MARINE MAMMAL MONITORING AND MITIGATION PLAN

for

Shallow Hazards and Site Clearance Surveys
and Geotechnical Soil Investigations in
the Alaskan Chukchi Sea, 2011

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Introduction

Statoil USA E&P inc. (Statoil) plans to conduct shallow hazards and site clearance surveys and geotechnical soil investigations on and near existing lease holdings in the Chukchi Sea. One survey vessel and one geotechnical soil investigation vessel will be used to complete the project during the 2011 open-water season. The Marine Mammal Monitoring and Mitigation Program (4MP) developed for Statoil's planned activities is designed to protect the marine mammal resources in the area, fulfill reporting obligations to the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), the National Marine Fisheries Service (NMFS), and the U.S. Fish and Wildlife Service (USFWS), and provide a means for gathering additional data on marine mammals for future operations planning.

Operations to be Conducted

Statoil acquired 16 leases in the Chukchi Sea during Lease Sale 193 held in February 2008. The leased areas are located ~240 km (150 mi) west of Barrow and ~160 km (~100 mi) northwest of Wainwright. 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).

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 (BOEMRE). Data are typically collected using multiple types of acoustic equipment. During the site surveys, Statoil proposes to use the following acoustic sources: 4×10 in^3 airgun cluster, single 10 in^3 airgun, Kongsberg SBP3000 subbottom profiler, GeoAcoustics 160D side-scan sonar, and a Kongsberg EM2040 multibeam echosounder. The operating frequencies and estimated source levels of this equipment are provided in the sub-section below.

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^3 airgun cluster) will be collected across the rectangular areas covering Statoil's leases as shown in Fig. 1. More detailed data, again using all acoustics sources, will be collected using closely spaced lines at ~5 potential exploration drilling locations on Statoil's leases. In total, a maximum of 2500 km of survey line are planned to occur on or near Statoil leases covering a total area of ~665 km^2.

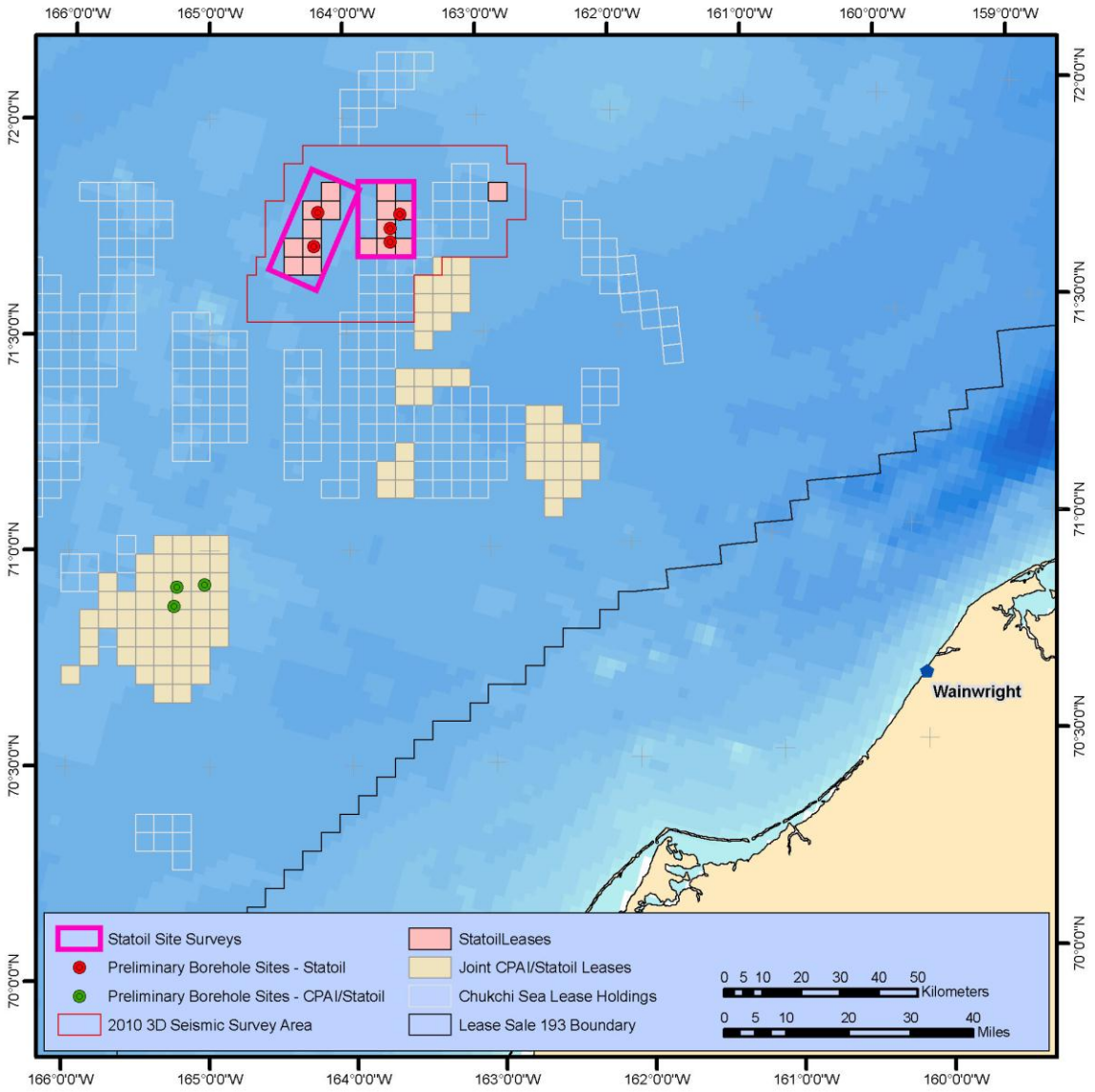

Figure 1. Location of the planned 2011 site survey and geotechnical soil investigation activities in the Chukchi Sea, Alaska.

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 5 prospective drilling locations on Statoil's leases and up to 3 boreholes may be completed at each of up to 3 potential drilling locations on leases jointly owned with CPAI. This results 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.

Marine Mammal Monitoring

Statoil's 4MP is a combination of active monitoring of the area of operations and the implementation of mitigation measures designed to minimize project impacts to marine resources. If marine mammals are observed within or about to enter specific safety radii around the proposed survey activities, mitigation will be initiated by vessel-based marine mammal observers (MMOs). The size of the 180 and 190 dB re 1 μPa (rms) safety radii were modeled and are described below in the section *Mitigation Measures during Survey Activities.* These radii will be used to initiate mitigation during initial survey activities at which time an acoustics contractor will measure underwater sound propagation from the airguns to empirically determine the size of the safety radii. These measured radii will be used for mitigation purposes as soon as they become available and through the duration of the survey. An initial sound source analysis will be supplied to NMFS and the seismic survey operators within 120 hours of completion of the measurements. A more detailed report describing the sounds produced by the airguns will be provided to NMFS as part of the 90-day report following the end of the survey.

Visual monitoring by MMOs during airgun and soil investigation activities, and periods when geophysical surveys are not active, will provide information on the numbers of marine mammals potentially affected by the survey activities and facilitate real time mitigation to prevent impacts to marine mammals by industrial sounds or activities. Vessel-based MMOs onboard the survey vessel will record the numbers and species of marine mammals observed in the area and any observable reaction of marine mammals to the survey activities. An acoustic monitoring program, separate from the sound source measurements described above, will record the sounds produced by the airguns within the survey area, record marine mammal vocalizations, and to the extent possible localize those calls. The layout and location of the acoustic monitoring array relative to Statoil's lease holdings is intended to be consistent with similar arrays deployed on other lease holdings in the Chukchi Sea and consistent with future deployments during different activities.

Vessel-Based Marine Mammal Monitoring Program

Introduction

The vessel-based operations of Statoil's 4MP are designed to meet the requirements of Incidental Harassment Authorization (IHA) and Letter of Authorization (LOA) permits issued by NMFS and USFWS, respectively, and to meet any other stipulation agreements between Statoil and other agencies or groups. The objectives of the program will be:

- to ensure that disturbance to marine mammals and subsistence hunts is minimized and all permit stipulations are followed,
- to document the effects of the proposed survey activities on marine mammals, and
- to collect baseline data on the occurrence and distribution of marine mammals in the study area.

The 4MP will be implemented by a team of experienced MMOs, including both biologists and Inupiat personnel. MMOs will be stationed aboard the survey vessels through the duration of the project. Reporting of the results of the vessel-based monitoring program will include the estimation of the number of "takes" as stipulated in the IHA and LOA.

The vessel-based portion of Statoil's 4MP will be required to support the survey activities in the Chukchi Sea. The survey dates and specific operating areas are described above, but will also depend somewhat upon ice and weather conditions.

The vessel-based work will provide:

- the basis for real-time mitigation, if necessary, as required by the various permits that Statoil receives,
- information needed to estimate the number of "takes" of marine mammals by harassment, which must be reported to NMFS and USFWS,
- data on the occurrence, distribution, and activities of marine mammals in the areas where the survey program is conducted,
- information to compare the distances, distributions, behavior, and movements of marine mammals relative to the survey vessel at times with and without airgun activity,
- a communication channel to coastal communities including Inupiat whalers and other subsistence users, and

The 4MP will be operated and administered consistent with monitoring programs conducted during seismic and shallow hazards surveys in 2006–2010 or such alternative requirements as may be specified in the authorizations issued this project. Any other stipulations from agreements between Statoil and agencies or groups such as MMS, USFWS, the North Slope Borough (NSB), and the Alaska Eskimo Whaling Commission (AEWC) will also be fully incorporated. All MMOs will be provided training through a program approved by NMFS and Statoil, as described below. At least one observer on each vessel will be an Inupiat who will have the additional responsibility of communicating with coastal communities and directly with Inupiat whalers during the whaling season.

Mitigation Measures during Survey Activities

Statoil's planned site survey and geotechnical soil investigation program incorporates both design features and operational procedures for minimizing potential impacts on marine mammals and on subsistence hunts. The design features and operational procedures have been described in the IHA and LOA applications submitted to NMFS and USFWS, respectively and are summarized below. Survey design features include:

- timing and locating survey activities to avoid interference with the annual fall bowhead whale hunt;
- identifying transit routes and timing to avoid other subsistence use areas and communicate with coastal communities before operating in or passing through these areas, and;
- limiting the size of the seismic sound source to minimize energy introduced into the marine environment;
- establishing precautionary safety radii based on previous measurements of a similar sound source in the area for implementation prior to completion of sound source measurements in 2011.

The potential disturbance of marine mammals during survey operations will be minimized further through the implementation of several ship-based mitigation measures if mitigation becomes necessary.

Safety and Disturbance Zones

Under current NMFS guidelines (e.g., NMFS 2000), "safety radii" for marine mammals around industrial sound sources are customarily defined as the distances within which received sound levels are

≥180 dB re 1 µPa (rms) for cetaceans and ≥190 dB re 1 µPa (rms) for pinnipeds. These safety criteria are based on an assumption that sound energy received at lower received levels will not injure these animals or impair their hearing abilities, but that higher received 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 safety and disturbance radii for the sound levels produced by the planned airgun configurations have been estimated (Table 1). 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 4, 10-in^3 airguns (total discharge volume of 40 in^3) and a single 10 in^3 airgun. Underwater sound propagation from a similar 4×10-in^3 airgun cluster and single 10 in^3 was measured in 2009 (Reiser et al. 2010). Those measurements resulted in 90th percentile propagation loss equations of RL = 218.0 - 17.5LogR - 0.00061R for the 4×10 in^3 airgun cluster and RL = 204.4 - 16.0LogR - 0.00082R for the single 10 in^3 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 (Table 1).

Table 1. Distances to specified received levels measured from a 4×10 in^3 airgun cluster and a single 10-in^3 airgun on the Burger prospect in 2009 as reported by Reiser et al. (2010). The 2011 "Pre-SSV" distances are a precautionary 25% increase above the reported 2009 results and will be used by MMOs for mitigation purposes until an SSV is completed in 2011.

Received Level	Distance (m)			
	Airgun Cluster (4×10 in^3)		Mitigation Airgun (1×10 in^3)	
dB re 1µPa rms	2009 Results	2011 pre-SSV	2009 Results	2011 pre-SSV
≥190	39	50	8	10
≥180	150	190	34	45
≥160	1,800	2,250	570	715
≥120	31,000	39,000	19,000	24,000

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 are 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 MMOs within 120 hrs of completing the measurements. The mitigation measures to be implemented at the 190 and 180 dB sound levels will include power downs and shut downs as described below.

Speed and Course Alterations

If a marine mammal is detected outside the applicable safety radius and, based on its position and the relative motion, is likely to enter the safety radius, changes of the vessel's speed and/or direct course will be considered if this does not compromise operational safety. For marine seismic surveys using large streamer arrays, course alterations are not typically possible. However, for the smaller airgun array and streamer planned during the proposed site surveys, such changes may be possible. After any such speed and/or course alteration is begun, the marine mammal activities and movements relative to the seismic

vessel will be closely monitored to ensure that the marine mammal does not approach within the safety radius. If the mammal appears likely to enter the safety radius, further mitigative actions will be taken, including a power down or shut down of the airgun(s).

Ramp Ups

A ramp up of an airgun array provides a gradual increase in sound levels, and involves a step-wise 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 the proposed site survey program, the seismic operator will ramp up the airgun cluster 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 is typically the amount of time it would take the source vessel to cover the 180-dB safety radius. Given the small size of the planned airgun array, we estimate that period to be about 1–2 minutes based on the modeling results described above and a survey speed of 4 kts.

A full ramp up, after a shut down, will not begin until there has been a minimum of 30 min of observation of the safety zone by MMOs to assure that no marine mammals are present. The entire safety zone must be visible during the 30-minute lead-in to a full ramp up. If the entire safety zone is not visible, then ramp up from a cold start cannot begin. If a marine mammal(s) is sighted within the safety 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 safety 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 or brief transits between seismic transects, one airgun will continue operating. The ramp-up procedure will still be followed when increasing the source levels from one airgun to the full 4-airgun cluster. 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 the 30-minute watch period of the full safety radius required for a cold start. MMOs 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 MMOs will automatically be observing during the 30-minute period preceding a ramp up. Later in the season, MMOs will be called to duty at night to observe prior to and during any ramp ups. The seismic operator and MMOs will maintain records of the times when ramp-ups start, and when the airgun arrays reach full power.

Power Downs

A power down for immediate mitigation purposes is the immediate reduction in the number of operating airguns such that the radii of the 190 dB (rms) and 180 dB (rms) zones are decreased to the extent that an observed marine mammal(s) are not in the applicable safety zone of the full array. Power downs are also used while the vessel turns from the end of one survey line to the start of the next. During a power down, one airgun (or some other number of airguns less than the full airgun array) continues firing. The continued operation of one airgun is intended to (a) alert marine mammals to the presence of the seismic vessel in the area, and (b) retain the option of initiating a ramp up to full operations under poor visibility conditions.

The array will be immediately powered down whenever a marine mammal is sighted approaching close to or within the applicable safety zone of the full array, but is outside the applicable safety zone of the single mitigation airgun. Likewise, if a mammal is already within the safety zone when first detected, the airguns will be powered down immediately. If a marine mammal is sighted within or about to enter the applicable safety zone of the single mitigation airgun, it too will be shut down (see following section).

Following a power down, operation of the full airgun array will not resume until the marine mammal has cleared the safety zone. The animal will be considered to have cleared the safety zone if it

- is visually observed to have left the safety zone of the full array, or
- has not been seen within the zone for 15 min in the case of pinnipeds or small odontocetes, or
- has not been seen within the zone for 30 min in the case of mysticetes or large odontocetes.

Shut Downs

The operating airgun(s) will be shut down completely if a marine mammal approaches or enters the then-applicable safety radius and a power down is not practical or adequate to reduce exposure to less than 190 or 180 dB (rms), as appropriate. In most cases, this means the mitigation airgun will be shut down completely if a marine mammal approaches or enters the estimated safety radius around the single 10 in^3 airgun while it is operating during a power down. Airgun activity will not resume until the marine mammal has cleared the safety radius. The animal will be considered to have cleared the safety radius as described above under power down procedures.

A shut down of the borehole drilling equipment may be requested by MMOs if an animal is sighted approaching the vessel close enough to potentially interact with and be harmed by the soil investigation operation.

Marine Mammal Observers

Vessel-based monitoring for marine mammals will be done by trained MMOs throughout the period of survey activities to comply with expected provisions in the IHA and LOA that Statoil receives. The observers will monitor the occurrence and behavior of marine mammals near the survey vessels during all daylight periods during operation, and during most daylight periods when airgun operations are not occurring. MMO 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.

Number of Observers

A sufficient number of MMOs will be required onboard the survey vessel to meet the following criteria:

- 100% monitoring coverage during all periods of survey operations in daylight;
- maximum of 4 consecutive hours on watch per MMO;
- maximum of ~12 hours of watch time per day per MMO.

MMO teams will consist of Inupiat observers and experienced field biologists. An experienced field crew leader will supervise the MMO team onboard the survey vessels. The total number of MMOs may decrease later in the season as the duration of daylight decreases assuming NMFS does not require continuous nighttime monitoring. Statoil currently plans to have 5 MMOs aboard the site survey vessel

and 3 MMOs aboard the soil investigation vessel, with the potential of reducing the number of MMOs later in the season as daylight periods decrease in length.

Crew Rotation

Depending on the duration of the activities, Statoil may conduct one crew during the season. During crew rotations detailed hand-over notes will be provided to the incoming crew leader by the outgoing leader. Other communications such as email, fax, and/or phone communication between the current and oncoming crew leaders during each rotation will also occur when possible. In the event of an unexpected crew change Statoil will facilitate such communications to insure monitoring consistency among shifts.

Observer Qualifications and Training

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.

Biologist-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. Resumés 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 MMOs (see below).

Observers will complete a two or three-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.

Primary objectives of the training include:

- review of the marine mammal monitoring plan for this project, including any amendments specified by NMFS or USFWS in the IHA or LOA, by BOEMRE, or by other agreements in which Statoil may elect to participate;
- review of marine mammal sighting, identification, and distance estimation methods;
- review of operation of specialized equipment (reticle binoculars, night vision devices, and GPS system);
- review of, and classroom practice with, data recording and data entry systems, including procedures for recording data on marine mammal sightings, monitoring operations, environmental conditions, and entry error control. These procedures will be implemented through use of a customized computer database and laptop computers;
- review of the specific tasks of the Inupiat Communicator.

MMO Handbook

A Marine Mammal Observers' Handbook will be prepared for Statoils' monitoring program. Handbooks contain maps, illustrations, and photographs, as well as text, and are intended to provide guidance and reference information to trained individuals who will participate as MMOs. The following topics will be covered in the MMO Handbook for the Statoil project:

- summary overview descriptions of the project, marine mammals and underwater noise, the marine mammal monitoring program (vessel roles, responsibilities), the NMFS IHA and USFWS LOA and other regulations/permits/agencies, the Marine Mammal Protection Act;
- monitoring and mitigation objectives and procedures, initial safety radii;
- responsibilities of staff and crew regarding the marine mammal monitoring plan;
- instructions for ship crew regarding the marine mammal monitoring plan;
- data recording procedures: codes and coding instructions, common coding mistakes, electronic database; navigational, marine physical, field data sheet;
- list of species that might be encountered: identification, natural history;
- use of specialized field equipment (reticle binoculars, NVDs, laser rangefinders);
- reticle binocular distance scale;
- table of wind speed, Beaufort wind force, and sea state codes;
- data storage and backup procedures;
- safety precautions while onboard;
- crew and/or personnel discord; conflict resolution among MMOs and crew;
- drug and alcohol policy and testing;
- scheduling of cruises and watches;
- communications;
- list of field gear that will be provided;
- suggested list of personal items to pack;
- suggested literature, or literature cited; and
- copies of the NMFS IHA and USFWS LOA when available.

Monitoring Methodology

The observer(s) will watch for marine mammals from the best available vantage point on the survey vessels, typically the bridge. The observer(s) will scan systematically with the unaided eye and 7×50 reticle binoculars, supplemented with 20×60 image-stabilized Zeiss Binoculars or Fujinon 25×150 "Big-eye" binoculars, and night-vision equipment when needed (see below). Personnel on the bridge will assist the marine mammal observer(s) 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:

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

The ship's position, speed of the vessel, 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 substantial change in any of those variables.

Distances to nearby marine mammals will be estimated with binoculars (Fujinon 7×50 binoculars) containing a reticle to measure the vertical angle of the line of sight to the animal relative to the horizon. Observers may use a laser rangefinder to test and improve their abilities for visually estimating distances to objects in the water. However, previous experience has shown that a Class 1 eye-safe device was not able to measure distances to seals more than about 70 m (230 ft) away. The device was very useful in improving the distance estimation abilities of the observers at distances up to about 600 m (1968 ft)—the maximum range at which the device could measure distances to highly reflective objects such as other vessels. Humans observing objects of more-or-less known size via a standard observation protocol, in this case from a standard height above water, quickly become able to estimate distances within about ±20% when given immediate feedback about actual distances during training.

When a marine mammal is seen within the safety radius applicable to that species, the geophysical crew will be notified immediately so that mitigation measures called for in the applicable authorization(s) can be implemented. As in 2006–2010, it is expected that the airgun arrays will be shut down within several seconds—often before the next shot would be fired, and almost always before more than one additional shot is fired. The marine mammal observer will then maintain a watch to determine when the mammal(s) appear to be outside the safety zone such that airgun operations can resume.

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).

Specialized Field Equipment

Statoil will provide or arrange for the following specialized field equipment for use by MMOs aboard the survey vessel: reticle binoculars, 20×60 image-stabilized Zeiss Binoculars or Fujinon 25×150 "Big-eye" binoculars, GPS unit, laptop computer(s), night vision binoculars, digital still and possibly digital video cameras.

Field Data-Recording, Verification, Handling, and Security

The observers will record their observations onto datasheets or directly into handheld computers. During periods between watches and periods when operations are suspended, those data will be entered into a laptop computer running a custom computer database. The accuracy of the data entry will be verified in the field by computerized validity checks as the data are entered, and by subsequent manual checking of the database printouts. These procedures will allow initial summaries of data to be prepared during and shortly after the field season, and will facilitate transfer of the data to statistical, graphical or other programs for further processing. Quality control of the data will be facilitated by (1) the start-of-season training session, (2) subsequent supervision by the onboard field crew leader, and (3) ongoing data checks during the field season.

The data will be backed up regularly onto CDs and/or USB disks, and stored at separate locations on the vessel. If possible, data sheets will be photocopied daily during the field season. Data will be secured further by having data sheets and backup data CDs carried back to the Anchorage office during crew rotations.

In addition to routine MMO duties, observers will have available Traditional Knowledge and Natural History datasheets to record observations that are not captured by the sighting or effort data. Copies of these records will be available to observers for reference if they wish to prepare a statement about their observations. If prepared, this statement would be included in the 90-day and final reports documenting the monitoring work.

Field Reports

Throughout the survey program, observers will prepare a report each day or at such other intervals as NMFS, USFWS, BOEMRE or Statoil may require, summarizing the recent results of the monitoring program. The reports will summarize the species and numbers of marine mammals sighted. These reports will be provided to NMFS and to the survey operators.

Reporting

The results of the 2011 vessel-based monitoring, including estimates of "take by harassment", will be presented in 90-day and final technical reports. Reporting will address the requirements established by NMFS and USFWS.

The technical report(s) will include:

- summaries of monitoring effort: total hours, total distances, and distribution of marine mammals through the study period accounting for sea state and other factors affecting visibility and detectability of marine mammals;
- analyses of the effects of various factors influencing detectability of marine mammals including sea state, number of observers, and fog/glare;
- species composition, occurrence, and distribution of marine mammal sightings including date, water depth, numbers, age/size/gender categories, group sizes, and ice cover;
- analyses of the effects of survey operations:
  - sighting rates of marine mammals during periods with and without airgun activities (and other variables that could affect detectability);
  - 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;
  - estimates of "take by harassment".

Acoustic Monitoring Plan

Sound Source Measurements

As described above, previous measurements of airguns in the Chukchi Sea were used to estimate the distances at which received levels are likely to fall below 120, 160, 180, and 190 dB rms from the planned airgun sources. These modeled distances will be used as temporary safety radii until measurements of the airgun sound source are conducted. The measurements will be made at the beginning of the field season and the measured radii used for the remainder of the survey period. An acoustics contractor will use their equipment to record and analyze the underwater sounds and write the summary reports as described below.

The objectives of the sound source verification measurements planned for 2011 in the Chukchi Sea will be (1) to measure the distances at which broadband received levels reach 190, 180, 170, 160, and 120 dB re 1 μPa (rsm) for the airgun configurations that may be used during the survey activities. The configurations will include at least the full array (4×10 in^3) and the operation of a single 10 in^3 airgun that will be used during power downs or very shallow penetration surveys. The measurements of airgun sounds will be made by an acoustics contractor at the beginning of the survey. 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 (rms) will be reported in increments of 10 dB. Sound levels during soil investigation operations will also be measured. However, source levels are not expected to be strong enough to require mitigation actions at the 190 dB or 180 dB levels.

Data will be previewed in the field immediately after download from the hydrophone instruments. An initial sound source analysis will be supplied to NMFS and the vessel within 120 hours of completion of the measurements, if possible. The report will indicate the distances to sound levels based on fits of empirical transmission loss formulae to data in the endfire and broadside directions. A more detailed report will be issued to NMFS as part of the 90-day report following completion of the acoustic program.

2011 Joint Environmental Studies Program

Statoil, Shell, and ConocoPhillips (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 in 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 tentative acoustic recorder locations are shown in Fig. 2 and 3.

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.

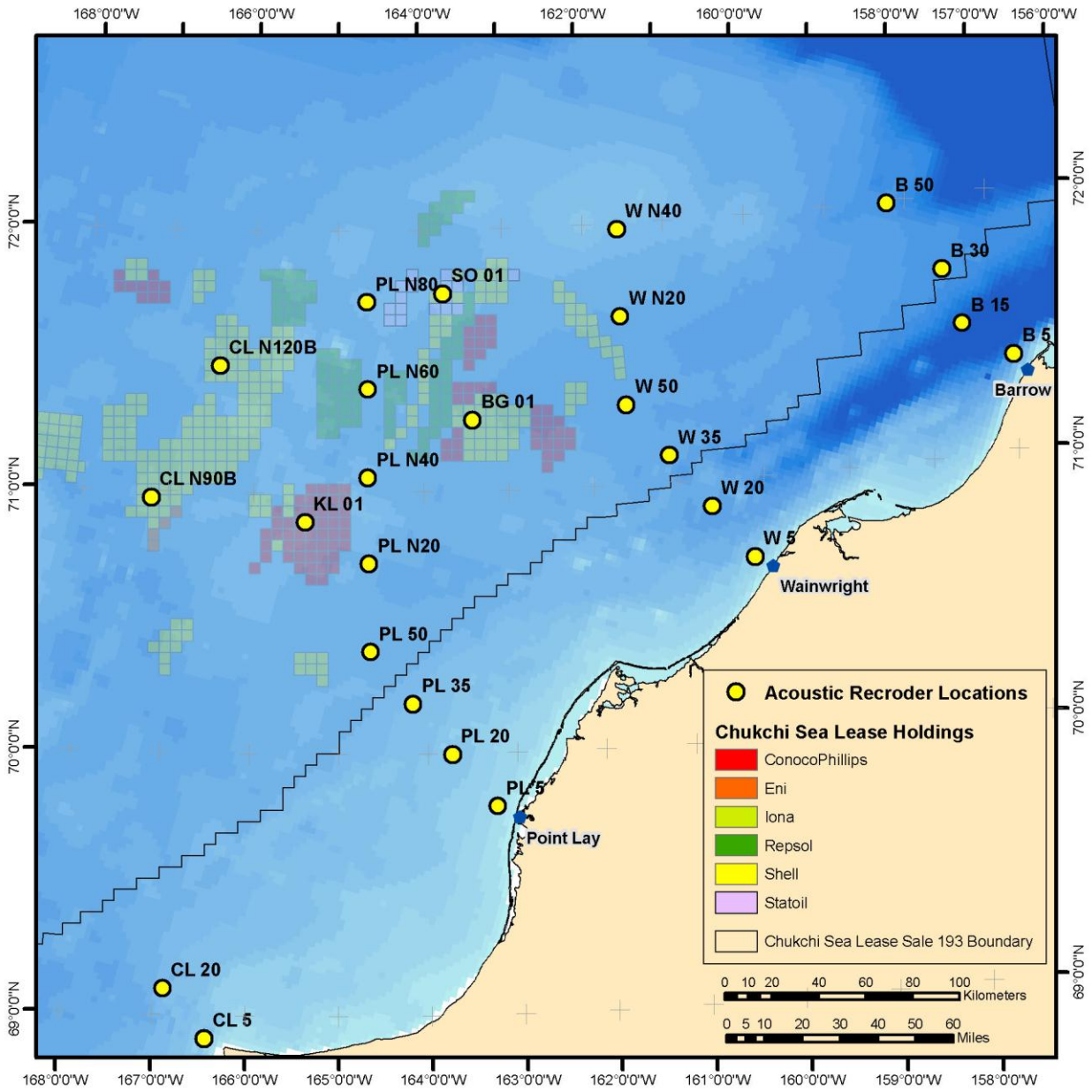

Figure 2. Preliminary locations of recorders to be deployed late July through early October.

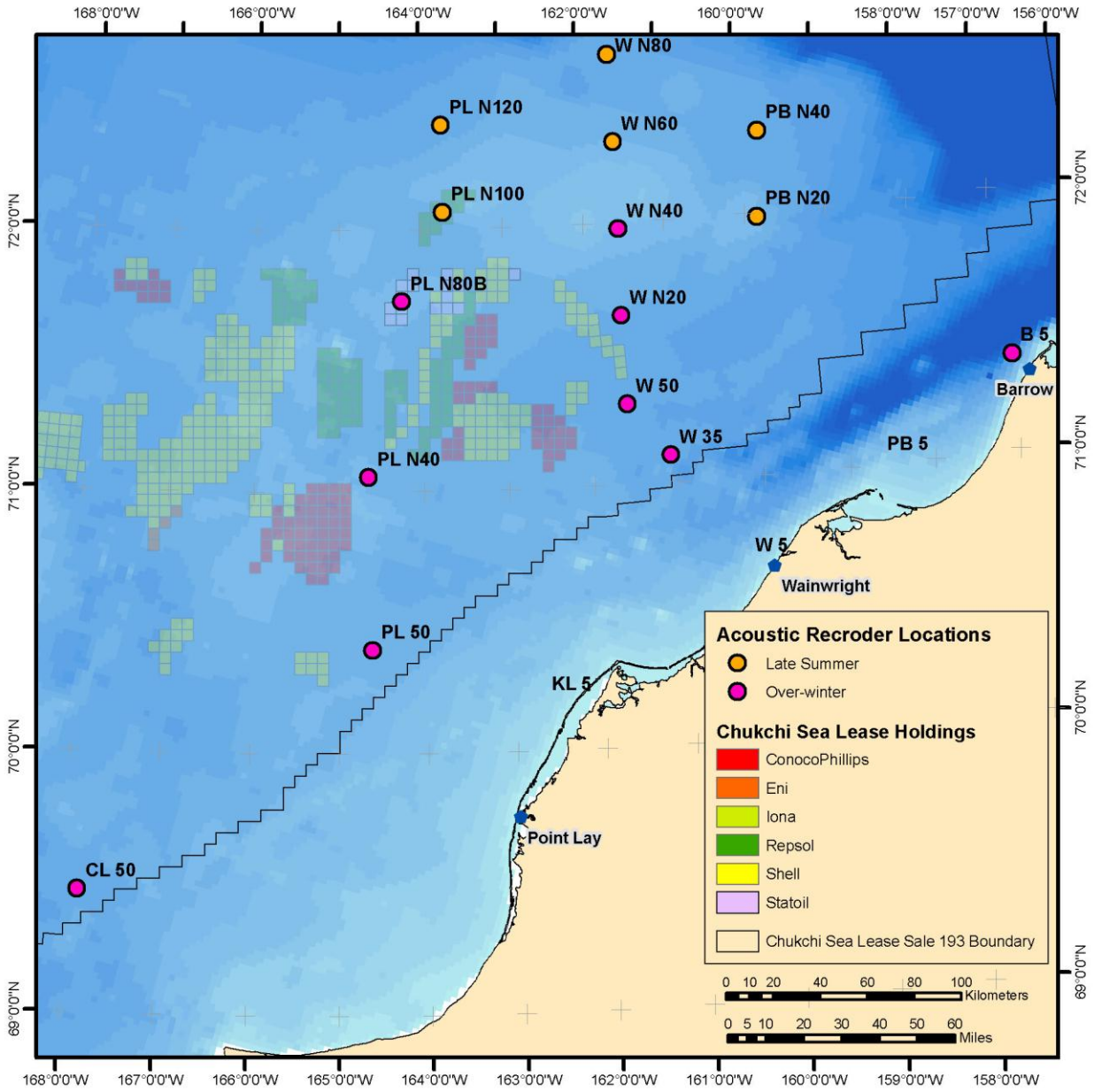

Figure 3. Preliminary locations of recorders to be deployed in mid-August through early October (late summer) or in October to over-winter (2001-2012).

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