

Seismic Survey Mitigation Measures: Arctic Ocean

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

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

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

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

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

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

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

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

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

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

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

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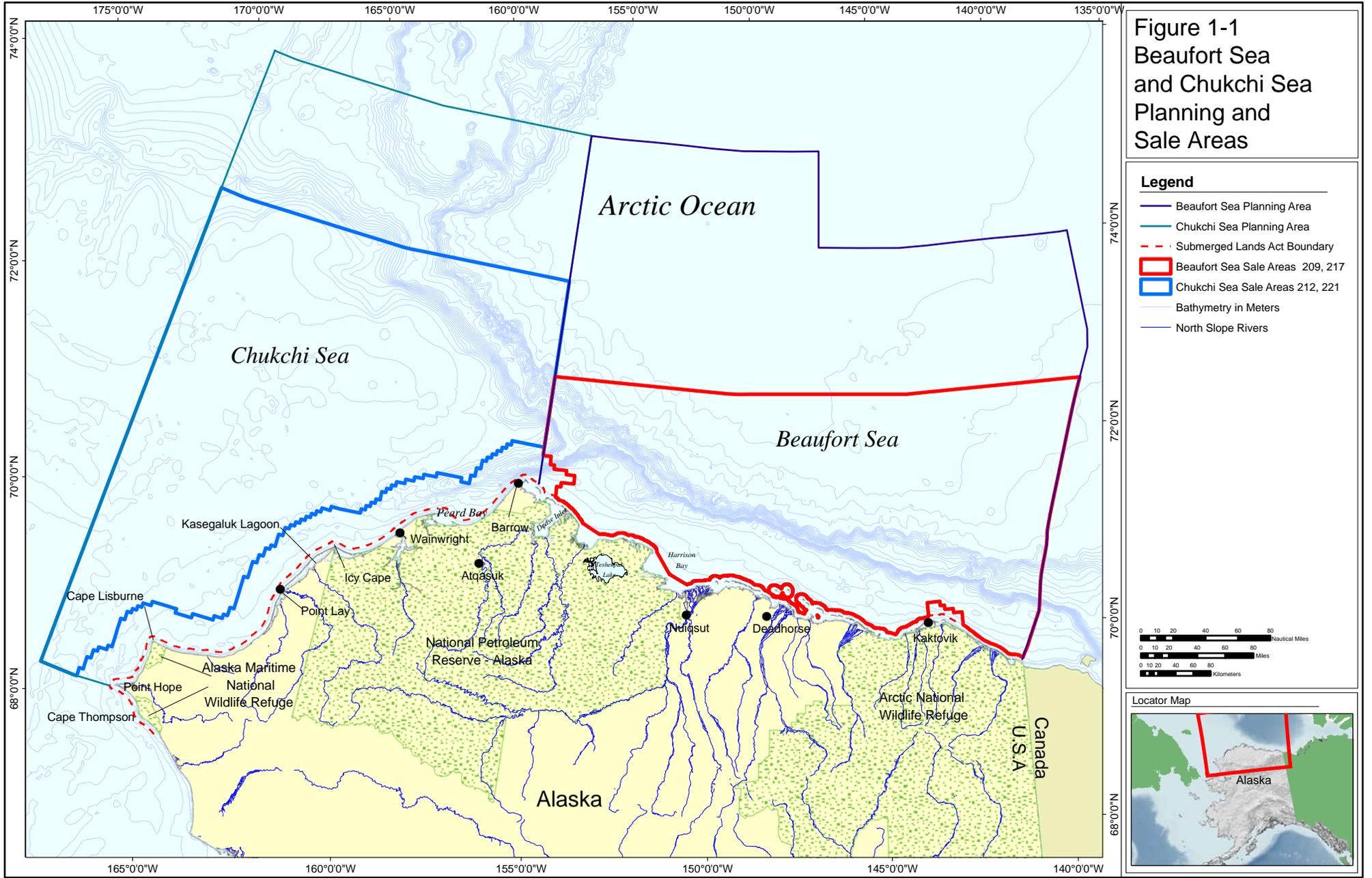
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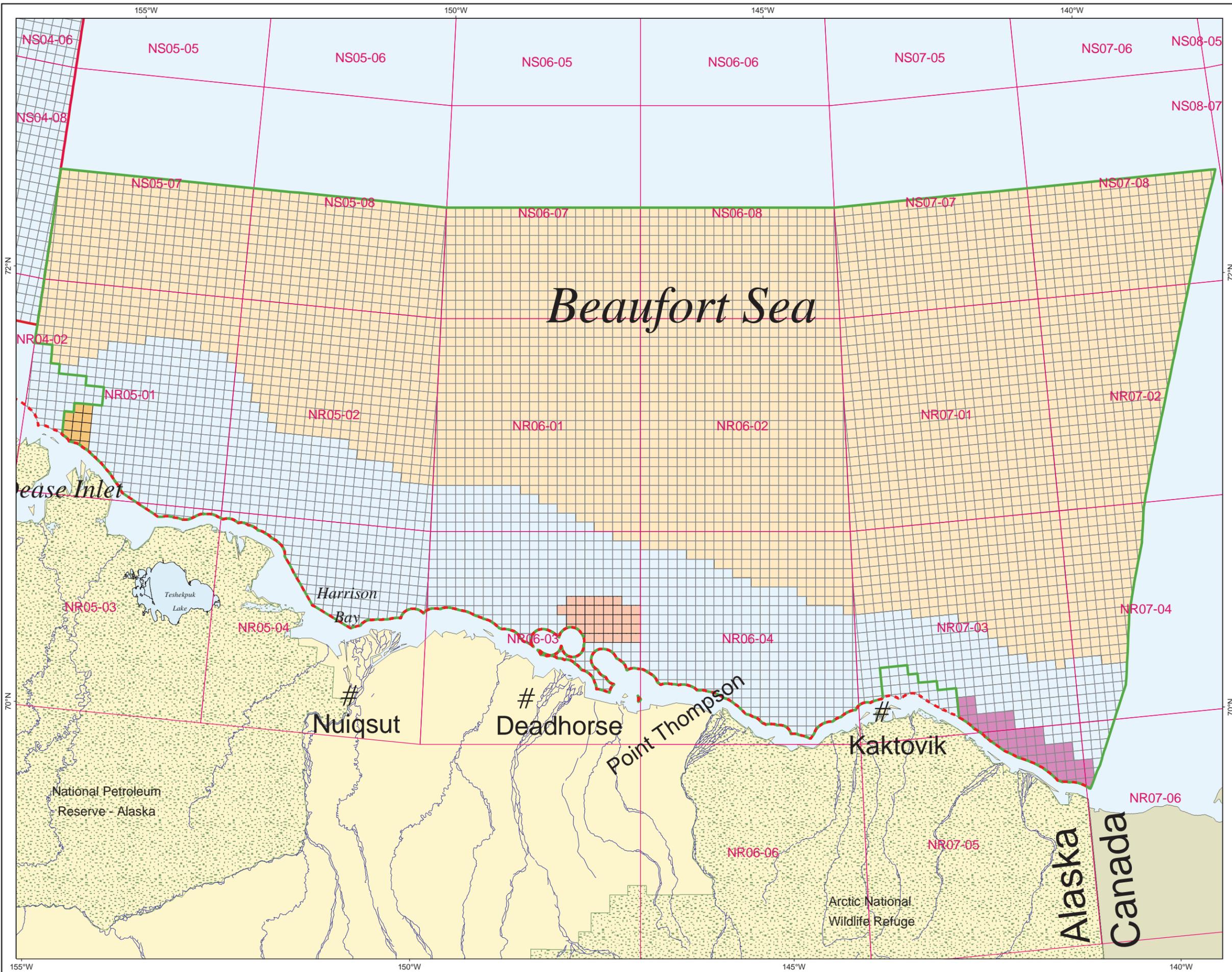
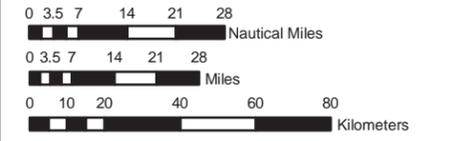


Figure 2-1
Beaufort Sea
Program Area

Legend

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



Locator Map



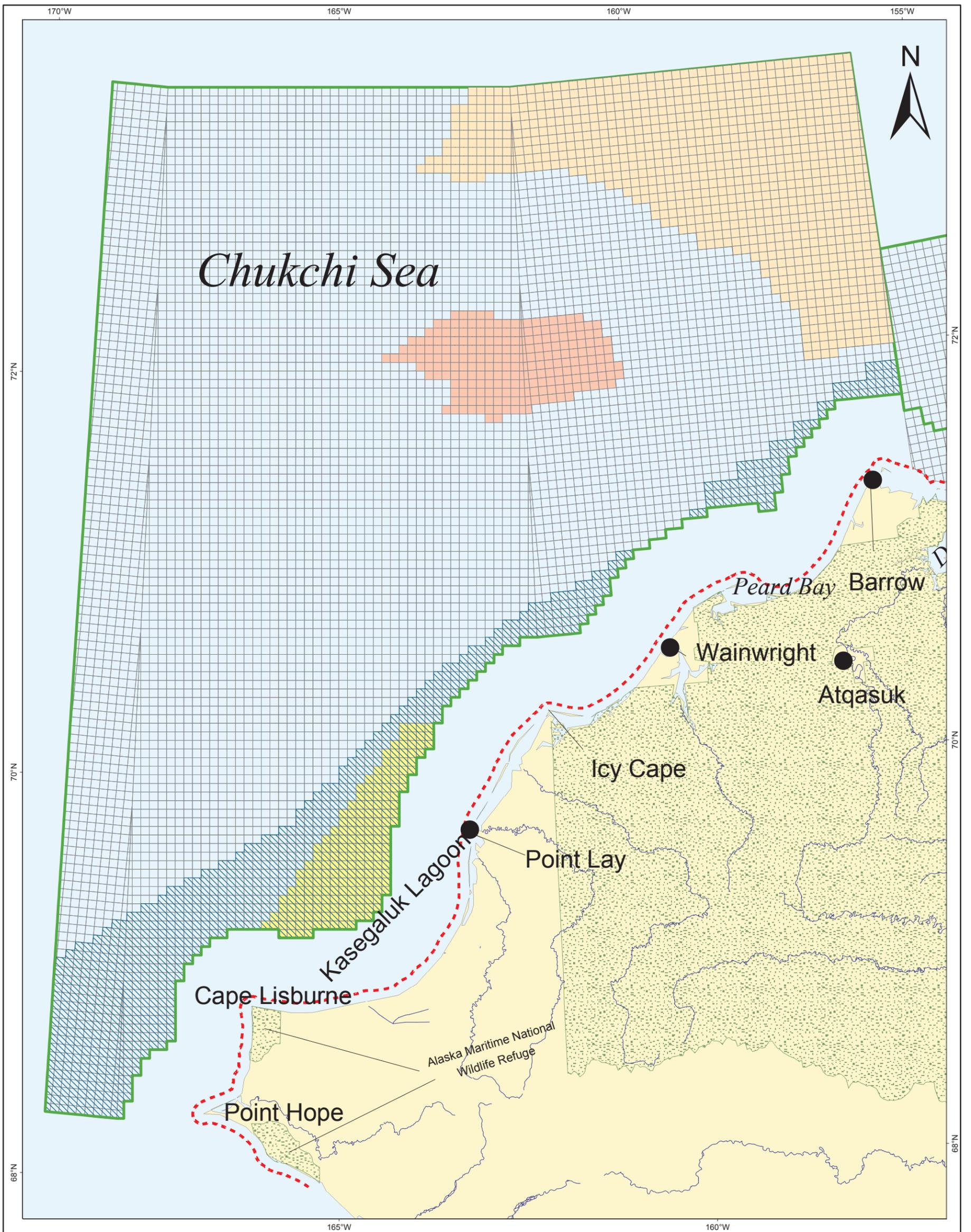


Figure 2-2
 Deferral Areas
 Chukchi Sea
 Program Area

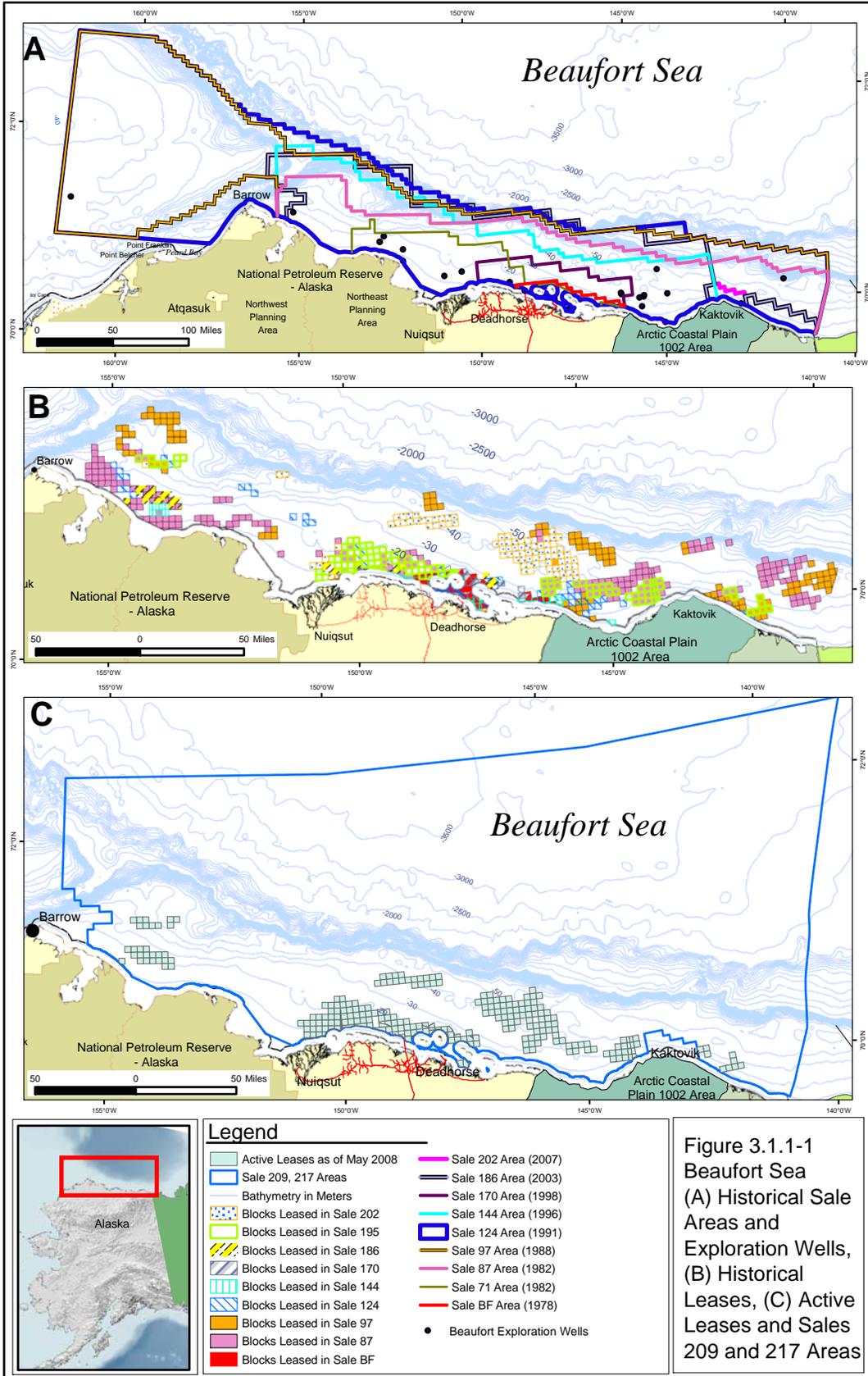


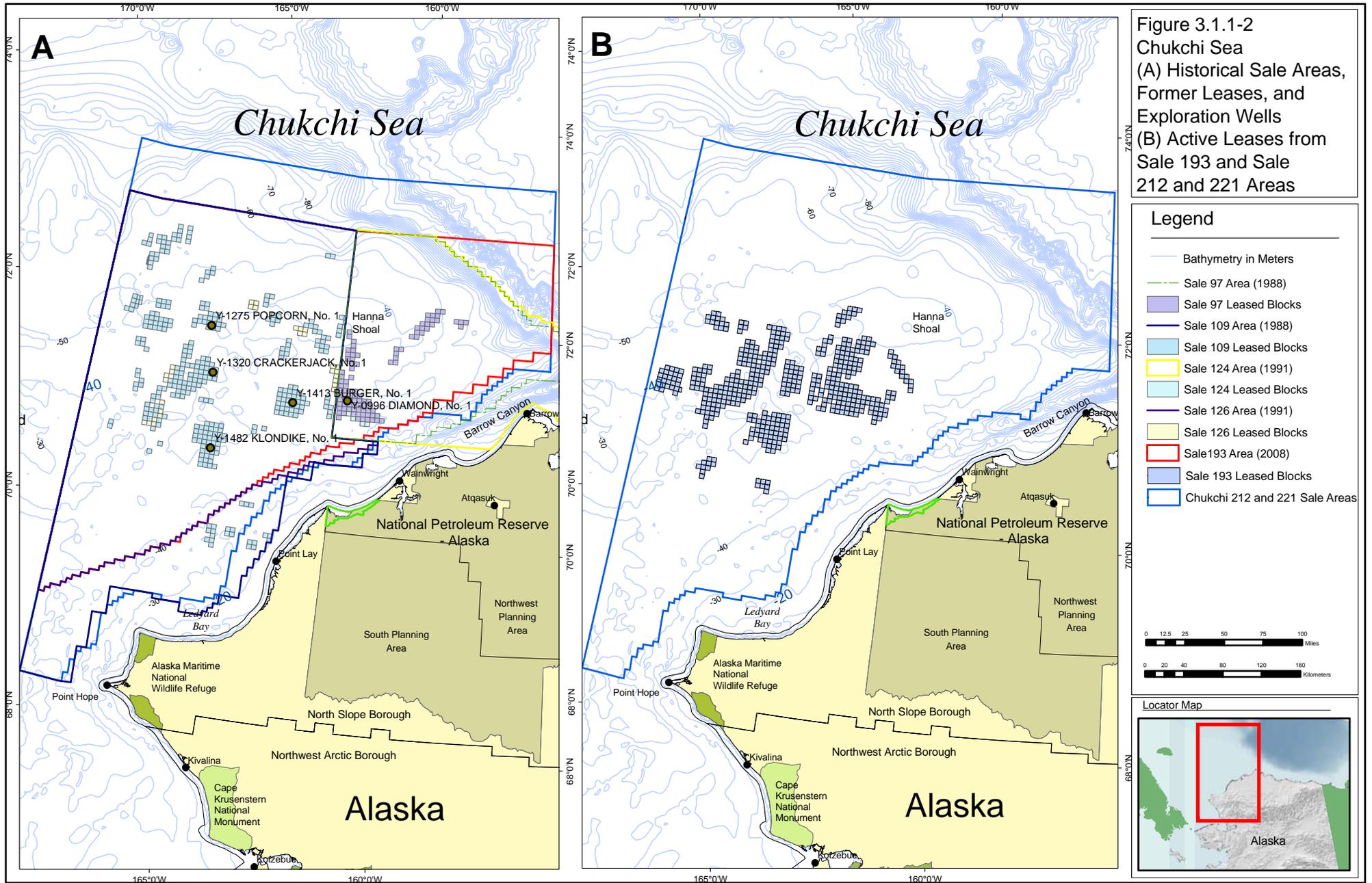
Legend

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

Locator Map







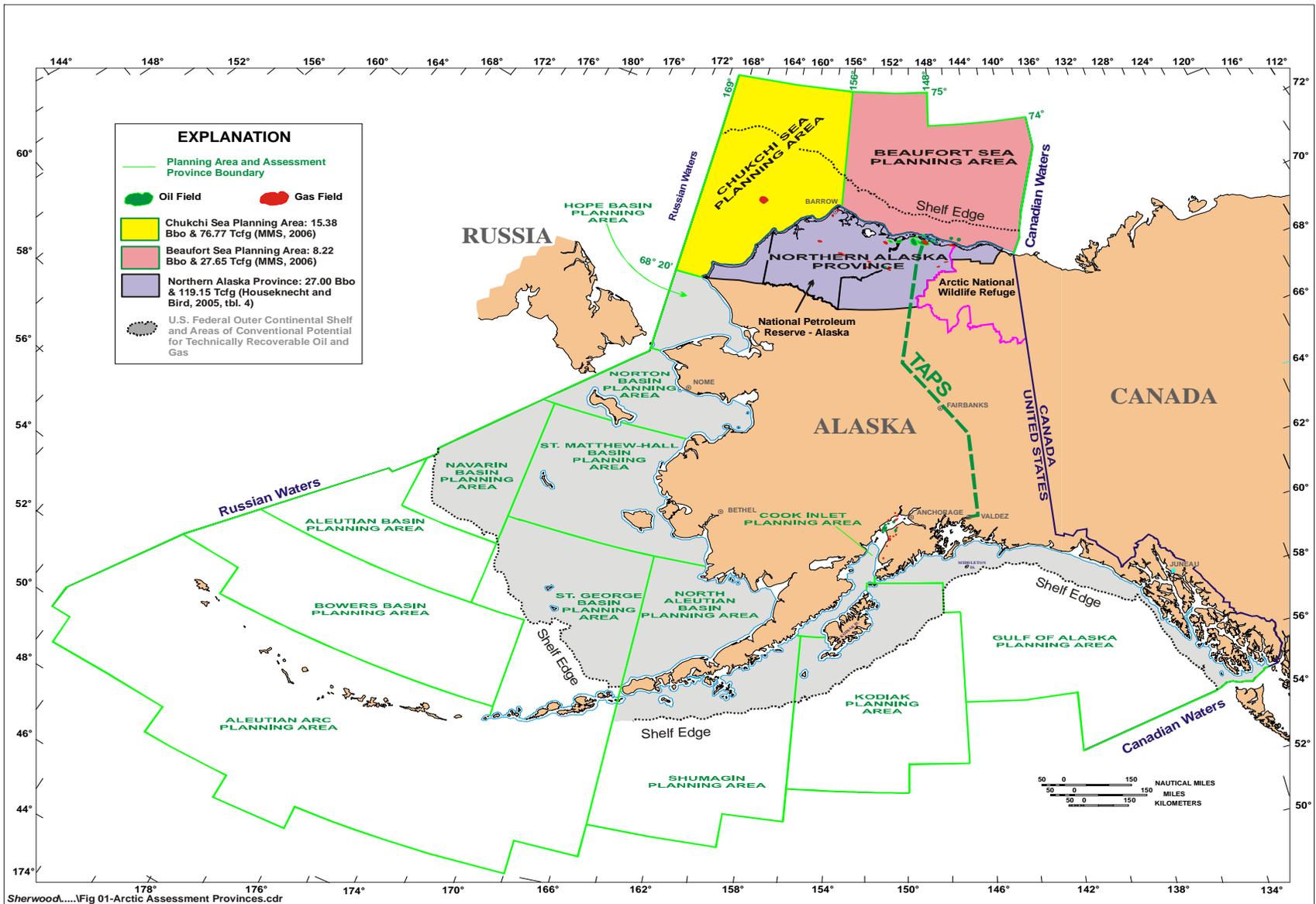


Figure 3.2.1-1 The Three Components of the Arctic Alaska Petroleum Province: (1) the Northern Alaska (onshore) Province; (2) the Chukchi Sea Planning Area; and (3) the Beaufort Sea Planning Area. The Alaska Federal OCS Planning Areas Also Are Shown.

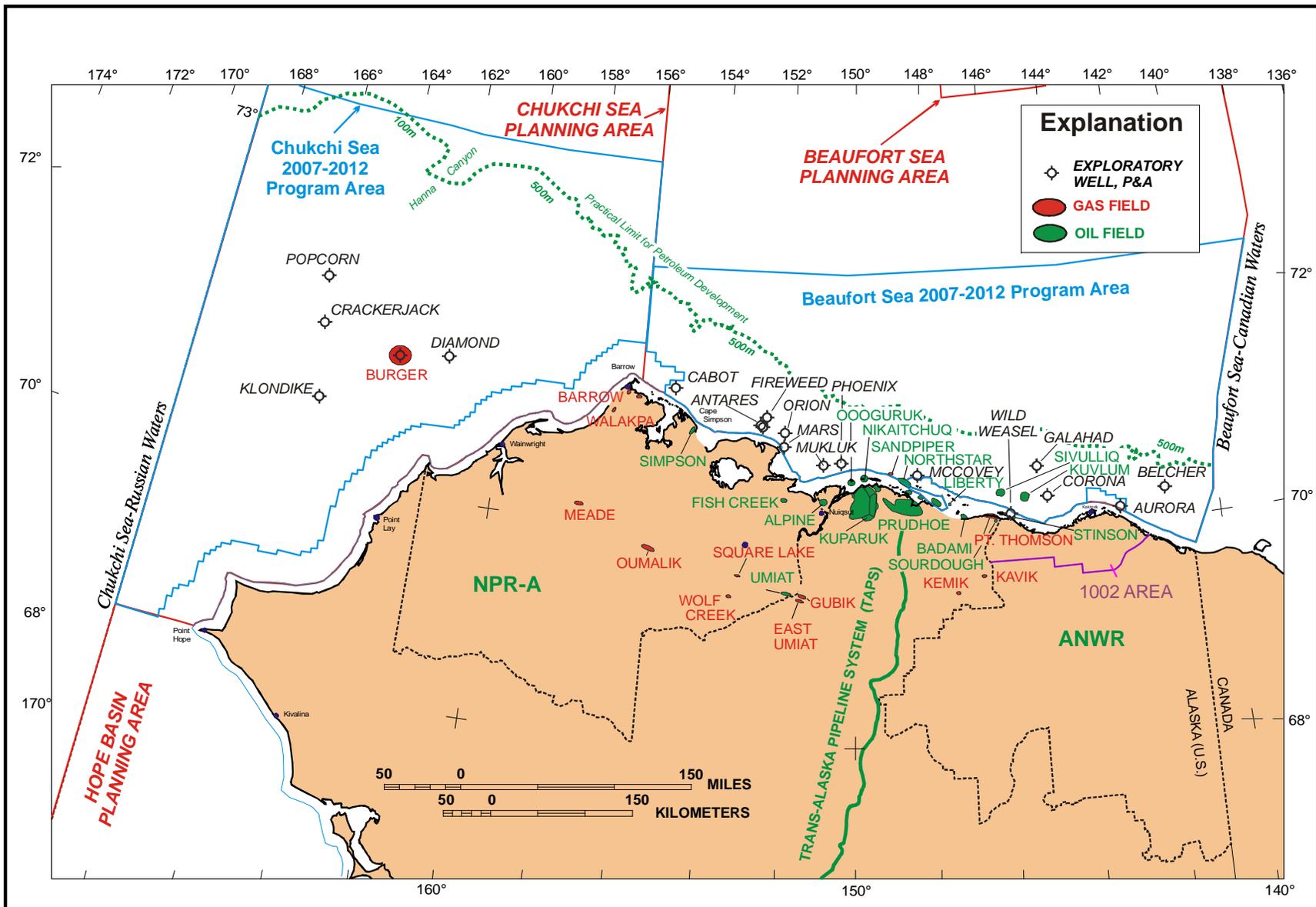


Figure 3.2.1-2 Oil and Gas Fields and Offshore Wells in the Beaufort Sea and Chukchi Sea Planning Areas. The 2007-2012 Five-Year Program Areas Are Subareas Within the Larger Planning Areas.

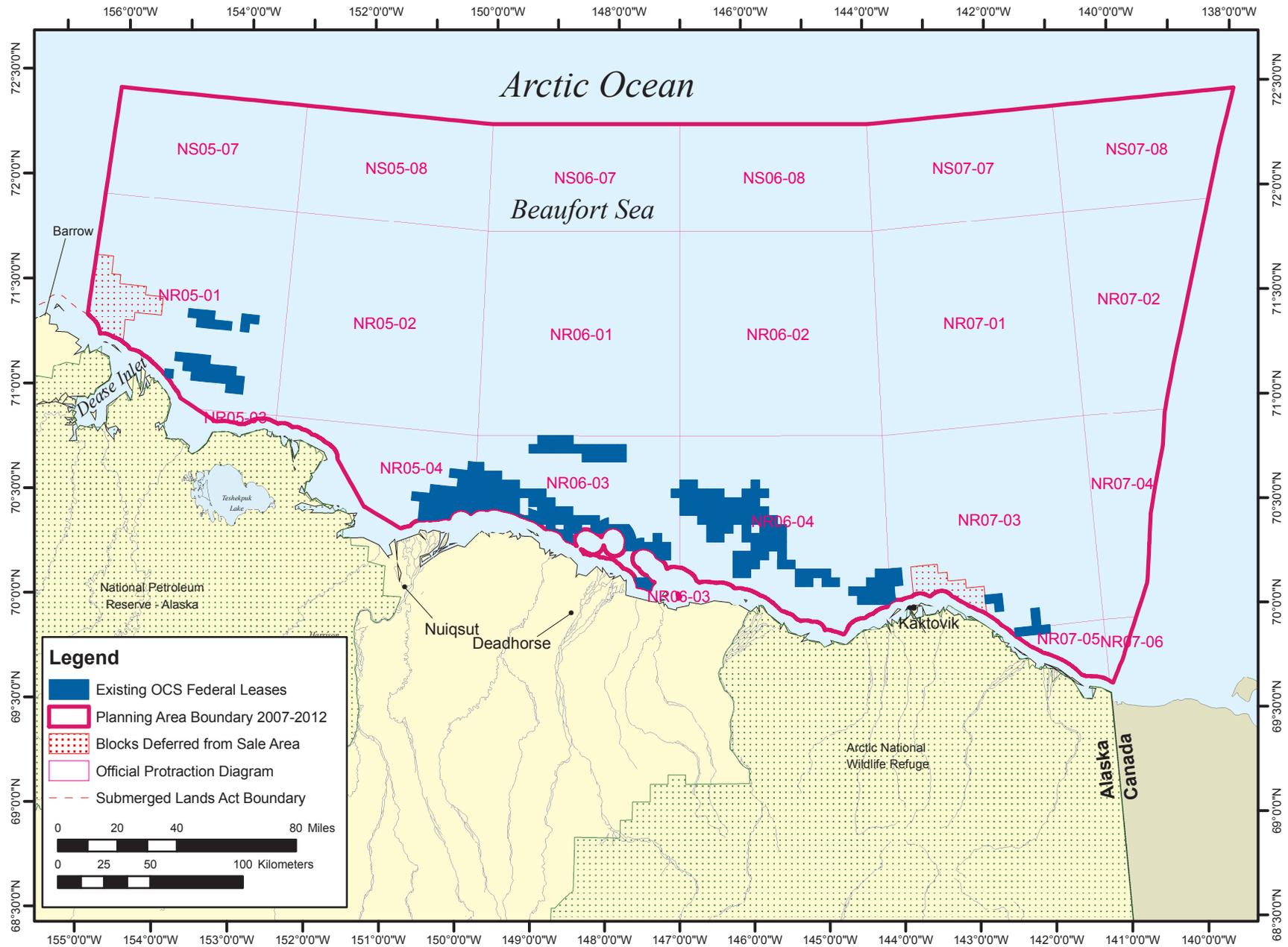


Figure 3.2.1-3 The 261 Active Leases in the Beaufort Sea Planning Area (as of November 2007). The original file of this map is available for download in pdf format at http://www.mms.gov/alaska/Maps/bf_leases.pdf.

Seismic Data Coverage - Arctic Outer Continental Shelf (Alaska)

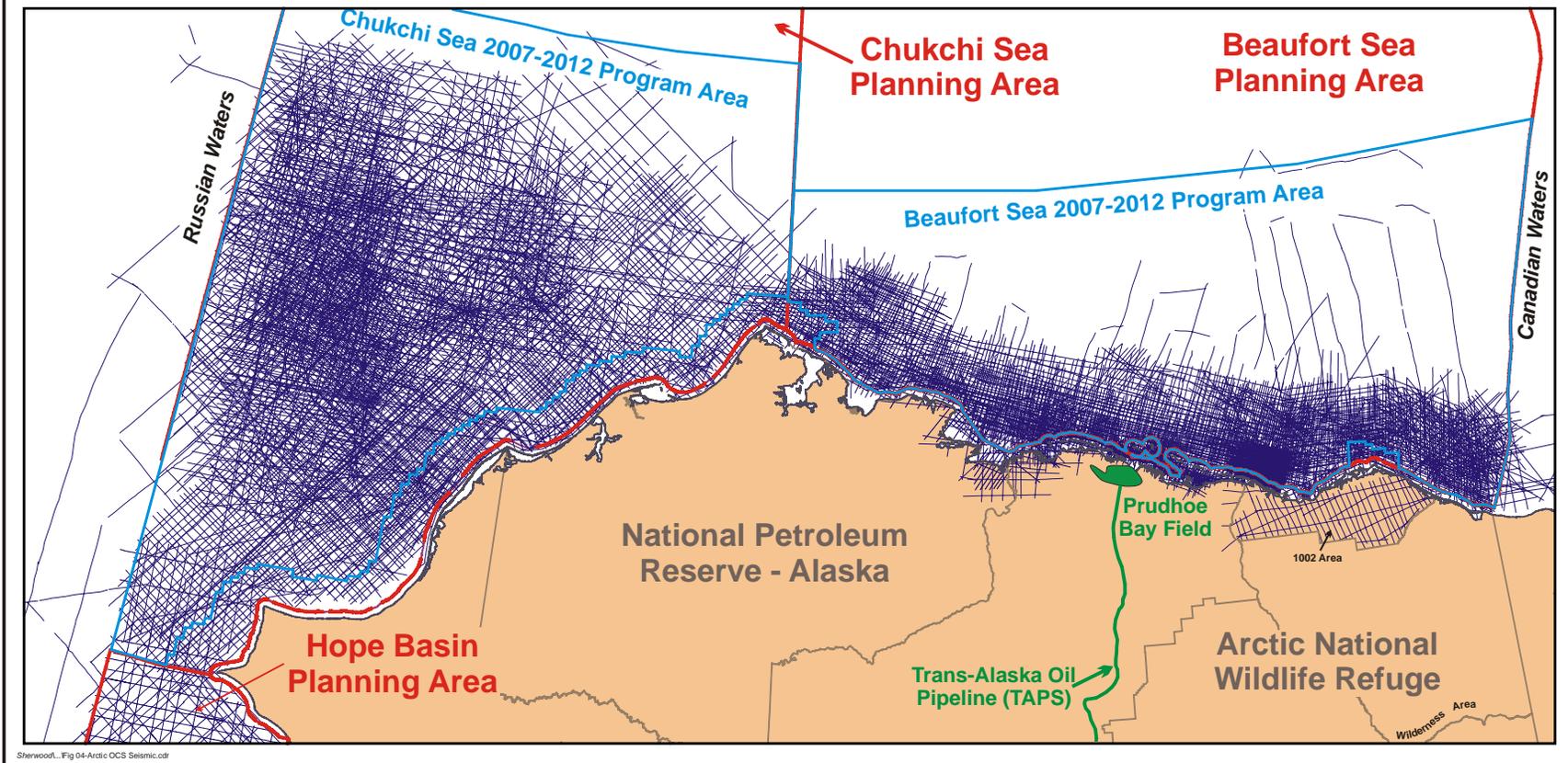


Figure 3.2.1-4 Coverage of 2D Seismic Data in the Beaufort Sea and Chukchi Sea Planning Areas. Only “speculative” (shot by geophysical companies and then offered on the open market) surveys are shown. The locations of 3D seismic surveys conducted in both planning areas are not shown.

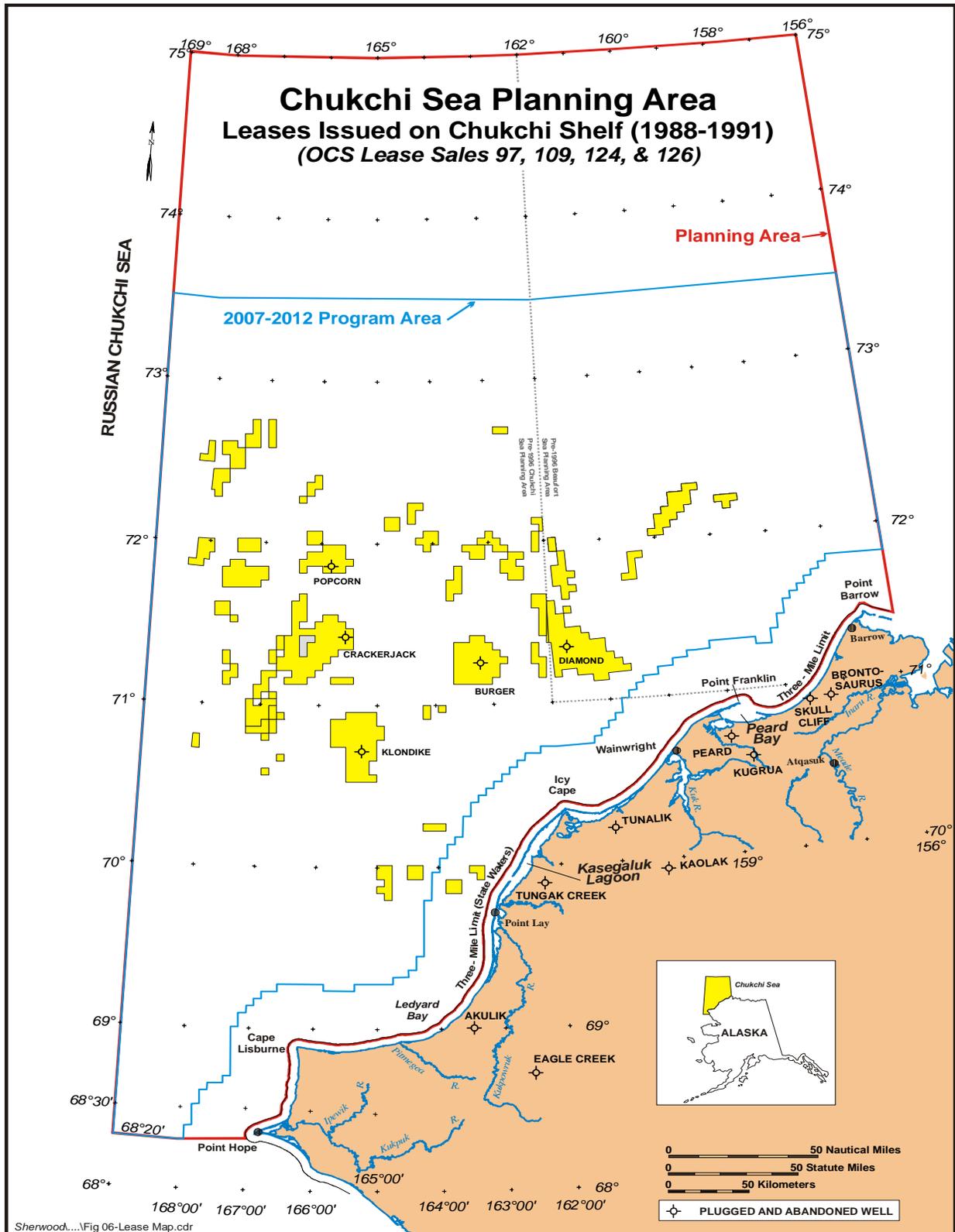


Figure 3.2.1-5 Chukchi Sea Planning Area, Leases Issued on Chukchi Shelf, 1988-1991, OCS Lease Sales 97, 109, 124, and 126. Locations of 483 leases issued (total high bids 512 million dollars) in 1988 and 1991 lease sales in modern Chukchi Sea Planning Area. The pre-1996 boundary between the Beaufort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

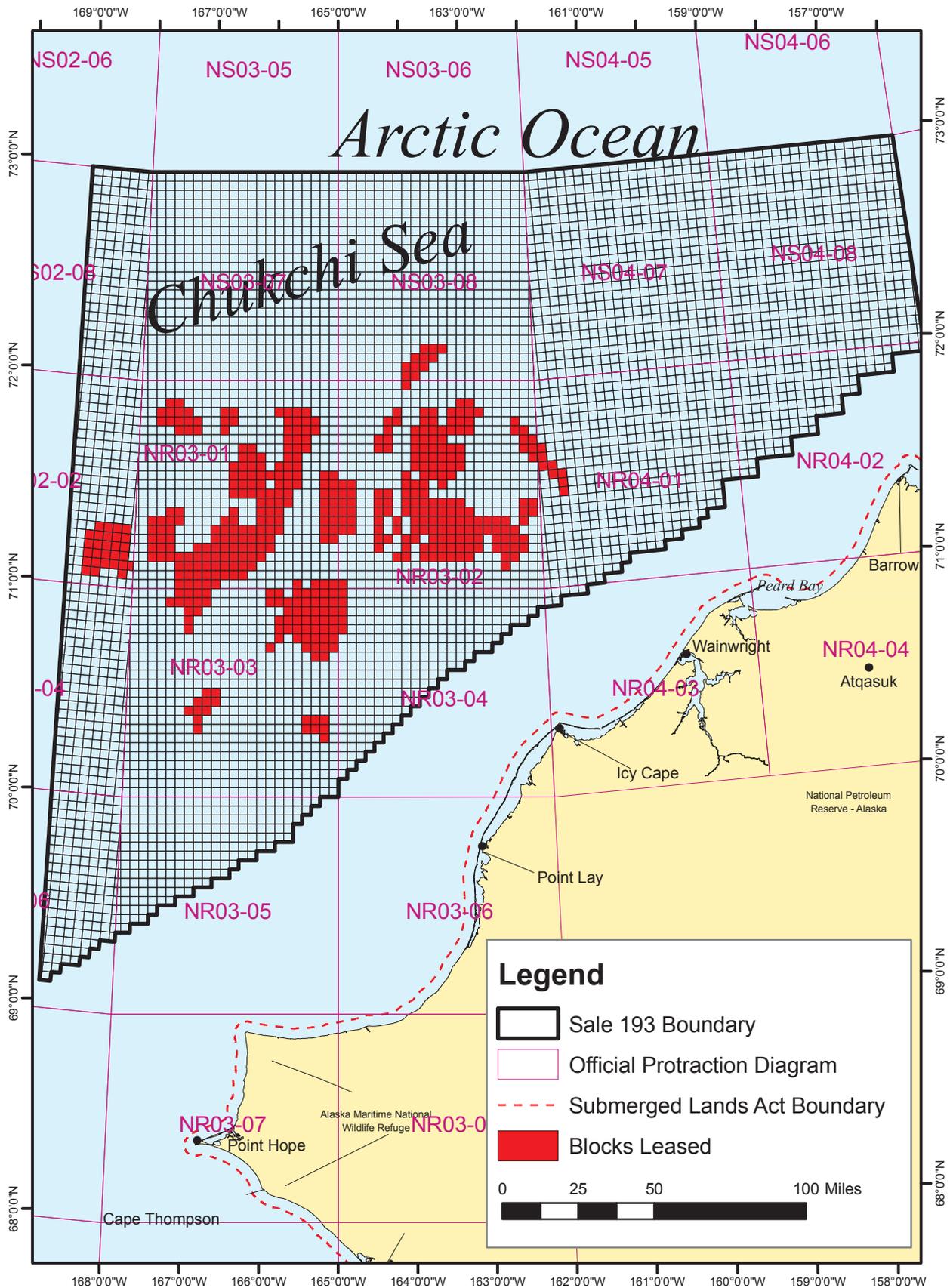


Figure 3.2.1-6 Blocks Leased in Chukchi Sea Sale 193 (February 6, 2008). Adaped from original file of map available for download in pdf format at http://www.mms.gov/alaska/cproject/Chukchi193/193Saleday/Sale_193_blx.pdf

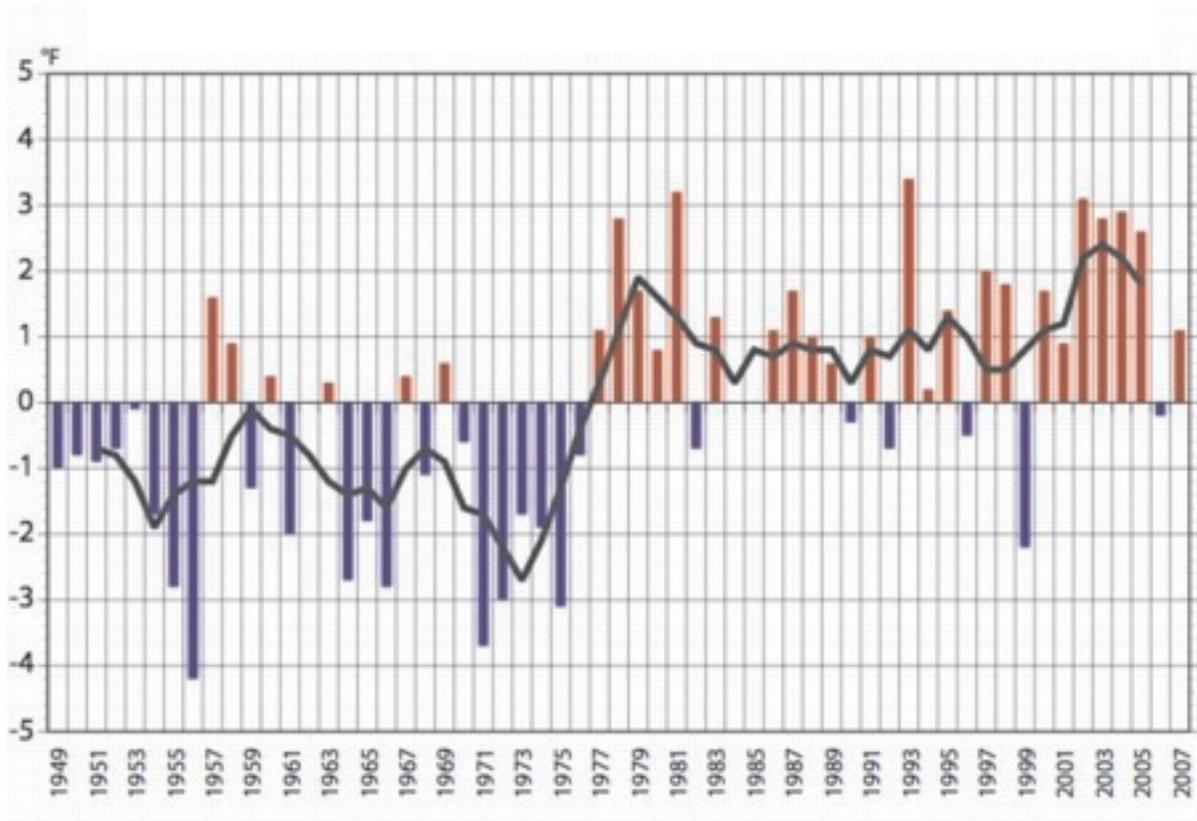


Figure 3.2.2-1 Mean Annual Temperature Departure for Alaska (°F), 1949-2007

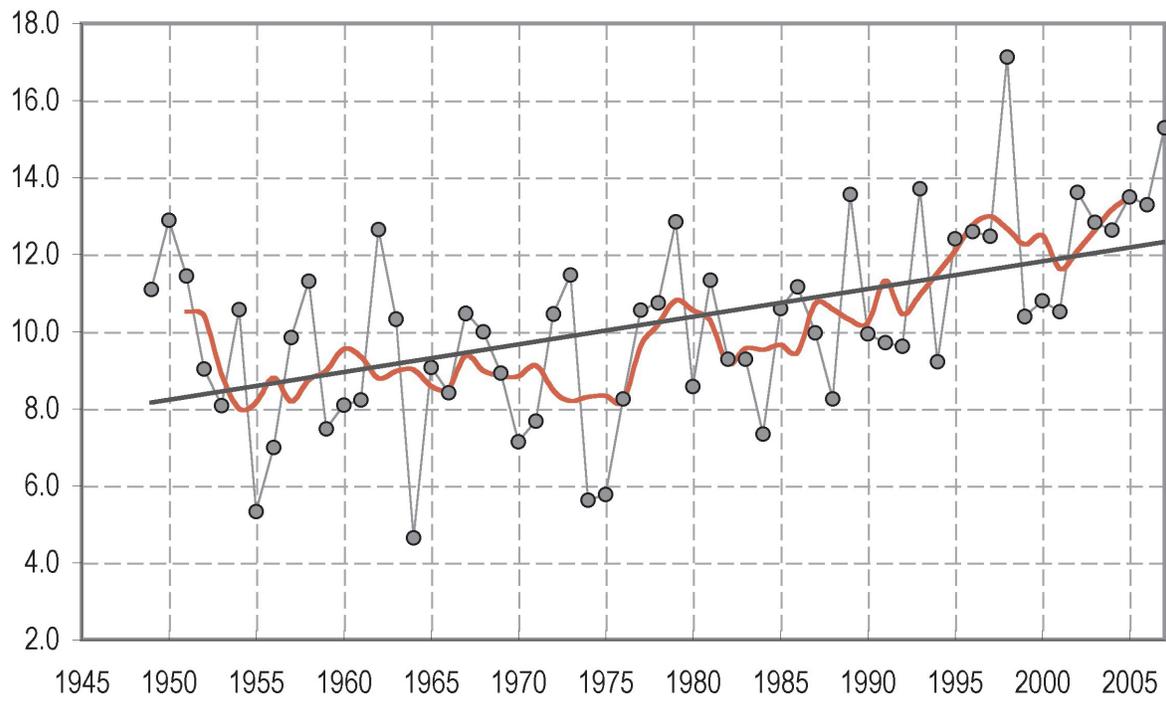


Figure 3.2.2-2 Barrow Mean Annual Temperature (°F)

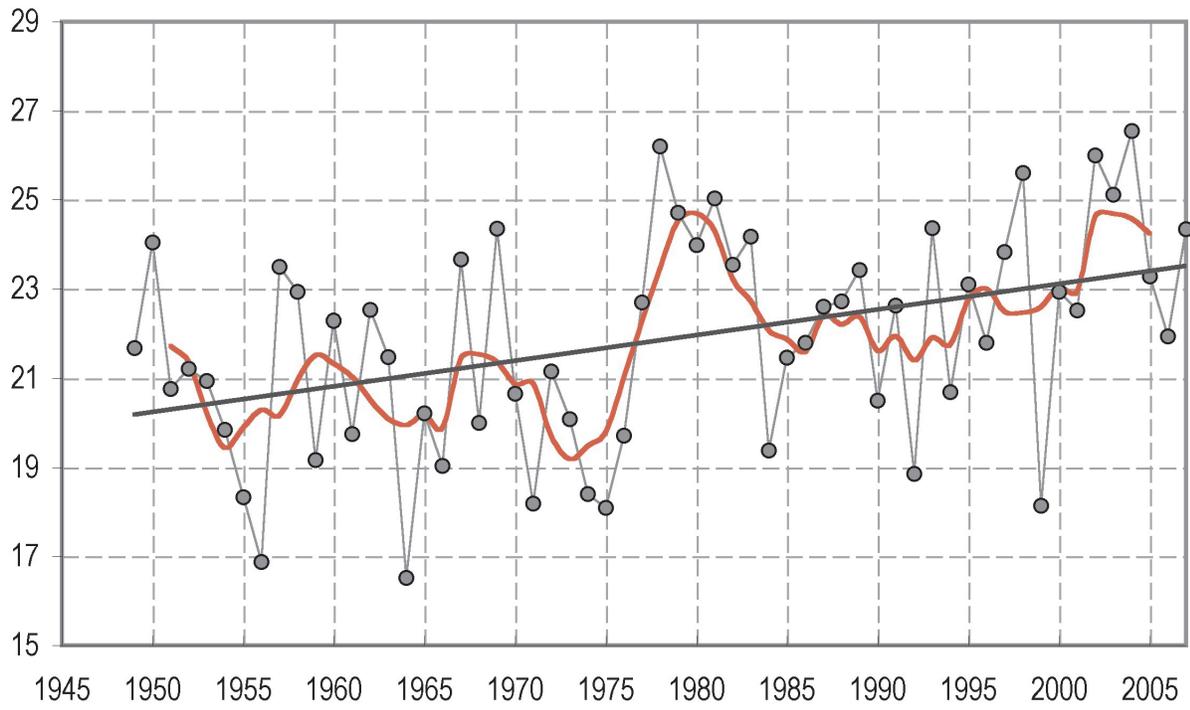


Figure 3.2.2-3 Kotzebue Mean Annual Temperature (°F)

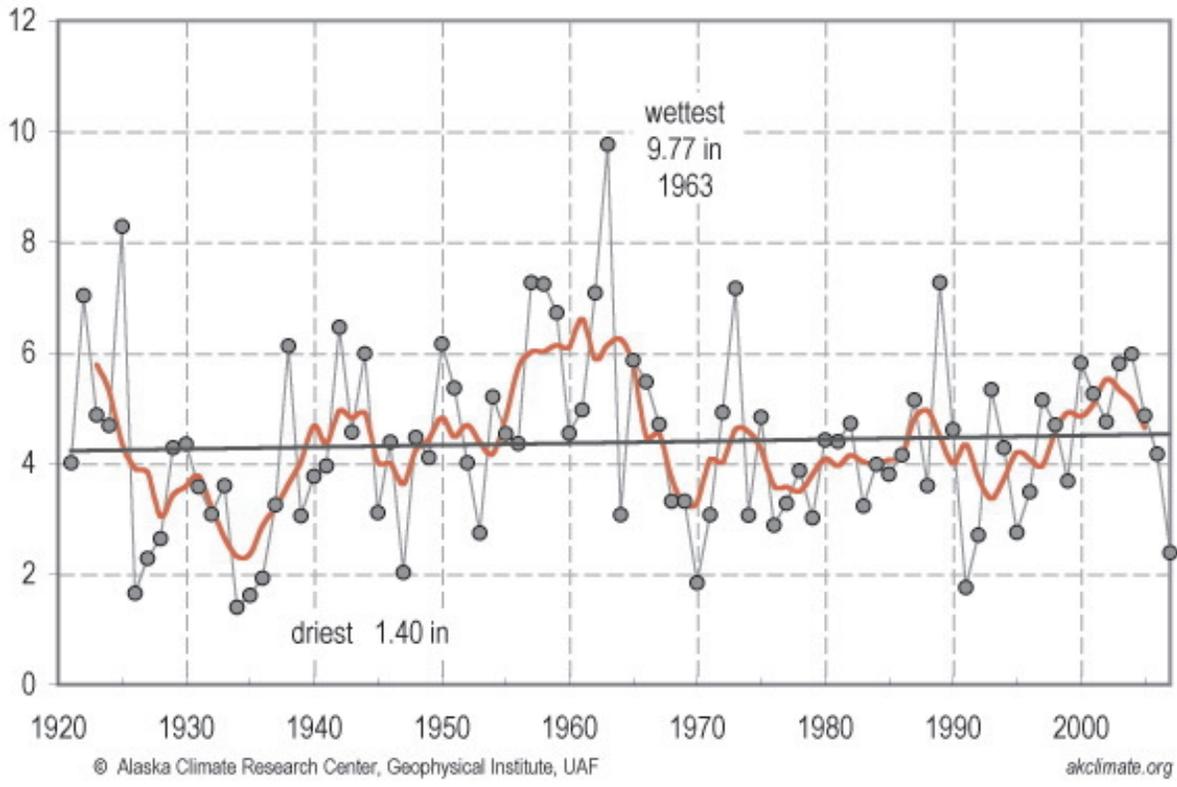


Figure 3.2.2-4 Barrow Total Annual Precipitation (inches)

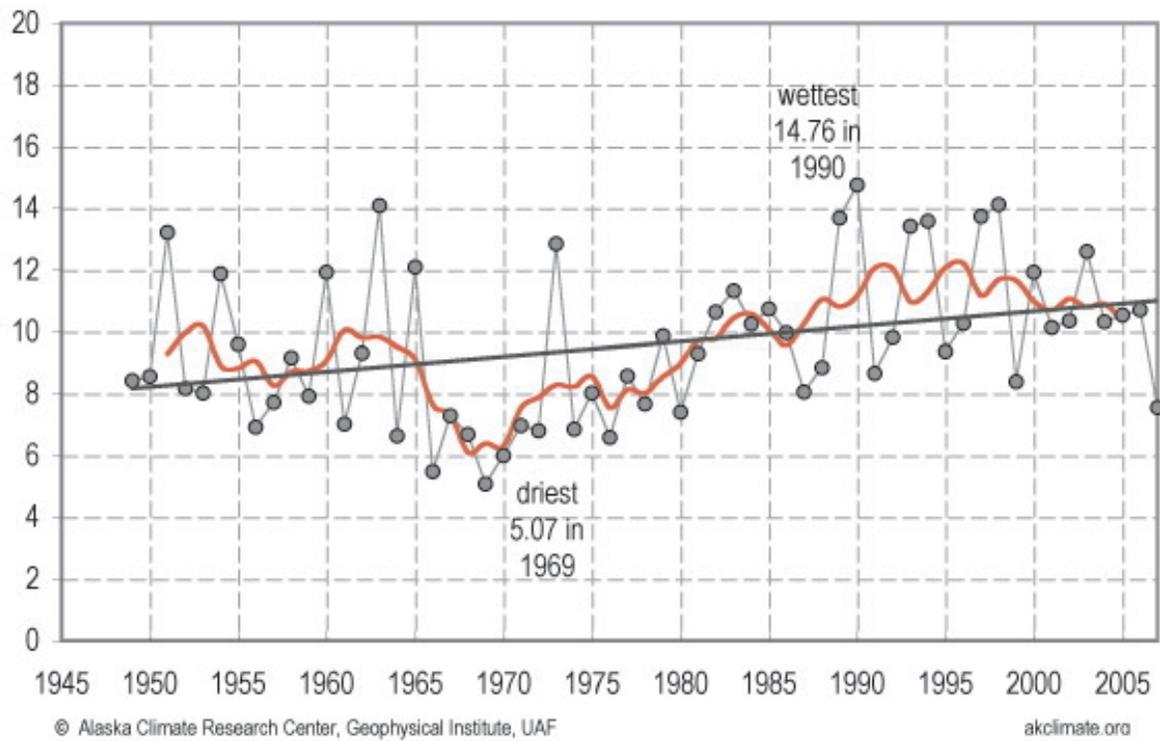
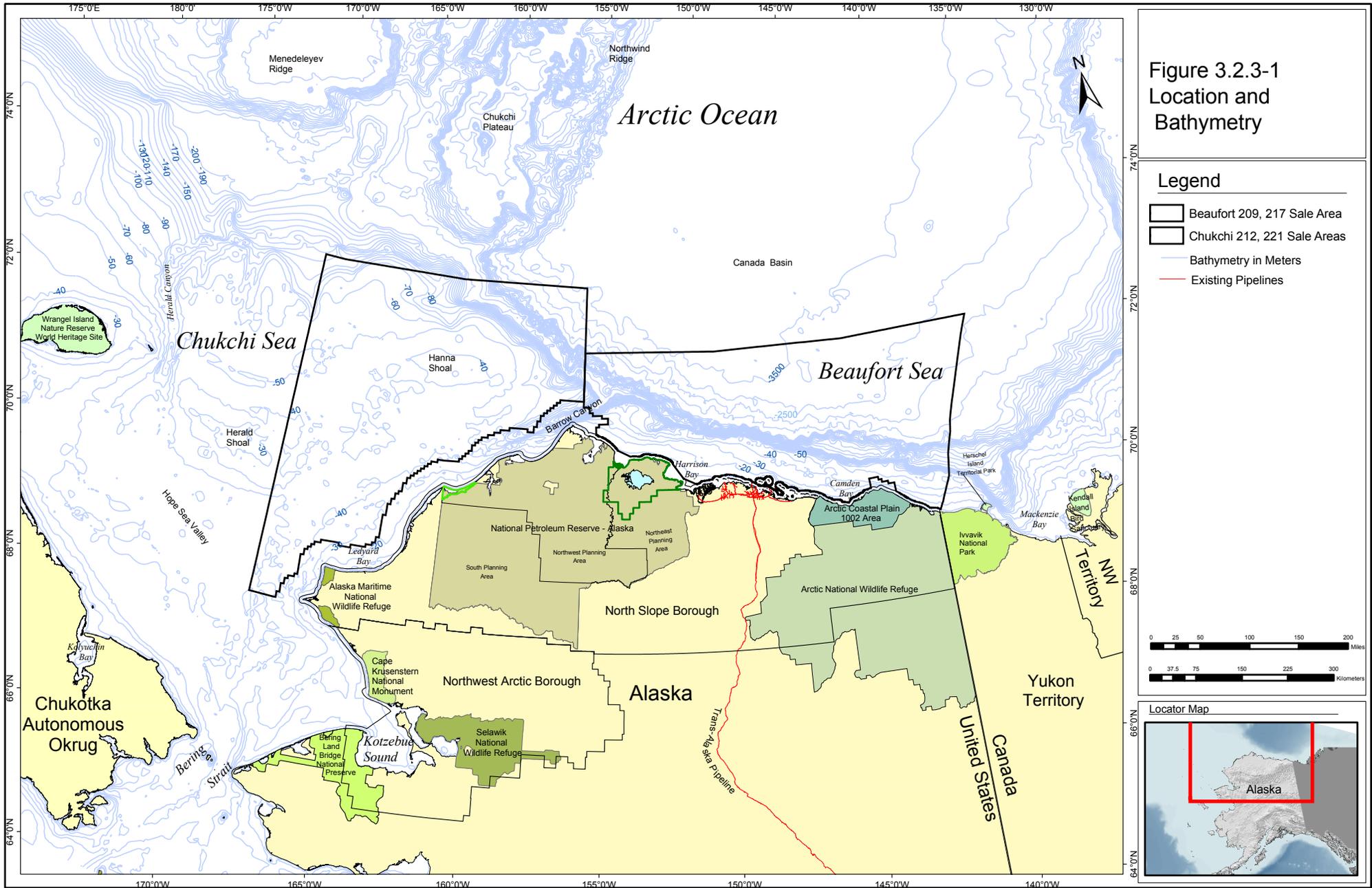


Figure 3.2.2-5 Kotzebue Total Annual Precipitation (inches)



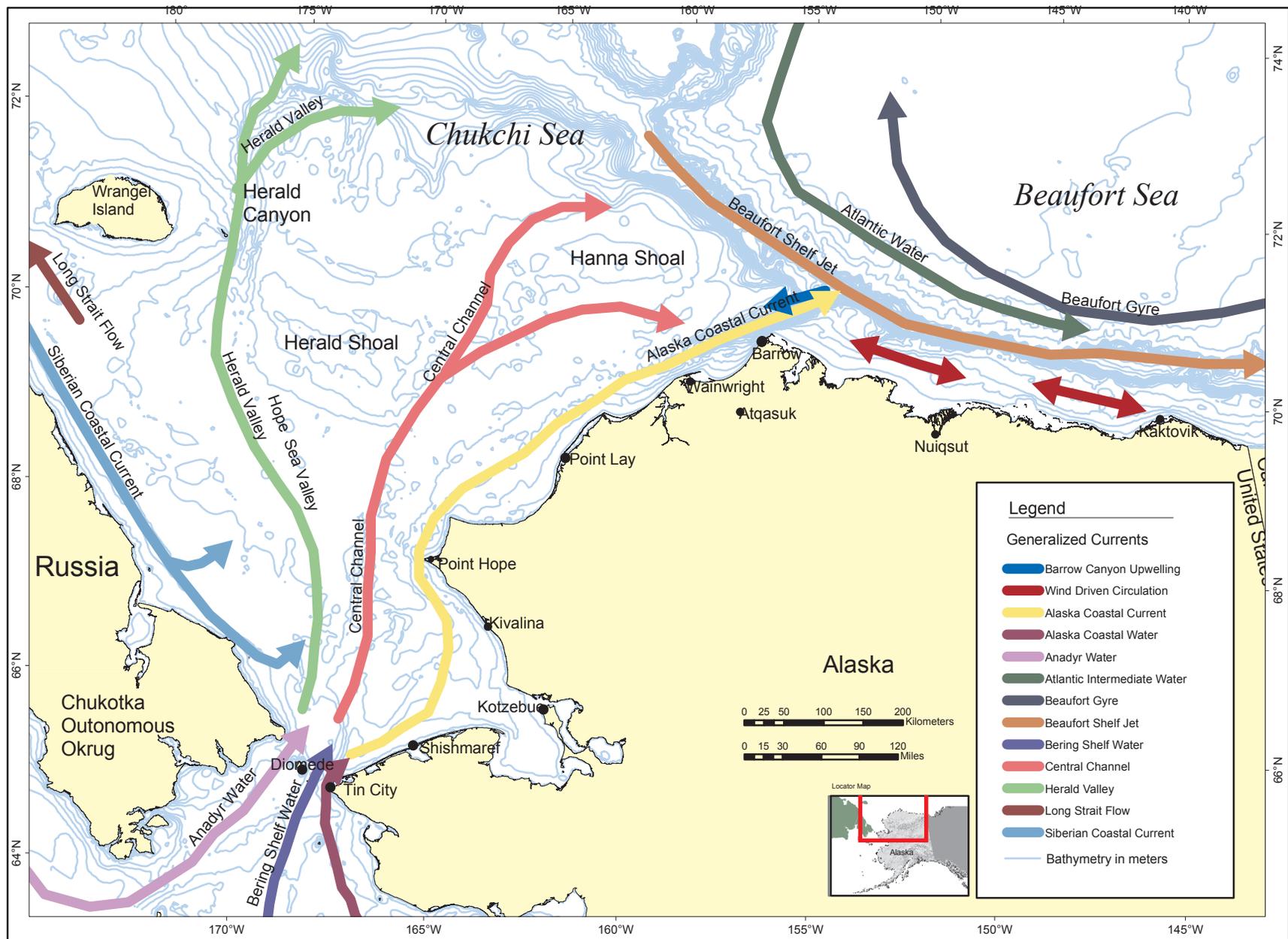
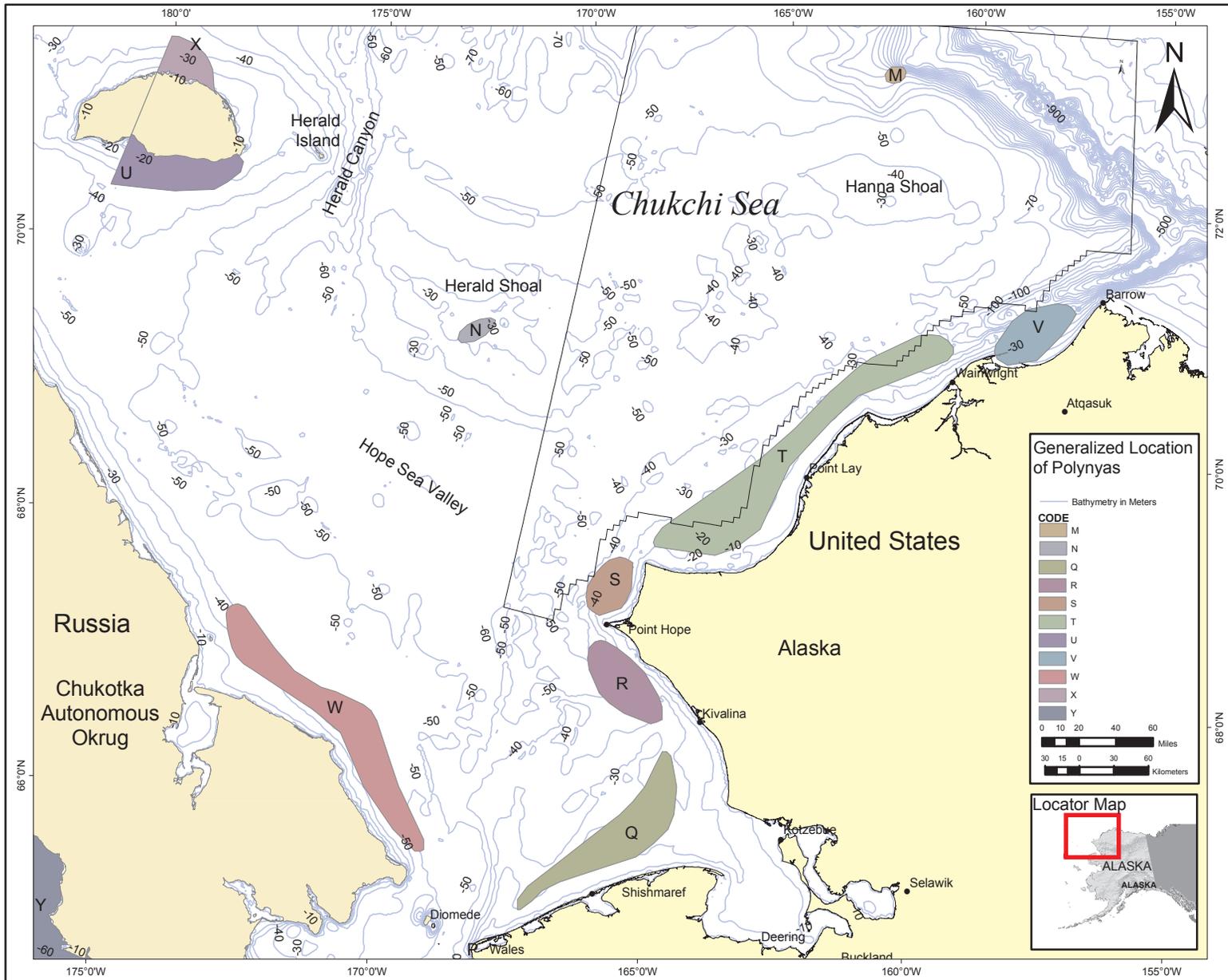
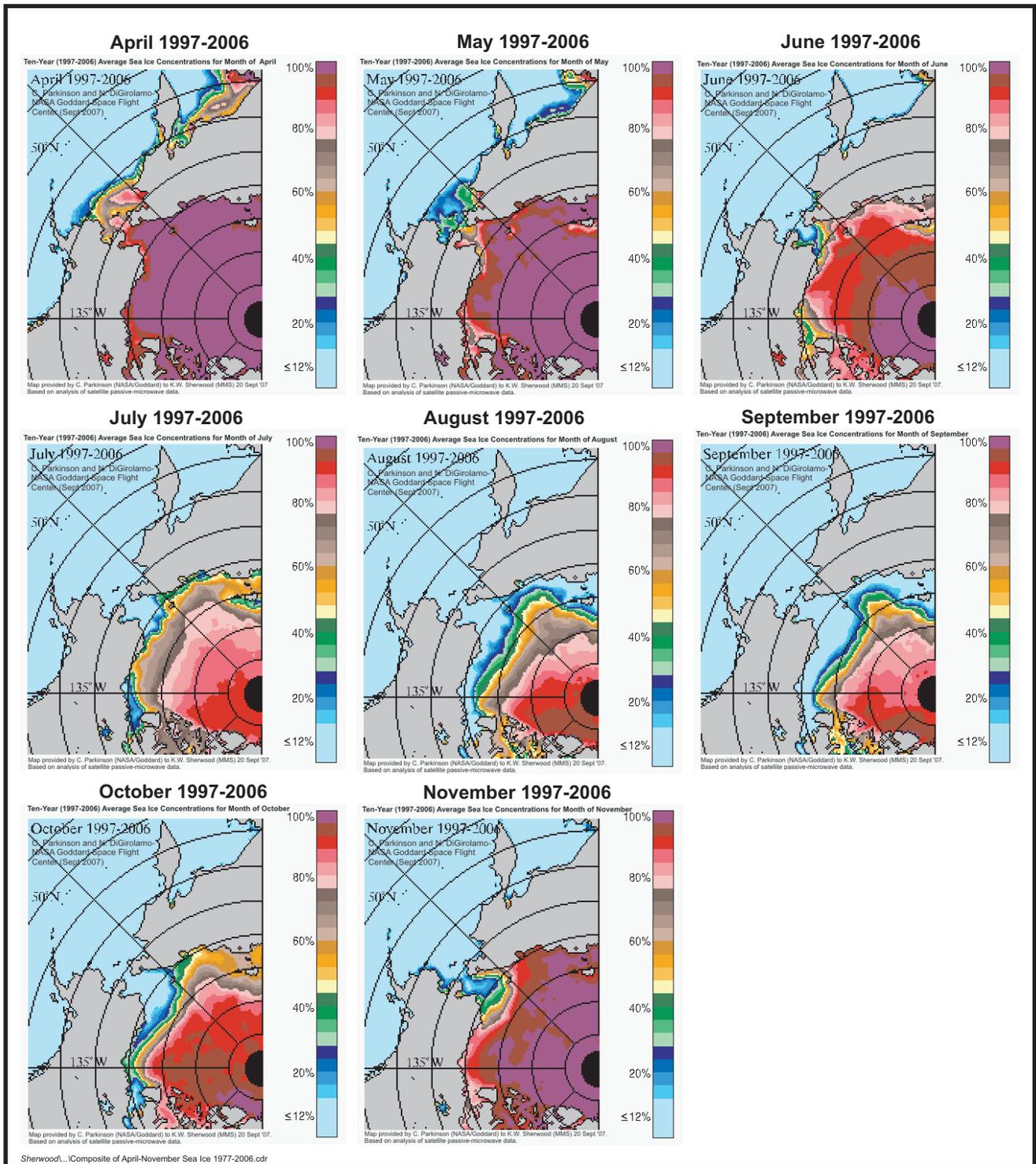


Figure 3.2.3-2 Generalized Circulation over the Chukchi and Beaufort Seas.



Source: Stringer et al. 1991.

Figure 3.2.4-1. Generalized Location of Chukchi Polynyas



Source: Parkinson, 2007

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

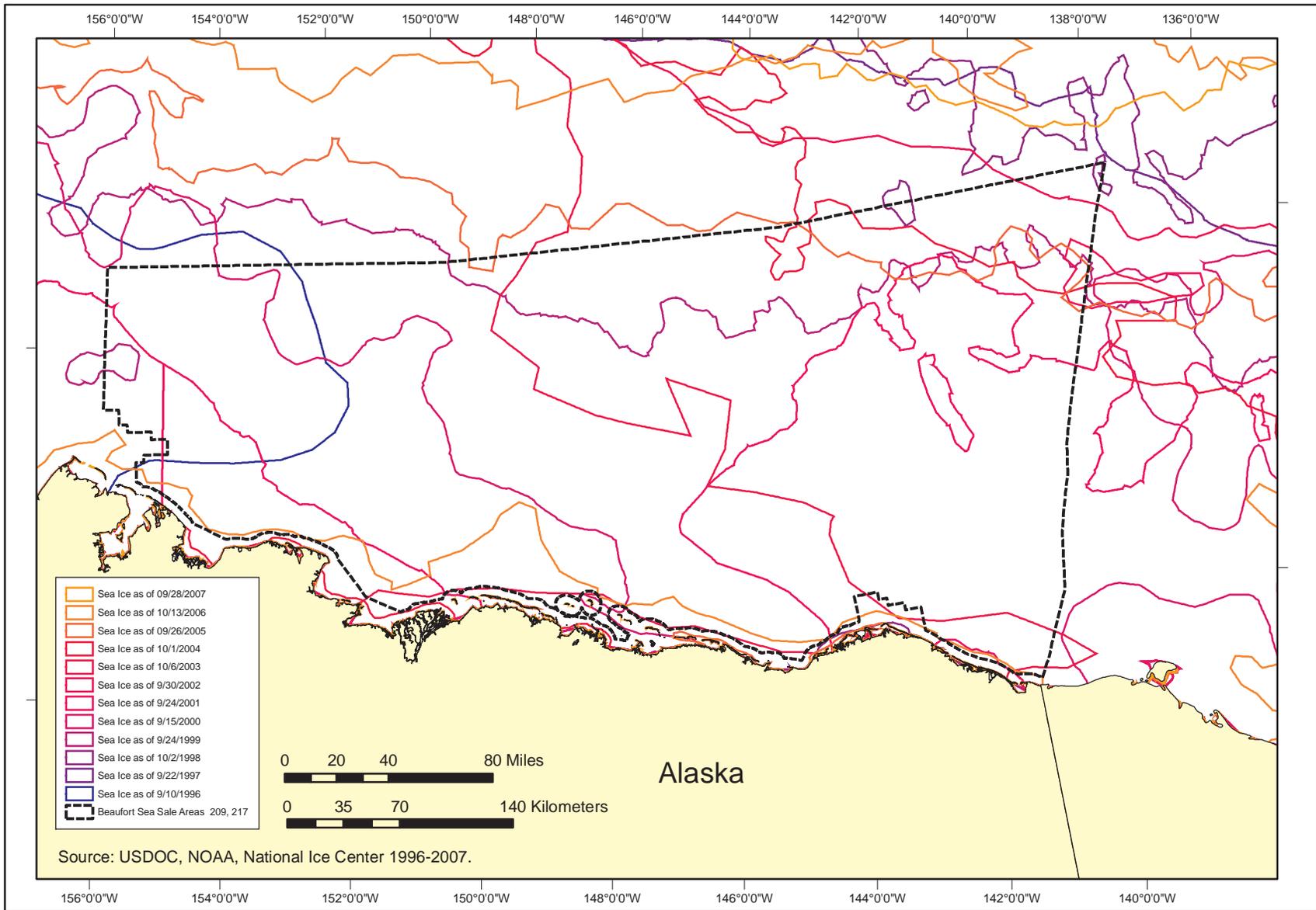


Figure 3.2.4-3. Beaufort Sea Generalized Maximum Retreat of Sea Ice 1996-2007.

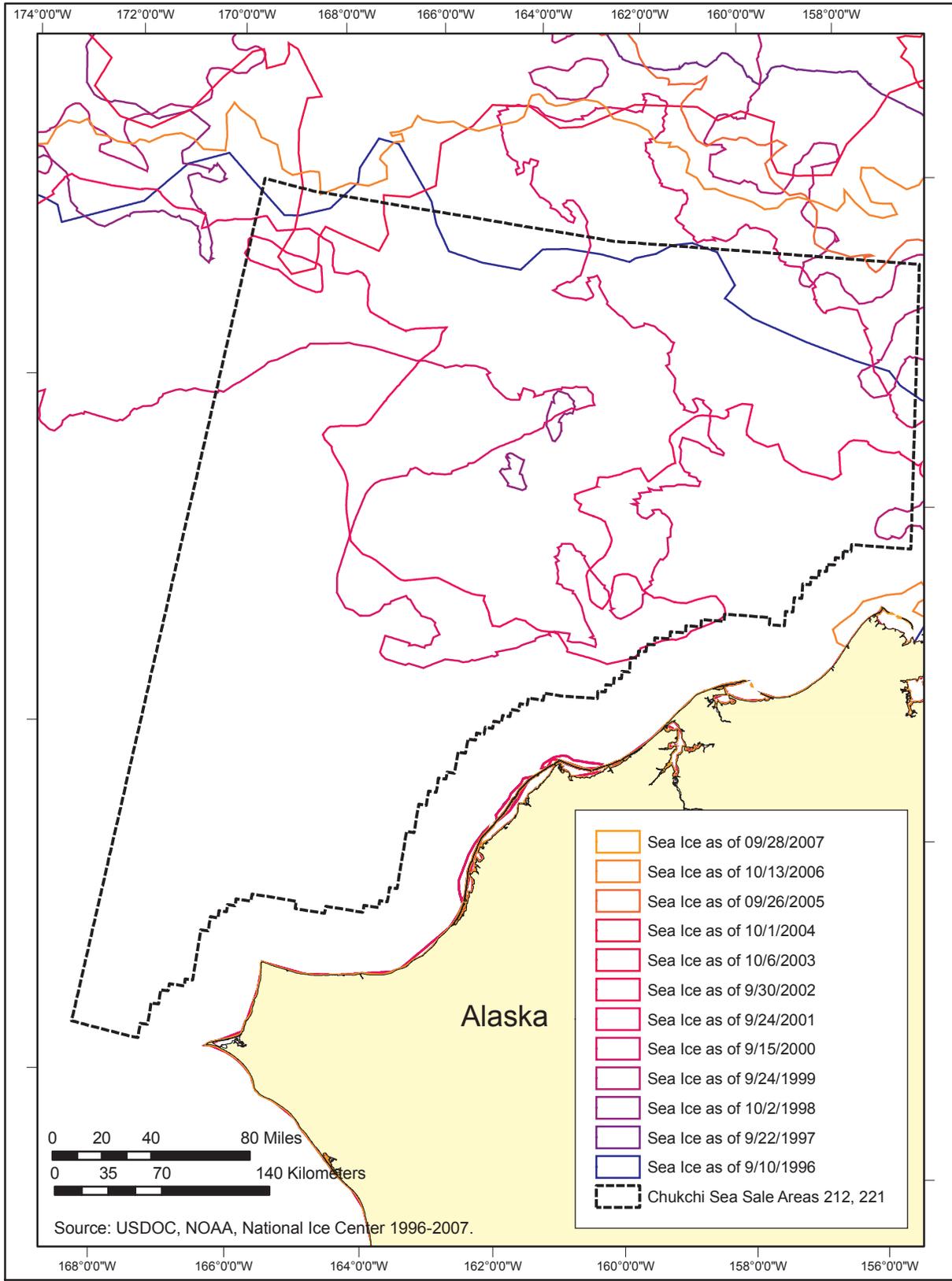


Figure 3.2.4-4. Chukchi Sea Generalized Maximum Retreat of Sea Ice 1996-2007.

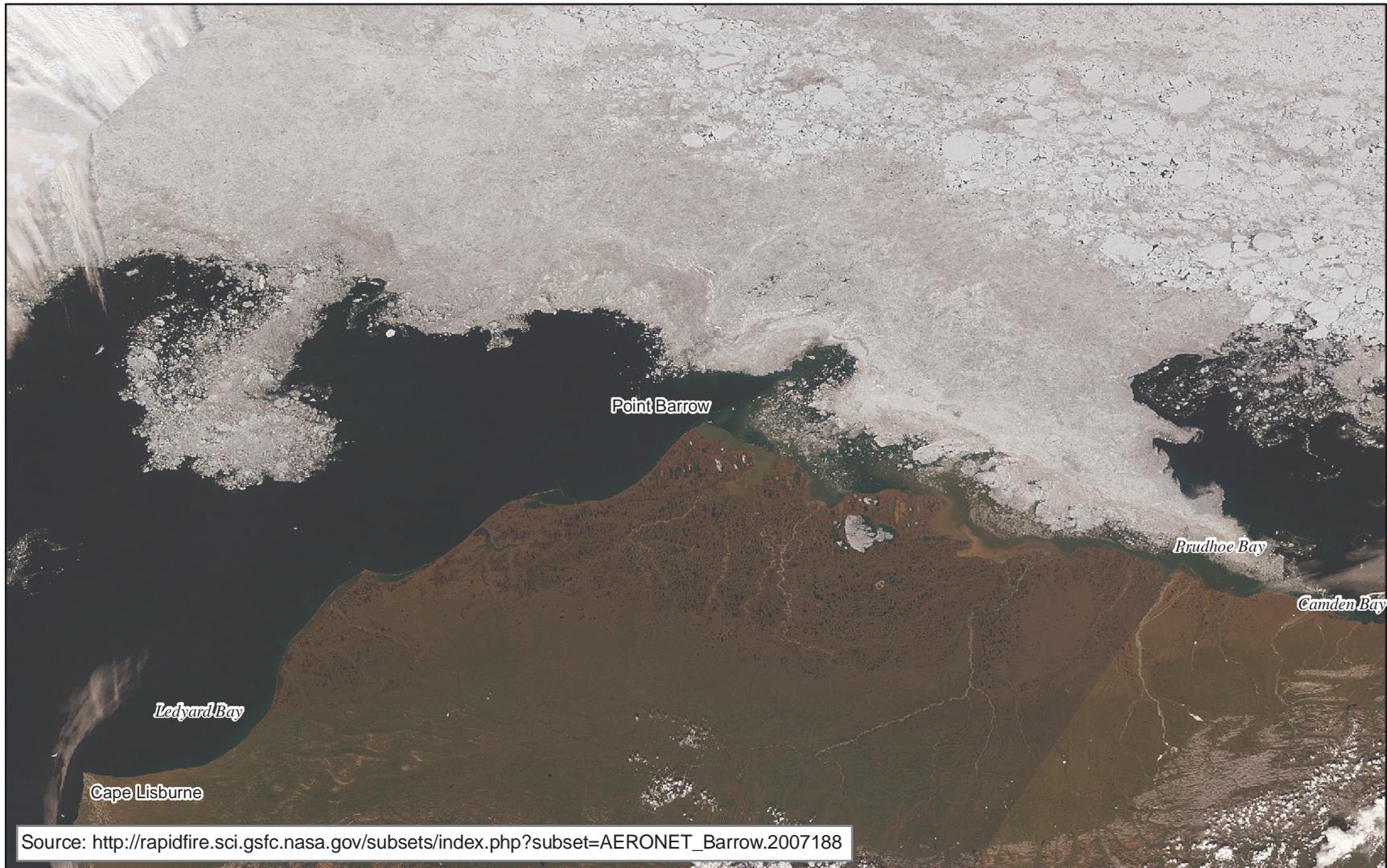


Figure 3.3.1-1 Early summer sea ice and coastal production in part of the proposed lease areas. Some locations in the satellite photograph are Cape Lisburne and Ledyard Bay in the Chukchi Sea on the left, Point Barrow in the center, and Camden Bay in the Beaufort Sea on the right edge. The apparent line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

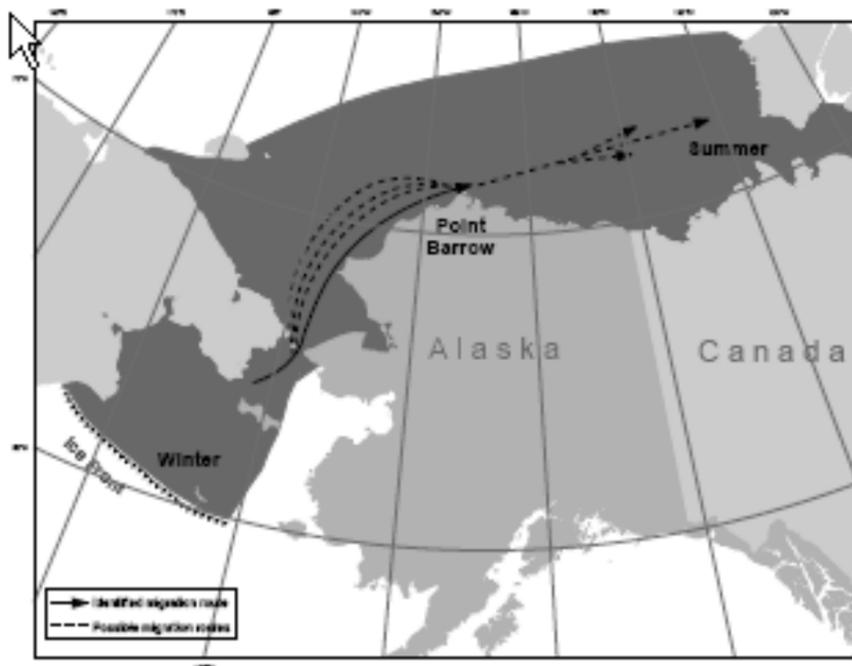


Figure 3.3.4.1-1. Bowhead Whale Distribution and Spring Migration Routes, Shaded area depicts the approximate distribution of Arctic stock bowhead whales. Spring migration is noted by lines and arrows following a route from the Bering Sea wintering areas to the Beaufort Sea summering area. Reproduced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

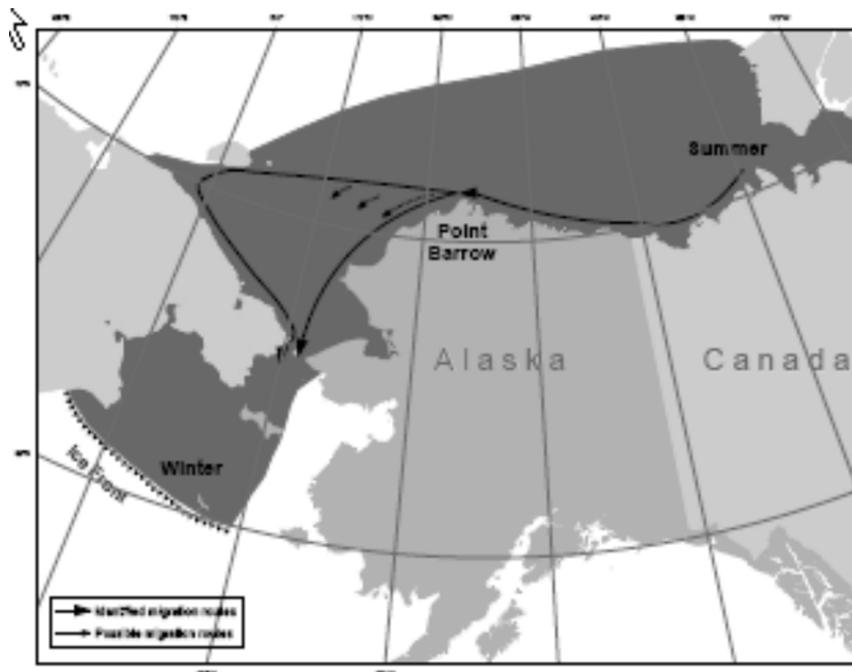


Figure 3.3.4.1-2. Bowhead Whale Distribution and Fall Migration Routes, Shaded area depicts the approximate distribution of Arctic stock bowhead whales. Fall migration is noted by lines and arrows following a route from the Beaufort Sea summering areas to the Bering Sea wintering areas. Reproduced from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

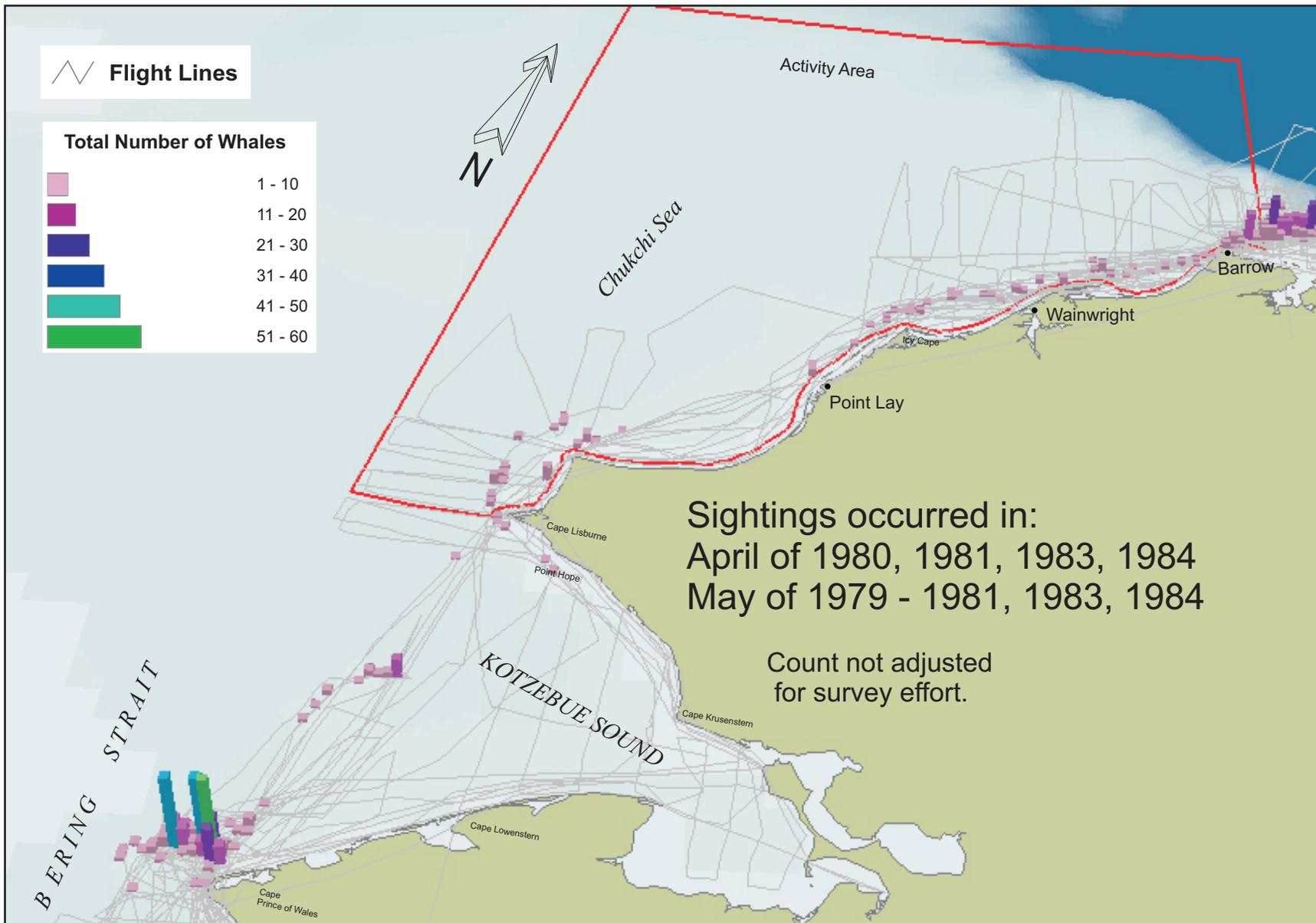


Figure 3.3.4.1-3 Counts of Bowhead Whales in April -May in the Chukchi Sea taken by the MMS (Alaska OCS Region) Bowhead Whale Aerial Survey Project. (Counts are aggregated on a 5-km grid).

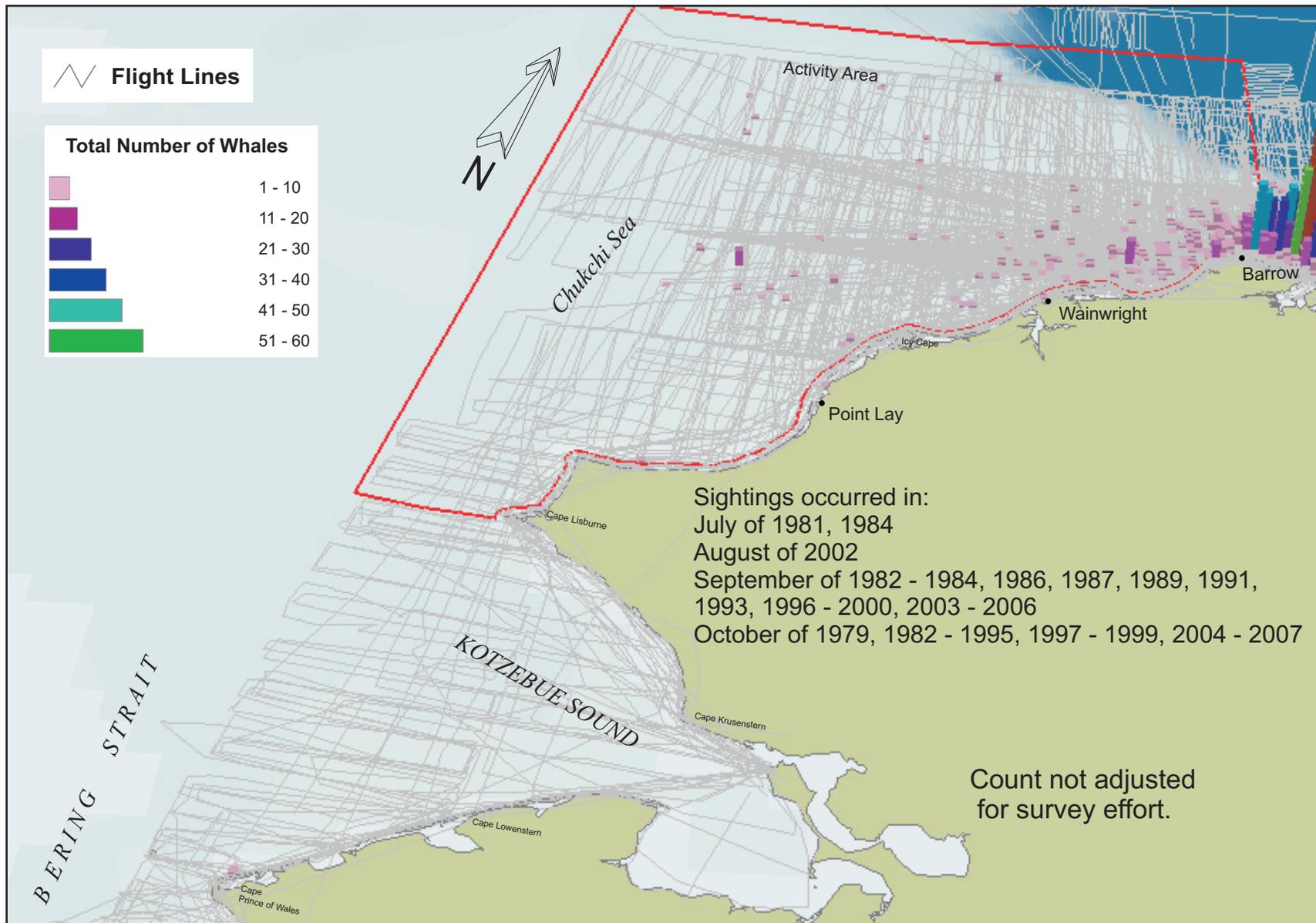


Figure 3.3.4.1-4 Counts of Bowhead Whales in July - November in the Chukchi Sea taken by the MMS (Alaska OCS Region) Bowhead Whale Aerial Survey Project. (Counts are aggregated on a 5-km grid).

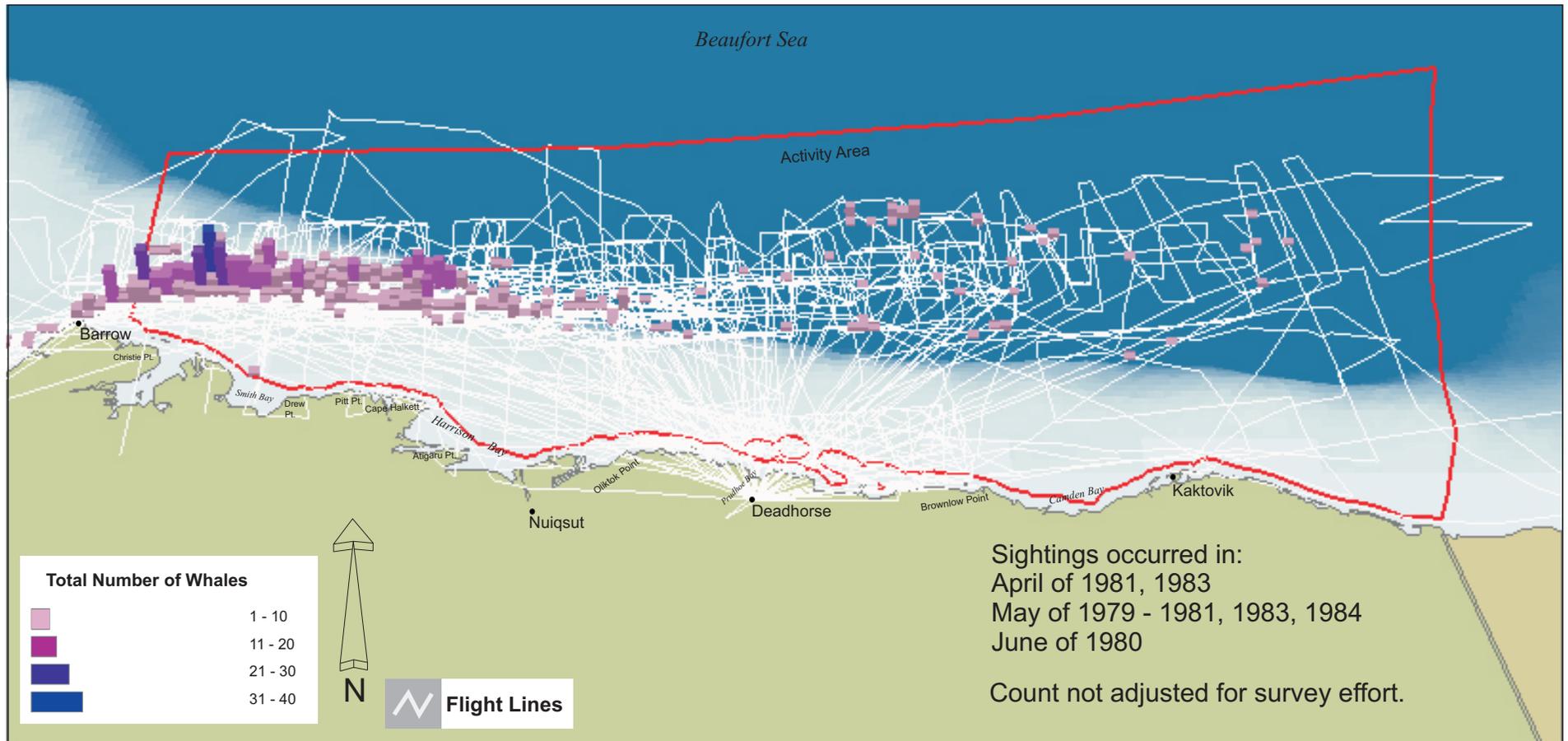


Figure 3.3.4.1-5 Counts of Bowhead Whales in April - June in the Beaufort Sea taken by the MMS (Alaska OCS Region) Bowhead Whale Aerial Survey Project. (Counts are aggregated on a 5-km grid).

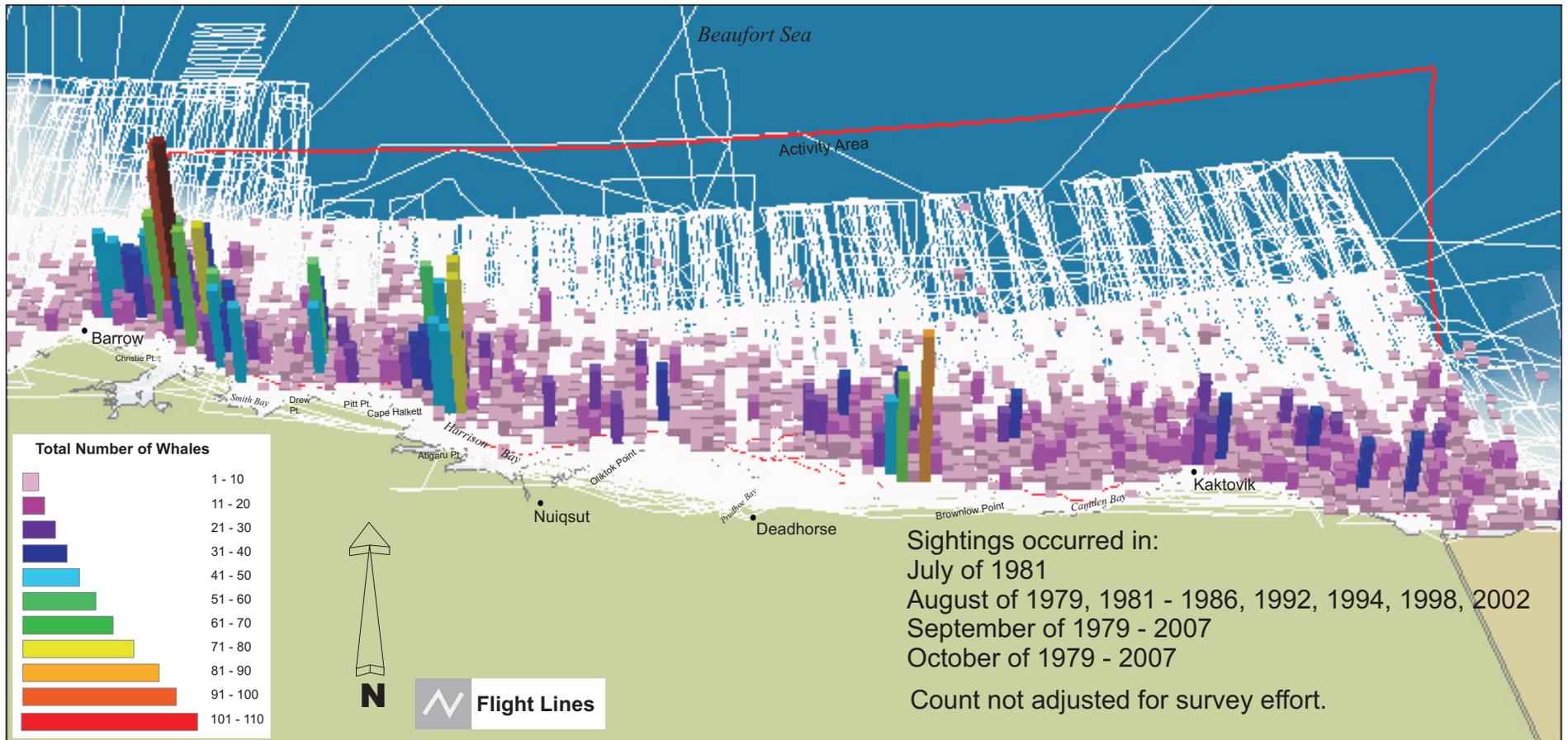


Figure 3.3.4.1-6 Counts of Bowhead Whales in July -October in the Beaufort Sea taken by the MMS (Alaska OCS Region) Bowhead Whale Aerial Survey Project. (Counts are aggregated on a 5-km grid).

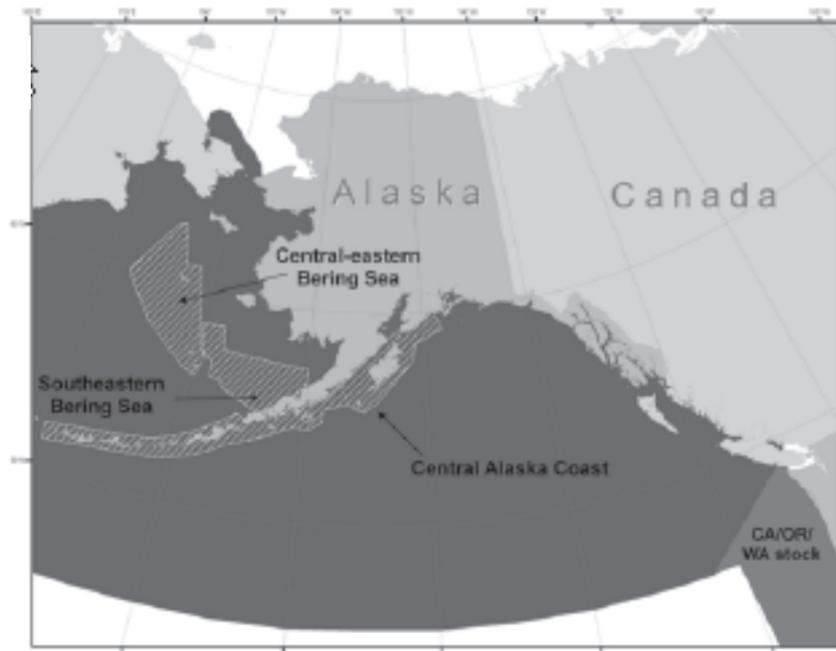


Figure 3.3.4.1-7. Approximate Distribution of Fin Whales in the Eastern North Pacific (shaded area). Striped areas indicate where vessel surveys occurred in 1999-2000 (Moore et al. 2002) and 2001-2003 (Zebrini et al. 2006). Reproduced from Figure 40 of Angliss and Outlaw Rev. 03/03/07.

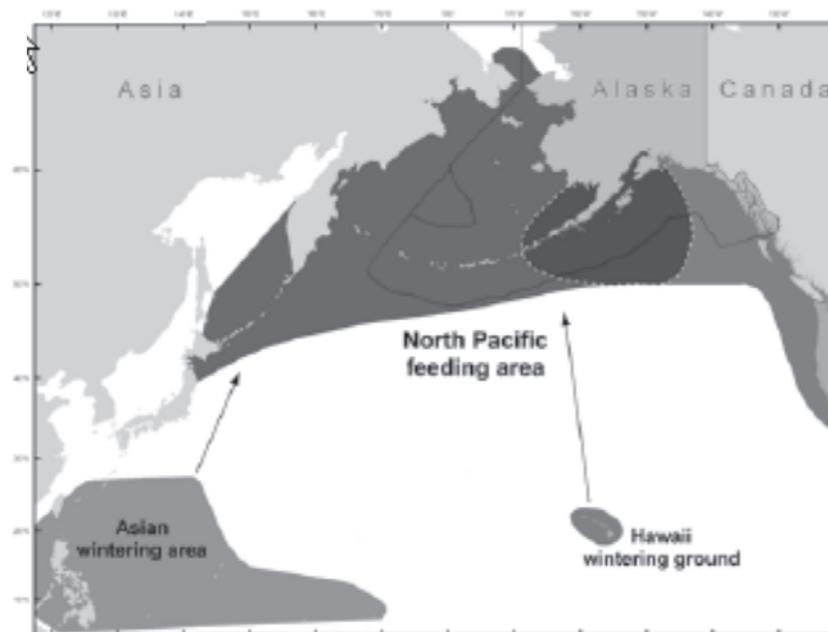
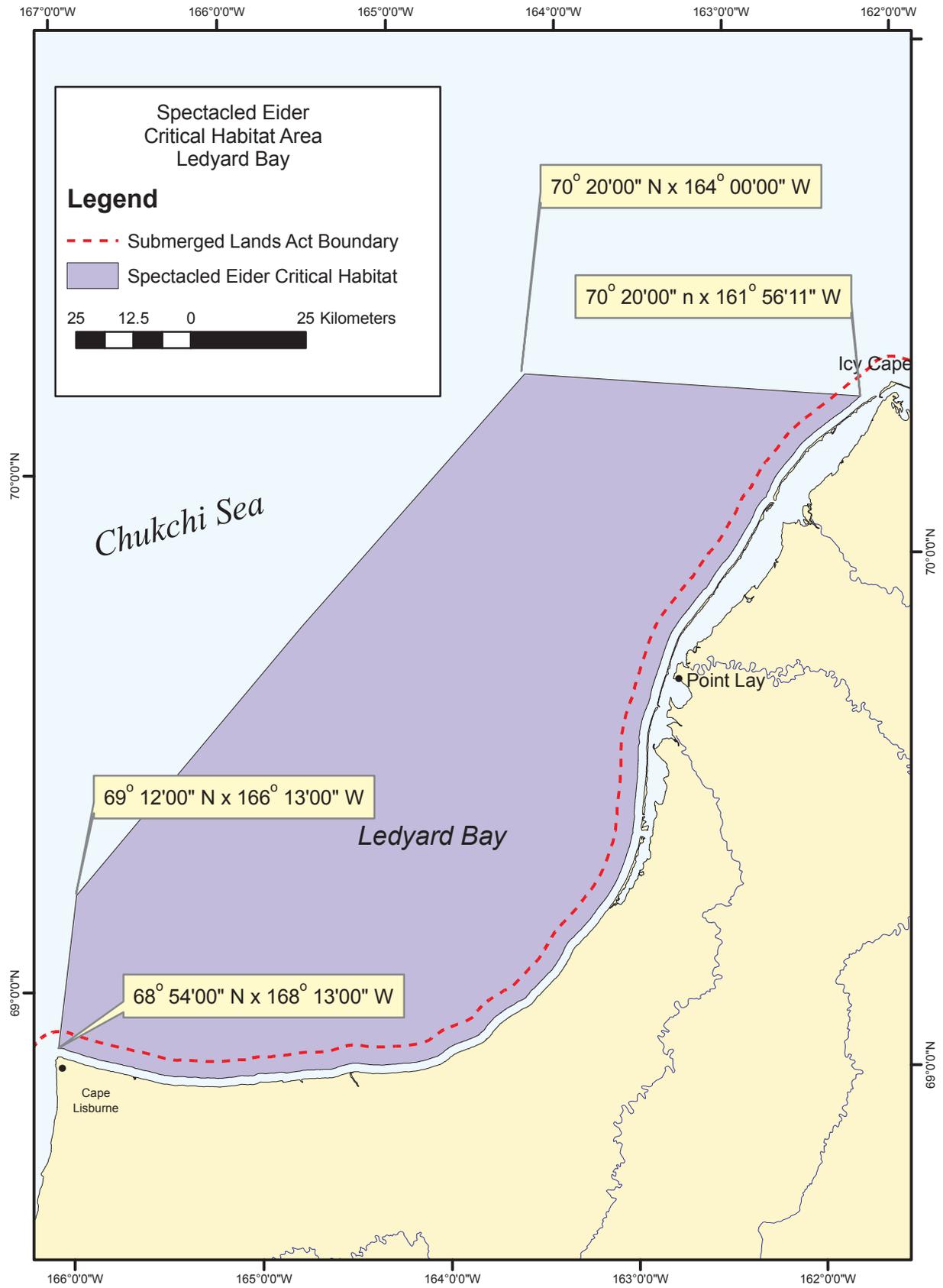


Figure 3.3.4.1-8. Approximate distribution of humpback whales in the Western North Pacific (shaded areas). Feeding and wintering grounds are presented. The dark shading within the dotted line is known to be an area of overlap of the Central North Pacific stock. Reproduced from Figure 38 of Angliss and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



Source: USDOI, FWS (2001b)

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

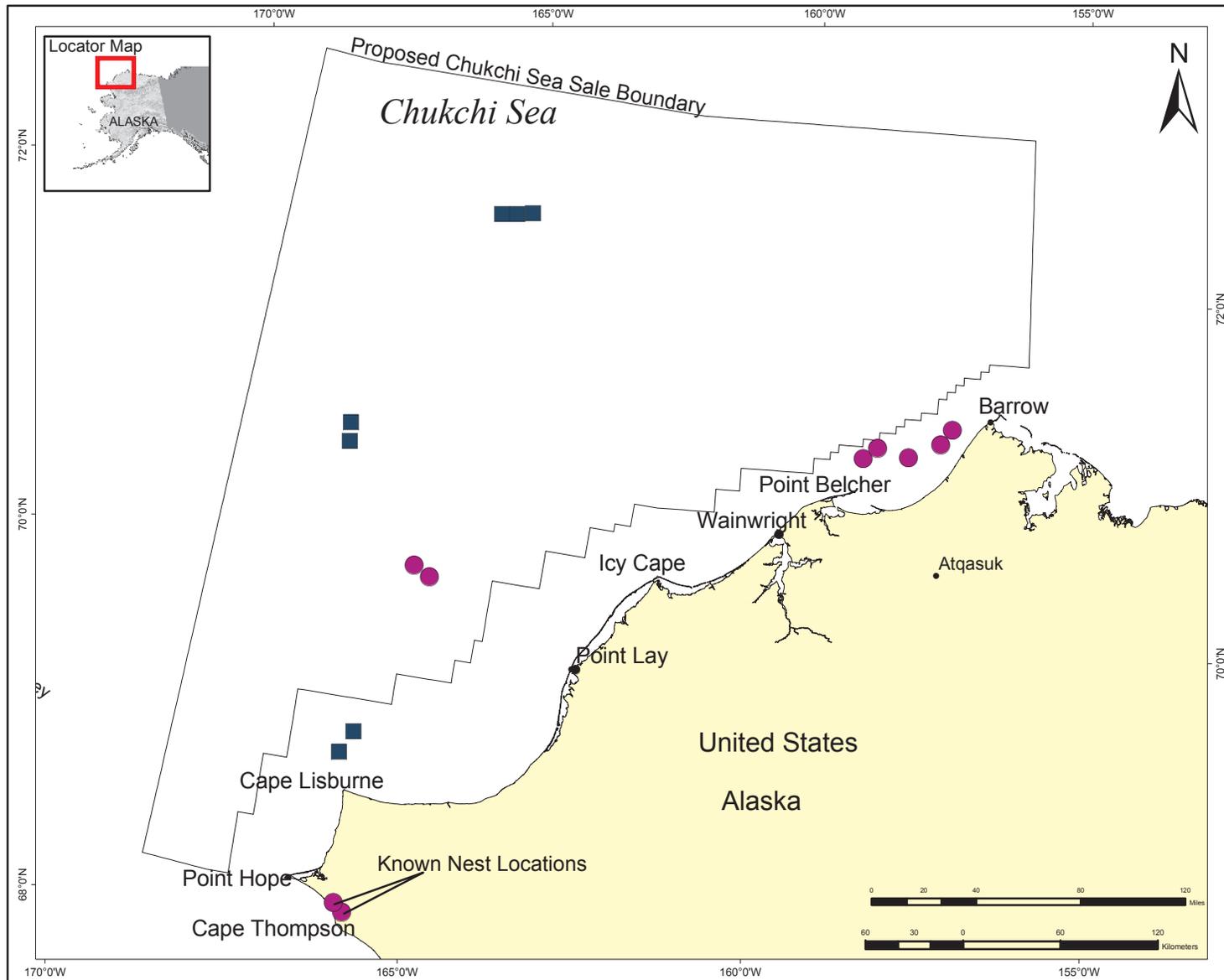
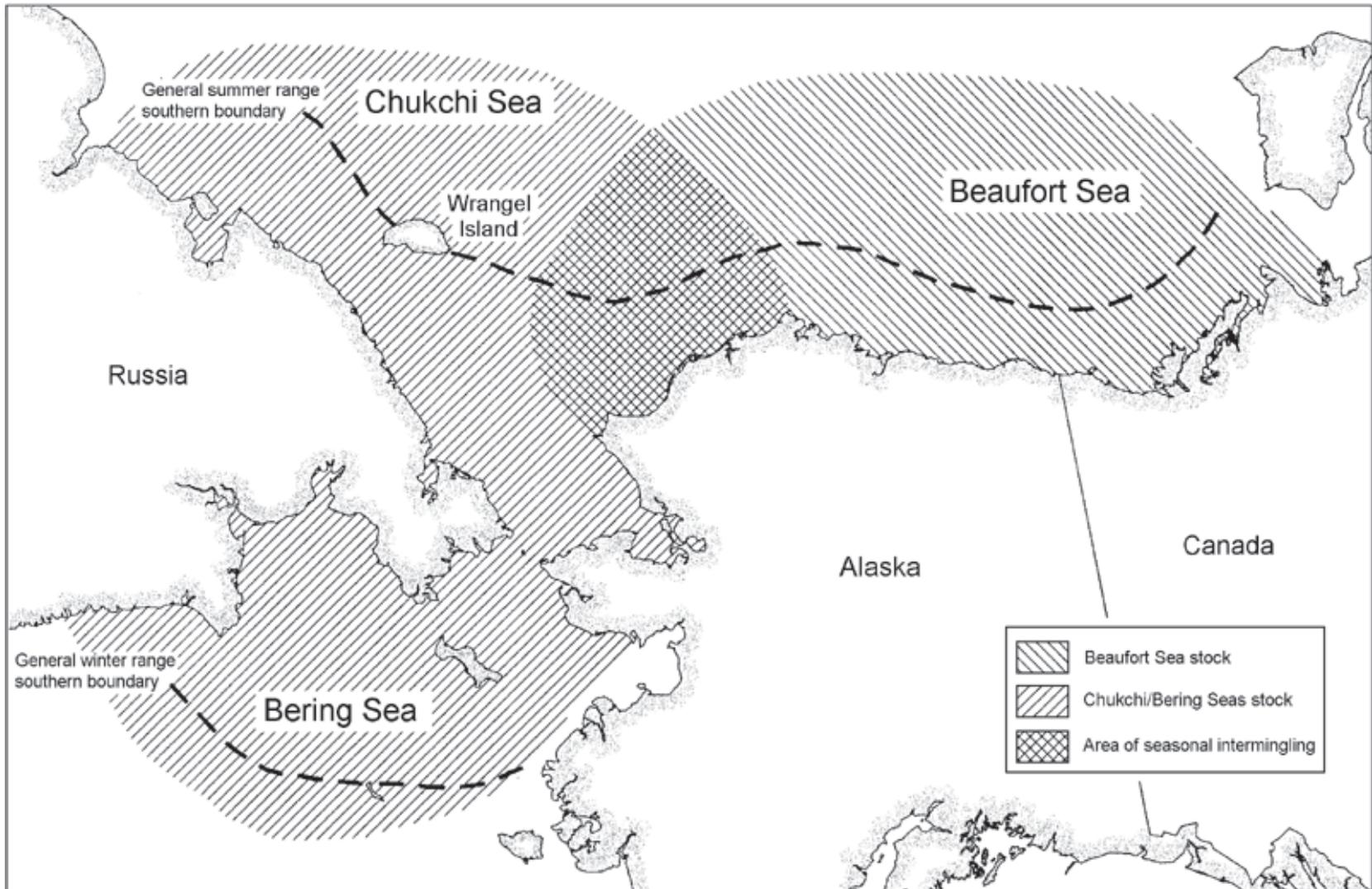


Figure 3.3.4.2-2 Kittlitz's Murrelet Offshore Observations and Nesting Information. Potential nesting area based on Day et al. (1990). Nest locations based on USDOI (2004). Offshore observations are designated as blocks (24 Aug-22 September) and dots (22 September-17 October) (Divoky 1987).



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

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