	<0.5-32	<0.5-25	<0.5-39
ERA 40	Wainwright/ Chukchi Sea polynya area	<0.5-8	<0.5-38	<0.5-18	<0.5-52
ERA 55	Pt. Barrow, Plover Islands	<0.5	<0.5	<0.5-3	<0.5-3
ERA 58	Chukchi Sea polynya area offshore	<0.5-18	<0.5-19	2-33	2-37
ERA 59	Ostrov Kolyuchin	<0.5	<0.5	<0.5	<0.5
ERA 66	Herald island	<0.5	<0.5	<0.5-1	<0.5-1
LS 85	Barrow, Browerville, Elson Lagoon	<0.5-2	<0.5-1	<0.5-6	<0.5-6
GLS 142[1]	Russian Chukchi Sea coastline	<0.5-8	<0.5-8	<0.5-8	<0.5-9
GLS 143[1]	U. S. Chukchi Sea coastline	<0.5-13	<0.5-21	<0.5-28	2-38
GLS 144[1]	U. S. Beaufort Sea coastline	<0.5	<0.5-1	<0.5-11	<0.5-10

Note[1]: Most contacts to GLS 143 occur to LSs 64-85 (Pt. Hope to Barrow). We use GLS 142, 143 and 144 as a proxy to represent potentially available coastal denning habitat.

Source: Appendix A, Tables A.3-33, A.3-36, A.3-39, A.3-42, A.3-45 and A.3-48.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally-owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. Administration.

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