Alaska Outer Continental Shelf

OCS EIS/EA
BOEMRE 2011-036

Chukchi Sea Planning Area

Statoil USA E&P Inc.
2011 Ancillary Activities

Chukchi Sea, Alaska

Environmental Assessment

Prepared by:
Bureau of Ocean Energy Management, Regulation and Enforcement
Alaska OCS Region
Office of Leasing and Environment

U.S. Department of the Interior
Bureau of Ocean Energy Management,
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Alaska OCS Region

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1. Purpose of the Proposed Action

On March 31, 2011, Statoil USA E&P Inc. (Statoil) submitted to the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) an Ancillary Activities Notice (Statoil, 2011a) and Plan of Operations (Statoil, 2011b) for a proposed 2011 open-water, shallow hazards seismic survey program within the federal Outer Continental Shelf (OCS) of the Chukchi Sea Planning Area (Figure 1). The purpose of the seismic survey is to collect bathymetric and shallow sub-seafloor data for site clearance and shallow hazards assessment in support of future oil and gas exploration and development activities on Statoil's OCS leases in the Chukchi Sea. Statoil also proposes a geotechnical soil investigation to evaluate the properties of the seafloor on Statoil leases and leases held jointly with ConocoPhillips Alaska Inc. (CPAI).

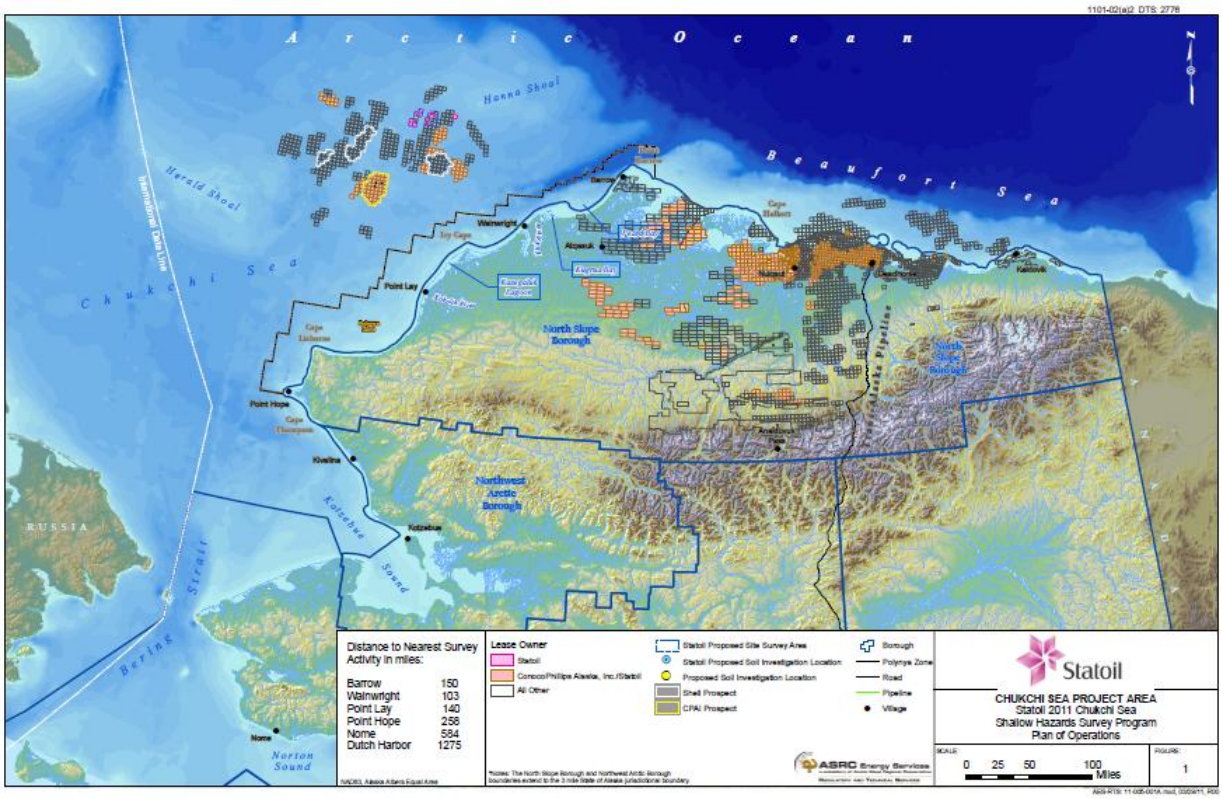

Figure 1. Area of Statoil's proposed shallow hazards survey and geotechnical investigation (Statoil, 2011c).

On May 13, 2011, Statoil submitted an Environmental Evaluation Document (EED) (Statoil, 2011c) in support of their Ancillary Activities Notice. Ancillary activities are regulated by 30 CFR 250 subpart B. Statoil submitted the Ancillary Activities Notice in compliance with 30 CFR 250.208. The Notice can be found at http://www.regulations.gov/#!submitComment;D=BOEM-2011-0052-0001.

BOEMRE conducts environmental assessments (EAs) to ensure proposed activities do not unreasonably interfere with other uses of the OCS and do not cause undue or serious harm or damage to the human, marine, or coastal environment (30 CFR 250.202(d) and (e)) and to help in BOEMRE decision making and planning. In accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) regulations at 40 CFR 1501.3(b) and 1508.9, Department of the Interior (USDOI) regulations implementing NEPA at 43 CFR Part 46, and BOEMRE policy, BOEMRE prepared this EA of the potential effects of Statoil's proposed 2011 shallow hazards survey and geotechnical program in the Chukchi Sea Planning Area of the Alaska

OCS. The purpose of the EA is to assist with BOEMRE planning and decision making (40 CFR 1501.3(b)), and to determine whether the potential effects of Statoil proposed ancillary activities would require Statoil to propose these activities in an Exploration Plan (EP).

2. Prior Environmental Analyses

BOEMRE previously addressed seismic activities, such as Statoil's proposed shallow hazards survey, throughout the Chukchi Sea (USDOI, MMS, 2006b; 2007b). This EA tiers from or incorporates by reference the following documents:

- Final Programmatic Environmental Assessment, Arctic Ocean Outer Continental Shelf, Seismic Surveys-2006 (OCS EIS/EA MMS 2006-038). June 2006 (USDOI, MMS, 2006b or PEA).
- Final Environmental Impact Statement, Chukchi Sea Planning Area, Oil and Gas Sale 193 EIS and Seismic Surveying Activities in the Chukchi Sea (OCS EIS/EA MMS 2007-026), May 2007 (USDOI, MMS, 2007b or Sale 193 EIS).
- Environmental Assessment, Chukchi Sea Planning Area, Statoil USA E&P Inc., Geological & Geophysical Permit, 2010 3D/2D Seismic Acquisition, Chukchi Sea, Alaska (OCS EIS/EA BOEMRE 2010-020) (USDOI, BOEMRE, 2010b or 2010 Statoil G&G EA).

The tiering process is established by regulation (40 CFR 1502.20 and 1508.28) and is intended to eliminate repetitive discussions of similar issues and focus the analysis on issues related to the proposed activities. Incorporation by reference is also established by regulation (40 CFR 1502.21) and is intended to reduce the bulk of NEPA documents without impeding agency and public review. Statoil's proposed activities are within the scope of seismic surveys previously evaluated (see Table 2-1).

Statoil's proposed ancillary activities are within the scope of current BOEMRE consultations with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) under section 7 of the Endangered Species Act (ESA). The consultation documents listed below have been reviewed, summarized, and incorporated, as appropriate, in this EA.

- Biological Evaluation of the Potential Effects of Oil and Gas Leasing and Exploration in the Alaska OCS Beaufort Sea and Chukchi Sea Planning Areas on Endangered Bowhead Whales (*Balaena mysticetus*), Fin Whales (*Balaenoptera physalus*), and Humpback Whales (*Megaptera novaeangliae*) (USDOI, MMS, 2006a).
- Supplement to the 2006 Biological Evaluation of the Potential Effects of Oil and Gas Leasing and Exploration in the Alaska OCS Beaufort Sea and Chukchi Sea Planning Areas on Endangered Bowhead Whales (*Balaena mysticetus*), Fin Whales (*Balaenoptera physalus*), and Humpback Whales (*Megaptera novaeangliae*) (USDOI, MMS, 2008a).
- Biological Opinion (BO) for Oil and Gas Leasing and Exploration Activities in the U.S. Beaufort and Chukchi Seas, Alaska and Authorization of Small Takes under the Marine Mammal Protection Act (USDOC, NMFS, 2008a).
- Biological Opinion for Beaufort and Chukchi Sea Program Area Lease Sales and Associated Seismic Surveys and Exploratory Drilling (USDOI, FWS, 2009).
- Supplemental Essential Fish Habitat Analysis: Arctic Cod, Saffron Cod and Opilio Crab, for July-December, 2010 (USDOI, BOEMRE, 2010).

Table 2-1. Statoil's proposed 2010 survey parameters compared with those in the PEA (USDOI, MMS, 2006b).

Comparative Parameters	Statoil's Proposed Shallow Hazards Survey (Statoil, 2011b&c)	2006 Final Seismic PEA (USDOI, MMS, 2006b)
Survey Type	High-resolution	2D/3D streamer; ocean-bottom-cable; high resolution
Geographic Survey Area	Chukchi Sea OCS (See Figure 1)	Chukchi Sea OCS/Beaufort Sea OCS
Ancillary Activity Authorization Period	8/1–11/15 (2011)	7/1 - 12/31
Number of Seismic Source Vessels	1	Up to 4
Energy Source Array	four 10-in^3 airguns	1,800 - 4,000 in^3
Streamer/Receiver Array	1 streamer/receiver cable ~600-m long 1 streamer/receiver cable ~150 m long	4-12 streamer/receiver cables each cable 3-8 km long
Streamer/Receiver Array Width	n/a	400-900 m (1,312-2,953 ft)
Streamer Buoyancy	150 m streamer – 180 liters of kerosene 600 m streamer – solid/gel	Liquid paraffin or solid/gel
Support Vessels	1-2 (1 dynamically positioned soil investigation vessel; 1 support boat to transfer personnel and equipment through Nome, if necessary)	Up to 3 per survey (including crew boats, supply boats, monitoring vessels, icebreakers)
Aircraft	None	Fixed-wing and/or helicopter
Mitigation & Monitoring	Incidental Harassment Authorization (IHA) application to NMFS and Marine Mammal Monitoring and Reporting Plan (February 2009); Letter of Authorization (LOA) application to FWS (12/31/2011); Plan of Cooperation (POC) (5/13/2011); NMFS BOs (2008a&b),FWS BOs (2007; 2008; and 2009)	IHA from NMFS; ITA from FWS; POC; Marine Mammal Monitoring and Mitigation Plan

Sources: BOEMRE (USDOI, MMS, 2006b) and Statoil (2011b&c).

The PEA and the Sale 193 EIS addressed seismic activities throughout the Chukchi Sea, including Statoil's proposed project area. In developing this EA, BOEMRE has focused on site-specific information associated with the proposed action, considering and analyzing new information, such as recent environmental studies, that update previous NEPA analyses. BOEMRE reviewed and evaluated Statoil's EED (Statoil, 2011b) pursuant to 40 CFR 1506.5(a) below, supplementing the information provided in the EED where necessary (40 CFR 1506.5(a)):

> 40 CFR 1506.5 Agency responsibility.
>
> (a) Information. If an agency requires an applicant to submit environmental information for possible use by the agency in preparing an environmental impact statement, then the agency should assist the applicant by outlining the types of information required. The agency shall independently evaluate the information submitted and shall be responsible for its accuracy. If the agency chooses to use the information submitted by the applicant in the environmental impact statement, either directly or by reference, then the names of the persons responsible for the independent evaluation shall be included in the list of preparers (Sec. 1502.17). It is the intent of this paragraph that acceptable work not be redone, but that it be verified by the agency.

3. Proposed Action

Statoil proposes to conduct a shallow hazards seismic survey and geotechnical investigation during the 2011 open-water season in the Chukchi Sea. The primary objectives of the proposed ancillary activities are the acquisition of high-resolution seismic data and geotechnical coring samples. The shallow hazards survey is designed to collect data to evaluate the potential for shallow faults, gas zones, and archaeological features on Statoil's leases.

The proposed geotechnical soil investigation activities are categorically excluded and do not meet any of the criteria for extraordinary circumstances listed in 43 CFR 46.215(a)-(l) under which, actions otherwise covered by a categorical exclusion would require further analysis under NEPA in accordance with 43 CFR 46.205(c).

Information on Statoil's proposed action was obtained from the following documents:

- Ancillary Activities Notice, March 31, 2011 (Statoil, 2011a).
- Plan of Operations, 2011 Shallow Hazards Survey, Chukchi Sea, Alaska, submitted March 31, 2011 (Statoil, 2009b).
- Environmental Evaluation Statoil 2011 Chukchi Shallow Hazards Survey, Chukchi Sea, Alaska, May 2011, submitted May 13, 2011 (Statoil, 2011c).
- Request by Statoil to NMFS for an Incidental Harassment Authorization to Allow the Incidental Take of Marine Mammals During a Shallow Hazards Survey in the Chukchi Sea, Alaska, 2011, February 2011 (Statoil, 2011d).
- Request by Statoil to FWS for Letter of Authorization for the Incidental Take of Polar Bears and Pacific Walrus and Intentional Take of Polar Bears by Harassment, Statoil USA E&P Inc., 2011 Shallow Hazards Survey: Chukchi Sea, Alaska, March 2011 (Statoil, 2009e)
- Statoil's Plan of Cooperation (POC), 2011 Shallow Hazards Survey, Chukchi Sea, Alaska, submitted on 16 May 2011 (Statoil, 2011f).

The proposed activity area encompasses the 16 leases owned by Statoil and 3 leases jointly owned by Statoil and CPAI. All leases were obtained in Lease Sale 193 held in February 2008 (USDOI, MMS, 2008a). The activity area on Statoil's leases is located ~165 km (~103 mi) northwest of Wainwright and ~240 km (~150 mi) west of Barrow in the Chukchi Sea (Figure 1). The Statoil/CPAI lease area is located ~188 km (~117 mi) west of Wainwright and ~304 km (~189 mi) west of Barrow (Figure 1).

The ice-strengthened seismic survey vessel *M/V Duke* (or a similarly equipped vessel) and the dynamically positioned (DP) soil investigation vessel *M/V Fugro Synergy* (or a similarly equipped vessel) would begin work in the lease area on or about August 1, and continue working through October. If all permitted activities have not been completed and weather conditions permit, operations may continue as late as November 15. Upon completion of operations, the vessels will leave the lease area.

3.1 Shallow Hazards Survey

The shallow hazards survey will use a towed airgun array with a single ~600 m towed hydrophone streamer, as well as lower-power, higher-frequency survey instrumentation to collect bathymetric and sub-bottom data. Statoil will also use a 150-m-long streamer with up to 180 liters (approximately 48 gallons) of kerosene. The proposed survey would collect about 2,500 km (1,553 mi) of data on or near Statoil's leases, covering an area of ~625 km^2 (245 mi^2). The site-survey work on Statoil's leases would take approximately 23 days to complete.

Table 3-1. Operating frequency and sound source levels for equipment associated with the proposed ancillary activity. Asterisk (*) indicates that information was unavailable. (Statoil, 2011a; 2011d).

Equipment	Operating Frequency	Source Levels
Four 10-in^3 airgun array	10–120 kHz	>190 dB re 1 µPa · m
Single 10-in^3 airgun	10–120 kHz	>190 dB re 1 µPa · m
Kongsberg SBP3000 sub-bottom profiler	2–7 kHz	~225 dB re 1 µPa · m
GeoAcoustics 160D side-scan sonar	114–410 kHz	~233 dB re 1 µPa · m
Kongsberg EM 2040 multibeam echosounder	200–400 kHz	210 dB re 1 µPa · m
Kongsberg HiPAP 500	21–30.5 kHz	200–210 dB re 1 µPa · m
Acoustic Doppler Current Profiler	500 kHz +	~230 dB re 1 µPa · m
Ice Profiling Sonar	420 kHz	~220 dB re 1 µPa · m
Kongsberg EA600 Echosounder	18–200 kHz	210 dB re 1 µPa · m

Operating frequencies and estimated source levels of these systems are provided in Table 3-1. Measurements from previous airgun use in the Chukchi Sea were used to estimate the distances at which received levels are likely to fall below 120, 160, 180, and 190 dB rms for the proposed airgun configurations, and are depicted in Table 3-2. The modeled distances (Table 3-2) will be used as temporary safety radii until measurements of the airgun sound sources are conducted in the field prior to operations (Table 3-1). Sound source verification (SSV) data would be collected as soon as the systems are deployed and operational.

The proposed action activities would commence with the deployment of the airgun array and hydrophone streamer. The airgun array would be towed at a depth of 2 m (6.5 ft) and at a distance of roughly 25 m (82 ft) astern for the mini airgun, and at a 2-m (6.5 feet) depth and ~40 m (130 ft) astern for the main gun, firing every 10 seconds. The *M/V Duke* would proceed along pre-planned survey lines at a speed of 4 to 5 knots, discharging at 8 second intervals in an alternating mode. A single 10-in^3 mitigation airgun would be used as the *M/V Duke* repositions to discourage marine mammals and fish from approaching.

Table 3-2. Distances to specified received levels measured from a 40 in3 airgun cluster and a 10 in3 airgun on the Burger prospect in 2009 as reported by Reiser et al. (2010) and 2011 estimated "Pre-SSV" distances implementing a 25% increase over modeled distances. Data for coring activities were adapted from Statoil USA E&P Inc.'s IHA application (Statoil, 2011d).

Received Level	Distance (m)				
	Airgun Cluster (4×10 in^3)		Mitigation Airgun (1×10 in^3)		Coring
dB re 1µPa rms	2009 Results	2011 pre-SSV	2009 Results	2011 pre-SSV	
≥190	39	50	8	10	N/A
≥180	150	190	34	45	N/A
≥160	1,800	2,250	570	715	N/A

3.2 Geotechnical Investigation

Geotechnical coring would be performed to collect detailed data on seafloor sediments and geological structure to a maximum depth of 100 m (328 ft) at prospective drilling locations. The proposed coring locations would be surveyed and cleared of historic resources and surface hazards before the cores are

collected. The diameter of the borehole would be around 10 in. (25.4 cm) depending on soil type, and samples would be taken through and in front of the drill bit with a sampler ID (inner diameter) of 2.1–2.83 inches (5.3–7.2 cm) and a sampler OD (outer diameter) of 2.25–3.0 inches (5.7–7.6 cm). The cores would be stored on the vessel until transport to shore facilities for geotechnical analysis.

Three to four cores would be collected at each of up to 5 potential drilling locations on Statoil leases and 6–9 cores at 3 drilling locations on leases jointly owned by Statoil and CPAI. A maximum of 29 cores would be taken collectively by Statoil during the geotechnical survey. The geotechnical soil investigation component of the ancillary activity would not involve anchoring. Lubrication of the coring holes would be performed using sea water, and in some instances bentonite and/or barite. As a consequence, some drilling muds and/or cuttings could be picked up and transported by currents.

The Fugro Synergy operates a Kongsberg EA600 echo sounder and uses a Kongsberg 400 high precision acoustic position system for precise positioning during coring.

3.3 Mitigation and Monitoring

Statoil has proposed the mitigation and monitoring below as part of their proposed ancillary activities.

Mitigation

Statoil will adhere to the following mitigation measures during the shallow hazards survey and geotechnical soil investigation, and during the performance of any other operations in support of survey activities:

- Prior to the SSV, the safety radii for all three dB levels that were modeled and described in the Statoil's 2011 Marine Mammal Monitoring and Mitigation Program will be implemented. At a minimum, SSV would measure where the received level is:
  - Greater to or equal to 180 dB relative to one microPascal (re 1 μPa)
  - Greater to or equal to 190 dB re 1 μPa
  - Greater to or equal to 160 dB re 1 μPa

MMOs will actively monitor for marine mammals and provide direction to vessel crew regarding mitigation measures (e.g., power down, shutdown) specified below:

- Speed and course alterations to maintain safety radii relative to observed marine mammals.
- Ramp-up, power-down, and shutdown procedures if a marine mammal comes within the safety radii.
- Both vessels will be staffed with MMOs who will alert the crew to the presence of marine mammals so that vessel crews can initiate appropriate mitigation measures.
- One marine mammal observer (MMO) would be located on the bridge or weatherdeck of each vessel to watch for marine mammals.
- Vessels will reduce speed, and alter course as appropriate, when approaching groups of marine mammals and maintain the maximum practicable distance from groups of marine mammals.
- If weather or visibility conditions make it necessary, vessels should reduce speed to avoid the likelihood of injury to walruses.
- Vessels should not approach pacific walruses or polar bears on ice or land closer than 0.5 miles.
- Vessels must take precautions to avoid harassment of concentrations of feeding walruses. Vessels should reduce speed and stay a minimum of 0.5 miles from groups of feeding walrus.
- Vessels will be operated so that they do not separate members of groups of marine mammals.

- If a marine mammal is detected outside the exclusion zone radius and appears to be entering the zone radius while the vessel is conducting surveys (e.g., seismic or sonar activities), the source vessel may alter its speed and/or track to prevent the marine mammal from entering the exclusion zone. If these actions cannot prevent the marine mammal from entering the exclusion zone, power-down procedures will be initiated (addressed below).
- Ramp-up. The following ramp-up procedures will be adhered to for all shallow hazards surveys involving seismic and sonar sound sources, including airgun testing, to allow marine mammals to depart the exclusion zone before the seismic data acquisition begins:
  - Visually monitor the exclusion zone and adjacent water for marine mammals for at least 30 minutes before initiating ramp-up procedures. Ramp-up procedures will not be initiated until no marine mammals are observed in the exclusion zone for a 30 consecutive minute observation period.
  - Ramp-up cannot be performed at night or when the MMOs cannot visually monitor the exclusion zone for marine mammals.
  - Ramp-up procedures should be initiated by discharge of a single airgun. Ramp-up will continue by gradual activation of additional airguns over a period of time as specified in the applicable permit until the operating energy output is reached.
  - If one airgun has maintained operation during a power-down period (e.g., a mitigation gun), ramp-up to full power will be permissible at night or during poor visibility conditions, based upon the assumption that marine mammals will be alerted by sounds from the mitigation gun and could move away from the airgun array with a very low possibility of a TTS or PTS.
- Power Down/Shutdown. Power down/shutdown involves decreasing the number of operating airguns to decrease the size of the safety radii. Power-down/shutdown procedures will be adhered to in the following situations:
  - Immediately power down/shut down the airgun array (or other acoustic sources) whenever marine mammals are sighted approaching close to, entering, or within the permit-stipulated exclusion zone.
  - Power down in the event that aggregations of marine mammals (e.g., twelve or more walruses in water; four or more whale cow/calf pairs) are observed within the 160 dB re 1 µPa safety radii so that the sound pressure level received by the walrus does not exceed 160 dB re 1 µPa.
  - If power down cannot reduce the received sound pressure level to that mandated by permit stipulations (180 dB re 1 µPa for whales and walrus; 190 dB re 1 µPa for polar bear and seals), the sound source must immediately be shut down.
- Emergency Shutdown. If observations are made or credible reports are received that one or more marine mammals are within the seismic survey area and are injured, dead, dying, or indicate acute distress due to seismic sounds, the airgun array should undergo emergency shutdown and the applicable regulatory agency (i.e., NMFS or FWS) would be contacted immediately.
- Adaptive Response for Walrus Aggregations. Whenever an aggregation of 12 or more walrus in the water is observed within the 160 dB re 1 µPa exclusion zone ahead of or perpendicular to the seismic vessel track, the vessel must:
  - Immediately power down/shutdown the airgun array and other acoustic sources so that the sound pressure level received by the walruses does not exceed 160 dB re 1 µPa.
  - Not power up until it can be established that there are no walrus within the 160 dB re 1 µPa zone, based upon vessel course, direction, and distance from the last walrus sighting. If shutdown was required, ramp-up procedures should be followed.

- Vessels will reduce their use of high-intensity lighting during periods of darkness and inclement weather (i.e., rain, fog) to minimize the potential for birds to become disoriented and strike these vessels.
- To avoid conflict with other users of the OCS, Statoil intends to maintain an open and transparent process with all stakeholders throughout the activities in the Chukchi Sea.
- Statoil has developed a Plan of Cooperation (POC) that identifies the actions Statoil will take to identify important subsistence activities, inform subsistence users of the proposed survey activities, and obtain feedback from subsistence users regarding how to provide cooperation between subsistence activities and the Statoil survey.

Monitoring

Statoil will maintain trained MMOs to carry out the monitoring necessary to perform mitigation as required by the LOA and IHA. At least one Alaska Native knowledgeable about marine mammals will be part of the MMO team located on each survey vessel, and at least one MMO (when practicable, two MMOs) will monitor for marine mammals during daylight operations and during nighttime startups. For low-visibility and nighttime monitoring night-vision equipment (Generation 3 binocular image intensifiers, or equivalent units) will be available for use as needed. Statoil plans to have 5 MMOs aboard the site survey vessel and 3 MMOs aboard the coring vessel, working shifts not to exceed 4 hours.

- MMOS will carry out the specific monitoring activities necessary to evaluate the effect of activities authorized by the LOA on walruses, polar bears, and subsistence uses of walruses and polar bears and by the IHA on marine mammals; and document marine mammal sightings and interactions with vessels.

4. Existing Environment and Environmental Evaluation

The activity area is at least ~165 km (~103 mi) northwest of Wainwright and ~240 km (~150 mi) west of Barrow in the Chukchi Sea (Figure 1). Water depth in the activity area is ~30–50 m (~100–165 ft). The environmental conditions in the proposed activity area are expected to be the same as the general conditions described in the PEA and Sale 193 EIS; no recent studies or site-specific information indicate the area would differ from what was described in these previous NEPA documents.

Summers frequently exhibit fog and southwesterly wind conditions, while winter snowstorms are accompanied by strong easterly, northeasterly, and northerly winds. In general, the region has 6–10 storm-days per month with storms typically lasting from 6 to 24 hours; however, individual storms may last up to 14 days.

The start of project activities onsite would begin on or after August 1, which is after the retreat of the ice in most years (early June to late July). Two forms of sea ice can be found in the activity area, including (1) grounded ridge ice that is not associated with landfast ice and (2) pack ice that may accumulate under the influence of winds and currents. The duration of open-water conditions in the central Chukchi Sea averages 17 weeks; however, the duration of open water is variable from year to year and ice could be present at the proposed location. Statoil's ancillary activities are planned for the open-water season when grounded ice is not expected in the activity area, with a possible exception of Hanna Shoal for part of the open water season. Winds and currents could move pack ice into the area at any time during operations.

Hanna Shoal (Appendix A, Figure A-1): Hanna Shoal rises from the ocean floor to within 20 m of the surface waters in some places. It is believed to be a feeding area for seals, Pacific walrus, some sea birds, and historically, gray whales (USDOI, MMS, 2009). The shoal often retains grounded sea ice well into early summer, providing resting and foraging platforms for seals and walrus. Gray

whales are believed to use offshore shoals, such as Hanna Shoal, in the Chukchi Sea for feeding during the summer months. Gray whales typically have shown documented disturbance reactions at levels at or above 160 dB. Hanna Shoal lies more than 8 mi from the shallow hazards survey area and, as indicated in Tables 3-2 and 5-1, 160 dB levels associated with the proposed ancillary activities would not extend to Hanna Shoal. Due to the small scale of the proposed ancillary activities and the distance between the surveys and Hanna Shoal, it is extremely unlikely anything related to the proposal would affect Hanna Shoal. Consequently, Hanna Shoal will not be analyzed further in this EA.

Ledyard Bay Critical Habitat Unit (LBCHU) (Appendix A, Figure A-4): LBCHU is a critical habitat area designated by the FWS for the protection of spectacled eiders. Spectacled eiders are listed as threatened under the ESA. The nearest proposed shallow hazards survey area is more than 90 mi (144 km) from LBCHU (Appendix A, Figure A-4). Due to the small scale of the proposed ancillary activities and the distance between the surveys and LBCHU, it is extremely unlikely anything related to the proposal would affect LBCHU. Consequently, LBCHU will not be analyzed further in this EA.

4.1 Preliminary Screening of Potential Impacts and Affected Biological Resources.

Previous NEPA analyses (BOEMRE, 2010b, 2010c; MMS, 2007, 2008, 2010); Statoil's Environmental Evaluation Document (EED), Plan of Operation (POO), Plan of Cooperation (POC), and IHA application (Statoil, 2011c, 2011b, 2011f, 2011d) were reviewed to provide information to evaluate expected levels of potential effects from the proposed activities. Recent biological surveys (Blanchard et al., 2010; Blees et al., 2010; Brueggeman et al., 1992; Brueggeman, 2009a; Brueggeman, 2009b; Funk et al, 2007; Funk et al, 2008; Funk et al, 2010; Gall and Day, 2009; Ireland et al, 2008; Ireland et al, 2009a; Ireland et al, 2009b; Ireland et al, 2009c) were also reviewed to determine the presence or absence of biological resources during the July–November operational timeframe in the vicinity of the proposed survey area. MMPA and ESA protected species, and any resources affected to a minor or greater level of effects are carried into the effects analyses in Sections 5.2, 5.3, and 5.5.

4.1.1 Levels of Effects Definitions for Biological Resources

4.1.1.1 Significance

Biological significance is a term used in association with ESA consultations. It refers to effects from an activity or event impacting the health, well-being, behavior, or reproductive potential of individual animals or plants and how many of those get transferred to population level effects.

Significantly is defined by the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR 1500-1508) in terms of both context and intensity (40 CFR 1508.27). "Context" considers the setting of the Proposed Action, what the affected resource might be, and whether the effect on this resource would be local or more regional in extent. Factors to be considered in evaluating "intensity" include: (1) the severity of the impact; (2) whether the impact is beneficial or adverse; (3) the degree to which the Proposed Action affects public health and safety; (4) the unique characteristics of the affected area; (5) the degree of controversy; (6) uncertainty; (7) establishing precedence; (8) the cumulative, direct, and indirect aspects of the impact; (9) the affects upon endangered or threatened species; and (10) whether Federal, State, or local laws may be violated.

The terms Significance (Significant) and Biological significance (Biologically Significant) are not interchangeable.

4.1.1.2 Level of Effects Definitions

The following definitions are used for biological resources in this document to apply specific levels of effects, as indicated:

Negligible: Negligible levels of effects would not be considered to be significant impacts.

- No measurable physiological impacts and/or no population-level effects.
- A small number of mortalities could occur among invertebrates.
- No mortalities are expected to occur among vertebrates.
- May cause brief behavioral reactions such as temporary avoidances or deflections around an area.
- May involve localized and small numbers of invertebrates mortalities.
- Localized short-term disturbance or habitat effects experienced during one season are not anticipated to accumulate across multiple seasons.
- No detectable impacts to reproductive success or recruitment are anticipated.
- Mitigation measures are fully implemented or are unnecessary.

Minor: Minor levels of effects would not be considered to be significant impacts.

- Low but measurable physiological impacts with no population-level effects.
- Larger but highly localized mortalities among invertebrates could occur.
- A small number of mortalities are unlikely but possible with vertebrate species.
- May cause behavioral reactions such as avoidances of or deflections around an area lasting from one hour to several days.
- Localized, disturbance or habitat effects experienced during one season may accumulate across subsequent seasons, but not over one year.
- No mortality or detectable impacts to reproductive success or recruitment are anticipated.
- Mitigation measures are fully implemented or are unnecessary.

Moderate: Moderate levels of effects would not be considered to be significant impacts.

- Numerically moderate levels of mortalities or disturbances could occur, but with no detectable population-level effects.
- Mortalities are likely, but not to an extent resulting in detectable population level effects.
- Adverse impacts to ESA-listed species could occur.
- Widespread annual or chronic disturbances or habitat effects could persist for multiple years and up to a decade.
- Widespread implementation of mitigation measures for similar activities may be effective in reducing the level of avoidable adverse effects.
- Unmitigated or unavoidable adverse effects may be short term and widespread, or are long term and localized.

Major: Major levels of effects would be considered to be significant impacts.

- Mortalities or disturbances occur that have detectable population-level effects.
- For marine mammals, mortality might occur at or above the estimated Potential Biological Removal as a result of the proposed action.

- For fish and benthic invertebrates, the anticipated mortality is estimated or measured in terms of tens of thousands of individuals or >20% of a local breeding population and/or >5% of a regional population, which may produce population-level effects.
- Widespread seasonal or chronic effects are cumulative and are likely to persist for more than one decade.
- Mitigation measures are implemented only for a small portion of similar impacting activities, but more widespread implementation for similar activities could be more effective in reducing the level of avoidable adverse effects.
- Unmitigatable or unavoidable adverse effects are widespread and long lasting.

Tables 4-1 through 4-4 indicate the expected levels of impact based upon previous NEPA analyses wherein the same mitigations were implemented (USDOI, MMS, 2006a; 2007b; USDOI, BOEMRE, 2010b). The impact levels presented in Section 4.3 describe the expected impact levels of the proposed activities on the biota in the vicinity of ancillary activities. The impact level determinations are based on the types and levels of effects outlined in previous NEPA documents (see Section 2.0; USDOI, MMS, 2006b, 2007b; USDOC, NMFS, 2008b), BOEMRE's EFH Arctic Consultation with NMFS (USDOI, BOEMRE, 2011), and Endangered Species Act (ESA) consultation documents (USDOI, MMS 2006a, 2008a; USDOI, FWS, 2009; USDOC, NMFS, 2008a). Effects level determinations are applied independent of the presence, absence, or numbers of a species that might occur at the site-specific level, but do consider any mitigations that are part of the proposed action.

4.1.2 Marine Mammals

Table 4-1 shows the expected level of effects of ancillary activities on marine mammal species. BOEMRE considered whether additional studies of marine mammals would be necessary to determine the effects for an analysis of shallow hazard surveys in the Chukchi Sea. Although information on marine mammal species in the Chukchi Sea is sometimes limited compared to other regions of Alaska, there is sufficient data to evaluate the effects on marine mammals from the

Table 4-1. NEPA effects level determination results for marine mammal species expected to occur in the Chukchi Sea Planning Area.

Species	Vessel Traffic	Vessel Noise	Sub-bottom Profiler	Sidescan Sonar	Single or Multi-beam Echosounder	Sediment Coring	Airgun Noise	Cumulative Effects
Bearded Seal	NG	NG	NG	NG	NG	NG	NG	NG
Beluga Whale	NG	NG	NG	NG	NG	NG	NG	NG
Bowhead Whale	NG	NG	NG	NG	NG	NG	NG	NG
Fin Whale	NG	NG	NG	NG	NG	NG	NG	NG
Gray Whale	MN	NG	NG	NG	NG	NG	NG	NG
Harbor Porpoise	NG	NG	NG	NG	NG	NG	NG	NG
Humpback Whale	NG	NG	NG	NG	NG	NG	NG	NG
Killer Whale	NG	NG	NG	NG	NG	NG	NG	NG
Minke Whale	NG	NG	NG	NG	NG	NG	NG	NG
Narwhal	NG	NG	NG	NG	NG	NG	NG	NG
Pacific Walrus	MN	NG	NG	NG	NG	NG	NG	MN
Polar Bear	NG	NG	NG	NG	NG	NG	NG	NG
Ribbon Seal	NG	NG	NG	NG	NG	NG	NG	NG

Species	Vessel Traffic	Vessel Noise	Sub-bottom Profiler	Sidescan Sonar	Single or Multi-beam Echosounder	Sediment Coring	Airgun Noise	Cumulative Effects
Ringed Seal	NG	NG	NG	NG	NG	NG	NG	NG
Spotted Seal	NG	NG	NG	NG	NG	NG	NG	NG

Note: NG = negligible, MN = minor, MO = moderate, MJ = major. Determinations are based on existing analyses in USDOI, MMS, 2006b and USDOI, MMS, 2007b, and incorporate more recent information from other sources, as appropriate.

proposed activities. These effects include noise, physical disturbance, and temporary displacement. The area of disturbance would be very limited in time and space. The largest effect determination was for the Pacific walrus where a minor level of effect from vessel traffic led to a minor cumulative level of effect.

Vessel traffic related to the proposed activities would not occur in sensitive nearshore waters, such as Ledyard Bay. Vessels would have marine mammal observers posted at all times and would slow down and/or change course to avoid close approaches to marine mammals as necessary.

4.1.3 Birds

Tables 4-2 and 4-3 summarize the level of effects for similar activities analyzed in previous NEPA documents (USDOI, MMS, 2006b; 2007b). Birds are typically present in the proposed survey area in low densities, and would easily move away from vessel traffic and noise, airgun noise, and other disturbances associated with survey activity (Statoil, 2010b). The distance between the survey area and aggregations such as colonies or nesting/brood-rearing areas for waterfowl, seabirds, loons, and shorebirds makes their occurrence in the vicinity of the survey area sporadic with comparatively low population densities. Minor levels of cumulative effect were generally determined for bird species in the Chukchi Sea in the PEA and in Lease Sale 193 EIS; however, mitigations that are part of the proposed action and other project-specific characteristics have interacted to lower the levels of effect to negligible for some species.

Table 4-2. NEPA effects level determination results for seabird and shorebird species that occur in the Chukchi Sea Planning Area.

Species	Vessel Traffic	Vessel Noise	Sub-bottom Profiler	Sidescan Sonar	Single or Multi-beam Echosounder	Sediment Coring	Airgun Noise	Bird/Ship Collisions	Cumulative Effects
Common Murre	NG	NG	NG	NG	NG	NG	NG	NG	NG
Thick-Billed Murre	NG	NG	NG	NG	NG	NG	NG	NG	NG
Tufted Puffin	NG	NG	NG	NG	NG	NG	NG	NG	NG
Horned Puffin	NG	NG	NG	NG	NG	NG	NG	NG	NG
Black Guillemot	NG	NG	NG	NG	NG	NG	NG	NG	NG
Parakeet Auklet	NG	NG	NG	NG	NG	NG	NG	NG	NG
Least Auklet	NG	NG	NG	NG	NG	NG	NG	NG	NG
Crested Auklet	NG	NG	NG	NG	NG	NG	NG	NG	NG
Kittlitz's Murrelet	NG	NG	NG	NG	NG	NG	NG	NG	NG
Black-legged Kittiwake	NG	NG	NG	NG	NG	NG	NG	NG	NG
Short-Tailed Shearwater	NG	NG	NG	NG	NG	NG	NG	NG	NG
Northern Fulmar	NG	NG	NG	NG	NG	NG	NG	NG	NG
Pelagic Cormorant	NG	NG	NG	NG	NG	NG	NG	NG	NG
Glaucous Gull	NG	NG	NG	NG	NG	NG	NG	NG	NG
Ivory Gull	NG	NG	NG	NG	NG	NG	NG	NG	NG
Ross's Gull	NG	NG	NG	NG	NG	NG	NG	NG	NG
Sabine's Gull	NG	NG	NG	NG	NG	NG	NG	NG	NG
Arctic Tern	NG	NG	NG	NG	NG	NG	NG	NG	NG

Species	Vessel Traffic	Vessel Noise	Sub-bottom Profiler	Sidescan Sonar	Single or Multi-beam Echosounder	Sediment Coring	Airgun Noise	Bird/Ship Collisions	Cumulative Effects
Pomarine Jaeger	NG	NG	NG	NG	NG	NG	NG	NG	NG
Parasitic Jaeger	NG	NG	NG	NG	NG	NG	NG	NG	NG
Long-Tailed Jaeger	NG	NG	NG	NG	NG	NG	NG	NG	NG
Red-Necked Phalarope	NG	NG	NG	NG	NG	NG	NG	NG	NG
Red Phalarope	NG	NG	NG	NG	NG	NG	NG	NG	NG

Note: NG = negligible, MN = minor, MO = moderate, MJ = major; Determinations are based on existing analyses in USDOI, MMS, 2006b and USDOI, MMS, 2007b, and incorporate more recent information from other sources, as appropriate.

Recent BOs (FWS, 2009) and Lease Stipulation No. 7 (MMS 2007-0026) limits the use of high intensity shipboard lights to critical operations for safety, lessening the chance of attracting or disorienting birds. Most bird species are likely to avoid ongoing surveys (Statoil, 2010b); accordingly, BOEMRE (USDOI, MMS, 2006a; 2007b) has concluded many bird species would not occur near the survey.

Table 4-3. NEPA effects level determination for waterfowl species that occur in the Chukchi Sea Planning Area.

Species	Vessel Traffic	Vessel Noise	Sub-bottom Profiler	Sidescan Sonar	Single or Multi-beam Echosounder	Sediment Coring	Airgun Noise	Bird/Ship Collisions	Cumulative Effects
Common Eider	NG	NG	NG	NG	NG	NG	NG	MN	MN
Spectacled Eider	NG	NG	NG	NG	NG	NG	NG	MN	MN
Steller's Eider	NG	NG	NG	NG	NG	NG	NG	MN	MN
King Eider	NG	NG	NG	NG	NG	NG	NG	MN	MN
Northern Pintail	NG	NG	NG	NG	NG	NG	NG	NG	NG
Red-Breasted Merganser	NG	NG	NG	NG	NG	NG	NG	NG	NG
Long-tailed Duck	NG	NG	NG	NG	NG	NG	NG	MN	MN
Black Scoter	NG	NG	NG	NG	NG	NG	NG	NG	NG
White-Winged Scoter	NG	NG	NG	NG	NG	NG	NG	NG	NG
Greater Scaup	NG	NG	NG	NG	NG	NG	NG	NG	NG
Lesser Snow Goose	NG	NG	NG	NG	NG	NG	NG	NG	NG
Greater White-Fronted Goose	NG	NG	NG	NG	NG	NG	NG	NG	NG
Canada Goose	NG	NG	NG	NG	NG	NG	NG	NG	NG
Pacific Black Brant	NG	NG	NG	NG	NG	NG	NG	NG	NG
Tundra Swan	NG	NG	NG	NG	NG	NG	NG	NG	NG
Pacific Loon	NG	NG	NG	NG	NG	NG	NG	NG	NG
Red-Throated Loon	NG	NG	NG	NG	NG	NG	NG	NG	NG
Yellow-Billed Loon	NG	NG	NG	NG	NG	NG	NG	NG	NG

Note: NG = negligible, MN = minor, MO = moderate, MJ = major; Determinations are based on existing analyses in USDOI, MMS, 2006b and USDOI, MMS, 2007b, and incorporate more recent information from other sources, as appropriate.

4.1.4 Fish, Essential Fish Habitat, and Lower Trophic Species

More than 66 species of fish have been documented in the northeastern Chukchi Sea (Barber et al., 1997; Statoil, 2010b). These include marine fish (largely restricted to marine habitats) and diadromous (migratory) fish that utilize both marine and freshwater habitats. Most of the literature that is available on Arctic fish is related to adult fish in the nearshore environment during the open-water season and addresses general distribution and abundance. Information regarding discrete populations, migration, offshore occurrence and life history of most fish species in the U.S. Arctic is limited. The distribution of marine fish species in the Chukchi Sea is driven by salinity, water depth, and percentage of gravel in the sediments (Barber et al., 1997; Norcross et al., 2010) and often shifts

as seasonal changes occur. There is sufficient information to describe the types of marine fish that would be expected to occur in the survey area. Barber et al. (1994) identified Arctic cod as the most abundant fish species in the survey area. Arctic cod depend on a variety of habitats throughout their life history, including nearshore, offshore, and sea ice (Craig, 1984; Craig, et al, 1982).

The five species of Pacific salmon occurring in the Chukchi Sea Planning Area are managed under the Alaska Salmon Fishery Management Plan (NMFS, 1990, and amendments). The EFH for salmon encompasses the entire Chukchi Sea OCS Planning Area (Appendix A, Figure A-5). FH for Pacific salmon eggs and larvae do not occur in the activity area.

The Arctic Fishery Management Plan (NMFS, 2009a) identified Arctic cod, saffron cod and snow crab (opilio crab) as target species in the region north of the Bering Strait (Appendix A, Figure A-6 for Arctic Cod, and Appendix A, Figure A-7 for Saffron Cod). The EFH for these three species occurs in the Chukchi Sea. Only the Arctic cod EFH fully overlaps with the proposed activity area. EFH for the Saffron cod and Opilio crab do not occur in the activity area.

Benthic and epibenthic organisms are diverse and abundant in the survey area. The northeastern quadrant of the Chukchi Sea generally supports a higher biomass of benthic organisms than other areas of the Chukchi Sea (Grebmeier and Dunton, 2000).

Hard-bottom communities are aggregations of macrophytic algae (large kelps), benthic microalgae, and benthic invertebrates associated with rocks and other hard substrate. Seafloor surveys conducted in the area have not revealed any unusual or special benthic features or communities. No kelp beds, hard-bottom communities, or other special benthic habitats are known to occur in the area or have been identified in nearby areas.

Table 4-4 shows the more common fish and invertebrate species expected to occur within the survey area and the expected level of effects of ancillary activities on these species.

Table 4-4. NEPA effects level determination results for fish and invertebrate species that regularly occur in the Chukchi Sea Planning Area.

Species	Vessel Traffic	Vessel Noise	Sub-bottom Profiler	Sidescan Sonar	Single or Multi-beam Echosounder	Sediment Coring	Airgun Noise	Cumulative Effects
Arctic Cod	NG	NG	NG	NG	NG	NG	NG	NG
Saffron Cod	NG	NG	NG	NG	NG	NG	NG	NG
Sculpin	NG	NG	NG	NG	NG	NG	NG	NG
Staghorn Sculpin	NG	NG	NG	NG	NG	NG	NG	NG
Bering Flounder	NG	NG	NG	NG	NG	NG	NG	NG
Warty Sculpin	NG	NG	NG	NG	NG	NG	NG	NG
Hamecon	NG	NG	NG	NG	NG	NG	NG	NG
Walleye Pollock	NG	NG	NG	NG	NG	NG	NG	NG
Ribbed Sculpin	NG	NG	NG	NG	NG	NG	NG	NG
Capelin	NG	NG	NG	NG	NG	NG	NG	NG
Wattled Eelpout	NG	NG	NG	NG	NG	NG	NG	NG
Pacific Herring	NG	NG	NG	NG	NG	NG	NG	NG
Slender Eelblenny	NG	NG	NG	NG	NG	NG	NG	NG
Canadian Eelpout	NG	NG	NG	NG	NG	NG	NG	NG
Eelpout	NG	NG	NG	NG	NG	NG	NG	NG
Sturgeon Poacher	NG	NG	NG	NG	NG	NG	NG	NG
Pacific Cod	NG	NG	NG	NG	NG	NG	NG	NG
Variegated Snailfish	NG	NG	NG	NG	NG	NG	NG	NG
Butterfly Sculpin	NG	NG	NG	NG	NG	NG	NG	NG
Hookear Sculpin	NG	NG	NG	NG	NG	NG	NG	NG
Sandlance	NG	NG	NG	NG	NG	NG	NG	NG

Species	Vessel Traffic	Vessel Noise	Sub-bottom Profiler	Sidescan Sonar	Single or Multi-beam Echosounder	Sediment Coring	Airgun Noise	Cumulative Effects
polychaetes	NG	NG	NG	NG	NG	NG	NG	NG
echinoderms	NG	NG	NG	NG	NG	NG	NG	NG
sipunculids	NG	NG	NG	NG	NG	NG	NG	NG
bivalves	NG	NG	NG	NG	NG	NG	NG	NG
amphipods	NG	NG	NG	NG	NG	NG	NG	NG
Opilio crab	NG	NG	NG	NG	NG	NG	NG	NG
copepods	NG	NG	NG	NG	NG	NG	NG	NG
euphausids	NG	NG	NG	NG	NG	NG	NG	NG

Note: NG = negligible, MN = minor, MO = moderate, MJ = major; Determinations are based on existing analyses in USDOI, MMS, 2006b and USDOI, MMS, 2007b, and incorporate more recent information from other sources, as appropriate.

Pelagic schooling species, such as adult Arctic cod and salmon are highly mobile and would likely avoid areas where airguns are active. Sedentary and epibenthic-obligated fish could likely experience a higher level of effects from seismic activities because of their limited mobility; however, they would only be subjected to very brief periods of exposure. As summarized in Section 4.4.3 and Table 4-4, the PEA and Sale 193 EIS (USDOI, MMS, 2006b; 2007b) concluded negligible effects from airgun noise to marine fish species in the Arctic OCS. Consequently, fish and EFH will not be assessed further in this EA.

Studies conducted during the past ten years have indicated there may be adverse effects from survey sound on certain developmental stages of lower trophic species (such as snow crabs) as described the PEA and Lease Sale 193 (USDOI, MMS, 2006 b and 2007b). Available information indicates that these effects are considered to be negligible (Sale 193 EIS; Blanchard et al., 2010). Therefore, lower trophic organisms will not be further analyzed in this EA.

Marine seismic streamers do not physically disrupt the benthic habitat and, therefore, are not expected to cause direct or long-lasting alteration of benthic habitat or invertebrate populations in the survey area of the Chukchi Sea. Sediments and drilling lubricants from coring activities would be released into the Chukchi Sea as cores are drilled. Any released sediments or lubricants released into the water column would be quickly dispersed into the Chukchi Sea via ocean currents. The low-level drilling noises should not affect any benthic organisms appreciably. Consequently, any benthic invertebrates in the vicinity of the proposed coring activities are expected to be negligibly affected. Because of the relatively small size of these streamers, they are likely to affect pelagic biota to a negligible degree. Therefore, benthic habitat, benthic populations, and other pelagic biota will not be further analyzed in this EA.

4.2 Presence and Habitat Use

Population estimates, habitat preferences, and anticipated exposure of species to sound are discussed in this section.

4.2.1 Marine Mammals

Results from surveys conducted in nearby areas (Blees et al., 2010; Funk et al, 2007; Funk et al, 2008; Funk et al, 2010; Brueggeman, 2009; Nelson et al., 1993; Ljungblad et al., 1988; Ireland et al, 2008; Ireland et al, 2009a; Ireland et al, 2009b; Ireland et al, 2009c) acknowledged the presence of polar bear, five pinnipeds (four ice seal species and the Pacific walrus), and nine cetaceans (four odontocetes [toothed whales] and five mysticetes [baleen whales]) (Funk et al., 2009). Pacific walrus were most often encountered along with ringed seals, bearded seals, and gray whales. Less common were spotted seals, ribbon seals, bowhead whales, beluga whales, harbor porpoises, killer whales, minke whales, and polar bears (Brueggeman, 2009a; 2009b). Fin and humpback whales are

considered rare or uncommon (Table 4-5) in the survey area (USDOI, MMS, 2006b and 2008b; NMFS, 2008a and 2008b).

Allen and Angliss (2010) characterize the population estimates for ice seals (ringed, ribbon, bearded, and spotted seals) as unreliable or tentative, noting populations are known to be in the tens to hundreds of thousands across the Arctic. Ice seals are associated with sea ice for all or part of the year. Some species tend to remain near the ice edge during the summer months, but regularly occur in open water. Seals are likely to be widely dispersed as they forage through the area.

Table 4-5. Population information and habitat use for marine mammal species occurring in the Chukchi Sea Planning Area.

Species	Population Size	Area Habitat Preferences During Open Water Season
Bearded Seal	No reliable population estimate in Bering/Chukchi/ Beaufort Seas (Allen and Angliss, 2010). Cameron et al. (2010) estimated 155,000 bearded seals in the Beringian Distinct Population Segment (DPS), about 27,000 of which reside in the Chukchi Sea. Cameron et al. (2010) reported the population density of bearded seals in the Chukchi Sea to average 0.07 and 0.14 bearded seals/km2 based on coastal aerial surveys flown between Barrow and Shishmaref, Alaska (Bengtson et al. 2005)	Circumpolar distribution, ranging south into the Sea of Okhotsk. Shallow waters less than 200 m deep that are at least seasonally ice covered. Areas of broken sea ice and sometimes fast ice areas with access to open waters. Typically found in continental shelf waters with 70 - 90% ice cover and between 20 and 100 nautical miles offshore. May remain near ice, or in open waters.
Beluga Whale	32,453 Bering/Chukchi/Beaufort Seas stock, 3,710 eastern Chukchi Sea stock, and 18,142 eastern Bering Sea stock (Allen and Angliss, 2010).	Usually follow lead systems and nearshore areas in spring migration. Summer habitat use is segregated with older males using the continental shelf break and heavy ice, while females with young prefer shallower water over the shelf. Belugas migrate westward along the shelf edge during their fall migration. Common in nearshore waters and lagoons where they most likely molt.
Bowhead Whale	1,836 Western Arctic Stock (Allen and Angliss, 2010).	Migrate through the Chukchi Sea in spring and fall, feeding over deep water and in shallow waters in U.S. Beaufort Sea, and to a lesser extent, Chukchi Sea, in summer. An unknown portion of the population migrates westward or southward through or through the 160 dB noise footprint of the proposed survey area in the fall.
Fin Whale	5,700 northeast Pacific stock (Allen and Angliss, 2010).	Deep offshore waters and continental shelf waters in the project area. Considered uncommon in the Alaska Chukchi Sea, but sightings are becoming more frequent.
Gray Whale	Minimum estimate of 17,752 Eastern Pacific/Stock (Allen and Angliss, 2010).	Waters over continental shelf, nearshore waters, and shallow offshore areas. Historically Hanna Shoal was an important feeding ground for Eastern Pacific gray whales. In recent years (2008-2010) fewer feeding gray whales have been observed near Hanna Shoal.
Harbor Porpoise	Unreliable estimate of 48,215 Bering Sea stock (Allen and Angliss, 2010).	Uncommon in open waters of the Chukchi Sea. Usually found over the continental shelf and in coastal lagoons.
Humpback Whale	Minimum estimate of 732 western North Pacific stock (Allen and Angliss, 2010).	Considered rare and extralimital, Sightings are becoming more common recently.
Killer Whale	>314 Bering Sea transient stock (Allen and Angliss, 2010).	Open water and ice front, some coastal areas. Uncommon in the eastern Chukchi Sea. More common in waters off Chukotka.
Minke Whale	No estimates available, no min. abundance estimate available (Allen and Angliss, 2010).	Common but not abundant in the Bering/Chukchi Seas., may penetrate loose ice in summer, migratory.
Narwhal	Estimate of 60,000-80,000 world wide (Richard et al., 2010).	A few records exist for the Chukchi Sea, Rare and most likely extralimital. Feed in deep waters near continental shelf edge.

Species	Population Size	Area Habitat Preferences During Open Water Season
Pacific Walrus	129,000 in the Bering/Chukchi Seas (Allen and Angliss, 2010; Garlich-Miller, 20l11).	Seasonally abundant in area. Usually foraging over continental shelf. Hanna Shoal is an important feeding ground. Brueggeman et al. (2009) observed 965 walrus during marine mammal surveys in the Chukchi Sea Open Water Surveys, while Blees et al. (2010) observed at least 1042 individual walruses during 2010 seismic operations at the proposed project area, enroute to coastal haulouts.
Polar Bear	2,000 Chukchi-Bering Stock(Allen and Angliss, 2010 , 1,526 Southern Beaufort Sea Stock (Allen and Angliss, 2010)	Areas of sufficient sea ice cover north of the project location from July-October. Some in open water transiting between sea ice and the coast. Females with young, and sub adults may occur onshore.
Ribbon Seal	49,000 in eastern and central Bering Sea (Allen and Angliss, 2010).	Pelagic waters in the Bering and Chukchi Seas. Brueggeman et al. (2009) observed 6 ribbon seals by MMOs during Chukchi Sea seismic surveys, while Blees et al. (2010) observed at least 1 ribbon seal during Statoil's 2010 2D/3D seismic data collection. Larger numbers of ribbon seals are found in the southern and southwestern Chukchi Sea, and in the Northern Bering Sea during the open water season.
Ringed Seal	Unreliable estimate of 249,000 in Bering/Chukchi Seas (Allen and Angliss, 2010). Kelly et al. (2010) estimates 1,000,000 ringed seals occur in the Beaufort and Chukchi Seas in varying densities.	Shallow waters over continental shelf. Brueggeman et al. (2009) observed >117 ringed seals by MMOs during Chukchi Sea seismic surveys, while Blees et al. (2010) noted >35 ringed seals identified during 2010 3D seismic data collections.
Spotted Seal	Unreliable estimate of 59,214 Bering/Chukchi Seas (Allen and Angliss, 2010).	Seasonal visitor to Chukchi Sea. Shallow waters over continental shelf. Occupy terrestrial haulout outs in summer, including Kasegaluk Lagoon.

Source: Information sources are USDOC, NMFS (2008a; 2008b; and 2009b) and USDOI, FWS (2007; 2008; and 2009), unless otherwise noted.

Also dependent upon available sea ice are walrus and polar bears. Partial counts indicated a minimum of 129,000 walrus in the Bering and Chukchi Seas (Allen and Angliss, 2010; Garlich-Miller et al., 2011), but a more accurate population estimate is unavailable. Pacific walrus remain along the ice edge for much of the year, with most males migrating to terrestrial haulout sites along the coast in summer. Females and calves remain along the ice edge until sea ice retreats north of the continental shelf. Then females and calves move to terrestrial haulout sites along the coast of the Chukchi Sea. Polar bears prefer to remain with the sea ice, using it as a resting or hunting platform during summer months, but may be found transiting open water after sea ice disappears from the region.

In recent years, the sea ice edge has retreated north of the proposed survey area by mid to late July (Statoil, 2011a; Polar Research Group, 2010).

From July to October bowhead whale feeding concentrations occur in the Canadian Arctic and near Point Barrow or Wrangel Island (Appendix A, Figure A-10). Unknown numbers pass through the proposed survey area as they migrate from the Beaufort Sea to Wrangel Island or to the Chukotka coastal waters. Although data are preliminary, results from recent tagging projects (Quakenbush, 2010) indicate varied movements of migrating bowhead whales in the Chukchi Sea.

Gray whales have historically been found in shallow nearshore waters or shallow offshore areas, such as Hanna Shoal more than 8 mi from the shallow hazards survey area, feeding on benthic organisms (Appendix A, Figure A-11).

The actual presence and abundance of each species of marine mammal within the survey area depends upon factors such as food presence, water depth, time of year, and the sea ice presence. Depth preference varies between species and sea ice abundance has a direct bearing on the number of ice-associated marine mammals, particularly polar bears, ice seals, and Pacific walrus that may be present during shallow hazards surveys. Further, sea ice abundance and presence has varied greatly in past years in the prospect areas (Polar Research Group, 2010).

Marine mammals are federally protected under the MMPA. There are no state-listed marine mammal species of special concern within the northeastern Chukchi Sea area. Polar bears and bowhead, humpback, and fin whales are listed under the ESA. Pacific walrus, ringed seals, and bearded seals have been proposed for protected status under the ESA (*Federal Register*, 2011; 2010c; 2010d).

Blees et al. (2010) noted bearded seals (128 individuals) were the most commonly identified seals in the project area during 2010 seismic operations, followed by ringed (35 individuals), spotted (5 individuals), and ribbon seals (1 individual). The same survey identified 1,042 Pacific walruses, 6 bowhead whales, 10 gray whales, 5 minke whales, 20 unidentifiable mysticete whales, 3 unidentifiable toothed whales, and no polar bears. In 2008, Brueggeman et al. (2009) observed 119 bearded seals, 117 ringed seals, 60 spotted seals, 6 ribbon seals, 181 ringed or spotted seals, and 607 unidentifiable seals. This study also detected 965 walruses, 22 gray whales, 9 killer whales, 7 harbor porpoises, 1 bowhead whale, 1 minke whale, 1 Dall's porpoise, and 9 polar bears. A total of 2,149 marine mammals were observed during 610 hours of survey work over 5,344 miles of track line at the Burger and Klondike prospect areas. Dall's porpoise was observed off Point Hope Alaska during the retrograde phase of the survey and one polar bear mother with a pair of cubs was observed just offshore from Wainwright, Alaska.

4.2.2 Birds

Bird habitat use in the northeastern Chukchi Sea was studied by Divoky (1987) from mid-July through mid-October in the 1970s and 1980s. His studies found three species of jaegers (pomarine, parasitic, and long-tailed) were common in the Chukchi Sea until late September and dispersed throughout his study areas. Encounters with gulls varied by species and time throughout the July-October time frame.

Glaucous gulls were found to be present in all areas and ivory gulls were common to abundant in areas where ice was present, including the area of the Burger prospect from late September until the end of the observations on October 12 (Divoky, 1987). The lack of ice during his surveys likely had an effect on the number of ivory gull sightings. Ross's gulls became common in late September at the ice edge, though small numbers were seen well south of the ice, but they were found over most of his survey area and would be expected in the area of Statoil's survey.

Black-legged kittiwakes were common throughout most of the Divoky (1987) survey area in the 1970s - 1980s, including the area of the Burger prospect, from mid-July until late September. Densities increased from 1 to more than 2 birds/sq mi from late August to early September and subsequently decreased as they left the Chukchi Sea (Divoky, 1987).

Sabine's gulls and Arctic terns were rarely found in the pelagic Chukchi Sea; most observations were within 29 mi (46 km) from shore (Divoky, 1987). The lack of offshore sightings indicates migration likely occurs landward of the 66 ft (20 m) isobath. Divoky (1987) reported alcids (murres, auklets, murrelets, and puffins) were commonly encountered during the July-October period, but densities varied by species and time.

Murres were most abundant in the southern and south central areas of the Chukchi Sea, and less abundant in the northeastern Chukchi Sea (Divoky, 1987)(Table 4-6). Murre sightings decreased after August 20 as they migrated south. Black guillemots were regularly found in low densities in the central and northern Chukchi Sea when ice was present and were common in offshore areas during July and August. Parakeet auklets were uncommon until late August when they temporarily became common in the southern Chukchi Sea, becoming uncommon again in late September (Divoky, 1987).

Crested auklets move from the Bering Sea into the central Chukchi Sea in late August and early September; they were regularly encountered from August 27 into the first half of October. However, crested auklets were encountered in patches, likely reflecting the availability of zooplankton (Divoky, 1987). He found small numbers of least auklets in the central Chukchi Sea after late September and

few after October 1. Tufted puffins occurred in the central and southern Chukchi Sea but were only regularly found in the southern Chukchi Sea (Divoky, 1987). Few horned puffins occurred in the central Chukchi Sea in August and numbers increased in September after the breeding season (Divoky, 1987). Most horned puffins in the central Chukchi Sea were observed near Cape Lisburne. Puffins were not observed during recent studies in the vicinity of the Burger prospect near the proposed survey area (Gall and Day, 2009).

Recent surveys conducted at nearby prospects during July–October 2008 (Gall and Day, 2009), identified Pacific loon, northern fulmar, short-tailed shearwater, black-legged kittiwake, glaucous gull, thick-billed murre, least auklet, and crested auklet as the bird species most commonly encountered. Generally, birds were more numerous in early fall, and less numerous in late summer or late fall. Short-tailed shearwaters were the most numerous species at both sites with an average density of 40 birds/km^2 in the area of the Klondike prospect in early fall, and 32 birds/km^2 in the area of the Burger prospect in early fall (Gall and Day, 2009).

Table 4-6. Population information, density, and habitat use for bird species occurring in the Chukchi Sea Planning Area.

Species	Population Size	Range of Estimated Densities[A]	Area Habitat Preferences During Open Water Season
Black-Legged Kittiwake	Estimate of 1,322,000 in Alaska, (FWS, 2006).	0.2-17.7 birds/km^2	Nest southeast Alaska north to Point Hope; winters at sea Bering Sea, Gulf of Alaska
Crested Auklet	2.9 million in North America, (FWS, 2006).	0.0-0.3 birds/km^2	Nest Aleutian / Bering Sea islands. Non-breeding in Chukchi Sea. Winters offshore.
Glaucous Gull	Population numbers are poorly known, but estimate 100,000 in Alaska (FWS, 2006).	0.1-4.2 birds/km^2	Colonial nester along most of coastline, most common gull
Kittlitz's Murrelet	20,000 in Alaska (90% of the world's population) (FWS, 2009)	uncommon, no observations (Grebmeier, 2009)	Occur at sea in substantial numbers along the ice edge in late summer and fall, particularly in the central Chukchi Sea.
Least Auklet	Difficult to census, estimates of 5.5-9 million in North America, (FWS, 2006).	0.0-0.1 birds/km^2	Nest AK Peninsula/Aleutians - Bering Sea islands. Non-breeding in Chukchi Sea. Winters offshore.
Long-tailed Ducks	Estimate of 116,400 on Arctic Coastal Plain (Sea Duck Joint Venture, 2003a).	Maximum density of 2.2/km^2 in northern Chukchi Sea (Sept.-Oct.) (Divoky, 1987).	Nearshore areas in 20-m isobath. Most feeding is in water <9 m (30 ft) deep, but dives >60 m (200 ft) do occur. Nest inland and on Arctic coast near water. Molting occurs in coastal areas. (Sea Duck Joint Venture, 2003b)
Northern Fulmar	2.1 million breeding birds in North America, (FWS, 2006).	0.1-1.1 birds/km^2	Nests on Alaska Peninsula and Bering Sea islands. Winters at sea – Bering Sea, Gulf of Alaska
Pacific Loon	39,945 for the Arctic coastal plain survey area (FWS, 2006)	0-4.9 birds/km^2	Breeds on freshwater tundra lakes. Rests on open ocean during migration. Winters on ocean waters near coast, and sometimes on bays or estuaries
Short-Tailed Shearwater	Estimate 23 million breeding birds world-wide, (FWS, 2006).	0.0-31.6 birds/km^2	Most at sea in south Bering Sea, Gulf of Alaska, fewer in Chukchi & Beaufort Seas.
Spectacled Eider	5,047-7,368 nest on Alaska's North Slope (Larned et al, 2009)	rare	Currently breeding distribution includes the central coast of the Yukon-Kuskokwim (Y-K) Delta, the Arctic Coastal Plain of Alaska, and the Arctic Coastal Plain of Russia (USDOI, FWS 2005). After nesting, spectacled eiders move to coastal waters where they migrate to molting areas.

Species	Population Size	Range of Estimated Densities[A]	Area Habitat Preferences During Open Water Season
Steller's Eider	100-866 on Alaska's North Slope (USDOI, FWS, 2009)	rare	Coastal and offshore areas provide habitat for Steller's eiders. The Alaska-breeding population is primarily confined to the Arctic Coastal Plain of Alaska's North Slope, with a distinguished concentration around Pt. Barrow (FWS, 2002c)
Thick-Billed Murre	Estimates of 2.2 million birds in Alaska (USDOI, FWS, 2006).	0.0-0.1 birds/km^2	Nest SE Alaska to Cape Lisburne. Winter in open water Bering Sea, Gulf of Alaska
Yellow-Billed Loon	3,000-4,000 in Alaska (USDOI, FWS, 2009).	rare	Breeds on coastal and inland low-lying tundra in association with fish-bearing lakes, winters in coastal waters.

Note: [A] Late summer, early fall, late fall (from nearby Burger area, 2008 surveys).

Source: USDOI, MMS, 2006b; 2007b and USDOI, FWS, 2007; 2008; 2009, unless otherwise noted.

During surveys conducted as part of the BOEMRE-funded COMIDA (Chukchi Offshore Monitoring in Drilling Area) studies from mid-July through mid-August in 2009 no ESA-listed species were observed, and the highest bird densities occurred in the nearshore waters and at Hanna Shoal, which is more than 8 mi from the shallow hazards survey area (Grebmeier, 2009).

Northern fulmars were (Divoky, 1987; Gall and Day, 2009) present in the central Chukchi Sea before late August, and became more common from late August to mid-September and absent after late September. Shearwaters were common to abundant in the Chukchi Sea during the late August to late September ice retreat and their distribution appears to follow zooplankton abundance and distribution (Divoky, 1987; Gall and Day, 2009).

Based on the available literature, northern fulmars; short-tailed shearwaters; red and red-necked phalaropes; glaucous, ivory, and Ross's gulls; kittiwakes; pomarine, parasitic, and long-tailed jaegers; common and thick-billed murres; black guillemots; and least and crested auklets can be expected to occur in the vicinity of Statoil's survey area during the August–November time frame. These species often forage in the pelagic Chukchi Sea. Loons and sea ducks are typically found in nearshore waters where depths are shallower, but occasionally they can be found in pelagic habitat. Overall, bird densities in offshore waters are lower than in nearshore waters (Divoky, 1987; Gall and Day, 2009).

Surveys along 35 x 35 mi (56 x 56 km) transects in the vicinity of the survey area were performed by ABR, Inc. from July 23 to October 12, 2008 (Gall and Day, 2009). Comparisons between the ABR data and data collected by Divoky are difficult. The ABR data was collected during a single year, the studies have poor spatial overlap, and survey designs differed, as did sample sizes (Gall and Day, 2009). Both studies found shearwaters, crested auklets, black-legged kittiwakes, northern fulmars, and thick-billed murres to be the most abundant species, accounting for 65% of the observations (Gall and Day, 2009).

Of the 31 bird species recorded during surveys, eight were detected frequently enough to generate reliable estimates of density (Gall and Day, 2009). Densities for the eight most-abundant species differed substantially between seasons; however, seasonal patterns of abundance differed by species. Thick-billed murres were most numerous in late summer and early fall, while short-tailed shearwaters, northern fulmars, black-legged kittiwakes, and Pacific loons were most numerous in early fall; glaucous-gulls and least auklets were most numerous in both early and late fall; and crested auklets were most numerous only in late fall (Gall and Day, 2009).

4.3 Species Carried into Effects Analysis

Tables 4-1 through 4-4 provide information regarding effector-specific and cumulative levels of effects that can be expected for marine mammal, bird, and fish species in the northeastern Chukchi

Sea. This information was reviewed along with information provided in Tables 4-5 and 4-6 to determine which species are most likely to be encountered (based on habitat use, and presence), a species' ESA status, the expected cumulative level of effects that would apply to each of these species (Table 4-7), and the effectors needing to be analyzed, by species, in Section 5. The information presented in Table 4-7 was then reviewed to identify all species that (a) had an ESA status, (b) MMPA status, or (c) would experience a minor level of effects or greater. The results from the Table 4-7 review were then summarized in Table 4-8. Those species featured in Table 4-8 that were not excluded from further analysis were carried forward to Section 5.3 for more detailed analyses.

Table 4-7. Northeastern Chukchi Sea species listed under the ESA and MMPA, and those that may occur in the proposed survey area during the open water season.

Marine Mammal Species (All marine mammals have MMPA status)	ESA Status	Cumulative Level of Effects	Effectors
Bearded Seal	P	NG	None
Beluga Whale	NS	NG	None
Bowhead Whale	E	NG	Vessels, Airguns
Fin Whale	E	NG	Vessels, Airguns
Gray Whale	NS	NG	Vessels, Airguns
Harbor Porpoise	NS	NG	Vessels
Humpback Whale	E	NG	Vessels, Airguns
Killer Whale	NS	NG	Vessels
Minke Whale	NS	NG	Vessels, Airguns
Pacific Walrus	P	MN	Vessels, Airguns
Polar Bear	T	NG	Vessels
Ribbon Seal	NS	NG	Vessels
Ringed Seal	P	NG	Vessels, Airguns
Spotted Seal	NS	NG	Vessels, Airguns
Bird Species	**ESA Status**	**Level of Effects**	**Effectors**
Black-legged Kittiwake	NS	NG	Vessels
Crested Auklets	NS	NG	Vessels
Glaucous Gulls	NS	NG	Vessels
Kittlitz's Murrelet	C	NG	Vessels
Least Auklet	NS	NG	Vessels
Long-tailed Duck	NS	MN	Vessels
Northern Fulmar	NS	NG	Vessels
Pacific Loon	NS	NG	Vessels
Short-tailed Shearwater	NS	NG	Vessels
Spectacled Eider	E	NG	Vessels
Steller's Eider	E	NG	Vessels
Thick-billed Murre	NS	NG	Vessels

Marine Mammal Species (All marine mammals have MMPA status)	ESA Status	Cumulative Level of Effects	Effectors
Yellow-billed Loon	C	NG	Vessels

Note: NS = No ESA Status, E = Endangered ESA Status, T = Threatened ESA Status, C = Candidate ESA Status, P = Proposed ESA Status, NG = negligible, MN = minor, MO = moderate, MJ = major

Source: BOEMRE (USDOI, MMS, 2006b; 2007b); FWS (USDOI, FWS, 2007; 2008; 2009); Divoky (1987); Gall and Day (2009).

Table 4-8. Species included and excluded from subsequent effects analysis.

Species	Excluded from further analysis? Yes or No (Y/N)	Reason for Exclusion
Marine Mammals		
Bearded Seal	N	--
Beluga Whale	N	--
Bowhead Whale	N	--
Fin Whale	N	--
Gray Whale	N	--
Harbor Porpoise	N	--
Humpback Whale	N	--
Killer Whale	N	--
Minke Whale	N	--
Narwhal	Y	EO
Pacific Walrus	N	--
Polar Bear	N	--
Ribbon Seal	N	--
Ringed Seal	N	--
Spotted Seal	N	--
Birds		
Black-legged Kittiwake	Y	LE
Crested Auklets	Y	LE
Glaucous Gulls	Y	LE
Kittlitz's Murrelet	N	--
Least Auklet	Y	LE
Long-tailed Duck	N	--
Northern Fulmar	Y	LE
Pacific Loon	Y	--
Short-tailed Shearwater	Y	LE
Spectacled Eider	N	--
Steller's Eider	N	--

Species	Excluded from further analysis? Yes or No (Y/N)	Reason for Exclusion
Thick-billed Murre	Y	LE
Yellow-billed Loon	N	--

Note: Y = Yes, N = No, LE = Level of Effects, EO = Extralimital Occurrence, - = not excluded (i.e., included for further analysis).

Source: BOEMRE (USDOI, MMS, 2006b; 2007b), FWS (USDOI, FWS, 2007; 2008; 2009), Gall and Day (2009), Divoky (1987), Ireland et al (2008; 2009a; 2009b), Funk et al, (2007; 2008; 2010), Brueggeman (2009b).

The species most likely encountered in the proposed activity area would be Pacific walrus, bearded and ringed seals, gray whales, bowhead whales, beluga whales, and a very small number of humpback whales, fin whales, killer whales, minke whales and ribbon or spotted seals. Species protected by the MMPA (all marine mammals), ESA-listed species, ESA-candidate species, and species proposed for ESA listing are analyzed further in Section 5.3.

Pacific walrus densities are generally relatively low in the proposed activity area because walrus are likely to remain on the sea ice north of the survey area, and later occur onshore later in the summer-fall period. Hanna Shoal, more than 8 mi from the shallow hazards survey area, can be a foraging area for Pacific walruses at certain times of the year (USGS, 2007; 2008). Tagging studies indicate that walrus forage in shallow waters throughout the area during this time period. Consequently, individuals and groups of walrus could be encountered by the proposed ancillary activities at some point during the open water season as they migrate between the ice edge and shore and between feeding areas in the nearshore area and those associated with offshore shoals. A large number (346 sightings for a total of 1042 individuals; an average of 3 walrusus per sighting) of walrus were sighted by MMOs aboard Statoil's seismic acquisition vessel in 2010 (Blees et al., 2010). The major portion of these walrus sightings (250 sightings of 823 individuals) occurred between 28 and 31 August while the walrus were moving from the ice edge toward shore. By far, the typical number of walrus observed in any one group was 1-3. This is true even for the period 28-31 August.

Ice seals are widely dispersed offshore. In December 2010, NMFS proposed to designate the Beringian DPS of bearded seals and the Arctic population of ringed seals as protected by the ESA, due to the anticipated effects of future climate change on their respective habitats.

Gray whales feed in shallow nearshore and offshore areas of the Chukchi Sea. Hanna Shoal, more than 8 mi from the shallow hazards survey area, can be a foraging area for gray whales at certain times of the year (USGS, 2007; 2008). Consequently, individuals and groups of gray whales could be encountered by the proposed ancillary activities at some point during the open water season as they move between nearshore and offshore shoal areas, or opt to use resources where the ancillary activities are proposed.

The literature indicates bowhead whales predominately feed near Point Barrow or Wrangel Island in the Chukchi Sea between July and October; and unknown numbers pass through the survey area as they depart the Beaufort Sea (Quakenbush, 2010), peaking in late September and early October.

The remaining cetaceans widely dispersed offshore.

Polar bear are likely to remain on the sea ice north of the survey area. Any polar bears encountered are expected to be swimming in the open water between sea ice and the coast or searching for ice floes to use as resting or hunting platforms.

Steller's and spectacled eiders were included in the 2009 BO (FWS, 2009) addressing the effects of exploratory activities in the Beaufort and Chukchi Seas on ESA-listed birds. Both species will be included in the bird-strikes analysis below, as will yellow-billed loons and Kittlitz's murrelet. Long-

tailed ducks will also be analyzed due to their numbers in the Chukchi Sea and their presence in the survey area during certain times of the year.

The offshore waters of the proposed survey area are too deep to provide effective habitat for most bird species including Steller's eiders and yellow-billed loons. Groups of Kittlitz's murrelets have been noted in the ocean west of Point Barrow. Humpback and fin whales are believed to be rare visitors to the northern Chukchi Sea; however, they may occur in the area and their ESA-protected status necessitates an analysis.

4.4 Preliminary Screening of Potential Effects to Economics, Public Health, and Subsistence Resources and Activities

In evaluating the potential adverse effects from OCS activities, BOEMRE examines both the magnitude and duration of the disruption. For the screening analysis of subsistence activities and sociocultural issues BOEMRE used the following four categories of impact levels (ranging from negligible to high as documented in previous analyses) to characterize effects:

Negligible: Negligible levels of effects would not be considered to be significant impacts.

- Periodic, brief effects that have no consequent effects on subsistence resources or harvests.
- Periodic, brief effects with no measurable effects on normal or routine community functions.
- Periodic, brief effects with no measurable effects on individual or community health.

Minor: Minor levels of effects would not be considered to be significant impacts.

- One or more subsistence resources would be affected for up to one year (a harvest season), but none of these resources would become unavailable, undesirable for use, or experience population reductions.
- Sociocultural systems being affected for a period up to one year, but effects would not disrupt normal or routine community functions and could be avoided with proper mitigation.
- Individual or public health is affected for up to one year but not to a level of severity that interferes with the function of individuals or a community.

Moderate: Moderate levels of effects would not be considered to be significant impacts.

- Although one of more subsistence resources would be unavailable, undesirable for use, or experience population reductions for a period up to 1 year (1 harvest season), with subsistence harvests being affected for that period, the affected subsistence resources and harvests would be expected to recover completely if proper mitigation is applied or proper remedial action is taken once mitigation is implemented.
- Effects on sociocultural systems would be unavoidable for a period longer than 1 year. Affected normal or routine community functions would have to adjust somewhat to account for impact disruptions, but they would be expected to recover completely if proper mitigation is applied during the life of the proposed action or proper remedial action is taken once the impacting agent is eliminated.
- Individual or public health is affected for greater than one year, but in a manner insufficient to create long-term health issues for individuals or communities.

Major: Major levels of effects would be considered to be significant impacts.

- The affected subsistence resources and harvests would not be expected to fully recover within 1 year, even if proper mitigation is applied during the life of the proposed action, or even if proper remedial action is taken once the impacting agent is eliminated.
- One or more important subsistence resources would become unavailable, undesirable for use, or available only in greatly reduced numbers for a period of 1–2 years.
- Chronic disruption of sociocultural systems occurs for a period of 2–5 years, with a tendency toward the displacement of existing social patterns.
- Effects on sociocultural systems would be unavoidable and normal or routine community functions would experience disruptions to a degree beyond what is normally acceptable. Once the impacting agent is eliminated, affected community functions may retain measurable effects, even if proper remedial action is taken. This would constitute a major impact on sociocultural systems.
- Individual or public health is affected for greater than one year, and long-term health issues for individuals or communities have ensued.

The subsistence communities closest to the proposed survey area are Barrow (150 mi to the east), Wainwright (103 mi to the southeast), and Point Lay (140 mi to the south) (Appendix A, Figure A-1). The subsistence areas for these communities are discussed in the Sale 193 FEIS (USDOI, MMS, 2007b). The proposed survey area is far beyond the subsistence use areas for these communities (Braund, 2000; Braund and Burnham, 1984; Stephen R. Braund & Associates, 1989a; Stephen R. Braund & Associates, 1989b; Stephen R. Braund & Associates, 2010; Huntington, 1999; Huntington, H.P. and N.I. Mymrin, 1996; Huntington and Quakenbush, 2009; Huntington and The Communities of Buckland, Elim, Koyuk, Point Lay, and Shaktoolik, 1999: Kassam, K-A.S. and Wainwright Traditional Council, 2001; North Slope Borough, Planning Dept., 1993; USDOI, MMS, 2007a; 2007b) making any measurable impacts to subsistence extremely unlikely. Furthermore, the proposed ancillary activities would occur after the close of the spring whale hunt, with much of the work completed before the fall migration of bowheads and other marine mammals begins. We conclude there will be negligible effects to subsistence activities. Therefore, no further analysis of the potential effects to subsistence activities is necessary.

The number of local residents employed for the proposed activities is expected to be small (4 individuals hired as MMOs) (Statoil, 2011f) and the effect is expected to be negligible at the community level. In terms of Environmental Justice, because the proposed activities are expected to have negligible impacts on subsistence resources, subsistence practices, and sociocultural systems, and the proposed activities are expected to have no disproportionate adverse impacts on low-income or minority populations. The proposed activities are not expected to have adverse impacts on the health of the residents of the NSB. Therefore, no further analysis of the potential economic or public health effects is necessary.

4.5 Proposed-Action-Related Activities and Considerations

Crews will be housed aboard their respective ships. Personnel and equipment may also be transferred through Barrow or Wainwright in case of emergency or other unforeseen circumstances. Statoil has determined that the *M/V Fugro Synergy* cannot dock in the port of Nome because of its deep draft. If there is a need for access through Wainwright, Olgoonik's *Tukpuk* will be used. The *Tukpuk* is a 32-ft (9.75 m) vessel with the capacity to carry a maximum six people.

Aircraft support operations are not planned as part of this survey, although in an emergency, helicopter transport of individuals and equipment may be used.

The proposed activities would be supported from existing infrastructure located outside the coastal area of the Chukchi Sea Planning area. These business interactions are expected to have a minor

positive effect on the economies of Dutch Harbor and Nome and are not expected to adversely affect community health within these communities. The economic impacts to North Slope Borough (NSB) communities are expected to be negligible. In terms of Environmental Justice, because the proposed activities are expected to have negligible impacts on subsistence resources, subsistence practices, and sociocultural systems, and the proposed activities are expected to have no disproportionate adverse impacts on low-income or minority populations. The proposed activities are not expected to have adverse impacts on the health of the residents of the NSB, Nome, or Dutch Harbor. Therefore, no further analysis of the potential economic or public health effects is necessary.

Refueling is expected to take place at Nome though it is possible that fuel re-supply could occur at sea, if necessary. Statoil estimates the following volumes of fuel could discharge should there be an operational or equipment failure. BOEMRE finds these to be reasonable volume estimates:

- If a disconnection occurs during a fuel transfer, Statoil estimates that 33 gallons (0.79 barrels) of No. 2 Marine gas oil could be spilled. This volume includes the use of positive pressure fuel hoses and dry quick disconnect coupling.
- If a hose ruptures and there is total line drainage, Statoil estimates that up to 66 gallons (1.57 barrels) of No. 2 Marine gas oil could be spilled. This volume includes the volume in the hose; maximum time to discover release; maximum time to shutdown pumping; and maximum flow rate.

BOEMRE conducted a spill effects analysis for a range of refueling spills including 5 gallons, 13 barrels, and 48 barrels. The oil weathering model estimates approximately 21% of a 13 bbl spill would evaporate and 79% would disperse within 48 hours and is consistent with the weathering analysis of a 48 bbl fuel-transfer spill in the 2010 Statoil G&G EA (USDOI, BOEMRE, 2010) and Shell's 2010 Exploration Plan for the Burger, Crackerjack, and SW Shoebill Prospects (USDOI, MMS, 2009). The analyses in the PEA of a 5-gallon spill and in Shell's 2009 Exploration Plan EA of a 48-bbl spill concluded any effects from a diesel fuel spill would be localized, and temporary (persisting up to 3 days). The effects of the 33–66 gallon diesel fuel spill estimated for the proposed activity also would be expected to be localized, persisting less than 3 days. The effects of such a spill would be negligible. Accordingly, refueling spills will not be further analyzed in this EA.

Damage to the 150-m streamer could release kerosene into the marine environment. The chance of damage to streamers depends on the hazards in the area (e.g., other vessels), the weather conditions, and the operational procedures. Previous seismic survey work indicates damage to one segment of each streamer occurs every three to six months (SEIC, 2003 as cited in LGL, Limited, Royal Haskonging, and Jasco Research Ltd., 2009). Should a segment of streamer be damaged and leak kerosene, approximately 5 gallons could be released. The PEA analyzed a 5-gallon spill and determined that impacts would be negligible to minor from fuel or streamer spills; therefore, such spills were not further analyzed (USDOI, MMS, 2006).

The following factors are expected to mitigate the likelihood and potential effects if an accidental release of kerosene were to occur from the 150-m streamer:

- The potential of streamer fluid release is mitigated by best industry practices for the handling of oil-based products in a marine environment. A Material Safety Data Sheet (MSDS) will be maintained and appropriate management protocols implemented.
- In the event of a discharge, a thin slick in a localized area in the immediate vicinity of the streamer could occur. This slick would evaporate and disperse rapidly, thus minimizing the potential impact to marine mammals.
- The Shipboard Oil Pollution Emergency Program (SOPEP), as required under MARPOL, identifies reporting procedures and counter-pollution actions necessary to respond to a discharge. All planning and response procedures are in compliance with state and federal

regulations. The SOPEP will be employed to take appropriate countermeasures to respond to a potential streamer fluid release.

Emissions and discharges from the survey vessels must comply with regulations and apply to all vessels. Discharges from Statoil's proposed activities would be regulated under the Environmental Protection Agency's National Pollutant Discharge Elimination System Vessel General Permit for Discharges Incidental to the Normal Operation of Vessels (USEPA, 2009). The U.S. Coast Guard (USCG) regulations related to pollution prevention and discharges for vessels carrying oil, noxious liquid substances, garbage, municipal or commercial waste, and ballast water are at 33 CFR Part 151. Previous PEA and Sale 193 EIS analyses of emissions and discharges related to seismic surveys concluded any effects would be localized, temporary, and negligible. Therefore, effects to air quality from emissions will not be further analyzed in this EA. The effects to water quality will be analyzed since small quantities of sediments, cuttings, and perhaps drilling muds from coring activities could enter the environment.

Ballast-water discharge, hull fouling, and equipment placed overboard (e.g., anchors, seismic airguns, hydrophone arrays) are potential vectors for introducing invasive species. Vessels brought into State of Alaska or Federal waters are subject to USCG regulations (33 CFR Part 151, Subpart D), which are intended to reduce the risk of introduction of invasive species. The regulations require vessels coming from overseas to conduct mid-ocean ballast water exchange at least 200 nautical miles from shore, preferably in water depths greater than 200 m prior to entering U.S. waters; retain the ballast water on board while in U.S. water; or use a USCG-approved alternative environmentally sound method to treat the ballast water. The regulations require ballast water management plans and vessel inspections. As documentation of compliance with these USCG regulations, Statoil submitted a copy of the ballast water management plans for the vessels. Statoil has asserted that their standard practice is to fill ballast tanks with freshwater, alleviating the risks of introducing non-native or invasive species into the marine environment.

Standard practice in the seismic survey industry is to remove species such as barnacles from hydrophone streamers and other equipment when recovering the gear at the completion of a project by scraping or a high-pressure, sea-water wash. Statoil's contractors would follow standard procedures aboard the *M/V Duke* and *M/V Fugro Synergy* to remove species such as barnacles from hydrophone streamers and other equipment when recovering the gear at the completion of the project by scraping or with a high-pressure, sea-water wash.

These procedures, USCG regulations and inspections, and the limited duration and area of the proposed surveys, the contribution of the proposed activity to risk of introducing invasive species and impacts are not anticipated. Therefore, invasive species will not be further analyzed in this EA.

Statoil will adhere to the following mitigation measures when mobilizing to the survey area and demobilizing from the survey area, and during any vessel traffic to port for crew, changes, supplies, or fuel:

- Vessel transits will be timed to avoid subsistence use areas.
- Statoil will participate in cost sharing for the Communications Center in the Chukchi Sea coastal community of Wainwright and the vessels will communicate with coastal communities according to established protocol.
- One marine mammal observer (MMO) would be located on the bridge or weatherdeck of each vessel to watch for marine mammals during vessel transit.
- Both vessels will be staffed with MMOs who will alert the crew to the presence of marine mammals so that vessel crews can initiate appropriate mitigation measures.

- Vessels will reduce speed, and alter course as appropriate, when approaching groups of marine mammals and maintain the maximum practicable distance from groups of marine mammals.
- If weather or visibility conditions make it necessary, vessels should reduce speed to avoid the likelihood of injury to walruses.
- Vessels should not approach pacific walruses or polar bears on ice or land closer than 0.5 miles.
- Vessels must take precautions to avoid harassment of concentrations of feeding walruses. Vessels should reduce speed and stay a minimum of 0.5 miles from groups of feeding walrus.
- Vessels will be operated so that they do not separate members of groups of marine mammals.
- Vessels will avoid areas of active or anticipated subsistence hunting.

Statoil will provide reports to NMFS and FWS regarding the progress of authorized activities, as required by the permits (e.g., prior to the beginning of shallow hazards survey and geotechnical soil investigation activities, periodic progress reports, incidents involving marine mammals and birds, and upon completion of shallow hazards survey and geotechnical soil investigation activities), and Statoil will maintain a log of seismic activity noting the date and time of all changes in airgun activity (ramp up, power down, changes in active airguns, etc.) and any corresponding changes in monitoring radii. Statoil will maintain a record of all marine mammal observations. This information will be provided to FWS and NMFS and will be used to complete the 90-Day Report at the conclusion of the survey. The 90-Day Final Reports will describe the operations that were conducted and provide a summary of the monitoring effort and the results of the monitoring effort. Estimates and nature of takes based upon marine mammal sightings will also be included in the 90-Day Final Report.

Vessels are required to document and report any bird strikes. These measures will avoid or minimize adverse effects to marine and coastal birds using pelagic, nearshore, or other coastal habitats during the open-water season.

5. Environmental Consequences and Effects Analyses

This section provides an assessment of the direct, indirect, and cumulative impacts of those items carried forward from Section 4 for detailed analysis.

As discussed above in Section 3 Proposed Action and Section 4 Existing Environment and Environmental Evaluation, the following issues and environmental resources were considered but are not further analyzed in the EA.

- Freshwater and Marine fishes
- Essential Fish Habitat
- Benthic invertebrates
- Most non-ESA listed marine birds
- Air quality
- Hanna Shoal
- Ledyard Bay Critical Habitat Unit
- Terrestrial mammals
- Coastal wetlands
- Subsistence activities
- Economic Effects
- Public Health

5.1 Topics for Consideration

The energy emitted from airguns, i.e., the acoustic source for ancillary seismic surveys, has the greatest potential to have adverse effects on environmental resources, particularly marine mammals. Vessel traffic, noise, and lights associated with survey source and support vessels might potentially have adverse impacts, particularly on marine mammals and birds. Issues and concerns associated with seismic survey operations have been extensively documented by the scientific community, in government publications, and at scientific symposia.

See Section 4.1 for a description of the issues and concerns identified by technical analysts for consideration in this EA.

5.2 Water Quality

The impact levels used for this water quality analysis are taken from the Arctic MultiSale Draft EIS (MMS, 2008c) and adjusted as they relate to water quality. The impact levels are defined as follows:

Negligible

- No measurable impacts.

Minor

- Most impacts to water quality could be avoided with proper mitigation
- If impacts occur, water quality would recover completely without any mitigation once the impacting agent is eliminated.

Moderate

- Impacts to water quality are unavoidable; but water quality is not threatened although some impacts may be irreversible.
- Water Quality would recover completely if proper mitigation is applied during the life of the proposed action or if proper remedial action is taken once the impacting agent is eliminated.

Major

- Impacts to water quality are unavoidable.
- Water quality may be threatened; and would not fully recover even if proper mitigation is applied during the life of the proposed action or remedial action is taken once the impacting agent is eliminated.

The proposed ancillary activities are expected to produce highly localized, brief, and negligible to minor effects to the water quality and the aquatic environment.

The geotechnical soil investigation component of the ancillary activities is expected to cause resuspension of a small amount of sediments at each location. The re-suspended materials are expected to settle from the water column in close vicinity to the coring location and may have minor temporary effects on water quality in the immediate vicinity.

Lubrication of the coring holes would be performed using sea water, and in some instances bentonite and barite. The relatively small amounts of materials are expected to settle out of the water column in close vicinity to coring location and may have minor temporary effects on water quality in the immediate vicinity.

Small wastewater and ballast water discharges would be limited to what is permissible under USCG regulations and are not expected to affect water quality more than locally and temporarily.

There is a remote chance of a spill occurring during refueling operations at sea. In the event of an accidental spill, up to 13 bbl of No. 2 marine gas could contact nearby marine waters, and persist in the environment for up to 3 days before removal via weathering processes.

The ~150 m (492 ft) long streamer may contain up to 180 liters (50 gallons) of kerosene for electrical insulation and to maintain neutral buoyancy. The kerosene is kept in several isolated segments within the streamer. The likelihood of a rupture of any particular segment of the streamer and, therefore, the potential for a discharge, is low. However, if a rupture were to occur, the kerosene would quickly evaporate into the atmosphere, resulting in extremely small effects to water quality.

The analysis of the potential effects of seismic-survey-related vessel discharges was analyzed in the Sale 193 EIS. This analysis is incorporated by reference. The Sale 193 EIS (USDOI, MMS, 2007b: Section IV.C.1.a(7)) determined that impacts to marine water quality from seismic survey vessels and support vessels would not represent appreciable impacts to the marine water quality due to limited duration of such activities and low degree of likelihood of major discharges. Therefore, direct and/or long term degradation of marine water quality would be unlikely.

The overall, unmitigated effects to Chukchi Sea water quality from Statoil's proposed ancillary activities would be negligible to minor.

5.3 Analysis of Effects on Biological Resources from the Proposed Action

The following analyses address the significance of the Proposed Action's potential impacts on appropriate biological resources, considering such factors as the nature of the impact (e.g., habitat disturbance or mortality), the spatial extent (local and regional), temporal and recovery times (years, generations), and the effects of mitigation and any associated mitigation monitoring plan. Impacts on some environmental resources may be measurable, but are not considered significant, because their potential effects and contribution to cumulative effects (additive, synergistic, and countervailing) would be minimal and/or brief.

BOEMRE has determined that no unique resources or seafloor habitats occur in the vicinity of the proposed seismic survey area. The anticipated effects of the proposed action are consistent with those in previous BOEMRE NEPA documents (USDOI, MMS, 2006b; 2007b) and authorizations pursuant to MMPA and ESA.

5.3.1 Vessel Traffic and Vessel Noise

The effects of vessel traffic and vessel noises on marine mammals have been fully analyzed in the PEA, Sale 193 EIS, and NMFS IHA (NMFS, 2009b). Those effects are summarized below or hereby incorporated by reference. Vessels typically produce sounds in the lower frequency bandwidths from 156–186 Hz with decibel levels ranging from 128–186 dB re 1μPa2-m (Greene and Moore, 1995). Greene (2003) concluded that a broadband source level of 171 dB re 1μP at 1 m is a reasonable and potentially a conservative (higher than the likely actual source level) estimate to use as a source level for the smaller vessels used by ConocoPhillips during demobilization activities in the Beaufort Sea. After evaluating alternative models for estimating transmission loss, and considering likely ambient noise levels (based on data collected in 1996 offshore of Northstar), Greene (2003) applied the estimated source level to what he viewed as the most reasonable sound-propagation-loss model to estimate the received level of sound at four distances (0.1–63 km [0.6–39.1 mi]) from the tug and barge. He estimated the following received sound levels at specific distances: 131 dB re 1 μPa at 0.1 km (0.6 mi); 111 dB re 1 μPa at 1.0 km (0.62); 102 dB re 1 μPa at 2.8 km (1.7 mi); and 75 dB re 1 μPa at 63 km (39 mi). Given the assumptions associated with hearing and the approximations regarding sound transmission loss, Greene (2003) stated it would be best to consider the estimates of received sound levels as "guidelines."

5.3.1.1 Pinnipeds

Seals. Richardson (1995) found that vessel noise does not seem to strongly affect ice seals already in the water. Richardson explained seals on haulouts often respond more strongly to the presence of vessels by slipping into the water. Since the brief disturbance would occur during the open water season, and seals have a high tolerance to vessels and vessel noise while in the water, BOEMRE anticipates the proposed action would result in a negligible level of effects to seals.

Pacific Walrus. Vessel traffic could disturb walruses at sea and may interrupt the movements or foraging of walrus by temporarily displacing some animals as vessels pass through an area. Such traffic is expected to have a short-term (a few hours to a few days) effect on walrus movements or distributions. Adult walruses and sub-adults have the ability to cover large distances in a relatively small amount of time. Walrus calves with their mothers usually concentrate near haulout sites at areas of residual sea ice or along the Chukchi coasts. However, repeated disturbances from vessel traffic could have energetic costs and have the potential to separate walrus calves from cows, although repeated disturbances are unlikely given the survey design. Because of the expected lack of sea ice in most of the survey area during the open water season, and the distance between the survey area and coastal haulout sites, BOEMRE does not expect many walrus cow/calf pairs to be affected. Because of the brief disturbance and the mitigations incorporated in the proposed activities, including interaction plans (Statoil, 2011c and 2011e) and use of MMOs, BOEMRE anticipates a minor level of effects on Pacific walrus from the proposed action.

5.3.1.2 Polar Bears and Polar Bear Critical Habitat

Ancillary operations are proposed for the open water season when there is less than 10% ice cover in the survey area. Any polar bears encountered during the course of the proposed action would most likely be swimming towards shore, pack ice, or between ice floes, and not actively hunting in open water. The disturbance created by the presence and noise of survey vessels presents a brief disturbance, without lasting effects (BOEMRE, 2010b). The negligible level of effects from vessel traffic and noise would be further mitigated by implementing the mitigation measures described in Statoil's application for an Incidental Harassment Authorization (Statoil, 2011b). This includes the use of MMOs on each vessel, resulting in a negligible level of effects on polar bears.

The potential effects of the proposed action on the primary constituent elements (PCEs) of the polar bear critical habitat units are evaluated below.

Unit 1, Sea ice: Sea ice habitat is used by polar bears for feeding, breeding, denning, and movements (75 FR 76086). As it is impossible to predict the precise distribution and composition of future sea ice, some sea ice may drift into the proposed action area during operations. Statoil's vessels are not equipped for ice management or icebreaking and would need to avoid concentrations of sea ice for safety reasons. Vessels would be shifted to work in another ice-free portion of the proposed action area should sea ice be blown southward into the open water area during operations. No adverse impacts to Unit 1, sea ice habitat, are anticipated from the proposed action.

Unit 2, Terrestrial denning: Terrestrial denning habitat includes topographic features such as coastal bluffs and riverbanks with steep stable slopes that have water or relatively level ground below (75 FR 76086). No terrestrial denning habitat occurs within the proposed project area and no activities will take place on or near terrestrial denning habitat. No adverse impacts to Unit 2, terrestrial denning habitat, are anticipated.

Unit 3, Barrier island: Barrier island habitat includes all barrier islands along the Alaskan Chukchi coastline and their associated spits and a 1.6 km (1 mile) buffer zone around the barrier islands and spits. Polar bears use barrier island habitat for denning, as a refuge from human disturbance, and for movements along the coastline between denning and foraging habitats (75 FR 76086). No planned

activities associated with the proposed action will take place on or near barrier island critical habitat. No adverse impacts to Unit 3, barrier island habitat, are anticipated.

5.3.1.3 Cetaceans

The best available information indicates bowhead, fin, gray, humpback, and minke whales respond to vessel traffic and vessel noise by avoidance. Vessels could strike or entangle (with streamers or gear) whales, causing injury or death. Potential effects of vessel traffic and noise depend on the size, propulsion systems, use, speed, and temporal/spatial relationships to whales, their habitat, and other human activities. The proposed action would occur at a time after the spring whale migrations and end during or after the fall whale migrations.

Bowhead whales are increasingly being observed in the Chukchi Sea during the open water season; however, their numbers peak during their migration out of the Beaufort Sea. In the fall, migrating bowhead whales disperse across the Chukchi Sea after passing Point Barrow, while gray whales tend to use coastal waters in their migrations, and belugas typically associate with coastal areas or the ice front (Appendix A, Figure A-11). Consequently, vessel noise, presence, and activity related to the proposed ancillary activities would not restrict fall cetacean migrations out of the Chukchi Sea. Tagging studies indicate substantial numbers of bowheads migrate through or adjacent to the overall noise footprint of the proposed ancillary activity, and small alterations by individual whales may occur as they divert around areas of noise or activity. NMFS has concluded that such activities and small alterations in migration by whales are likely to result in negligible effects to bowhead whales (USDOC, NMFS 2008).

The ability of cetaceans to communicate, navigate, and echolocate can be compromised by underwater noises such as those produced by vessel engines and propulsion systems that can mask or interfere with sound reception in whales. Masking is the obscuring of the perception stimulus, resulting from the presence of a stronger interfering stimulus in the same range (Richardson et al., 1995a; Richardson et al, 1995b). Decibels (dB) are used to describe the strength or “volume” of a sound. The proposed pressure criterion for non-pulsed energy leading to injury is 230 dB re 1µPa (peak). The sound exposure level criterion for nonpulse injury was calculated at 215 dB re 1µPa2-s (Southall et al., 2007). These can result in temporary threshold shifts (TTS), with recovery after minutes or hours, or to permanent threshold shifts (PTS) with no recovery (Gordon et al., 2004; 1998). The sound produced by vessels typically falls within the 128 to 186 dB range (Greene and Moore, 1995).

Frequency sensitivity is also a consideration for marine mammals. Frequencies and frequency sensitivities are described in units of hertz (Hz), kilo-hertz (kHz), etc. (the range of sounds detectable by an animal). Vessel strikes resulting in injury and/or mortality of large cetaceans are theoretically possible; however, slow operational speeds, MMO and vessel mitigation responses, and the historical absence of confirmed cetacean injuries or mortalities from vessel strikes in the Arctic indicate negligible levels of effect from vessel presence and movement.

Odontocetes (belugas, killer whales, harbor porpoises, etc.). Belugas and other toothed whales seem to be most sensitive to frequencies near or above 10 kHz; sensitivity to frequencies below 10 kHz declines rapidly as frequencies decrease (Cosens and Dueck, 1993). For belugas, detection of vessel noise below 5 kHz appears to be limited by their auditory threshold. Belugas tend to react to sounds when they are just detectable, so their reaction zone is equivalent to their detection zones. Belugas apparently are unable to detect low frequencies beyond a few hundred meters from the source. However, reaction distances for belugas will be larger when industry noise contains high frequency components (Cosens and Dueck, 1993).

Some belugas have an aversion to anthropogenic noise, particularly outboard-powered boat traffic (Huntington, 1999; Huntington and Mymrin, 1996), but may be capable of habituating to loud noises

not associated with hunting (Huntington, 1999). The PEA and Sale 193 EIS concluded belugas could react to the approach of vessels at great distances. Statoil (2011b) proposes to conduct their seismic surveys during the open water season when sea ice has retreated far north of the proposal area. Consequently most belugas will be molting and feeding in coastal waters such as Kasegaluk Lagoon, or near the ice front, north of the survey area. Because of the low likelihood of encountering belugas, slow survey speeds, ice avoidance, and the mitigation plans (Statoil, 2011c; 2011d) in place, BOEMRE anticipates a negligible level of effects on belugas from vessel traffic.

The rarity of killer whales in the survey area leads us to conclude that there is a very low likelihood of encountering an individual, let alone any groups during the activities. Toothed whales such as killer whales and porpoises are sensitive to high frequency noise, not the mostly low-frequency noise produced by vessel traffic. Therefore, killer whales and porpoises are expected to experience negligible levels of effects from vessel traffic.

Mysticetes (bowhead whale, fin whale, gray whale, humpback whale, minke whale, etc.). From a behavioral perspective, increased noises (including vessel noise) could mask whale vocalizations and interfere with whale communications, or alter natural behaviors (i.e., displacement from migration routes or feeding areas; disruption of feeding, resting, or nursing). Behavioral impacts may vary by gender, reproductive status, age, accumulated hearing damage, type of activity engaged in at the time, group size, and/or whether the animal has heard the sound previously (e.g., Olesiuk et al., 1995; Richardson et al., 1995a; Kraus et al., 1997; NRC, 2003, 2005). For example, mysticete females with calves show a heightened behavioral response to seismic noise (Henley and Ryback, 1995; McCauley et al., 2000). In other studies on responses of feeding bowhead to seismic activity, some animals ceased feeding and others continued feeding (Fraker, Richardson, and Würsig, 1995; Richardson, Wells, and Würsig, 1985).

Gray whales are low-frequency hearing specialists, with an auditory range starting at 10 Hz and possibly extending to 30 kHz (Ketten, 1998). Erbe (2002) (inferring from gray whale vocalizations) suggested they would be sensitive to frequencies between 20 Hz and 4.5 kHz, with their greatest sensitivity occurring in the 20 Hz–1.2 kHz range. Clicks were reported up to 10 kHz, with main frequencies between 1.4 and 4 kHz. The lowest response threshold reported was 82–95 dB at 800 Hz (Erbe, 2002). Other studies suggest gray whales habituate to whale-watching vessels and may even approach them. Gray whales showed no evident avoidance to underwater playback of outboard engine noise, but call rates and call structure changed with exposure to actual boats, perhaps to compensate for outboard noise masking their calls (Richardson et al., 1995b).

Minke whales appear most sensitive to sound between 100 and 200 Hz, with good sensitivity extending from 60 Hz–2 kHz. High-frequency clicks were analyzed in two studies, indicating some sensitivity between 4 and 7.5 kHz, up to 20 kHz (Erbe, 2002). BOEMRE anticipates the effects to be generally similar to those noted for other mysticete whales because of shared morphological characteristics and similar biological needs. A more accurate level of effects determination cannot be made since little is known regarding minke whale-habitat use, distribution, movements, or productivity in the Chukchi Sea; however, the existing information is sufficient to inform the decision maker of the likely effects of the Proposed Action.

Bowhead whales react to the approach of vessels at greater distances than they react to most other industrial activities. According to Richardson and Malme (1993), most bowheads begin to quickly swim away when vessels approach rapidly and directly. This avoidance may be related to the fact that bowheads have been commercially hunted within the lifetimes of some individuals within the population, and they continue to be hunted for subsistence throughout portions of their range. Avoidance usually begins when a rapidly approaching vessel is 1–4 km (0.62–2.5 mi) away. A few whales may react at distances from 5–7 km (3.1–4.3 mi), and a few whales may not react until the vessel is <1 km (<0.62 mi) away. Received noise levels as low as 84 dB re 1 µPa or 6 dB above

ambient may elicit strong avoidance of an approaching vessel at a distance of 4 km (2.5 mi) (Richardson and Malme, 1993).

In the Canadian Beaufort Sea, bowheads observed in vessel-disturbance experiments began to orient away from an oncoming vessel at a range of 2–4 km (1.2–2.5 mi) and to move away at increased speeds when approached closer than 2 km (1.2 mi) (Richardson and Malme, 1993). Vessel disturbance during these experimental conditions temporarily disrupted activities and sometimes social groups, scattering as vessels approached. Reactions to slow-moving vessels, especially those that do not approach directly, are much less dramatic. Bowheads are often more tolerant of vessels moving slowly or in directions other than toward them (Richardson, 1995). Fleeing from a vessel generally stopped within minutes after the vessel passed, but scattering may persist for hours. After some disturbance incidents, at least some bowheads returned to their original locations (Richardson and Malme, 1993). Some whales may exhibit subtle changes in their surfacing and blow cycles, while others appear unaffected. Bowheads actively engaged in social interactions, feeding, or mating may be less responsive to vessels.

Vessel activities associated with proposed activities are not expected to disrupt the bowhead fall migration, and brief deflections in individual bowhead-swimming paths and temporary reductions in use of possible bowhead-feeding areas near activity area would not result in adverse effects on the species (NMFS, 2008a; 2008b; 2009b).

In addition to acting as a source of noise and disturbance, marine vessels potentially could strike bowhead, fin, gray, and humpback whales, causing injury or death. Available information indicates that current rates of vessel strikes of bowheads are low and there have been no known fin or humpback whale strikes in the Alaskan Arctic (USDOI, MMS, 2006b; 2007b).

Similar data regarding humpback and fin whale-specific responses to vessel traffic and vessel noise in the Arctic is unavailable; however, BOEMRE assumes that their responses would be similar to bowhead responses due to similarities in perception, morphology, and the environment (but differences might still exist). Few fin or humpback whales are expected to occur in the eastern Chukchi Sea, and even fewer are anticipated to occur in the proposed activity area.

The presence of MMOs onboard the vessels and a general slow speed for surveys (4–5 knots) (Statoil, 2011d) is expected to prevent ship-whale collisions. While conducting day or nighttime seismic surveys, the propagation of noise from seismic activity would briefly divert most, if not all, cetaceans out of the immediate area of effects for vessel activity.

The small chance of encountering bowhead, humpback, fin, or minke whales greatly lowers the potential impact of the proposed action on those species. In the unlikely event of an encounter with one of these species, the approaching and repetitive noise of discharging 40-cm^3 airguns would likely deflect individuals from the area of effects until the shallow hazards survey vessel has passed (expected to be a few minutes). Consequently, BOEMRE anticipates a negligible to minor level of effects from vessel traffic and vessel noise to all cetacean species.

5.3.2 Bird-Strikes (Collisions)

The effects of bird-ship collisions have been fully analyzed in the PEA, Sale 193 EIS, and NMFS IHA (NMFS, 2009b). Those effects are summarized below or incorporated by reference.

Population information, density, and habitat use for bird species likely to occur in the survey area are shown in Table 4-6. The birds likely to occur in the activity area are components of larger populations with ranges that extend beyond the boundaries of the activity area. The greatest potential for collision occurs where structures are in nearshore or coastal areas where birds, particularly eiders and long-tailed ducks, are known to migrate.

Statoil (2011c) estimates no ESA-listed birds strikes with vessels participating in the proposed action. This estimate is in line with the FWS (2009) predictions, which called for no more than one Steller's eider take, and six spectacled eider takes per year, across the entire Sale 193 area in the Chukchi Sea. The FWS estimate (0.239 Stellar's eider, and 5.27 spectacled eider takes per year, rounded up to the nearest whole number) were based on the maximum level of permissible exploratory activity, and an intentional, conservative, overestimate of potential ESA-listed bird collisions with seismic survey vessels. Because the proposed ancillary activities are planned for an area far away from the known preferred habitat of ESA-listed eiders, yellow-billed loons, and Kittlitz's murrelets, the collision probabilities would be less than what was analyzed by the FWS (2009).

The proposed ancillary activities would occur 103 mi northwest of Wainwright and 150 mi west of Barrow, and far from any migration or concentration areas for Spectacled and Steller's eiders (Appendix A, Figure A-13), yellow-billed loons (Appendix A, Figure A-14), or long-tailed ducks. During the period of proposed activities spectacled eiders concentrate in Ledyard Bay (Appendix A, Figure A-12) and coastal waters from 12–30 mi (19–48 km) offshore (Petersen, Larned, and Douglas, 1999). Long-tailed ducks and yellow-billed loons are usually found at their inland breeding areas during this timeframe, or in the case of non-breeding individuals, coastal waters. Very few if any threatened eiders are expected to use the proposed activity area because of the water depths and the distance offshore. No threatened eiders were observed in the vicinity of the nearby Burger Prospect during intensive bird surveys carried out in the 2008 open water season (Gall and Day, 2009). Based on this data, no bird strikes between vessels and spectacled or Steller's eiders are expected for the proposed activities.

Bird-ship collisions could result in injury or death. While an individual collision could be mortal to the individual, such events are unlikely to approach population-level significance effects. Statoil's ancillary activities in the Chukchi Sea is not expected to result in ESA-listed eider strikes because operations are planned in areas where spectacled and Steller's eider presence is extremely unlikely and when there are prolonged periods of daylight. Bird strikes would not occur during the spring migration of spectacled and Steller's eiders since those migrations occur well before the vessels would enter the Chukchi Sea.

Long-tailed ducks are prone to collisions with structures and vessels, and they frequently venture into OCS areas. The diving ability of long-tailed ducks permits them to forage on the seafloor in the proposed activities area; however, during much of August the long-tailed duck remains in coastal areas where they molt, and the likelihood of any long-tailed duck strikes on ships during most of August is remote.

Because of the small numbers of birds expected to occur in the activity area because of its location far offshore, the scarcity of ESA-listed bird species, and our expectation that birds will move away from slow-moving vessels, BOEMRE has concluded it is unlikely ESA-listed birds will strike any of the vessels. Furthermore the low likelihood of strikes by waterfowl and seabirds, including ESA-listed eiders, would be further reduced by mitigation measures such as mandating lighting protocols, and impact recording/reporting to minimize adverse effects to Steller's and spectacled eiders (Lease Stipulation No. 7) (MMS 2007-0026). Consequently, a negligible level of effects is expected for all species except long-tailed ducks, which could experience a minor level of effects from birds striking vessels.

5.3.3 Sound from Discharging Airguns

The effects of seismic surveys were assessed in MMS (2006b; 2007b), NMFS (2007b; 2008b; 2009b), and biological surveys that have occurred in the vicinity of the proposed survey area (Brueggeman et al., 2009b; Funk et al., 2010; Blees et al., 2010, and others). Table 5-1 shows the estimated distance to received sound radii associated with the use of a 40-in^3 airgun in the Chukchi Sea (Statoil, 2011c; 2011d), and Table 5-2 shows the anticipated marine mammal Level B

Harassment takes in the IHA request to NMFS (Statoil, 2011d). NMFS has established 180 dB as the minimum noise levels for Level A harassment with mysticete whales might occur, and 190 dB for pinnipeds and most odontocete whales. Likewise the NMFS established noise levels for Level B harassment are 160 dB for cetaceans, and 170 dB for pinnipeds and most odontocete whales. There is no specific evidence or documentation indicating exposure to airgun pulses has resulted in a PTS for any marine mammal in Alaskan waters. Because both the animals and the seismic vessel are moving and the required implementation of mitigation measures (Section 3.3), exposure of any one animal to seismic sound levels 180 dB or above is expected to last of several minutes or less.

Table 5-1. Measure of distance to received sound levels from a 4x10 in^3 airgun (Statoil, 2011d).

MEASURED DISTANCE TO RECEIVED SOUND LEVELS FROM A 4X10 IN³ IN AIRGUN ARRAY

Received Sound Levels dB re 1 uPa rms	Distance (m)			
	Airgun cluster (4x10 in³)		Mitigation Airgun (1x10 in³)	
	2009	2011 Pre-SSV	2009	2011 Pre-SSV
≥190	39	50	8	10
≥180	150	190	34	45
≥160	1,800	2,250	570	715

Note: specified received levels measured from a 4×10 in³ airgun cluster and a single 10- in³ airgun on the Burger prospect in 2009 as reported by Reiser et al. (2010) and 2011 "Pre-Sound Source Verification" distances used for estimation purposes in this application based on a precautionary 25% increase above the reported 2009 results.

Table 5-2. Number of Anticipated Marine Mammal Exposures to Sound Levels > 160 dB re 1µPa, for Statoil's 2011 Chukchi Sea Shallow Hazards Survey (Statoil, 2011d).

	Summer				Fall				Grand Total	
	Open Water		Ice Margin		Open Water		Ice Margin			
	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max[1]
Odontocetes										
Belugas	3	5	1	3	13	26	1	3	18	36
Narwhal	0	0	0	0	0	0	0	0	0	5
Killer Whale	0	0	0	0	0	0	0	0	0	5
Harbor Porpoise	1	1	0	0	0	1	0	0	1	5
Mysticetes										
Bowhead Whale	1	3	0	0	0	1	1	1	15	31
Fin Whale	0	0	0	0	0	0	0	0	0	5
Gray Whale	6	13	1	1	5	10	1	1	13	25
Humpback Whale	0	0	0	0	0	0	0	0	0	5
Minke Whale	0	0	0	0	0	0	0	0	0	5
Pinnipeds										
Bearded Seal	8	16	1	2	8	16	1	2	19	37
Ribbon Seal	0	2	0	0	0	2	0	0	1	5

Ringed Seal	289	478	43	71	194	321	43	71	568	941
Spotted Seal	6	10	1	1	4	6	1	1	11	19

Note: Where population data does not support the conclusion that more than 5 individuals would be affected, a grand total maximum value of 5 individuals was adopted by Statoil. BOEMRE believes the value of 5 is most likely a significant overestimate of the true number of individuals that would be affected in this case.

Source: Statoil USA E&P Inc. IHA request (Statoil, 2011).

5.3.3.1 Pinnipeds

Ringed, Spotted, Ribbon, and Bearded Seals. Ice seals use the acoustic properties of seawater to aid in social communication, and possibly, predator avoidance. Ice seals may spend >80% of their time submerged in the water (Gordon et al., 2004) depending upon the season; consequently, they may be exposed to noise from seismic surveys. Southall et al. (2007) estimated the functional hearing of seals to be 75 Hz–75 kHz underwater and 75 Hz–30 kHz in the air. Southall et al. (2007) likewise found that pinnipeds in the water exhibited little if any reactions to sound pulses between 150 and 180 dB re 1 µPa, noting that it took Received Levels (RL) ≥190 dB re 1 µPa to elicit responses in some ringed seals. The authors concluded:

> Thus, in the case of ringed seals exposed to sequences of airgun pulses from an approaching seismic vessel, most animals may show little avoidance unless the noise level is high enough for mild TTS to be likely.

Reported seal responses to seismic surveys have been variable and often contradictory, although they do suggest that pinnipeds frequently do not avoid the area within a few hundred meters of operating airgun arrays (Richardson, 2000). However, Brueggeman et al. (1991) reported that 96% of the seals they encountered during seismic operations in the Beaufort Sea were encountered during non-seismic activities, suggesting avoidance of active seismic operations. Miller and Davis (2002) reported on average, seals sighted during active seismic surveys in the Beaufort Sea were substantially farther from the vessel (210 m [689 ft]) than those sighted during periods without airgun use (150 m [492 ft]). At the 210-m (689-ft) distance, seals would have been exposed to noise levels of about 190 dB re 1 µPa (rms), supporting Southall et al.'s (2007) position.

Sighting rates of ringed seals from another seismic vessel in the Beaufort Sea showed no difference between periods with the full array, partial array, or no guns firing (Harris, Miller, and Richardson, 2001). Mean distances to seals sighted did increase during full airgun array operations, suggesting some local avoidance at levels between 190 and 200 dB rms. By contrast, telemetry work by Thompson et al. (1998, as cited in Gordon et al., 2004) suggests avoidance and behavioral reactions to small airgun sources may be more dramatic than ship-based visual observations indicate. Instrumented gray seals (*Halichoreus grypus*) and harbor seals exhibited avoidance behavior of small airguns, swimming rapidly away from the seismic source. Many ceased feeding and some hauled out, possibly to avoid the noise. The behavior of most of the seals seemed to return to normal within 2 hours after the event had concluded. Consequently, the discharging of airgun arrays in the proposed area is expected to result in brief, temporary disturbances with no long-lasting effects, leading BOEMRE to conclude there is a negligible level of effects to ice seals.

More recently Funk et al. (2010) reported the MMO effort was required where noise levels were <120 dB re 1 µPa during 2006-2008 Beaufort and Chukchi Sea seismic survey activities. In the same report, pinniped sighting rates from monitoring vessels in the Beaufort and Chukchi Seas were higher than those from seismic vessels, with the highest rates occurring in the <120 dB re 1 µPa zone, suggesting localized avoidance of active seismic vessels.

During a 2010 seismic survey in the Chukchi Sea, MMOs from the seismic vessel had the highest sighting rate in the ≥160 dB re 1 µPa zone, while MMOs on the monitoring vessels had their highest sighting rates in the 159–120 dB re 1 µPa (Blees et al. 2010). MMOs on both vessels observed

roughly similar sighting rates of 12.5 (seismic vessel) and 11.8 (monitoring vessels) during periods of non-seismic activity or when dB levels were <120 dB re 1 μPa. Results from Blees et al. (2010) conflict with the position that seismic surveys would likely displace ringed seals from an area where received noise levels are in excess of 159 dB re 1 μPa since monitoring vessels enjoyed their highest seal sighting rates from monitoring vessels in the 159-120 dB re 1 μPa zone (18.8) as opposed to the seismic vessel where the highest seal sighting rate was in the ≥160 dB re 1 μPa zone (31.5). Although 146 seals were observed from the seismic vessel during airgun operations, only 10 were detected in the ≥190 dB re 1 μPa zone, while 154 seals were observed by monitoring vessels where there was no ≥190 dB re 1 μPa zone.

Ultimately Blees et al. (2010) estimated 416 ringed seals may have been exposed to airgun pulses ~21 each with pulses ≥160 dB re 1 μPa, based on the assumption that ~19.1% (416/2180=0.191, and 0.191 x 100%= 19.1%) of the seals observed were ringed seals. By applying this 19.1% estimate to the number of seals observed in the ≥190 dB re 1 μPa zone (652), a rough estimate (0.191 x 652=124.5≈125 seals) can be derived suggesting 125 ringed seals were exposed to noise levels ≥190 dB re 1 μPa for approximately 2 times each, if there was no avoidance of the sound source. Caution should be used in interpreting this calculation since Blees et al. (2010) did not specify the ringed seals estimate for the ≥190 dB re 1 μPa zone, because the estimate of 652 exposed seals is much higher than the 10 seals that were actually witnessed in the zone, and because the author states that the actual numbers of seals exposed to RSL ≥190 dB re 1 μPa was likely greater than the 10 observations, but lower than the estimate of 652 seal exposures.

Pacific Walrus. Based on previous monitoring efforts in the Chukchi Sea, seismic surveys are expected to result in the take (Level B harassment) of small to large numbers of walrus (FWS, 2008; Blees et al., 2010; Funk et al., 2010). Seismic operations occur in open water, where walrus may be feeding or passing through but are typically less likely to be maintain a presence in large numbers. Seismic operators are required to have marine mammal observers on board to avoid large aggregations of walrus and to shut down if walrus enter the safety zone, identified as the zone where noise levels reach or exceed 180 dB. Statoil proposes to immediately power down/shutdown the airgun array and other acoustic sources so that the sound pressure level received by the walruses does not exceed 160 dB re 1 μPa whenever an aggregation of 12 or more walrus in the water is observed within the 160 dB re 1 μPa exclusion zone ahead of or perpendicular to the seismic vessel track.

Effects from seismic activity would be negligible due to Statoil's (2009b) proposed mitigation measures. Some walrus may exhibit temporary avoidance reactions or possibly experience brief TTS in hearing with no lasting effects and quick recoveries (FWS, 2008). Impacts from seismic-survey activities to walrus in the Chukchi Sea are anticipated to be negligible to minor.

5.3.3.2 Polar Bears

Polar bears generally swim with their heads above water. They may dive below the surface when hunting between ice floes, but are very unlikely to have their heads underwater near an active airgun and no adverse effects are anticipated since their ears will not be exposed to audible airgun noises.

5.3.3.3 Cetaceans

Odontocetes (Beluga Whale, Killer Whale, Harbor Porpoise). Few belugas are expected to occur in the proposed survey area during the open water season. During the open water season most belugas occur along the coast or the ice front north of the survey area; however, some individuals may opt to visit the survey area for unknown reasons. Mitigation measures incorporated in the proposed activities and any additional mitigation imposed through the MMPA authorization process are expected to reduce potential effects to a level of negligible adverse impacts to beluga whales.

The rarity of killer whales in the proposed survey area leads BOEMRE to conclude there is a very low likelihood of encountering an individual or pod during the survey. Odontocetes including killer

whales and porpoises are most sensitive to high frequency noise, not the low-frequency noise produced by seismic surveying and vessel traffic. Consequently, killer whales and harbor porpoises would be affected negligibly by seismic survey noise.

Mysticetes (bowhead whale, fin whale, gray whale, humpback whale, minke whale). Bowhead, fin, gray, humpback, and minke whales could reasonably be expected to occur in the Chukchi Sea during the open water season, and a small number may occur in the proposed survey area.

Bowheads appear to continue normal behavior when exposed to the noise generated by high-resolution seismic surveys. In a study by Richardson, Wells, and Würsig (1985), four controlled tests were conducted by firing a single 40 in^3 airgun at a distance of 2–5 km (1.2–3.1 mi) from the whales. Bowheads sometimes continued normal activities (skim feeding, surfacing, diving, and travel) when the airgun began firing 3–5 km (1–3 mi) away (received noise levels at least 118–133 dB re 1 µPa rms). Some whales oriented away during an experiment at a range of 2–4.5 km (1.2–2.8 mi), and another experiment at a range of 0.2–1.2 km (0.12–0.75 mi) (received noise levels at least 124–131 and 124–134 dB, respectively). Frequencies of turns, pre-dive flexes, and fluke-out dives were similar with and without airguns; and surfacing and respiration variables and call rates did not change substantially during the experiments.

It is unlikely there would be adverse effects from noise and disturbance associated with seismic-survey activities in the proposed survey area on fin whales because of their low numbers and rare occurrence in the Alaska Chukchi Sea, and distance (hundreds of kilometers) from the majority of the Northeastern Pacific fin whale population. Negligible population-level impacts are likely for fin whales, but effects, though highly unlikely, could occur to a small number of individuals.

Effects of such noise detection on fin, humpback, and minke whales would be brief, resulting in short, temporary behavioral changes that result in negligible population-level effects. Long distances between the survey area and populations of fin whales would put received survey noise levels below the noise-exposure-criteria levels that could result in injury or the onset of detrimental behavioral responses. The most probable effects would be some increased attentiveness to the survey noise, slightly increased attentiveness to other sounds, and possible vocalization changes.

Humpback whale observations during the open-water periods from 2006-2009 in the western Beaufort Sea and southern and eastern Chukchi Sea indicate the presence of this species in the planning areas during times that seismic-survey activities would be conducted. Assuming humpbacks continue to use habitats in the Chukchi Sea, individuals could be affected by seismic-survey-related noise.

During one study, the mean airgun noise level at which avoidance was observed was 140 dB re 1 µPa (rms), the mean standoff range was 143 dB re 1 µPa (rms), and the startle response was observed at 112 dB re 1 µPa (rms) (McCauley et al., 2000). Standoff ranges were 1.22–4.4 km (0.76–2.73 mi). McCauley found that adult male humpbacks were much less sensitive to airgun noise than were females. At times, they approached the seismic-survey source vessel. McCauley et al. (2000) speculated that males that did so may have been attracted by the sound because of similarities between a single airgun signal and a whale-breaching event.

Malme et al. (1985) noted approaches by humpback whales to a single 100 in^3 airgun source at ranges corresponding to sound-exposure levels of up to 172 dB re 1 µPa rms, but they did not speculate on gender or similarity of a single airgun noise and the potential attraction response to the sound of a breaching whale. Based on the aforementioned, it is likely that any humpback whales feeding or resting in areas within and adjacent to areas within the proposed survey area could have their movement and feeding behavior affected by noise associated with seismic surveys. The most likely demographic group to be impacted in that humpback population would be females with calves.

Humpbacks make a variety of sounds. Their song is complex, with components ranging from <20 Hz–4 kHz, and occasionally up to 8 kHz. Songs can be detected by hydrophones up to 13–15 km (8.1–9.3 mi). Songs can last as long as 30 minutes. Humpbacks can make general sounds as high as 192 dB at the source. They typically are heard on low-latitude wintering grounds and occasionally have been heard on northern feeding grounds (McSweeney et al., 1989). It is unlikely that seismic-survey noise would interfere with hearing these songs in the open-water season in the Chukchi Sea. Humpbacks on high-latitude summer grounds are less vocal. Calls, clicks, and buzzes are made while feeding and may serve to manipulate prey and as "assembly calls" (Richardson et al., 1995a; NMFS, 2007a). These calls are between 20 and 2,000 Hz.

No studies that address the effects of seismic survey noise on minke whales are available; however, BOEMRE expects the reactions of minke whales to be similar to those of other mysticete whales because of similar physiologies, shared evolutionary lineages, similar environmental challenges, and similar adaptations to meet those challenges (Southall et al., 2007).

Gray whales are low-frequency hearing specialists, with an auditory range starting at 10 Hz and possibly moving as high as 30 kHz (Ketten, 1998). Erbe (2002), inferring from gray whale vocalizations, suggested they would be sensitive to frequencies between 20 Hz and 4.5 kHz, with best sensitivity around 20 Hz–1.2 kHz. Clicks are reported up to 10 kHz, with main energy between 1.4 and 4 kHz. The lowest response threshold reported was 82–95 dB at 800 Hz (Erbe, 2002). By comparison, minke whales appear most sensitive to sound between 100 and 200 Hz, with good sensitivity extending from 60 Hz–2 kHz. High-frequency clicks were published in two studies, indicating some sensitivity between 4 and 7.5 kHz, up to 20 kHz (Erbe, 2002). The PEA outlines the potential effects of noise and disturbance that can be expected from marine mammals, with a particular focus on cetaceans (USDOI, MMS, 2006a: Sections III.F.3.f(3), III.F.3.f(5), III.F.3.f(6), and III.F.3.f(8)).

Overall, studies of gray, bowhead, and humpback whales have shown that received levels of impulses in the 160-170 dB re 1 µPa rms range appear to cause avoidance behavior in a significant portion of the animals exposed. Dahlheim (1987) reported that in noisy environments, gray whales increase the timing and level of their vocalizations and use more frequency-modulated signals. Malme et al. (1986) studied the responses of feeding eastern Pacific gray whales to pulses from a single 100-in^3 airgun off St. Lawrence Island in the northern Bering Sea. Based on small sample sizes, these authors estimated that 50% of feeding gray whales ceased feeding at an average received pressure level of 173 dB re 1 µPa on an (approximate) rms basis, and that 10% of feeding whales interrupted feeding at received levels of 163 dB. Malme at al. (1986) estimated that an average pressure level of 173 dB occurred at a range of 2.6–2.8 km (1.4–1.5 mi) from an airgun array with a source level of 250 dB (0–peak) in the northern Bering Sea. These findings generally were consistent with the results of experiments conducted on larger numbers of gray whales that were migrating along the California coast.

Malme and Miles (1985) concluded that, during migration, changes in swimming pattern occurred for received levels of about 160 dB re 1 µPa and higher, on an approximate rms basis. The 50% probability of avoidance was estimated to occur at a closest point of approach distance of 2.5 km (1.3 mi) from a 4,000-in^3 array operating off central California. This would occur at an average received sound level of about 170 dB (rms). Some slight behavioral changes were noted at received sound levels of 140–160 dB (rms). However, these slight behavioral changes at levels below 160 dB may have been more relevant to the location of the noise source as the seismic array was placed in the middle of the gray whale migratory pathway. In Würsig et al. (1999), observations of gray whales near Sakhalin Island showed no indication that gray whales exposed to seismic noise were displaced from these feeding grounds in 1999 and 2001. However, there were indications of subtle behavioral effects and, in 2001, whales shifted their distribution away from a region where geophysical seismic surveys were being conducted (Johnson, 2002; Weller et al., 2002).

There is no specific evidence that exposure to pulses of airgun noise have caused PTS to the hearing of any marine mammal, even with large arrays of airguns. However, a PTS injury (Level A Harassment) from seismic surveys could theoretically occur if animals were to enter a ≥230 dB zone immediately surrounding a discharging airgun array (Southall et al, 2007). Southall et al. (2007) placed the functional hearing of bowhead, fin, gray, humpback, and minke whales in a group of cetaceans hearing in the low-frequency bandwidth between 7Hz–22kHz, with a likely PTS Sound Pressure Level threshold of 230 dB re 1 µPa (peak), and a TTS Sound Exposure Level threshold of 198 dB re 1 µPa. These thresholds for mysticete whales were obtained from study data and modeling of morphological measurements. However the 180 dB level remains the established standard for a TTS in cetaceans resulting in a Level A Harassment, while the Level B Harassment standard occurs at 160 dB (NMFS, 2008b).

Consequently, Southall et al. (2007) suggests the area posing an actual TTS or PTS threat may be smaller than the 160 dB (2,250 m) or 180 dB (190 m) re 1 µPa radii from operating airguns imposed through the IHA. BOEMRE and NMFS believe that with the ramp up mitigation protocols, posted MMOs, and the tendency of mysticete whales to avoid the "noisy" areas by a measure of kilometers, there is a very remote likelihood of inflicting a TTS or PTS on a mysticete whale for a shallow hazards survey. Regardless, the operator shall comply with the standards described in NMFS (2008b).

In summary, mysticete and odontocete cetaceans are expected to experience a negligible level of effect from firing airguns, after using the proposed mitigations.

5.3.4 Conclusion for Effects on Biological Resources

Vessel presence is likely to have the greatest impact on the largest number of species, because of the possibility of bird strikes and avoidance behavior by marine mammals. Nevertheless, bird strikes are expected to have a negligible population level effect on spectacled and/or Steller's eiders, yellow-billed loons, or long-tailed ducks even in the event of a small number of mortalities. Bird-ship collisions would be limited because of bird scarcity, the low densities of birds expected to be present in the survey area relative to significantly larger numbers present elsewhere, mandatory lighting protocols, and the flight behavior of most bird species. Additional avoidance of bird strikes are anticipated as a result of long daylight hours, lighting protocols, and slow vessel speeds. Therefore, the effects of birds striking vessels are expected to be negligible for all species except long-tailed ducks.

Discharging a small (40 in^3) airgun array could elicit temporary avoidance reactions from some marine mammals at a distance, precluding exposures to higher dB levels closer to the survey.

Fall migrating bowheads generally disperse across the Chukchi Sea, with most moving on to Wrangel Island or the Chukotka coastal areas. The ancillary activities, including the firing of airgun arrays, would result in occasional diversions around the area of operations as whales migrate west. For mysticete whale populations and ice seals, the effects of discharging airguns would be negligible. Pacific walrus usually avoid vessels and may take days to reoccupy an area, which qualifies as a minor level of effect. Beluga whales tend to aggregate in Ledyard Bay, Kasegaluk Lagoon, and near the ice front over deeper waters, and not in the vicinity of Statoil's operations. Likewise, killer whales, minke, fin, humpback whales, ribbon seals, and harbor porpoises tend to use areas farther south and/or east, occurring sporadically or rarely in waters near the proposed ancillary activities, while polar bears would not be affected by underwater airgun discharges. Gray whales on the other hand are typically found in shallower, nearshore areas, and historically around Hanna Shoal during the open water season

Considering the low survey speeds (4–5 knots), the expected marine mammal avoidance of airgun noise sources, MMO presence on all vessels during operations, and the fact that the disturbance zones

for vessel noise would be smaller than that for discharging airguns; the likelihood of injury to marine mammals from vessel collisions are expected to be extremely low.

5.4 Additional Mitigation Considered but Not Recommended for Implementation

A mitigation measure considered was a requirement for passive acoustic recorders to identify the presence of cetaceans and pinnipeds while underwater. This measure is not being recommended, because review of passive acoustic monitoring during prior seismic surveys has shown that it was ineffective in identifying the presence of marine mammals during seismic surveying in the Chukchi Sea. In 2006, GXT towed a passive acoustic array to attempt to monitor the 120 dB zone. This proved to be ineffective in identifying whale sounds and has not been required by NMFS in MMPA authorizations since.

A mitigation measure considered was to require survey shutdown during periods of low visibility (darkness, high sea states, and inclement weather) to avoid whale-ship collisions. This measure is not being recommended. Previous NEPA analyses by BOEMRE and NMFS determined that the appropriate mitigation when the full arrays are not operating is the continuous firing of a small airgun to deter approaching marine mammals. The vessel must maintain forward thrust when the receiver streamers are deployed, deployment of the streamers and airgun arrays takes several days, and retrieval of the equipment is likely to take more than 24 hours. Therefore, complete shutdown of operations from data collection to no vessel movement is not possible on a daily basis.

A mitigation measure was considered to prohibit ramp-up procedures during conditions of darkness, to prevent airguns from discharging in close proximity to marine mammals, potentially resulting in TTS or PTS incidents among exposed marine mammals. In larger 3D/2D seismic surveys the ≥190 dB is too large to allow for night time scanning with artificial lights. However, the radius of minimum noise levels that could result in a TTS or PTS (≥190 dB according to Southall et al., 2007) only extends 10 m (~33 ft) from the mitigation airgun (Tables 4-2 and 5-1). Consequently, this measure is not being recommended, because the small size of the ≥190 dB zone would allow MMOs to scan the area for marine mammals using artificial lights.

A mitigation measure considered was to require that vessels to disengage propellers if a surfacing whale is observed within 300 ft (100 m) of the ship to avoid potential propeller injury to the whale (prop strike) and, to a lesser degree, collision, and that propellers would remain disengaged until the whale moves beyond 300 ft (100 m) from the ship. This measure is not being recommended, because the survey vessel must maintain forward thrust when the receiver streamers are deployed, and the existing required mitigation calls for marine mammal avoidance.

5.5 Alternatives

5.5.1 No Action Alternative

Under the No Action Alternative, Statoil's application for ancillary activities permit would be denied. Statoil's shallow hazard and coring surveys would not occur as proposed. The data and information collected from the proposed activities would be used to evaluate operational and safety-related aspects of possible future exploration drilling operations. Failure to collect, evaluate, and consider such data and information could result in lost opportunities for discovery and production of oil and gas resources. Disapproval of the proposed ancillary activities could ultimately result in lost opportunity for discovery and production of oil and gas resources and any associated economic benefits for Alaska and the United States of America.

The No Action Alternative would eliminate any potential adverse effects from the acquisition of shallow hazard seismic survey or coring data in the Statoil and ConocoPhillips/Statoil Chukchi Sea

leases during the 2011 open-water season. Potential economic benefits to the communities and residents of Dutch Harbor, Nome, and the North Slope would be delayed or would not be realized. Although the number of local residents employed for the proposed activities is expected to be relatively small and the effect to be negligible at the community level, any BOEMRE disapproval of the proposed activities during the 2011 season would have a considerable adverse effect on individuals who lost potential employment.

5.5.2 Alternatives Considered but Not Included for Further Analysis

CEQ has indicated that "Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense…" (CEQ NEPA's 40 Most Asked Questions, Question #2 ceq.hss.doe.gov/nepa/regs/40/1-10.HTM). Alternatives must also meet the purpose and need of the proposal (40 CFR 1502.13). The purpose of the proposed seismic survey is to collect shallow hazards and coring data on Statoil and ConocoPhillips/Statoil Chukchi Sea leases for use in evaluating the potential for hydrocarbon accumulations on their leases and making decisions related to leasing and making decisions about future leasing and exploration activities. Statoil's proposed surveys of their Chukchi Sea leases is consistent with the overall objectives of the OCS Lands Act to determine the extent of the oil and natural gas resources of the OCS at the earliest practicable time. No additional alternatives that meet the purpose and need for the proposal were identified by BOEMRE.

5.6 Cumulative Effects

Cumulative impacts result from individually minor but collectively significant actions taking place over time. The scope of the cumulative impacts for this analysis is the incremental impact from Statoil's proposed seismic surveys, plus the aggregate effects of other activities known or reasonably expected to occur in the same timeframe (July–November 2010) and in the vicinity of Statoil's activities, and to have potential effects on the same environmental resources. It is not helpful to consider other activities outside of this timeframe, since the notable impacts of seismic surveys are almost entirely temporal in nature, generally lasting only as long as the duration of the seismic surveying activities.

The cumulative effects from OCS activities, plus past, current, and reasonable foreseeable activities in the Chukchi Sea OCS and adjacent areas have been assessed in recent BOEMRE NEPA documents. Cumulative effects analyses were included in the PEA (USDOI, MMS, 2006b) and the Sale 193 EIS (USDOI, MMS, 2007b). The reasonably foreseeable level of OCS activity in the Chukchi Sea Planning Area during the open-water season in 2011 is within the level of activities evaluated in these prior NEPA documents. This level of activities is also within the scope of the 2008 BO (NMFS, 2008a) and 2009 BO (FWS, 2009).

No other oil and gas related activities are currently planned for the 2011 open water season in the Chukchi Sea. The proposed ancillary activities are expected to result in negligible short-term and long-term effects on local and regional water quality.

Currently, Statoil's proposal has the only application to conduct survey activities in the Chukchi Sea OCS during the 2011 open water season. On February 10, 2010, BOEMRE received an application from ION Geophysical to perform late-season seismic surveys in the Beaufort and northeastern Chukchi Sea near Point Barrow in 2010. ION has since withdrawn the permit application.

The University of Alaska Fairbanks (UAF),Geophysical Institute (GI) intends to conduct a 2-D seismic survey of the Chukchi Borderland at ~72.5°N, 162°W, >200 km (120 mi) from Barrow, from September 5 through October 9, 2011. Most work will be performed in the Chukchi Borderland area to the North of Statoil's proposed surveys. At the closest point of the UAF GI's survey approaches to 30 km (18.5 mi) from the area for ancillary activities.

The UAF GI's project involves the use of the 235 ft *R/V Marcus G. Langseth* that will tow an array of 10 airguns (1,830 in^3) and a 2-km hydrophone streamer, and employ the use of a multibeam echosounder and a sub-bottom profiler over 3,419 mi (~5,502 km) of survey lines (Statoil, 2011c; Bailey, 2011).

The 160 dB re 1 µPa rms ensonification zones for Statoil's and UAF GI's proposed surveys will not overlap at any point during their respective programs (Statoil, 2011c), and would not exceed the estimates for concurrent seismic activities that were analyzed in the PEA (MMS, 2006b) and Sale 193 EIS (MMS, 2007b). Consequently, very minor effects are expected from the combined influence of Statoil's 2011 ancillary activities, the proposed ION 2011 seismic activity in the Beaufort Sea, and the UAF GI 2011 2D seismic survey in the northern Chukchi Sea.

Effects on marine mammals, marine birds, and fishes from Statoil's proposed activities would be restricted to disturbance with associated changes in behavior and temporary displacement. Disturbance factors include vessel presence, vessel sound, sounds produced by discharging 40 in^3 airguns and other acoustic equipment such as subbottom profilers, sonar, etc. Studies have shown that many of the effects on marine mammals are ephemeral, ending within minutes or hours after the disturbance has ceased, depending on the noise duration, frequency, and decibel levels that an animal would be subjected to. Previous, much larger, 2D and 3D seismic surveys in the analysis area are not known to have had any lasting deleterious effects on biological resources, nor have adverse effects to any of the bird, fish, or mammal species been attributed to previous ancillary activities in the Chukchi or Beaufort seas.

Sound levels and frequency characteristics of vessels are generally related to vessel size and speed. Larger vessels generally emit more sound than smaller vessels, and those underway with a full load, or those pushing or towing a load, are noisier than unladen vessels. The primary sources of sounds are engines, propellers, bearings, and other mechanical parts. The sound from these sources reaches the water through the vessel hull. Other than during icebreaking activities, the loudest sounds from vessels are made by cavitation of the propellers. Navigation and other vessel-operation equipment also generate subsurface sounds. The dominant source of noise from vessels is from the propeller operation, and the intensity of this noise is largely related to ship size and speed. Vessel noise from activities resulting from the proposed action will produce low levels of noise, generally in the 150- to 170-dB re 1 µPa-m at frequencies below 1,000 Hz. Vessel noise is transitory and generally does not propagate at great distances from the vessel (Richardson et al., 1995).

Other than vessels associated with the proposed activities, traffic in the project area is expected to include icebreakers, another seismic vessel, and a few USCG vessels, supply ships and barges. Vessel traffic in the proposed survey area is expected to be very limited. With the exception of Statoil's ancillary activities, most vessels are expected to transit through the Chukchi Sea area within 12.5 mi (20 km) of the coast. During ice-free months (June-October), barges are used for supplying the local communities, Alaskan Native villages, and the North Slope oil-industry complex at Prudhoe Bay with larger items that cannot be flown in on commercial air carriers. Usually, one large fuel barge and one supply barge visit the villages per year and one barge per year traverses the Arctic Ocean to the Canadian Beaufort Sea.

Vessel strikes with marine mammals in the Arctic Ocean are rare, in part because overall vessel traffic in the Alaska Chukchi Sea is very limited. Impacts to marine mammals from Statoil's vessels are expected to be short term and mostly negligible, because of the slow survey speed (4–5 knots) of the survey vessel and the limited scope of the support vessels' activities.

The proposed activities would result in negligible or minor incremental contributions to the existing environment for water quality, marine mammals, birds, fishes, and marine invertebrates by briefly disrupting behaviors in some individuals. Mitigation measures incorporated in the proposed action, and additional measures imposed by NMFS and FWS through ESA consultation and MMPA

authorizations processes would prevent Level A Harassment (injury), minimize Level B Harassment, and mitigate the potential for population-level adverse effects.

Statoil has agreed to participate with other operators in baseline science studies in the Chukchi Sea. Olgoonik/Fairweather LLC will operate the research vessel and perform the following scientific baseline studies:

- Seabed, water column, and plankton sampling at historical exploratory drilling locations in the Chukchi Sea.
- Distribution, abundance, and ecology of Arctic marine fishes in the northeastern Chukchi Sea.
- Offshore acoustic monitoring program using seabed acoustic recorders to record and analyze marine mammal activity in the Chukchi Sea.

Statoil's proposed activities are expected to have no effects on subsistence activities and are not expected to add incrementally to cumulative effects on subsistence activities, particularly in light of the large distances between known subsistence use areas and Statoil's OCS lease holdings in the Chukchi Sea.

The incremental contribution to cumulative impacts from Statoil's proposed activities to overall cumulative effects on biological resources and the marine environment is expected to be negligible. Statoil's proposed activities are not expected to add to cumulative effects on subsistence activities.

6. Conclusions

Statoil's proposed 2011 ancillary activities are within the scope of activities covered by the PEA (USDOI, MMS 2006b) and the Sale 193 EIS (USDOI, MMS, 2007b), which concluded four concurrently operating seismic surveys in the Chukchi Sea would result in adverse, but not significant, effects (USDOI, MMS, 2006b: Table 3.1). Potential cumulative impacts would not exceed those described in the PEA and the Sale 193 EIS. No proposed action or site-specific circumstances indicate that the proposed activities would have any effects different from those analyzed in the PEA and Sale 193 EIS.

Statoil's proposed monitoring and mitigation (as identified in Statoil's IHA application to NMFS and LOA application to FWS) are expected to reduce adverse effects to marine mammals. Statoil's POC and the distance of the proposed survey area from subsistence harvest areas are expected to avoid adverse effects to subsistence activities.

The potential incremental contribution of the proposed action to cumulative impacts is expected to be negligible. Overall, cumulative effects are not likely to exceed those described in the PEA and the Sale 193 EIS.

BOEMRE has concluded:

> No major adverse effects, as defined in Sections 4 and 5, on the quality of the human environment are expected to occur from Statoil's ancillary activities as proposed in their permit application.

7. Consultations and Public Input

7.1 Endangered Species Act Consultation

Section 7(a)(2) of the ESA requires each Federal Agency to ensure that any action that they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the adverse modification of designated critical habitat. BOEMRE consults with FWS and NMFS for

listed species under each Service's jurisdiction. For ESA consultation on proposed lease sales, BOEMRE specifically requests incremental section 7 consultation. Regulations at 50 CFR 402.14(k) allow consultation on part of the entire action as long as that step does not violate section 7(a)(2), there is a reasonable likelihood that the entire action will not violate section 7(a)(2), and the agency continues consultation with respect to the entire action, obtaining a biological opinion for each step. Thus, at the lease sale stage, BOEMRE consults on the early lease activities (seismic surveying, ancillary activities, and exploration drilling) to ensure that activities under any leases issued will not result in jeopardy to a listed species or cause adverse modification of designated critical habitat.

A letter requesting NMFS concurrence that Statoil's proposed ancillary activities is covered by the July 17, 2008, BO for Oil and Gas Leasing and Exploration Activities in the U.S. Beaufort and Chukchi Seas, Alaska and Authorization of Small Takes Under the Marine Mammal Protection Act (NMFS, 2008) (http://www.mms.gov/alaska/ref/BioOpinions/2008_0717_bo.pdf) was sent on June 28, 2011.

On July 08, 2011, BOEMRE forwarded to FWS a biological evaluation for consultation on Statoil's proposed ancillary activities with regard to polar bear critical habitat and Pacific walrus, a candidate species. BOEMRE also requested FWS concurrence that Statoil's proposed ancillary activities are covered by the September 3, 2009, BO for Beaufort and Chukchi Sea Program Area Lease Sales and Associated Seismic Surveys and Exploratory Drilling (FWS, 2009; http://www.mms.gov/alaska/ref/BioOpinions/2009_0903_BO4BFCK.pdf) for other species under FWS jurisdiction.

7.2 Essential Fish Habitat Consultation

The most recent Pacific salmon EFH consultation for OCS ancillary activities in the Chukchi Sea was conducted concurrently with the preparation and public review of the Arctic Multiple-Sale Draft EIS (2009). NMFS provided conservation recommendations in a letter dated June 26, 2009. After the Department of Commerce adopted the Arctic Fisheries Management Plan on May 4, 2010, BOEMRE reinitiated consultation for Arctic cod, saffron cod, and opilio crab on 24 June, 2010. On June 10, 2011, BOEMRE requested concurrence from NMFS that Statoil's proposed ancillary activities are covered by the June 24, 2010, EFH consultation.

7.3 National Historic Preservation Act Consultation

Per the National Historic Preservation Act, BOEMRE consulted with the State Historic Preservation Officer (SHPO) via letter dated June 22, 2011. BOEMRE provided the following findings to the SHPO:

- Because the proposed coring locations would be surveyed and cleared of historic resources and surface hazards before cores are collected, offshore historic sites (e.g., shipwrecks) are not expected to be affected by the proposed activities.
- Should a submerged and buried site be encountered, the disturbance would be minimal and the cores themselves would be the appropriate means for identifying and documenting such sites by a qualified specialist.

On June 23, 2011 SHPO responded with a concurrence letter.

7.4 Opportunities for Public input

Public participation regarding Statoil's proposed activities has been provided for through a notice of preparation of an EA, community meetings held by the applicant, and the NMFS Incidental Harassment Authorization (IHA) process.

In addition to the public involvement opportunities related specifically to Statoil's proposed action, the public has participated in the on-going discussion of seismic survey activities in the Arctic OCS throughout preparation of several environmental analyses and related processes. A brief summary of these public input opportunities is provided below. The environmental documents listed below are available at http://www.mms.gov/alaska/ref/EIS_EA.htm. BOEMRE has considered the issues, alternatives, and mitigation measures identified from this ongoing process during preparation of this EA.

Notification of Preparation of the EA. On June 6, 2011, a notice of preparation of an EA on Statoil's proposed ancillary activities was posted on the Alaska OCS Region website. The notice provided "opportunity for the public to provide input that may inform the decision-making process, including issues or information regarding environmental impacts that should be considered in the preparation of the EA, prior to a decision being made by the Responsible Official(s)." The notice stated that written comments would be accepted for consideration through June 16, 2011.

In response to the notice, BOEMRE received timely input from AEWC and Alaska Wilderness League et al. A brief summary of the substantive issues in the comments received and our consideration of them was prepared for the responsible BOEMRE decision-maker.

Applicant Outreach and Plan of Cooperation (POC). Statoil has indicated that it intends to maintain an open and transparent process with all stakeholders throughout the life-cycle of their proposed activities in the Chukchi Sea. Statoil began the stakeholder engagement process in 2011 with meetings with Chukchi Sea community leaders at the tribal, city, and corporate level.

As part of stakeholder engagement for the proposed 2011 shallow hazards survey, Statoil has developed a POC (Statoil, 2011c). The POC identifies the actions Statoil will take to identify important subsistence activities, inform subsistence users of the proposed survey activities, and obtain feedback from subsistence users regarding how to provide cooperation between subsistence activities and the Statoil program.

A POC is required to comply with federal regulations [50 CFR 216.104(a)(12)ii)] and meet the requirements of three major federal authorizations: (1) the NMFS Incidental Harassment Authorization, (2) the FWS Letter of Authorization, and (3) the BOEMRE Ancillary Activities Notice.

Statoil intends to maintain an open and transparent process with all stakeholders throughout the lifecycle of activities in the Chukchi Sea. Statoil began the stakeholder engagement process in 2009 with meetings with Chukchi Sea community leaders at the tribal, city, and corporate level. In 2010 and into 2011, Statoil met again with leadership to present the 2010 seismic survey results and to introduce their 2011 shallow hazards survey program. The meetings included the following:

- November 9-10, 2010: presentation to the Beluga Whale Committee and attendance at the Ice Seal Committee meeting
- November 3-5, 2010: joint village meetings with CPAI in Kotzebue, Point Hope, Point Lay, Wainwright, and Barrow
- December 8-9, 2010: attendance at the 4th Quarter Alaska Eskimo Whaling Commission (AEWC) Commissioner's Meeting in Anchorage
- December 16, 2010: presentation to the North Slope Borough Planning Commission
- December 17, 2010: presentation to the North Slope Borough Wildlife Department
- February 18, 2011: attendance at the AEWC Mini-Convention Conflict Avoidance Agreement Meeting in Barrow
- March 7-8, 2011: presentation at the Arctic Open Water Meeting

- March 22-26, 2011: Plan of Cooperation meetings held jointly with CPAI in Point Hope, Point Lay, Wainwright, and Barrow, Alaska
- March 29-31, 2011: attendance at the North Slope Science Initiative Workshop in Barrow
- April 28, 2011: presentation to the North Slope Borough Planning Commission

On several occasions, Statoil met with NSB Mayor Itta and his staff and other leadership groups to present the results of the 2010 seismic survey, introduce the 2011 Chukchi Sea shallow hazards survey and geotechnical soil investigation project, and to discuss local concerns regarding subsistence activities, timing of operations, and local hire and workforce development. Statoil intends to continue to engage with leaders, community members, and subsistence groups (as well as local, state, and federal regulatory agencies) in preparation for the 2011 program and throughout the exploration process.

The POC will document all consultations with community leadership, subsistence-user groups, individual subsistence users, and community members. The POC will be submitted to NMFS, FWS, and BOEMRE upon completion of consultation and will include feedback from the leadership meetings and POC meetings. The POC will be submitted to each member of the leadership Statoil met with during their October to December leadership meetings, as well as other selected community members. Statoil will continue to document all consultations with the communities and subsistence stakeholders.

NMFS IHA process. Statoil has applied for incidental harassment authorization issued under the MMPA by NMFS. The NMFS IHA review and decision process includes opportunities for public participation. The Open Water and Peer Review meetings are part of IHA process. NMFS publishes draft authorizations in the *Federal Register* for public review and comment.

Programmatic EA for Arctic Ocean Outer Continental Shelf Seismic Surveys (OCS EIS/EA MMS 2006-038). The BOEMRE and NMFS jointly prepared the PEA. A draft PEA was circulated for public review. The majority of comments received by BOEMRE addressed similar issues (e.g., EIS versus EA, significance criteria, potential mitigation measures, reasonable alternatives, data quality, and data gaps). A summary of the major categories of comments and our response to those comments can be found in Appendix D of the PEA. After careful consideration and evaluation, many of these substantive comments resulted in modifying the text in the PEA.

Draft Programmatic Environmental Impact Statement (DPEIS) Seismic Surveys in the Beaufort and Chukchi Seas, Alaska (OCS EIS/EA MMS 2007-001). BOEMRE and NMFS jointly initiated this Programmatic EIS. Publication of the notice of intent (NOI) began the official scoping period. In addition to the NOI, the NMFS and BOEMRE pursued other avenues for scoping seismic survey issues. At the October 2006 Open Water Meeting, industry representatives, BOEMRE and NMFS and other federal and state agencies, tribal government representatives, subsistence stakeholders, and other interested parties participated in presentations and discussions about the 2006 open water seismic survey season. During public hearings for the BOEMRE Chukchi Sea Lease Sale 193 draft EIS and Draft Proposed Program for 2007-2012 OCS Oil and Gas Leasing (5-Year Program), BOEMRE personnel discussed how seismic surveys are conducted. Public hearings on the DPEIS were held in April 2007 in Anchorage, Nuiqsut, Point Hope, Point Lay, Wainwright, and Barrow. Based on verbal requests during the public hearings and two written requests, the DPEIS comment period was extended from May 14, 2007 to June 29, 2007 (72 FR 26788, May 11, 2007). At the request of the Alaska Eskimo Whaling Commission, the comment period was extended a second time, from June 29, 2007 to July 30, 2007 (72 FR 36427, July 3, 2007). NMFS withdrew the DPEIS in 2009 (74 FR 55539, October 28, 2009) and published a Notice of Intent to begin a new EIS process (75 FR 6175, February 8, 2010).

Final Environmental Impact Statement, Oil and Gas Lease Sale 193 and Seismic Surveying Activities in the Chukchi Sea (OCS EIS/EA MMS 2007-026). Scoping meetings for the EIS were held in Barrow, Wainwright, Point Hope, Point Lay, and Anchorage, Alaska in January–February 2006. Government-to-Government Consultation meetings were held with the Native Villages of Point Hope, Point Lay, Wainwright, and Barrow and the Inupiat Community of the Arctic Slope (ICAS) in January–February 2006. Public hearings on the draft EIS were held in Barrow, Wainwright, Point Hope, Point Lay, and Anchorage, Alaska in November–December 2006. See Section VI of the FEIS for a description of public involvement process. Volume II of the Final EIS contains the substantive comments and responses to those comments, which include comments on seismic surveying activities. NMFS was a cooperating agency for this EIS.

Draft Environmental Impact Statement - Beaufort and Chukchi Sea Planning Areas - Oil and Gas Lease Sales 209, 212, 217, and 221 OCS EIS/EA MMS 2008-055. Scoping meetings for the EIS were held in Barrow, Kaktovik, Nuiqsut, Wainwright, Point Hope, Point Lay, and Anchorage in September–November 2007. Government-to-Government meetings were held with the Nuiqsut Tribal Council, the Native Village of Point Hope, and ICAS in September and October 2007. The draft EIS was filed with the EPA and the Notice of Availability (NOA) was announced in the *Federal Register* on December 19, 2008. The NOA provided for a 90-day public comment period, which was extended by 2 weeks. Public hearings were held in January-March 2009, in Barrow, Kaktovik, Nuiqsut, Wainwright, Point Hope, Point Lay, and Anchorage. Government-to-Government consultation meetings with the Native Villages of Nuiqsut and Barrow, and ICAS were also held during this period. The Government-to-Government meeting with the Native Village of Point Hope did not occur because of lack of a quorum. BOEMRE requested Government-to-Government meetings with the Native Villages of Kaktovik, Point Lay, and Wainwright, but the requests were declined or no response was received. A number of comments received on the draft EIS related to seismic surveys and mitigation. Volume III, Chapter V, describes the public involvement process.

Environmental Impact Statement on the Effects of Oil and Gas Activities in the Arctic Ocean, February 2010. NMFS, with BOEMRE as a cooperating agency, is preparing an EIS to analyze the environmental impacts of issuing incidental take authorizations pursuant to the MMPA to the oil and gas industry for the taking of marine mammals incidental to offshore exploration seismic surveying and exploration drilling activities in the Beaufort and Chukchi Seas, including seismic surveys. The Notice of Intent (NOI) to prepare an EIS on the effects of oil and gas activities (seismic surveys and exploratory drilling) in the U.S. Arctic Ocean was published in the *Federal Register* on Monday, February 8, 2010. The NOI announced a 60-day public scooping period. Public scoping meetings for this EIS were held during in February and March, 2010, in Kotzebue, Point Hope, Point Lay, Wainwright, Barrow, Nuiqsut, Kaktovik, and Anchorage. Both NMFS and BOEMRE representatives were at each scoping meeting. Because the EIS will be completed after the 2010 open-water season, BOEMRE's preparation of EAs for proposed 2010 OCS activities open-water season, including Statoil's proposed seismic survey, was discussed at each meeting. BOEMRE received some comments on the Statoil proposed seismic survey and BOEMRE's EA during these public scoping meetings.

8. Verification

Pursuant to the CEQ regulations (40 CFR 1506.5(a)) that acceptable work by an applicant not be redone but be verified by the agency, BOEMRE reviewed, evaluated, and verified the information and analysis provided in Statoil's EED (Statoil, 2011c), which BOEMRE considered in preparation of this EA.

9. Reviewers and Preparers

In compliance with 40 CFR 1506.5(a), the persons responsible for the review of Statoil's Ancillary Activities Notice and supporting information and analysis, and for preparation and review of this EA are listed below:

Name	Title
Augustine, Gene	Biologist
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Cranswick, Deborah	Supervisory Environmental Specialist, Chief, Environmental Analysis Section I
Crews, Christopher	Wildlife Biologist
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Deschu, Nancy	Fisheries Biologist
Hartung, Daniel	Regulatory Analyst
Scordino, Steven	Solicitor, BOEMRE
Smith, Caryn	Oceanographer / Oil spill Risk Analysis
Swears, Bill	Technical Editor

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Appendix A: Environmental Resources Maps

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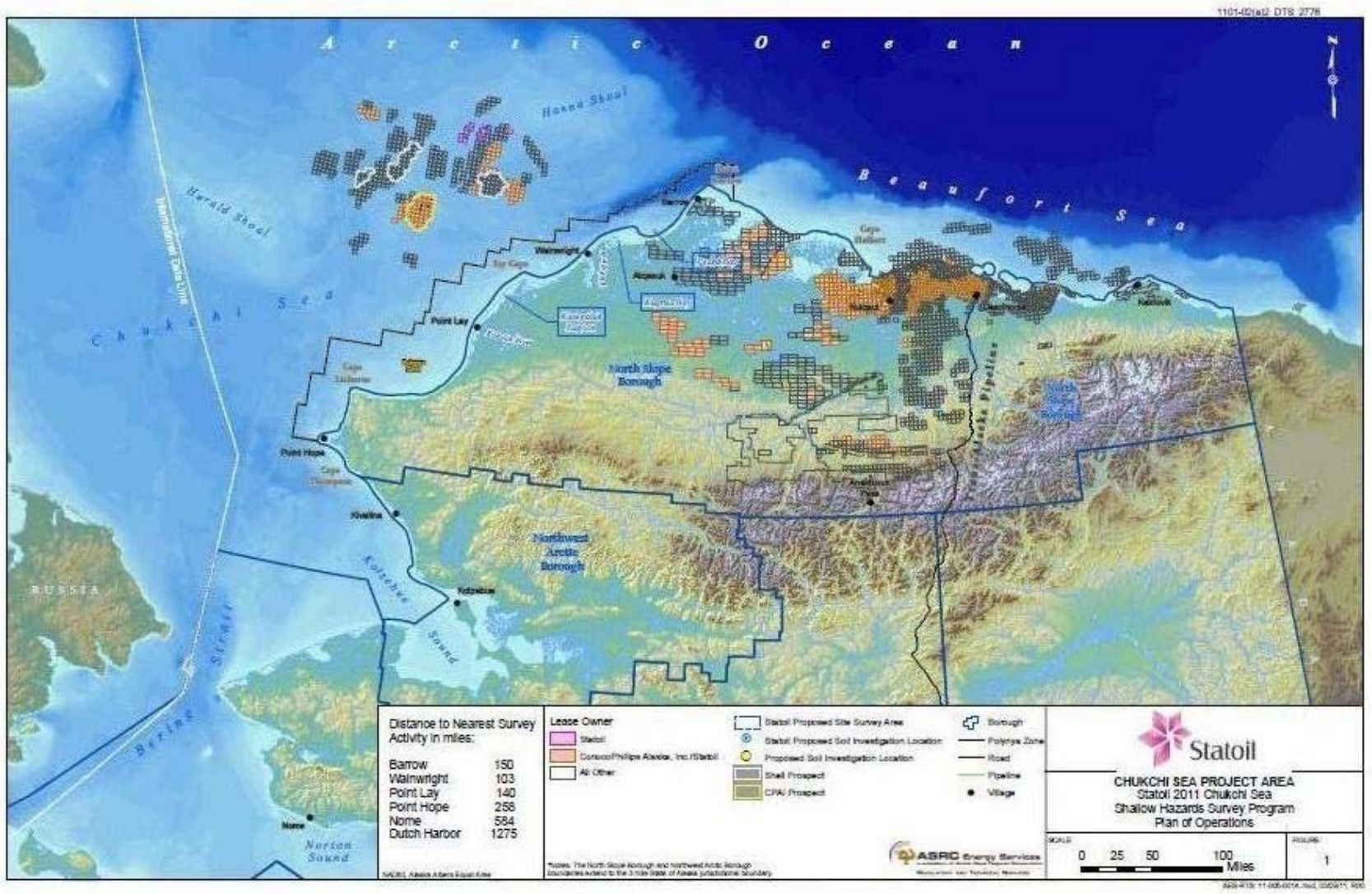
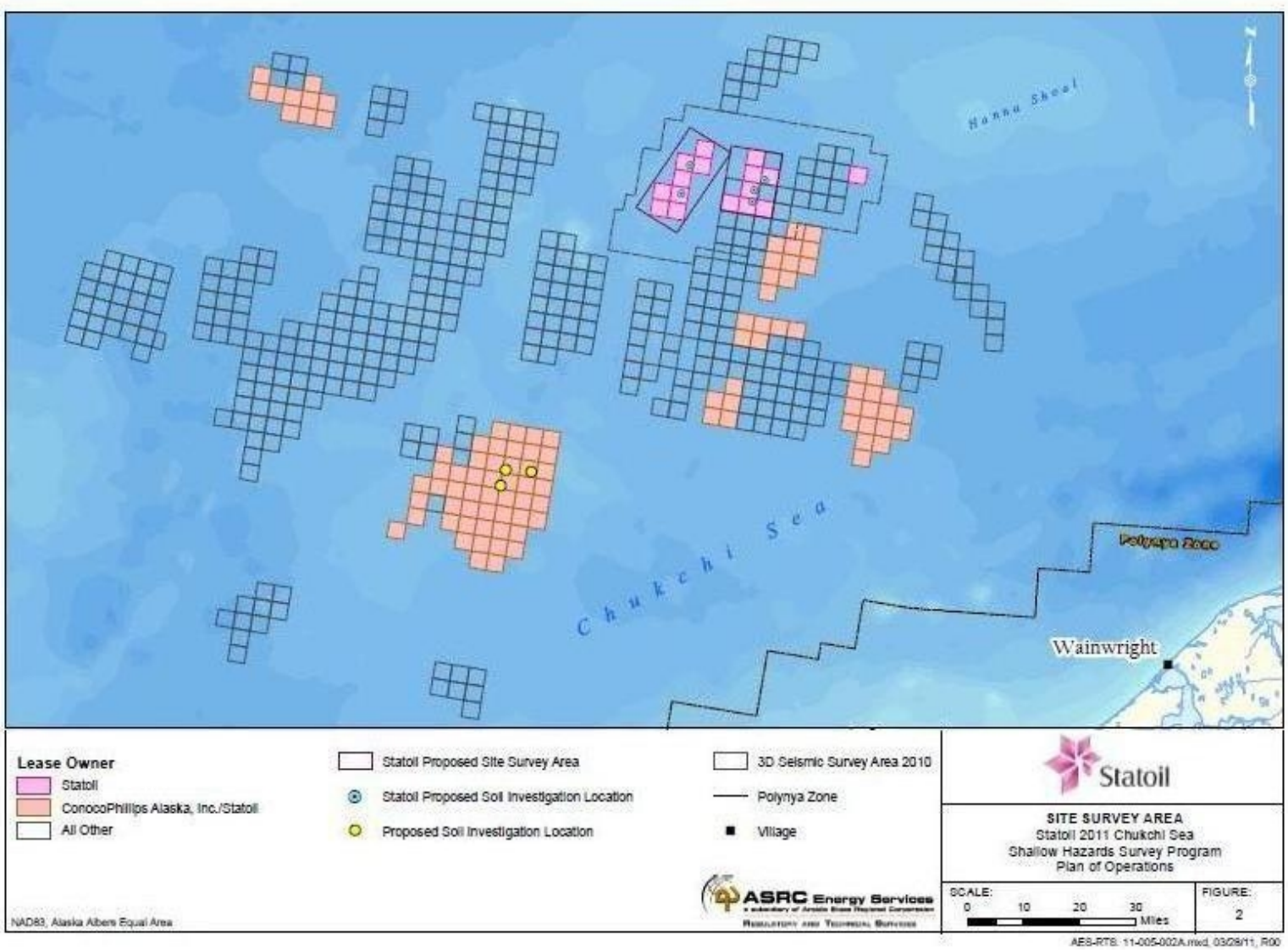


Figure A-1. Statoil 2011 Chukchi Sea marine survey project area (Statoil 2011).



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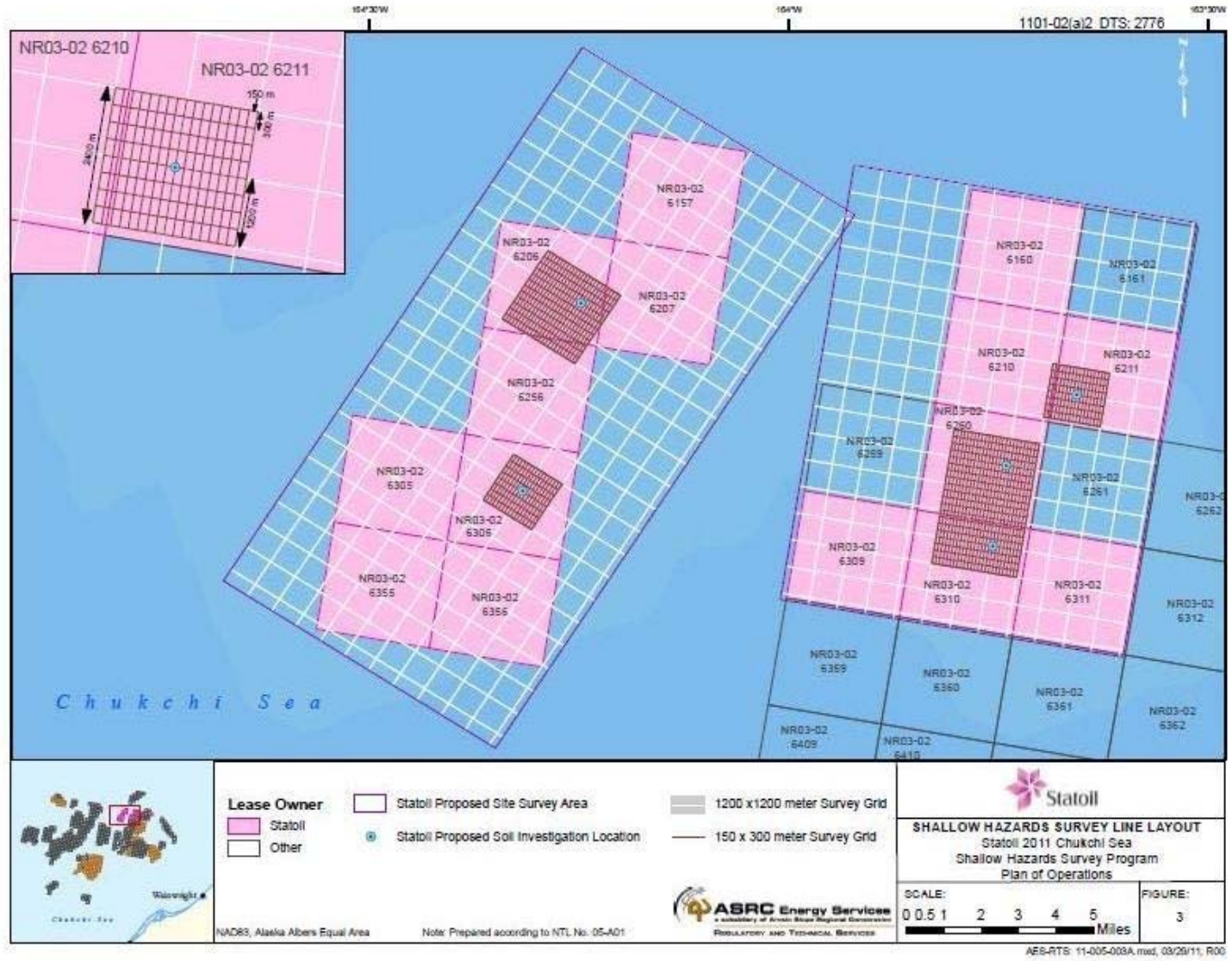

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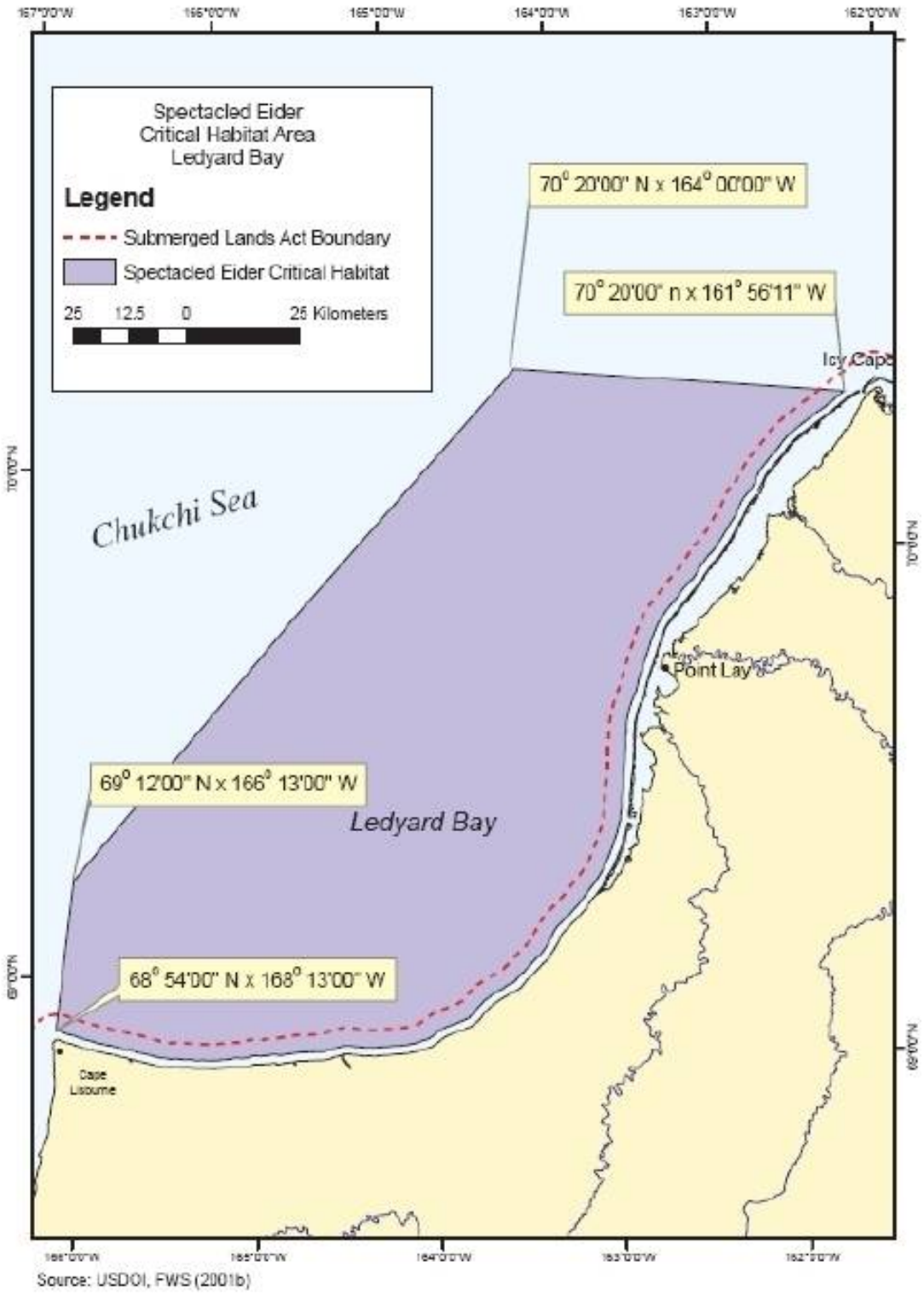

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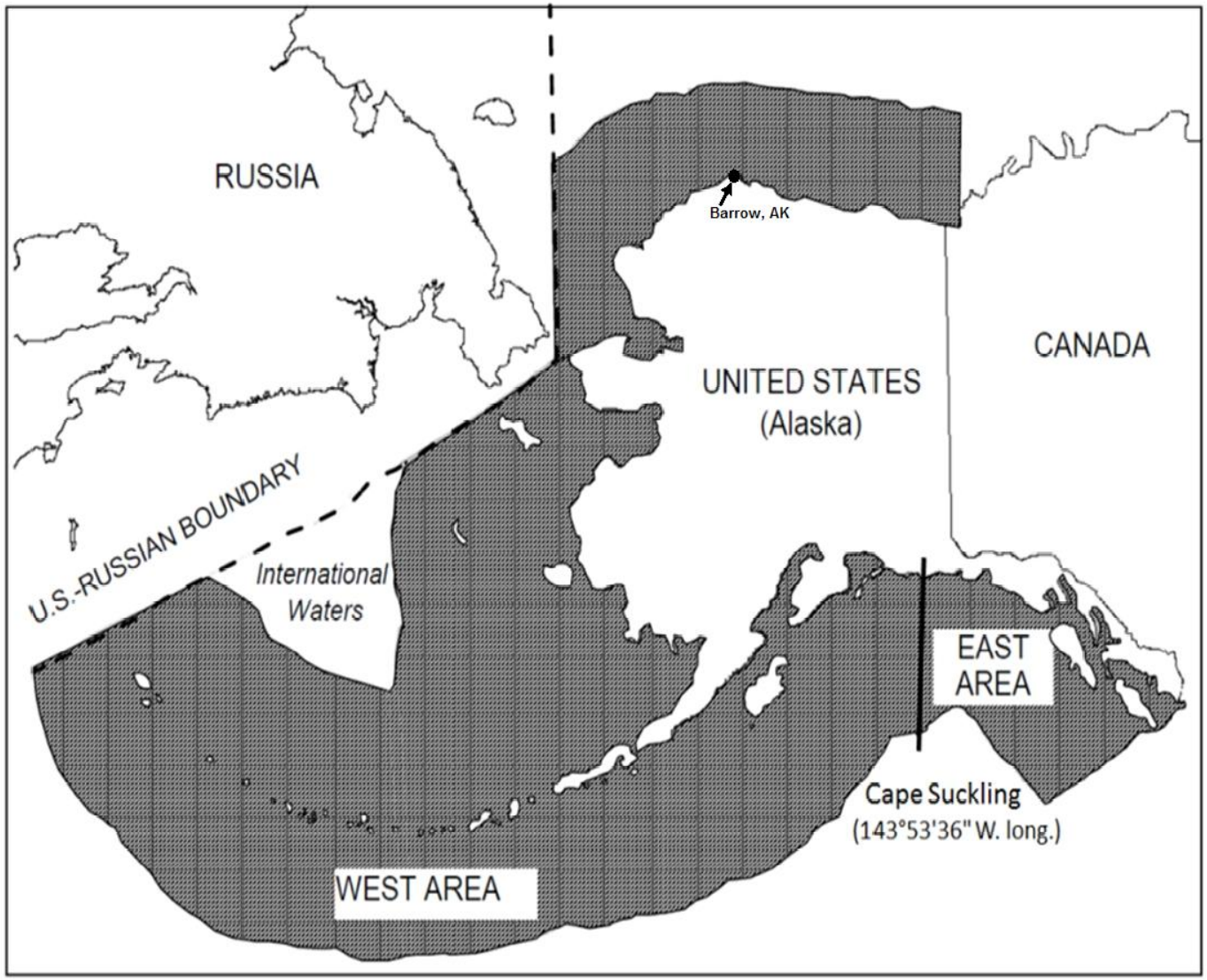

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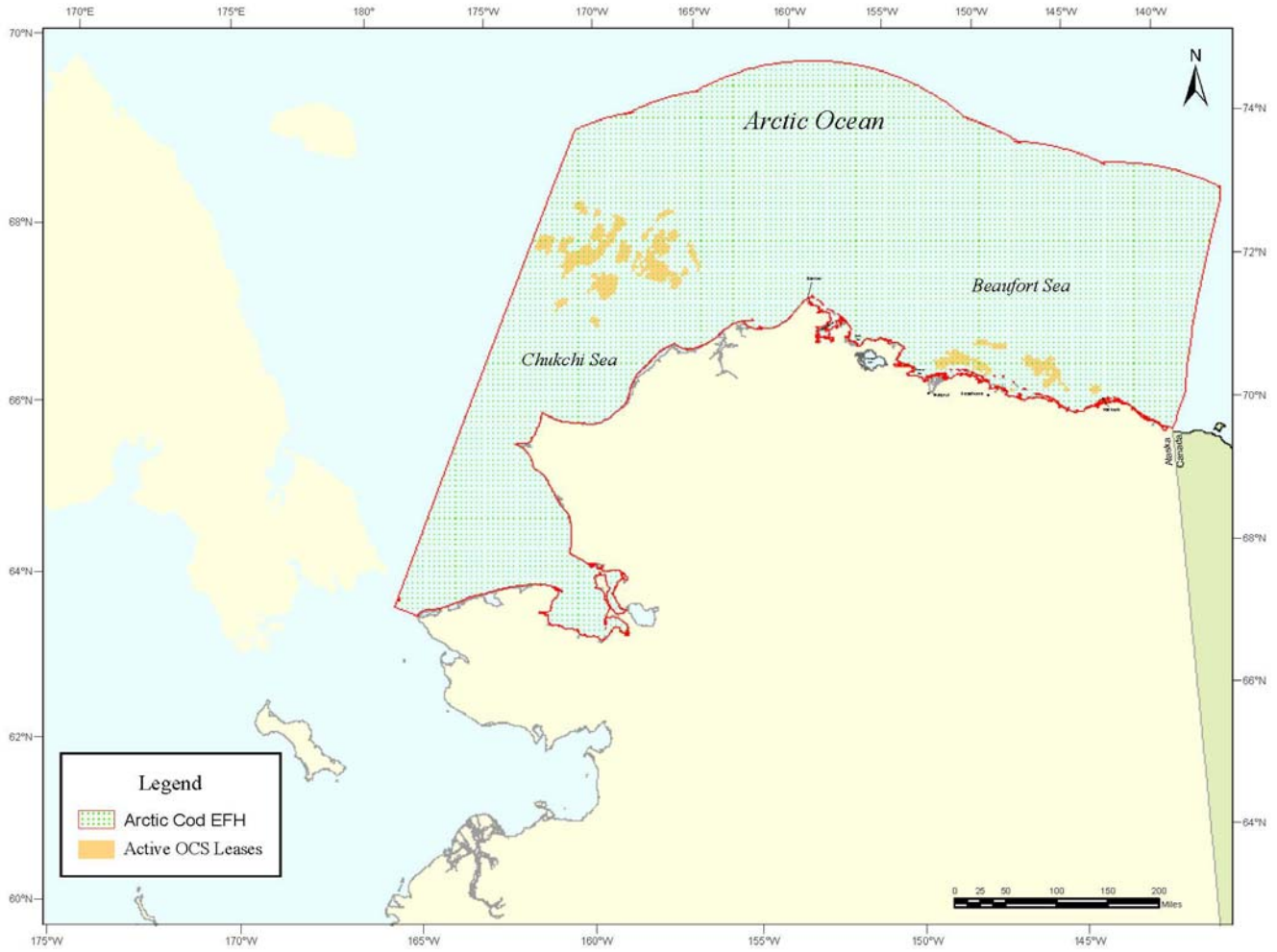

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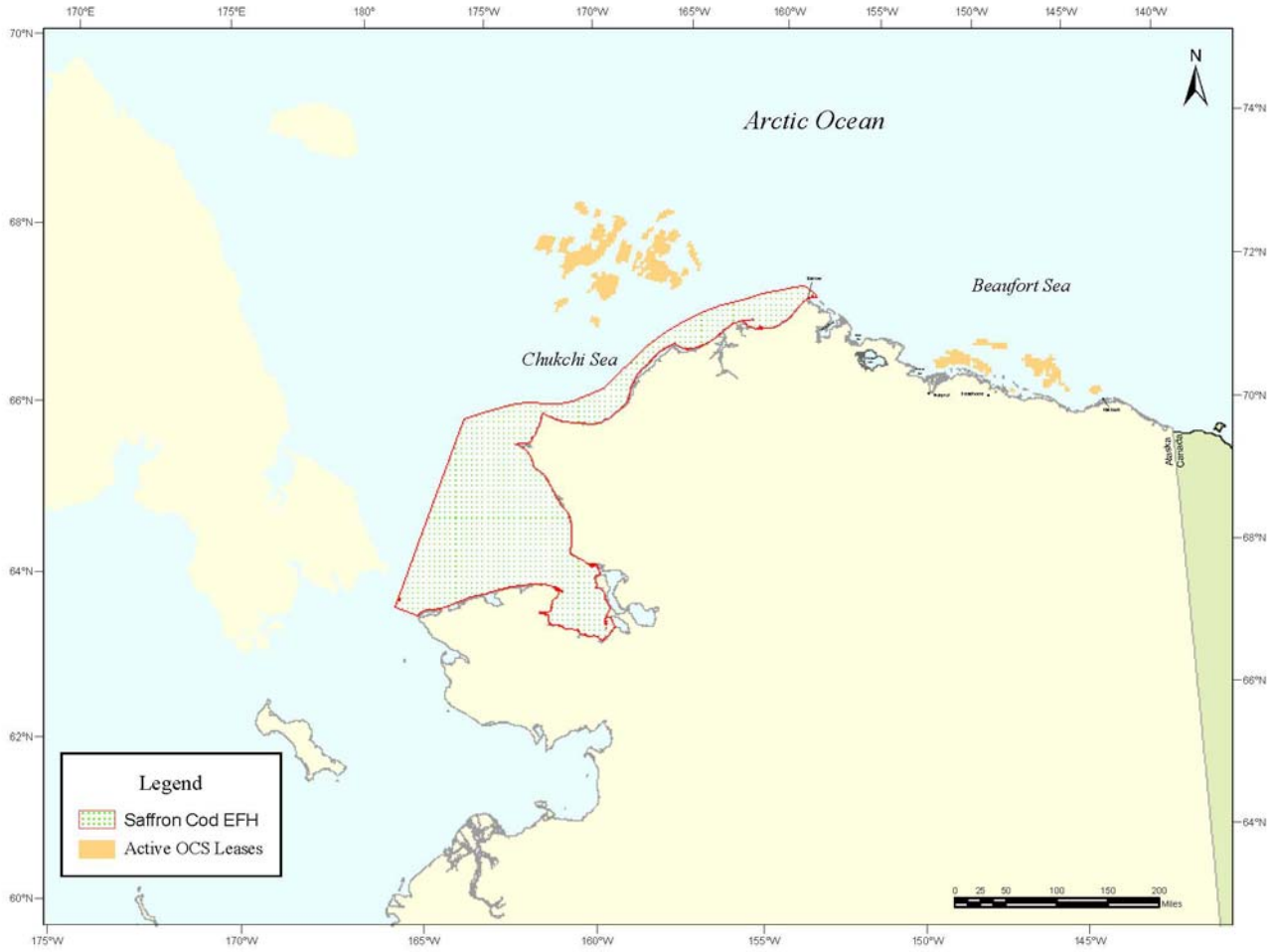

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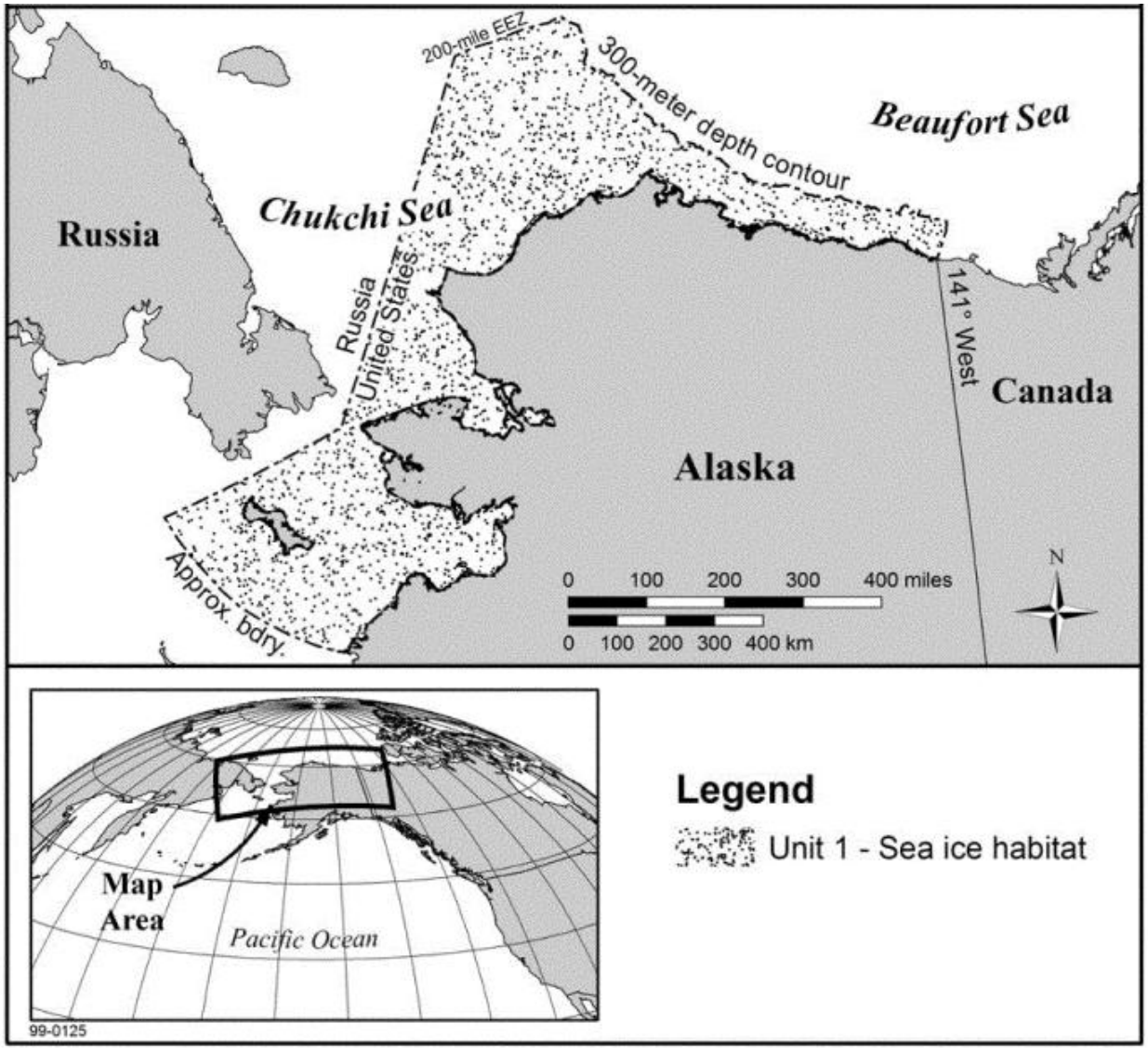

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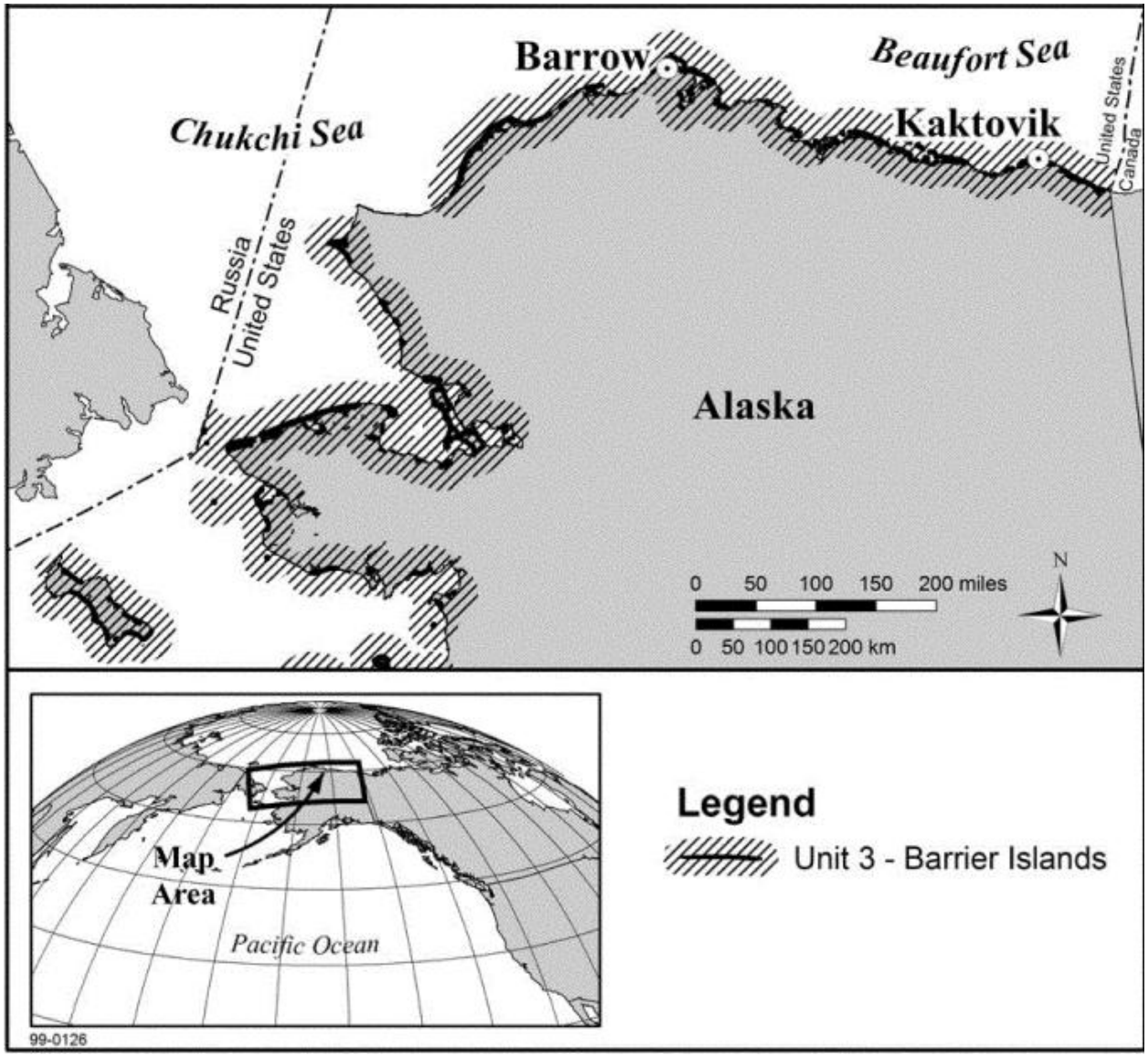

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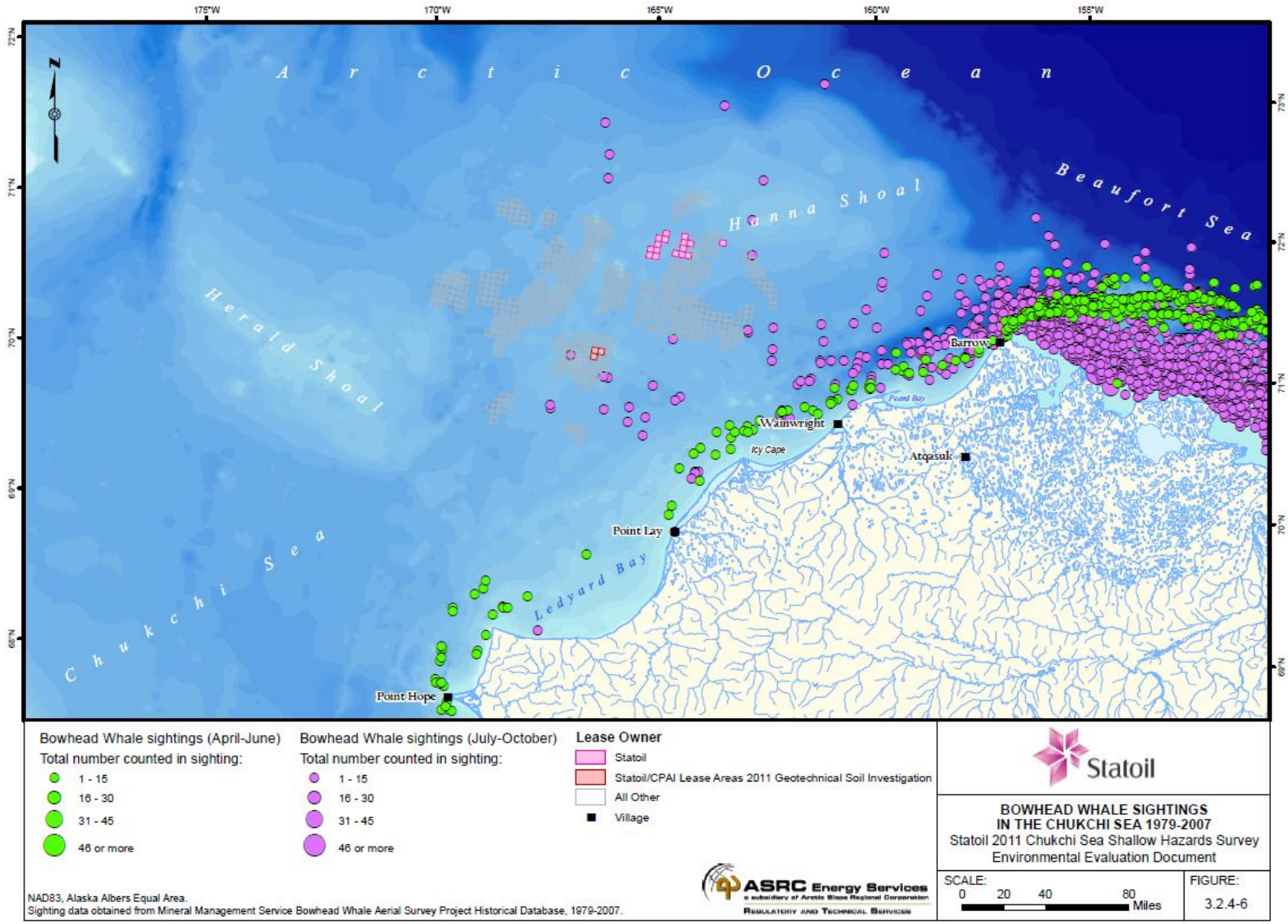

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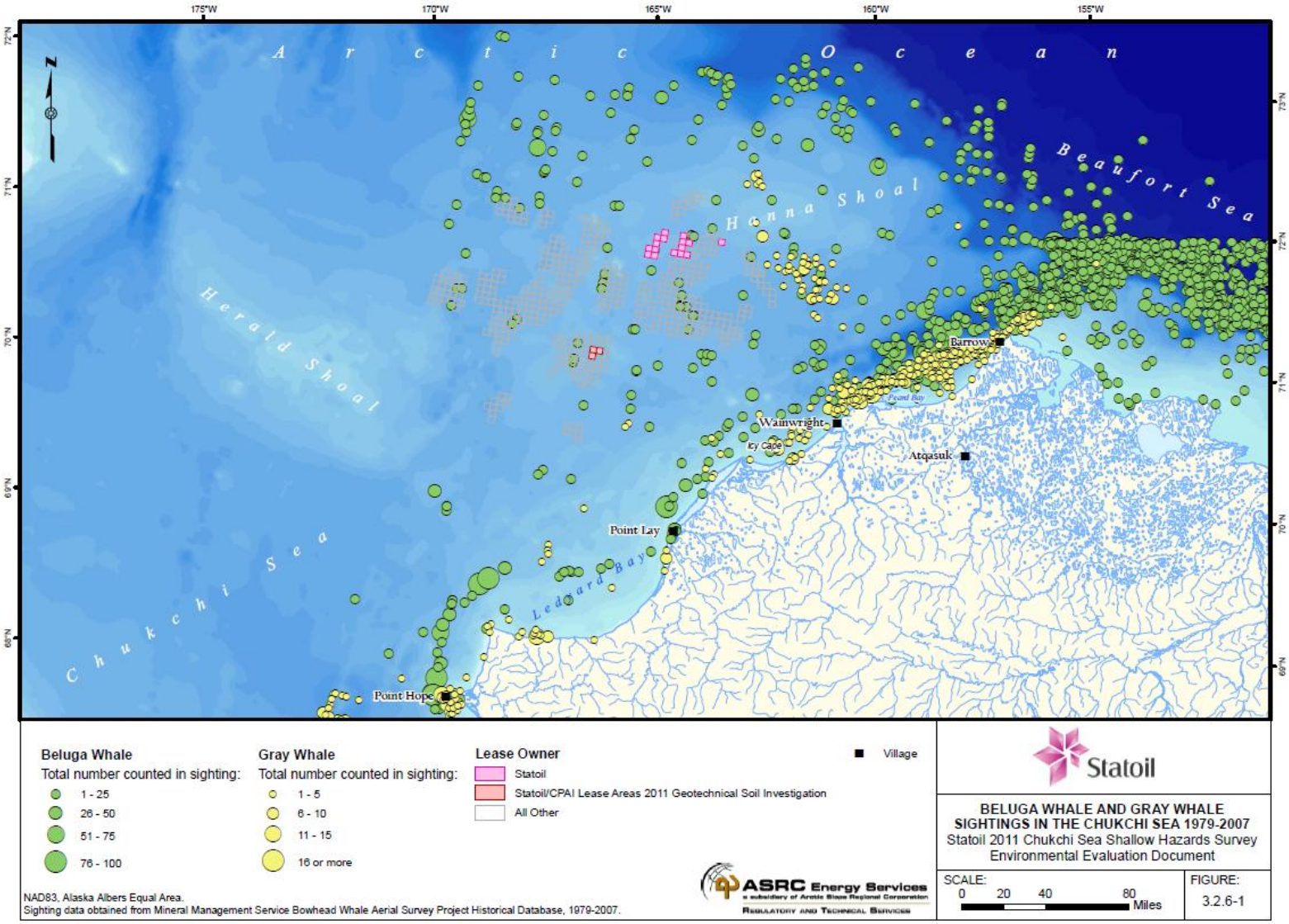

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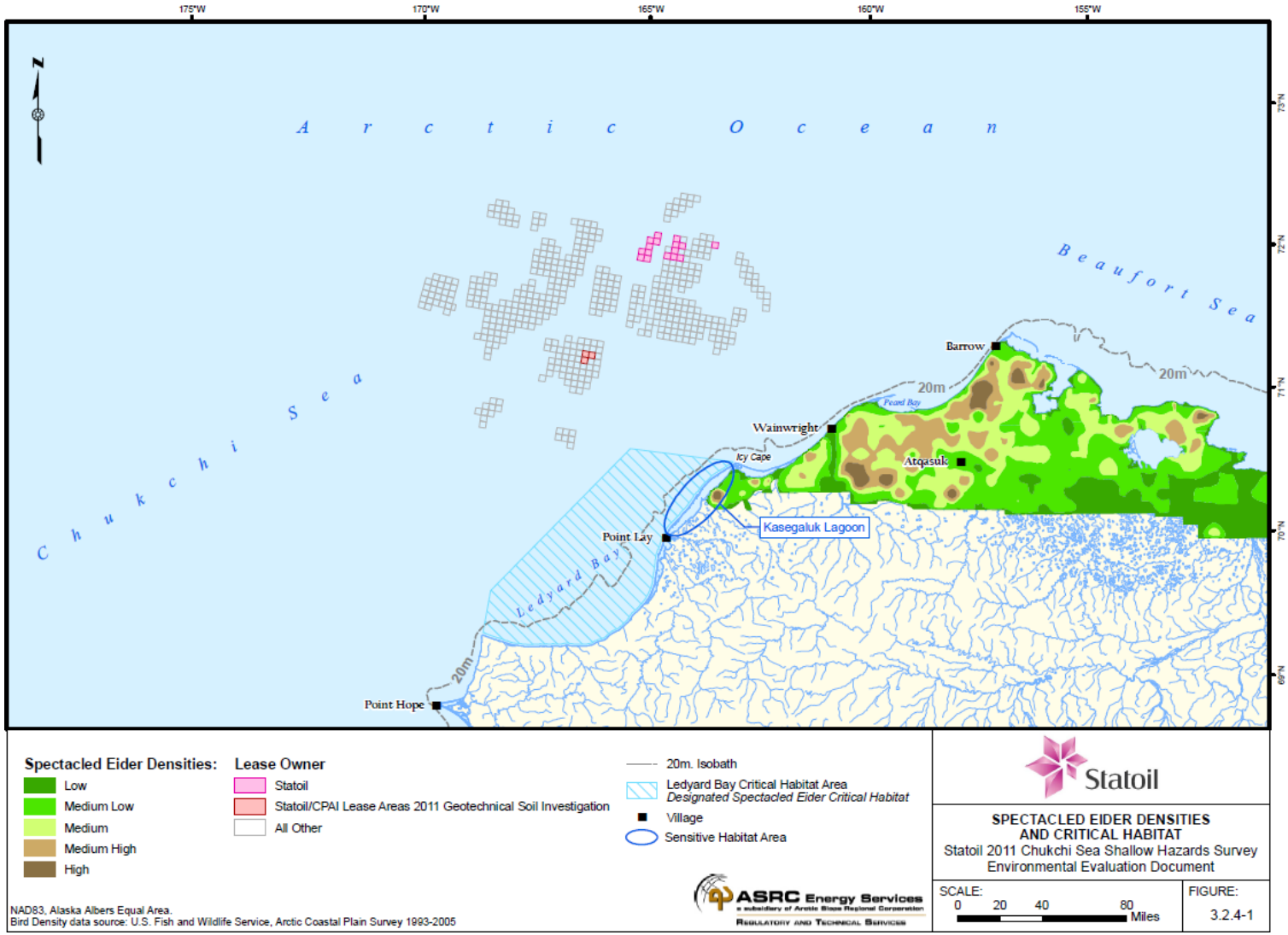

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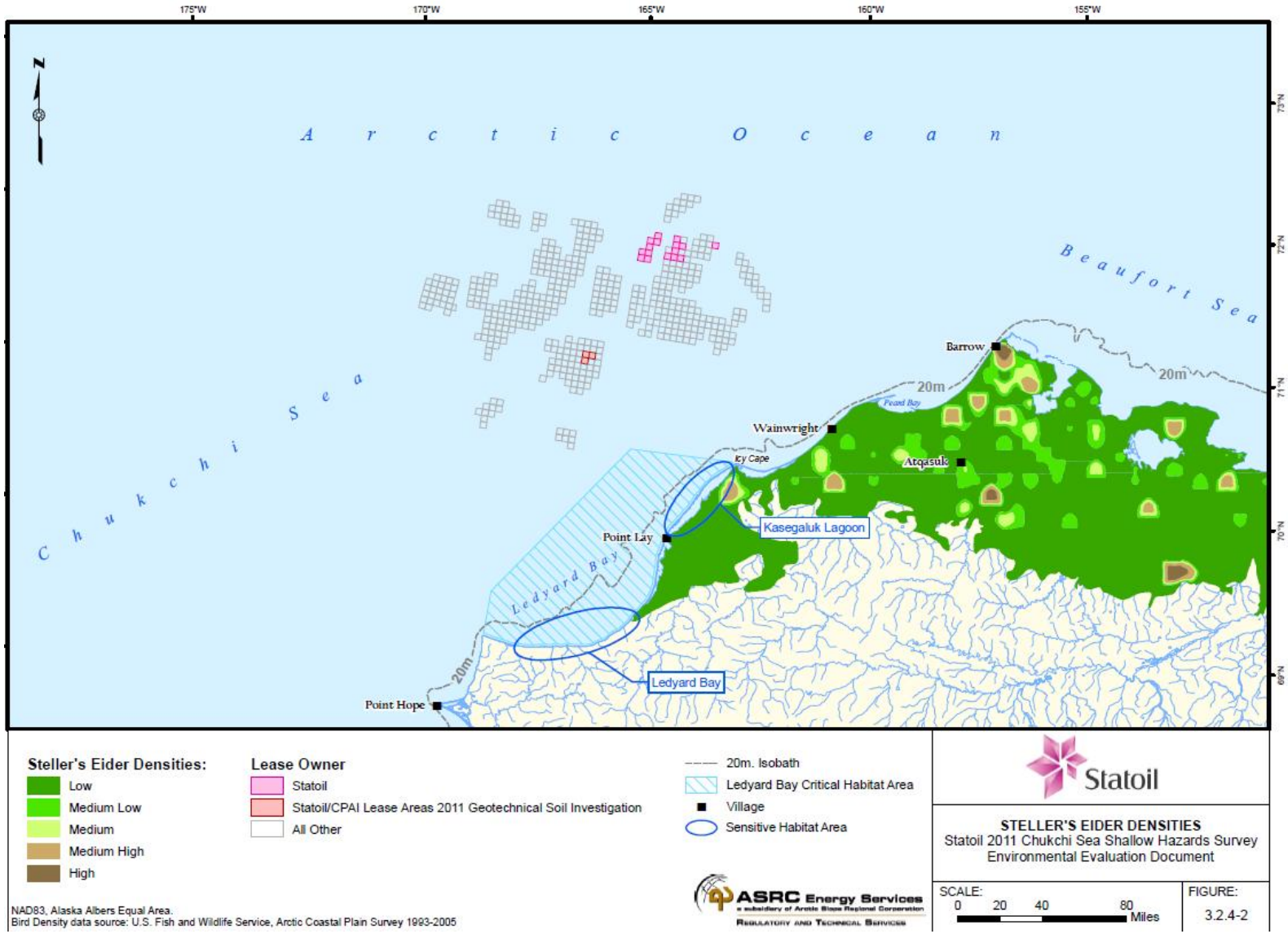

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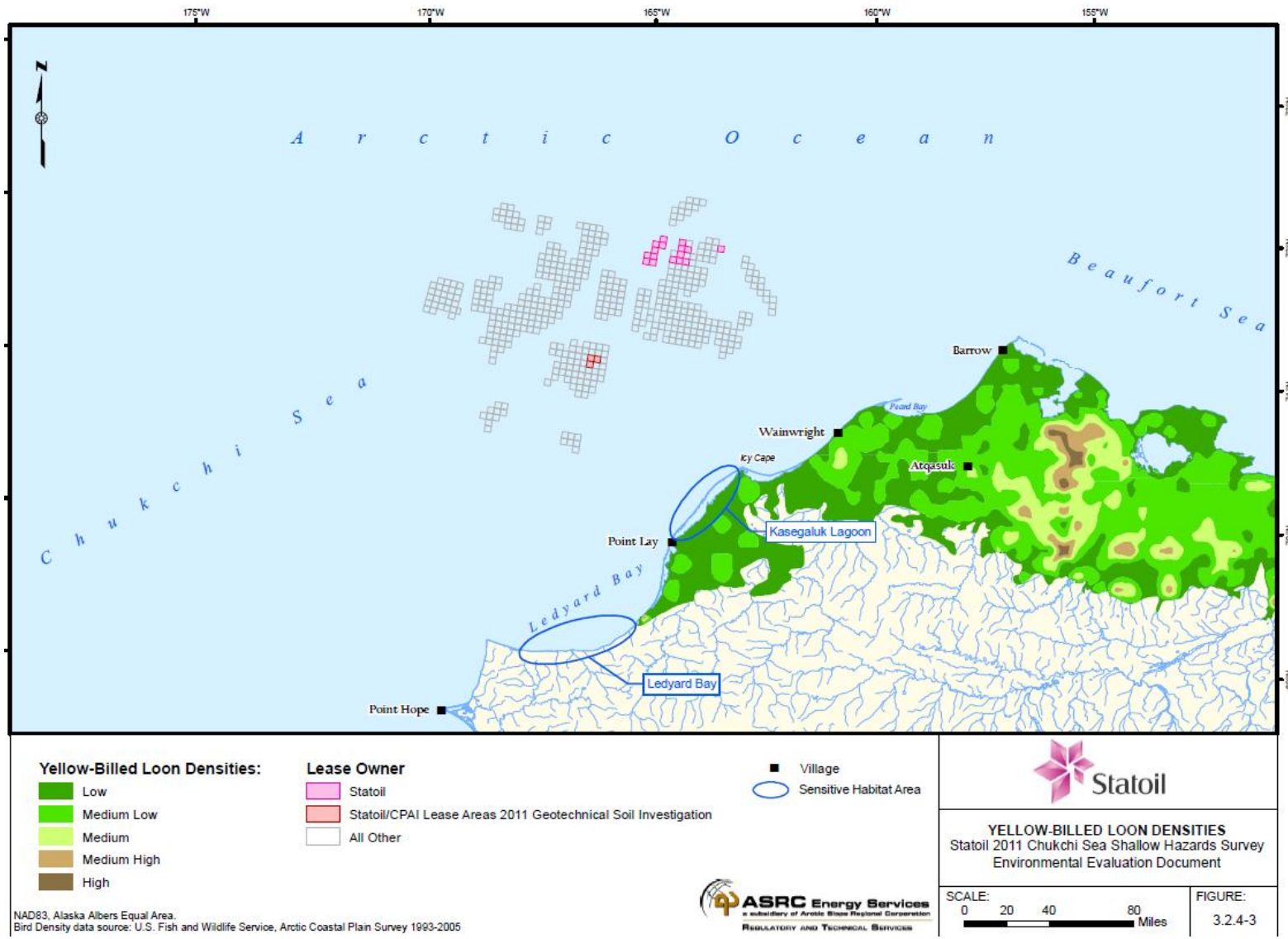

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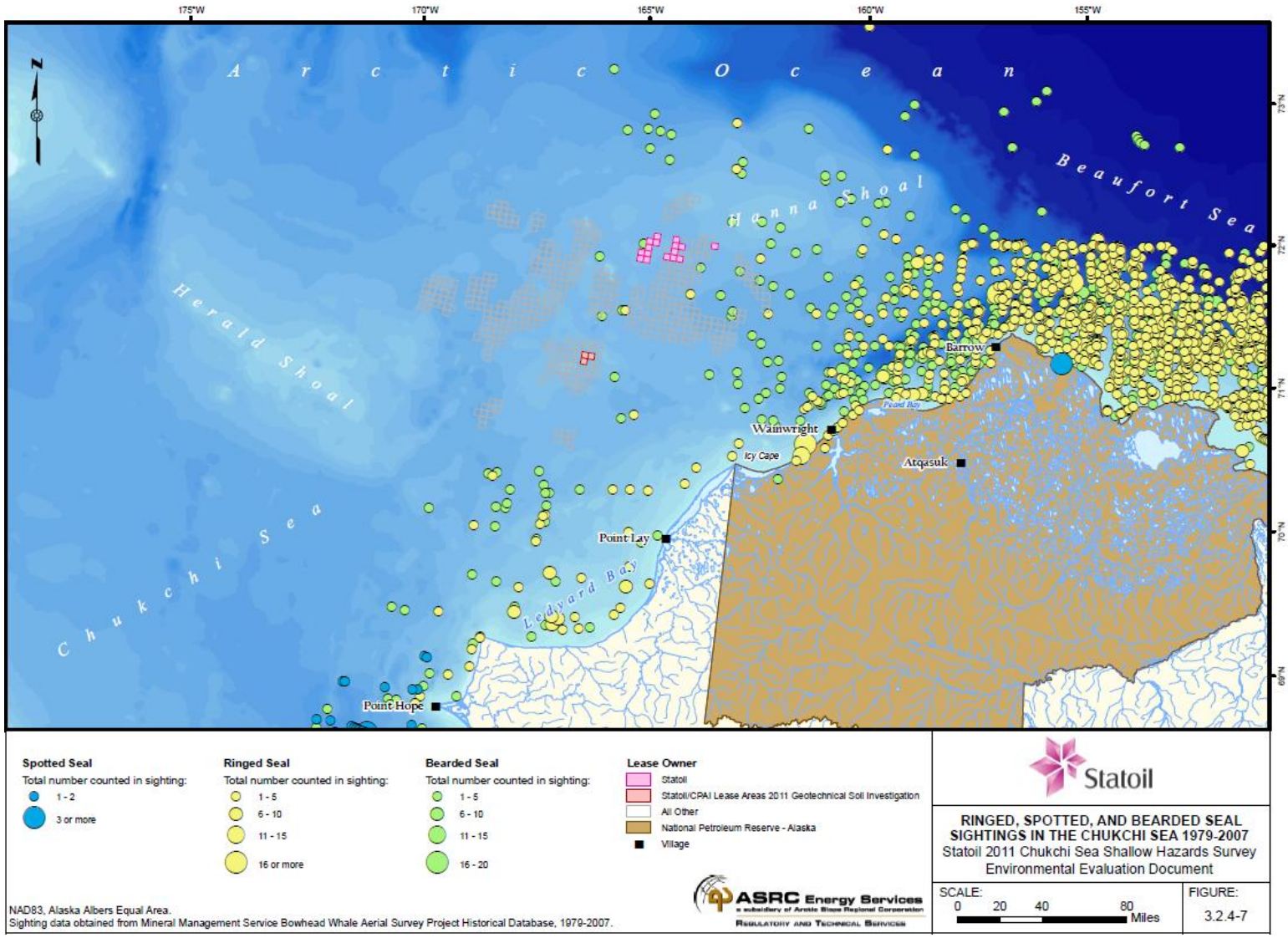

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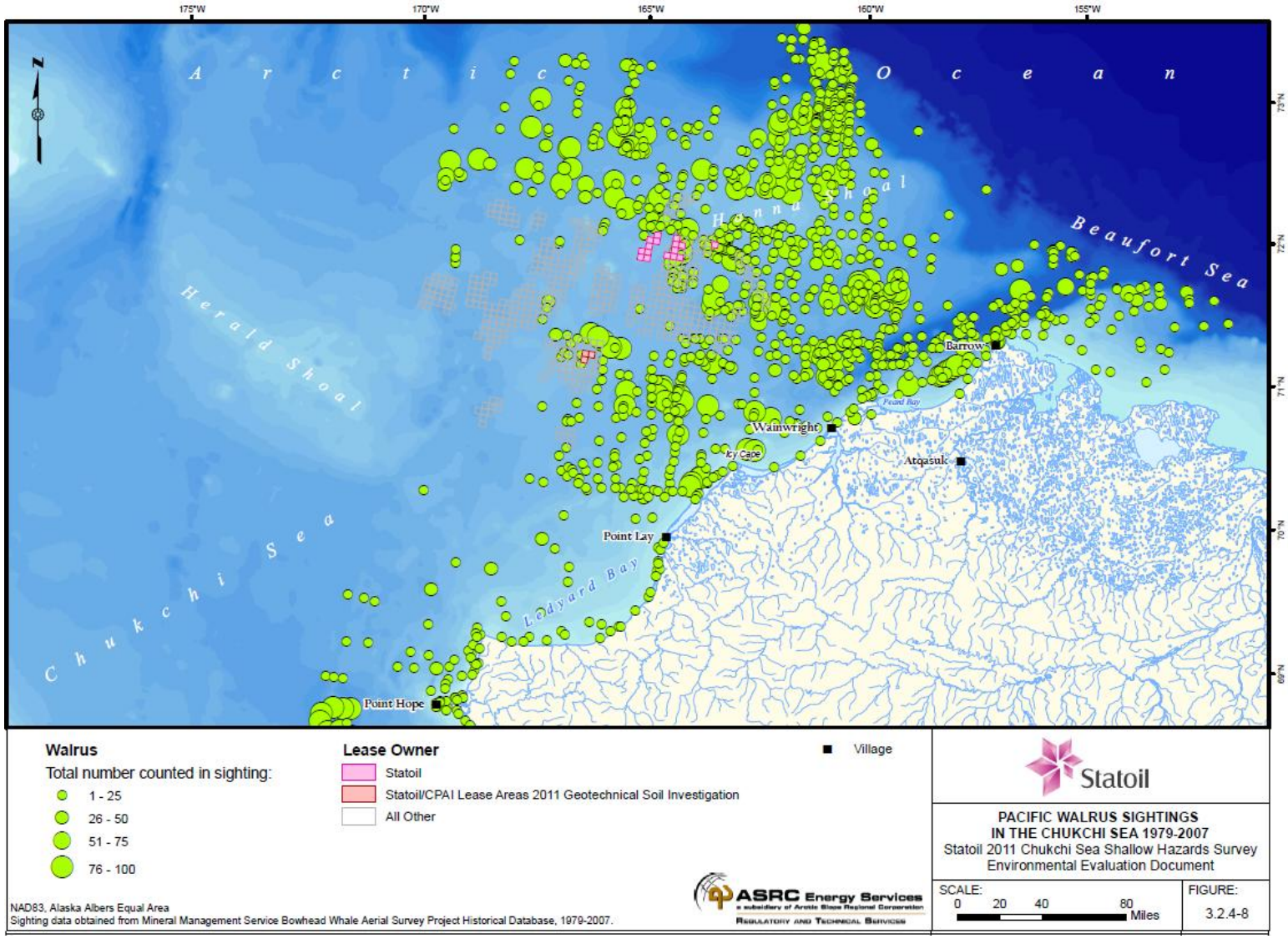

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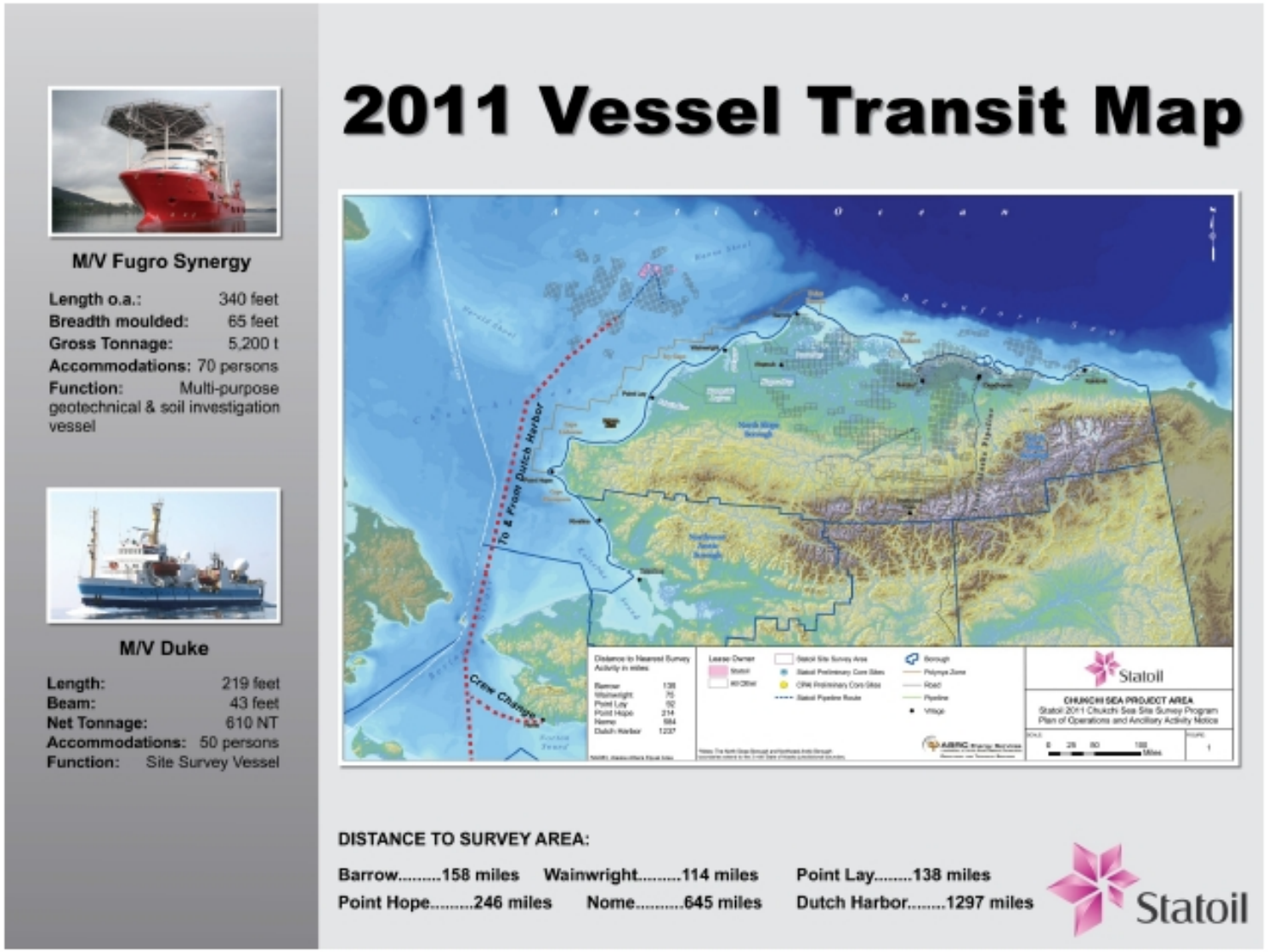

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