

## SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

### FOR THE ISSUANCE OF AN INCIDENTAL HARASSMENT AUTHORIZATION TO TAKE MARINE MAMMALS BY HARASSMENT INCIDENTAL TO CONDUCTING OPEN WATER SHALLOW HAZARDS SURVEYS BY STATOIL USA E&P INC IN THE CHUKCHI SEA, ALASKA

This document supplements the “*Environmental Assessment for the Issuance of Incidental Harassment Authorizations to Take Marine Mammals by Harassment Incidental to Conducting Open Water Seismic and Marine Surveys in the Chukchi and Beaufort Seas*”

July 2011



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**ABSTRACT:** The National Marine Fisheries Service proposes to issue an Incidental Harassment Authorization (IHA) to Statoil USA E&P Inc (Statoil) for the taking, by Level B harassment, of small numbers of marine mammals incidental to conducting open water marine and seismic surveys in the Chukchi Sea, Alaska.



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## List of Acronyms, Abbreviations, and Initialisms

4MP	Marine Mammal Monitoring and Mitigation Plan
AAM	Active Acoustic Monitoring
AEWC	Alaska Eskimo Whaling Commission
BOEM	Bureau of Ocean Energy Management, Regulation and Enforcement
BPXA	BP Exploration Alaska
CEQ	President's Council on Environmental Quality
CPAI	ConocoPhillips Alaska Inc.
CZMA	Coastal Zone Management Act
dB	decibel
DP	dynamic positioning
DPS	distinct population segment
EA	Environmental Assessment
ECS	extended continental shelf
EEZ	Exclusive Economic Zone
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ft	foot/feet
FR	Federal Register
HZ	hertz
IHA	Incidental Harassment Authorization
in <sup>3</sup>	cubic inch
ION	ION Geophysical
kHz	kilohertz
km	kilometer
km <sup>2</sup>	square kilometer
m	meter
mi	mile
mi <sup>2</sup>	square mile
PSO	Marine Mammal Observer
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service, currently the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEM)
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OBS	Ocean Bottom Seismometer
OCS	Outer Continental Shelf
OMB	Office of Management and Budget
PAM	Passive Acoustic Monitoring
POC	Plan of Cooperation
PSO	Protected Species Observer
RL	Received Level
SEA	Supplemental Environmental Assessment

SSV	Sound Source Verification
UAGI	University of Alaska Geophysics Institute
U.S.C.	United States Code
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service
μPa	micro pascal

## CHAPTER 1 PURPOSE AND NEED FOR ACTION

### 1.1 Introduction

Pursuant to the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*), this Supplemental Environmental Assessment (SEA) has been prepared to analyze the potential impacts to the human environment that may result from the National Marine Fisheries Service's (NMFS) proposed issuance of an incidental harassment authorization (IHA) under section 101(a)(5)(D) of the Marine Mammal Protection Act (MMPA; 16 USC 1371(a)(5)(D)) to Statoil USA E&P Inc (Statoil) for conducting shallow hazards surveys in the Chukchi Sea off Alaska. This document incorporates by reference the analyses contained in the July 2010 "*Environmental Assessment for the Issuance of Incidental Harassment Authorizations to Take Marine Mammals by Harassment Incidental to Conducting Open Water Seismic and Marine Surveys in the Chukchi and Beaufort Seas*" (2010 EA) prepared by NMFS (NMFS 2010), and supplements those analyses with specific information for Statoil's proposed activities during the 2011 open-water season. The amount, type, and degree of the proposed shallow hazards survey effort evaluated in this SEA falls within the scope of activities evaluated in the 2010 EA.

#### 1.1.1 BACKGROUND

On March 1, 2011, NMFS received an application from Statoil requesting an authorization for the harassment of small numbers of marine mammals incidental to conducting open water marine surveys in the Chukchi Sea off Alaska. After addressing comments from NMFS, Statoil modified its application and submitted a revised application on April 15, 2011 (Statoil 2011).

To comply with the MMPA, Statoil has submitted an IHA application due to the presence of marine mammal species in the vicinity of its proposed marine survey area. Marine mammals under NMFS' jurisdiction that could be adversely affected by the proposed marine survey are:

- Beluga whale (*Delphinapterus leucas*)
- Narwhal (*Monodon monoceros*)
- Killer whale (*Orcinus orca*)
- Harbor porpoise (*Phocoena phocoena*)
- Bowhead whale (*Balaena mysticetus*)
- Gray whale (*Eschrichtius robustus*)
- Humpback whale (*Megaptera novaeangliae*)
- Fin whale (*Balaenoptera physalus*)
- Minke whale (*B. acutorostrata*)
- Bearded seal (*Erignathus barbatus*)
- Ringed seal (*Phoca hispida*)
- Ribbon seal (*P. fasciata*)
- Spotted seal (*P. largha*)

### **1.1.2 PURPOSE AND NEED**

The purpose and need of the proposed action is to ensure compliance with the MMPA and its implementing regulations in association with Statoil's proposed open-water shallow hazards surveys in the Chukchi Sea. The MMPA prohibits takes of all marine mammals with certain exceptions.

In response to the receipt of the IHA application from Statoil, NMFS proposes to issue an IHA pursuant to the MMPA §101(a)(5)(D). The primary purpose of the IHA is to provide an exception from the take prohibitions under the MMPA to authorize "takes" by "level B harassment" of marine mammals, including endangered species, incidental to the proposed open water marine surveys in the Chukchi Sea by Statoil. The need for the issuance of the IHA is related to NMFS' mandates under the MMPA. Specifically the MMPA prohibits takes of marine mammals, with specific exceptions, including the incidental, but not intentional, taking of marine mammals, for periods of not more than one year, by United States citizens who engage in a specified activity (other than commercial fishing).

IHA issuance criteria require that activities authorized by an IHA will have a negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses. In addition, the IHA must set forth the permissible methods of taking, other means of effecting the least practicable impact on the species or stock and its habitat, and requirements for monitoring and reporting of such takings.

Issuance of an IHA is a federal agency action. For purposes of section 7 of the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 et seq), NMFS must consult with itself to ensure that its action is not likely to jeopardize the continued existence of any federally-listed species or result in the destruction or adverse modification of critical habitat.

In addition, this SEA is prepared in accordance with NEPA for the analysis of the potential environmental impacts as the result of NMFS' proposed issuance of the IHA.

## **1.2 Scoping Summary**

The purpose of scoping is to identify the issues to be addressed and the significant issues related to the proposed action, as well as identify and eliminate from detailed study the issues that are not significant or that have been covered by prior environmental review. An additional purpose of the scoping process is to identify the concerns of the affected public and Federal agencies, states, and Indian tribes.

The MMPA and its implementing regulations governing issuance of an IHA require that upon receipt of a valid and complete application for an IHA, NMFS publish a notice of receipt or proposed IHA in the *Federal Register* (50 CFR § 216.104(b)(1)). The notice summarizes the purpose of the requested IHA, includes a statement about whether an EA or an Environmental Impact Statement (EIS) was or will be prepared, and invites interested parties to submit written comments concerning the application.



NOAA Administrative Order (NAO) 216-6, established agency procedures for complying with NEPA and the implementing regulations issued by the President's Council on Environmental Quality (CEQ). NAO 216-6 specifies that the issuance of an IHA under the MMPA is among a category of actions that require environmental review and the preparation of NEPA documentation.

### **1.2.1 Comments on Application and SEA**

On May 24, 2011, NMFS published a notice of a proposed IHA for Statoil's marine surveys in the Chukchi Sea in the *Federal Register* (76 FR 30110), which announced the availability of Statoil's IHA application for public comment for 30 days. The public comment period for the proposed IHA afforded the public the opportunity to provide input on environmental impacts, many of which are highlighted in this SEA. In addition, NMFS will post the final 2011 SEA and Finding of No Significant Impact (assuming NMFS makes this finding) on the Internet at: <http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications>.

During the public comment period, NMFS received written comments on the proposed IHA from the following:

- Marine Mammal Commission
- Alaska Eskimo Whaling Commission
- Alaska Wilderness League, Center for Biological Diversity, Defenders of Wildlife, Earthjustice, Natural Resources Defense Council, Oceana, Pacific Environment, and Sierra Club

Responses to all relevant comments will be included in the *Federal Register* notice of issuance if NMFS decides to issue the IHA.

### **1.2.2 Analysis of the Scope of NMFS 2010 EA for the 2011 Proposed Action**

In July 2010, NMFS prepared an *Environmental Assessment for the Issuance of Incidental Harassment Authorizations to Take Marine Mammals by Harassment Incidental to Conducting Open Water Seismic and Marine Surveys in the Chukchi and Beaufort Seas* (2010 EA).

The anticipated adverse impacts to the human environment from the proposed 2011 open water shallow hazards survey are expected to be less than the environmental impacts analyzed in the NMFS 2010 EA. NMFS determined, therefore that it would be appropriate to supplement the 2010 EA to support NMFS' NEPA compliance for the 2011 proposed issuance of an IHA to Statoil. This approach is warranted as the proposed shallow hazards survey in the Chukchi Sea during the 2011 open water season is similar in scope to the 2010 EA's evaluation of two shallow hazards surveys in the Beaufort and Chukchi Seas and a 3D seismic survey in the Chukchi Sea. This SEA incorporates by reference the 2010 EA and other related documents, and the Biological Opinion issued for the 2010 Statoil and Shell seismic and marine surveys in the Chukchi and Beaufort Seas.

NMFS reviewed the 2010 EA to determine which aspects of the proposed 2011 authorization and its potential environmental consequences warrant supplementation to meet the spirit and

intent of NEPA. Detailed comparable analyses of the 2010 EA and the content of this SEA are provided in Table 1-1 below.

**Table 1-1. A comparison of the activities and content contained in the 2010 EA and the proposed activities and content contained in this SEA**

<b>Chapter</b>	<b>2010 EA</b>	<b>SEA</b>
<b>Chapter 1: Purpose and Need for Action</b>	The proposed action is for NMFS to issue two IHAs to Statoil and Shell to take marine mammals incidental to open-water seismic survey and shallow hazards and clearance surveys in the Chukchi and Beaufort Seas. Described the statutory and regulatory framework of the permitting process. Provided detailed description of the seismic and marine surveys during the 2010 open-water season.	Updated the purpose and need of the proposed action to reflect 2011 authorization via IHA (MMPA Sec 101(a)(5)(D)). Provided a detailed description of Statoil's 2011 proposed open water shallow hazard surveys in the Chukchi Sea.
<b>Chapter 2: Alternatives Included in the Proposed Action</b>	Three alternatives evaluated.	The three alternatives considered in the 2010 EA were incorporated herein by reference. Alternative 2 was chosen as the preferred alternative.
<b>Chapter 3: Affected Environment</b>	Affected physical, biological (including bowhead, humpback, fin, minke, gray, beluga, and killer whales, harbor porpoise, ringed, bearded, spotted, and ribbon seals, walruses, polar bears, marine birds, and fish), and socioeconomic environment of the Beaufort and Chukchi Seas, and subsistence uses of the resources, etc. were analyzed in detail.	For the most part, there are no changes made in this chapter, and the 2010 EA is incorporated by reference. Update to include narwhals as this species could occur in the Chukchi Sea. Updated proposed ESA-listing of ringed and bearded seals and Pacific walrus. Updated polar bear critical habitat designation.
<b>Chapter 4: Environmental Consequences</b>	Environmental impacts from seismic surveys on marine mammals, marine birds, fish, and the physical environment of the Beaufort and Chukchi Seas, acoustic environment, and subsistence uses of the resources, etc. were analyzed.  Cumulative impact on fish/fishery resources and essential fish habitat, seismic survey activities, vessel and air traffic, oil and gas exploration and development, subsistence harvest activities, military activities, industrial development, and climate change were analyzed in detail.	The proposed 2011 open-water shallow hazards survey in the Chukchi Sea by Statoil is expected to have the same or substantially similar environmental effects as analyzed in the 2010 EA for the shallow hazards survey by Shell in the same ocean basin. There are no changes in the environmental consequences; therefore, this section of the 2010 EA is incorporated herein by reference. Updated information on marine and seismic surveys and potential oil and gas development in the Arctic region since the 2010 EA, and incorporated by reference the cumulative effects from the 2010 EA as there are no substantial changes on the levels of these activities.
<b>Chapter 5: Mitigation Measures</b>	Basic mitigation measures include: 180/190 dB safety zones for cetaceans and pinnipeds, respectively; safety zone monitoring; shut-down and power down when marine mammals are entering or approaching safety zones; ramp-up; sound source verification (SSV) for seismic surveys, and using marine mammal observers for monitoring. Additional mitigation and monitoring measures were discussed in different alternatives.	Specific mitigation measures are described for Statoil's proposed 2011 open-water shallow hazards surveys in the Chukchi Sea. For the most part, these mitigation measures are similar to those implemented by Statoil for its 2010 open-water 3D seismic survey.

<b>Chapter</b>	<b>2010 EA</b>	<b>SEA</b>
<b>Chapter 6: Monitoring and Reporting Requirements</b>	Basic monitoring measures include using NMFS-approved marine mammal observers to conduct vessel-based visual monitoring. “Big Eye” binocular are required for long-range monitoring. For shallow hazards surveys in Beaufort Sea, aerial survey was also required. The applicants are required to submit SSV reports within 120 hours after the tests. 90 day technical reports are required.	Specific monitoring and reporting requirements are described for Statoil’s proposed 2011 open-water shallow hazards surveys in the Chukchi Sea. For the most part, these monitoring measures are similar to those implemented by Statoil for its 2010 open-water 3D seismic survey.

In addition, NMFS compared the level of activities (number of surveys) and potential type of seismic effort in the Arctic that were analyzed in the 2010 EA and this 2011 SEA (Table 1-2).

Pursuant to NEPA, this SEA has been prepared to determine the potential impacts that may result from the proposed actions, which would be the issuance of an IHA to Statoil for taking, by Level B (behavioral or TTS) harassment of marine mammals during the 2011 open-water shallow hazards survey operations from August to November.

The remaining scope, objectives, and assumptions in this SEA remain the same as those described in the 2010 EA. Section 1.3 of the 2010 EA summarizes federal, state, and local laws, permits, licenses, approvals, and consultation requirements necessary to implement the proposed actions, as well as who is responsible for obtaining them. These include NEPA, ESA, MMPA, Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), and Coastal Zone Management Act (CZMA). The description of applicable laws and necessary permits, licenses, and entitlements in the 2010 EA is incorporated herein by reference.

**Table 1-2. Comparison of level of activities (number of surveys) in the NMFS 2010 EA and this SEA.**

	<b>NMFS 2010 EA</b>	<b>NMFS 2011 SEA</b>
Chukchi Sea	2 seismic surveys: <ul style="list-style-type: none"> <li>• 3D deep seismic survey (Statoil)</li> <li>• Shallow hazard/site clearance survey (SOI)</li> </ul>	1 seismic survey: <ul style="list-style-type: none"> <li>• Shallow hazard/site clearance survey (Statoil)</li> </ul>
Beaufort Sea	1 seismic survey: <ul style="list-style-type: none"> <li>• Shallow hazard/site clearance survey (SOI)</li> </ul>	No activity

### **1.3 Applicable Laws and Necessary Federal Permits, Licenses, and Entitlements**

As mentioned previously, this section summarizes federal, state, and local laws, permits, licenses, approvals, and consultation requirements necessary to implement the proposed actions, as well as who is responsible for obtaining them. These laws include the National Environmental Policy Act, Endangered Species Act, Marine Mammal Protection Act, Magnuson-Stevens Fishery Conservation and Management Act, and Coastal Zone Management Act. There is no change regarding these issues from the 2010 EA, therefore, Section 1.3 of the 2010 EA is incorporated herein by reference.

#### **1.4 Description of the Specified Activities**

Statoil acquired 16 leases in the Chukchi Sea during Lease Sale 193 held in February 2008. The leased areas are located ~240 km west of Barrow and ~160 km northwest of Wainwright, Alaska. During the open-water season of 2010, Statoil conducted a 3D seismic survey over its lease holdings and the surrounding area. The data gathered during that survey are currently being analyzed in order to determine potential well locations on the leases. These analyses will be completed prior to commencement of the site survey program. During the open-water season of 2011, Statoil proposes to conduct shallow hazards and site clearance surveys (site surveys) and soil investigations (geotechnical boreholes).

The proposed operations will be performed from two different vessels. Shallow hazards surveys will be conducted from the M/V *Duke*, while geotechnical soil investigations will be conducted from the M/V *Fugro Synergy*. Both vessels will mobilize from Dutch Harbor in late July and arrive in the Chukchi Sea to begin work on or after 1 August. Allowing for poor weather days, operations are expected to continue into late September or early October. However, if weather permits and all planned activities have not been completed, operations may continue as late as 15 November.

The site survey work on Statoil's leases will require approximately 23 days to complete. Geotechnical soil investigations on Statoil leases and on leases jointly held with ConocoPhillips Alaska Inc. (CPAI) will require approximately 14 days of operations.

##### **1.4.1 Shallow Hazards and Site Clearance Surveys**

Shallow hazards site surveys are designed to collect bathymetric and shallow sub-seafloor data that allow the evaluation of potential shallow faults, gas zones, and archeological features at prospective exploration drilling locations, as required by the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEM). Data are typically collected using multiple types of acoustic equipment.

Statoil has contracted with Gardline CGGVeritas who will use their vessel M/V *Duke* to perform the site surveys in the Chukchi Sea. Site surveys will primarily occur on Statoil leases, with some overlap onto neighboring leases or unleased acreage in order to provide uniform coverage of the area. A coarse grid of data using all acoustics sources (including the 4×10 in<sup>3</sup> airgun cluster) will be collected across the rectangular areas covering Statoil's leases as shown in Figure 1-1. More detailed data, again using all acoustics sources, will be collected using closely spaced lines at approximately five potential exploration drilling locations on Statoil's leases. In total, a maximum of 2,500 km of survey line are planned to occur on or near Statoil leases covering a total area of approximately 665 km<sup>2</sup>.

During the site surveys, Statoil proposes to use the following acoustic sources: 4×10 in<sup>3</sup> airgun cluster, single 10 in<sup>3</sup> airgun, Kongsberg SBP3000 sub-bottom profiler, GeoAcoustics 160D side-scan sonar, and a Kongsberg EM2040 multi-beam echosounder. The operating frequencies and estimated source levels of this equipment are provided below.

### **Airguns**

A 4×10 in<sup>3</sup> airgun cluster will be used to obtain geological data during the shallow hazards survey. A similar airgun cluster was measured by Shell in 2009 during shallow hazards surveys on their nearby Burger prospect (Reiser *et al.* 2010). The measurements resulted in 90th percentile propagation loss equations of  $RL = 218.0 - 17.5 \times \log(R) - 0.00061 \times R$  for a 4×10 in<sup>3</sup> airgun cluster and  $RL = 204.4 - 16.0 \times \log(R) - 0.00082 \times R$  for a single 10 in<sup>3</sup> airgun (where RL = received level and R = range). The estimated 190, 180, and 160 dB<sub>rms</sub> re 1 μPa isopleths are estimated at 39 m, 150 m, and 1,800 m from the source. The frequency spectra from the airguns are expected to be mostly below 1 kHz. More accurate isopleths at these received levels will be established prior to Statoil's shallow hazards survey (see Section 5.1.1 below).

### **Kongsberg SBP300 Sub-bottom Profiler**

This instrument will be operated from the M/V *Duke* during site survey operations. This sub-bottom profiler operates at frequencies between 2 and 7 kHz with a manufacturer specified source level of ~225 dB re 1 μPa-m. The sound energy is projected downwards from the hull in a maximum 15° cone. However, field measurements of similar instruments in previous years have resulted in much lower actual source levels (range 161 - 186 dB) than specified by the manufacturers (i.e. the manufacturer source level of one instrument was reported as 214 dB, and field measurements resulted in a source level estimate of 186.2 dB) (Reiser *et al.* 2010). Although it is not known whether these field measurements captured the narrow primary beam produced by the instruments, Statoil will measure the sounds produced by this instrument (and all other survey equipment) at the start of operations, and if sounds from the instrument are found to be above mitigation threshold levels (180 dB for cetaceans, 190 dB for seals) at a distance beyond the footprint of the vessel, then the same power-down and shut-down mitigation measures used during airgun operations will be employed during use of the sub-bottom profiler.

### **GeoAcoustics 160D Side-scan Sonar**

The side-scan sonar will be operated from the M/V *Duke* during site survey operations. This unit operates at 114 kHz and 410 kHz with a source level of ~233 dB re 1 μPa-m. The sound energy is emitted in a fan shaped pattern that is narrow (0.3–1.0°) in the fore/aft direction of the vessel and broad (40–50°) in the port/starboard direction.

### **Kongsberg EM2040 Multi-beam Echosounder**

Multi-beam echosounders also emit energy in a fan-shaped pattern, similar to the side-scan sonar described above. This unit operates at 200 to 400 kHz with a source level of ~210 dB re 1 μPa-m. The beam width is 1.5° in the fore/aft direction. The multi-beam echosounder will be operated from the M/V *Duke* during site survey operations.

## **1.4.2 Geotechnical Soil Investigations**

Geotechnical soil investigations are performed to collect detailed data on seafloor sediments and geological structure to a maximum depth of 100 m. These data are then evaluated to help determine the suitability of the site as a drilling location. Statoil has contracted with Fugro who will use the vessel M/V *Fugro Synergy* to complete the planned soil

investigations. Three to four bore holes will be collected at each of up to five prospective drilling locations on Statoil's leases and up to three boreholes may be completed at each of up to three potential drilling locations on leases jointly owned with CPAI. This would result in a maximum total of 29 bore holes to be completed as part of the geotechnical soil investigation program. The *Fugro Synergy* operates a Kongsberg EA600 Echosounder and uses a Kongsberg 500 high precision acoustic positioning (HiPAP) system for precise vessel positioning while completing the boreholes. The operating frequencies and estimated source levels of the acoustic equipment, as well as the sounds produced during soil investigation sampling, are provided in the sub-section below.

### **Kongsberg EA600 Echosounder**

This echosounder will be operated from the M/V *Fugro Synergy* routinely as a fathometer to provide depth information to the bridge crew. This model is capable of simultaneously using four transducers, each with a separate frequency. However, only two transducers will be mounted and used during this project. These transducers will operate at 18 kHz and 200 kHz and have similar or slightly lower source levels than the multi-beam echosounder described above. The energy from these transducers is emitted in a conical beam from the hull of the vessel downward to the seafloor.

### **Kongsberg HiPAP 500**

The Kongsberg high precision acoustic positioning system (HiPAP) 500 is used to aid the positioning of the M/V *Fugro Synergy* during soil investigation operations. An acoustic signal is sent and received by a transponder on the hull of the vessel and a transponder lowered to the seafloor near the borehole location. The two transponders communicate via signals with a frequency of between 21–30.5 kHz with source levels expected to be in the 200–210 dB range.

### **Geotechnical Soil Investigation Sounds**

In-water sounds produced during soil investigation operations by the M/V *Fugro Synergy* have not previously been measured, and estimates of such activities vary. Measurements of another Fugro vessel that often conducts soil investigations were made in the Gulf of Mexico in 2009. However, because measurements were taken using a towed hydrophone system, recordings of soil investigation related sounds could not be made while the vessel was stationary. Therefore, sounds recorded while the vessel was in transit were compared to sounds recorded while the vessel also operated generators and mechanical equipment associated with soil investigation operations while in transit. The difference in sound levels during transit alone and during transit with soil investigation equipment operating was negligible, and this was attributed to the fact that transit noise was dominant up to at least 7 kHz and likely masked the lower frequency sounds produced by the simulated soil investigation activities.

### **Dynamic Positioning Sound**

During soil investigation operations, the M/V *Fugro Synergy* will remain stationary relative to the seafloor by means of a dynamic positioning (DP) system that automatically controls and coordinates vessel movements using bow and/or stern thrusters, as well as the primary propeller(s). The sounds produced by soil investigation equipment are not likely to

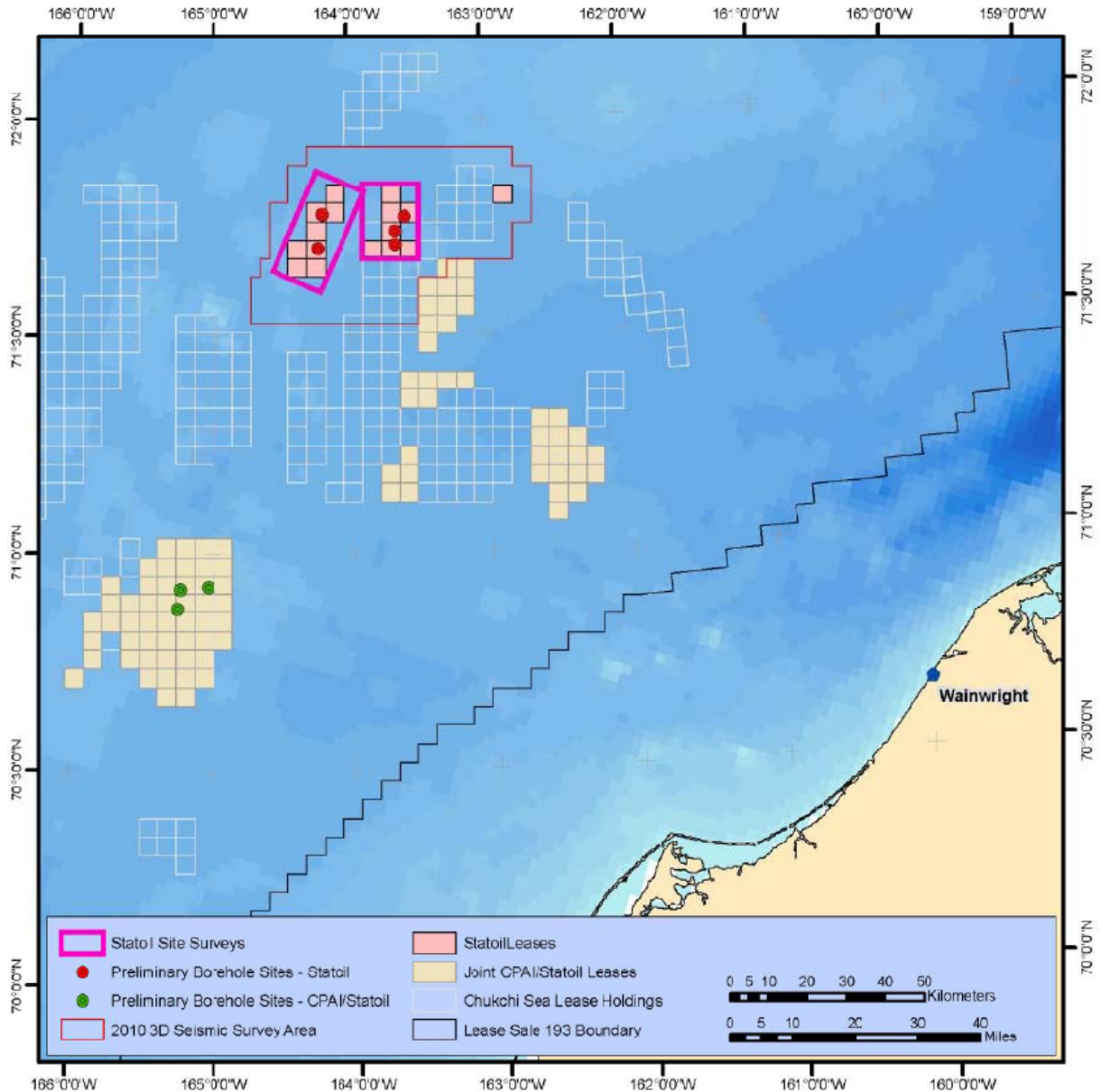
substantially increase overall source levels beyond those produced by the various thrusters while in DP mode. Measurements of a vessel in DP mode with an active bow thruster were made in the Chukchi Sea in 2010 (Chorney *et al.* 2011). The resulting source level estimate was 175.9 dB<sub>rms</sub> re 1 μPa-m. Using the transmission loss equation from measurements of a single 60 in<sup>3</sup> airgun on Statoil's lease in 2010 ( $RL = 205.6 - 13.9 \times \log(R) - 0.00093 \times R$ ; O'Neill *et al.* 2011) and replacing the constant term with the 175.9 results in an estimated range of 4.97 km to the 120 dB level. To allow for uncertainties and some additional sound energy being contributed by the operating soil investigation equipment, an inflation factor of 1.5 was applied to arrive at an estimated  $\geq 120$  dB radius of 7.5 km for soil investigation activities.

A comparison of acoustic sources between the proposed 2011 shallow hazards and geotechnical surveys and the 2010 open-water marine surveys is listed in Table 1-3.

**Table 1-3. Comparison of Acoustic Sources between Shell’s 2010 Marine Surveys and Statoil’s Proposed 2011 Shallow Hazards and Geotechnical Surveys, Matched by Their Acoustic Characteristics**

Active Acoustic Sources Used in 2010 Survey			Active Acoustic Sources Proposed to be Used in 2011 Survey		
Active Acoustic Sources	Measured Bandwidth	Measured Maximum* Source Level (dB <sub>rms</sub> re 1 μPa)	Active Acoustic Sources	Frequency	Modeled Source Level (dB <sub>rms</sub> re 1 μPa)
3×40 in <sup>3</sup> airgun array	Broadband	222	4×10 in <sup>3</sup> airgun cluster	Broadband	218
EdgeTech dual frequency AUV side-scan sonar	Only 410 kHz were used	175	Kongsberg EA600 echosounder	18 & 200 kHz downward	unknown
EdgeTech 4200-MP dual frequency towfish	120 & 400 kHz	At 120 kHz: 185 At 400 kHz: 191	GeoAcoustics 160D side-scan sonar	114 & 410 kHz	~233
Odom Echotrac CVM single beam sonar	200 – 210 kHz	151			
EdgeTech 3100 SB-216S sub-bottom profiler towfish	3.5 – 11.5 kHz	184			
EdgeTech 216 AUV sub-bottom profiler	3 – 7 kHz	168	Kongsberg SBP300 sub-bottom profiler	2 – 7 kHz	186
GeoPulse sub-bottom profiler	1.5 – 20 kHz	186			
Kongsberg EM vessel-mounted 3002 multibeam sonar	280 – 320 kHz	162			
Kongsberg EM 2000 AUV multibeam sonar	180 – 220 kHz	177			
RESON SeaBat 8101 multibeam sonar	230 – 250 kHz	201	Kongsberg EM2040 multibeam echosounder	200 – 400 kHz	~210
Kongsberg HUGIN 1000 AUV acoustic communication	21 – 23 kHz	209	Kongsberg HiPAP 500	21 – 30.5 kHz	200 – 210
Kongsberg HUGIN 1000 AUV’s Doppler velocity log	230 – 380 kHz	191			
R/V <i>Ocean Pioneer</i> DP	Broadband	176	M/V <i>Fugro Synergy</i> DP	Broadband	176
Vibracore, vibratory coring system	Broadband	187	Geotechnical soil investigation	Broadband up to 7 kHz	unknown





**Figure 1-1. Location of the planned 2011 site survey and geotechnical soil investigation activities in the Chukchi Sea, Alaska. (adopted from Statoil (2011)).**

### 1.5 Other EAs/EIS that Influence the Scope of this EA

The history of other EAs/EISs that influence the scope of NEPA analysis on oil and gas related seismic survey activities is provided in the 2010 EA and is incorporated herein by reference. The 2010 EA, which was issued in July 2010, analyzed potential environment effects that could result from NMFS' issuance of IHAs to Shell Offshore Inc. (Shell or SOI) to take marine mammals incidental to its shallow hazards and site clearance surveys in the Beaufort and Chukchi Seas and to Statoil to take marine mammals incidental to its 3D deep penetration seismic survey in the Chukchi Sea.

Separately, on February 8, 2010, NMFS published a *Federal Register* notice announcing its intent to prepare 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 activities (e.g., seismic surveys and exploratory drilling) in Federal and state waters of the U.S. Chukchi and Beaufort Seas off Alaska (75 FR 6175). BOEM and the North Slope Borough are cooperating agencies on this EIS. This EIS is anticipated to be completed in summer 2012.

## **CHAPTER 2 ALTERNATIVES INCLUDING THE PROPOSED ACTION**

The NEPA implementing regulations (40 CFR § 1502.14) and NAO 216-6 provide guidance on the consideration of alternatives to a federal proposed action and require rigorous exploration and objective evaluation of all reasonable alternatives. Alternatives must be consistent with the purpose and need of the action and be feasible. Since the activities to be analyzed in 2011 are within the scope of those in the 2010 EA, the description of the alternatives for the 2010 EA are incorporated herein by reference. Section 2.4 of the 2010 EA discussed alternatives considered but eliminated from further consideration. That section is incorporated herein by reference. A list of the alternatives is provided below.

### **2.1 Alternative 1—No Action Alternative**

Under the No Action Alternative, NMFS would not issue an IHA to Statoil for the harassment of marine mammals incidental to conducting an open-water shallow hazards survey in the Chukchi Sea during 2011.

### **2.2 Alternative 2—Issuance of an IHA with Required Mitigation, Monitoring, and Reporting Measures (Preferred Alternative)**

Under this alternative, NMFS would issue an IHA under section 101(a)(5)(D) of the MMPA to Statoil, allowing the take by Level B harassment of small numbers of marine mammal species incidental to conducting a shallow hazards survey in the Chukchi Sea during the 2011 Arctic open-water season. In order to reduce the incidental harassment of marine mammals to the lowest level practicable, Statoil would be required to implement the mitigation, monitoring, and reporting measures described in Chapters 5 and 6 of this EA.

### **2.3 Alternative 3—Issuance of an IHA with Additional Mitigation and Monitoring Measures**

Under Alternative 3, NMFS would issue an IHA under section 101(a)(5)(D) of the MMPA to Statoil, allowing the incidental take by Level B harassment only of small numbers of marine mammal species incidental to conducting a shallow hazards survey in the Chukchi Sea during the 2011 Arctic open-water season. While all of the mitigation, monitoring, and reporting measures that would be required under Alternative 2 would also be required under Alternative 3, the difference under this alternative is that additional mitigation and monitoring measures would be required. Additional measures that would be required by NMFS under this alternative include: a 120-dB monitoring (and safety) zone for bowhead whale cow/calf pairs in the Chukchi Sea, near real-time passive acoustic monitoring (PAM), active acoustic monitoring (AAM), and the use of unmanned aerial vehicles to conduct aerial monitoring. At this time, these technologies are still being developed or refined. For example, while there has been some testing of unmanned aerial vehicles conducted recently, the technology has not yet been proven effective for monitoring or mitigation as would be required under an IHA. Additionally, the existing PAM devices have not been proven effective for implementing mitigation measures that would be required in an IHA. However, once the monitoring technologies are either developed or refined, requiring the implementation of these measures (e.g., PAM) would allow for increased effectiveness in implementing mitigation measures (e.g., shutdown), which would reduce potential impacts to marine mammals even further.

## CHAPTER 3 AFFECTED ENVIRONMENT

The physical, biological, and socioeconomic environment of the Chukchi Sea, including its geology and oceanography, air quality, acoustic environment from natural and anthropogenic sounds, marine organisms at different trophic levels, fish/fishery resources and EFH, marine birds, marine mammals, community setting and regional economy, subsistence use of natural resources, culture and traditional knowledge, and coastal and marine use by industry, military, and fisheries, is described in detail in the 2010 EA (NMFS 2010), therefore, this information is incorporated herein by reference.

The Chukchi Sea environment is covered by the arctic ice pack 7–10 months each year, but supports a diverse biological ecosystem driven primarily by the seasonal presence of sea ice. The ice pack shapes the habitat for many of the biological organisms, from the primary productivity of the plankton communities to the migration patterns of the bowhead whale. The Arctic Ocean sea ice conditions are influenced by weather, wind, ocean currents, and extreme daylight conditions. The sociocultural settings of the Chukchi Sea communities are closely intertwined with the biological resources and the ice conditions of the Arctic Ocean.

For purposes of this analysis, updated information is available on one marine mammal species, the narwhal (*Monodon monoceros*), that has the potential to occur in the action area and that was not analyzed in the 2010 EA. In addition, updates are provided for ringed (*Phoca hispida*) and bearded seals (*Erignathus barbatus*), Pacific walrus (*Odobenus rosmarus divergens*), and polar bear (*Ursus maritimus*) on the development of the proposed ESA-listing of these species and critical habitat designation.

### **Narwhal**

***Distribution:*** Narwhal is a panarctic species and is mostly found within the Arctic Circle. However, its main distribution is from the central Canadian Arctic (Peel Sound and northern Hudson Bay) eastward to Greenland and to the eastern Russian Arctic. They are rarely seen in the far eastern Russian Arctic, Alaska, or the western Canadian Arctic (Jefferson *et al.* 2008).

***Life History:*** The most unique feature of narwhal is its tusk possessed by male animals. The tusk is actually the left tooth located upper jaw. In females, this tooth is almost always embedded in the upper jaw bones, but in males this tooth grows out through the front of its head. Adult male narwhals can grow up to 4.8 m long (without tusk) and can reach 1,600 kg, while females typically are up to 4.2 m long and weight up to 1,000 kg.

The main diet of narwhal is composed of fish, squid, and shrimp, especially medium to large-size Arctic fish species, such as turbot, Arctic cod, and polar cod.

***Conservation Status:*** Narwhals are not listed as “depleted” under the MMPA or listed as “threatened” or “endangered” under the ESA. Due to a very low occurrence in U.S. waters, no population estimate of this species is available in the stock assessment reports.

### **Ringed Seal**

A detailed description of ringed seals is provided in the 2010 EA and is incorporated herein by reference. The following is an update regarding its ESA-listing since the preparation of the 2010 EA.

On 10 December 2010, NMFS published a proposed rule to list the Arctic, Okhotsk, Baltic, and Ladoga subspecies as threatened and the Saimaa subspecies as endangered under the ESA (75 FR 77476). The only subspecies that might occur in the action area is the Arctic subspecies. NMFS has not proposed to designate critical habitat for the Arctic ringed seal, because it is not currently determinable. A detailed comprehensive description of the distribution, life history, and abundance of ringed seals is included in the status review of the ringed seal recently published by NMFS (Kelly *et al.* 2010).

### **Bearded Seal**

A detailed description of bearded seals is provided in the 2010 EA and is incorporated herein by reference. The following is an update regarding its ESA-listing since the preparation of the 2010 EA.

In response to a petition by the Center for Biological Diversity, NMFS conducted a status review of the bearded seal, in which the Biological Review Team further delineated the subspecies found in the Pacific sector into an Okhotsk Distinct Population Segment (DPS) and a Beringia DPS. The Okhotsk DPS is found in the Sea of Okhotsk, and the Beringia DPS is found in the Bering, Chukchi, and Beaufort Seas, and is therefore, the DPS of interest for this action. NMFS subsequently promulgated a proposed rule to list the Beringia DPS and the Okhotsk DPS of bearded seals as threatened throughout their ranges under the ESA on December 10, 2010 (75 FR 77496). Listing of the Atlantic sector subspecies was determined to be unwarranted. NMFS has not proposed to designate critical habitat for either the Beringia DPS or the Okhotsk DPS of bearded seals because it is not currently determinable. A detailed comprehensive description of the distribution, life history, and abundance of bearded seals is included in the status review of the bearded seal recently published by NMFS (Cameron *et al.* 2010).

### **Pacific Walrus**

A detailed description of Pacific walrus is provided in the 2010 EA and is incorporated herein by reference. The following is an update regarding its ESA-listing since the preparation of the 2010 EA.

On September 10, 2009, the U.S. Fish and Wildlife Service (USFWS) announced a finding on a petition submitted by the Center for Biological Diversity to list the Pacific walrus as threatened or endangered under the ESA and to designate critical habitat. The USFWS found that the petition presented scientific information indicating that listing a subspecies may be warranted. On February 8, 2011, the USFWS designated the Pacific walrus as a candidate for ESA protection (76 FR 7634). The 12-month finding indicated that, while the Pacific walrus warrants protection under the ESA, there are higher priority species that need to be addressed prior to the walrus. The walrus' status will be reviewed

annually, and a proposed rule to protect the species under the ESA will be developed in the future.

**Polar Bear**

A detailed description of polar bear is provided in the 2010 EA and is incorporated herein by reference. The following is an update regarding its critical habitat designation since the preparation of the 2010 EA.

On May 15, 2008, the USFWS listed polar bear as a threatened species range-wide under the ESA (73 FR 28212; May 15, 2008). Critical habitat for polar bears was designated by the USFWS on December 7, 2010, and comprises approximately 484,734 km<sup>2</sup> (187,157 mi<sup>2</sup>) of offshore sea ice habitat and onshore/nearshore denning habitat (75 FR 76086; December 7, 2010).

## CHAPTER 4 ENVIRONMENTAL CONSEQUENCES

The effects and impacts to the aforementioned resources in the Chukchi Sea from the proposed action and alternatives are analyzed in detail in the 2010 EA. The proposed 2011 open-water shallow hazards survey in the Chukchi Sea by Statoil is expected to have the same or substantially similar environmental effects as analyzed in the 2010 EA for the shallow hazards survey by Shell in the same ocean basin.

Potential effects from the proposed shallow hazards survey are expected from noise generated from various sound sources including airgun arrays. The sounds produced by the airgun arrays are likely to cause behavioral harassment of marine mammals in the action areas, while some marine mammals may avoid the area of ensonification or with survey activities altogether. Additionally, masking of natural sounds may occur. Auditory impacts (i.e., temporary and permanent threshold shifts) could also occur if no mitigation or monitoring measures are implemented. Monitoring of safety zones for the presence of marine mammals allows for the implementation of mitigation measures, such as power-downs and shutdowns of the airguns when marine mammals occur within these zones. These measures are required to avoid the onset of shifts in hearing thresholds. However, if a marine mammal occurs within these high energy ensonified zones, it is possible that hearing impairments to marine mammals could occur. Additionally, although unlikely, based on its proximity to the airgun array and the small size of the airgun array used in the shallow hazards survey, permanent threshold shift (PTS) could also occur, but this possibility is thought to be unlikely if the exposure is of a few pulses.

There are no changes in the environmental consequences, therefore, this section of the 2010 EA is incorporated herein by reference. This SEA updates the estimation of takes and cumulative effects sections contained in Chapter 4 of the 2010 EA.

### 4.1 Estimation of Takes

For purposes of evaluating the potential significance of the takes by harassment, estimations of the number of potential takes are discussed in terms of the populations present. The specific number of takes considered for the authorizations is developed via the MMPA process, and the analysis in this EA provides a summary of the anticipated numbers that would be authorized to give a relative sense of the nature of impact of the proposed actions. The methods to estimate take by harassment and present estimates of the numbers of marine mammals that might be affected during Statoil's proposed shallow hazards survey are described in detail in Statoil's IHA application and the proposed IHA, which was published in the *Federal Register* on May 24, 2011 (76 FR 30110). Specifically, the average estimate of "take" for each species was calculated by multiplying the expected average species densities by the area of ensonification for the 160 dB<sub>rms</sub> re 1 μPa for impulse sounds and 120 dB<sub>rms</sub> re 1 μPa for non-impulse sounds in the survey region, time period, and habitat zone to which that density applies.

The marine mammal species under NMFS jurisdiction that could be taken by harassment incidental to Statoil's proposed shallow hazards survey in the Chukchi Sea during the 2011 Arctic open-water season are: beluga whale, killer whale, harbor porpoise, bowhead whale, gray whale, humpback whale, fin whale, minke whale, narwhal, bearded seal, ribbon seal, ringed seal, and spotted seal. Takes are most likely to result from noise propagation during the use of airguns. All anticipated takes would be by Level B harassment, involving temporary changes in

behavior. The required mitigation and monitoring measures that are discussed in detail in the *Federal Register* notice for the proposed IHA (76 FR 30110; May 24, 2011) are expected to prevent the possibility of TTS (Level B) or injurious takes (Level A).

It is estimated that approximately 4 beluga whales, 5 killer whales, 2 harbor porpoise, 26 bowhead whales, 44 gray whales, 5 humpback whales, 5 fin whales, 5 minke whales, 28 bearded seals, 2 ribbon seals, 803 ringed seals, and 17 spotted seals would be taken by Level B harassment incidental to the proposed shallow hazards survey that would be conducted by Statoil. These take numbers represent 0.11% of the Eastern Chukchi Sea stock of beluga whales, 1.59% of the Aleutian Island and Bering Sea transient stock of killer whales, 0.004% of the Bering Sea stock of harbor porpoise, 0.18% of the Bering-Chukchi-Beaufort stock of bowhead whales, 0.25% of the Eastern North Pacific stock of gray whales, 0.09% of the North Pacific stock of fin whales, 0.53% of the Western North Pacific stock of humpback whales, 0.50% of the Alaska stock of minke whales, and 0.01, 0.001%, 0.35%, and 0.03% of the Alaska stocks of bearded, ribbon, ringed, and spotted seals, respectively. In addition, up to 5 narwhals could also be taken by Level B harassment if they occur in the vicinity of the project area. No population estimates of narwhal are available in U.S. waters due to its extralimital distribution here. The world population of narwhal is estimated at 75,000 (Laidre *et al.* 2008), and most of them are concentrated in the fjords and inlets of Northern Canada and western Greenland. The estimated take of 5 narwhals represents approximately 0.01% of its population (Table 4-1).

**Table 4-1. Numbers of marine mammals estimated to be taken incidental to the proposed 2011 shallow hazards survey in the Chukchi Sea.**

Species / Stocks	Take Estimates	
	no.	%
<i>Beluga whale / Eastern Chukchi Sea</i>	4	0.11
<i>Killer whale / Aleutian Island &amp; Bering Sea transient</i>	5	1.59
<i>Harbor porpoise / Bering Sea</i>	2	0.004
<i>Bowhead whale / Bering-Chukchi-Beaufort Sea</i>	26	0.18
<i>Gray whale / Eastern North Pacific</i>	44	0.25
<i>Humpback whale / Western North Pacific</i>	5	0.53
<i>Fin whale / North Pacific</i>	5	0.09
<i>Minke whale / Alaska</i>	5	0.50
<i>Narwhal</i>	5	0.01
<i>Bearded seal / Alaska</i>	28	0.01
<i>Ribbon seal / Alaska</i>	2	0.001
<i>Ringed seal / Alaska</i>	803	0.35
<i>Spotted seal / Alaska</i>	17	0.03

## 4.2 Cumulative Effects

Cumulative effect is defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions” (40 CFR §1508.7). Cumulative impacts may occur when there is a relationship between a proposed action and other actions expected to occur in a similar location or during a similar time period, or when past or future actions may result in impacts that would additively or synergistically affect a resource of concern. These relationships may or may not be obvious.



Actions overlapping within close proximity to the proposed action can reasonably be expected to have more potential for cumulative effects on “shared resources” than actions that may be geographically separated. Similarly, actions that coincide temporally will tend to offer a higher potential for cumulative effects.

Cumulative effects in the action area are essentially the same regarding past commercial whaling, subsistence hunting, regional shipping, and climate change as those that were analyzed in the 2010 EA, therefore, information from the 2010 EA is incorporated herein by reference. These include seismic survey activities, vessel and air traffic, oil and gas exploration and development in Federal and state waters, subsistence harvest activities, military activities, industrial development, community development, and climate change.

Although the levels of marine and seismic surveys related to oil and gas exploration have been stable in the past few years in the Arctic region, exploratory drilling for oil and gas has been proposed by Shell. However, given the growing interest of oil and gas companies to explore and develop oil and gas resources on the Arctic Ocean Outer Continental Shelf (OCS), there is the potential that seismic surveys will continue in the Chukchi and Beaufort Seas into the near future and be dependent on: (1) the amount of data that are collected in 2011; and (2) what the data indicate about the subsurface geology. NMFS anticipates that future marine and seismic surveys will continue as the demands on oil and gas are expected to grow worldwide. An update of these activities is provided below.

## **4.2.1 Geophysical Survey and Oil and Gas Development**

### **4.2.1.1 Marine and Seismic Surveys**

BOEM-permitted seismic surveys have been conducted in the Federal waters of the Chukchi and Beaufort Seas since the late 1960’s/early 1970’s (MMS 2007a). Over this period, more BOEM-permitted seismic activity has occurred in the Beaufort Sea OCS than in the Chukchi Sea OCS (MMS 2007a).

For activities since those described in the 2010 EA, NMFS issued IHAs to Shell and Statoil to take marine mammals by Level B harassment incidental to conducting marine and seismic surveys in the Beaufort and Chukchi Seas during the 2010 open-water season (Shell’s marine survey: 75 FR 49710; August 13, 2010; Statoil’s 3D seismic survey: 75 FR 49760; August 13, 2010). NMFS also issued an IHA to the U.S. Geological Survey (USGS) to take marine mammals incidental to its marine geophysical (seismic reflection/refraction) and bathymetric survey in the Arctic Ocean from September through October 2010 (75 FR 60174; September 29, 2010). In addition, ION Geophysical (ION) applied for an IHA to take marine mammals incidental to its icebreaking seismic survey in the Alaskan Beaufort Sea extending from the U.S.-Canadian border in the east to Point Barrow in the west (ION 2010) between October and December 2010. However, ION eventually withdrew its application due to the break-down of its seismic source vessel.

In January 2011, ION submitted an IHA application to take marine mammals incidental to its proposed icebreaking 2D seismic survey during October through

December 2011. The proposed seismic operations are virtually the same as ION proposed last year (ION 2011) and are described in detail in the 2010 EA (NMFS 2010). However, ION eventually withdrew its application for the 2011 season due to concerns about traversing the Northwest Passage. ION intends to attempt this survey during the 2012 open-water season.

In addition to marine and seismic surveys operated by the oil and gas industry, academia, research institutions, and government agencies also conduct geophysical surveys using airguns to study ocean bottom sediments and geological structure. The University of Alaska Geophysics Institute (UAGI) is planning to conduct a seismic survey in the Arctic Ocean from the R/V *Marcus G. Langseth* (*Langseth*). The survey will occur in International Waters and within the U.S. Exclusive Economic Zone (EEZ), encompassing the area 72.5–77°N, 160–175°W. The project is scheduled to occur approximately September 5 – October 9, 2011. The proposed survey will include collection of seismic reflection data across the transition from the Chukchi Shelf to the Chukchi Borderland to define the apparent change in structure between two large continental blocks.

The source vessel, the R/V *Langseth*, will deploy an array of 10 airguns as an energy source at a tow depth of 6 m. The receiving system will consist of a 2-km long hydrophone streamer. As the airgun array is towed along the survey lines, the hydrophone streamer will receive the returning acoustic signals and transfer the data to the on-board processing system. In addition, at least 72 sonobuoys will be deployed in order to record seismic refraction data. The program will consist of a total of ~5,502 km of survey lines, not including transits to and from the survey area when airguns will not be in use. Water depths within the study area range from ~30 – 3,800 m. Just over half of the survey effort (55%) will occur in water 100 – 1,000 m deep, 32% will take place in water >1,000 m deep, and 13% will occur in water depths <100 m. There will be additional seismic operations in the survey area associated with turns, airgun testing, and repeat coverage of any areas where initial data quality is sub-standard. In addition to the operations of the airgun array, a multibeam echosounder and a sub-bottom profiler will also be operated from the *Langseth* continuously throughout the cruise. A 75-kHz acoustic doppler current profiler may also be used.

UAGI submitted an IHA application to take marine mammals by Level B harassment in March 2011, and NMFS is currently reviewing its proposed activities.

UAGI's survey is the only marine seismic activity besides Statoil's operation that would occur in the U.S. Arctic in 2011. This level of activity is within the scope analyzed in the 2010 EA, therefore, the analysis in the 2010 EA is incorporated herein by reference.

#### **4.2.1.2 Oil and Gas Development and Production**

Oil and gas exploration and production activities have occurred on the North Slope since the early 1900's, and production has occurred for more than 50 years. Since the

discovery and development of the Prudhoe Bay and Kuparuk oil field, more recent fields generally have been developed not in the nearshore environment, but on land in areas adjacent to existing producing areas. Pioneer Natural Resources Co. is developing its North Slope Oooguruk field, which is in the shallow waters of the Beaufort Sea approximately 13 km northwest of the Kuparuk River unit.

BP Exploration Alaska Inc. (BP) is currently producing oil from an offshore development in the Northstar Unit, which is located between 3.2 and 12.9 km offshore from Point Storkersen in the Beaufort Sea. This development is the first in the Beaufort Sea that makes use of a subsea pipeline to transport oil to shore and then into the Trans-Alaska Pipeline System. The Northstar facility was built in State of Alaska waters on the remnants of Seal Island ~9.5 km offshore from Point Storkersen, northwest of the Prudhoe Bay industrial complex, and 5 km seaward of the closest barrier island. The unit is adjacent to Prudhoe Bay, and is approximately 87 km northeast of Nuiqsut, an Inupiat community. To date, it is the only offshore oil production facility north of the barrier islands in the Beaufort Sea.

On November 6, 2009, NMFS received an application from BP requesting authorization for the take of six marine mammal species incidental to operation of the Northstar development in the Beaufort Sea, AK, over the course of 5 years, which would necessitate the promulgation of new five-year regulations (BP 2009). Construction of Northstar was completed in 2001. The proposed activities for 2011 – 2016 include a continuation of drilling, production, and emergency training operations but no construction or activities of similar intensity to those conducted between 1999 and 2001 (75 FR 12734; March 17, 2010) (MMS 1996). On July 6, 2011, NMFS published proposed regulations regarding the take of marine mammals incidental to operation of the Northstar facility (76 FR 39706).

In addition, Shell plans to conduct two offshore exploration drilling programs, each on OCS leases in the Beaufort and Chukchi Seas, in the summer 2012. Shell submitted its IHA applications to NMFS in May 2011, which are currently being reviewed. Other companies have expressed interest in conducting offshore exploration drilling programs in the Chukchi Sea beginning in either 2013 or 2014.

Based on the analyses provided in the 2010 EA and in this section of the SEA, NMFS believes that the proposed Statoil shallow hazards survey in the Chukchi Sea during the 2011 open water season would not be expected to substantially contribute to overall adverse cumulative effects on marine mammals from past, present, and future activities. The potential impacts to marine mammals and their habitat are expected to be minimal based on the limited noise footprint and the short duration of the proposed projects. In addition, mitigation and monitoring measures described in Chapter 5 are expected to further reduce any potential adverse effects.

## **CHAPTER 5 MITIGATION MEASURES**

As required under the MMPA, NMFS considered mitigation to effect the least practicable impact on marine mammals and has developed a series of mitigation measures, as well as monitoring and reporting procedures (Chapter 6), that would be required under the IHA (if issued) for the proposed open-water shallow hazards survey described earlier in this SEA. Mitigation measures have been proposed by Statoil for its 2011 open-water shallow hazards survey. Additional measures have also been considered by NMFS pursuant to its authority under the MMPA to ensure that the proposed activities will result in the least practicable impact on marine mammal species or stocks in the Chukchi Sea. The mitigation requirements contained in the MMPA IHA will help to ensure that takings are of small numbers, potential impacts to marine mammals will be negligible, and that there will be no unmitigable adverse impacts to subsistence uses of the affected species or stocks. If issued, all mitigation measures contained in the IHA must be followed.

### **5.1 Standard Mitigation Measures for Statoil's Operations**

As part of the application, Statoil submitted to NMFS a Marine Mammal Monitoring and Mitigation Plan (4MP) for its shallow hazards survey in the Chukchi Sea during the 2011 open-water season. The objectives of the 4MP are: (1) to ensure that disturbance to marine mammals and subsistence hunts is minimized and all permit stipulations are followed, (2) to document the effects of the proposed survey activities on marine mammals, and (3) to collect baseline data on the occurrence and distribution of marine mammals in the study area.

The potential disturbance of cetaceans and pinnipeds during survey operations will be minimized further through the implementation of several ship-based mitigation measures, which include establishing and monitoring safety and disturbance zones, speed and course alterations, ramp-up (or soft start), power-down, and shutdown procedures, and provisions for poor visibility conditions.

Additional mitigation measures were required by NMFS based on NMFS review and analyses to address some uncertainties regarding the impacts to aggregations of whales from the proposed activities.

The following discussion provides details of the mitigation measures associated with the Preferred Alternative:

#### **5.1.1 Sound Source Measurements**

Before conducting the survey, Statoil shall conduct sound source verification (SSV) tests to verify the radii of the safety and monitoring zones within real-time conditions in the field. This provides for more accurate radii rather than relying on modeling techniques before entering the field. When moving a shallow hazards survey operation into a new area, the operators shall re-verify the new radii of the exclusion zones. The purpose of this mitigation measure is to establish and monitor more accurate safety zones based on empirical measurements, as compared to the zones based on modeling and extrapolation from different datasets.

The configurations for the SSV tests will include at least the full array and the operation of a single source that will be used during power downs, as well as all active sonar equipment that will be used in the survey. The measurements of energy source array sounds will be made at the beginning of the survey and the distances to the various radii will be reported as soon as possible after recovery of the equipment. The primary radii of concern will be the 190 and 180 dB safety radii for pinnipeds and cetaceans, respectively, and the 160 dB disturbance radii. In addition to reporting the radii of specific regulatory concern, nominal distances to other sound isopleths down to 120 dB re 1  $\mu$ Pa (rms) will be reported in increments of 10 dB.

Data will be previewed in the field immediately after download from the ocean bottom hydrophone (OBH) instruments. An initial sound source analysis will be supplied to NMFS and the airgun operators within 120 hours of completion of the measurements, if possible. The report will indicate the distances to sound levels between 190 dB re 1  $\mu$ Pa (rms) and 120 dB re 1  $\mu$ Pa (rms) based on fits of empirical transmission loss formulae to data in the endfire and broadside directions. The 120-hour report findings will be based on analysis of measurements from at least three of the OBH systems. More detailed reports including analysis of data from all OBH systems will be issued to NMFS as part of the 90-day reports following completion of the marine and seismic survey programs.

The output of the above data processing steps includes listings and graphs of airgun array and sonar equipment narrow band and broadband sound levels versus range, and spectrograms of shot waveforms at specified ranges. Of particular importance are the graphs of level versus range that are used to compute representative radii to specific sound level thresholds. Contractors shall also pay attention to potential low-frequency side-lobes from the high frequency sonar equipment.

### **5.1.2 Establishing Exclusion and Disturbance Zones**

Under current NMFS guidelines, exclusion zones for marine mammal exposure to impulse sources are customarily defined as the distances within which received sound levels are  $\geq 180$  dB re 1  $\mu$ Pa (rms) for cetaceans and  $\geq 190$  dB re 1  $\mu$ Pa (rms) for pinnipeds. These criteria are based on an assumption that SPL received at levels lower than these will not injure these animals or impair their hearing abilities, but that SPL received at higher levels might have some such effects. Disturbance or behavioral effects to marine mammals from underwater sound may occur after exposure to sound at distances greater than the safety radii (Richardson *et al.* 1995). Initial radii for the sound levels produced by the survey activities have been modeled. These radii will be used for mitigation purposes until results of direct measurements are available early during the exploration activities.

The proposed surveys will use an airgun source composed of four 10-in<sup>3</sup> airguns (total discharge volume of 40 in<sup>3</sup>) and a single 10 in<sup>3</sup> airgun. Underwater sound propagation from a similar 4 $\times$ 10-in<sup>3</sup> airgun cluster and single 10 in<sup>3</sup> was measured in 2009 (Reiser *et al.* 2010). Those measurements resulted in 90th percentile propagation loss equations of  $RL = 218.0 - 17.5\text{Log}R - 0.00061R$  for the 4 $\times$ 10 in<sup>3</sup> airgun cluster and  $RL = 204.4 - 16.0\text{Log}R - 0.00082R$  for the single 10 in<sup>3</sup> airgun (where RL = received level and R = range). The estimated distances for the proposed 2011 activities are based on a 25% increase over 2009 results.

The modeled distances to 190, 180, 160, and 120 dB isopleths are 50 m, 190 m, 2,250 m, and 39,000 m from the source, respectively.

In addition to the site surveys, Statoil plans to use a dedicated vessel to conduct geotechnical soil investigations. Sounds produced by the vessel and soil investigation equipment are not expected to be above 180 dB (rms). Therefore, mitigation related to acoustic impacts from these activities is not expected to be necessary.

An acoustics contractor will perform direct measurements of the received levels of underwater sound versus distance and direction from the airguns and soil investigation vessel using calibrated hydrophones. The acoustic data will be analyzed as quickly as reasonably practicable in the field and used to verify and adjust the safety distances. The field report will be made available to NMFS and the protected species observers (PSOs) within 120 hrs of completing the measurements.

### **5.1.3 Monitoring Exclusion and Disturbance Zones**

Trained PSOs will be hired to monitor the area around the survey for the presence of marine mammals to maintain marine mammal-free exclusion zones and monitor for avoidance or take behaviors. Visual observers monitor the exclusion zones to ensure that marine mammals do not enter these zones for at least 30 minutes prior to ramp up, during active data acquisition, or before resuming use of the airguns after a shutdown. During night-time or poor visibility conditions, PSOs will be provided with infra-red or night-vision binoculars. The purpose of this mitigation measure is to ensure that no marine mammal is present within the exclusion zone during the seismic activities, thus preventing the onset of TTS.

Although a power-down or shutdown of the airguns is not required if a marine mammal is sighted within the 160-dB radius (except for aggregations of 12 or more bowhead or gray whales), PSOs will also monitor this radius to note how many animals are taken by Level B harassment and to record any observed behaviors of the animals during airgun operations.

Detailed protocols for marine mammal monitoring are discussed in Chapter 6.

### **5.1.4 Power-downs and Shutdowns**

A power-down is the immediate reduction in the number of operating energy sources from all firing to some smaller number. A shutdown is the immediate cessation of firing of all energy sources. The arrays will be immediately powered down whenever a marine mammal is sighted approaching close to or within the applicable exclusion zone of the full arrays but is outside or about to enter the applicable exclusion zone of the single mitigation source. If a marine mammal is sighted within the applicable exclusion zone of the single mitigation airgun, the entire array will be shut down (i.e., no sources firing). Although PSOs will be located on the bridge ahead of the center of the airgun array, the shutdown criterion for animals ahead of the vessel will be based on the distance from the bridge (vantage point for PSOs) rather than from the airgun array—a precautionary approach. For marine mammals sighted alongside or behind the airgun array, the distance is measured from the array.

Following a power-down or shutdown, operation of the airgun array will not resume until the marine mammal has cleared the applicable exclusion zone. The animal will be considered to have cleared the exclusion zone if it:

- Is visually observed to have left the exclusion zone;
- Has not been seen within the zone for 15 min in the case of small odontocetes and pinnipeds; or
- Has not been seen within the zone for 30 min in the case of mysticetes.

### **5.1.5 Emergency Shutdown**

In the unanticipated event that an injured or dead marine mammal is sighted within an area where the airguns were deployed and utilized within the past 24 hours, the array must be shutdown immediately. Activities may resume after the lead PSO (to the best of his or her abilities) determines how long the animal has been dead and in the case of an injury if that injury resulted from something other than airgun operations (e.g., gunshot wound, polar bear attack). After written certification and supporting documentation (e.g., photographs or other evidence to support the certification) by the lead PSO, operations may resume. Within 24 hours after the event specified herein, operators must notify NMFS and provide NMFS with the written certification and supporting documents.

However, in the event that the cause of the injury or death cannot be immediately determined by the lead PSO, the incident must be reported immediately to either the NMFS OPR or the NMFS AKRO. The seismic airgun array shall not be restarted until NMFS is able to review the circumstances of the take, make determinations as to whether modifications to the activities are appropriate and necessary, and has notified Statoil that activities may be resumed.

In all cases, operators must call the Alaska Region Marine Mammal Stranding Hotline no later than 24 hours after sighting a stranded marine mammal.

### **5.1.6 Ramp Ups**

A ramp up of an airgun array provides a gradual increase in sound levels, and involves a stepwise increase in the number and total volume of airguns firing until the full volume is achieved.

The purpose of a ramp up (or “soft start”) is to “warn” cetaceans and pinnipeds in the vicinity of the airguns and to provide the time for them to leave the area and thus avoid any potential injury or impairment of their hearing abilities.

During Statoil’s proposed shallow hazards survey program, the seismic operator will ramp up the airgun arrays slowly. Full ramp ups (i.e., from a cold start after a shut down, when no airguns have been firing) will begin by firing a single airgun in the array. The minimum duration of a shut-down period, i.e., without air guns firing, which must be followed by a ramp up typically is the amount of time it would take the source vessel to cover the 180-dB

exclusion radius. The actual time period depends on ship speed and the size of the 180-dB exclusion radius. That period is estimated to be about 1 - 2 minutes based on the modeling results described above and a survey speed of 4 knots.

A full ramp up, after a shut down, will not begin until there has been a minimum of 30 min of observation of the exclusion zone by PSOs to assure that no marine mammals are present. The entire exclusion zone must be visible during the 30-minute lead-in to a full ramp up. If the entire exclusion zone is not visible (due to darkness, fog, or other low visibility conditions), then ramp up from a cold start cannot begin. If a marine mammal(s) is sighted within the exclusion zone during the 30-minute watch prior to ramp up, ramp up will be delayed until the marine mammal(s) is sighted outside of the exclusion zone or the animal(s) is not sighted for at least 15 - 30 minutes: 15 minutes for small odontocetes and pinnipeds, or 30 minutes for baleen whales and large odontocetes.

During turns and transit between seismic transects, at least one airgun will remain operational. The ramp-up procedure still will be followed when increasing the source levels from one airgun to the full arrays. However, keeping one airgun firing will avoid the prohibition of a cold start during darkness or other periods of poor visibility. Through use of this approach, seismic operations can resume upon entry to a new transect without a full ramp up and the associated 30-minute lead-in observations. PSOs will be on duty whenever the airguns are firing during daylight, and during the 30-min periods prior to ramp-ups as well as during ramp-ups. Daylight will occur for 24 h/day until mid-August, so until that date PSOs will automatically be observing during the 30-minute period preceding a ramp up. Later in the season, PSOs will be called out at night to observe prior to and during any ramp up. The seismic operator and PSOs will maintain records of the times when ramp-ups start, and when the airgun arrays reach full power.

#### **5.1.7 Speed and Course Alterations**

If a marine mammal (in water) is detected outside the exclusion radius and, based on its position and the relative motion, is likely to enter the exclusion radius, the vessel's speed and/or direct course would be changed in a manner that does not compromise safety requirements. The animal's activities and movements relative to the source vessel will be closely monitored to ensure that the individual does not approach within the exclusion radius. If the mammal is sighted approaching near or close to the applicable exclusion radius, further mitigative actions will be taken, i.e., either further course alterations or power-down or shutdown of the airgun(s). The purpose of this mitigation measure is to prevent marine mammals from entering the applicable exclusion zones.

#### **5.1.8 Vessel Speed**

All vessels should reduce speed when within 300 yards (274 m) of whales, and those vessels capable of steering around such groups should do so. Vessels may not be operated in such a way as to separate members of a group of whales from other members of the group.

Vessels shall avoid multiple changes in direction and speed when within 300 yards (274 m) of whales.



When weather conditions require, such as when visibility drops, support vessels must adjust speed accordingly to avoid the likelihood of injury to whales.

## **5.2 Mitigation Measures Concerning Whale Aggregations**

Besides the standard mitigation measures discussed above, the following additional protective measures are required to address some uncertainties regarding the impacts to aggregations of whales from the proposed open water marine and seismic surveys.

A 160-dB vessel monitoring zone for bowhead and gray whales will be established and monitored in the Chukchi Sea during all shallow hazards surveys. Whenever an aggregation of bowhead whales or gray whales (12 or more whales of any age/sex class that appear to be engaged in a nonmigratory, significant biological behavior (e.g., feeding, socializing)) are observed during an aerial or vessel monitoring program within the 160-dB safety zone around the seismic activity, the seismic operation will not commence or will shut down, until two consecutive surveys (aerial or vessel) indicate they are no longer present within the 160-dB safety zone of seismic-surveying operations.

Survey information, especially information about bowhead whale cow-calf pairs or feeding bowhead or gray whales, shall be provided to NMFS as required in MMPA authorizations, and will form the basis for NMFS determining whether additional mitigation measures, if any, will be required over a given time period.

## **5.3 Subsistence Mitigation Measures**

The following subsistence mitigation measures, plans, and programs are aimed to mitigate any adverse effects that could potentially affect subsistence groups and communities. These measures, plans, and programs have been effective in past seasons of work in the Arctic and were developed in past consultations with these communities. These measures, plans, and programs will be implemented by Statoil during its 2011 shallow hazards survey in the Chukchi Sea to monitor and mitigate potential impacts to subsistence users and resources.

In addition, regulations at 50 CFR 216.104(a)(12) require IHA applicants for activities that take place in Arctic waters to provide a Plan of Cooperation (POC) or information that identifies what measures have been taken and/or will be taken to minimize adverse effects on the availability of marine mammals for subsistence purposes. The POC developed by Statoil is also discussed in the following subsection.

Statoil will not be entering the Chukchi Sea until early August, so there will be no potential conflict with spring bowhead whale or beluga subsistence whaling in the polynya zone. Statoil's planned activities area is ~100 mi (~ 161 km) northwest of Wainwright which reduces the potential impact to subsistence hunting activities occurring along the Chukchi Sea coast.

The communication center in Wainwright will be jointly funded by Statoil and other operators, and Statoil will routinely call the communication center according to the established protocol while in the Chukchi Sea. Depending on survey progress, Statoil may perform a crew change in the Nome area in Alaska. The crew change will not involve the use of helicopters. Statoil does have a contingency plan for a potential transfer of a small number of crew via ship-to-shore

vessel at Wainwright. If this should become necessary, the Wainwright communications center will be contacted to determine the appropriate vessel route and timing to avoid potential conflict with subsistence users.

Prior to survey activities, Statoil will identify transit routes and timing to avoid other subsistence use areas and communicate with coastal communities before operating in or passing through these areas.

### **Plan of Cooperation**

Statoil states that it intends to maintain an open and transparent process with all stakeholders throughout the life-cycle of activities in the Chukchi Sea. Statoil began the stakeholder engagement process in 2009 with meeting Chukchi Sea community leaders at the tribal, city, and corporate level. Statoil will continue to engage with leaders, community members, and subsistence groups, as well as local, state, and federal regulatory agencies throughout the exploration and development process.

As part of stakeholder engagement, Statoil is developing a Plan of Cooperation (POC) for the proposed 2011 activities. The POC summarizes 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 promote cooperation between subsistence activities and the Statoil program.

During the early phase of the POC process for the proposed project, Statoil met with the North Slope Borough Department of Wildlife Management (Dec 2010) and the AEW (mini-convention in Barrow, Feb 2011). Statoil also arranged to visit and hold public meetings in the affected Chukchi Sea villages, including Pt. Hope, Pt. Lay, Wainwright, and Barrow during the week of 21 March, 2011.

Based upon these meetings, a draft POC document is being developed. Upon completion, the draft POC will be submitted to each of the community leaders Statoil visited during the March meetings as well as other interested community members. Statoil will also submit the draft POC to NMFS, USFWS, and BOEMRE.

A final POC that documents all consultations with community leaders, subsistence user groups, individual subsistence users, and community members will be submitted to NMFS, USFWS, and BOEMRE upon completion of consultations.

## **5.4 Mitigation Conclusions**

NMFS has carefully evaluated Statoil's proposed mitigation measures and considered a range of other measures in the context of the NEPA's requirement to discuss means to mitigate adverse environmental impacts. Our evaluation of potential measures included consideration of the following factors in relation to one another:

- the manner in which, and the degree to which, the successful implementation of the measure is expected to minimize adverse impacts to marine mammals;

- the proven or likely efficacy of the specific measure to minimize adverse impacts as planned; and
- the practicability of the measure for applicant implementation.

Based on our evaluation of the applicants' proposed measures, as well as other measures considered by NMFS, NMFS has determined, after considering the CEQ NEPA regulations, that the proposed mitigation measures under Alternative 2 (Preferred Alternative) are sufficient to minimize any potential adverse impacts to the human environment, particularly marine mammal species or stocks and their habitat.

### **5.5 Additional Mitigation Measures under Alternative 3**

As discussed in Section 2.3, additional measures that would be required by NMFS under this alternative include a 120-dB monitoring (and safety) zone for bowhead whale cow/calf pairs in Chukchi Sea. However, the estimated 120-dB isopleths for Statoil's shallow hazards survey in the Chukchi is approximately 39,000 m in radius, which renders vessel-based monitoring impossible. In addition, due to human safety and practical reasons (e.g., fewer airports can be utilized to support a survey aircraft for its survey activities and the prevalence of fog and other inclement weather in the area), aerial monitoring is not an option either. Therefore, NMFS does not consider this condition feasible, especially when considering that the bowhead population in the Chukchi Sea is low during Statoil's shallow hazards survey season. Therefore, NMFS does not believe that this additional mitigation measure under Alternative 3 would provide any added benefits.

## CHAPTER 6 MONITORING AND REPORTING REQUIREMENTS

Under both the Preferred Alternative (Alternative 2) and Alternative 3, NMFS would require Statoil to undertake the monitoring activities described in Section 6.1. The monitoring measures described in that section are standard measures that have been required of IHA holders in Arctic waters in recent years. Section 6.2 describes “emerging” monitoring technologies that Statoil would be required to use during their 2011 survey if Alternative 3 were the selected alternative. However, as will be described in further detail below, many of these monitoring technologies are infeasible at this time. The reporting requirements outlined in Section 6.3 would be implemented under the two action alternatives.

### 6.1 Monitoring Requirements

As part of its IHA application, Statoil submitted a 4MP, which consists of monitoring and mitigation for its proposed shallow hazards survey in the Chukchi Sea during the 2011 Arctic open-water season. The programs consist of monitoring and mitigation during Statoil’s various activities related to survey data acquisition, including transit and data acquisition. These programs will provide information on the numbers of marine mammals potentially affected by the marine and shallow hazards survey programs and real-time mitigation to prevent possible injury or mortality of marine mammals by sources of sound and other vessel related activities. Monitoring efforts will be initiated to collect data to address the following specific objectives: (1) improve the understanding of the distribution and abundance of marine mammals in the Chukchi Sea project areas; and (2) assess the effects of sound and vessel activities on marine mammals inhabiting the project areas and their distribution relative to the local people that depend on them for subsistence hunting. These objectives and the monitoring and mitigation goals will be addressed through the utilization of PSOs on the survey source vessel. Additional information can be found in Statoil’s IHA application and the proposed IHA, which were published in the *Federal Register* on May 24, 2011 (76 FR 30110).

The MMPA requires that the monitoring plan be independently peer reviewed “where the proposed activity may affect the availability of a species or stock for taking for subsistence uses” (16 U.S.C. 1371(a)(5)(D)(ii)(III)). Regarding this requirement, NMFS’ implementing regulations state, “Upon receipt of a complete monitoring plan, and at its discretion, [NMFS] will either submit the plan to members of a peer review panel for review or within 60 days of receipt of the proposed monitoring plan, schedule a workshop to review the plan” (50 CFR 216.108(d)). Reviewers are selected by NMFS, in consultation with the Marine Mammal Commission (Commission), Alaska Eskimo Whaling Commission (AEWC) and/or other Alaskan native organizations as appropriate, and the applicant. Selected panelists are experts who are not currently employed or contracted by either the affected Alaskan native organization or the applicant. An independent peer review of Statoil’s 2011 4MP occurred during the Open Water Meeting in Anchorage, Alaska, in early March 2011. Subsequently, the review panel provided comments to NMFS in late April 2011. NMFS considered all recommendations made by the reviewers, and based on discussions with Statoil will incorporate appropriate changes into the monitoring requirements of the IHA. The reviewers’ findings and recommendations will be published in the final IHA *Federal Register* notice of issuance or denial.

### **6.1.1 Vessel-Based Monitoring**

Vessel-based monitoring for marine mammals will be done by trained PSOs throughout the period of marine survey activities. PSOs will monitor the occurrence and behavior of marine mammals near the survey vessel during all daylight periods during operation and during most daylight periods when airgun operations are not occurring. PSO duties will include watching for and identifying marine mammals, recording their numbers, distances, and reactions to the survey operations, and documenting “take by harassment” as defined by NMFS.

#### **6.1.1.1 Protected Species Observers (PSOs)**

A sufficient number of PSOs will be required onboard the survey vessel to meet the following criteria: (1) 100% monitoring coverage during all periods of survey operations in daylight; (2) maximum of 4 consecutive hours on watch per PSO; and (3) maximum of 12 hours of watch time per day per PSO.

PSO teams will consist of Inupiat observers and experienced field biologists. An experienced field crew leader will supervise the PSO team onboard the survey vessel. The total number of PSOs may decrease later in the season as the duration of daylight decreases.

Crew leaders and most other biologists serving as observers in 2011 will be individuals with experience as observers during recent seismic or shallow hazards monitoring projects in Alaska, the Canadian Beaufort, or other offshore areas in recent years.

Observers will have previous marine mammal observation experience, and field crew leaders will be highly experienced with previous vessel-based marine mammal monitoring and mitigation projects. Resumes for those individuals will be provided to NMFS for review and acceptance of their qualifications. Inupiat observers will be experienced in the region, familiar with the marine mammals of the area, and complete a NMFS-approved observer training course designed to familiarize individuals with monitoring and data collection procedures. A marine mammal observers’ handbook, adapted for the specifics of the planned survey program, will be prepared and distributed beforehand to all PSOs.

Most observers, including Inupiat observers, will also complete a two-day training and refresher session on marine mammal monitoring, to be conducted shortly before the anticipated start of the 2011 open-water season. Any exceptions will have or receive equivalent experience or training. The training session(s) will be conducted by qualified marine mammalogists with extensive crew-leader experience during previous vessel-based seismic monitoring programs.

#### **6.1.1.2 Monitoring Methodology**

PSOs will watch for marine mammals from the best available vantage point on the survey vessel, typically the bridge. PSOs will scan systematically with the unaided eye and 7 x 50 reticle binoculars, supplemented with 20 x 60 image-stabilized Zeiss Binoculars or Fujinon 25 x 150 “Big-eye” binoculars and night-vision equipment

when needed. Personnel on the bridge will assist the PSOs in watching for marine mammals.

Information to be recorded by marine mammal observers will include the same types of information that were recorded during recent monitoring programs associated with Industry activity in the Arctic (e.g., Ireland *et al.* 2009). When a mammal sighting is made, the following information about the sighting will be recorded:

- (A) Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from the PSO, apparent reaction to activities (e.g., none, avoidance, approach, paralleling, etc.), closest point of approach, and behavioral pace;
- (B) Time, location, speed, activity of the vessel, sea state, ice cover, visibility, and sun glare; and
- (C) The positions of other vessel(s) in the vicinity of the PSO location.

The ship's position, speed of support vessels, and water temperature, water depth, sea state, ice cover, visibility, and sun glare will also be recorded at the start and end of each observation watch, every 30 minutes during a watch, and whenever there is a change in any of those variables.

#### **Monitoring At Night and In Poor Visibility**

Night-vision equipment (Generation 3 binocular image intensifiers, or equivalent units) will be available for use when/if needed. Past experience with night-vision devices (NVDs) in the Beaufort and Chukchi Seas and elsewhere has indicated that NVDs are not nearly as effective as visual observation during daylight hours (e.g., Harris *et al.* 1997, 1998; Moulton and Lawson 2002).

#### **6.1.2 Acoustic Monitoring**

Statoil, Shell, and CPAI are working on plans to once again jointly fund an extensive environmental studies program in the Chukchi Sea. This program is expected to be coordinated by Olgoonik-Fairweather LLC (OFJV) during the 2011 open water season. The environmental studies program is not part of the Statoil site survey and soil investigations program, but acoustic monitoring equipment is planned to be deployed on and near Statoil leases and will therefore collect additional data on the sounds produced by the 2011 activities. The program components include:

- Acoustics Monitoring
- Fisheries Ecology
- Benthic Ecology
- Plankton Ecology
- Marine Mammal Surveys
- Seabird Surveys, and
- Physical Oceanography.

The planned 2011 program will continue the acoustic monitoring programs carried out in 2006–2010. A similar number of acoustic recorders as deployed in past years will be distributed broadly across the Chukchi lease area and nearshore environment. In past years, clusters of recorders designed to localize marine mammal calls originating within or nearby the clusters have been deployed on each of the companies' prospects: Amundsen (Statoil), Burger (Shell), and Klondike (CPAI). This year, recorders from the clusters are planned to be relocated in a broader deployment on and around Hanna Shoal.

The recorders will be deployed in late July or mid-August and will be retrieved in early to mid-October, depending on ice conditions. The recorders will be AMAR and AURAL model acoustic buoys set to record at 16 kHz sample rate. These are the same recorder models and same sample rates that have been used for this program from 2006–2010. The broad area arrays are designed to capture both general background soundscape data, industrial sounds and marine mammal call data across the lease area. From previous deployments of these recordings we have been able to gain insight into large-scale distributions of marine mammals, identification of marine mammal species present, movement and migration patterns, and general abundance data.

## **6.2 “Emerging” Monitoring Technologies**

The information provided in this section outlines monitoring technologies and techniques that are not currently considered viable by NMFS; however, these methods may become viable, effective, and feasible in future seasons. The monitoring requirements described in this section would only be required under Alternative 3. These “emerging” monitoring technologies include:

- near real-time passive acoustic monitoring (PAM),
- active acoustic monitoring (AAM), and
- the use of unmanned aerial vehicles to conduct aerial monitoring.

Regarding the use of AAM and PAM for near real-time monitoring and the use of unmanned aerial vehicles for aerial monitoring, at this time, these technologies are still being developed or refined. NMFS does not believe that at the current stage, requiring PAM (either towed or stationary) for real-time acoustic monitoring or deploying unmanned aircraft for aerial monitoring would yield reliable data. During the 2010 open-water seismic survey, Statoil tested PAM for the presence of bowhead whales onboard a support vessel during the seismic operations, and preliminary results show that the detection rates were low (Bruce Martin, pers. comm. March 2011). As far as AAM is concerned, many technical issues (such as detection range and resolution) and unknowns (such as target strength of marine mammal species in the Arctic) remain to be resolved before it can be made a reliable monitoring tool. Environmental consequences concerning additional sound being introduced into the water column from an active sonar source also need to be addressed. Therefore, NMFS does not believe it is beneficial to adopt these “emerging” monitoring technologies at the current stage.

## **6.3 Reporting Requirements**

### **6.3.1 SSV Reports**

Reports on the preliminary results of the acoustic verification measurements, including as a minimum the measured 190-, 180-, 160-, and 120-dB re 1  $\mu$ Pa (rms) radii of airgun array, active acoustic sources, vessels used in the operation, and noise generated during geotechnical surveys, will be submitted within 120 hr after collection and analysis of those measurements at the start of the field season. These reports will specify the distances of the safety zones that were adopted for the shallow hazards survey activities that are conducted by Statoil.

### **6.3.2 Field Reports**

Statoil states that throughout the survey program, the observers will prepare a report each day or at such other interval as the IHA (if issued), or Statoil may require, summarizing the recent results of the monitoring program. The field reports will summarize the species and numbers of marine mammals sighted. These reports will be provided to NMFS and to the survey operators.

### **6.3.3 Technical Reports**

The results of Statoil's 2011 open-water shallow hazards survey monitoring programs (i.e., vessel-based and acoustic), including estimates of "take" by harassment, will be presented in the "90-day" and Final Technical Reports. These Technical Reports will include:

- (a) summaries of monitoring effort (e.g., total hours, total distances, and marine mammal distribution through the study period, accounting for sea state and other factors affecting visibility and detectability of marine mammals);
- (b) analyses of the effects of various factors influencing detectability of marine mammals (e.g., sea state, number of observers, and fog/glare);
- (c) species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/gender categories (if determinable), group sizes, and ice cover;
- (d) analyses of the effects of survey operations; and
- (e) sighting rates of marine mammals during periods with and without airgun activities (and other variables that could affect detectability), such as:
  - initial sighting distances versus airgun activity state;
  - closest point of approach versus airgun activity state;
  - observed behaviors and types of movements versus airgun activity state;
  - numbers of sightings/individuals seen versus airgun activity state;
  - distribution around the survey vessel versus airgun activity state; and
  - estimates of take by harassment.



This information will be reported for both the vessel-based and aerial monitoring.

#### **6.4 Review of the 2008, 2009, and 2010 Open Water Seismic Survey Reports**

In 2008, NMFS issued five IHAs for the harassment of marine mammals incidental to conducting seismic and/or site clearance and shallow hazards surveys in the Beaufort and Chukchi Seas to Shell, CPAI, BPXA, PGS, and AES. In 2009, NMFS issued an IHA to Shell for its site clearance and shallow hazards survey in the Chukchi Sea. In 2010, NMFS issued two IHAs to Shell and Statoil for the taking of marine mammals incidental to their marine survey and 3D seismic surveys, respectively, in the Beaufort and Chukchi Seas. NMFS has reviewed the reports submitted by these companies (Aerts *et al.* 2008; Hauser *et al.* 2008; Brueggeman 2009; Ireland *et al.* 2009; Reiser *et al.* 2010; 2011; Bles et al. 2011) (The work conducted by AES was on behalf of Shell, so information that would be contained in a 90-day report for their survey operations were contained in Shell's report for the 2008 season.) Based on the results of these studies collectively, NMFS concludes that the previous monitoring and mitigation measures prescribed in these marine mammal take authorizations were effective. In addition, actual take of marine mammals by Level B harassment was generally lower than expected due to the implementation of monitoring and mitigation measures. No Level A harassment (injuries included) or mortality was observed or suspected as a result of the operations.

#### **6.5 Conclusion**

The inclusion of the mitigation and monitoring requirements in the IHA, as described in the Preferred Alternative, will ensure that Statoil's activities and the proposed mitigation measures under Alternative 2 (Preferred Alternative) are sufficient to minimize any potential adverse impacts to the human environment, particularly marine mammal species or stocks and their habitat. With the inclusion of the required mitigation and monitoring requirements, NMFS has determined that the proposed activities (described in Section 1.4 of this SEA) by Statoil, and NMFS' proposed issuance of an IHA to Statoil, will result at worst in a temporary modification of behavior (Level B harassment) of some individuals of 13 species of marine mammals in the Chukchi Sea. In addition, no take by injury, death and/or serious injury is anticipated, and the potential for temporary or permanent hearing impairment will be avoided through the incorporation of the mitigation and monitoring measures described earlier in this document.

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No people or agencies were consulted for the preparation of this SEA.

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