Alaska Outer Continental Shelf

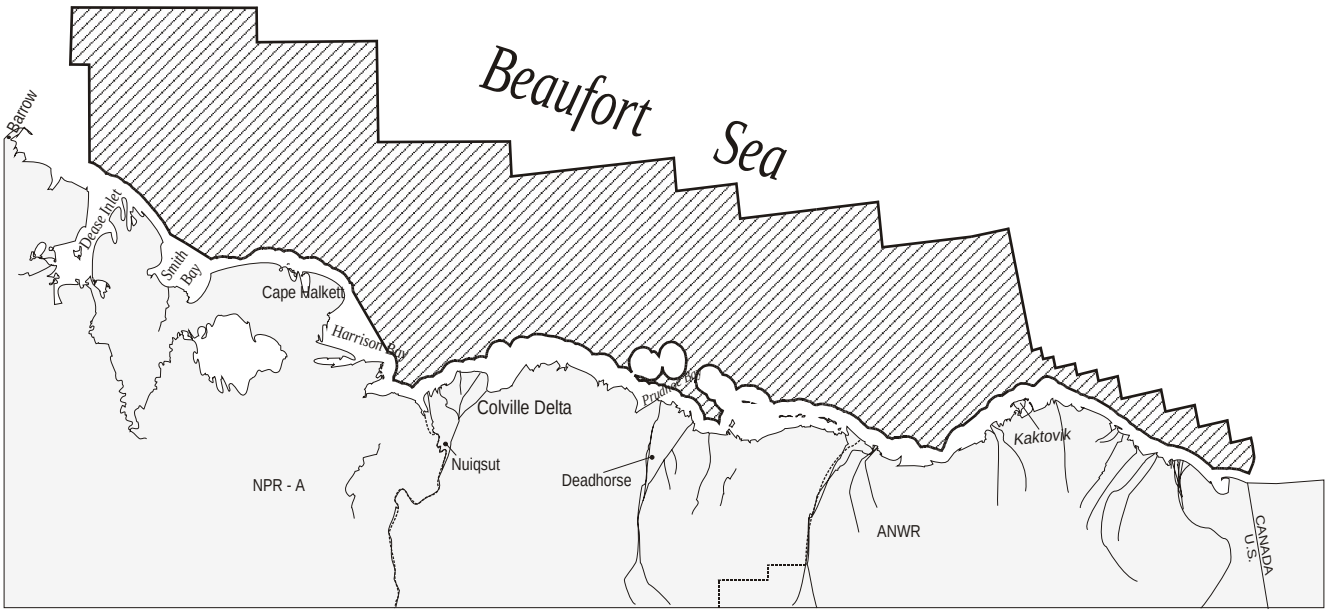
OCS EIS/EA
MMS 2002-029

Beaufort Sea Planning Area

Sales 186, 195, and 202
Oil and Gas Lease Sale

Draft Environmental
Impact Statement

Volume II
(Tables, Figures, and Maps For Volume I)



U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

Alaska Outer Continental Shelf

OCS EIS/EA
MMS 2002-029

Beaufort Sea Planning Area
Sales 186, 195, and 202
Oil and Gas Lease Sale

Draft Environmental
Impact Statement

Volume II

(Tables, Figures, and Maps For Volume I)

Author
Minerals Management Service
Alaska OCS Region

U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

June 2002

TABLE OF CONTENTS

Contents

VOLUME II – TABLES, FIGURES, AND MAPS

TABLES

FIGURES

TABLES

Table II.A-1 Possible Sales-Related Activities

Sale	Near/Shallow Zone		Midrange/Medium Zone		Far/Deepwater Zone		Total Projects
	Leasing and Exploration	Develop-ment Projects	Leasing and Exploration	Develop-ment Projects	Leasing and Exploration	Develop-ment Projects	
186	70%	2	20%	1	10%	0	**3**
195	50%	1	30%	1	20%	0	**2**
202	40%	0	30%	0	30%	1	**1**
Total	**53%**	**3**	**27%**	**2**	**20%**	**1**	**6**

Table II.A-2 Area and Deferral Comparisons for Alternatives I Through VI

Alternative	Whole or Partial Blocks Deferred	Whole or Partial Blocks in Alternative	Hectares Deferred	Hectares in Alternative	Acres Deferred	Acres in Alternative
Alternative I Program Area Proposal	1,877	NA	NA	3,953,832	NA	9,769,921
Alternative II No Action	0	NA	NA	NA	NA	NA
Alternative III Barrow Subsistence Whale Deferral	26	1,851	55,735	3,898,097	137,721	9,632,199
Alternative IV Nuiqsut Subsistence Whale Deferral	30	1,847	65,518	3,888,314	161,895	9,608,025
Alternative V Kaktovik Subsistence Whale Deferral	28	1,849	49,116	3,904,715	121,367	9,648,553
Alternative VI Eastern	60	1,817	114,395	3,839,437	282,670	9,487,250

Table II.A-3 Resource Potential Affected by Deferrals

Beaufort OCS Deferral Areas	Opportunity-Index (Commercial Chance)
No Action	**100%**
Barrow Subsistence Whale Deferral	0.01
Nuiqsut Subsistence Whale Deferral	0.05
Kaktovik Subsistence Whale Deferral	0.03
Eastern Deferral	0.03

1. For purposes of analysis, we assume that 460 million barrels of oil could be discovered and produced from a typical lease sale offering the entire Beaufort Sea Planning Area.

2. One or more prospects could exist in any of the deferral areas that could hold oil resources totaling 460 million barrels of oil.

3. The chance that all of the resources are located, will be leased and discovered, and eventually become commercial oil fields in a deferral area is given by the Opportunity Index. For example, there is a 5% chance (or 1in 20) that commercial fields will be discovered and produced from the Nuiqsut Whale Subsistence Deferral. There is a 95% chance that the assumed 460 million barrels will be leased, discovered, and produced elsewhere in the planning area.

Table II.A-4 Summary of Effects for Sale 186
Beaufort Sea Multiple Lease Sale Environmental Impact Statement

Note to Reader: Please keep the following information in mind as you read the summaries in this table.

This table provides summary information by alternative and resource for Sale 186. For each resource, this table first summarizes the effects that are common to all alternatives, except for Alternative II (No Action). Then it summarizes the effects of the Proposal (Alternative I) and all other deferral alternatives having the same effects. When applicable, this table identifies the other alternative combinations that have different effects. Table II.A-5 and Table II.A-6 provide similar summaries of effects by resource and alternative for Sales 195 and 202. The bold text in column 2 of Table II.A-5 and Table II.A-6 help identify the differences in effects between Sale 186, 195, and 202. Table IV-1 Summary provides a comparison of effects for all resources, for all deferral alternatives and sales. In evaluating the alternatives, an analyst may identify different effects between alternatives, but those differences do not translate to changes in the overall effect. For this EIS, we assume that removing areas (deferral alternatives) will decrease the opportunity that an economic resource will be found in the remainder of the area being offered. However, if economic oil and gas resources are discovered in the remaining area the level of development activity and the amount of production (460 million barrels) will be the same. This assumption reflects the real-world situation that only larger economic fields can and will be developed. Small, non-economic fields, when discovered, do not result in development activity.

This EIS uses the comparative term “the same as” to indicate that an impact is essentially identical to or as similar as can be determined to that noted for another alternative. Within the EIS analysis, we use the phrase “the same as” to indicate to the reader that two impacts are considered to be equal. We do not intend this in the pure or mathematical sense. We are not saying that two alternatives are exactly the same in all aspects. Rather, we use the phrase to indicate that two impacts are so close that finding a difference between them is beyond our analytical ability to measure or analyze.

The effects associated with potential oil spills are based upon the assumption, for purposes of analysis, that a spill occurs and no spill-response activities are conducted. Most of the numbers presented in the oil-spill-risk analysis assume that the oil spill occurs and provides information about the likelihood of such a spill contacting a resource. The reader should keep in mind that the probability of a large oil spill (greater than or equal to 1,000 barrels of oil) is less than 10%. The chance of an oil spill occurring and reaching a resource is much less than 10%. Furthermore, MMS requires companies to have and implement oil-spill-response plans to help prevent oil from reaching critical areas and to remove oil from the environment. Because we cannot predict a specific level of cleanup, which would vary based upon location, weather conditions, time of year, etc., we make a very conservative assumption of zero cleanup and containment.

The summaries presented in this table are based on the comprehensive analysis provided in Section IV.C and Section V. Readers are encouraged to go to the appropriate Sections in IV.C and V for the full analysis.

Water Quality (Section IV.C.1)

Lower Trophic-Level Organisms (Section IV.C.2)

Fishes (Section IV.C.3)

Essential Fish Habitat (Section IV.C.4)

Endangered and Threatened Species (Section IV.C.5)

Bowhead Whales (Section IV.C.5.a)

Spectacled Eiders (Section IV.C.5.b)’

Steller’s Eiders (Section IV.C.5.c)

Marine and Coastal Birds (Section IV.C.6)

Marine Mammals (Section IV.C.7)

Terrestrial Mammals (Section IV.C.8)

Vegetation and Wetlands (Section IV.C.9)

Economy (Section IV.C.10)

Subsistence-Harvest Patterns (Section IV.C.11)

Sociocultural Systems (Section IV.C.12)

Archaeological Resources (Section IV.C.13)

Land Use Plans and Coastal Management Programs (Section IV.C.14)

Air Quality (Section IV.C.15)

Environmental Justice (Section IV.C.16)

Table II.A-4 Summary of Effects for Sale 186 (continued)

Water Quality	
Effects Common to Alternatives I, III, IV, V, and VI	Hydrocarbons from small spills could result in local, chronic hydrocarbon contamination; and hydrocarbons from a large oil spill could exceed the 1.5 parts per million acute toxic criterion during the first day and the 0.015 parts per million chronic criterion for up to a month in an area the size of a small bay. Other effects of the lease sales would not affect regional water quality, including the following three permitted activities. The increased turbidity from permitted construction activities would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers. If produced waters were discharged, the effect on water quality would be local but would last over the life of the field(s).

Lower-Trophic-Level Organisms	
Effects Common to Alternatives I, III, IV, V, and VI	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas, and even small spills of refined petroleum in relatively shallow water could affect benthic organisms, including kelp communities. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).
Alternatives I, III, IV, V, and VI	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).

Fishes	
Effects Common to Alternatives I, III, IV, V, and VI	Noise and discharges from dredging, gravel mining, island construction and reshaping, pipeline trenching, and abandonment are likely to have no measurable effect on fish populations (including incidental anadromous species). A few fish could be harmed or killed, but most in the immediate area would avoid these activities and would be otherwise unaffected. Effects on most overwintering fish are likely to be short term and sublethal, with no measurable effect on overwintering fish populations. In the unlikely event of a large oil or diesel fuel spill, effects on arctic fishes (including incidental anadromous species) would depend primarily on the season and location of the spill; the lifestage of the fishes (adult, juvenile, larval, or egg); and the duration of the oil contact. Because of their very low numbers in the spill area, no measurable effects are likely on fishes in winter. Effects would be more likely to occur from an offshore oil spill moving into nearshore waters during summer, where fishes concentrate to feed and migrate. If an offshore spill did occur and contact the nearshore area, some marine and migratory fish may be harmed or killed. However, it likely would not have a measurable effect on fish populations, and recovery would be likely within 5-10 years. In general, the effects of fuel spills on fishes are likely to be less than those of crude oil spills. In the unlikely event of an onshore pipeline oil spill contacting a small waterbody supporting fish (for example, ninespine stickleback, arctic grayling, and Dolly Varden char) and that had restricted water exchange, it likely would kill or harm most of the fish within the affected area. Recovery would be likely in 5-10 years. However, because of the small amount of oil or diesel fuel likely to enter freshwater habitat, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in overwintering areas or small waterbodies (containing many fish or fish eggs), an onshore spill of this kind is not likely to have a measurable effect on fish populations on the Arctic Coastal Plain.

Table II.A-4 Summary of Effects for Sale 186 (continued)

Essential Fish Habitat	
Effects Common to Alternatives I, III, IV, V, and VI	The same type and size of disturbance (for example, seismic activity, turbidity from construction, or an oil spill) or size of deferral can be expected to have a slightly greater effect in the western Beaufort than in the eastern Beaufort. Less impact would be expected in the central region. One exception is that freshwater effects would be greatest in the central region. The disturbance effects during the exploratory phase are all limited to the 45-day open-water season, except for the possible 3-year recovery of benthic prey and their habitat around exploratory wells. However, benthic organisms are only a minor prey item. Effects on essential fish habitat from seismic surveys, drilling-mud disposal, turbidity, and pipeline construction (both offshore and onshore), are considered low. The effects of ice-road construction could range from low to moderate because of the uncertainty of withdrawing up to 15% of the free water from lakes during the winter. In most cases, the salmon would recover within one generation. In the unlikely event that a large oil spill occurs, effects on freshwater essential fish habitat would be low. Effects of the spill on estuarine and marine essential fish habitats could be moderate and could affect smolting salmon. These salmon would recover within one generation. Changes in abundance would be limited to a population or portion of a population (populations in one stream or in even or odd years for pink salmon populations) and/or for a short time period.

Endangered and Threatened Species - Bowhead Whales	
Effects Common to Alternatives I, III, IV, V, and VI	Bowhead whales exposed to noise-producing activities such as vessel and aircraft traffic, drilling operations, and seismic surveys most likely would experience temporary, nonlethal effects. Some avoidance behavior could persist up to 12 hours. The Industry Site-Specific Bowhead Whale-Monitoring Program should be effective in preventing a delay or blockage of the migration. Any effects from the discharge of muds and cuttings or suspension of sediment in the water column would be very localized around the drill rig because of the rapid dilution/deposition of these materials. Effects on the bowheads prey species likely would be negligible. Whales exposed to spilled oil would likely experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The stipulation on Pre-booming Requirements for Fuel Transfers should ensure that no fuel spills would affect bowhead whales during their migration. The differences in noise and oil-spill effects to bowhead whales from these deferrals would likely be difficult to measure. Overall, leasing, exploration, and production activities associated with Sale 186 likely would have minimal effect on bowhead whales. The effects from an encounter with aircraft generally are brief, and the whales should resume their normal activities within minutes. Bowheads may exhibit temporary avoidance behavior to vessels at a distance of 1-4 kilometers, including the transport of bottom-founded drilling platforms. Most bowhead whales during the fall migration are likely to avoid an area around a seismic vessel operating in nearshore waters by a radius of up to 20 kilometers. Avoidance may persist up to 12 hours after the end of seismic operations. In addition, provisions under the Conflict Avoidance Agreement that are likely to be implemented during the bowhead whale migration place limitations on where and when seismic operations can be conducted. Some bowheads may avoid drilling noise at 20 kilometers or more. Drilling operations from drill ships with icebreaker support during the bowhead whale migration are likely to have a low effect on bowhead whales, causing most whales to avoid the area around a drill site, particularly if an icebreaker is actively managing ice in the area. Overall, bowhead whales exposed to noise-producing activities most likely would experience temporary, nonlethal effects. In the unlikely event of a large oil spill, some individuals may be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals affected likely would be small. Some bowheads could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of oil-contaminated prey items, and/or perhaps temporary displacement from some feeding areas. Exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, although most individuals exposed to spilled oil likely would experience temporary, nonlethal effects.

Table II.A-4 Summary of Effects for Sale 186 (continued)

Endangered and Threatened Species – Steller's Eiders	
Effects Common to Alternatives I, III, IV, V, and VI	Steller's eiders are not likely to experience adverse effects from potentially disturbing routine activities, collisions with structures, foraging habitat reduction, or oil-spill-cleanup activity. The effects of normal activities on Steller's eiders are likely to be significantly less than those obtained if leasing and development occurred throughout the planning area with equal intensity. Low Steller's eider mortality is expected in the unlikely event a large oil spill occurs; however, recovery of the Alaska population from spill-related losses is not likely to occur while the regional population is declining.

Endangered and Threatened Species -Spectacled Eiders	
Effects Common to Alternatives I, III, IV, V, and VI	The effects from normal activities associated with oil and gas exploration and development in the Beaufort Sea are likely to include the loss of a small number of spectacled eiders. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness, survival, or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter support traffic. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Although the eider population, which currently is declining at a non-significant rate, may be slower to recover from small losses or declines in fitness or productivity, no significant overall population effect is likely. In the unlikely event a large oil spill occurs, spectacled eider mortality is likely to be fewer than 100 individuals; however, any substantial loss (25+ individuals) would represent a significant effect. Recovery from substantial mortality is not likely to occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in population numbers.
Alternatives I, III, V, and VI	The effects from normal activities include nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures. In the unlikely event of a large oil spill, the risk of contact is likely to be somewhat lower than if developments were spread throughout the planning area, which could include some areas used by eiders, which have higher contact probabilities indicated by the MMS oil-spill model.
Alternative IV	The effects on spectacled eiders from normal activities and in the unlikely event a large oil spill occurs from Alternative IV are likely to be somewhat less than under Alternative I.

Table II.A-4 Summary of Effects for Sale 186 (continued)

Marine and Coastal Birds	
Effects Common to Alternatives I, III, IV, V, and VI	The adverse effects on marine and coastal birds from normal exploration and development/production activities in the Beaufort Sea are likely to include the loss of small numbers of marine and coastal birds. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness or survival of individuals or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter traffic, causing displacement from preferred-use areas, and increased levels of energy use and predation. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Disturbance of local nesting birds probably would have little effect on Arctic Coastal Plain bird populations as a whole. However, populations currently declining at a non-significant rate may be slower to recover from small losses or declines in fitness or productivity, and those declining at a significant rate are likely to require a protracted recovery period. No significant overall population effect is likely to result from small losses for most species. In the unlikely event a large oil spill occurs, mortality is likely to reflect local population size and vulnerability determined by seasonal habitat use and stage of annual cycle at the time of contact (for example, molting versus non-molting). As the most abundant species, long-tailed duck mortality is likely to exceed 1,000 individuals, while that of other common species such as king eider, common eider, and scoters likely would be in the low hundreds, and loon species fewer than 25 individuals each. Mortality at the higher levels predicted by Fish and Wildlife Service data could result in significant effects for the long-tailed duck, king eider, and common eider. The probability of a large oil spill occurring, low throughout the planning area, is likely to decrease from the Near Zone to the Far Zone due to the greater likelihood of oil development in the former area.
Alternatives I, III, V and VI	The effects from activities include nonsignificant disturbance, and the potential loss of small numbers of birds from collision with structures. In the unlikely event a large oil spill occurs, the risk of contact is likely to be somewhat lower than if developments were spread throughout the planning area, which could include some areas used by marine and coastal birds that have higher contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil-spill mortality is not likely to occur in any species whose population is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Overall effects of a unlikely large oil spill could result in significant effects for long-tailed ducks and king and common eiders. Because Alternatives III, V, and VI defer areas well removed from primary support facilities in the central Beaufort, where most leasing and development is likely to occur, effects from activities and any oil spill on marine and coastal birds are likely to be the same as under Alternative I.
Alternative IV	The effects from activities associated with Alternatives IV on several bird species are likely to be somewhat less than under Alternative I; however, in the unlikely event a large oil spill occurs, effects on regional populations of several species could be lowered substantially.

Marine Mammals	
Effects Common to Alternatives I, III, IV, V, and VI	The effects from activities associated with Beaufort Sea oil and gas exploration and development are estimated to include the loss from a large oil spill (8-10 % chance) of small numbers of pinnipeds (perhaps 100-200 ringed seals but probably fewer than 10-20 spotted and 30-50 bearded seals and small numbers [fewer than 100] walruses), polar bears (6-10 bears), and beluga and gray whales (fewer than 10), with populations recovering (recovery meaning the replacement of individuals killed as a consequence of exploration and development) within about 1 year.

Terrestrial Mammals	
Effects Common to Alternatives I, III, IV, V, and VI	The effects of Beaufort Sea oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes likely would include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances likely would not affect caribou, muskox, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), probably fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.

Table II.A-4 Summary of Effects for Sale 186 (continued)

Vegetation and Wetlands	
Effects Common to Alternatives I, III, IV, V, and VI	Disturbances mainly come from building gravel pads and ice roads and installing the onshore pipeline. Gravel pads, the pipeline trench, and the 12- or 50-mile-long onshore pipelines would destroy a few acres of vegetation and affect a few acres of nearby vegetation and have only local effects on the tundra ecosystem. Ice roads would have local effects (compression of tundra under the ice roads) on vegetation, with recovery expected within a few years, and no vegetation would be killed. The mean number of one or more oil spills greater than or equal to 1,000 barrels occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. In the unlikely event that such a spill occurs. There is a less than 0.5-21% conditional chance that an offshore spill will contact coastline habitats in the planning area, which include wetlands and other vegetation cover. An estimated 29-40 kilometers of coastline could be oiled from a 1,500- or 4,600-barrel spill. The shoreline of the planning area contains some habitats with fairly high values (1 being the lowest and 10 being the highest) for oil-spill retention (lagoonal beaches have a value of 5, and peat shores have a value of 6) along river deltas and near the mouths of other streams. Stranded oil on sheltered intertidal areas, especially along peat shorelines, likely would persist for many years.

Economy	
Effects Common to Alternatives I, III, IV, V, and VI	Each alternative will generate increases in North Slope Borough property taxes that will average about 1% above the level of Borough revenues without the Sales in the early years and taper to less than 0.5% in the latter years. In the early years of production, each alternative will generate increases in revenues to the State of Alaska of less than 0.25% above the level without a sale. The increases will taper to an even smaller percent in the latter years of production. The change in total employment and personal income is less than 3% over the 1999 baseline for the North Slope Borough and the rest of Alaska for each of the three major phases of OCS activity: exploration, development, and production. The employment and personal income increase includes workers to cleanup possible large oil spills of 1,500-barrels or 4,600 barrels. These increases will occur for each alternative and sale. For purposes of analysis, we assume that the exploration and development scenario for Sale 186 will be the same as for each deferral alternative; that is, the OCS activity will occur in a different area and be the same for each deferral alternative.

Table II.A-4 Summary of Effects for Sale 186 (continued)

Subsistence-Harvest Patterns	
Effects Common to Alternatives I, III, IV, V, and VI	For the communities of Barrow, Nuiqsut and Kaktovik, disturbances periodically could affect subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt. The chance of an oil spill occurring and entering offshore waters is estimated to be low. Based on the assumption that a spill has occurred, the chance of an oil spill during summer from a platform or a pipeline contacting important traditional bowhead whale- and seal-harvest areas over a 360-day period would be 75% or less for the Barrow whaling area, 41% or less for the Nuiqsut whaling area, and 34% or less for the Kaktovik whaling area. A spill also could affect other subsistence resources and harvest areas used by the communities of Barrow, Nuiqsut, and Kaktovik. Overall, oil spills could affect subsistence resources periodically in the communities of Barrow, Nuiqsut, and Kaktovik. In the unlikely event of a large oil spill, many harvest areas and some subsistence resources could be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads and threaten a pivotal element of Inupiat culture. There also is concern that the International Whaling Commission, which sets the quota for the Inupiat subsistence harvest of bowhead whales, would reduce the harvest quota following a major oil spill or, as a precaution, as the migration corridor becomes increasingly developed to ensure that overall population mortality did not increase. Such a move would have a profound cultural and nutritional impact on Inupiat whaling communities. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree these resources were contaminated. In the case of extreme contamination, harvests could cease until such time as resources were perceived as safe by local subsistence hunters. Overall, such effects are not expected from routine activities and operations. Tainting concerns also would apply to polar bears, seals, beluga whales, walruses, fish, and birds. Additionally, effects from a large oil spill likely would produce potential short-term but serious adverse effects to long-tailed duck and king and common eider populations. All areas directly oiled, areas to some extent surrounding them, and areas used for staging and transportation corridors for spill response would not be used by subsistence hunters for some time following a spill. Oil contamination of beaches would have a profound impact on whaling because even if bowhead whales were not contaminated, Inupiat subsistence whalers would not be able to bring them ashore and butcher them on a contaminated shoreline. The duration of avoidance by subsistence users would vary depending on the volume of the spill, the persistence of oil in the environment, the degree of impact on resources, the time necessary for recovery, and the confidence in assurances that resources were safe to eat. Such oil-spill effects would be considered significant.
Alternative IV	Even though effects on subsistence would be essentially the same as described for Alternative I, effects on subsistence-harvest patterns are expected to be reduced because no exploration or production activities would occur in these deferral areas, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished.

Table II.A-4 Summary of Effects for Sale 186 (continued)

Sociocultural Systems	
Effects Common to Alternatives I, III, IV, V, and VI	Effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from industrial activities, from changes in population and employment, and from periodic interference with subsistence-harvest patterns from oil spills and oil-spill cleanup. Altogether, effects periodically could disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternatives I, III, V, and VI	The consequential effects on sociocultural systems are expected to be similar to those discussed under Effects Common to All Alternatives. Altogether, effects periodically could disrupt but not displace ongoing social systems; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternative IV	The effects to subsistence-harvest patterns are expected to be reduced under this alternative. Subsequent effects reductions to sociocultural systems also would be expected.

Archaeological Resources	
Effects Common to Alternatives I, III, IV, V, and VI	Potential effects on archaeological resources would be from exploration and development activities on both onshore and offshore resources, including historic and prehistoric. Onshore resources are more at risk for effects from disturbance caused by construction or oil-spill-cleanup operations. Potential offshore resources are at greater risk for effects from bottom-disturbing activities, notably anchor dragging and pipeline trenching. Generally, potential effects from activities increase with the level of activities, from the exploration phase to the development phase. For onshore archaeological resources, the potential for effects increases with the distance from existing pipeline infrastructure and from oil-spill size and associated cleanup operations. Archaeological surveys and analyses are required in areas where potential archaeological resources are at risk from offshore operations. These requirements are specified in the MMS Handbook 620.1H, Archaeological Resource Protection; in regulations (30 CFR 250.194; 30 CFR 250.126; 30 CFR 250.201; 30 CFR 250.203; 30 CFR 250.204; 30 CFR 250.414; 30 CFR 250.1007(a)(5); and 30 CFR 250.1009); and in law through the National Historic Preservation Act. Any archaeological resources, either onshore or offshore, will be identified before any activities are permitted, and they will be avoided or potential effects will be mitigated. Each of the alternatives would provide some level of protection to archaeological resources by removing areas from leasing and potential exploration and development activities. The MMS has identified 502 whole or partial blocks in the program area that may contain prehistoric or historic resources (see Section III.C). The following indicates the number of blocks with archaeological potential within each alternative, their relative percent of the total number of blocks with archaeological resource potential, and the blocks with archaeological resource potential remaining in the sale area. • Alternative III would remove 9 (1.8%), leaving 493 blocks or partial blocks • Alternative IV would remove 17 (3.4%), leaving 485 blocks or partial blocks • Alternative V would remove 20 (4%), leaving 482 blocks or partial blocks • Alternative VI would remove 48 (9.6%), leaving 454 blocks or partial blocks
Alternatives I, IV, V, and VI	The potential effects on archaeological resources are essentially the same as discussed for general effects, with activity concentrated in the Near Zone, close to existing infrastructure. If extended-reach drilling techniques are used instead of offshore platforms or islands, possible offshore effects would be minimized. More potential effects could occur onshore as opposed to offshore, and in the development phase rather than the exploration phase, because of possible oil-spill-cleanup activities. Although all the projected development is in the Near and Midrange zones where there is a higher potential for archaeological resources to occur, prehistoric and historic resources both onshore and offshore will be identified by archaeological surveys and avoided or mitigated.
Alternative III	Alternatives III would reduce the potential for effects on prehistoric or historic resources in the deferral areas. The potential for encountering shipwrecks during offshore operations would be greatly reduced because of the high potential for possible shipwrecks to occur in the general area offshore Barrow. There would less potential disturbance in the adjacent land areas, which otherwise might have experienced construction activities related to pipeline infrastructure or a staging area.

Table II.A-4 Summary of Effects for Sale 186 (continued)

Land Use Plans and Coastal Management Programs	
Effects Common to Alternatives I, III, IV, V, and VI	Conflicts with the Statewide standards of the ACMP and the NSB CMP policies are not expected. Through the use of mitigating measures and regulatory oversight, it should be possible to comply with all of the standards and policies. Most of these policies will be more precisely addressed if and when specific proposals are brought forward by lessees. All Exploration and Development and Production plans must be accompanied by a consistency certification for State review and concurrence. The State will review OCS plans and concur or object with the lessee's consistency certification. The MMS cannot issue a permit for any activities described in the plans in the absence of the State's concurrence unless the Secretary of Commerce overrides the State's objection.
Alternatives I, III, IV, V, and VI	No conflicts with the Statewide standards of the ACMP or with the enforceable policies of the NSB CMP are anticipated.

Air Quality	
Effects Common to Alternatives I, III, IV, V, and VI	Effects on onshore air quality from air emissions likely would be only a very small percent of the maximum allowable PSD Class II increments. The concentrations of criteria pollutants in the onshore ambient air would remain well within the air-quality standards. Consequently, there likely would be only a minimal effect on air quality with respect to standards. Principally, because of the distance of emissions from land, the other effects of air-pollutant concentrations at the shore due to exploration and development and production activities or accidental emissions would not be sufficient to harm vegetation. A light, short-term coating of soot over a localized area could result from oil fires. The air-quality analysis is based on the specific emission controls and emission limitations that the operators would apply to meet the appropriate Environmental Protection Agency regulations and permit requirements for any development and production activities. The effects of all these activities would cause only small, local, temporary increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards. Therefore, effects from the proposed sales would be low. Individual air masses move constantly with atmospheric circulation, we expect that the major differences in effects of the different alternatives on air quality would be in which specific geographic areas could be affected by air emissions. Because these emissions should not be significant other than in extremely localized areas, we conclude that none of the alternatives to the proposed sales would result in significant effects different from or other than those discussed in Section IV.C.15.a. Air quality effects of all activities under all sales and all alternatives would cause only small increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards.

Environmental Justice	
Effects Common to Alternatives I, III, IV, V, and VI	Sale-specific environmental justice effects would derive from potential noise, disturbance, and oil spill effects on subsistence resources, subsistence-harvest patterns, and sociocultural systems. The only substantial source of potential environmental justice-related effects to Native villages from the Beaufort Sea multiple sales and the range of alternatives would occur in the unlikely event of a large oil spill, which could affect subsistence resources. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.

Table II.A-5 Summary of Effects for Sale 195
Beaufort Sea Multiple Lease Sale Environmental Impact Statement

Note to Reader: Please keep the following information in mind as you read the summaries in this table.

The information in this summary provides summary information by alternative and resource for Sale 195. For each resource, this table first summarizes the effects that are common to all alternatives, except for Alternative II, No Action. See Section IV.B for the effects of Alternative II. Then it summarizes the effects of the Proposal (Alternative I) and all Alternatives III-VI having the same effects. When applicable, this table identifies the other alternative combinations that have different effects. Table II.A-4 and Table II.A-6 provide similar summaries of effects by resource and alternative for Sales 186 and 202. The bold text in column 2 in this table and Table II.A-6 help identify the differences in effects between Sales 186, 195, and 202. Table IV-1 Summary provides a comparison of effects for all resources, for all alternatives and sales. In evaluating the alternatives, an analyst may identify different effects between alternatives, but those differences do not translate to changes in the overall effect. For this EIS, we assume that removing areas (deferral alternatives) will decrease the opportunity that an economic resource will be found in the remainder of the area being offered. However, if economic oil and gas resources are discovered in the remaining area, the level of development activity and the amount of production (460 million barrels) will be the same. This assumption reflects the real-world situation that only larger economic fields can and will be developed. Small, non-economic fields, when discovered, do not result in development activity.

This EIS uses the comparative term “the same as” to indicate that an impact is essentially identical to or as similar as can be determined to that noted for another alternative. Within the EIS analysis, we use the phrase “the same as” to indicate to the reader that two impacts are considered to be equal. We do not intend this in the pure or mathematical sense. We are not saying that two alternatives are exactly the same in all aspects. Rather, we use the phrase to indicate that two impacts are so close that finding a difference between them is beyond our analytical ability to measure or analyze.

The effects associated with potential oil spills are based upon the assumption, for purposes of analysis, that a spill occurs and no spill-response activities are conducted. Most of the numbers presented in the oil-spill-risk analysis assume that the oil spill occurs and provides information about the likelihood of such a spill contacting a resource. The reader should keep in mind that the probability of a large oil spill (greater than or equal to 1,000 barrels of oil) is less than 10%. The chance of an oil spill occurring and reaching a resource is much less than 10%. Furthermore, MMS requires companies to have and implement oil-spill-response plans to help prevent oil from reaching critical areas and to remove oil from the environment. Because we cannot predict a specific level of cleanup, which would vary based upon location, weather conditions, time of year, etc., we make a very conservative assumption of zero cleanup and containment.

The summaries presented in this table are based on the comprehensive analysis provided in Section IV.C and Section V. Readers are encouraged to go to the appropriate Sections in IV.C and V for the full analysis.

Water Quality (Section IV.C.1)

Lower Trophic-Level Organisms (Section IV.C.2)

Fishes (Section IV.C.3)

Essential Fish Habitat (Section IV.C.4)

Endangered and Threatened Species (Section IV.C.5)

Bowhead Whales (Section IV.C.5.a)

Spectacled Eiders (Section IV.C.5.b)’

Steller’s Eiders (Section IV.C.5.c)

Marine and Coastal Birds (Section IV.C.6)

Marine Mammals (Section IV.C.7)

Terrestrial Mammals (Section IV.C.8)

Vegetation and Wetlands (Section IV.C.9)

Economy (Section IV.C.10)

Subsistence-Harvest Patterns (Section IV.C.11)

Sociocultural Systems (Section IV.C.12)

Archaeological Resources (Section IV.C.13)

Land Use Plans and Coastal Management Programs (Section IV.C.14)

Air Quality (Section IV.C.15)

Environmental Justice (Section IV.C.16)

Table II.A-5 Summary of Effects for Sale 195 (continued)

Water Quality	
Effects Common to Alternatives I, III, IV, V, and VI	Hydrocarbons from small spills could result in local, chronic hydrocarbon contamination; and hydrocarbons from a large oil spill could exceed the 1.5 parts per million acute toxic criterion during the first day of a spill and the 0.015 parts per million chronic criterion for up to a month in an area the size of a small bay. Other effects of the lease sales would not affect regional water quality, including the following three permitted activities. Increased turbidity from permitted construction activities would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers. If produced waters were discharged, the effect on water quality would be local but would last over the life of the field(s).

Lower-Trophic-Level Organisms	
Effects Common to Alternatives I, III, IV, V, and VI	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas, and even small spills of refined petroleum in relatively shallow water could affect benthic organisms, including kelp communities. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).
Alternatives I, III, IV, V, and VI	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).

Fishes	
Effects Common to Alternatives I, III, IV, V, and VI	Noise and discharges from dredging, gravel mining, island construction and reshaping, pipeline trenching, and abandonment are likely to have no measurable effect on fish populations (including incidental anadromous species). A few fish could be harmed or killed, but most in the immediate area would avoid these activities and would be otherwise unaffected. Effects on most overwintering fish are likely to be short term and sublethal, with no measurable effect on overwintering fish populations. In the unlikely event of a large oil or diesel fuel spill, effects on arctic fishes (including incidental anadromous species) would depend primarily on the season and location of the spill; the lifestage of the fishes (adult, juvenile, larval, or egg); and the duration of the oil contact. Because of their very low numbers in the spill area, no measurable effects are likely on fishes in winter. Effects would be more likely to occur from an offshore oil spill moving into nearshore waters during summer, where fishes concentrate to feed and migrate. If an offshore spill did occur and contact the nearshore area, some marine and migratory fish may be harmed or killed. However, it likely would not have a measurable effect on fish populations, and recovery would be likely within 5-10 years. In general, the effects of fuel spills on fishes are likely to be less than those of crude oil spills. In the unlikely event of an onshore pipeline oil spill contacting a small waterbody supporting fish (for example, ninespine stickleback, arctic grayling, and Dolly Varden char) and that had restricted water exchange, it likely would kill or harm most of the fish within the affected area. Recovery would be likely in 5-10 years. However, because of the small amount of oil or diesel fuel likely to enter freshwater habitat, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in overwintering areas or small waterbodies (containing many fish or fish eggs), an onshore spill of this kind is not likely to have a measurable effect on fish populations on the Arctic Coastal Plain.

Table II.A-5 Summary of Effects for Sale 195 (continued)

Essential Fish Habitat	
Effects Common to Alternatives I, III, IV, V, and VI	The same type and size of disturbance (for example, seismic activity, turbidity from construction, or an oil spill) or size of deferral can be expected to have a slightly greater effect in the western Beaufort than in the eastern Beaufort. Less impact would be expected in the central region. One exception is that freshwater effects would be greatest in the central region. The disturbance effects during the exploratory phase are all limited to the 45-day open-water season, except for the possible 3-year recovery of benthic prey and their habitat around exploratory wells. However, benthic organisms are only a minor prey item. Effects on essential fish habitat from seismic surveys, drilling-mud disposal, turbidity, and pipeline construction (both offshore and onshore), are considered low. The effects of ice-road construction could range from low to moderate because of the uncertainty of withdrawing up to 15% of the free water from lakes during the winter. In most cases, the salmon would recover within one generation. In the unlikely event that a large oil spill occurs, effects on freshwater essential fish habitat would be low. Effects of the spill on estuarine and marine essential fish habitats could be moderate and could affect smolting salmon. These salmon would recover within one generation. Changes in abundance would be limited to a population or portion of a population (populations in one stream or in even or odd years for pink salmon populations) and/or for a short time period.

Endangered and Threatened Species - Bowhead Whales	
Effects Common to Alternatives I, III, IV, V, and VI	Bowhead whales exposed to noise-producing activities such as vessel and aircraft traffic, drilling operations, and seismic surveys most likely would experience temporary, nonlethal effects. Some avoidance behavior could persist up to 12 hours. The Industry Site-Specific Bowhead Whale-Monitoring Program should be effective in preventing a delay or blockage of the migration. Any effects from the discharge of muds and cuttings or suspension of sediment in the water column would be very localized around the drill rig because of the rapid dilution/deposition of these materials. Effects on the bowheads prey species likely would be negligible. Whales exposed to spilled oil would likely experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The stipulation on Pre-booming Requirements for Fuel Transfers should ensure that no fuel spills would affect bowhead whales during their migration. The differences in noise and oil-spill effects to bowhead whales from these deferrals would likely be difficult to measure. Overall, leasing, exploration, and production activities associated with Sale 195 likely would have minimal effect on bowhead whales. The effects from an encounter with aircraft generally are brief, and the whales should resume their normal activities within minutes. Bowheads may exhibit temporary avoidance behavior to vessels at a distance of 1-4 kilometers, including the transport of bottom-founded drilling platforms. Most bowhead whales during the fall migration are likely to avoid an area around a seismic vessel operating in nearshore waters by a radius of up to 20 kilometers. Avoidance may persist up to 12 hours after the end of seismic operations. In addition, provisions under the Conflict Avoidance Agreement that are likely to be implemented during the bowhead whale migration place limitations on where and when seismic operations can be conducted. Some bowheads may avoid drilling noise at 20 kilometers or more. Drilling operations from drill ships with icebreaker support during the bowhead whale migration are likely to have a low effect on bowhead whales, causing most whales to avoid the area around a drill site, particularly if an icebreaker is actively managing ice in the area. Overall, bowhead whales exposed to noise-producing activities most likely would experience temporary, nonlethal effects. In the unlikely event of a large oil spill, some individuals may be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals affected likely would be small. Some bowheads could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of oil-contaminated prey items, and/or perhaps temporary displacement from some feeding areas. Exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, although most individuals exposed to spilled oil likely would experience temporary, nonlethal effects.

Table II.A-5 Summary of Effects for Sale 195 (continued)

Endangered and Threatened Species – Steller's Eiders	
Effects Common to Alternatives I, III, IV, V, and VI	Steller's eiders are not likely to experience adverse effects from potentially disturbing routine activities, collisions with structures, foraging habitat reduction, or oil-spill-cleanup activity. The effects of normal activities on Steller's eiders are likely to be significantly less than those obtained if leasing and development occurred throughout the planning area with equal intensity. Low Steller's eider mortality is expected in the unlikely event a large oil spill occurs; however, recovery of the Alaska population from spill-related losses is not likely to occur while the regional population is declining.

Endangered and Threatened Species -Spectacled Eiders	
Effects Common to Alternatives I, III, IV, V, and VI	The effects from normal activities associated with oil and gas exploration and development in the Beaufort Sea are likely to include the loss of a small number of spectacled eiders. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness, survival, or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter support traffic. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Although the eider population, which currently is declining at a non-significant rate, may be slower to recover from small losses or declines in fitness or productivity, no significant overall population effect is likely. In the unlikely event a large oil spill occurs, spectacled eider mortality is likely to be fewer than 100 individuals; however, any substantial loss (25+ individuals) would represent a significant effect. Recovery from substantial mortality is not likely to occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in population numbers.
Alternatives I, III, V, and VI	The effects from normal activities include nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures. **Disturbance of eiders in the Near Zone is likely to be lower than under Sale 186, because a lower proportion of leasing and exploration is expected to take place there.** In the unlikely event of a large oil spill, the risk of contact is likely to be somewhat lower under Sale 195 than under Sale 186, which proposes one more development project than Sale 195, or lower than if developments were spread throughout the planning area, which could include some areas used by eiders that have higher spill-contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil-spill mortality is not likely to occur while the species is in a declining status; however, determination of status may be obscured by natural variation in population numbers. **Effects are likely to be somewhat less than those that could occur as a result of Sale 186.**
Alternative IV	The effects on spectacled eiders from normal activities and in the unlikely event a large oil spill occurs from Alternative IV are likely to be somewhat less than under Alternative I.

Table II.A-5 Summary of Effects for Sale 195 (continued)

Marine and Coastal Birds	
Effects Common to Alternatives I, III, IV, V, and VI	The adverse effects on marine and coastal birds from normal exploration and development/production activities in the Beaufort Sea are likely to include the loss of small numbers of marine and coastal birds. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness or survival of individuals or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter traffic, causing displacement from preferred-use areas, and increased levels of energy use and predation. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Disturbance of local nesting birds probably would have little effect on Arctic Coastal Plain bird populations as a whole. However, populations currently declining at a non-significant rate may be slower to recover from small losses or declines in fitness or productivity, and those declining at a significant rate are likely to require a protracted recovery period. No significant overall population effect is likely to result from small losses for most species. In the unlikely event a large oil spill occurs, mortality is likely to reflect local population size and vulnerability determined by seasonal habitat use and stage of annual cycle at the time of contact (for example, molting versus non-molting). As the most abundant species, long-tailed duck mortality is likely to exceed 1,000 individuals, while that of other common species such as king eider, common eider, and scoters likely would be in the low hundreds, and loon species fewer than 25 individuals each. Mortality at the higher levels predicted by Fish and Wildlife Service data could result in significant effects for the long-tailed duck, king eider, and common eider. The probability of a large oil spill occurring, low throughout the planning area, is likely to decrease from the Near Zone to the Far Zone due to the greater likelihood of oil development in the former area.
Alternative I	The effects from normal activities include non-significant disturbance and the potential loss of small numbers of birds from collisions with structures. **Disturbance of birds in the Near zone is likely to be lower than under Sale 186, because a lower proportion of leasing and exploration is likely to occur there, while lease activity in the Midrange zone is somewhat greater but the number of development projects is the same. In the event a large oil spill occurs, the risk of contact is likely to be somewhat lower under Sale 195 than under Sale 186, which proposes one more development project than Sale 195, or lower than if developments were spread throughout the planning area, which could include some areas used by several bird species that have higher spill-contact probabilities indicated by the MMS oil-spill model.** Recovery from substantial oil spill mortality is not likely to occur for any species whose population is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Overall effects are likely to be somewhat less than those that could occur as a result of Sale 186 but still could result in significant effects for long-tailed duck and king and common eider.
Alternatives III, V and VI	Because Alternatives III, V, and VI defer areas well removed from primary support facilities in the central Beaufort, where most leasing and development is likely to occur, effects from activities and any oil spill on marine and coastal birds are likely to be the same as under Alternative I.
Alternatives IV	The effects from activities associated with Alternatives IV on several bird species are likely to be somewhat less than under Alternative I; however, in the unlikely event a large oil spill occurs, effects on regional populations of several species could be lowered substantially.

Marine Mammals	
Effects Common to Alternatives I, III, IV, V, and VI	The effects from activities associated with Beaufort Sea oil and gas exploration and development are estimated to include the loss from a large oil spill (8-10 % chance) of small numbers of pinnipeds (perhaps 100-200 ringed seals but probably fewer than 10-20 spotted and 30-50 bearded seals and small numbers [fewer than 100] walruses), polar bears (6-10 bears), and beluga and gray whales (fewer than 10), with populations recovering (recovery meaning the replacement of individuals killed as a consequence of exploration and development) within about 1 year.

Table II.A-5 Summary of Effects for Sale 195 (continued)

Terrestrial Mammals	
Effects Common to Alternatives I, III, IV, V, and VI	The effects of Beaufort Sea oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes likely would include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances likely would not affect caribou, muskox, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), probably fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.

Vegetation and Wetlands	
Effects Common to Alternatives I, III, IV, V, and VI	Disturbances mainly come from building gravel pads and ice roads and installing the onshore pipeline. Gravel pads, the pipeline trench, and the 12- or 50-mile-long onshore pipelines would destroy a few acres of vegetation and affect a few acres of nearby vegetation and have only local effects on the tundra ecosystem. Ice roads would have local effects (compression of tundra under the ice roads) on vegetation, with recovery expected within a few years, and no vegetation would be killed. The mean number of one or more oil spills greater than or equal to 1,000 barrels occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. In the unlikely event that such a spill occurs. There is a less than 0.5-21% conditional chance that an offshore spill will contact coastline habitats in the planning area, which include wetlands and other vegetation cover. An estimated 29-40 kilometers of coastline could be oiled from a 1,500- or 4,600-barrel spill. The shoreline of the planning area contains some habitats with fairly high values (1 being the lowest and 10 being the highest) for oil-spill retention (lagoonal beaches have a value of 5, and peat shores have a value of 6) along river deltas and near the mouths of other streams. Stranded oil on sheltered intertidal areas, especially along peat shorelines, likely would persist for many years.

Economy	
Effects Common to Alternatives I, III, IV, V, and VI	Each alternative will generate increases in North Slope Borough property taxes that will average about 1% above the level of Borough revenues without the Sales in the early years and taper to less than 0.5% in the latter years. In the early years of production, each alternative will generate increases in revenues to the State of Alaska of less than 0.25% above the level without a sale. The increases will taper to an even smaller percent in the latter years of production. The change in total employment and personal income is less than 3% over the 1999 baseline for the North Slope Borough and the rest of Alaska for each of the three major phases of OCS activity: exploration, development, and production. The employment and personal income increase includes workers to cleanup possible large oil spills of 1,500-barrels or 4,600 barrels. These increases will occur for each alternative and sale. For purposes of analysis, we assume that the exploration and development scenario for Sale 195 will be the same as for each deferral alternative; that is, the OCS activity will occur in a different area and be the same for each deferral alternative.

Table II.A-5 Summary of Effects for Sale 195 (continued)

Subsistence-Harvest Patterns	
Effects Common to Alternatives I, III, IV,V, and VI	For the communities of Barrow, Nuiqsut and Kaktovik, disturbances periodically could affect subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt. The chance of an oil spill occurring and entering offshore waters is estimated to be low. Based on the assumption that a spill has occurred, the chance of an oil spill during summer from a platform or a pipeline contacting important traditional bowhead whale- and seal-harvest areas over a 360-day period would be 75% or less for the Barrow whaling area, 41% or less for the Nuiqsut whaling area, and 34% or less for the Kaktovik whaling area. A spill also could affect other subsistence resources and harvest areas used by the communities of Barrow, Nuiqsut, and Kaktovik. Overall, oil spills could affect subsistence *resources* periodically in the communities of Barrow, Nuiqsut, and Kaktovik. In the unlikely event of a large oil spill, many harvest areas and some subsistence resources could be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads and threaten a pivotal element of Inupiat culture. There also is concern that the International Whaling Commission, which sets the quota for the Inupiat subsistence harvest of bowhead whales, would reduce the harvest quota following a major oil spill or, as a precaution, as the migration corridor becomes increasingly developed to ensure that overall population mortality did not increase. Such a move would have a profound cultural and nutritional impact on Inupiat whaling communities. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree these resources were contaminated. In the case of extreme contamination, harvests could cease until such time as resources were perceived as safe by local subsistence hunters. Overall, such effects are not expected from routine activities and operations. Tainting concerns also would apply to polar bears, seals, beluga whales, walruses, fish, and birds. Additionally, effects from a large oil spill likely would produce potential short-term but serious adverse effects to long-tailed duck and king and common eider populations. All areas directly oiled, areas to some extent surrounding them, and areas used for staging and transportation corridors for spill response would not be used by subsistence hunters for some time following a spill. Oil contamination of beaches would have a profound impact on whaling because even if bowhead whales were not contaminated, Inupiat subsistence whalers would not be able to bring them ashore and butcher them on a contaminated shoreline. The duration of avoidance by subsistence users would vary depending on the volume of the spill, the persistence of oil in the environment, the degree of impact on resources, the time necessary for recovery, and the confidence in assurances that resources were safe to eat. Such oil-spill effects would be considered significant.
Alternative IV	Even though effects on subsistence would be essentially the same as described for Alternative I, effects on subsistence-harvest patterns are expected to be reduced because no exploration or production activities would occur in these deferral areas, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished.

Table II.A-5 Summary of Effects for Sale 195 (continued)

Sociocultural Systems	
Effects Common to Alternatives I, III, IV, V, and VI	Effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from industrial activities, from changes in population and employment, and from periodic interference with subsistence-harvest patterns from oil spills and oil-spill cleanup. Altogether, effects periodically could disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternatives I, III, V, and VI	The consequential effects on sociocultural systems are expected to be similar to those discussed under Effects Common to All Alternatives. Altogether, effects periodically could disrupt but not displace ongoing social systems; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternative IV	The effects to subsistence-harvest patterns are expected to be reduced under this alternative. Subsequent effects reductions to sociocultural systems also would be expected.

Archaeological Resources	
Effects Common to Alternatives I, III, IV, V, and VI	Potential effects on archaeological resources would be from exploration and development activities on both onshore and offshore resources, including historic and prehistoric. Onshore resources are more at risk for effects from disturbance caused by construction or oil-spill-cleanup operations. Potential offshore resources are at greater risk for effects from bottom-disturbing activities, notably anchor dragging and pipeline trenching. Generally, potential effects from activities increase with the level of activities, from the exploration phase to the development phase. For onshore archaeological resources, the potential for effects increases with the distance from existing pipeline infrastructure and from oil-spill size and associated cleanup operations. Archaeological surveys and analyses are required in areas where potential archaeological resources are at risk from offshore operations. These requirements are specified in the MMS Handbook 620.1H, Archaeological Resource Protection; in regulations (30 CFR 250.194; 30 CFR 250.126; 30 CFR 250.201; 30 CFR 250.203; 30 CFR 250.204; 30 CFR 250.414; 30 CFR 250.1007(a)(5); and 30 CFR 250.1009); and in law through the National Historic Preservation Act. Any archaeological resources, either onshore or offshore, will be identified before any activities are permitted, and they will be avoided or potential effects will be mitigated. Each of the alternatives would provide some level of protection to archaeological resources by removing areas from leasing and potential exploration and development activities. The MMS has identified 502 whole or partial blocks in the program area that may contain prehistoric or historic resources (see Section III.C). The following indicates the number of blocks with archaeological potential within each alternative, their relative percent of the total number of blocks with archaeological resource potential, and the blocks with archaeological resource potential remaining in the sale area. • Alternative III would remove 9 (1.8%), leaving 493 blocks or partial blocks • Alternative IV would remove 17 (3.4%), leaving 485 blocks or partial blocks • Alternative V would remove 20 (4%), leaving 482 blocks or partial blocks • Alternative VI would remove 48 (9.6%), leaving 454 blocks or partial blocks
Alternatives I, IV, V, and VI	The effect of exploration and development activities on possible archaeological resources would be essentially the same as discussed under effects common to all alternatives**, except that activities may be farther away from existing onshore infrastructure. Exploration activities probably would be conducted from offshore facilities, which reduces the potential impact on onshore archaeological resources. Marine archaeological surveys in areas where offshore archaeological resources may exist would identify likely resources, which would be avoided or effects mitigated. In the development phase, the potential for effects to archaeological resources increases with distance from existing infrastructure, primarily because of onshore pipeline distances and associated construction and right-of-way access and the increased possibility for oil-spill-cleanup activities. Onshore archaeological surveys would identify any potential resources, which will be avoided or possible effects mitigated.**

Table II.A-5 Summary of Effects for Sale 195 (continued)

Archaeological Resources	
Alternative III	Alternatives III would reduce the potential for effects on prehistoric or historic resources in the deferral areas. The potential for encountering shipwrecks during offshore operations would be greatly reduced because of the high potential for possible shipwrecks to occur in the general area offshore Barrow. There would less potential disturbance in the adjacent land areas, which otherwise might have experienced construction activities related to pipeline infrastructure or a staging area.

Land Use Plans and Coastal Management Programs	
Effects Common to Alternatives I, III, IV, V, and VI	Conflicts with the Statewide standards of the ACMP and the NSB CMP policies are not expected. Through the use of mitigating measures and regulatory oversight, it should be possible to comply with all of the standards and policies. Most of these policies will be more precisely addressed if and when specific proposals are brought forward by lessees. All Exploration and Development and Production plans must be accompanied by a consistency certification for State review and concurrence. The State will review OCS plans and concur or object with the lessee's consistency certification. The MMS cannot issue a permit for any activities described in the plans in the absence of the State's concurrence unless the Secretary of Commerce overrides the State's objection.
Alternatives I, III, IV, V, and VI	No conflicts with the Statewide standards of the ACMP or with the enforceable policies of the NSB CMP are anticipated.

Air Quality	
Effects Common to Alternatives I, III, IV, V, and VI	Effects on onshore air quality from air emissions likely would be only a very small percent of the maximum allowable PSD Class II increments. The concentrations of criteria pollutants in the onshore ambient air would remain well within the air-quality standards. Consequently, there likely would be only a minimal effect on air quality with respect to standards. Principally, because of the distance of emissions from land, the other effects of air-pollutant concentrations at the shore due to exploration and development and production activities or accidental emissions would not be sufficient to harm vegetation. A light, short-term coating of soot over a localized area could result from oil fires. The air-quality analysis is based on the specific emission controls and emission limitations that the operators would apply to meet the appropriate Environmental Protection Agency regulations and permit requirements for any development and production activities. The effects of all these activities would cause only small, local, temporary increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards. Therefore, effects from the proposed sales would be low. Individual air masses move constantly with atmospheric circulation, we expect that the major differences in effects of the different alternatives on air quality would be in which specific geographic areas could be affected by air emissions. Because these emissions should not be significant other than in extremely localized areas, we conclude that none of the alternatives to the proposed sales would result in significant effects different from or other than those discussed in Section IV.C.15.a. Air quality effects of all activities under all sales and all alternatives would cause only small increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards.

Environmental Justice	
Effects Common to Alternatives I, III, IV, V, and VI	Sale-specific environmental justice effects would derive from potential noise, disturbance, and oil spill effects on subsistence resources, subsistence-harvest patterns, and sociocultural systems. The only substantial source of potential environmental justice-related effects to Native villages from the Beaufort Sea multiple sales and the range of alternatives would occur in the unlikely event of a large oil spill, which could affect subsistence resources. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.

Table II.A-6 Summary of Effects for Sale 202
Beaufort Sea Multiple Lease Sale Environmental Impact Statement

Note to Reader: Please keep the following information in mind as you read the summaries in this table.

The information in this summary provides summary information by alternative and resource for Sale 202. For each resource, this table first summarizes the effects that are common to all alternatives, except Alternative II, No Action. See Section IV.C for information about the effects of Alternative II. Then it summarizes the effects of the Proposal (Alternative I) and Alternatives III-VI having the same effects. When applicable, this table identifies the other alternative combinations that have different effects. Table II.A-4 and Table II.A-5 provide similar summaries of effects by resource and alternative for Sales 186 and 195. The bold text in column 2 of this table and Table II.A-5 help identify the differences in effects between Sale 186, 195, and 202. Table IV-1 Summary provides a comparison of effects for all resources, for all alternatives and sales. In evaluating the alternatives, an analyst may identify different effects between alternatives, but those differences do not translate to changes in the overall effect. For this EIS, we assume that removing areas (deferral alternatives) will decrease the opportunity that an economic resource will be found in the remainder of the area being offered. However, if economic oil and gas resources are discovered in the remaining area, the level of development activity and the amount of production (460 million barrels) will be the same. This assumption is necessary and realistic and reflects the real-world assumption that only larger economic fields can and will be developed. Small, non-economic fields, when discovered, do not result in development activity.

This EIS uses the comparative term “the same as” to indicate that an impact is essentially identical to or as similar as can be determined to that noted for another alternative. Within the EIS analysis, we use the phrase “the same as” to indicate to the reader that two impacts are considered to be equal. We do not intend this in the pure or mathematical sense. We are not saying that two alternatives are exactly the same in all aspects. Rather, we use the phrase to indicate that two impacts are so close that finding a difference between them is beyond our analytical ability to measure or analyze.

The effects associated with potential oil spills are based upon the assumption, for purposes of analysis, that a spill occurs and no spill-response activities are conducted. Most of the numbers presented in the oil-spill-risk analysis cumulative effects assume that the oil spill occurs and provides information about the likelihood of such a spill contacting a resource. The reader should keep in mind that the probability of a large oil spill (greater than or equal to 1,000 barrels of oil) is less than 10%. The chance of an oil spill occurring and reaching a resource is much less than 10%. Furthermore, MMS requires companies to have and implement oil-spill-response plans to help prevent oil from reaching critical areas and to remove oil from the environment. Because we cannot predict a specific level of cleanup, which would vary based upon location, weather conditions, time of year, etc., we make a very conservative assumption of zero cleanup and containment.

The summaries presented in this table are based on the comprehensive analysis provided in Section IV.C and Section V. Readers are encouraged to go to the appropriate Sections in IV.C and V for the full analysis.

Water Quality (Section IV.C.1)

Lower Trophic-Level Organisms (Section IV.C.2)

Fishes (Section IV.C.3)

Essential Fish Habitat (Section IV.C.4)

Endangered and Threatened Species (Section IV.C.5)

Bowhead Whales (Section IV.C.5.a)

Spectacled Eiders (Section IV.C.5.b)’

Steller’s Eiders (Section IV.C.5.c)

Marine and Coastal Birds (Section IV.C.6)

Marine Mammals (Section IV.C.7)

Terrestrial Mammals (Section IV.C.8)

Vegetation and Wetlands (Section IV.C.9)

Economy (Section IV.C.10)

Subsistence-Harvest Patterns (Section IV.C.11)

Sociocultural Systems (Section IV.C.12)

Archaeological Resources (Section IV.C.13)

Land Use Plans and Coastal Management Programs (Section IV.C.14)

Air Quality (Section IV.C.15)

Environmental Justice (Section IV.C.16)

Table II.A-6 Summary of Effects for Sale 202 (continued)

Water Quality	
Effects Common to Alternatives I, III, IV, V, and VI	Hydrocarbons from small spills could result in local, chronic hydrocarbon contamination; and hydrocarbons from a large oil spill could exceed the 1.5 parts per million acute toxic criterion during the first day of a spill and the 0.015 parts per million chronic criterion for up to a month in an area the size of a small bay. Other effects of the lease sales would not affect regional water quality, including the following three permitted activities. The increased turbidity from permitted construction activities would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers. If produced waters were discharged, the effect on water quality would be local but would last over the life of the field(s).

Lower-Trophic-Level Organisms	
Effects Common to Alternatives I, III, IV, V, and VI	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas, and even small spills of refined petroleum in relatively shallow water could affect benthic organisms, including kelp communities. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).
Alternatives I, III, IV, and V	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).
Alternative VI	**The deferral would reduce the risk that hydrocarbons from a large oil spill would contaminate (Section IV.C.1.b) the bowhead-feeding area near Kaktovik for several days. Other effects would be similar to those described for Sale 202 without a deferral (Alternative I). Permitted drilling discharges likely would adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. The Aurora Prospect in this area was explored during 1988, with no noticeable effects of discharges on lower trophic-level organisms. Platform and pipeline construction likely would adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unintentional construction effects on unusual kelp communities could be avoided by required benthic surveys (Stipulation No. 1).**

Table II.A-6 Summary of Effects for Sale 202 (continued)

Fishes	
Effects Common to Alternatives I, III, IV, V, and VI	Noise and discharges from dredging, gravel mining, island construction and reshaping, pipeline trenching, and abandonment are likely to have no measurable effect on fish populations (including incidental anadromous species). While a few fish could be harmed or killed, most in the immediate area would avoid these activities and would be otherwise unaffected. Effects on most overwintering fish are likely to be short term and sublethal, with no measurable effect on overwintering fish populations. In the unlikely event of a large oil or diesel fuel spill, effects on arctic fishes (including incidental anadromous species) would depend primarily on the season and location of the spill; the lifestage of the fishes (adult, juvenile, larval, or egg); and the duration of the oil contact. Because of their very low numbers in the spill area, no measurable effects are likely on fishes in winter. Effects would be more likely to occur from an offshore oil spill moving into nearshore waters during summer, where fishes concentrate to feed and migrate. If an offshore spill did occur and contact the nearshore area, some marine and migratory fish may be harmed or killed. However, it likely would not have a measurable effect on fish populations, and recovery would be likely within 5-10 years. In general, the effects of fuel spills on fishes are likely to be less than those of crude oil spills. In the unlikely event of an onshore pipeline oil spill contacting a small waterbody supporting fish (for example, ninespine stickleback, arctic grayling, and Dolly Varden char) and that had restricted water exchange, it likely would kill or harm most of the fish within the affected area. Recovery would be likely in 5-10 years. However, because of the small amount of oil or diesel fuel likely to enter freshwater habitat, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in overwintering areas or small waterbodies (containing many fish or fish eggs), an onshore spill of this kind is not likely to have a measurable effect on fish populations on the Arctic Coastal Plain.

Essential Fish Habitat	
Effects Common to Alternatives I, III, IV, V, and VI	The same type and size of disturbance (for example, seismic activity, turbidity from construction, or an oil spill) or size of deferral can be expected to have a slightly greater effect in the western Beaufort than in the eastern Beaufort. Less impact would be expected in the central region. One exception is that freshwater effects would be greatest in the central region. The disturbance effects during the exploratory phase are all limited to the 45-day open-water season, except for the possible 3-year recovery of benthic prey and their habitat around exploratory wells. However, benthic organisms are only a minor prey item. Effects on essential fish habitat from seismic surveys, drilling-mud disposal, turbidity, and pipeline construction (both offshore and onshore), are considered low. The effects of ice-road construction could range from low to moderate because of the uncertainty of withdrawing up to 15% of the free water from lakes during the winter. In most cases, the salmon would recover within one generation. In the unlikely event that a large oil spill occurs, effects on freshwater essential fish habitat would be low. Effects of the spill on estuarine and marine essential fish habitats could be moderate and could affect smolting salmon. These salmon would recover within one generation. Changes in abundance would be limited to a population or portion of a population (populations in one stream or in even or odd years for pink salmon populations) and/or for a short time period.

Table II.A-6 Summary of Effects for Sale 202 (continued)

Endangered and Threatened Species - Bowhead Whales	
Effects Common to Alternatives I, III, IV, V, and VI	Bowhead whales exposed to noise-producing activities such as vessel and aircraft traffic, drilling operations, and seismic surveys most likely would experience temporary, nonlethal effects. Some avoidance behavior could persist up to 12 hours. The Industry Site-Specific Bowhead Whale-Monitoring Program should be effective in preventing a delay or blockage of the migration. Any effects from the discharge of muds and cuttings or suspension of sediment in the water column would be very localized around the drill rig because of the rapid dilution/deposition of these materials. Effects on bowheads' prey species likely would be negligible. Whales exposed to spilled oil would likely experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The stipulation on Pre-booming Requirements for Fuel Transfers should ensure that no fuel spills would affect bowhead whales during migration. The differences in noise and oil-spill effects to bowhead whales from these deferrals would likely be difficult to measure. Overall, leasing, exploration, and production activities associated with Sale 202 likely would have minimal effect on bowhead whales. The effects from an encounter with aircraft generally are brief, and the whales should resume normal activities within minutes. Bowheads may exhibit temporary avoidance behavior to vessels at a distance of 1-4 kilometers, including the transport of bottom-founded drilling platforms. Most bowhead whales during the fall migration are likely to avoid an area around a seismic vessel operating in nearshore waters by a radius of up to 20 kilometers. Avoidance may persist up to 12 hours after the end of seismic operations. In addition, provisions under the Conflict Avoidance Agreement that are likely to be implemented during the bowhead whale migration place limitations on where and when seismic operations can be conducted. Some bowheads may avoid drilling noise at 20 kilometers or more. Drilling operations from drill ships with icebreaker support during the bowhead whale migration are likely to have a low effect on bowhead whales, causing most whales to avoid the area around a drill site, particularly if an icebreaker is actively managing ice in the area. Overall, bowhead whales exposed to noise-producing activities most likely would experience temporary, nonlethal effects. In the unlikely event of a large oil spill, some individuals may be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals affected likely would be small. Some bowheads could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of oil-contaminated prey items, and/or perhaps temporary displacement from some feeding areas. Exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, although most individuals exposed to spilled oil likely would experience temporary, nonlethal effects.

Endangered and Threatened Species – Steller's Eiders	
Effects Common to Alternatives I, III, IV, V, and VI	**Steller's eiders are not likely to experience adverse effects from potentially disturbing routine activities, collisions with structures, foraging habitat reduction, or oil-spill-cleanup activity. The effects of normal activities on Steller's eiders are likely to be significantly less than those obtained if leasing and development occurred throughout the planning area with equal intensity. Low Steller's eider mortality is expected in the unlikely event a large oil spill occurs; however, recovery of the Alaska population from spill-related losses is not likely to occur while the regional population is declining.**

Table II.A-6 Summary of Effects for Sale 202 (continued)

Endangered and Threatened Species -Spectacled Eiders	
Effects Common to Alternatives I, III, IV, V, and VI	The effects from normal activities associated with oil and gas exploration and development in the Beaufort Sea are likely to include the loss of a small number of spectacled eiders. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness, survival, or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter support traffic. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Although the eider population, which currently is declining at a non-significant rate, may be slower to recover from small losses or declines in fitness or productivity, no significant overall population effect is likely. In the unlikely event a large oil spill occurs, spectacled eider mortality is likely to be fewer than 100 individuals; however, any substantial loss (25+ individuals) would represent a significant effect. Recovery from substantial mortality is not likely to occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in population numbers.
Alternatives I, III, V, and VI	The effects from normal activities include a small amount of nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures**.** In the unlikely event a large oil spill occurs, the risk of contact is low, because only one development is likely, probably located where spectacled eiders are relatively scarce. **Effects are likely to be considerably less than those that could occur as a result of Sales 186 or 195.**
Alternative IV	**The effects on spectacled eiders from normal activities and in the unlikely event a large oil spill occurs from Alternative IV are likely to be somewhat less than under Alternative I.**

Marine and Coastal Birds	
Effects Common to Alternatives I, III, IV, V, and VI	The adverse effects on marine and coastal birds from normal exploration and development/production activities in the Beaufort Sea are likely to include the loss of small numbers of marine and coastal birds. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness or survival of individuals or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter traffic, causing displacement from preferred-use areas, and increased levels of energy use and predation. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Disturbance of local nesting birds probably would have little effect on Arctic Coastal Plain bird populations as a whole. However, populations currently declining at a non-significant rate may be slower to recover from small losses or declines in fitness or productivity, and those declining at a significant rate are likely to require a protracted recovery period. No significant overall population effect is likely to result from small losses for most species. In the unlikely event a large oil spill occurs, mortality is likely to reflect local population size and vulnerability determined by seasonal habitat use and stage of annual cycle at the time of contact (for example, molting versus non-molting). As the most abundant species, long-tailed duck mortality is likely to exceed 1,000 individuals, while that of other common species such as king eider, common eider, and scoters likely would be in the low hundreds, and loon species fewer than 25 individuals each. Mortality at the higher levels predicted by Fish and Wildlife Service data could result in significant effects for the long-tailed duck, king eider, and common eider. The probability of a large oil spill occurring, low throughout the planning area, is likely to decrease from the Near Zone to the Far Zone due to the greater likelihood of oil development in the former area.
Alternative I, III, V and VI	The effects from normal activities include a small amount of nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures**.** In the unlikely event a large oil spill occurs, the risk of contact is low, because only one development is likely, probably located where spectacled eiders are relatively scarce. **Effects are likely to be considerably less than those that could occur as a result of Sales 186 or 195.**
Alternatives IV	The effects from activities associated with Alternatives IV on several bird species are likely to be somewhat less than under Alternative I; however, in the unlikely event a large oil spill occurs, effects on regional populations of several species could be lowered substantially.

Table II.A-6 Summary of Effects for Sale 202 (continued)

Marine Mammals	
Effects Common to Alternatives I, III, IV, V, and VI	The effects from activities associated with Beaufort Sea oil and gas exploration and development are estimated to include the loss from a large oil spill (8-10 % chance) of small numbers of pinnipeds (perhaps 100-200 ringed seals but probably fewer than 10-20 spotted and 30-50 bearded seals and small numbers [fewer than 100] walruses), polar bears (6-10 bears), and beluga and gray whales (fewer than 10), with populations recovering (recovery meaning the replacement of individuals killed as a consequence of exploration and development) within about 1 year.
Alternative VI	Effects could be reduced from about Barter Island east to Demarcation Bay. Potential conditional risks of oil contact to pinniped, polar bear, and beluga whale offshore habitats from about Barter Island east to Herschel Island (ERA's 36-37 assuming contact occurs within 30 days during the summer) would be reduced somewhat, if oil exploration and development were deferred under this alternative (Table A2-21: LA18). However, potential oil-spill risks to habitats west of the Beaufort Lagoon area (Table A2-21: ERA's 29-35 Ice/Sea Segments 1-6) would be the same as described under Effects Common to All Alternatives.

Terrestrial Mammals	
Effects Common to Alternatives I, III, IV, V, and VI	The effects of Beaufort Sea oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes likely would include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances likely would not affect caribou, muskox, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), probably fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.
Alternative VI	Potential noise and disturbance and habitat effects could be reduced from about Barter Island to Demarcation Bay. The chance of contact to terrestrial mammal coastal habitats from about the Barter Island east to Herschel Island (Land Segments 49-55), within 30 days during summer, would be reduced (0-16%) if oil exploration and development were deferred under this alternative (Appendix A2, Table A2-27: LA18 and P7). However, the chance of contact to coastal habitats west of west of Barter (Appendix A2, Table A2-27: Land Segments 25-42) would be about the same as described in Section IV.C.8.b. The overall effects on caribou, muskoxen, grizzly bears, and arctic foxes likely would be about the same as described under Alternative I, for 202.

Vegetation and Wetlands	
Effects Common to Alternatives I, III, IV, V, and VI	Disturbances mainly come from building gravel pads and ice roads and installing the onshore pipeline. Gravel pads, the pipeline trench, and the 12- or 50-mile-long onshore pipelines would destroy a few acres of vegetation and affect a few acres of nearby vegetation and have only local effects on the tundra ecosystem. Ice roads would have local effects (compression of tundra under the ice roads) on vegetation, with recovery expected within a few years, and no vegetation would be killed. The mean number of one or more oil spills greater than or equal to 1,000 barrels occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. In the unlikely event that such a spill occurs. There is a less than 0.5-21% conditional chance that an offshore spill will contact coastline habitats in the planning area, which include wetlands and other vegetation cover. An estimated 29-40 kilometers of coastline could be oiled from a 1,500- or 4,600-barrel spill. The shoreline of the planning area contains some habitats with fairly high values (1 being the lowest and 10 being the highest) for oil-spill retention (lagoonal beaches have a value of 5, and peat shores have a value of 6) along river deltas and near the mouths of other streams. Stranded oil on sheltered intertidal areas, especially along peat shorelines, likely would persist for many years.
Alternative VI	Under Alternative VI for Sale 202, potential onshore habitat effects could be avoided from about Barter Island east to Demarcation Bay and potential onshore habitat effects from gravel mining, gravel pads, and onshore pipeline installation in this area. The chance of contact to vegetation-wetland coastal habitats from about Beaufort Lagoon east to Herschel Island (Land Segments 49-55 within 30 days during the summer) would be reduced (2-11%), if oil exploration and development were deferred under this alternative (Appendix A2, Table A2-27: LA18). However, the chance of contact to coastal habitats west of Beaufort Lagoon (Appendix A2, Table A2-27: Land Segments 25-48) would be about the same as described under general effects.

Table II.A-6 Summary of Effects for Sale 202 (continued)

Economy	
Effects Common to Alternatives I, III, IV, V, and VI	Each alternative will generate increases in North Slope Borough property taxes that will average about 1% above the level of Borough revenues without the Sales in the early years and taper to less than 0.5% in the latter years. In the early years of production, each alternative will generate increases in revenues to the State of Alaska of less than 0.25% above the level without a sale. The increases will taper to an even smaller percent in the latter years of production. The change in total employment and personal income is less than 3% over the 1999 baseline for the North Slope Borough and the rest of Alaska for each of the three major phases of OCS activity: exploration, development, and production. The employment and personal income increase includes workers to cleanup possible large oil spills of 1,500-barrels or 4,600 barrels. These increases will occur for each alternative and sale. For purposes of analysis, we assume that the exploration and development scenario for Sale 202 will be the same as for each deferral alternative; that is, the OCS activity will occur in a different area and be the same for each deferral alternative.

Subsistence-Harvest Patterns	
Effects Common to Alternatives I, III, IV, V, and VI	For the communities of Barrow, Nuiqsut and Kaktovik, disturbances periodically could affect subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt. The chance of an oil spill occurring and entering offshore waters is estimated to be low. Based on the assumption that a spill has occurred, the chance of an oil spill during summer from a platform or a pipeline contacting important traditional bowhead whale- and seal-harvest areas over a 360-day period would be 75% or less for the Barrow whaling area, 41% or less for the Nuiqsut whaling area, and 34% or less for the Kaktovik whaling area. A spill also could affect other subsistence resources and harvest areas used by the communities of Barrow, Nuiqsut, and Kaktovik. Overall, oil spills could affect subsistence *resources* periodically in the communities of Barrow, Nuiqsut, and Kaktovik. In the unlikely event of a large oil spill, many harvest areas and some subsistence resources could be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads and threaten a pivotal element of Inupiat culture. There also is concern that the International Whaling Commission, which sets the quota for the Inupiat subsistence harvest of bowhead whales, would reduce the harvest quota following a major oil spill or, as a precaution, as the migration corridor becomes increasingly developed to ensure that overall population mortality did not increase. Such a move would have a profound cultural and nutritional impact on Inupiat whaling communities. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree these resources were contaminated. In the case of extreme contamination, harvests could cease until such time as resources were perceived as safe by local subsistence hunters. Overall, such effects are not expected from routine activities and operations. Tainting concerns also would apply to polar bears, seals, beluga whales, walruses, fish, and birds. Additionally, effects from a large oil spill likely would produce potential short-term but serious adverse effects to long-tailed duck and king and common eider populations. All areas directly oiled, areas to some extent surrounding them, and areas used for staging and transportation corridors for spill response would not be used by subsistence hunters for some time following a spill. Oil contamination of beaches would have a profound impact on whaling because even if bowhead whales were not contaminated, Inupiat subsistence whalers would not be able to bring them ashore and butcher them on a contaminated shoreline. The duration of avoidance by subsistence users would vary depending on the volume of the spill, the persistence of oil in the environment, the degree of impact on resources, the time necessary for recovery, and the confidence in assurances that resources were safe to eat. Such oil-spill effects would be considered significant.
Alternative III	**Because no exploration or production activities would occur in this deferral area, potential oil-spill, chronic noise, and disturbance effects on subsistence whaling and on Barrow's traditional subsistence-whaling area would be reduced.**

Table II.A-6 Summary of Effects for Sale 202 (continued)

Subsistence-Harvest Patterns	
Alternative IV	Although effects on subsistence resources would be essentially the same as described for Alternative I, effects on subsistence-harvest patterns in Nuiqsut are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished.
Alternative V	**Although effects on subsistence resources would be essentially the same as described for Alternative I, effects on subsistence-harvest patterns in Kaktovik are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling and the western half of Kaktovik's traditional subsistence-whaling area.**
Alternative VI	**Potential reductions in oil-spill contact to seals, polar bears, gray and beluga whales, caribou, muskoxen, grizzly bears, and arctic foxes from about Barter Island east to Demarcation Bay would reduce effects on these important subsistence resources and on important Kaktovik subsistence-harvest areas.**

Sociocultural Systems	
Effects Common to Alternatives I, III, IV, V, and VI	Effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from industrial activities, from changes in population and employment, and from periodic interference with subsistence-harvest patterns from oil spills and oil-spill cleanup. Altogether, effects periodically could disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternatives I	The consequential effects on sociocultural systems are expected to be similar to those discussed under Effects Common to All Alternatives. Altogether, effects periodically could disrupt but not displace ongoing social systems; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternatives III, V, and VI	**Because no exploration or production activities would take place in these deferral areas, potential oil spill, chronic noise, and disturbance effects under Alternative IV for Sale 202 on subsistence whaling and on Barrow's traditional subsistence-whaling area would be reduced.**
Alternative IV	The effects to subsistence-harvest patterns are expected to be reduced under this alternative. Subsequent effects reductions to sociocultural systems also would be expected.

Table II.A-6 Summary of Effects for Sale 202 (continued)

Archaeological Resources	
Effects Common to Alternatives I, III, IV, V, and VI	Potential effects on archaeological resources would be from exploration and development activities on both onshore and offshore resources, including historic and prehistoric. Onshore resources are more at risk for effects from disturbance caused by construction or oil-spill-cleanup operations. Potential offshore resources are at greater risk for effects from bottom-disturbing activities, notably anchor dragging and pipeline trenching. Generally, potential effects from activities increase with the level of activities, from the exploration phase to the development phase. For onshore archaeological resources, the potential for effects increases with the distance from existing pipeline infrastructure and from oil-spill size and associated cleanup operations. Archaeological surveys and analyses are required in areas where potential archaeological resources are at risk from offshore operations. These requirements are specified in the MMS Handbook 620.1H, Archaeological Resource Protection; in regulations (30 CFR 250.194; 30 CFR 250.126; 30 CFR 250.201; 30 CFR 250.203; 30 CFR 250.204; 30 CFR 250.414; 30 CFR 250.1007(a)(5); and 30 CFR 250.1009); and in law through the National Historic Preservation Act. Any archaeological resources, either onshore or offshore, will be identified before any activities are permitted, and they will be avoided or potential effects will be mitigated. Each of the alternatives would provide some level of protection to archaeological resources by removing areas from leasing and potential exploration and development activities. The MMS has identified 502 whole or partial blocks in the program area that may contain prehistoric or historic resources (see Section III.C). The following indicates the number of blocks with archaeological potential within each alternative, their relative percent of the total number of blocks with archaeological resource potential, and the blocks with archaeological resource potential remaining in the sale area. Alternative III would remove 9 (1.8%), leaving 493 blocks or partial blocks Alternative IV would remove 17 (3.4%), leaving 485 blocks or partial blocks Alternative V would remove 20 (4%), leaving 482 blocks or partial blocks Alternative VI would remove 48 (9.6%), leaving 454 blocks or partial blocks
Alternatives I, IV, V, and VI	**The effect of exploration and development activities on possible archaeological resources would be essentially the same as discussed under effects common to all alternatives, except that activities would be more dispersed. In the exploration phase, some drilling could take place in deeper water, using floating drilling platforms or ships. These drilling units would use anchors and would probably have their blowout preventer buried, which could disturb potential archaeological resources in the immediate area. No impact is expected to prehistoric archaeological resources from activities in water depths greater than 50 meters. In the development phase, floating drilling and production platforms and possibly subsea production well-head assemblies would have the same disturbance effect to the seafloor as in the exploration phase: anchor dragging and digging the glory hole. The effect of gravel islands or bottom-founded production systems would be the same as discussed under effects common to all alternatives, compression and skirt penetration of sediments. The effect of oil-spill cleanup activities depend on the size of the spill and would probably be limited to the Near Zone, but the response area would be larger and more difficult for response personnel to access, potentially exposing unknown archaeological resources to risk of damage. Onshore and offshore archeological surveys and analyses would be conducted and would identify potential archaeological resources, which will be avoided or possible effects would be mitigated.**
Alternative III	Alternatives III would reduce the potential for effects on prehistoric or historic resources in the deferral areas. The potential for encountering shipwrecks during offshore operations would be greatly reduced because of the high potential for possible shipwrecks to occur in the general area offshore Barrow. There would less potential disturbance in the adjacent land areas, which otherwise might have experienced construction activities related to pipeline infrastructure or a staging area.

Table II.A-6 Summary of Effects for Sale 202 (continued)

Land Use Plans and Coastal Management Programs	
Effects Common to Alternatives I, III, IV, V, and VI	Conflicts with the Statewide standards of the ACMP and the NSB CMP policies are not expected. Through the use of mitigating measures and regulatory oversight, it should be possible to comply with all of the standards and policies. Most of these policies will be more precisely addressed if and when specific proposals are brought forward by lessees. All Exploration and Development and Production plans must be accompanied by a consistency certification for State review and concurrence. The State will review OCS plans and concur or object with the lessee's consistency certification. The MMS cannot issue a permit for any activities described in the plans in the absence of the State's concurrence unless the Secretary of Commerce overrides the State's objection.
Alternatives I, III, IV, V, and VI	No conflicts with the Statewide standards of the ACMP or with the enforceable policies of the NSB CMP are anticipated.

Air Quality	
Effects Common to Alternatives I, III, IV, V, and VI	Effects on onshore air quality from air emissions likely would be only a very small percent of the maximum allowable PSD Class II increments. The concentrations of criteria pollutants in the onshore ambient air would remain well within the air-quality standards. Consequently, there likely would be only a minimal effect on air quality with respect to standards. Principally, because of the distance of emissions from land, the other effects of air-pollutant concentrations at the shore due to exploration and development and production activities or accidental emissions would not be sufficient to harm vegetation. A light, short-term coating of soot over a localized area could result from oil fires. The air-quality analysis is based on the specific emission controls and emission limitations that the operators would apply to meet the appropriate Environmental Protection Agency regulations and permit requirements for any development and production activities. The effects of all these activities would cause only small, local, temporary increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards. Therefore, effects from the proposed sales would be low. Individual air masses move constantly with atmospheric circulation, we expect that the major differences in effects of the different alternatives on air quality would be in which specific geographic areas could be affected by air emissions. Because these emissions should not be significant other than in extremely localized areas, we conclude that none of the alternatives to the proposed sales would result in significant effects different from or other than those discussed in Section IV.C.15.a. Air quality effects of all activities under all sales and all alternatives would cause only small increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards.

Environmental Justice	
Effects Common to Alternatives I, III, IV, V, and VI.	Sale-specific environmental justice effects would derive from potential noise, disturbance, and oil spill effects on subsistence resources, subsistence-harvest patterns, and sociocultural systems. The only substantial source of potential environmental justice-related effects to Native villages from the Beaufort Sea multiple sales and the range of alternatives would occur in the unlikely event of a large oil spill, which could affect subsistence resources. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.

Table III.A-1 Climatic Conditions Onshore

Arctic Coast	
Distance to the ocean (km)	<20
Elevation (m)	<50
Air Temperature (C)	
Mean diurnal amplitude	4 to 8
Range (extreme low-high)	–50 to +26
Mean annual	–12.4 ± 0.4
Annual amplitude	17.5 ± 1.2
Degree-Day (C-day)	
Freeze	4930 ± 150
Thaw	420 ± 120
Precipitation (mm)[1]	
Snow	113
Rain	85
Annual total	198
Seasonal Snow Cover	
Average starting date	27 Sep.
Range	4 Sep. to 14 Oct.
Average duration (days)	259
Range (extreme)	212 to 288
Average maximum thickness (cm)	32
Range (extreme)	10 to 83
Thaw Season	
Average starting time	6 Jun.
Range (extreme)	26 May to 19 Jun.
Average length (days)	106
Range (extreme)	77 to 153

Source: Zhang, Osterkamp, and Stamnes (1996).
[1] From Natural Resources Conservation Service (1994).

Table III.A-2 Wind Speed and Air Temperature at Tern Island from February to May 1987

Month	Average Wind Speed		Median Wind Speed		Average Air Temperature		Median Air Temperature	
	kts	m/s	kts	m/s	°F	°C	°F	°C
February	9.0	4.6	7.5	3.9	-21.6	-29.8	-21.5	-29.7
March	9.4	4.8	6.0	3.1	-17.6	-27.6	-14.0	-25.6
April	9.1	4.7	9.0	4.6	-4.5	-20.3	-6.0	-21.1
May	12.4	6.4	12.0	6.2	17.0	-8.3	13.0	-10.6

Source: USDOI, MMS (1998). Calculated from meteorological data collected at Tern Island in 1987.

Table III.A-3 Summary of Hydrologic Data for Alaska North Slope Streams Adjacent to the Beaufort Sea Multiple Sale Planning Area

Stream Location (lat., long.)	Headwaters	Drainage Area (mi^2)	Avg. Runoff (cfm)	Peak Runoff (cfsm)	Record Year
Miguakiuk River 70°40'13", 154°19'20"	Coastal Plain	1,460	0.12	1.1	1
Fish Creek 70°19"00", 151°28'36"	Coastal Plain	1,699	0.12*	7.0**	<1
Ikpikpuk River 70°08'12",154°38'30"	Foothills	3,980	0.29*	58.6**	<1
Colville River (nr. Nuiqsut) 70°09'56",150°55'00"	Brooks Range	20,670	0.70	29.0	7***

Source: Arnborg, Walker, and Peippo (1966); Childers et al (1979); Shannon and Wilson Consultants (1996); U.S. Geological Survey (1978).
*Calculated from regional regression.
**Field estimate of maximum evident flood-peak discharge.
***Some years' data are incomplete.

Table III.A-4 Summary of Long-Term Stream-Gauging Data for North Slope Streams Adjacent to the Beaufort Sea Multiple-Sale Planning Area

Stream Location (lat., long.)	Headwaters	Drainage Area (mi^2)	Avg. Runoff (cfm)	Peak Runoff (cfsm)	Record Year
Nunavak Creek 71°15'35", 156°46'57"	Coastal Plain	2.8	0.37	47.0	25
Putuligayuk River 70°16"04", 148°37'36"	Coastal Plain	176	0.24	28.3	15
Kuparuk River 70°16'54",148°57'50"	Foothills	3,130	0.43	37.7	25
Sagavanirktok River 69°05'24",148°45'34"	Brooks Range	2,208	0.75	28.1	9

Source: U.S. Geological Survey (1979, 1987, 1996).

Table III.A-5 Ambient Air Quality Standards Relevant to the Beaufort Sea Planning Area

Pollutant[1]	Averaging Time Criterion				
	Annual	24 hr	8 hr	3 hr	1 hr
Total Suspended Particulates [2]	60 [3]	150	*	*	*
Class II [4]	19 [3]	37	*	*	*
Carbon Monoxide	*	*	10,000	*	40,000
Ozone [5]	*	*	*	*	235 6
Nitrogen Dioxide	100 [7]	*	*	*	*
Class II [4]	25 [7]	*	*	*	*
Inhalable Particulate Matter (PM_{10})	50 [9]	150 [10]	*	*	*
Class II [4]	17	30	*	*	*
Lead	1.5[11]	*	*	*	*
Sulfur Dioxide	80 [7]	365	*	1,300	*
Class II [4]	20 [7]	91	*	512	*
Reduced Sulfur Compounds [2]	*	*	*	*	*

Source: State of Alaska, Dept. of Environmental Conservation (1982), 80, 18, AAC 50.010, 18 AAC 50.020; 40 CFR 52.21 (43 *Federal Register* 26388); 40 CFR 50.6 (52 *Federal Register* 24663); 40 CFR 51.166 (53 *Federal Register* 40671).

Footnotes:

Measured in micrograms per cubic meters; an asterisk [*] indicates that no standards have been established.

[1]All-year averaging times not to be exceeded more than once each year, except that annual means may not be exceeded.

[2]State of Alaska air-quality standard (not national standard).

[3]Annual geometric mean.

[4]Class II standards refer to the PSD Program. The standards are the maximum increments in pollutants allowable above previously established baseline concentrations.

[5]The State ozone standard compares with national standards for photochemical oxidants, which are measured as ozone. [6]The 1-hour standard for ozone is based on a statistical, rather than a deterministic, allowance for an "expected exceedance during a year."

[7]Annual arithmetic mean.

[8]PM_{10} is the particulate matter less than 10 micrometers in aerodynamic diameter.

[9]Attained when the expected annual arithmetic mean concentration, as determined in accordance with 40 CFR 50 subpart K, is equal to or less than 50 µg/m³.

[10]Attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m³. as determined in accordance with 40 CFR 50, subpart K, is equal to or less than 1.

[11]Maximum arithmetic mean averaged over a calendar quarter.

Table III.A-6 Measured Air Pollutant Concentrations at Prudhoe Bay, Alaska 1986-1996

Pollutant[1]	Monitor Site				National Standard[6]	Class II Increment[7]
	A[2]	B[3]	C[4]	D[5]		
Ozone						
Annual Maximum 1 hr.	115.8	180.3	115.6	100.0	235	**
Nitrogen Dioxide						
Annual	26.3	11.9	16.0	4.9	100	25
Inhalable Particulate Matter (PM_{10})						
Annual	**	**	10.5	**	50	17
Annual Maximum 24 hrs.	29.3	**	25.0 [8]	**	150	30
Sulfur Dioxide						
Annual	2.6	**	5.2	2.6	80	20
Annual Maximum 24 hrs.	10.5	**	26.2[8]	13.1	365	91
Annual Maximum 3 hrs.	13.1	**	44.5	55.0	1,300	512
Carbon Monoxide						
Annual Maximum 8 hrs.	**	**	1,400	**	10,000	**
Annual Maximum 1 hr.	**	**	2,500 [8]	**	40,000	**

Sources: ERT Company, Inc. (1987), Environmental Science and Engineering (1987), and ENSR, (1996), as cited in U.S. Army Corps of Engineers (1999).

Footnotes:

Measured in micrograms per cubic meter; absence of data is indicated by asterisks [**].

[1]Lead was not monitored. [2]Site CCP (Central Compressor Plant), Prudhoe Bay monitoring program, selected for maximum pollutant concentrations. All data are for years 1992-1996. [3]Site Pad A (Drill Pad A), Prudhoe Bay monitoring program, site of previous monitoring, selected to be more representative of the general area or neighborhood. All data are for years 1992-1996. [4]Site CPF-1 (Central Processing Facility), Kuparuk monitoring program, selected for maximum pollutant concentrations. Ozone, nitrogen dioxide, and sulfur dioxide are for years 1990-1992; PM_{10} and carbon monoxide data are for 1986-1987. [5]Site DS-1F, Kuparuk monitoring program site selected to be representative of the general area or neighborhood. All data are for years 1990-1992. [6]Applicable National Ambient Air Quality Standards. Refer to Table III.A-5 for more specific definitions of air-quality standards. [7]Class II PSD Standard Increments. [8]Second highest observed value (in accordance with approved procedures for determining ambient-air quality).

Table III.B-1 Salmon Essential Fish Habitat Components, Seasons, and Areas in the Beaufort Sea

Habitat	Lifestage	Season*	Characteristics	EFH Area in Sale
Freshwater	Eggs and larvae	July to May	Substrate	**~314 kilometers**
	Juveniles	Year-round	Water column, prey, prey habitat	
	Adult	June x Dec.	Substrate, water column	
Estuarine	Juveniles	March-Aug.	Water column, prey, prey habitat	**~713,000 hectares**
	Adult migrants	June x Sept.	Water column, prey, prey habitat	
Marine	Immature	Year-round	Water column, prey, prey habitat	**~4,027,000 hectares**
	Adult migrants	June x Sept.	Water column, prey, prey habitat	

*** Source:** North Pacific Fisheries Management Council (1997).

Table III.C-1 North Slope Borough Employment by Industry 1990-1998 (Nonagricultural Wage and Salary Employment)

Industry	Nonagricultural Wage and Salary Employment by Year (No. of Persons)								
	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total Industries	9,185	9,208	8,400	8,823	9,570	9,114	9,149	9,102	9,404
Mining	5,126	5,018	4,411	4,213	4,617	4,436	4,431	4,158	4,753
Construction	373	484	387	361	623	415	344	354	371
Manufacturing	0	0	0	0	0	2	3	7	8
Trans., Comm., & Util.	362	364	241	238	378	403	428	440	435
Wholesale Trade	0	0	0	0	0	0	0	0	0
Retail Trade	252	205	213	487	522	481	524	540	567
Finance, Ins., R.E.	183	177	167	166	166	145	143	175	177
Services	976	1,031	1,008	1,308	949	804	890	1,046	1,035
Government	1,901	1,929	1,964	2,040	2,315	2,428	2,385	2,293	2,068
Federal	107	98	78	57	70	78	43	38	28
State	32	64	60	59	58	58	57	52	56
Local	1,762	1,767	1,827	1,925	2,187	2,293	2,286	2,204	1,983
Miscellaneous	0	0	5	0	0	0	1	1	1
Total Less Mining	**4,059**	**4,190**	**3,989**	**4,610**	**4,953**	**4,678**	**4,718**	**4,854**	**4,651**

Source: Alaska Department of Labor and Workforce Development, Research and Analysis Section.
Notes: 1999 and 2000 data are not available as of November 2001.
Mining in the North Slope Borough's is completely oil and gas industry employment.

Table III.C-2 1998 Employment by Employer North Slope Borough, Nuiqsut, Kaktovik, and Barrow

Employer	Employment by Location (No. of Persons)							
	NSB		NUIQSUT		KAKTOVIK		BARROW	
	Employment	Percent	Employment	Percent	Employment	Percent	Employment	Percent
Village Corporation	413**	17	33	27	15	20	81	5
NSB School District	296	12	8	6	7	9	176	11
NSB Government	998	41	38	31	35	46	671	44
City Government	59	2	7	7	4	5	30	2
State and Federal Government	74	3	3	2	3	4	53	3
All Other Employees	606	25	35	28	12	16	530	34
Total Less Mining	2,476	100	124	100	76	100	1,541	100

Source: North Slope Borough (1999).
Notes: Percentage may not total 100 due to rounding.
Results represent only those individuals participating on the census survey.
Include Arctic Slope Regional Corporation.

Table III.C-3 North Slope Borough, 1998 Employment by Employer, Employees by Ethnicity

	Employment by Employer (No. of Persons)			
	Inupiat	**Caucasian**	**Other Minorities**	**Grand Total**
Federal Government	17	11	11	39
State Government	9	19	7	35
City Government	43	8	6	57
NSB Government	509	217	151	877
NSB School District	134	108	47	289
NSB CIP	82	23	7	112
Oil Industry	10	4	2	16
Private Construction	44	14	8	66
ASRC or Subsidiary	90	26	16	132
Village Corporations	225	33	17	275
Financial/Insurance	0	1	0	1
Transportation	14	17	12	43
Communications	0	4	1	5
Trade	14	9	12	35
Service	28	36	19	83
Ilisagvik College	21	36	12	69
Other	171	68	45	285
Total	**1,411**	**634**	**373**	**2,418**

Source: North Slope Borough (1999)

NSB = North Slope Borough
CIP = Capital Improvement Program
ASRC = Arctic Slope Regional Corporation

Table III.C-4 North Slope Employment by Community

	Employment by Area (No. of Persons)			
	NSB	**Nuiqsut**	**Kaktovik**	**Barrow**
Labor Force	3,823	176	141	2,508
Permanent/Full Time	2,114	85	62	1,565
Temporary/Seasonal	523	56	19	287
Part Time	222	13	9	91

Source: North Slope Borough (1999).

Table III.C-5 1998 Unemployment and Underemployment in Percent of Total Labor Force

	Percent of Labor Force Unemployed or Underemployed			
	NSB	**Nuiqsut**	**Kaktovik**	**Barrow**
Unemployment	16	10	15	10
Underemployment (The number of people who indicated that they believe themselves to be underemployed)	13	27	14	12
Underemployment (Those who worked less than 40 weeks in 1998)	27	62	41	24

Note: The percentage of the total labor force.
Source: North Slope Borough (1999).

Table III.C-6 Employment Estimates Nonagricultural Wage and Salary Employment)

	Employment by Year (Thousands of Persons)					
	1995	**1996**	**1997**	**1998**	**1999**	**2000**
Anchorage – Mat-Su Region	131	132	135	141	144	148
Kenai Peninsula Borough	16	16	16	17	17	n.a.
Fairbanks North Star Borough	31	31	32	33	33	34
Total for 3 areas	178	179	183	191	194	199*
Alaska Total	**261**	**264**	**269**	**275**	**278**	**284**

Source: Alaska Department of Labor and Workforce Development, Research and Analysis Section.
n.a. = Not available as of November 2001.
Assumes 17,000 persons for Kenai Peninsula Borough.

Table III.C-7 1998 Annual Household Subsistence Expenditure by Ethnicity, North Slope Borough (NSB)

Amount	Annual Household Subsistence Expenditure by Ethnicity ($)			
	Inupiat	**Caucasian**	**Other Minorities**	**Total**
$0	90	11	7	108
$1 to $500	139	20	11	170
$501 to $1,000	103	12	10	125
$1,001 to $2,000	82	6	7	95
$2,001 to $4,000	97	9	1	107
$4,001 to $6,000	97	10	2	109
$6,001 to $8,000	78	3	0	81
$8,001 to $10,000	43	2	1	46
$10,001 or More	112	6	1	119
Total	**841**	**79**	**40**	**960**

Source: NSB, 1999.

Table III.C-8 Resources Used in Barrow, Kaktovik, and Nuiqsut

Species	Inupiaq Name	Scientific Name	Location B[1]	K[2]	N[3]
Marine Mammals					
Bearded seal	*Ugruk*	Erignathus barbatus	√	√	√
Ringed seal	*Natchiq*	Phoca hispida	√	√	√
Spotted seal	*Qasigiaq*	Phoca largha	√	√	√
Ribbon seal	*Qaigulik*	Phoca fasciata	√		
Beluga whale	*Quilalugaq*	Delphinapterus leucas	√	√	
Bowhead whale	*Agviq*	Balaena mysticetus	√	√	√
Polar bear	*Nanuq*	Ursus maritimus	√	√	√
Walrus	*Aiviq*	Odobenus rosmarus	√	√	
Terrestrial Mammals					
Caribou	*Tuttu*	Rangifer tarandus	√	√	√
Moose	*Tuttuvak*	Alces alces	√	√	√
Brown bear	*Aklaq*	Ursus arctos	√	√	√
Dall sheep	*Imnaiq*	Ovis dalli	√	√	√
Musk ox	*Uminmaq*	Ovibus moschatus		√	√
Arctic fox (Blue)	*Tigiganniaq*	Alopex lagopus	√	√	√
Red fox [4]	*Kayuqtuq*	Vulpes fulva	√	√	√
Porcupine	*Qinagluk*	Erethizon dorsatum	√		
Ground squirrel	*Siksrik*	Spermophilus parryii	√	√	√
Wolverine	*Qavvik*	Gulo gulo	√	√	√
Weasel	*Itigiaq*	Mustela erminea		√	√
Wolf	*Amaguk*	Canis lupus	√	√	√
Marmot	*Siksrikpak*	Marmota broweri		√	√
Fish					
Salmon (ns)			√	√	√
Chum	*Iqalugruaq*	Oncorhynchus keta	√		√
Pink (humpback)	*Amaqtuuq*	Oncorhynchus gorbuscha	√	√	√
Silver (coho)	*Iqalugruaq*	Oncorhynchus kisutch		√[5]	
King (chinook)		O. tshawytscha			
Sockeye (red)		Oncorhynchus nerka			
Whitefish (ns)	*Aanaakliq*	Coregonus sp.	√	√	
Round w.f.	*Aanaakliq*	Prosopium cylindraceum	√		
Broad w.f.	*Aanaakliq*	Coregonus nasus	√	√	√
Humpback w.f.	*Pikuktuuq*	Coregonus clupeaformis	√		√
Least cisco	*Iqalusaaq*	Coregonus sardinella	√	√	√
Bering, Arctic cisco	*Qaaktaq*	Coregonus autumnalis	√	√	√
Other f.w. fish					
Arctic grayling	*Sulukpaugaq*	Thymallus arcticus	√	√	√
Arctic char	*Iqalukpik*	Salvelinus alpinus	√	√	√
Burbot (Ling cod)	*Tittaaliq*	Lota lota	√	√	√
Lake trout	*Iqaluaqpak*	Salvelinus narnaycush	√	√	√
Northern pike	*Siulik*	Esox lucius	√		

Species	Inupiaq Name	Scientific Name	Location B[1]	K[2]	N[3]
Fish (continued)					
Other coast. fish					
Capelin	*Pagmaksraq*	Mallotus villosus	√		
Rainbow smelt	*Ilhuagniq*	Osmerus mordax	√		√
Arctic cod	*Iqalugaq*	Boreogadus saida	√	√	√
Tomcod	*Uugaq*	Eleginus gracilis	√	√	
Flounder (ns)	*Nataagnaq*	Liopsetta glacialis		√	
Birds					
Snowy owl	*Ukpik*	Nyctea scandiaca			√
Red-throated loon	*Qaqsraupiagruk*	Gavia stellata	√		
Tundra swan	*Qugruk*	Cygnus columbianus		√	√
Eider					
Common eider	*Amauligruaq*	Somateria mollissima	√	√	√
King eider	*Qinalik*	Somateria spectabilis	√	√	√
Spectacled eider	*Tuutalluk*	Somateria fischeri	√		
Steller's eider	*Igniqauqtuq*	Polysticta stelleri	√		
Other ducks (ns)	*Qaugak*		√	√	
Pintail	*Kurugaq*	Anas acuta		√	
Long-tailed ducks	*Aaqhaaliq*	Clangula hyemalis	√	√	
Surf scoter	*Aviluktuq*	Melanitta perspicillata	√		
Goose					
Brant	*Niglingaq*	Branta bernicla n.	√	√	√
White-fronted g.	*Niglivialuk*	Anser albifrons	√	√	√
Snow goose	*Kanuq*	Chen caerulescens	√	√	√
Canada goose	*Iqsragutilik*	Branta canadensis	√	√	√
Ptarmigan (ns)	*Aqargiq*	Lagopus sp.	√	√	√
Willow ptarmigan	*Nasaullik*	Lagopus lagopus	√		
Other Resources					
Berries (ns)			√	√	√
Blueberry	*Asiaq*	Vaccinium uliginosum	√		
Cranberry	*Kimminnaq*	Vaccinium vitis-idaea	√		
Salmonberry	*Aqpik*	Rubus spectabilis	√		
Bird eggs (ns)	*Mannik*		√	√	
Gull eggs				√	
Geese eggs				√	
Eider eggs			√	√	
Greens/roots (ns)			√	√	√
Wild rhubarb	*Qunulliq*	Oxyric digyna	√		
Wild chives	*Quagaq*	Allium schoenoprasum	√		
Clams	*Imaniq*		√		
Wood				√	√
Fresh water	*Imiq*		√		
Freshwater ice	*Sikutaq*		√		
Sea ice	*Siku*		√		

Sources: Stephen R. Braund and Assocs. and University of Alaska, Anchorage, Institute of Social and Economic Research (1993); Pedersen (1995a,b); Stephen R. Braund and Assocs. (1996).
Footnotes: [1] B, Barrow, resources used 1987–1990. [2] K, Kaktovik, resources used 1992–1993. [3] N, Nuiqsut, resources used 1993. [4] Red fox (Cross, Silver) [5] Harvest of silver, king, and sockeye salmon is rare.
Note: An unchecked box may 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.
Abbreviations: ns, nonspecified**; w.f.,** whitefish; **f.w.,** freshwater; coast., coastal.

Table III.C-9 Proportion of Inupiat Household Food Obtained from Subsistence Activities, 1977, 1988, and 1993

	Percent of Household Food from Subsistence (All Communities of the North Slope Borough)		
Proportion	**1977**	**1988**	**1993**
None	13	20	18
Less Than Half	42	31	25
Half	15	14	15
More Than Half	30	35	42

Source: Harcharek (1995).

Table III.C-10 Participation in Successful Harvests of Selected Resources

	Percentage of Households per Resource		
	Barrow[1]	**Nuiqsut[2]**	**Kaktovik[3]**
Total	87 %	90 %	89 %
Marine mammals	76	37	40
Terrestrial mammals	77	76	68
Fish	60	81	81
Birds	65	76	64
Marine Mammals			
Bowhead whale	75 %	5 %	6 %
Walrus	29	0	2
Bearded seals	46	7	28
Ringed seals	19	31	26
Spotted seals	1	2	4
Polar bear	7	2	4
Terrestrial Mammals			
Caribou	77 %	74 %	55 %
Moose	7	10	6
Brown bear	0	8	0
Dall sheep	3	0	28
Wolverine	1	16	13
Arctic Fox	5	13	15
Red Fox	*	23	11
Fish			
Whitefish (all species)	54 %	74 %	70 %
Grayling	21	65	15
Arctic Char	5	31	79
Salmon (all species)	16	36	9
Burbot	10	57	0
Birds			
Geese	40 %	73 %	47 %
Eiders	52	36	38
Ptarmigan	26	45	57

Sources: S.R. Braund and Assocs. and UAA, ISER (1993); Pedersen (1995a,b); S.R. Braund and Assocs. (1996).
Notes:
All numbers are percentages.
Dates resources used: [1]11987–1990. [2]1993. [3]1992–1993.
*Represents less than 0.1%.

Table III.C-11 Percent of Total Subsistence Resources Consumed and Total/Per Capita Harvests

	Barrow (%)		Nuiqsut (%)		Kaktovik (%)	
Resource	**1962-82[1]**	**1989**	**1993**	**1994-95**	**1962-82**	**1992**
Bowhead Whale	21.3	38.7	28.7	0	27.5	63.2
Caribou	58.2	22.2	30.6	58	16.2	11.1
Walrus	4.6	8.9	0	—	3.2	— *
Bearded Seal	2.9	2.1	0.3	—	7.4	2.4
Hair Seals	4.3	1.6	2.7	2 [2]	4.1	1.0
Beluga Whales	0.5	0.	0	—	6.2	0.
Polar Bears	0.3	2.2	0.	—	2.8	0.7
Moose	0.3	2.2	1.6	5	3.5	1.1
Dall Sheep	0	0.1	0	—	3.8	2.5
Muskox	—	—	0	—	—	1.8
Small Land Mammals	0.1	— *	— [3]	— [3]	0.4	— *
Birds4	0.9	3.3	1.5	5	0.4	1.9
Fishes	6.6	7.8	33.7	30	21.7	13.4
Vegetation	—	0.1	1.4	— *	—	0.1
Total Harvest (lb)	**928,205**	**872,092**	**160,035**	**267,818**	**32,408**	**170,939**
Per Capita Harvest (lb)	**540**	**289.16**	**399.19**	**741.75**	**219**	**885.60**

Source: Stoker, 1983, as cited by ACI/Braund (1984); Stephen R. Braund & Assocs. (1989); State of Alaska, Dept. of Fish and Game (1995a).

Notes:

[1] Averaged for the period.

[2] Represents all marine mammals harvested in 1994-95: 1 polar bear and 35 ringed seals.

[3] Not harvested for food.

[4] Birds and eggs.

[5] Not calculated in report**.**

***Represents less than 0.1%.

Table III.C-12 Number of Animals Harvested, Barrow, 1987-1990 (weighted)

	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—rivers 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 III.C-13 Barrow Subsistence-Harvest Summary for Marine Mammals, Terrestrial Mammals, Fish, and Birds, 1989

	Total Number Harvested	Edible Pounds Harvested			Household Percent Participation
		Total	Household Harvest Mean	Per Capita	
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	x
TERRESTRIAL MAMMALS					
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
Small Land Mammals/Furbearers	68	7	0.01	0.00	2.0
Arctic Fox	48*	0	0.00	0.00	x
Red Fox	2*	0	0.0	0.00	x
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	x
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	x
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
Long-Tailed Duck	2	4	0.00	0.00	0.0
Goose	3,944	16,289	17.38	5.40	13.0
Brant	973	2,920	3.12	0.97	4.0
Snow Geese	4	19	0.02	0.01	0.0
White-Fronted	2,932	13,193	14.08	4.37	12.0
Seabirds and Loons	3	9	0.01	0.00	x
Ptarmigan	329	231	0.25	0.08	5.0
Bird Eggs	--	--	--	--	--

Source: State of Alaska, Dept. of Fish and Game (1995b) Database Community Profile.

Notes: Number of households in the sample =101; number of households in the community = 937.
***** not eaten. [S] Some not eaten. [x] Percent harvested less than 0.1%.

Table III.C-14 Annual Harvest of Polar Bears for the Harvest Years 1983 to 1995 for the Communities of Barrow, Nuiqsut, and Kaktovik

Harvest Season[1]	Number of Bears		
	Barrow	Nuiqsut	Kaktovik
1984/85	31	1	0
1985/86	13	4	5
1986/87	21	5	3
1987/88	12	3	6
1988/89	31 [2]	2	8
1989/90	14	0	0
1990/91	14	0	0
1991/92	22	0	0
1992/93	24	0	3
1993/94	28	3	5
1994/95	8	1	1

Source: Schliebe, (1995).
[1] Harvest year runs from 1 July to 30 June.
[2] Atqasuk harvested 2 bears during the 1988/89 season.

Table III.C-15 Nuiqsut 1993 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	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	2.86
Ringed Seal	98	7,277	79.96	20.15
Spotted Seal	4 *	0	0.00	0.00
Terrestrial Mammals				
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
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	11.25
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
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	455	1,092	12.00	3.02
Swan	7	73	0.80	0.20
Ptarmigan	973	681	7.48	1.89

Source: State of Alaska, Dept. of Fish and Game (1995b) Community Profile Database.
Notes: Number of households in the sample = 62; number of households in the community = 91.
***Not eaten. §Some not eaten.

Table III.C-16 Subsistence Harvest by Month for Nuiqsut, July 1, 1994, to June 30, 1995

Item	1994						1995						Total 71 HH's	Est. Total 83 HH's
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun		
Arctic Char	0	8	0	0	0	0	0	0	0	0	0	0	8	8
Arctic Cisco[1]	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	3,120	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[1]	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
Geese 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 (gal)	0	9	0	0	0	0	0	0	0	0	0	0	9	9
Cranberries (gal)	0	0.5		0	0	0	0	0	0	0	0	0	0.5	1
Blueberries (gal)	0	2.5		0	0	0	0	0	0	0	0	0	2.5	3
Blackberries (gal)	0	0.5		0	0	0	0	0	0	0	0	0	0.5	1

Source: Brower and Opie (1997); Brower and Hepa (1998).
Notes:
HH = Household.
[1]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."

Table III.C-17 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				
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
Small Land Mammals/Furbearers	213	162	2.56	0.84
Arctic Fox	36.*	0	0.00	0.00
Red Fox	11.0*	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	0.00	0.00
Fish				
Total Fish	18,468	22,952	364.32	118.91
Total Salmon	50	105	1.66	0.54
Total Non-Salmon	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
Migratory Birds	970	2,702	42.88	14.00
Ducks	369	553	8.77	2.86
Eiders	248	372	5.90	1.93
Oldsquaw	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	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

Source: State of Alaska, Department of Fish and Game 1995b, Community Profile Database.

Notes: Number of households in the sample = 62; number of households in the community = 91.

*Not eaten. §Some not eaten.

Table III.C-18 The Number of Surveyed Households in Each of the Four Survey Seasons (December 1, 1994 to November 30, 1995) in Kaktovik that Reported a Given Activity Code

Activity Code* Reported	Number of Surveyed Households in Each Surveyed Season			
	WINTER	SPRING	SUMMER	FALL
	December 1, 1994 to March 31, 1995	April 1 to June 30, 1995	July 1 to September 30, 1995	October 1 to November 30, 1995
1	17	22	42	**13**
2	7	3	2	**13**
3	48	40	24	**41**
4	0	0	1	**0**
5	1	7	2	**3**
6	0	0	1	**0**
7	0	0	0	**0**
8	0	1	1	**0**
Total	**73**	**73**	**73**	**70**

***Activity Code:**
1 = harvest
2 = attempted—harvest but not successful
3 = did not attempt to harvest
4 = out hunting
5 = out of town
6 = could not contact
7 = did not want to be interviewed
8 = other (any other activity not mentioned above)

Table III.C-19 Reported Subsistence Harvest by Month for Kaktovik, Alaska December 1, 1994 to November 30, 1995*

Harvest Item	1994	Winter			Spring			Summer			Fall		Unk.*	Reported for All Survey Seasons
	Dec.	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.		
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	4	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	6	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**

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

Table III.C-20 Cultural/Archaeological Resources Near the Beaufort Sea Multiple Sale Area

AHRS Site Number	Location	Resource
No reported AHRS sites	Point Barrow to Dease Inlet	--
BAR-0093	Dease Inlet to Cape Simpson	(H) Structure, house ruin
BAR-0023	"	(P) Site, paleontological
BAR-0045	"	(H) Reburial
TES-0031	"	(P) Site, paleontological
TES-0027	"	(H) Test well site
TES-0030	Cape Simpson to Pitt Point	(P) Site, paleontological
TES-0028	"	(H) Site
TES-0048	"	(H) POW-1 DEW Line site
HAR-0019	Pitt Point to Cape Halkett	(H) Site, trading post
No number	"	(H) Site, house (NSB TLUI)
No number	Cape Halkett to Atigaru Point	(H) Site, reindeer corral (NSB TLUI)
No number	"	(H) Site, DEW Line landing strip
HAR-0012	"	(H) Site
HAR-0013	"	(H) Site
HAR-0022	"	(H) Site
HAR-0025	"	(H) Site
HAR-0002	"	(P) Site, lithic remains
HAR-0014	"	(H) Structure
HAR-0018	"	(H) Site
HAR-0040	"	(P) Site, paleontological
HAR-0026	"	(H) Site
HAR-0024	Atigaru Point to Colville River Delta	(H) Site
HAR-0046	"	(H) Site, campsite, tent area, old whaling boat
HAR-0045	"	(H) Site, campsite, drying racks
HAR-0027	"	(H) Site, sod house, ice cellar
HAR-0029	"	(H) Site, sod house, ruins
No number	"	(H) Site, house (NSB TLUI)
HAR-0051	"	(H) Site, remains in dune
HAR-0030	"	(H) Site, settlement, sod houses
No number	"	(H) Site, reindeer herding (NSB TLUI)
HAR-0028	"	(H) Site
HAR-0044	"	(H) Site, recently tended grave
HAR-0169	"	(P)(H) Site, trading, settlement, burials
HAR-0054	"	(H) Structure, lifeboat
HAR-0056	"	(H) Site
HAR-0052	"	(H) Site, historic remains
HAR-0162	"	(H) Site
HAR-0001	"	(P) Site, settlement, houses, artifacts (likely destroyed by a storm)
HAR-0015	"	(H) Site
HAR-0160	"	(H) Site
HAR-0016	"	(H) Site, burials
HAR-0159	"	(H) Site
XBP-0002	Colville River Delta to Milne Point	(H) Site, hunting camp
XBP-0039	"	(H) POW-2 DEW Line site
XBP-0036	"	(H) Site, sod houses, ice cellars, burials
XBP-0044	"	(P?) Site
XBP-0037	"	(P)(H) Site, camp, lithic remains, historic remains

Table III.C-20 Cultural/Archaeological Resources Near the Beaufort Sea Multiple Sale Area (continued)

AHRS Site Number	Location	Resource
XBP-0008	"	(P)(H) Site, lithic remains from Arctic Small Tool Tradition, historic remains
XBP-0009	"	(H) Site, cabins, house depressions, present-day whaling camp
XBP-0047	"	(P) Site, activity area, lithic remains
XBP-0010	Milne Point to Prudhoe Bay	(H) Site, residential, hunting camp, sod houses and other structures
XBP-0011	"	(H) Site, Naval Arctic Research Laboratory station
XBP-0012	"	(H) Site, old village dating from 1500 AD
XBP-0013	"	(H) Site, sod houses, by 1983 site almost entirely destroyed by natural forces
XBP-0014	"	(H) Site, driftwood structures, whalebone
XBP-0066	"	(H) Site, camp, meat cellar, cache, drying rack
XBP-0003	"	(H) Site, Ahvakana home
XBP-0004	"	(H) Site, sod houses
XBP-0065	"	(H) Site, depression, meat cellar
XBP-0063	"	(H) Site, cemetery, burials
XBP-0064	"	(H) Site, cemetery, burials
XBP-0015	"	(H) Site, sod houses, scattered graves
XBP-0016	"	(H) Site, house ruin
XBP-0043	"	(P) Site, Arctic Small Tool Tradition
XBP-0017	"	(H) Site, sod houses
XBP-0045	"	(P) Site, short-term camp, hearth, lithic artifacts, fire-cracked rock
XBP-0048	"	(P) Site, activity area, hearth, lithic remains
XBP-0049	"	(P) Site, activity area, hearth, lithic remains
XBP-0071	"	(P) Site
XBP-0018	"	(H) Structure, whaling boat
XBP-0040	"	(H) POW-C DEW Line site
XBP-0019	"	(H) Site, sod house ruins, driftwood, milled wood
XBP-0056	"	(H) Discovery well, Prudhoe Bay State No. 1
XBP-0007	"	(P) Site, fire hearth and lithic scatters from Arctic Small Tool, Archaic, and Paleoarctic Traditions
XBP-0005	"	(H) Site, Prudhoe Bay #1, semi-subterranean houses, driftwood cabin
XBP-0006	Prudhoe Bay to Tigvariak Island	(H) Site, settlement, tent rings, destroyed by Niakuk oilfield development
XBP-0001	"	(H) Site
XBP-0022	"	(H) Site
XBP-0061	"	(P)(H) Site, depression, house pit
XBP-0023	"	(H) Site
XBP-0024	"	(H) Site, settlement, sod houses
XBP-0025	"	(H) Site
XBP-0020	"	(H) Site, sod and wooden houses, cellars
XBP-0030	"	(H) Site, grave
XBP-0034	"	(P)(H) Site, houses
XBP-0035	"	(H) Site, sod houses, graves
XBP-0038	"	(P)(H) Site, artifacts
XBP-0042	"	(P) Site, fire-cracked rock
XBP-0043	"	(P) Site, artifacts from Arctic Small Tool Tradition

Table III.C-20 Cultural/Archaeological Resources Near the Beaufort Sea Multiple Sale Area (continued)

AHRS Site Number	Location	Resource
XBP-0062	"	(P)(H) Site, depression, house pit
XBP-0026	"	(H) Site
XBP-0060	"	(H) Site, burial
XBP-0067	"	(H) Site, tent ring, cobbles
XBP-0068	"	(P)(H) Site, cache pit, meat cellar?
XBP-0027	"	(H) Site, sod structure, remains
XBP-0031	Tigvariak Island to Bullen Point	(H) Site, camp, dwellings, burials
XBP-0069	"	(H) Site, burials
XBP-0032	"	(H) Site
XBP-0028	"	(H) Site, settlement, habitation, ice cellar
XFI-0021	Flaxman Island to Bullen Point	(H) POW-3 DEW Line site
XFI-0024	"	"
XFI-0001	"	"
XFI-0025	"	"
XFI-0023	"	"
XFI-0026	"	"
XFI-0004	Bullen Point to Brownlow Point	(H) Site, single dwelling, sod house, settlement
XFI-0005	"	(H) Site, settlement, sod houses
XFI-0006	"	(H) Site, settlement, sod houses
XFI-0002	"	(H) Site, governmental camp, research, permafrost
XFI-0007	"	(H) Site, burials (eroded away)
XFI-0008	"	(H) Site, settlement, sod houses
XFI-0009	"	(H) POW-D DEW Line site
XFI-0020	Brownlow Point to Collinson Point	(H) Site, single dwelling, sod house
XFI-0019	"	(H) Site, single dwelling, sod house
XFI-0018	"	(H) Site, single dwelling, sod house
XFI-0017	"	(H) Site, burials
XMM-0018	"	(H) Site
XMM-0019	"	(H) Site
XMM-0004	"	(H) Site
XMM-0114	"	(H) Camden Bay DEW line Station
XMM-0013	"	(P) Site
XMM-0014	"	(P) Site
XMM-0015	"	(P) Site
XMM-0016	"	(P) Site
XMM-0017	"	(P) Site
XMM-0005	"	(H) Site
XMM-0009	"	(P) Site
XMM-0010	"	(P) Site
XMM-0007	"	(P) Site
XMM-0008	"	(P) Site
XMM-0011	"	(P) Site
XMM-0012	"	(P) Site
No number	"	(P?)(H?) Site
XMM-0042	"	(H) Site
XMM-0043	"	(H) Site
XMM-0045	"	(H) Site, cemetery
XMM-0001	"	(P) Site
XMM-0046	"	(H) Site

Table III.C-20 Cultural/Archaeological Resources Near the Beaufort Sea Multiple Sale Area (continued)

AHRS Site Number	Location	Resource
XMM-0041	"	(H) Site
XFI-0013	"	(H) Site, ice cellar
XFI-0015	"	(H) Site, single dwelling, sod house
XFI-0014	"	(H) Structure, lookout tower
XFI-0003	"	(P) Site
XFI-0016	"	(H) Site, settlement, sod houses, sod quarry
XFI-0011	"	(H) Site, cabin, ice cellar, camp
XFI-0012	"	(H) Site, single dwelling, sod house
XFI-0010	"	(H) Site, settlement, sod houses
BRL-0007	"	(P) Site
BRL-0001	Barter Island to Canadian Border	(P) Site
BRL-0004	"	(H) Site
BRL-0023	"	(H) BAR-M DEW Line site
BRL-0046	"	(H) Site, village
BRL-0002	"	(H) Site
BRL-0009	"	(H) Site, burial
BRL-0006	"	(H) Site
BRL-0014	"	(H) Site
BRL-0015	"	(H) Site
BRL-0016	"	(P) Site
BRL-0008	"	(H) Site
BRL-0010	"	(H) Site, ice cellar
BRL-0012	"	(H) Site
BRL-0013	"	(H) Site
BRL-0003	"	(H) Site, ice cellar
BRL-0011	"	(H) Site, burial
BRL-0017	"	(H) Site, burial
BRL-0005	"	(H) Site
No number	"	(H) Site, DEW Line staging site
BRL-0021	"	(H) Site
BRL-0019	"	(H) Site, (cabins?)
XDP-0004	"	(H) Site
XDP-0026	"	(H) Site
XDP-0027	"	(H) Site
XDP-0028	"	(H) Site
XDP-0001	"	(H) Site
XDP-0045	"	(H) Beaufort Lagoon DEW Line Station
XDP-0029	"	(H) Site
XDP-0024	"	(H) Site
XDP-0023	"	(P)(H) Site
XDP-0025	"	(P)(H) Site
XDP-0003	"	(H) Site
XDP-0016	"	(H) Site
XDP-0013	"	(H) Site
XDP-0011	"	(H) Site
XDP-0012	"	(H) Site
XDP-0010	"	(H) Site
XDP-0009	"	(H) Site

Table III.C-20 Cultural/Archaeological Resources Near the Beaufort Sea Multiple Sale Area (continued)

AHRS Site Number	Location	Resource
XDP-0008	"	(H) Site
XDP-0002	"	(H) Site, Gordon (trading post) and Demarcation Point DEW Line Station
XDP-0005	"	(H) Site, Cemetery
XDP-0006	"	(H) Site
XDP-0007	"	(H) Site
XDP-0014	"	(P)(H) Site
XDP-0015	"	(H) Site
XDP-0044	"	(H) Structure, caribou fence, tent ring

Table III.C-21 Shipwrecks Potentially Within the Beaufort Sea Multiple-Sale Area

Vessel Name	Type	Tons	Date Wrecked	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.
Josephine	Whaling Bark	363	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	Trapped 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, Mar. 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 (western most of Midway Islands) was named after this vessel. All hands 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. Captain 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	1/2 mi NE of Cape Halkett	Caught in ice floe 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 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 dog sled. Sightings in the Beaufort Sea as late as the 1960's were reported by local Inupiat.
Unnamed	Native whaling boat	?	9/11/1988	30 mi off Point Barrow	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; 2 others were injured.
Unnamed	Native whaling boat	?	9/28/1991	30 mi N of Cross Island	Nuiqsut whaling captain Eli Nukapigak and his 4 crew lost their whaling boat after a bowhead whale they had struck pulled their 18-foot boat under water. The men were hauled aboard the 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 IV-1 Summary
Comparisons of Impacts and Cumulative Effects Among Alternatives in the Beaufort Sea Multiple Lease Sale Environmental Impact Statement

Note to Reader: Please keep the following information in mind as you read the summaries in this table.

The information in this summary provides and compares information among the alternatives and sales. For each resource, this table first summarizes the effects that are common to all alternatives and sales, except for Alternative II, No Action. See Section IV.B for the analysis of effects for Alternative II. The table summarizes the effects of the Proposal (Alternative I) for the first sale (Sale 186) and Alternatives III-VI and Sales (195 and 202) having the same effects. When applicable, this table identifies the other alternative and sale combinations that have different effects. Table II.A-4, Table II.A-5, and Table II.A-6 provide similar summaries of effects by resource and Alternatives I and III-VI for Sales 186, 195, and 202. In evaluating the alternatives, an analyst may identify different effects between alternatives and sales, but those differences do not translate to changes in the overall effect. For this EIS, we assume that removing areas (deferral alternatives) will decrease the opportunity that an economic resource will be found in the remainder of the area being offered; however, if economic oil and gas resources are discovered in the remaining area, the level of development activity and the amount of production (460 million barrels) will be the same. This assumption is necessary and realistic and reflects the real-world assumption that only larger economic fields can and will be developed. Small, non-economic fields, when discovered, do not result in development activity.

This EIS uses the comparative term “the same as” to indicate that an impact is essentially identical to or as similar as can be determined to that noted for another alternative. Within the EIS analysis, we use the phrase “the same as” to indicate to the reader that two impacts are considered to be equal. We do not intend this in the pure or mathematical sense. We are not saying that two alternatives are exactly the same in all aspects. Rather, we use the phrase to indicate that two impacts are so close that finding a difference between them is beyond our analytical ability to measure or analyze.

The effects associated with potential oil spills are based upon the assumption, for purposes of analysis, that a spill occurs and no spill-response activities are conducted. Most of the numbers presented in the oil-spill-risk analysis cumulative effects assume that the oil spill occurs and provides information about the likelihood of such a spill contacting a resource. The reader should keep in mind that the probability of a large oil spill (greater than or equal to 1,000 barrels of oil) is less than 10%. The chance of an oil spill occurring and reaching a resource is much less than 10%. Furthermore, MMS requires companies to have and implement oil-spill-response plans to help prevent oil from reaching critical areas and to remove oil from the environment. Because we cannot predict a specific level of cleanup, which would vary based upon location, weather conditions, time of year, etc., we make a very conservative assumption of zero cleanup and containment.

The summaries presented in this table are based on the comprehensive analysis provided in Section IV.C and Section V. Readers are encouraged to go to the appropriate Sections in IV.C and V for the full analysis.

Water Quality (Section IV.C.1)

Lower Trophic-Level Organisms (Section IV.C.2)

Fishes (Section IV.C.3)

Essential Fish Habitat (Section IV.C.4)

Endangered and Threatened Species (Section IV.C.5)

Bowhead Whales (Section IV.C.5.a)

Spectacled Eiders (Section IV.C.5.b)’

Steller’s Eiders (Section IV.C.5.c)

Marine and Coastal Birds (Section IV.C.6)

Marine Mammals (Section IV.C.7)

Terrestrial Mammals (Section IV.C.8)

Vegetation and Wetlands (Section IV.C.9)

Economy (Section IV.C.10)

Subsistence-Harvest Patterns (Section IV.C.11)

Sociocultural Systems (Section IV.C.12)

Archaeological Resources (Section IV.C.13)

Land Use Plans and Coastal Management Programs (Section IV.C.14)

Air Quality (Section IV.C.15)

Environmental Justice (Section IV.C.16)

Table IV Summary

Water Quality	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	Hydrocarbons from small spills could result in local, chronic hydrocarbon contamination; and hydrocarbons from a large oil spill could exceed the 1.5 parts per million acute toxic criterion during the first day of a spill and the 0.015 parts per million chronic criterion for up to a month in an area the size of a small bay. Other effects of the lease sales would not affect regional water quality, including the following three permitted activities. The increased turbidity from permitted construction activities would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers. If produced waters were discharged, the effect on water quality would be local but would last over the life of the field(s).

Lower-Trophic-Level Organisms	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas, and even small spills of refined petroleum in relatively shallow water could affect benthic organisms, including kelp communities.. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).
Alternatives I, III, IV, V, and VI for Sales 186 and 195, and Alternatives I, III, IV, and V for Sale 202	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).
Alternative VI for 202	The deferral would reduce the risk that hydrocarbons from a large oil spill would contaminate (Section IV.C.1.b) the bowhead-feeding area near Kaktovik for several days. Other effects would be similar to those described for Sale 202 without a deferral (Alternative I). Permitted drilling discharges likely would adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. The Aurora Prospect in this area was explored during 1988, with no noticeable effects of discharges on lower trophic-level organisms. Platform and pipeline construction likely would adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unintentional construction effects on unusual kelp communities could be avoided by required benthic surveys (Stipulation No. 1).

Table IV Summary (continued)

Fishes	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	Noise and discharges from dredging, gravel mining, island construction and reshaping, pipeline trenching, and abandonment are likely to have no measurable effect on fish populations (including incidental anadromous species). While a few fish could be harmed or killed, most in the immediate area would avoid these activities and would be otherwise unaffected. Effects on most overwintering fish are likely to be short term and sublethal, with no measurable effect on overwintering fish populations. In the unlikely event of a large oil or diesel fuel spill, effects on arctic fishes (including incidental anadromous species) would depend primarily on the season and location of the spill; the lifestage of the fishes (adult, juvenile, larval, or egg); and the duration of the oil contact. Because of their very low numbers in the spill area, no measurable effects are likely on fishes in winter. Effects would be more likely to occur from an offshore oil spill moving into nearshore waters during summer, where fishes concentrate to feed and migrate. If an offshore spill did occur and contact the nearshore area, some marine and migratory fish may be harmed or killed. However, it likely would not have a measurable effect on fish populations, and recovery would be likely within 5-10 years. In general, the effects of fuel spills on fishes are likely to be less than those of crude oil spills. In the unlikely event of an onshore pipeline oil spill contacting a small waterbody supporting fish (for example, ninespine stickleback, arctic grayling, and Dolly Varden char) and that had restricted water exchange, it likely would kill or harm most of the fish within the affected area. Recovery would be likely in 5-10 years. However, because of the small amount of oil or diesel fuel likely to enter freshwater habitat, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in overwintering areas or small waterbodies (containing many fish or fish eggs), an onshore spill of this kind is not likely to have a measurable effect on fish populations on the Arctic Coastal Plain.

Essential Fish Habitat	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	The same type and size of disturbance (for example, seismic activity, turbidity from construction, or an oil spill) or size of deferral can be expected to have a slightly greater effect in the western Beaufort than in the eastern Beaufort. Less impact would be expected in the central region. One exception is that freshwater effects would be greatest in the central region. The disturbance effects during the exploratory phase are all limited to the 45-day open-water season, except for the possible 3-year recovery of benthic prey and their habitat around exploratory wells. However, benthic organisms are only a minor prey item. Effects on essential fish habitat from seismic surveys, drilling-mud disposal, turbidity, and pipeline construction (both offshore and onshore), are considered low. The effects of ice-road construction could range from low to moderate because of the uncertainty of withdrawing up to 15% of the free water from lakes during the winter. In most cases, the salmon would recover within one generation. In the unlikely event that a large oil spill occurs, effects on freshwater essential fish habitat would be low. Effects of the spill on estuarine and marine essential fish habitats could be moderate and could affect smolting salmon. These salmon would recover within one generation. Changes in abundance would be limited to a population or portion of a population (populations in one stream or in even or odd years for pink salmon populations) and/or for a short time period.

Table IV Summary (continued)

Endangered and Threatened Species - Bowhead Whales	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	Bowhead whales exposed to noise-producing activities such as vessel and aircraft traffic, drilling operations, and seismic surveys most likely would experience temporary, nonlethal effects. Some avoidance behavior could persist up to 12 hours. The Industry Site-Specific Bowhead Whale-Monitoring Program should be effective in preventing a delay or blockage of the migration. Any effects from the discharge of muds and cuttings or suspension of sediment in the water column would be very localized around the drill rig because of the rapid dilution/deposition of these materials. Effects on the bowheads prey species likely would be negligible. Whales exposed to spilled oil would likely experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The stipulation on Pre-booming Requirements for Fuel Transfers should ensure that no fuel spills would affect bowhead whales during their migration.
Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	The effects of noise and oil spills on bowhead whales are likely to be essentially the same as described in Sections IV.C.5.a(1) and IV.C.5.a(2), because the activities expected to occur are likely to be similar. The differences in noise and oil-spill effects to bowhead whales from these deferrals would likely be difficult to measure. Overall, leasing, exploration, and production activities associated with Sales 186, 195, and 202 likely would have minimal effect on bowhead whales. The effects from an encounter with aircraft generally are brief, and the whales should resume their normal activities within minutes. Bowheads may exhibit temporary avoidance behavior to vessels at a distance of 1-4 kilometers, including the transport of bottom-founded drilling platforms. Most bowhead whales during the fall migration are likely to avoid an area around a seismic vessel operating in nearshore waters by a radius of up to 20 kilometers. Avoidance may persist up to 12 hours after the end of seismic operations. In addition, provisions under the Conflict Avoidance Agreement that are likely to be implemented during the bowhead whale migration place limitations on where and when seismic operations can be conducted. Some bowheads may avoid drilling noise at 20 kilometers or more. Drilling operations from drill ships with icebreaker support during the bowhead whale migration are likely to have a low effect on bowhead whales, causing most whales to avoid the area around a drill site, particularly if an icebreaker is actively managing ice in the area. Overall, bowhead whales exposed to noise-producing activities most likely would experience temporary, nonlethal effects. In the unlikely event of a large oil spill, some individuals may be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals affected likely would be small. Some bowheads could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of oil-contaminated prey items, and/or perhaps temporary displacement from some feeding areas. Exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, although most individuals exposed to spilled oil likely would experience temporary, nonlethal effects.

Endangered and Threatened Species – Steller's Eiders	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	Steller's eiders are not likely to experience adverse effects from potentially disturbing routine activities, collisions with structures, foraging habitat reduction, or oil-spill-cleanup activity. The effects of normal activities on Steller's eiders under Alternative I for Sales 186 and 195 are likely to be significantly less than those obtained if leasing and development occurred throughout the planning area with equal intensity. Low Steller's eider mortality is expected in the unlikely event a large oil spill occurs; however, recovery of the Alaska population from spill-related losses is not likely to occur while the regional population is declining.

Table IV Summary (continued)

Endangered and Threatened Species -Spectacled Eiders	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	Effects from normal activities associated with oil and gas exploration and development during three sales in the Beaufort Sea are likely to include the loss of a small number of spectacled eiders. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness, survival, or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter support traffic. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Although the eider population, which currently is declining at a non-significant rate, may be slower to recover from small losses or declines in fitness or productivity, no significant overall population effect is likely. In the unlikely event a large oil spill occurs, spectacled eider mortality is likely to be fewer than 100 individuals; however, any substantial loss (25+ individuals) would represent a significant effect. Recovery from substantial mortality is not likely to occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in numbers.
Alternatives I, III,V, and VI for Sale 186	The effects from normal activities include nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures. In the unlikely event of a large oil spill, the risk of contact is likely to be somewhat lower than if developments were spread throughout the planning area, which could include some areas used by eiders, which have higher contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil-spill mortality is not likely to occur while the spectacled eider is in a declining status; however, determination of status may be obscured by natural variation in numbers.
Alternatives I, III, V, and VI Sale 195	The effects from normal activities include nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures. Disturbance of eiders in the Near Zone is likely to be lower than under Sale 186, because a lower proportion of leasing and exploration is expected to take place there. In the unlikely event of a large oil spill, the risk of contact is likely to be somewhat lower under Sale 195 than under Sale 186, which proposes one more development project than Sale 195, or lower than if developments were spread throughout the planning area, which could include some areas used by eiders that have higher spill-contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil-spill mortality is not likely to occur while the species is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Effects are likely to be somewhat less than those that could occur as a result of Sale 186.
Alternatives I, III, V, and VI for Sale 202	The effects from normal activities include a small amount of nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures. In the unlikely event a large oil spill occurs, the risk of contact is low, because only one development is likely, probably located where spectacled eiders are relatively scarce. Effects are likely to be considerably less than those that could occur as a result of Sales 186 or 195.
Alternative IV for Sales 186, 195, and 202	The effects on spectacled eiders from normal activities and in the unlikely event a large oil spill occurs from Alternative IV are likely to be somewhat less than under Alternative I for Sales 186, 195, and 202.

Table IV Summary (continued)

Marine and Coastal Birds	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	The adverse effects on marine and coastal birds from normal exploration and development/production activities during three sales in the Beaufort Sea are likely to include the loss of small numbers of marine and coastal birds. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness or survival of individuals or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter traffic, causing displacement from preferred-use areas, and increased levels of energy use and predation. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Disturbance of local nesting birds probably would have little effect on Arctic Coastal Plain bird populations as a whole. However, populations currently declining at a non-significant rate may be slower to recover from small losses or declines in fitness or productivity, and those declining at a significant rate are likely to require a protracted recovery period. No significant overall population effect is likely to result from small losses for most species. In the unlikely event a large oil spill occurs, mortality is likely to reflect local population size and vulnerability determined by seasonal habitat use and stage of annual cycle at the time of contact (for example, molting versus non-molting). As the most abundant species, long-tailed duck mortality is likely to exceed 1,000 individuals, while that of other common species such as king eider, common eider, and scoters likely would be in the low hundreds, and loon species fewer than 25 individuals each. Mortality at the higher levels predicted by Fish and Wildlife Service data could result in significant effects for the long-tailed duck, king eider, and common eider. The probability of a large oil spill occurring, low throughout the planning area, is likely to decrease from the Near Zone to the Far Zone due to the greater likelihood of oil development in the former area.
Alternative I for Sale 186	The effects from activities associated with Alternative I for Sale 186 include nonsignificant disturbance, and the potential loss of small numbers of birds from collision with structures. In the unlikely event a large oil spill occurs, the risk of contact is likely to be somewhat lower than if developments were spread throughout the planning area, which could include some areas used by marine and coastal birds that have higher contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil-spill mortality is not likely to occur in any species whose population is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Overall effects of a unlikely large oil spill could result in significant effects for long-tailed ducks and king and common eiders.
Alternative I, Sale 195	The effects from normal activities associated with Alternative I, Sale 195 include non-significant disturbance and the potential loss of small numbers of birds from collisions with structures. Disturbance of birds in the Near zone is likely to be lower than under Sale 186, because a lower proportion of leasing and exploration is likely to occur there, while lease activity in the Midrange zone is somewhat greater but the number of development projects is the same. In the event a large oil spill occurs, the risk of contact is likely to be somewhat lower under Sale 195 than under Sale 186, which proposes one more development project than Sale 195, or lower than if developments were spread throughout the planning area, which could include some areas used by several bird species that have higher spill-contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil spill mortality is not likely to occur for any species whose population is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Overall effects are likely to be somewhat less than those that could occur as a result of Sale 186 but still could result in significant effects for long-tailed duck and king and common eider.
Alternative I, Sale 202	The effects from activities associated with Alternative I, Sale 202 include a small amount of nonsignificant disturbance, and the potential loss of small numbers of birds from collision with structures. The risk of oil-spill contact is relatively low, because only one development is likely, most likely located where most species are relatively scarce. Effects are likely to be considerably less than those that could occur as a result of Sales 186 or 195.
Alternatives III, V, and VI for Sales 186, 195, and 202	Because Alternatives III, V, and VI defer areas well removed from primary support facilities in the central Beaufort, where most leasing and development is likely to occur, effects from activities and any oil spill associated with any of the three sales on marine and coastal birds are likely to be the same as under Alternative I for Sales 186, 195, and 202.
Alternatives IV and VI for Sales 186, 195, and 202	The effects from activities associated with Alternatives V and VI on several bird species are likely to be somewhat less than under Alternative I for Sales 186, 195, and 202; however, in the unlikely event a large oil spill occurs, effects on regional populations of several species could be lowered substantially.

Table IV Summary (continued)

Marine Mammals	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	The effects from activities associated with Beaufort Sea oil and gas exploration and development are estimated to include the loss from a large oil spill (8-10 % chance) of small numbers of pinnipeds (perhaps 100-200 ringed seals but probably fewer than 10-20 spotted and 30-50 bearded seals and small numbers [fewer than 100] walruses), polar bears (6-10 bears), and beluga and gray whales (fewer than 10), with populations recovering (recovery meaning the replacement of individuals killed as a consequence of exploration and development) within about 1 year.
Alternatives I, III, IV, V, and VI, for Sales 186 and 202, and Alternatives I, III, IV, and V for Sale 202	The effects from activities associated with exploration and development are estimated to include the loss of small numbers of pinnipeds, polar bears, and beluga and gray whales (perhaps 100-200 ringed seals, probably fewer than 10-20 spotted and 30-50 bearded seals, fewer than 100 walruses, perhaps 6-10 bears, and fewer than 10 beluga and gray whales), with populations recovering within about 1 year. Under Alternative VI for Sale 202, effects could be reduced from about Barter Island east to Demarcation Bay. Potential conditional risks of oil contact to pinniped, polar bear, and beluga whale offshore habitats from about Barter Island east to Herschel Island (ERA's 36-37 assuming contact occurs within 30 days during the summer) would be reduced somewhat, if oil exploration and development were deferred under this alternative (Appendix A2, Table A2-21: LA18). However, potential oil-spill risks to habitats west of the Beaufort Lagoon area (Appendix A2, Table A2-21: ERA's 29-35 Ice/Sea Segments 1-6) would be the same as described under Effects Common to All Alternatives.

Terrestrial Mammals	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	The effects of Beaufort Sea oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes likely would include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances likely would not affect caribou, muskox, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), probably fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.
Alternatives I, III, IV, V, and VI for Sales 186 and 195, and Alternatives I, III, IV, and V for Sale 202	The effects of Alternative I for Sale 186 Beaufort Sea oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes are expected to include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances are not expected to affect caribou, muskoxen, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.
Alternative VI for Sale 202	Potential noise and disturbance and habitat effects could be reduced from about Barter Island to Demarcation Bay. The chance of contact to terrestrial mammal coastal habitats from about the Barter Island east to Herschel Island (Land Segments 49-55), within 30 days during summer, would be reduced (0-16%) if oil exploration and development were deferred under this alternative (Appendix A2, Table A2-27: LA18 and P7). However, the chance of contact to coastal habitats west of west of Barter (Appendix A2, Table A2-27: Land Segments 25-42) would be about the same as described in Section IV.C.8.b. The overall effects on caribou, muskoxen, grizzly bears, and arctic foxes likely would be about the same as described under Alternative I, for 202.

Table IV Summary (continued)

Vegetation and Wetlands	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	Disturbances mainly come from building gravel pads and ice roads and installing the onshore pipeline. Gravel pads, the pipeline trench, and the 12- or 50-mile-long onshore pipelines would destroy a few acres of vegetation and affect a few acres of nearby vegetation and have only local effects on the tundra ecosystem. Ice roads would have local effects (compression of tundra under the ice roads) on vegetation, with recovery expected within a few years, and no vegetation would be killed. The mean number of one or more oil spills greater than or equal to 1,000 barrels occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. In the unlikely event that such a spill occurs. there is a less than 0.5-21% conditional chance that an offshore spill will contact coastline habitats in the planning area, which include wetlands and other vegetation cover. An estimated 29-40 kilometers of coastline could be oiled from a 1,500- or 4,600-barrel spill. The shoreline of the planning area contains some habitats with fairly high values (1 the lowest and 10 the highest) for oil-spill retention (lagoonal beaches have a value of 5, and peat shores have a value of 6) along river deltas and near the mouths of other streams. Stranded oil on sheltered intertidal areas, especially along peat shorelines, likely would persist for many years.
Alternatives I, III, IV, V, and VI for Sales 186 and 195, and I, III, IV, and V for Sale 202	The effects of exploration and development on vegetation and wetlands likely would include the destruction of some acres of vegetation-wetlands from gravel mining, landfall gravel-pad and onshore pipeline installation, and potential oil-spill effects and spill-cleanup effects, which could persist for 10 years or longer.
Alternative VI for Sale 202	Under Alternative VI for Sale 202, potential onshore habitat effects could be avoided from about Barter Island east to Demarcation Bay and potential onshore habitat effects from gravel mining, gravel pads and onshore pipeline installation in this area. The chance of contact to vegetation-wetland coastal habitats from about Beaufort Lagoon east to Herschel Island (Land Segments 49-55 within 30 days during the summer) would be reduced (2-11%), if oil exploration and development were deferred under this alternative (Appendix A2, Table A2-27: LA18). However, the chance of contact to coastal habitats west of Beaufort Lagoon (Appendix A2, Table A2-27: Land Segments 25-48) would be about the same as described under general effects.

Economy	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	Each alternative will generate increases in North Slope Borough property taxes that will average about 1% above the level of Borough revenues without the Sales in the early years and taper to less than 0.5% in the latter years. In the early years of production, each alternative will generate increases in revenues to the State of Alaska of less than 0.25% above the level without a sale. The increases will taper to an even smaller percent in the latter years of production. The change in total employment and personal income is less than 3% over the 1999 baseline for the North Slope Borough and the rest of Alaska for each of the three major phases of OCS activity: exploration, development, and production. The employment and personal income increase includes workers to cleanup possible large oil spills of 1,500-barrels or 4,600 barrels. These increases will occur for each alternative and sale. For purposes of analysis, we assume that the exploration and development scenario for Alternative I for Sale 186, will be the same as for each deferral alternative and sale; that is, the OCS activity will occur in a different area and be the same for each deferral alternative as for Alternative I for Sale 186.

Table IV Summary (continued)

Subsistence-Harvest Patterns	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	For the communities of Barrow, Nuiqsut and Kaktovik, disturbances periodically could affect subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt. The chance of an oil spill occurring and entering offshore waters is estimated to be low. Based on the assumption that a spill has occurred, the chance of an oil spill during summer from a platform or a pipeline contacting important traditional bowhead whale- and seal-harvest areas over a 360-day period would be 75% or less for the Barrow whaling area, 41% or less for the Nuiqsut whaling area, and 34% or less for the Kaktovik whaling area. A spill also could affect other subsistence resources and harvest areas used by the communities of Barrow, Nuiqsut, and Kaktovik. Overall, oil spills could affect subsistence *resources* periodically in the communities of Barrow, Nuiqsut, and Kaktovik. In the unlikely event of a large oil spill, many harvest areas and some subsistence resources could be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads and threaten a pivotal element of Inupiat culture. There also is concern that the International Whaling Commission, which sets the quota for the Inupiat subsistence harvest of bowhead whales, would reduce the harvest quota following a major oil spill or, as a precaution, as the migration corridor becomes increasingly developed to ensure that overall population mortality did not increase. Such a move would have a profound cultural and nutritional impact on Inupiat whaling communities. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree these resources were contaminated. In the case of extreme contamination, harvests could cease until such time as resources were perceived as safe by local subsistence hunters. Overall, such effects are not expected from routine activities and operations. Tainting concerns also would apply to polar bears, seals, beluga whales, walruses, fish, and birds. Additionally, effects from a large oil spill likely would produce potential short-term but serious adverse effects to long-tailed duck and king and common eider populations. All areas directly oiled, areas to some extent surrounding them, and areas used for staging and transportation corridors for spill response would not be used by subsistence hunters for some time following a spill. Oil contamination of beaches would have a profound impact on whaling because even if bowhead whales were not contaminated, Inupiat subsistence whalers would not be able to bring them ashore and butcher them on a contaminated shoreline. The duration of avoidance by subsistence users would vary depending on the volume of the spill, the persistence of oil in the environment, the degree of impact on resources, the time necessary for recovery, and the confidence in assurances that resources were safe to eat. Such oil-spill effects would be considered significant.
Alternatives I, III, V, and VI for Sale 186; Alternatives I, III, V, and VI for Sale 195; and Alternative I for Sale 202	Based on the sale-specific effects on subsistence resources mentioned above from noise, disturbance, and oil spills, the consequent effects on subsistence-harvest patterns are expected to be similar to those discussed in effects common to all alternatives above. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. For the communities of Barrow, Nuiqsut, and Kaktovik, disturbances periodically could affect these subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt.

Table IV Summary (continued)

Subsistence-Harvest Patterns	
Alternative IV for Sales 186 and 195	Even though effects on subsistence would be essentially the same as described for Alternative I for Sale 186, effects on subsistence-harvest patterns are expected to be reduced because no exploration or production activities would occur in these deferral areas, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished.
Alternative III for Sale 202	Because no exploration or production activities would occur in this deferral area under Alternative III for Sale 202, potential oil-spill, chronic noise, and disturbance effects under Alternative III for Sale 202 on subsistence whaling and on Barrow's traditional subsistence-whaling area would be reduced.
Alternative IV for Sale 202	Although effects on subsistence resources under Alternative IV for Sale 202 would be essentially the same as described for Alternative I for Sale 202, effects on subsistence-harvest patterns in Nuiqsut are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished.
Alternative V for Sale 202	Although effects on subsistence resources would be essentially the same as described for Alternative I for Sale 202, effects on subsistence-harvest patterns in Kaktovik are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling and the western half of Kaktovik's traditional subsistence-whaling area.
Alternative VI for Sale 202	Potential reductions in oil-spill contact to seals, polar bears, gray and beluga whales, caribou, muskoxen, grizzly bears, and arctic foxes from about Barter Island east to Demarcation Bay would reduce effects on these important subsistence resources and on important Kaktovik subsistence-harvest areas.

Sociocultural Systems	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	Effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from industrial activities, from changes in population and employment, and from periodic interference with subsistence-harvest patterns from oil spills and oil-spill cleanup. Altogether, effects periodically could disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternatives I, III, V, and VI for Sales 186 and 195, and Alternative I for Sale 202	The consequential effects on sociocultural systems are expected to be similar to those discussed under Effects Common to All Alternatives. Altogether, effects periodically could disrupt but not displace ongoing social systems; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternative IV for Sales 186, 195, and 202	The effects to subsistence-harvest patterns are expected to be reduced under this alternative. Subsequent effects reductions to sociocultural systems also would be expected.
Alternatives III, V, and VI for Sale 202	Because no exploration or production activities would take place in these deferral areas for Sale 202, potential oil spill, chronic noise, and disturbance effects under Alternatives III, V, and VI for Sale 202 on subsistence whaling and on Barrow's, Nuiqsut's, and Kaktovik's traditional subsistence-whaling area would be reduced.

Table IV Summary (continued)

Archaeological Resources	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	Potential effects on archaeological resources would be from exploration and development activities on both onshore and offshore resources, including historic and prehistoric. Onshore resources are more at risk for effects from disturbance caused by construction or oil-spill-cleanup operations. Potential offshore resources are at greater risk for effects from bottom-disturbing activities, notably anchor dragging and pipeline trenching. Generally, potential effects from activities increase with the level of activities, from the exploration phase to the development phase. For onshore archaeological resources, the potential for effects increases with the distance from existing pipeline infrastructure and from oil-spill size and associated cleanup operations. Archaeological surveys and analyses are required in areas where potential archaeological resources are at risk from offshore operations. These requirements are specified in the MMS Handbook 620.1H, Archaeological Resource Protection; in regulations (30 CFR 250.194; 30 CFR 250.126; 30 CFR 250.201; 30 CFR 250.203; 30 CFR 250.204; 30 CFR 250.414; 30 CFR 250.1007(a)(5); and 30 CFR 250.1009); and in law through the National Historic Preservation Act. Any archaeological resources, either onshore or offshore, will be identified before any activities are permitted, and they will be avoided or potential effects will be mitigated. Each of the alternatives would provide some level of protection to archaeological resources by removing areas from leasing and potential exploration and development activities. The MMS has identified 502 whole or partial blocks in the program area that may contain prehistoric or historic resources (see Section III.C). The following indicates the number of blocks with archaeological potential within each alternative, their relative percent of the total number of blocks with archaeological resource potential, and the blocks with archaeological resource potential remaining in the sale area. • Alternative III would remove 9 (1.8%), leaving 493 blocks or partial blocks • Alternative IV would remove 17 (3.4%), leaving 485 blocks or partial blocks • Alternative V would remove 20 (4%), leaving 482 blocks or partial blocks • Alternative VI would remove 48 (9.6%), leaving 454 blocks or partial blocks
Alternatives I, IV, V, and VI for Sale 186	The potential effects on archaeological resources are essentially the same as discussed for general effects, with activity concentrated in the Near Zone, close to existing infrastructure. If extended-reach drilling techniques are used instead of offshore platforms or islands, possible offshore effects would be minimized. More potential effects could occur onshore as opposed to offshore, and in the development phase rather than the exploration phase, because of possible oil-spill-cleanup activities. Although all the projected development for Sale 186 is in the Near and Midrange zones where there is a higher potential for archaeological resources to occur, prehistoric and historic resources both onshore and offshore will be identified by archaeological surveys and avoided or mitigated.
Alternatives I, IV, V, and VI, for Sale 195	The effect of exploration and development activities on possible archaeological resources would be essentially the same as discussed under effects common to all alternatives, except that activities may be farther away from existing onshore infrastructure. Exploration activities probably would be conducted from offshore facilities, which reduces the potential impact on onshore archaeological resources. Marine archaeological surveys in areas where offshore archaeological resources may exist would identify likely resources, which would be avoided or effects mitigated. In the development phase, the potential for effects to archaeological resources increases with distance from existing infrastructure, primarily because of onshore pipeline distances and associated construction and right-of-way access and the increased possibility for oil-spill-cleanup activities. Onshore archaeological surveys would identify any potential resources, which will be avoided or possible effects mitigated.

Table IV Summary (continued)

Archaeological Resources	
Alternatives I, IV, V and VI, for Sale 202	The effect of exploration and development activities on possible archaeological resources would be essentially the same as discussed under effects common to all alternatives, except that activities would be more dispersed. In the exploration phase, some drilling could take place in deeper water, using floating drilling platforms or ships. These drilling units would use anchors and would probably have their blowout preventer buried, which could disturb potential archaeological resources in the immediate area. No impact is expected to prehistoric archaeological resources from activities in water depths greater than 50 meters. In the development phase, floating drilling and production platforms and possibly subsea production well-head assemblies would have the same disturbance effect to the seafloor as in the exploration phase: anchor dragging and digging the glory hole. The effect of gravel islands or bottom-founded production systems would be the same as discussed under effects common to all alternatives, compression and skirt penetration of sediments. The effect of oil-spill cleanup activities depend on the size of the spill and would probably be limited to the Near Zone, but the response area would be larger and more difficult for response personnel to access, potentially exposing unknown archaeological resources to risk of damage. Onshore and offshore archeological surveys and analyses would be conducted and would identify potential archaeological resources, which will be avoided or possible effects would be mitigated.
Alternative III for Sales 186, 195, and 202	Alternatives III and IV for Sales 186, 195, and 202 would reduce the potential for effects on prehistoric or historic resources in the deferral areas. The potential for encountering shipwrecks during offshore operations would be greatly reduced because of the high potential for possible shipwrecks to occur in the general area offshore Barrow. There would less potential disturbance in the adjacent land areas, which otherwise might have experienced construction activities related to pipeline infrastructure or a staging area.

Land Use Plans and Coastal Management Programs	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	Conflicts with the Statewide standards of the ACMP and the NSB CMP policies are not expected. Through the use of mitigating measures and regulatory oversight, it should be possible to comply with all of the standards and policies. Most of these policies will be more precisely addressed if and when specific proposals are brought forward by lessees. All Exploration and Development and Production plans must be accompanied by a consistency certification for State review and concurrence. The State will review OCS plans and concur or object with the lessee's consistency certification. The MMS cannot issue a permit for any activities described in the plans in the absence of the State's concurrence unless the Secretary of Commerce overrides the State's objection.
Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	No conflicts with the Statewide standards of the ACMP or with the enforceable policies of the NSB CMP are anticipated.

Table IV Summary (continued)

Air Quality	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	Effects on onshore air quality from air emissions likely would be only a very small percent of the maximum allowable PSD Class II increments. The concentrations of criteria pollutants in the onshore ambient air would remain well within the air-quality standards. Consequently, there likely would be only a minimal effect on air quality with respect to standards. Principally, because of the distance of emissions from land, the other effects of air-pollutant concentrations at the shore due to exploration and development and production activities or accidental emissions would not be sufficient to harm vegetation. A light, short-term coating of soot over a localized area could result from oil fires. The air-quality analysis is based on the specific emission controls and emission limitations that the operators would apply to meet the appropriate Environmental Protection Agency regulations and permit requirements for any development and production activities. The effects of all these activities would cause only small, local, temporary increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards. Therefore, effects from the proposed sales would be low. Individual air masses move constantly with atmospheric circulation, we expect that the major differences in effects of the different alternatives on air quality would be in which specific geographic areas could be affected by air emissions. Because these emissions should not be significant other than in extremely localized areas, we conclude that none of the alternatives to the proposed sales (186, 195, and 202) would result in significant effects different from or other than those discussed in Section IV.C.15.a. Air quality effects of all activities under all sales and all alternatives would cause only small increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards.

Environmental Justice	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202	Sale-specific environmental justice effects would derive from potential noise, disturbance, and oil spill effects on subsistence resources, subsistence-harvest patterns, and sociocultural systems. The only substantial source of potential environmental justice-related effects to Native villages from the Beaufort Sea multiple sales and the range of alternatives would occur in the unlikely event of a large oil spill, which could affect subsistence resources. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.

Table IV.A-1 Representative Development Schedule for Sale 186

Year	Exploration Wells	Delineation Wells	Exploration Drilling Rigs	Production Platforms	Production Wells	Injection Wells	Production Drilling Rigs	Offshore Pipelines (Miles)	New Shore Bases	Oil Production (MMbbl)	Oil Production (MMbbl)	Oil Production (MMbbl)	Combined Oil Production (MMbbl)	Cumulative Oil Production (MMbbl)
2003														
2004	1		1											
2005	1		1											
2006	1	2	2											
2007	1		1											
2008	1	2	2											
2009	1		1	1	3	3	1	10						
2010		2	1		10	4	1			7.9			7.9	7.9
2011				1	13	7	2	10		15.7			15.7	23.6
2012					10	4	1			15.7	7.9		23.6	47.2
2013					10	4	1			15.7	15.7		31.5	78.7
2014				1	3	3	1	20		13.0	15.7		28.7	107.4
2015					10	4	1			10.7	15.7	13.2	39.6	147.0
2016					10	4	1			8.8	13.0	22.0	43.8	190.8
2017										7.3	10.7	22.0	40.0	230.8
2018										6.0	8.8	22.0	36.8	267.6
2019										5.0	7.3	22.0	34.2	301.9
2020										4.1	6.0	18.9	29.0	330.9
2021										3.4	5.0	16.3	24.6	355.5
2022										2.8	4.1	14.0	20.9	376.4
2023										2.3	3.4	12.0	17.7	394.1
2024										1.9	2.8	10.3	15.0	409.1
2025											2.3	8.9	11.2	420.3
2026											1.9	7.7	9.5	429.9
2027												6.6	6.6	436.5
2028												5.7	5.7	442.1
2029												4.9	4.9	447.0
2030												4.2	4.2	451.2
2031												3.6	3.6	454.8
2032												3.1	3.1	457.9
2033												2.7	2.7	460.5
	6	6		3	69	33		40		120	120	220	460.5	

Source: USDOI, MMS, Alaska OCS Region**.**

Notes: Each oil production column represents annual production from a single field. There are 3 fields assumed for this sale. A combined production stream and cumulative production stream are also provided. All other activities represent a sum of activities associated with these 3 fields.

Table IV.A-2 Representative Development Schedule for Sale 195

Year	Exploration Wells	Delineation Wells	Exploration Drilling Rigs	Production Platforms	Production Wells	Injection Wells	Production Drilling Rigs	Offshore Pipelines (Miles)	New Shore Bases	Oil Production (MMbbl)	Oil Production (MMbbl)	Combined Oil Production (MMbbl))	Cumulative Oil Production (MMbbl)
2003													
2004													
2005													
2006													
2007	1		1							`			
2008	1		1										
2009		2	1										
2010	1		1										
2011													
2012	2		2	1	3	3	1	10					
2013	1	2	2		10	4	1			7.9		7.9	7.9
2014		2	1		10	4	1			15.7		15.7	23.6
2015										15.7		15.7	39.3
2016				1	3	3	1	30		15.7		15.7	55.1
2017				1	13	7	2			13.0	21.5	34.5	89.5
2018					20	8	2			10.7	28.6	39.4	128.9
2019					10	4	1			8.8	28.6	37.5	166.3
2020										7.3	28.6	35.9	202.3
2021										6.0	28.6	34.7	236.9
2022										5.0	28.6	33.6	270.5
2023										4.1	25.2	29.3	299.8
2024										3.4	22.2	25.6	325.4
2025										2.8	19.5	22.3	347.7
2026										2.3	17.2	19.5	367.2
2027										1.9	15.1	17.0	384.2
2028											13.3	13.3	397.5
2029											11.7	11.7	409.2
2030											10.3	10.3	419.5
2031											9.1	9.1	428.6
2032											8.0	8.0	436.5
2033											7.0	7.0	443.6
2034											6.2	6.2	449.7
2035											5.4	5.4	455.2
2036											4.8	4.8	460.0
2037													
	6	**6**		**3**	**69**	**33**		**40**		**120**	**340**	**460**	

Source: USDOI, MMS, Alaska OCS Region**.**
Notes: Each oil production column represents annual production from a single field. There are 2 fields assumed for this sale. A combined production stream and cumulative production stream are also provided. All other activities represent a sum of activities associated with these 2 fields.

Table IV.A-3 Representative Development Schedule for Sale 202

Year	Exploration Wells	Delineation Wells	Exploration Drilling Rigs	Production Platforms	Production Wells	Injection Wells	Production Drilling Rigs	Offshore Pipelines (miles)	New Shorebases	Oil Production (MMbbl)	Cumulative Oil Production (MMbbl)
2003											
2004											
2005											
2006											
2007									`		
2008											
2009											
2010	1		1								
2011											
2012	1		1								
2013	1	1	1								
2014		2	1								
2015	1	2	1						1		
2016											
2017	1		1								
2018	1		1	1	4	4	1	35			
2019				1	14	8	2			30.8	30.8
2020					20	8	2			38.6	69.4
2021					20	9	2			38.6	108.0
2022					10	5	1			38.6	146.6
2023										38.6	185.2
2024										38.6	223.8
2025										34.0	257.8
2026										29.9	287.7
2027										26.3	314.0
2028										23.2	337.2
2029										20.4	357.6
2030										17.9	375.5
2031										15.8	391.3
2032										13.9	405.2
2033										12.2	417.4
2034										10.8	428.2
2035										9.5	437.7
2036										8.3	446.0
2037										7.3	453.3
2038										6.7	460.0
2039											
	6	5	7	2	68	34		35	1	460.0	

Source: USDOI, MMS, Alaska OCS Region**.**
Notes: Each oil production column represents annual production from a single field. There is 1 field assumed for this sale. A cumulative production stream is also provided. All other activities represent a sum of activities associated with this field.

Table IV.A-4 Summary of Basic Exploration Development, Production, and Transportation Assumptions for Alternatives I, III, and VI[1]

PHASE Activity/Event	Sale 186 Time Frame and Assumed Number	Sale 195 Time Frame and Assumed Number	Sale 202 Time Frame and Assumed Number
EXPLORATION			
Well Drilling	**2004-2010**	**2007-2014**	**2010-2018**
Exploration Rigs	1-2	1-2	1
Exploration Wells	6	6	6
Delineation Wells	6	6	5
Drilling Discharges			
Drilling Muds (Short Tons, dry)	1,040	1,040	935
Cuttings (Short Tons, dry)	6,300	6,300	5,775
Support Activities (Annual)			
Helicopter Flights [2]	155	155	140
Supply-Boat Trips	0-14	0-14	0-7
Surface Transport[3]	See footnote [3]	See footnote [3]	See footnote [3]
Shallow-Hazards Site Surveys			
Blocks Surveyed	6	6	6
Total Area Covered[4] (mi^2)	54	54	54
DEVELOPMENT AND PRODUCTION			
Platforms Installed	**2009-2014**	**2012-2017**	**2018-2019**
	3	3	2
Production and Injection Service Wells	2009-2016	2012-2019	2018-2022
	102	102	102
Number of Fields	3	2	1
Oil Production	2010-2033	2013-2036	2019-2038
Total (MMbbl)	460	460	460
Peak Yearly (MMbbl)	2016	2018	2020-2024
	43.8	39.4	38.6
Monthly Support Activities			
Helicopter Flights: Construction[5]	300-600	300-600	600
Helicopter Flights: Development	28-56	28-56	56
Helicopter Flights: Production	12-28	12-28	28
Supply-Boat Trips	See Footnote[6]	See Footnote[6]	See Footnote[6]
Surface Transport[7]			
Construction Phase	12,000	6,000	N/A
Operation Phase	30-60	25-30	N/A
Drilling Discharges			
Drilling Muds (Short tons, dry)	13,300	13,300	13,300
Cuttings (Short tons, dry)	84,000	84,000	84,000
Shallow-Hazard Surveys [8]			
Total Area Covered (mi^2)	105	105	70
TRANSPORTATION			
Oil Pipeline Installation	2008-2014	2012-2016	2018
Offshore Length (miles)	40	40	35
Onshore Length miles)			85[9]
Tanker Transport			
Peak Years of Production	2016	2018	2020-2024
Number of Loadings [10]	63	56	55
OIL SPILLS	**See** Table IV.A-4		

Source: Most of the information in this table may be found in Appendix B of this EIS.

[1] The figures in this table forecast activities beginning and ending in discrete time periods. This is done for consistent and methodical analysis. In reality, these periods may blend with and overlap each other. Estimates are speculative and based on a situational average.

[2] Helicopter trips are expressed in an annual average.

[3] Surface transport estimates vary according to the location of the exploration platform. Even if the exploration platform is located in the landfast ice zone, surface transport volumes by ice road to the drill site will be less than half on the volumes forecast for a post find construction phase. During the operations phase vehicle trips could decline 100-200 per season.

[4] An OCS block is 8.9 square miles.

[5] Helicopter support trips will decline sharply after the construction phase; however, far/deepwater structures will consistently require greater levels of air support.

[6] Marine support traffic for the construction phase will vary from 150-200 per open-water season for each nearshore platforms to as many as 250 for structures beyond the landfast ice zone. Vessel traffic will decline into the production phase, with 4-6 trips per season for nearshore platforms.

[7] Based on a 90-day ice-road season. Estimates for Sale 195 based on one platform in landfast ice zone. The platform assumed for sale 202 will be beyond the landfast ice zone.

[8] MMS's site-clearance seismic survey requirements specify a minimum of 35 square miles.

[9] The portrayed mileage is a rough estimate of a pipeline route from Smith Bay to the Kuparuk mainline. Should the pipeline landfall occur at Point Thomson, it would connect at the Badami field, a distance of 12 miles.

[10] Assuming 100,000 deadweight-ton tankers.

Table IV.A-5 Large, Small, and Very Large Spill Sizes We Assume for Analysis in this EIS by Section

EIS Section	Source of Spill	Type of Oil	Size of Spill(s) (Barrels)	Receiving Environment
Large Spills (≥1,000 barrels)				
IV.C	**Offshore** Pipeline Platform/Gravel Island Storage Tank	 Crude Crude	 4,600 1.500	 Open Water Under Ice On Top of Sea Ice Broken Ice
Small Spills (< 1000 barrels)				
IV.C	**Offshore and Onshore** Operational Spills from All Sources	 Diesel or Crude Crude	147-184 spills <1 barrel[1] 48-59 spills ≥1 barrel but <25 barrels 3 spills >25 and <500 bbl 0 spills >500 and <1,000 bbl	Gravel Island Open Water On Top of Sea Ice
	Onshore and Offshore	Refined	157-202 spills of 0.7 barrels each	Broken Sea Ice Snow/Ice Tundra
Very Large Spills (≥150,000 barrels)				
IV.I	**Blowout from the Gravel Island**	Crude	180,000	Open Water On Top of Sea Ice Broken Sea Ice

Source: USDOI, MMS, Alaska OCS Region (2002)
Note: Tables A1-6a through A1-6e in Appendix A1 show the distribution of small crude and refined spills by Alternative.

Table IV.A-6a Fate and Behavior of a Hypothetical Oil Spill, 1,500 Barrels in Size, from a Platform in the Beaufort Sea

	Summer Spill[1]				Meltout Spill[2]			
Time After Spill in Days	1	3	10	30	1	3	10	30
Oil Remaining (%)	81	73	58	28	84	78	73	65
Oil Dispersed (%)	2	5	16	43	0.2	0.6	2	6
Oil Evaporated (%)	17	22	26	29	16	21	25	29
Thickness (mm)	3.5	2.1	1.2	1	7.6	2.8	1.7	1
Discontinuous Area (km^2)[5]	2	9	44	181	2	7	18	143
Estimated Coastline Oiled (km)[6]			**29**				**32**	

Note: For the Alternative I Sales 186, 195 and 202 and their alternatives, the median platform spill is assumed to be 1,500 barrels.

Table IV.A-6b Fate and Behavior of a Hypothetical Oil Spill, 4,600 Barrels in Size, from a Pipeline in the Beaufort Sea

	Summer Spill[1]				Meltout Spill[2]			
Time After Spill in Days	1	3	10	30	1	3	10	30
Oil Remaining (%)	83	77	65	40	85	81	71	69
Oil Dispersed (%)	1	3	10	32	0.1	0.4	3	4
Oil Evaporated (%)	16	20	25	28	15	19	26	27
Thickness (mm)	3.5	2.1	1.2	1	7.7	4.9	2.9	1.7
Discontinuous Area (km^2)[5]	4	16	77	320	3	13	61	252
Estimated Coastline Oiled (km)[6]			**49**				**54**	

Source: USDOI, MMS, Alaska OCS Region (2001).
Notes: Calculated with the Sintef oil-weathering model Version 1.8 of Reed et al. (2000) and assuming an Alaska North Slope crude type. For the Alternative I Sales 186, 195 and 202 and their alternatives, the median pipeline spill is assumed to be 4,600 barrels.
[1] Summer (July through September), 12-knot wind speed, 2 degree Celsius, 0.4-meter wave height.
[2] Meltout Spill. Spill is assumed to occur in May into first-year pack ice, pools 2-centimeter thick on ice surface for 2 days at 0 degree Celsius prior to meltout into 50% ice cover, 11-knot wind speed, and 0.1 meter wave heights.
[4] This is the area of oiled surface.
[5] Calculated from Equation 6 of Table 2 in Ford (1985) and is the discontinuous area of a continuing spill or the area swept by an instantaneous spill of a given volume. Note that ice dispersion occurs for about 30 days before meltout.
[6] Calculated from Equation 17 of Table 4 in Ford (1985) and is the results of stepwise multiple regression for length of historical coastline affected.

Table IV.B-1 Essential Fish Habitat Ranking for Alternatives

	Freshwater Rank	Estuary Rank	Marine Rank	Composite Rank	Composite if Freshwater Weighted
No Sale (II)*	1	1	1	1	1
Barrow Subsistence Whale Deferral(III)	5	4	4	5	5
Nuiqsut Subsistence Whale Deferral (IV)	2	3	3	3	2
Kaktovik Subsistence Whale Deferral (V)	4	5	5	4	4
Eastern (VI)	3	2	2	2	3
Full Sale, No Deferral	6	6	6	6	6

***** While Alternative II would lower potential effects in the Beaufort Sea, those effects would be transferred to another location, see Section IV.C.2.

Table IV.C-1 Number of Pacific Salmon Collected by Fyke Net in the Prudhoe Bay/Sagavanirktok River Region of Alaska, 1981-1997

Year	Effort (Net Days)	Number of Salmon Collected				
		Pink	Chum	Chinook	Sockeye	Coho
1981	193	0	0	0	0	0
1982	249	41*	0	0	0	0
1983	625	0	0	0	0	0
1984	1,603	15	2	1	0	0
1985	1,239	27	0	0	0	0
1986	1,289	74	6	0	0	0
1987	863	8	1	0	0	0
1988	572	0	0	0	0	0
1989	678	13	5	0	0	0
1990	371	19	1	0	0	0
1991	613	20	1	0	0	0
1992	627	21	1	0	0	0
1993	620	16	9	0	0	0
1994	403	5	0	0	0	0
1995	463	0	1	0	0	0
1996	360	17	4	0	0	0
1997	84	0	0	0	0	0
Total	**11,477**	**276**	**31**	**1**	**0**	**0**

Source: Griffiths and Gallaway (1982), Griffiths et al. (1983), Woodward-Clyde Consultants (1983), Biosonics (1984), Moulton et al. (1986), Cannon et al. (1987), Glass et al. (1990), LGL Ecological Research Assocs., Inc. (1990, 1991, 1992, 1993, 1994a), Reub et al. (1991), Griffiths et al. (1995, 1996, 1997).

*Includes 11 fish caught upstream in the Sagavanirktok River.

Table IV.C-2 Sale 186 Employment and Personal Income Effects

Area of Residence/Phase of OCS Activity	Employment (Annual Average Jobs)			Total Personal Income Annual Average (Millions of Constant 1999$)		
	Direct	Indirect & Induced	Total	Direct Workers	Indirect & Induced Workers	Total
NSB (a)						
Exploration	3	1	4	0.3	0.1	0.4
Development	30	10	40	2.4	1.0	3.4
Production	7	2	9	0.5	.2	0.7
Southcentral Alaska & Fairbanks (b)						
Exploration	40	20	60	3.2	0.6	3.8
Development	400	200	600	32.0	6.0	38.0
Production	260	130	390	21.0	4.0	25.0

Source: MMS, "Arctic IMPAK: 1st Step Model" and "Arctic IMPAK: 2nd Step Model"
(a) NSB: North Slope Borough for place of residence meaning villages in the NSB but not in the OCS worker enclave or enclaves.
(b) Southcentral includes Municipality of Anchorage, Matanuska-Susitna Borough, and Kenai Peninsula Borough. Fairbanks means the Fairbanks Northstar Borough.

Table IV.I-1 Discharge Conditions for a Well Blowout to Open Water or Solid Ice

Discharge Category	Volume of Oil (Barrels)				
	Day 1	Day 2	Day 3	Day 15	15-Day Totals
Well's Discharge Volume	15,000	15,000	15,000	15,000	225,000
Evaporation (20%)	-3,000	-3,000	-3,000	-3,000	-45,000
Fall out to Gravel Island	6000	6,000	6,000	6,000	90,000
Oil Remaining on Gravel Island	-3,400	0 [1]	0 [1]	0 [1]	-3,400
Oil Draining to the Sea from Gravel Island	2,600	6000	6,000	6,000	86,600
Oil Falling to the Sea or Solid Ice	6,000	6,000	6,000	6,000	90,000
Total Oil to the Sea or Solid Ice	8,600	12,000	12,000	12,000	176,600

Source: S.L. Ross Environmental Research Ltd., D.F. Dickins and Associates, and Vaudrey and Associates (1998); BPXA (2000b).
Notes: Assumes Alaska North Slope crude; constant wind speed of 20 knots; winds change from west-southwest to east-northeast; current speed of 0.6 knots; wave height of 1-5 feet; and air temperature of 45 °F.
[1] After hour 14, the Gravel Island is saturated with oil. All oil falling on the Gravel Island drains to the sea.

Table IV.I-2 Discharge Conditions for a Well Blowout to Broken Ice

Discharge Category	Volume of Oil (Barrels)				
	Day 1	Day 2	Day 3	Day 15	15-Day Totals
Well's Discharge Volume	15,000	15,000	15,000	15,000	225,000
Evaporation (20%)	-3,000	-3,000	-3,000	-3,000	-45,000
Fall out to Gravel Island	6000	6,000	6,000	6,000	90,000
Oil Remaining on Gravel Island	-3,400	0 [1]	0 [1]	0 [1]	-3,4000
Oil Draining to the Sea from Gravel Island	2,600	6,000	6,000	6,000	86,600
Oil Falling to the Open Water	3,000	3,000	3,000	3,000	45,000
Oil Falling to Ice Floes	3,000	3,000	3,000	3,000	45,000
Total Oil to the Environment	8,600	12,000	12,000	12,000	176,600
Oil Thickness on Floe	0.0004 to 0.9 mm				

Source: S.L. Ross Environmental Research Ltd., D.F. Dickins and Associates, and Vaudrey and Associates (1998); BPXA (2000b).
Notes: Assumes Alaska North Slope crude; wind speed averages 19 knots; air temperature 8–18 °F; 5/10th's icefloes; ice is 0.6-0.8 feet thick and covered by 2-4 inches of snow; floes are hundreds of thousands of feet in size; 50% of the oil spray lands on the ice, 50% lands on the water.
[1] After 14 hours, the Gravel Island is saturated with oil; all oil falling on the gravel island drains to the sea.

Table IV.I-3 General Mass Balance of Oil from a 180,000-Barrel Solid-Ice Spill

Day[1]	Oil Remaining (bbl)	Evaporated (bbl)
0	180,000	45,000 [2]
3	178,000	47,100
10	170,000	56,000
30	168,000	59,000

Source: USDOI, MMS, Alaska OCS Region (2002); Calculated with the Reed et al (2000) weathering model assuming an Alaska North Slope Crude
Notes: Based on a 225,000-barrel spill size with 20% evaporated during the blowout. Assumes Alaska North Slope crude, constant wind speed of 11 knots, and water temperature 0 °C.
Footnotes: [1] We assume day zero is 15 days after the start of the spill, when 180,000 barrels of oil is in the water.

Table IV.I-4 General Mass Balance of Oil from a 180,000-Barrel Broken-Ice Spill

Day[1]	Oil Remaining (bbl)	Evaporated (bbl)	Dispersed (bbl)	Sedimented (bbl)	Onshore (bbl)
0	180,000	45,000 [2]	—	—	—
3	153,800	47,100	1,500	1,000	21,600
10	139,400	56,000	3,000	2,600	26,000
30	120,900	59,000	5,000	4,100	36,000

Source: USDOI, MMS, Alaska OCS Region (2002); Calculated with the Reed et al (2000) weathering model assuming an Alaska North Slope Crude.
Notes: Based on a 225,000-barrel spill size with 20% evaporated during the blowout. Assumes Alaska North Slope crude, constant wind speed of 11 knots, and water temperature 0 °C.
Footnotes: [1] We assume day zero is 15 days after the start of the spill, when 180,000 barrels of oil is in the water.

Table IV.I-5 Areas of Discontinuous and Thick Slicks from a 180,000-Barrel Winter Meltout Spill

	Discontinuous Slick Area (km^2)[1]	Area of Thick Slick (km^2)[2]
Initial Spill Area	—	125
Area During Oil Pooling on Ice Surface	—	12
Days after Spill Reaches Water Surface[1]		—
3	160	5
10	770	8
30	3,200	16
60	7,900	22

Source: USDOI, MMS, Alaska OCS Region (1998).
Footnotes: [1]Calculated from Ford (1985)
and Kirstein and Redding (1987). [2] Based on ocean-ice weathering model of Kirstein and Redding 1987).

Table IV.I-6a General Mass Balance of Oil from a 180,000-Barrel Broken-Ice Spill

Day[1]	Oil Remaining in Slick (bbl)	Evaporated (bbl)	Dispersed (bbl)	Sedimented (bbl)	Onshore (bbl)
0	180,000	45,000 [2]	—	—	—
3	142,800	49,000	10,800	1,000	21,600
10	116,500	56,000	25,000	2,600	26,000
30	71,900	73,900	53,000	4,100	36,000

Source: USDOI, MMS, Alaska OCS Region (2002); Calculated with the Reed et al (2000) weathering model assuming an Alaska North Slope Crude.
Notes: Based on a 225,000-barrel spill size with 20% evaporated during the blowout. Assumes Alaska North Slope crude, constant wind speed of 11 knots, and water temperature 2 °F.
Footnotes: [1] We assume day zero is 15 days after the start of the spill, when 180,000 barrels of oil is in the water.

Table IV.I-6b Length of Coastline a 180,000-Barrel Spill Might Contact Without Oil-Spill Response

Days	Amount of Coastline Contacted (in Miles and Kilometers)[1]	
	Winter-Ice Conditions	Summer Open Water
3	0	50 –140
10	50	155 – 170
30	100-130	275 – 300
360	350 – 425	485 –575

Source: USDOI, MMS, Alaska OCS Region (2002).
[1]Calculated from oil-spill-risk analysis conditional probabilities. We add the length of land segments with chance of contact >0.5% to estimate the amount of coastline contacted. This calculation assumes no oil-spill response and includes land segments that have a very small chance of contact.

Table IV.I-7 General Mass Balance of Oil from a Spill of 180,000 Barrels in Open Water

Day[1]	Oil Remaining in Slick (bbl)	Evaporated (bbl)	Dispersed (bbl)	Sedimented (bbl)	Onshore (bbl)
0	180,000	45,000	—	—	—
3	142,600	49,000	10,800	1,000	21,600
10	116,500	58,900	25,000	2,600	26,000
30	71,900	73,900	53,000	4,100	36,000

Source: USDOI, MMS, Alaska OCS Region (2002); Calculated with the Reed et al. 2000 weathering model assuming an Alaska North Slope Crude.
Notes: Based on a 225,000-barrel spill size with 20 percent evaporated during the blowout. Assumes Alaska North Slope crude, constant wind speed of
12 knots, and water temperature 2 °F.
Footnotes: [1] We assume day zero is 15 days after the start of the spill, when 180,000 barrels of oil is in the water.

Table IV.I-8 Areas of Discontinuous and Thick Oil Slicks from a Spill of 180,000 Barrels in Open Water

Days After Spill Reaches Water Surface	Discontinuous Slick Area (km^2)[1]	Area of Thick Slick (km^2)[2]
3	290	7
10	1,370	12
30	5,700	19
60	14,000	24

Source: USDOI, MMS, Alaska OCS Region (1995).
[1] Calculated from Ford (1985) and Kirstein and Redding (1987).
[2] Based on ocean-ice weathering model of Kirstein and Redding (1987).

Table IV.I-9a Summary of the Conditional Probabilities (expressed as percent chance) that an Oil Spill Starting During Summer in the Nearshore Zone (L1 or LA12) Will Contact a Certain Environmental Resource Area Within 1, 3, 10, 30, or 360 Days

Environmental Resource Area	Summer Spill From LA10 (Time in Days)					Summer Spill from LA12 (Time in Days)				
	1	3	10	30	360	1	3	10	30	360
Land		3	17	41	71		6	17	34	75
Kasegaluk Lagoon		n	n	n	n		n	n	n	n
Point Barrow, Plover Islands		n	n	1	4		n	n	n	3
Thetis and Jones Islands		7	16	23	26		1	5	13	18
Cottle and Return Islands, West Dock		3	7	10	13		2	8	13	16
Midway Islands		1	3	4	5		2	4	6	7
Cross and No Name Islands		n	2	4	4		4	7	9	10
Endicott Causeway		n	1	1	2		1	2	3	4
McClure Islands		n	1	1	2		3	6	7	8
Stockton Islands		n	n	1	1		2	4	5	6
Tigvariak Island		n	n	n	n		n	1	1	1
Maguire Islands		n	n	n	1		1	3	4	4
Flaxman Island		n	n	1	1		n	2	3	4
Barrier Islands		n	n	n	1		n	n	1	2
Anderson Point Barrier Islands		n	n	n	n		n	n	n	n
Arey and Barter Islands, Bernard Spit		n	n	n	n		n	n	1	1
Jago and Tapkaurak Spits		n	n	n	1		n	n	1	2
Angun and Beaufort Lagoons		n	n	n	n		n	n	n	1
Icy Reef		n	n	n	1		n	n	n	2
Chukchi Spring Lead 1		n	n	n	n		n	n	n	n
Chukchi Spring Lead 2		n	n	n	n		n	n	n	n
Chukchi Spring Lead 3		n	n	n	n		n	n	n	n
Chukchi Spring Lead 4		n	n	n	n		n	n	n	n
Chukchi Spring Lead 5		n	n	n	n		n	n	n	n
Beaufort Spring Lead 6		n	n	n	n		n	n	n	n
Beaufort Spring Lead 7		n	n	n	n		n	n	n	n
Beaufort Spring Lead 8		n	n	n	n		n	n	n	n
Beaufort Spring Lead 9		n	n	n	1		n	n	n	1
Beaufort Spring Lead 10		n	n	n	2		n	n	n	2
Ice/Sea Segment 1		n	n	1	2		n	n	n	1
Ice/Sea Segment 2		n	1	4	7		n	n	1	4
Ice/Sea Segment 3		3	10	18	21		n	1	6	9
Ice/Sea Segment 4		24	29	35	37		7	12	21	25
Ice/Sea Segment 5		2	5	8	10		21	26	30	31
Ice/Sea Segment 6		n	n	2	2		2	6	9	10
Ice/Sea Segment 7		n	n	n	1		n	n	2	5
Ice/Sea Segment 8		n	n	n	1		n	n	1	4
Ice/Sea Segment 9		n	n	n	1		n	n	n	3
Point Hope Subsistence Are		n	n	n	n		n	n	n	n
Point Lay Subsistence Area		n	n	n	n		n	n	n	n
Wainwright Subsistence Area		n	n	n	n		n	n	n	n
Barrow Subsistence Area 1		n	n	n	n		n	n	n	n
Barrow Subsistence Area 2		n	n	3	5		n	n	n	2
Nuiqsut Subsistence Area		1	5	9	10		32	37	40	41
Kaktovik Subsistence Area		n	n	n	1		n	n	2	3

Environmental Resource Area	Summer Spill From LA10 (Time in Days)					Summer Spill from LA12 (Time in Days)				
	1	3	10	30	360	1	3	10	30	360
Whale Concentration Area	n	n	n	n	n		n	n	n	1
Herald Shoal Polynya	n	n	n	n	n		n	n	n	n
Ice/Sea Segment 10	n	n	n	n	n		n	n	n	n
Ice/Sea Segment 11	n	n	n	n	n		n	n	n	1
Hanna's Shoal Polynya	n	n	n	n	1		n	n	n	1
Ice/Sea Segment 12	n	n	n	n	n		n	n	n	n
Ice/Sea Segment 13	n	n	n	n	n		n	n	n	n
Ice/Sea Segment 14	n	n	n	n	1		n	n	n	1
Ice/Sea Segment 15	n	n	1	6	11		n	n	2	7
Ice/Sea Segment 16a	4	3	16	33	38		n	2	12	19
Ice/Sea Segment 17		34	47	55	57		10	24	35	39
Ice/Sea Segment 18a	5	1	6	11	12		41	55	59	59
Ice/Sea Segment 19	1	n	n	2	3		1	5	9	12
Ice/Sea Segment 20a	n	n	n	1	8		n	1	4	15
Ice/Sea Segment 21	n	n	n	n	7		n	n	1	12
Ice/Sea Segment 22	n	n	n	n	7		n	n	n	11
Ice/Sea Segment 22	n	n	n	n	4		n	n	n	6
Ice/Sea Segment 24a	n	n	n	n	3		n	n	n	4
Ledyard Bay	n	n	n	n	n		n	n	n	n
Peard Bay		n	n	n	n		n	n	n	n
ERA 1		n	n	2	3		n	n	n	1
ERA 2		n	3	8	11		n	n	2	6
Ice/Sea Segment 16b		3	16	33	37		n	2	11	17
Harrison Bay		n	2	6	7		n	n	2	3
Harrison Bay/Colville Delta		2	8	16	19		n	1	5	10
ERA 3		27	43	53	55		n	5	15	19
Simpson Lagoon		4	12	17	20		1	5	12	17
Gwyder Bay		n	2	2	3		1	2	4	4
Prudhoe Bay		n	1	1	1		n	1	1	2
Cross Island ERA		2	6	10	11		44	50	53	54
Water over Boulder Patch 1		n	2	2	4		6	9	11	13
Water over Boulder Patch 2		n	1	2	4		6	8	10	12
Foggy Island Bay		n	n	1	2		3	4	5	6
Mikkelsen Bay		n	n	n	n		3	3	3	3
ERA 4		n	2	4	5		25	32	34	35
Ice/Sea Segment 18b		1	6	11	12		41	55	59	59
Simpson Cove		n	n	n	n		n	n	n	1
ERA 5		n	n	n	1		n	1	3	4
Kaktovik ERA		n	n	n	1		n	n	2	5
Ice/Sea Segment 20b		n	n	1	6		n	1	4	10
ERA 6		n	n	n	1		n	n	n	4
ERA 7		n	n	n	2		n	n	n	4
ERA 8		n	n	n	2		n	n	n	3
Ice Sea Segment 24b		n	n	n	n		n	n	n	1

Source: Johnson, Marshall, and Lear (2002).

n = less than 0.5%.

Note: For Environmental Resource Areas, see Maps A-2a through A-2d; for Land Segments, see Maps A-3a and A-3b; and for Spill Areas LA1D and LA12, see Maps A-4a and A-4b.

Table IV.I-9b Summary of the Conditional Probabilities (expressed as percent chance) that an Oil Spill Starting During Winter in the Nearshore Zone (L10 or LA12) Will Contact a Certain Environmental Resource Area Within 1, 3, 10, 30, or 360 Days

Environmental Resource Area	Winter Spill From LA10 (Time in Days)					Winter Spill from LA12 (Time in Days)					Environmental Resource Area	Winter Spill From LA10 (Time in Days)					Winter Spill From LA12 (Time in Days)				
	1	3	10	30	360	1	3	10	30	360		1	3	10	30	360	1	3	10	30	360
Land		n	3	7	52		1	3	6	55	Whale Concentration Area	n	n	n	n	n		n	n	n	1
Kasegaluk Lagoon		n	n	n	n		n	n	n	n	Herald Shoal Polynya	n	n	n	n	n		n	n	n	n
Point Barrow, Plover Islands		n	n	n	3		n	n	n	3	Ice/Sea Segment 10	n	n	n	n	n		n	n	n	n
Thetis and Jones Islands		1	3	3	20		n	1	2	12	Ice/Sea Segment 11	n	n	n	n	1		n	n	n	1
Cottle and Return Islands, West Dock		n	1	2	8		n	2	2	11	Hanna's Shoal Polynya	n	n	n	n	3		n	n	n	2
Midway Islands		n	n	n	2		n	1	1	5	Ice/Sea Segment 12	n	n	n	n	1		n	n	n	1
Cross and No Name Islands		n	n	n	2		1	1	2	6	Ice/Sea Segment 13	n	n	n	n	1		n	n	n	1
Endicott Causeway		n	n	n	1		n	n	1	3	Ice/Sea Segment 14	n	n	n	n	3		n	n	n	2
McClure Islands		n	n	n	n		n	1	1	4	Ice/Sea Segment 15	n	n	1	6	15		n	n	2	9
Stockton Islands		n	n	n	n		n	n	1	2	Ice/Sea Segment 16a	4	3	15	27	42		n	2	9	24
Tigvariak Island		n	n	n	n		n	n	n	1	Ice/Sea Segment 17		32	46	51	61		10	25	33	44
Maguire Islands		n	n	n	n		n	n	n	1	Ice/Sea Segment 18a	5	1	2	4	8		40	50	52	59
Flaxman Island		n	n	n	n		n	n	n	1	Ice/Sea Segment 19	1	n	n	n	2		n	2	3	8
Barrier Islands		n	n	n	n		n	n	n	n	Ice/Sea Segment 20a	n	n	n	n	2		n	n	2	7
Anderson Point Barrier Islands		n	n	n	n		n	n	n	n	Ice/Sea Segment 21	n	n	n	n	1		n	n	n	3
Arey and Barter Islands, Bernard Spit		n	n	n	n		n	n	n	1	Ice/Sea Segment 22	n	n	n	n	2		n	n	n	5
Jago and Tapkaurak Spits		n	n	n	1		n	n	n	2	Ice/Sea Segment 22	n	n	n	n	4		n	n	n	7
Angun and Beaufort Lagoons		n	n	n	n		n	n	n	n	Ice/Sea Segment 24a	n	n	n	n	3		n	n	n	5
Icy Reef		n	n	n	n		n	n	n	n	Ledyard Bay	n	n	n	n	n		n	n	n	n
Chukchi Spring Lead 1		n	n	n	n		n	n	n	n	Peard Bay		n	n	n	n		n	n	n	n
Chukchi Spring Lead 2		n	n	n	n		n	n	n	n	ERA 1		n	n	1	5		n	n	n	3
Chukchi Spring Lead 3		n	n	n	n		n	n	n	n	ERA 2		n	1	4	19		n	n	1	11
Chukchi Spring Lead 4		n	n	n	n		n	n	n	n	Ice/Sea Segment 16b		1	6	11	27		n	1	4	16
Chukchi Spring Lead 5		n	n	n	n		n	n	n	n	Harrison Bay		n	1	1	6		n	n	n	5
Beaufort Spring Lead 6		n	n	1	3		n	n	n	2	Harrison Bay/Colville Delta		n	1	2	15		n	n	1	6
Beaufort Spring Lead 7		n	n	1	3		n	n	n	2	ERA 3		9	15	17	36		n	2	5	20
Beaufort Spring Lead 8		n	n	2	5		n	n	1	3	Simpson Lagoon		1	2	3	17		n	1	2	12
Beaufort Spring Lead 9		n	n	2	6		n	n	1	4	Gwyder Bay		n	n	n	1		n	n	1	3
Beaufort Spring Lead 10		n	4	8	14		n	n	3	8	Prudhoe Bay		n	n	n	n		n	n	n	1
Ice/Sea Segment 1		n	n	n	n		n	n	n	n	Cross Island ERA		n	1	1	5		14	15	15	26
Ice/Sea Segment 2		n	n	n	1		n	n	n	n	Water over Boulder Patch 1		n	n	n	1		3	4	4	8
Ice/Sea Segment 3		1	2	2	3		n	n	1	1	Water over Boulder Patch 2		n	n	n	1		3	3	4	8
Ice/Sea Segment 4		6	7	7	7		1	2	2	3	Foggy Island Bay		n	n	n	1		1	1	1	4
Ice/Sea Segment 5		n	n	1	1		5	6	6	6	Mikkelsen Bay		n	n	n	n		1	1	1	3
Ice/Sea Segment 6		n	n	n	n		n	1	1	1	ERA 4		n	n	n	2		7	8	8	14
Ice/Sea Segment 7		n	n	n	n		n	n	n	n	Ice/Sea Segment 18b		n	1	1	5		14	17	18	28
Ice/Sea Segment 8		n	n	n	n		n	n	n	n	Simpson Cove		n	n	n	n		n	n	n	n
Ice/Sea Segment 9		n	n	n	n		n	n	n	1	ERA 5		n	n	n	n		n	n	n	1
Point Hope Subsistence Are		n	n	n	n		n	n	n	n	Kaktovik ERA		n	n	n	1		n	n	n	4
Point Lay Subsistence Area		n	n	n	n		n	n	n	n	Ice/Sea Segment 20b		n	n	n	1		n	n	1	4
Wainwright Subsistence Area		n	n	n	1		n	n	n	n	ERA 6		n	n	n	n		n	n	n	1
Barrow Subsistence Area 1		n	n	n	n		n	n	n	n	ERA 7		n	n	n	n		n	n	n	2
Barrow Subsistence Area 2		n	n	n	2		n	n	n	2	ERA 8		n	n	n	n		n	n	n	2
Nuiqsut Subsistence Area		n	n	n	1		4	5	5	5	Ice Sea Segment 24b		n	n	n	1		n	n	n	3
Kaktovik Subsistence Area		n	n	n	n		n	n	n	n											

Source: Johnson, Marshall, and Lear (2002).

n = less than 0.5%.

Note: For Environmental Resource Areas, see Maps A-2a through A-2d; for Land Segments, see Maps A-3a and A-3b; and for Spill Areas LA1D and LA12, see Maps A-4a and A-4b.

Table IV.I-9c Summary of the Conditional Probabilities (expressed as percent chance) that an Oil Spill Starting During Summer or Winter in the Nearshore Zone (L10 or LA12) Will Contact a Certain Land Segment Within 1, 3, 10, 30, or 360 Days

Land Segment Number	Land Segment Area	Summer Spill from LA10 (Time in Days)					Summer Spill from LA12 (Time in Days)					Winter Spill from LA10 (Time in Days)					Winter Spill from LA12 (Time in Days)				
		1	3	10	30	360	1	3	10	30	360	1	3	10	30	360	1	3	10	30	360
20	Asiniak Point, Kugrua Bay, Kugrua River					n					n					n					n
22	Skull Cliff				n	n				n	n					n					n
23	Nulavik				n	n				n	n					n					n
24	Walakpa Bay, Walakpa River				n	1				n	1				n	1				n	1
25	Barrow, Elson Lagoon		n	n	1	2		n	n	n	2			n	n	2			n	n	3
26	Dease Inlet		n	n	n	2		n	n	n	1		n	n	n	1		n	n	n	1
27	Kurgorak Bay		n	n	n	n		n	n	n	n		n	n	n	n		n	n	n	n
28	Cape Simpson		n	n	1	1		n	n	n	1		n	n	n	2		n	n	n	1
29	Ikpikpuk River, Smith Bay		n	n	n	1		n	n	n	n		n	n	n	1		n	n	n	1
30	Drew Point, McLeod Point		n	n	1	3		n	n	n	1		n	n	n	2		n	n	n	2
31	Lonely AFS Airport, Pitt Point, Pogik Bay		n	n	2	4		n	n	1	3		n	n	1	8		n	n	n	5
32	Cape Halkett		n	2	5	7		n	n	2	4		n	n	1	9		n	n	n	6
33	Atigaru Point, Kogru River		n	1	3	4		n	n	1	1		n	n	n	2		n	n	n	2
34	Fish Creek		n	1	4	5		n	n	1	2		n	n	n	2		n	n	n	1
35	Colville River		n	3	5	7		n	n	1	3		n	n	1	6		n	n	n	3
36	Oliktok Point		1	4	6	8		n	n	3	5		n	1	1	5		n	n	n	2
37	Milne Point, Simpson Lagoon		1	4	7	8		1	3	6	8		n	1	1	6		n	1	1	6
38	Kuparuk River		n	2	2	3		1	3	4	5		n	n	n	1		n	n	1	2
39	Point Brower, Prudhoe Bay		n	1	2	3		2	3	4	5		n	n	n	1		n	1	1	4
40	Foggy Island Bay, Kadleroshilik River		n	n	1	2		1	2	2	3		n	n	n	1		n	n	n	1
41	Bullen Point, Point Gordon, Reliance Point		n	n	n	1		1	3	3	3		n	n	n	n		n	n	1	3
42	Point Hopson, and Sweeney, Staines River		n	n	1	1		1	2	3	4		n	n	n	n		n	n	n	1
43	Brownlow Point, Canning River		n	n	n	1		n	1	1	2		n	n	n	n		n	n	n	n
44	Collinson Point, Konganevik Point		n	n	n	n		n	n	n	1			n	n	n			n	n	n
45	Anderson Point, Sadlerochit River		n	n	n	n		n	n	n	1			n	n	n			n	n	n
46	Arey Island, Barter Island		n	n	n	n		n	n	n	1			n	n	n			n	n	n
47	Kaktovik		n	n	n	1		n	n	n	2			n	n	1			n	n	2
48	Griffin Point, Oruktalik Lagoon		n	n	n	n		n	n	n	1			n	n	n			n	n	n
49	Angun Point, Beaufort Lagoon		n	n	n	n		n	n	n	1			n	n	n			n	n	n
50	Icy Reef, Kongakut River, Siku Lagoon		n	n	n	n		n	n	n	1			n	n	n			n	n	n
51	Demarcation Bay, Demarcation Point		n	n	n	n		n	n	n	2			n	n	n			n	n	n
52	Clarence Lagoon, Backhouse River		n	n	n	n			n	n	1			n	n	n			n	n	1
53	Komakuk Beach, Fish Creek			n	n	1			n	n	1				n	n				n	1
54	Nunaluk Spit				n	n				n	1					n					n
55	Herschel Island				n	1				n	2					1					1
56	Ptarmigan Bay					n					n					n					1
57	Roland and Phillips Bay, Kay Point					n					n					n					2
58	Sabine Point					n					n					n					n
59	Shingle Point					4					3					n					n
60	Trent and Shoalwater Bays					n					1					n					n
62	Shallow Bay, West Channel					n					n					n					n
63	Outer Shallow Bay, Olivier Islands					1					1					n					n
64	Middle Channel, Gary Island					1					1					n					1
65	Kendall Island					n					n					n					n
66	North Point, Pullen Island					n					n					n					n

Source: Johnson, Marshall, and Lear (2002).

n = less than 0.5%.

Note: For Environmental Resource Areas, see Maps A-2a through A-2d; for Land Segments, see Maps A-3a and A-3b; and for Spill Areas LA1D and LA12, see Maps A-4a and A-4b.

Table V-1a Alaska North Slope Oil and Gas Discoveries as of November 30, 2001

	Name	Location of Field or Pool	Production (Oil, Gas)	Location of Production Facility	Discovery Year	Year Production Began	Category	Ranking Criterion
PAST DEVELOPMENT AND PRODUCTION								
1	South Barrow	Onshore	Gas	Onshore	1949	1950	Field	
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]	**When Production Began**
11	Walakpa	Onshore	Gas	Onshore	1980	1992	Field	
12	Pt McIntyre	Offshore	Oil	Onshore	1988	1993	Field	
13	N. 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[4]	
PRESENT DEVELOPMENT								
29	Meltwater	Onshore	Oil	Onshore	2000	(2002)	Pool	
30	Nanuk/Nanuq	Onshore	Oil	Onshore	1996	(2003)	Pool	**When Production**
31	Palm	Onshore	Oil	Onshore	2001	(2003)	Pool	
32	Fiord	Onshore	Oil	Onshore	1992	(2003)	Pool	
REASONABLY FORESEEABLE FUTURE DEVELOPMENT AND PRODUCTION								
33	Spark/Rendezvous	Onshore	Gas & Oil	Onshore	2000		Prospect	
34	Liberty	Offshore	Oil	Offshore	1983		Pool	
35	Kalubik	Offshore	Oil	Onshore	1992		Prospect	
36	Pete's Wicked	Onshore	Oil	Onshore	1997		Prospect	
37	Sikulik	Onshore	Gas	Onshore	1988		Pool	
38	Thetis Island	Offshore	Oil	Offshore	1993		Prospect	**When We Estimate Chance and Timing of Development (highest/first to lowest/last)**
39	Gwydyr Bay	Offshore	Oil	Onshore	1969		Pool	
40	Point Thomson	Onshore	Gas & Oil	Onshore	1977		Pools	
41	Mikkelson	Onshore	Oil	Onshore	1978		Prospect	
42	Sourdough	Onshore	Oil	Onshore	1994		Pool	
43	Yukon Gold	Onshore	Oil	Onshore	1994		Prospect	
44	Flaxman Island	Offshore	Oil	Offshore	1975		Prospect	
45	Sandpiper	Offshore	Gas & Oil	Offshore	1986		Pool	
46	Stinson	Offshore	Oil	Offshore	1990		Prospect	
47	Hammerhead	Offshore	Oil	Offshore	1985		Pool	
48	Kuvlum	Offshore	Oil	Offshore	1987		Prospect	
SPECULATIVE FUTURE DEVELOPMENT								
49	Hemi Springs	Onshore	Oil	Onshore	1984		Prospect	
50	Ugnu	Onshore	Oil	Onshore	1984		Pool	
51	Umiat	Onshore	Oil	Onshore	1946		Pool	
52	Fish Creek	Onshore	Oil	Onshore	1949		Prospect	
53	Simpson	Onshore	Oil	Onshore	1950		Pool	
54	East Kurupa	Onshore	Gas	Onshore	1976		Show	**Insufficient Information to Estimate Chance of Development**
55	Meade	Onshore	Gas	Onshore	1950		Show	
56	Wolf Creek	Onshore	Gas	Onshore	1951		Show	
57	Gubik	Onshore	Gas	Onshore	1951		Pool	
58	Square Lake	Onshore	Gas	Onshore	1952		Show	
59	E. Umiat	Onshore	Gas	Onshore	1964		Prospect	
60	Kavik	Onshore	Gas	Onshore	1969		Show	
61	Kemik	Onshore	Gas	Onshore	1972		Show	

Notes: Field information is taken from State of Alaska, Dept. of Natural Resources (2000). **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 V-1b Trans-Alaska Pipeline System and Future Natural Gas Projects

Name	Estimated Pipeline Length (miles)	Project Description and Route
Active Project		
Trans-Alaska Pipeline (TAPS)	800	TAPS is the key transportation link for all North Slope oil fields. It has been in operation since 1977 and to date, has carried nearly 13 billion barrels of oil. Approximately 16.3 square miles are contained in the pipeline corridor that runs between Prudhoe Bay and Valdez. The Dalton Highway (or Haul Road) was constructed parallel to the pipeline between Prudhoe Bay and Fairbanks. The pipeline design capacity is 2 million barrels per day, and it reached near peak capacity in 1988. Presently, the TAPS is running at about 1.0 million barrels per day. The lower operational limit generally is thought to be between 200,000 and 400,000 barrels per day. If oil production from northern Alaska cannot be sustained above this minimum rate, the TAPS will become nonoperational and all oil production is likely to be shut in.
Future Natural Gas Projects		
Trans-Alaska Gas System (TAGS)	800	The TAGS plan consists of a gas-conditioning plant on the North Slope; an 800-mile, 42-inch pipeline; a liquefied natural gas (LNG) plant and marine terminal at Valdez; and a fleet of new LNG carriers. LNG would be transported to Japan and other Pacific Rim countries. The Yukon Pacific Corporation has obtained permits for construction of TAGS and export of Alaska North Slope gas to Asia. The LNG facility and marine terminal in Valdez has received the Final EIS prepared by the Federal Energy Regulatory Commission. Yukon Pacific believes the large scale of the project (2.05 billion cubic feet per day to yield 14 million metric tons of LNG annually) will make this project competitive with other new LNG projects. The project is currently stalled by the lack of commitments from the North Slope gas producers, delivery contracts to Asian buyers, and high construction costs.
Alaska Natural Gas Transportation System (ANGTS)[1]	2,102	The ANGTS plan is a pipeline system connecting Alaska North Slope gas production through Canada to the lower 48. The new pipeline would run parallel to the TAPS from the North Slope to interior Alaska and then cross the Yukon Territory to connect to existing pipelines in Alberta. The primary market would be consumers in the U.S. Numerous permits, rights-of-way, and approvals have been obtained for the proposed pipeline route through Alaska and Canada. Downward revisions to construction costs and the recent increase in gas prices into the $3-$4-million/cubic-foot range make this project more appealing today. Currently, several variations to routes are being considered for the overland gas pipeline system.
Arctic Resources, Northern Gas Pipeline Project	326 offshore 874 onshore	This project involves a 52-inch, high-pressure gas pipeline running offshore from Prudhoe Bay in Alaska to the Mackenzie delta in Northwest Territory and then south through the Mackenzie River Valley to the existing gas pipeline network in northern Alberta. The 326-mile offshore portion would be trenched in 30-60 feet of water. The 874-mile onshore portion also would be buried. It is expected to deliver 2.5 billion cubic feet per day to markets primarily in the U.S. The project would involve a consortium of gas producers, pipeline companies, and Native corporations in both Alaska and Canada. Commitments of gas producers and gas buyers have not yet been obtained, right-of-way permits also have not been issued.
Natural Gas to Liquids Conversion[2]	Will use existing TAPS Pipeline	Atlantic Richfield Co. (ARCO) and Syntroleum Corp constructed a pilot-scale, natural gas to liquids (GTL) conversion facility in Puget Sound, Washington. More recently, BP-Amoco has begun design work on a GTL pilot project on the Kenai Peninsula in Alaska. As a result of the BP-Amoco-ARCO merger, BP-Amoco now holds an equal interest in the gas reserves in the Prudhoe Bay field. All of the major North Slope gas owners (BP-Amoco, Exxon-Mobil, and Phillips-Alaska) are studying the feasibility of various gas commercialization projects. GTL is an attractive option because it will use the existing TAPS pipeline (extending its life and lowering future tariffs) and produce clean-burning fuels to meet more stringent Environmental Protection Agency emission standards for vehicles. At the present time, the overall cost of a full-scale gas to liquids project is comparable to a similar sized LNG project. As an emerging technology, new cost-reduction breakthroughs are expected for gas to liquids processing, improving the economic potential for future gas to liquid projects.

[1] Thomas et al. (1996). [2] Alaska Report (1997).

Table V-1c Future Lease Sales

Sale	Proposed Sale Date(s)	Area/Description	Resources or *Hydrocarbon Potential*
FEDERAL OCS			
5-Year Program – 186, 195, 202	2003, 2005, 2007	As much as 9.9 million acres from the Canadian border on the east to Barrow on the west in the Beaufort Sea (*Federal Register,* 2001c).	1.02-1.71 Bbbl Oil (Estimated)
Northeast NPR-A	June 2002	As much as 3 million acres of the Northeast NPR-A Planning Area (USDOI, BLM, 2001).	0.50-2.2 Bbbl Oil (Estimated)
Northwest NPR A	To Be Determined	As much as 9.98 million acres of the Northwest NPR-A Planning Area (Federal Register, 2001d).	To Be Determined
STATE OF ALASKA			
North Slope Areawide	Oct 2002, Oct 2003, Oct 2004, , Oct 2005	As much as 5,100,000 acres of State-owned lands between the Canning and Colville Rivers and north of the Umiat Base Line (about 69° 20' N.).	*Moderate to High*
Beaufort Sea Areawide	Oct 2002, Oct 2003, Oct 2004, Oct 2005	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 Staines and Colville rivers. The gross proposed sale area is in excess of 2,000,000 acres. The State of Alaska was scheduled to hold its first areawide sale in the Beaufort Sea on October 13, 1999. This sale was delayed pending the outcome of the British Petroleum-Amoco and ARCO merger and related uncertainties in future lease holdings.	*Moderate to High*
North Slope Foothills Areawide	May 2002	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*

Source: USDOI, MMS, Alaska OCS Region (2001).

Table V-2 Past Development: 2000 Production and Reserve Data

Unit or *Area*	Field	Type (Oil or Gas)	Discovery	Production[1]				Reserves[2]	
				Began	Gas (Bcf)	2000 Oil (MMbbl)[1]	Production to	Oil (MMbbl)[1]	Gas (Bcf)
Duck Island	Endicott	O	1973	1987	–	11.622	Endicott	189[3]	–
	Sag Delta North[2]	O	1989	1989	–	–[3]	Endicott	-	–
	Sag Delta[2]	O	1976	1989	–	–[3]	Endicott	-	–
	Eider	O	1998	1998	–	0.148	Endicott	5	–
	Ivishak	O			–	0.248	Endicott	–	
Prudhoe Bay	Prudhoe Bay	O	1967	1977	–	187.056	Prudhoe	2,678	–
	P Bay Satellites	O	–	–	–	–	Prudhoe	311	–
	Lisburne	O	1968	1981	–	3.202	Lisburne	37	–
	Niakuk	O	1985	1994	–	7.336	Lisburne	56	–
	West Beach	O	1976	1994	–	0.401	Lisburne	6	–
	N. Prudhoe Bay	O	1970	1993	–	–	Lisburne	1	–
	Pt. McIntyre	O	1988	1993	–	23.737	Lisburne	227	
	Midnight Sun	O	1998	1999	–	1.441	Prudhoe		
	Aurora	O	1999	2001	-	-	Prudhoe	40	
	NW Eileen/Borealis	O	1999	2001			Prudhoe	80	–
	Polaris	O	1999	2001			Prudhoe	40	-
Kuparuk River	Kuparuk River	O	1969	1981	–	74.133	Kuparuk	960	–
	Tabasco	O	1992	1998	–	1.911	Kuparuk	27	–
	Tarn	O	1992	1998	–	8.767	Kuparuk	63	–
	West Sak	O	1969	1998	–	1.520	Kuparuk	101	–
Milne Point	Milne Point	O	1969	1985	–	16.572	Milne Pt.	292	–
	Cascade[4]	O	1993	1996	–	–	Milne Pt.	-[4]	–
	Schrader Bluff	O	1969	1991	–	2.498	Milne Pt.	105	–
	Sag River	O	1968	1994	–	–	Milne Pt.	7	–
Badami	Badami	O&G	1990	1998	–	0.930	TAPS	8	–
Colville River	Alpine	O	1994	2000	–	2.231	Kuparuk	427	–
Northstar	Northstar	O	1984	2001	-	-	Prudhoe	158	-
***NPR-A*[1]**	East Barrow	G	1974	1981	0.090	–	Barrow	–	5
	South Barrow	G	1949	1950	0.037	–	Barrow	–	4
	Walakpa	G	1980	1993	1.352	–	Barrow	–	25
All Units or Areas Total								**5,818**	**34**

[1] Production information is from State of Alaska, AOGCC (2001).

[2] Reserves were estimated by subtracting 2000 production from State of Alaska AOGCC (2001) from the Reserve Data in State of Alaska, DNR (2000). Reserve estimates for Aurora and Polaris are from Drilling Wire Alaska 2001 a and b respectively.

[3] Endicott include Endicott, Sag Delta, and Sag Delta North.

[4] Cascade is included in Milne Point.

Table V-3 Past Development: Infrastructure and Facilities

UNIT OR *AREA* Field	Gravel Roads, Pads, & Airstrips (acres)	Pipelines: Gathering, Common Carrier, Unspecified (miles)			Gravel Mines		Wells[5]	Pads	Reserve Pits		Facilities					Roads (Miles)	River Crossings
		G	C	U	Num.	Acres			Num.	Acres	Prod. Centers	Camps Base and Const.	Plants: Power Topping Gas Seawater	Docks and Causeways	Airports and Airstrips		
DUCK ISLAND																	
Endicott	392 [2]	3	26		1 [2]	179 [2]	129	2 [1]	0 [2]	0 [2]	0	0 [1]	3 [1]	2 [1]	0 [1]	15 [1]	1 [1]
PRUDHOE BAY																	
Prudhoe Bay	4,590 [2]			145	6 [2]	726 [2]	1,764	38	106 [2]	560 [2]	6 [1]	4 [1]	4 [1]	2 [1]	2 [1]	200 [1]	3 [1]
Lisburne	213 [2]	50	–	–	0 [2]	0 [2]	80	5 [1]	10 [2]	16 [2]	1 [1]	1 [1]	1 [1]	0 [1]	0 [1]	18 [1]	–
Niakuk	22 [2]	5		–	0 [2]	0 [2]	19		0 [2]	0 [2]	–	–	–	–	–	–	–
West Beach	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
N. Prudhoe Bay	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Pt. McIntyre	33 [2]	12	–	–	0 [2]	0 [2]	84	–	0 [2]	0 [2]	–	–	–	–	–	–	–
Aurora	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0
KUPARUK RIV.																	
Kuparuk River	1,435 [2]	97	37		5 [2]	564 [2]	996	34 [1]	126 [2]	161 [2]	3 [1]	2 [1]	4 [1]	1 [1]	1 [1]	94 [1]	5
West Sak	–	–	–	–	0	0	17		0	0	0	0	0	0	0		0
MILNE POINT																	
Milne Point	205 [2]	30	10		1 [2]	43 [2]	182	4 [1]	20 [2]	19 [2]	1 [1]	0 [1]	2 [1]	0 [1]	0 [1]	19 [1]	1 [1]
Cascade	31 [2]	–	–	–	0 [2]	0 [2]	–	–	0 [2]	0 [2]	–	–	–	–	–	–	–
Schrader Bluff	–	–	–	–	–	–	52	–	–	–	–	–	–	–	–	–	–
Sag River	–	–	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–
BADAMI	85 [2]		26	35	1 [2]	89 [2]	10	2	0 [2]	0 [2]	1	1	0	1	1	4.5	5
ALPINE	97			34	0	0	150	2	0	0	1	2	–	0	1	3	5
West of Kuparuk																	
Tarn[3]	72.8			10	0-1 [4]		16	2	0	0	0	0	0	0	0	10	2
NORTHSTAR	18	26	26	0	0	0	23	1	0	0	1	1	0	0	0	0	0
Totals	**7,126**	**197**	**99**	**224**	**14-15**	**1,601**	3,537	**89**	**262**	**756**	**13**	**110**	**14**	**6**	**5**	**364**	**22**
NPR-A																	
East Barrow							4										
South Barrow							19										
Walakpa							9										

[1] Eg&G Idaho, Inc. (1991).

[2] BPXA (1996).

[3] U.S. Army Corps of Engineers, Public Notice of Application for Permit Reference Number 4-970705.

[4] The gravel would come from Mine Site F and should be sufficient. However, a future aliquot to the north has already been permitted for expansion necessary, this aliquot may need to be opened to support the project.

[5] *Alaska Oil and Gas Conservation Commission 1998 Annual Report.*

Table V-4 Present Development: Estimated Reserve Data

Unit or Area	Field	Type (Oil, Gas)	Discovery Year	Status	Oil Reserves (MMbbl)
Kuparuk	Meltwater	Oil	2000	Present Development	50
Colville River	Fiord	Oil	1992	Present Development	50
Colville River	Nanuk/Nanuq	Oil	1996	Present Development	50
Kuparuk	Palm	Oil	2001	Present Development	35
Total for All Units or Areas					185

Table V-5 Present Development: Proposed Infrastructure and Facilities

									Facilities						
	Gravel Roads, Pads, & Airstrips (Acres)	Pipe-lines (Miles)	Gravel Mines				Reserve Pits		Prod. Centers	Camps Base and Const.	Plants: Power Topping Gas Seawater	Docks and Cause-ways	Airports and Airstrips	Roads (miles)	River Cross-ings
Unit or Area/Field			Num.	Acres	Wells	Pads	Num.	Acres							
Kuparuk/Meltwater	78	10	1	-	26	1	0	0	0	0	0	0	1	10	0
Colville River/Fiord	40	7	1	45	40	1	0	0	0	0	0	0	1	0	0
Colville River/ Nanuk/Nanuq	40	4	0	0	40	1	0	0	0	0	0	0	0	3.8	0
Kuparuk/Palm		5	0	0	18	1	0	0	0	0	0	0	0	–	0
Prudhoe/NW Eileen/Borealis		5	0	0	60	1	0	0	0	0	0	0	0	–	0
Prudhoe/Polaris						1	0	0	0	0	0	0	0	–	0

Note: Fiord (*Petroleum News Bulletin*, 2001a), Meltwater (*Petroleum New Bulletin*, 2000), Nanuq (*Petroleum News Bulletin*, 2001b) Palm wells estimated using a 2-MMbbl recovery typical of Kuparuk reservoir satellites.

Table V-6a Reasonably Foreseeable Future Development: Estimated Resources for Purposes of Analysis

Area/Group	Pool	Type (Oil and Gas)	Discovery Year	Facility Location	Oil Resource (MMbbl)
NPR-A	Spark/Rendezvous	Gas and Oil	2000	Onshore	To Be Determined
Western Group	Kalubik	O	1992	Offshore	
	Thetis Island	O	1993	Offshore	250
Central Group (Northstar)	Gwyder Bay	O	1969	Offshore	
	Pete's Wicked	O	1997	Onshore	
	Sandpiper	Gas and Oil	1986	Offshore	200
Eastern Group (Badami)	Mikkelson	O	1978	Onshore	
	Sourdough	O	1994	Onshore	
	Liberty	O	1983	Offshore	120
	Yukon Gold		1994	Onshore	
	Pt. Thompson	Gas and Oil	1977	Onshore	
	Flaxman Island	O	1975	Offshore	
	Stinson	O	1990	Offshore	
	Hammerhead	O	1985	Offshore	
	Kuvlum	O	1987	Offshore	1,000
Total					**1,570**

Source: USDOI, MMS, Alaska OCS Region.

Resource estimates are assumed for purposes of cumulative-effects analysis only. Accurate oil volumes for individual fields generally are unavailable, as these discoveries have not been adequately delineated or studied for their development potential. Most of these discoveries are noncommercial at the present time and will require new technology or higher oil prices to be economic. It is possible that many of these pools will remain undeveloped. Future development likely would occur in conjunction with the infrastructure for the fields shown in parentheses.

Resource estimates for Hemi Springs and Ugnu are not included in this table, but they are included in the 2.0 billion barrels expected to be produced from satellites, pools, and enhanced recovery in existing fields. Gas resources are not listed because commercial production from the North Slope will require a new gas transportation system to reach outside markets.

The oil volume including the Point Thompson pool is largely condensate recovered with associated gas production wells. We assume that produced gas will be used for field operations (fuel) or be reinjected into reservoirs in nearby oil fields to optimize oil production. Reinjected gas could be recovered at some later date, when a transportation system for North Slope gas is constructed.

Table V-6b Reasonably Foreseeable Future Development: Estimated New Infrastructure for Purposes of Analysis

Area/Group	Pads	Footprint (Acres)	Wells	Production Facilities	Base Camps	Docks	Airstrips	Roads	Pipeline Length (Miles)
NPR-A									
Western	4	120	131	1	1	1	0	0	38
Central	3	60	87	0	0	0	0	0	22
Eastern	10	316	343	6	4	2	3	12	131
Southern	1	25	20	0	0	0	0	12	12

Source: USDOI, MMS, Alaska OCS Region.

Development Assumptions: (1) Industry will minimize permanent (gravel) roads by using ice roads; (2) new pipelines from satellite fields will tie into pipelines from main fields (Alpine, Northstar, Badami, Kuparuk River); (3) number of pads and wells are estimated from resource volumes; (4) production pad footprints are estimated from pad number, connecting roads, landfall/docks, and airstrips. Hemi Springs and Ugnu are considered to be examples of satellites and enhanced oil recovery, respectively, and will be developed using existing infrastructure of the Prudhoe Bay and Kuparuk River fields.

Table V-7a Oil and Gas Production 1969 to December 2000 on the North Slope of Alaska

Production To Date	Oil (Billions of Barrels)	Gas (Billions of Cubic Feet)	Reference
Onshore	12.889	38.76 [1, 2]	State of Alaska, AOGCC (2001)
Offshore	0.417	0	
Total	**13.306**	**38.76** [2]	

Source: USDOI, MMS, Alaska OCS Region.

Notes: Production and Reserve Data as of December 2000. [1] Gas production to date is from Barrow gas fields supplied for local use to the village of Barrow. [2] Currently, all gas production from existing oilfields is consumed by facilities or reinjected for reservoir pressure maintenance.

Table V-7b Summary of Reserve and Resource Estimates We Use for Analytical Purposes in the Cumulative Analysis

Production Activity	Oil (Billions of Barrels)	Contribution of Sale 186 by Volume of Oil (%)	Reference Table
Low End of the Range (Past and Present)	6	7.66	Table V-7
Middle Portion (Past, Present, and Reasonably Foreseeable)	12	3.80	Table V-7
High End (Past, Present, Reasonably Foreseeable, and Speculative)	15	3.07	Table V-7

Source: USDOI, MMS, Alaska OCS Region.
Note: Sales 195 and 202, with similar resource estimates of 0.460 billion barrels, would each contribute 3.80% by volume of oil.

Table V-7c Detailed Reserve and Resource Estimates We Use for Analytical Purposes in the Cumulative Analysis

Activity	Oil (Billions of Barrels)	Gas (Billions of Cubic Feet)	Reference Table
Past and Present Production (Total)	6.002	34[1]	Table V-2
Onshore–past (Prudhoe Bay, Kuparuk River, Milne Point, Badami, Colville River & NPR-A)	5.470	34[1]	Table V-4
Offshore–past (Duck Island Unit and Northstar)	0.352		
Onshore–present (Fiord, Meltwater, Nanuk and Palm)	0.185		
Reasonably Foreseeable Future Production (Total)	5.450	– [2]	Table IV.I-6b
Discovered Onshore	0.500		
Discovered Offshore	1.070		
Undiscovered Onshore	2.500[4]		
Undiscovered Offshore (Sale 186)	0.46		
Undiscovered Offshore (Sales 195 and 202)	0.92[5a]		
Speculative Production (Total)	3.420	32,800[3]	See notes below
Onshore	2.500[4]		
Offshore	0.92[5b]		
Total	**14.872**	**32,834**	Table V-1a to 7b

Source: USDOI, MMS, Alaska OCS Region.
Notes: Production and Reserve Data as of December 2000. [1] Gas production to date is from Barrow gas fields supplied for local use to the village of Barrow. [2] Currently, all gas production from existing oilfields is consumed by facilities or reinjected for reservoir pressure maintenance. No gas production is transported and marketed outside of the North Slope. [3] Future production of natural gas assumes that a transportation system eventually will be constructed to move North Slope gas resources to outside markets. All proposed systems are uneconomic under current conditions. [4] Includes 2.0 billion barrels in unnamed satellite fields and from enhanced oil recovery from existing oil fields. [5a] Includes 60% of the mid-point undiscovered resources between the base case ($18.00) and high case ($30.00) of MMS's 2000 Assessment of Beaufort Sea. [5b] Includes the remaining portion (40%) of the mid-point undiscovered offshore resources recoverable between $18.00 and $30.00 per barrel.

Table V-7d Estimates for Speculative Oil and Gas Resources

Area	Oil (Billions of Barrels)	Gas (Trillions of Cubic Feet)	Study/Source
Beaufort Shelf	1.8–3.2		USDOI, MMS (2000)–*1*
Northern Alaska	0.6–3.3	—	USGS (1995)–*2*
Beaufort-MacKenzie River Delta	1.0	9.0	NEB (1998)–*3*
Northeast NPR-A	0.5–2.2	—	USDOI ,MMS/BLM (1997)–*4*
Arctic National Wildlife Refuge	2.4–6.3	—	USGS (1998)–*5*
North Slope-State lands	4.0	32.8	Industry–*6*; MMS–*7*
Chukchi Shelf	1.0–6.1	—	USDOI, MMS (2000)–*1*

Sources:

1. MMS Update Assessment for 2002-2007 OCS Program.
2. USGS Circular 1145.
3. National Energy Board, Canada, Probabilistic Estimates of Hydrocarbon Volumes in the MacKenzie Delta and Beaufort Sea Discoveries.
4. USDOI, BLM and MMS, 1998.
5. USGS ANWR Assessment Team, Open-file Report 98-34
6. Informal industry estimates of oil recoverable from enhanced recovery technology and from new small satellite fields near existing North Slope infrastructure.
7. Discovered but undeveloped gas reserves, mainly associated with existing oil fields (Sherwood and Craig, 2000).

Notes: The resource estimates for the Beaufort Shelf (USDOI, MMS, Alaska OCS Region, 2000) and Northern Alaska (U.S. Geological Survey, 1995) are mean undiscovered volumes that are economically recoverable at oil prices between $18 and $30 per barrel. Economic resources represent a small fraction of the total recoverable petroleum endowment, much of which is in pools too small or too remote to be economic under modeling assumptions. It is impossible to accurately predict the timing of commercial discoveries or future production volumes for speculative resources. Resource estimates often change with new information or modeling assumptions. For example, a new Geological Survey assessment (1998) reports that more economic oil may occur in the small coastal plain of the Arctic National Wildlife Refuge than previously estimated (U.S. Geological Survey, 1995) for all of Northern Alaska. The economic analysis in Section III.D.5 including Table III.D-5 uses $16 per barrel price for the proposal. The estimates shown above use $18 to $30 as reference prices. Assuming different price ranges is reasonable given the volatility of oil prices. A more optimistic assumption, that is a higher price, is reasonable for the cumulative analysis.

For the Liberty Proposal, exploration/appraisal is completed and the field is ready for development. For the cumulative effects analysis, regional exploration in Arctic Alaska is not complete and development may be delayed long into the undetermined future. The hope for giant oil fields will continue to draw leasing and exploration activities in the future. However, it is unreasonable to speculate on the timing and infrastructure needed to produce resources that have not been discovered. More than 30 trillion cubic feet of gas has been discovered on the North Slope and remains undeveloped due to the lack of a regional transportation infrastructure and market. This huge proven resource base will undoubtedly be produced before major exploration efforts are focused on undiscovered gas resources in other onshore areas or the Beaufort Sea off Alaska.

Table V-8 Seasonal Transportation Access for Projects off the Road System

Project	Construction Period			Operation/Production Period		
	Summer	**Breakup**	**Winter**	**Summer**	**Breakup**	**Winter**
***ALPINE*[1]**						
Aircraft [2]	4-7 round trips monthly	N/A	3-6 round trips monthly	4 round trips monthly or as needed	N/A	4 round trips monthly or as needed
Surface	Frequent	N/A	Frequent	Daily	N/A	Daily
Marine	N/A	N/A	N/A	N/A	N/A	N/A
***NORTHSTAR*[3]**						
Aircraft [4]	See footnote [4]	N/A	2,480 round trips	See footnote [4]	N/A	7 round trips per month
Surface	See footnote [5]	N/A	35,013 [5] round trips	See footnote [5]	N/A	190 round trips Yearly
Marine	132 round trips	N/A	None	5-6 round trips Yearly	N/A	None
***BADAMI*[6]**						
Aircraft	See footnote [6]	See footnote [6]	See footnote [6]	36 round trips weekly during drilling[7]	40 round trips weekly during drilling[7]	2 round trips weekly during drilling [7]
Surface	See footnote [6]	See footnote [6]	See footnote [6]	1 round trip yearly[8]	N/A	30 round trips daily during drilling [9]
Marine	See footnote [6]	See footnote [6]	See footnote [6]	10[10]	N/A	N/A

[1]For the Alpine Project, summer is defined as April 20 to November 30; the rest of the year is winter. Alpine construction and development drilling phase may last from present to approximately 2005, with the field life estimated at another 15 to 20 years.

[2]Aircraft operations calculated for the Alpine project, by Arco contractors, were made on the basis of an amalgamation of three aircraft type: Hercules cargo planes, Twin Otter's and Boeing 737s.

[3]The Northstar project should be completed (island construction and development drilling) within 4 years of initiation. The life of the field is projected at 15 to 20 years. The transportation requirements indicated here are the construction of the Northstar island in a single season.

[4]Data presented in the Northstar Final EIS (US Army Corps of Engineers, 1999) for helicopter transport are not separated out by season.

[5]Data presented in the Northstar Final EIS for surface transport are not separated out by season. However, of the presented figure of 35,013 surface transport round trips, 2,775 round trips are composed of bus trips and would be primarily involved with the movement of personnel to construction sites. The balance of the surface transport trips are truck traffic.

[6]The Badami project has proceeded beyond the construction phase and is now in developmental drilling.

[7]For all three periods, 6 aircraft operations will occur weekly after drilling.

[8]Planned pipeline inspection via rolligon; emergency use of rolligons not estimated.

[9]After drilling, 3 yearly round trips planned for pipeline inspection via rolligons; emergency use not estimated. [10]An additional 10 round trips are planned in summer of 1998 to support drilling operations.

Table V-9a Tundra-Ice Road Water-Volume Requirements

Road Length (Miles)	Gallons of Required Water Volume by Road Width (Feet)			
	30	50	100	200
0.5	213,270	355,450	710,899	1,421,798
1.0	426,540	710,899	1,421,798	2,843,597
1.5	639,809	1,066,349	2,132,698	4,265,395
2.0	853,079	1,421,798	2,843,597	5,687,194
2.5	1,066,349	1,777,248	3,554,496	7,108,992
3.0	1,279,619	2,132,698	4,265,395	8,530,790
3.5	1,492,888	2,488,147	4,976,294	9,952,589
4.0	1,706,158	2,843,597	5,687,194	11,374,387
4.5	1,919,428	3,199,046	6,398,093	12,796,186
5.0	2,132,698	3,554,496	7,108,992	14,217,984
5.5	2,345,967	3,909,946	7,819,891	15,639,782
6.0	2,559,237	4,265,395	8,530,790	17,061,581
6.5	2,772,507	4,620,845	9,241,690	18,483,379
7.0	2,985,777	4,976,294	9,952,589	19,905,178
7.5	3,199,046	5,331,744	10,663,488	21,326,976
8.0	3,412,316	5,687,194	11,374,387	22,748,774
8.5	3,625,586	6,042,643	12,085,286	24,170,573
9.0	3,838,856	6,398,093	12,796,186	25,592,371
9.5	4,052,125	6,753,542	13,507,085	27,014,170
10.0	4,265,395	7,108,992	14,217,984	28,435,968

Source: Alaska Interstate Construction, LLC.

Assumptions:
– 6-inch total road thickness.
– 2/3 of thickness is fresh water.
– 1/3 of thickness is snow.
– Typical tundra topography.
– 20% contingency for topographic feature correction, (i.e., stream ramps, etc.).
– Water volumes are calculated for construction only.
– No additional water included for ice road maintenance.

Table V-9b Sea-Ice Road Water-Volume Requirements

Road Length (Miles)	Gallons of Required Water Volume by Road Width (Feet)			
	100	200	300	400
0.5	888,624	1,777,248	2,665,872	3,554,496
1.0	1,777,248	3,884,496	5,331,744	7,108,992
1.5	2,665,872	5,331,744	7,997,616	10,663,488
2.0	3,554,496	7,108,992	10,663,488	14,217,984
2.5	4,443,120	8,886,240	13,329,360	17,772,480
3.0	5,331,744	10,663,488	15,995,232	21,326,976
3.5	6,220,368	12,440,736	18,661,104	24,881,472
4.0	7,108,992	14,217,984	21,326,976	28,435,968
4.5	7,997,616	15,995,232	23,992,848	31,990,464
5.0	8,886,240	17,772,480	26,658,720	35,544,960
5.5	9,774,664	19,549,728	29,324,592	39,099,456
6.0	10,663,488	21,326,976	31,990,464	42,653,952
6.5	11,552,112	23,104,224	34,656,336	46,208,448
7.0	12,440,736	24,881,472	37,322,208	49,762,944
7.5	13,329,360	26,658,720	39,988,080	53,317,440
8.0	14,217,984	28,435,968	42,653,952	56,871,936
8.5	15,106,608	30,213,216	45,319,824	60,426,432
9.0	15,995,232	31,990,464	47,985,696	63,980,928
9.5	16,883,856	33,767,712	50,651,568	67,535,424
10.0	17,772,480	34,544,960	53,417,440	71,089,920

Source: Alaska Interstate Construction, LLC.

Assumptions:
– 6-inch freshwater cap on top of brine ice.
– Water volumes are calculated for construction only.
– No additional water included for ice-road maintenance.
– No contingency for rough ice surfaces.

Table V-10 Characteristics of North Slope Oil Fields

Oil Field[1] (Year Production Began)	Unit Area (Hectares[2])	Number of Production Facility Pads	Mine Sites and Gravel Placement	
			Area Disturbed (Hectares)	Percent of Unit Disturbed (%)
Prudhoe Bay (1977)	99,103.2	50	2,592.5	2.62
Kuparuk River (1981)	104,514.2	49	1,033.8	0.99
Milne Point (1985)	22,002.8	11	182.0	0.83
Lisburne (1986)	32,359.5	8	100.7	0.31
Endicott (1987)	7,099.1	2	207.1	2.92
Point McIntyre (1993)	4,384.1	2	12.7	0.29
Niakuk (1994)	2,623.7	1	9.8	0.37
Badami (1998)	15,139.6	1	74.4	0.49
Alpine (2000[3])	32,576.5	2	56.5	0.17
Northstar (2001[3])	12,491.8	1	1.8	0.01
Pt Thomson/Sourdough	33,896.8	4	112.0	0.33
TAPS and Dalton Highway (North Slope)	NA	NA	4,412.9	NA

Source: Gilders and Cronin (2000).
[1] Oil field refers to both units and participating areas.
[2] Unit areas cannot be totaled because of overlap that exists among the units and participating areas.
[3] Table V-1a.

Table V-11 Summary of Cumulative Effects

Resources	Summary of Effects
Water Quality	Based on the total number of projects or the number of offshore projects, the contribution from Alternative I for Sale 186 could range up to one-tenth of the foreseeable cumulative effects. A spill could affect water quality for 10 or more days in a local area. The effects of discharges and offshore construction activities are expected to be short term, lasting as long as the individual activity, and have the greatest impact in the immediate vicinity of the activity. The contribution from Alternative I for Sale 186 to the total number of offshore projects (11) is about 9% and it would contribute about one-tenth of the cumulative effects described in the effects common to all alternatives.
Lower-Trophic-Level Organisms	One offshore oil spill of about 3,000 barrels is estimated for the past, present, and reasonably foreseeable developments. About half of the reasonably foreseeable developments would be outside of the barrier islands, and the cumulative risk to river deltas and other sensitive portions of the coastline would not increase proportionally. Also, none of the developments other than possibly Liberty would be near the Boulder Patch and, therefore, the cumulative risk to it would be slightly greater with Alternative I for Sale 186. Benthos would be disturbed (buried) during pipeline and island construction for the reasonably foreseeable developments. The total disturbed area would probably be less than 800 acres, and the effect would be moderated by benthic colonization on old exploration islands that were abandoned during the past decade. The contribution of Alternative I for Sale 186 to the cumulative analysis for lower-trophic-level organisms is minimal for disturbance effects and estimated at about 4% of the effects from a large oil spills to the cumulative effects. Alternative I for Sale 186 is not expected to make a measurable contribution to the cumulative effect on these organisms.
Fishes	Disturbances associated with Alternative I for Sale 186 are not likely to make a measurable contribution to the overall cumulative effect on fishes. Some fish in the vicinity of a large oil spill may be adversely affected by it. Those that are affected are likely to experience effects ranging from minor and short-term to no effect at all. Large oil spills associated with Alternative I for Sale 186 are not likely to have a measurable additive effect on fish populations. The contribution of Alternative I for Sale 186 to the cumulative effects from disturbances and oil spills are not likely to make a measurable contribution to the overall cumulative effect on fishes.
Essential Fish Habitat	The low level of effects from seismic surveys, exploration and drilling activities, and drilling mud are unlikely to increase above the present level of effects. The substantial accumulation of effects on essential fish habitat are more likely to occur from oil spills effects on freshwater and estuarine water than on marine water essential fish habitat. However, because of the low water temperatures, the marine habitat is unlikely to support any salmon, even with a maximum trend of temperature increases each decade. Therefore, no cumulative effect of oil spills on marine essential fish habitat is likely, because the effects likely would dissipate before salmon ever use the habitat. If there are cumulative effects on essential fish habitat, they are a decrease in the theoretical time to extinction of any existing marginal salmon populations using freshwater or estuarine habitat. The contribution of Alternative I for Sale 186 to the cumulative effect level of seismic surveys, exploratory drilling and drilling mud disposal are unlikely to increase above the present low level of effects. If a large oil spill actually occurs as a result of Alternative I for Sale 186, the greatest likelihood of oil reaching the coastal freshwater essential fish habitat is 3-14%.
Endangered and Threatened Species – Bowhead Whales	Overall, exposure of bowhead whales to noise from oil and gas operations is not expected to kill any bowhead whales, but some could experience temporary, nonlethal effects. Whales exposed to spilled oil likely would experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The incremental contribution of effects from Alternative I for Sale 186 to the overall effects under the cumulative effects is not likely to cause an adverse effect on the bowhead whale population.
Endangered and Threatened Species – Steller's Eiders	Although little Steller's Eider mortality is expected from an oil spill, knowledge regarding their numbers and distribution in this region is insufficient to allow realistic calculation of risk or effects from cumulative adverse factors. Contribution of Alternative I for Sale 186 to the cumulative effects is likely to be about 4 % of the local short-term disturbance and habitat alteration effects on eiders. Only in the case of a large offshore oil spill would these projects be expected to increase cumulative adverse effects to potentially significant population-level consequences.

Table V-11 Summary of Cumulative Effects (continued)

Resources	Summary of Effects
Endangered and Threatened Species - Spectacled Eiders	The effects from normal activities associated with cumulative exploration and development of oil and gas prospects in the Beaufort Sea are expected to include the loss of a small number of spectacled eiders. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness, survival, or production of young may occur where birds are exposed frequently to various disturbance factors, particularly helicopter support traffic. The frequency of such disturbance is expected to be highest in the vicinity of primary support facilities. Overlap between cumulative project developments could increase disturbance effects. The spectacled eider population, currently declining at a non-significant rate, may be slow to recover from small losses or declines in fitness or productivity. No significant overall population effect is expected to result from small losses. In the event a large oil spill occurs in the marine environment, spectacled eider mortality is expected to be less than 100 individuals; however, any substantial loss (for example, 25+ individuals) would represent a significant effect. Mortality resulting from the cumulative effects of oil and gas projects would be additive to natural mortality and interfere with the recovery of the Arctic Coastal Plain population. Recovery from substantial mortality is not expected to occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in population numbers. The contribution of Alternative I for Sale 186 to the cumulative effects is likely to be about 4 % of the local short-term disturbance and habitat alteration effects on eiders. Only in the case of a large offshore oil spill would these projects be expected to increase cumulative adverse effects to potentially significant population-level consequences.
Marine and Coastal Birds	Overall cumulative effects of oil-industry activities on marine and coastal birds potentially could be substantial in the case of loon species and king eider, and significant in the case of long-tailed duck and common eiders, primarily as a result of mortality from oil spills. Although the chance of oil-spill occurrence is small, the potential is highest for contact with bird concentrations in the vicinity of primary support facilities in the central Beaufort where most projects assumed in the cumulative effects likely will occur. Also, as a result of the apparent decline in populations of some species, and the challenge of recovering spilled oil, particularly in broken-ice conditions, there is uncertainty as to the ultimate effect of any spills on bird populations. Disturbance may cause some small loss of productivity and lowered fitness or survival of birds occupying areas with high levels of industry-activity, but these effects are not expected to be significant. Effects resulting from oil and gas development activities likely would be additive to naturally occurring effects.
Marine Mammals	The overall effects (mainly from one oil spill assumed for this analysis) is the potential losses of perhaps up to 10 polar bears and a few hundred seals and walruses, and small numbers (probably fewer than 10) of beluga and gray whales. In the likely cumulative effects, pinnipeds, polar bear, and beluga and gray whale populations are expected to recover within 1 year, assuming only one large spill (greater than or equal to 1,000 barrels) occurs. Potential cumulative oil spills along the tanker route to the U.S. west coast could have long-term (more than one generation or perhaps 5-10 years) effect on sea otters and perhaps harbor seals and other marine mammals. Cumulative noise and disturbance in the Beaufort Sea Planning Area is expected to briefly and locally disturb or displace a few seals, walruses, beluga and gray whales, and polar bears. A few polar bears could be temporarily attracted to the production island, with no significant effects on the population's distribution and abundance. The contribution of Alternative I for Sale 186 is expected to be about 2-4% of the local short-term disturbance and habitat effects on pinnipeds, polar bears, and beluga and gray whales (based on 0.46-billion barrel/11.5-billion barrel oil reserves in Table V-12). Alternative I for Sale 186 likely would contribute about 17% of cumulative offshore spills. The estimated mean number of cumulative offshore spills is 0.65, but the most likely number of offshore spills is zero (Table V-12).

Table V-11 Summary of Cumulative Effects (continued)

Resources	Summary of Effects
Terrestrial Mammals	Terrestrial mammals that would be affected include caribou, muskoxen, grizzly bears, and arctic foxes. Oil development in the Prudhoe Bay area could continue to displace some caribou during the calving season within about 4 kilometers (2.48 miles) of some roads with vehicle traffic that crosses calving habitat. The general shift of caribou calving away from the extensive oil fields may persist. Cows and calves of the Central Arctic Herd may, over time, reduce calving and the use of summer habitats near roads with high levels of traffic. If they do, these activities potentially could affect the caribou's productivity and abundance over the long term. However, this potential effect may not be measurable, because the caribou's productivity greatly varies under natural conditions. Some oil-development projects, such as Badami and Alpine, do not include roads constructed to connect to Prudhoe Bay and the Dalton Highway. They are not likely to disturb or displace calving caribou or change caribou movements across the Arctic Slope. Cumulative oil development is likely to have only local effects on the distribution and abundance of caribou, muskoxen, arctic foxes, and grizzly bears on the North Slope of Alaska but not affect overall distribution and abundance. Potential cumulative oil spills along the tanker route to the U.S. west coast could have short-term (1-3 years) effects on other terrestrial mammals. The contribution from Alternative I for Sale 186 to the cumulative effects is expected to be about 4% of the local short-term disturbance and habitat effects on of caribou, muskoxen, grizzly bears, and arctic foxes and zero reduced use of habitat for calving (based on 0.46-barrel/11.5-barrel oil reserves [Table V-12]). It could attract few if any foxes to facilities and construction sites, with no effects on distribution and abundance. Alternative I for Sale 186 is estimated to contribute about 17% of cumulative offshore spills. The estimated mean number of cumulative offshore spills is 0.65, but the most likely number of offshore spills is zero (Table V-12).
Vegetation and Wetlands	Oil-field development on Alaska's North Slope centers on the Arctic Coastal Plain, which covers about 13 million acres. Existing gravel-mine reserve pits, pads, and other facilities cover more than 7,800 acres (Tables V-3 and V-5). About 50 miles of shoreline, including vegetation and wetland habitats, potentially would be affected by cumulative development within the Alternative I for Sale 186 area. (See Section III.B.8 for a description of the distribution of vegetation and wetland in the project area.) All projects in Map 1 and 2 either have or would destroy vegetation through construction of onshore gravel pads, gravel mines, and roads; burial of pipelines; or installation of vertical support members for elevated pipelines. Sources of past and potential impacts include directly digging up and burying vegetation; changes in snow drifting and water drainage; accumulation of dust, salt, and chemicals along roads and near gravel pads; and damage from oil spills and other accidental chemical spills. In terms of acres of land affected, construction causes more than 99% of the effects, with spills having a very minor role. Rehabilitation of gravel pads can result in the growth of grasses-sedges within 2 years after abandonment of the pads. Natural growth of plant cover on abandoned gravel pads would be very slow. Construction of existing facilities, past exploration pads, and vehicle tracts across the tundra landscape has affected a small percentage of the total tundra-wetland habitats on the Arctic Coastal Plain. However, local additive effects of gravel pads, roads, mines, and other facilities on tundra wetlands are expected to persist decades long after the oil fields are abandoned. Complete recovery of oiled coastal wetlands from an unlikely large oil spill could take several decades to fully recover from the spill and associated cleanup activities. Alternative I for Sale 186 would contribute about 4% of the cumulative disturbance effects on over 7,800 acres of tundra and wetlands now affected by oil development (based on 0.46-barrel/11.5-barrel oil reserves [Table V-12]). Alternative I for Sale 186 is estimated to contribute about 17% mean number of cumulative offshore spills. The estimated mean number of cumulative offshore spills is 0.65 , but the most likely number of offshore spills is zero (Table V-12).

Table V-11 Summary of Cumulative Effects (continued)

Resources	Summary of Effects
Economy	In total, the cumulative effects would generate the following additive annual revenues: • $15 million to the North Slope Borough • $90 million to the State • $125 to the Federal Government This cumulative effects is projected to generate additive employment and personal income increases as follows: • 160 jobs annual average for North Slope Borough residents during development, declining to 40 during production. • $10 million in total average annual personal income for workers residing in the North Slope Borough during development, declining to $2.8 million during production. • 5,800 jobs annual average during development, declining to 3,300 during production. $367 million in total average annual personal income for workers residing in Southcentral Alaska and Fairbanks during development, declining to $211 million during production. • $367 million in total average annual personal income for workers residing in residing in the rest of the U.S. during development, declining to $211 million during production. • 60-190 jobs for 6 months for cleanup of unlikely oil spills in the Beaufort Sea. The contribution Alternative I for Sale 186 to the cumulative effect would be as follows: • $1 million revenue average annually to the North Slope Borough annually for 22 years of production • $27 million revenue average annually to the State for 22 years of production • $57 million revenue average annually to the Federal Government for 22 years of production • 40 jobs annual average for North Slope Borough residents during development declining to 9 during production. • $3.4 million in total average annual personal income for workers residing in the North Slope Borough development and declining to $0.7 million during production. • 600 jobs annual average during development, declining to 390 during production. • $38 million in total average annual personal income for production workers, declining to $25 million during production for these workers. • 60-190 jobs for 6 months for cleanup of unlikely oil spills in the Beaufort Sea • 10,000 jobs for 6 months for cleanup of an unlikely tanker spill in the Gulf of Alaska
Subsistence-Harvest Patterns	Cumulative effects on subsistence-harvest patterns include effects from Alternative I for Sale 186 exploration and development and other past, present, and reasonably foreseeable North Slope projects with one or more important subsistence resources becoming unavailable or undesirable for use for 1-2 years, a significant adverse effect. Sources that could affect subsistence resources include potential oil spills, noise and traffic disturbance, and disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, and supply efforts. Barrow, Nuiqsut, and Kaktovik potentially would be most affected. Nuiqsut potentially would be the most affected community, because it is within an expanding area of oil exploration and development both onshore (Alpine and the Northeast National Petroleum Reserve-Alaska) and offshore (Northstar and McCovey). In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major additive (but not synergistic) significant effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Because a large oil spill is unlikely, attaining a level of significant effect also is unlikely. The contribution of Alternative I for Sale 186 is about 4% of the total past, present, and reasonably foreseeable oil and gas development in the Beaufort Sea area. While the most likely number of oil spills greater than or equal to 500 barrels from all past, present, and future activities onshore is estimated to be 5, the most likely number of offshore spills is estimated to be 0. Alternative I for Sale 186 is estimated to contribute about 17% of the estimated mean number of cumulative offshore spills, with a most likely number of spills of zero (Table V-12). In the unlikely event of a spill from Alternative I for Sale 186, many harvest areas and some subsistence resources would be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads, threatening a critical underpinning of Inupiat culture. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree that these resources were contaminated.

Table V-11 Summary of Cumulative Effects (continued)

Resources	Summary of Effects
Sociocultural Systems	The contribution from Alternative I for Sale 186 to cumulative effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from oil-spill-cleanup activities, small changes in population and employment, and disruption of subsistence-harvest patterns from oil spills and oil-spill cleanup. Disturbance effects periodically could disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. Community activities and traditional practices for harvesting, sharing, and processing subsistence resources could be seriously curtailed in the short term, if there are concerns over the tainting of bowhead whales from an oil spill.
Archaeological Resources	In addition to Alternative I for Sale 186, other activities associated with this cumulative analysis that may affect archaeological resources in the Beaufort Sea include lease sales and activity in the National Petroleum Reserve-Alaska and State lands, State oil and gas fields, oil and gas transportation, noncrude carriers, and any Federal activities. Cumulatively, these proposed projects likely would disturb the seafloor more often, but remote-sensing surveys made before approval of any Federal or State lease actions should keep these effects low. Federal laws would preclude effects to most archaeological resources from these planned activities. The contribution of Alternative I for Sale 186 to the cumulative effects is expected to be minimal for archaeological resources, because any surface-disturbing activities that could damage archaeological sites would be mitigated by current State and Federal procedures, which require identification and mitigation of archaeological resources in the proposed project areas. Overall effects of the Alternative I for Sale 186 would be additive to effects anticipated for other future projects and, in the case of oil spills, is uncertain. However, data from the *Exxon Valdez* oil spill indicate that less than 3% of the resources within a spill area would be significantly affected.
Land Use Plans and Coastal Management Programs	The potential for conflicts arising from the cumulative effects is the same as those discussed in Section IV.C, Effects Common to All Alternatives. Conflicts with Statewide standards of the ACMP and the policies of the NSB CMP are not inherent in the hypothetical scenarios presented in the cumulative effects. Alternative I for Sale 186, represents a small proportion (4%) of the total past, present, and reasonably foreseeable oil and gas development in the Beaufort Sea area. No conflicts are anticipated for activities associated with Alternative I for Sale 186 and its contribution to the cumulative effects does not alter the conclusion for the cumulative effects. This conclusion is based partly on the small contribution of Alternative 1 for Sale 186, but predominantly on the conclusion that exploration and development and production can proceed consistent with the enforceable policies of the ACMP and the NSB CMP. The MMS regulatory oversight and lease stipulations address many of the concerns applicable to the enforceable standards. In addition, the consistency review of these activities will address the applicable policies at the time that specific plans are submitted.
Air Quality	The cumulative effects of all projects affecting the North Slope of Alaska in the past and occurring now have caused generally little deterioration in air quality, which remains better than required by national standards. All reasonably foreseeable North Slope projects (see Table V-1a) would not change this situation. Considering that predicted discoveries and development from Alternative I for Sale 186 would represent only a few percent of the existing North Slope activity, air emissions from Alternative I, Sale 186 would have no significant contribution to cumulative effects for air quality.
Environmental Justice	Potential effects would focus on the Inupiat communities of Barrow, Nuiqsut, and Kaktovik within the North Slope Borough; however, effects are not expected from routine activities and operations. If a large spill assumed in the cumulative effects occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered disproportionately high adverse effects on Alaskan Natives, because oil-spill contamination of subsistence foods is the main concern regarding potential effects on Native health. Any potential effects to subsistence resources and subsistence harvests are expected to be mitigated substantially, though not eliminated. Only in the event of a large spill, which is a low likelihood event, would disproportionate high adverse effects be expected on Alaska Natives from Alternative I for Sale 186.

Table V-12 Cumulative Oil-Spill-Occurrence Estimates ≥500 Barrels or ≥1,000 Barrels Resulting from Oil Development over the Assumed 15-20 Year Production Life of the Sale 186

Category	Crude-Oil Spills					
	Reserves and Resources (Bbbl)	Spill Rate (Spills/Bbbl)	Size Category (bbl)	Assumed Size (Barrels)	Most Likely Number of Spills	Estimated Mean Number of Spills
Offshore						
Past, Present, and Reasonably Foreseeable	2.34	0.23	≥1000		0	0.54
Alternative I for Sale 186	0.46	0.23	≥1000		0	0.11
Total	**2.80**	**0.23**	**≥1000**		**0**	**0.65**
Onshore						
Past, Present, and Reasonably Foreseeable	8.66	0.64	≥500	500–925	5	5.54
Alternative I for Sale 186	0.46	0.11	≥500	720–1,142	0	0.05
Total	**9.12**	**0.11**	**≥500**	**500–1,142**	**5**	**5.59**
TAPS Pipeline						
Past, Present, and Reasonably Foreseeable	11.04	0.11	≥500	500–999	1	1.21
Alternative I for Sale 186	0.46	0.11	≥500	500–999	0	0.05
Total	**11.50**	**0.11**	**≥500**	**500–999**	**1**	**1.24**
TAPS Tanker						
Past, Present, and Reasonably Foreseeable	11.04	0.88	≥1,000	Table V-15	9	9.66
Alternative I for Sale 186	0.46	0.88	≥1,000	Table V-15	0	0.41
Total	**11.50**	**0.88**	**≥1,000**	**Table V-15**	**10**	**10.07**

Source: USDOI, MMS, Alaska OCS Region (2001).

Notes: The Alaska Dept. of Environmental Conservation database has no significant crude oil spills on the North Slope resulting from well blowouts and no facility or onshore pipeline spills greater than 1,000 barrels for the years 1985-2000.

Table V-13 Contribution by Mean Number and Most Likely Number of Spills Resulting from Oil Development over the Assumed 15-20-Year Production Life of Sale 186

Spill Category	Percent of Mean Number of Spills	Most Likely Number of Spills over 15-20-Year Production Life
Offshore	17%	0
Onshore	0.8%	5
TAPS Pipeline	4%	1
TAPS Tanker	1.5%	10

Table V-14 Trans-Alaska Pipeline System Tanker Spills ≥1,000 Barrels, 1977 through 1998

Date	Vessel	Location	Destination	No. of Barrels
8/29/78	Overseas Joyce	Balboa Channel	Perth Amboy, New Jersey	1,816
6/7/80	Texaco Connecticut	Panama Canal Zone	Port Neches, Texas	4,047
12/12/81	Stuyvesant	Gulf of Tehuantepec	Panama	3,600
12/21/85	ARCO Anchorage	Puget Sound	Cherry Point, Washington	5,690
1/9/87	Stuyesant	Gulf of Alaska, British Columbia	Puerto Armuelles, Panama	15,000
7/2/87	Glacier Bay	Cook Inlet, Alaska	Nikiski, Alaska	4,900
10/4/87	Stuyvesant	Gulf of Alaska, British Columbia	Puerto Armuelles, Panama	14,286
1/3/89	Thompson Pass	Port of Valdez	Panama	1,700
3/24/89	Exxon Valdez	Prince William Sound, Alaska	Long Beach, California	240,500
2/7/90	American Trader	Huntington Beach, California	Long Beach, California	9,929
2/22/91	Exxon San Francisco	Fidalgo Bay, Washington	Anacortes, Washington	5,000

Source: Anderson and Lear (1994) and Anderson (2000).

Table V-15 Sizes of Tanker Spills We Assume from the Trans-Alaska Pipeline System in the Cumulative Analysis

Size Category	Number of Spills	Average Size (Barrels)	Total Volume (Barrels)
≤6,000	7	4,000	28,000
>6,001-≤15,000	2	13,000	26,000
>200,000	1	250,000	250,000
Total	10		298,000

Source: USDOI, MMS, Alaska OCS Region 2002).
Notes: The distribution of the number of spills is based on the percentage of the number of spills in a size category from actual Trans-Alaska Pipeline System tanker spills listed in Table V-12. Table V-12 shows that 66% are ≤6,000, 17% are >6,001-≤15,000, and 8% are ≥ 200,000.

FIGURES

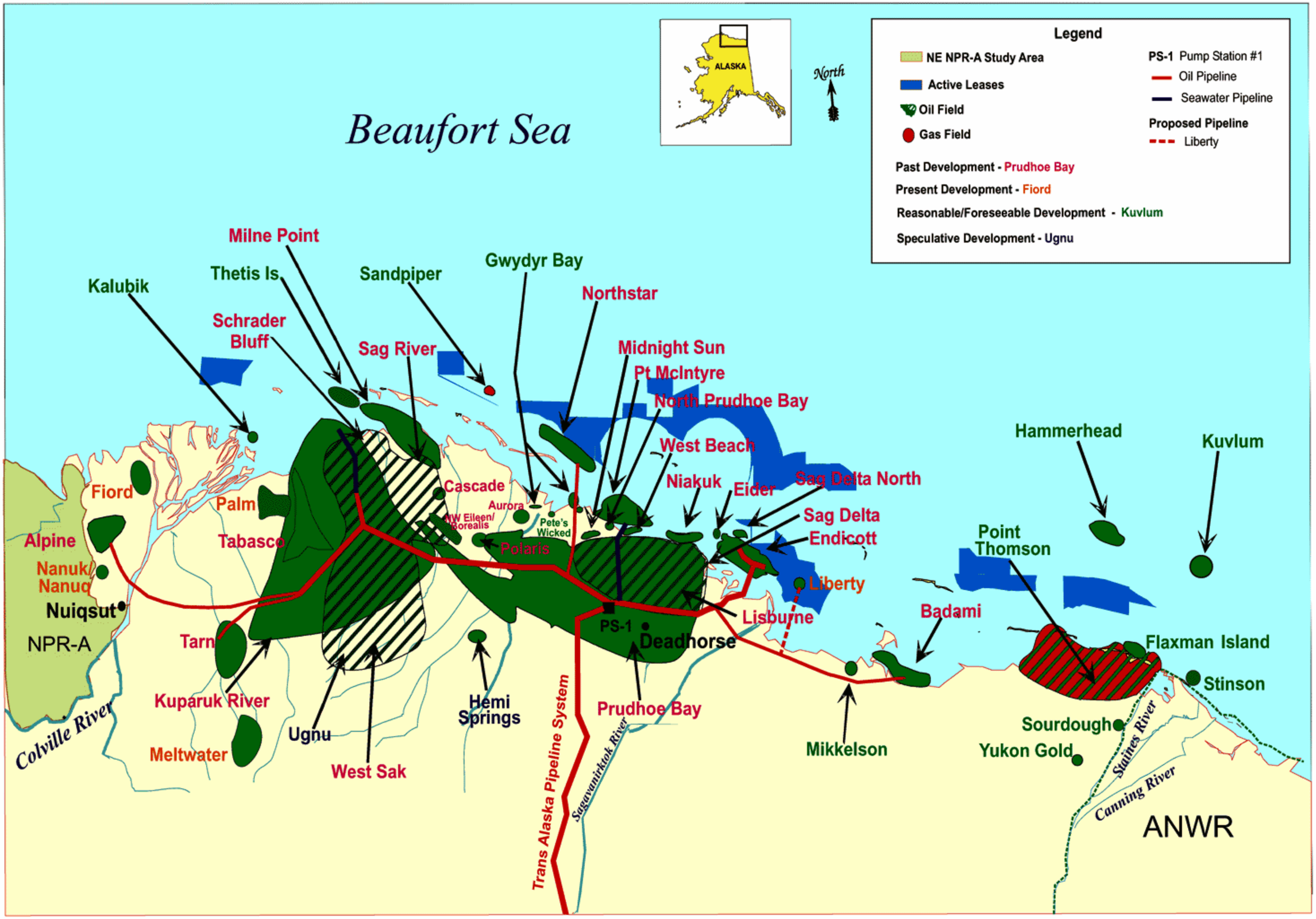


Figure III.A-1 North Slope Fields and Main Infrastructure

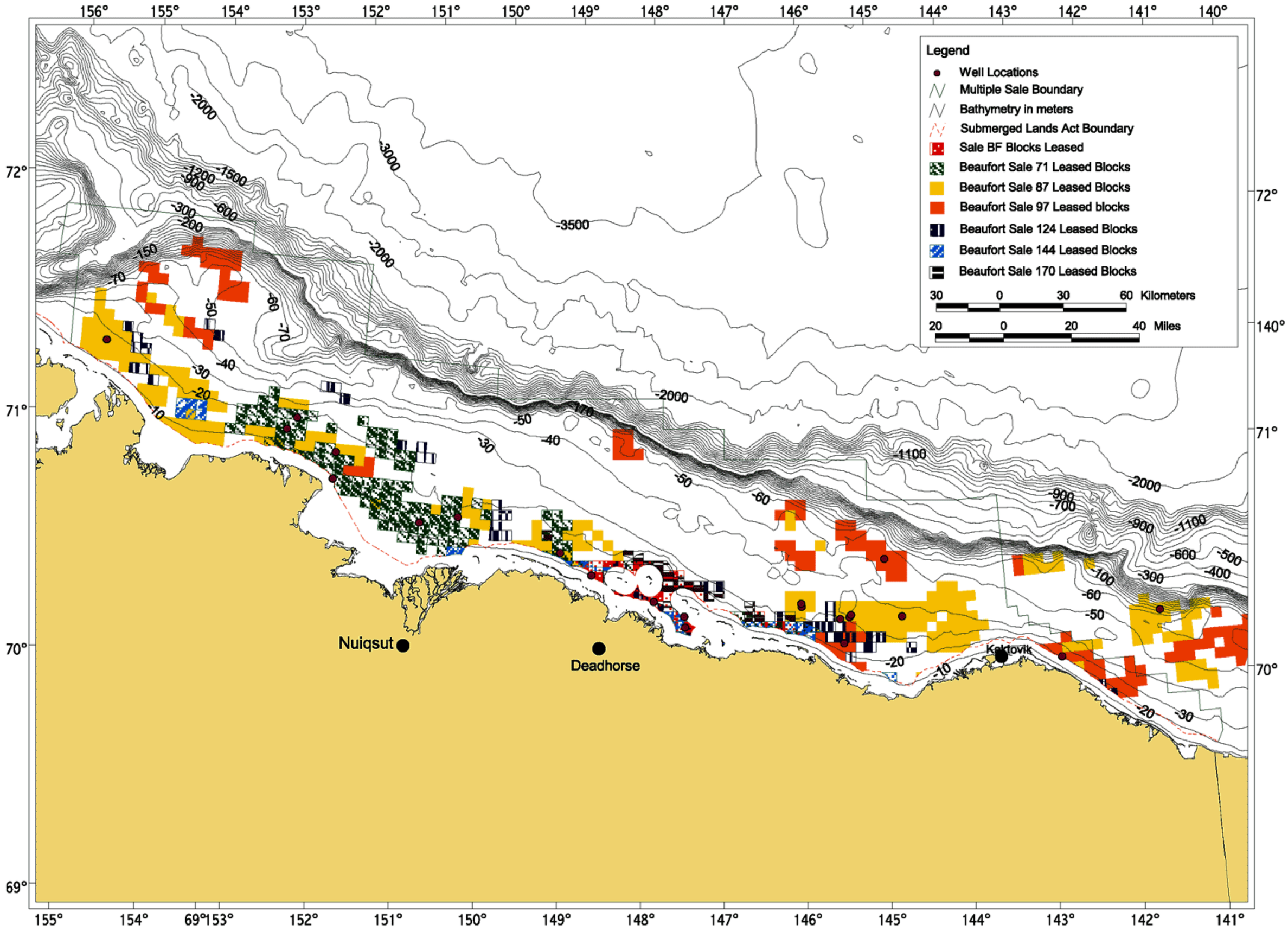


Figure III.A-2 Historical Leases in the Multiple - Sale Area

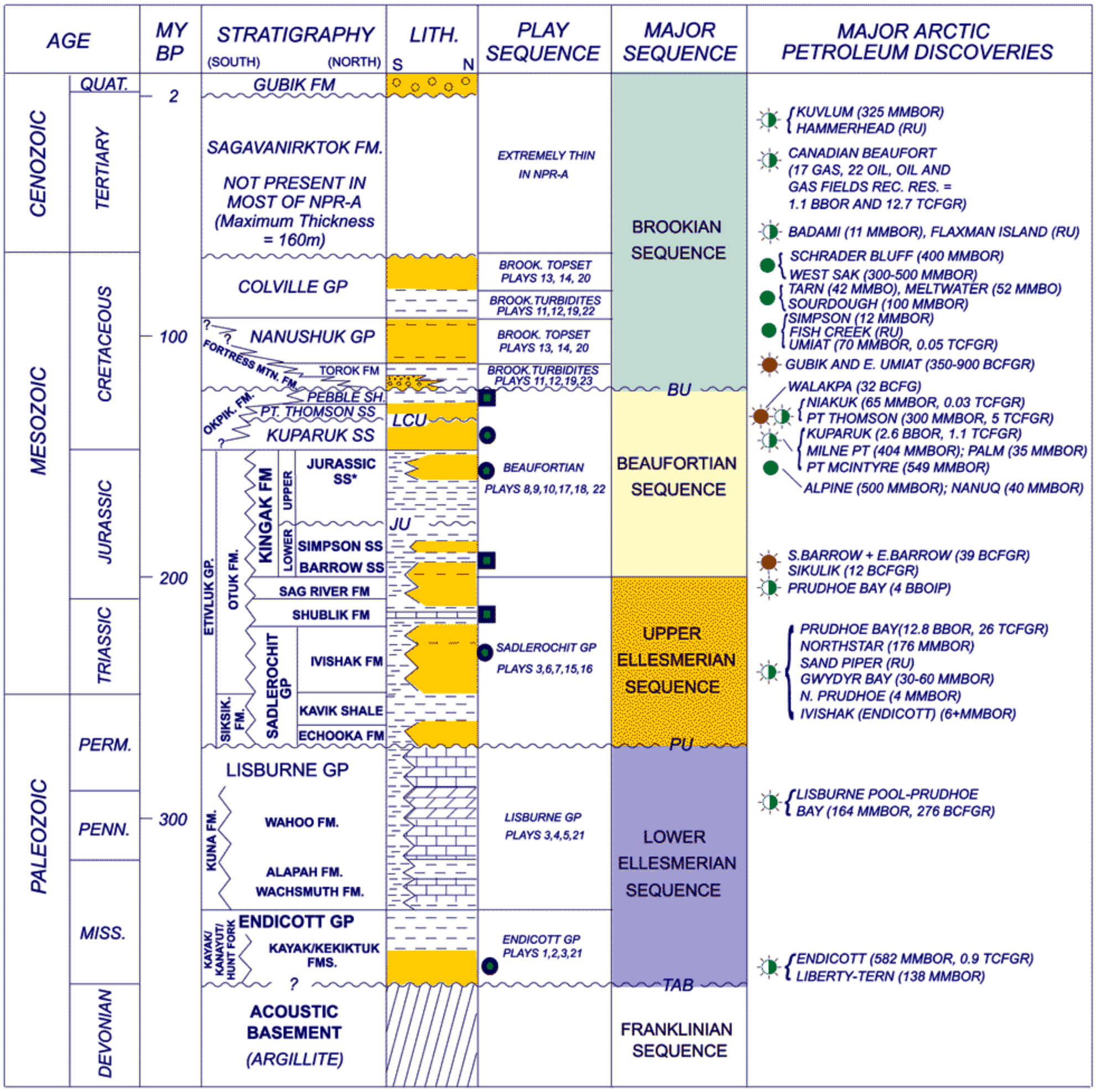
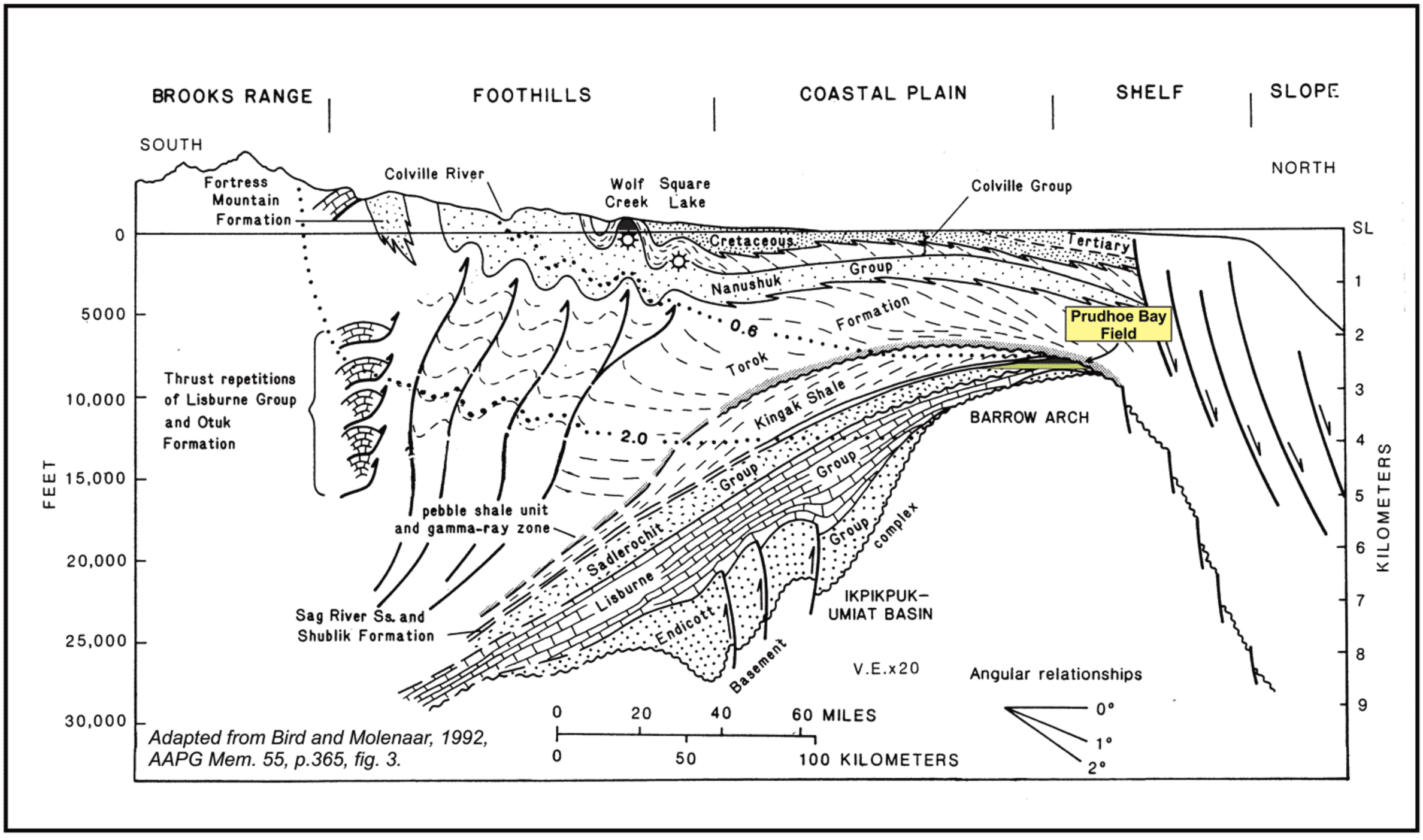


Figure III.A.3 National Petroleum Reserve - Alaska Stratigraphic Column



Adapted from Bird and Molenaar, 1992, AAPG Mem. 55, p.365, fig. 3.

Figure III.A-4 Geologic Cross-Section from the Brooks Range to the Beaufort Sea

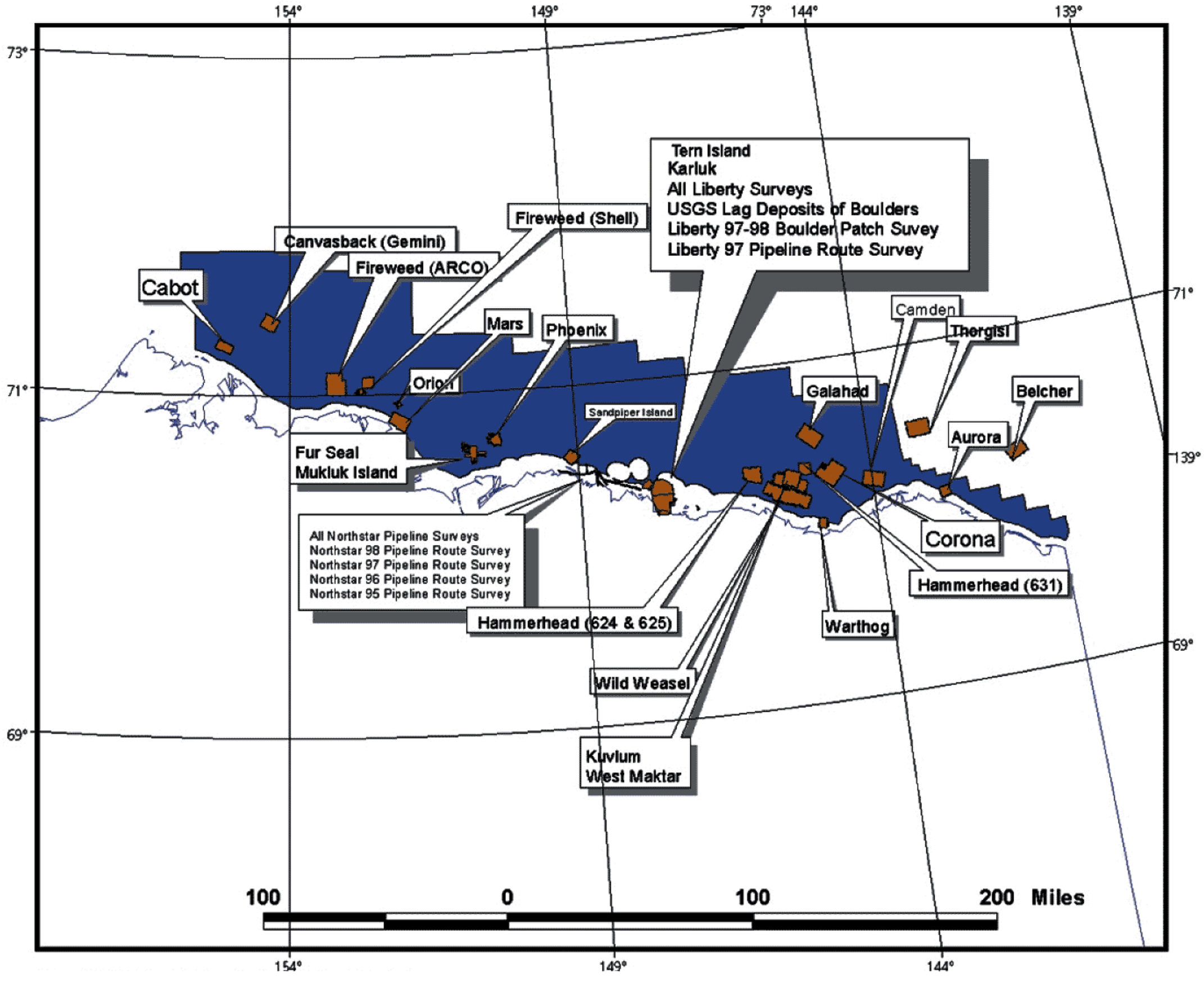


Figure III.A-5 Beaufort Sea High-Resolution Seismic Surveys

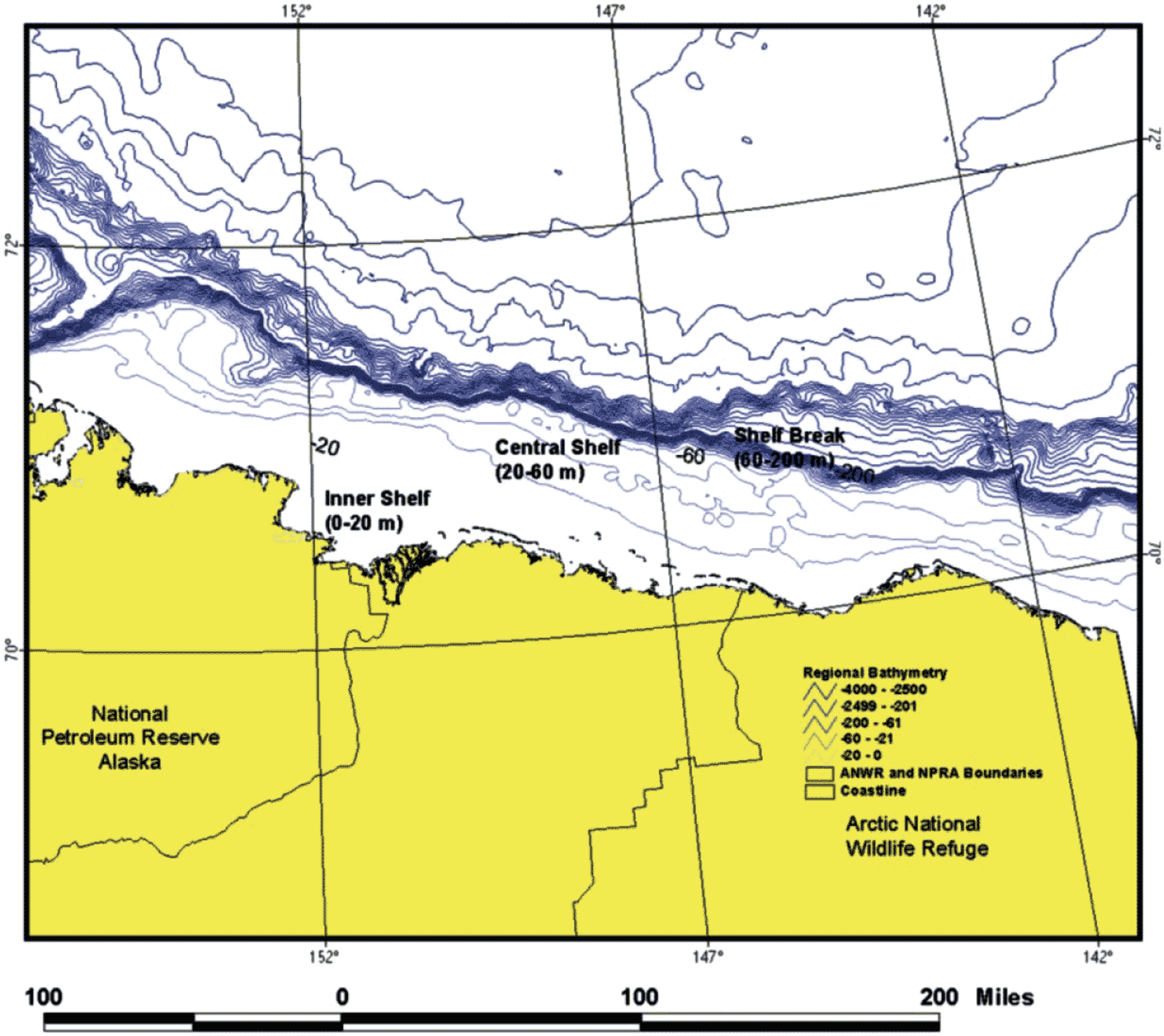


Figure III.A-6 Regional Bathymetry and Shelf Divisions

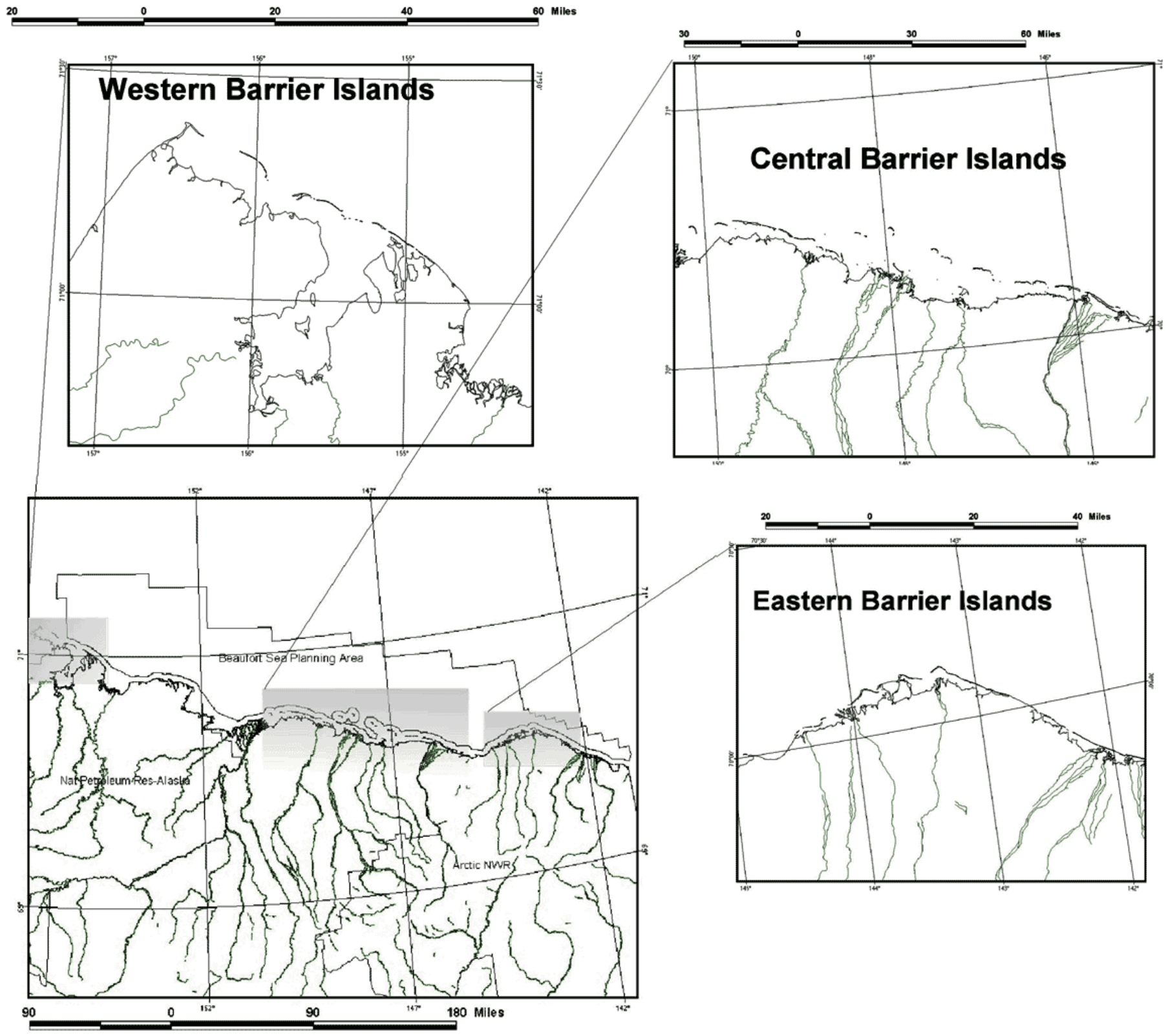


Figure III.A-7 Western, Central, and Eastern Barrier Islands

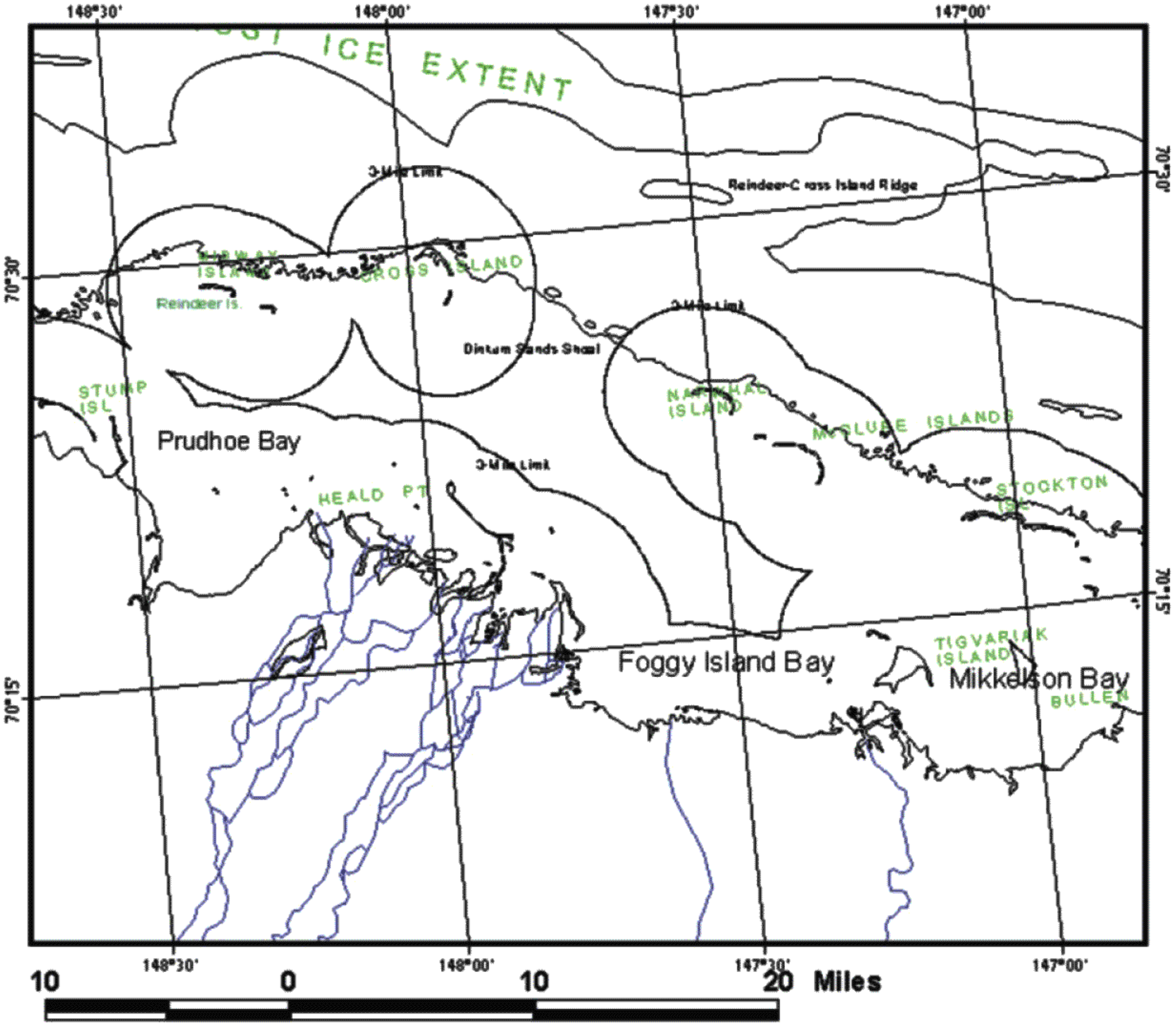


Figure III.A-8 Barrier Islands and Shoals of the Central Beaufort Coast

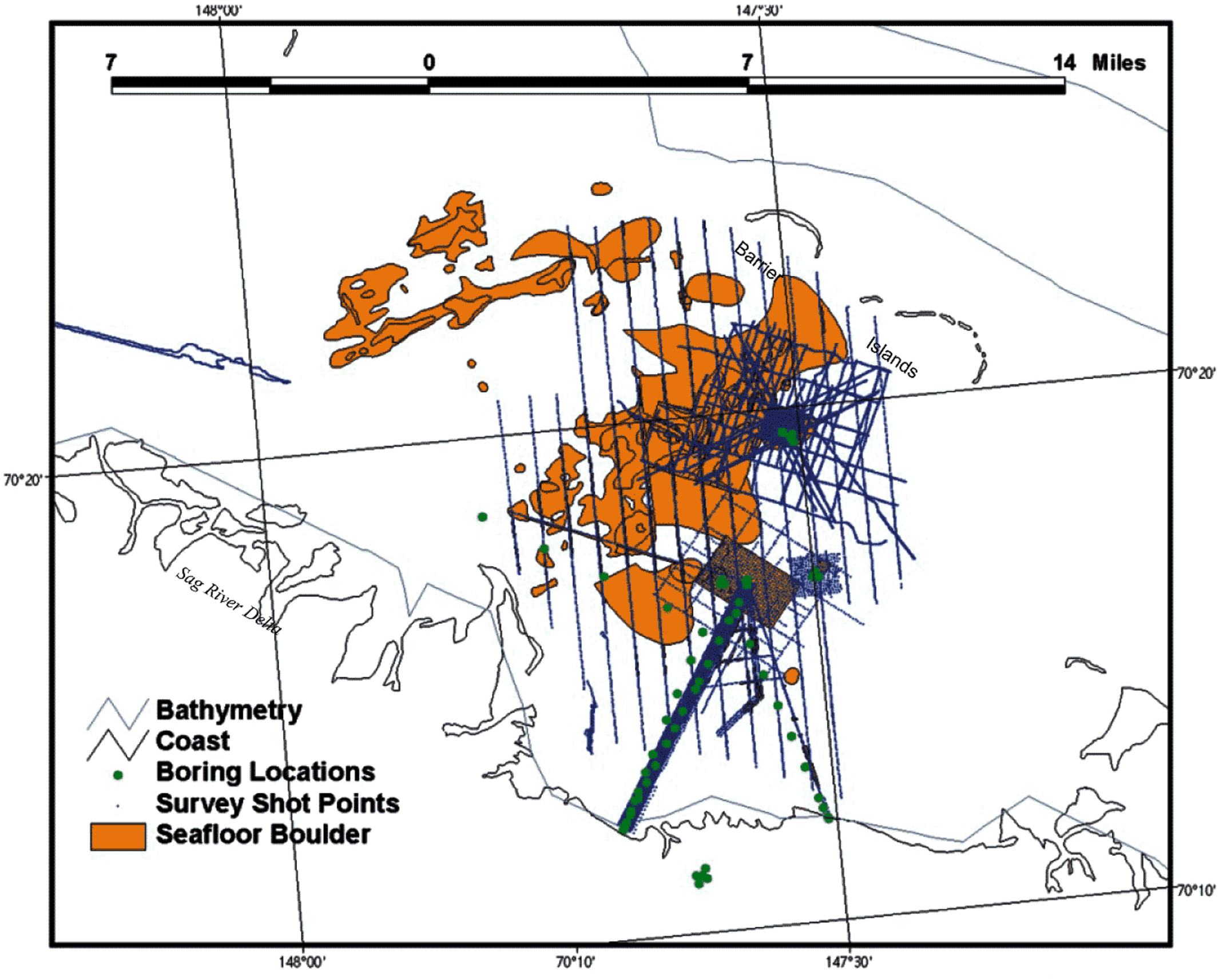


Figure III.A-9 Boulder Patch Kelp Habitat in Foggy Island Bay

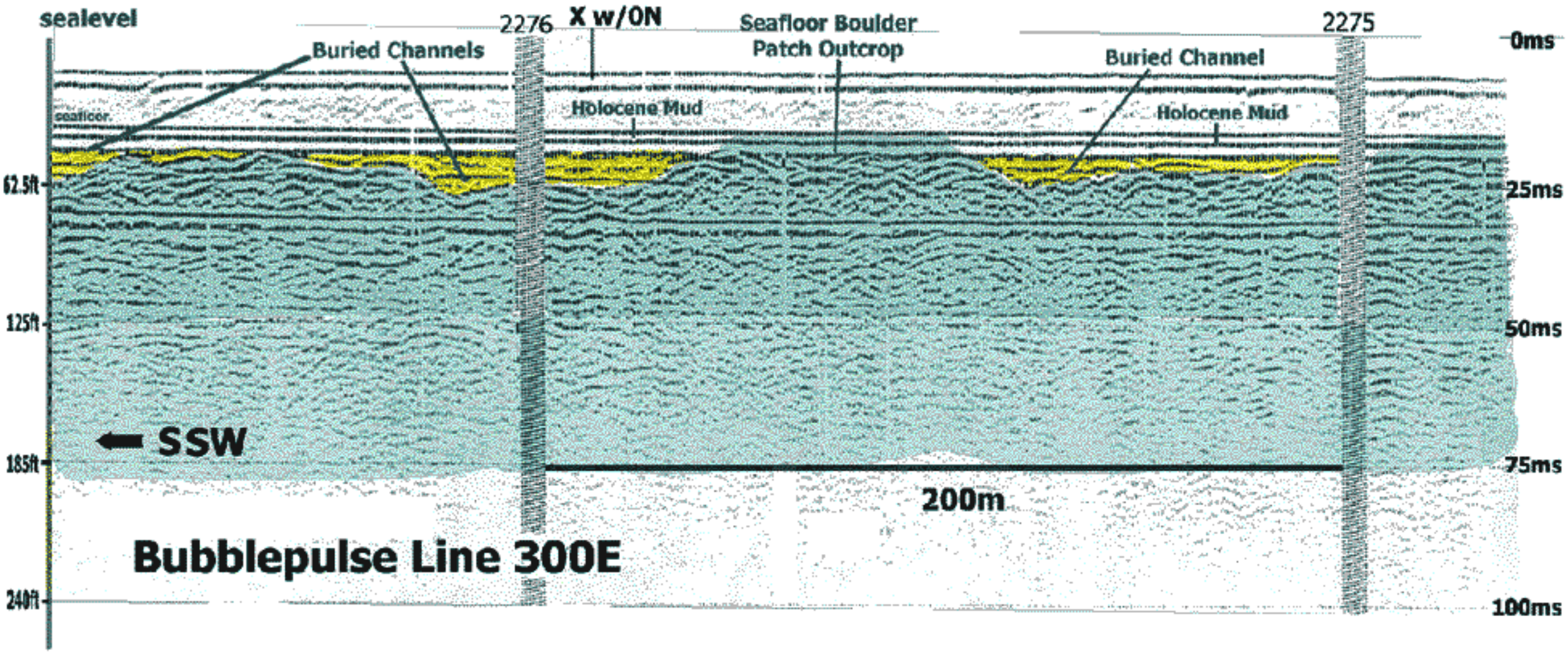


Figure III.A-10a Warthog Profile

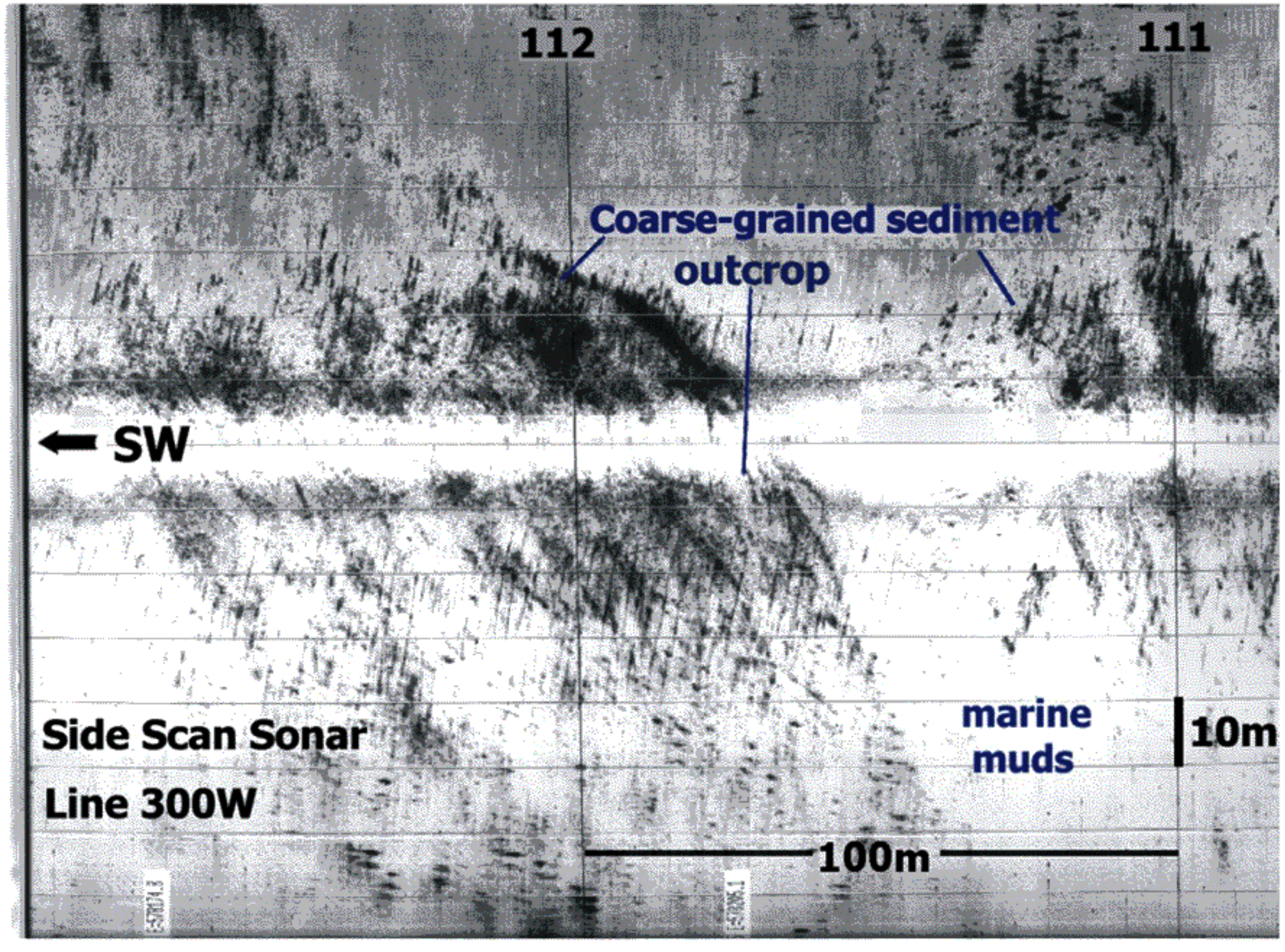


Figure III.A-10b Side Scan Sonar Image of Boulder Outcrop

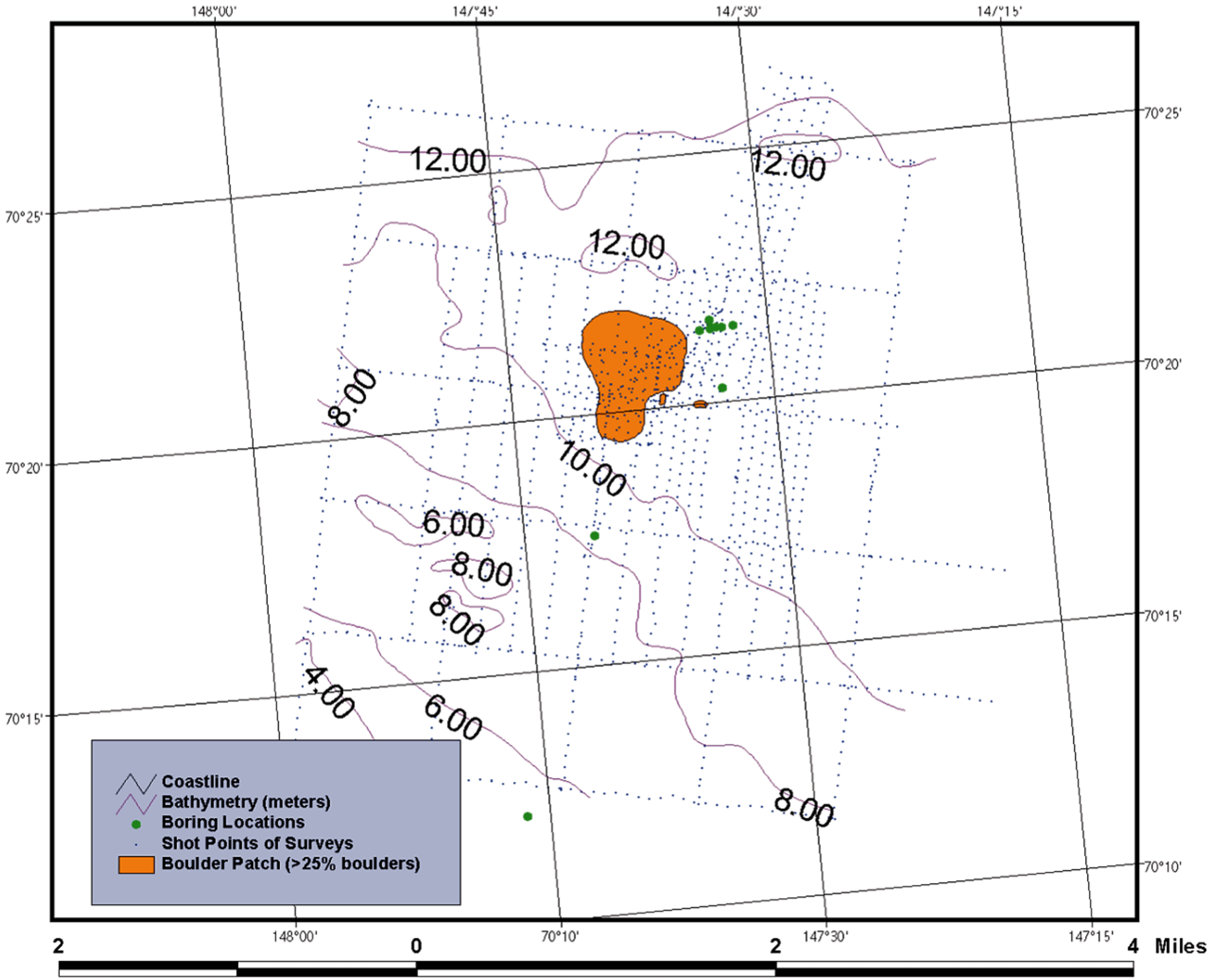


Figure III.A-11 Boulder Patch in Camden Bay, near the Warthog Prospect

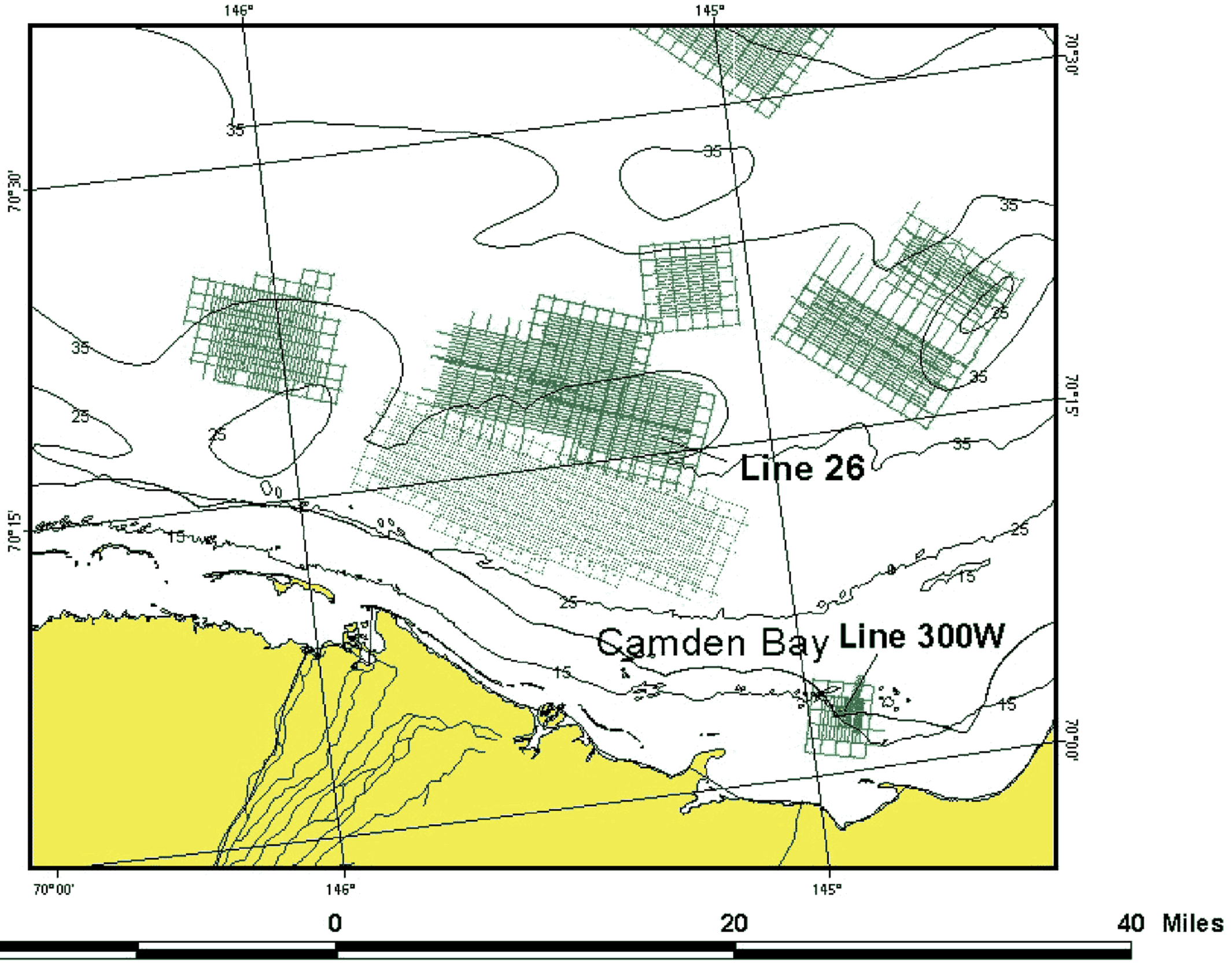


Figure III.A-12 Surveys in Camden Bay Showing Location of Lines in Figures III.A-13 and III.A-14

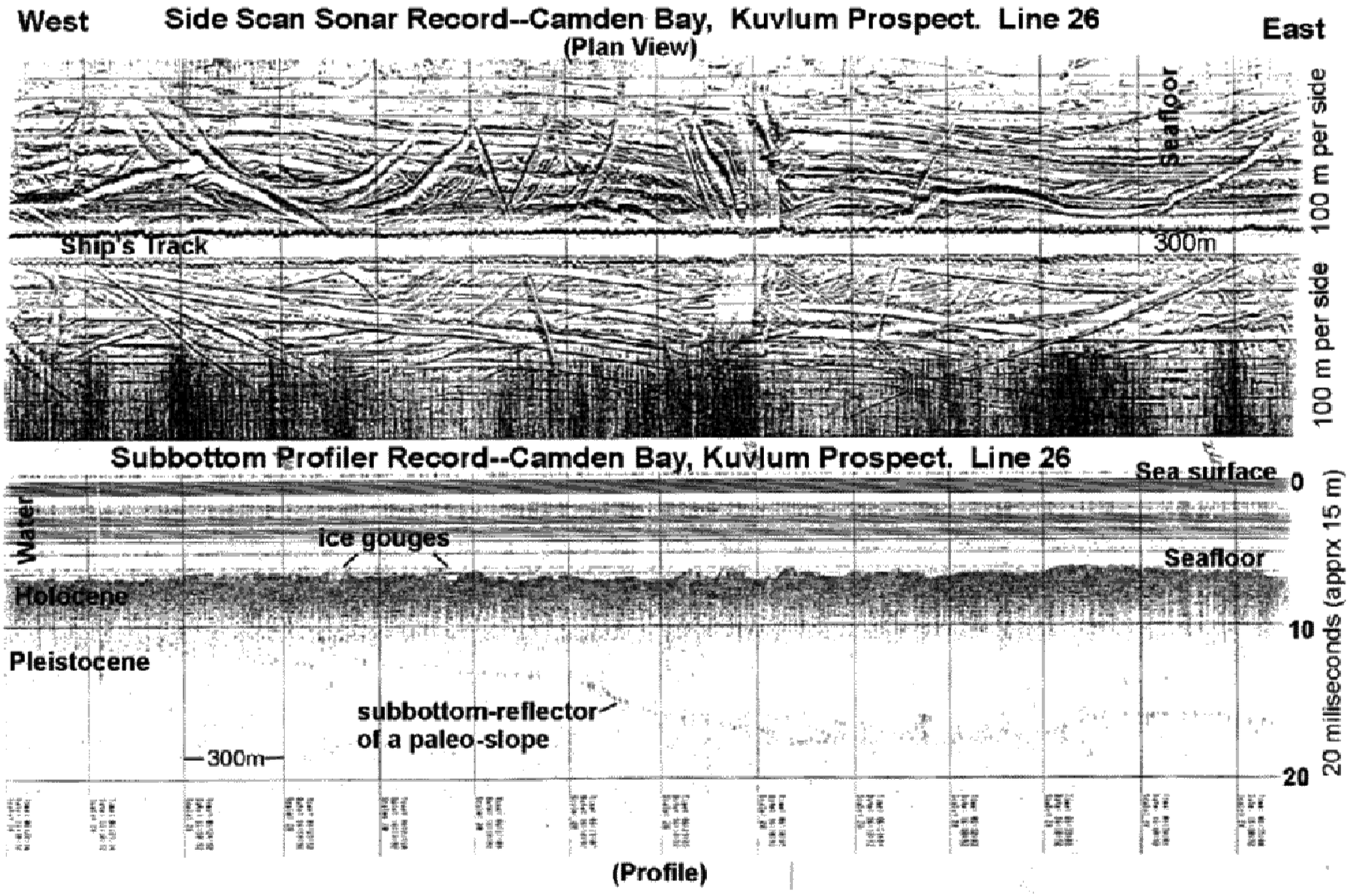


Figure III.A-13

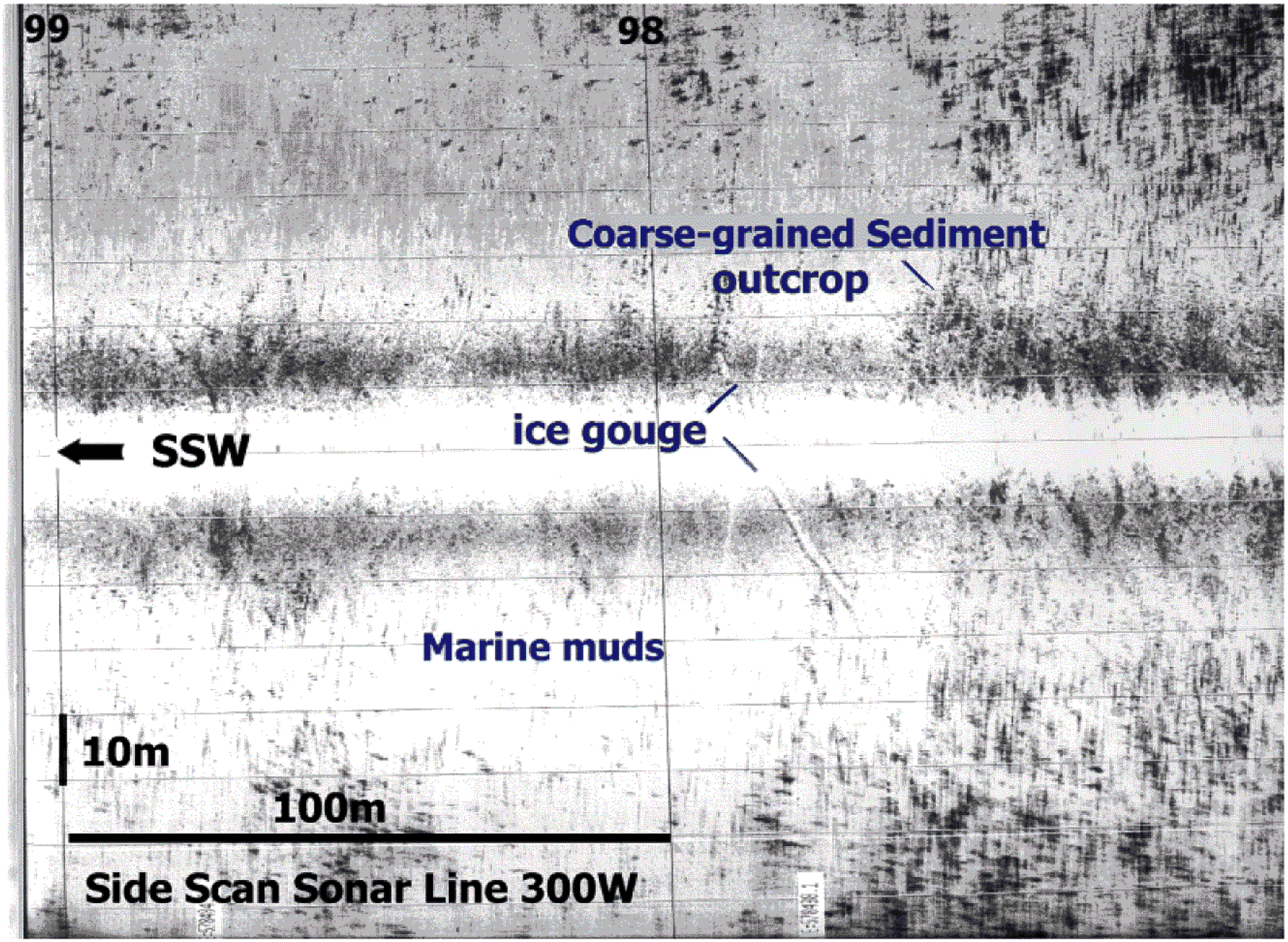


Figure III.A-14 Camden Bay Sea Floor

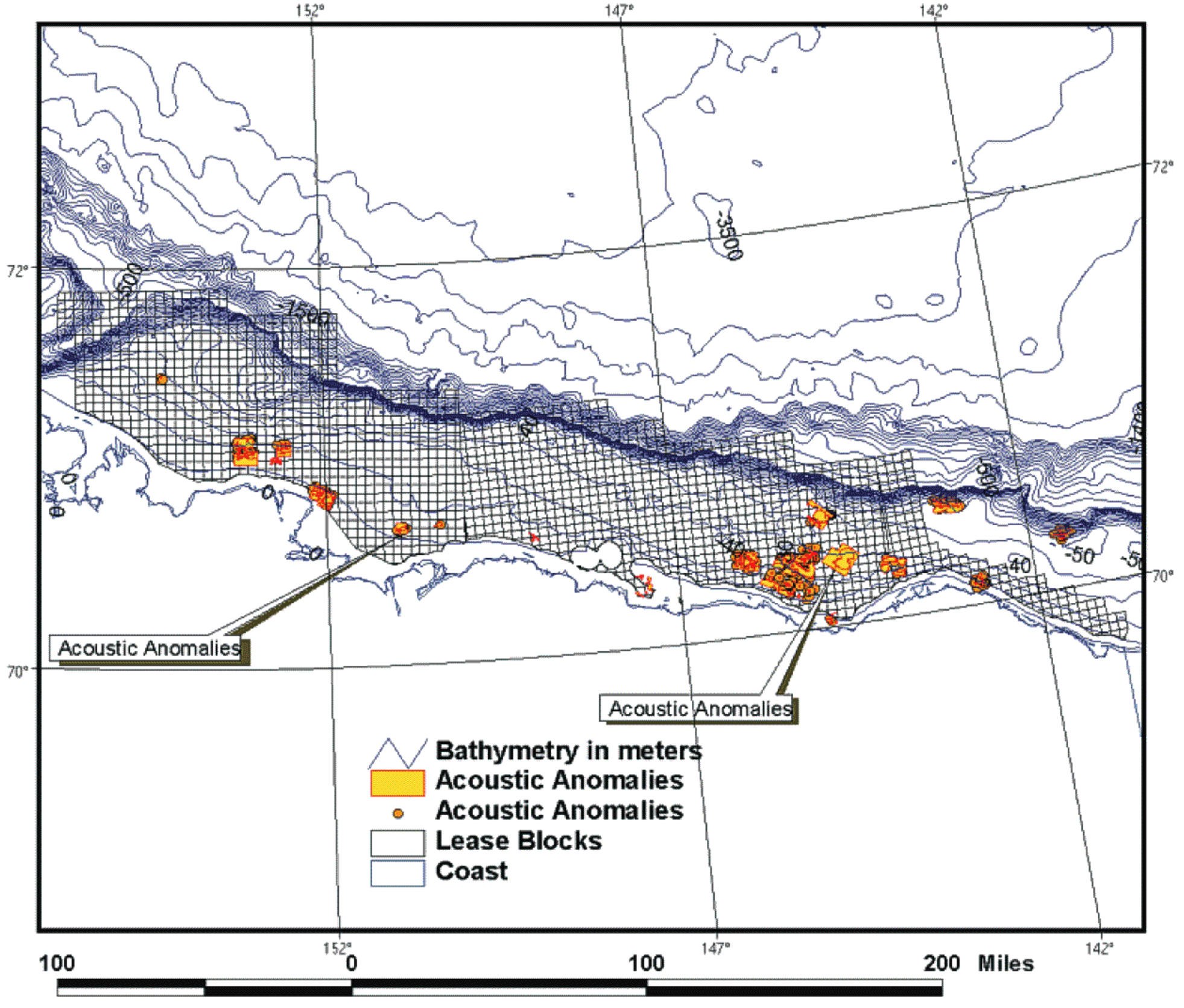


Figure III.A-15 Accoustic Anomalies indicated in High Resolution Seismic Surveys

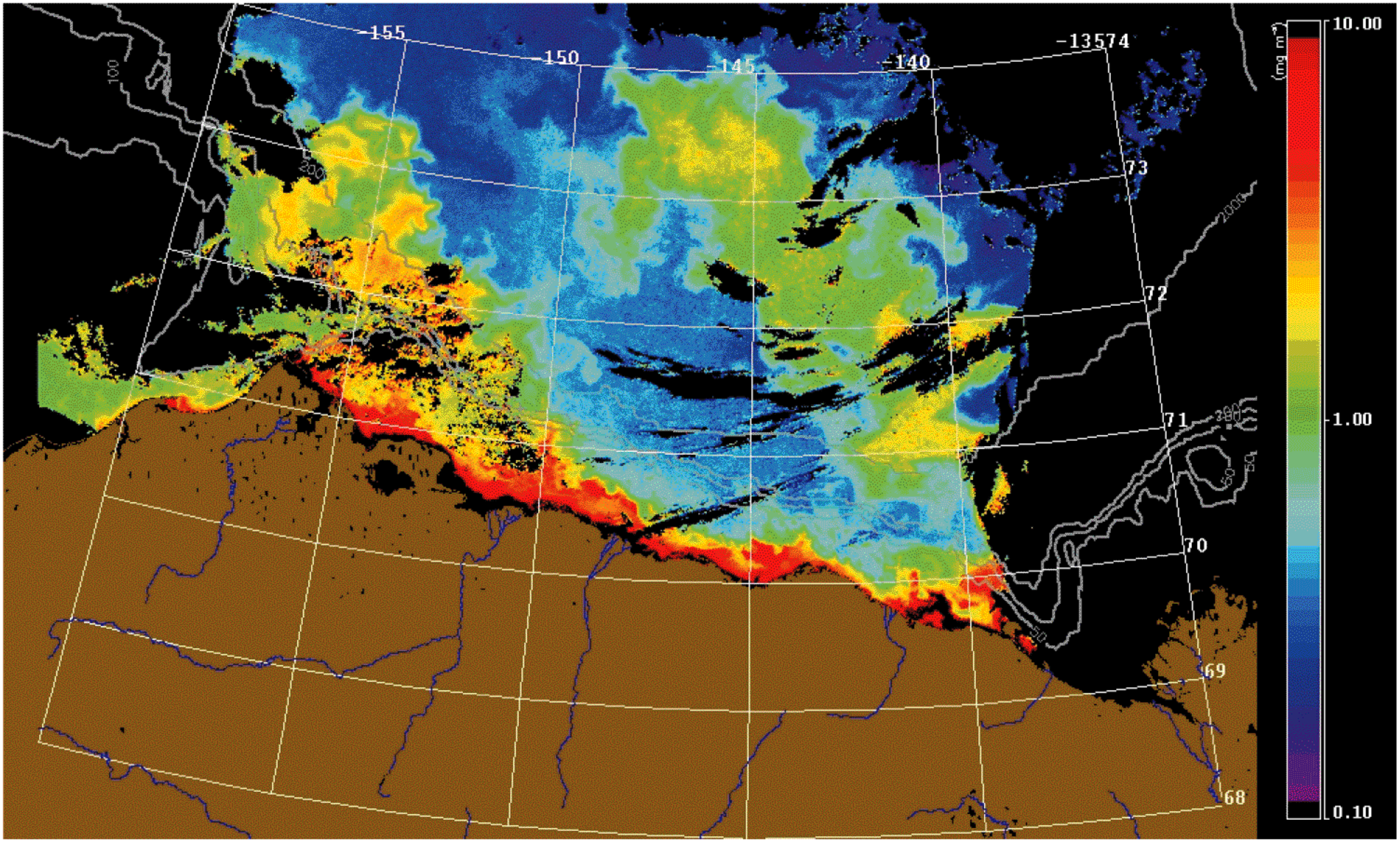


Figure III.B-1a Beaufort Sea Concentrations of Phytoplankton Chlorophyll-a (mg/m)
Derived from SeaWiFS data obtained on 26 July 1998. Image provided by SeaWiFS Project, NASA/Goddard Space Flight Center, and ORBIMAGE.
Black areas indicate sea ice, cloud cover, or coastal waters with high sediment concentrations.

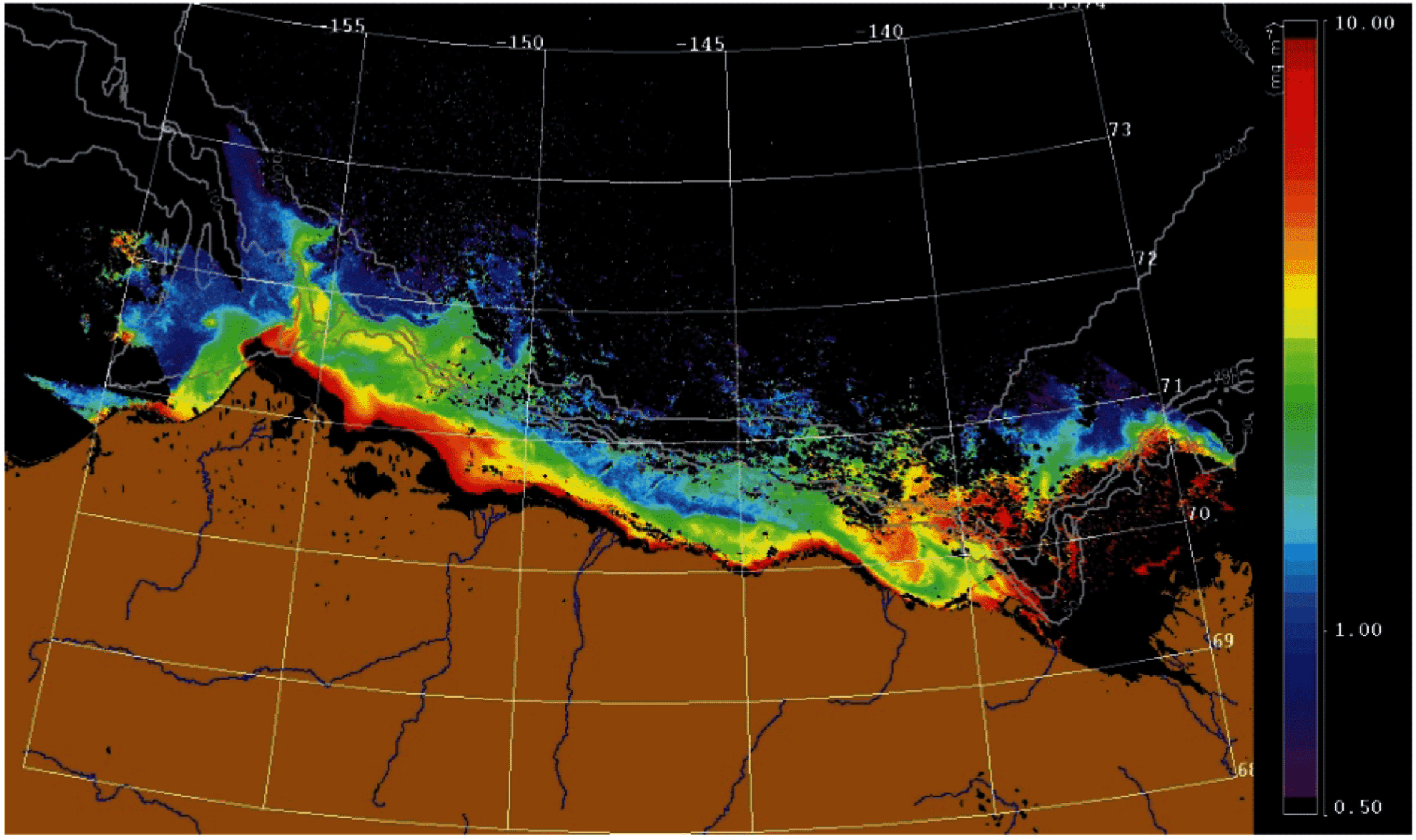


Figure III.B-1b Beaufort Sea Concentrations of Phytoplankton Chlorophyll-a (mg/m^3)
Derived from SeaWiFS data obtained on 30 August 2000. Image provided by SeaWiFS Project, NASA/Goddard Space Flight Center.
Black areas indicate sea ice, cloud cover, or coastal waters with high sediment concentrations.

Freshwater Fish

Ninespine stickleback (2.5")

Arctic grayling (12-15")

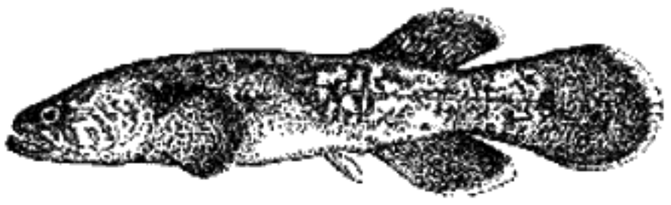
Round whitefish (8-12")

Slimy sculpin (3")

Burbot (15")

Lake trout (15-20")

Longnose sucker (12-14")



Alaska blackfish (3-6")

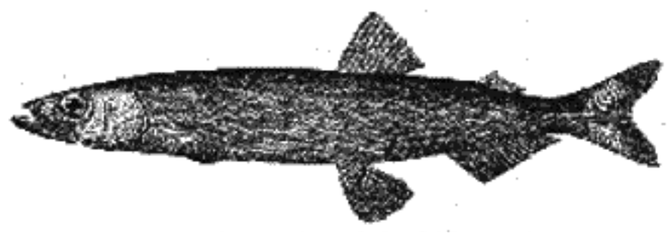
Northern pike (18-30")

Arctic lamprey (11")

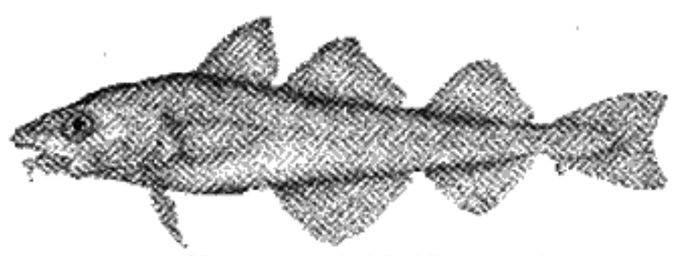
Marine Fish

Arctic cod (13" max.)

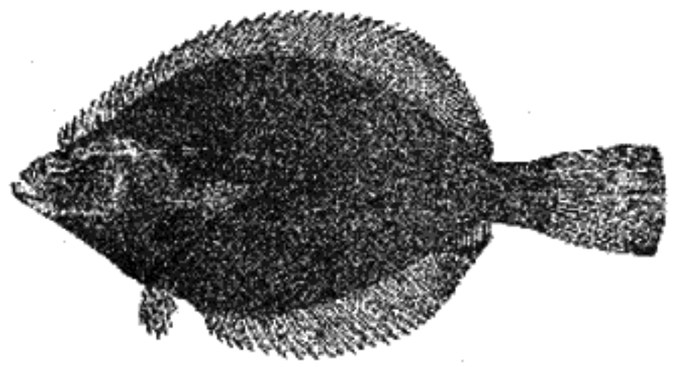
Fourhorn sculpin (8")



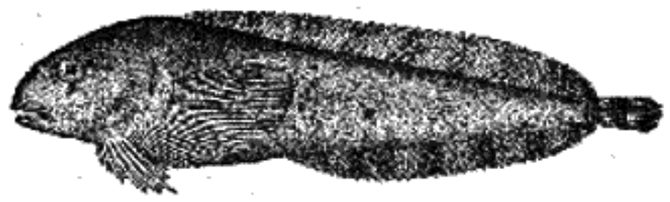
Capelin (5-8")



Saffron cod (20" max.)



Arctic flounder (14" max.)



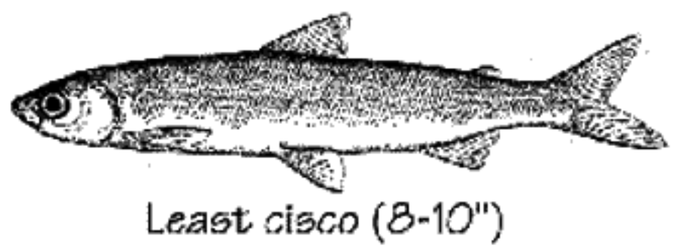
Snailfish (5-10")

Canadian eelpout (12")

(Average size unless otherwise indicated)

Migratory Fish

Arctic cisco (12-15")



Least cisco (8-10")

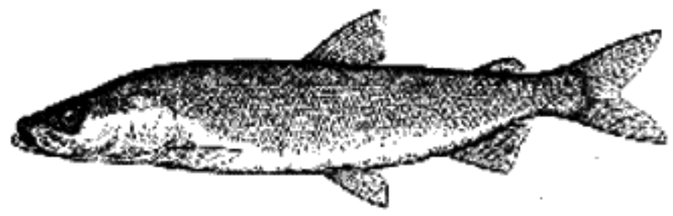
Humpback whitefish (16")

Broad whitefish (18")

Rainbow smelt (7-8")

Bering cisco (12")

Arctic char (15-18")



Inconnu (18-30")

Sources: Mcphail and Lindsey (1970); Turner (1886); Morrow(1980)
Dalen (1980); Evermann and Goldsbourgh (1904)

Figure III.B-2 Fishes of the Arctic Environment

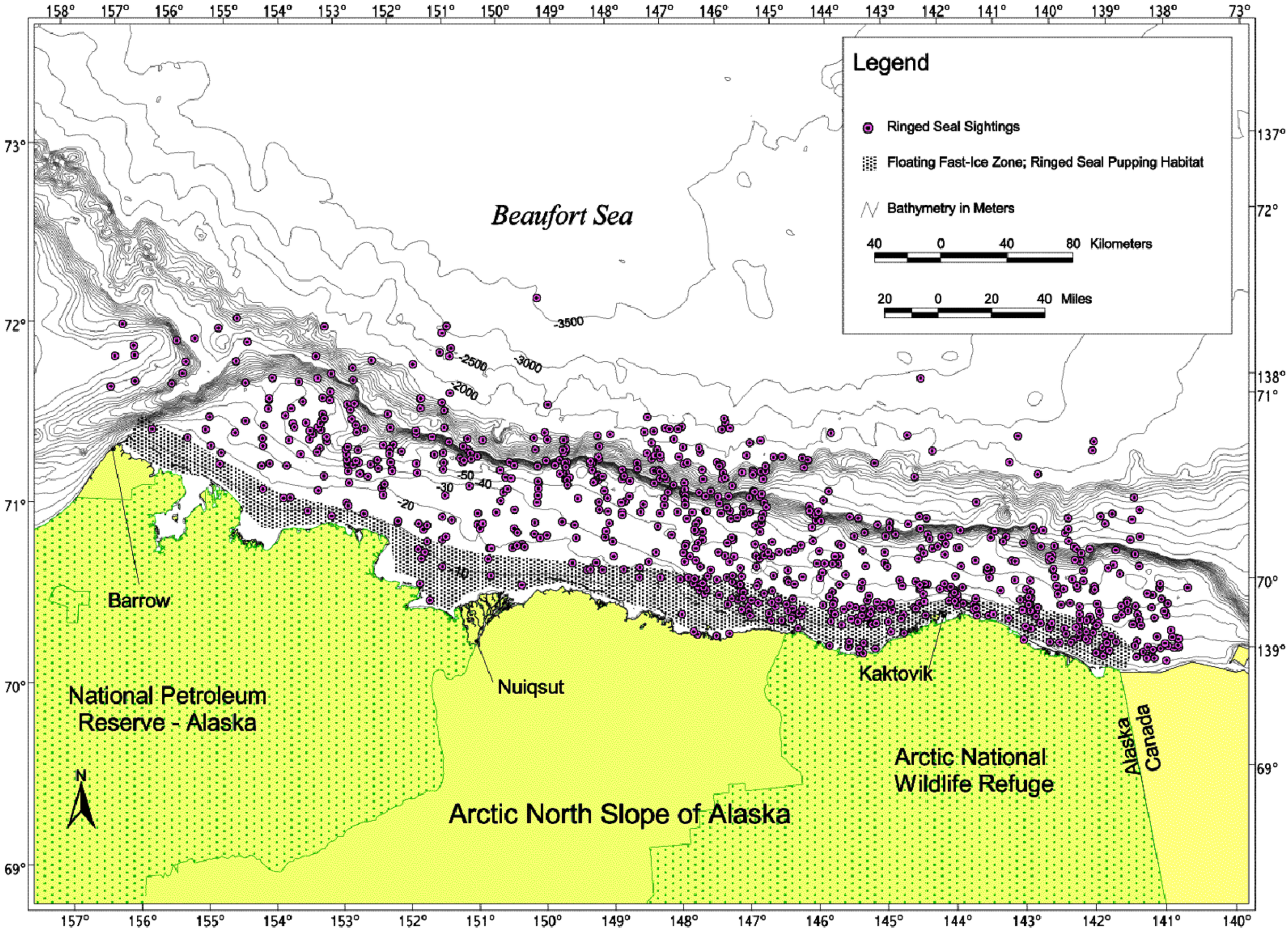


Figure III.B-3.a Ringed Seal Sightings in the Beaufort Sea Planning Area Recorded during Aerial Surveys from 1987 through 1999 (BWASP database).

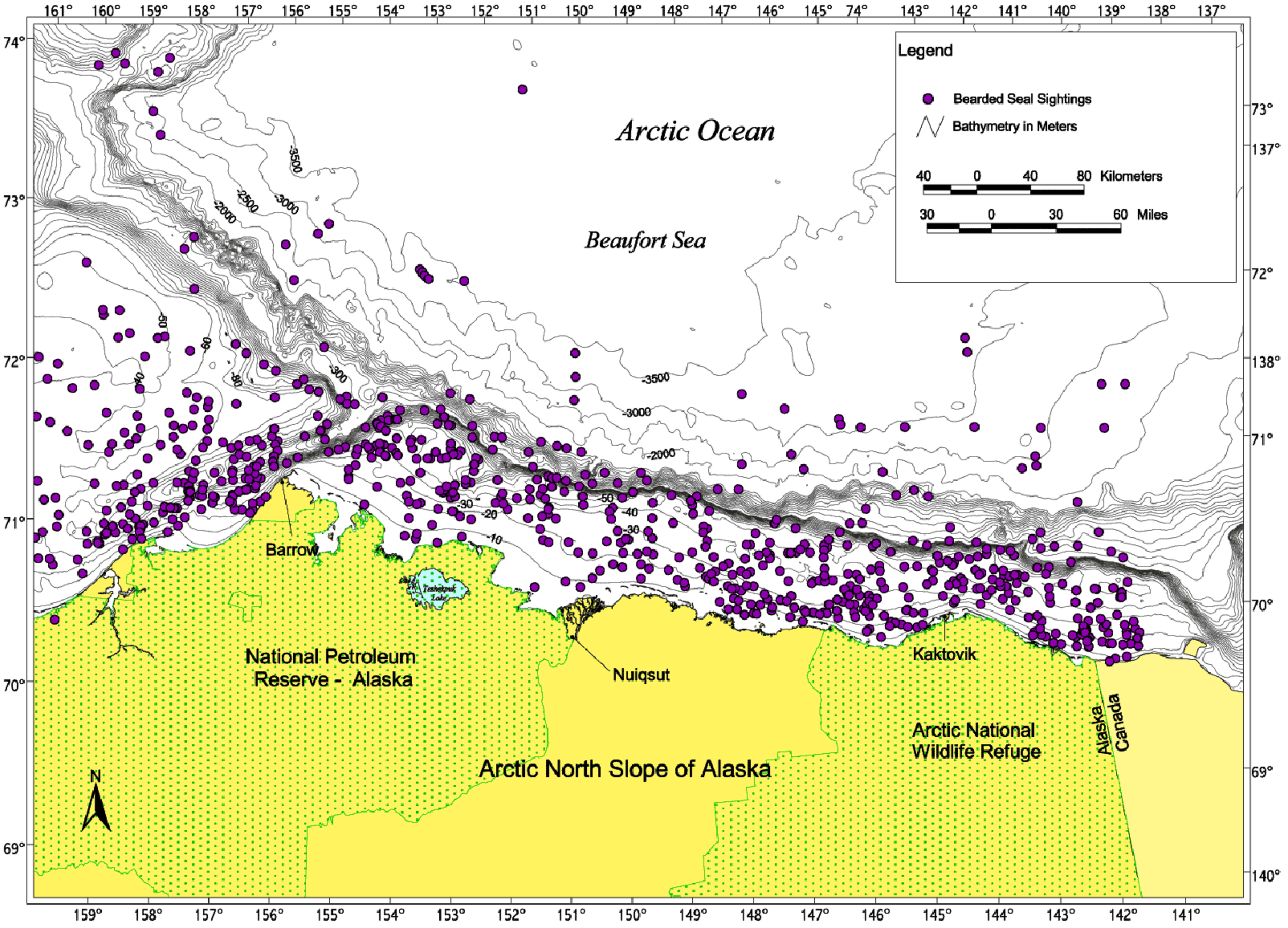


Figure III.B-3b Bearded Seal Sightings in the Beaufort Sea Planning Area Recorded during Aerial Surveys from 1979 through 1999 (NOSC and BWASP databases).

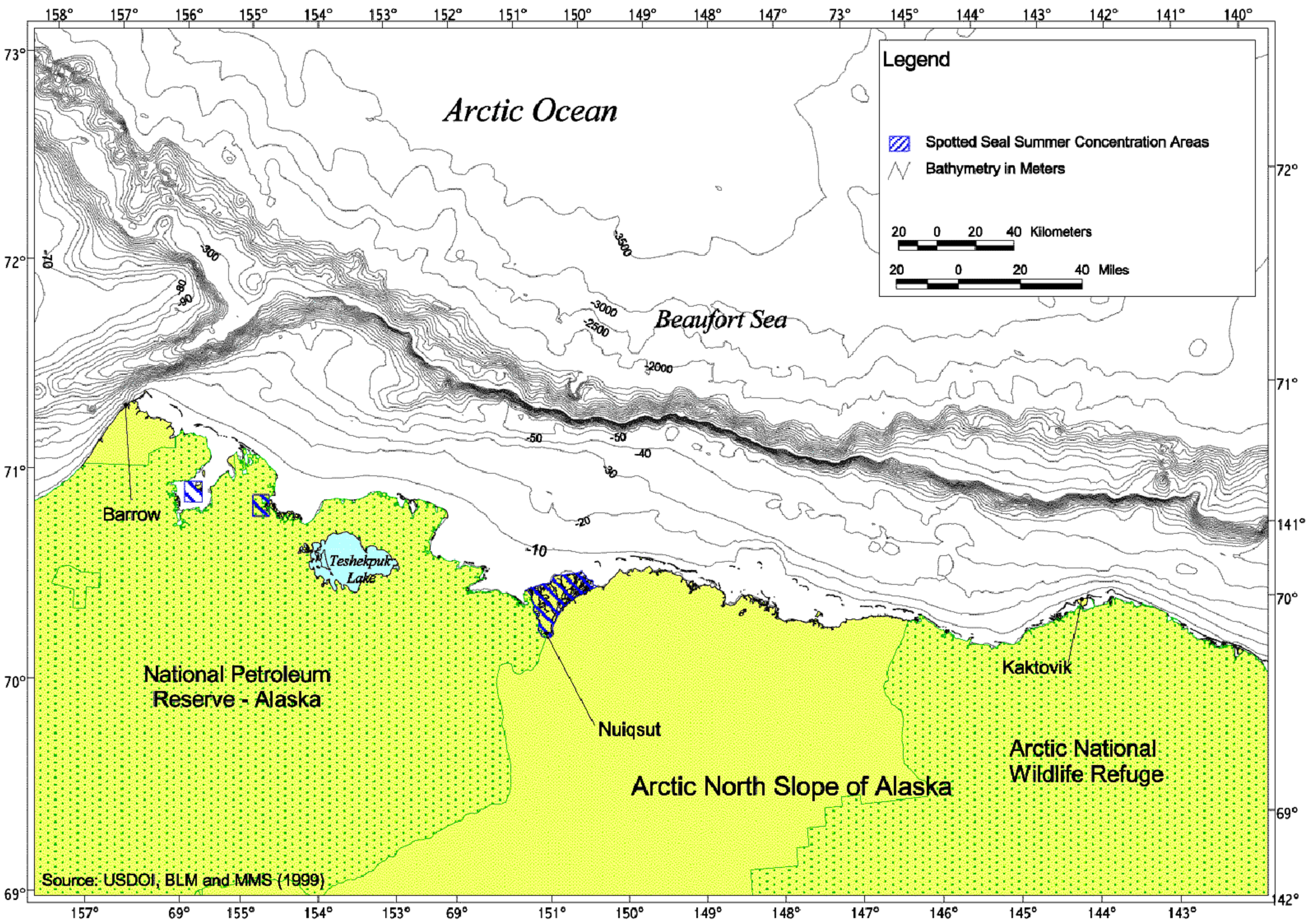


Figure III.B-3c Spotted Seal Summer Concentration Areas

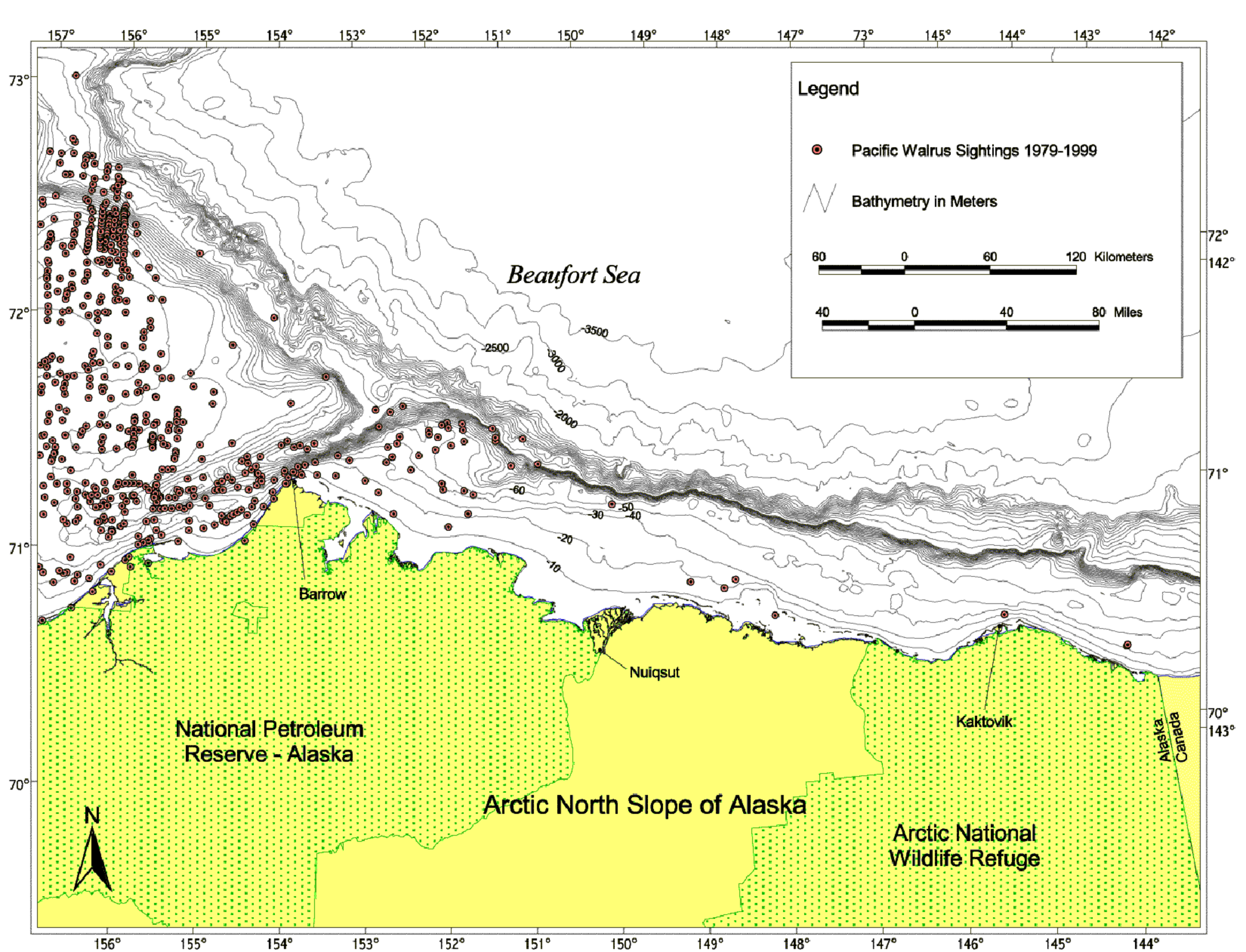


Figure III.B-3d Walrus Sightings in the Beaufort Sea Planning Area Recorded during Aerial Surveys from 1979 through 1999 (NOSC and BWASP databases).

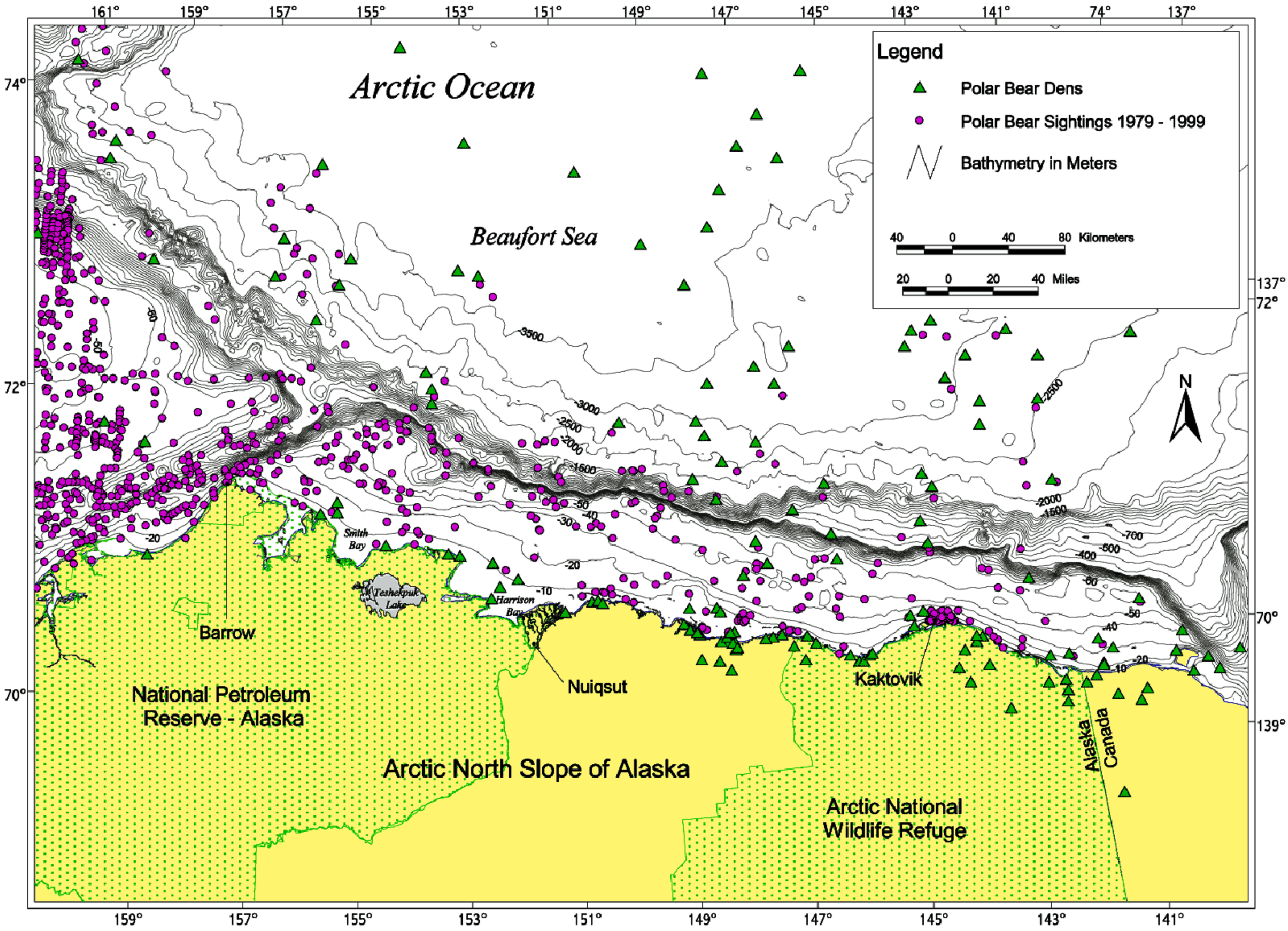


Figure III.B-3e Polar Bear Sightings in the Beaufort Sea Planning Area Recorded during Aerial Surveys from 1979 through 1999 (NOSC and BWASP databases). Maternity Polar Bear Dens Discovered by Radio Telemetry (Dr. Steven C. Amstrup, USGS).

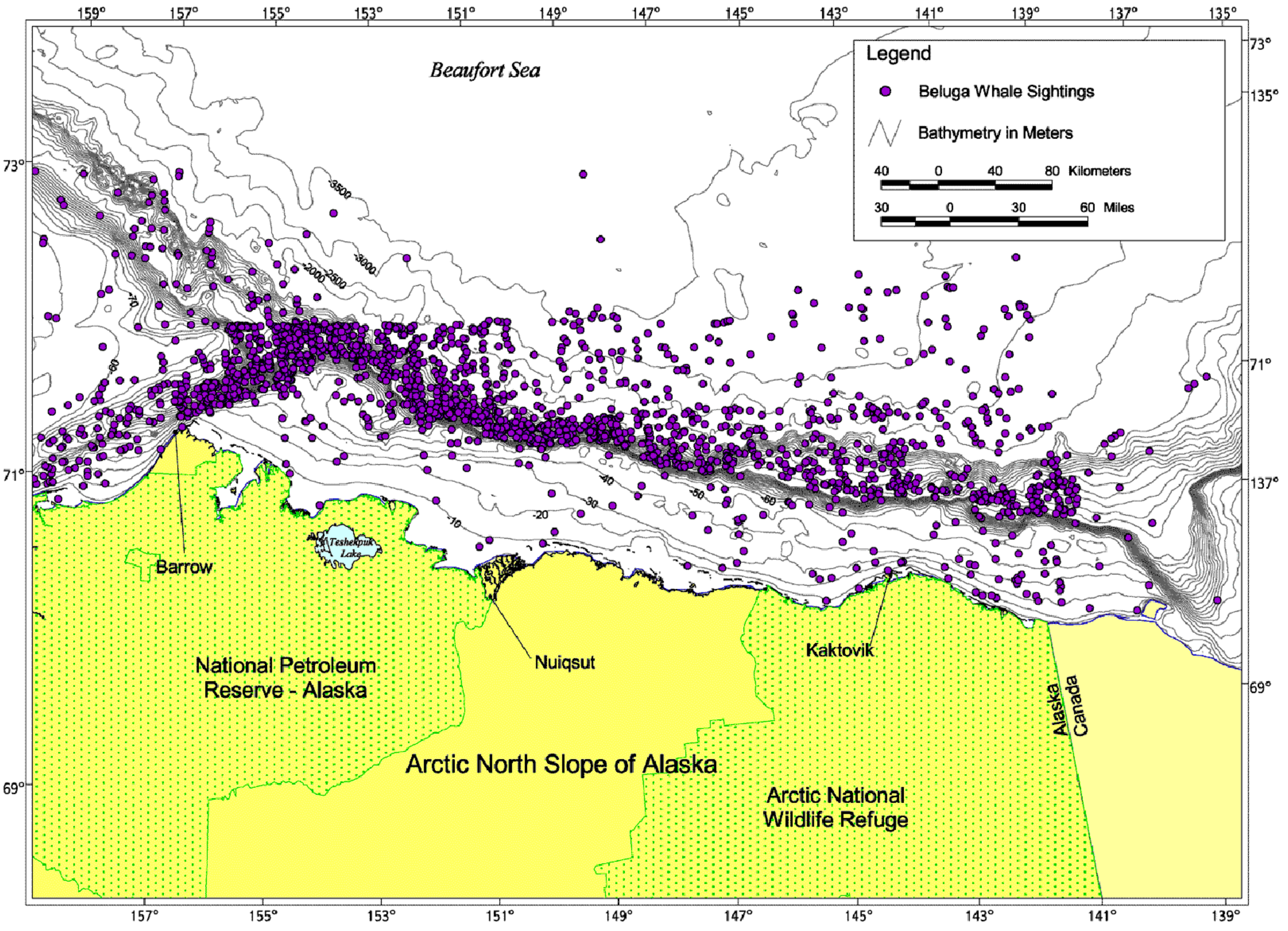


Figure III.B-3f Beluga Whale Sightings in the Beaufort Sea Planning Area Recorded during Aerial Surveys from 1979 through 1999 (NOSC and BWASP databases).

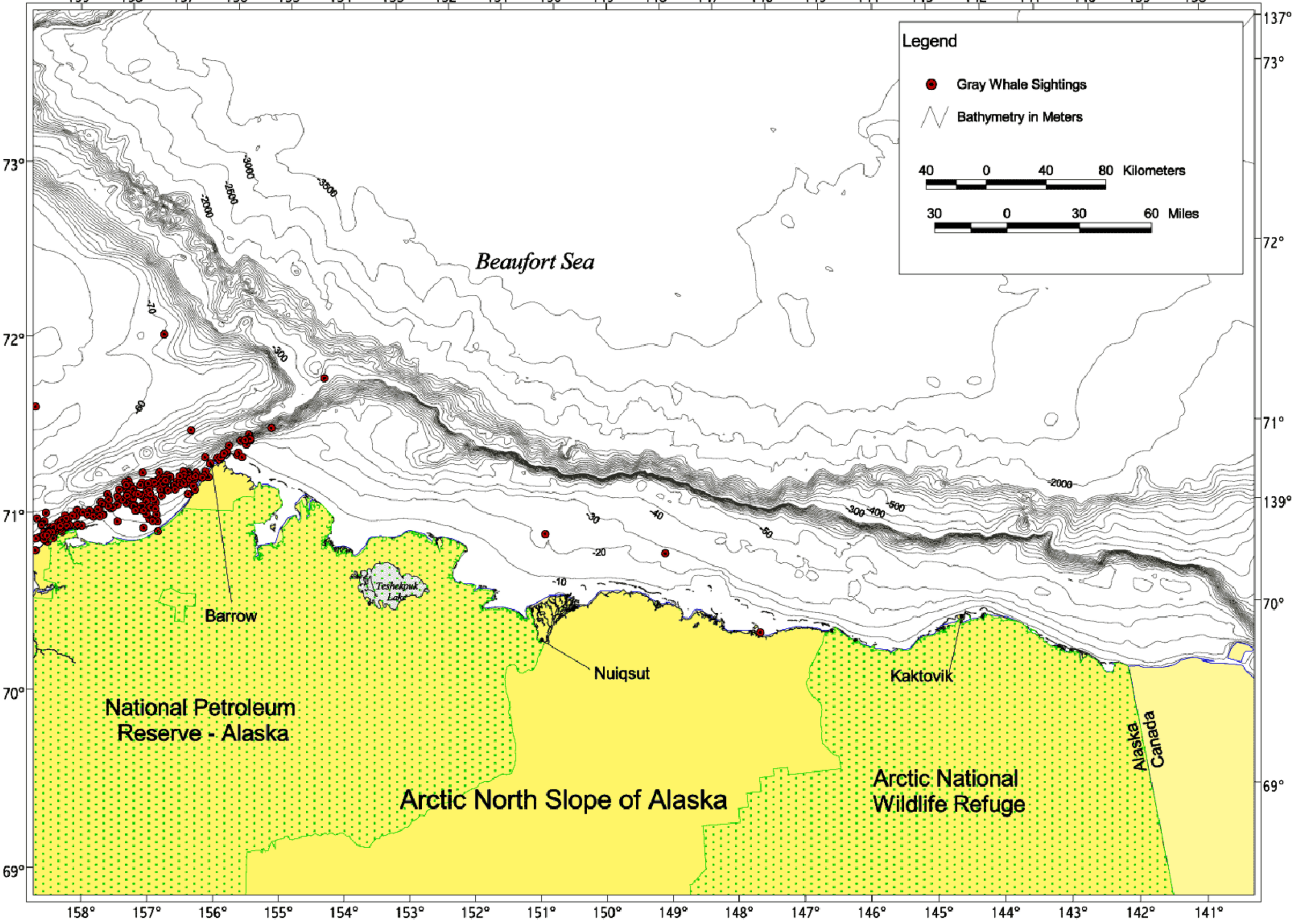


Figure III.B-3g Gray Whale Sightings in the Beaufort Sea Planning Area Recorded during Aerial Surveys from 1979 through 1999 (NOSC and BWASP databases).

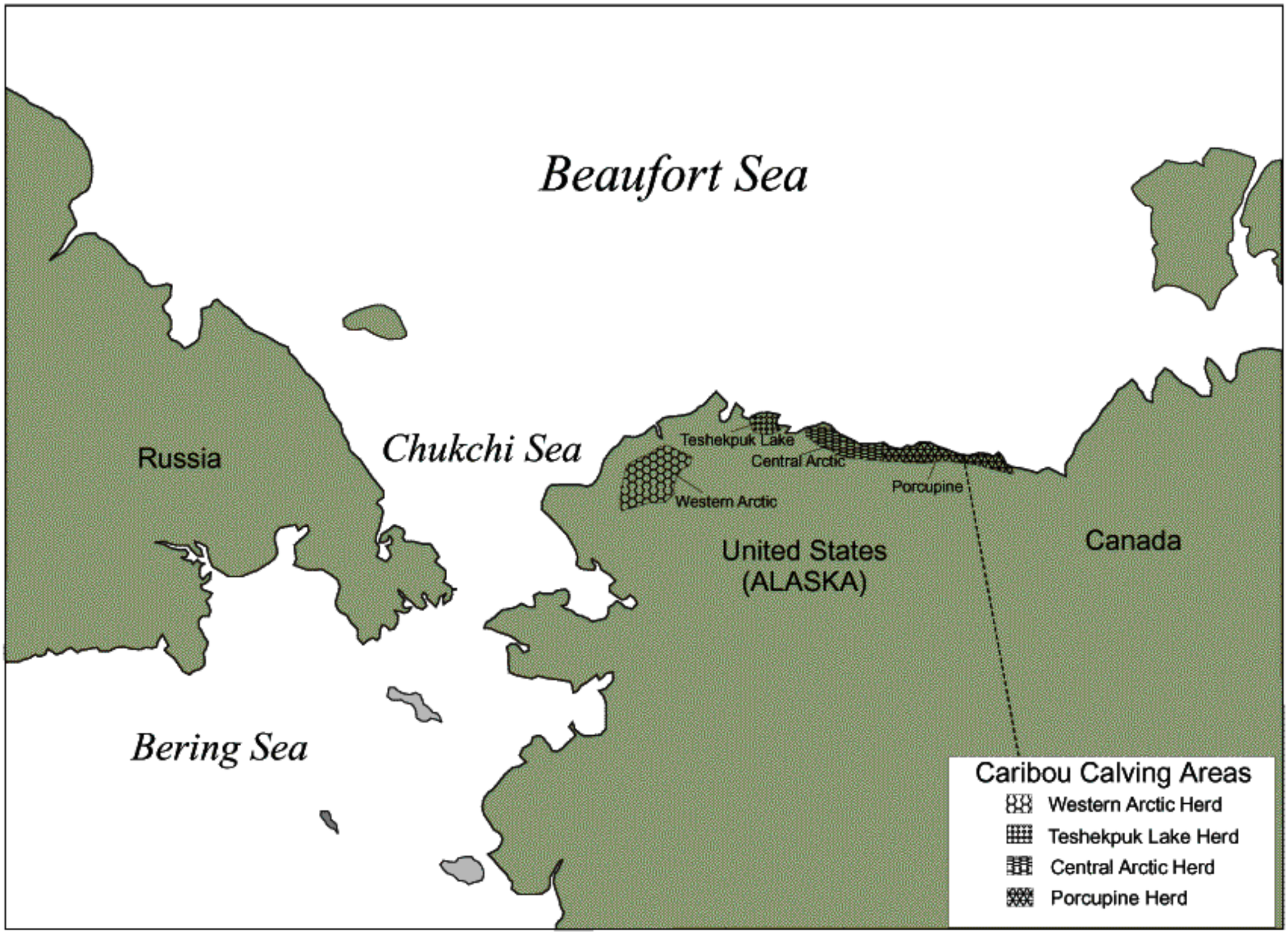


Figure III.B-4 Caribou Calving Areas

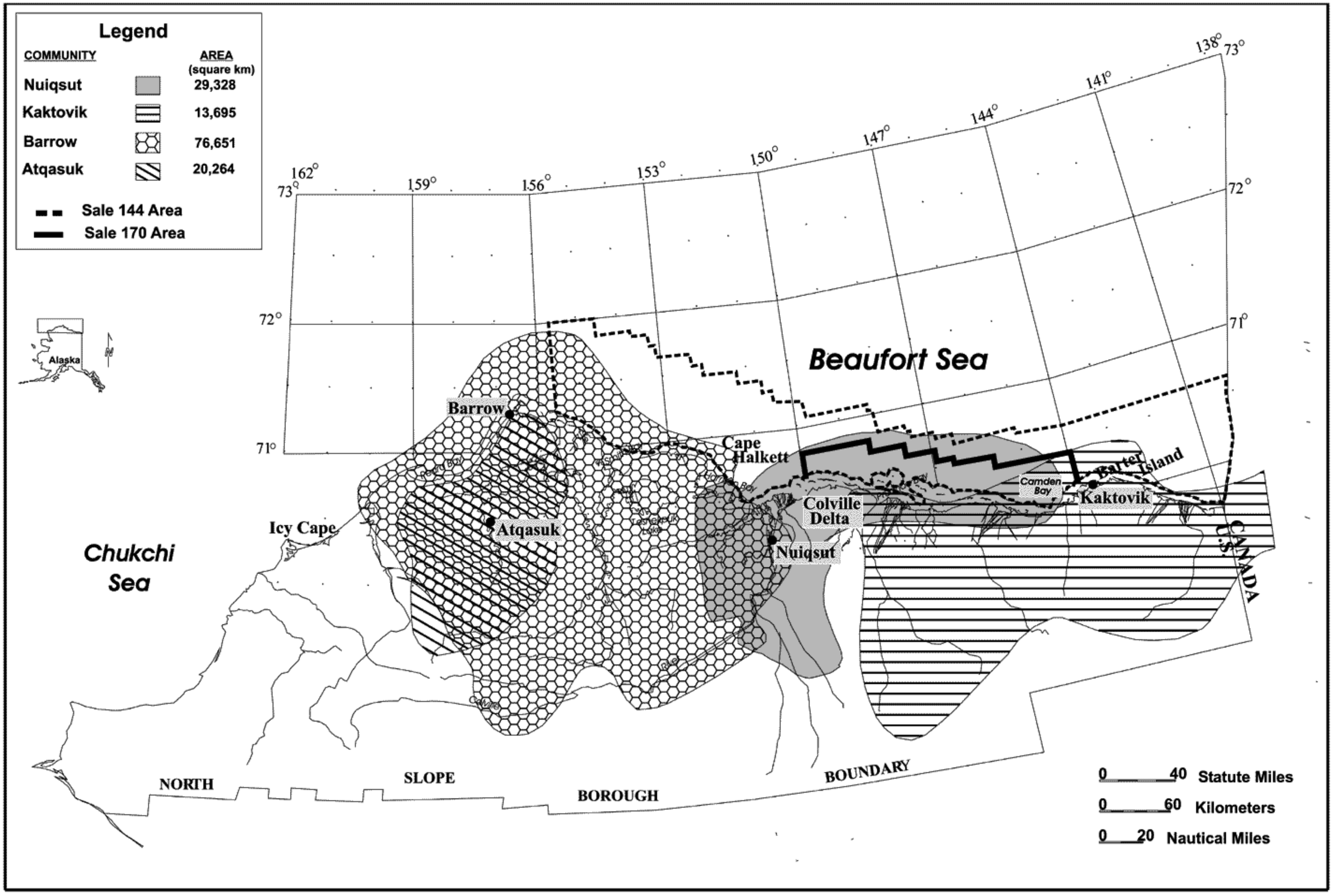


Figure III.C-1 Subsistence-Harvest Areas for Beaufort Sea Communities
Sources: Impact Assessment Inc. (1990a and b) (Nuiqsut and Kaktovik); and Braund (1989a and b) (Barrow).

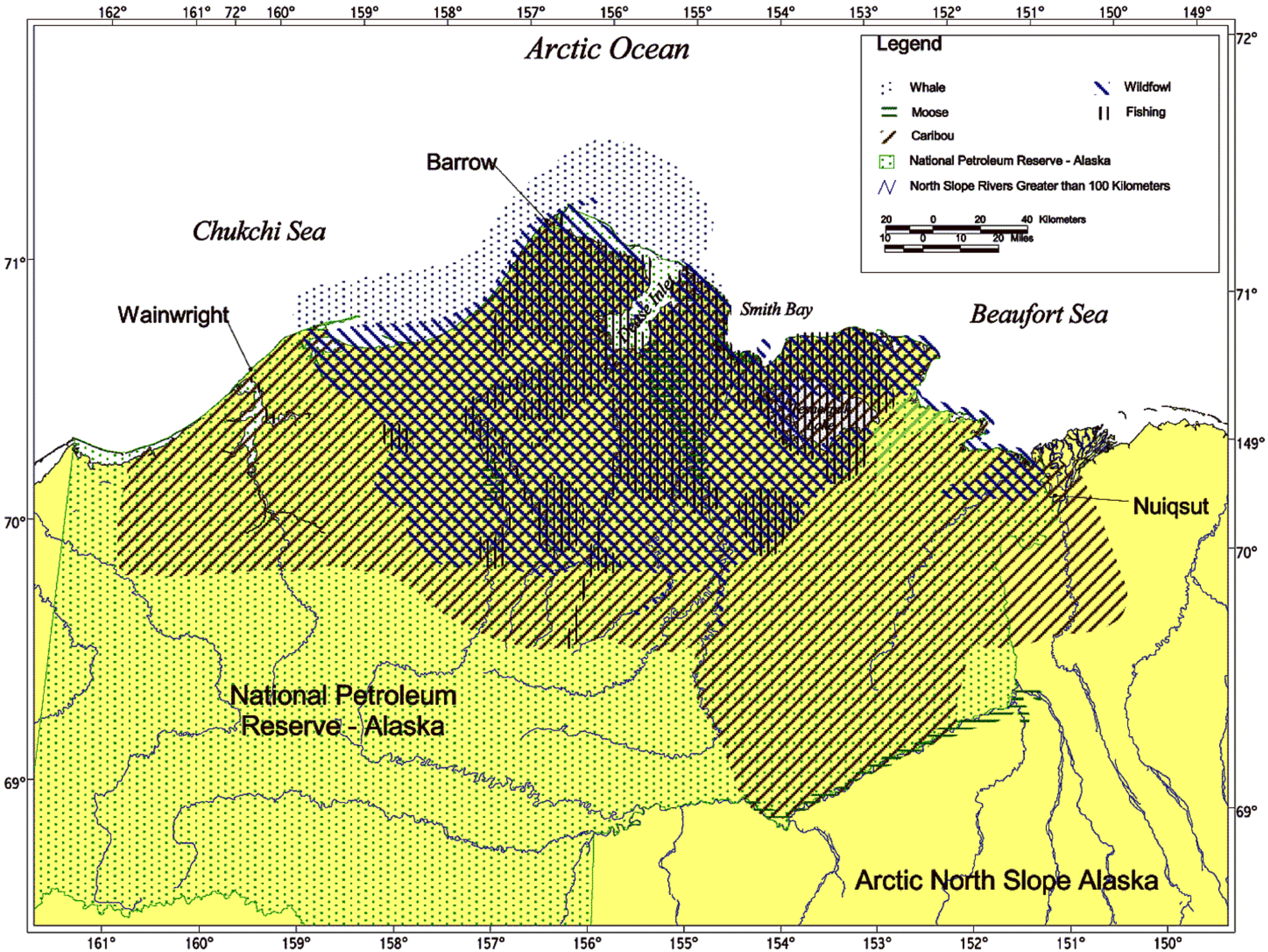


Figure III.C-2 Subsistence Areas for Barrow
(Described in 1979)

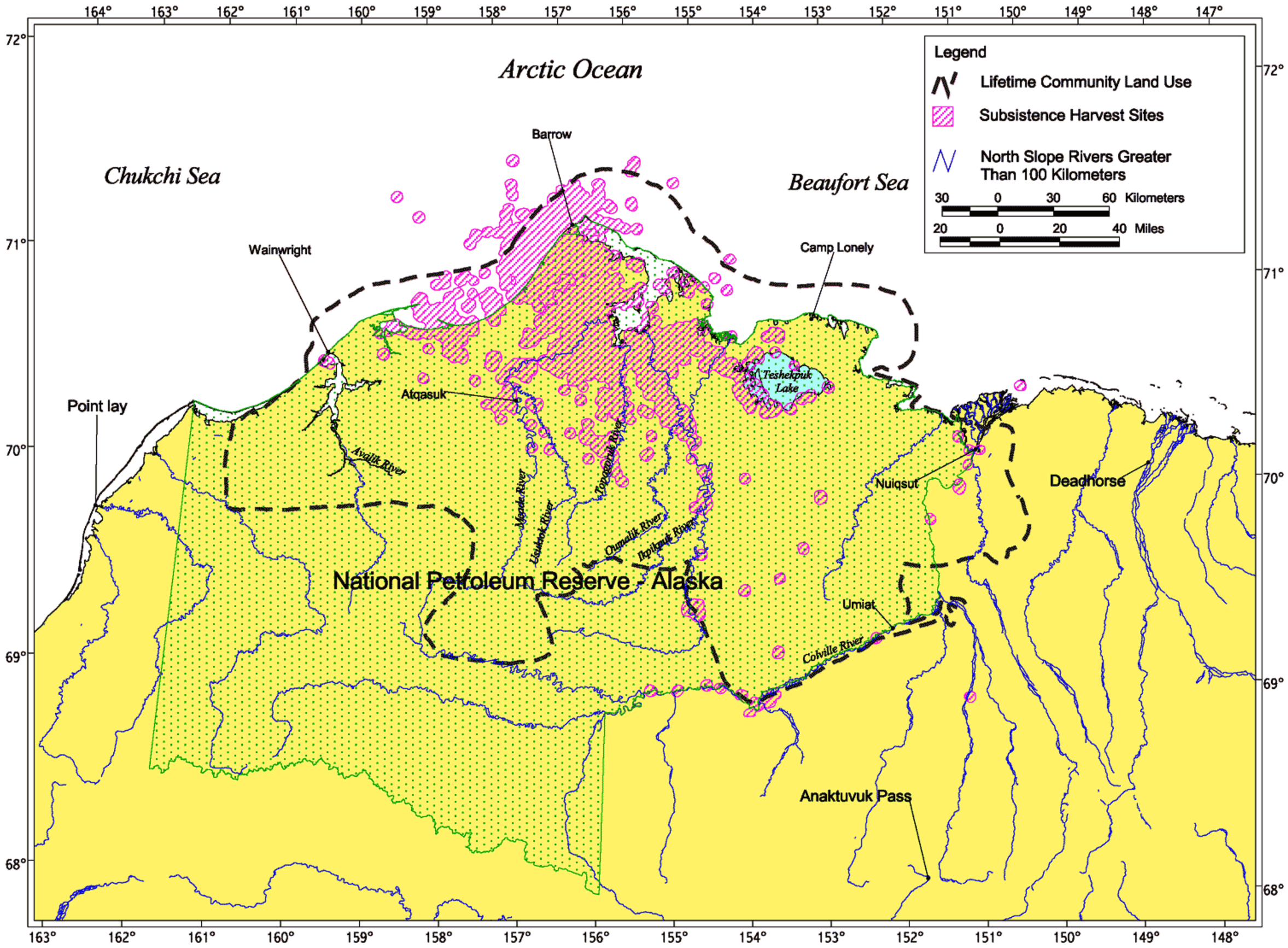


Figure III.C-3 Barrow Subsistence Harvest Sites for All Resources April 1, 1987 to March 31, 1990

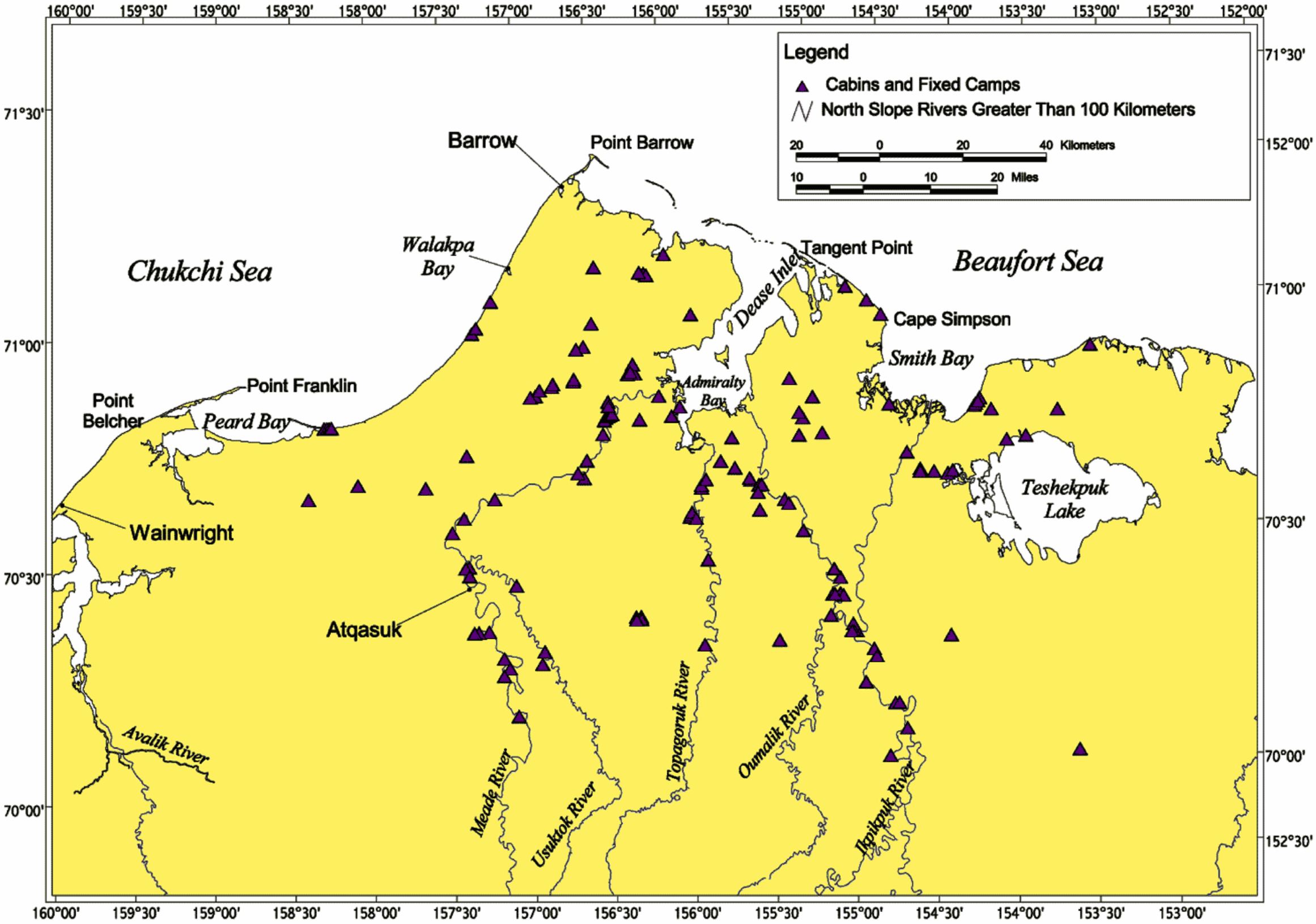
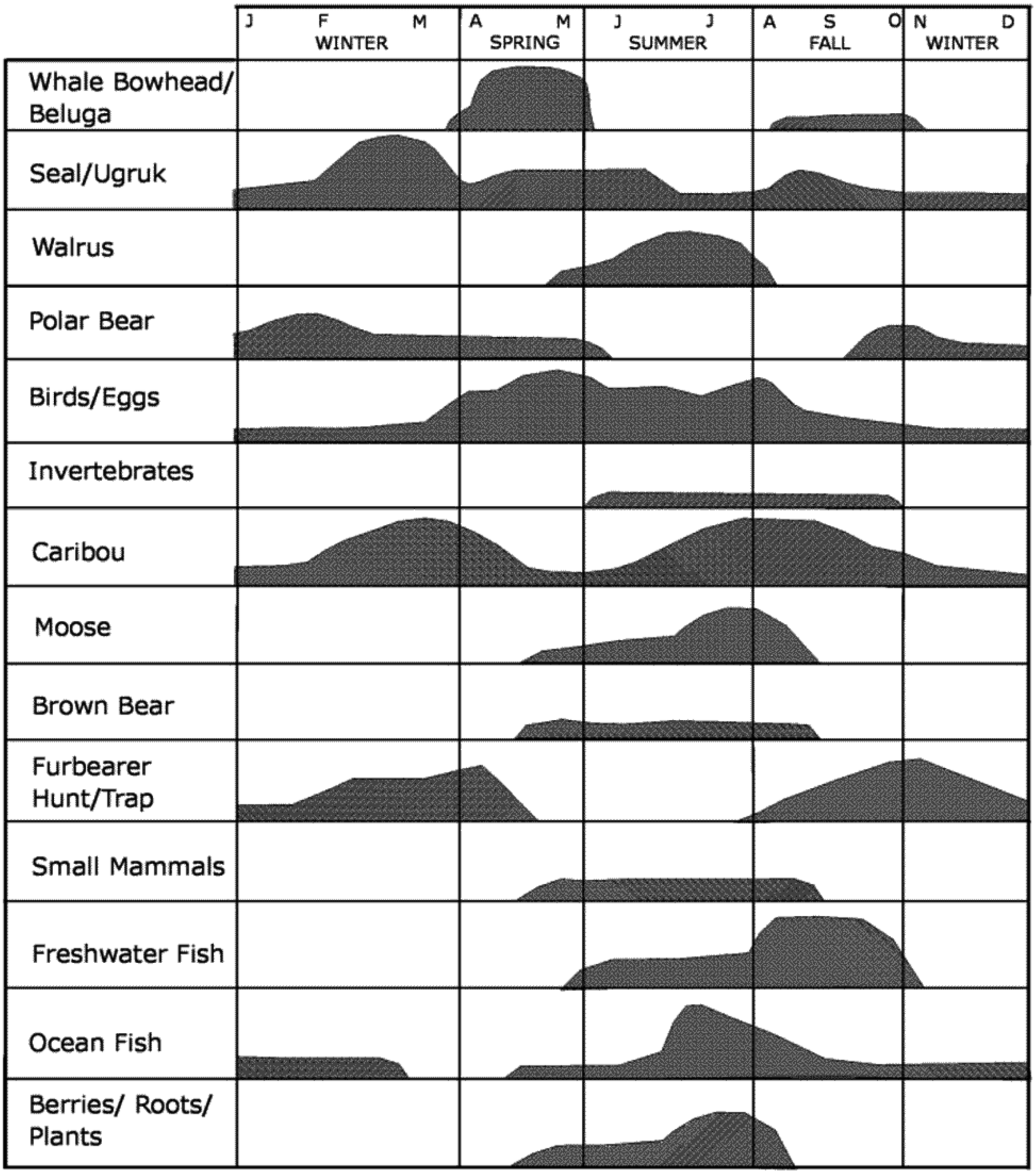


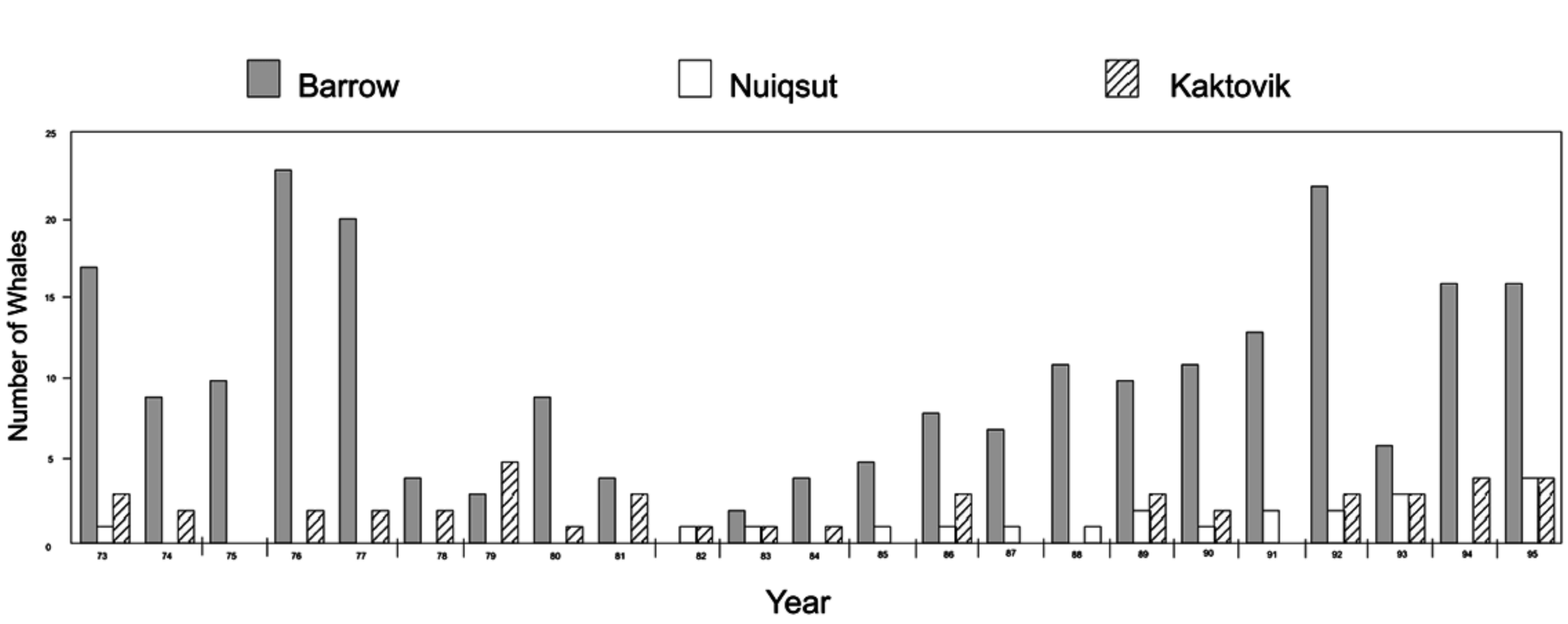
Figure III.C-4 Barrow Fixed Hunting and Fishing Camps



Source: North Slope Borough Contract Staff (1979).

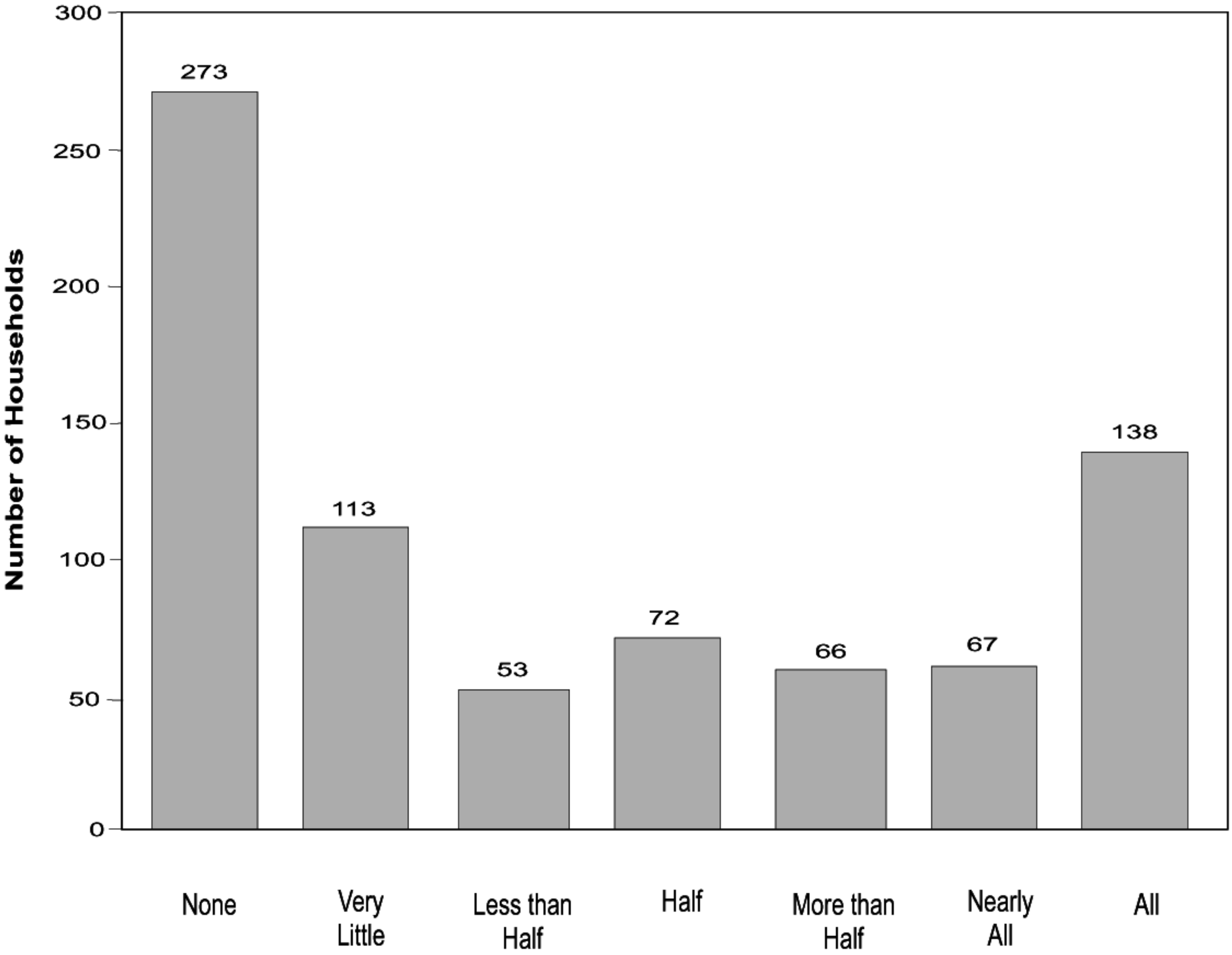
Figure III.C-5 Barrow Annual Subsistence Cycle

Patterns indicate desired periods for pursuit of each species based on the relationship of abundance, hunter access,seasonal Needs, and desirability. Peaks represent optimal periods of pursuit of subsistence resources. (Data for invertebrates, sheep, and ocean fish are unavailable.)



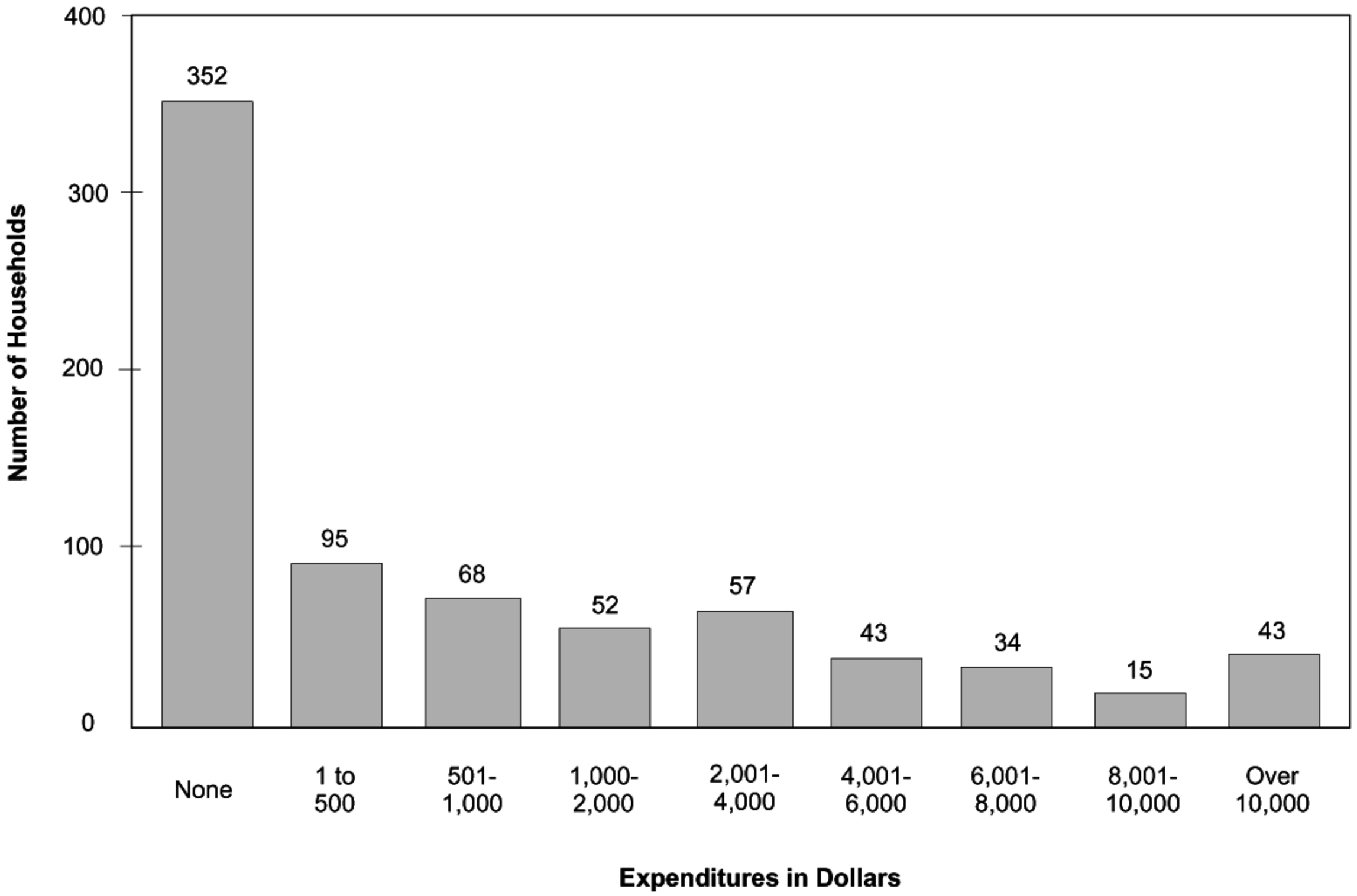
Sources: ACI/Braund (1984); Alaska Eskimo Whaling Commission (1993, 1994, 1995);George et al. (1993); Gusey (1993); Philo et al. (1993); State of Alaska Department of Fish and Game, (1993a,b); Stoker and Krupnik (1983)

Figure III.C-6 Annual Subsistence Harvest of Bowhead Whales by the North Slope Communities of Barrow , Nuiqsut, and Kaktovik, 1973 -1995



Source: Harcharek (1995)

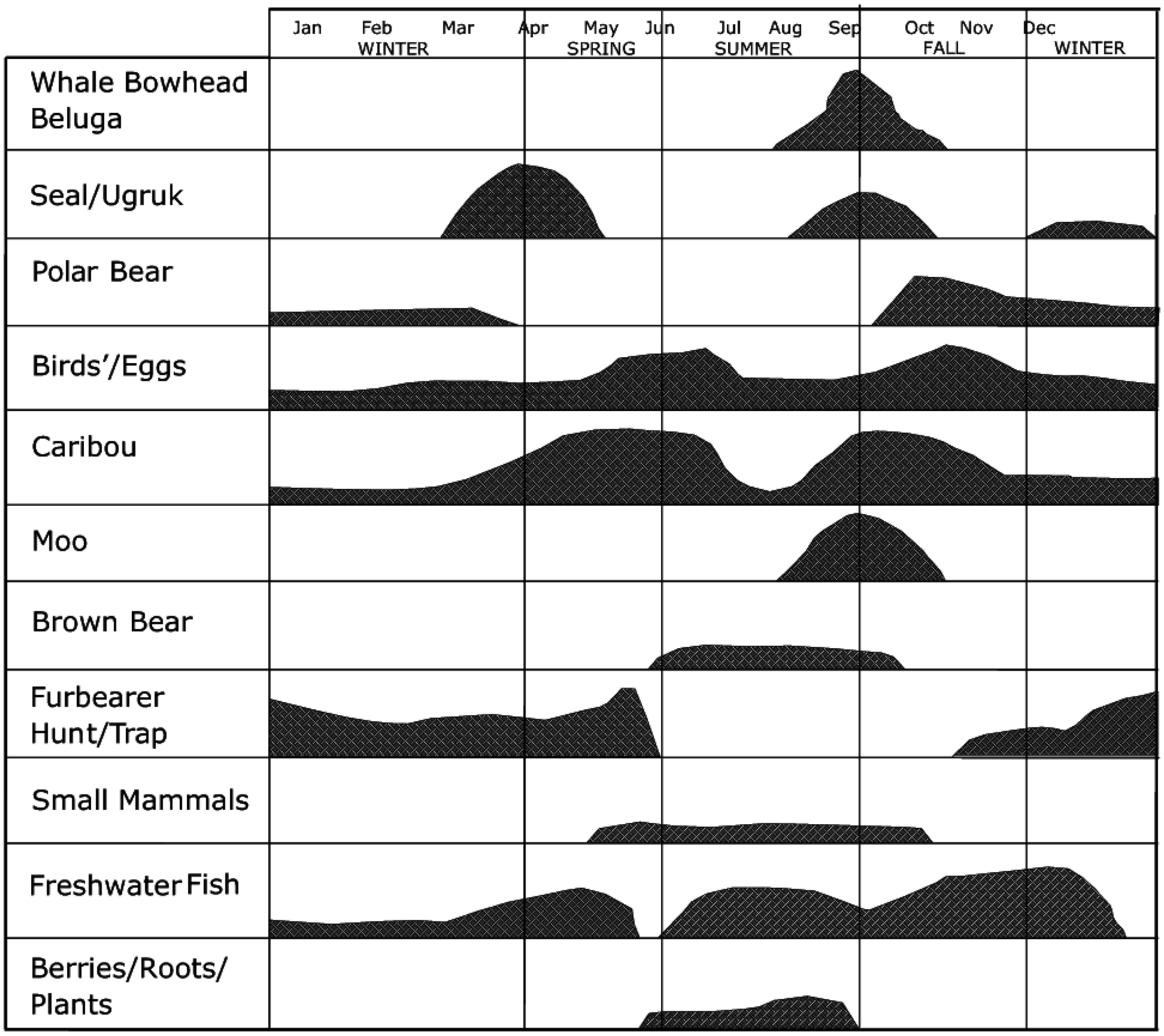
Figure III.C-7 Barrow Household Consumption of Meat, Fish, and Birds from Subsistence Activities
These results include only those households that participated in the census survey.



Source: Harcharek (1995)

Figure III.C-8 Barrow Household Expenditures on Subsistence Activities

These results include only those households that participated in the census survey.
Probably no one spends more than $10,000 as an average over several years, but individuals could purchase a boat or incur some other major expense for the year surveyed.



Source: North Slope Borough Contract Staff (1979).

Figure III.C-9 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. (Data forinvertebrates, sheep, and ocean fish are unavailable.)

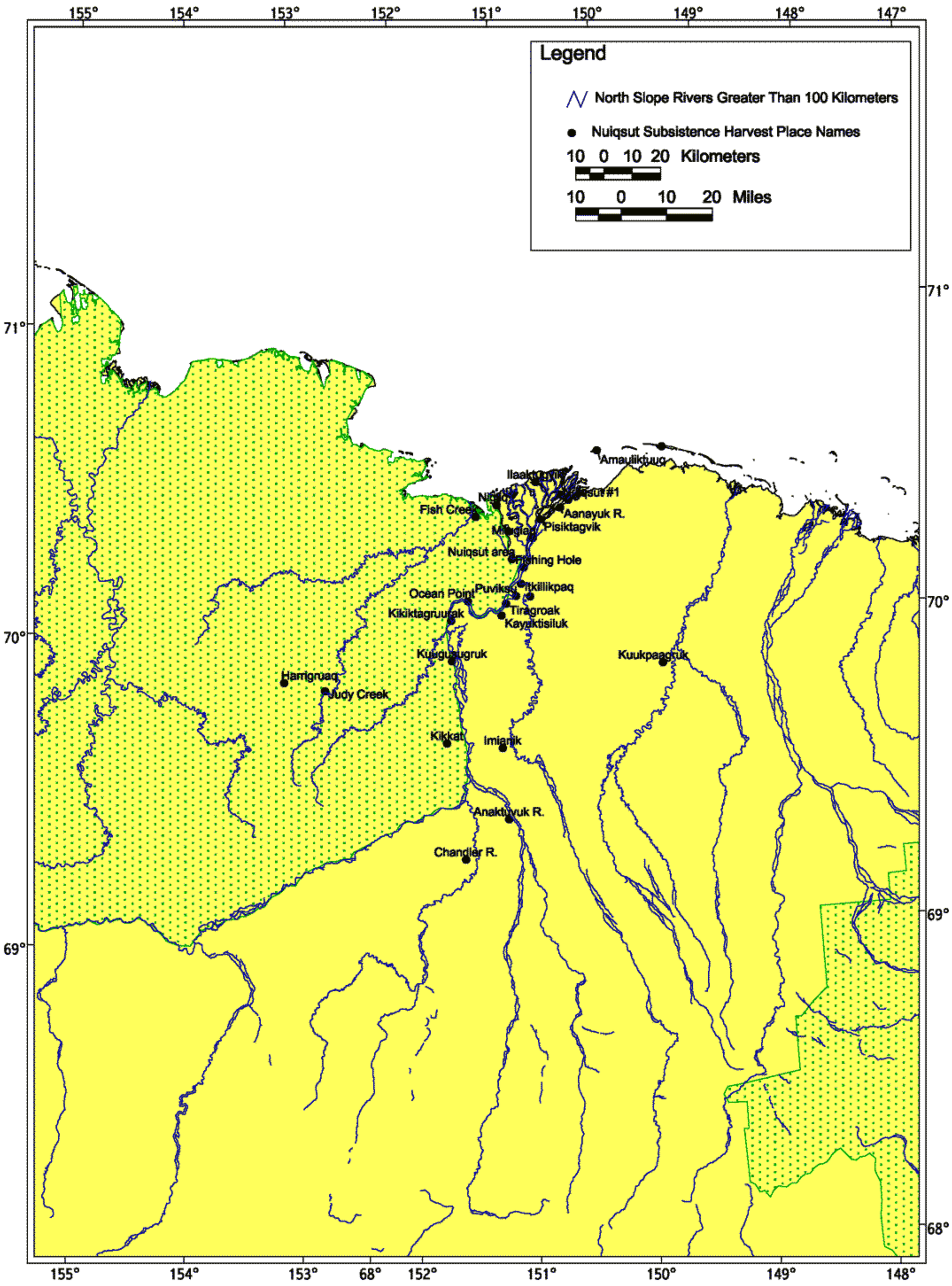
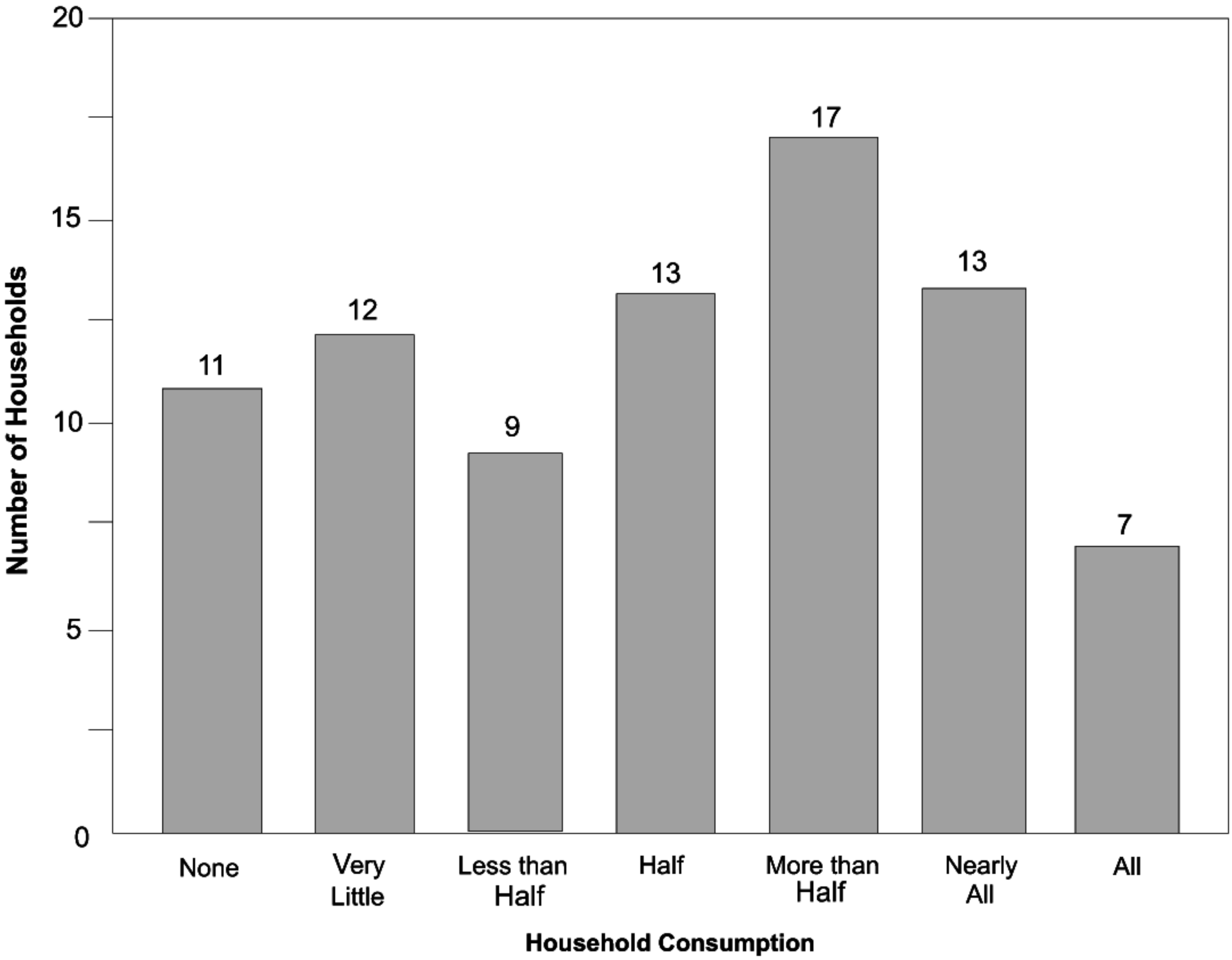


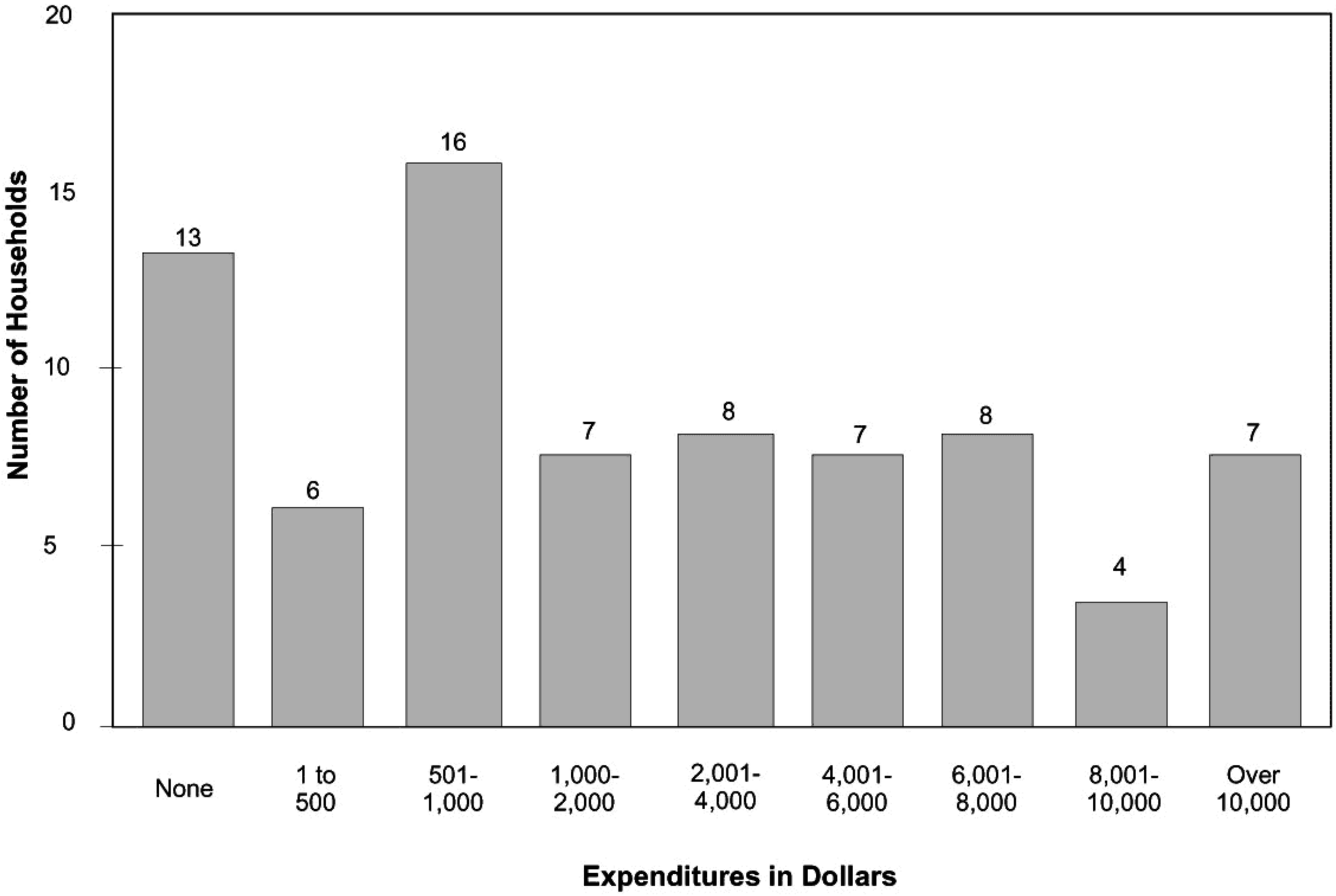
Figure III.C-10 Nuiqsut Subsistence Harvest Place Names July 1, 1994 - June 30, 1995



Source: Harcharek (1995)

Figure III.C-11 Nuiqsut Household Consumption of Meat, Fish, and Birds from Subsistence Activities

These results include only those households that participated in the census survey



Source: Harcharek (1995)

Figure III.C-12 Nuiqsut Household Expenditures on Subsistence Activities

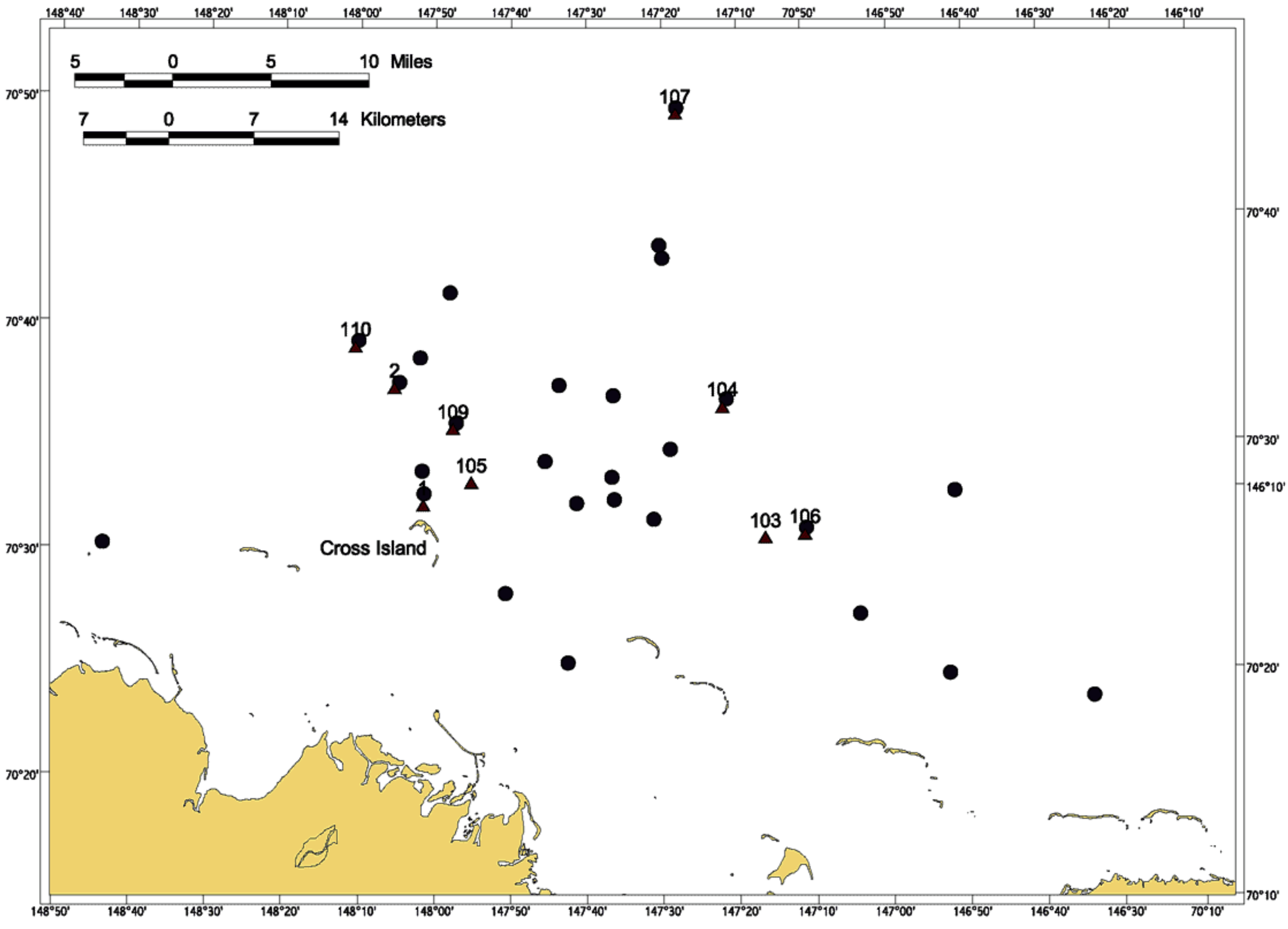
These results include only those households that participated in the census survey. Probably no one spends more than $10,000 as an average over several years, but individuals could purchase a boat or incur some other major expense for the year surveyed

	J F M WINTER	A M SPRING	J J SUMMER	A S O FALL	N D WINTER
Whale Bowhead/ Beluga					
Seal/Ugruk					
Walrus					
Polar Bear					
Birds'/Eggs					
Invertebrates	NA				
Caribou					
Moose					
Brown Bear					
Furbearer Hunt/Trap					
Small Mammals					
Sheep					
Freshwater Fish					
Ocean Fish					
Berries/ Roots/ Plants	NA				

Source: North Slope Borough Contract Staff (1979).

Figure III.C-13 Kaktovik Annual Subsistence Cycle

Patterns indicate desired periods for pursuit of each species based on the relationship of abundance, hunter access, seasonal Needs, and desirability. Peaks represent optimal periods of pursuit of subsistence resources. (Data for invertebrates, sheep, and ocean fish are unavailable.)

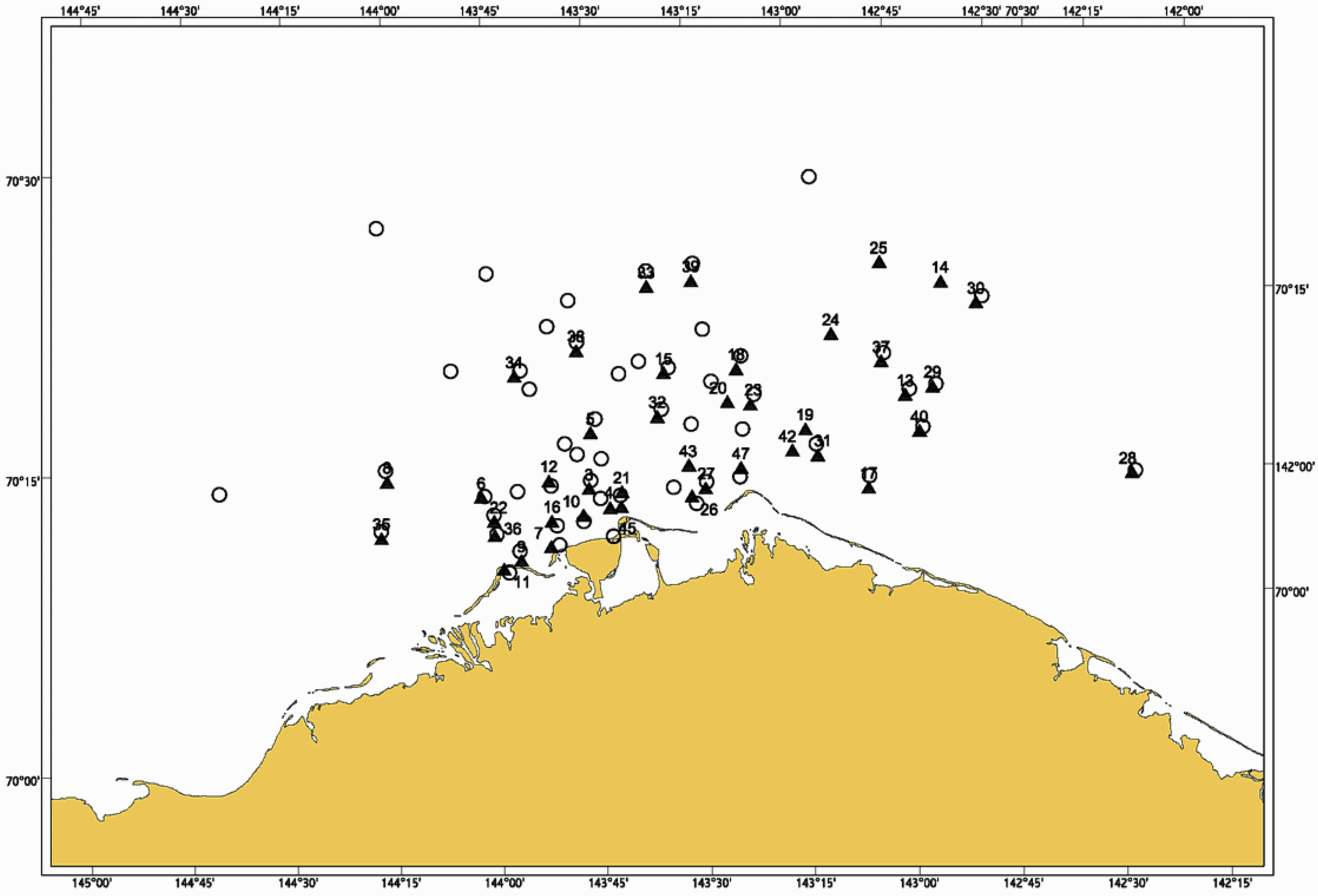


▲ Bowhead Whale Strikes 1937-1992
● Historic Bowhead Strikes 1937-2001

Location Id	Captain	Year
1	Taaqpak	1937
2	Taaqpak	1940
101	Thomas Napageak	1973
102	Thomas Napageak	1982
103	Billy Oyagak	1983
104	Lloyd Kittick	1985
105	Patsy Tukle	1986
106	Thomas Napageak	1990
107	Archie Ahkiviana	1991
109	Roxy Oyagak	1992
110	Patsy Tukle	1992

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

Figure III.C-14 Bowhead Whale Harvest Locations Near Cross Island



▲ Bowhead Strikes 1988-1995

○ North Slope Borough Bowhead Strikes 1989-2001

Captain	Location Id	Harvest Date
Simeo Patkotak	1	9-17-1988
Jake Adams	2	10-02-1988
Savik Ahmaogak	3	10-02-1988
Ben Itta	4	10-02-1988
Joash Tukle	5	10-02-1988
Lloyd Panigeo	6	9-27-1991
Arnold Brower, Jr.	7	9-28-1991
Clifford Okpeah	8	10-02-1991
Norman Leavitt	9	10-04-1991
George Ahmaogak	10	8-31-1992
Jacob Adams	11	9-1-1992
Simeon Patkotak	12	9-2-1992
Edward Itta	13	9-1-1992
George Adams	14	9-1-1992
Carl Brower	15	9-3-1992
Arnold Brower, Sr.	16	9-12-1992
Jonathan Aiken	17	9-17-1992
Donald Long	18	9-19-199
Simeon Patkotak	19	9-23-1992
Tony Edwardsen	20	9-24-1992
Eugene Brower	21	9-26-1992

Captain	Location Id	Harvest Date
George Ahmaogak	22	9-26-1992
Norman Leavitt	23	10-8-1992
Alfred Tukle, Sr.	24	10-5-1993
Don Nungasak	25	10-7-1993
Norman Leavitt	26	10-13-1993
Tony Edwardsen	27	10-18-1993
Arnold Brower, Jr.	28	10-19-1993
Jonathan Aiken	29	10-20-1993
Savik Ahmaogak	30	10-13-1993
George Ahmaogak	31	10-1-1994
Clifford Okpeaha	32	9-5-1995
Van Edwardsen	33	9-6-1995
Thomas Brower III	34	9-1 -1995
Jonathan Aiken	35	9-16-1995
Raymond Kalayauk	36	9-16-1995
Jeslie Kaleak	37	9-18-1995
Simeon Patkotak	38	9-20-1995
Leslie Itta	39	9-20-1995
Ben Itta	40	10-16-1995
Simeon Patkotak	41	10-17-1995
Johnny Leavitt	42	10-17-1995

Sources: Kaleak, 1996; North Slope Borough Planning Dept., 1993; NSB, 2001.

Figure III.C-15 Bowhead Whale Harvest Locations Near Kaktovik

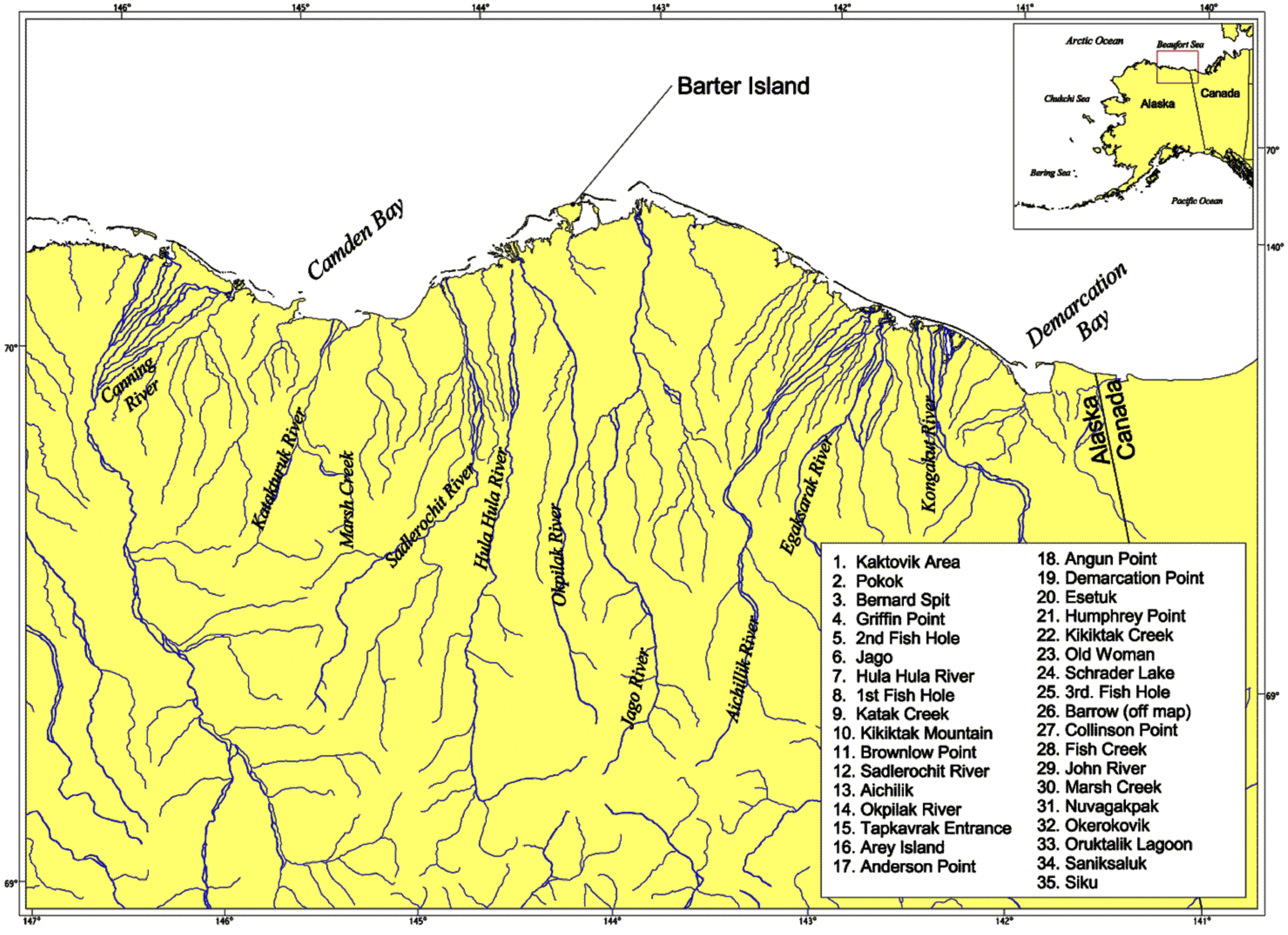
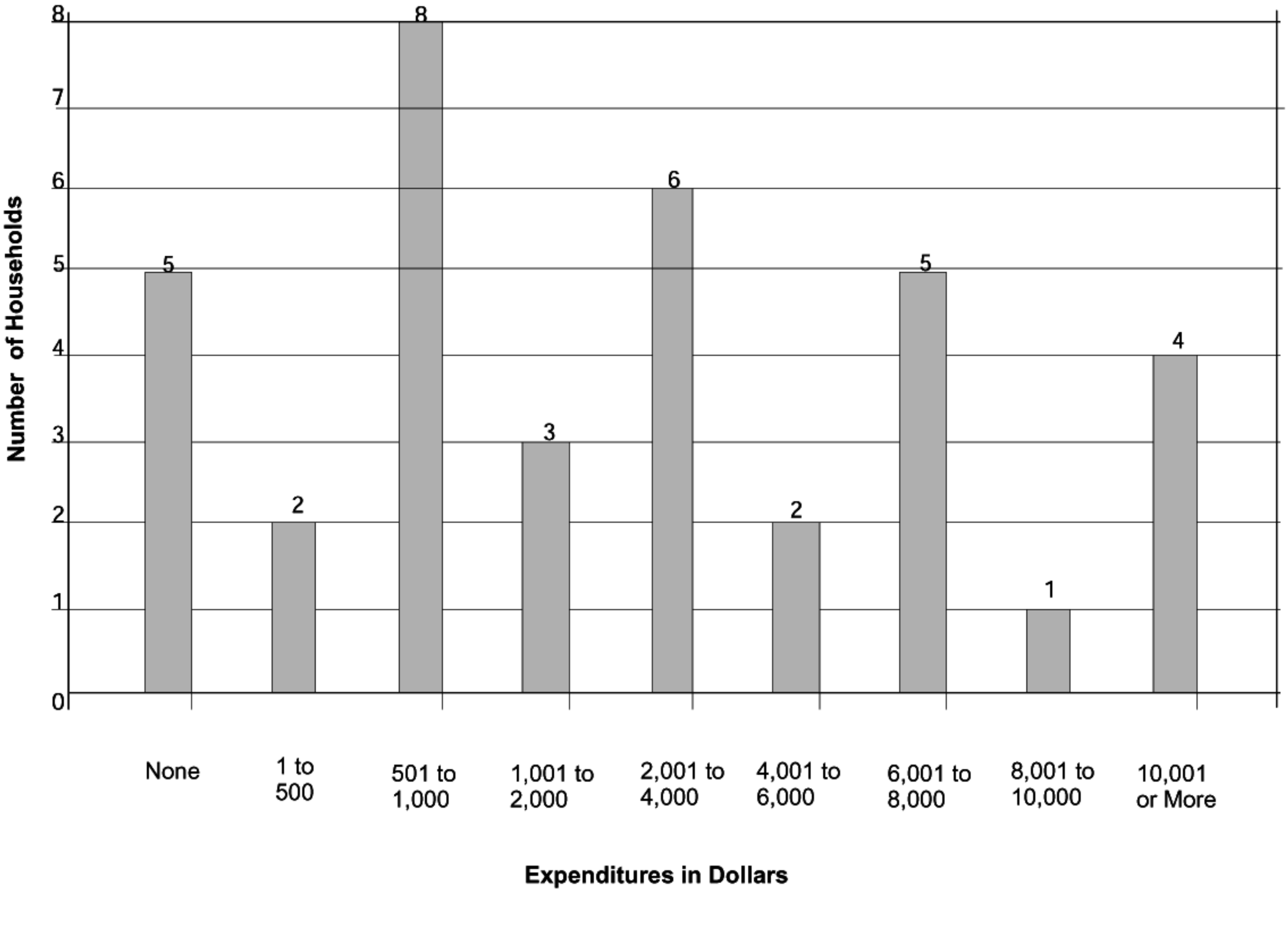


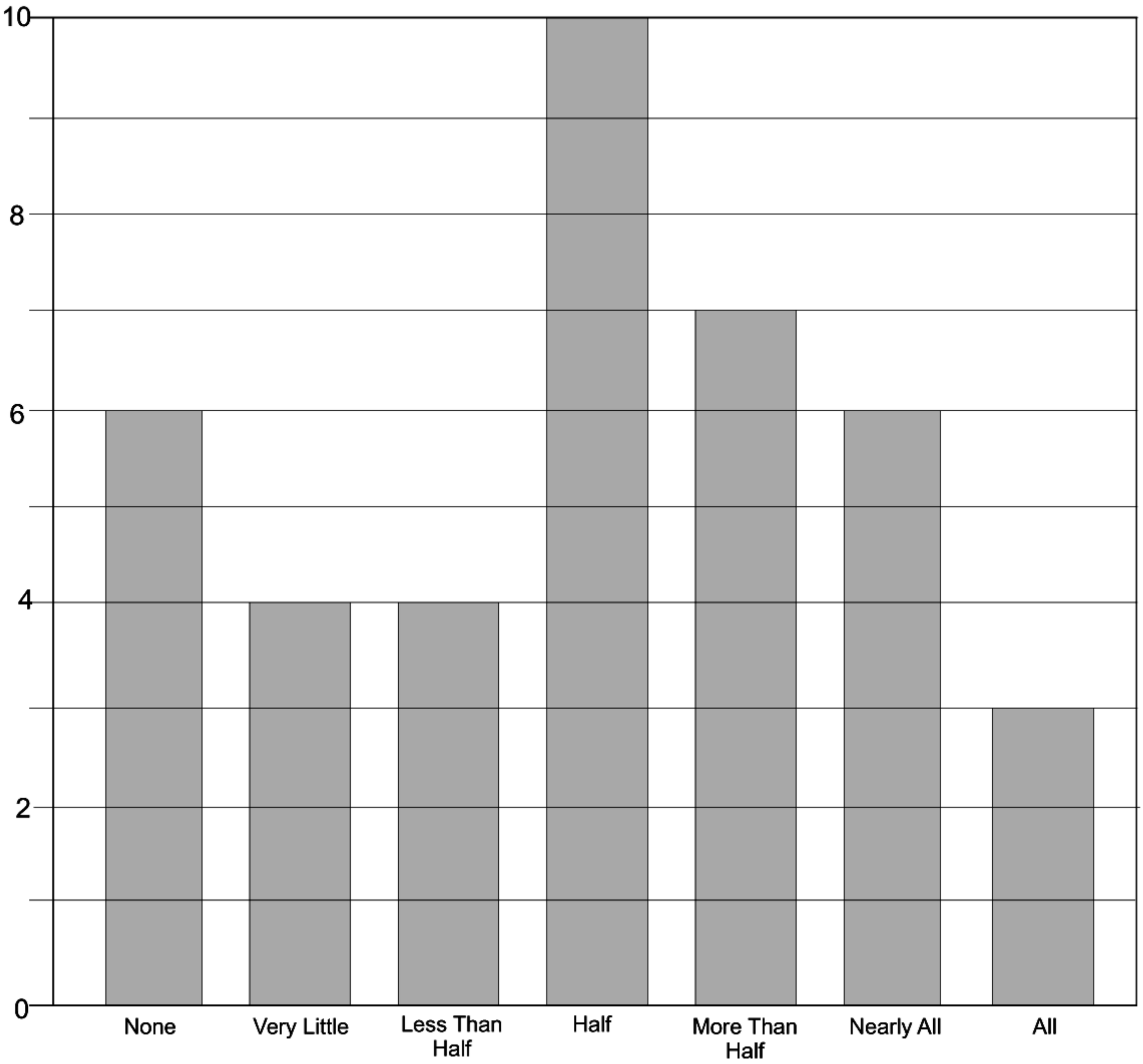
Figure III.C-16 North Slope Borough Department of Wildlife Management kaktovik Subsistence Harvest Place Name Map July 1, 1994 to June 30, 1995



Source: Harcharek (1995)

Figure III.C-17 Kaktovik Household Expenditures on Subsistence Activities

These results include only those households that participated in the census survey.



Source: Harcharek, 1995.

Figure III.C-18 Kaktovik Household Consumption of Meat, Fish and Birds from Subsistence Activities.
These results include only those households that participated in the census survey.

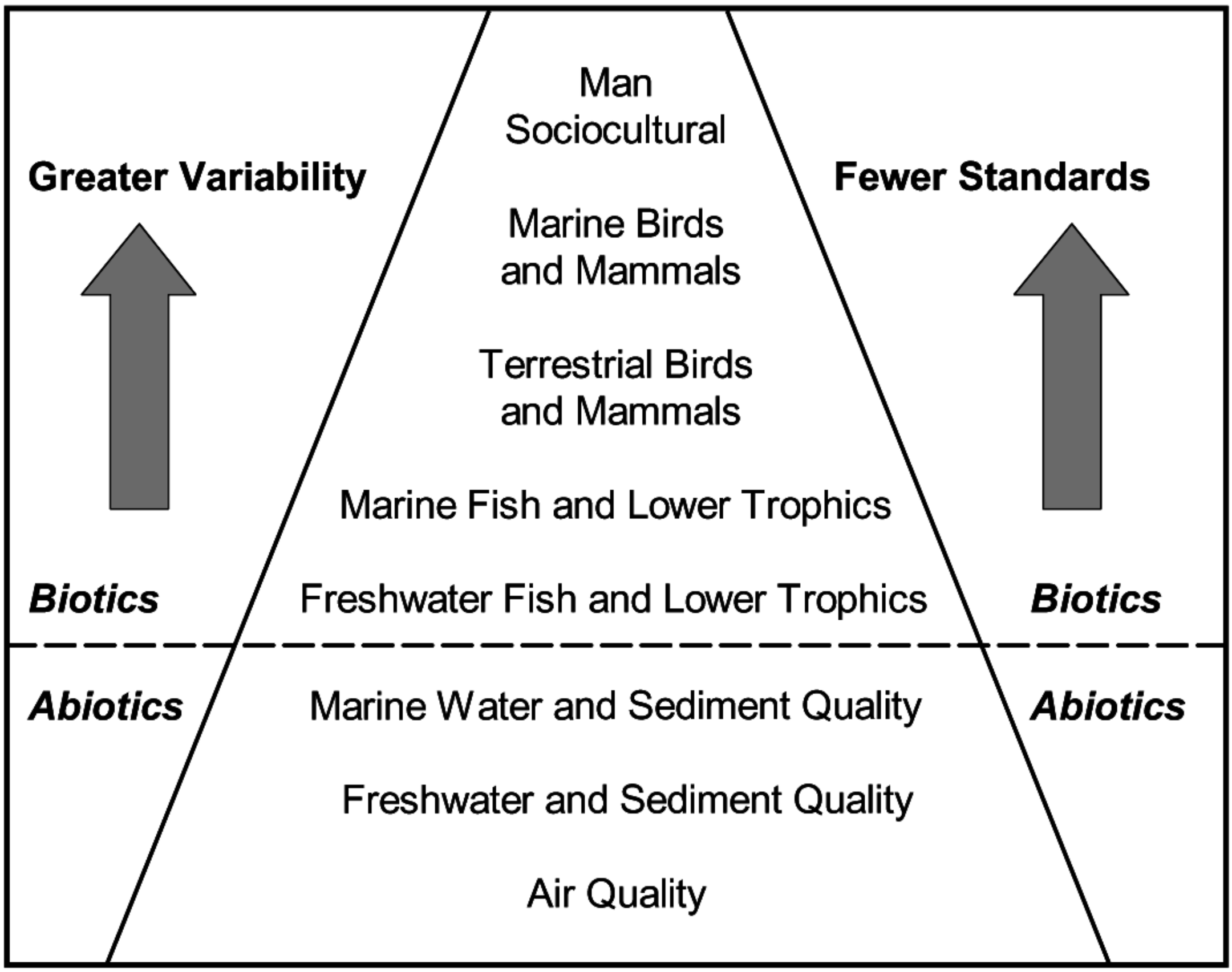


Figure V-1 Relationship Among Resources, Standards, and Degree of Variability

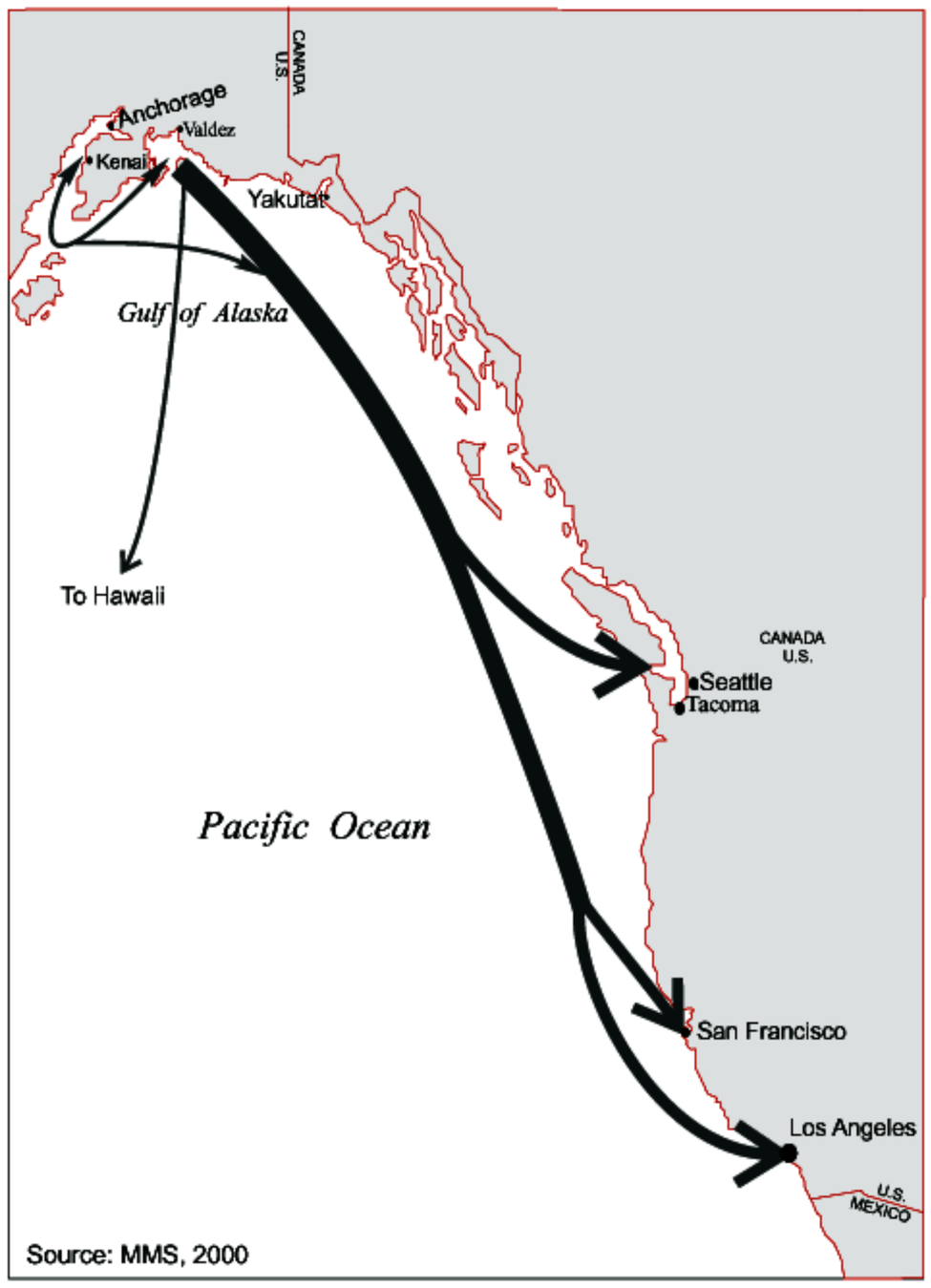


Figure V-2 General Tanker Routes and Ports of Entry

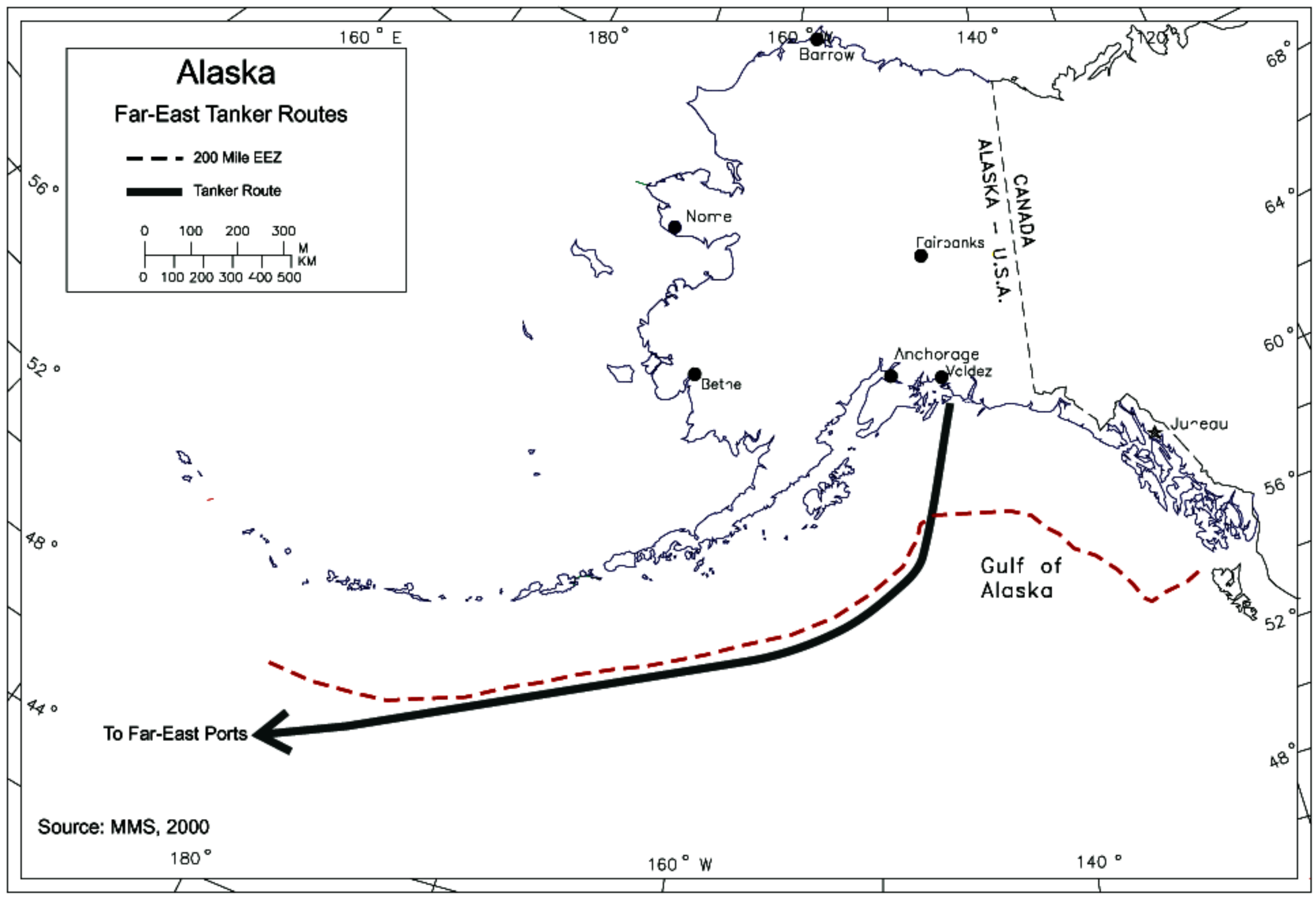


Figure V-3 Potential Valdez to Far East Tanker Route

MAPS

Map 1
Program Area

Legend

- Bathymetry in Meters
- Program Area Boundary
- Exclusive Economic Zone Limit
- North Slope Rivers Greater Than 100 Km
- Submerged Lands Act Boundary

30 0 30 60 Kilometers

20 0 20 40 Miles

Locator Map

Alaska

Chukchi Sea

Arctic Ocean

Beaufort Sea

Harrison Bay

Smith Bay

Dease Inlet

Teshekpuk Lake

Barrow

Point Barrow

Franklin Bay

Atkasuk

Atqasuk

McLeod Point

Cape Halkett

Oliktok Point

Cross Island

Nuiqsut

Deadhorse

Brownlow Point

Point Thomson

Barter Island

Kaktovik

Demarcation Bay

Exclusive Economic Zone Limit

Alaska - U.S. Canada

National Petroleum Reserve - Alaska (NPR-A)

Arctic National Wildlife Refuge (ANWR)

1000 500 200 100 50 40

Map 2
Beaufort Sea Multiple-Sale Deferral Options

Legend

- Submerged Lands Act Boundary
- Bathymetry in Meters
- Exclusive Economic Zone Limit
- North Slope Rivers Greater Than 100 Km
- ANWR and NPR-A
- I (Proposal – The Program Area)
- II (No Sale – not shown)
- III (Barrow Subsistence Whale Deferral)
- IV (Nuiqsut Subsistence Whale Deferral)
- V (Kaktovik Subsistence Whale Deferral)
- VI (Eastern Deferral)

30 0 30 60 Kilometers

20 0 20 40 Miles

Locator Map

Arctic Ocean

Beaufort Sea

Barrow

Dease Inlet

Teshekpuk Lake

Cape Halkett

Oliktok Point

Harrison Bay

Prudhoe Bay

Colville Delta

Nuiqsut

Deadhorse

Sagavanirktok River

Point Thompson

Canning River

Barter Island

Kaktovik

Exclusive Economic Zone Limit

National Petroleum Reserve - Alaska (NPR-A)

Arctic National Wildlife Refuge (ANWR)

Alaska - U.S. Canada

1000

500

200

100

50

40

N

Map 3
Cross Island
Stipulations 6a and 6b

Legend

- Cross Island Stipulation 6a
- Cross Island Stipulation 6b
- Current Offshore Federal Leases
- Lease Blocks
- Submerged Lands Act Boundary
- North Slope Rivers Greater Than 100 Kilometers

4 0 4 8 Kilometers

3 0 3 6 Miles

N

Locator Map

Alaska

Cross Island

Prudhoe Bay

Map 4
Geographic Zones

Legend

- North Slope Rivers Greater Than 100 Km
- Bathymetry in Meters
- Near/Shallow Water Zone
- Midrange/Medium Zone
- Far/Deepwater Zone
- Teshekpuk Lake Special Area
- 1002 Arctic Coastal Plain Area
- Existing Pipelines

30 0 30 60 Kilometers

20 0 20 40 Miles

Locator Map

Arctic Ocean

Beaufort Sea

N

-3000
-2500
-2000
-1500
-3500
-70
-60
-50
-40
-30
-20
-10
-300
-400
-500
-600

Point Barrow

Dease Inlet

Smith Bay

McLeod Point

Cape Halkett

Harrison Bay

Oliktok Point

Cross Island

Alaktak Lake

Teshekpuk Lake

Atkasuk
Atqasuk

Colville River Delta

Prudhoe Bay

Nuiqsut

Deadhorse

Brownlow Point

Barter Island

Point Thomson

Kaktovik

Demarcation Bay

National Petroleum Reserve - Alaska

Arctic National Wildlife Refuge

Alaska

Canada

Map 5
Generalized Circulation and Currents in the Chukchi and Beaufort Seas

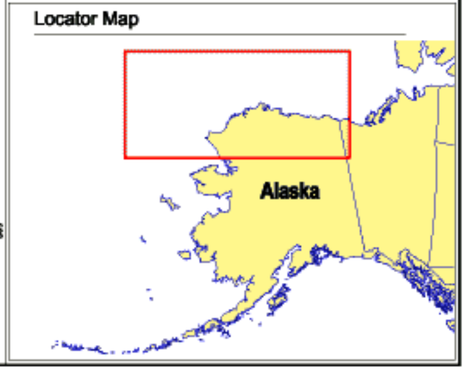
Legend

- Generalized Circulation
- North Slope Rivers Greater Than 100 Kilometers
- 1002 Arctic Coastal Plain
- Bathymetry in Meters
- Teshekpuk Special Use Area
- Existing Pipelines

40 0 40 80 Kilometers

30 0 30 60 Miles

Locator Map



Arctic Ocean

Beaufort Sea

Chukchi Sea

Northwind Ridge

Atlantic Water

Beaufort Gyre

Hanna Shoal

Herald Shoal

Central Channel

Barrow Canyon

20 cm/s

3 cm/s

Alaska Coastal Current

Beaufort Undercurrent

Wainwright

Barrow

Atqasuk

Nuiqsut

Deadhorse

Kaktovik

Cape Lisburne

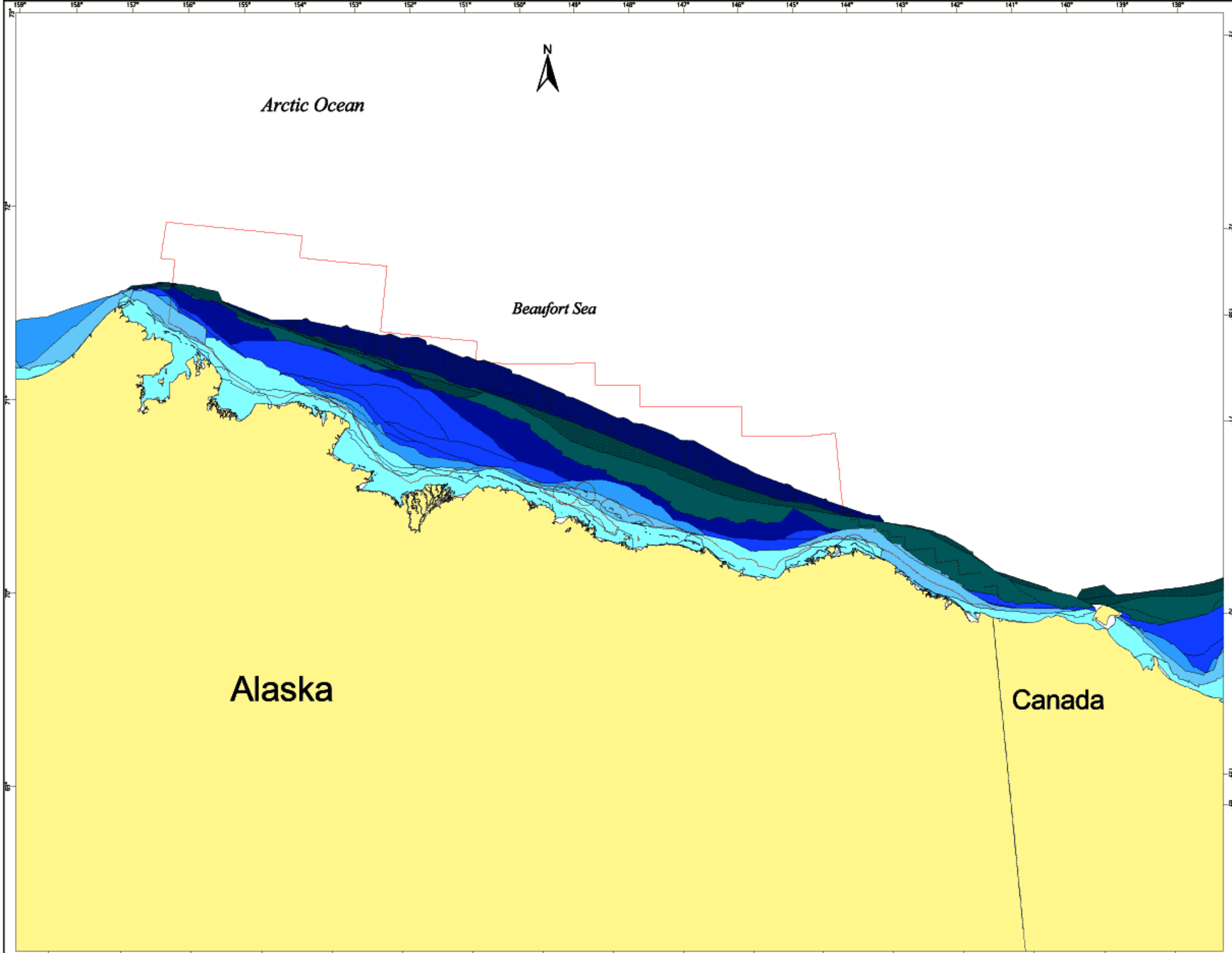
National Petroleum Reserve - Alaska

1002 Arctic Coastal Plain

Arctic National Wildlife Refuge

-1500 -400 -300 -200 -150 -100 -70 -80 -60 -50 -40 -60 -3500 -3000 -2000 -50 -40 -30 -10 -20 -40 -10

Map 6
Landfast Ice



Legend

Multi-sale Area Outline

All Months

- Last Week of October 1997-2000
- Last Week of November 1997-2000
- Last Week of December 1997-2000
- Last Week of January 1997-2000
- Last Week of June 1997-2000
- Last Week of February 1997-2000
- Last Week of March 1997-2000
- Last Week of April 1997-2000
- Last Week of May 1997-2000

20 0 20 40 Kilometers

20 0 20 40 Miles

Source: USDOC, NOAA, National Ice Center

Locator Map

Map 7
Fall Bowhead Whale Sightings on Transect (1982-2000), Showing Mean Distance From Shore

Legend

- Analysis Region
- One Standard Deviation from Mean Distance
- Mean Distance from Normalized Shoreline
- Multisale Area Boundary
- Normalized Shore
- Major Rivers (North Slope)

30 0 30 60 Kilometers

20 0 20 40 Miles

Map Description / Data Source / Limitations

Bowhead whale sightings made by MMS BWASP and NOSC on randomized aerial transects during September and October within east and west Beaufort Sea analysis regions unadjusted for effort (1982-2000), showing the mean distance of these sightings north of a normalized shoreline.

Projection: Transverse Mercator, UTM Zone 6
Spheroid GRS: 80, North American Datum 83
Central Meridian: -147

E&S Map ID: SDT-009 **Date:** 14 Feb 2002
E&S Source Names: Stephen D. Treacy

Signature: Stephen D. Treacy

Locator Map

West Region

East Region

Beaufort Sea

Barrow

Dease Inlet

Atqasuk

Smith Bay

Cape Halkett

Teshekpuk Lake

Harrison Bay

Colville Delta

Nuiqsut

Oliktok Pt.

Prudhoe Bay

Deadhorse

National Petroleum Reserve Alaska

Kaktovik

Arctic Coastal Plain 1002 KIC Area

Camden Bay

Arctic National Wildlife Refuge

Herschel Is.

U.S.A.

CANADA

Map 7
Fall Bowhead Whale Sightings on Transect (1982-2000), Showing Mean Distance From Shore

Legend

- Analysis Region
- One Standard Deviation from Mean Distance
- Mean Distance from Normalized Shoreline
- Multisale Area Boundary
- Normalized Shore
- Major Rivers (North Slope)

30 0 30 60 Kilometers

20 0 20 40 Miles

Map Description / Data Source / Limitations

Bowhead whale sightings made by MMS BWASP and NOSC on randomized aerial transects during September and October within east and west Beaufort Sea analysis regions unadjusted for effort (1982-2000), showing the mean distance of these sightings north of a normalized shoreline.

Projection: Transverse Mercator, UTM Zone 6
Spheroid GRS: 80, North American Datum 83
Central Meridian: -147

E&S Map ID: SDT-009 **Date:** 14 Feb 2002
E&S Source Names: Stephen D. Treacy

Signature: Stephen D. Treacy

Locator Map

West Region

East Region

Beaufort Sea

Barrow

Dease Inlet

Atqasuk

Smith Bay

Cape Halkett

Teshekpuk Lake

Harrison Bay

Colville Delta

Nuiqsut

Oliktok Pt.

Prudhoe Bay

Deadhorse

National Petroleum Reserve Alaska

Kaktovik

Arctic Coastal Plain 1002 KIC Area

Camden Bay

Arctic National Wildlife Refuge

Herschel Is.

U.S.A.

CANADA

Map 8
Fall Sighting Rates of Bowhead Whales on Transect (1982-2000), For Years of Heavy, Moderate, and Light Sea-Ice Severity

Legend

- Existing Pipelines
- North Slope Rivers Greater Than 100 Kilometers

Sightings per km: Heavy Ice Years
- 0 (surveyed)
- 0 - 0.009
- 0.01 - 0.019
- 0.02 - 0.029
- 0.03 - 0.039
- 0.04 - 0.122

Sightings per km: Moderate Ice Years
- 0 (surveyed)
- 0 - 0.009
- 0.01 - 0.019
- 0.02 - 0.029
- 0.03 - 0.039
- 0.04 - 0.112

Sightings per km: Light Ice Years
- 0 (surveyed)
- 0 - 0.009
- 0.01 - 0.019
- 0.02 - 0.029
- 0.03 - 0.039
- 0.04 - 0.19

Projection: Transverse Mercator, UTM Zone 6
Spheroid GRS: 80, North American Datum 83
Central Meridian: -147

Note:
Bowhead whale sighting rates for MMS BWASP and NOSC randomized aerial transects in the Beaufort Sea during September and October, 1982-2000, showing years of heavy, moderate, and light sea-ice severity. Sighting rates within grid cells (5' latitude by 15' longitude) were used to adjust for discontinuities in survey effort. Central Alaskan Beaufort Sea boundaries highlight an area of distinct fluctuation in migratory patterns by sea-ice category. ETOPO-5 isobaths show the shelf break.

ESS Map ID: SDT-008 **Date: 1 Nov 2001**
ESS Source Name: Stephen D. Treacy
Signature: S. Stephen D. Treacy

30 0 30 60 Kilometers
20 0 20 40 Miles

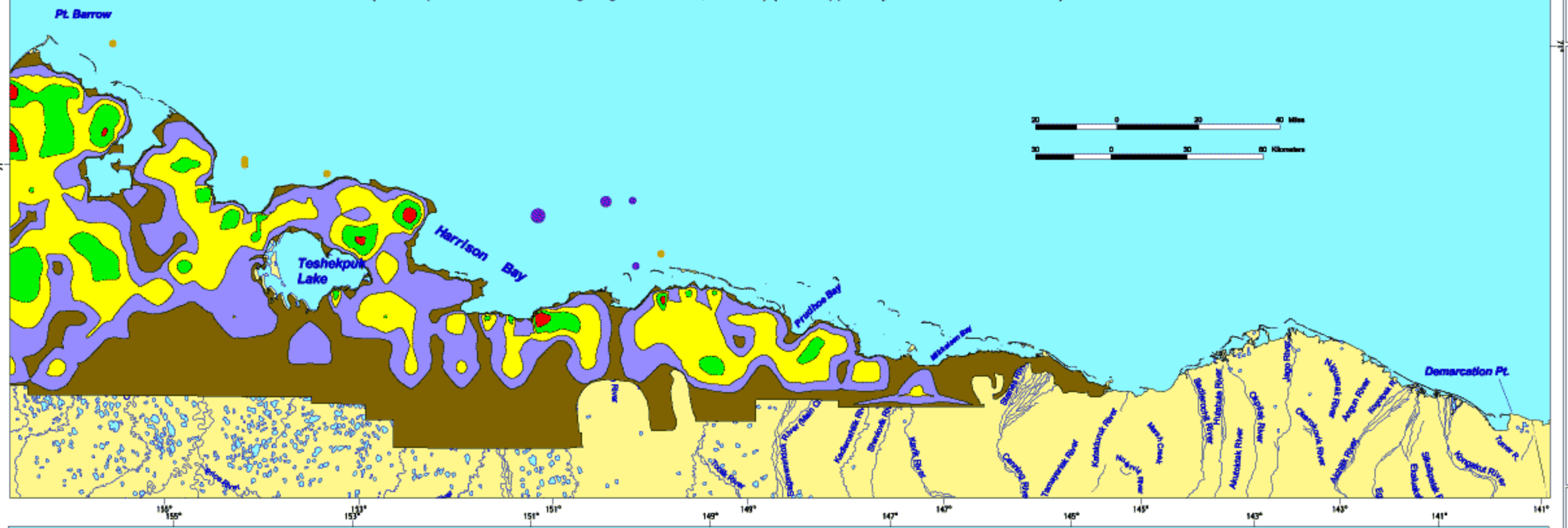
Locator Map

Central Alaskan Beaufort Sea
Barrow
Dease Inlet
Peard Bay
Smith Bay
Cape Halkett
Teshekpuk Lake
Harrison Bay
Colville Delta
National Petroleum Reserve - Alaska
Oliktok Pt.
Nuiqsut
Deadhorse
Flaxman Is.
Kaktovik
Arctic Coastal Plain 1002 KIC Area
Camden Bay
Demarcation Pt.
Herschel Is.
Alaska
Arctic National Wildlife Refuge
U.S.A.
CANADA

Map 9a and 9b Spectacled and Steller's Eider Distribution

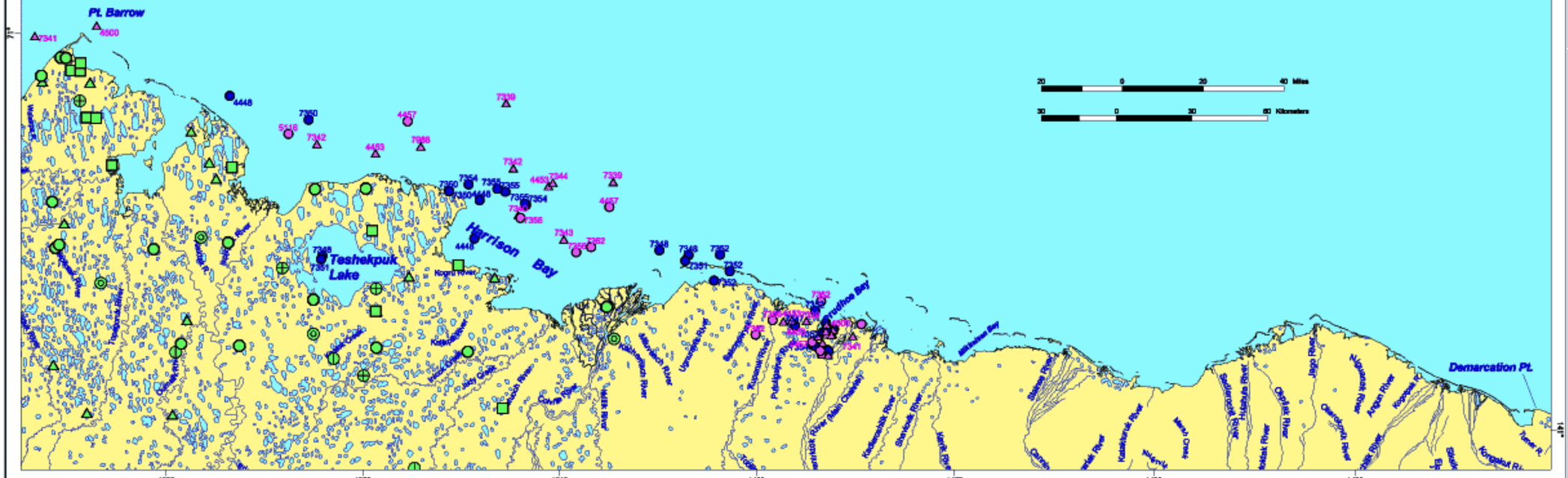
a. Aerial Survey Sightings

Spectacled Eider offshore distribution observed during aerial surveys late July 2000 (from Harrison Bay to Mikkelsen Bay) and late July 2001 (from Point Barrow to Demarcation Point), and relative density onshore determined from aerial surveys in mid-June 1998-2001 (for interpretation of offshore sightings distribution, see text) (Data supplied by Fish and Wildlife Service).



b. Eider Locations

Locations of 9 satellite-transmitter-equipped male (June - July, 1996) and 13 female (July - September 1995, 1996) Spectacled Eiders (Numbers identify individual birds), and onshore sightings of Steller's Eiders observed during aerial surveys 1989 - 1995 (data supplied by the U.S.G.S. - Alaska Biological Sciences Research Center and Fish and Wildlife Service)



Legend

Spectacled Eider Offshore Distribution

2000 Survey	2001 Survey
1 - 10	
11 - 30	
31 - 100	

Spectacled Eider Onshore Density

- High
- Medium High
- Medium
- Low
- No Spectacled Eiders Observed
- Outside Survey Area

Locator Map

Spectacled Eider Satellite Transmitter Locations

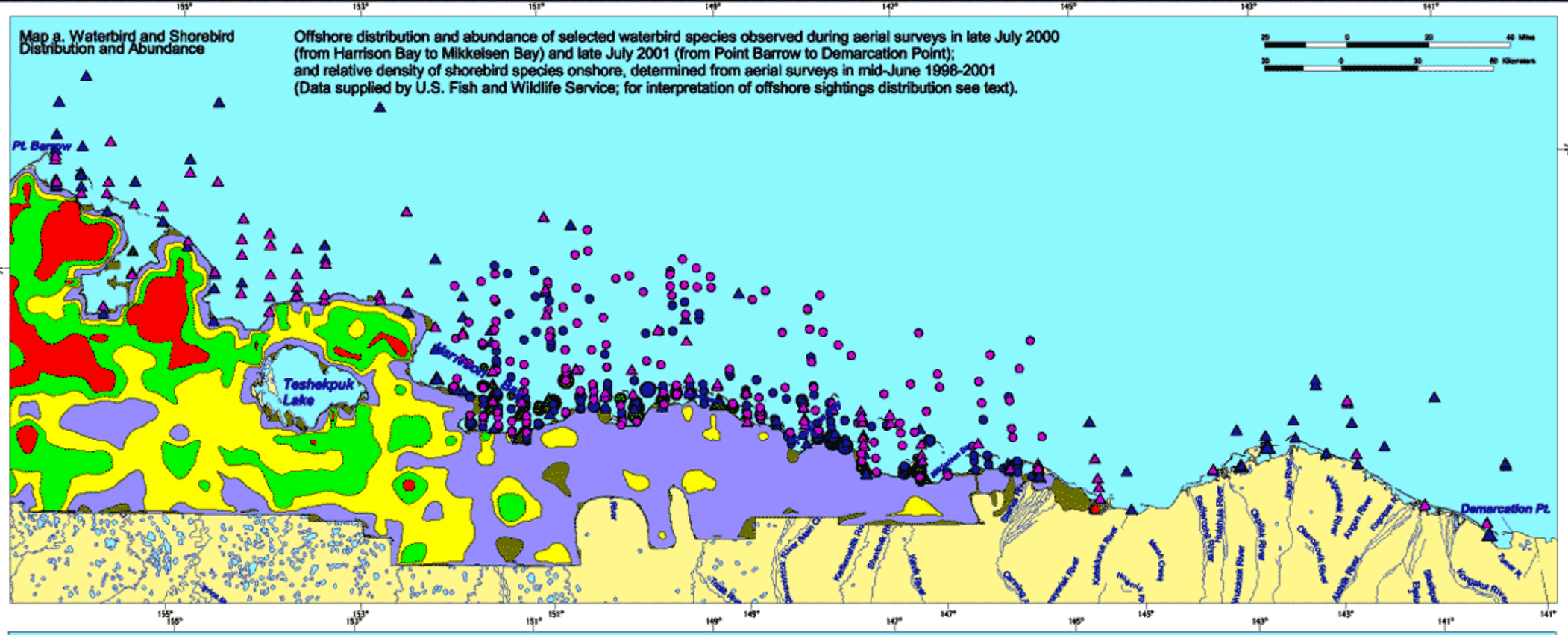
- 1995
- 1996
- Female
- Male

Steller's Eider Sightings

1989	1993
1990	1994
1991	1995
1992	

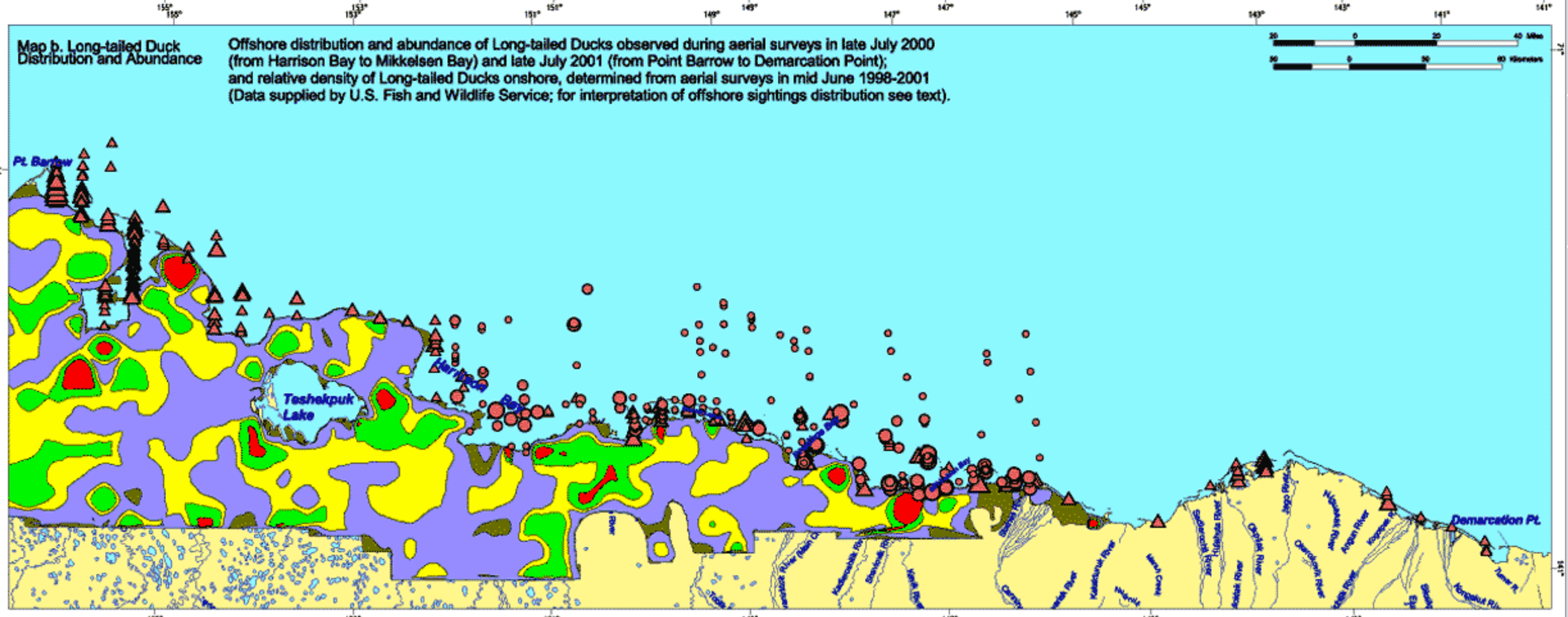
Map a. Waterbird and Shorebird Distribution and Abundance

Offshore distribution and abundance of selected waterbird species observed during aerial surveys in late July 2000 (from Harrison Bay to Mikkelsen Bay) and late July 2001 (from Point Barrow to Demarcation Point); and relative density of shorebird species onshore, determined from aerial surveys in mid-June 1998-2001 (Data supplied by U.S. Fish and Wildlife Service; for interpretation of offshore sightings distribution see text).



Map b. Long-tailed Duck Distribution and Abundance

Offshore distribution and abundance of Long-tailed Ducks observed during aerial surveys in late July 2000 (from Harrison Bay to Mikkelsen Bay) and late July 2001 (from Point Barrow to Demarcation Point); and relative density of Long-tailed Ducks onshore, determined from aerial surveys in mid June 1998-2001 (Data supplied by U.S. Fish and Wildlife Service; for interpretation of offshore sightings distribution see text).



Map 10a and 10b

Legend

Map 10a. Offshore Species Distributions

- Pacific Loon
- Surf Scoter
- Glaucous Gull

Numbers of Individuals

2000 Survey		2001 Survey
○	1 - 5	△
○	6 - 20	△
○	21 - 70	△
○	71+	△

Maps a and b. Onshore Density of Long-tailed Ducks or Shorebirds

- High
- Medium high
- Medium
- Low
- No Shorebirds or Long-Tailed Ducks Observed
- Outside Survey Area

Locator Map

Map 10b. Offshore Distribution

- Long-tailed Duck

Numbers of Individuals

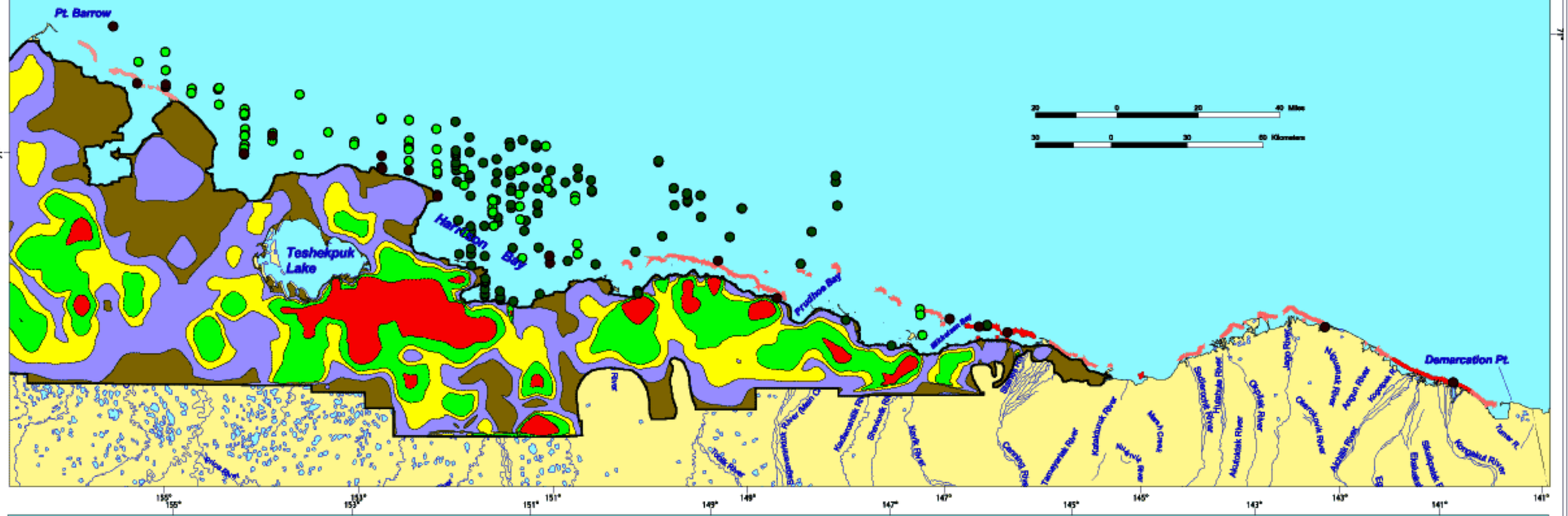
2000 Survey		2001 Survey
○	1 - 5	△
○	6 - 20	△
○	21 - 70	△
○	71+	△

Onshore Density of Long-tailed Ducks: see Color Key Above

Map 11a and 11b
King and Common Eider Distribution

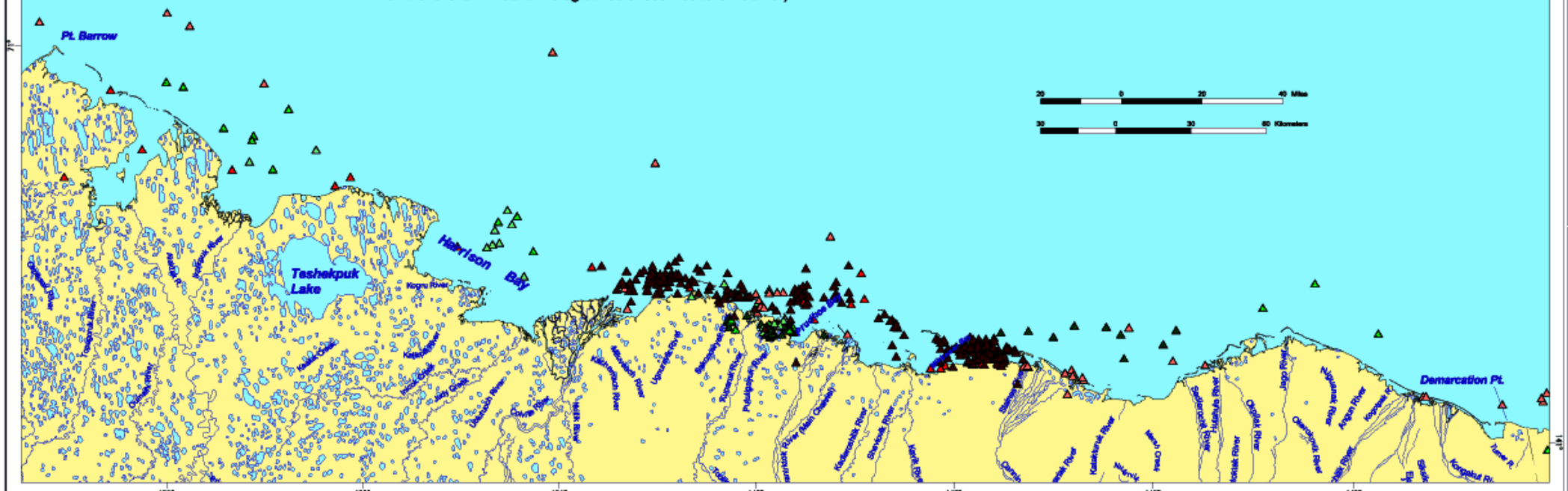
a. Aerial Survey Sightings

King Eider offshore distribution observed during aerial surveys late July 2000 (from Harrison Bay to Mikkelsen Bay) and late July 2001 (from Point Barrow to Demarcation Point), and relative density onshore determined from aerial surveys in mid-June 1998-2001 (for interpretation of offshore sightings distribution, see text); Common Eider nesting distribution (barrier islands) and offshore distribution in late July 2001 (see above) (Data supplied by U.S. Fish and Wildlife Service).



b. Satellite Transmitter Locations

Locations of 5 satellite-transmitter-equipped male and female King Eiders in June, July, and August 1999; similarly-equipped Common Eider females molting or staging in summer 2000 (18 individuals, multiple locations per female shown), and migrating in fall 2000 (12 individuals) and spring 2001(13 individuals) (data supplied by the Canadian Wildlife Service and U.S.G.S. - Alaska Biological Sciences Research Center)



Legend

King Eider Offshore Distribution
- July 2000
- July 2001

King Eider Onshore Density
- High
- Medium High
- Medium
- Low
- No King Eiders Obs.
- Outside Survey Area

Common Eider Offshore Distribution
- July 2001

Common Eider Numbers (Barrier Islands)
- High
- Medium
- Low

Satellite Transmitter Locations

King Eider
- June 1999
- July 1999
- August 1999

Common Eider
- Summer 2000
- Fall 2000
- Spring 2001

Locator Map

Barrow
Point Barrow
Beaufort Sea
Dease Inlet
Colville Delta
Smith Bay
Cape Halkett
Cross Island
Liberty Prospect
Tigvariak Island
Atqasuk
Harrison Bay
Barter Island
Kaktovik
Kupiruk River
Putuligayuk River
Sagavanirktok River
Shaviovik River
Canning River
Camden Bay
Colville River
National Petroleum
Reserve-Alaska
Deadhorse
Nuiqsut
Arctic National
Wildlife Refuge

Map 12
Historical Subsistence Land Use for Nuiqsut 1973-1986

Legend

- Nuiqsut Fish Harvest Area
- Nuiqsut Wildfowl Harvest Area
- Nuiqsut Caribou Harvest Area
- Nuiqsut Moose Harvest Area
- Nuiqsut Whale Harvest Area
- North Slope Rivers Greater Than 100 Kilometers

20 0 20 40 Kilometers

20 0 20 40 Miles

N

Locator Map

Alaska

Map 13
Essential
Fish Habitat (EFH)

Arctic Ocean

West

Central

East

Beaufort Sea

National Petroleum
Reserve - Alaska

1002 Arctic Coastal Plain Area

Arctic National
Wildlife Refuge

Legend

- Freshwater EFH (Anadromous Streams)
- Estuarine EFH
- Marine EFH
- Hypothetical Pipelines
- Lease Boundary
- Nuiqsut Subsistence Whale Deferral
- Hypothetical Spill Boxes
- Kaktovik Subsistence Whale Deferral
- Eastern Deferral
- Barrow Subsistence Whale Deferral
- Existing Pipelines
- Northeast NPR-A Planning Area

20 0 20 40 Kilometers

20 0 20 40 Miles

Locator Map

Map 14a KnownPermitted Gravel and Water Sources

Legend

- Submerged Lands Act Boundary
- OCS Units
- Active gravel sites
- Airstrips
- Rehabilitated Gravel Sites
- Proposed Gravel Sources
- Fresh water sources
- North Slope Rivers Greater Than 100 Kilometers

9 0 9 18 Kilometers

7 0 7 14 Miles

Locator Map

Map 14b
North East NPRA Permitted Water Sources and Ice Roads Through 2001

Legend

- Proposed Well Sites 2002
- Drilled Locations 1999-2001
- Ice Roads and Rolligon Routes 2002
- Eastern Boundary of NPRA
- Known Permitted Water Sources

2 0 2 4 Miles

2 0 2 4 Kilometers

Locator Map

Alaska

Pad H

Pad A

Coleville River Delta

Nuiqsut Village

Alpine Mine Site

Airstrip

Airstrip