MARINE MAMMAL MONITORING AND MITIGATION DURING EXPLORATORY DRILLING BY SHELL IN THE CHUKCHI SEA, JULY–OCTOBER 2015: 90-DAY REPORT

Prepared by

Alaska Research Associates, Inc.

2000 W International Airport Road, Suite C-1, Anchorage, AK 99502

and

JASCO APPLIED SCIENCES

4464 Markham St., Suite 2101, Victoria, BC V8Z 7X8, Canada

for

Shell Gulf of Mexico, Inc.

777 Walker Street, Houston, TX 77002

and

National Marine Fisheries Service, Office of Protected Resources

1315 East-West Hwy, Silver Spring, MD 20910-3282

and

U.S. Fish and Wildlife Service, Marine Mammal Management

1101 E. Tudor Road, M.S. 341, Anchorage, AK 99503

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Edited by

Darren Ireland and Lauren Bisson

LGL Alaska Research Associates, Inc.
2000 W International Airport Road, Suite C-1, Anchorage, AK 99502, USA

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LIST OF ACRONYMS AND ABBREVIATIONS

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4MP	Marine Mammal Monitoring and Mitigation Plan
AEWC	Alaska Eskimo Whaling Commission
AMAR	Autonomous Multi-channel Acoustic Recorder
ASAMM	Aerial Surveys of Arctic Marine Mammals
BCB	Bering/Chukchi/Beaufort Sea
Bf	Beaufort Wind Force
BOP	Blowout Preventer
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CAA	Conflict Avoidance Agreement
CPA	Closest (Observed) Point of Approach
dB	decibel
DMA	Detailed Manual Analysis
DP	Dynamic Positioning
DPS	Distinct Population Segment
DSLR	Digital Single Lens Reflex
ESA	(U.S.) Endangered Species Act
ESW	effective strip width
$f(0)$	sighting probability density at zero perpendicular distance from survey track; equivalently, 1/(effective strip width)
FAA	Federal Aviation Administration
ft	feet
GIS	Geographic Information System
GPS	Global Positioning System
$g(0)$	probability of seeing a group located directly on a survey line
h	hours
HSWUA	Hanna Shoal Walrus Use Area
Hz	Hertz (cycles per second)
IHA	Incidental Harassment Authorization (under U.S. MMPA)
IMP	Ice Management Plan
ITR	Incidental Take Regulations
JASCO	JASCO Applied Sciences
kHz	kilohertz
km	kilometer
km^2	square kilometers
km/h	kilometers per hour
kt	knots
kW	kilowatt
LOA	Letter of Authorization
mPa, µPa	micro Pascal
V/µPa	1 Volt per microPascal
m	meters
mi	miles
min	minutes

MLC	Mud-Line Cellar
MMPA	(U.S.) Marine Mammal Protection Act
M/V	Motor Vessel
n	sample size
n.mi.	nautical miles
NMFS	(U.S.) National Marine Fisheries Service
No.	number
NVD	Night Vision Devices
OCS	Outer Continental Shelf
$p(0)$	Trackline sighting probability
PSO	Protected Species Observer
RAR	Rig Anchor Release
re	in reference to
rms	root-mean-square: an average, in the present context over the duration of a sound pulse
RSL	Received Sound Level
RTB	Rotor Track and Balance
s	seconds
SA	Subsistence Advisor
SAR	Search and Rescue
s.d.	standard deviation
SPL	Sound Pressure Level; the SPL for a seismic pulse is equivalent to its rms level
SSC	Sound Source Characterization
TL	Transmission Loss
UAS	Unmanned Aerial System
UD	Utilization Distribution Area
UTC	Coordinated Universal Time
USFWS	U.S. Fish and Wildlife Service
V	Volt
ZVSP	Zero-Offset Vertical Seismic Profiling

EXECUTIVE SUMMARY

Background and Introduction

Shell Gulf of Mexico, Inc. (Shell) conducted exploratory drilling in the Chukchi Sea during the 2015 open-water period. Marine exploration drilling activities could have effects on marine mammals that would constitute "taking" under the provisions of the U.S. Marine Mammal Protection Act (MMPA) and the U.S. Endangered Species Act (ESA). The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) share jurisdiction over the marine mammal species that were likely to be encountered during the project.

Shell's exploratory drilling activities in the Chukchi Sea were conducted under the jurisdiction of an Incidental Harassment Authorization (IHA) issued by NMFS and a Letter of Authorization (LOA) issued by the USFWS. The IHA and LOA included provisions to mitigate potential impacts from the sound sources generated by exploratory drilling and to reduce behavioral disturbances that might be considered as "take by harassment" under the MMPA.

A monitoring and mitigation program was conducted to reduce and attempt to measure potential effects of Shell's exploration drilling activities on marine mammals and to ensure that Shell was in compliance with the provisions of the IHA and LOA. This program required protected species observers (PSOs) onboard all of the project vessels to detect and monitor marine mammals and their responses to industry activities, and to initiate mitigation measures if necessary.

The primary objectives of the monitoring and mitigation program were to:

1. provide real–time sighting data needed to implement the mitigation requirements;
2. collect data on the occurrence, distribution, and activities of marine mammals in the areas where drilling activity was conducted;
3. determine the reactions (if any) of marine mammals potentially exposed to exploratory drilling sounds and related activities;
4. estimate the numbers of marine mammals potentially exposed to low-level continuous sounds generated by the drilling operations and support activities near well sites;
5. communicate with coastal communities including whalers; and,
6. employ and build capacity for local residents, and to develop a large pool of experienced Alaska Native PSOs.

This 90-day report describes the operations that were conducted and the methods and results from the monitoring and mitigation program.

Exploratory Drilling Operations Described

Shell conducted exploratory drilling activities in the Chukchi Sea during the 2015 open-water period using the *Polar Pioneer*, an ice-strengthened semi-submersible drilling unit, at the Burger J drill site. One well was completed at that location—which included boring a pilot hole, constructing a Mud-Line Cellar (MLC), hole-opening operations to set conductor and surface casing, and finally drilling to total well depth. The *Noble Discoverer*, an industry-standard, ice-strengthened drillship, was anchored and idle at the Burger V drill site during the 2015 season. No drilling occurred at the Burger V drill site in 2015. Project vessels were present in the Chukchi Sea Activity Area (north of Pt. Hope, Alaska) from 6 July to 16 October.

Exploratory drilling began at the Burger J drill site on 30 July and drilling was completed on 22 September. An MLC was constructed from 3 to 11 August to ensure that the wellhead and blowout preventer (BOP) were located below the maximum ice-keel gouge depth. The *Polar Pioneer* spent a total of 75 days in the Chukchi Sea Activity Area, with 45 of those days engaged in exploratory drilling or related activities.

Anchor handling, ice management and support vessels were active on and near the drill site during exploratory drilling activities. The *Aiviq*, *Tor Viking*, and *Ross* performed all anchor handling, mooring, and unmooring operations during the 2015 season. Anchor handling activities occurred in distinct pulses from 13 July to 20 September 2013. The *Nordica*, *Aiviq*, and *Tor Viking* were involved in ice scouting and ice management activities near the drill site in the Chukchi Sea. Ice scouting was performed by the between 7 July and 11 August upwind of the Burger prospect along the ice edge. The actual amount of time spent actively pushing or breaking ice in the Chukchi Sea was limited to three very brief events on 28, 29 and 30 July 2015.

Various aircraft were used in support of both marine mammal monitoring and the 2015 exploratory drilling program in the Chukchi Sea. All aircraft active in the Chukchi Sea Activity Area in 2015 were operated out of Barrow. Four S-92 helicopters provided support for crew change, resupply and search-and-rescue. Flights were routed through two main corridors throughout the season, the first between Barrow and the Burger drill sites, and the second between Barrow and an area off the coast of Wainwright. An Aero Commander fixed-wing aircraft was flown to conduct aerial surveys for marine mammals and to conduct ice reconnaissance flights in-season.

Monitoring for marine mammals by PSOs was conducted from two drilling units and 17 support vessels operated by Shell in support of exploration drilling. PSOs stationed on drilling units and support vessels monitored for marine mammals during all daylight periods and during some nighttime operational periods. PSOs aboard vessels in transit implemented mitigation measures as stipulated in Shell's IHA and LOA (e.g. reduce speed, alter course, maximize distance from marine mammals) to minimize potential impacts.

Acoustic measurements and monitoring were conducted in the Chukchi Sea by JASCO Applied Sciences (JASCO). Underwater measurements of sound propagation from each project vessel that had not previously been measured in the Chukchi Sea were conducted from 25 July to 10 August. Six recorders were deployed within 16 km of each drill site to record and characterize sounds associated with the drilling activities from July 24 to October 4. Additionally, a widely distributed regional array of recorders was deployed across much of the northeastern Chukchi Sea.

Shell conducted aerial surveys of marine mammals from a manned fixed-wing aircraft using high-definition digital still cameras over the Burger drill site in the Chukchi Sea. The first survey was conducted on 7 July 2015 and the last was completed on 2 October. There were 29 flights flown for the Chukchi Aerial Survey Program.

Underwater Sound Measurements

Shell conducted exploratory drilling at one site (Burger J) in the Chukchi Sea in 2015 and made preparations to begin drilling at a second site (Burger V). Shell was required to monitor and report underwater sound levels from its 2015 offshore operations as stipulated in the IHA from NMFS. JASCO Applied Sciences carried out the sound monitoring studies on behalf of Shell from 7 July to 5 October 2015. Chapter 3 of this report provides detailed descriptions of the methods employed for the sound study and

gives the results of the measurements performed. An overview of the study and a summary of the results are given below.

Shell's 2015 IHA required measurement of underwater sound levels for all vessels and some specific activities involved with the drilling program. The measurements were to be analyzed to determine the distances corresponding to sound levels between 190 and 120 dB re 1 μPa (rms), reported in 10 dB steps. Source sound levels for all vessels and equipment were also to be provided.

The deployment and recovery of acoustic monitoring equipment was primarily performed from the icebreaker *MSV Fennica.* Vessel sound source characterizations were conducted for every support vessel that operated in the Chukchi Sea that had not been previously characterized during Shell's 2012 drilling program. Sounds from different phases of the drilling operations were characterized by activity. The activities considered included anchor laying, mudline cellar construction, circulating, running casing, and drilling.

The acoustic measurements were made with seabed-deployed Autonomous Multichannel Acoustic Recorders (AMAR, JASCO Applied Sciences) recording at 64 kHz and equipped with calibrated GeoSpectrum M8E and M8K hydrophones. In-field calibrations of the AMARs were performed using GRAS 42AC pistonphone calibrators immediately before and after each measurement. Three AMARs were used to measure vessel sounds and six AMARs were used to measure sounds from drilling activities at the two drill sites, Burger J and Burger V. Distances to specific sound level thresholds for each activity characterized in this report are listed below (Table 1).

The best-fit trendline coefficients were used to model composite sound footprints for multiple concurrent sound sources at both Burger J and Burger V. The model outputs were used to compute areas of ensonification at 120 dB re 1 μPa on an hourly and daily basis. For a model that included noise from drilling and vessels on dynamic positioning or laying anchors within 1 km of either drill site, the average hourly ensonified area was 193 km^2.

TABLE 1. Sound level threshold distances for drilling activities at the Burger J and Burger V drill sites. Distances were obtained from 90th percentile fits to sound levels versus range for the respective activity.

Activity	rms SPL threshold distances (m)			
	190 dB re 1 μPa	180 dB re 1 μPa	160 dB re 1 μPa	120 dB re 1 μPa
Circulating[1]	0*	0*	0*	1150
Running casing[1]	0*	<10*	<10*	1750
Drilling[1]	0*	0*	0*	6150
Mudline cellar construction[1]	<10*	<10*	40*	20,880*
Anchor handling[2]	<10*	<10*	60*	11,140*

*Extrapolated beyond measurement range.
[1] Measured at Burger J
[2] Measured at Burger V

Vessel-Based Monitoring, Mitigation, and Data Analysis Methods

Marine mammal monitoring methods were designed to meet the requirements and objectives specified in the IHA and LOA. PSOs were stationed aboard the drill rigs and all support vessels to conduct visual watches for marine mammals to serve as the basis for implementation of mitigation measures, to collect observation data to estimate the numbers of marine mammals present and potentially exposed to low-level continuous sounds generated by drilling-related activity scenarios, and to document any potential reactions of marine mammals to exploratory drilling and related support activities.

Observer effort and marine mammal sightings were divided into several analysis categories related to environmental conditions and vessel activity. These categories included the following: location in the Chukchi Sea, whether the vessel was moving or stationary, the activity scenario occurring at the time of data entry (e.g. drilling with a supply vessel using DP, concurrent anchor handling and drilling, etc.), and environmental conditions such as Beaufort wind force.

Effort and sightings data were also categorized as having occurred within or outside of areas where RSLs were ≥120 dB re 1μPa (rms SPL) based on the acoustic modeling described in Chapter 3. In Chapters 5 and 6, data were categorized by received sound level (RSL) using modeled sound footprints which included activities at the drill sites, all support vessel activities in the Chukchi Sea Activity Area, and all ice management activities. To estimates potential "takes" in Chapter 7, data were categorized by received sound level using modeled sound footprints that included all drilling and all support vessels that were using DP or performing anchor handling within 1 km (0.6 mi) of either drill site, which most closely replicated the modeling used in the IHA application.

Two methods were used to estimate the number of pinnipeds and cetaceans exposed to sound levels that may have caused disturbance or other effects. The first method was an estimate based upon direct observations made by PSOs aboard vessels throughout the 2015 season. The second method involved multiplying the most recently available values for densities of marine mammals by the area ensonified by average daily sound footprints during the 2015 season.

Vessel-based Marine Mammal Monitoring Results – Cetaceans and Seals

In total, 193 sightings of 214 cetaceans and 1809 sightings of 1901 seals were recorded during Shell's 2015 Chukchi Sea exploratory drilling program. The most frequently sighted cetacean was the gray whale; 68 sightings of 121 individuals. A little less than half of cetacean sightings could not be identified to species (~45%); it is likely that many unidentified mysticete whales were also gray whales. There were only five sightings of seven individual bowhead whales in the Chukchi Sea Activity Area. Bearded seal was the most abundant seal species identified followed by ringed and spotted seals, respectively. Over half of the seals sightings (51%) could not be identified to species. Unidentified sightings were either too brief, too distant, or occurred during periods of poor visibility conditions to accurately identify the animals to species.

Sighting rates across species groups were influenced by environmental conditions. For example, sighting rates during Beaufort wind force categories >3 were typically lower than sighting rates during Beaufort wind force categories ≤ 2. When comparing sighting rates during different operational activities, sighting rates of cetaceans were generally higher in areas where RSLs were <120 dB re 1 μPa (rms SPL) than in areas with higher RSLs. Approximately 96% of cetaceans displayed no observable reaction to vessels. The mean CPA distances of cetaceans in areas where RSLs were ≥120 dB re 1 μPa (rms SPL) during activity scenarios were not consistently larger than the mean CPA distances to vessels where RSLs were <120 dB re 1 μPa (rms SPL). Most cetacean movements relative to vessels were "neutral" or

"unknown." The most commonly recorded behavior for cetaceans sighted from both moving and stationary vessels was blow (~35% and ~43%, respectively).

For seals, sighting rates were generally higher during all activity scenarios in areas where RSLs were ≥120 dB re 1 µPa (rms SPL) than in areas were RSLs were <120 dB re 1 µPa (rms SPL). The most frequently observed seal reaction to project vessels was to "look" at the vessel, followed by "dive" and "swim". The overall mean CPA distance for seals sighted from stationary vessels was greater in areas where RSLs of ≥120 dB re 1 µPa (rms SPL; 288 m) compared with areas where RSLs were less than 120 dB re 1 µPa (rms SPL; 128 m) and the difference was statistically significant (Wilcoxon rank sum test; W = 56,154, p = 0.0014). The majority of seal movements relative to vessels was "neutral" or "unknown".

Vessel-Based Marine Mammal Monitoring Results – Pacific Walrus and Polar Bear

In total, 500 sightings of 1397 Pacific walruses and five sightings of five polar bears were recorded during Shell's 2015 Chukchi Sea exploratory drilling program. Most of the in-water walrus sightings were of small groups (~2 individuals per sighting on average). There were 14 sightings of 673 individuals hauled out on ice with an average group size of 48 individuals. The on-ice sightings represent ~48% of total individual walruses observed by PSOs during the entire season. Of the five sightings of polar bears, two were observed in August and three were observed in September, all near the Burger Prospect and quite distant from the nearest sea ice. Two of the sightings in September are believed to be of the same bear due to the temporal and spatial proximity of the recorded observations.

From both moving and stationary vessels, the highest walrus sighting rates occurred in areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during the drilling, anchor handling with drilling, and routine vessel activity scenarios. These results are not consistent with a large-scale avoidance response as a result of sounds produced by drilling and related support vessel activities. Walrus sighting rates were low until the week of 23 August and remained somewhat higher through the week of 27 September. Sighting rates for walrus were also higher in areas with ice concentrations >0-30%. Approximately half of the Pacific walruses demonstrated no observable reaction to vessels. The second most common reaction was "look". The majority of walrus movement relative to vessels was "neutral" or "swim towards".

All of the sightings of polar bears were in the areas where RSLs were ≥120 dB re 1 µPa (SPL rms). None of the polar bear sightings met the criteria for being able to reliably detect polar bears to calculate sighting rates. Four of the polar bear sightings were during low visibility conditions (<2 km of visibility) and one sighting was during a high sea states (>Bf 7). PSOs recorded a reaction of "look" for all five polar bears. Four polar bear movements relative to the vessel were recorded as "neutral" and one was recorded as "swimming away" from the vessel.

Mitigation Measures Implemented and Exposure Estimates

The most common forms of mitigation implemented by PSOs aboard vessels during 2015 were reductions in vessel speed and alterations of vessel headings during routine vessel operations. These actions were intended to maintain distance from marine mammals sufficient to limit disturbance and avoid separating individuals from groups of marine mammals. Other mitigation measures implemented by PSOs aboard vessels included postponement of equipment deployments over the side of a vessel (e.g., hydrophone recorders and remotely operated vehicles), or other delays in operational activity (e.g., cargo transfers between vessels) due to the presence of marine mammals in the immediate area. In order to minimize potential impacts to marine mammals observed near vessel operations, PSOs regularly requested mitigation

measures be implemented well before marine mammals approached within the distance stipulated by the permits.

Marine mammal sightings that occurred near specific vessel activities were tallied to provide one estimate the number of marine mammals potentially "taken" during the exploration drilling program. Based on direct observations during the specific activity scenarios described in the IHA and LOA applications, 27 cetaceans were observed in areas where RSLs were ≥120 dB re 1 μPa (rms SPL) and a total of 686 seals were observed in areas where where RSLs were ≥120 dB re 1 μPa (rms SPL). Approximately 39% of all seals observed in areas ensonified to ≥120 dB re 1 μPa (rms SPL) while drilling activities or MLC construction were occurring were observed by PSOs on the *Polar Pioneer*. Four seals were observed by PSOs during ice management activities. Of the 1397 total individual walruses observed, 306 were observed in areas where RSLs were ≥120 dB re 1 μPa (rms SPL) during the specified activities. Approximately 15% of the 306 walruses were observed by PSOs aboard vessels actively anchor handling or the *Polar Pioneer* actively engaged in drilling activities or MLC construction. Three of the five polar bears observed were located where received sound levels were ≥120 dB re 1 μPa (rms SPL).

Based on density estimates used in Shell's 2015 IHA application, 342 individual cetaceans may have been exposed to continuous sound levels ≥120 dB re 1 μPa (rms SPL) if there was no avoidance of drilling activities. Using the IHA application density estimates for seals, 3316 individual seals may have been exposed to continuous sound levels ≥120 dB re 1 μPa (rms SPL) assuming there was no avoidance of drilling activities. Finally, density based calculations for walrus and polar bear resulted in an estimated 532 Pacific walruses and 7 polar bears potentially being exposed to RSL ≥120 dB re 1 μPa (rms SPL) from drilling activities in the Chukchi Sea.

Chukchi Sea Aerial Survey Program Results

Aerial surveys for marine mammals were conducted in the Alaskan Chukchi Sea from 7 July through 2 October 2015 in support of exploratory drilling activities by Shell. Surveys were flown to meet monitoring requirements and obtain data on the occurrence, distribution, and movements of marine mammals. To minimize human risk while collecting these data, Digital Single Lens Reflex (DSLR) cameras were used to capture imagery during surveys with only the pilots on board the aircraft. Twenty flights successfully collected on-transect image data in 2015, and imagery from eight of these surveys was reviewed.

Three cetacean sightings of four individuals were recorded while on-transect. Species detected were humpback whale, unidentified mysticete whale, and harbor porpoise. A number of factors are likely to have contributed to the low number of cetacean sightings, particularly the weather and the season end date. Poor weather limited survey effort and affected image quality, and the last survey of the season was flown on 2 October. In comparison, all but one of the bowhead, beluga, and unidentified whale sightings from a similar survey effort in 2012 were recorded from 29 September to 27 October.

A total of 343 on-transect pinniped sightings of 5107 individuals was detected, including pacific walruses, bearded seals, and unidentified phocid seals. Walrus was the most commonly identified pinniped with 276 sightings of 5039 individuals. Walruses were detected throughout the season, but the majority of sightings were recorded during two surveys in late July when ice was present in the northern portion of the survey area. Smaller pinnipeds, such as ringed, ribbon, and spotted seals, could not be identified to species during image analysis and these sightings were entered as unidentified phocid seals, which was the second most common pinniped with 31 sightings of 31 individuals recorded. Unidentified phocid seals were detected in six out of the eight surveys reviewed. Further review and analysis of all available data using

automated detection methods is planned for the comprehensive report and abundance, distribution, and potential impacts from drilling operations will be discussed therein.

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We thank the captains and crews of the Noble Discoverer, Polar Pioneer, Fennica, Nordica, Aiviq, Tor Viking II, Ross Chouest, Harvey Supporter, Harvey Champion, Harvey Explorer, Harvey Spirit, Sisuaq, Nanuq, Lauren Foss, Ocean Wind, Ocean Wave, Marika, Minerva Antarctica, and Guardsman, as well as the pilots of Clearwater Air, Inc. for their support during this project. We also thank representatives of the National Marine Fisheries Service, U.S. Fish & Wildlife Service, North Slope Borough Department of Wildlife Management, Alaska Eskimo Whaling Commission, and Bureau of Ocean Energy Management for their advice and comments during numerous meetings and interactions. Louis Brzuzy, Lev Yampolsky, Koen Broker, Valeriya San Filippo, Michael Macrander, Susan Childs, Alaska Journey Management and Logistics Teams, Arctic Slope Regional Corporation Environmental Services, NANA Management Services, and Bering Straits Native Corporation provided valuable support prior to and throughout the field season. We also thank all of the protected species observers (PSOs) who participated in the project – they were essential to the completion and success of this endeavor.

1. BACKGROUND AND INTRODUCTION[1]

This report describes the activities and results of the marine mammal monitoring and mitigation program performed by Shell Gulf of Mexico, Inc. (Shell) during the 2015 Chukchi Sea Outer Continental Shelf (OCS) exploration drilling program. It fulfills the 90-day post-activity reporting requirements of the Incidental Harassment Authorization (IHA) and Letter of Authorization (LOA) received from the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS), respectively.

Marine exploration drilling activities emit sound energy into the water (Greene and Richardson 1988; Richardson et al. 1995; Tolstoy et al. 2004, 2009) and have the potential to affect marine mammals given the reported auditory and behavioral sensitivity of many such species to underwater sounds (Richardson et al. 1995; Gordon et al. 2004). The effects are likely to be limited to behavioral or distributional changes from most drilling activities, and perhaps temporary or permanent reduction in hearing sensitivity from limited periods of seismic profiling (for animals that occurred very close to the sound source). Potential effects on hearing sensitivity, however, may be reduced by marine mammals moving away from sound sources or avoiding areas where stationary sound sources are operating (Reiser et al. 2009; Richardson et al. 1995; Stone and Tasker 2006; Gordon et al. 2004; Smultea et al. 2004), or by the implementation of prescribed mitigation measures as outlined in Shell's monitoring and mitigation plan and identified within the federal authorizations issued to Shell. Either disturbance or injury (if they occur) could constitute "taking" under the provisions of the U.S. Marine Mammal Protection Act (MMPA) and the U.S. Endangered Species Act (ESA).

A number of cetacean and pinniped species inhabit parts of the Chukchi Sea (Table 1.1). The NMFS and the USFWS share jurisdiction over the marine mammal species in this region. Three cetacean species under NMFS jurisdiction that may occur in these waters are listed as endangered under the ESA, including bowhead whale, humpback whale, and fin whale. The bowhead whale population, however, is likely approaching its pre-commercial whaling population size after ~30 years of population growth (Brandon and Wade 2006 Gerber et al. 2007), growing at an estimated 3.7% annually (Givens et al. 2013). In April of 2015, NMFS initiated a status review and proposed dividing the globally listed endangered humpback whale into 14 distinct population segments (DPSs), and delisting a DPS of humpback whales spanning the entire North Pacific and a DPS of humpback whales in the Central North Pacific (NMFS 2015a). In late 2012, NMFS declared the Beringia and Okhotsk distinct population segments (DPSs) of bearded seal, and the Arctic, Okhotsk, and Baltic subspecies of ringed seal as threatened under the ESA (Table 1.1; NMFS 2012a,b). NMFS determined that no listing action was warranted for the Bering Sea and Okhotsk populations of spotted seal (NMFS 2010), or the ribbon seal (NMFS 2013).

The USFWS manages two marine mammal species occurring in the Chukchi Sea, the Pacific walrus and polar bear. The polar bear was listed as threatened under the ESA in 2008 (USFWS 2008). A petition to list Pacific walrus as threatened or endangered was submitted to USFWS (CBD 2008) and resulted in their designation as an ESA candidate species (Table 1.1; USFWS 2011).

Because of the potential for marine mammals to be encountered during planned exploration drilling activities in the Chukchi Sea during the 2015 open-water season, Shell submitted an application to NMFS on 18 September 2014 for an IHA under the MMPA to authorize non-lethal "takes" of marine mammals incidental to Shell's proposed activities in the Chukchi Sea. Subsequently, NMFS requested that Shell revise the application and Shell resubmitted the modified application on 17 December 2014 (Shell 2015a).

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[1] By H.J. Reider, L.N. Bisson, and D.S. Ireland (LGL)

The notice announcing Shell's request for the IHA was published in the *Federal Register* on 4 March 2015 and public comments were invited (NMFS 2015b). NMFS issued an IHA for the proposed activities in the Chukchi Sea to Shell on 12 June 2015 (NMFS 2015c). The IHA authorized "potential take by harassment" of various cetacean and seal species during offshore exploration drilling on OCS leases from 1 July 2015 through 31 October 2015 (Appendix A).

TABLE 1.1. The conservation status of marine mammal species potentially present in the Chukchi Sea Activity Area, 2015.

Species	Latin Name	Stock	ESA[1]
Odontocetes			
Beluga Whale	*Delphinapterus leucas*	Eastern Chukchi Sea Stock and Beaufort Sea Stock	Not listed
Killer Whale	*Orcinus orca*	Alaska Resident Stock and Alaska Transient Stock	Not listed
Harbor Porpoise	*Phocoena phocoena*	Bering Sea Stock	Not listed
Mysticetes			
Bowhead Whale	*Balaena mysticetus*	Western Arctic Stock	Endangered
Gray Whale	*Eschrichtius robustus*	Eastern Pacific Stock	Not listed
Minke Whale	*Balaenoptera acutorostrata*	Alaska Stock	Not listed
Fin Whale	*Balaenoptera physalus*	NE Pacific Stock	Endangered
Humpback Whale	*Megaptera novaeangliae*	Western North Pacific Stock and Central North Pacific Stock	Endangered
Pinnipeds			
Bearded Seal	*Erignathus barbatus*	Beringia Stock	Candidate[2]
Spotted Seal	*Phoca largha*	Alaska Stock	Arctic pop. segments not listed
Ringed Seal	*Pusa hispida*	Alaska Stock	Threatened
Ribbon Seal	*Histriophoca fasciata*	Alaska Stock	Not Listed
Pacific Walrus	*Odobenus rosmarus divergens*	Alaska Stock	Threatened
Ursids			
Polar Bear	*Ursus martimus*	Chukchi/Bering Sea Stock	Threatened

[1] U.S. Endangered Species Act.

[2] On 25 July 2014 the U.S. 9th district court vacated the listing rule with respect to the Beringia bearded seal DPS and remanded the rule to NMFS to correct the deficiencies identified in the opinion. The Beringia DPS is not listed (identified as "Candidate"), but the listing is still in effect for the Okhotsk DPS (which is located in the Okhotsk Sea off the coast of Russia).

Similarly, on 16 September 2014, Shell requested a LOA under the MMPA from the USFWS for non-lethal unintentional and intentional "take" of small numbers of polar bears and Pacific walruses incidental to Shell's 2015 Chukchi Sea exploration drilling program (Shell 2014a). The intentional "take" application was specific to ice management activities, and included an adaptive Approach to Ice Management in the presence of Pacific walruses. Shell prepared its LOA application in accordance with the USFWS' Chukchi Sea oil and gas incidental take regulations (ITRs; USFWS 2013). On several subsequent occasions, the USFWS requested that Shell provide additional supplemental information with greater detail about Shell's 2015 Burger Prospect exploration drilling program, including additional data and analysis concerning the planned operations, and potential impacts to Pacific walruses in the Chukchi Sea. Shell provided this supplemental information on 20 April, 22 May, 29 May and 18 June (Shell 2015b). The USFWS issued Shell an LOA on 30 June 2015 for the unintentional "take" of small numbers of polar bears and Pacific walruses incidental to proposed activities occurring in the Chukchi Sea during the 2015 open-water season. The LOA was valid between 1 July 2015 and 1 November 2015 (Appendix B). The LOA received by Shell included several additional restrictions related to the Hanna Shoal Walrus Use Area (HSWUA). This included limitation on entry into the HSWUA, including Pacific walrus utilization distribution areas (UDs) during July, August, and September. The operation of two drilling units simultaneously within 15 mi (24 km) was also not authorized.

Having received these authorizations, Shell conducted exploratory drilling activities in the Chukchi Sea during the open-water period of 2015 in support of potential future oil and gas development. The 2015 activities were a continuation of an exploration drilling program Shell began in the Chukchi and Beaufort seas in 2012. Exploratory drilling in the Chukchi Sea was conducted by the *Transocean Polar Pioneer (Polar Pioneer)*, an ice-strengthened semi-submersible drilling unit. The Noble Corporation industry-standard, ice-strengthened Motor Vessel (M/V) *Noble Discoverer (Noble Discoverer)* drillship, though mobilized to the Chukchi Sea and located within 15 mi (24 km) of the *Polar Pioneer*, was restricted from drilling simultaneously due to the USFWS LOA. The drilling units were attended by 17 support vessels in the Chukchi Sea for the purposes of ice management, anchor handling, oil spill response, refueling, resupply, and environmental monitoring.

This document serves to meet reporting requirements specified in the IHA and LOA. The primary purposes of this report are to summarize the project activities in the Chukchi Sea, to describe the associated marine mammal monitoring and mitigation program and results, and to estimate the numbers of marine mammals potentially exposed to levels of sound generated by the exploratory drilling activities at or above presumed effect levels as prescribed by the respective agencies. In addition, a Joint Monitoring Program Report, that will present a comprehensive overview of offshore exploration activities conducted by the oil and gas industry, will be made available in the summer of 2016.

Incidental Harassment Authorizations and Letters of Authorization

IHAs and LOAs typically include provisions to minimize the possibility that marine mammals close to the sound source might be exposed to levels of sound high enough to cause short- or long-term hearing loss or other physiological effects. However, for the 2015 exploration drilling program, with the exception of the zero-offset vertical seismic profile (ZVSP; which did not occur), sound levels that could cause hearing loss or other physiological effects were not generated. During this project, sounds were generated by the drilling units *Polar Pioneer* and *Noble Discoverer* (though not drilling), support vessels (including ice-management and anchor-handler vessels), and aircraft on and near Shell's lease holdings in the Chukchi Sea. Shell was given authorization to conduct ZVSP surveys at the completion of a well, which involve

the emission of pulsed sounds from an airgun array. A single well was drilled reaching the anticipated hydrocarbon zone; however, no ZVSP surveys were conducted by Shell in 2015. Given the nature of the operations and mitigation measures, no injuries or deaths of marine mammals were anticipated as a result of the activities, and no such injuries or deaths were observed or attributed to these activities. Nonetheless, the sound produced by exploratory drilling and associated operations described in Chapter 2 had the potential to "take" marine mammals by harassment.

The authorizations were granted to Shell on the expectation that

- the numbers of marine mammals potentially harassed (as defined by NMFS and the USFWS criteria) during exploratory drilling operations would be "small";
- the effects of such harassment on marine mammal populations would be negligible;
- no marine mammals would be injured or killed;
- there would be no unmitigated adverse impacts on the availability of marine mammals for subsistence hunting in Alaska; and,
- the agreed upon monitoring and mitigation measures would be implemented.

The IHA issued by NMFS to Shell authorized incidental Level-B harassment "takes" of five ESA-listed species including bowhead whale, humpback whale, fin whale, and regional populations of ringed and bearded seals (NMFS 2012a,b) as well as several non-listed species including gray whale, minke whale, killer whale, beluga whale, harbor porpoise, and spotted and ribbon seals. Marine mammals exposed to pulsed sounds ≥160 decibels (dB) referenced to one micropascal (μPa) root mean square (rms) sound pressure level (SPL) are assumed by NMFS to be potentially subject to behavioral disturbance. However, the planned ZVSP surveys were not conducted, so no pulsed sounds were generated. NMFS assumes that marine mammals exposed to continuous sounds from drilling activities with received sound levels (RSLs) ≥120 dB re 1 μPa (rms SPL) are likely to be disturbed behaviorally. That assumption is based mainly on data concerning behavioral responses of baleen whales, as summarized by Richardson et al. (1995) and Gordon et al. (2004).

The LOA issued to Shell by USFWS was based on similar expectations for potential impacts to polar bears and Pacific walruses as those described for cetaceans and seals in the IHA. The ≥180 and ≥190 dB re 1 μPa (rms SPL) guidelines for potential impacts to hearing sensitivity from pulsed sounds are employed by USFWS for Pacific walrus and polar bear, respectively. These safety criteria are based on a cautionary assumption that sound energy at lower received levels will not harm these animals or impair their hearing abilities, but that higher received levels might have some such effects (USFWS 2013). The ≥160 dB re 1 μPa (rms SPL) is considered a threshold for behavioral, sub-lethal take of Pacific walruses for pulsed sounds (USFWS 2013). Pinnipeds generally seem to be less responsive to exposure to industrial sound than most cetaceans. Existing data suggest that walruses typically display no observable reaction when exposed to pulsed sound levels <160 dB re 1 μPa (rms SPL) and continuous sound associated with drilling <120 dB re 1 μPa (rms SPL; LGL and JASCO 2014; USFWS 2013). The reasonably likely impacts of the specified activities on marine mammal populations will be related to acoustic effects and encounters with project-related vessels. In general, disturbance effects are expected to depend on the species of marine mammal, the activity of the animal at the time of exposure, the distance from the sound source, the received level of the sound, and the associated water depth.

Marine Mammal Monitoring and Mitigation Plan

As part of the IHA and LOA applications, a Marine Mammal Monitoring and Mitigation Plan (4MP) was developed and submitted to the agencies for review (Shell 2014b). The 4MP contained a description of the marine mammal monitoring and mitigation Shell planned to conduct during the Chukchi Sea exploration drilling program, including vessel-based monitoring by Protected Species Observers (PSOs), acoustic monitoring using autonomous passive acoustic recorders, and aerial photographic surveys.

The primary objectives of the monitoring and mitigation program were to:

- provide real-time sighting data needed to implement the mitigation requirements;
- collect data on the occurrence, distribution, and activities of marine mammals in the areas where drilling activity was conducted;
- determine the reactions (if any) of marine mammals potentially exposed to exploratory drilling sounds and related activities;
- estimate the numbers of marine mammals potentially exposed to low-level continuous sounds generated by the drilling operations and support activities near well sites;
- communicate with coastal communities including whalers; and,
- employ and build capacity for local residents, with one objective being to develop a larger pool of experienced Alaska Native PSOs.

A summary of the methods and results of the 4MP program are provided in the following chapters.

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2. EXPLORATORY DRILLING OPERATIONS DESCRIBED[2]

Shell conducted exploratory drilling activities in the Chukchi Sea during the 2015 open-water period using the *Polar Pioneer*, an ice-strengthened semi-submersible drilling unit, at the Burger J drill site. One well was completed at that location—which included boring a pilot hole, constructing a Mud-Line Cellar (MLC), hole-opening operations to set conductor and surface casing, and finally drilling to total well depth. The *Noble Discoverer*, an industry-standard, ice-strengthened M/V drillship, was anchored and idle at the Burger V drill site during the 2015 season. No drilling occurred at the Burger V drill site in 2015.

All activities involved in drilling the Burger J well to total depth, and the idle occupancy at the Burger V drill site, were in compliance with Bureau of Ocean Energy Management (BOEM) and Bureau of Safety and Environmental Enforcement (BSEE) regulations. The following sections provide a more detailed description of anchor handling, ice management, and exploratory drilling in the Chukchi Sea during 2015.

Location and Timing of Operations

The geographic region where the exploration drilling program occurred in the Chukchi Sea was on BOEM Alaska OCS lease holdings in the Chukchi Sea Planning Area designated by Oil and Gas Lease Sale 193 (Figure 2.1). The Burger J drill site was located approximately 111 km offshore and approximately 139 km northwest of the closest village, Wainwright, which is located on the northwestern coast of Alaska. The Burger V drill site was located approximately 105 km offshore and approximately 126 km northwest of Wainwright. Water depths in the Burger Prospect area average 40–48 m (131-157 ft).

The vessels used during Shell's 2015 program, all of which were staffed with Protected Species Observers (PSOs), are listed below by their primary capabilities or task.

- **Drilling Units** – *Transocean Polar Pioneer* (*Polar Pioneer*, semi-submersible platform that requires towing) and *Noble Discoverer* (self-propelled drillship)
- **Ice Management Vessels** – M/V *Fennica (Fennica)* and M/V *Nordica (Nordica)*
- **Anchor Handlers and Secondary Ice Management Vessels** – M/V *Tor Viking (Tor Viking)*, M/V *Ross Chouest (Ross)*, and M/V *Aiviq (Aiviq)*
- **Offshore Supply Vessels (OSVs)** – M/V *Harvey Supporter (Supporter)*, M/V *Harvey Champion (Champion)*, and M/V *Harvey Spirit (Spirit)*
- **Drilling Discharge Monitoring (DDM) Vessel** – M/V *Harvey Explorer (Explorer)*
- **OSV and Crew Change Platform** – M/V *Sisuaq (Sisuaq)*
- **Arctic Oil Storage Tanker (OST)** – M/V *Marika (Marika)*
- **Arctic Offshore Spill Response (OSR) Tanker** – *M/V Minerva Antarctica (Minerva)*
- **Offshore Spill Response (OSR) Vessels** – M/V *Nanuq (Nanuq)* and M/V *Guardsman (Guardsman)*
- **General Logistics and Support** –M/V *Lauren Foss (Lauren Foss)*, M/V *Ocean Wave (Ocean Wave)*, and M/V *Ocean Wind (Ocean Wind)*

The *Aiviq, Nordica, and Explorer* were the first vessels to sail northward from Dutch Harbor when they departed on 2 July 2015. These three vessels entered the Chukchi Sea Activity Area, defined as the

[1]By L. Ackein, H. Reider, D. Ireland (LGL)

area of the Chukchi Sea north of Point Hope, on 6 July. On 16 October, the *Champion, Sisuaq, Explorer, Marika,* and *Nanuq* were the last of Shell's vessel assets to depart the Chukchi Sea Activity Area en route to Dutch Harbor. Most 2015 project vessels departed the Chukchi Sea Activity Area between late-September and early-October. The *Champion, Sisuaq, Lauren Foss,* and *Nanuq* were the last to return to Dutch Harbor on 20 October.

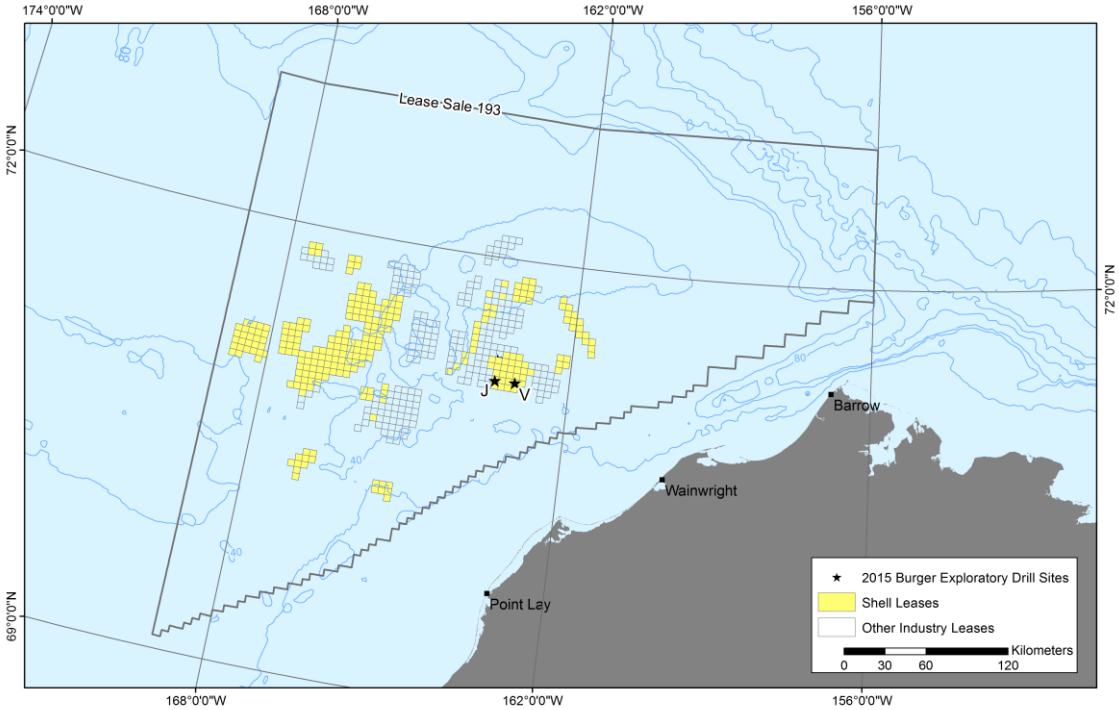


FIGURE 2.1. The location of Shell lease holdings in the Alaskan Chukchi Sea and the exploratory drill sites Burger J and Burger V where activities were focused in 2015.

Exploratory Drilling and Related Activities

The drilling unit *Polar Pioneer,* tow-assist vessels *Ocean Wind* and *Ocean Wave,* and additional support vessels departed Dutch Harbor on 17 July 2015. These vessels arrived in the Chukchi Sea Activity Area on 23 July and subsequently arrived at the Burger J drill site on 25 July. Exploratory drilling began at the Burger J drill site on 30 July and drilling was completed on 22 September. There was a 10-day period in which active drilling did not occur due to a weather event (24 August to 3 September). The *Polar Pioneer* departed the prospect on 4 October and subsequently exited the Chukchi Sea Activity Area on 5 October. The *Polar Pioneer* spent a total of 75 days in the Chukchi Sea Activity Area, with 45 of those days engaged in exploratory drilling or related activities (Figure 2.2).

The drillship *Noble Discoverer*, assist vessel *Lauren Foss,* and accompanying support vessels departed Dutch Harbor on 16 July 2015. These vessels arrived in the Chukchi Sea Activity Area on 22 July and subsequently arrived at the Burger Prospect on 23 July (Figure 2.2). The *Noble Discoverer* spent a total of 75 days in the Chukchi Sea Activity Area, but did not engage in exploratory drilling activities at any point in the 2015 season. The *Noble Discoverer* departed the prospect on 2 October and subsequently exited the Chukchi Sea Activity Area on 4 October.

Anchor handling, ice management, and support vessels were active on and near both drill sites as required during the operational period. The *Aiviq*, *Tor Viking*, and *Ross* performed all anchor handling, mooring, and unmooring operations during the 2015 season. The *Nordica*, *Aiviq*, and *Tor Viking* were involved in ice scouting and ice management activities near the drill site in the Chukchi Sea. A summary of the periods of time when each project vessel was in the Activity Area is shown in Figure 2.2.

Anchor Handling

The drilling units each had an 8-point anchored mooring system with a maximum anchor radius of ~910 m (2986 ft). Each drilling unit was affixed to the seafloor using eight 7000 kg (15,432 lbs) Stevpris anchors arranged in a radial array. The drilling unit anchors were designed for rapid connect and disconnect using a Rig Anchor Release (RAR) system, with a submersible anchor buoy to ensure the line did not get stuck on the sea floor. The different phases of anchor handling included anchor setting, anchor hook-up, disconnection, and anchor retrieval. Each phase of anchor handling was accomplished in discrete time periods ranging from ~2 to 7 days. Underwater sound propagation during these activities was measured and is described in Chapter 3.

The *Aiviq* arrived on prospect ahead of the drilling units to pre-lay anchors at the Burger V drill site from 13 to 16 July 2015 (Figure 2.3). Anchor setting and connection of the anchors to the *Polar Pioneer* at the Burger J drill site occurred from 25 to 27 July, and the drilling unit remained on anchor until disconnection at the end of the season on 3 and 4 October. Connection of the anchors to the *Noble Discoverer* at the Burger V drill site occurred from 5 to 9 August. Deteriorating weather conditions resulted in the *Noble Discoverer* disconnecting from its anchors on 27 August. The *Ross* and *Aiviq* performed anchor handling and anchor repositioning activities from 6 to 8 September and 12 to 17 September as weather conditions allowed, before the *Noble Discoverer* returned to the Burger V drill site to reconnect to anchors from 19 to 20 September. Anchors were retrieved from the Burger J drill site during final unmooring of the *Polar Pioneer*, but remained on the seafloor at the Burger V drill site following the completion of unmooring operations.

Exploratory Drilling and MLC Construction

Exploratory drilling was conducted using standard rotary drilling technology and seawater from 30 July through 22 September, 2015. Exploratory drilling by the Polar Pioneer commenced at Burger J drill site on 30 July. Upon reaching target depth for the pilot hole on 2 August, an MLC was constructed from 3 to 11 August to ensure that the wellhead and blowout preventer (BOP) were located below the maximum ice-keel gouge depth. The MLC was constructed in the seafloor using a large-diameter bit operated by hydraulic motors.

Upon completion of the MLC, drilling operations associated with construction of the well to total depth (e.g. drilling, casing, and cementing) continued from 12 to 22 August (Figure 2.3). Deploying and testing of the BOP occurred from 22 to 24 August, after which the Polar Pioneer temporarily stopped drilling due to weather. Drilling activities resumed on 4 September and continued until drilling operations were completed on 22 September.

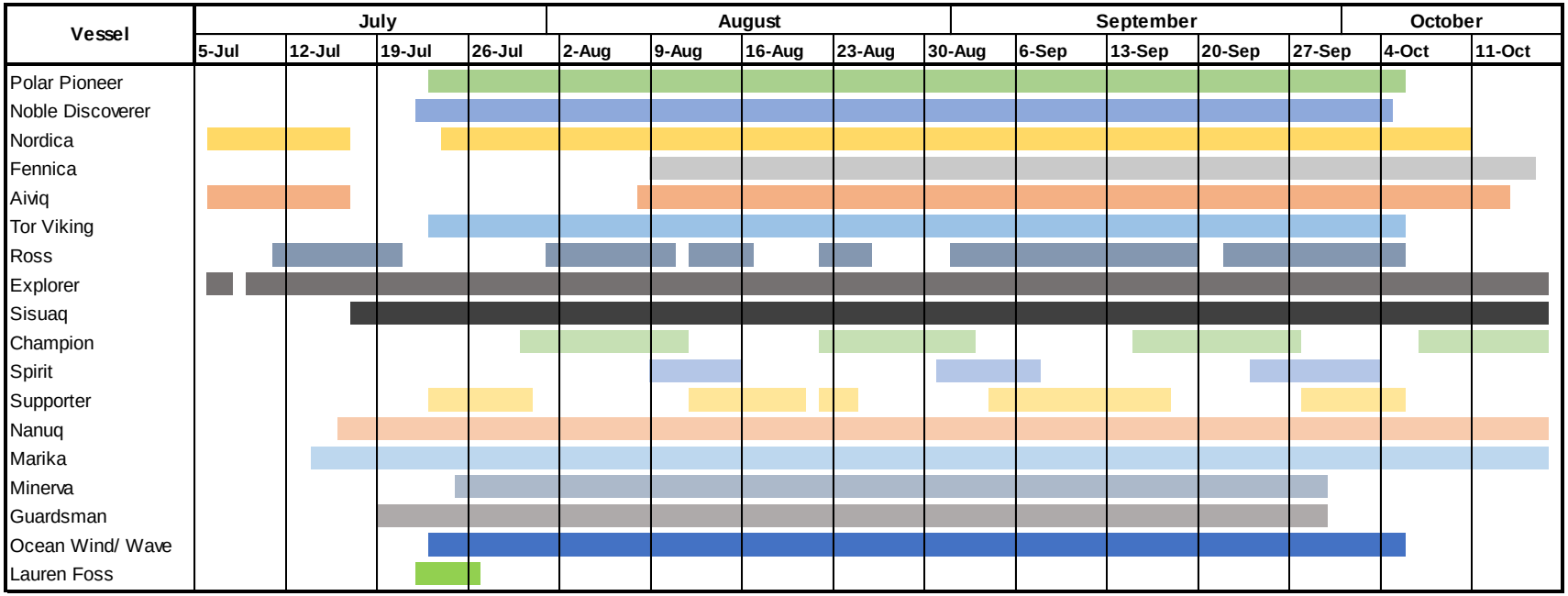


FIGURE 2.2. Periods when each project vessel was present in the Chukchi Sea Activity Area during Shell's exploratory drilling program, 2015.

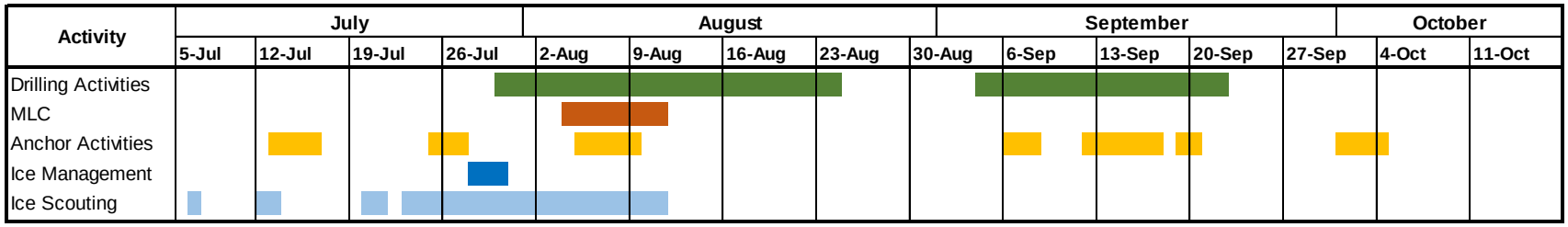


FIGURE 2.3. Periods when exploratory drilling and related support activities were conducted during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Ice Scouting and Ice Management

The exploration drilling program was located in an area characterized by active sea-ice movement and ice scouring. Potentially hazardous ice was observed during the 2015 program in the Chukchi Sea and ice management and scouting were a part of the exploration drilling activities. Shell implemented an Ice Management Plan (IMP) to provide real-time ice and weather forecasting to identify conditions that might put operations at risk. The IMP provided Shell with a mechanism to modify the drilling schedule and activities as necessary with changing weather and ice conditions.

Ice scouting was performed by the *Nordica*, *Aiviq*, and *Tor Viking* between 7 July and 11 August (Figure 2.4), upwind of the Burger Prospect along the ice edge and often along the border of HSWUA, an LOA-designated area near the drill sites with restrictions on entry (see Chapter 1 and Appendix B). Ice scouting occurred near the July and August 50% UD areas of HSWUA, depending on timing of operations and presence of ice. Ice scouting typically involved transit to the active ice edge in order to monitor ice from a distance to determine observable composition, as well as using dynamic positioning (DP) to determine set and drift of ice fields in order to determine hazard times for the two drilling units. While scouting ice on 29 July, the *Tor Viking* inadvertently entered the HSWUA and July 50% UD area for <3 hr. No walrus were encountered during that time and the USFWS was notified the same day.

In general, ice management activities included physical pushing or breaking of drift ice to determine composition of the ice. A small amount of ice management occurred along the ice edge outside of HSWUA, upwind of the Burger J and Burger V drill sites. The actual amount of time spent actively pushing or breaking ice in the Chukchi Sea was limited to discrete, isolated events between 28 and 30 July 2015. Vessel tracklines shown in Figure 2.4 represent the locations of these isolated events, with a total ice management effort duration of ~3 hours (77 minutes for the *Nordica*, 89 minutes for the *Aiviq*, and 14 minutes for the *Tor Viking*).

Aircraft Operations

Various aircraft were used in support of both marine mammal monitoring and the 2015 exploratory drilling program in the Chukchi Sea. All aircraft active in the Chukchi Sea Activity Area in 2015 were operated out of Barrow. An Aero Commander fixed-wing aircraft was flown to conduct aerial surveys for marine mammals over the drilling prospect as part of the monitoring program (see Chapter 7). The Aero Commander was also flown to conduct ice reconnaissance flights in-season. Additionally, three S-92 helicopters provided support for crew change and resupply. A fourth S-92 helicopter served as the search-and-rescue (SAR) asset operated by Shell during the drilling season.

Crew changes and resupply were conducted with three S-92 helicopters contracted from PHI Inc. PHI conducted 304 round-trip flights out of Barrow, which included crew change, training, maintenance, resupply and rotor track and balance flights (RTBs), along with flights to Wainwright, Atqasuk, and Deadhorse. Of the 304 helicopter flights, 256 flights departed Barrow and landed on at least one project vessel's helideck (i.e., *Polar Pioneer*, *Noble Discoverer*, *Aiviq*, *Fennica*, *Nordica*, and *Sisuaq*). Of these flights, 89 were to the *Polar Pioneer*, 77 were to the *Noble Discoverer*, and the remaining 90 flights were to the support vessels *Aiviq*, *Fennica*, *Nordica*, and *Sisuaq*. Crew-change flights were flown from 10 July through 18 October 2015 in the Chukchi Sea.

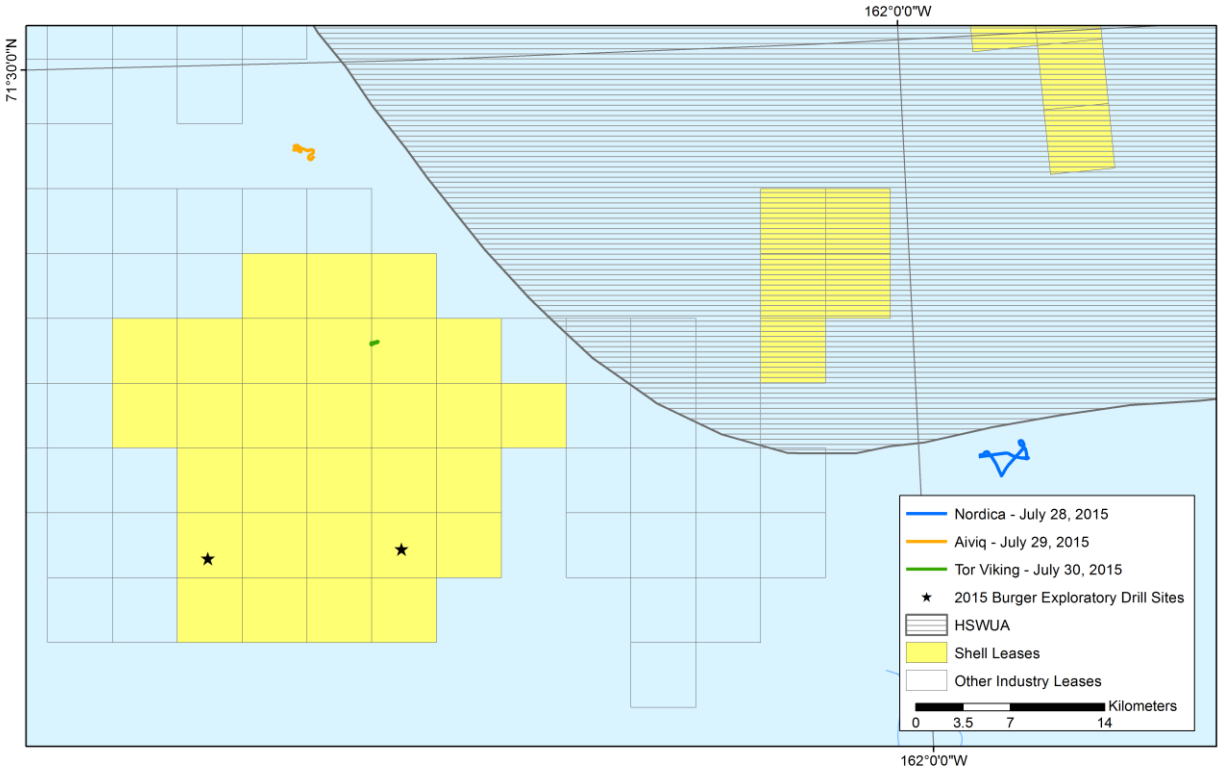


FIGURE 2.4 Ice Management activity during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Flights were routed through two main, Federal Aviation Administration (FAA) -mandated corridors throughout the season, the first between Barrow and the Burger drill sites and the second between Barrow and an area off the coast of Wainwright that required shorter flight times and often provided better weather conditions than could be found at the drill sites. On a few occasions, flight routes deviated from these two corridors as necessary for mechanical, weather, or medical flight considerations. Flight paths between Barrow and the drill sites complied with restrictions outlined in the permits, including during transit within the boundary of HSWUA (Figure 2.5).

Shell flew fixed-wing ice reconnaissance flights to scout and assess ice conditions for asset protection and project planning purposes. The objectives of this program were to collect ice images for verifying satellite data and to scout for ice hazards real-time. There were a total of 14 reconnaissance flights flown between 4 July and 12 August.

Shell had one additional helicopter that was primarily for SAR purposes, contracted from CHI Inc. This aircraft remained on the ground in Barrow except during training drills, medical flights, and other non-routine events. A total of 83 flights were made by this helicopter during the season, including training flights near Barrow, starting on 4 June.

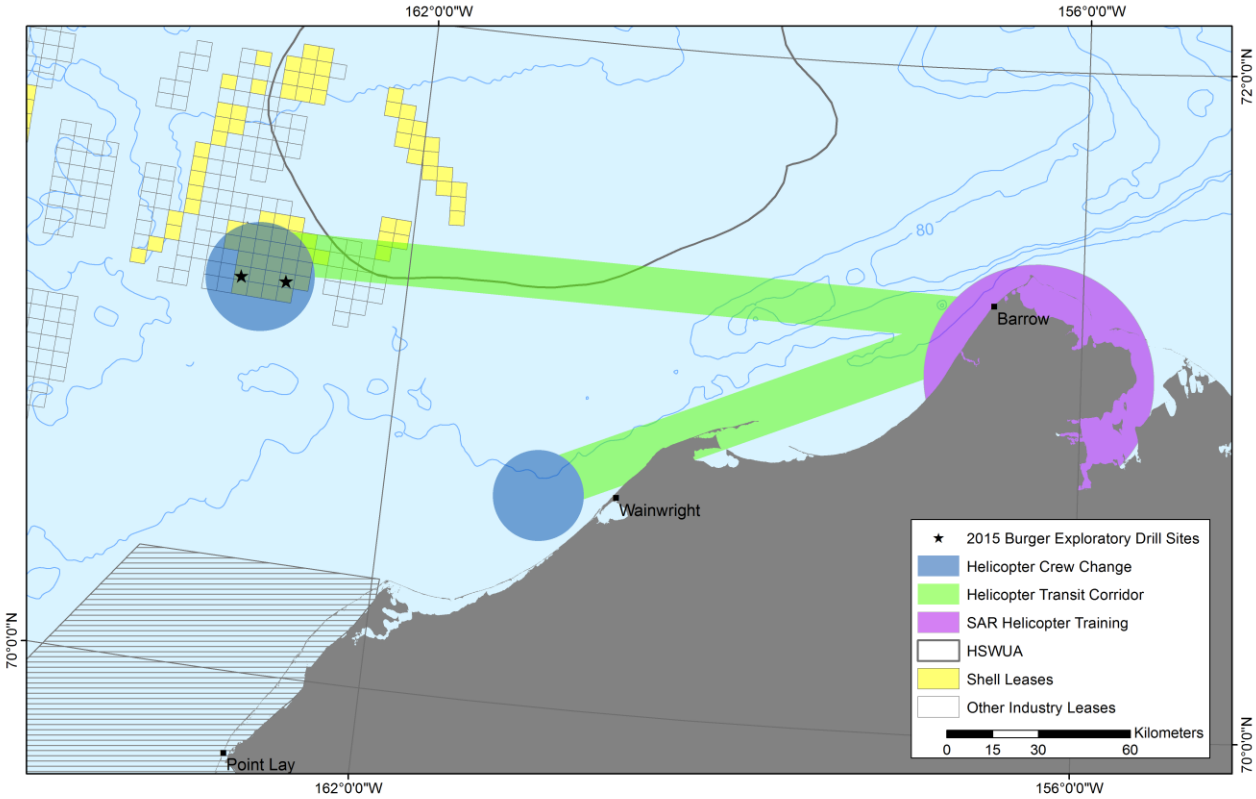


FIGURE 2.5. Flight corridors during Shell's exploratory drilling operations in the Chukchi Sea, 2015

4MP Operations

Monitoring for marine mammals by PSOs was conducted from two drilling units and 17 support vessels operated by Shell in support of exploration drilling. PSOs first started boarding vessels on 26 June in Dutch Harbor for the transit north to the Chukchi Sea Activity Area, and the last PSOs disembarked from Dutch Harbor on 20 October at the completion of the season. PSOs were stationed onboard the drilling units and the support vessels to detect and monitor marine mammals and their responses to industry activities, and to initiate mitigation measures, if required. PSOs stationed on drilling units and support vessels monitored for marine mammals during all daylight periods and during some nighttime operational periods. PSOs aboard vessels in transit implemented general mitigation measures as stipulated in Shell's IHA and LOA (e.g. reduce speed, alter course, maximize distance from marine mammals) to minimize potential impacts. All of Shell's vessels operated in accordance with the provisions of the IHA issued by NMFS (Appendix A) and LOA issued by the USFWS (Appendix B), as well as a Conflict Avoidance Agreement (CAA) negotiated between Shell and the Alaska Eskimo Whaling Commission (AEWC).

Acoustic measurements and monitoring were conducted in the Chukchi Sea by JASCO Applied Sciences (JASCO). Underwater measurements of sound propagation from each project vessel that had not previously been measured in the Chukchi Sea were conducted from 25 July to 10 August, ~35 km south-southwest of the Burger V drill site. The measurements were performed using three JASCO Autonomous Multi-channel Acoustic Recorders (AMARs) deployed from the Supporter to capture sound levels as a function of distance and direction from each vessel. Additionally, six recorders were deployed within 16 km of each drill site to record and characterize sounds associated with the drilling activities from 24 July

to 4 October (see Chapter 3 for a complete description of the sound source measurements and analyses). These included sounds associated with anchor placement and handling and the drilling of a well, which involves the boring of a pilot hole, MLC construction, and drilling to total well depth. Additionally, a widely distributed regional array of recorders was deployed across much of the northeastern Chukchi Sea. This was a continuation of similar monitoring efforts conducted by multiple industry operators since 2006. One recorder in the regional array, that was also a part of the drill site sound source verification array, was deployed from the Supporter on 25 July in the July 50% UD of the HSWUA limited entry area. Shell received a variance from USFWS to conduct this activity. The locations of several other acoustic recorders in the regional array were revised as a result of limited entry into HSWUA stipulated in the USFWS LOA. These changes, the methods, and results of the acoustic monitoring program are described in Chapter 3.

Shell conducted aerial surveys of marine mammals from a manned fixed-wing aircraft using high-definition digital still cameras over the Burger drill sites in the Chukchi Sea. The objectives of the 2015 aerial survey program were to collect data on the abundance and distribution of marine mammals near the Burger Prospect, and, to the extent possible, estimate potential changes in distribution relative to the drill sites. The first survey was conducted on 7 July and the last was completed on 2 October. There were 29 flights flown for the Chukchi Aerial Survey Program. Of the 29 flights, 20 were fully or partially completed surveys over the Burger prospect, seven were attempts that did not collect any usable images over the survey area due to weather or other operational considerations, and two were test flights. Revisions were made to the aerial survey design as a result of stipulations in the LOA and those revisions are explained further, along with the methods and preliminary results of the surveys, in Chapter 7.

Shell Communications with Local Village Communication Centers

Personnel aboard the drilling units and support vessels, most often the PSOs, routinely contacted Alaska Native communities via a network of communication centers (com centers). Com centers were maintained in Barrow, Wainwright, Point Lay, Point Hope, Kivalina, Deering, Kotzebue, Wales, Savoonga, and Nome during the 2015 exploratory drilling season. These communications between Shell and local communities were intended to ensure that project activities did not interfere with subsistence activities of the Arctic Slope, Northwest Arctic, and Bering Straits regions. Communications were made when the vessels were within 50 miles of the closest com center. Communications were made via phone, VHF radio, or email by each vessel every 6 hours (0000, 0600, 1200, and 1800 hours). Information reported during each communication included the current vessel location, activity, heading, and the proposed activities for the next 24 hours. In addition to daily com center communications, Shell held twice daily Subsistence Advisor (SA) calls with potentially affected communities. These SA calls afforded Shell real-time, direct communication with those communities and further mitigated the prospect of an unmitigable impact on marine and coastal subsistence activities.

3. UNDERWATER SOUND MEASUREMENTS[3]

This chapter presents the results from an underwater acoustic monitoring study that characterized the sound emissions of vessels and equipment used during Shell's 2015 drilling program in the Alaskan Chukchi Sea. JASCO collected acoustic recordings between 7 July and 5 October 2015 at the Burger Prospect in the Chukchi Sea. This study was performed to fulfill the underwater acoustic monitoring requirements of Shell's IHA issued by NMFS.

Conditions 10(c) and 11(b) of the IHA define the monitoring and reporting requirements for these sound source characterization (SSC) and verification measurements:

"10. Monitoring Measures:

...(c) Acoustic Monitoring:

(i) Field Source Verification: the Holder of the Authorization is required to conduct sound source verification tests for the drilling units, support vessels, and the airgun array not measured in previous seasons. Sound source verification shall consist of distances at which broadband received levels reach 190, 180, 170, 160, and 120 dB re 1 µPa (rms). For the airgun array, the configuration shall include at least the full array and the operation of a single source the will be used during power downs.

(ii) Acoustic "Net" Array: Deploy acoustic recorders across the U.S. Chukchi Sea and on the prospect as detailed in the 4MP."

"11. Reporting Requirements: The Holder of the Authorization is required to:

...(b) Submit a draft report on all activities and monitoring results to the Office of Protected Resources, NMFS, within 90 days of the completion of the exploration drilling program. This report must contain and summarize the following information:

...(ii) Sound source verification and sound source characterization results for drilling units and vessels recorded in 2015"

This chapter addresses the detailed reporting tasks of Condition 11(b)(ii) and provides further information about the measurements performed under Condition 10. Condition 10(c) requires regional passive acoustic monitoring be conducted. JASCO will report the results from that monitoring in the forthcoming Comprehensive Report; this chapter does not contain those results.

Vessel sounds were measured with three dedicated underwater acoustic recorders that were deployed perpendicular to a vessel track to measure support vessel sounds in the forward, aft, and broadside directions. This chapter reports these data in plots of sound pressure levels versus range and in tables that list ranges at which sound levels between 190 and 120 dB re 1 µPa (rms SPL, in 10 dB steps) were measured, per condition 10(c) of the IHA. Source level estimates are also reported for each vessel in 1/3–octave bands.

Sounds from drilling and related activities were measured at 14 underwater acoustic recording stations: seven at the Burger J drill site and seven at the Burger V drill site. The IHA permitted incidental takes for the following activities: ZVSP using a small airgun array, drilling and associated vessels on DP, vessel sounds during ice management or icebreaking, MLC construction, and anchor handling. This chapter reports sound characterizations for anchor handling, MLC construction, drilling, and vessel DP. ZVSP

[3] By M. Austin and Z. Li. (JASCO Applied Sciences)

sound measurements were planned at the Burger J and Burger V drill sites but the profiling did not occur. Ice management occurred too far away from the acoustic recorders for sound characterization of that activity. For each measured activity, this report presents the sound levels received at each recorder along with the spectral composition of the measured drilling sounds and the ranges at which underwater sound levels were between 190 and 120 dB re 1 µPa (rms SPL) in 10 dB steps.

Goals of the Acoustics Study

The goals of the acoustic monitoring study were to:

- Establish distances from all vessels not previously measured where received sound levels were between 190 dB re 1 µPa (rms SPL) and 120 dB re 1 µPa (rms SPL) in 10 dB steps.
- Establish the distances from drilling activities at which received sound levels were between 190 dB re 1 µPa (rms SPL) and 120 dB re 1 µPa (rms SPL) in 10 dB steps.
- Characterize the spectral composition of sounds from all vessels and drilling equipment.
- Establish source sound pressure levels for vessels and drilling equipment.
- Model the temporal evolution of sound footprints for all drilling and vessel activities.

Methods

Equipment

Underwater sounds were measured with 23 AMARs (JASCO) that were positioned to characterize sounds from vessels at one site, and drilling and ZVSP planned at two sites (Burger J and Burger V). The AMARs were deployed directly on the seabed with their hydrophones approximately 30 cm (12 in) above the ocean floor. Each AMAR had an attached ground line and small anchor (Figure 3.1) so they could be retrieved with a grapple hook. Table 3.1 lists the number of AMARs, hydrophone model and sensitivity, and duty cycle for each sound source. Each AMAR recorded acoustic data to internal memory at a 64 kHz sample rate with 24-bit resolution, a configuration that captured acoustic frequencies from 10 Hz to 32 kHz.

TABLE 3.1. Summary of sound sources monitored with the number of AMARs and their GeoSpectrum hydrophones.

Sound source	Activity occurred	Number of AMARs	Hydrophone model	Nominal hydrophone sensitivity (dB re V/µPa)	Duty cycle
Vessels	Yes	3	M8E-35dB	-164	Continuous
Anchor handling at Burger J	Yes	1	M8E-35dB	-164	Continuous
Anchor handling at Burger V	Yes	1	M8E-35dB	-164	Continuous
Drilling at Burger J	Yes	6	M8E-35dB	-164	27 minutes recording then 3 minutes sleeping
Drilling at Burger V	No	6	M8E-35dB	-164	27 minutes recording then 3 minutes sleeping
ZVSP at Burger J	No	3	M8E-0dB	-200	27 minutes recording then 3 minutes sleeping
ZVSP at Burger V	No	3	M8E-0dB	-200	27 minutes recording then 3 minutes sleeping

Each AMAR was calibrated before deployment and after retrieval with a 42AC pistonphone calibrator (G.R.A.S. Sound & Vibration A/S), which generates a known 250 Hz reference tone accurate to 0.1 dB at the AMAR hydrophone sensor. The pressure calibration of each AMAR was obtained from the level of the reference signal in the digital calibration recording. Typical calibration variance using this method is less than 0.5 dB absolute pressure. The pressure sensitivity obtained from the pistonphone calibration was used in subsequent data analysis.

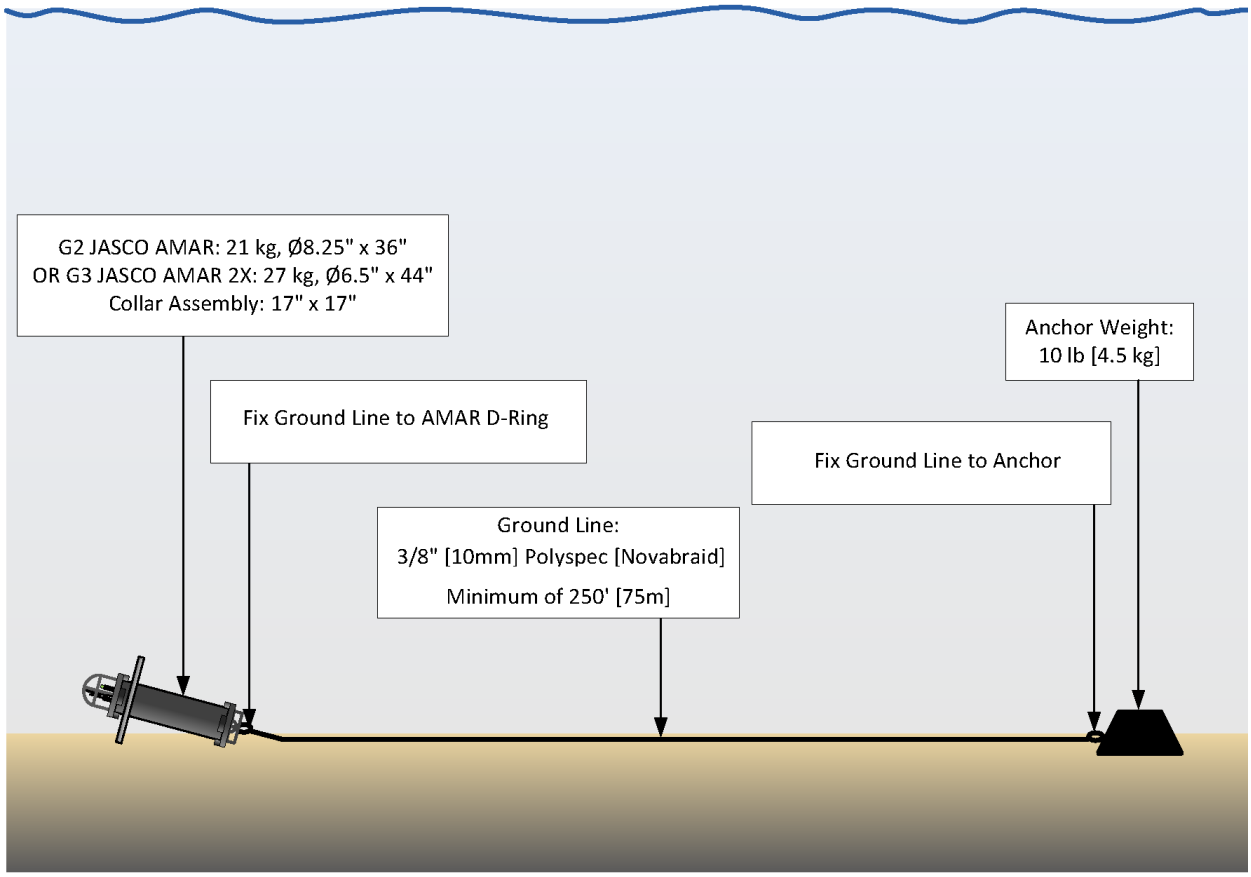


FIGURE 3.1. AMAR mooring design.

Sound Sources Monitored

The IHA required SSC measurements of underwater sound levels emitted by each support vessel operating at the drilling prospect. SSC measurements for some of the support vessels were not required in the IHA because the vessels had been previously measured at the prospect and are reported in JASCO Applied Sciences and Greeneridge Sciences, Inc. (2014). Table 3.2 lists all the support vessels used near the drill sites and denotes the ten vessels measured in this study. This chapter contains underwater sound characterizations for vessels conducting the following activities, as applicable: transiting, DP, and anchor handling.

This chapter also contains characterizations of sounds from the Polar Pioneer for MLC construction, drilling, circulating, and running casing. These activities will be collectively referred to in this chapter as 'drilling activities'. The times when the various drilling activities occurred were identified from activity logs that were maintained throughout operations by PSOs onboard the vessels. Data collected at these times were used to compute trends of sound pressure levels as a function of distance for each activity. The SPL analysis considered only data from times when there were no ancillary vessels within 5 km (3 mi) of any included AMAR. This chapter contains only drilling measurements at Burger J as neither drilling at Burger V nor ZVSP at either site occurred in the 2015 open water season.

TABLE 3.2. Specifications for the vessels operating at the drill sites.

Vessel	Operator	Type	Length (m/ft)	Width (m/ft)	Draft (m/ft)	Engine	Propeller
*Aiviq**	Edison Chouest Offshore	Anchor handler	110/360	24/80	10/34	4 × Caterpillar C280, 21,600 kW total	Rolls Royce CP
*Fennica**	Arctia	Ice management	116/380	26/85	8.4/27.5	2 × Wärtsilä Vasa, 16 V 32/6000 kW 2 × Wärtsilä Vasa, 12 V 32/4500 kW	2 × azimuth, 4-blade, fixed pitch
*Guardsman**	Crowley Marine Services Inc.	Oil spill response	38.8/127	11.1/36.5	3.3/10.8	2 × EMD 20-645-EG, 5369 kW	2 × 5-blade, fixed pitch 3.4 m diameter
Champion	Harvey Gulf International Marine LLC	Offshore Supply Vessel	89/292	19.5/64	5.4/18	4 × Cummins QSK60 Diesel Electric	Z-drive
*Explorer**	Harvey Gulf International Marine LLC	Offshore Supply Vessel	73.2/240	17.1/56	3.05/10.0	2 × CAT 3516B, 3370 kW	2 × 5-blade, fixed pitch 2.6 m diameter
*Spirit**	Harvey Gulf International Marine LLC	Offshore Supply Vessel	85.4/280	18.3/60	5.0/16.5	2 × GE 7FDM12, 4579 kW total	2 × fixed pitch, 5-blades 2.4 m diameter
Supporter	Harvey Gulf International Marine LLC	Offshore Supply Vessel	89/292	19.5/64	5.1/17	4 × Cummins QSK60 Diesel Electric	Z-drive
*Lauren Foss**	Foss Maritime Company	Supply Tug	45.5/150	12/40	5.8/19	Alco Diesel, 6189 kW	Twin screw conventional, Kort nozzle

Vessel	Operator	Type	Length (m/ft)	Width (m/ft)	Draft (m/ft)	Engine	Propeller
Marika	Thome Ship Management	Tanker	229/750	32/105	10/33	MAN B&W 6S60M-C	CPP, 6.8 m dia., 4 blades
Minerva Antarctica	Minerva Marine Inc.	Oil tanker	249/817	44/144	8.2/26.9	MAN B&W 7S60MC	7.4 m dia.
*Nanuq**	Edison Chouest Offshore	Oil spill response	91.9/301	18.3/60	5.0/16.5	2 × Caterpillar 3608 4920 kW	Controllable pitch
Noble Discoverer	Noble Drilling	Drilling unit	157/514	26/85	8.2/27	Mitsubishi/UBE 6UEC 65/135A, 5369 kW	4-blades, fixed, 5.505 m diameter, 3.7 m pitch
*Nordica**	Arctia	Ice management	116/380	26/85	8.4/27.5	2 × Wärtsilä Vasa, 16 V 32/6000 kW 2 × Wärtsilä Vasa, 12 V 32/4500 kW	2 × azimuth, 4-blades, fixed pitch, variable rpm
Ocean Wave	Crowley Marine Services	Support Tug	44.5/146	14/46	6.4/21	2c Caterpillar C-280-12 Tier II 10,880 BHP	4 blade CPP
Ocean Wind	Crowley Marine Services	Support Tug	44.5/146	14/46	6.4/21	2c Caterpillar C-280-12 Tier II 10,880 BHP	4 blade CPP

Vessel	Operator	Type	Length (m/ft)	Width (m/ft)	Draft (m/ft)	Engine	Propeller
Polar Pioneer	Transocean Ltd	Semisubmersible drilling unit	85/279	82/269	9.1/30	5 × Bergen KVG-18 diesel engines rated at 2,750 kW each driving 1 × AC generator	4 × Liaan TNCP 105/75-280 rated at 2,400 kW azimuthing
Ross	Edison Chouest Offshore	Anchor Handler	78/256	16.5/54	5.2/17	Main, 2 × Caterpillar 3612 DDTs, 2× Caterpillar 3512 TT, 1× Caterpillar 3508	CPP
Sisuaq	Harvey Gulf International Marine LLC	Offshore Supply Vessel	88.5/292	19/64	5.8/19	4 × Cummins QSK60DM 7300 kW total	Schottell z-drive x2
*Tor Viking II**	Viking Supply	Anchor handling and secondary ice management	83.7/275	18/59	6/20	2 × Mak 6 M32, 2880 kW 2 × Mak 8 M32, 3840 kW	2 × KaMeWa 4-blades, controllable pitch 4.1 m diameter

*Characterized in the 2012 SSC study.

Data Acquisition

Vessel Sound Source Characterization

Vessel SSC measurements were performed with three AMARs to capture sound levels as a function of distance and direction from vessels working at the prospect. The three AMARs were deployed perpendicular to a 15 km (9.3 mi) vessel trackline—at 0, 500, and 1000 m (0, 1640, and 3280 ft) (Figure 3.2). Vessel operators were instructed to sail from the start to the end of the track at each vessel's normal operating speed. In addition, vessels that use DP were required to maintain position at two locations, which were 200 m and 10 km from AMAR A, at two perpendicular headings for at least five minutes. The vessels logged their locations digitally using Global Positioning System (GPS) as they transited along the track; these GPS navigation logs were used to calculate the distance between the vessels and the AMARs.

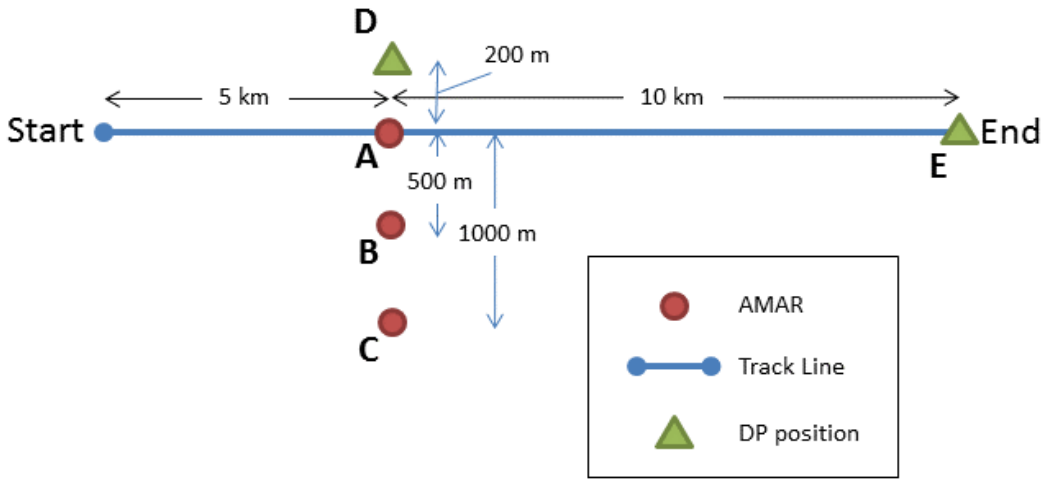


FIGURE 3.2. AMAR deployment geometry and vessel trackline for the vessel SSC, including positions for dynamic positioning (DP) measurements.

The vessel SSC site for the Chukchi Sea drill program was south-southwest of the Burger J drill site (Figure 3.3). The water depths along the SSC vessel trackline were similar to those at Burger J. Table 3.3 lists AMAR deployment coordinates and vessel trackline start and end points. Measurements were carried out between 24 July and 10 August 2015; Table 3.4 shows when the sounds were measured from each vessel.

TABLE 3.3. AMAR deployment locations, deployment and retrieval times, and track line start and end points for the vessel SSCs near the Burger J Prospect in the Chukchi Sea. Dates and times are given in Coordinated Universal Time (UTC).

Location	Latitude	Longitude	Water depth (m)	Deployed (UTC)	Retrieved (UTC)
A	70°53.199′ N	163°55.518′ W	46.3	24 Jul 13:55	16 Aug 07:29
B	70°53.375′ N	163°56.134′ W	46.9	24 Jul 14:28	16 Aug 08:07
C	70°53.545′ N	163°56.763′ W	46.3	24 Jul 14:59	16 Aug 08:46
Trackline start	70°51.147′ N	164°00.767′ W	–	–	–
Trackline end/E	70°57.314′ N	163°44.866′ W	–	–	–
D	70°53.032′ N	163°54.858′ W	–	–	–

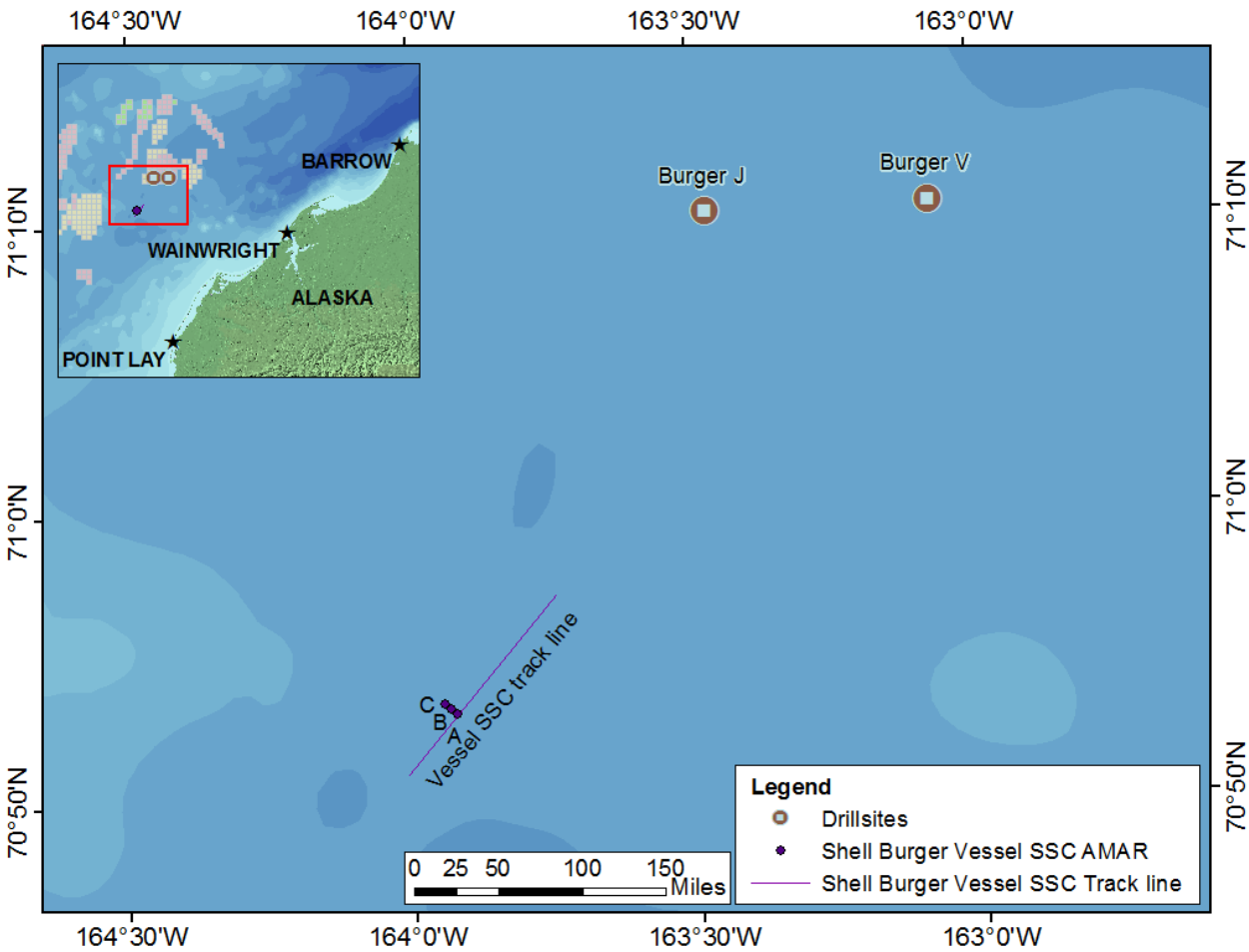


FIGURE 3.3. Vessel SSC location relative to Burger J and Burger V drill sites in the Chukchi Sea.

TABLE 3.4. Schedule of underwater acoustic measurements for the vessel SSC near the Burger J and Burger V drill sites in the Chukchi Sea. Dates and times are given in UTC.

Vessel	Date	Start (UTC)	End (UTC)	Transit speed (kts)
Noble Discoverer	4 Aug	18:24	20:08	5.4
Champion	10 Aug	20:54	21:46	9.2
Sisuaq	28 Jul	07:00	08:09	7.2
Supporter	30 Jul	08:09	09:04	8.7
Marika	3 Aug	16:41	17:18	12.9
Minerva	26 Jul	16:18	17:11	8.7
Ocean Wave	25 Jul	16:57	18:27	6.3
Ocean Wind	25 Jul	16:57	18:27	6.3
Polar Pioneer	25 Jul	17:04	18:21	6.4
Ross	2 Aug	10:41	11:25	11.1

Sound from Drilling Activities

Six AMARs were deployed at ranges of 0.5, 1, 2, 4, 8, and 16 km (0.3, 0.6, 1.2, 2.5, 5, and 10 mi) from both planned drill sites. A second AMAR, outfitted with a lower sensitivity hydrophone for recording sounds during ZVSP, was deployed at each of the three recorder locations nearest to each drill site. Also, before the Polar Pioneer and Noble Discoverer arrived at the Burger J and Burger V drill sites, an AMAR was deployed at 1 km (0.6 mi) from each drill site to measure sounds from anchor laying activities (BGJ-AH and BGV-AH). These AMARs remained in place throughout the open water season, providing an additional point of measurement. Table 3.5 lists the AMAR locations and deployment and retrieval dates.

The six AMARs deployed to measure sound from drilling activities were aligned in a north-south direction from each drill site (Figure 3.4). This orientation was a modification of the initial layout of the acoustic array following recommendations of a peer review panel for the drilling monitoring plan; the layout was designed to optimize SSC of the drilling unit as well as to better evaluate spatial displacement of marine mammals around the drill sites using possible marine mammal call detections. This report does not contain results from the marine mammal call detection analysis.

TABLE 3.5. AMAR deployment locations and deployment and retrieval times for drilling SSC at the Burger J and Burger V drill sites in the Chukchi Sea. Dates and times are given in UTC.

AMAR	Range from drill site (km)	Latitude	Longitude	Water depth (m)	Deployed	Retrieved
BGJ-AH	1	71°10.574' N	163°06.019' W	*46	7 Jul 22:56	4 Oct 12:00
BGJ-0.5 km	0.5	71°10.651' N	163°28.512' W	46.0	24 Jul 23:06	4 Oct 21:45
BGJ-1 km	1	71°10.903' N	163°28.802' W	46.0	24 Jul 22:36	4 Oct 23:17
BGJ-2 km	2	71°11.475' N	163°28.250' W	46.3	24 Jul 21:22	5 Oct 00:05
BGJ-4 km	4	71°12.544' N	163°28.161' W	46.3	24 Jul 19:50	5 Oct 01:24
BGJ-8 km	8	71°14.691' N	163°27.992' W	45.7	24 Jul 19:01	5 Oct 03:04
BGJ-16 km	16	71°18.988' N	163°27.314' W	46.6	24 Jul 18:11	5 Oct 04:35
BGV-AH	1	71°10.574' N	163°06.019' W	*47	7 Jul 21:29	28 Sep 12:30
BGV-0.5 km	0.5	71°10.293' N	163°04.492' W	46.9	25 Jul 00:48	5 Oct 06:48
BGV-1 km	1	71°10.039' N	163°04.742' W	46.9	25 Jul 02:00	3 Oct 18:00
BGV-2 km	2	71°09.506' N	163°04.460' W	46.9	25 Jul 02:40	3 Oct 18:47
BGV-4 km	4	71°08.415' N	163°04.586' W	46.3	25 Jul 04:14	3 Oct 19:50
BGV-8 km	8	71°06.276' N	163°04.787' W	46.6	25 Jul 04:46	3 Oct 20:55
BGV-16 km	16	71°01.980' N	163°05.199' W	46.6	25 Jul 05:45	3 Oct 22:09

*Water depth was not measured at these sites.

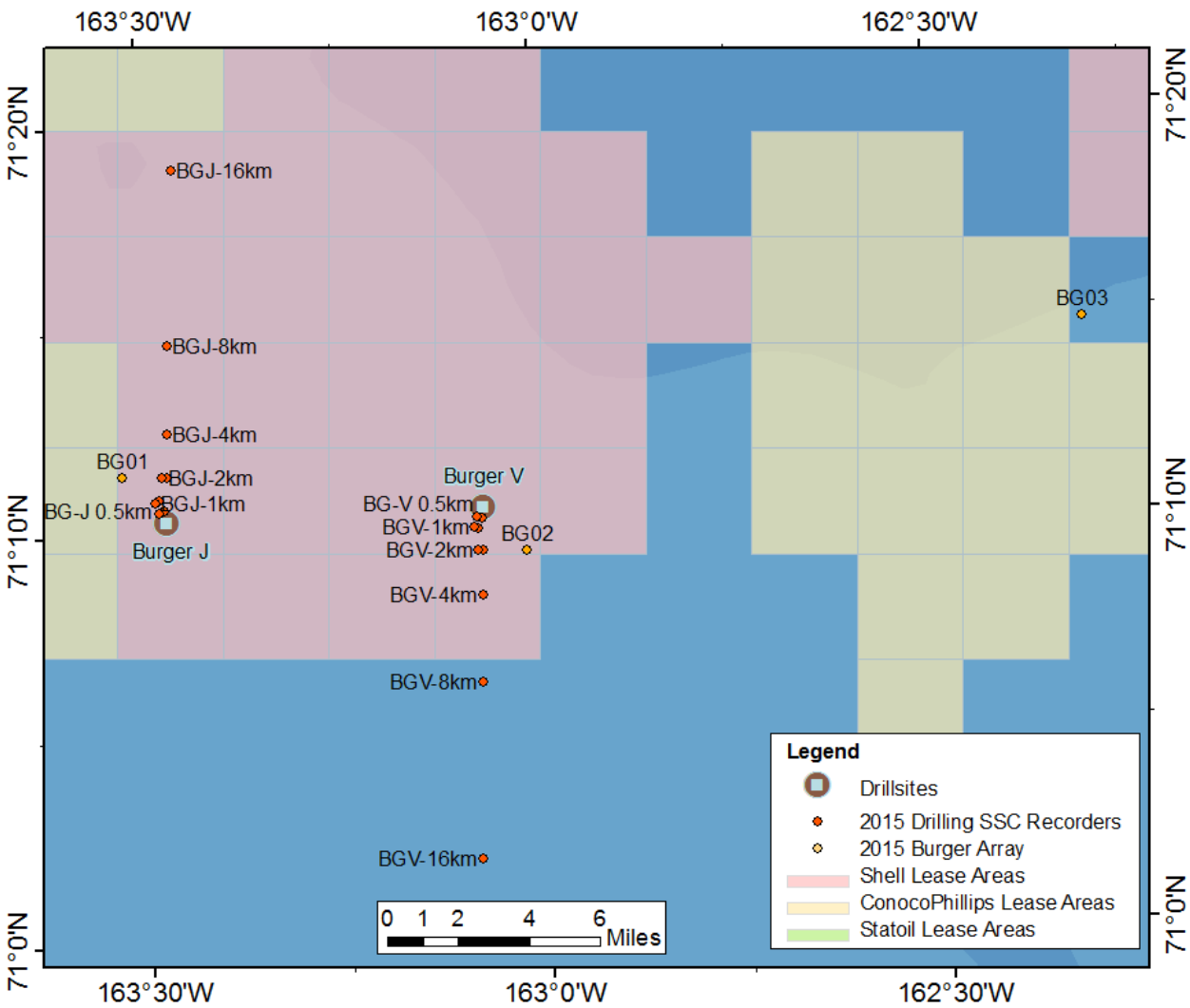


FIGURE 3.4. Drill SSC recorder deployment locations relative to the Burger J and Burger V drill sites.

Data Analysis

Acoustic data from the vessel SSC measurements were analyzed using JASCO's custom processing software. This software outputs spectral and broadband SPLs versus range from each sound source in specified time windows. Ranges were calculated from the time-stamped vessel GPS logs.

Acoustic Metrics

Underwater sound amplitude is measured in decibels (dB) relative to a fixed reference pressure (po) of 1 µPa. Several sound level metrics are commonly used to evaluate the loudness or effects of underwater sound. The sound sources considered in this report are sources of continuous noise, and therefore the primary sound level metric of importance is the rms SPL (denoted by LP). This metric was computed from the measured pressure time series, p(t) according to this equation:

$$L_p = 10\log_{10}\left(\frac{1}{T}\int_T p^2(t)dt \Big/ p_o^2\right) \quad (1)$$

The rms SPLs were calculated with Hanning-weighted time windows with 50% overlap. A 1-second time window was applied for data from the support vessel SSCs. For data from drilling activities, a 1-minute window length was used to compute rms SPL.

Spectral Analysis

The broadband frequency content of the recorded sounds was characterized in several formats for this report. Sounds specific to the defined drilling activities were characterized in 10-minute averaged power spectral density plots. Support vessel and drilling source sound levels were also computed in 1/3-octave bands.

The acoustics community has adopted standard 1/3-octave frequencies (more precisely these are tenth-decade band frequencies) (ISO R 266 and ANSI S1.6-1984) to facilitate comparisons between studies; the central frequency of the ith standard passband is:

$$f_{ci} = 10^{i/10},\ i = 1, 2, 3,\ldots \quad (2)$$

The bandwidth of a single 1/3-octave band is ~23% of the central frequency of the band.

Distances to SPL Thresholds

Ranges to various SPL thresholds were computed for each vessel pass and for each drilling activity by fitting the SPL data to an empirical propagation loss curve of one of the following forms:

$$\mathrm{RL} = \mathrm{SL} - A\log_{10} R \quad (3)$$

$$\mathrm{RL} = \mathrm{SL} - A\log_{10} R - \alpha R \quad (4)$$

where R is the slant range (m) from the source to the acoustic recorder, RL is the received sound level, SL is the estimated source level (dB re 1 µPa @ 1 m), A is the geometric spreading loss coefficient, and α is the absorption loss coefficient. The second equation was used if absorptive losses were present or if apparent curvature existed in the received level versus log (range) data trend, whereas the first was used if significant absorptive losses were not observed.

The appropriate equation was fit to the SPL data by using least squares to minimize the difference between the trend line and the measured level-range samples. Ranges to SPL thresholds between 120 and 190 dB re 1 µPa, in 10 dB increments, were obtained from these fits. To provide a conservative estimate of the distances, the best-fit line was shifted upwards so that the trend line exceeded 90% of all data. The

90th percentile ("90% fit") and best-fit values for SL and A (and α, when applicable) are shown in the SPL versus range plot annotations in the following sections and distances to rms SPL thresholds were computed using both trend lines.

Source Level Calculations

Source sound levels, defined at a standard reference range of 1 m, were derived from measurements obtained at ranges much greater than 1 m. An adjustment referred to as "back-propagation" was used to convert the measured levels to source levels. A common practice is to apply a back-propagation correction that assumes that sound waves spread away from a source uniformly in all directions, decaying in proportion to the geometric spreading of the acoustic wavefront. Often a simple "spherical-spreading loss" correction factor of 20 times the logarithm of the measurement distance is applied—expressed 20 log(r) for distance r, in meters. For low frequencies and shallow water conditions, where interactions with the surface and bottom strongly influence the sound propagation, the spherical-spreading loss approximation is generally only valid for measurements taken at close range. We could apply spherical-spreading back-propagation to derive source levels because vessel and drilling activity sound levels were measured at appropriately short ranges. The closest-range sound data were band-pass filtered into 1/3-octave frequency bins, and the level of each bin was computed. These levels were then back-propagated to a range of 1 m.

Total Sound Footprint Modeling

Multiple sound-generating activities occurred simultaneously throughout the drilling program. An acoustic modeling approach provided a means to investigate the total sound footprint from all pertinent activities. This analysis considered the combined sounds generated by the drilling units and their support vessels at both of the drill sites.

Modeling was performed in three separate ways: the first to facilitate a comparison of the results with the modeling performed in the IHA application and the others to provide a more comprehensive analysis that incorporated vessel movements at greater distances from the drill sites. The first approach most closely replicated the modeling used in the IHA application and considered all support vessels that were using DP or performing anchor handling within 1 km (0.6 mi) of either drill site. In the second modeling approach, the composite sound footprint calculations included sound from all activities at the drilling units and any vessels operating within 5 km (3.1 mi) of either drill site for a more comprehensive assessment. This second approach included sound from moving vessels in addition to sound from vessels using DP or performing anchor handling. The third modeling approach computed footprints including sound for all vessels associated with the drilling program in the Chukchi Sea, at all ranges, and all activity states. The third modeling approach provided the most comprehensive analysis of all sound sources. However, this approach does include sound from normal marine activities that do not typically require assessment in an IHA application.

The models incorporated coefficients from the best-fit, empirical Transmission Loss (TL) curves (used to compute the distances to SPL thresholds, as described above and provided in the results below) to estimate the received sound levels at a grid of points surrounding each sound source. These grids were summed to compute a composite sound footprint. We modeled the total sound footprint for each hour of the drilling program using the following procedure:

- Extract a nominal position for each vessel from the time-stamped PSO GPS logs.
- Assign an activity state to each vessel based on the Activity Code from the time-stamped PSO logs.
- Look-up the appropriate activity-dependent, empirical TL coefficients for each vessel from the collection of SSC results.

- Use the TL coefficients, the range from the source to each point in the computation grid, and Equation (4) to estimate the sound contribution from each vessel at each grid point.
- Sum the sound contributions from each vessel at each grid point.
- Generate sound level contours from the grid of computed sound levels.

Vessel SSC results for the Chukchi Sea from 2012, 2013, and 2015 were used for TL coefficients for transiting vessels and DP; the vessel SSC results were used directly and were not adjusted to account for variations in transit speed or thruster power. The best-fit TL curves were applied in the model as a way to account for an averaging of the possible vessel power settings. Modeled sound levels computed using the 90% fit empirical TL coefficients were found to overestimate the received sound levels when compared with the levels that were actually measured at the AMAR locations in 2015; model results obtained using the best-fit TL coefficients provided good agreement with the measured levels.

When empirical TL coefficients were not directly available for a particular vessel and activity state, a suitable surrogate was used from available measurements (Table 3.6). During the SSC measurements of the Ocean Wave and Ocean Wind, the vessels jointly escorted the Polar Pioneer and operational restrictions limited the distances at which they could be separated from each other. As a result, the SSC data for those vessels contain some sound contributions from each vessel and overestimate the levels for the vessels individually. Because of this, we used TL coefficients from a surrogate vessel for the Ocean Wave and Ocean Wind transiting for the sound footprint modeling.

TABLE 3.6. Surrogates used for total sound footprint modeling

Activity State	Vessel lacking suitable measurement	Surrogate
DP	*Supporter*	*Champion* DP
	Explorer	*Champion* DP
	Sisuaq	*Champion* DP
	Spirit	*Nordica*, measured in Chukchi in 2013[1]
	Fennica	*Nordica*, measured in Chukchi in 2013[1]
	Guardsman	*Nordica*, measured in Chukchi in 2013[1]
	Nanuq	*Nordica*, measured in Chukchi in 2013[1]
	Minerva	*Champion* DP
	Marika	*Champion* DP
	Ocean Wind	*Nordica*, measured in Chukchi in 2013[1]
	Ocean Wave	*Nordica*, measured in Chukchi in 2013[1]
	Tor Viking	*Nordica*, measured in Chukchi in 2013[1]
Transiting	*Ocean Wind*	*Lauren Foss*, measured in 2012[2]
	Ocean Wave	*Lauren Foss*, measured in 2012[2]
Cementing	*Polar Pioneer*	*Polar Pioneer* running casing
Cleaning	*Polar Pioneer*	*Polar Pioneer* running casing
Tripping	*Polar Pioneer*	*Polar Pioneer* running casing
Anchor handling	All vessels	*Aiviq* anchor handling at Burger V
Ice management	All vessels	*Tor Viking* ice management at Burger A in 2012[2]

[1]Austin et al. (2013).
[2]JASCO Applied Sciences and Greeneridge Sciences Inc. (2014).

Results

Burger J, Chukchi Sea

Figure 3.5 through Figure 3.10 plot the hourly averaged SPL measured between 24 July and 4 October at distances between 0.5 and 16 km (0.3 and 10 mi) from Burger J. Each plot includes broadband and decade band levels.

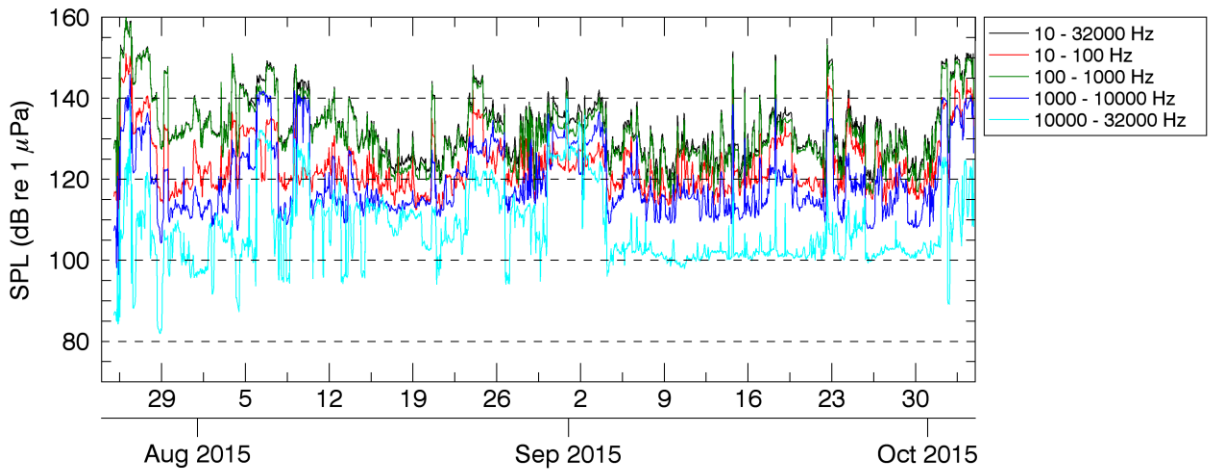


FIGURE 3.5. Hourly SPLs (24 July to 4 October 2015 UTC) from the AMAR at 0.5 km (0.3 mi) from Burger J (AMAR BGJ-0.5 km).

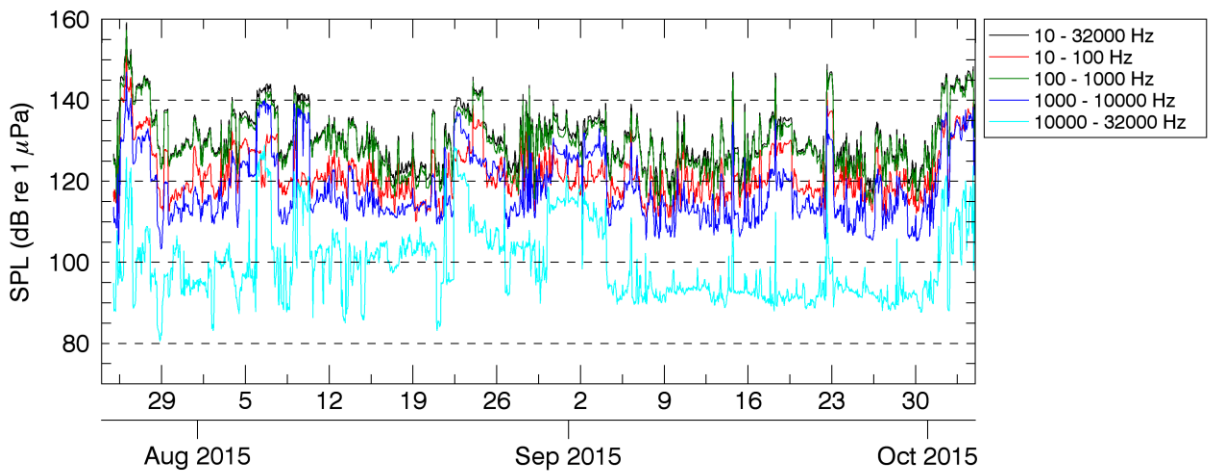


FIGURE 3.6. Hourly SPLs (24 July to 4 October 2015 UTC) from the AMAR at 1 km (0.6 mi) from Burger J (AMAR BGJ-1 km).

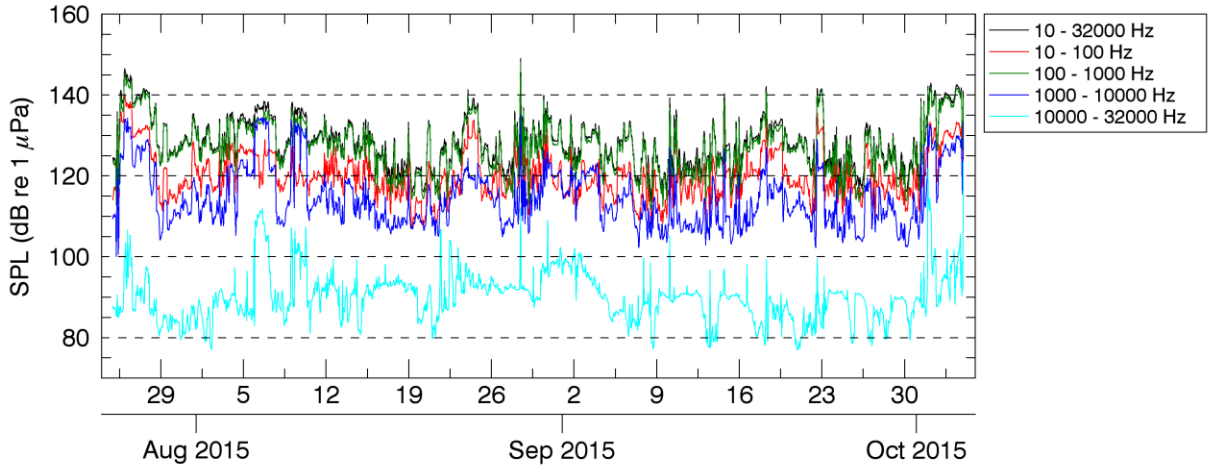


FIGURE 3.7. Hourly SPLs (24 July to 5 October 2015 UTC) from the AMAR at 2 km (1.2 mi) from Burger J (AMAR BGJ-2 km).

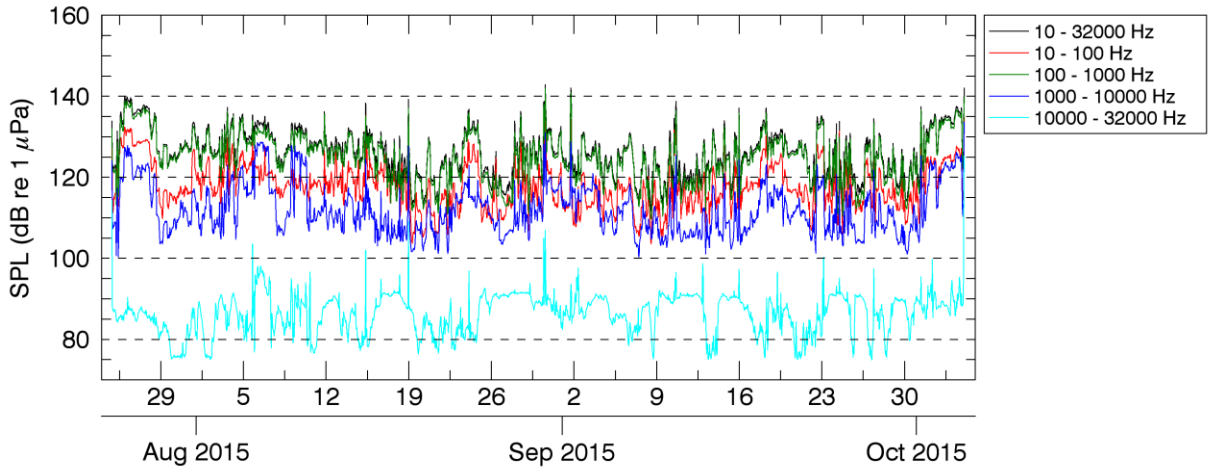


FIGURE 3.8. Hourly SPLs (24 July to 5 October 2015 UTC) from the AMAR at 4 km (2.5 mi) from Burger J (AMAR BGJ-4 km).

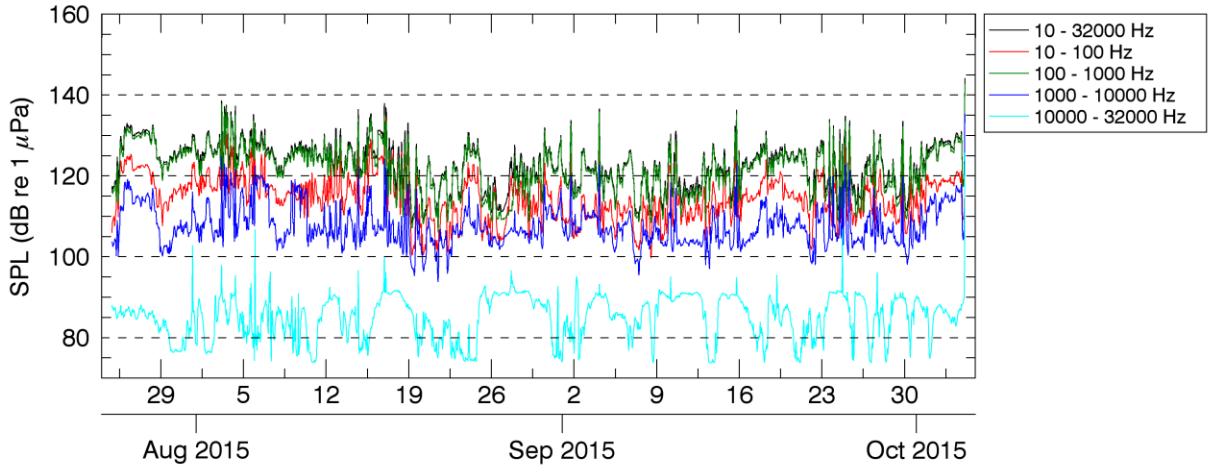


FIGURE 3.9. Hourly SPLs (24 July to 5 October 2015 UTC) from the AMAR at 8 km (5 mi) from Burger J (AMAR BGJ-8 km).

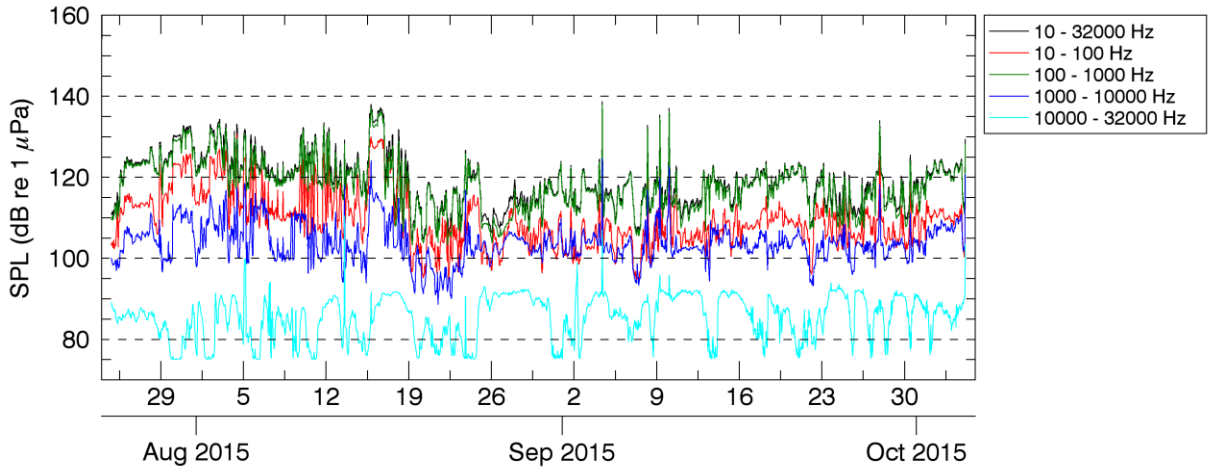


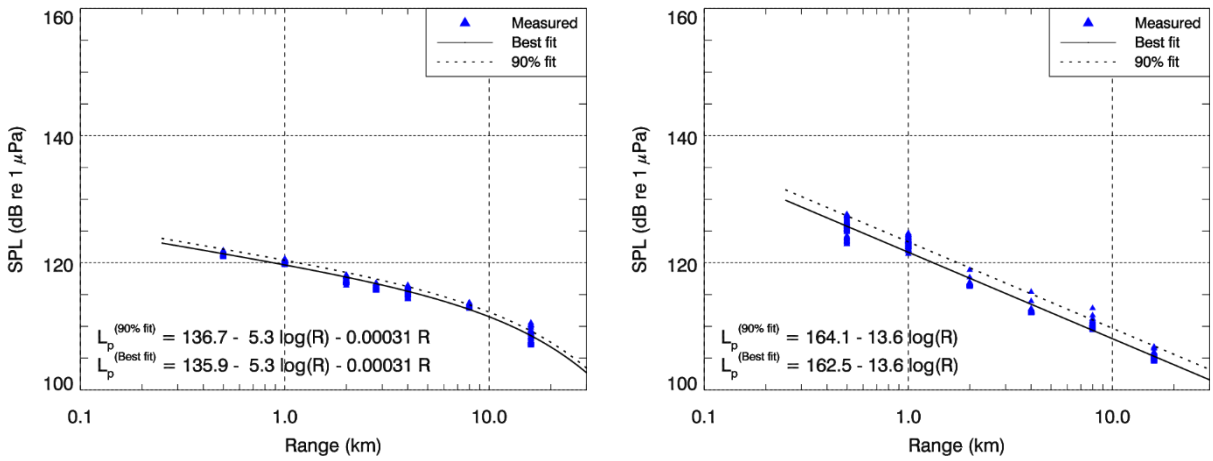
FIGURE 3.10. Hourly SPLs (24 July to 5 October 2015 UTC) from the AMAR at 16 km (10 mi) from Burger J (AMAR BGJ-16 km).

Polar Pioneer Drilling Activities

Figure 3.11 and Figure 3.12 plot the measured sound levels for specific times (Table 3.7) that correspond to the following drilling activities: circulating, running casing, drilling, and MLC construction. Table 3.8 lists the distances to sound level thresholds between 190 and 120 dB re 1 µPa (rms SPL) for each activity. Figure 3.13 and Figure 3.14 plot the power spectral density of data recorded at seven ranges at the Burger J drill site, averaged over the periods for drilling and MLC construction, respectively. Figure 3.15 and Figure 3.16 are the 1/3-octave band source levels derived from the same measurements.

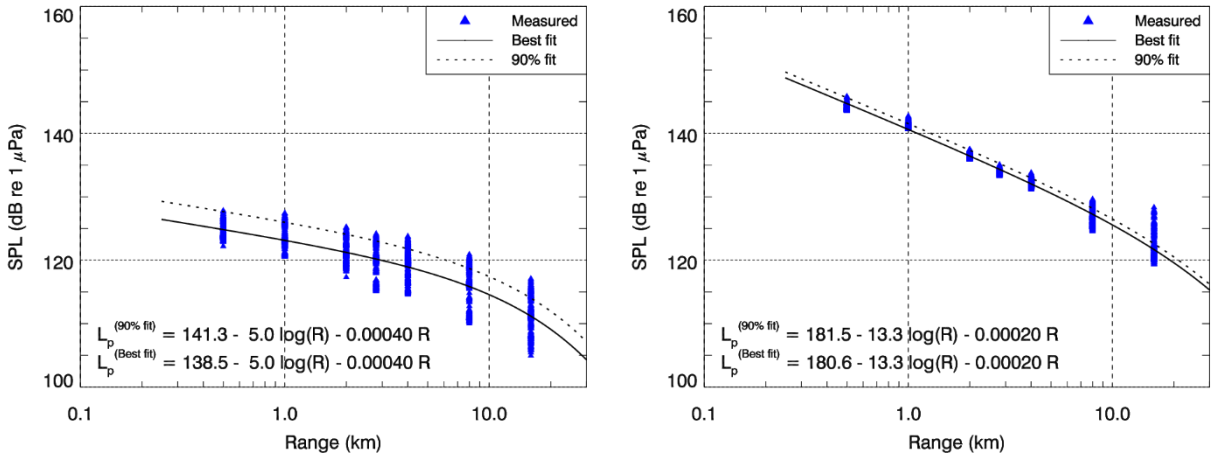
TABLE 3.7. Periods selected as representative of drilling activities at the Burger J drill site.

Activity	Analysis period (UTC)
Circulating	21 Aug 05:00–05:30
Running casing	22 Aug 07:30–08:10
Drilling	19 Aug 23:10–24:00
	20 Aug 00:00–02:00
	7 Sep 10:30–10:50
MLC construction	9 Aug 11:20–12:00
	9 Aug 14:30–15:40
	9 Aug 18:00–18:50
	9 Aug 21:40–24:00



(a) (b)

FIGURE 3.11. SPL versus range recorded at seven ranges while the *Polar Pioneer* was at the Burger J drill site and (a) circulating and (b) running casing.



(a) (b)

FIGURE 3.12. SPL versus range recorded at seven ranges while the *Polar Pioneer* was (a) drilling and (b) involved in MLC construction at the Burger J drill site.

TABLE 3.8. Distances to sound levels between 190 and 120 dB re 1 µPa (rms SPL) for several drilling activities using best-fit and 90% fit models to sound levels recorded at multiple ranges from Burger J.

rms SPL (dB re 1 µPa)	Circulating Range (m)		Running casing Range (m)		Drilling Range (m)		MLC construction Range (m)	
	Best-fit	90% fit	Best-fit	90% fit	Best-fit	90% fit	Best-fit	90% fit
190	0*	0*	0*	0*	0*	0*	<10*	<10*
180	0*	0*	<10*	<10*	0*	0*	<10*	<10*
170	0*	0*	<10*	<10*	0*	0*	<10*	<10*
160	0*	0*	<10*	<10*	0*	0*	40*	40*
150	0*	0*	<10*	11*	0*	0*	200*	240*
140	<10*	<10*	50*	60*	<10*	<10*	1,110	1,290
130	10*	20*	240*	320*	50*	180*	5,430	6,200
120	870	1,150	1,330	1,750	2,950	6,150	19,050*	20,880*

*Extrapolated beyond measurement range.

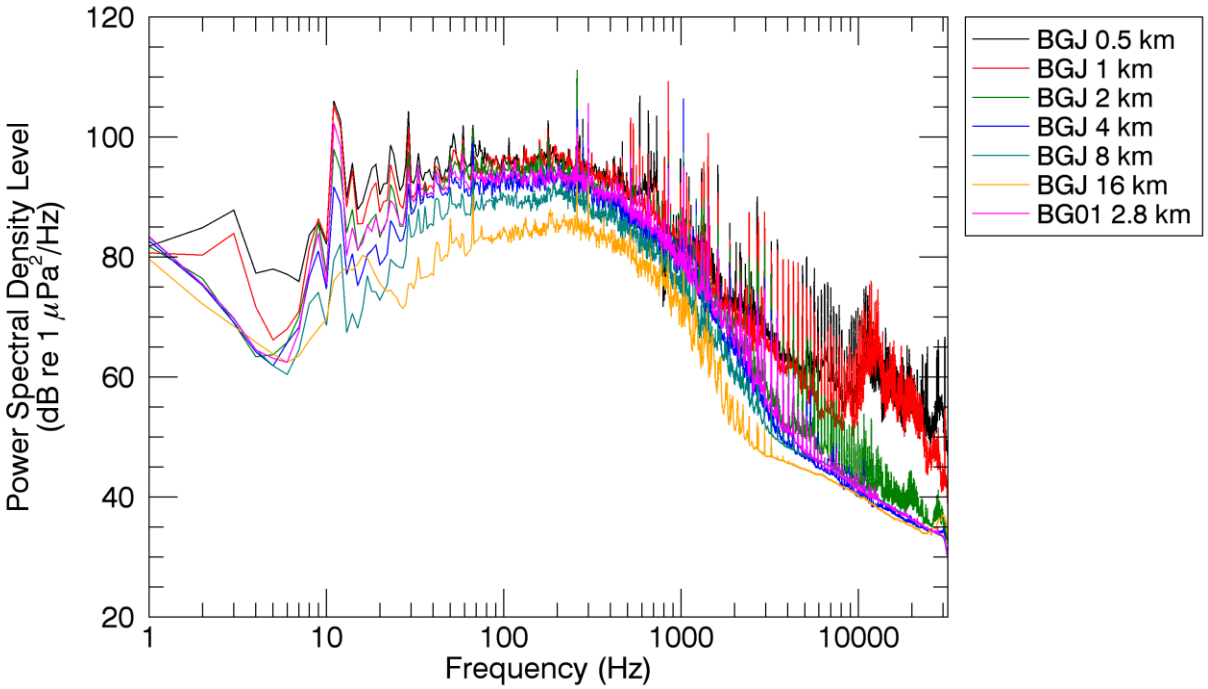


FIGURE 3.13. Power spectral density for drilling at the Burger J drill site as received on AMARs at seven ranges over the period indicated in Table 3.7.

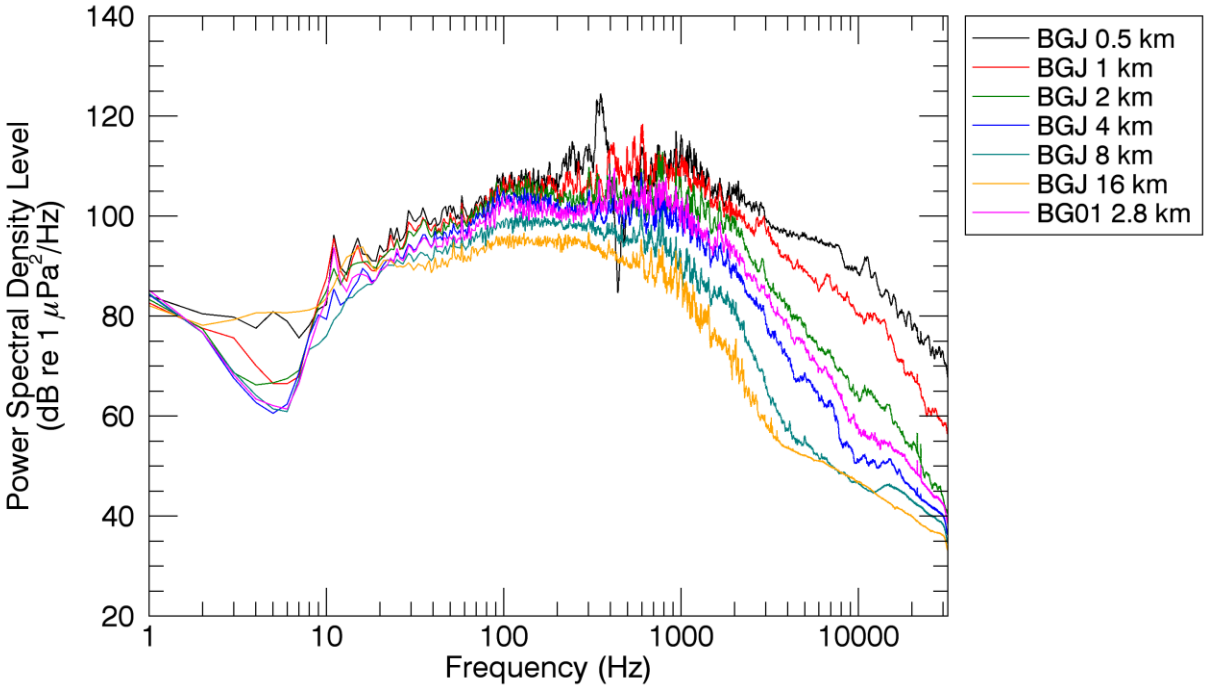


FIGURE 3.14. Power spectral density for MLC construction at the Burger J drill site as received on AMARs at seven ranges at the period indicated in Table 3.7.

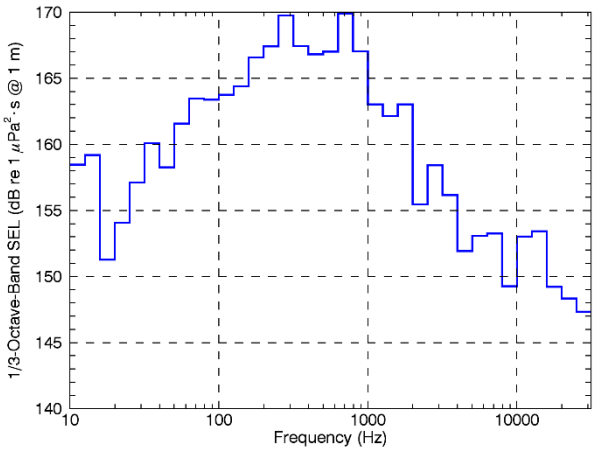


FIGURE 3.15. 1/3-octave band source level for the *Polar Pioneer* drilling at the Burger J drill site.

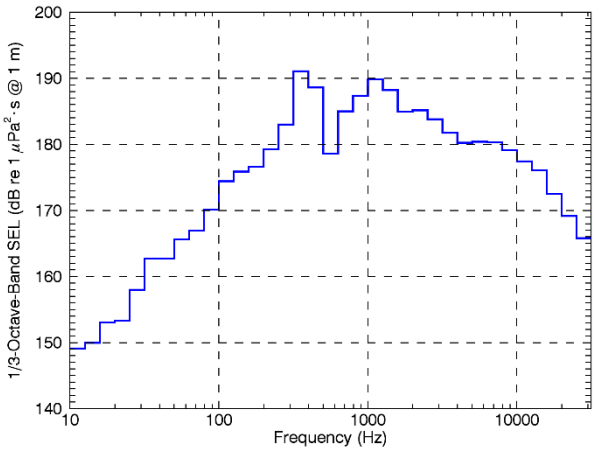


FIGURE 3.16. 1/3-octave band source level for the *Polar Pioneer* during MLC construction at the Burger J drill site.

Burger V, Chukchi Sea

Figure 3.17 through Figure 3.22 plot the hourly averaged SPL measured between 25 July and 5 October at distances between 0.5 and 16 km (0.3 and 10 mi) from Burger V. Each plot includes broadband and decade band levels.

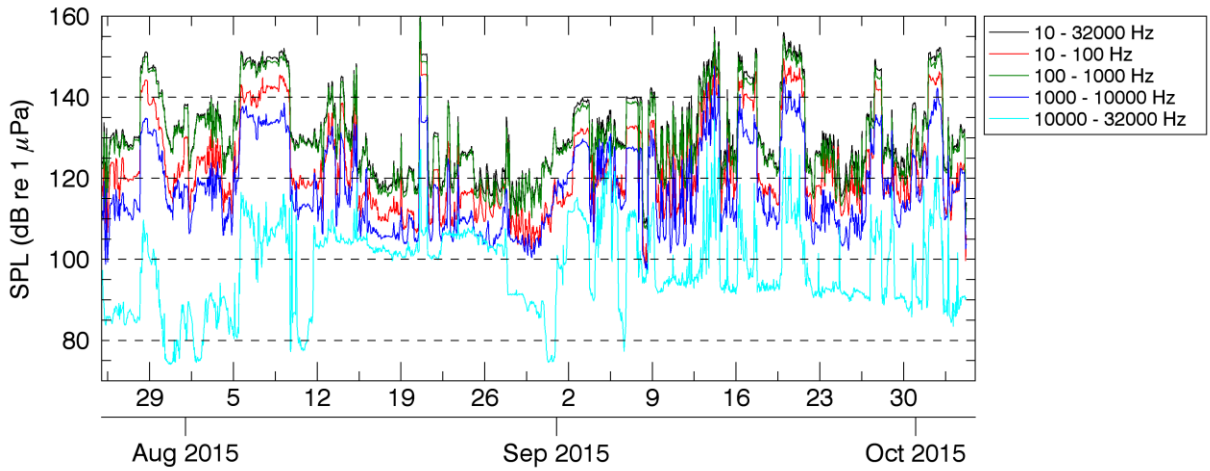


FIGURE 3.17. Hourly SPLs (25 July to 5 October 2015 UTC) from the AMAR at 0.5 km (0.3 mi) from Burger V (AMAR BGV-0.5 km).

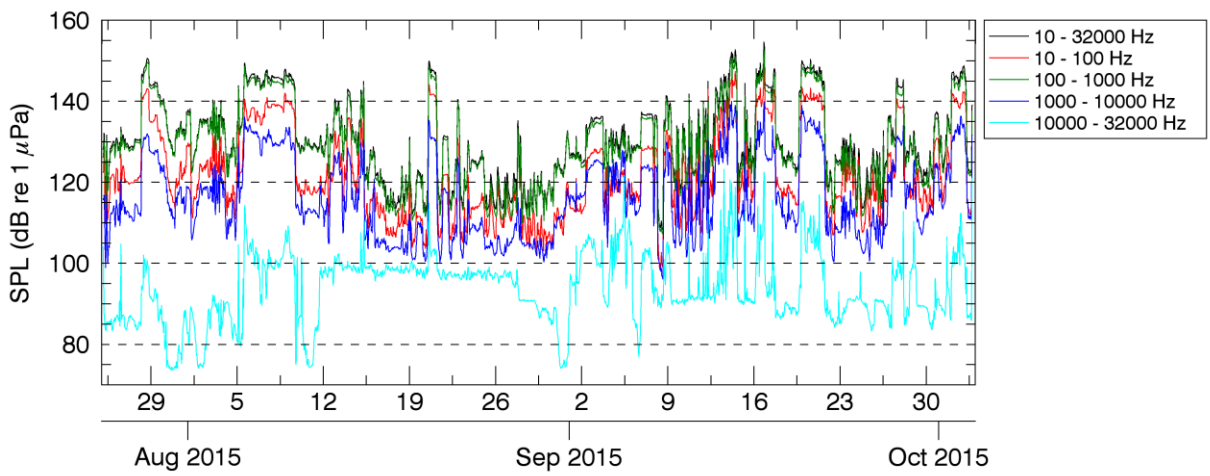


FIGURE 3.18. Hourly SPLs (25 July to 3 October 2015 UTC) from the AMAR at 1 km (0.6 mi) from Burger V (AMAR BGV-1 km).

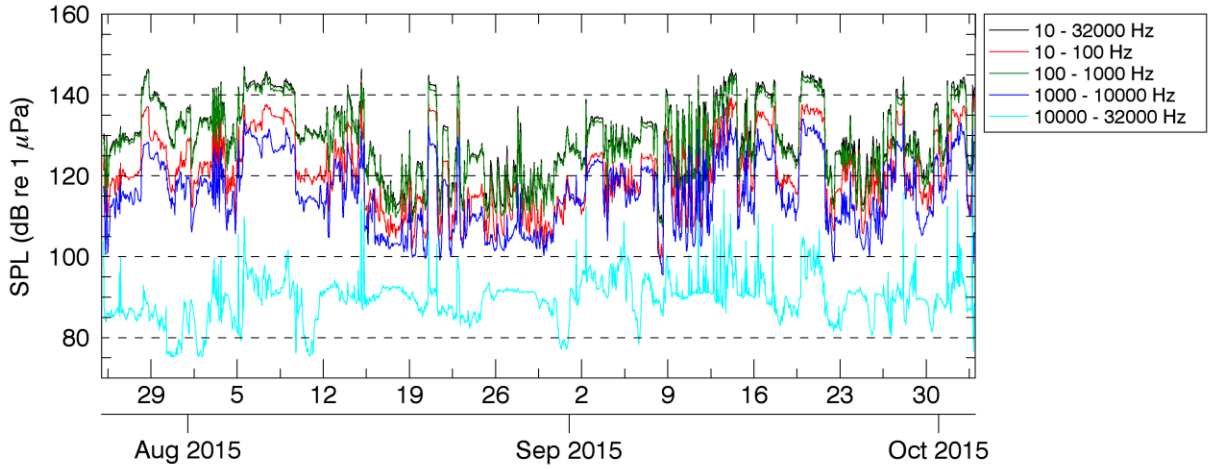


FIGURE 3.19. Hourly SPLs (25 July to 3 October 2015 UTC) from the AMAR at 2 km (1.2 mi) from Burger V (AMAR BGV-2 km).

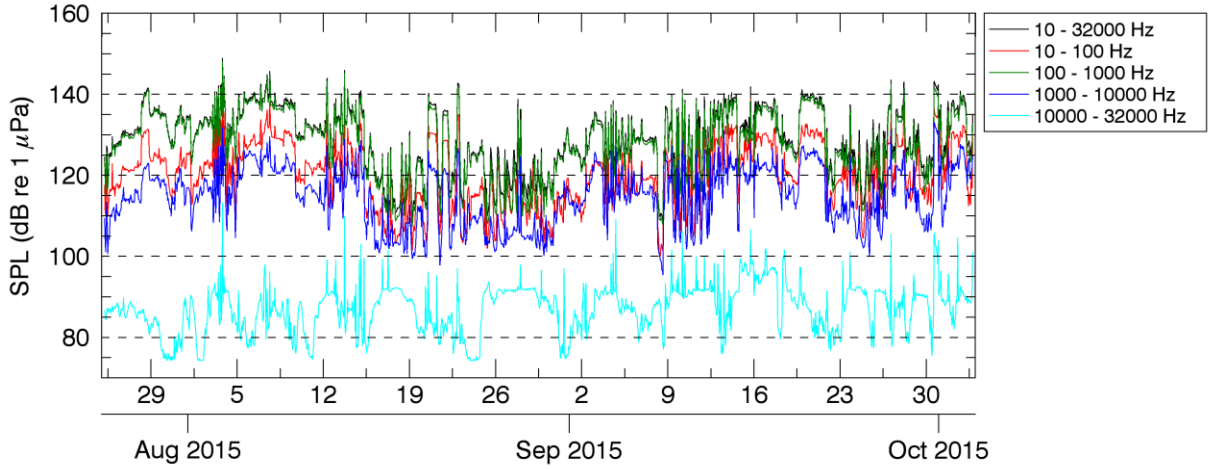


FIGURE 3.20. Hourly SPLs (25 July to 3 October 2015 UTC) from the AMAR at 4 km (2.5 mi) from Burger V (AMAR BGV-4 km).

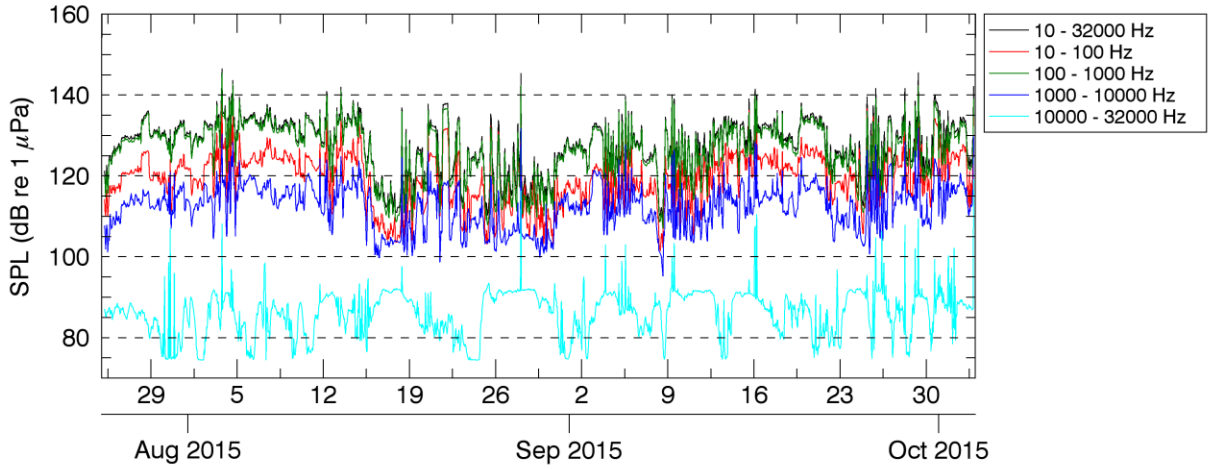


FIGURE 3.21. Hourly SPLs (25 July to 3 October 2015 UTC) from the AMAR at 8 km (5 mi) from Burger V (AMAR BGV-8 km).

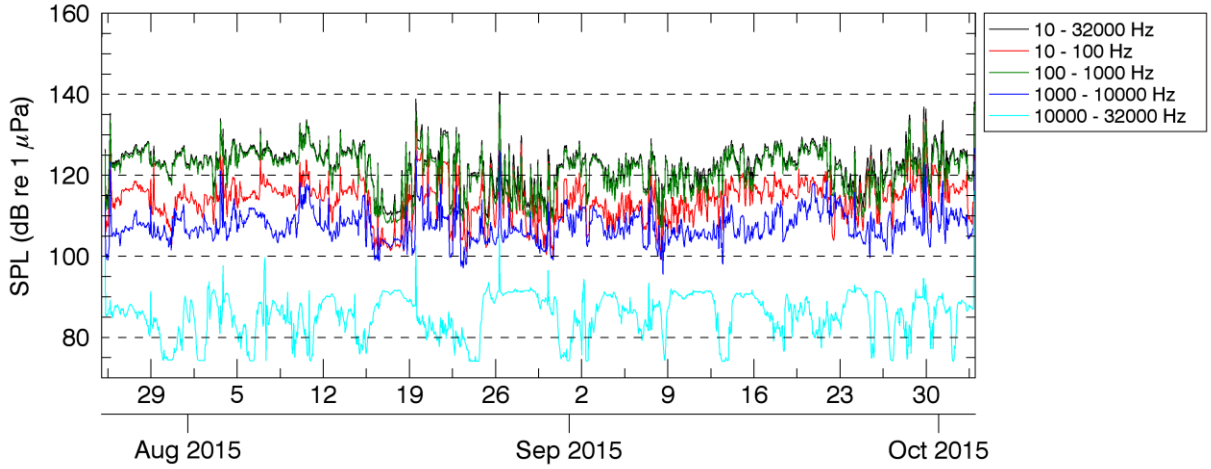


FIGURE 3.22. Hourly SPLs (25 July to 3 October 2015 UTC) from the AMAR at 16 km (10 mi) from Burger V (AMAR BGV-16 km).

Anchor Handling at Burger V

Figure 3.23 plots vessel sound levels as a function of range recorded on the BGV-AH recorder while the *Aiviq* was laying anchors at the Burger V drill site (Table 3.9). Table 3.10 lists the ranges to sound level thresholds between 190 and 120 dB re 1 µPa (rms SPL) based on the 90th percentile and the best-fit lines to these data.

TABLE 3.9. Periods that best represent anchor laying at Burger V drill site.

Activity	Analysis period (UTC)
Anchor laying	14 Jul 10:00–12:00
	14 Jul 13:30–14:30
	15 Jul 9:30–10:30
	15 Jul 15:30-19:00
	16 Jul 1:30–05:29
	Jul 16 09:31–11:00

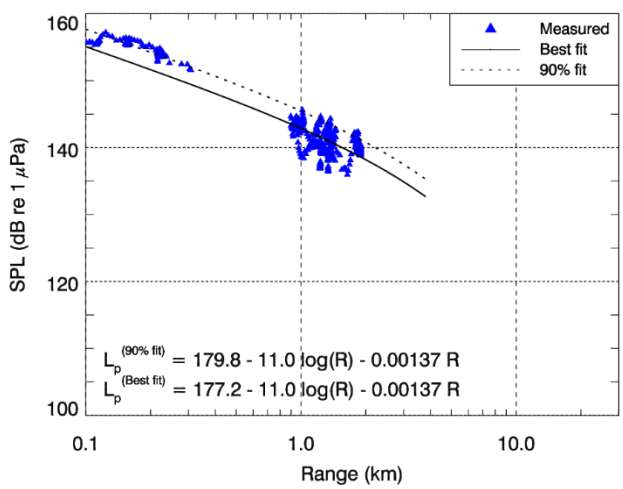


FIGURE 3.23. SPL versus range recorded from recorder BGV-AH while the *Aiviq* was laying anchors at the Burger V drill site.

TABLE 3.10. Distances to sound levels between 190 and 120 dB re 1 µPa (rms SPL) for anchor handling using best-fit and 90% fit models to sound levels recorded while the *Aiviq* was anchor handling at the Burger V drill site.

rms SPL (dB re 1 µPa)	*Aiviq* anchor handling	
	Best-fit range (m)	90% fit range (m)
190	<10*	<10*
180	<10*	<10*
170	<10*	<10*
160	40*	60*
150	280	450
140	1,560	2,220*
130	4,890*	6,030*
120	9,730*	11,140*

*Extrapolated beyond measurement range.

Support Vessels on DP

Figure 3.24 through Figure 3.26 plot vessel sound levels as a function of range for vessels measured on DP. Table 3.12, Table 3.14, and Table 3.16 list the ranges to sound level thresholds between 190 and 120 dB re 1 µPa (rms SPL) based on the 90th percentile and the best-fit lines to these data.

The *Champion*, *Sisuaq*, *Supporter*, and *Ross* each performed DP operations at the vessel SSC test site. Because of calm conditions during these measurements, all the vessels, other than the *Ross*, employed very low thruster power and did not emit sound that was measureable at more than one range from the vessels. Only the data from the *Ross* are presented and used in this report (Table 3.15). To augment the library of SSC results for vessels on DP, measurements for the *Champion* and the *Aiviq* were extracted from data on the SSC recorders at the Burger J drill site for the periods listed below (Table 3.11 and Table 3.13).

Champion

TABLE 3.11. Period that best represents *Champion* on DP.

Activity	Analysis period (UTC)
Champion on DP	27 Aug 11:30–12:30

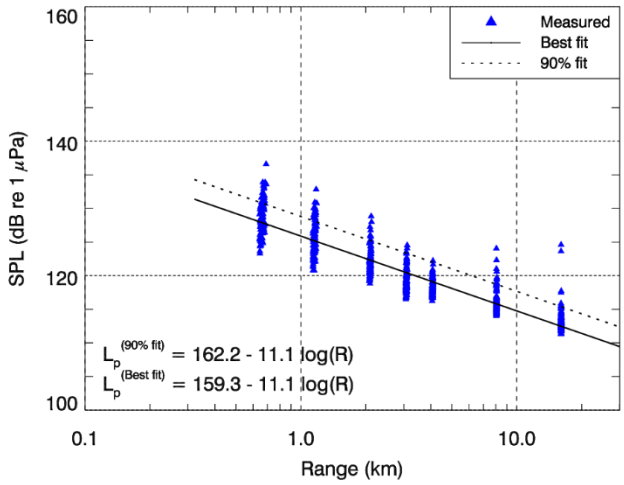


FIGURE 3.24. SPL versus range recorded at seven ranges while the *Champion* was on DP at the Burger J drill site.

TABLE 3.12. Distances to sound levels between 190 and 120 dB re 1 µPa (rms SPL) for *Champion* on DP using best-fit and 90% fit models to sound levels recorded near the Burger J drill site.

rms SPL (dB re 1 µPa)	*Champion* on DP	
	Best-fit range (m)	90% fit range (m)
190	0*	0*
180	0*	0*
170	<10*	<10*
160	<10*	<10*
150	<10*	10*
140	50*	100*
130	430*	780
120	3380	6180

*Extrapolated beyond measurement range.

Aiviq

TABLE 3.13. Period that best represents *Aiviq* on DP.

Activity	Analysis period (UTC)
Aiviq on DP	25 Jul 17:00–18:00

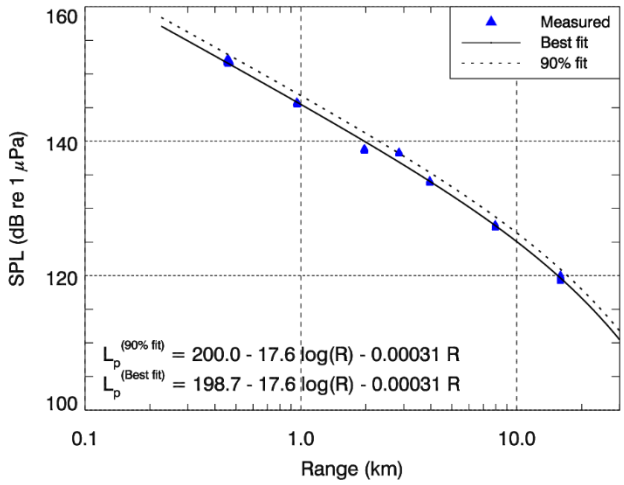


FIGURE 3.25. SPL versus range recorded at seven ranges while the *Aiviq* was on DP at Burger J drill site.

TABLE 3.14. Distances to sound levels between 190 and 120 dB re 1 µPa (rms SPL) for *Aiviq* on DP using best-fit and 90% fit models to sound levels recorded near the Burger J drill site.

rms SPL (dB re 1 µPa)	*Aiviq* on DP	
	Best-fit range (m)	90% fit range (m)
190	<10*	<10*
180	10*	10*
170	40*	50*
160	160*	180*
150	560	670
140	1,970	2,300
130	6,140	7,030
120	15,410	17,190*

*Extrapolated beyond measurement range.

Ross

TABLE 3.15. Period that best represents *Ross* on DP.

Activity	Analysis period (UTC)
Ross on DP	2 Aug 04:20–06:00

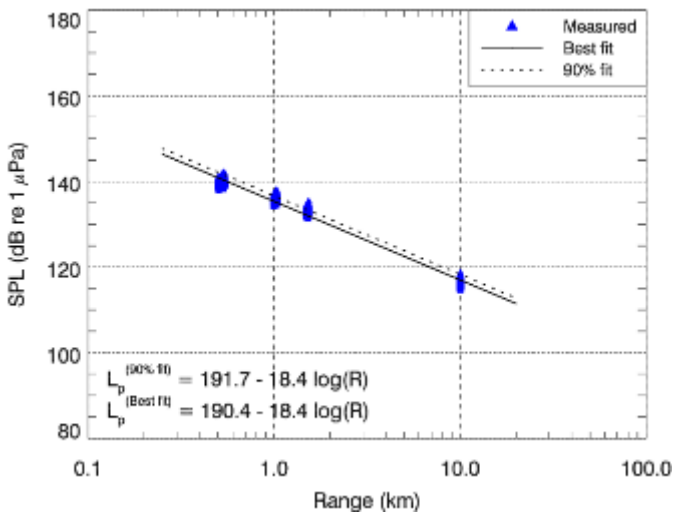


FIGURE 3.26. SPL versus range recorded on the vessel SSC AMARs while the *Ross* was on DP at the Vessel SSC test site.

TABLE 3.16. Distances to sound levels between 190 and 120 dB re 1 µPa (rms SPL) for *Ross* on DP using best-fit and 90% fit models to average sound levels recorded at the three vessel SSC recorders.

rms SPL (dB re 1 µPa)	*Ross* on DP	
	Best-fit range (m)	90% fit range (m)
190	<10*	<10*
180	<10*	<10*
170	10	10
160	50	50
150	160	190
140	560	660
130	1,960	2,310
120	6,880	8,100

*Extrapolated beyond measurement range.

Vessels in Transit

Figure 3.27 through Figure 3.46 plot vessel sound levels as a function of range and mean 1/3-octave band source levels calculated from 10s of data centered on the closest point of approach for each vessel. These data were measured on the three vessel SSC recorders at 0, 500, and 1000 m (0, 1640, 3280 ft) from the vessel SSC trackline. Table 3.17 through Table 3.26 list the ranges to sound level thresholds between 190 and 120 dB re 1 µPa (rms SPL) based on the 90th percentile and the best-fit lines to these data.

The *Ocean Wave* and *Ocean Wind* were jointly escorting the *Polar Pioneer* when they transited along the SSC trackline. Operational restrictions limited the distances at which they could be separated from each other. The resulting SSC data for those vessels likely contain some sound contributions from each vessel and overestimate the levels for the individual vessels.

Noble Discoverer

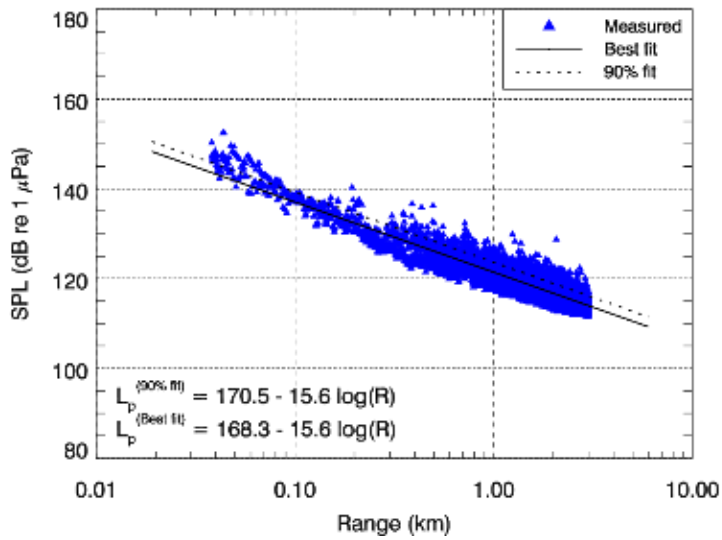


FIGURE 3.27. Vessel rms SPLs from AMARs A–C for the *Noble Discoverer* transiting at 5.4 kts.

TABLE 3.17. Measured distances to rms SPL thresholds for the *Noble Discoverer*, as determined from a linear fit to the rms SPL versus range data.

rms SPL (dB re 1 µPa)	Best-fit range (m)	90% fit range (m)
190	<10*	<10*
180	<10*	<10*
170	<10*	<10*
160	<10*	<10*
150	15*	21*
140	65	90
130	280	390
120	1,200	1,700

*Extrapolated beyond minimum measurement range of 38 m.

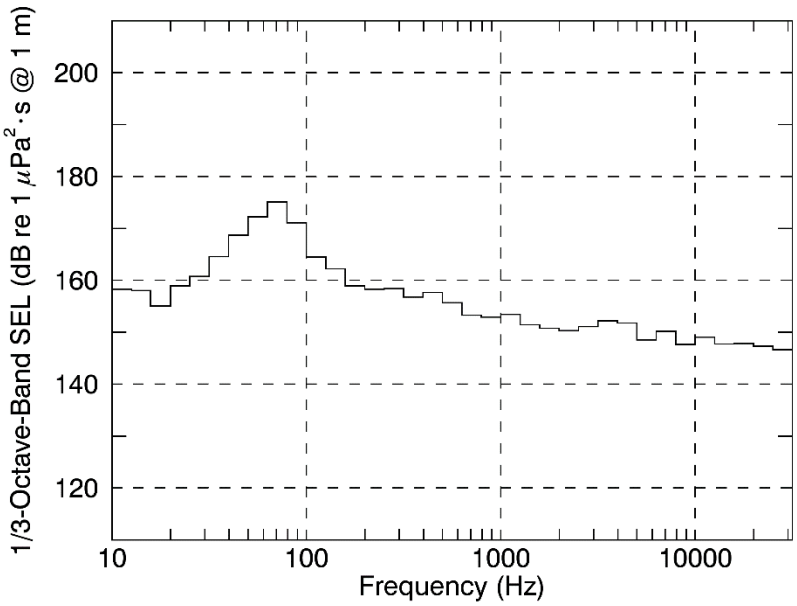


FIGURE 3.28. 1/3-octave band source levels for the *Noble Discoverer* transiting at 5.4 kts.

<u>*Champion*</u>

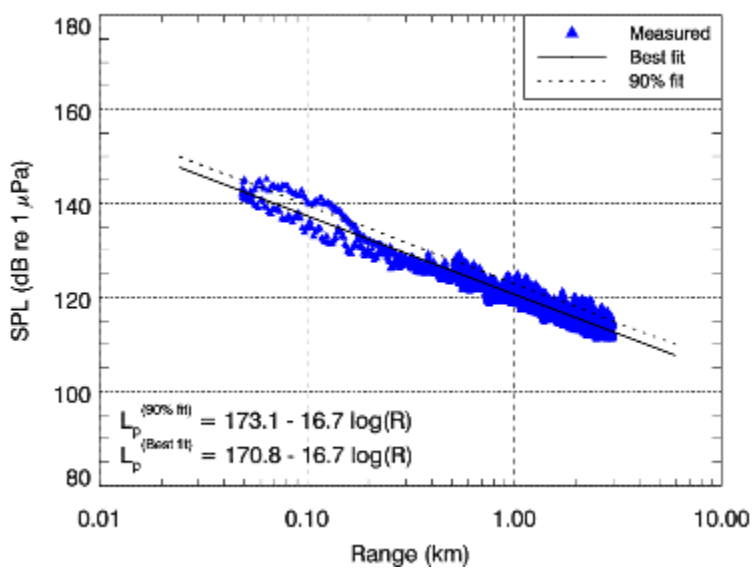


FIGURE 3.29. Vessel rms SPLs from AMARs A–C for the *Champion* transiting at 9.2 kts.

TABLE 3.18. Measured distance to rms SPL thresholds for the *Champion*, as determined from linear fits to rms SPL versus range data.

rms SPL (dB re 1 µPa)	Best-fit range (m)	90% fit range (m)
190	<10*	<10*
180	<10*	<10*
170	<10*	<10*
160	<10*	<10*
150	18*	24*
140	70	96
130	280	380
120	1,100	1,500

*Extrapolated beyond minimum measurement range of 49 m.

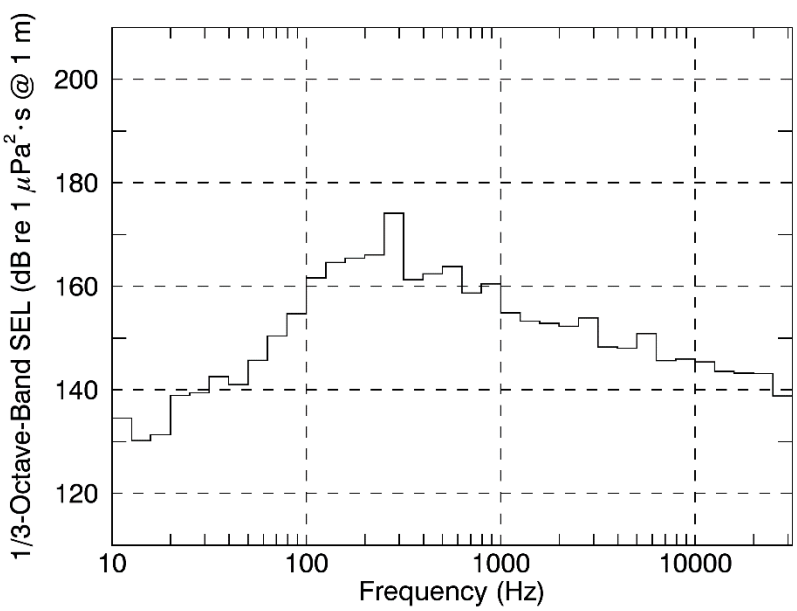


FIGURE 3.30. 1/3-octave band source levels for the *Champion* transiting at 9.2 kts.

Sisuaq

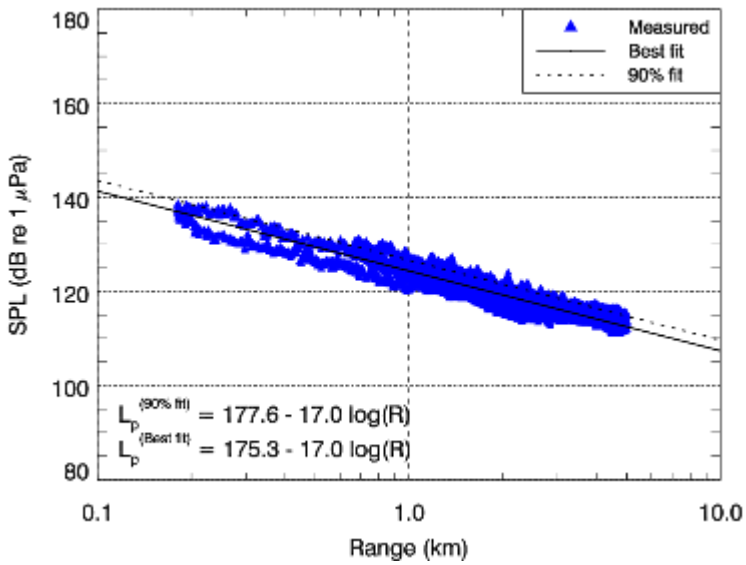


FIGURE 3.31. Vessel rms SPLs from AMARs A–C for the *Sisuaq* transiting at 7.2 kts.

TABLE 3.19. Measured distance to rms SPL thresholds for the *Sisuaq*, as determined from linear fits to rms SPL versus range data.

rms SPL (dB re 1 µPa)	Best-fit range (m)	90% fit range (m)
190	<10*	<10*
180	<10*	<10*
170	<10*	<10*
160	<10*	<10*
150	31*	42*
140	120*	160*
130	470	640
120	1,800	2,500

*Extrapolated beyond minimum measurement range of 180 m.

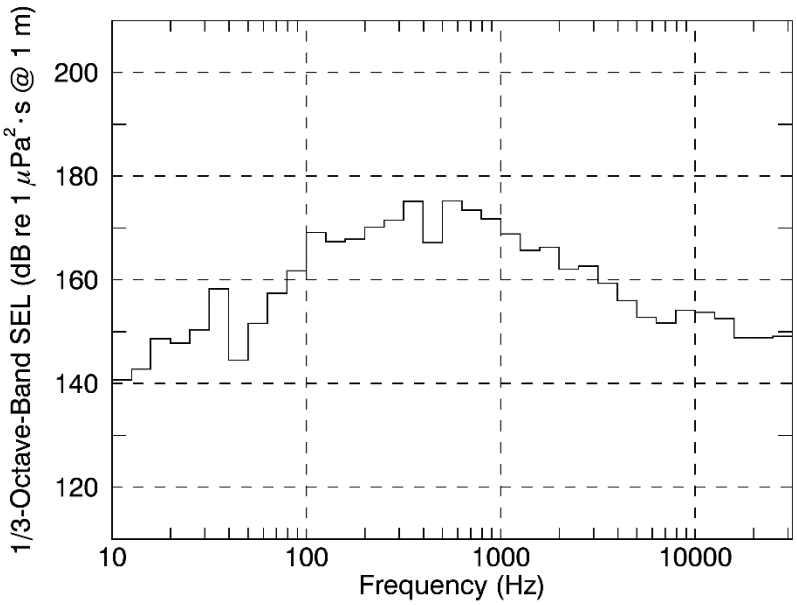


FIGURE 3.32. 1/3-octave band source levels for the *Sisuaq* transiting at 7.2 kts.

<u>*Supporter*</u>

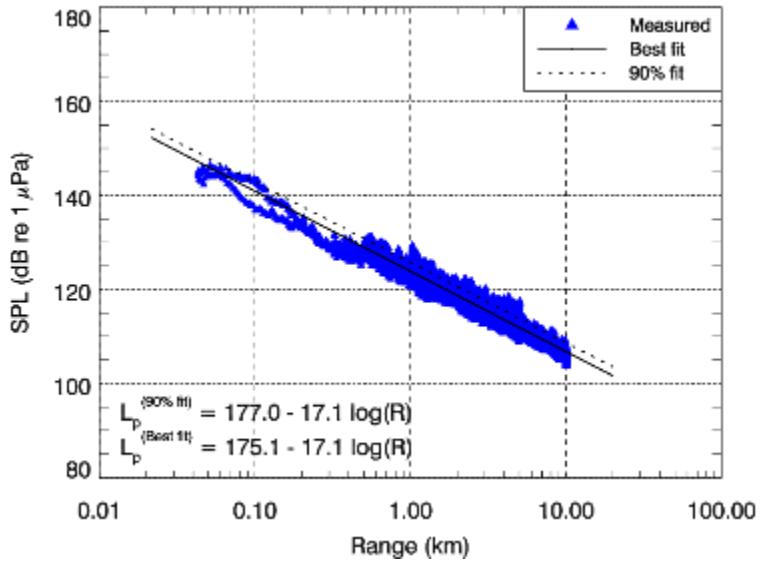


FIGURE 3.33. Vessel rms SPLs from AMARs A–C for the *Supporter* transiting at 8.7 kts.

TABLE 3.20. Measured distance to rms SPL thresholds for the *Supporter*, as determined from linear fits to rms SPL versus range data.

rms SPL (dB re 1 µPa)	Best-fit range (m)	90% fit range (m)
190	<10*	<10*
180	<10*	<10*
170	<10*	<10*
160	<10*	<10*
150	29*	38*
140	110	150
130	440	560
120	1700	2200

*Extrapolated beyond minimum measurement range of 43 m.

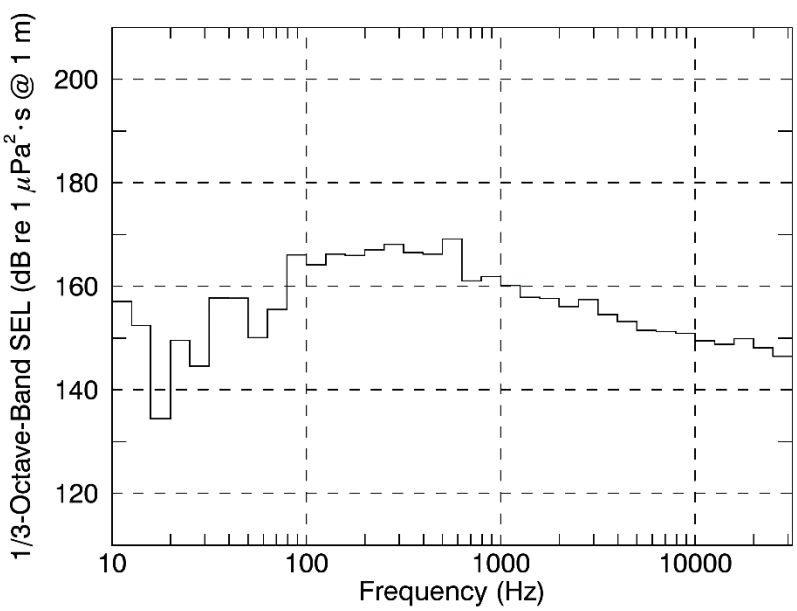


FIGURE 3.34. 1/3-octave band source levels for the *Supporter* transiting at 8.7 kts.

Marika

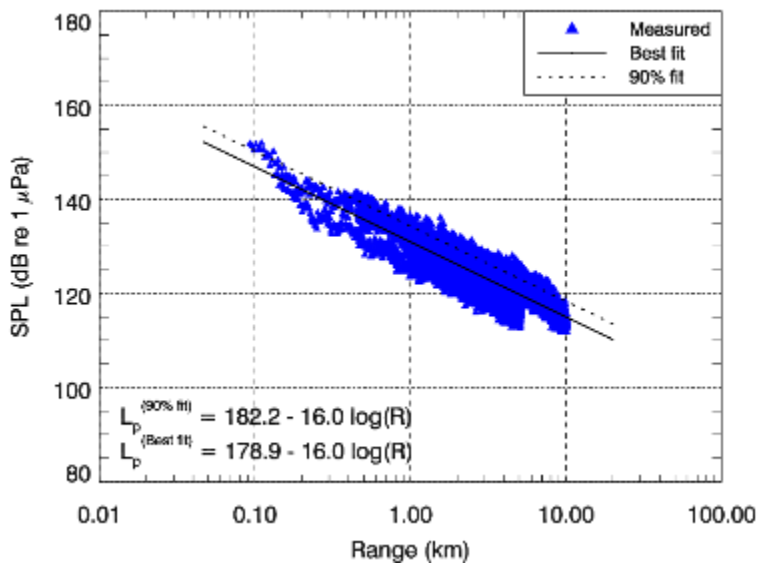


FIGURE 3.35. Vessel rms SPLs from AMARs A–C for the *Marika* transiting at 12.9 kts.

TABLE 3.21. Measured distance to rms SPL thresholds for the *Marika*, as determined from linear fits to rms SPL versus range data.

rms SPL (dB re 1 µPa)	Best-fit range (m)	90% fit range (m)
190	<10*	<10*
180	<10*	<10*
170	<10*	<10*
160	15*	25*
150	64*	100
140	270	440
130	1,100	1,900
120	4,900	7,900

*Extrapolated beyond minimum measurement range of 92 m.

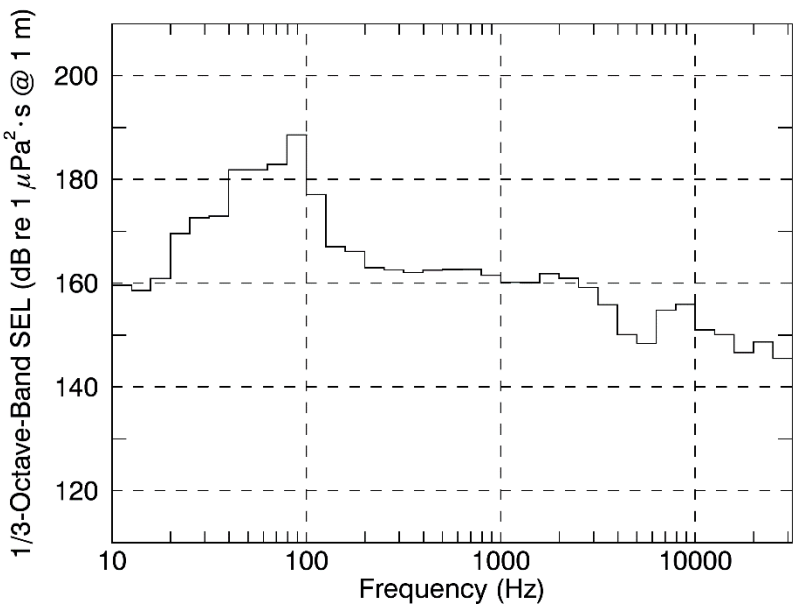


FIGURE 3.36. 1/3-octave band source levels for the *Marika* transiting at 12.9 kts.

Minerva

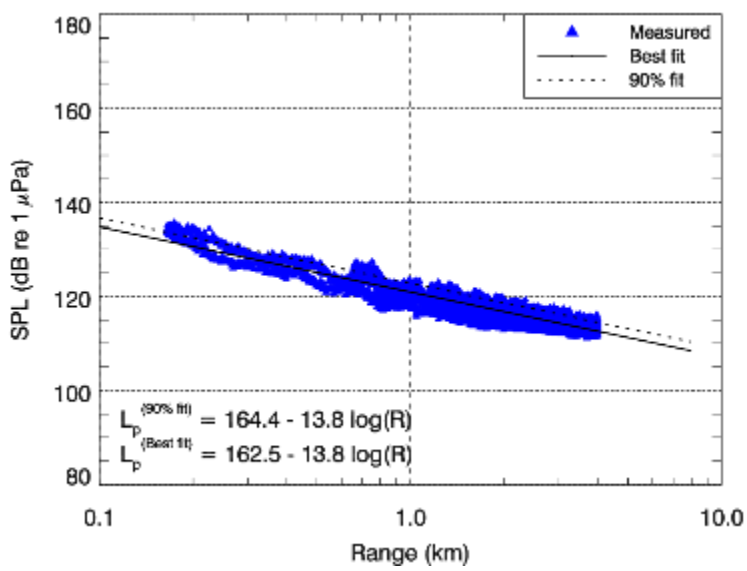


FIGURE 3.37. Vessel rms SPLs from AMARs A–C for the *Minerva* transiting at 8.7 kts.

TABLE 3.22. Measured distance to rms SPL thresholds for the *Minerva*, as determined from linear fits to rms SPL versus range data.

rms SPL (dB re 1 µPa)	Best-fit range (m)	90% fit range (m)
190	<10*	<10*
180	<10*	<10*
170	<10*	<10*
160	<10*	<10*
150	<10*	11*
140	42*	58*
130	220	300
120	1,200	1,600

*Extrapolated beyond minimum measurement range of 165 m.

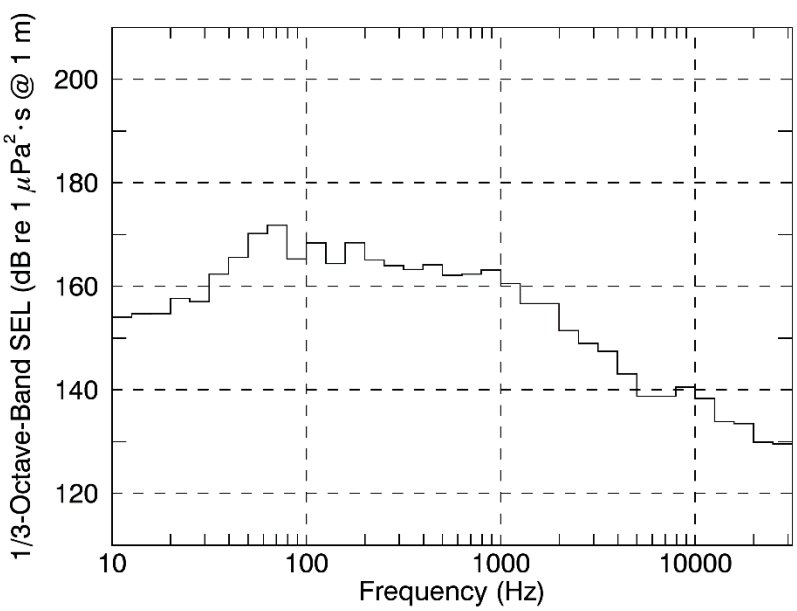


FIGURE 3.38. 1/3-octave band source levels for the *Minerva* transiting at 8.7 kts.

Ocean Wave

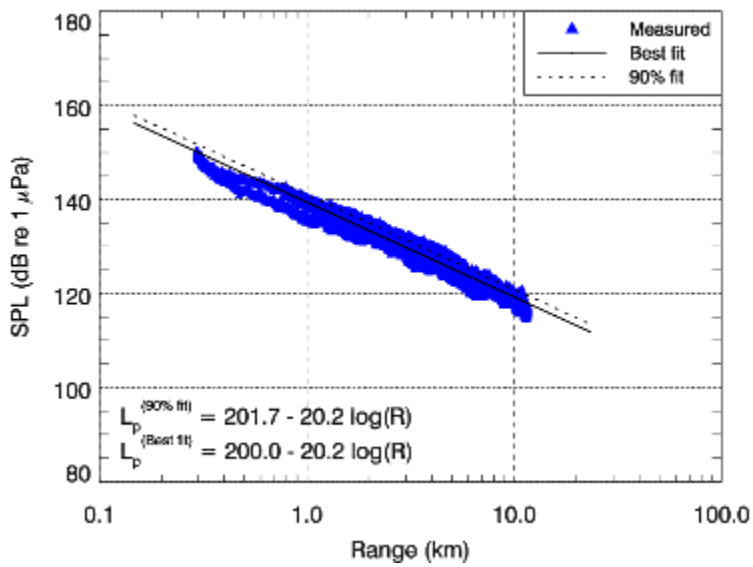


FIGURE 3.39. Vessel rms SPLs from AMARs A–C for the *Ocean Wave* transiting at 6.3 kts. Note: *Ocean Wave* and *Ocean Wind* were jointly escorting the *Polar Pioneer* during this measurement; these data include sound from all the vessels.

TABLE 3.23. Measured distance to rms SPL thresholds for the *Ocean Wave*, as determined from linear fits to rms SPL versus range data. Note: *Ocean Wave* and *Ocean Wind* were jointly escorting the *Polar Pioneer* during this measurement; these data include sound from all the vessels.

rms SPL (dB re 1 µPa)	Best-fit range (m)	90% fit range (m)
190	<10*	<10*
180	10*	12*
170	31*	37*
160	96*	120*
150	300	360
140	940	1,100
130	2,900	3,500
120	9,200	11,000

*Extrapolated beyond minimum measurement range of 294 m.

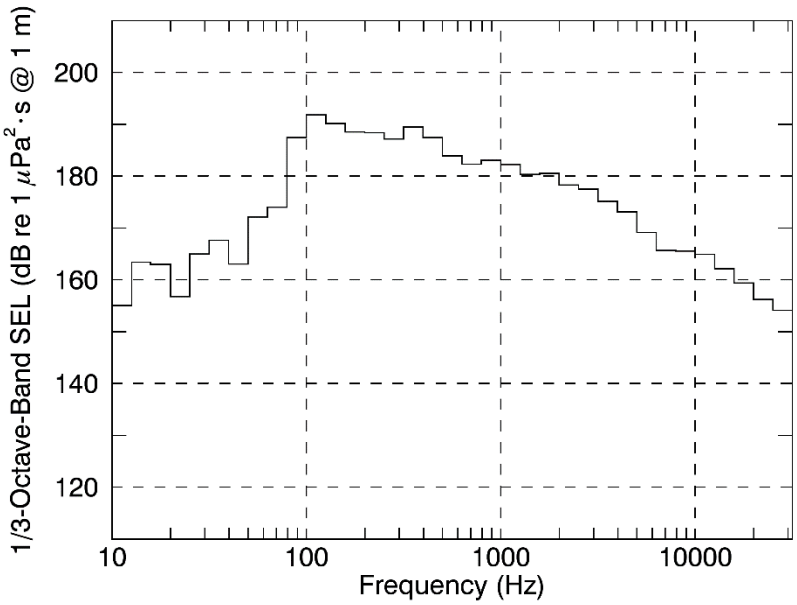


FIGURE 3.40. 1/3-octave band source levels for the *Ocean Wave* transiting at 6.3 kts.

Ocean Wind

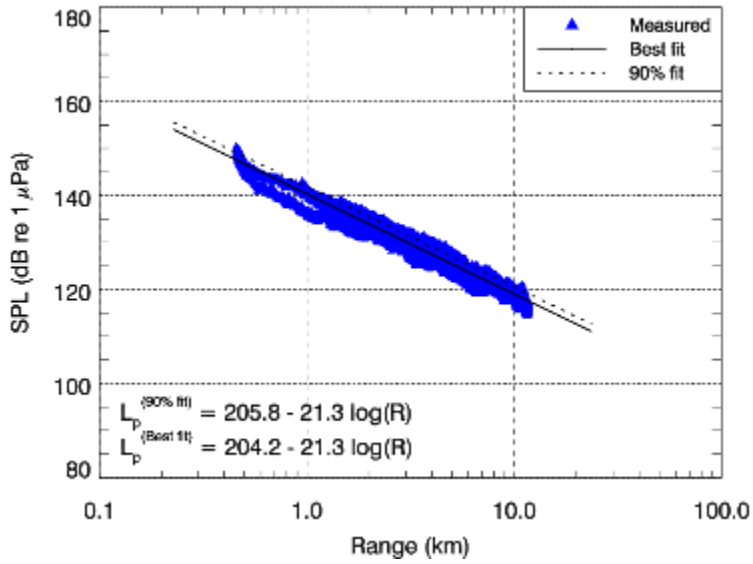


FIGURE 3.41. Vessel rms SPLs from AMARs A–C for the *Ocean Wind* transiting at 6.3 kts. Note: *Ocean Wave* and *Ocean Wind* were jointly escorting the *Polar Pioneer* during this measurement; these data include sound from all the vessels.

TABLE 3.24. Measured distance to rms SPL thresholds for the *Ocean Wind*, as determined from linear fits to rms SPL versus range data. Note: *Ocean Wave* and *Ocean Wind* were jointly escorting the *Polar Pioneer* during this measurement; these data include sound from all the vessels.

rms SPL (dB re 1 µPa)	Best-fit range (m)	90% fit range (m)
190	<10*	<10*
180	14*	16*
170	41*	48*
160	120*	140*
150	350*	420*
140	1,000	1,200
130	3,100	3,600
120	9,000	11,000

*Extrapolated beyond minimum measurement range of 456 m.

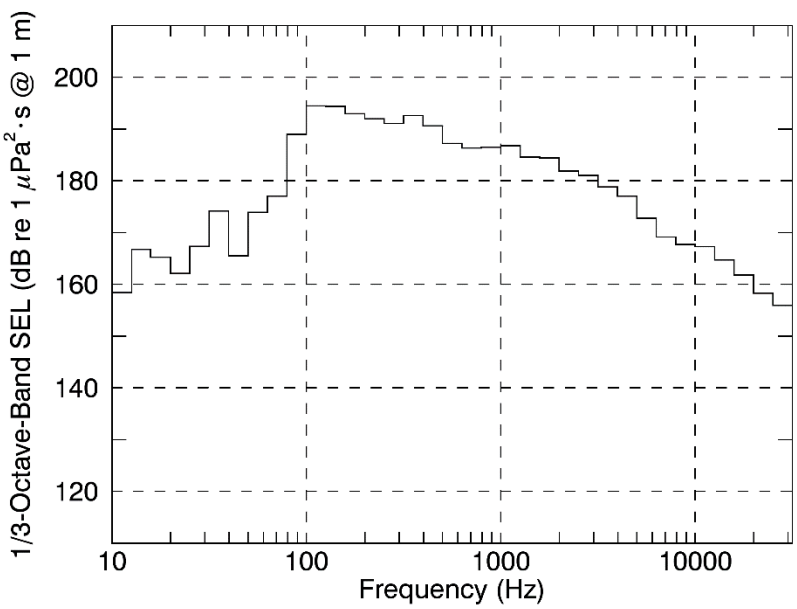


FIGURE 3.42. 1/3-octave band source levels for the *Ocean Wind* transiting at 6.3 kts.

Polar Pioneer

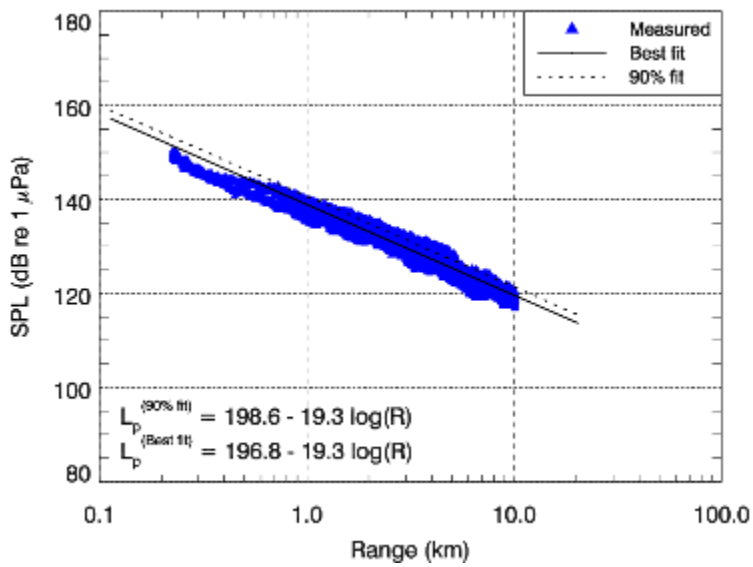


FIGURE 3.43. Vessel rms SPLs from AMARs A–C for the *Polar Pioneer* transiting at 6.4 kts. Note: *Ocean Wave* and *Ocean Wind* were escorting the *Polar Pioneer* during this measurement; these data include sound from all the vessels.

TABLE 3.25. Measured distance to rms SPL thresholds for the *Polar Pioneer*, as determined from linear fits to rms SPL versus range data. Note: *Ocean Wave* and *Ocean Wind* were escorting the *Polar Pioneer* during this measurement; these data include sound from all the vessels.

rms SPL (dB re 1 µPa)	Best-fit range (m)	90% fit range (m)
190	<10*	<10*
180	<10*	<10*
170	25*	30*
160	81*	100*
150	270	330
140	880	1,100
130	2,900	3,600
120	9,600	12,000

*Extrapolated beyond minimum measurement range of 226 m.

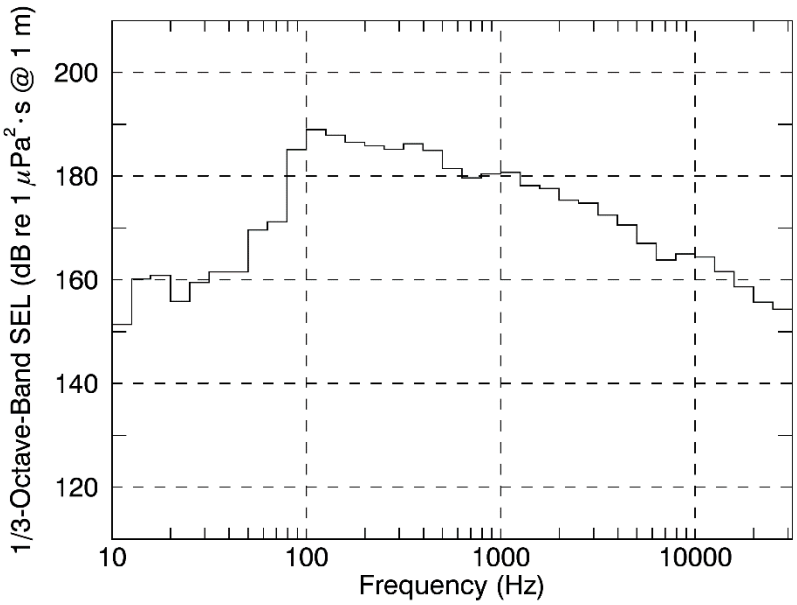


FIGURE 3.44. 1/3-octave band source levels for the *Polar Pioneer* transiting at 6.4 kts.

<u>*Ross*</u>

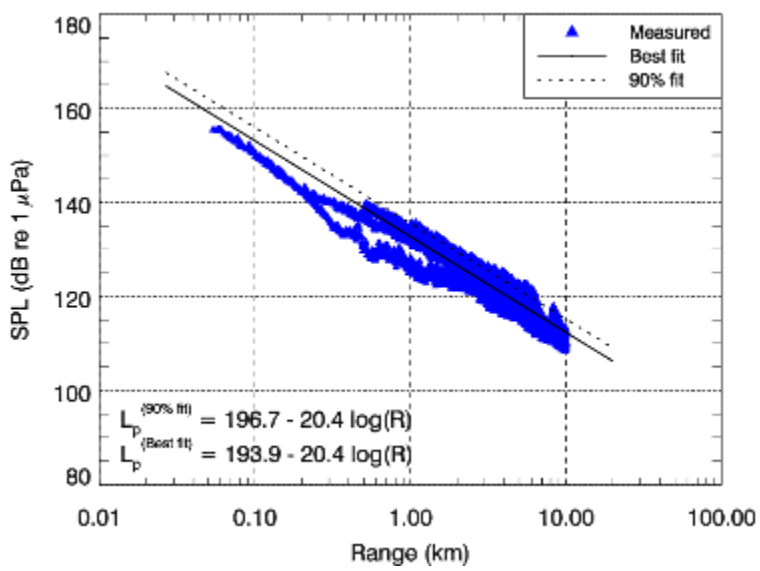


FIGURE 3.45. Vessel rms SPLs from AMARs A–C for the *Ross* transiting at 11.1 kts.

TABLE 3.26. Measured distance to rms SPL thresholds got the *Ross*, as determined from linear fits to rms SPL versus range data.

rms SPL (dB re 1 µPa)	Best-fit range (m)	90% fit range (m)
190	<10*	<10*
180	<10*	<10*
170	15*	21*
160	46*	63
150	140	200
140	440	610
130	1,400	1,900
120	4,200	5,800

*Extrapolated beyond minimum measurement range of 54 m.

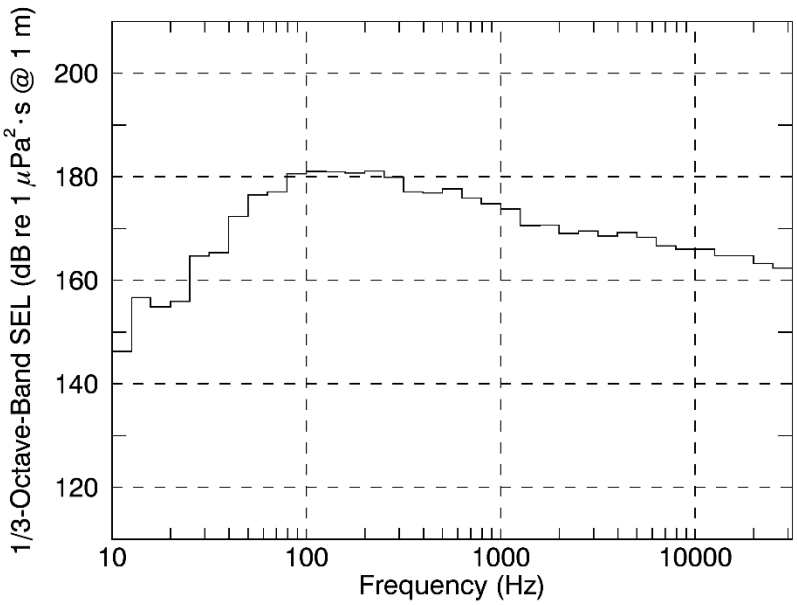


FIGURE 3.46. 1/3-octave band source levels for the *Ross* transiting at 11.1 kts.

Daily Average Sound Level at 1 km from Each Drill Site

Figure 3.47 is a plot of the daily average received sound level measured at 1 km from Burger J and 1 km from Burger V. The separation between the two drill sites is 14.4 km (8.9 mi). The sound levels received at 1 km from each drill site were not strongly correlated with each other but, rather, were each influenced by vessel activities local to each drill site. The daily average levels were highest at each site on days when local mooring and anchor activities were taking place.

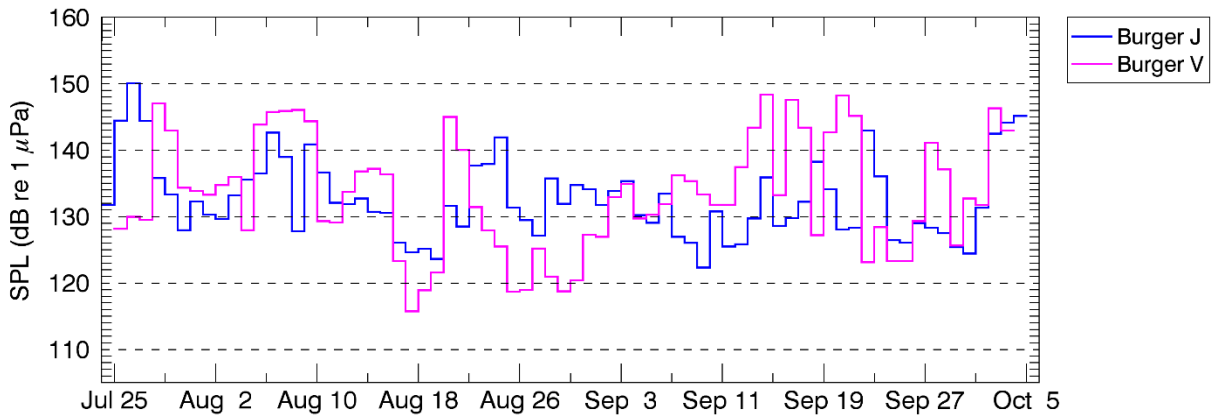


FIGURE 3.47. Daily average received sound level measured at 1 km from Burger J and at 1 km from Burger V.

Modeled Total Sound Footprint

Contours of the modeled, total sound are mapped in Figure 3.48 for an hour representative of drilling and an hour representative of MLC construction. The map includes contours for the three different model approaches. The first approach (contours with solid lines) most closely replicates the modeling from the IHA application and includes sound from the drilling units and from vessels using DP or laying anchors within 1 km (0.6 mi) of either drill site. The second model approach (dotted contour lines) is more comprehensive and includes sound from the drilling units and all vessels performing any activity within 5 km (3 mi) of either drill site. The third model approach (dashed contour lines) allows a consideration of the total sound from the drilling units and all vessels at all ranges in the Chukchi Sea. This model approach gives the most comprehensive overview of the total sound footprint but includes sound from normal vessel traffic that is not included in the take calculations.

The model simulations yielded sound contours such as those in Figure 3.48 for each hour during which the AMARs were in the water. Figure 3.49 through Figure 3.51 are plots of the areas encompassed by the contours for 120 dB re 1 µPa (rms SPL), on an hourly and daily basis through the course of the season, for the three model approaches. Comparison of the average areas of the contours for 120 dB re 1 µPa (rms SPL; Table 3.27) gives an indication of the amount by which the spatially distributed sound from all vessels increased the total ensonified area.

Ice management occurred on three separate occasions over a three-day period. Ice management occurred greater than 5 km away from the drill sites, and therefore was only included in the third modeling approach. To compare the relative extent of ensonification due ice management alone, sound level contours were also generated separately for these periods of ice management (Table 3.28).

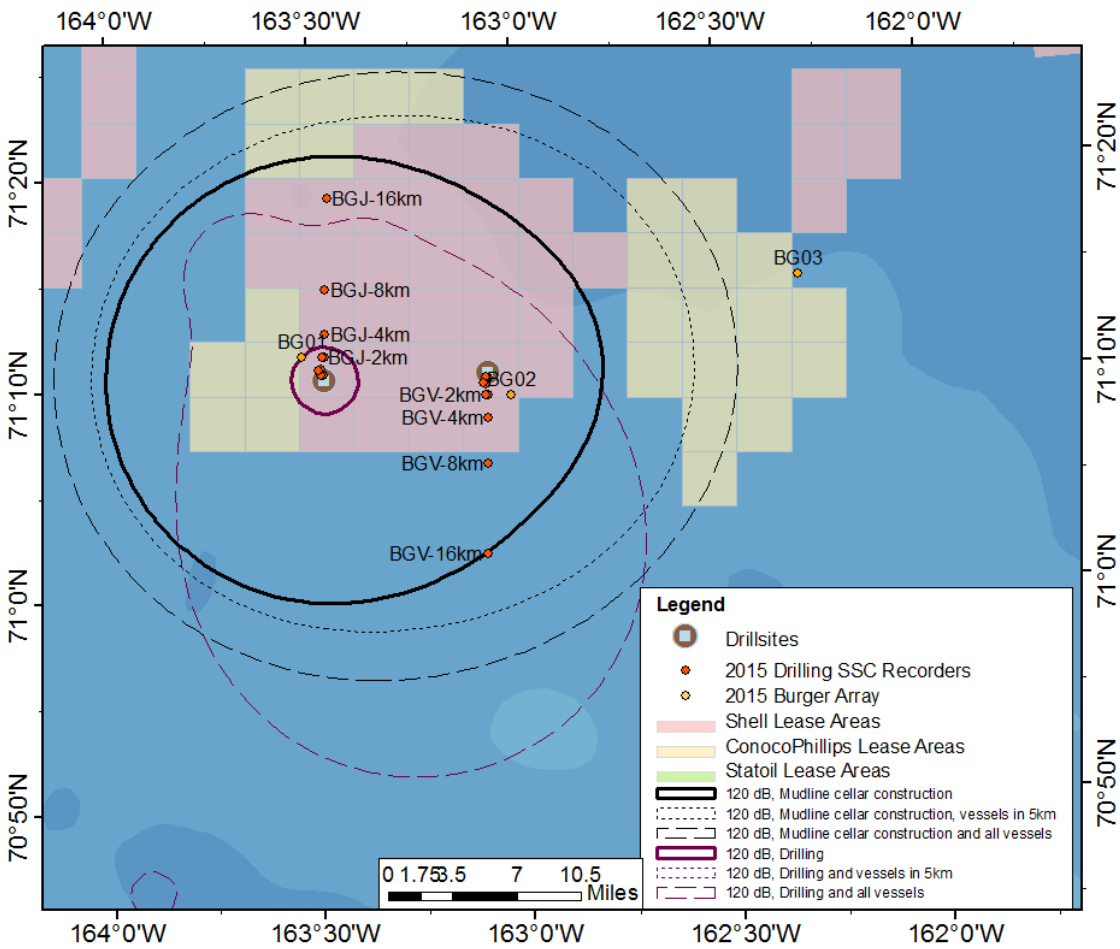


FIGURE 3.48. Contours of SPL at 120 dB re 1 µPa (rms SPL) from modeled sound footprints for drilling and MLC construction. Solid contours are from model simulations that include only sound from the drilling units and support vessels on DP or anchor handling within 1 km (0.6 mi) of either drill site; dotted contours include sound from all vessels within 5 km (3 mi) of either drill site; and the dashed contours include sound from all vessels at all ranges.

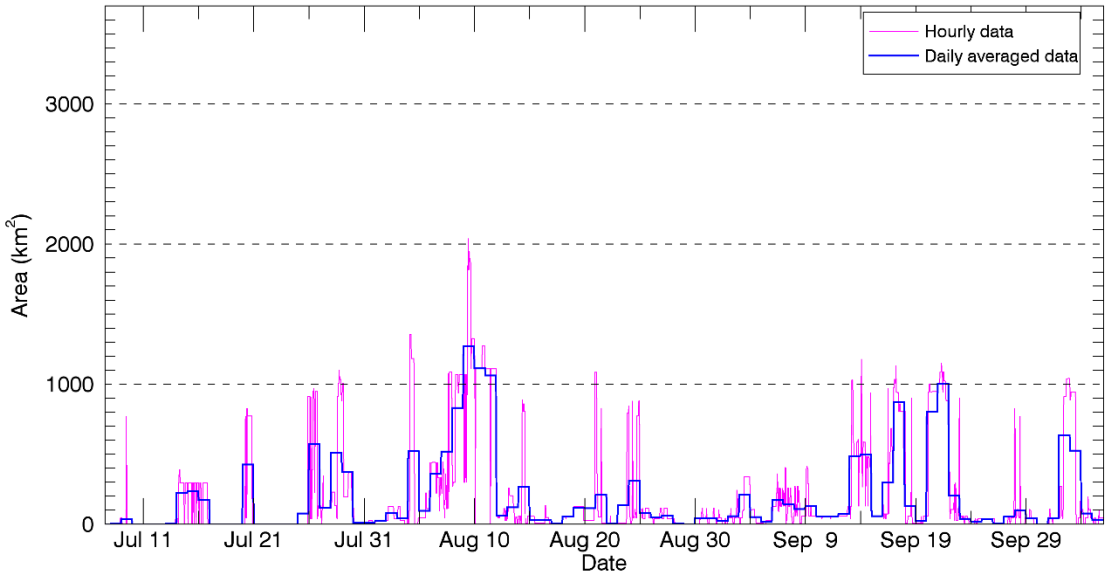


FIGURE 3.49. Simulated hourly and daily averaged 120 dB contour sizes (km^2) for all drilling activities and all vessels on DP or anchor handling within 1 km (0.6 mi) of either drill site.

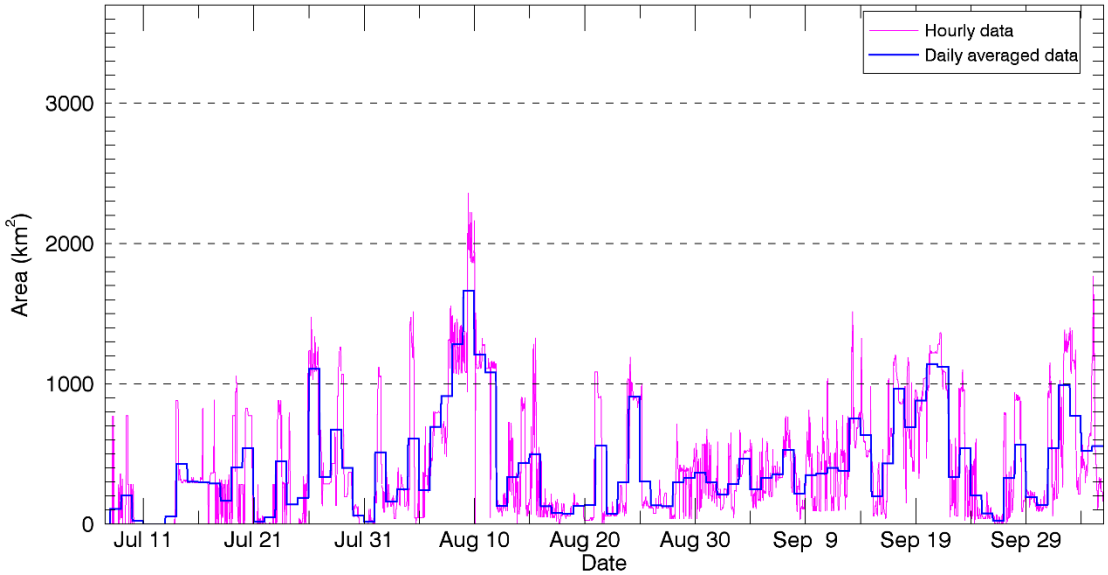


FIGURE 3.50. Simulated hourly and daily averaged 120 dB contour sizes (km^2) for all drilling activities and all vessels within 5 km (3 mi) of either drill site.

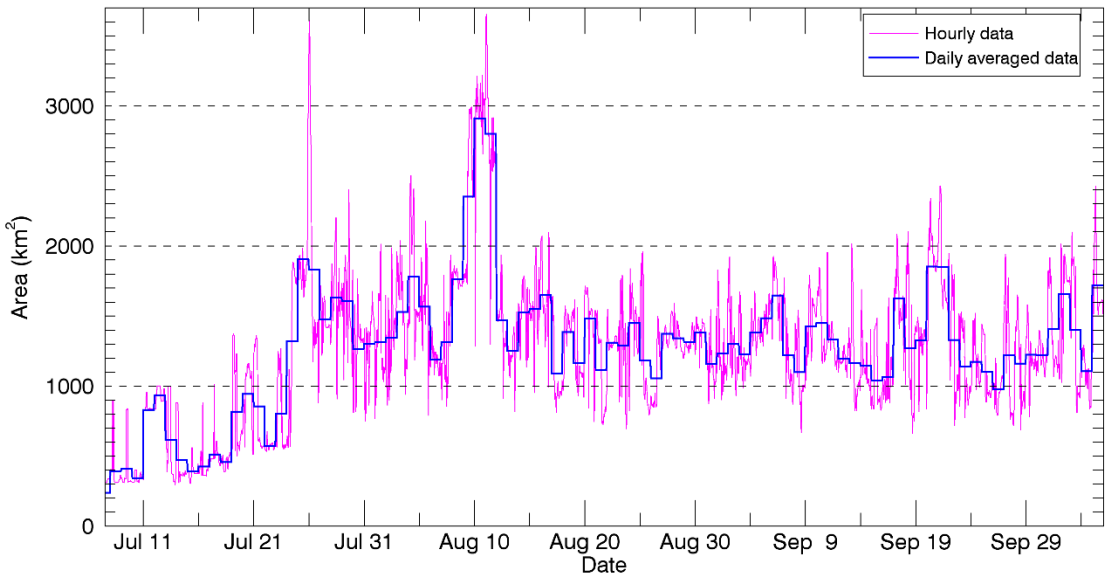


FIGURE 3.51. Simulated hourly and daily averaged 120 dB contour sizes (km^2) for all vessel and drilling activities over the entire Chukchi area.

TABLE 3.27. Average areas ensonified at 120 dB re 1 µPa (rms SPL) for the total sound footprint computed using three model approaches.

Model approach	Area (km^2)	Ratio of area compared to the first approach
Drilling units and vessels within 1 km (DP and anchor laying only)	193	1
Drilling units and vessels within 5 km (DP, anchor laying, and transiting)	410	2.1
Drilling units and all vessels (DP, anchor laying, transiting, and ice management)	1,264	6.5

TABLE 3.28. Average area ensonified at 120 dB re 1 µPa (rms SPL) for ice management only.

Model approach	Area (km^2)
Single vessel performing ice management	276

Summary

This chapter presents results from an acoustic monitoring study that characterized sounds from vessels and equipment associated with Shell's 2015 drilling program in the Chukchi Sea. Distances to the sound level thresholds of 190, 180, 160, and 120 dB re 1 µPa are summarized below (Table 3.29 to Table 3.31) for each vessel and activity characterized in this report, from fits to sound levels versus range data. The 90th percentile fits represent a conservative estimate of the sound propagation distances for each activity. Numerical simulations of the total sound footprint from several sound sources were generated using best-fit trend lines to sound levels versus range. These distances provide a more realistic estimation of the total ensonified areas, encompassing a range of vessel power settings.

Drilling activities at Burger J Drill Site

TABLE 3.29. Sound level threshold distances for drilling activities at the Burger J and Burger V drill sites. Distances were obtained from fits to sound levels versus range for the respective activity.

Activity	rms SPL threshold distances (m)							
	190 dB re 1 µPa		180 dB re 1 µPa		160 dB re 1 µPa		120 dB re 1 µPa	
	Best fit	90% fit	Best fit	90% fit	Best fit	90% fit	Best fit	90% fit
Circulating[1]	0*	0*	0*	0*	0*	0*	870	1,150
Running casing[1]	0*	0*	<10*	<10*	<10*	<10*	1,330	1,750
Drilling[1]	0*	0*	0*	0*	0*	0*	2,950	6,150
MLC construction[1]	<10*	<10*	<10*	<10*	40*	40*	19,050*	20,880*
Anchor handling[2]	<10*	<10*	<10*	<10*	40*	60*	9,730*	11,140*

*Extrapolated beyond measurement range.
[1] Measured at Burger J
[2] Measured at Burger V

TABLE 3.30. Sound level threshold distances for vessels operating at the Burger J and Burger V drill sites. Distances were obtained from fits to sound level versus range for the respective vessels.

Vessel	rms SPL threshold distances (m)							
	190 dB re 1 µPa		180 dB re 1 µPa		160 dB re 1 µPa		120 dB re 1 µPa	
	Best fit	90% fit	Best fit	90% fit	Best fit	90% fit	Best fit	90% fit
Noble Discoverer	<10*	<10*	<10*	<10*	<10*	<10*	1,200	1,700
Champion	<10*	<10*	<10*	<10*	<10*	<10*	1100	1,500
Sisuaq	<10*	<10*	<10*	<10*	<10*	<10*	1,800	2,500
Supporter	<10*	<10*	<10*	<10*	<10*	<10*	1,700	2,200
Marika	<10*	<10*	<10*	<10*	25*	25*	4,900	7900
Minerva	<10*	<10*	<10*	<10*	<10*	<10*	1,200	1,600
*Ocean Wave***	<10*	<10*	10*	12*	96*	120*	9,200	11,000
*Ocean Wind***	<10*	<10*	14*	16*	120*	140*	9,000	11,000
*Polar Pioneer***	<10*	<10*	<10*	<10*	81*	100*	9,600	12,000
Ross	<10*	<10*	<10*	<10*	46*	63	4,200	5,800

*Extrapolated beyond minimum measurement range
***Ocean Wave* and *Ocean Wind* were jointly escorting the *Polar Pioneer*; this measurement includes sound from all vessels

TABLE 3.31. Sound level threshold distances for vessels on DP. Distances were obtained from fits to sound level versus range for the respective vessels.

Vessel	rms SPL threshold distances (m)							
	190 dB re 1 µPa		180 dB re 1 µPa		160 dB re 1 µPa		120 dB re 1 µPa	
	Best fit	90% fit	Best fit	90% fit	Best fit	90% fit	Best fit	90% fit
Champion	0*	0*	0*	0*	<10*	<10*	3,380	6,180
Aiviq	<10*	<10*	10*	10*	160*	180*	15,410*	17,190*
Ross	<10*	<10*	<10*	<10*	50	50	6,880	8,100

*Extrapolated beyond minimum measurement range

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Glossary

attenuation

The acoustic energy loss due to absorption and scattering.

broadband sound level

The total sound pressure level measured over a specified frequency range. If the frequency range is unspecified, it refers to the entire measurement range.

broadside direction

Perpendicular to the travel direction of a source.

continuous sounds

Sounds that gradually vary in intensity with time, for example, sound from a transiting ship.

decibel

A logarithmic unit of the ratio of a quantity to a reference quantity of the same kind. Unit symbol: decibel (dB).

frequency

The rate of oscillation of a periodic function measured in units of cycles-per-unit-time. The reciprocal of the period. Unit: hertz (Hz). Symbol: *f*. For example, 1 Hz = 1 cycle per second.

Global Positioning System (GPS)

A satellite based navigation system providing accurate worldwide location and time information.

hydrophone

An underwater sound pressure transducer. A passive electronic device for recording or listening to underwater sound.

omnidirectional hydrophone

A hydrophone that has a uniform directivity, i.e., measures sound equally in any direction.

power spectrum density

The acoustic signal power per unit frequency as measured at a single frequency. Unit: $\mu Pa^2/Hz$, or $\mu Pa^2 \cdot s$.

power spectrum density level

The decibel level ($10\log_{10}$) of the power spectrum density, usually presented in 1 Hz bins. Unit: dB re 1 $\mu Pa^2/Hz$.

pressure, acoustic

The deviation from the ambient hydrostatic pressure caused by a sound wave. Also called overpressure. Unit: pascal (Pa).

received level (RL)

The sound pressure level measured at the receiver. Unit: dB re 1 μPa @ 1 m.

rms

root mean square.

rms sound pressure level (rms SPL)

The root-mean-square average of the instantaneous sound pressure (symbol is L_p) as measured over some specified time interval (symbol T). For continuous sound, the time interval is one second.

sound

A time-varying pressure disturbance generated by mechanical vibration waves travelling through a fluid medium such as air or water.

sound intensity

Sound energy flowing through a unit area perpendicular to the direction of propagation per unit time.

sound pressure level (SPL)

The decibel ratio of the time-mean-square sound pressure, in a stated frequency band, to the square of the reference sound pressure (ANSI S1.1-1994 R1999). Unit: decibel (dB). Symbol: L_p.

For sound in water, the reference sound pressure is one micropascal (p_o = 1 μPa) and the unit for SPL is dB re 1 μPa:

$$L_P = 10\log_{10}\left(p^2 / p_o^2\right) = 20\log_{10}\left(p / p_o\right)$$

Unless otherwise stated, SPL refers to the root-mean-square sound pressure level (rms SPL).

source level (SL)

The sound pressure level measured 1 metre from a point-like source that radiates the same total amount of sound power as the actual source. Unit: dB re 1 μPa @ 1 m.

spectrum

An acoustic signal represented in terms of its power (or energy) distribution versus frequency.

See also power spectrum density.

transmission loss (TL)

The decibel reduction in sound level that results from sound spreading away from an acoustic source, subject to the influence of the surrounding environment. Also referred to as propagation loss.

wavelength

Distance over which a wave completes one oscillation cycle. Unit: metre (m). Symbol: λ.

4. VESSEL-BASED MONITORING, MITIGATION, AND DATA ANALYSIS METHODS[4]

This chapter describes the marine mammal monitoring and mitigation measures implemented during Shell's exploratory drilling operations in the Chukchi Sea during the 2015 open-water season. The required monitoring and mitigation measures were detailed in the IHA and LOA issued to Shell by NMFS and USFWS, respectively. This chapter also describes the methods used to categorize and analyze the vessel-based monitoring data collected by observers and reported in the following chapters.

Monitoring Tasks

The main purposes of the marine mammal monitoring and mitigation program were to ensure that the provisions of the IHA and LOA issued to Shell in 2015 were satisfied, effects on marine mammals were minimized, and residual effects on animals were documented. Tasks specific to monitoring and mitigation are listed below:

- use of dedicated PSOs aboard the drilling units (*Polar Pioneer* and *Noble Discoverer*) and the support vessels to visually monitor the occurrence and behavior of marine mammals near the vessels and within the exclusion zones;
- use the visual observations as a basis for implementing the required mitigation measures;
- record (insofar as possible) the effects of exploratory drilling operations and drilling-related activities and the resulting sounds on marine mammals;
- estimate the number of marine mammals potentially exposed to low-level continuous sounds at specified levels from drilling and drilling-related activities.

Safety and Potential Disturbance Radii

IHAs typically include provisions to minimize the possibility that marine mammals close to the sound source are exposed to levels of sound high enough to cause short- or long-term hearing loss or other physiological injury.

Under current NMFS guidelines (e.g., NMFS 2001), "safety radii" to prevent Level A takes of marine mammals around sound sources are defined as the distances within which RSLs are ≥180 dB re 1 μPa (rms SPL) for cetaceans and ≥190 dB re 1 μPa (rms SPL) for pinnipeds. The ≥180 and ≥190 dB (rms SPL) guidelines were also employed by USFWS for the species under its jurisdiction (≥180 and ≥190 dB [rms SPL] for walrus and polar bear, respectively) in the LOA issued to Shell. Those safety radii are based on a cautionary assumption that other sounds at lower received levels will not injure these mammals or impair their hearing abilities, but that higher received levels might have such effects. Shell did not request Level A takes for in-water sounds and planned to implement mitigation measures to prevent exposures at those levels. However, the planned ZVSP surveys were not conducted, so no pulsed sounds were generated and sounds levels above the ≥180 and ≥190 dB re 1 μPa (rms SPL) guidelines were not generated by other exploration drilling activities.

[4] By L.N. Bisson and D.S. Ireland (LGL)

Marine mammals exposed to pulsed sounds ≥160 dB re 1 μPa (rms SPL) or non-pulse (continuous) sounds ≥120 dB re 1 μPa (rms SPL) are assumed by NMFS to be potentially subject to behavioral disturbance. Pulsed sounds from airguns used in ZVSP surveys of exploratory wells were authorized in Shell's 2015 IHA; however, no ZVSP surveys were conducted by Shell in the Arctic during 2015. Therefore, the focus within this report is on continuous sounds produced during exploratory drilling operations.

Exploration Drilling Activities

Pre-Season Activity Scenario Estimates

Shell's IHA and LOA applications described potential "activity scenarios" for the planned 2015 exploration drilling program by considering the various combinations of different continuous sound sources that may operate at the same time at one or more locations. Sound propagation modeling of each activity scenario was performed by incorporating each of the respective individual, continuous sound sources using measured source levels from 2012 or representative source levels if measured levels were unavailable. This approach to sound propagation modeling allowed for the consideration of additive acoustic effects from overlapping sound fields produced by numerous, continuous sound sources and ultimately attempted to more accurately simulate the underwater acoustic environment resulting from the exploratory drilling program proposed by Shell in 2015. A total of nine representative activity scenarios were modeled to estimate areas exposed to continuous sounds ≥120 dB re 1 μPa rms for Shell's planned 2015 exploration drilling program in the Chukchi Sea (Table 4.1) and a tenth scenario addressed pulsed sounds from planned zero-offset vertical profile seismic surveys.

Activity scenarios identified in the IHA and LOA applications that actually occurred in 2015 included: ***(1)*** drilling with one or more stationary support vessels using DP at one site; ***(2)*** MLC construction at one site; ***(3)*** anchor handling at one site; ***(4)*** simultaneous drilling at one site and anchor handling at second site; and ***(5)*** simultaneous MLC construction at one site and anchor handling at a second site. Ice management conducted by a single vessel occurred far from other project vessels and in short, discrete periods in 2015 (see Chapter 2 for details) and measurements of these activities were not obtained.

Sound Source Measurements and Post-Season Modeled Estimates

Field measurements of underwater sounds as a function of distance were acquired during drilling and related support activities and are presented in Chapter 3 of this report. Chapter 3 also describes how the areas exposed to RSLs in 10 dB bins on an hourly basis were modeled based on the vessel movement recorded by onboard GPS units and the vessel activity status as recorded by PSOs aboard the vessels. When possible, these hourly footprints were created using data recorded in 2015 during times when specific activities (e.g., anchor handling or MLC construction) were occurring near acoustic recorders and no other vessels were within 5 km. When measurement data of 2015 activities were not available because other vessels were operating nearby or activities occurred far from acoustic recorders (e.g., ice management), source level estimates of vessels and activities measured in previous years were used as inputs to the modeling (see Table 3.6).

TABLE 4.1 Sound propagation modeling results of drilling-related representative activity scenarios and estimates of the total area potentially ensonified above threshold levels summed on a daily basis at the Burger Prospect in the Chukchi Sea, Alaska, during the planned 2015 Exploration Drilling Program.

Activity/Source	Received Level (dB re 1 µPa)	Site Area Potentially Ensonified (km^2)		Activity Days per Season		Total Area Potentially Ensonified (km^2)	
		Summer	Fall	Summer	Fall	Summer	Fall
Drilling at 1 site	120 dB	10.2	10.2	4	4	40.8	40.8
Drilling and DP vessel at 1 site	120 dB	111.8	111.8	2	6	223.6	670.8
Drilling and DP Vessel (1 site) + Drilling and DP Vessel (2nd site)	120 dB	295.5	295.5	21	20	6,205.5	5,910.0
Mudline Cellar Construction at 2 sites	120 dB	575.5	575.5	14	14	8,057.0	8,057.0
Anchor Handling at 1 site	120 dB	1,534.9	1,534.9	3	3	4,604.7	4,604.7
Drilling and DP Vessel (1 site) + Anchor Handling at 2nd	120 dB	1,759.2	1,759.2	8	8	14,073.6	14,073.6
Mudline Cellar Construction at 2 sites + Anchor Handling at 3rd site	120 dB	2,046.3	2,046.3	6	6	12,277.8	12,277.8
Two-vessel Ice Management	120 dB	937.4	937.4	20	10	18,748.0	9,374.0
Four-vessel Ice Management	120 dB	1,926.0	1,926.0	4	4	7,704.0	7,704.0
ZVSP at 2 different sites	160 dB	449.0	449.0	0	4	0.0	1,796.0

Three different approaches to calculating acoustic footprints produced by 2015 exploration drilling and support vessel activities are described in Chapter 3. The three methods used different radial distances from the drill sites to determine whether support vessel activities were included in the modeled footprints. The first approach (Method 1) most closely replicated the modeling described in the IHA and LOA applications (see Pre-Season Activity Scenario Estimates above) and included activities at the drill sites and support vessels that were using DP or performing anchor handling within 1 km of the drill sites. The second approach (Method 2) included all activities at the drill sites and any vessels operating within 5 km of either drill site, including all activity states (e.g., anchor handling, DP, and transiting). The third approach (Method 3), which included the drilling operations, all support vessel activities in the Chukchi Sea Activity Area, and all ice management activities, produced the largest ≥120 dB re 1 µPa (rms SPL) areas by including vessel activities beyond those required for inclusion in the IHA Application. The 24, hourly footprints from each day were then averaged to produce the average daily ensonified areas for each of the three methods. The average daily ensonified areas from Method 1 are summarized in Table 4.2.

TABLE 4.2 Sound propagation results of drilling-related activity scenarios for Scenario 1 and total area ensonified above threshold levels averaged and summed on a daily basis at the Burger Prospect in the Chukchi Sea, Alaska, during 2015 Exploration Drilling Program.

Activity/Source	Received Level dB re 1 µPa (rms SPL)	Activity Days per Season		Average Daily Area Ensonified (km^2)		Total Area Ensonified (km^2)	
		Summer	Fall	Summer	Fall	Summer	Fall
Drilling and DP Vessel at 1 site	120 dB	17	8	109.9	205.7	1,867.6	1,645.6
Mudline Cellar Construction at 1 site	120 dB	4	0	684.9	0.0	2,739.7	0.0
Anchor Handling at 1 site	120 dB	7	4	200.7	320.1	1,404.7	1,280.3
Drilling and DP Vessel at 1 site + Anchor Handling at 2nd site	120 dB	0	11	0.0	320.7	0.0	3,527.8
Anchor Handling at 1 site + Mudline Cellar Construction at 2nd site	120 dB	5	0	614.4	0.0	3,071.8	0.0
Ice Management	120 dB	3	0	276.0	0.0	828.0	0.0

Mitigation Measures as Implemented

The implementation of mitigation measures during Shell's 2015 exploratory drilling program in the Chukchi Sea spanned all aspects of operations. Mitigation measures were focused on reducing potential impacts to marine mammals and subsistence activities from a wide range of vessel activities. Specifically, vessel activities related to transit, drilling, the handling and setting of the anchors used to moor the drilling units, and ice scouting and management activities were all mitigated by various actions requested by PSOs. Vessel-based PSOs also played a role in the routing of aircraft to minimize potential impacts on marine mammals, particularly for helicopters used to facilitate offshore crew changes. Potential impacts to local subsistence activities were mitigated through communications from each vessel to the nearest shore-based communication center every six hours (see Chapter 2) as well as twice-daily conference calls with subsistence advisors in Chukchi Sea coastal villages. Shell did not conduct ZVSP surveys in 2015, which precluded the establishment of 180 and 190 dB (rms) exclusion zones for marine mammals around the drilling units as stipulated in Shell's IHA and LOA for periods with active airgun operations.

The most common forms of mitigation implemented by PSOs aboard vessels during 2015 were reductions in vessel speed and alterations of vessel headings during routine vessel operations. All efforts were made to maximize distance from marine mammals and avoid separating individuals from groups of marine mammals. Other mitigation measures implemented by PSOs aboard vessels included delay of operations (e.g., equipment deployments, helicopter landings, crane operations, etc.) due to the presence of marine mammals in the area. Vessel transit routes through the Chukchi Sea and within the drilling area were altered as a result of PSOs sharing information on marine mammals observed in specific areas. Summaries of the mitigation measures implemented are presented in Chapter 7 and in Appendix C.

Required and Voluntary Mitigation Measures

Mitigation measures implemented during Shell's 2015 exploratory drilling program in the Chukchi Sea can be categorized into two general types: ***(1)*** required mitigations stipulated in the IHA and LOA and ***(2)*** voluntary mitigations implemented to reduce impacts to observed marine mammals from vessel activities. Mitigation measures implemented as required by the IHA or LOA include reductions in speed or course alterations for species groups observed within specific distances. PSOs routinely requested

mitigation well before marine mammals approached within the distance stipulated by the permits, based on the vessel trajectory and the location and movement of the marine mammals relative to the vessel. Voluntary mitigations were not required by the IHA and LOA and were implemented to reduce the impact to individual marine mammals observed in the vicinity of Shell's 2015 activities. These included course alterations or reductions in speed not stipulated in the IHA or LOA (i.e., reducing speed for a single walrus observed in the water), rerouting of helicopters, delay of vessel operations including ice scouting, transit, crew change operations, and equipment deployment and retrieval. Required and voluntary mitigation measures implemented by Shell during 2015 activities are described further and summarized in Chapter 7.

Special Mitigation Measures During Ice Management

Ice scouting and management activities in the Chukchi Sea during 2015 involved significant communication between PSOs and vessel operators. Whenever possible, these activities were restricted to periods with good visibility to allow for larger detection distances of marine mammals in the area prior to approaching sea ice. The location of animals on or near ice was communicated to vessel operators and shore-based project managers. Ice scouting activities took place from early July to mid-August, and only small amounts of ice were managed between 28 July and 30 July (see Chapter 2).

As a part of the request to the USFWS for the incidental harassment of Pacific walrus and polar bears, Shell proposed a process to monitor and assess the potential for activities to interact with walruses on ice, especially if ice posed a potential threat to the drill site. The process assimilated near real-time information from multiple data sources including vessel-based observations, aerial surveys, satellite-linked GPS tags on walruses, and satellite imagery of ice conditions and movements. These data were reviewed daily and assessed in the context of planned activities to assign a risk level (low, medium, or high). The risk level was communicated to all assets in the field and decision makers during morning operations briefings. A low risk level meant that planned activities could occur without further review. A medium risk level meant that some operations had a greater potential of interacting with walrus on ice and that additional discussions of those activities were required to determine the relative risk of potential impacts compared to the importance of the planned activity. A high risk level meant that the planned activities were necessary and walrus on ice were likely to be encountered. In that case, USFWS agency personnel would have been directly incorporated into the assessment and decision-making process; however, a high risk level was never reached during the 2015 season.

Special Mitigation Measures inside Hanna Shoal Walrus Use Area

Shell's activities in HSWUA were conducted in accordance with additional mitigation measures specific to HSWUA as stipulated in the LOA. The additional mitigation measures included restrictions on vessel movement based on monthly walrus utilization distribution areas prior to 30 September, restricting vessel activities based on weather or visibility conditions, and providing 48-hour notice to USFWS prior to a vessel entering and after leaving the overall HSWUA. When operating within HSWUA, PSOs altered observation protocols to emphasize monitoring in all 360º around the vessel rather than placing greater emphasis on monitoring ahead of the vessel's path. The two occasions when Shell vessels entered HSWUA are described in Chapter 2 and PSOs did not observe any walruses from the vessels during those times.

Marine Mammal Monitoring Methods

Marine mammal monitoring methods were designed to meet the requirements and objectives specified in the IHA and LOA. The main purposes of PSOs aboard the drilling units and support vessels were as follows:

- Conduct visual watches for marine mammals to serve as the basis for implementation of mitigation measures for cetaceans, seals, walruses, and polar bears;
- Collect data on observation effort and sightings to estimate the numbers of marine mammals potentially exposed to low-level continuous sounds generated by drilling and support activities; and
- Document any potential reactions of marine mammals to exploratory drilling and related support activities, and whether there was any potential effect on accessibility of marine mammals to subsistence hunters in Alaska.

Results of marine mammal monitoring in the Chukchi Sea are presented in detail in Chapters 5, 6, and 7. The visual monitoring methods that were implemented during Shell's 2015 exploratory drilling program were similar to those used during Shell's 2012 exploratory drilling program. The standard visual observation methods utilized by PSOs aboard vessels are described below and in greater detail in Appendix C.

Vessel-based marine mammal monitoring and mitigation was conducted from the drilling units and support vessels throughout operations in the Chukchi Sea. Permit stipulations required that two PSOs be on watch aboard drilling units and support vessels during all active drilling, anchor handling, and ice management operations from nautical twilight-dawn to nautical twilight-dusk. As a conservative approach, at least one PSO maintained an active watch during periods of darkness when drilling or ice management was occurring, and an additional PSO was on-call during these periods. At least one PSO was on watch on the additional support vessels when the vessel was engaged in active operational activities and at other times whenever practicable. During daylight hours, scans were made with Fujinon 7×50 reticle binoculars and the unaided eye. During periods with excellent visibility on the drilling units and primary support vessels, Fujinon 25×150 "Big-Eye" binoculars or Zeiss 20×60 image stabilized binoculars were used to monitor for distant marine mammals. PSOs frequently scanned areas around the vessel during periods of darkness using Generation 3 night vision devices (NVDs).

NMFS Expert Panel Recommendations

As part of the NMFS IHA application process, an independent peer review panel reviewed and provided comments and recommendations on the proposed marine mammal mitigation and monitoring plan. Shell adjusted data collection methods and analyses in 2015 as a result of recommendations made by the peer review panel including revisions to the acoustic recorder layout (see Chapter 3 for more details) and the inclusion of sightability curves by species group as part of the vessel-based visual monitoring results summarized in this 90-day report (see Chapters 5 and 6).

Previous peer review panel reports have made recommendations for training procedures, field observation techniques, data recording procedures, and final reporting, and these were included as a part of the planned program in 2015. These recommendations included:

- pre-season training with vessel operators to ensure on-duty PSOs had the ability to successfully request required mitigation measures;
- training of all observers, including Alaska Natives, together at the same time;
- instructing observers to identify animals as unknown/unidentified when appropriate rather than striving to identify a sighting to species without evidence of diagnostic features;
- correcting for effort of the sampling of the relative nearfield around operations to provide the best possible estimates of marine mammals in exclusion and disturbance zones;
- maximizing observers' time with their eyes on the water by utilizing a direct-entry, computer-software program designed specifically for data entry by PSOs aboard vessels;

- training PSOs using visual aids (e.g., photos) to help them identify the species that they were likely to encounter in the conditions under which the animals would likely be seen;
- pairing new and experienced observers together during training and in the field to maximize understanding, mentorship opportunities, and consistency of data collection;
- documenting visibility conditions during observation periods;
- instructing observers to maximize time spent monitoring areas directly associated with operations and zones associated with mitigation;
- stationing PSOs in the best possible positions for observing: the bridge, bridge wings, flying bridge, or stern; and
- combining the use of "Big-Eye" binoculars, low power binoculars, and naked eye searches during watches to cover the greatest area allowable by weather conditions.

Data Analysis Methods

Categorization of Data

PSO effort was recorded using the systematic collection of observation records that captured the distance or amount of time spent with at least one observer ***(1)*** actively searching for marine mammals and ***(2)*** documenting environmental conditions and vessel activities. For periods when vessels were moving, effort was quantified as the distance the vessel traveled while PSOs actively looked for marine mammals and recorded environmental and vessel activity data. For periods when vessels were stationary, effort was quantified as the number of hours during which PSOs actively looked for marine mammals and recorded data. The amount of effort was subdivided by various environmental or operational variables that may have influenced the ability of PSOs to detect marine mammals or the actual distribution of marine mammals in the area (e.g., Beaufort wind force, vessel activity). PSO effort was used to calculate marine mammal sighting rates and density estimates in the following chapters of this report.

Observer effort and marine mammal sightings data were divided into several categories related to environmental conditions and vessel activity. The categories were similar to those used during previous exploration activities by Shell conducted under MMPA authorizations in this region (e.g., Funk et al. 2008; Ireland et al. 2007a,b; Patterson et al. 2007; Reiser et al. 2010; Reiser et al. 2011; Bisson et al. 2013). These categories are defined briefly below, with a more detailed description provided in Appendix C.

Species Groups

Results are presented separately by groups including cetaceans, pinnipeds (excluding walrus), Pacific walrus, and polar bear. Cetaceans and pinnipeds are treated separately due to expected differences in potential reactions to exploration activities and related support activities. Pacific walrus and polar bear are presented separately due to their management by USFWS.

Geographic Boundaries

Data were collected during the entire cruise period for all vessels including transits between Dutch Harbor and the activity area in the Chukchi Sea. For the purposes of this report, only data recorded north of Point Hope were included as shown by the outline of the Chukchi Sea Activity Area (Figure 4.1). Appendix E includes weekly sighting maps for all vessels.

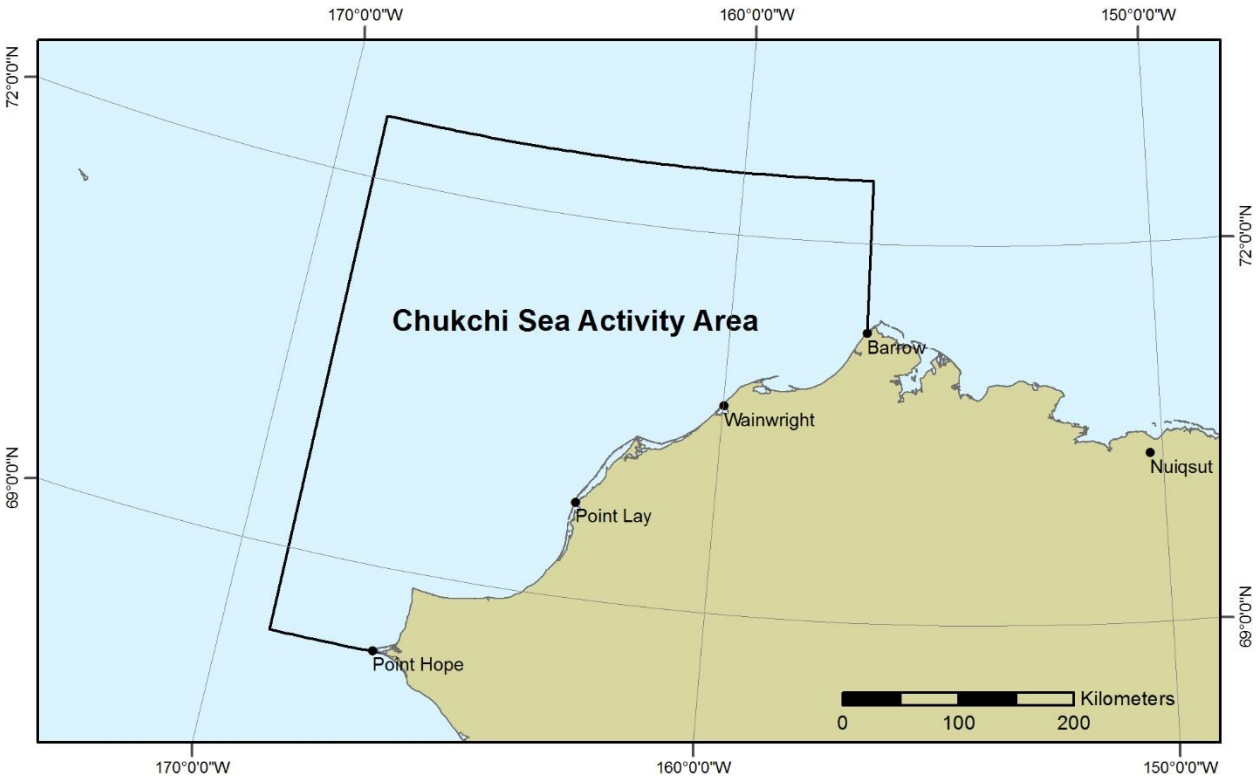

FIGURE 4.1. The Chukchi Sea Activity Area boundaries used to categorize marine mammal data for analysis and presentation in Chapters 5, 6, and 7.

Vessel Activity Scenarios

The activity of each vessel was routinely recorded by on-watch PSOs and these records were reviewed and used to define overall periods of time during which major sound producing activities occurred in the Activity Area (see section Sound Source Measurements and Post-Season Modeled Estimates above for more detail). These sound producing activities included drilling, DP sounds by support vessels attending the drilling units, anchor handling, MLC construction, and ice management. Marine mammal sightings and observer effort data from all vessels in the Activity Area were then categorized based on the time they were collected into the following six activity scenario bins: (1) drilling with one or more support vessels using DP; (2) MLC construction at one site; (3) anchor handling at one site; (4) simultaneous drilling at one site and anchor handling at second site; (5) simultaneous MLC construction at one site and anchor handling at a second site; and (6) routine vessel operations including periods with no drilling, MLC construction, or anchor handling. Vessel activities 1–5 are consistent with the vessel-based acoustic sources that were authorized for incidental take of cetaceans and pinnipeds by Shell's 2015 IHA and LOA. The sixth activity scenario, routine vessel operations, is included in the report in order to compare results against the other five scenarios that were part of the incidental take authorizations.

Received Sound Level

Data were categorized as having occurred within or outside of areas where RSLs were ≥120 dB re 1μPa (rms SPL) based on the acoustic modeling of actual 2015 activities. As discussed above, three different approaches to calculating acoustic footprints produced by 2015 exploration drilling and support vessel activities were described in Chapter 3. The third approach (Method 3), which included activities at the drill sites, all support vessel activities in the Chukchi Sea Activity Area, and all ice management

activities, produced the largest ≥120 dB re 1 μPa (rms SPL) areas by including vessel activities beyond those required for inclusion in the IHA Application. Method 3 was used to categorize PSO effort and sightings data by RSL in Chapters 5 and 6. This was done to increase the likelihood of identifying differences in potential disturbance responses that may have otherwise been masked by using the smaller modeled footprints from Method 1 or 2.

Since the footprints from modeling Method 3 are larger than those that reflect the operations specified in the IHA and LOA, the numbers of animals categorized as occurring in areas where RSLs were ≥120 dB re 1μPa (rms SPL) are not comparable to the takes authorized by the IHA and LOA. The first modeling approach (Method 1) most closely replicated the modeling used in the IHA application and included all support vessels that were using DP or performing anchor handling within 1 km (0.6 mi) of either drill site. Method 1 is used to categorize PSO effort and sightings by RSL and calculate takes in Chapter 7.

PSO observational effort data were categorized as "≥120 dB" if the data were collected within the ≥120 dB re 1μPa (rms SPL) average daily ensonified area and were classified as "<120 dB" if they were collected outside the ≥120 dB re 1μPa (rms SPL) average daily ensonified area. The locations of marine mammal sightings were calculated using PSO records of the distance of the animal(s) from the vessel and the direction of the animal(s) relative to the vessel. Positions were calculated for both the initial sighting and closest point of approach (CPA) for each sighting; if at any time the sighting fell within the ≥120 dB re 1μPa (rms SPL) average daily ensonified area, the sighting was calculated as "≥120 dB."

Sighting Rate Calculation and Comparisons

Sighting rates (sightings per 1000 km of PSO effort, or sightings per 10 h of PSO effort) are presented in Chapters 5, 6, and 7 by Beaufort wind force (Bf), number of PSOs on watch, and vessel activity scenario. Sighting rates are presented independently by species groups including cetaceans, pinnipeds (excluding walrus), Pacific walrus, and polar bear. Where appropriate and sample sizes permitted, comparisons of sightings rates between categories were made using a chi-square (χ^2) test. In general, however, small sample sizes precluded meaningful statistical analyses in most cases.

Sighting rates have the potential to be biased by a number of different factors other than the variable being considered. In order to present meaningful and comparable sighting rates within and between categories, especially for purposes of considering the potential effects of drilling-associated sounds on the distribution and behavior of marine mammals, effort and sightings data were categorized by sighting conditions (e.g., environmental conditions) and operational conditions (activity scenarios and exposure area). The criteria were intended to exclude data from periods of observation effort when conditions would have made it unlikely for PSOs to be able to detect marine mammals that were at the surface, such as nighttime. If those data were to be included in analyses, important metrics like sighting rates and density estimates would be biased downward. It is important to note that data from periods that met the criteria outlined in the next paragraph were used to estimate the number of animals potentially exposed to underwater sounds from Shell's activities for the entirety of the project, including periods of reduced visibility and darkness.

Criteria for Sighting Rate Data

PSO observation effort and sightings occurring under the conditions listed below were excluded when calculating sighting rates. Different Beaufort wind force criteria were used for small cetaceans in order to account for differences in the likelihood of detecting these animals with increasing sea states.

- for moving-vessel data, periods when ship speed was <3.7 km/h (2 kt);
- periods with seriously impaired visibility including:
    - all nighttime observations;

- visibility distance <3.5 km (2.2 mi);
- Beaufort wind force (Bf) >5 (Bf >2 for minke whales, belugas, and porpoises; See Appendix D for Beaufort wind force definitions);
- >60º of severe glare in the forward 180° of the vessel.

Distribution and Behavior

Initial Sighting Distance and Distribution

For each sighting, PSOs recorded an initial sighting distance and a direction of animal movement. Polar plots created for each vessel type (e.g., drilling unit, support vessel, etc.) display the distribution, direction, and initial sighting distance of marine mammals. Sightings were classified by vessel activity scenario bins. Sightings were also categorized by those made during periods of good visibility and sightings made during periods of poor visibility.

Closest Point of Approach

The CPA of each sighting to the observer position was calculated in a geographic information system (GIS) using the closest sighting record to the PSO position on the vessel. The mean, standard deviation, and range of CPA distances to the observer are classified by vessel activity scenario bins.

Similar to sighting rate calculations, the calculation of mean CPA distances and subsequent comparisons during different vessel activity states could be biased by including data from observation periods of poor visibility or when animals may have been affected by something other than seismic sounds. Therefore, only sightings that met the criteria for inclusion in the sighting rate calculations were used in the calculation of mean CPA distances.

Movement

Animal movements relative to the vessel were grouped into five categories: swim (move) away, swim (move) towards, neutral (e.g., parallel), none, or unknown. The observed movements of animals that fell into these categories were compared across vessel activity scenario bins.

Initial Behavior

For each sighting, an initial behavior was recorded by the PSO. Animal behavior codes included: sink, thrash, fluke, dive, look, log, spyhop, swim, breach, lobtail, flipper slap, blow, bow ride, porpoise, raft, wake ride, unknown, walk, and other. Activities, or a collection of behaviors that indicate an overall behavioral state, were also included as an initial behavior if PSOs clearly observed animals exhibiting these combinations of behaviors. Activity codes included: travel, surface active, surface active-travel, mill, feed, mate, and rest. The initial behaviors recorded for each sighting were summarized and compared across the vessel activity scenario bins.

Reaction Behavior

Animal reactions in response to the vessel presence were recorded during each sighting. Reaction behavior codes included: change in direction, increase or decrease in speed, look, splash, rush, bow or wake ride, interaction with gear, and no reaction. If animals displayed multiple reactions during a sighting, PSOs were instructed to record the most substantial reaction (e.g., if an animal looked at a vessel and then changed its direction of travel, PSOs recorded “change direction” rather than “look”). The reaction behaviors of animals that fell into these categories were compared across vessel activity scenario bins.

Estimating Numbers of Marine Mammals Potentially Affected

Both NMFS and USFWS assume that “take by harassment” (Level B harassment) may occur if marine mammals are exposed to intermittent impulsive sounds like seismic pulses at RSLs exceeding 160

dB re 1 μPa (rms SPL) (NMFS 2005, 2006; USFWS 2013). For non-impulse sounds, like those created by drilling and ice-management activities, Level B harassment is assumed to occur at received levels ≥120 dB re 1 μPa (rms SPL). When calculating the number of mammals potentially affected as described below, we used the daily average sound footprints shown in Table 4.2 derived from the first modeling approach (Method 1) described in Chapter 3.

Two methods were used to estimate the number of marine mammals exposed to sound levels that may have caused disturbance. The methods were:

A) estimates based on direct observations during drilling and specified support activities; and

B) estimates based on pinniped and cetacean densities utilized in Shell's 2015 IHA application (Shell 2015) multiplied by the area ensonified to ≥120 dB re 1 μPa (rms SPL) during drilling and related support activities specified in the IHA.

Density-based exposure estimates were calculated by multiplying the following values:

- average daily footprints of the areas ensonified by drilling and related support activities within each season (July–August and September–October).
- expected densities of marine mammals from the best available data as described and used in similar calculations in the IHA Application (Shell 2015).

This density-based exposure method is a modified version of the approach originally developed to estimate numbers of seals potentially affected by seismic surveys in the Alaskan Beaufort Sea conducted under previous IHAs (e.g., Harris et al. 2001; Funk et al. 2008; Ireland et al. 2007a,b; Patterson et al. 2007; Reiser et al. 2010; Reiser et al. 2011).

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5. CHUKCHI SEA VESSEL-BASED MARINE MAMMAL MONITORING RESULTS FOR CETACEANS AND SEALS[5]

Monitoring Effort and Marine Mammal Encounter Results

This section summarizes the visual PSO effort from project vessels inside the Chukchi Sea Activity Area (north of Point Hope, see Chapter 4) during Shell's 2015 exploratory drilling operations. The survey period began when the first project vessels, the *Nordica, Aiviq,* and *Explorer,* entered the Chukchi Sea Activity Area on 6 July 2015 and ended when the last project vessels, the *Champion, Sisuaq, Explorer, Marika,* and *Nanuq,* departed the area on 16 October 2015.

As described in Chapter 4, PSO visual effort and sightings were categorized as having occurred either within or outside of areas where RSLs were ≥120 dB re 1μPa (rms SPL) as determined by acoustic models that were based upon activity and vessel specific sound profiles and actual 2015 activity patterns. Three different methods of calculating acoustic footprints produced by 2015 exploration drilling and support vessel activities are described in Chapter 3. Each of the three methods produced a different estimate of the ≥120 dB re 1μPa (rms SPL) sound field around the drill sites on the basis of whether support vessel activities were included or excluded in the modeled footprints. The third approach (Method 3), which included the cumulative sound contributions from drilling operations, all support vessel activities within the Chukchi Sea Activity Area, and ice management activities, produced ≥120 dB re 1 μPa (rms SPL) areas most representative of actual sound exposures at, or above, this presumptive regulatory relevant exposure level. While the modeled area of ensonification ≥120 dB re 1μPa (rms SPL) from Method 3 was larger than the area predicted by Method 1, which included only those activities that were considered for regulation under the IHA, this approach provided a conservative method for analyzing marine mammal observations for indications of behavioral response.

Project vessels traveled a total of 89,608 km in the Chukchi Sea Activity Area during the 2015 exploratory drilling season (Table 5.1). The drilling unit *Polar Pioneer* was towed a total of 763 km to and from the drill site and was moored at the Burger J drill site for 72 days from 25 July to 4 October. On 30 July the *Polar Pioneer* started drilling activities and completed them on 22 September. Drilling activities occurred for 45 days, or 63% of the time on prospect, and involved the boring of a pilot hole, the construction of a mudline cellar (MLC), and drilling to total well depth (see Chapter 2). The drilling unit *Noble Discoverer* traveled a total of 1,185 km within the Activity Area. The *Noble Discoverer* was moored at the Burger V drill site for 37 days from 5 August to 27 August and 19 September to 2 October. In late August, the drilling unit briefly unmoored from Burger V due to several storms and continued high sea states. The *Noble Discoverer* spent a total of 75 days in the Chukchi Sea Activity Area but did not engage in exploratory drilling in the 2015 season.

By H.J. Reider, L.A Ackein, and K.B. Matthews (LGL)

TABLE 5.1. Total distance (km) project vessels traveled in the Chukchi Sea Activity Area during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Vessel	Distance Traveled in the Chukchi Sea Activity Area (km)
Polar Pioneer	763
Noble Discoverer	1185
Nordica	3901
Fennica	6448
Aiviq	6006
Tor Viking	4295
Ross	7968
Other Support Vessels	59,042
Total	***89,608***

Observer Effort

PSOs aboard project vessels in the Chukchi Sea Activity Area were on watch for a total of 72,396 km (9,380 h) while vessels were moving and 16,034 h while they were stationary (Table 5.2). There was 38,197 km (6387 h) of moving observer effort in areas where RSLs were ≥120 dB re 1 μPa (rms SPL) and 34,199 km (3002 h) of moving observer effort in areas where RSLs were <120 dB re 1 μPa (rms SPL). There was 14,389 h of stationary observer effort in areas where RSLs were ≥120 dB re 1 μPa (rms SPL) and 1645 h of stationary observer effort in areas where RSLs were <120 dB re 1 μPa (rms SPL; Table 5.2). PSOs were on watch during darkness for 8841 km (1228 h) while vessels were moving and 2458 h while they were stationary (Figure 5.1 and 5.2). During exploratory drilling activities, at least one observer aboard the *Polar Pioneer* was on watch during 100% (1244 h) of daylight and 100% (461 h) of darkness.

TABLE 5.2. Total observer effort from moving and stationary vessels outside and inside the exposure area during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Vessel Status	≥120 dB	<120 dB	*Total*
km			
Moving	38,197	34,199	***72,396***
h			
Moving	6378	3002	***9380***
Stationary	14,389	1645	***16,034***

Observer Effort by Beaufort Wind Force

Observer effort from the project vessels occurred between Beaufort wind force (Bf) 0 and Bf ≥7 (Figure 5.3 and 5.4). The greatest amount of observer effort while moving occurred during Bf 3, which accounted for 27% (19,330 km; 2375 h) of PSO effort aboard the project vessels (Figure 5.3). The greatest amount of observer effort while stationary, 29% (4708 h), also occurred during Bf 3 (Figure 5.4). Overall, 64% (46,320 km; 5705 h) of effort while moving and 69% (11,101 h) of effort while stationary occurred in Bf 2, 3, or 4.

Observer Effort by Number of PSOs

On project vessels that were moving, one PSO was on watch during 62% (45,427 km; 6362 h) of the observation effort and two PSOs were on watch during 37% (26,616 km; 2975 h) of the observation effort (Figure 5.5). While stationary, one PSO was on watch for 50% (7937 h) of observation effort and two PSOs were on watch for 50% (8004 h) of observation effort (Figure 5.6). PSOs were scheduled to maximize effort during daytime hours when visibility conditions increased the likelihood of successful monitoring and mitigation efforts. Two PSOs were required to be on watch from nautical twilight dawn to nautical twilight dusk when vessels were engaged in drilling, anchor handling, and ice management activities. On vessels which performed these activities, *Polar Pioneer, Discoverer, Nordica, Fennica, Ross, Aiviq, Tor Viking*, two PSOs (8656 h) were on watch more frequently than one PSO (1900 h).

Observer Effort by Activity Scenario

Most observer effort from project vessels occurred while one of the activity scenarios (described in Chapter 4) was occurring (Figure 5.7 and 5.8). Approximately 60% (43,664 km; 5707 h) of observer effort from moving vessels occurred during anchor handling, drilling, and MLC activities that comprised the activity scenarios and the remaining 40% (28,732 km; 3673 h) was during routine vessel operations. Within the specific activity scenarios, 24% (17,358 km; 2213 h) of observer effort from moving vessels occurred during anchor handling and activities concurrent with anchor handling; 39% (28,728 km; 3927 h) of observer effort from moving vessels occurred during drilling and activities concurrent with drilling, and 10% (7224 km; 1007 h) of observer effort from moving vessels occurred during MLC operations and activities concurrent with MLC operations (Figure 5.7). Approximately 52% (38,197 km; 6378 h) of observer effort from moving vessels was in areas where RSLs were ≥120 dB re 1 μPa (rms SPL) and 47% (34,199 km; 3002 h) occurred in areas where RSLs were <120 dB re 1 μPa (rms SPL).

Most observer effort from stationary vessels (72%; 11,538 h) was during anchor handling, drilling, and MLC activities that comprised the activity scenarios and the remaining 28% (4497 h) of observer effort from stationary vessels was during routine vessel operations. Within the specific activity scenarios, 32% (5226 h) of observer effort from stationary vessels occurred during anchor handling and activities concurrent with anchor handling; 49% (7888 h) of observer effort from stationary vessels occurred during drilling and activities concurrent with drilling; and 13% (2158 h) of observer effort from stationary vessels occurred during MLC operations and activities concurrent with MLC operations (Figure 5.8). Using the Method 3 modeled acoustic footprints, approximately 90% (14,398 h) of observer effort from stationary vessels was in areas where RSLs were ≥120 dB re 1 μPa (rms SPL) and 10% (1643 h) occurred in areas where RSLs were <120 dB re 1 μPa (rms SPL).

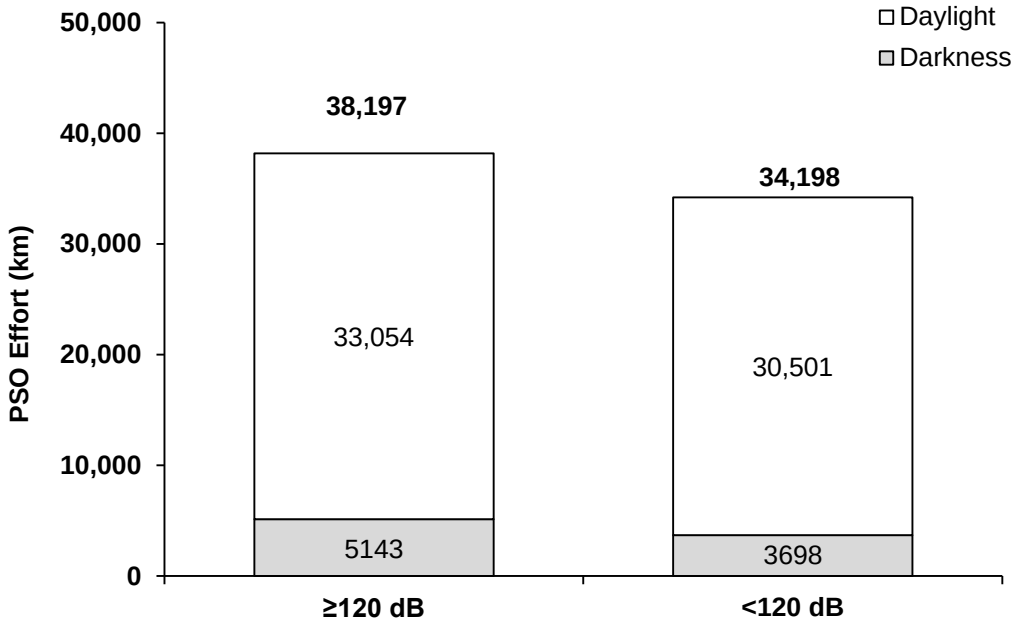

FIGURE 5.1. Total PSO observation effort (km) from moving vessels during daylight and darkness periods in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

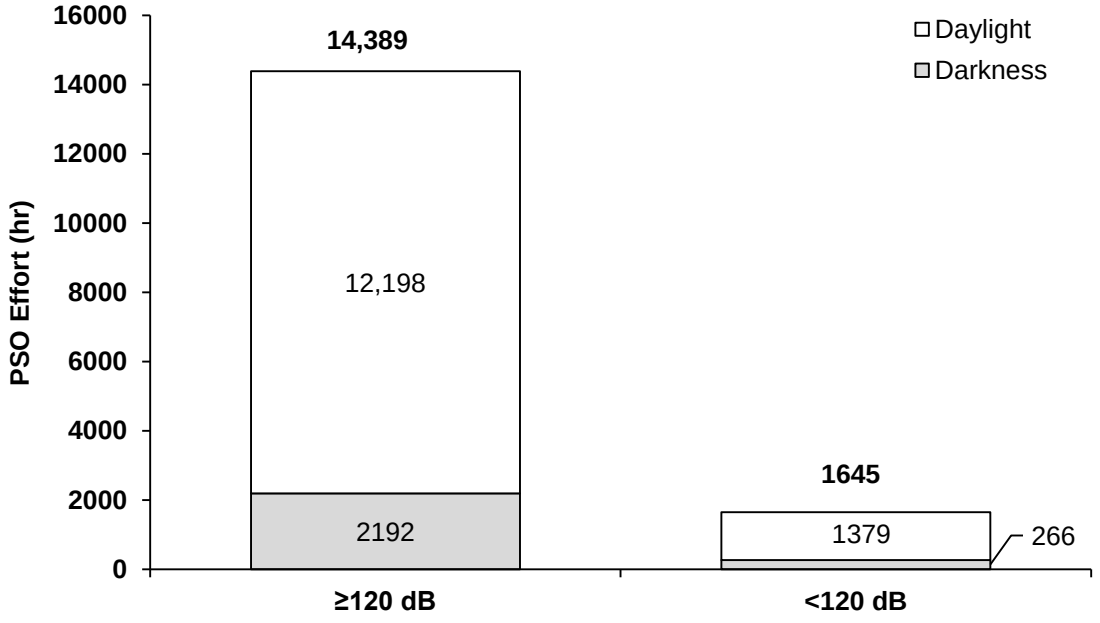

FIGURE 5.2. Total PSO observation effort (h) from stationary vessels during daylight and darkness periods in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

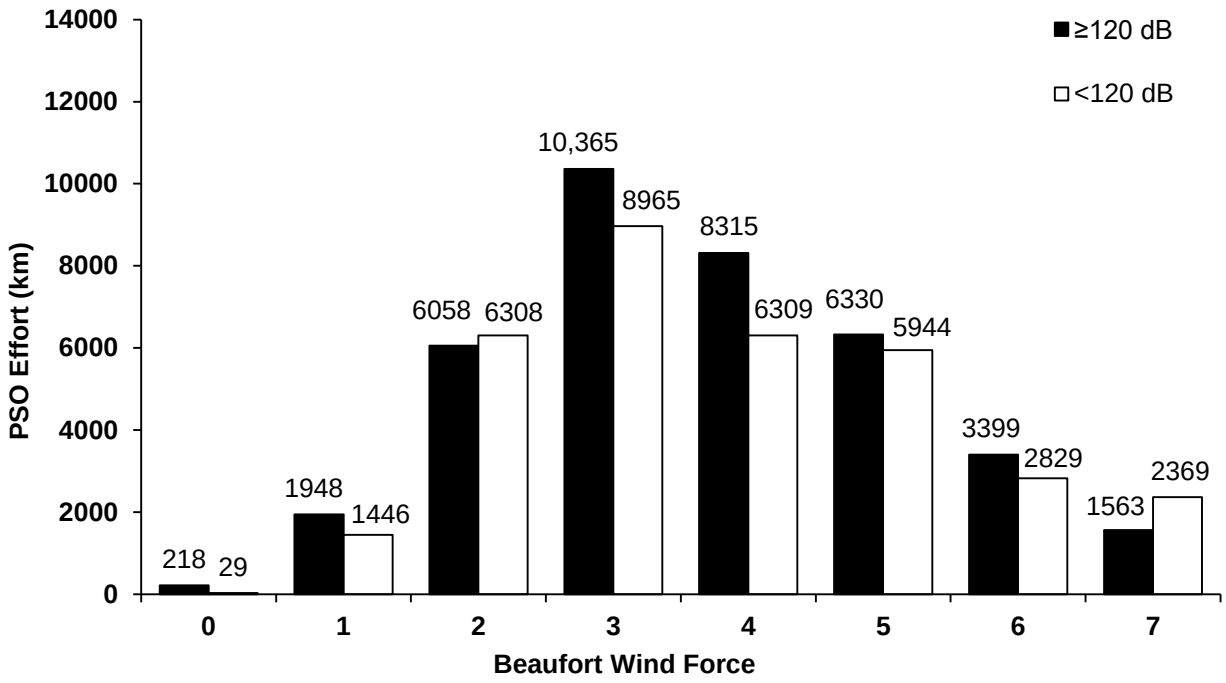

FIGURE 5.3.Total PSO observation effort (km) by Beaufort Wind Force from moving vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

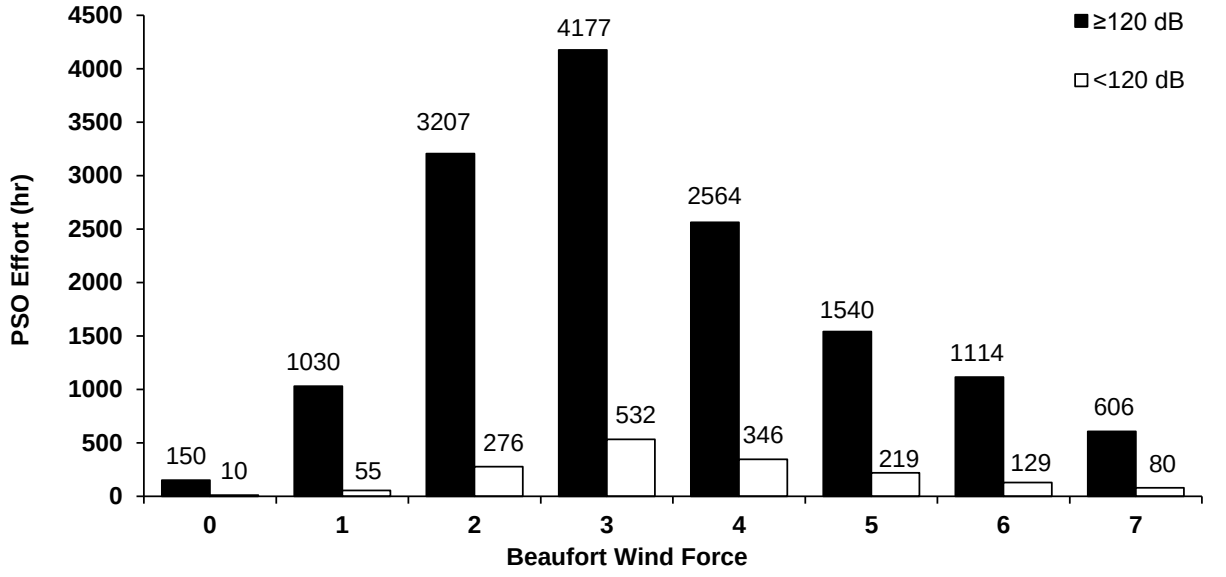

FIGURE 5.4.Total PSO observation effort (h) by Beaufort Wind Force from stationary vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

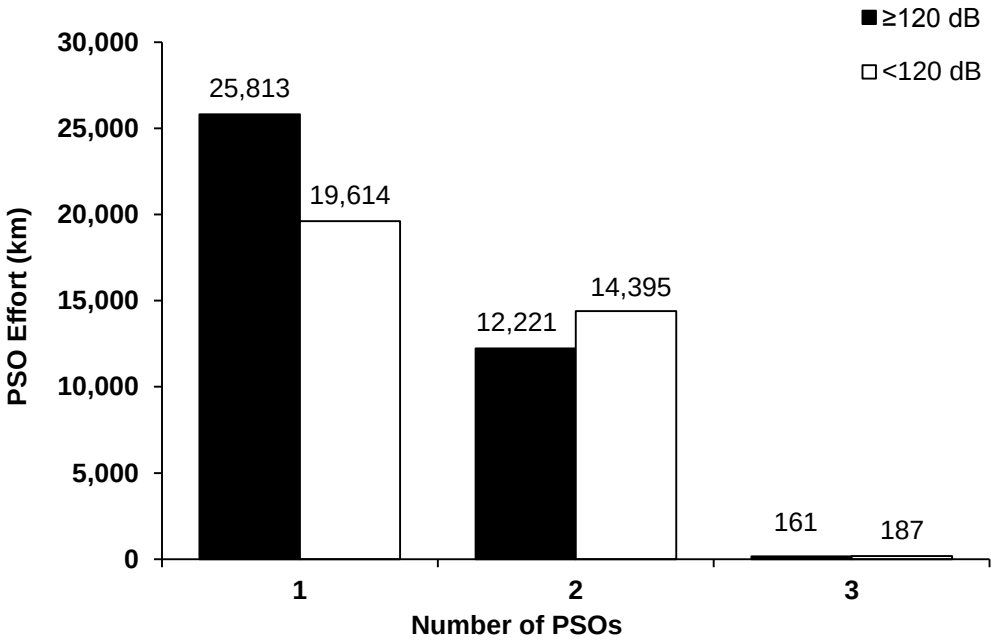

FIGURE 5.5. Total PSO observation effort (km) from moving vessels by number of PSOs in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

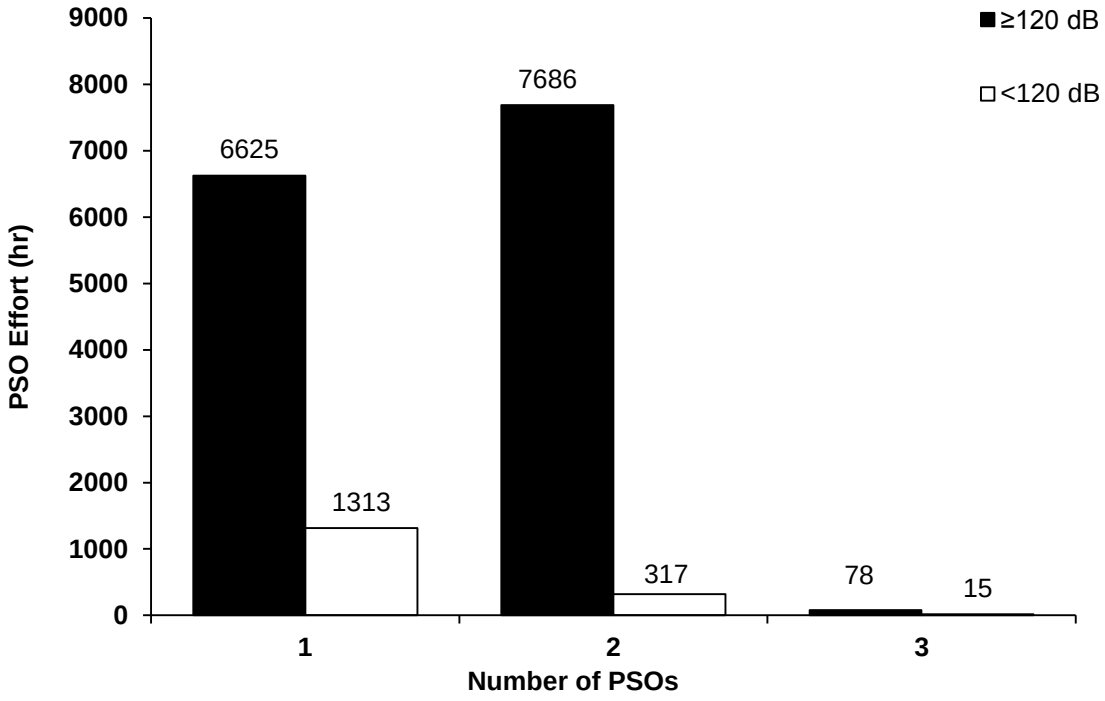

FIGURE 5.6. Total PSO observation effort (h) from stationary vessels by number of PSOs in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

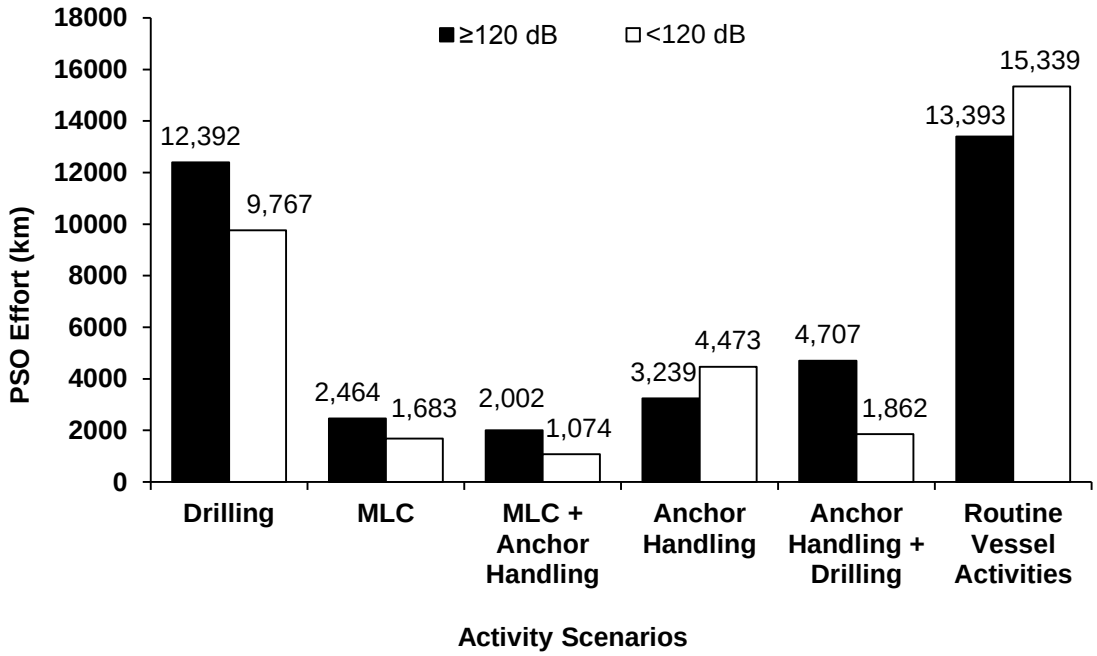

FIGURE 5.7. Total PSO observation effort (km) by activity scenarios from moving vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

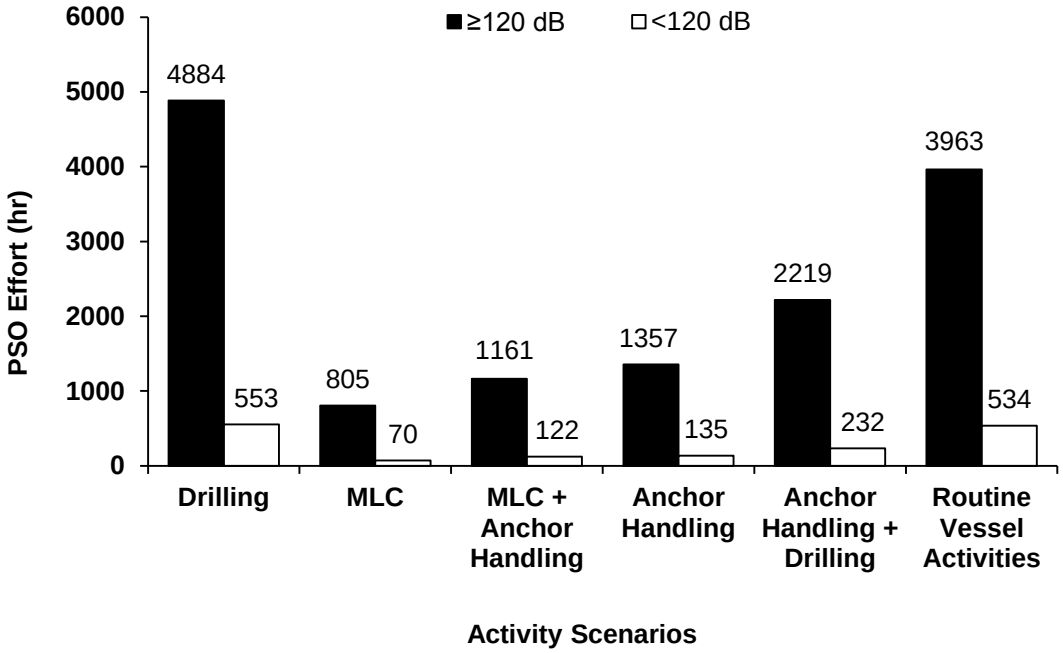

FIGURE 5.8. Total PSO observation effort (h) by activity scenarios from stationary vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

Marine Mammal Sightings

During Shell's exploration drilling program, PSOs observed a total of 2513 sightings of 3645 marine mammals from project vessels in the Chukchi Sea Activity Area. Details of each marine mammal sighting are available in Appendix F. Sighting rates for cetaceans and ice seals from moving vessels are summarized below as sightings per 1000 km and from stationary vessels as sightings per 10 h.

Cetacean Sightings

PSOs observed 193 sightings of 314 cetaceans in the Chukchi Sea Activity Area (Table 5.3). More cetacean sightings (65%) occurred in areas where RSLs were ≥120 dB re 1 μPa (rms SPL) than in areas where RSLs were <120 dB re 1 μPa (rms SPL; 35%). Cetaceans were observed most frequently during transit periods and near Wainwright (63%; Figure 5.9). The most commonly identified species was gray whale; however, approximately 45% of cetacean sightings could not be identified to species (Table 5.3). Diagnostic features for identifying cetaceans to species are often not easily observed from vessels. PSOs were instructed to identify animals based on clearly observed characteristics and, if none were apparent, to record the sighting to the highest taxonomic level possible. Comments for unidentified cetaceans in many cases indicate probable species designations, such as characteristics consistent with gray whales such as a heart-shaped blow.

TABLE 5.3. Total number of cetacean sightings (total number of individuals) from all the project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

Cetacean Species	≥120 dB	<120 dB	*Total*
Beluga Whale	1 (3)	–	***1 (3)***
Bowhead Whale	8 (14)	–	***8 (14)***
Dall's Porpoise	–	1 (1)	***1 (1)***
Fin Whale	–	2 (3)	***2 (3)***
Gray Whale	47 (69)	21 (52)	***68 (121)***
Harbor Porpoise	2 (4)	8 (12)	***10 (16)***
Humpback Whale	–	6 (10)	***6 (10)***
Killer Whale	5 (28)	–	***5 (28)***
Minke Whale	2 (2)	3 (3)	***5 (5)***
Unidentified Mysticete Whale	42 (52)	22 (33)	***64 (85)***
Unidentified Odontocete Whale	1 (1)	–	***1 (1)***
Unidentified Whale	17 (21)	5 (6)	***22 (27)***
Total Cetaceans	**125 (194)**	**68 (120)**	**193 (314)**

TABLE 5.4. The number of cetacean sightings (number of individuals) from moving and stationary project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

Cetacean Species	**≥120 dB**	**<120 dB**	***Total***
Moving Vessels			
Beluga Whale	–	–	–
Bowhead Whale	3 (7)	–	***3 (7)***
Dall's Porpoise	–	1 (1)	***1 (1)***
Fin Whale	–	2 (3)	***2 (3)***
Gray Whale	19 (29)	17 (46)	***36 (75)***
Harbor Porpoise	1 (3)	6 (10)	***7 (13)***
Humpback Whale	–	5 (9)	***5 (9)***
Killer Whale	3 (14)	–	***3 (14)***
Minke Whale	–	2 (2)	***2 (2)***
Unidentified Mysticete Whale	8 (9)	18 (26)	***26 (35)***
Unidentified Odontocete Whale	1 (1)	–	***1 (1)***
Unidentified Whale	6 (9)	3 (4)	***9 (13)***
Total Moving	***41 (72)***	***54 (101)***	***95 (173)***
Stationary Vessels			
Beluga Whale	1 (3)	–	***1 (3)***
Bowhead Whale	5 (7)	–	***5 (7)***
Dall's Porpoise	–	–	–
Fin Whale	–	–	–
Gray Whale	28 (40)	4 (6)	***32 (46)***
Harbor Porpoise	1 (1)	2 (2)	***3 (3)***
Humpback Whale	–	1 (1)	***1 (1)***
Killer Whale	2 (14)	–	***2 (14)***
Minke Whale	2 (2)	1 (1)	***3 (3)***
Unidentified Mysticete Whale	34 (43)	4 (7)	***38 (50)***
Unidentified Odontocete Whale	–	–	–
Unidentified Whale	11 (12)	2 (2)	***13 (14)***
Total Stationary	***84 (122)***	***14 (19)***	***98 (141)***

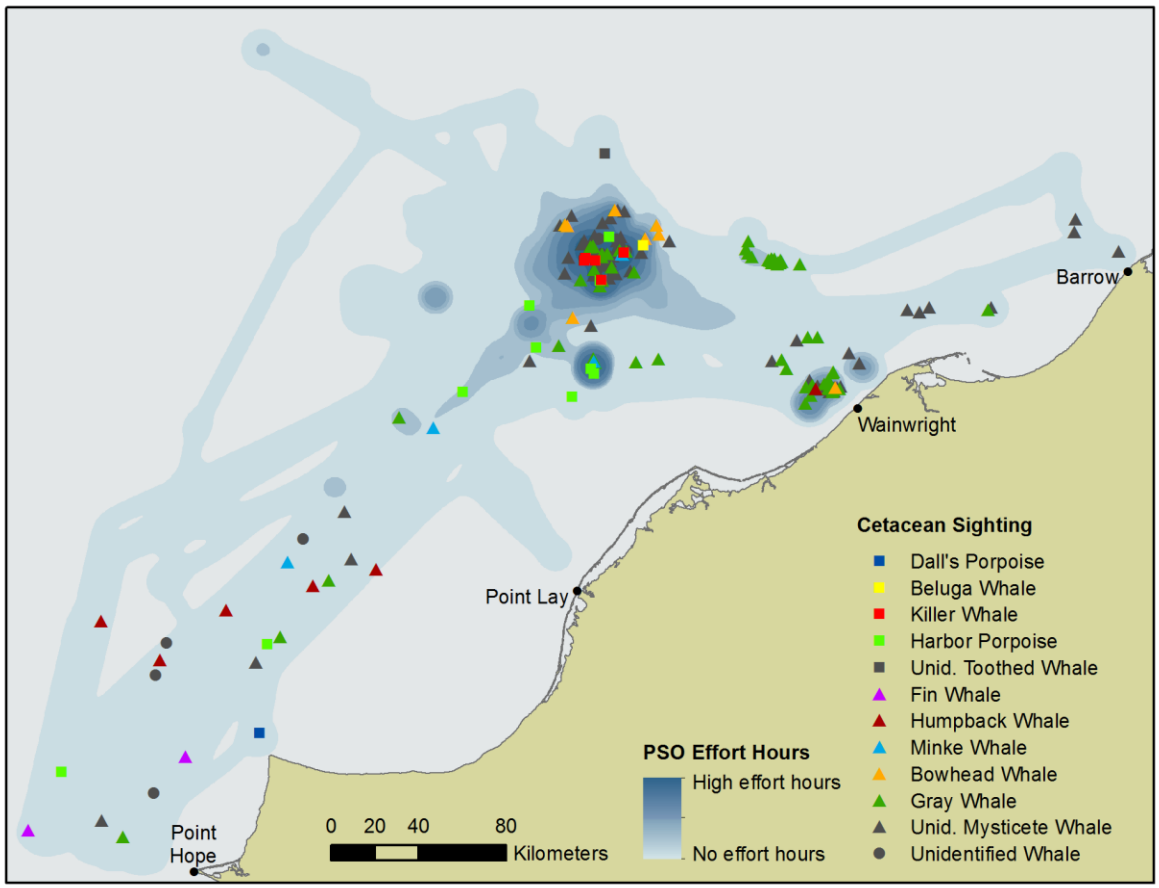

FIGURE 5.9. Location of cetacean sightings by species and effort hours from project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

Cetacean Sighting Rates

Cetacean sighting rates were calculated using only the periods of effort that met the criteria for being able to reliably detect cetaceans (See Chapter 4 and Appendix F) and the sightings that occurred during those periods. Tables summarizing the data that met those criteria are presented in Appendix F.

Cetacean Sighting Rates by Beaufort Wind Force

Cetacean sighting rates tend to decrease with increased Bf wind force (LGL, JASCO, and Greeneridge 2014). During 2015 operations, cetacean sighting rates from both moving and stationary vessels did not strongly reflect the same trend. This result was driven by a high number of gray whale and unidentified mysticete whale sightings (45% of the total) recorded during a crew change from 9 July to 12 July near the coast off Wainwright during periods of high Bf wind force (Bf 4-5; Figure 5.9). This is a location where gray whales are commonly observed in the Chukchi Sea (LGL, JASCO, and Greeneridge 2014). Cetacean sighting rates by PSOs aboard moving vessels were highest during periods when sea states were recorded as Bf 1, 2 and 3. For stationary vessels, cetacean sighting rates were highest during periods when sea states were recorded as Bf 1 or 4 (Figure 5.10 and 5.11).

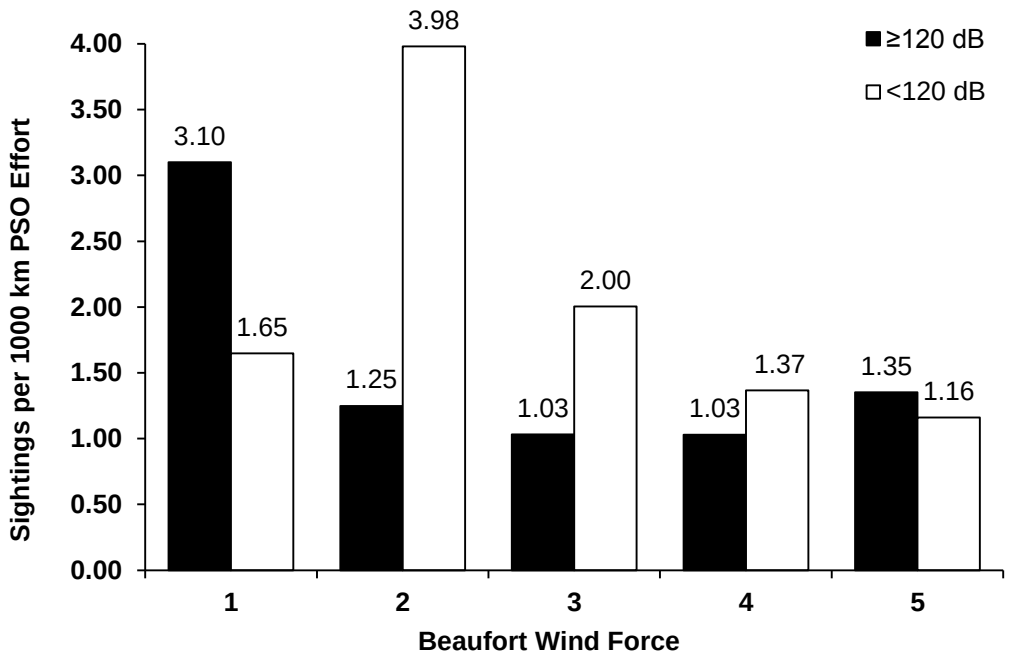

FIGURE 5.10. Cetacean sighting rates by Beaufort wind force from moving project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Note that < 250 km of observer effort occurred in Bf 0, which precluded meaningful inclusion.

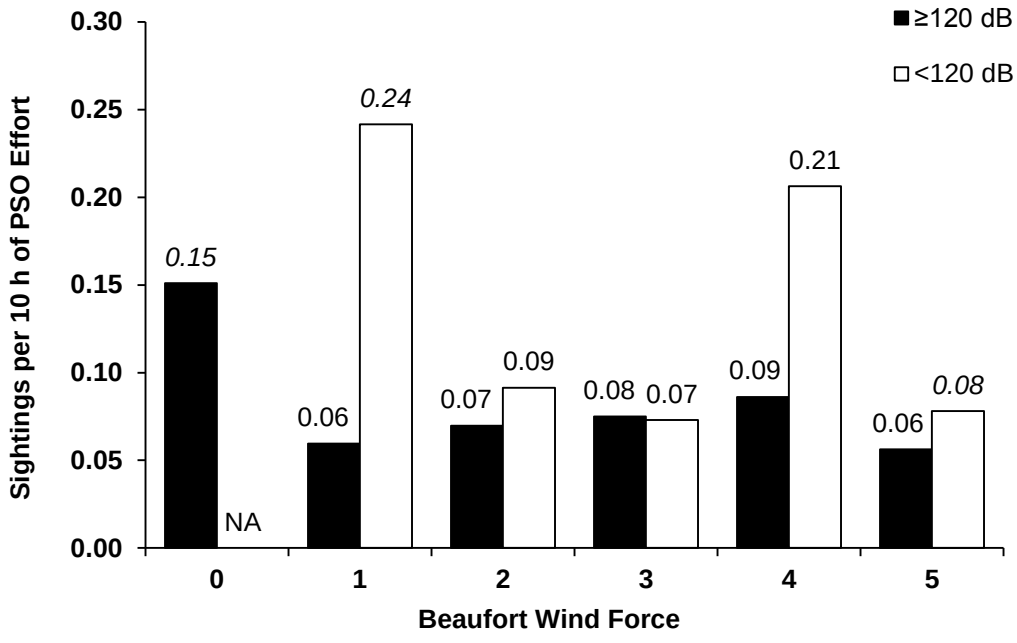

FIGURE 5.11. Cetacean sighting rates by Beaufort wind force from stationary project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Italicized numbers indicate that the sighting rate may not be reliable due to a limited amount of observation effort having occurred within the category.

Cetacean Sighting Rates by Number of PSOs

Regulatory requirements mandated that vessels such as ice breakers, anchor handlers and drilling units utilize two PSOs to monitor during daytime periods when specific activities were occurring. Transiting support vessels typically utilized one PSO to maximize effort across daylight periods. From moving vessels, the overall cetacean sighting rate with two PSOs on watch (2.6 cetaceans/1000 km) was nearly three times greater than with one PSO on watch (0.9 cetaceans/1000 km; $X^2 = 2.7$, $df = 1$, $p < 0.001$). From stationary vessels, the overall cetacean sighting rate during periods with two PSOs on watch, (0.11 cetaceans/10 h) was also higher than with one PSO on watch (0.4 cetaceans/10 h; $X^2 = 18.6$, $df = 1$, $p < 0.001$; Figure 5.12 and 5.13).

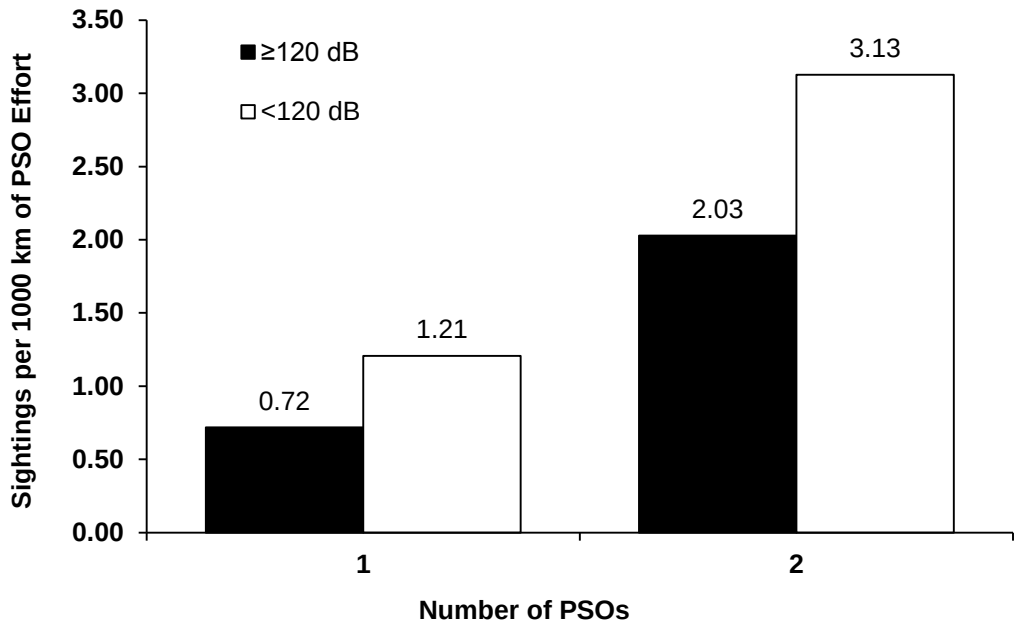

FIGURE 5.12. Cetacean sighting rates by number of PSOs from moving project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Note that < 250 km of observer effort occurred with three PSOs on watch, which precluded meaningful inclusion.

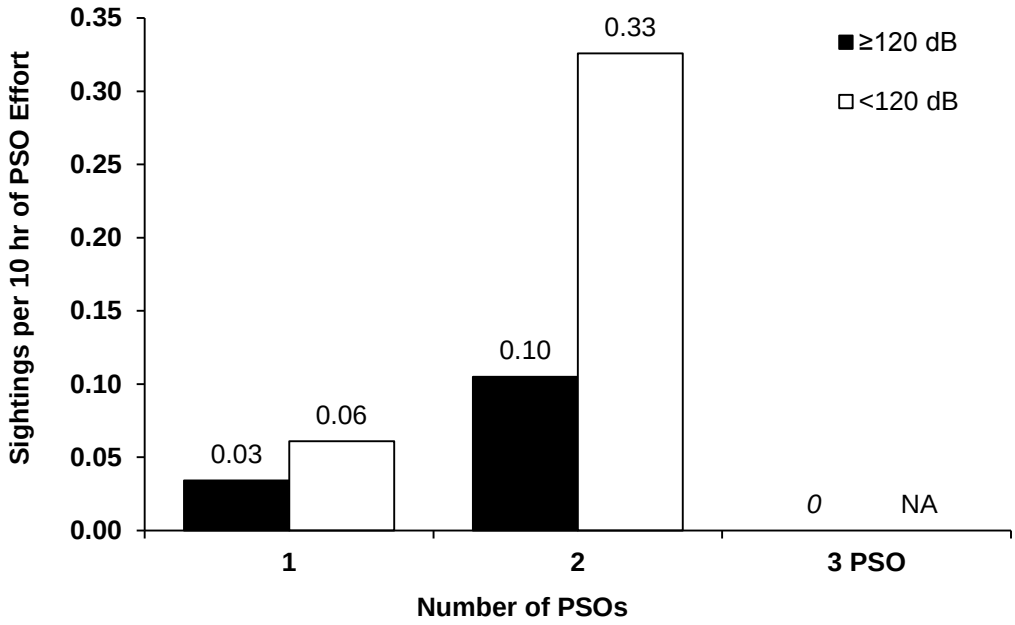

FIGURE 5.13. Cetacean sighting rates by number of PSOs from stationary project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. NA indicates that there was insufficient effort in the category to calculate a sighting rate. Italicized numbers indicate that the sighting rate may not be reliable due to a limited amount of observation effort having occurred within the category.

Cetacean Sighting Rates during Vessel Activity

Sighting rates of cetaceans were generally higher in areas where RSLs were <120 dB re 1 μPa (rms SPL) during activity scenarios (Figure 5.14 and 5.15). That trend is more clear in the data from moving vessels (Figure 5.14) than it is in data from stationary vessels (Figure 5.15). Although the trend of higher sighting rates from moving vessels in areas where RSLs were <120 dB re 1 μPa (rms SPL) during activity scenarios suggests some possible avoidance by cetaceans, other factors such as the specific location and timing of vessel activities relative to known areas of cetacean concentrations also contribute to the observed differences. In previous years, cetaceans have been observed more frequently near shore than at the Burger Prospect, with the possible exception of bowhead whales which migrate across the Chukchi Sea in late fall (LGL, JASCO, and Greeneridge 2014). Consistent with this, most cetacean sightings (62%) were observed during transit periods and near Wainwright where less PSO effort occurred (Figure 5.9) than on the Burger Prospect. Approximately 54% of all cetacean sightings were observed by PSOs on the *Aiviq, Fennica, Nordica,* and *Ross,* which were vessels that frequently transited or crew changed off the coast of Wainwright.

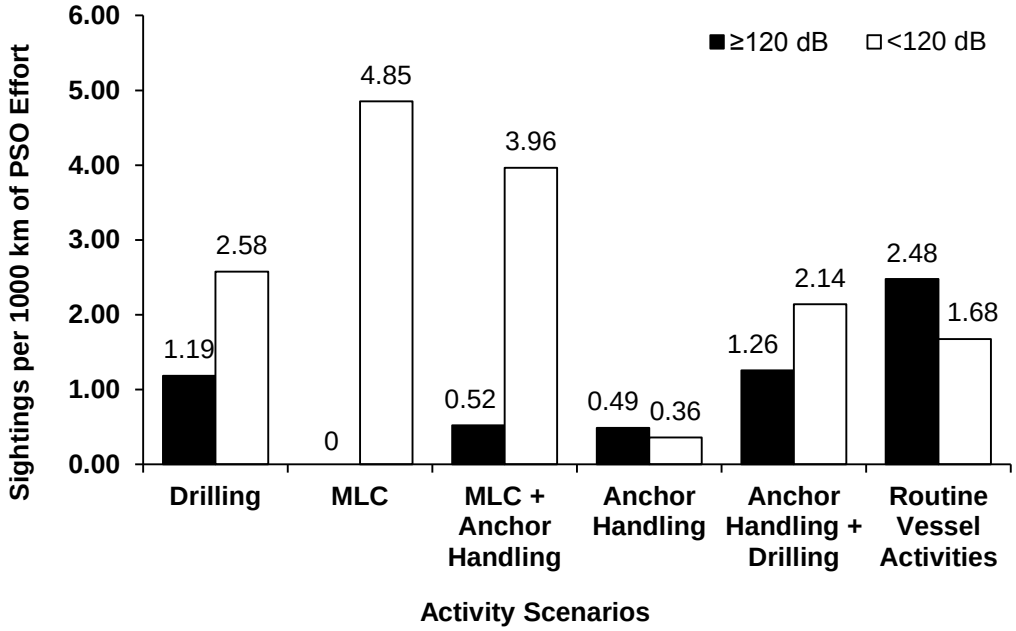

FIGURE 5.14. Cetacean sighting rates by activity scenarios from moving project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Routine vessel operations are periods with no drilling, MLC construction, or anchor handling scenarios occurring.

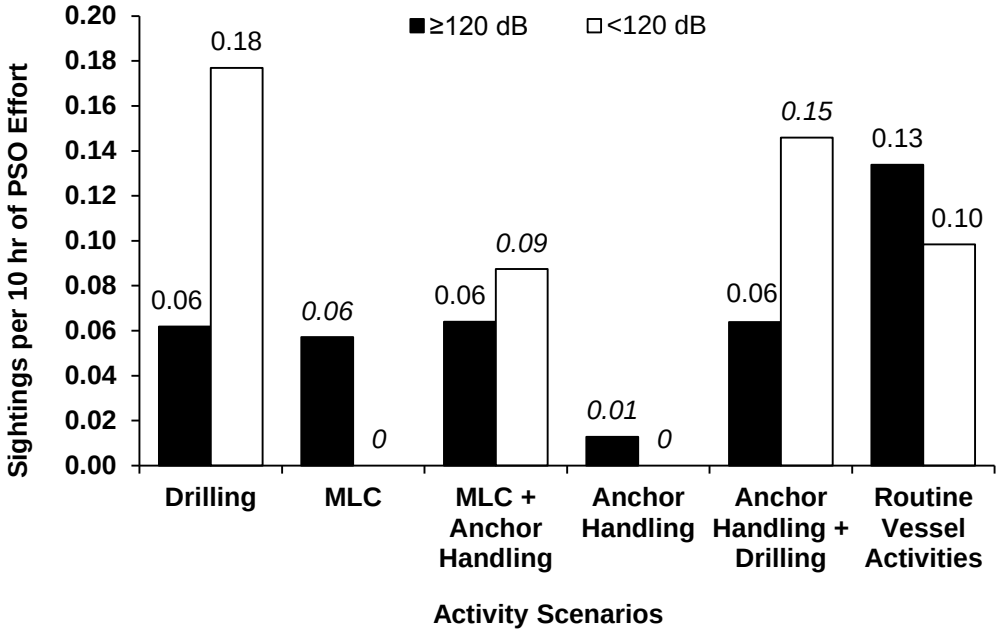

FIGURE 5.15. Cetacean sighting rates by activity scenarios from stationary project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Routine vessel operations are periods with no drilling, MLC construction, or anchor handling scenarios occurring. Italicized numbers indicate that the sighting rate may not be reliable due to a limited amount of observation effort having occurred within the category.

Cetacean Distribution and Behavior

Marine mammal behaviors and reactions were often difficult to observe because individuals and/or groups of animals typically spent relatively little time at the water surface and project vessels could not be stopped to allow for extended periods of observation. Additionally, the primary duty of PSOs was to implement mitigation measures for all marine mammals potentially in the area rather than collect extensive behavioral data on a single sighting. Nonetheless, relevant data collected by PSOs include estimated closest observed point of approach (CPA), direction of movement relative to the vessel, initial behavior of the animal, reaction of the animal to the vessel presence or activity, and duration of the sighting. In the following sections we summarize these data from all project vessels within the Chukchi Sea Activity Area while distinguishing between stationary and moving vessels as well as the times and locations when the specified activity scenarios were occurring.

Cetacean Closest Point of Approach

To avoid biasing results, the average closest point of approach (CPA) of cetaceans was calculated using only sightings that occurred during periods of effort that met the criteria for being able to reliably detect cetaceans (see Chapter 4 and Appendix F). Of the 193 total sightings, 159 met those criteria. One hypothesis would be that if cetaceans showed greater avoidance of all project vessels present in areas where received sound levels were elevated, observed average CPA distances would be larger in areas where RSLs were ≥120 dB re 1 μPa (rms SPL) than in areas where RSLs were <120 dB re 1 μPa (rms SPL), regardless of whether they were observed from a support vessel in the area or from the sound-producing source itself.

Cetacean CPA distances to moving vessels ranged from 10 to 5015 m from the observer station. The overall mean CPA distances of cetaceans sighted from moving vessels did not differ significantly between areas where RSLs were ≥120 dB re 1 μPa (rms SPL; 1151 m) compared with areas where RSLs were <120 dB re 1 μPa (rms SPL; 1121 m) (Wilcoxon rank sum test; $W = 752$, $p = 0.8142$). CPA distances from moving vessels during the concurrent anchor handling and drilling activity scenario in areas where RSLs were <120 dB re 1 μPa (rms SPL) averaged 40 m (Figure 5.16), but included only three sightings of harbor porpoise.

From stationary vessels, cetacean CPA distances ranged from 10 to 7000 m and the mean CPA distance was larger than from moving vessels (1793 m and 1132 m, respectively). Limited sample size in the <120 dB re 1 μPa (rms SPL) category precluded meaningful statistical comparison of overall mean CPA distances of cetaceans sighted from stationary vessels. The one cetacean sighting from a stationary vessel during the anchor handling only activity scenario was a harbor porpoise, at a CPA distance of 30 m (Figure 5.17). Similarly, there was one cetacean sighting of a minke whale with a CPA of 60 m from a vessel on anchor in an area where RSLs were <120 dB re 1 μPa (rms SPL) during the MLC with concurrent anchor handling activity scenario. The lack of a consistent difference between average CPA distances from vessel in areas where RSLs were ≥120 dB re 1 μPa (rms SPL) than in areas where RSLs were <120 dB re 1 μPa (rms SPL) does not support the hypothesis that whales avoided project vessels at greater distances where RSLs were higher.

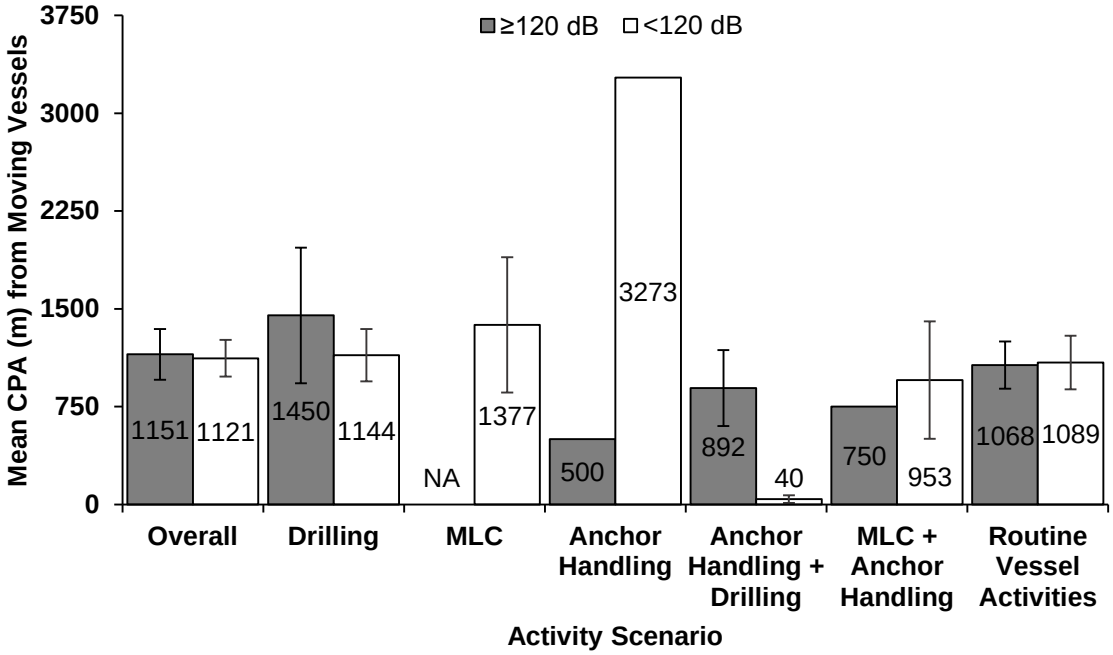

FIGURE 5.16. Comparison of mean cetacean CPA distances by vessel activity from moving project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015. The overall mean includes CPA distances for sightings exposed to all six vessel activities. Error bars represent standard error of the mean where n > 1. NA represents a sample size of zero.

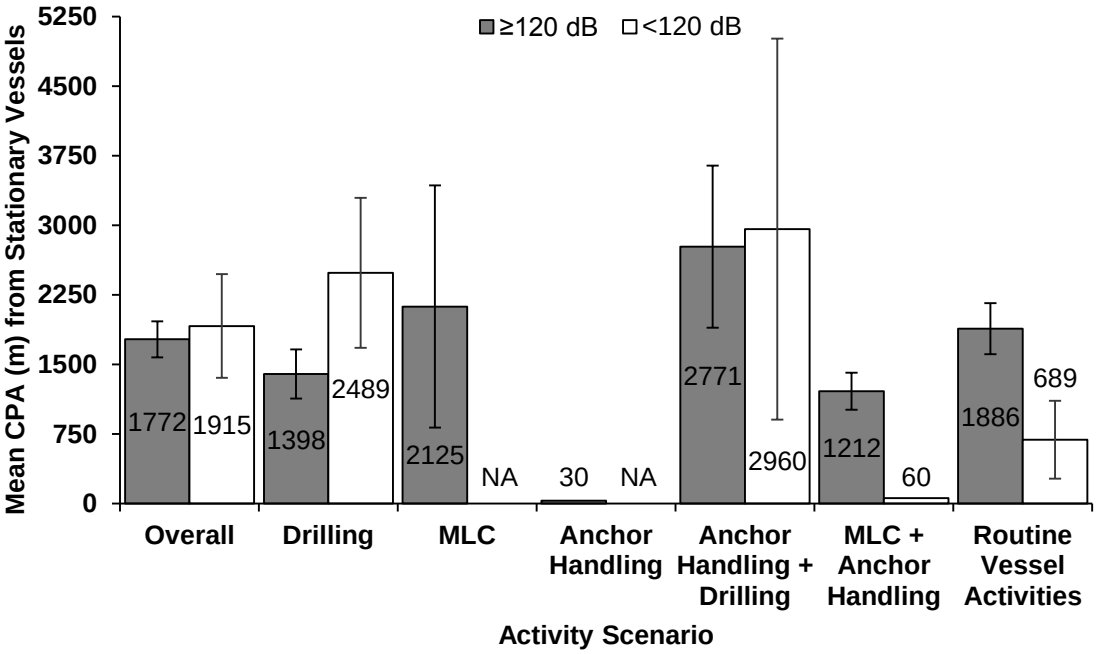

FIGURE 5.17. Comparison of mean cetacean CPA distances by vessel activity from stationary project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015. The overall mean includes CPA distances for sightings exposed to all six vessel activities. Error bars represent standard error of the mean where n > 1. NA represents a sample size of zero.

Cetacean Initial Sighting Distance

The initial sighting distance was recorded for cetacean sightings from both moving and stationary vessels (Figures 5.18 and 5.19). The initial sighting distance and the CPA distance were recorded as the same value for sightings in which a marine mammal was observed only once. A change in initial and CPA distances from a moving vessel would have involved either a change in location of the vessel or change in location of the marine mammal, or both, during the course of observation. If the observing vessel was stationary, any difference would only be caused by the approach of the cetacean to the vessel. Results of this analysis are similar to that of CPA distances as there is no consistent trend of greater (or lesser) initial sighting distances in areas where RSLs were ≥120 dB re 1 µPa (rms SPL).

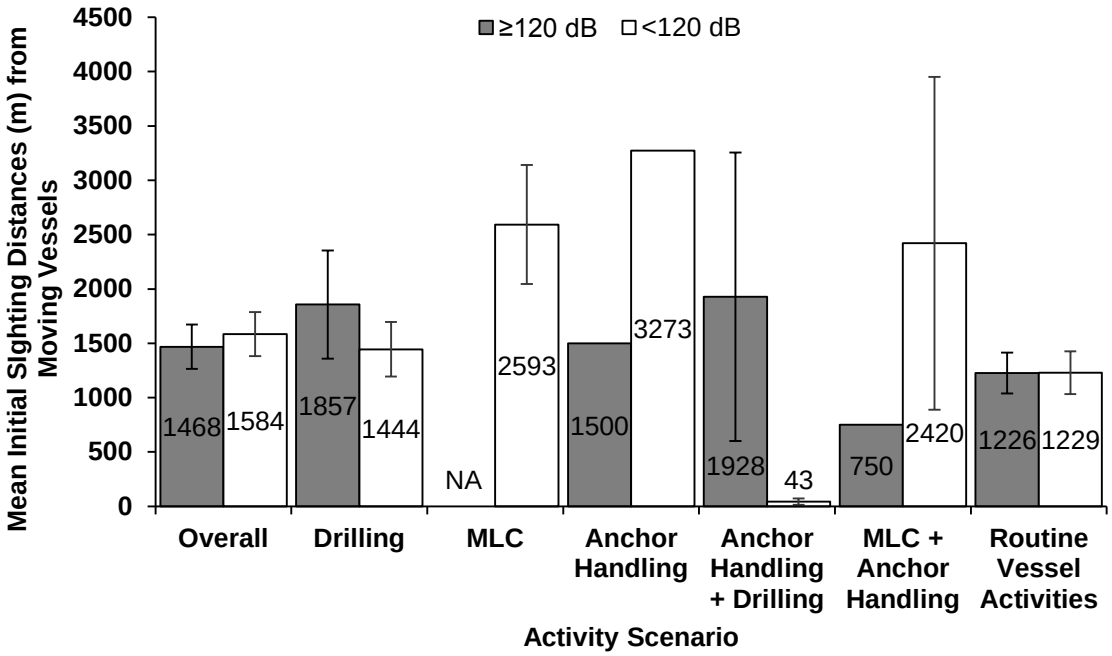

FIGURE 5.18. Comparison of mean cetacean CPA distances by vessel activity from stationary project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015. The overall mean includes CPA distances for sightings exposed to all six vessel activities. Error bars represent standard error of the mean where n > 1. NA represents a sample size of zero.

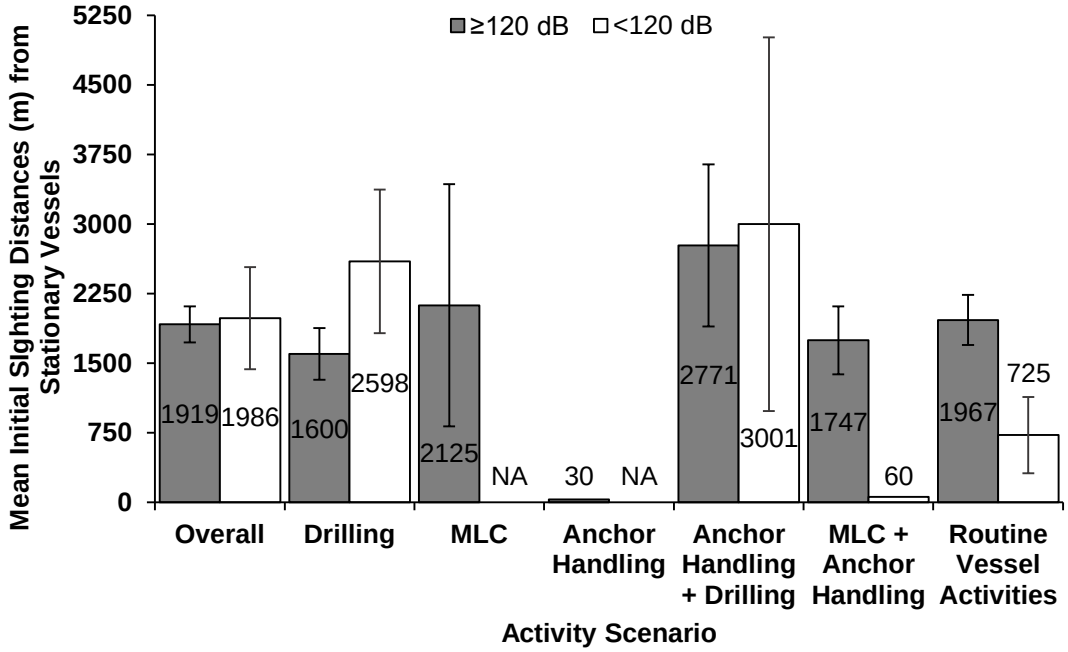

FIGURE 5.19. Comparison of mean cetacean CPA distances by vessel activity from stationary project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015. The overall mean includes CPA distances for sightings exposed to all six vessel activities. Error bars represent standard error of the mean where n > 1. NA represents a sample size of zero.

Cetacean Movement

The most common movements of cetaceans observed from both moving vessels and stationary vessels were neutral (54% and 56%, respectively) and unknown (19% and 22%, respectively; Figures 5.20 and 5.21). Neutral movement included occasions when the animal(s) was swimming neither towards nor away from the vessel (e.g., parallel to vessel).

There does not appear to be a consistent difference in the direction of cetacean movements relative to the vessel between RSL categories. If cetaceans were avoiding areas with elevated sounds produced during the activity scenarios, then one hypothesis would be that the occurrence of the swim away movement would be higher than the swim toward movement in areas where RSLs were ≥120 dB re 1 µPa (rms SPL), and another hypothesis would be that the swim away movement would be more prevalent overall in areas where RSLs were ≥120 dB re 1 µPa (rms SPL) than in areas where RSLs were <120 dB re 1 µPa (rms SPL). However, neither result is apparent in the data.

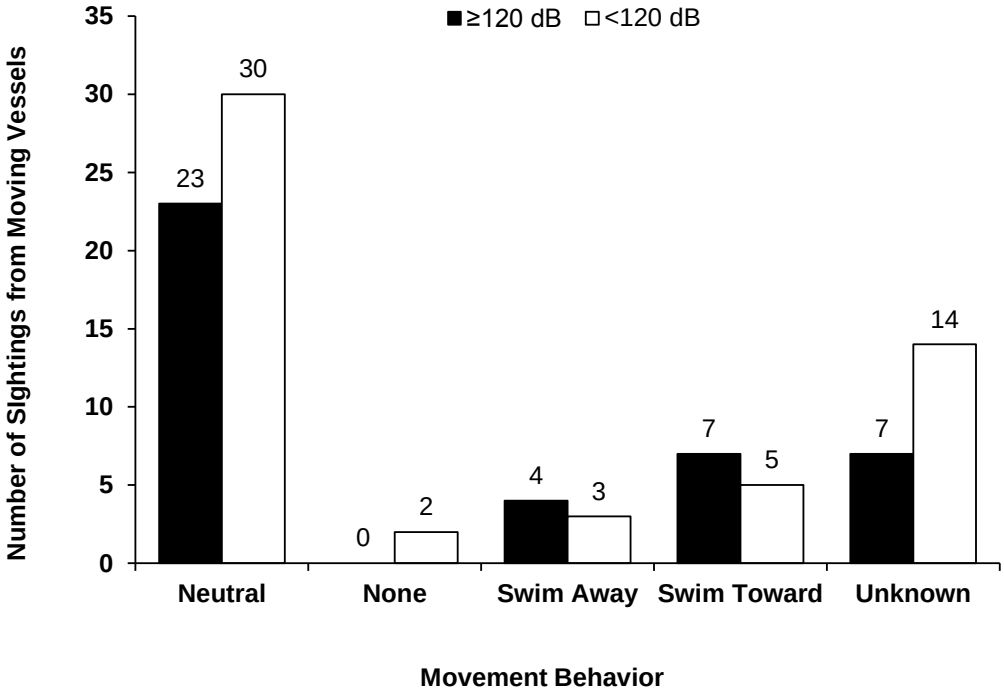

FIGURE 5.20. Number of cetacean sightings within each category of movement (relative to a vessel) from moving vessels within each Activity Scenario during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

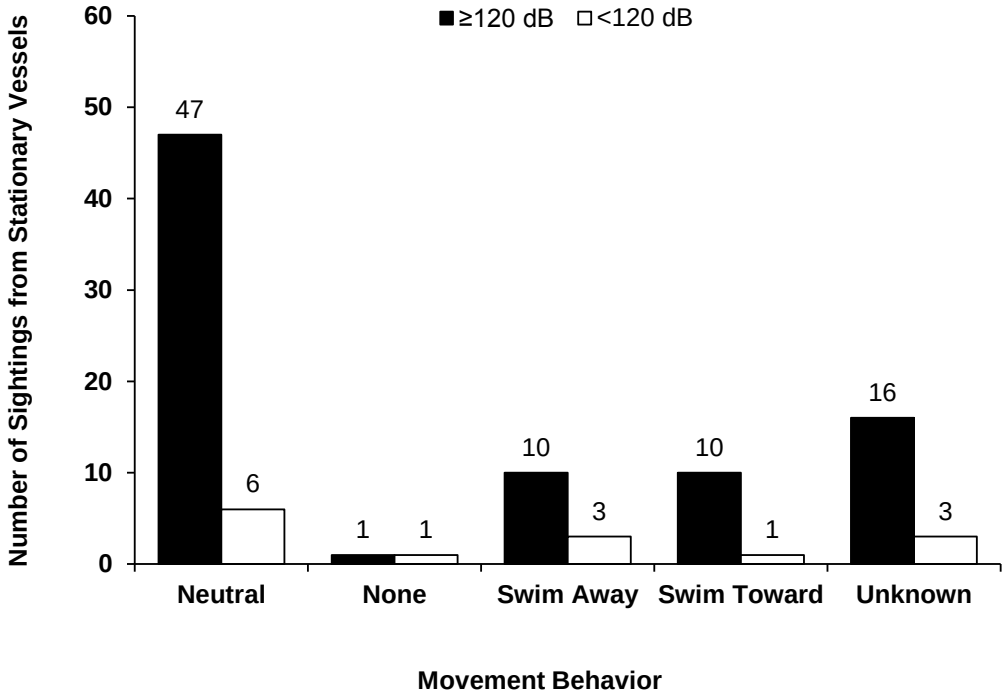

FIGURE 5.21. Number of cetacean sightings within each category of movement (relative to a vessel) from stationary vessels within each Activity Scenario during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Cetacean Initial Behavior

The five most common initial behaviors for cetaceans were the same from both moving and stationary vessels (Figures 5.22 and 5.23). The most commonly recorded behavior for cetaceans sighted from both moving and stationary vessels was blow (35% and 43%, respectively). This is expected because a blow is also a highly visible sighting cue and often the only behavior or action observed. Observers recorded 1 to 5 instances of the following behaviors in each movement category: breach, feed, log, lobtail, mill, porpoise, surface active, spyhop, surface active travel, and thrash in addition to those shown below; these behaviors are combined in the "other" category in Figures 5.20 and 5.21.

Of the 95 cetacean sightings observed from moving vessels, no consistent difference in initial behaviors was observed between sightings that occurred in areas where RSLs were <120 dB re 1 μPa (rms SPL) as compared to sightings that occurred in areas where RSLs were ≥120 dB re 1 μPa (rms SPL). Of the 98 cetacean sightings observed from stationary vessels, 14 occurred in areas where RSLs were <120 dB re 1 μPa (rms SPL). This did not provide a meaningful sample size for comparison to initial behaviors observed from stationary vessels in areas where RSLs were ≥120 dB re 1 μPa (rms SPL).

Cetacean Reaction Behavior

Cetaceans observed from moving and stationary vessels were most often recorded as having no observable reaction (94% and 98%, respectively). Observable reactions for cetaceans from moving vessels included change of direction (4%), increase in speed (1%), and splash (1%). The only observable reaction for cetaceans from stationary vessels was change of direction (2%).

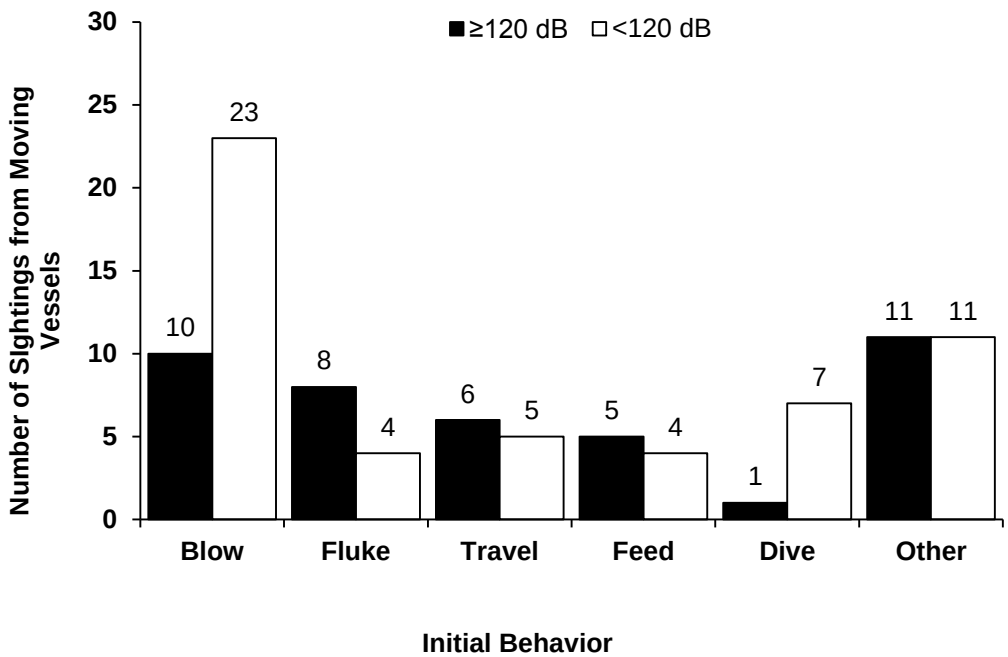

FIGURE 5.22. Comparison of cetacean initial behaviors by from moving vessels, inside and outside areas where RSLs were ≥120 dB re 1 μPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

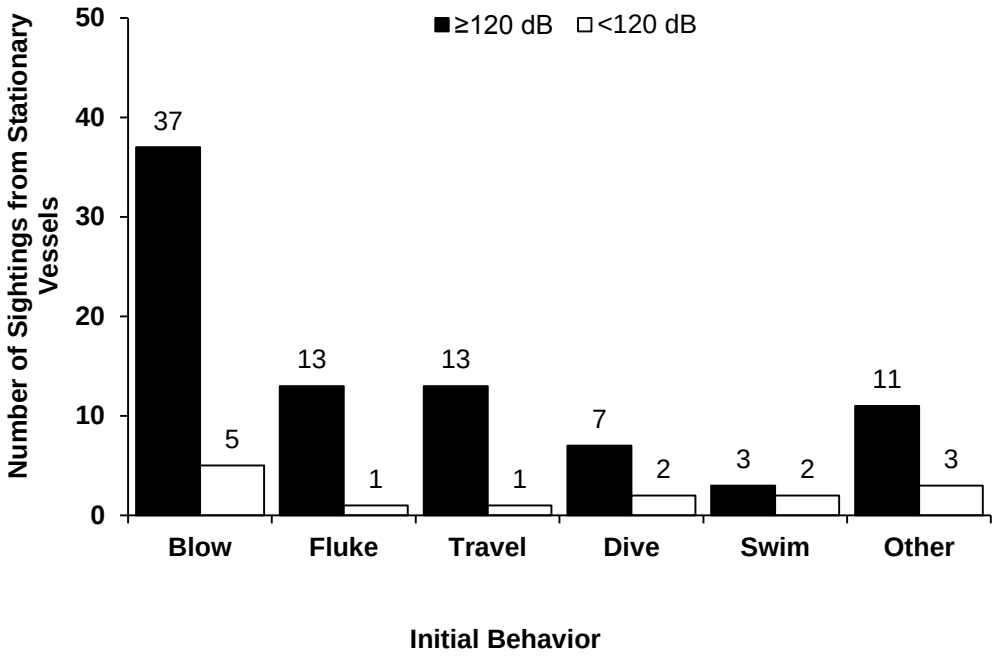

FIGURE 5.23. Comparison of cetacean initial behaviors by from stationary vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Seal Sightings

There were 1809 sightings of 1901 individual seals by PSOs on project vessels inside the Chukchi Sea Activity Area (Table 5.5). Of these sightings, 739 occurred while project vessels were moving and 1070 of the sightings occurred while vessels were stationary (Table 5.6). More seal sightings (79%) occurred in areas where RSLs were ≥120 dB re 1 µPa (rms SPL) than in areas where RSLs were <120 dB re 1 µPa (rms SPL; 21%). Seals were distributed throughout the Chukchi Sea Activity Area, with the highest number of sightings in areas with high effort hours (Figure 5.24). Bearded seal was the most frequently identified seal species, although half of all seal sightings could not be identified to species (51%; Table 5.6). Diagnostic features for identifying seals to species are often not observed from vessels since seal sightings tend to be brief in duration.

TABLE 5.5. Total number of seal sightings (number of individuals) from all the project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

Seal Species	**≥120 dB**	**<120 dB**	***Total***
Bearded Seal	456 (461)	108 (112)	***564* (573)**
Ribbon Seal	2 (2)	2 (2)	***4* (4)**
Ringed Seal	146 (167)	19 (19)	***165* (186)**
Spotted Seal	109 (114)	43 (45)	***152* (159)**
Unidentified Pinniped	133 (140)	40 (45)	***173* (185)**
Unidentified Seal	576 (616)	175 (178)	***751* (794)**
Total Seals	***1422 (1500)***	***387 (401)***	***1809 (1901)***

TABLE 5.6. Total number of seal sightings (number of individuals) from the moving and stationary project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

Seal Species	**≥120 dB**	**<120 dB**	***Total***
Moving Vessels			
Bearded Seal	175 (178)	47 (48)	***222 (226)***
Ribbon Seal	–	2 (2)	***2 (2)***
Ringed Seal	27 (34)	11 (11)	***38 (45)***
Spotted Seal	30 (32)	18 (19)	***48 (51)***
Unidentified Pinniped	61 (65)	27 (32)	***88 (97)***
Unidentified Seal	204 (218)	137 (139)	***341 (357)***
Total Moving	***497 (527)***	***242 (251)***	***739 (778)***
Stationary Vessels			
Bearded Seal	281 (283)	61 (64)	***342 (347)***
Ribbon Seal	2 (2)	–	***2 (2)***
Ringed Seal	119 (133)	8 (8)	***127 (141)***
Spotted Seal	79 (82)	25 (26)	***104 (108)***
Unidentified Pinniped	72 (75)	13 (13)	***85 (88)***
Unidentified Seal	372 (398)	38 (39)	***410 (437)***
Total Stationary	***925 (973)***	***145 (150)***	***1070 (1123)***

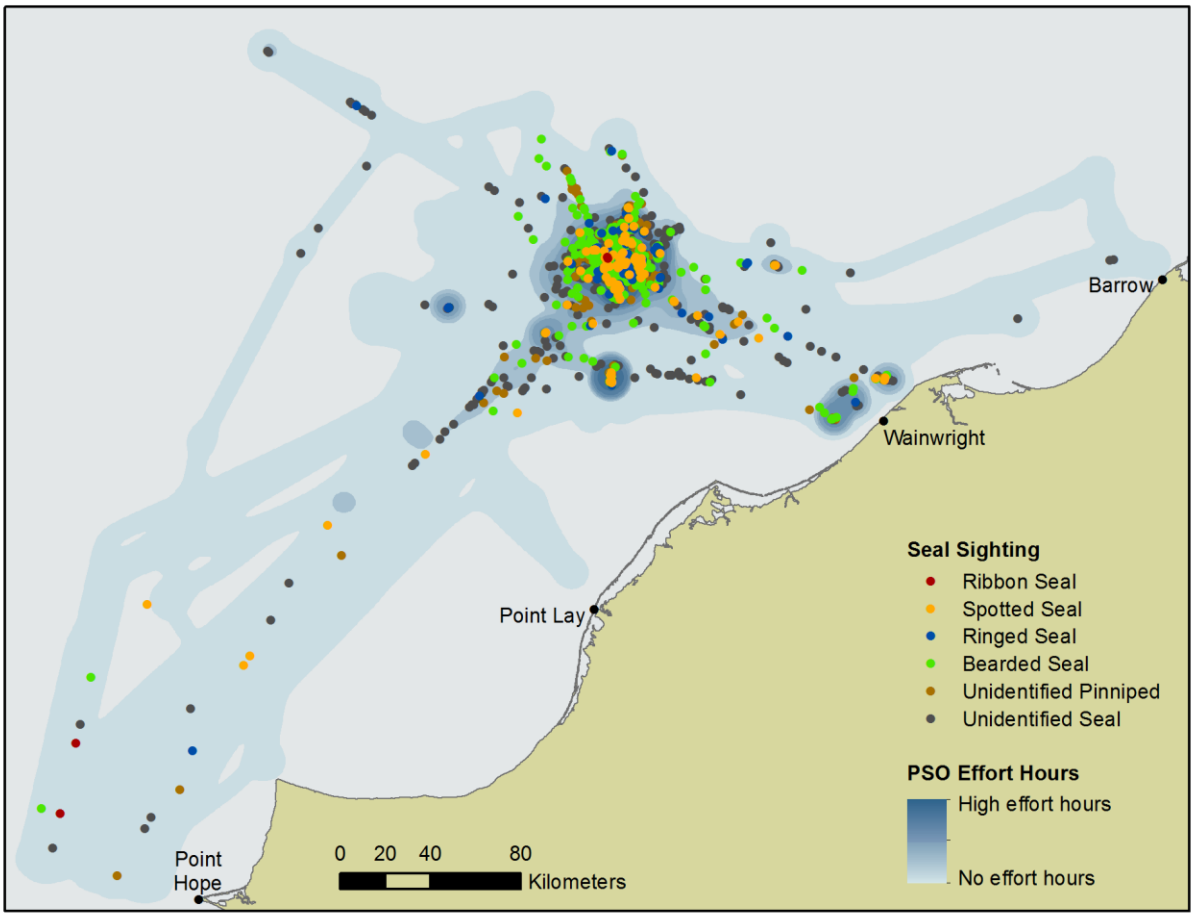

FIGURE 5.24. Location of seal sightings by species and effort hours from project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

Seal Sighting Rates

Seal sighting rates were calculated using only the periods of effort that met the criteria for being able to reliably detect seals and the sightings that occurred during those periods (see Chapter 4 and Appendix F).

Seal Sighting Rates by Beaufort Wind Force

Seal sighting rates from moving project vessels were greatest during periods of Bf 1 (Figure 5.25). Seal sighting rates from stationary project vessels were also greatest during Bf 0 and 1; however, there was limited observation effort for stationary vessels during Bf 0 so the sighting rate should be viewed with some caution (Figure 5.26).

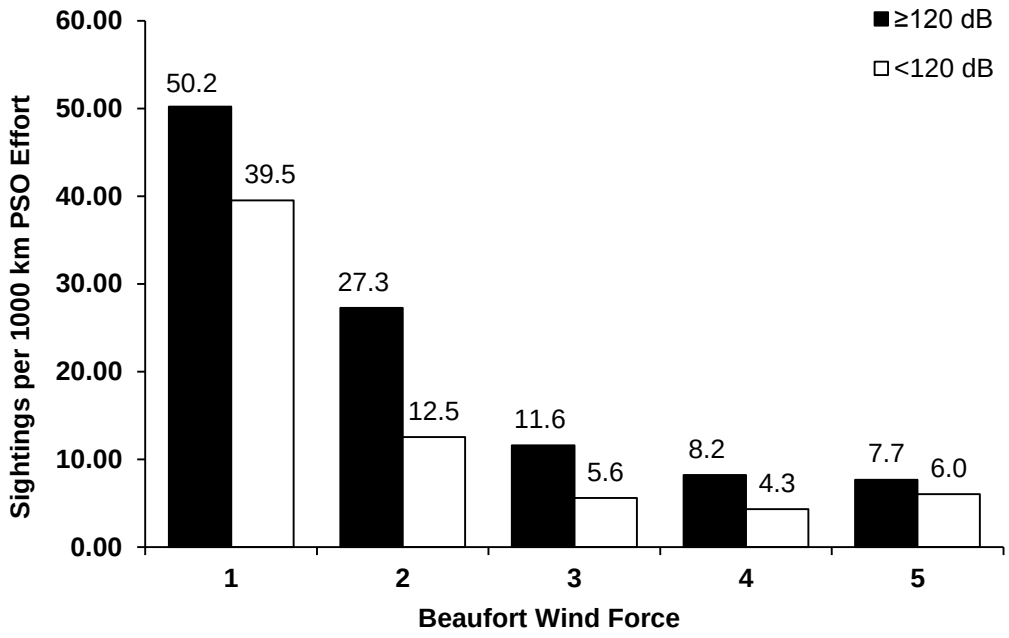

FIGURE 5.25. Seal sighting rates by Beaufort wind force from moving project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Note that < 250 km of observer effort occurred in Bf 0, which precluded meaningful inclusion.

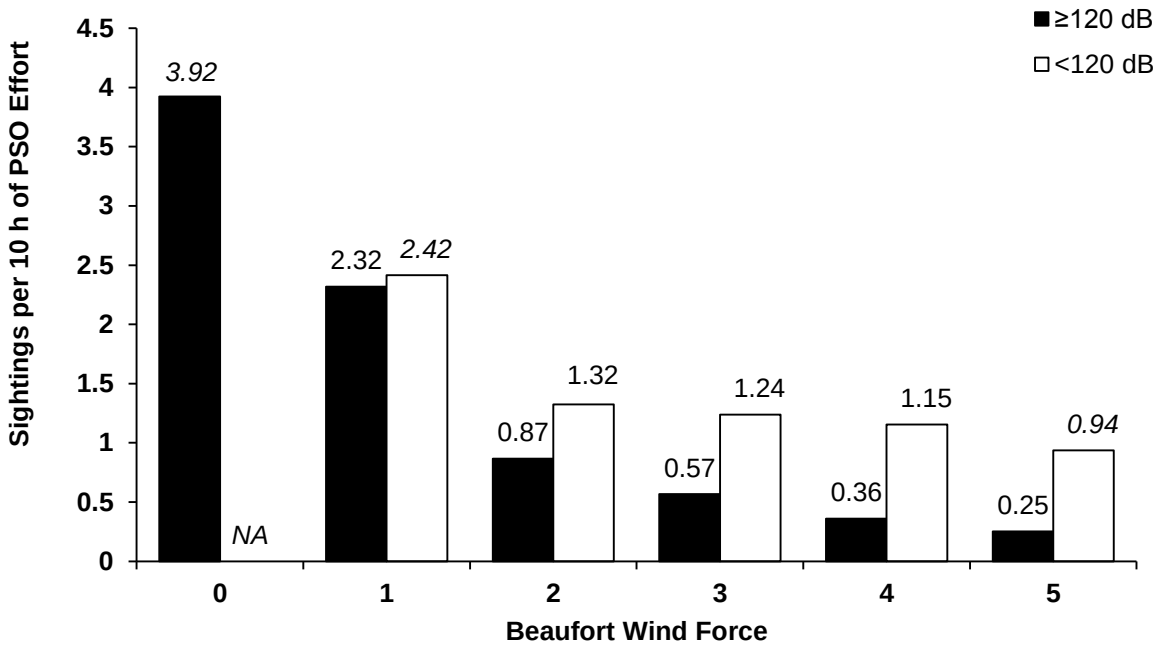

FIGURE 5.26. Seal sighting rates by Beaufort wind force from stationary project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Italicized numbers indicate that the sighting rate may not be reliable due to a limited amount of observation effort having occurred within the category.

Seal Sighting Rates by Number of PSOs

From moving vessels, the overall seal sighting rate when two PSOs were on watch (17 seals/1000km) was higher than when one PSO was on watch (11 seals/1000km; $X^2 = 24.63$, $df = 1$, $p < 0.001$; Figure 5.27). From stationary vessels, the overall seal sighting rate when two PSOs were on watch (0.9 seals/10 h) was also higher than when one PSO was on watch (0.8 seals/10 h; $X^2 = 4.99$, $df = 1$, $p = 0.025$; Figure 5.28).

Seal Sighting Rates by Vessel Activity

From moving vessels, sighting rates were higher during all activity scenarios in areas where RSLs were ≥120 dB re 1 μPa (rms SPL) than in areas were RSLs were <120 dB re 1 μPa (rms SPL; Figure 5.29). From stationary vessels, sighting rates were higher in areas where RSLs were <120 dB re 1 μPa (rms SPL) during the following activities: drilling with concurrent anchor handling, drilling alone and routine vessel activities (Figure 5.30). Additionally, sighting rates during routine vessel operations were not appreciably higher than sighting rates during other activities. That trend is clearer in the data from moving vessels (Figure 5.29) than it is in data from stationary vessels (Figure 5.30). These results are not consistent with a large-scale avoidance response by seals as a result of sounds produced by drilling and related support vessel activities.

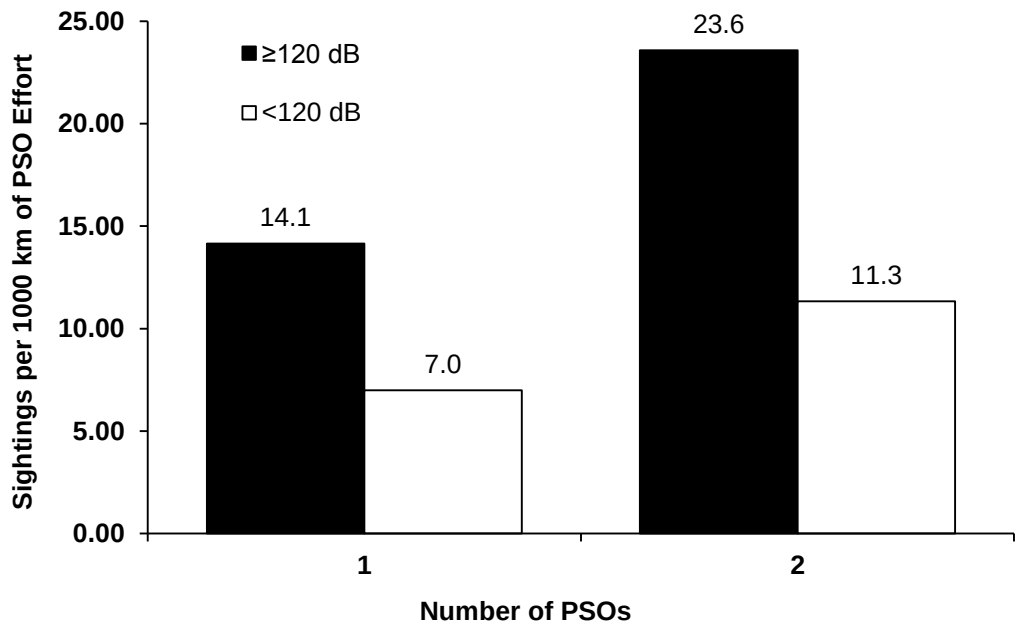

FIGURE 5.27. Seal sighting rates by the number of PSOs from moving project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Note that < 250 km of observer effort occurred with 3 PSOs on watch precluding meaningful inclusion.

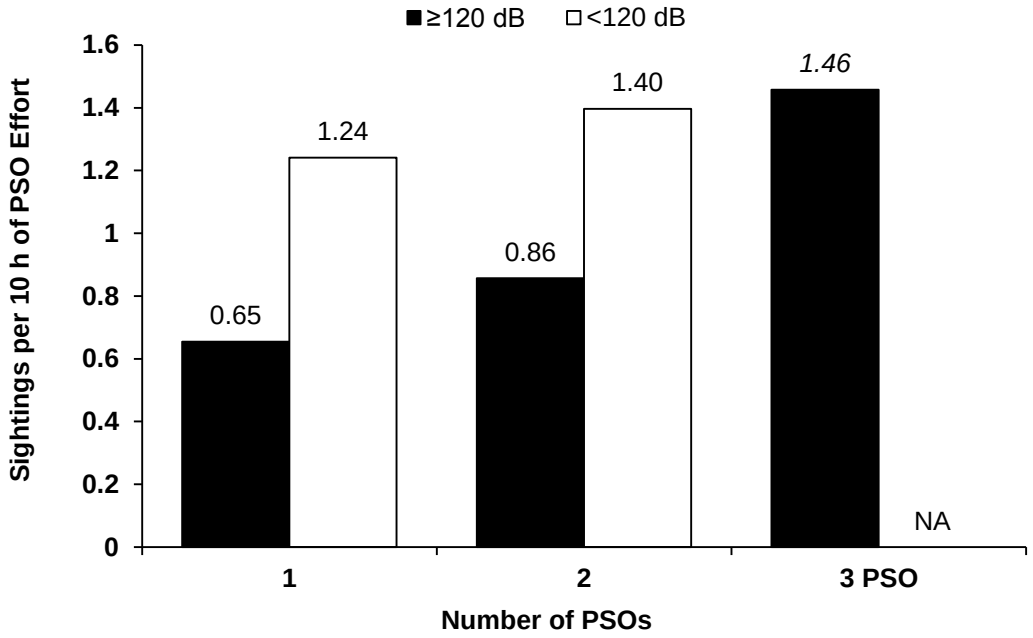

FIGURE 5.28. Seal sighting rates by the number of PSOs from stationary project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. NA indicates that there was insufficient effort in the category to calculate a sighting rate. Italicized numbers indicate that the sighting rate may not be reliable due to a limited amount of observation effort having occurred within the category.

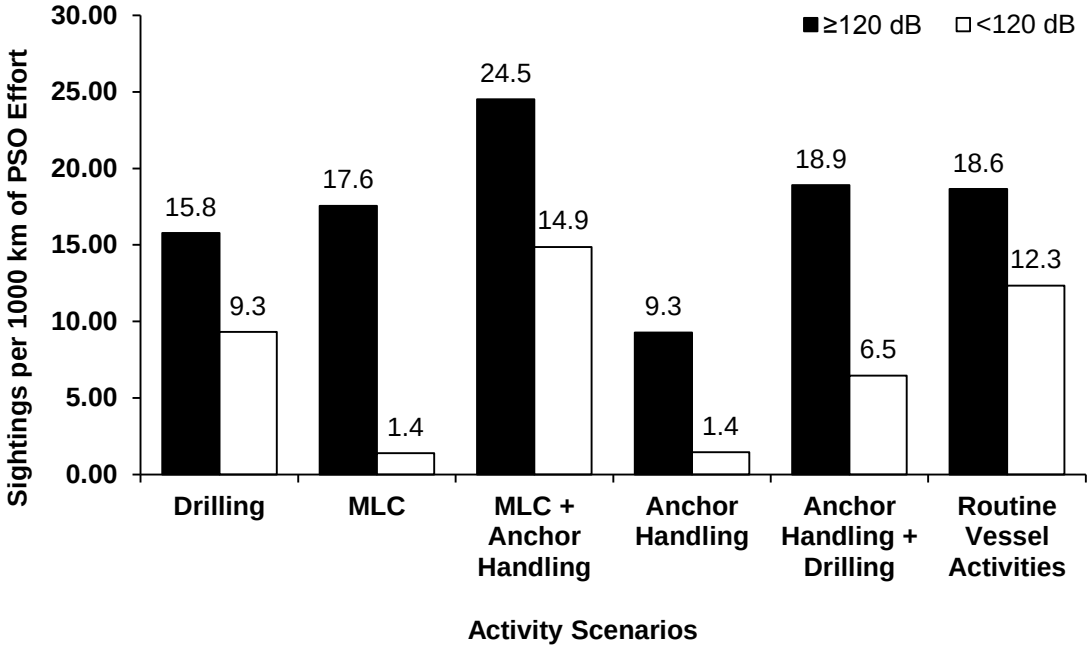

FIGURE 5.29. Seal sighting rates by activity scenarios from moving project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Routine vessel operations are periods with no drilling, MLC construction, or anchor handling scenarios occurring.

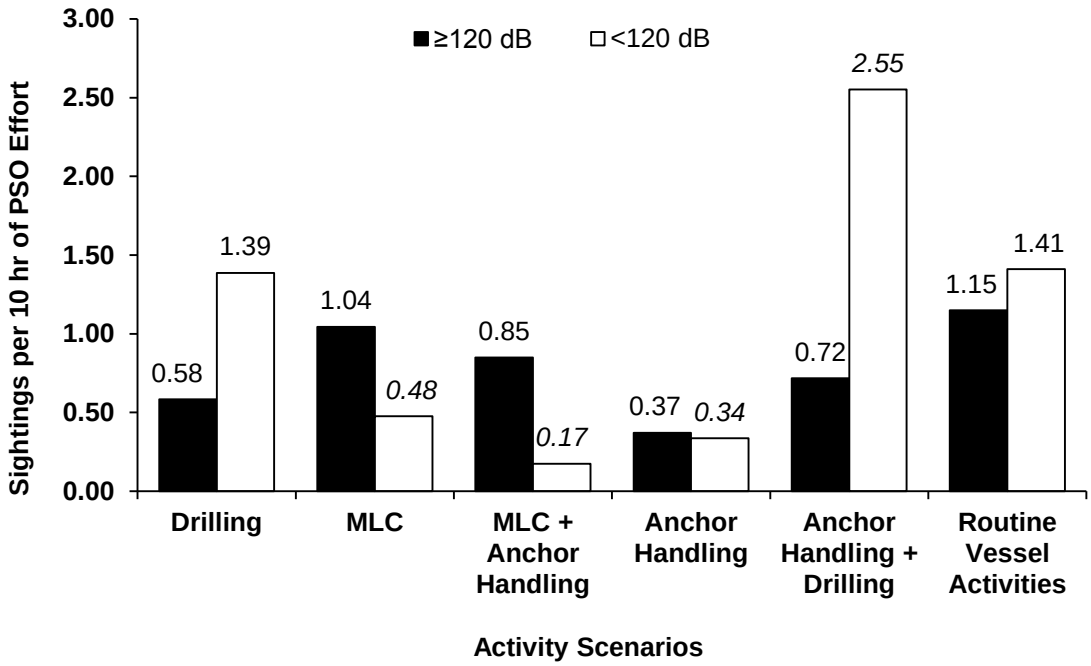

FIGURE 5.30. Seal sighting rates by activity scenarios from stationary project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Routine vessel operations are periods with no drilling, MLC construction, or anchor handling scenarios occurring. Italicized numbers indicate that the sighting rate may not be reliable due to a limited amount of observation effort having occurred within the category.

Seal Distribution and Behavior

Seal Closest Point of Approach

To avoid biasing results, the average closest point of approach (CPA) of seals was calculated using only sightings that occurred during periods of effort that met the criteria for being able to reliably detect seals (see Chapter 4 and Appendix F). Of the 1796 total seal sightings in water, 1475 met the detection criteria. The overall mean CPA distances for seals in water did not vary greatly between moving and stationary vessels (240 m and 263 m, respectively). Mean CPA distances for seals in water from moving vessels ranged from 1 to 2444 m from the observer station (Figure 5.30). The overall mean CPA distance of seals sighted from moving vessels in areas where RSLs were ≥120 dB re 1 µPa (rms SPL; 260 m) was greater than in areas where RSLs were <120 dB re 1 µPa (rms SPL; 197 m) and the difference was statistically significant (Wilcoxon rank sum test; W = 48498, p = 0.0021).

From stationary vessels, CPA distances for seals in water ranged from 0 to 4000 m (Figure 5.31). A CPA distance of 0 m represents a sighting in which the mammal was observed to make contact with the vessel. The overall mean CPA distances for seals sighted from stationary vessels was once again greater in areas where RSLs of ≥120 dB re 1 µPa (rms SPL; 288 m) compared with areas where RSLs were less than 120 dB re 1 µPa (rms SPL; 128 m) and the difference was statistically significant (Wilcoxon rank sum test; W = 56,154, p = 0.0014). The small but statistically significant differences in mean CPA distances for sightings from both moving and stationary vessels suggest that seals may have exhibited some avoidance of sounds produced by industry vessels during the activity scenarios. This result is similar to the short-range avoidance by seals around seismic surveys previously documented in this region (Reiser et al. 2009).

Of the 13 total seal sightings observed on ice, eight met the detection criteria for calculating CPA distances. A CPA distance of 150 m was recorded for the one seal sighting on ice observed from a moving vessel. The mean CPA distance for the remaining seven seal sightings on ice observed from stationary vessels was 3528 m (range 1401 m to 6411 m).

Seal Initial Sighting Distance

The initial sighting distance for seals in water was recorded for sightings from both moving and stationary vessels (Figures 5.33 and 5.34). The initial sighting distance and the CPA distance were recorded as the same number for sightings in which a marine mammal was observed only once. A change in initial and CPA distances from a moving vessel would have involved either a change in location of the vessel or change in location of the marine mammal, or both. From moving vessels, most seal sighting are quite brief and there is often little difference between the initial sighting distance and the CPA distance. If the vessel was stationary, any difference would only be caused by a closer approach of the seal to the observing vessel. Similar to the analysis of CPA distances, initial sighting distances in areas where RSLs were ≥120 dB re 1 µPa (rms SPL) were somewhat greater than those in areas where RSLs were <120 dB re 1 µPa (rms SPL; Figures 5.33 and 5.34) suggesting some possible avoidance of vessels in areas with elevated sound levels.

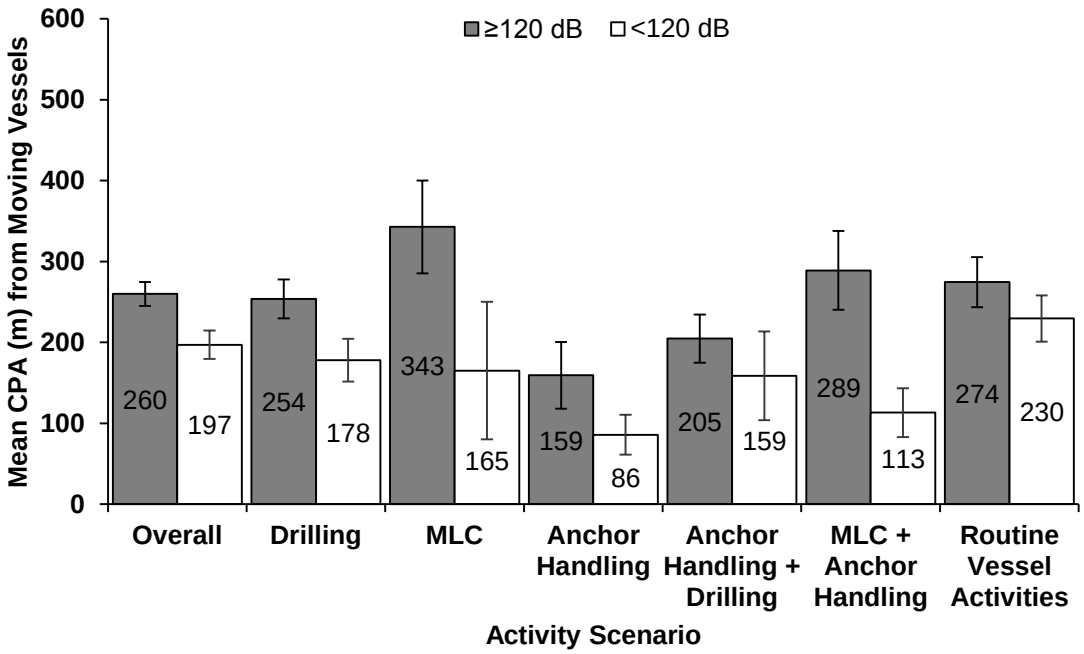

FIGURE 5.31. Comparison of mean seal CPA distances by vessel activity from moving project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015. The overall mean includes CPA distances for sightings exposed to all six vessel activities. Error bars represent standard error of the mean where n > 1. NA represents a sample size of zero.

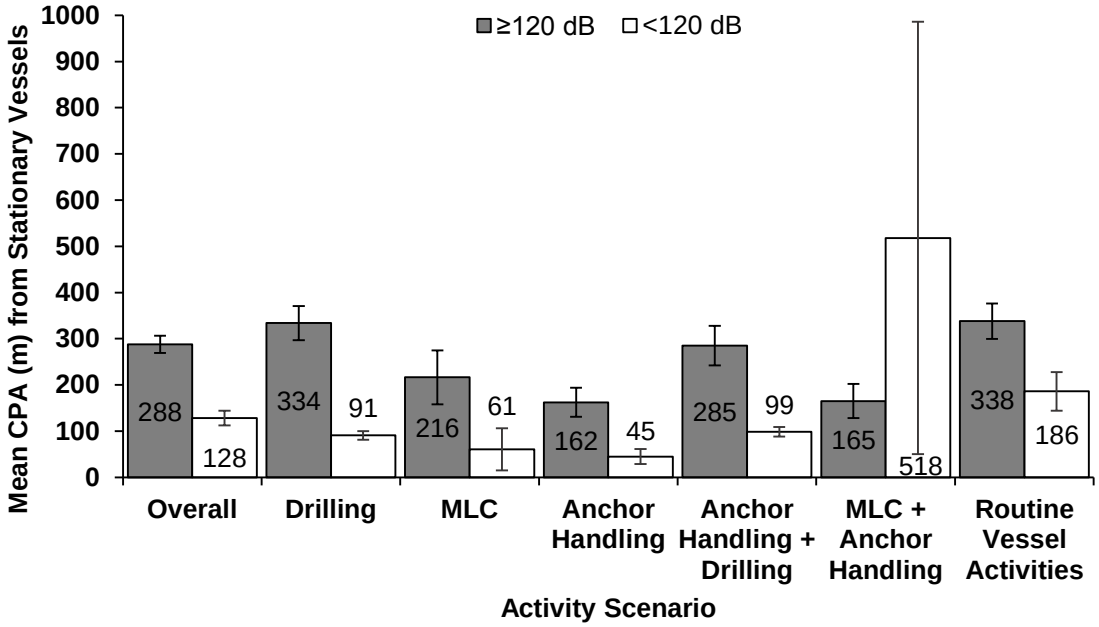

FIGURE 5.32. Comparison of mean seal CPA distances by vessel activity from stationary project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015. The overall mean includes CPA distances for sightings exposed to all six vessel activities. Error bars represent standard error of the mean where n > 1. NA represents a sample size of zero.

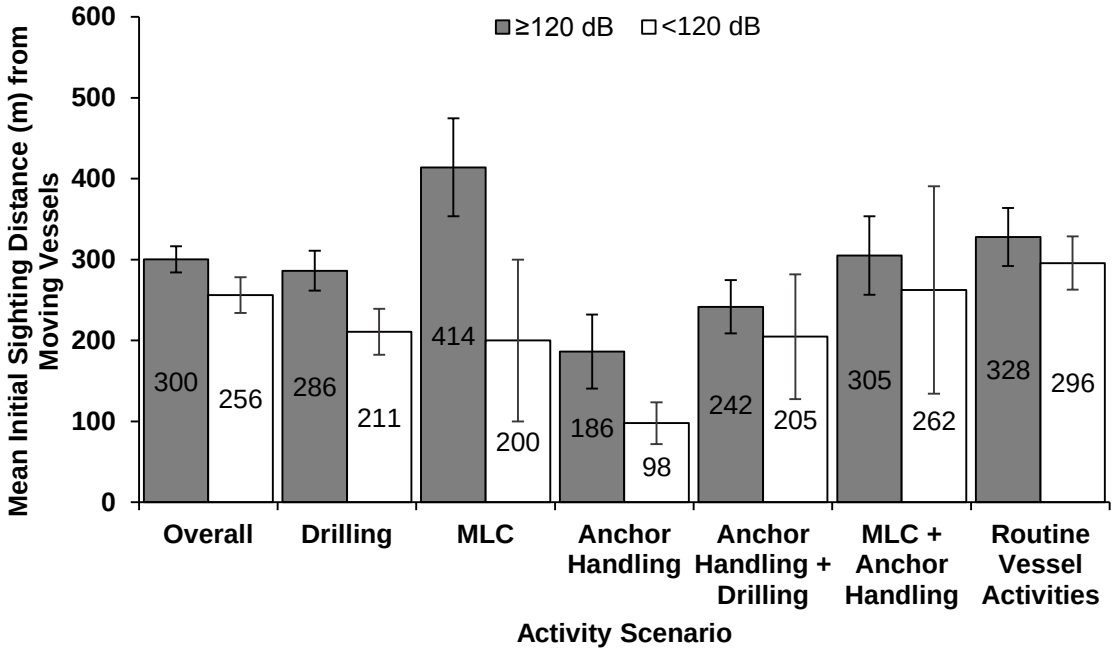

FIGURE 5.33. Comparison of mean seal initial sighting distances by vessel activity from moving project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015. The overall mean includes initial sighting distances for sightings exposed to all six vessel activities. Error bars represent standard error of the mean where n > 1. NA represents a sample size of zero.

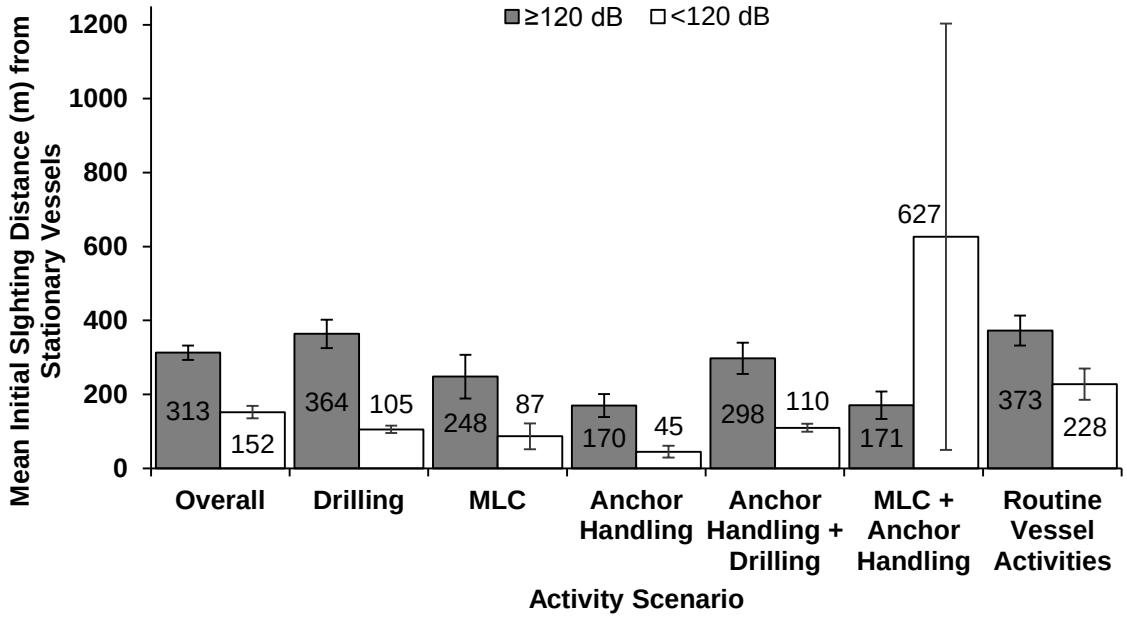

FIGURE 5.34. Comparison of mean seal initial sighting distances by vessel activity from stationary project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015. The overall mean includes initial sighting distances for sightings exposed to all six vessel activities. Error bars represent standard error of the mean where n > 1. NA represents a sample size of zero.

Seal Movement

The most common movements of seals in water from both moving and stationary vessels were neutral (44% and 30%, respectively) and unknown (23% and 35%, respectively; Figures 5.35 and 5.36). If seals were actively avoiding all project vessels in areas where sound levels were elevated, then the occurrence of swim away behavior might be greater than swim toward behavior in areas where RSLs were ≥120 dB re 1 µPa (rms SPL) and as compared between areas where RSLs were ≥120 dB re 1 µPa (rms SPL) and areas where RSLs were <120 dB re 1 µPa (rms SPL). For seal sightings from moving vessels, the swim away movement is twice as prevalent as swim toward across both RSL categories (2.21 times greater in areas where RSLs were ≥120 dB re 1 µPa (rms SPL) and 1.48 times greater in areas where RSLs were <120 dB re 1 µPa (rms SPL). However, for seal sightings from stationary vessels, occurrence of swim away and swim toward are quite similar, both in areas where RSLs were ≥120 dB re 1 µPa (rms SPL; 18% swim away, 16% swim toward) and in areas where RSLs were <120 dB re 1 µPa (rms SPL; 11% swim away, 15% swim toward). This suggests that during the sightings, seals may have been more responsive to whether or not the vessel was moving than what the overall received sound level was in the area.

Of the 13 sightings of seals hauled out on ice, only one had a recorded movement away from the vessel. The remaining 12 sightings had a recorded movement relative to the vessel of none (7), unknown (4), or neutral (1).

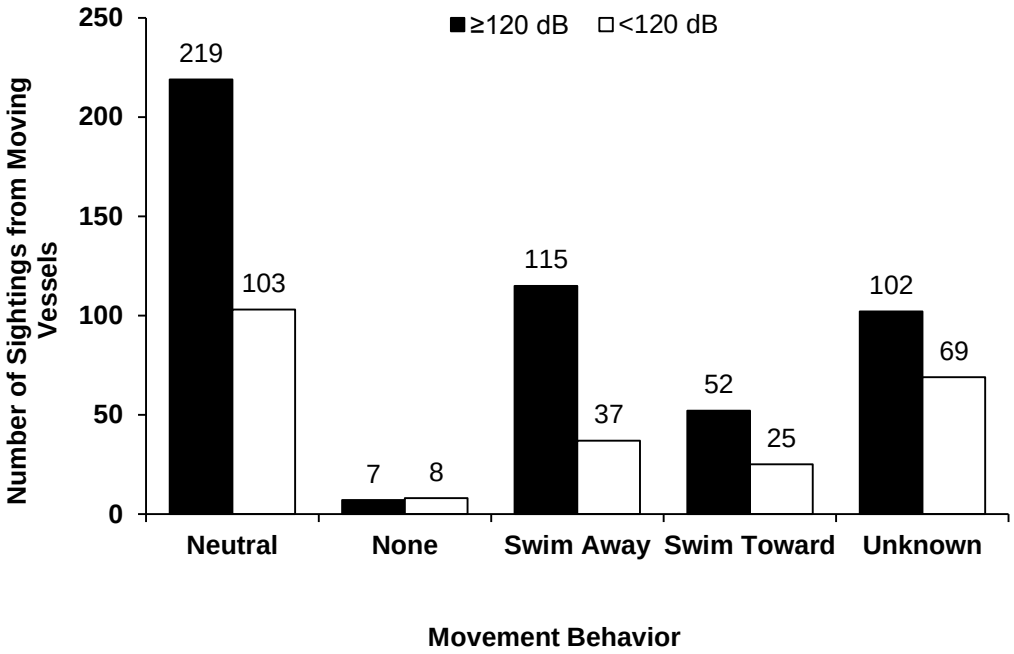

FIGURE 5.35. Number of seal sightings within categories of movement relative to moving vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

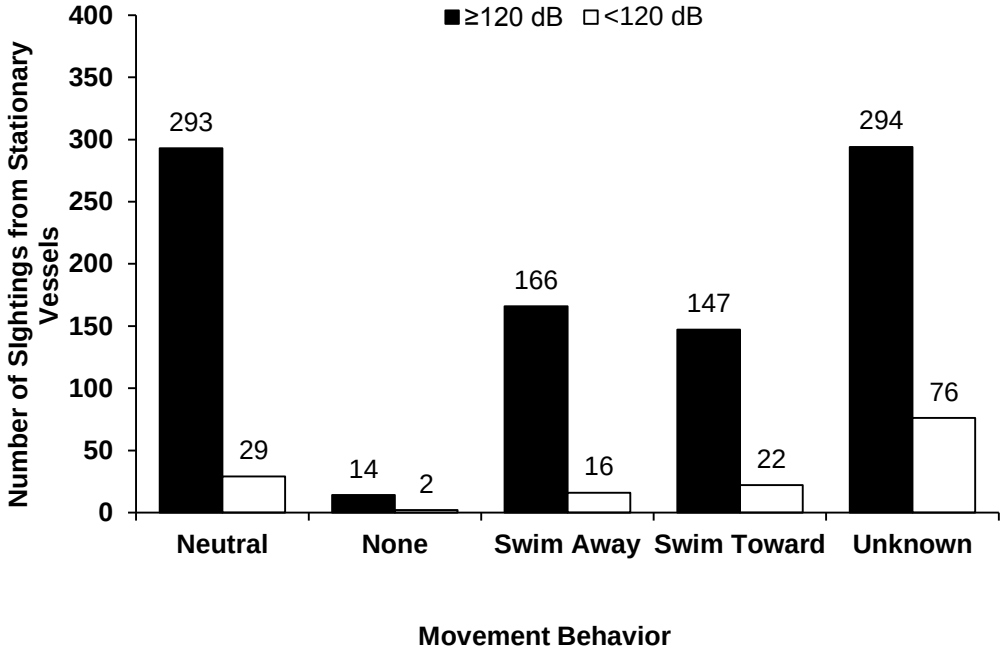

FIGURE 5.36. Number of seal sightings within categories of movement relative to stationary vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Seal Initial Behavior

The most common behavior recorded for seal sightings in water from both moving and stationary vessels was look (40% and 41%, respectively), followed by dive (17% and 15%, respectively) and swim (18% and 14%, respectively; Figures 5.37 and 5.38). Of the remaining sightings, there was some difference between sightings made from stationary and moving vessels. The next two most common seal behaviors observed from moving vessels were surface active (5%) and travel (4%), both relatively active behaviors. For stationary vessels, the next two most common behaviors were float on back (11%) and rest (7%), both relatively inactive behaviors. Observers recorded 1 to 35 instances of the following behaviors in each movement category: blow, feed, flipper slap, mill, other (not categorized), porpoise, sink, and thrash behaviors, in addition to those shown below, which are recorded in the combined "other" category. There does not appear to be a consistent difference in seal initial behaviors between received sound level categories.

Of the two sightings from moving vessels of seals hauled out on ice, one behavior was recorded as resting. The second, observed from the *Nordica* during ice management activities, was recorded as "other" and is detailed in the "Mitigations during Specified Activities" section of Chapter 7. Of the 11 sightings from stationary vessels of seals hauled out on ice, nine were recorded as an initial behavior of resting, one was recorded as dive, and one, observed from the *Tor Viking*, was recorded as surface active behavior as two seals swam at a distance of over three kilometers from the vessel and one hauled out on a piece of ice.

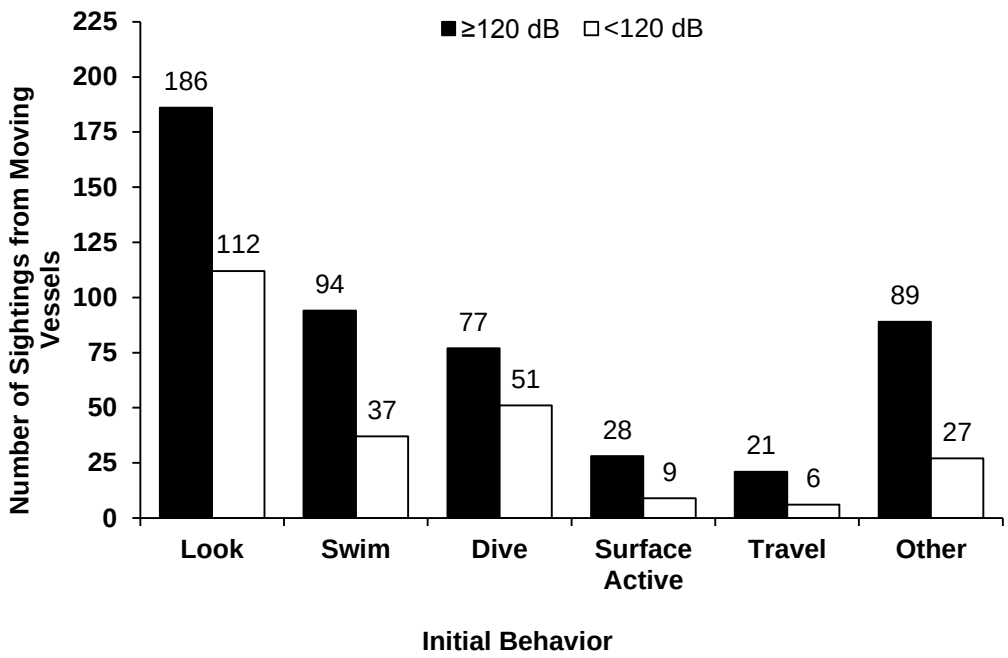

FIGURE 5.37. Number of seal sightings from moving vessels within categories of initial behavior, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

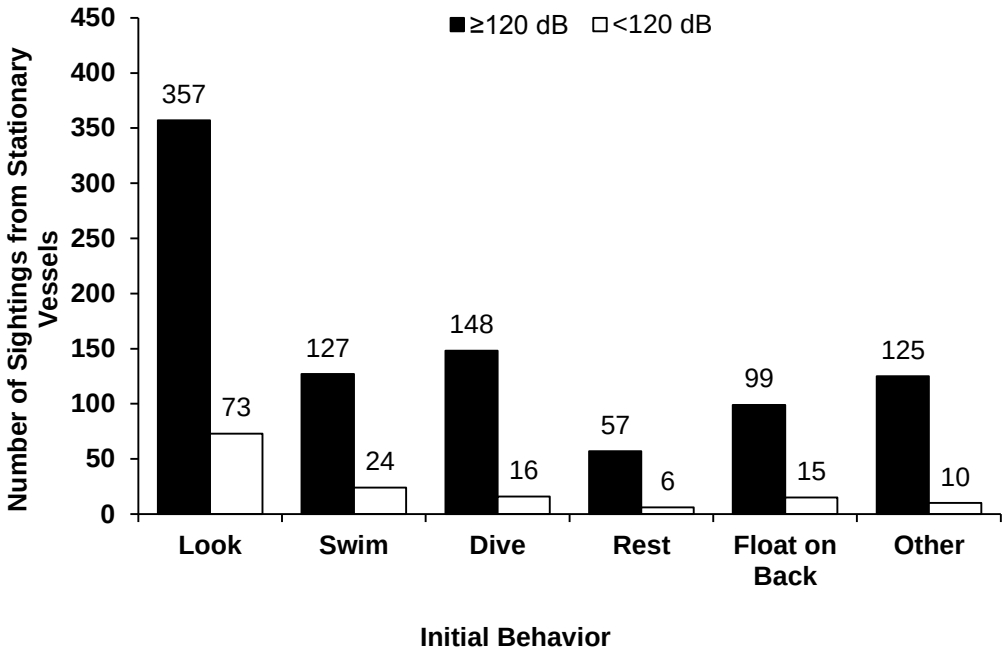

FIGURE 5.38. Number of seal sightings from stationary vessels within categories of initial behavior, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Seal Reaction Behavior

Seals observed in water from moving and stationary vessels were most often recorded as having no reaction to the vessel (50% and 58%, respectively) or looking at the vessel (40% for each; Figures 5.39 and 5.40). The next most common reaction recorded for seals observed in water from moving vessels was splash (5%). Very few reactions other than looking at the vessel were recorded for seal sightings from stationary vessels, with the next most common reaction recorded being change direction (1%). Observers recorded 1 to 19 instances of increase speed and decrease speed behaviors, in addition to those shown below, which are recorded in the combined "other" category. There does not appear to be a consistent difference in seal reaction behaviors to the vessel between received sound level categories.

Of the two sightings from moving vessels of seals hauled out on ice, both reactions were recorded as looking at the vessel. Of the 11 sightings from stationary vessels of seals hauled out on ice, one reaction was recorded as looking at the vessel, and the remaining nine sightings had no reaction recorded.

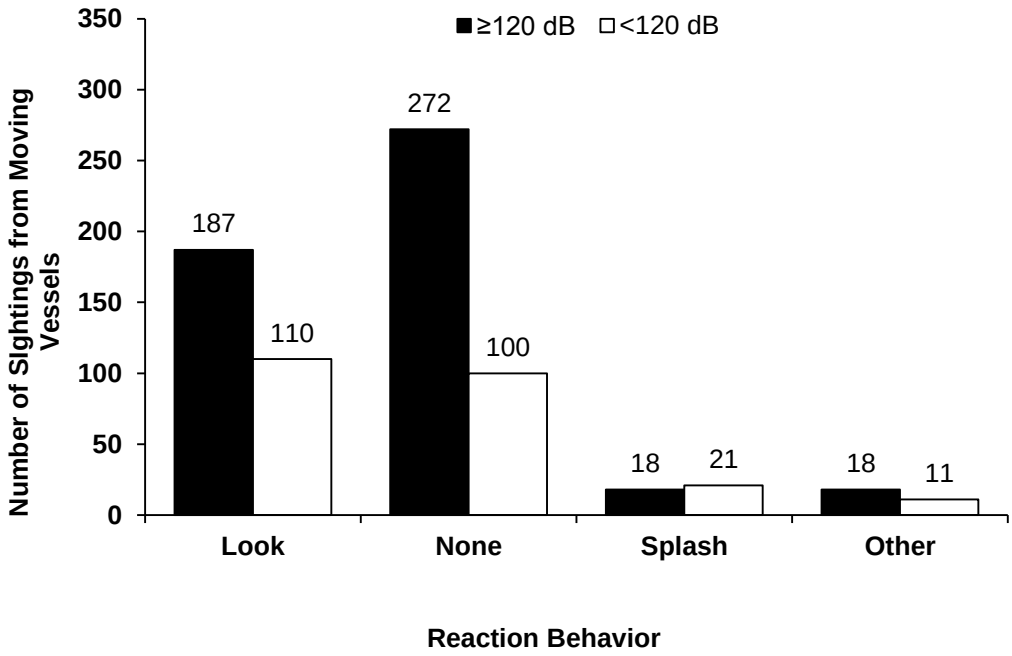

FIGURE 5.39. Number of seal sightings from moving vessels within categories of reaction behavior, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

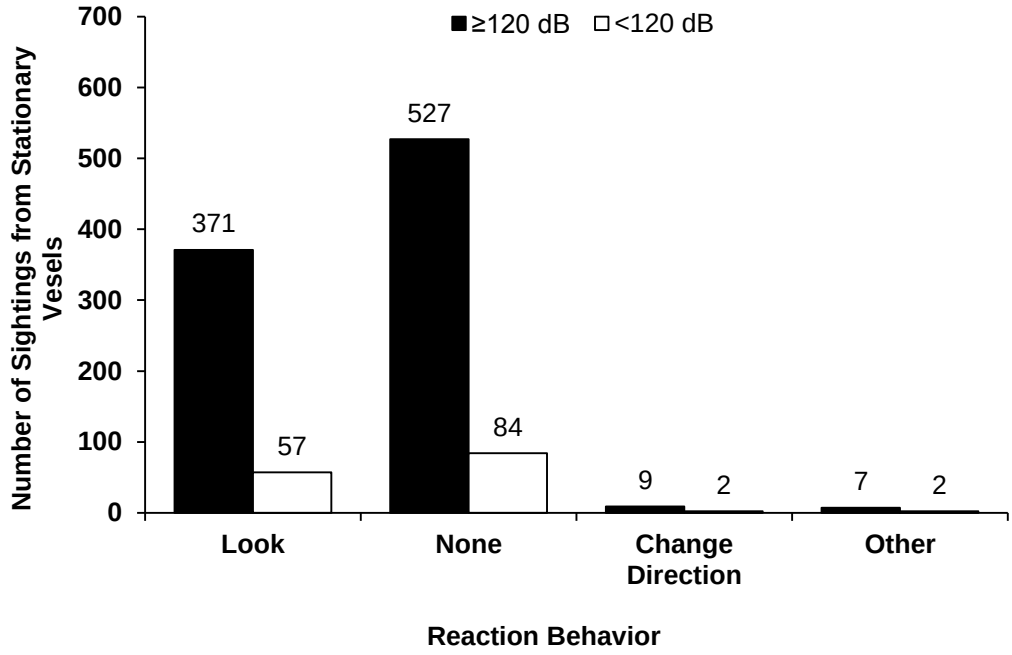

FIGURE 5.40. Number of seal sightings from stationary vessels within categories of reaction behavior, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Literature Cited

LGL Alaska Research Associates, Inc, JASCO Applied Sciences, Inc., and Greeneridge Sciences, Inc. 2014. Joint Monitoring Program in the Chukchi and Beaufort Seas, 2012. LGL Alaska Final Report P1272-2 for Shell Offshore, Inc. ION Geophysical, Inc, and Other Industry Contributors, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 320 p. plus Appendices.

Reiser, C.M., B. Haley, J. Beland, D.M. Savarese, D.S. Ireland, D.W. Funk. 2009. Evidence for short-range movements by phocid species in reaction to marine seismic surveys in the Alaskan Chukchi and Beaufort seas.

6. CHUKCHI SEA VESSEL-BASED MARINE MAMMAL MONITORING RESULTS–PACIFIC WALRUS AND POLAR BEAR[6]

Monitoring Effort and Marine Mammal Encounter Results

This section summarizes the visual observations of Pacific walruses and polar bears from project vessels inside the Chukchi Sea Activity Area (north of Point Hope, see Chapter 4) during Shell's 2015 exploratory drilling operations. The LOA from the USFWS received by Shell in 2015 included mitigation measures for Pacific walrus and polar bear consistent with the incidental take regulations as well as several additional limitations related to the HSWUA. This included limitation on entry into HSWUA, including Pacific walrus UDs, during July, August, and September.

The activities began when the first project vessels, the *Nordica*, *Aiviq*, and *Explorer*, entered the Chukchi Sea Activity Area on 6 July 2015 and ended when the last project vessels, the *Champion*, *Sisuaq*, *Explorer*, *Marika*, and *Nanuq*, departed the area on 16 October 2015. Drilling activities occurred for 45 days by the drilling unit *Polar Pioneer* (see Chapter 2). The *Noble Discoverer* spent a total of 75 days in the Chukchi Sea Activity Area but did not engage in exploratory drilling in the 2015 season. Vessel-based monitoring, mitigation and data analysis methods, and observer effort from project vessels are described in Chapter 4 and Chapter 5, respectively.

Both Pacific walrus and polar bear distributions are variable and highly related to the presence of sea ice. The 2015 activity period was characterized by low sea ice concentrations over the Burger Prospect. Moving vessels and stationary vessels operated in sea ice free conditions for 99% (71,549 km, 15,859 h) of the total distance traveled and total time, including periods when PSOs were not on watch.

Pacific Walrus Sightings

PSOs recorded 500 sightings of 1,397 individual Pacific walruses in the Chukchi Sea Activity Area. There were 170 walrus sightings of 497 individuals made by PSOs on moving vessels and 330 walrus sightings of 900 individuals made by PSOs on stationary vessels (Table 6.1). Most walrus sightings (90%) occurred in areas where RSLs were ≥120 dB re 1 μPa (rms SPL); however, 51% (n = 668) of those walruses were observed on ice and would not have experienced the modeled in-water RSLs ≥120 dB re 1 μPa (rms SPL; Table 6.1).

As expected, most walrus sightings occurred in areas with high PSO effort (Figure 6.1). However, large groups of walruses were observed north of the Burger Prospect in an area of relatively little PSO effort (Figure 6.1). These large groups were observed by PSOs on the *Aiviq* during ice scouting and management activities from 28 to 30 July. PSOs made 14 sightings of 673 individual Pacific walruses hauled out on ice, resulting in an average group size of 48 individuals. These sightings represent 48% of the total number of walruses observed by PSOs during the entire season. There were no other sightings of walruses hauled out on ice in 2015.

The average group size of walruses observed in water from moving and stationary vessels was 1.5 individuals per sighting. The maximum group size of walruses observed in water from moving vessels was nine and from stationary vessels it was seven.

By L.A. Ackein, H.J. Reider, L.N Bisson, and K.B. Matthews

TABLE 6.1. Total number of Pacific walrus sightings (number of individuals), in water and on ice from moving and stationary project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL), in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

	In Water		On Ice		
Pacific Walrus	**≥120 dB**	**<120 dB**	**≥120 dB**	**<120 dB**	***Total***
Moving Vessels	124 (205)	38 (64)	6 (225)	2 (3)	***170 (497)***
Stationary Vessels	317 (447)	7 (8)	4 (443)	2 (2)	***330 (900)***
Total Pacific Walrus	***441 (652)***	***45 (72)***	***10 (668)***	***4 (5)***	***500 (1397)***

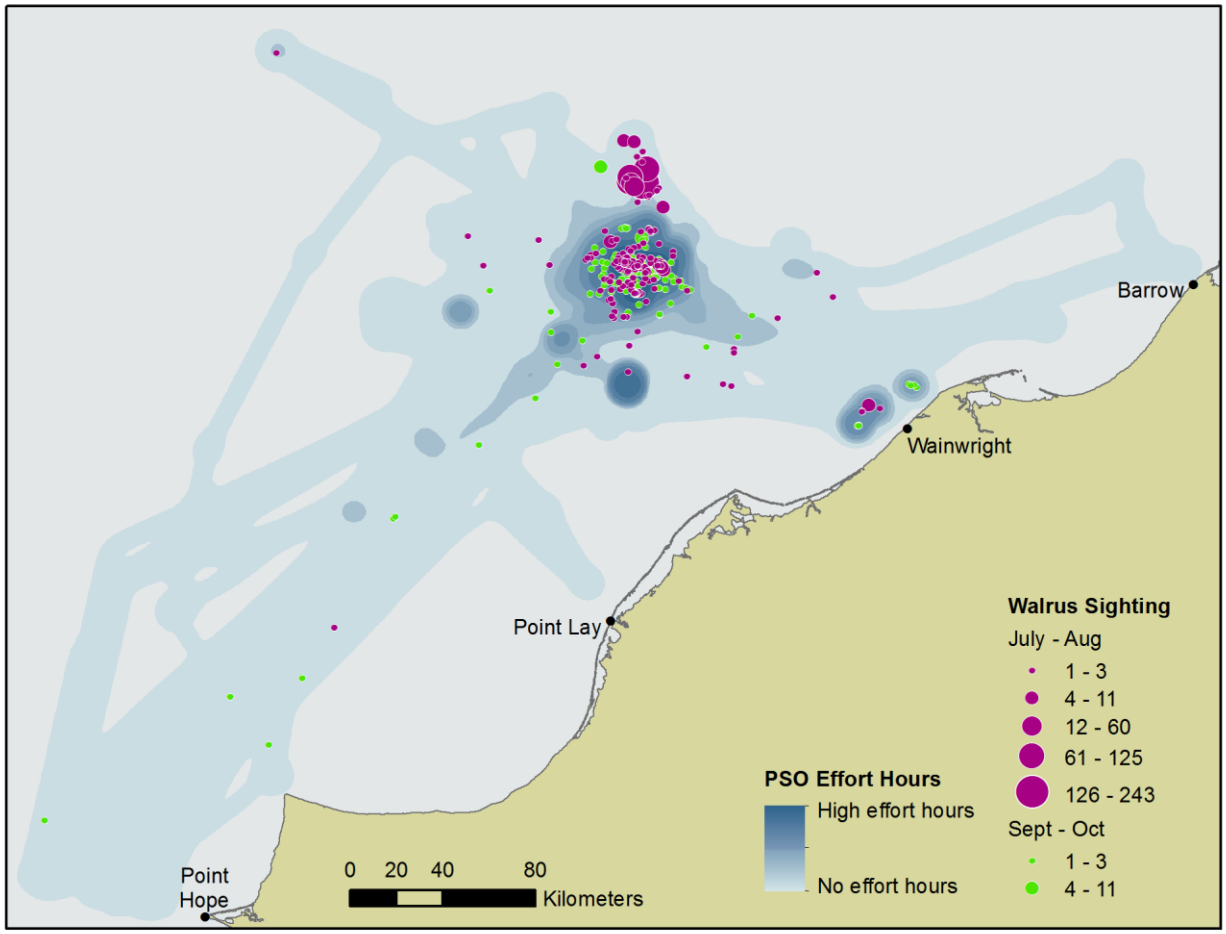

FIGURE 6.1. Location of Pacific walrus sightings, group sizes, time frame, and effort hours from project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

Pacific Walrus Sighting Rates

Pacific walrus sighting rates were calculated using only the periods of effort that met the criteria for being able to reliably detect walruses (See Chapter 4 and Appendix F) and the sightings that occurred during those periods.

Pacific Walrus Sighting Rates by Beaufort Wind Force

Pacific walrus sighting rates tended to decrease with increasing Bf wind force; however, there was a small increase in walrus sighting rates during Bf 5 from moving vessels (Figure 6.2 and 6.3). Observers on moving vessels recorded small groups of walruses (24 walrus sightings of 1 to 3 individuals) throughout August, September, and early-October in Bf 5 conditions.

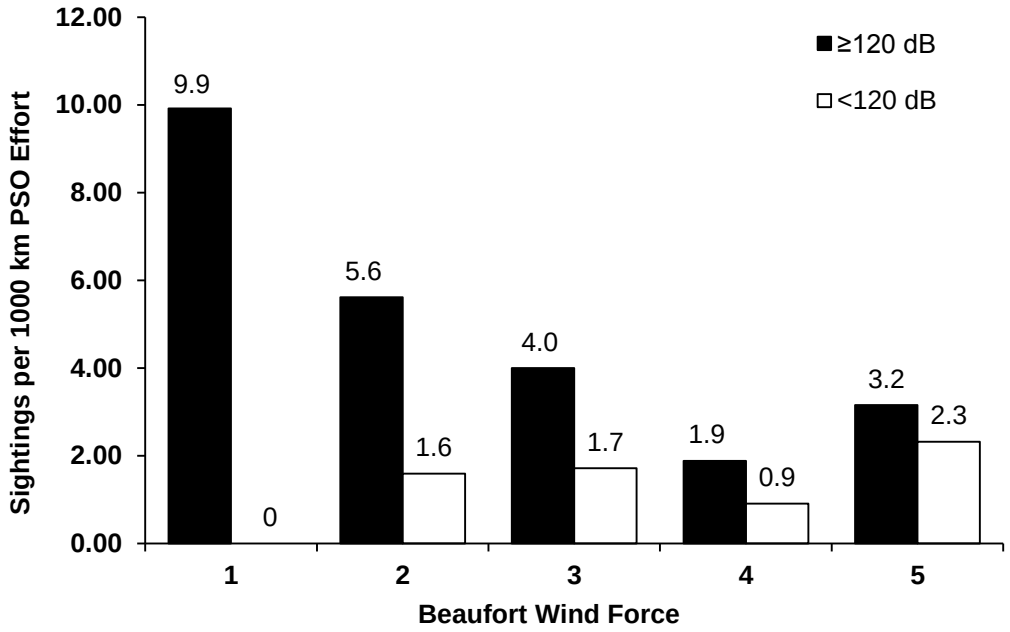

FIGURE 6.2. Walrus sighting rates by Beaufort wind force from moving project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL), in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Note that <250 km of observer effort occurred during Bf 0, precluding meaningful inclusion.

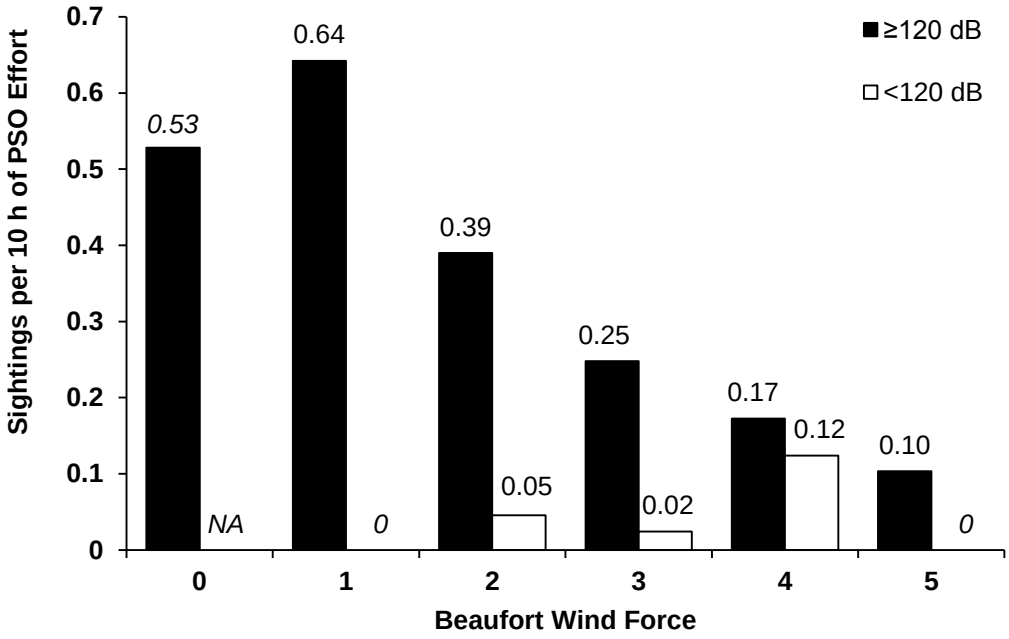

FIGURE 6.3. Walrus sighting rates by Beaufort wind force from stationary project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL), in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Italicized numbers indicate that the sighting rate may not be reliable due to a limited amount of observation effort having occurred within the category.

Pacific Walrus Sighting Rates by Number of PSOs

Pacific walrus sighting rates were highest during periods with two PSOs on watch for both moving and stationary vessels. During moving periods, the overall walrus sighting rate with two PSOs on watch (4.0 walrus sightings/1,000 km) was nearly two times greater than with one PSO on watch (2.4 walrus sightings/1,000 km; $X^2 = 9.6$, $df = 1$, $p = 0.002$; Figure 6.4). During stationary periods, the overall walrus sighting rate with two PSOs on watch (0.33 walrus sightings/10 h) was also higher than with one PSO on watch (0.19 walrus sightings/10 h; $X^2 = 18.9$, $df = 1$, $p = 0.00001$; Figure 6.5). Limited effort occurred with three PSOs on watch, and this sighting rate should be viewed with caution for stationary vessels.

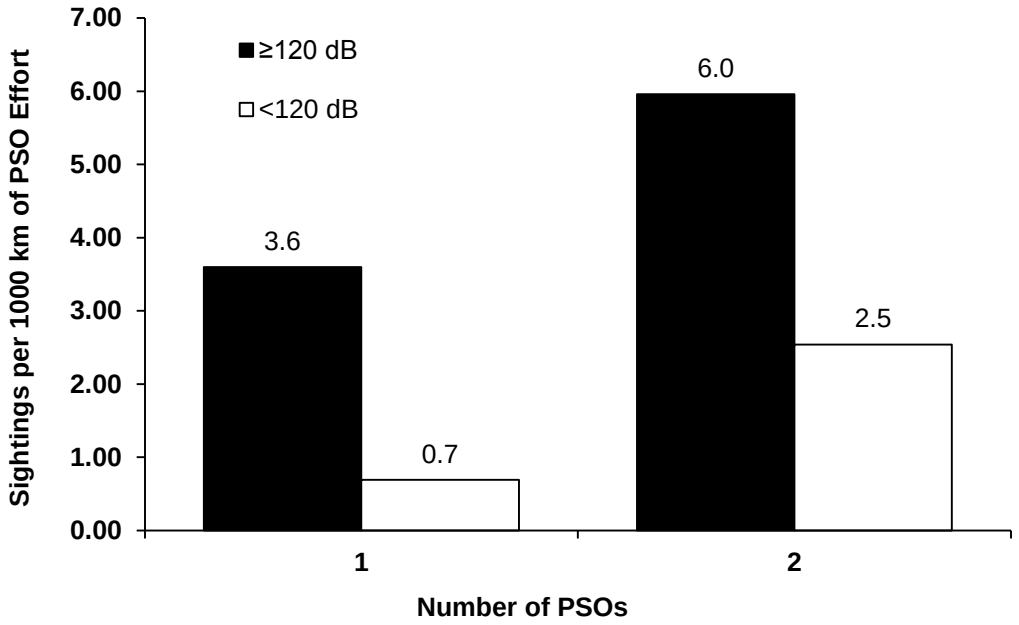

FIGURE 6.4. Walrus sighting rates by the number of PSOs from moving project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL), in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Note that <250 km of observer effort occurred with 3 PSOs on watch, precluding meaningful inclusion.

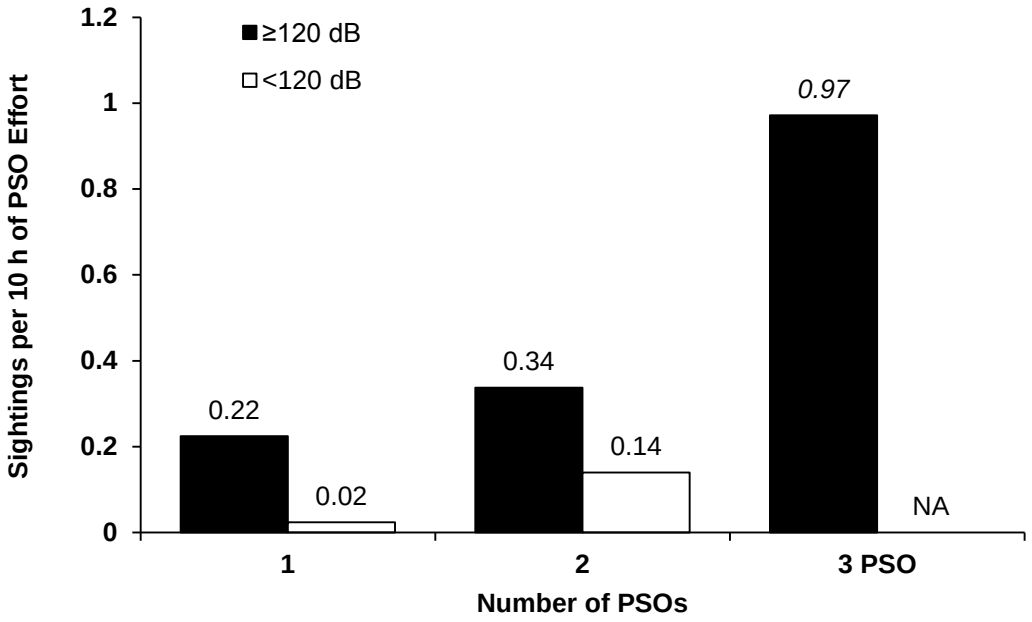

FIGURE 6.5. Walrus sighting rates by the number of PSOs from stationary project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL), in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. NA indicates that there was insufficient effort in the category to calculate a sighting rate. Italicized numbers indicate that the sighting rate may not be reliable due to a limited amount of observation effort having occurred within the category.

Pacific Walrus Sighting Rates by Vessel Activity

From both moving and stationary vessels, the highest sighting rates occurred in areas where RSLs were ≥120 dB re 1 µPa (rms SPL) during the drilling, anchor handling with drilling, and routine vessel activity scenarios (Figure 6.6 and 6.7). These results are not consistent with a large-scale avoidance response as a result of sounds produced by drilling and related support vessel activities. The difference in sighting rates may be more related to the timing of walrus movements towards and along the Alaskan Chukchi Sea coast than the status of drilling-related activities. Nonetheless, these results do not support the hypothesis that walruses showed significant avoidance of the drilling activities.

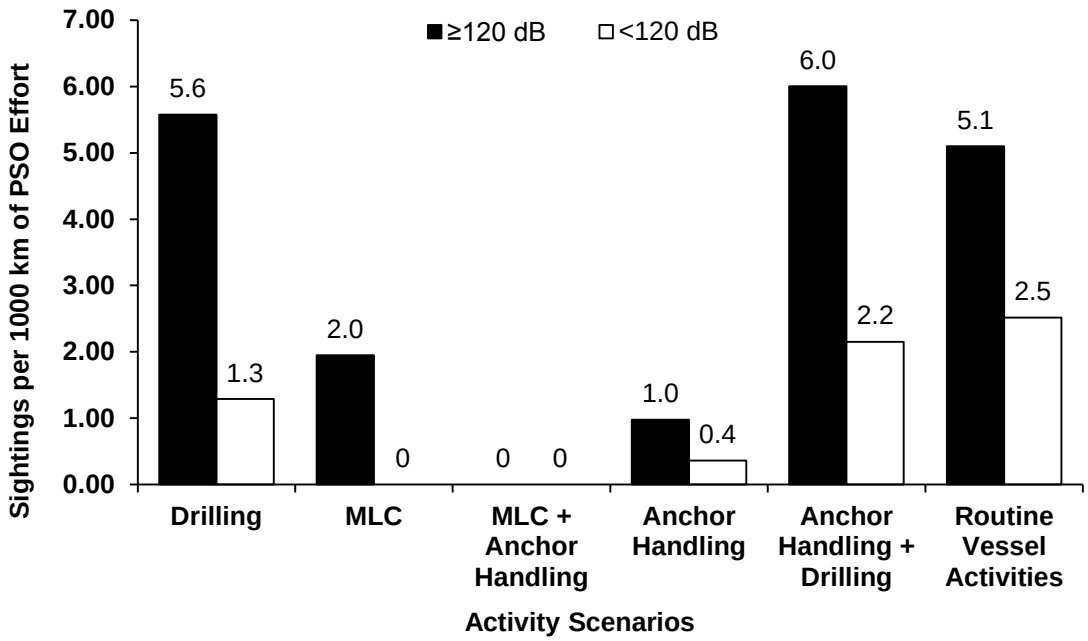

FIGURE 6.6. Walrus sighting rates by activity scenario from moving project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL), in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Routine vessel activities are periods with no drilling, MLC construction, or anchor handling scenarios occurring.

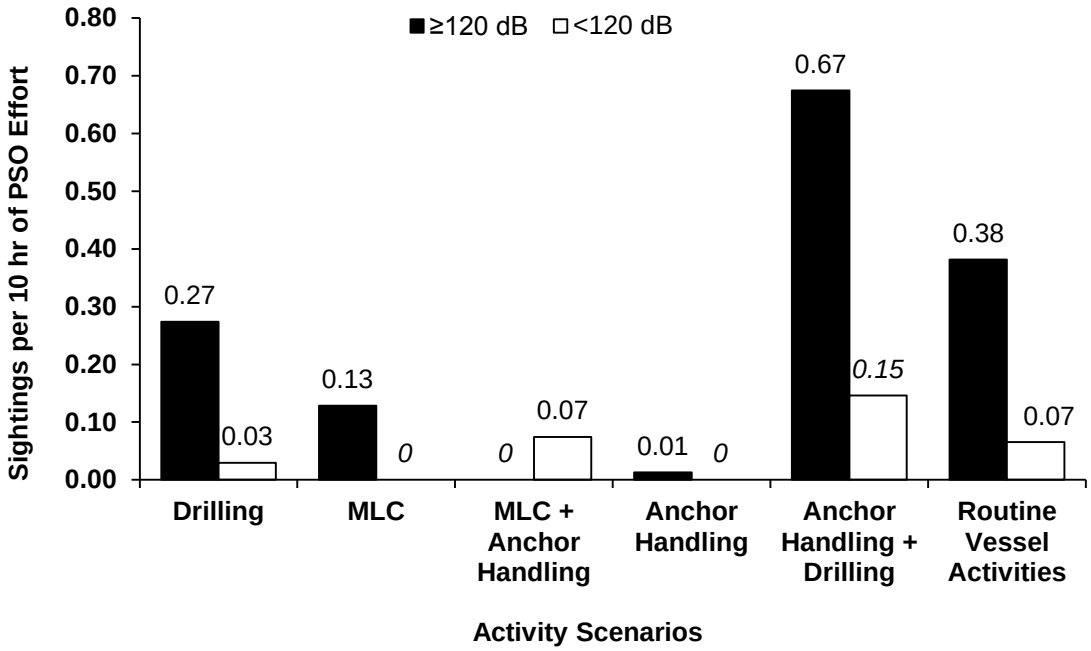

FIGURE 6.7. Walrus sighting rates by activity scenarios from stationary project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL), in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Routine vessel activities are periods with no drilling, MLC construction, or anchor handling scenarios occurring.

Pacific Walrus Sighting Rates Relative to Ice Concentrations

Sea ice did not persist during activities at the Burger Prospect in 2015, so there was very limited vessel effort in areas where ice concentrations were >0%. Given the limited effort in ice concentrations of >0%, effort from both RSL categories was pooled in order to compare sighting rates relative to ice concentration. The overall sighting rates from moving vessels in areas with ice concentrations >0–3% (9 walrus sightings/1,000 km) was three times higher than during periods that were ice free (3 walrus sightings/1,000 km). The sighting rate from stationary vessels in areas where ice concentrations were >0–3% (0.6 sightings/10 h) was higher than in areas that were ice free (0.3 walrus sightings/10 h). The low amount of effort in both the moving and stationary >0–3% categories precludes meaningful statistical comparisons between the rates.

Pacific Walrus Sighting Rates by Week

On a weekly basis, there was limited effort in areas where RSLs were <120 dB re 1 µPa (rms SPL); therefore, effort and sightings were pooled in order to compare the overall sighting rates of Pacific walrus by week. Rates of walrus sightings were relatively low until the week of 23 August, which had the highest sighting rate for moving vessels (10.9 walrus sightings/1,000 km) and stationary vessels (0.76 walrus sightings/10 h; Figure 6.8 and 6.9). The sighting rate declined in later weeks but still remained relatively high. The numbers and timing of walrus sightings reported from past oil and gas monitoring programs are highly variable and walrus sightings tend to be influenced by time periods when walrus are moving to and from the Alaskan Chukchi Sea coast (USFWS 2013; LGL and JASCO 2014).

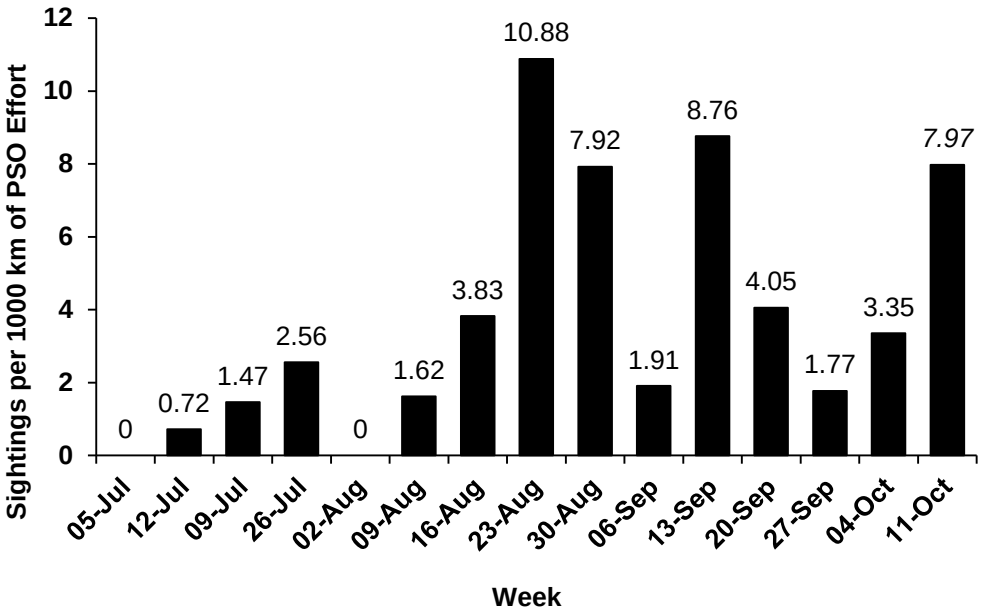

FIGURE 6.8. Walrus sighting rates by week from moving project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Italicized numbers indicate that the sighting rate may not be reliable due to a limited amount of observation effort having occurred within the category. Effort and sightings data were pooled due to limited effort in RSL bins.

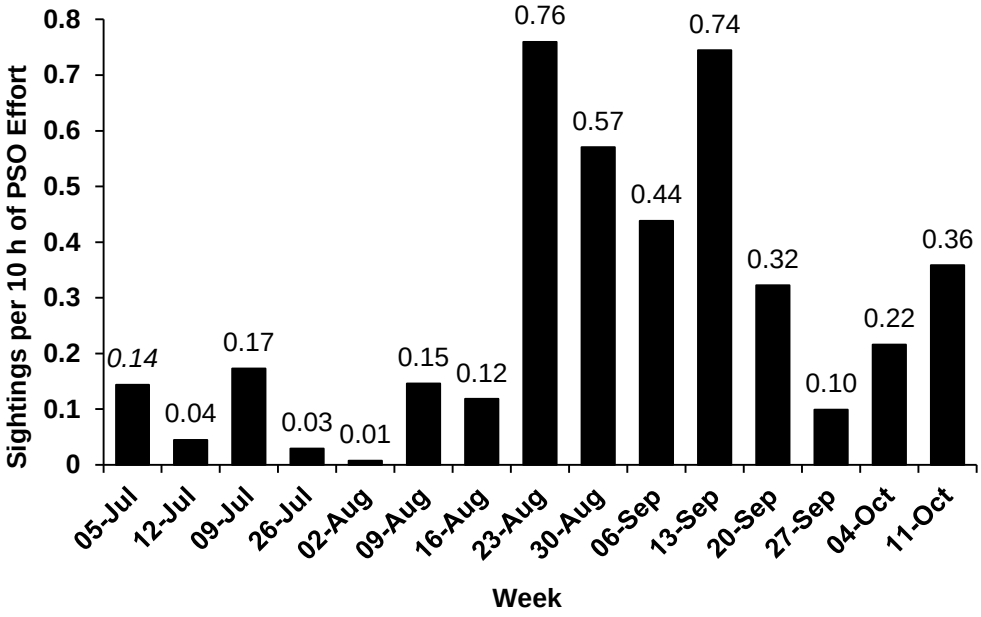

FIGURE 6.9. Walrus sighting rates by week from stationary project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015. Italicized numbers indicate that the sighting rate may not be reliable due to a limited amount of observation effort having occurred within the category. Effort and sightings data were pooled due to limited effort in RSL bins.

Pacific Walrus Distribution and Behavior

As discussed in Chapter 4, the PSOs' primary duty was to implement mitigation rather than collect extensive behavioral data. Marine mammal behaviors and reactions were difficult to observe because individuals and/or groups of animals typically spent most of their time below the water surface and could not be observed for extended periods. Relevant behavioral data collected include estimated closest observed point of approach (CPA), direction of movement relative to the vessel, initial behavior of the animal, reaction of the animal to the vessel presence or activity, and duration of the sighting. Sightings of walrus on ice are considered separately from walruses in water in the analyses below, because walruses hauled out on ice would not have been exposed to RSLs from drilling or related support activities that were comparable with those in the water at the same location. We present stationary and moving vessel data from all project vessels in the Chukchi Sea Activity Area.

Pacific Walrus Closest Point of Approach

To avoid biasing results, the average CPA of walruses was calculated using only sightings that occurred during periods of effort that met the criteria for being able to reliably detect walruses (see Chapter 4 and Appendix F). Of the 500 total sightings of walruses, 422 met those criteria (417 sightings of walruses in water, five sightings of walruses on ice). The CPA distances of Pacific walruses on ice and in water were considered separately.

From moving vessels, CPA distances of walruses in water ranged from 1 to 1,766 m from the observer station with a mean of 293 m. From stationary vessels, CPA distances of walruses in water ranged from 0 to 2,044 m with a mean of 295 m. For walruses in water observed from moving vessels, the overall mean CPA distance in areas where RSLs were ≥120 dB re 1 μPa (rms SPL; 322 m) was large than, but not significantly different from, the overall mean CPA distances to vessels where RSLs were <120 dB re 1 μPa (rms SPL; 201 m) (Wilcoxon rank sum test, $W= 2153.5$, $p = 0.0711$) (Figure 6.10). Limited sample size in the <120 dB re 1 μPa (rms SPL) category precluded meaningful statistical comparison of CPA distances of walruses sighted from stationary vessels (Figure 6.11).

Mean CPA distances for walruses on ice were noticeably larger than those for walruses in water. Walruses can be detected at greater distances on ice than in water and vessels maintained distances of >800 m (0.5 mi) from walruses observed on ice per the LOA. Of the 14 total sightings of walruses on ice, ten were initially observed at ≥4 km from the vessel. Of the five total sightings on ice that met detection criteria, the mean CPA distance for walruses on ice from moving vessels was 3,618 m, and from stationary vessels it was 5,339 m. The closest CPA distance of a sighting of walruses on ice was 977 m from the observer station.

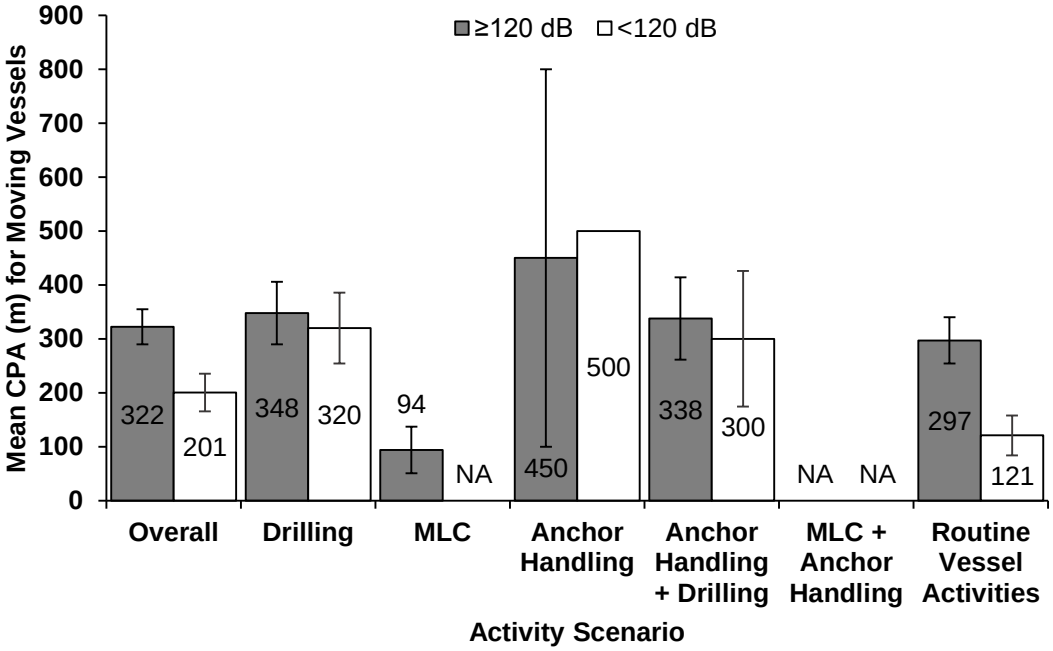

FIGURE 6.10. Comparison of mean Pacific walrus CPA distances in water by vessel activity from moving project vessels during Shell's exploratory drilling operations in the Chukchi Sea, 2015. The "Overall" category includes CPA distances from sightings recorded within all six of the other categories shown. Error bars represent standard error of the mean where n > 1. NA represents a sample size of zero.

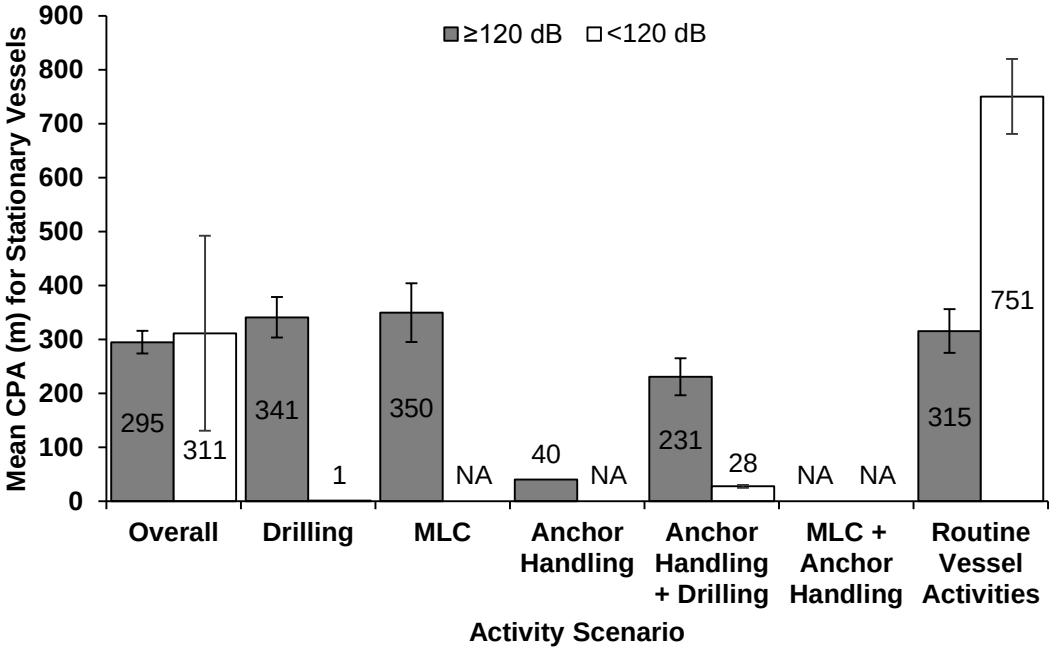

FIGURE 6.11. Comparison of mean Pacific walrus CPA distances in water by vessel activity from stationary project vessels during Shell's exploratory drilling operations in the Chukchi Sea, 2015. The "Overall" category includes CPA distances from sightings recorded within all six of the other categories shown. Error bars represent standard error of the mean where n > 1. NA represents a sample size of zero.

Pacific Walrus Movement

Nearly half of walrus movements in relation to both moving and stationary vessels was neutral (49% each; Figures 6.12 and 6.13). The second most common movement behavior from both moving and stationary vessels was swim toward (17% and 28%, respectively), followed by swim away (19% and 13%, respectively). Of the 317 walrus sightings in water from stationary vessels in areas where RSLs were ≥120 dB re 1 µPa (rms SPL), walruses were more than twice as likely to be observed swimming toward a vessel than swimming away. This does not suggest that walruses avoided project vessels in areas of higher RSLs, at least during the time that walruses were observed at the surface. Sample size for walruses observed in water from stationary vessels in areas of lower RSLs precluded meaningful comparisons (seven sightings).

Of the eight sightings of walruses on ice observed from moving vessels, seven were recorded as unknown movement relative to the vessel and one was recorded as no movement. Of the six sightings of walruses on ice from stationary vessels, all six were recorded as unknown movement relative to the vessel.

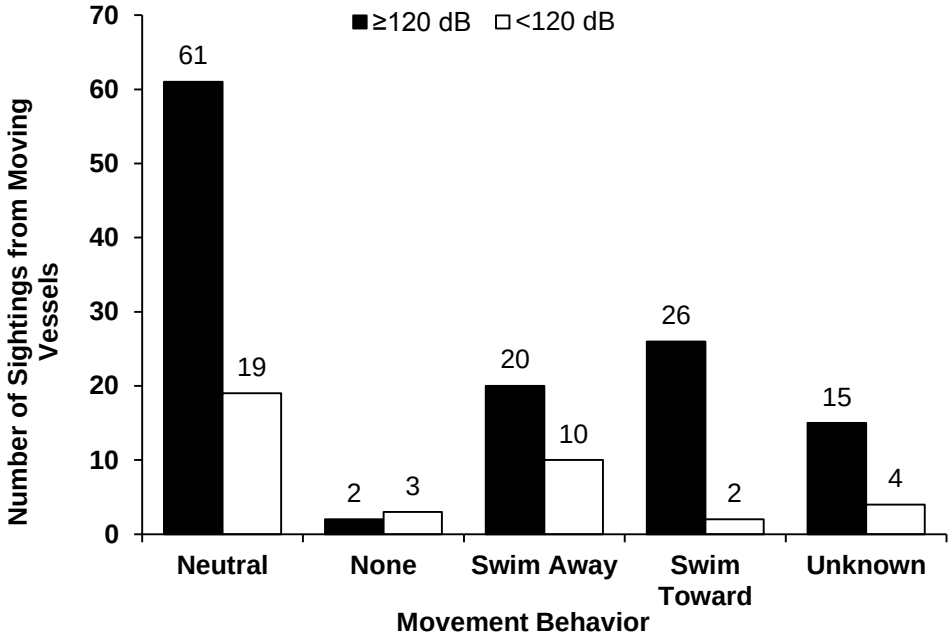

FIGURE 6.12. Total number of walrus in-water sightings within each category of movement (relative to a vessel) from moving vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL), during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

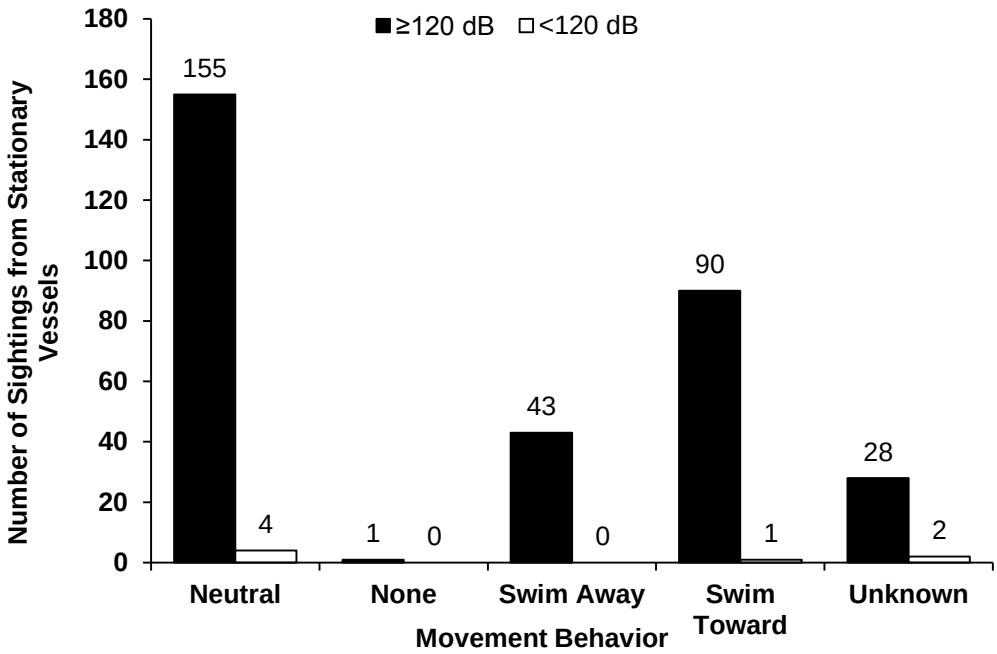

FIGURE 6.13. Total number of walrus in-water sightings within each category of movement (relative to a vessel) from stationary vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL), during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Pacific Walrus Initial Behavior

The most commonly recorded behavior for walrus sightings from both moving and stationary vessels was look (28% and 33%, respectively; Figures 6.14 and 6.15). The next two most commonly recorded behaviors for sightings from both moving and stationary vessels were swim (21% and 14%, respectively) and travel (15% and 16%, respectively). "Other" behavior consists of less frequently observed behaviors: blow, float on back, log, mill, other (not categorized), porpoise, raft, rest, surface active, sink, thrash, and wake ride. There does not appear to be a consistent difference in initial behavior recorded for walruses in areas where RSLs were ≥120 dB re 1 µPa (rms SPL) versus areas where RSLs were <120 dB re 1 µPa (rms SPL).

Of the eight sightings from moving vessels and six sighting from stationary vessels of walruses hauled out on ice, all 14 had a recorded behavior of rest.

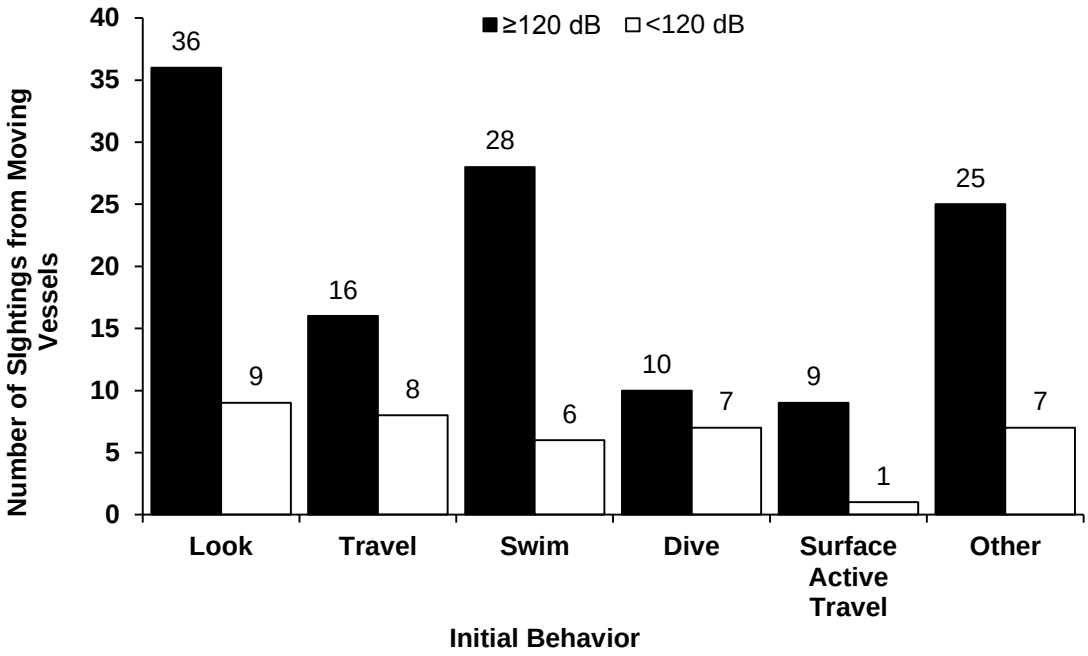

FIGURE 6.14. Total number of walrus in-water sightings within each category of initial behavior from moving vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL), during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

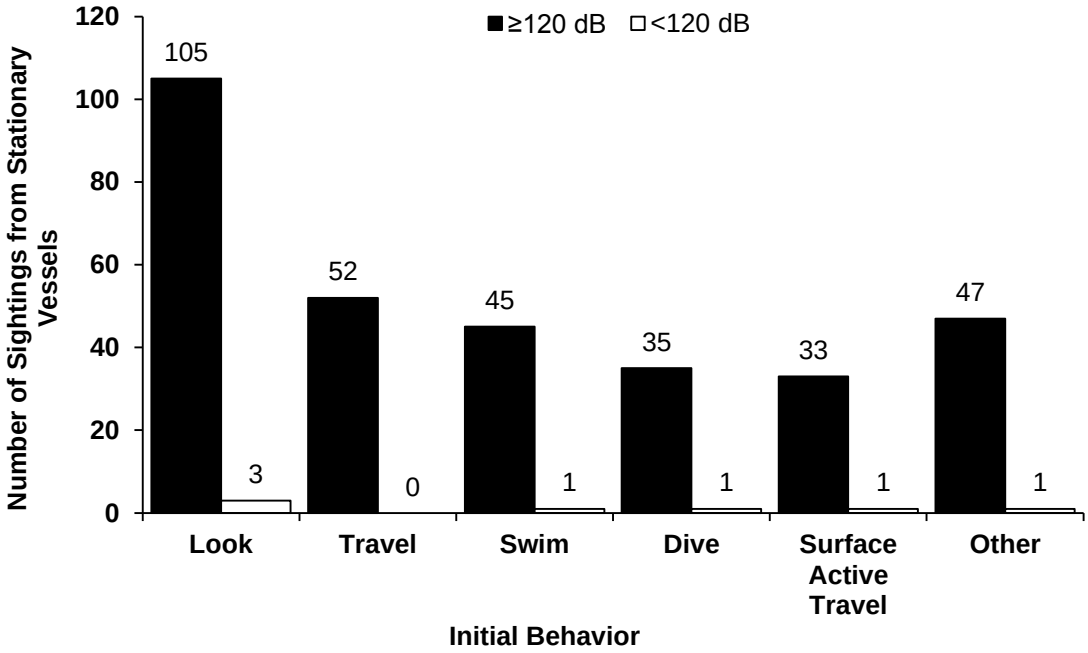

FIGURE 6.15. Total number of walrus in-water sightings within each category of initial behavior from stationary vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL), during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Pacific Walrus Reaction Behavior

Walruses observed from moving and stationary vessels were most often recorded as having no observable reaction to the vessel (45% and 46%, respectively; Figures 6.16 and 6.17). The most common observed reaction of walruses to both moving and stationary vessels was looking at the vessel (44% and 43%, respectively). The next most commonly observed reaction for sightings from both moving and stationary vessels was change in direction (6% and 10%, respectively). "Other" reactions observed by PSOs include: decrease in speed, increase in speed, splash, and bow or wake riding. There does not appear to be a consistent difference in reaction behavior recorded for walrus in areas where RSLs were ≥120 dB re 1 μPa (rms SPL) versus areas where RSLs were <120 dB re 1 μPa (rms SPL).

Of the nine sightings of walruses from PSOs on the *Polar Pioneer* during drilling activities, three sightings were recorded as having no reaction to the vessel, five sightings were recorded as looking at the vessel, and one sighting was recorded as changing direction. PSOs on the *Polar Pioneer* during MLC construction had one walrus sighting with a recorded reaction of looking at the vessel. Of the seven walrus sightings recorded by a vessel actively engaged in anchor handling, three sightings were recorded as having no reaction to the vessel, three sightings were recorded as looking at the vessel, and one sighting was recorded as changing direction.

Of the eight sightings from moving vessels and six sightings from stationary vessels of walruses hauled out on ice, all 14 were recorded as having no reaction to the vessel.

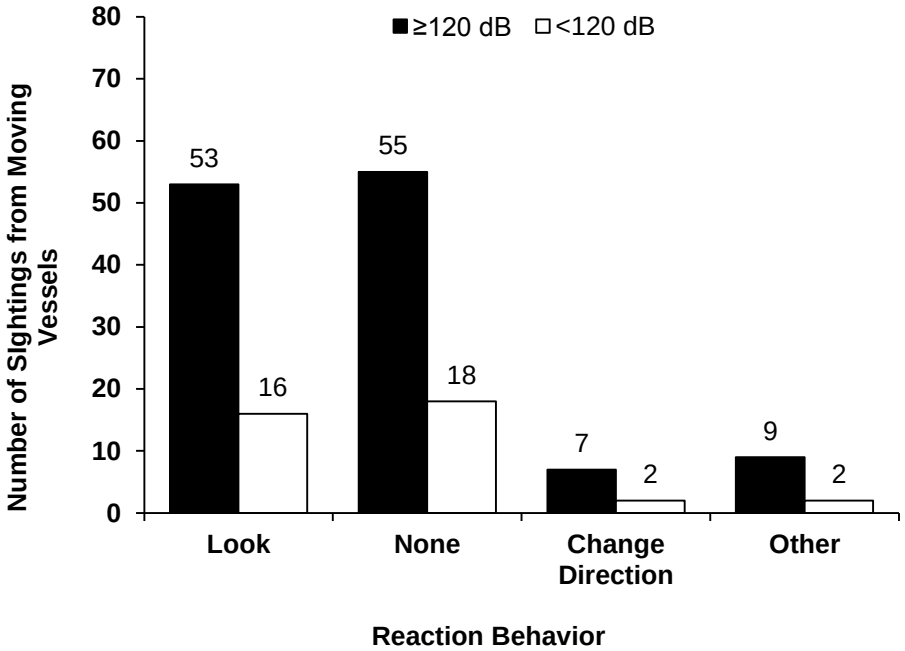

FIGURE 6.16. Total number of walrus in-water sightings within each category of reaction behavior from moving vessels, inside and outside areas where RSLs were ≥120 dB re 1 μPa (rms SPL), during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

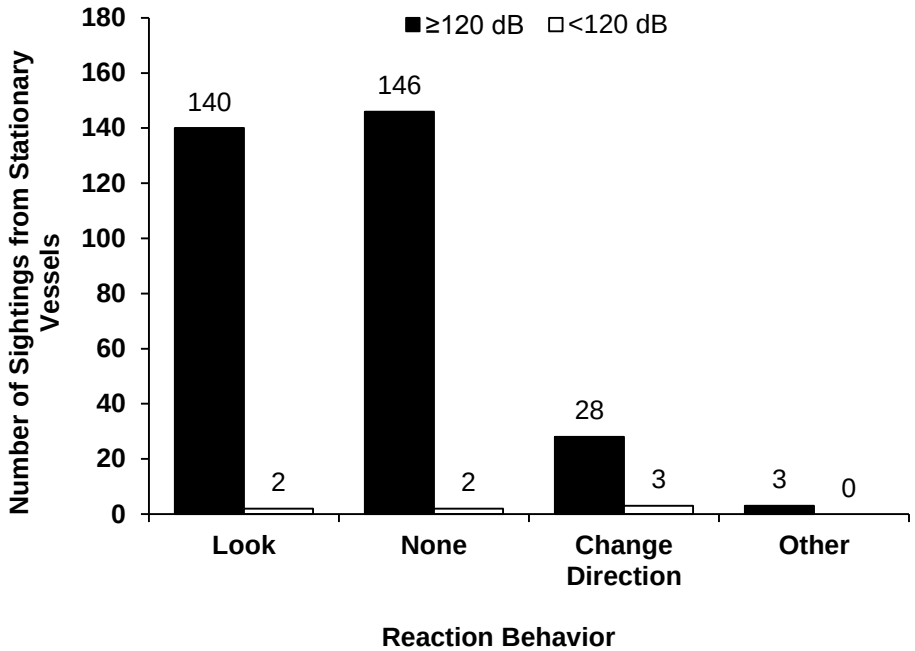

FIGURE 6.17. Total number of walrus in-water sightings within each category of reaction behavior from stationary vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL), during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Pacific Walrus Response to Vessel Activities

The following analysis uses the USFWS classification and terminology for behavioral responses of Pacific walruses to industrial activities as described in the Incidental Take Regulation (USFWS 2013). The numbers of individual Pacific walruses and associated response behaviors to vessels engaged in specific activities are shown in Table 6.2. Walruses were observed on ice only during ice scouting activities; all other responses were from walruses in water. All individuals in a group are assigned the strongest reaction shown by any individual in that group (e.g., if one walrus in a group looks at the vessel, all individuals in the group are assigned an attention response). The vast majority of individual walruses (72%) encountered during operations in 2015 did not exhibit an observable response to exploration activities. Walruses showed no observed avoidance or flight from drilling activities or anchor handling activities. Of the 11 walruses observed from vessels when helicopter operations were occurring, 27% had an avoidance response. Approximately 6% of walruses were observed "avoiding" or "fleeing" vessels engaged in routine vessel operations.

TABLE 6.2. Comparison of Pacific walrus responses, by number of individuals, to specific vessel activities during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

	Walrus Response				
Vessel Activity	**None**	**Attention**	**Approach**	**Avoidance**	**Flee**
Drilling Activities	1	1	1	0	0
Ice Scouting	615	6	1	1	0
Anchor Handling	4	3	2	0	0
Helicopter Takeoff/Landing	4	3	1	3	0
Routine Vessel Operations	386	287	30	31	17

Polar Bear Sightings

PSOs observed five sightings of five individual polar bears from the project vessels in the areas where RSLs were ≥120 dB re 1 µPa (rms SPL; Table 6.3). There was one polar bear recorded by PSOs on a moving vessel and four polar bears observed by PSOs on stationary vessels. Two polar bears were observed during the activity scenarios: one during drilling, the second during concurrent anchor handling and drilling activities. Of the five bears observed, the two sightings observed on 2 September are believed to be the same bear (Figure 6.18) because of the close temporal and spatial proximity of the recorded sightings. All polar bear sightings occurred in areas with high PSO effort (Figure 6.18).

TABLE 6.3. Total number of polar bear sightings (number of individuals) from moving and stationary project vessels, inside and outside areas where RSLs were ≥120 dB re 1 µPa (rms SPL), in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

Polar Bear	**≥120 dB**	**<120 dB**	***Total***
Moving Vessels	1 (1)	–	***1 (1)***
Stationary Vessels	4 (4)	–	***4 (4)***
Total Polar Bear	***5 (5)***	–	***5 (5)***

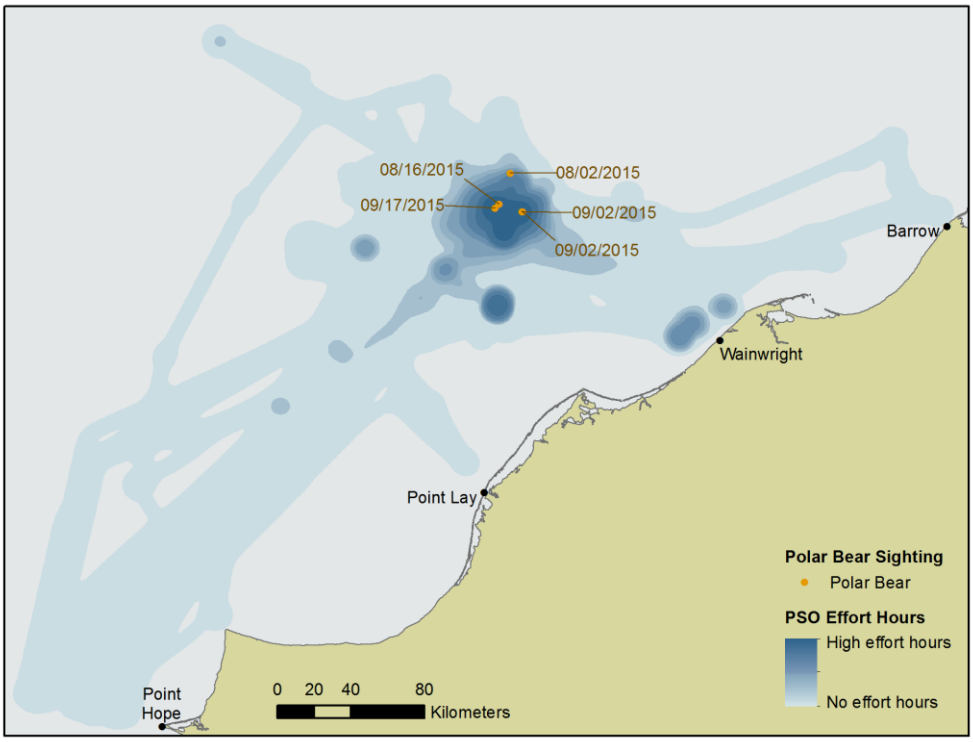

FIGURE 6.18. Location of polar bear sightings and effort hours from project vessels in the Chukchi Sea Activity Area during Shell's exploratory drilling operations, 2015.

Polar Bear Sighting Rates

Four of the polar bear sightings occurred during low visibility conditions (<2 km of visibility) and one sighting was during a high sea state; therefore, none of the sightings met the criteria for inclusion in calculating sighting rates (see Chapter 4 and Appendix F for sighting rate criteria).

Polar Bear Distribution and Behavior

The one polar bear sighting from a moving vessel had a CPA distance of 50 m and was observed while the vessel was running weather patterns. The sighting had a recorded movement of neutral in relation to the vessel, an initial behavior of look, and a reaction to the vessel of looking at the vessel.

Of the four polar bear sightings from stationary vessels, the CPA distances ranged from 20 to 300 m. The polar bear observed at 20 m from the observer station was observed while the vessel was idle, had a recorded behavior of swimming, and had no recorded reaction to the vessel. Two polar bear sightings made within minutes of each other from vessels that were in communication and located next to each other were likely of the same polar bear; however, PSO records do not clearly state this. The CPA distance was recorded as 300 m from one vessel and 50 m from the other. Both vessels were on DP and one was performing ROV operations. Both vessels recorded the initial behavior as looking and the reaction to the vessel as looking at the vessel. The fourth polar bear sighting from a stationary vessel was observed from a support vessel near the *Polar Pioneer* during drilling activities. The CPA distance to the observing vessel was recorded as 150 m; the bear was observed looking at the *Polar Pioneer* and then swimming away from the vessel.

Literature Cited

LGL Alaska Research Associates, Inc., JASCO Applied Sciences, Inc., and Greeneridge Sciences, Inc. 2014. Joint Monitoring Program in the Chukchi and Beaufort Seas, 2012. LGL Alaska Final Report P1272-2 for Shell Offshore, Inc., ION Geophysical, Inc., and Other Industry Contributors, Nat. Mar. Fish. Serv., and U.S. Fish and Wildlife Serv.. 320 p. plus appendices.

USFWS. 2013. Marine mammals; incidental take during specified activities, final rule. **Fed. Regist.** 78(113, 12 June):35364–35427.

7. MITIGATION MEASURES IMPLEMENTED AND EXPOSURE ESTIMATES[7]

Mitigation Measures Implemented

The implementation of mitigation measures during Shell's 2015 exploratory drilling program in the Chukchi Sea spanned all aspects of the operation. Mitigation measures were intended to reduce potential impacts to marine mammals and subsistence activities from a wide range of vessel activities and also from fixed-wing and rotary aircraft. Specifically, in the Chukchi Sea Activity Area, vessel activities related to transit, drilling, handling and setting of the anchors used to moor the *Polar Pioneer* and *Noble Discoverer*, and ice scouting and management activities were all mitigated by various actions requested by PSOs or implemented directly by vessel crew. Vessel-based PSOs also played a role in the routing of aircraft to minimize potential impacts on marine mammals, particularly for helicopters used to facilitate offshore crew changes. In accordance with the Plan of Cooperation, potential impacts to local subsistence activities were mitigated by the timing and location of Shell's operations in the Chukchi Sea, the implementation of a Subsistence Advisor Program with twice-daily teleconference calls, and through communications from each vessel to the nearest communication center every six hours. Shell did not conduct ZVSP surveys at the Burger drill sites in 2015, which precluded the establishment of 180 and 190 dB re 1 μPa (rms SPL) exclusion zones for marine mammals around the *Polar Pioneer* and *Noble Discoverer* as stipulated for periods with active airgun operations.

The following sections describe mitigation measures implemented during routine vessel activities and during the specific activity scenarios described in the IHA and LOA applications. Mitigation measures during routine vessel activities were typically reactive (i.e., reducing speed during transit for an observed cetacean). The IHA and LOA stipulated additional monitoring and mitigation requirements during specific activities, such as ice management, due to the increased potential of disturbing marine mammals. A third section compares implemented mitigation measures that were clearly required by the IHA and LOA with those that were implemented pro-actively or well before criteria in the IHA and LOA were met.

Mitigation Measures during Routine Vessel Activities

The most common forms of mitigation implemented by PSOs aboard vessels during 2015 in the Chukchi Sea were reductions in vessel speed and alterations of vessel heading during routine vessel operations (e.g., transit; Table 7.1). These actions were intended to maintain distance from marine mammals sufficient to limit disturbance and avoid separating individuals from groups of marine mammals. Other mitigation measures implemented by PSOs aboard vessels included postponement of equipment deployments over the side of a vessel (e.g., hydrophone recorders and remotely operated vehicles) and other delays in operational activity (e.g., cargo transfers between vessels) due to the presence of marine mammals in the immediate area.

By L.N. Bisson, L.A. Ackein, and D.S. Ireland.(LGL)

TABLE 7.1. Mitigation measures implemented during routine vessel operations for all species groups during Shell's exploratory drilling program in the Chukchi Sea, 2015.

Species Group	Speed Reduction	Course Alteration	Other Mitigation	*Total*
Cetaceans	9	2	1	***12***
Pacific Walrus	19	9	8	***36***
Polar Bear	1	--	--	***1***
Seals	--	2	--	***2***
Unknown	1	--	--	***1***
Total	***30***	***13***	***9***	***52***

Vessel transit routes through the Chukchi Sea and within the drilling area were altered on occasion as a result of PSOs on one vessel notifying other vessels of the presence of groups of walruses in a specific area. These areas were then avoided whenever possible. Inter-vessel communication by PSOs was a standard practice throughout the exploratory drilling program to ensure awareness of the distribution of marine mammals across the entire project area. In addition, sightings information was summarized at shore-based offices in Anchorage and routinely communicated to all vessel PSO crews to increase awareness of marine mammal distribution within the Chukchi Sea, particularly as distributions changed throughout the season.

Of the nine mitigation measures recorded as "other", three involved re-routing or delaying the approach of an inbound helicopter due to marine mammals in the vicinity—two involving Pacific walruses within 500 m of the vessel and one gray whale approximately 1,000 m from the vessel. The remaining six mitigation measures categorized as "other" involved a vessel delaying or aborting planned vessel operations due to the presence of marine mammals. All six operational delays involved the presence of one or several Pacific walruses in the immediate vicinity of a vessel while it was intending to transition from stationary to moving, transfer cargo or personnel between vessels, or deploy equipment into the water. On these six occasions, operations were delayed or postponed until the sighting had concluded or the PSOs and vessel crew felt that impact to marine mammals in the area had been minimized (e.g., marine mammal was no longer in the area required for operations).

Crew-change helicopter flight plans maximized onshore flight corridors to reduce aircraft activity over water, particularly in areas where marine mammals were known to be hauled out on ice. Vessels with helicopter decks served as the primary crew-change platforms within the program. These vessels were moved away from the main ice edge during helicopter operations to minimize potential impacts on marine mammals in accordance with permit stipulations. Vessels with helicopter decks were moved to distances >7 km (4.3 mi) from the main ice edge prior to helicopter flights to/from the vessel throughout the season as required by the LOA and Exploration Plan approval. See Chapter 8 for fixed-wing survey protocols in the Chukchi Sea, including minimum flight altitudes to reduce potential impacts to marine mammals.

As noted in Chapter 2, PSOs aboard each vessel contacted local communication centers located in coastal Chukchi Sea villages every six hours. These routine communications were designed to avoid conflicts between local subsistence users and Shell's operations. No conflicts were reported between Shell vessels and subsistence users in the Chukchi Sea during Shell's 2015 exploratory drilling program.

Mitigation Measures during Specific Activities

Ice scouting and management activities in the Chukchi Sea during 2015 involved significant communication between PSOs and vessel operators. Whenever possible, these activities were restricted to periods with good visibility conditions to allow for large detection distances of marine mammals in the area prior to approaching sea ice. Walruses hauled out on ice were often detected by PSOs using "Big-Eye" binoculars aboard ice-management vessels at distances between 5 and 8 km (3.1 and 5.0 mi). The location of these animals was communicated to vessel operators and shore-based project managers, and distances from animals were maintained or increased. As discussed in Chapter 2, only small amounts of hazardous ice were managed in the Chukchi Sea Activity Area. All operational decisions related to ice scouting and management involved significant assessment of the distribution of marine mammals known to be in the area prior to any detailed instructions being delivered from Shell's shore-based management team in Anchorage to vessels. Seven mitigation measures were requested by PSOs during ice scouting activities (five speed reductions, two course alterations), and one mitigation measure was requested during ice management activities. This request occurred on the *Nordica* when it was approaching a piece of ice it intended to manage. As the vessel neared the ice, a PSO observed three seals in the process of hauling out of the water through a hole near the center of the piece of ice. The PSO requested a course alteration to avoid the ice and no further attempts to manage the piece of ice were made.

Beyond requirements associated with routine vessel activities, the IHA and LOA did not include specific distances within which marine mammal sightings would have required a temporary reduction or stoppage of drilling, MLC construction, or anchor handling activities. PSOs on vessels actively engaged in drilling, MLC construction, or anchor handling did record sightings, but none of these sightings caused PSOs to request proactive mitigation measures or mitigation measures required during routine vessel activities.

Required versus Pro-active Mitigation Measures

As described in Chapter 4, mitigation requests made by PSOs during the season could be placed into two general categories: mitigation measures clearly required by stipulations in the IHA and LOA based on specific distances or group sizes and pro-active mitigation measures implemented well in advance of requirements (e.g., at distances much greater than that required by the authorizations or for individual animals when mitigation was only required for groups of animals; Table 7.2). Some additional mitigation measures also occurred for environmental reasons, typically reductions in speed due to limited visibility. These are not discussed here unless the mitigation request corresponded directly to a marine mammal sighting.

In order to minimize potential impacts to marine mammals observed near vessel operations, PSOs regularly requested mitigation measures be implemented well before marine mammals approached within the distance stipulated by the permits. Often, pro-active mitigation efforts were the result of a discussion between the PSOs and vessel crew to determine whether an observed marine mammal outside of minimum approach distances could be potentially impacted by current or planned operations. For example, once the vessel crew had been notified by PSOs that a cetacean had been observed forward of the vessel, the vessel would often elect to reduce speed at the time of the notification, instead of waiting for the mammal to be observed closer to or at the permit-stipulated distance.

TABLE 7.2. Mitigation measures for all species groups, by required or pro-active.

Species Group	Permit Required	Pro-active	*Total*
Cetaceans	6	6	***12***
Pacific Walrus	--	42	***42***
Polar Bear	--	1	***1***
Seals	--	4	***4***
Unknown	--	1	***1***
Total	***6***	***54***	***60***

All 42 mitigation measures enacted in the 2015 season to minimize potential impacts on observed Pacific walruses were considered pro-active, either because the mitigation measures were enacted while the marine mammals were well outside of minimum permitted distances or because the number of individuals did not require mitigation. There were two mitigation measures implemented for Pacific walruses on ice and these occurred at distances exceeding the minimum distance stipulated in the permits (Table 7.3). PSOs reported these sightings to the vessel crew, and the decision was made in both instances to maintain or increase the distance between the vessel and observed marine mammals based on the initial sighting distance.

Permit stipulations governing vessel activity near Pacific walruses in water included a minimum distance requirement to groups of 12 individuals or more. PSOs and vessel crews enacted 40 mitigation measures for Pacific walruses in water when group sizes were smaller than 12 (Table 7.3). Group size of these 40 sightings ranged from one to nine individuals, with an average of two individuals. The average CPA distance for Pacific walrus sightings in water in which pro-active mitigation measures were enacted was 242 m, with a range of 0–1,000 m (Table 7.4). The one sighting with a CPA distance of 0 m, meaning that at least one animal was observed to make contact with the vessel, was recorded from a stationary vessel.

TABLE 7.3. Mitigation measures implemented for Pacific walruses.

Sighting Location	Speed Reduction	Course Alteration	Other	*Total*
On Ice	1	1	0	***2***
In Water	23	9	8	***40***
Total	***24***	***10***	***8***	***42***

TABLE 7.4. Distances of Pacific walrus sightings in water for which mitigation measures were implemented.

Call Type	Mean CPA[a] (m)	s.d.	Range (m)	*n*
Speed Reduction	301	319	2-1000	***23***
Course Alteration	142	100	75-400	***9***
Other	185	198	0-417	***8***
Total	***242***	***267***	***0-1000***	***40***

[a] CPA=*Closest Point of Approach.*

Estimated Number of Marine Mammals Present and Potentially Affected

It is often difficult to estimate "take by harassment" for several reasons: ***(1)*** The relationship between the number of marine mammals that are observed and the number actually present is uncertain; ***(2)*** The most appropriate criteria for take by harassment are uncertain and presumed to vary among different species, individuals within species, activities that the individuals are involved in, and situations in which the animals are encountered; ***(3)*** The level of exposure to RSLs from activities varies depending on the animals depth in the water, and will be considerably reduced for animals near the surface (Greene and Richardson 1988; Tolstoy et al. 2004a,b) and even further reduced for animals that are out of the water on ice or land.

Potential marine mammal exposures to continuous sounds from drilling and related support activities in the Chukchi Sea are described below in detail. Two methods were used to estimate the number of marine mammals exposed to continuous sounds strong enough that they might have caused disturbance. The procedures included estimates based on ***(A)*** the direct observations of marine mammals in areas where received sounds were predicted to be ≥120 dB re 1 μPa (rms SPL) by the first approach (Method 1) to acoustic modeling described in Chapter 3, which most closely reflects the activity scenarios described in the IHA and LOA applications, and ***(B)*** the multiplication of marine mammal density estimates for the Chukchi Sea by the areas where received sounds were predicted to be ≥120 dB re 1 μPa (rms SPL) by the first approach (Method 1) to acoustic modeling described in Chapter 3, which most reflects the activity scenarios described in the IHA and LOA applications. The actual number of individuals exposed to, and potentially impacted by, drilling and specific support vessel activities likely was between the ranges of estimates provided in the following sections. Further details about the methods and limitations of these estimates are provided below.

Disturbance and Safety Criteria

IHAs and LOAs typically include provisions to minimize the possibility that marine mammals close to the sound source might be exposed to levels of sound high enough to cause short- or long-term hearing loss or other physiological injury. Given the nature of the operations and mitigation measures, no serious injuries or deaths of marine mammals were anticipated as a result of the activities, and no such injuries or deaths were observed or attributed to these activities. Nonetheless, the sound produced by exploratory drilling and associated operations described in Chapter 2 had the potential to "take" marine mammals by harassment.

Under current NMFS guidelines (e.g., NMFS 2001), "safety radii" to prevent Level A takes of marine mammals around sound sources are defined as the distances within which RSLs are ≥180 dB re 1 μPa (rms SPL) for cetaceans and ≥190 dB re 1 μPa (rms SPL) for pinnipeds. The ≥180 and ≥190 dB re 1 μPa (rms SPL) guidelines were also employed by USFWS for the species under its jurisdiction (≥180 and ≥190 dB re 1 μPa (rms SPL) for walrus and polar bear, respectively) in the LOA issued to Shell. Those safety radii are based on a cautionary assumption that other sounds at lower received levels will not injure these mammals or impair their hearing abilities, but that higher received levels might have some such effects. Shell did not request Level A takes for in-water sounds and planned to implement mitigation measures to prevent exposures at those levels. However, the planned ZVSP surveys were not conducted, so no pulsed sounds were generated, and sound levels above the ≥180 and ≥190 dB re 1 μPa (rms SPL) guidelines were not generated by other exploration drilling activities.

Marine mammals exposed to pulsed sounds ≥160 dB re 1 μPa (rms SPL) are assumed by NMFS to be potentially subject to behavioral disturbance. NMFS assumes that marine mammals exposed to continuous sounds from drilling activities with received levels ≥120 dB re 1 μPa (rms SPL) are likely to be disturbed. That assumption is based mainly on data concerning behavioral responses of baleen whales, as summarized by Richardson et al. (1995) and Gordon et al. (2004). The following sections provide estimates of the number of individuals potentially exposed to continuous sounds with received levels ≥120 dB re 1 μPa (rms SPL) generated during specific activity scenarios described in the IHA and LOA applications as predicted by the first approach (Method 1) to acoustic modeling described in Chapter 3, as this approach most closely reflects the activity scenarios in the IHA and LOA applications.

Estimates from Direct Observations

All marine mammal observations are included in the following exposure estimates based on direct observations, regardless of whether they met the data-analysis criteria for sighting rate calculations described in Chapter 4. As noted above, individuals were classified as exposed if the sighting was observed at any time within the average daily ≥120 dB re 1 μPa (rms SPL) acoustic footprint predicted by the first approach (Method 1) to acoustic modeling described in Chapter 3.

The number of individuals actually sighted by observers during drilling and related support activities is likely an underestimate of the number present near these operations. During daylight, animals are missed if they are below the surface when the ship is nearby. Other animals, even if they surface near the vessel, are missed because of factors limiting sightability (e.g., fog). Furthermore, marine mammals could not be seen effectively during periods of darkness, which increased as the operation progressed into late September. Animals may also have avoided the area where vessels were operating (see Richardson et al. 1995). Within the estimated exposure area, and perhaps farther away in the case of the more sensitive species and individuals, the distribution and behavior of pinnipeds and cetaceans may have been altered as a result of vessel activities. However, vessels frequently operated in close proximity to each other and PSOs routinely alerted PSOs on other vessels to the presence of marine mammals, resulting in the occasional double- and triple-counting of individuals. Individuals suspected to have been recorded from multiple vessels have not been removed from Table 7.5 as a conservative measure.

Estimates from Direct Observations of Cetaceans

During the specific activity scenarios described in the IHA and LOA applications, there were 27 individual cetaceans observed by PSOs aboard vessels where RSLs were ≥120 dB re 1 μPa (rms SPL) (Table 7.5). Nine of these individuals (33% of the total) were observed while only drilling with a support vessel on DP was occurring at Burger J. Of these nine, two individuals were observed by PSOs on the

Polar Pioneer. One gray whale had a CPA of 1,000 m and one unidentified mysticete whale approached the active drilling unit as close as 800 m.

Another 33% of the individual cetaceans observed where RSLs were ≥120 dB re 1 μPa (rms SPL) (seven sightings of nine individuals) were recorded during concurrent MLC construction at Burger J and anchor handling activities at Burger V. All seven sightings occurred on 8 August and 9 August. However, none of these cetaceans were observed by PSOs on vessels actually performing the anchor handling at Burger V and only one whale was observed by PSOs on the *Polar Pioneer* while the concurrent MLC construction occurred at Burger J. This unidentified mysticete whale was initially observed at 2,000 m swimming towards the *Polar Pioneer*, and was last observed 1,000 m away before it dove and was not seen again.

No cetaceans were observed where RSLs were ≥120 dB re 1 μPa (rms SPL) while only anchor handling was underway, but 7 sightings of 7 cetaceans were made by PSOs where RSLs were ≥120 dB re 1 μPa (rms SPL) while drilling with a vessel on DP at Burger J and anchor handling activities at Burger V occurred concurrently (Table 7.5). This included one gray whale observed by PSOs on the *Aiviq* while it was conducting anchor handling activities at Burger V. The CPA of the gray whale to the *Aiviq* was 1,763 m. One unidentified mysticete whale was observed by PSOs on the *Polar Pioneer* while it was drilling at Burger J. The CPA of the unidentified mysticete whale was 7,000 m, and due to the distance of the sighting the species could not be determined.

TABLE 7.5. Number of individual marine mammals by species observed in areas where received levels from specific activity scenarios were ≥120 dB re 1 µPa (rms SPL) during exploration drilling in the Chukchi Sea, 2015.

	Number of Individuals Exposed ≥120 dB re 1 µPa (rms SPL)					
Species	**Drilling Activities with Support Vessel using DP**	**MLC Construction**	**Anchor Handling Activities**	**Concurrent Anchor Handling and Drilling**	**Concurrent Anchor Handling and MLC Construction**	**Total**
Mysticetes						
Gray whale	3	0	0	1	5	***9***
Minke whale	1	0	0	0	0	***1***
Unid.mysticete whale	4	2	0	2	1	***9***
Unidentified whale	1	0	0	4	3	***8***
Pinnipeds						
Bearded seal	99	35	19	45	25	***223***
Ribbon seal	1	0	0	1	0	***2***
Ringed seal	38	15	14	5	11	***83***
Spotted seal	21	7	4	18	18	***68***
Pacific walrus	163	13	1	129	0	***306***
Unidentified pinniped	25	10	1	22	7	***65***
Unidentified seal	96	33	23	51	42	***245***
Ursids						
Polar bear	2	0	0	1	0	***3***

Estimates from Direct Observations of Seals

A total of 686 seals (650 different sightings) was observed by PSOs where RSLs were ≥120 dB re 1 μPa (rms SPL) (Table 7.5) during the specific activity scenarios described in the IHA and LOA applications. About half of these sightings were identified to species and ~32% were bearded seals, ~12% were ringed seals, and ~ 10% were spotted seals.

Nearly half (~41%) of all seal sightings where RSLs were ≥120 dB re 1 μPa (rms SPL) occurred during times when the *Polar Pioneer* was drilling with a supply vessel in DP. Of these, 99 individual seals were observed by PSOs on the *Polar Pioneer*. Seal sightings were usually brief in duration; however, some seals approached the *Polar Pioneer* and five individuals were identified and observed on multiple occasions over the season.

PSOs observed 100 seals where RSLs were ≥120 dB re 1 μPa (rms SPL) while only MLC construction was occurring at Burger J (Table 7.5). Of these, 14 sightings of 14 individual seals were observed by PSOs on the *Polar Pioneer*, including seven bearded seals, four ringed seals, and three unidentified seals.

PSOs recorded 61 individual seals from Shell vessels where RSLs were ≥120 dB re 1 μPa (rms SPL) when anchor handling was the only activity occurring (Table 7.5). Of these, only 13 sightings of 17 individual seals (28% of the total) were observed by PSOs on vessels that were directly involved in anchor-handling operations at the time of the sighting. These sightings included two bearded seals, nine ringed seals, one spotted seal, and five unidentified seals.

There were 142 seals (140 sightings) observed by PSOs aboard vessels where RSLs were ≥120 dB re 1 μPa (rms SPL) while drilling at Burger J was occurring concurrently with anchor handling at Burger V (Table 7.5). Of these, two unidentified seals were observed by PSOs on the *Ross* and the *Aiviq* while the vessels were conducting anchor handling activities at Burger V. PSOs on the *Polar Pioneer* observed 36 sightings of 36 individual seals (17 bearded seals, seven spotted seals, nine unidentified seals, and three unidentified pinnipeds) in the area immediately around the Burger J site where drilling activities were occurring.

A total of 103 seals was observed by PSOs aboard vessels where RSLs were ≥120 dB re 1 μPa (rms SPL) while MLC construction at Burger J was occurring concurrently with anchor handling activities at Burger V (Table 7.5). Seven individual seals (one bearded seal, two spotted seals, two unidentified seals, and two unidentified pinnipeds) were observed from vessels that were directly engaged in anchor handling activities. Twenty-two sightings of 26 individual seals were made by PSOs on the *Polar Pioneer*. These included six bearded seals, two ringed seals, four spotted seals, and 14 unidentified seals.

Estimates from Direct Observations of Pacific Walruses

During the specific activity scenarios described in the IHA and LOA applications, 206 sightings of 306 individual Pacific walruses were observed where RSLs were ≥120 dB re 1 μPa (rms SPL). Most of these walruses (~95%) were observed when drilling with a vessel on DP was occurring either alone or concurrently with anchor handling. The high proportion of sightings during these two activity scenarios resulted from most of the walrus sightings occurring in three distinct pulses when the ice edge was >200 km away, between 6 September and 20 September, when only these two activity scenarios took place. Numerous walruses from this total, however, were believed to be re-sightings of the same individuals because many comments in the PSO data for these sightings include descriptions that PSOs on other vessels were contacted about the sighting. However, it was not possible to determine precisely how many sightings represented new individuals versus re-sightings so none were excluded here.

There were 13 walruses (11 sightings) observed from vessels where RSLs were ≥120 dB re 1 μPa (rms SPL) during periods when only MLC construction was occurring (Table 7.5). Only one sighting of one walrus was made by PSOs on the *Polar Pioneer* while it constructed the MLC; the remaining sightings were recorded from nearby vessels.

PSOs recorded one sighting of an individual Pacific walrus from Shell vessels where RSLs were ≥120 dB re 1 μPa (rms SPL) when anchor handling was occurring (Table 7.5). This walrus was not observed from a vessel actually handling anchors at the time of the sighting.

Estimates from Direct Observations of Polar Bears

Three polar bears were observed where RSLs were ≥120 dB re 1 μPa (rms SPL) during the specific activity scenarios described in the IHA and LOA applications. Two individual polar bears were recorded by PSOs on stationary vessels using DP near the drill site; however, these sightings occurred within about 15 minute of each other from two nearby vessels, so it is likely that this was the same individual. A single polar bear was observed by PSOs aboard the *Champion* while anchor handling activities at Burger V and drilling activities at Burger J were occurring concurrently (Table 7.5). The *Champion* was stationary near Burger J and ~270 km away from the ice edge at the time of the sighting.

Estimates from Direct Observations from Ice Management Vessels during Ice Management Activities

Ice management activities occurred away from the drill sites in areas isolated from other vessels and in three very short, discrete time periods (see Chapter 2 for a more detailed description). Therefore, we did not include sightings from other vessels operating in the drilling-related exposure area in these estimates. Only marine mammals directly observed by PSOs aboard vessels actively managing ice are descried here as being exposed to sounds produced by ice management activities. PSOs on ice management vessels only sighted marine mammals during one of the three isolated ice management periods. Two seal sightings of four individuals, three unidentified seals and one ringed seal, were made by PSOs on the *Nordica*. The first sighting was of three individual unidentified seals observed 150 m away on an ice floe that was going to be actively managed. Approach of this ice floe was aborted when the seals were observed on the ice (see *Mitigation Measures during Specific Activity Scenarios* for more details). The reaction of the seals to the presence of the vessel was "looking." Since the seals were on ice and ice management was aborted, it is unlikely the seals were exposed to RSLs typically associated with ice breaking. The second sighting of one individual occurred after the *Nordica* broke an ice floe. The single ringed seal was observed ~100 m from the vessel in water surrounded by ice near the ice that had just been managed. The seal looked at the vessel and no other reaction was observed.

Exposure Estimates Calculated from Marine Mammal Densities

The number of marine mammals visually detected by PSOs likely underestimates the actual number of animals that were present. Distance sampling methods developed for estimating animal densities from survey data utilize correction factors to account for marine mammals that were not detected because of their distance from the survey platform, because they were simply missed by observers, and because they were not available at the surface to be detected (Buckland et al. 2001). In Shell's IHA application, densities calculated from line-transect surveys (with a few exceptions described in the application materials) were used to estimate the potential number of marine mammals exposed to specified RSLs by the proposed 2015 exploration drilling activities. The section below replicates the exposure estimation methods in the IHA application using those same density estimates, but the estimated area where RSLs were assumed to be ≥120 dB re 1 μPa (rms SPL) that appear in the IHA application have been replaced with the areas predicted to be ≥120 dB re 1 μPa (rms SPL) by acoustic modeling of actual 2015 activities. Chapter 3 described three different methods used to calculate acoustic footprints produced by 2015 exploration drilling and support

vessel activities. The three methods used different radial distances from the drill sites to determine whether support vessel activities were included in the modeled footprints. The first method, which included the drilling operations, support vessel activities within 1 km of the drill sites, and all ice management activities, is most consistent with the modeling approach used in the IHA Application. Therefore, the ensonified areas used in the calculations below are from the first approach (Method 1) to acoustic modeling described in Chapter 3.

The following density-based exposure estimates assume that all mammals present were well below the surface where they would have been exposed to RSLs as reported in Chapter 3. Some pinnipeds, cetaceans, and polar bears in the water might remain close to the surface, where sound levels would be reduced by pressure-release effects (Greene and Richardson 1988). Additionally, some marine mammals may have stayed away from sound sources through an avoidance response. Finally, some animals observed during the activities were hauled out on ice, particularly pinnipeds. Marine mammals on ice would not have been exposed to RSLs from drilling or related support activities that were comparable to those in the water at the same location.

Exposure Estimates Using IHA Application Densities

The densities used for the following exposure estimates include the cetacean and seal density estimates used in Shell's 2015 Chukchi Sea IHA application (Shell 2015), as well as polar bear (Evans et al. 2003) and walrus (Brueggeman et al. 1990) densities from aerial surveys in the vicinity of the Burger prospect area (Table 7.6). Marine mammal densities in the northeastern Chukchi Sea are likely to vary by season and habitat, particularly with the presence or absence of sea ice. Expected densities are provided for the July–August and September–October seasonal periods, and for open-water and ice-margin areas (Table 7.6).

The seasonal densities of marine mammals were then multiplied by the total area of water estimated to have been ensonified (i.e., exposed to sounds produced during drilling and related support activities; Table 7.7) based on the daily noise footprint modeling described in Chapter 3. This is mathematically equivalent to multiplying the individual daily ensonified areas by the densities and summing them over the duration of each season since the densities are assumed to remain the same throughout each season.

Variation in sea-ice cover within the project area was accounted for in the following ways. Drilling-related activities began in mid-July at the Burger Prospect, but only a small amount of sea ice was near enough to the drill sites to require ice management activities to occur (see Chapter 2 for a more detailed description of these activities). The area of water ensonified by those activities represents 7.4% of the total area ensonified during the July–August period. Therefore, ice-margin densities were applied to 7.4% of the total area ensonified to ≥120 dB re 1 μPa (rms SPL) and open-water densities were applied to the remaining 92.6% when calculating exposure estimates in the July–August period. Sea ice did not persist near the project area into the September–October period and Shell did not conduct ice-management activities in the Chukchi Sea during that period. Therefore, open-water densities were applied to 100% of the area where RSLs were ≥120 dB re 1 μPa (rms SPL) in the September–October period. This stratified-density approach is consistent with the methodology used in Shell's IHA application (Shell 2015), but the actual amount of ice management that occurred in 2015 was substantially less than accounted for in the application.

TABLE 7.6. Marine mammal densities in the Chukchi Sea used to calculate pre-season exposure estimates for Shell's 2015 exploratory drilling program.

	July - August[1]		September - October[2]	
Species	**Open-Water Density (# / km^2)**	**Ice-Margin Density (# / km^2)**	**Open-Water Density (# / km^2)**	**Ice-Margin Density (# / km^2)**
Odontocetes				
Monodontidae				
Beluga (*Chukchi Sea Stock*)	0.0010	0.0040	0.0009	NA
Beluga (*Beaufort Sea Stock*)	0.0000	0.0000	0.0091	NA
Narwhal	0.0000	0.0000	0.0000	NA
Delphinidae				
Killer whale	0.0001	0.0001	0.0001	NA
Phocoenidae				
Harbor porpoise	0.0022	0.0022	0.0021	NA
Mysticetes				
Bowhead whale	0.0010	0.0010	0.0230	NA
Fin whale	0.0001	0.0001	0.0001	NA
Gray whale	0.0080	0.0080	0.0040	NA
Humpback whale	0.0001	0.0001	0.0001	NA
Minke whale	0.0003	0.0003	0.0003	NA
Pinnipeds				
Bearded seal	0.0107	0.0142	0.0107	NA
Ribbon seal	0.0007	0.0007	0.0007	NA
Ringed seal	0.3668	0.4891	0.2458	NA
Spotted seal	0.0073	0.0098	0.0049	NA
Pacific walrus	0.0010	0.6169	0.0010	NA
Marine Fissiped				
Polar Bear	0.0001	0.0068	0.0001	NA

[1] The area of water exposed to received sounds from ice management activities was ~7.4% of the total July-August area. Therefore, ice-margin densities were applied to 7.4% of the total July-August area ensonified and open-water densities were applied to the remaining 92.6% of the total July-August area ensonified.

[2] Operations considered for density-based exposure estimates in Sep-Oct occurred exclusively in areas without ice cover. Therefore, ice-margin densities were not used for exposure estimate from this period.

TABLE 7.7. Seasonal daily average and total area ensonified (in km^2) to continuous sounds ≥120 re 1 μPa (rms SPL) from drilling and related support activities during Shell's 2015 exploratory drilling program in the Chukchi Sea.

Seasonal Period	Average Daily Area Exposed ≥120 dB re 1 μ Pa (rms SPL)	Total Activity Days in Period	Total Area Exposed ≥120 dB re 1 μ Pa (rms SPL)
July - August	201.1	56	11,262
September - October	202.1	35	7,074

Cetaceans

Table 7.8 shows the estimated numbers of cetaceans that may have been exposed to sounds from drilling and related support activities at received levels ≥120 dB re 1 μPa (rms SPL) based on the density estimates in Table 7.6 and the ensonified areas in Table 7.7. The estimated number of bowhead whale exposures has been calculated assuming 48-hour turnover of individuals occurring within ensonified areas as described in Shell's IHA application (Shell 2015). Approximately 24% of the estimated 340 cetaceans exposed to RSLs ≥120 dB re 1 μPa (rms SPL) in the Chukchi Sea during 2015 drilling activities would have been bowhead whales in the September–October period (Table 7.8). This is driven by the much higher expected bowhead whale densities in the Chukchi Sea during September–October compared with July–August (Table 7.6), despite the smaller total area ensonified during September–October (Table 7.7). A similar number of gray whales may have been exposed during the July–August period as a result of the higher expected density and the larger total ensonified area during that period compared with September–October. For all cetacean species, the total estimated exposures using pre-season densities and ensonified areas calculated from actual 2015 activities are substantially lower than those authorized in the IHA (Table 7.8).

Seals

The total number of seals estimated to have been exposed to continuous sounds ≥120 dB re 1 μPa (rms SPL) from drilling and related support activities in the Chukchi Sea during 2015 was 3,316 (Table 7.8). For consistency with the number of authorized exposures, the estimated number of ringed seal exposures has been calculated assuming 48-hour turnover of individuals occurring within ensonified areas as described in NMFS (2015). The majority of these would have been ringed seals during July–August given the higher estimated density for ringed seals than for other seal species in the Chukchi Sea (Table 7.6) and the larger total ensonified area during this period compared with September–October (Table 7.7). The remaining seal exposure estimates were comprised of relatively small numbers of bearded and spotted seals (Table 7.8). For all seal species, the total estimated exposures using pre-season densities and ensonified areas calculated from actual 2015 activities are substantially lower than those authorized in the IHA (Table 7.8).

Pacific Walruses

The total number of Pacific walruses estimated to have been exposed to continuous sounds ≥120 dB re 1 μPa (rms SPL) from drilling and related support activities in the Chukchi Sea during 2015 was 532 (Table 7.8). The majority of these estimated exposures would have occurred during July–August given the much higher expected densities during that period. The density estimates from Bruggeman et al. (1990) used in these calculations included animals hauled out on ice. Animals on ice would not have been exposed to underwater RSLs so this value is likely is an overestimate of actual exposure.

Polar Bears

The density-based exposure estimates to RSLs ≥120 dB re 1 μPa (rms SPL) of polar bears are shown in Table 7.8 and show that as many as eight polar bears may have been exposed during the 2015 activities. As with other marine mammals, polar bears on ice or near the surface would not have been exposed to RSLs as strong as those predicted by the noise footprints at the same distance as animals occurring at depth in the water column.

TABLE 7.8. Estimated numbers of individual marine mammals exposed to continuous sound levels ≥120 dB re 1 μPa (rms SPL) from drilling and related support activities during Shell's 2015 exploratory drilling program in the Chukchi Sea.

Species	Estimated Number of Individuals			Authorized
	July-August	September-October	Total	
Odontocetes				
Monodontidae				
Beluga (Chukchi Sea Stock)	14	6	20	344
Beluga (Beaufort Sea Stock)	0	65	65	1,318
Narwhal	0	0	0	0
Delphinidae				
Killer whale	1	1	2	14
Phocoenidae				
Harbor porpoise	25	15	40	294
Mysticetes				
Bowhead whale	6	81	87	1,038
Fin whale	1	1	2	14
Gray whale	90	28	118	834
Humpback whale	1	1	2	14
Minke whale	3	2	6	41
Pinnipeds				
Bearded seal	123	75	198	1,722
Ribbon seal	8	5	13	96
Ringed seal	2,117	869	2,986	25,217
Spotted seal	85	35	119	1,007
Pacific walrus	525	7	532	NA
Marine Fissiped				
Polar Bear	7	1	7	NA

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8. CHUKCHI SEA AERIAL SURVEYS[8]

Introduction

An aerial monitoring program for marine mammals was conducted from 7 July to 2 October 2015 in the Chukchi Sea in support of exploratory drilling activities by Shell Gulf of Mexico, Inc. (Shell). Surveys were flown to meet monitoring requirements and obtain data on the occurrence, distribution, and movements of marine mammals, particularly bowhead whales, other large whales, and walruses. Following the 2012 precedent, Shell again employed sensors to minimize human risk while collecting these data. Digital Single Lens Reflex (DSLR) cameras captured imagery during surveys conducted around drilling operations in the offshore Chukchi Sea with only the pilots on board the aircraft. The photographic equipment chosen could be used in Unmanned Aerial Systems (UAS) in the future and UAS are being considered to replace manned aerial surveys. Shell and LGL continue to develop alternative methodologies that are safer but equally effective in providing marine mammal distribution, density, and abundance data.

The 2015 aerial survey program, as in previous years, was designed to identify variation in marine mammal distribution and relative abundance in and around the area of operations in order to assess potential impacts. Aerial surveys were selected over vessel-based surveys because vessel surveys require much longer periods of time to cover the same area and have the potential to cause some disturbance themselves. Aerial platforms (manned or unmanned) minimize disturbance while allowing for the collection of unbiased data. The 2015 offshore survey area was designed to maximize effort to the north and south of the activity area and increase the likelihood of detecting a shift in bowhead distribution during the fall migration. Additionally, the initial survey area extended over HSWUA, which provided an opportunity to evaluate walrus presence, absence, and association with ice in a known feeding area. Sightings of all species contribute to the current knowledge and understanding of marine mammal species utilizing the dynamic northeastern Chukchi Sea environment and their potential responses to anthropogenic activities.

Bowhead whales are among the principal species of concern related to drilling operations in the Chukchi Sea. They are listed as endangered under the Endangered Species Act, they are hunted by local native communities, and most of the population migrates through the northeastern Chukchi Sea in proximity to where drilling operations occurred. Givens et al. (2013) estimated the Bering/Chukchi/Beaufort Sea (BCB) population to be 16,892 individuals in 2011 with an annual growth rate of 3.7%. Assuming a continuing annual population growth of 3.7%, the 2015 BCB bowhead population may have numbered around 19,534 animals. The annual subsistence harvest (landed animals) by Natives from Alaska, Russia, and Canada averaged 42 whales during 2008 through 2012 (Allen and Angliss 2015). Potential encounters with the exploration drilling activities in the Chukchi Sea were most likely during September, October, and November when bowhead whales migrate west through the Chukchi Sea (Mate et al. 2000; Quakenbush et al. 2007; 2009; 2010a,b; 2011).

In addition to bowheads, other cetacean species of interest in the survey area include beluga and gray whales. The eastern Chukchi Sea stock of beluga whales was estimated to contain ~3,710 individuals in 1991 (based on 1989–1991 aerial surveys), and the population size is considered stable (Allen and Angliss 2015). During June–July, the Chukchi Sea stock of beluga whales is typically found in nearshore waters and in lagoons along the Alaskan Chukchi Sea coast. The coastal villages, most notably Pt. Lay, conduct subsistence hunts for beluga whales during this period. By August, most Chukchi Sea beluga whales have

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[1]By K.E. Leonard, H.M. Patterson, and D.S. Ireland (LGL)

moved into the northern Chukchi Sea, the Arctic Ocean, or the Beaufort Sea, where they spend the rest of the summer (Suydam et al. 2001; NMFS 2006). They return to the eastern Chukchi Sea during their fall migration in October (NMFS 2006). The much larger Beaufort Sea stock of beluga whales (39,258; Allen and Angliss 2015) also migrates through the eastern Chukchi Sea during their spring (April–early June) and fall (October) migrations.

The Eastern North Pacific stock of gray whales had peak abundance estimates in 1987–88 (Allen and Angliss 2012), but the population was reduced following high mortality events in 1999 and 2000 (Gulland et al. 2005). Estimates for the Eastern North Pacific stock have been relatively stable since 2003 (Calambokidis et al. 2014), with a current estimate of 20,990 (Allen and Angliss 2015). Rugh et al. (2005) estimated the carrying capacity (*K*) to be 26,290 (CV=0.059) animals for this stock of gray whales.

Walrus are the primary pinniped species of concern related to exploration drilling activities in the Chukchi Sea and are also the most reliably detected given their larger size and close association with ice. The size of the Pacific walrus population has never been known with certainty and is believed to have fluctuated markedly in response to varying levels of human exploitation (Fay et al. 1989). The population was estimated at about 201,039 animals in 1990, after which aerial survey efforts to estimate population size were suspended due to unresolved problems with survey methods (USFWS 2014). Aerial surveys were conducted again in 2006, and the current minimum population estimate is 129,000 individuals (95% CI: 55,000–507,000; Speckman et al. 2011).

Walruses winter in the Bering Sea and begin spring migration in early April, with most individuals north of the Bering Strait by late June. Two large areas in the Arctic are occupied in the summer—from the Bering Strait west to Wrangel Island and along the northwest coast of Alaska from about Point Hope to north of Point Barrow. During low ice years (e.g., 2007, 2009, 2010, and 2011), walruses have hauled out on land along the Alaskan Chukchi Sea coast in the tens of thousands as opposed to dozens, as was previously seen (Jay et al. 2011). Walruses are hunted primarily from June through mid-August to the west of Point Barrow and southwest to Peard Bay. With the southern advance of the pack ice in the Chukchi Sea during the fall (October–December), most of the walrus population migrates south through the Bering Strait.

Alaskan Natives from several villages along the east coast of the Chukchi Sea hunt marine mammals during the summer, and there is concern that offshore oil and gas development activities may negatively impact their ability to harvest marine mammals. Of particular concern are potential impacts on the early summer beluga harvest at Point Lay, the fall bowhead harvest at Barrow, and proposed fall bowhead harvests at Point Hope and Wainwright. Native hunters at Point Hope and Wainwright have traditionally hunted bowheads in the spring when the whales pass through leads relatively close to shore. These villagers have not traditionally hunted bowheads during the fall, although one bowhead was harvested in late October 2011 (Suydam et al. 2012). Members of the coastal communities also hunt seals and walruses for subsistence purposes.

Objectives

The objectives of the 2015 aerial survey program were to:

- Collect data on the distribution and abundance of marine mammals near the drilling operations at the Burger Prospect, with an emphasis on bowhead whales, other large cetaceans, and walruses;
- Support regulatory reporting related to the estimation of impacts of drilling operations on marine mammals.

Methods

Based on results from similar photographic surveys in 2012, the methods used in 2015 continued the transition toward unmanned surveys. PSOs were not utilized in any of the surveys in 2015 and only a pilot and co-pilot were on board the aircraft during the flights. Three DSLR cameras were installed in the two belly ports of the aircraft to collect the aerial images during these photographic surveys for marine mammals.

Aerial surveys were conducted in the Chukchi Sea from 7 July through 2 October 2015. A total of 27 surveys were attempted, of which 20 flights successfully collected on-transect image data. Persistent unfavorable weather conditions throughout the Chukchi Sea region limited survey effort during the season.

Survey Area

Aerial surveys were planned for two locations in the Alaskan Chukchi Sea, the offshore area over the Burger Prospect and the nearshore area along the coast. Survey effort over the offshore area was designed to assess potential direct impacts from Shell's drilling operations and took precedence over nearshore surveys, where no drilling activity occurred. Due to this secondary priority status combined with poor weather, there were no nearshore surveys flown in 2015. All surveys conducted over offshore waters centered around the Burger Prospect area.

Two survey designs were flown offshore during the 2015 open water season. The initial design, flown between 7 July and 31 August, covered an elliptical area centered on the Burger J and V well sites with the long axis stretching 100 km in the north–south direction and the shorter 80-km long axis running east–west (Figure 8.1). An elliptical area was selected to maximize on-transect effort to the north and south of the activity area and thereby increase the chances of detecting a northerly or southerly shift in bowhead distribution during their (primarily) east to west migration through the northeastern Chukchi Sea. The survey consisted of eleven transects, with the inner nine (numbered 2–10) spaced 5 km apart and the outer two, positioned the furthest west and east, spaced 10 km from the neighboring line. A random starting point (±2 km east or west) was selected for each survey and all transects were correspondingly shifted east or west based on the start point. The total length of the survey lines was approximately 1,000 km.

The LOA required that all aircraft activity remain above 457 m (1,500 ft) altitude inside the overall HSWUA boundary to minimize potential disturbance to walruses. The increased altitude from the standard survey height of 305 m (1,000 ft) likely impacted the quality and quantity of marine mammal sightings detected in the survey image data. Additionally, the altitude change increased the necessary ceiling height, which resulted in missed survey opportunities due to weather. Between 7 July and 31 August, seven surveys that could have been conducted at 305 m were cancelled as a result of the 457 m altitude requirement.

In order to reduce the number of surveys cancelled due to weather and to improve the on-water resolution of the imagery, the initial survey design was revised to allow for flights at 305 m and was flown between 1 September and 2 October. An ~13 km (7 n. mi.) buffer was defined around HSWUA and all portions of the transects that crossed over that expanded boundary were removed from the revised survey design (Figure 8.2). Lines 1 and 2, the farthest west, remained intact while transects 3–11 were reduced by 13 to 51 km on the northern end. Spacing between lines remained the same and the process of selecting a random starting point and the associated shift east or west for each survey was maintained.

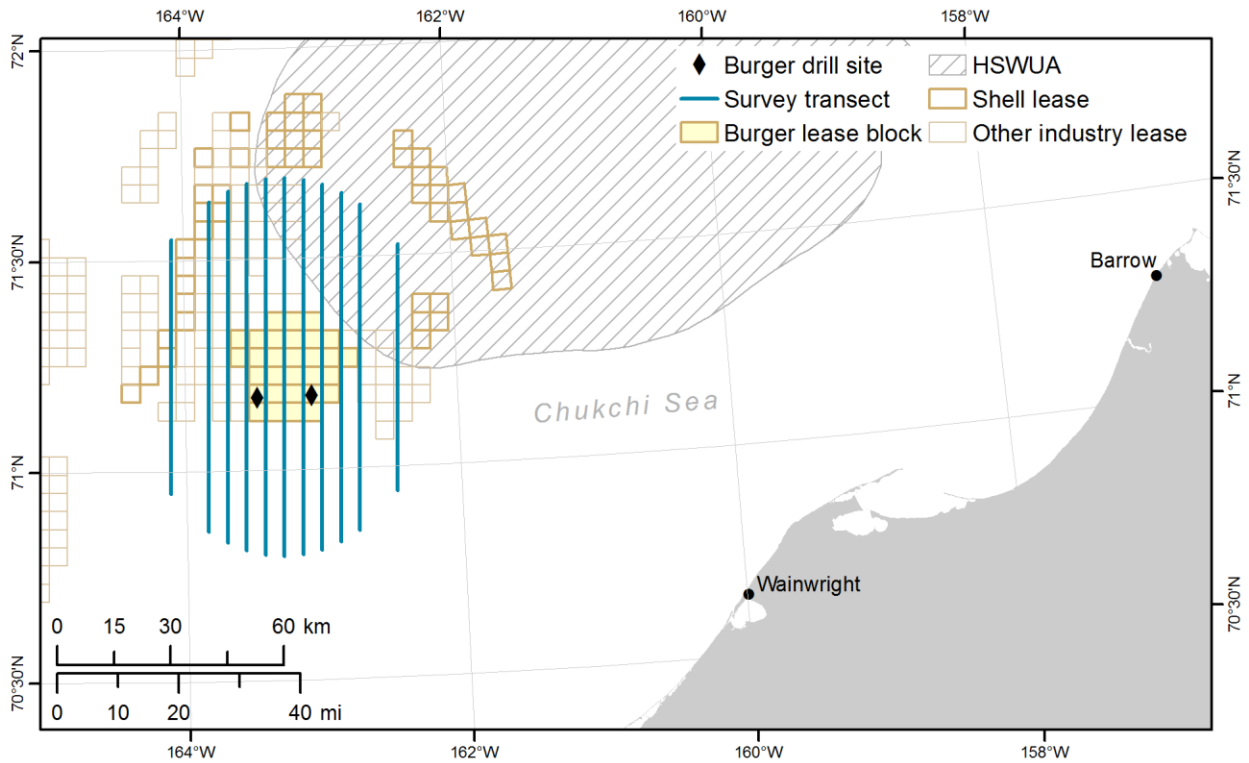

FIGURE 8.1. Offshore aerial photographic survey area and generalized transects for the initial survey design in the northeastern Chukchi Sea, summer 2015. This survey pattern was used from 7 July through 31 August at a minimum flight altitude of 1,500 ft.

Survey Procedures

Aerial surveys were flown in an Aero Commander aircraft operated by Clearwater Air, Alaska. This twin-engine high-wing aircraft was specially modified for survey work, including 110 V AC power for survey equipment and two camera ports in the belly of the aircraft for the camera equipment.

Fuel capacity of the Commander aircraft and associated safety measures precluded completion of the entire initial survey design. A typical flight would complete transects 1–7 or 5–11 (~640 km). Weather conditions and transects covered during preceding flights determined which section of the survey was selected for each flight. All transects from the revised survey design (636 km) could be completed in a single flight, weather permitting.

Surveys were conducted at an altitude of 457 m (1,500 ft) from 7 July to 31 August and at 305 m (1,000 ft) from 1 September to 2 October. The target groundspeed was 233 km/h (126 kts, 145 mph), with fluctuations due to head and tail winds.

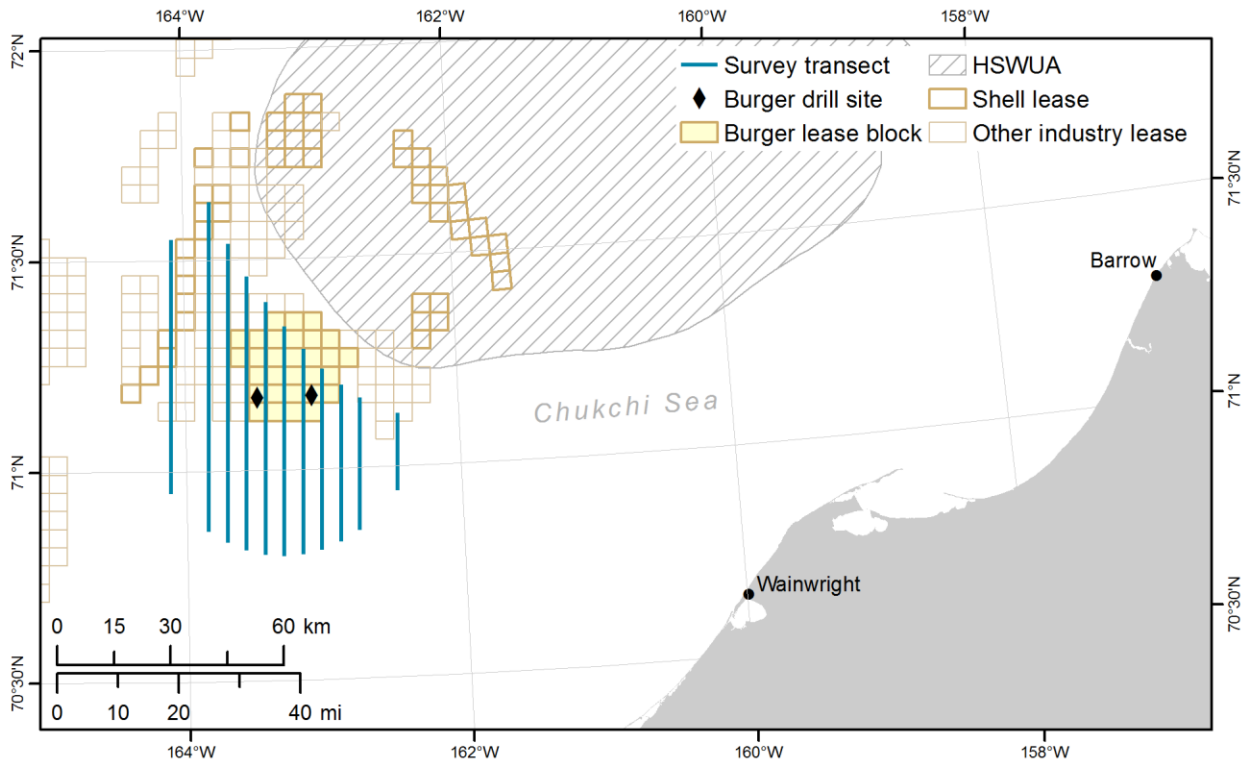

FIGURE 8.2. Offshore aerial photographic survey area and generalized transects for the revised survey design in the northeastern Chukchi Sea, summer 2015. This survey pattern was used from 1 September through 2 October at a minimum flight altitude of 1,000 ft.

Sensor Data Collection

The aircraft had three Nikon D810 DSLR cameras installed in two belly ports. One port contained two cameras angled 25 degrees left and right from the vertical with 21 mm Zeiss lenses. At an altitude of 305 m, the right and left oblique cameras had an overlap of 85 m on either side of the center line and covered an area out to 670 m from the center line (Table 8.1). In comparison, the Effective Strip Width (ESW) during 2006–2010 manned aerial surveys was 857–1,498 m for bowheads (Brandon et al. 2013; Thomas and Bourdon 2013) and 350–703 m for belugas (Harwood et al. 1996; Innes et al. 2002; Heide-Jørgensen et al. 2010; Brandon et al. 2013; Thomas and Bourdon 2013). One pixel in each image represented ~6 cm on the water directly below the aircraft and ~33 cm at the outer edge of the frame. The other belly port contained one camera pointed vertically with an 85 mm Zeiss lens. Pixel size on the water was 1.7 cm using this larger lens, which would increase the likelihood of detection and identification of smaller marine mammal species, particularly pinnipeds. However, the total swath covered was greatly reduced to 128 m. At an altitude of 457 m, the right and left oblique cameras had an area of overlap of 213 m on either side of the center line and covered an area out to 1,003 m from the center line (Table 8.1). One pixel represented ~9 cm on the water directly below the aircraft and ~49 cm at the outer edge of the frame. The vertical camera had a pixel size of 2.6 cm on the water and the swath increased to 192 m.

TABLE 8.1. Summary of areas covered by oblique and vertical cameras at 305 and 457 m above sea level. Pixel size indicates the level of on water clarity.

Altitude	Lens (mm)	Camera Position	Maximum distance from center line (m)	Total swath (m)	Center line overlap per side (m)	Total center line overlap (m)	Pixel size at center line (cm)	Pixel size on outer edge (cm)
305 m	21	Oblique (left/right)	670	1340	85	170	6	33
(1000 ft)	85	Vertical	64	128	N/A	N/A	1.7	1.7
457 m	21	Oblique (left/right)	1003	2006	213	426	9	49
(1500 ft)	85	Vertical	96	192	N/A	N/A	2.6	2.6

A GPS logger and geo-tagger were used to receive and insert GPS coordinates into the metadata of each image. Time and camera settings were also stored to the properties file associated with each image. All image data were saved to memory cards during the flight and backed up twice onto 2 TB portable hard drives after the aircraft returned to its base in Barrow.

Review of Imagery

An initial, overall evaluation of the imagery from each survey determined that only eleven of the twenty surveys flown had environmental conditions that met the parameters for image analysis that were consistent with what are considered acceptable survey conditions during manned surveys. Based on the available time and resources, eight of these eleven surveys were chosen for analysis. The six surveys conducted between 31 August and 1 October were selected after considering the area covered, the time of year, and the bowhead sightings reported by the NOAA Aerial Surveys of Arctic Marine Mammals (ASAMM) team.

Two methods of image analysis were utilized: a detailed manual analysis and a "quick review". A team of six photo analysts conducted detailed manual analysis on images from five surveys. Imagery was reviewed on 30-inch monitors with a 2560×1600 screen resolution using Adobe Photoshop. Each image analyzed was viewed at full (100%) resolution and ~1/18th of the image was visible on screen at a time. On average, an analyst would require 3–4 minutes to review one full image with good environmental conditions and no sightings. Higher sea states, greater ice presence, lighting conditions (e.g., presence of glare), and the number and size of sightings in an image are some of the variables that increase analysis time. Due to the quantity of images collected per survey and the level of effort entailed, only images from the left and right oblique cameras were analyzed.

When reviewing photographs, analysts recorded the following data on environmental and sighting conditions for each image: glare intensity, type and percentage of precipitation present, ice concentration, Beaufort wind force, and an overall sightability rating (ability to detect a marine mammal). When a potential marine mammal was identified in an image, analysts recorded the following data: species, sighting confidence, age class (when discernible), number of individuals in the water and/or on the ice, size of the ice floe being utilized, direction of travel in the water, whether the animal was at the surface or subsurface, potential reaction to the aircraft, location of the sighting in the image, and presence/absence in the oblique camera overlap zone. Smaller pinnipeds, like ringed, ribbon, and spotted seals, could not be identified to species in the surveys analyzed and were entered as unidentified phocid seals. At times it was also difficult to distinguish between the larger pinniped species of walrus and bearded seals. When an animal was

determined to be a larger pinniped but could not be identified to species, the species code was entered as a "walrus or bearded seal".

In an attempt to increase the sample size of large cetaceans available for reporting purposes, an additional photo analyst conducted a quick review of images from three surveys that were not reviewed by the detailed manual analysis method. Images were viewed on the same 30-inch monitor, but were sized to fit the screen rather than zoomed in to 100%. At this size, image resolution is only about one ninth of its potential but this resolution is as good as or better than that obtained by observers looking out of bubble windows – particularly toward the edges of the outer viewing area (Koski et al. 2013). Images were viewed as a slideshow with each image on screen for ~5 seconds. There is ~58% overlap at the center line in each still image, which meant that the area being analyzed was in view for slightly longer than 10 seconds. Sightings and environmental conditions were recorded onto digital recorders and the data were later transcribed into a database. To reduce analyst fatigue, continuous review of images was limited to 1 hour. Only left and right images were analyzed to further expedite the quick review process.

All marine mammals detected during image analysis were documented; however, sightings data on the smaller species, especially pinnipeds, are less consistent and reliable due to their size and the flight altitude.

Analyses of Aerial Survey Data

On-Transect Sightings and Effort

Environmental factors can affect an analyst's ability to detect marine mammals and bias results. To minimize such effects, the environmental data for each image were used to classify sightings and effort as "on-transect" or "off-transect" for quantitative analyses. For analyses relating to cetaceans, sightings and effort were considered on-transect when the following criteria were met: the animal was sighted while the aircraft was flying a pre-established transect, Beaufort wind force was 4 or less (winds 20–30 km/h; 11–16 kts or lower), clouds/fog/precipitation obstructed 30% or less of the image, and the overall sightability ranking was described as excellent to moderately impaired. Survey effort and sightings data that did not meet these criteria were excluded (off-transect) from analyses.

Pinnipeds are almost exclusively detected during optimal sightability conditions and are difficult to identify to species even under the best conditions. Accordingly, the on-transect criteria above were adjusted when considering pinniped effort and sightings on-transect; the Beaufort wind force was restricted to 2 or less (winds 7–11 km/h; 4–6 kts or lower), while all other criteria remained the same.

Additionally, sightings were further filtered by analyst confidence level in the classification of the sighting. Sightings with a confidence level of 100% or 75% were included, and those with a 50% or less confidence level were removed from the on-transect sightings analyses. Analyst sightings are typically reviewed by a panel of senior analysts who confirm, modify, or reject the initial sighting entry. The panel review process will be completed for the comprehensive report, but time constraints resulted in the broader filtering approach applied here.

Distribution

Effort and sightings were categorized as either "inner" or "outer" in relation to the drill site. This was done to allow comparisons of marine mammal sighting rates between the inner area where higher levels of vessel activities occurred and the outer area where less activity took place. For in-season tracking purposes and in this report, the inner area was defined by a square with 50 km sides centered on the two planned drill sites. The outer effort area included the farthest west and east transects, as well as the northern and southern ends of the remaining transects. Those portions of transects 2–10 that were closer to the drilling operations were designated as the inner effort area. Subsequent analyses of the data will utilize

outputs from the acoustic measurements and modeling described in Chapter 3 to refine the categorization of aerial survey data by received sound level.

Results

Overall Survey Effort

Twenty complete or partial aerial surveys were flown from 7 July through 2 October 2015. Daily effort ranged from 480 km to 639 km per survey (Table 8.2).

The initial survey design, flown from 7 July to 31 August, covered a significantly larger area. Transect lengths totaled 983 km, which was more than could be covered in a single flight. The total survey area was divided into two sections, transects 1–7 and 5–11, and a typical survey would target one of these two sections. Between 49% and 65% of the entire survey grid was covered per flight, with 75% to 100% of the intended section covered each flight. The total transect length for the revised survey design was 636 km, and was flown from 16 September to 2 October. These transects were flown in-full four times, and the other six surveys completed between 76% and 91% of the transect lines.

In total, 43,633 images from five surveys were reviewed with the detailed manual analysis method. An additional three surveys and 23,000 images were analyzed using the quick review method. The following results come from both the detailed manual analysis and quick review approaches.

Cetaceans

On-transect Survey Effort

Daily on-transect effort ranged from 389 km to 569 km per survey (Table 8.3). Coverage over the initial survey design for 29 and 30 July and 31 August was in the range of 42–58% of all transect lines and 65–89% of the lines planned to be covered each flight (i.e., transects 1–7 or 5–11). In comparison, on-transect effort over the shorter revised survey design, flown 17–22 September and 1 October, was 61–85% of the transect lines. Appendix Table F.1 summarizes the total aerial survey effort and cetacean sightings for each offshore survey reviewed including on-transect, off-transect, and low confidence sightings.

Sightings

In total, three cetacean sightings of four individuals were recorded (Table 8.3) while on-transect. Species detected were humpback whale, unidentified mysticete whale, and harbor porpoise (Figure 8.3). A number of factors are likely to have contributed to the low number of cetacean sightings. Ultimately, poor weather severely limited survey opportunities and affected flight time as well as the quality of images collected when surveys were possible. In total, seven potential cetacean sightings were excluded from on-transect analyses: six were filtered out due to a low confidence level and one due to a high sea state and seriously impaired sightability rating (Appendix Table F.1).

Distribution

With only three on-transect cetacean sightings detected in the survey area, the distribution relative to the drill site cannot be meaningfully assessed (Figure 8.4). Nonetheless, it is worth noting the rare occurrence of both humpback whales and a harbor porpoise in the offshore survey area.

TABLE 8.2. Summary of offshore aerial survey effort (km) in the Alaskan Chukchi Sea, 2015. DMA refers to the detailed manual analysis method and QR to the quick review method.

Date in 2015	Survey No.	Type of Review	Sighting Conditions	Outer Effort	Inner Effort	Total Effort
7-Jul	1	-	Very Poor	335	300	635
29-Jul	4	DMA	OK	289	250	539
30-Jul	5	DMA	Good	353	185	538
7-Aug	6	-	Poor	286	300	586
8-Aug	7	-	OK	273	300	573
9-Aug	8	-	Good	262	374	636
11-Aug	9	-	Very Poor	339	300	639
18-Aug	10	-	Poor	291	250	541
19-Aug	11	-	OK	180	300	480
31-Aug	12	DMA	Good	273	300	573
16-Sep	13	-	Poor	231	259	490
17-Sep	14	DMA	OK	255	322	577
18-Sep	15	-	Poor	255	284	539
20-Sep	16	QR	Good	210	272	482
21-Sep	17	QR	OK	231	259	490
22-Sep	18	DMA	OK	314	322	636
27-Sep	19	-	Poor	314	322	636
28-Sep	20	-	Very Poor	266	220	486
1-Oct	21	QR	OK	314	322	636
2-Oct	22	-	Poor	314	322	636
			Total Effort	***5,587***	***5,763***	***11,350***

TABLE 8.3. Summary of on-transect aerial survey effort (km) and number of cetacean sightings (number of individuals) in the Alaskan Chukchi Sea, 2015.

Date in 2015	Survey No.	On-transect Effort	Humpback Whale	Unidentified Mysticete Whale	Harbor Porpoise
29-Jul	4	527	0	0	1 (1)
30-Jul	5	417	0	0	0
31-Aug	12	569	1 (2)	0	0
17-Sep	14	539	0	0	0
20-Sep*	16	389	0	0	0
21-Sep*	17	458	0	0	0
22-Sep	18	456	0	1 (1)	0
1-Oct*	21	473	0	0	0
Total		***3,828***	***1 (2)***	***1 (1)***	***1 (1)***

* Indicates survey was analyzed with the quick review method

FIGURE 8.3. Cropped and enhanced photograph of two humpback whales. This image was taken by one of the oblique cameras paired with a 21 mm lens and the whales are towards the outer edge of the frame, where on-water resolution is lower. The image was captured during an aerial photographic survey in the offshore Chukchi Sea on 31 August, 2015.

Pinnipeds

On-transect Survey Effort

With more stringent on-transect criteria, daily effort for pinnipeds ranged from 0 km to 518 km per survey. Coverage over the initial survey design area for 29 and 30 July and 31 August was in the range of 23–53% of all transect lines and 35–81% of the lines planned to be covered each flight (i.e., transects 1–7 or 5–11). In comparison, effort over the shorter revised survey design, flown 17–22 September and 1 October, ranged from 0 to 58%. Appendix Table F.2 summarizes the total aerial survey effort and pinniped sightings for each offshore survey reviewed including on-transect, off-transect, and low confidence sightings.

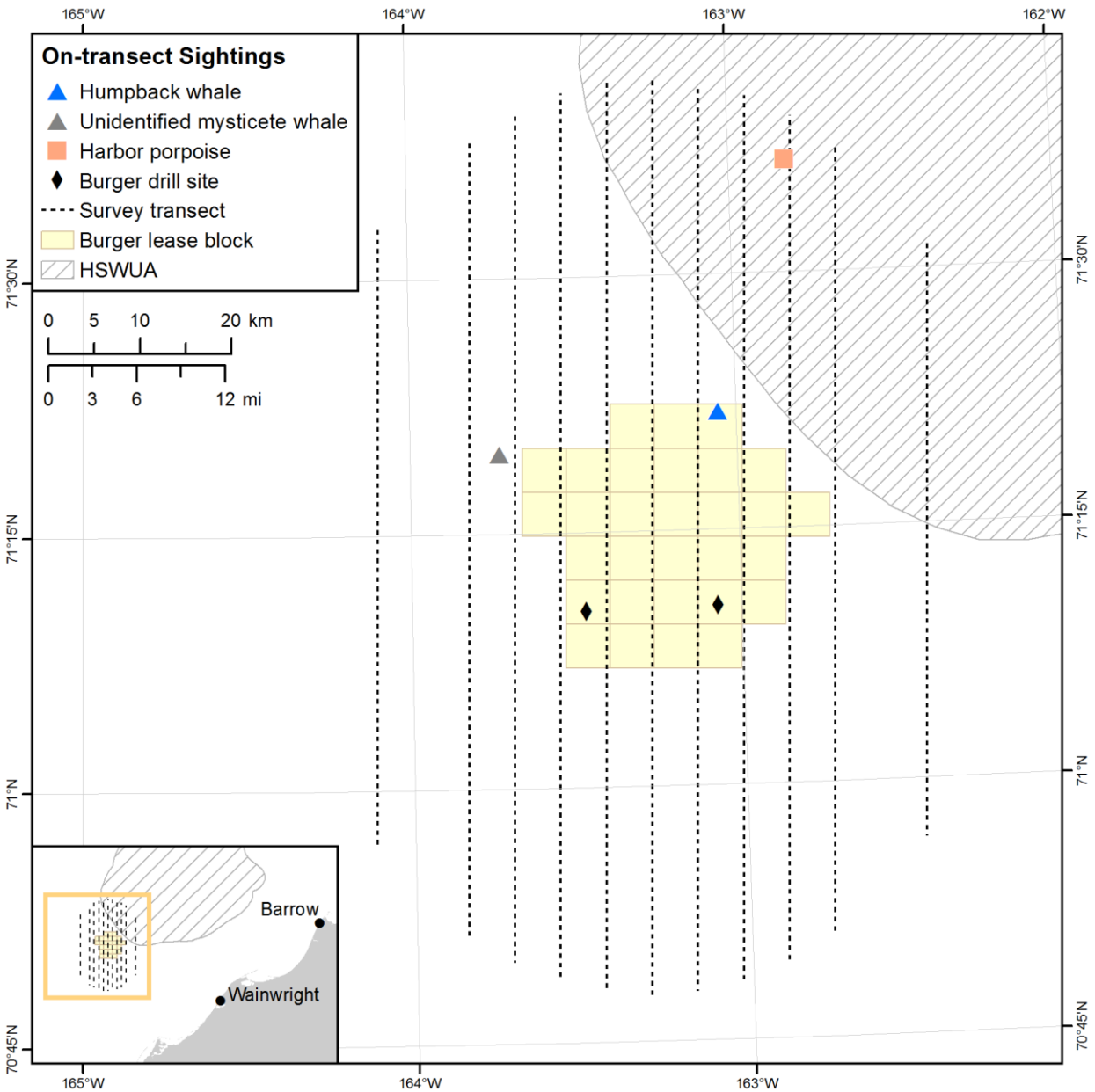

FIGURE 8.4. Locations of cetacean sightings during aerial surveys in the offshore Chukchi Sea during July to October 2015. Only on-transect sightings are shown.

Sightings

In total, 343 unique on-transect pinniped sightings of 5,106 individuals were detected in the eight surveys analyzed (Table 8.4). Due to both their small size and the higher resolution of the imagery, pinnipeds are more likely to be detected closer to the track line and in the zone directly below the aircraft, where images from the two oblique cameras overlap. Sightings located in the overlap zone of the right and left oblique cameras have not yet been cross-checked and removed. As a result, the sighting numbers reported here are overestimates by a currently unknown amount. In total, 216 potential pinniped sightings were excluded from on-transect analyses. The majority, 150 sightings, were filtered out due to a low

confidence level. Thirty-nine sightings were removed due to a higher sea state and the remaining 27 due to a combination of these factors (Appendix Table F.2).

Unidentified phocid seals were recorded in all five of the surveys reviewed by the detailed manual analysis method and in one of the quick reviewed surveys. All unidentified phocid seal sightings were of a single animal.

Walrus was the most commonly recorded pinniped species, and on-transect sightings were recorded in six of the eight surveys analyzed. Group size varied from 1 to 402, with a mean group size of 18.3 (Figure 8.5). Walruses were detected throughout the season (July–September) but the majority of sightings were recorded from the two surveys in late July when ice was present in the survey area. On 29 July, more than half of the sightings were of a single animal or small group (ten or less). There were, however, eleven sightings with group sizes ranging from 105 to 317 individuals. The majority of walrus sightings on 30 July were also of lone individuals or small groups. Two sightings contained groups of 357 and 402 animals, with the few remaining groups ranging between 17 and 69 individuals. The mean group sizes were only slightly larger for these two days at 19.5 and 20.1, respectively.

Distribution

The majority of pinniped sightings were recorded in the eastern half of the survey area, including transects 6–11 (Figure 8.6). Bearded seals and unidentified phocid seals were, for the most part, distributed evenly across these transects. Larger pinnipeds, identified as walrus or bearded seal, were also detected throughout the eastern portion of the survey area.

All but three of the total 275 on-transect walrus sightings were recorded in the eastern half of the survey area (transects 6–11). More specifically, distribution was mainly concentrated in the northeastern area of the survey grid where ice was present within HSWUA during surveys on 29 and 30 July (Figure 8.7). On these dates, ice concentration was variable in the northern half of the survey area and ranged from less than 10% up to 90% coverage. The transects extended into areas of 70-90% ice concentration to the northwest, but did not cover areas with those concentrations to the northeast in HSWUA. No sightings were recorded in areas of 70–90% ice cover that were surveyed. Of the 255 walrus sightings recorded during these two surveys, 246 (96%) were located in HSWUA and associated with ice. Analyst observations indicated that ice concentrations were relatively low in the images where walruses were detected, ranging from 1–27%. Despite these lower ice concentrations, almost all sightings were either on or in close proximity to the ice present in the images. Nine sightings were located outside of HSWUA, three of which were associated with ice. The other six were in open water south of the drill sites.

Walruses were detected on four of the remaining six surveys analyzed and an additional 20 sightings were documented (Figure 8.8). Again, the majority (90%) were located on transects 6-11 in the eastern half of the survey area. The ice had receded north during this timeframe and sightings were almost evenly distributed to the north and south on these transects. Three walruses were within HSWUA with one just south of the boundary, and six were recorded between transects 6 and 8 within the prospect area. South of the prospect, eight walrus sightings were loosely clustered on transects 9 and 10.

As described in the Methods section, sightings and effort were categorized as inner and outer effort to allow comparison of sighting rates in relation to drilling operations. However, larger pinniped sightings were predominantly associated with ice located in the outer portion of the survey area during late July, biasing the sighting rate comparison. Sightings of unidentified phocid seals are considered less reliable due to their smaller size and the survey altitude. For those reasons, we do not believe a comparison of pinniped sighting rates in the inner and outer effort areas is meaningful without further review and analyses.

TABLE 8.4. Summary of offshore aerial survey effort (km) and numbers of pinniped sightings (numbers of individuals) in the Alaskan Chukchi Sea, 2015.

Date in 2015	Survey No.	On-transect Effort	Pacific Walrus	Bearded Seal	Walrus or Bearded Seal	Unidentified Phocid Seal
29-Jul	4	518	205 (4,003)	11 (11)	15 (16)	11 (11)
30-Jul	5	222	50 (1,005)	3 (3)	4 (4)	3 (3)
31-Aug	12	307	10 (12)	0	3 (3)	9 (9)
17-Sep	14	82	2 (2)	0	0	1 (1)
20-Sep*	16	367	4 (9)	0	0	6 (6)
21-Sep*	17	267	0	0	0	0
22-Sep	18	155	4 (7)	0	0	1 (1)
1-Oct*	21	0	0	0	0	0
Total		***1,918***	***275 (5,038)***	***14 (14)***	***22 (23)***	***31 (31)***

* Indicates survey was analyzed with the quick review method

FIGURE 8.5. Cropped and enhanced photograph of walruses. This image was taken by the vertical camera paired with the 85 mm lenses, which produced a higher quality image than the oblique cameras with 21 mm lenses. The image was captured during an aerial photographic survey in the offshore Chukchi Sea on 29 July 2015.

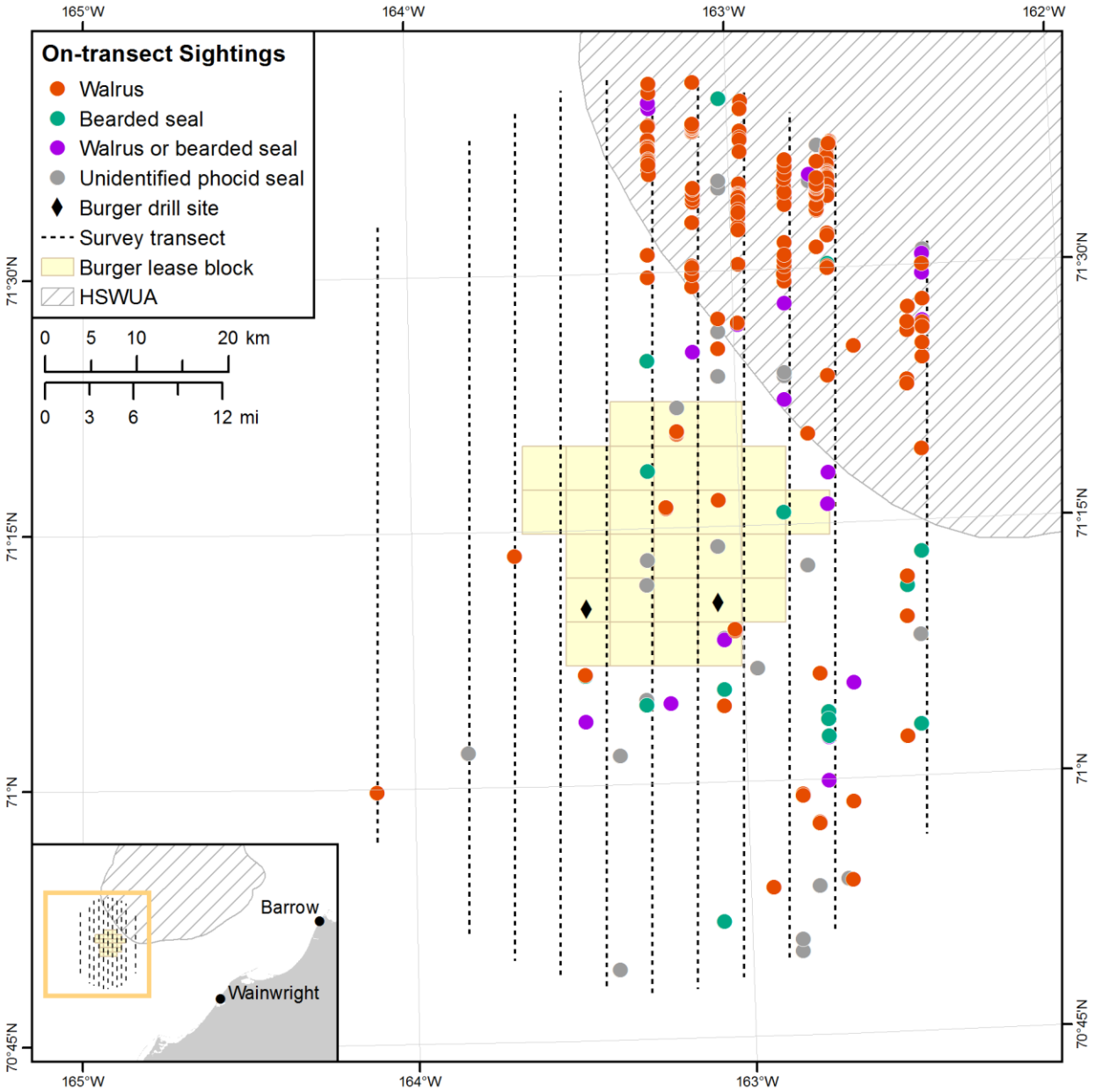

FIGURE 8.6. Locations of pinnipeds during aerial surveys in the offshore Chukchi Sea during July to October 2015. Only on-transect sightings are shown.

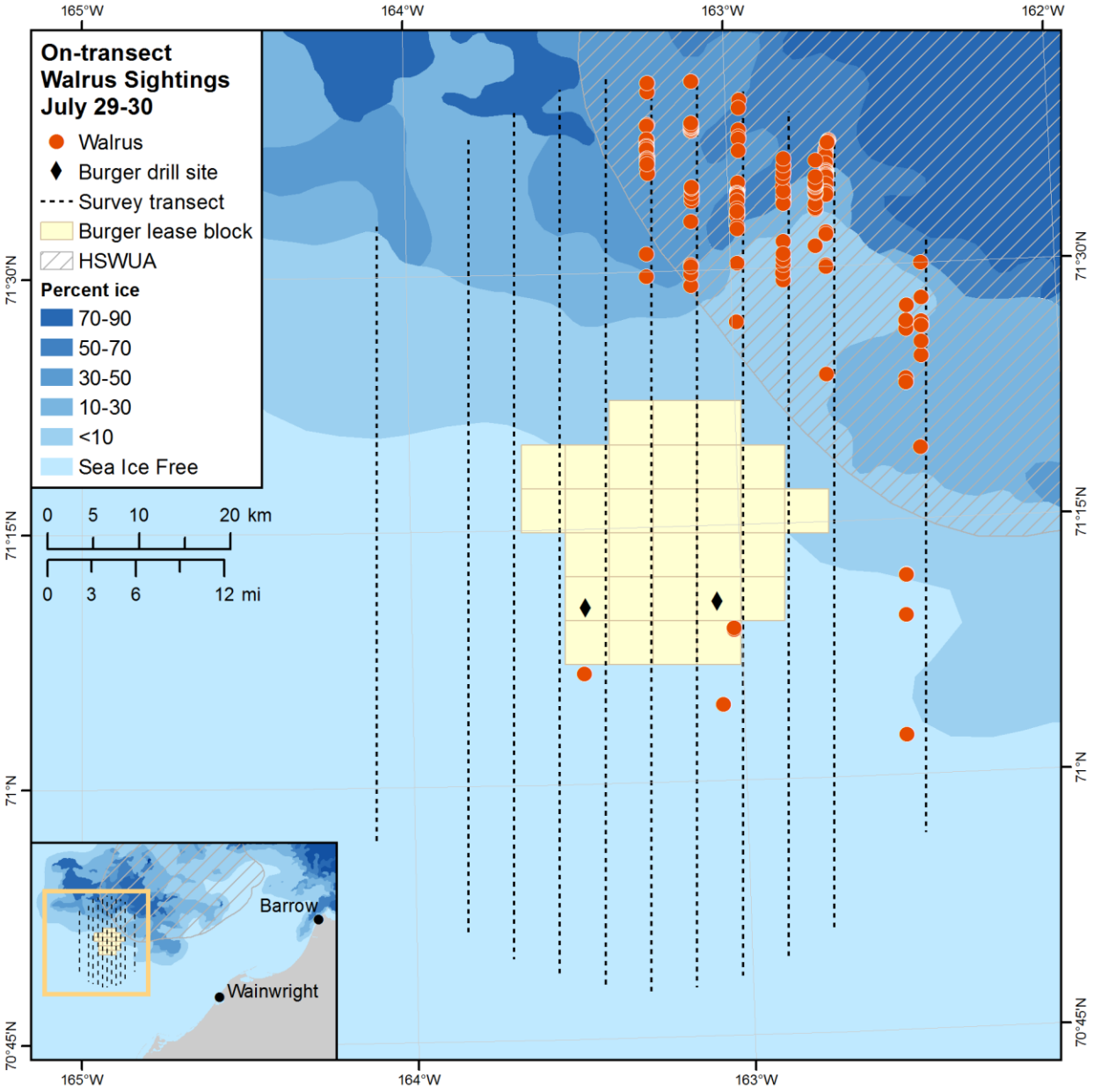

FIGURE 8.7. Locations of walrus sightings during aerial surveys in the offshore Chukchi Sea during 29 and 30 July in relation to ice presence and concentration. Only on-transect sightings are shown.

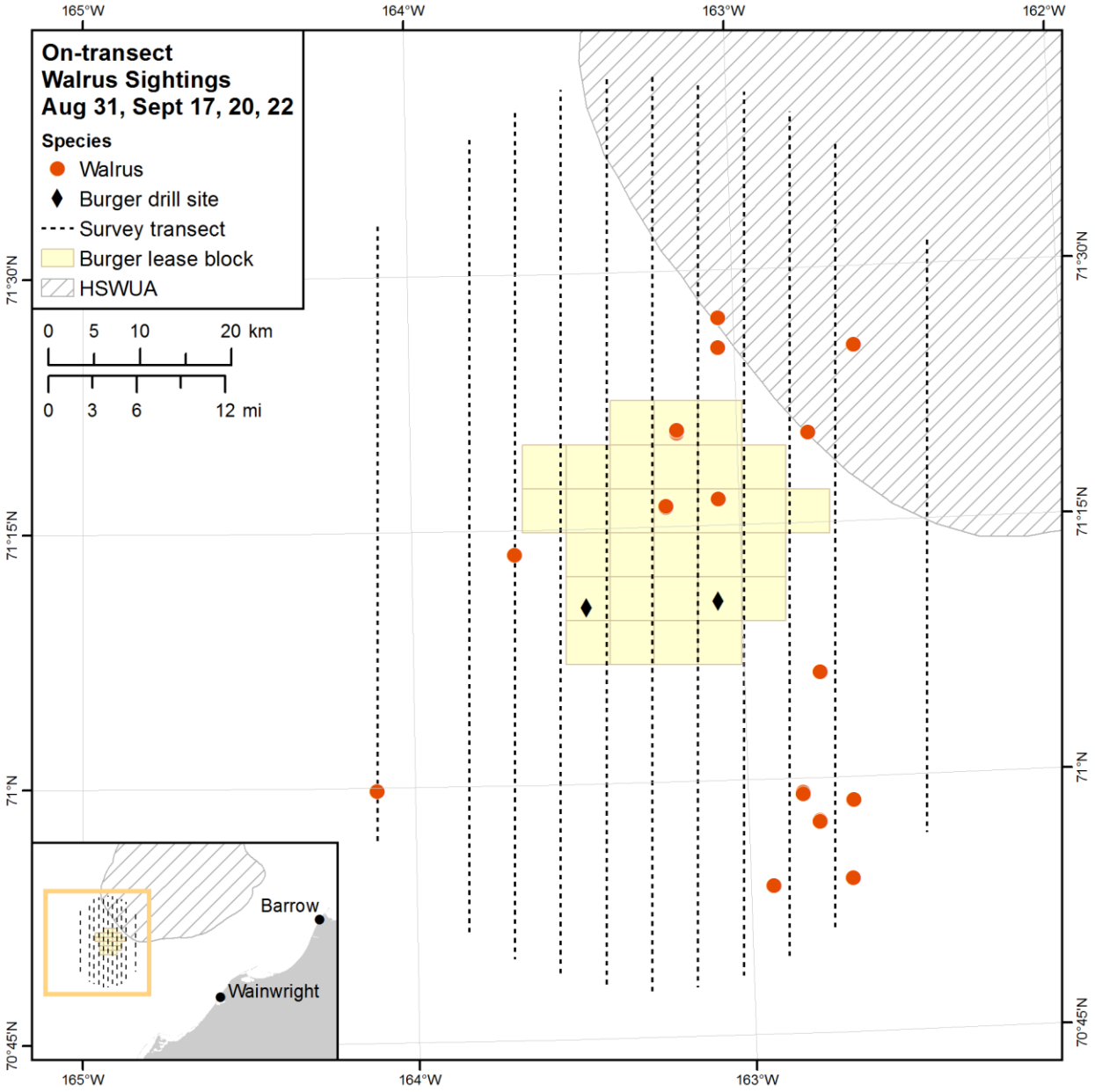

FIGURE 8.8. Locations of walrus sightings during aerial surveys in the offshore Chukchi Sea during 31 August and 17-22 September 2015. Only on-transect sightings are shown.

Discussion

This report includes results from the digital imagery examined for eight surveys, five reviewed by detailed manual analysis and three by quick review. The surveys chosen for analysis were determined by weather conditions during the survey, timing of drilling operations, likelihood of bowhead presence based on sightings reported from other surveys in the region, and available resources. The number and dates of surveys analyzed likely affected the sightings available for detection by analysts, particularly for cetaceans. Poor weather limited survey effort and affected image quality in September and the last survey flown for the season was on 2 October. It should be noted that all but one of the bowhead, beluga, and unidentified whale sightings in 2012 were recorded from 29 September to 27 October. If sightings from the 2012 offshore surveys indicate the timing of cetacean presence in the activity area, 2015 survey effort likely missed the peak timeframe for this region. With only two large whale sightings recorded to date in 2015, the abundance, distribution, and potential impacts from drilling operations cannot be meaningfully assessed at this time.

While there are significantly more pinniped sightings than cetacean sightings, the majority were recorded on a single day, 29 July. Because analysis of the available data is not complete, we have not attempted to estimate abundance, distribution, or potential impacts from drilling operations at this time. Efforts to analyze the imagery using automated detection methods will be included in the comprehensive report. The detailed manual analysis conducted on five surveys allows for validation of the automated detection software, and both components will inform the feasibility of deploying digital cameras in aircraft (manned or unmanned) in lieu of human observers in the future.

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APPENDIX A: NATIONAL MARINE FISHERIES SERVICE INCIDENTAL HARASSMENT AUTHORIZATION

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

Incidental Harassment Authorization

Shell Gulf of Mexico Inc. (Shell), 3601 C Street, Suite 1314, Anchorage, Alaska, 99503, is hereby authorized under section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C. 1371(a)(5)(D)) and 50 CFR 216.107 to take, by Level B harassment only, small numbers of marine mammals incidental to conducting an offshore exploratory drilling program in the Chukchi Sea in Arctic Ocean waters under the jurisdiction of the United States, contingent upon the following conditions:

1. This Authorization is valid from July 1, 2015 through October 31, 2015.

2. This Authorization is valid only for activities associated with Shell's 2015 Chukchi Sea exploration drilling program. The specific areas where Shell's exploration drilling program will be conducted are in the Outer Continental Shelf Lease Sale 193 area in the Chukchi Sea.

3. (a). The incidental taking of marine mammals, by Level B harassment only, is limited to the following species: beluga whale (*Delphinapterus leucas*); bowhead whale (Balaena mysticetus); gray whale (*Eschrichtius robustus*); killer whale (*Orcinus orca*); minke whale (*Balaenoptera acutorostrata*); fin whale (*Balaenoptera physalus*); humpback whale (*Megaptera novaeangliae*); harbor porpoise (*Phocoena phocoena*); bearded seal (*Erignathus barbatus*); ringed seal (*Phoca hispida*); spotted seal (*P. largha*); and ribbon seal (*Histriophoca fasciata*). Table 1 outlines the amount of take that is authorized for each species.

(b). The taking by injury (Level A harassment), serious injury, or death of any of the species listed in Condition 3(a) or the taking of any kind of any other species of marine mammal is prohibited and may result in the modification, suspension or revocation of this Authorization.

4. The authorization for taking by harassment is limited to the following acoustic sources (or sources with comparable frequency and intensity) and from the following activities:

(a) a three-airgun array consisting of three 150 in^3 airguns, or a two-airgun array consisting of two 250 in^3 airguns;

(b) drilling unit operation and associated dynamic positioning sounds during active drilling operations;

(c) vessel sounds generated during active ice management or icebreaking;

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(d) mudline cellar construction during the exploration drilling program;

(e) anchor handling during the exploration drilling program, and

(f) aircraft associated with marine mammal monitoring and support operations.

5. The taking of any marine mammal in a manner prohibited under this Authorization must be reported immediately to the Chief, Permits and Conservation Division, Office of Protected Resources, NMFS or her designee.

6. The holder of this Authorization must notify the Chief of the Permits and Conservation Division, Office of Protected Resources, at least 48 hours prior to the start of exploration drilling activities (unless constrained by the date of issuance of this Authorization in which case notification shall be made as soon as possible).

7. General Mitigation and Monitoring Requirements: The Holder of this Authorization is required to implement the following mitigation and monitoring requirements when conducting the specified activities to achieve the least practicable impact on affected marine mammal species or stocks:

(a) All vessels shall reduce speed to at least 5 knots when within 300 yards (274 m) of whales. The reduction in speed will vary based on the situation but must be sufficient to avoid interfering with the whales. 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. For purposes of this Authorization, a group is defined as being three or more whales observed within a 547-yd (500-m) area and displaying behaviors of directed or coordinated activity (e.g., group feeding);

(b) Avoid multiple changes in direction and speed when within 900 ft (300 yards /274 m) of whales;

(c) When weather conditions require, such as when visibility drops, support vessels must reduce speed as necessary (and as operationally practicable), to avoid the likelihood of injury to whales;

(d) Check the waters immediately adjacent to the vessel(s) to ensure that no whales will be injured when the propellers are engaged;

(e) In the Chukchi Sea, vessels should remain as far offshore as weather and ice conditions allow and at least 5 mi (8 km) offshore during transit;

(f) Aircraft shall not fly within 1,000 ft (305 m) of marine mammals or below 1,500 ft (457 m) altitude (unless engaged in marine mammal monitoring ,during takeoffs, landings, or in emergency situations) while over land or sea;

(g) Utilize two, NMFS-approved vessel-based Protected Species Observers (PSOs) (except during meal times and restroom breaks, when at least one PSO will be on watch) aboard the drilling units, Anchor handlers, and ice-management vessels to visually watch for and monitor marine mammals nearby during active drilling, airgun, anchor handling or ice-management operations (from nautical twilight-dawn to nautical twilight-dusk); and before and during start-ups of airguns day or night, and for 30 minutes after the activities are ceased. At least one PSO will be aboard each transiting support vessel to conduct watch. The vessels' crew shall also assist in detecting marine mammals, when their duty allows and when it is safe to do so.

(h) PSOs shall have access to reticle binoculars (7x50 Fujinon), big-eye binoculars (25x150), and/or night vision devices. PSO shifts shall last no longer than 4 consecutive hours and shall not be on watch more than 12 hours in a 24-hour period. PSOs shall also make observations during daytime periods when active operations are not being conducted for comparison of animal abundance and behavior, when their duty allows;

(i) When a mammal sighting is made, the following information about the sighting will be recorded by the PSOs:

(i) 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;

(ii) Time, location, speed, activity of the vessel, sea state, ice cover, visibility, and sun glare;

(iii) The positions of other vessel(s) in the vicinity of the PSO location; and

(iv) The ship's position, speed of support vessels, and, 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.

(j) PSO teams shall consist of Alaska Native observers and experienced field biologists to the extent practicable. An experienced field crew leader will supervise the PSO team onboard the survey vessel. New observers shall be paired with experienced observers to avoid situations where lack of experience impairs the quality of observations;

(k) PSOs will complete a two or three-day training session on marine mammal monitoring, to be conducted shortly before the anticipated start of the 2015 open-water season. The training session(s) will be conducted by qualified marine mammalogists with extensive crew-leader experience during previous vessel-based monitoring programs. A marine mammal

observers' handbook, adapted for the specifics of the planned program, will be reviewed as part of the training;

(l) PSO training that is conducted prior to the start of the survey activities shall be conducted with both Alaska Native PSOs and biologist PSOs being trained at the same time in the same room. There shall not be separate training courses for the different PSOs; and

(m) PSOs shall be trained using visual aids (e.g., videos, photos), to help them identify the species that they are likely to encounter in the conditions under which the animals will likely be seen.

(n) Within safe limits, the PSOs should be stationed where they have the best possible viewing. Viewing may not always be best from the ship bridge, and in some cases may be best from higher positions with less visual obstructions (e.g., flying bridge);

(o) PSOs should be instructed to identify animals as unknown where appropriate rather than strive to identify a species if there is significant uncertainty;

(p) PSOs should maximize their time with eyes on the water. This may require new means of recording data (e.g., audio recorder) or the presence of a data recorder so that the observers can simply relay information to them; and

(q) PSOs should plot marine mammal sightings in near real-time for their vessel into a GIS software program and relay information regarding the animal(s)' position between platforms and vessels with emphasis placed on relaying sightings with the greatest potential to involve mitigation or reconsideration of the vessel's course.

8. ZVSP Mitigation and Monitoring Measures: The Holder of this Authorization is required to implement the following mitigation and monitoring requirements when conducting the specified activities to achieve the least practicable impact on affected marine mammal species or stocks:

(a) PSOs shall conduct monitoring while the airgun array is being deployed or recovered from the water;

(b) PSOs shall visually observe the entire extent of the exclusion zone (EZ) (180 dB re 1 μPa [rms] for cetaceans and 190 dB re 1 μPa [rms] for pinnipeds) using NMFS-approved PSOs, for at least 30 minutes (min) prior to starting the airgun array (day or night). If the PSO finds a marine mammal within the EZ, Shell must delay the seismic survey until the marine mammal(s) has left the area. If the PSO sees a marine mammal that surfaces then dives below the surface, the PSO shall continue the watch. If the marine mammal has not been observed outside of the EZ at the conclusion of the initial 30 min period, the start of the survey shall, if necessary, be delayed such that it has been 15 min for species with shorter dive durations (small odontocetes and pinnipeds) or 30 min for species with longer dive durations (mysticetes and large odontocetes such as beluga whales) since the animal was observed in the EZ. If the PSO

sees no marine mammals during that time, they may assume that the animal has moved beyond the EZ. If for any reason the entire radius cannot be seen for the entire 30 min period (i.e., rough seas, fog, darkness), or if marine mammals are near, approaching, or in the EZ, the airguns may not be ramped-up. If one airgun is already running at a source level of at least 180 dB re 1 μPa (rms), the Holder of this Authorization may start the second airgun without observing the entire EZ for 30 min prior, provided no marine mammals are known to be near the EZ;

(c) Establish and monitor a 180 dB re 1 μPa (rms) and a 190 dB re 1 μPa (rms) EZ for cetaceans and pinnipeds, respectively, before the airgun array is in operation. Until the field verification tests, described in condition 10(c)(i) below, finds otherwise, the 180 dB radius is designated to be 1.38 km and the 190 dB radius is designated to be 255 m;

(d) Implement a "ramp-up" procedure when starting up at the beginning of seismic operations. During ramp-up, the PSOs shall monitor the EZ, and if marine mammals are sighted, a power-down, or shut-down shall be implemented as though the full array were operational. Therefore, initiation of ramp-up procedures from shut-down requires that the PSOs be able to view the full EZ;

(e) Power-down or shutdown the airgun(s) if a marine mammal is detected within, approaches, or enters the relevant EZ. A shutdown means all operating airguns are shutdown (i.e., turned off). A power-down means reducing the number of operating airguns to a single operating airgun, which reduces the EZ to the degree that the animal(s) is no longer in or about to enter it;

(f) Following a power-down, if the marine mammal approaches the smaller designated EZ, the airguns must then be completely shutdown. Airgun activity shall not resume until the PSO has visually observed the marine mammal(s) exiting the EZ and is not likely to return, or has not been seen within the EZ for 15 min for species with shorter dive durations (small odontocetes and pinnipeds) or 30 min for species with longer dive durations (mysticetes and large odontocetes such as beluga whales);

(g) Following a power-down or shut-down and subsequent animal departure, airgun operations may resume following ramp-up procedures described in Condition 8(d) above;

(h) ZVSP surveys may continue into night and low-visibility conditions if such segment(s) of the survey is initiated when the entire relevant EZs are visible and can be effectively monitored;

(i) If, for any reason, use of the airgun array has been discontinued for a period of 10 minutes or more, ramp-up procedures shall be implemented. Only if the PSO watch has been suspended, a 30-minute clearance of the exclusion zone is required prior to commencing ramp-up. Discontinuation of airgun activity for less than 10 minutes does not require a ramp-up; and

(j) No initiation of airgun array operations is permitted from a shutdown position at night or during low-light hours (such as in dense fog or heavy rain) when the entire relevant

EZ cannot be effectively monitored by the PSO(s) on duty.

(k). When utilizing the mitigation airgun, use a reduced duty cycle (approximately 1 shot every 5 minutes).

9. Subsistence Mitigation Measures: To ensure no unmitigable adverse impact on subsistence uses of marine mammals, the Holder of this Authorization shall:

(a) Not enter the Chukchi Sea prior to July 1 to minimize effects on spring and early summer whaling;

(b) Implement the Communication Plan in the Plan of Cooperation (POC) before initiating exploration drilling operations to coordinate activities with local subsistence users and Village Whaling Associations in order to minimize the risk of interfering with subsistence hunting activities;

(c) Participate in the Com Center Program. The Com Centers shall operate 24 hours/day during the 2015 bowhead whale hunt;

(d) Employ local Subsistence Advisors (SAs) from the Chukchi Sea villages to provide consultation and guidance regarding the whale migration and subsistence hunt, as described in the POC;

(e) Not operate aircraft below 1,500 ft (457 m) unless engaged in marine mammal monitoring, approaching, landing or taking off, or unless engaged in providing assistance to a whaler or in poor weather (low ceilings) or any other emergency situations;

10. Monitoring Measures:

(a) Vessel-based Monitoring: The Holder of this Authorization shall designate trained NMFS-approved PSOs aboard drilling units, icebreakers, and anchor handlers. All transiting support vessels will be staffed with at least one trained PSO. The PSOs are required to monitor for marine mammals in order to implement the mitigation measures described in conditions 7 and 8 above;

(b) Aerial Survey Monitoring: The Holder of this Authorization must implement the aerial survey monitoring program detailed in its Marine Mammal Mitigation and Monitoring Plan (4MP); and

(c) Acoustic Monitoring:

(i) Field Source Verification: the Holder of this Authorization is required to conduct sound source verification tests for the drilling units, support vessels, and the airgun array not measured in previous seasons. Sound source verification shall consist of distances at which broadband

received levels reach 190, 180, 170, 160, and 120 dB re 1 μPa (rms). For the airgun array, the configurations shall include at least the full array and the operation of a single source that will be used during power downs.

(ii) Acoustic "Net" Array: Deploy acoustic recorders across the U.S. Chukchi Sea and on the prospect as detailed in the 4MP.

11. Reporting Requirements: The Holder of this Authorization is required to:

(a) Submit daily PSO logs to NMFS during regular working days;

(b) Submit a draft report on all activities and monitoring results to the Office of Protected Resources, NMFS, within 90 days of the completion of the exploration drilling program. This report must contain and summarize the following information:

(i) Summaries of monitoring effort (e.g., total hours, total distances, marine mammal observations, and marine mammal distribution through the study period, accounting for sea state and other factors affecting visibility and detectability of marine mammals);

(ii) Sound source verification and sound source characterization results for drilling units and vessels recorded in 2015;

(iii) Analyses of the effects of various factors influencing detectability of marine mammals (e.g., sea state, number of observers, and fog/glare);

(iv) 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;

(v) Sighting rates of marine mammals during periods with and without exploration drilling activities (and other variables that could affect detectability), such as:

(A) initial sighting distances of marine mammals versus drilling state;
(B) closest point of approach of marine mammals versus drilling state;
(C) observed behaviors and types of movements of marine mammals versus drilling state;
(D) numbers of sightings/individuals seen versus drilling state;
(E) distribution/presence of marine mammals around the survey vessel versus drilling state; and
(F) estimates of marine mammal take by harassment;

(v) Reported results from all hypothesis tests should include estimates of the associated statistical power when practicable;

(vi) Estimate and report uncertainty in all take estimates. Uncertainty could be expressed by the presentation of confidence limits, a minimum-maximum, posterior probability distribution, etc.; the exact approach will be selected based on the sampling method and data available;

(vii) The report should clearly compare authorized takes to the level of actual estimated takes;

(viii) Sampling of the relative near-field around operations should be corrected for effort to provide the best possible estimates of marine mammals in EZs and exposure zones;

(ix) If, changes are made to the monitoring program after the independent monitoring plan peer review, those changes must be detailed in the report; and

(x) Marine mammal sightability curves and analysis overlaying visual and acoustic detections.

(c) The draft report will be subject to review and comment by NMFS. Any recommendations made by NMFS must be addressed in the final report prior to acceptance by NMFS. The draft report will be considered the final report for this activity under this Authorization if NMFS has not provided comments and recommendations within 90 days of receipt of the draft report.

(d) A draft comprehensive report describing the aerial, acoustic, and vessel-based monitoring programs will be prepared and submitted within 240 days after the end date of this Authorization. The comprehensive report will describe the methods, results, conclusions and limitations of each of the individual data sets in detail. The report will also integrate (to the extent possible) the studies into a broad based assessment of all industry activities and their impacts on marine mammals in the Arctic Ocean during 2015.

(e) The draft comprehensive report will be subject to review and comment by NMFS, the Alaska Eskimo Whaling Commission, and the North Slope Borough Department of Wildlife Management. The draft comprehensive report will be accepted by NMFS as the final comprehensive report upon incorporation of comments and recommendations.

12. (a) In the unanticipated event that the drilling program operation clearly causes the take of a marine mammal in a manner prohibited by this Authorization, such as an injury (Level A harassment), serious injury or mortality (e.g., ship-strike, gear interaction, and/or entanglement), Shell shall immediately cease operations and immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, by

phone or email and the Alaska Regional Stranding Coordinators. The report must include the following information:

(i) time, date, and location (latitude/longitude) of the incident;

(ii) the name and type of vessel involved;

(iii) the vessel's speed during and leading up to the incident;

(iv) description of the incident;

(v) status of all sound source use in the 24 hours preceding the incident;

(vi) water depth;

(vii) environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility);

(viii) description of marine mammal observations in the 24 hours preceding the incident;

(ix) species identification or description of the animal(s) involved;

(x) the fate of the animal(s); and

(xi) photographs or video footage of the animal (if equipment is available).

Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS shall work with Shell to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. Shell may not resume their activities until notified by NMFS via letter, email, or telephone.

(b) In the event that Shell discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (i.e., in less than a moderate state of decomposition as described in the next paragraph), Shell will immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, by phone or email and the NMFS Alaska Stranding Hotline and/or by email to the Alaska Regional Stranding Coordinators. The report must include the same information identified in Condition 12(a) above. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with Shell to determine whether modifications in the activities are appropriate.

(c) In the event that Shell discovers an injured or dead marine mammal, and the

lead PSO determines that the injury or death is not associated with or related to the activities authorized in Condition 2 of this Authorization (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), Shell shall report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, by phone or email and the NMFS Alaska Stranding Hotline and/or by email to the Alaska Regional Stranding Coordinators, within 24 hours of the discovery. Shell shall provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network. Activities may continue while NMFS reviews the circumstances of the incident.

13. In the unlikely event of an oil spill, Shell shall comply with NOAA's Marine Mammal Oil Spill Response Guidelines.

14. Activities related to the monitoring described in this Authorization do not require a separate scientific research permit issued under section 104 of the Marine Mammal Protection Act.

15. The Plan of Cooperation outlining the steps that will be taken to cooperate and communicate with the native communities to ensure the availability of marine mammals for subsistence uses must be implemented.

16. Shell is required to comply with the Terms and Conditions of the Incidental Take Statement (ITS) corresponding to NMFS's Biological Opinion issued to NMFS's Office of Protected Resources.

17. A copy of this Authorization and the ITS must be in the possession of all contractors and PSOs operating under the authority of this Incidental Harassment Authorization.

18. Penalties and Permit Sanctions: Any person who violates any provision of this Incidental Harassment Authorization is subject to civil and criminal penalties, permit sanctions, and forfeiture as authorized under the MMPA.

19. This Authorization may be modified, suspended or withdrawn if the Holder fails to abide by the conditions prescribed herein or if the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals, or if there is an unmitigable adverse impact on the availability of such species or stocks for subsistence uses.

Perry Gayaudo

Donna S. Wieting
Director
for Office of Protected Resources
National Marine Fisheries Service

JUN 12 2015
Date

Attachment

Table 1. Total authorized Level B take.

Species	Total Authorized Take
Beluga Whale (Beaufort Sea Stock)	1,318
Beluga Whale (E. Chukchi Stock)	344
Killer Whale	14
Harbor Porpoise	294
Bowhead Whale	1,038
Fin Whale	14
Gray Whale	834
Humpback Whale	14
Minke Whale	41
Bearded Seal	1,722
Ribbon Seal	96
Ringed Seal	25,217
Spotted Seal	1,007

APPENDIX B: U.S. FISH AND WILDLIFE SERVICE LETTER OF AUTHORIZATION

United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
1011 East Tudor Road
Anchorage, Alaska 99503-6199

IN REPLY REFER TO:

AFES/RD

LETTER OF AUTHORIZATION
Incidental Take
(15-CS-02)

EFFECTIVE: July 1, 2015
EXPIRES: November 1, 2015

In accordance with regulations published at 78 FR 35364, dated June 12, 2013, Shell Gulf of Mexico Inc. (Shell) is hereby authorized to take small numbers of polar bears (*Ursus maritimus*) and Pacific walrus (*Odobenus rosmarus divergens*) incidental to activities occurring during Shell's Outer Continental Shelf (OCS) 2015 exploration drilling program in the Chukchi Sea, Alaska.

Shell proposes to conduct an exploration drilling program on leases in the Burger Prospect, Lease Sale 193 area, Chukchi Sea, Alaska, from approximately July 4, 2015 through October 31, 2015. Shell proposes to drill up to six wells using two drill rigs, with a fleet of support vessels and aircraft. These activities are a continuation of an exploration drilling program Shell began in 2012 and will likely continue in future years. A detailed description of the proposed activities is provided in Shell's *Draft Revised Outer Continental Shelf Lease Exploration Plan, Chukchi Sea, Alaska, Burger Prospect: Posey Area Blocks 6714, 6762, 6764, 6812, 6912, 6915, Chukchi Sea Lease Sale 193* (Revision 2, August 2014).

This Letter of Authorization (LOA) and the required conditions below apply to all Shell employees, contractors and personnel performing Shell-approved work under the scope of operations to be conducted. This authorization is subject to the following conditions.

1. This LOA authorizes incidental take only. Intentional take is not authorized.
2. Shell Operations Managers, or designates, must be fully aware, understand, and capable of implementing the conditions of this authorization.
3. Shell's *Polar Bear, Pacific Walrus, and Grizzly Bear Avoidance and Human Encounter/Interaction Plan, Exploration Drilling Program Chukchi Sea, Alaska* (September 2014) and *Marine Mammal Monitoring and Mitigation Plan, Exploration Drilling of Selected Lease Areas in the Alaskan Chukchi Sea* (August 2014) are approved and incorporated by reference into this LOA. All provisions therein must be complied with unless specifically noted otherwise in this LOA.
4. A copy of this LOA and the approved interaction plans listed above must be posted and available for all personnel and in the possession of the operators of all vessels and aircraft engaging in the activities that could cause incidental take under the authority of this LOA.

5. Shell must comply with mitigation, monitoring and reporting requirements of 50 CFR §18.118. Holders of a LOA must use methods and conduct activities in a manner that minimizes to the greatest extent practicable adverse impacts on Pacific walruses and polar bears, their habitat, and on the availability of these marine mammals for subsistence uses. Dynamic management approaches, such as temporal or spatial limitations in response to the presence of marine mammals in a particular place or time or the occurrence of marine mammals engaged in a particularly sensitive activity (such as feeding), must be used to avoid or minimize interactions with polar bears, Pacific walruses, and subsistence users of these resources.
6. At a minimum, mitigation requirements include the following:
   a) General mitigation measures for all applicants:
      (i) The U.S. Fish & Wildlife Service (Service) requires holders of LOAs to cooperate with us and other designated Federal, State, and local agencies to monitor the impacts of oil and gas exploration activities on polar bears and Pacific walruses.
      (ii) Holders of a LOA must designate a qualified individual or individuals to observe, record, and report on the effects of their activities on polar bears and Pacific walruses.
   b) Operating conditions for operational and support vessels.
      (i) Operational and support vessels must be staffed with dedicated marine mammal observers to alert crew of the presence of walruses and polar bears and initiate adaptive mitigation responses.
      (ii) At all times, vessels must maintain the maximum distance possible from concentrations of walruses or polar bears. Under no circumstances, other than an emergency, may any vessel approach within an 805-m (0.5-mi) radius of walruses or polar bears observed on ice. Under no circumstances, other than an emergency, may any vessel approach within 1,610 m (1 mi) of groups of walruses observed on land or within an 805-m (0.5-mi) radius of polar bears observed on land.
      (iii) Vessel operators must take every precaution to avoid harassment of concentrations of feeding walruses when a vessel is operating near these animals. Vessels shall reduce speed and maintain a minimum 805-m (0.5-mi) operational exclusion zone around groups of 12 or more walruses encountered in the water. Vessels may not be operated in such a way as to separate members of a group of walruses from other members of the group. When weather conditions require, such as when visibility drops, vessels shall adjust speed accordingly to avoid the likelihood of injury to walruses.
      (iv) The transit of operational and support vessels through the specified geographic region is not authorized prior to July 1. This operating condition is intended to allow walruses the opportunity to disperse from the confines of the spring lead system and minimize interactions with subsistence walrus hunters. Exemption waivers to this operating condition may be issued by the Service on a case-by-case basis, based upon a review of seasonal ice conditions and available information on walrus and polar bear distributions in the area of interest.
      (v) All vessels must avoid areas of active or anticipated subsistence hunting for walrus or polar bear as determined through community consultations.
      (vi) We shall require a monitor on the site of the activity or on board drillships, drill rigs, aircraft, icebreakers, or other support vessels or vehicles to monitor the impacts of Industry's activity on polar bear and Pacific walruses.
      (vii) Shell`s Exploration Plan includes installation of four permanent moorings in Good

Hope Bay. The coordinates provided indicate that these proposed moorings would be located approximately 20 miles south of Cape Espenberg, which has been used sporadically as a haulout site by walruses in the fall. Condition 6(b)(ii) requires vessels to maintain a 1 mile separation distance from groups of walruses observed on land. Given that Cape Espenberg has been used in the past as a haulout by walruses, we request that in the fall (August 15 - October 15), vessel operations to and from these moorings maintain a 1 mile buffer while transiting past this potential haulout location, regardless of whether or not walrus are known to be hauled out at that time.

c) Operating conditions for aircraft.
   (i) Operators of support aircraft must, at all times, conduct their activities at the maximum distance possible from concentrations of walruses or polar bears.
   (ii) Under no circumstances, other than an emergency, may fixed wing aircraft operate at an altitude lower than 457 m (1,500 ft) within 805 m (0.5 mi) of walrus groups observed on ice, or within 1,610 m (1 mi) of walrus groups observed on land. Under no circumstances, other than an emergency, may rotary winged aircraft (helicopters) operate at an altitude lower than 914 m (3,000 ft) within 1,610 m (1 mi) of walrus groups observed on land. Under no circumstances, other than an emergency, may aircraft operate at an altitude lower than 457 m (1,500 ft) within 805 m (0.5 mi) of polar bears observed on ice or land. Helicopters may not hover or circle above such areas or within 805 m (0.5 mile) of such areas. When weather conditions do not allow a 457-m (1,500-ft) flying altitude, such as during severe storms or when cloud cover is low, aircraft may be operated below the required altitudes stipulated above. However, when aircraft are operated at altitudes below 457 m (1,500 ft) because of weather conditions, the operator must avoid areas of known walrus and polar bear concentrations and must take precautions to avoid flying directly over or within 805 m (0.5 mile) of these areas.
   (iii) Operators must plan all aircraft routes to minimize any potential conflict with active or anticipated walrus or polar bear hunting activity as determined through community consultations.

d) Additional mitigation measures for offshore exploration activities.
   (i) Offshore exploration activities will be authorized only during the open-water season, defined as the period July 1 to November 30. Exemption waivers to the specified open-water season may be issued by the Service on a case-by-case basis, based upon a review of seasonal ice conditions and available information on walrus and polar bear distributions in the area of interest.
   (ii) To avoid significant synergistic or cumulative effects from multiple oil and gas exploration activities on foraging or migrating walruses, operators must maintain a minimum spacing of 24 km (15 mi) between all active seismic source vessels and/or drill rigs during exploration activities. This does not include support vessels for these operations. No more than two simultaneous seismic operations and three offshore exploratory drilling operations will be authorized in the Chukchi Sea region at any time.
   (iii) No offshore exploration activities will be authorized within a 64-km (40-mi) radius of the communities of Barrow, Wainwright, Point Lay, or Point Hope, unless provided for in a Service-approved, site-specific Plan of Cooperation.
   (iv) A monitoring program acceptable to the Service will be required to estimate the

number of walruses and polar bears in a proposed project area.

(v) The Hanna Shoal Walrus Use Area (HSWUA) is a high use area for Pacific walruses. Due to the large numbers of walruses that could be encountered in the HSWUA from July through September, additional mitigation measures may be applied to activities within the HSWUA on a case-by-case basis. These mitigation measures include, but may not be limited to, seasonal restrictions, reduced vessel traffic, or rerouting of vessels. To the maximum extent practicable, aircraft supporting exploration activities shall avoid operating below 1,500 feet above sea level (ASL) over the HSWUA between July 1 and September 30.

e) Any offshore exploration activity expected to include the production of pulsed underwater sounds with sound source levels ≥160 dB re 1 μPa will be required to establish and monitor acoustic exclusion and disturbance zones and implement adaptive mitigation measures as follows:

(i) Monitor zones: Establish and monitor with trained marine mammal observers an acoustically verified exclusion zone for walruses surrounding seismic airgun arrays where the received level will be ≥ 180 dB re 1 μPa; an acoustically verified exclusion zone for polar bear surrounding seismic airgun arrays where the received level will be ≥ 190 dB re 1 μPa; and an acoustically verified walrus disturbance zone ahead of and perpendicular to the seismic vessel track where the received level will be ≥ 160 dB re 1 μPa.

(ii) Ramp-up procedures. For all seismic surveys, including airgun testing, use the following ramp-up procedures to allow marine mammals to depart the exclusion zone before seismic surveying begins:

A. Visually monitor the exclusion zone and adjacent waters for the absence of polar bears and walruses for at least 30 minutes before initiating ramp-up procedures. If no polar bears or walruses are detected, you may initiate ramp-up procedures. Do not initiate ramp-up procedures at night or when you cannot visually monitor the exclusion zone for marine mammals.

B. Initiate ramp-up procedures by firing a single airgun. The preferred airgun to begin with shall be the smallest airgun, in terms of energy output (dB) and volume (in^3).

C. Continue ramp-up by gradually activating additional airguns over a period of at least 20 minutes, but no longer than 40 minutes, until the desired operating level of the airgun array is obtained.

(iii) Power down and shutdown. Immediately power down or shut down the seismic airgun array and/or other acoustic sources whenever any walruses are sighted approaching close to or within the area delineated by the 180 dB re 1 μPa walrus exclusion zone, or polar bears are sighted approaching close to or within the area delineated by the 190 dB re 1 μPa polar bear exclusion zone. If the power down operation cannot reduce the received sound pressure level to 180 dB re 1 μPa (walrus) or 190 dB re 1 μPa (polar bear), the operator must immediately shut down the seismic airgun array and/or other acoustic sources.

(iv) Emergency shutdown. If observations are made or credible reports are received that one or more walruses and/or polar bears are within the area of the seismic survey and are in an injured or mortal state, or are indicating acute distress due to seismic noise, the seismic airgun array will be immediately shut down and the Service contacted.

The airgun array will not be restarted until review and approval has been given by the Service. The ramp-up procedures provided in of this section must be followed when restarting.

(v) Adaptive response for walrus aggregations. Whenever an aggregation of 12 or more walruses are detected within an acoustically verified 160 dB re 1 μPa disturbance zone ahead of or perpendicular to the seismic vessel track, the holder of this Authorization must:

A. Immediately power down or shut down the seismic airgun array and/or other acoustic sources to ensure sound pressure levels at the shortest distance to the aggregation do not exceed 160–dB re 1 μPa; and

B. Not proceed with powering up the seismic airgun array until it can be established that there are no walrus aggregations within the 160 dB zone based upon ship course, direction, and distance from last sighting. If a shutdown was required, the ramp-up procedures provided in section must be followed when restarting.

7. Monitoring requirements.

a) Maintain trained, Service-approved, on-site observers to carry out monitoring programs for polar bears and walruses necessary for initiating adaptive mitigation responses.

b) Marine Mammal Observers (MMOs) will be required on board all operational and support vessels to alert crew of the presence of walruses and polar bears and initiate adaptive mitigation responses identified in paragraph (a) of this section, and to carry out specified monitoring activities identified in the marine mammal monitoring and mitigation plan necessary to evaluate the impact of authorized activities on walruses, polar bears, and the subsistence use of these subsistence resources. The MMOs must have completed a marine mammal observer training course approved by the Service.

c) Cooperate with the Service and other designated Federal, State, and local agencies to monitor the impacts of oil and gas exploration activities in the Chukchi Sea on walruses or polar bears. Where insufficient information exists to evaluate the potential effects of Industry activities on walruses, polar bears, and the subsistence use of these resources, holders of a LOA may be requested to participate in monitoring and/or research efforts in order to help the Service address these information needs and ensure the least practicable impact to these resources. These monitoring and research efforts will employ rigorous study designs and sampling protocols in order to provide useful information. As an example, operators could test new technologies during their activities that will be beneficial in minimizing disturbance to animals. Information gaps and needs in the Chukchi Sea include, but are not limited to:

(i) Distribution, abundance, movements, and habitat use patterns of walruses and polar bears in offshore environments;

(ii) Patterns of subsistence hunting activities by the Native Villages of Kivalina, Point Hope, Point Lay, Wainwright, and Barrow for walruses and polar bears;

(iii) Immediate and longer term (when possible) behavioral and other responses of walruses and polar bears to seismic airguns, drilling operations, vessel traffic, and fixed wing aircraft and helicopters;

(iv) Contaminant levels in walruses, polar bears, and their prey;

(v) Cumulative effects of multiple simultaneous operations on walruses and polar bears; and

(vi) Oil spill risk assessment for the marine and shoreline environment of walruses, polar

bears, their prey, and important habitat areas (e.g., coastal haulouts and den sites).

8. Reporting requirements. Holders of a LOA must report the results of specified monitoring activities to the Service's Marine Mammals Management (MMM) office reporting email at fw7_mmm_reports@fws.gov.
   a) In-season monitoring reports.
      (i) Activity progress reports. Operators must keep the Service informed on the progress of authorized activities by:
         A. Notifying the Service at least 48 hours prior to the onset of activities;
         B. Providing weekly progress reports of authorized activities noting any significant changes in operating state and or location; and
         C. Notifying the Service within 48 hours of ending activity.
      (ii) Walrus observation reports. The operator must report, on a weekly basis, all observations of walruses during any Industry operation. Information within the observation report will include, but is not limited to:
         A. Date, time, and location of each walrus sighting;
         B. Number, sex, and age of walruses (if determinable);
         C. Observer name, company name, vessel name or aircraft number, LOA number, and contact information;
         D. Weather, visibility, and ice conditions at the time of observation;
         E. Estimated distance from the animal or group when initially sighted, at closest approach, and end of the encounter;
         F. Industry activity at time of sighting and throughout the encounter. If a seismic survey, record the estimated radius of the zone of ensonification;
         G. Behavior of animals at initial sighting, any change in behavior during the observation period, and distance from the observers associated with those behavioral changes;
         H. Detailed description of the encounter;
         I. Duration of the encounter;
         J. Duration of any behavioral response (e.g., time and distance of a flight response); and
         K. Actions taken.
      (iii) Polar bear observation reports. The operator must report, within 24 hours, all observations of polar bears during any Industry operation. Information within the observation report will include, but is not limited to:
         A. Date, time, and location of observation;
         B. Number, sex, and age of bears (if determinable);
         C. Observer name, company name, vessel name, LOA number, and contact information;
         D. Weather, visibility, and ice conditions at the time of observation;
         E. Estimated closest point of approach for bears from personnel and/or vessel/facilities;
         F. Industry activity at time of sighting, and possible attractants present;
         G. Behavior of animals at initial sighting and after contact;
         H. Description of the encounter;
         I. Duration of the encounter; and
         J. Actions taken.

(iv) Notification of incident report. Reports shall include all information specified under the species observation report, as well as a full written description of the encounter and actions taken by the operator. The operator must report to the Service within 24 hours:

A. Any incidental lethal take or injury of a polar bear or walrus; and

B. Observations of walruses or polar bears within prescribed mitigation monitoring zones.

b) After-action monitoring reports. The results of monitoring efforts identified in the marine mammal monitoring and mitigation plan must be submitted to the Service MMM for review within 90 days of completing the year's activities. Results must include, but are not limited to, the following information:

(i) A summary of monitoring effort including: Total hours, total distances, and distribution through study period of each vessel and aircraft;

(ii) Analysis of factors affecting the visibility and detectability of walruses and polar bears by specified monitoring;

(iii) Analysis of the distribution, abundance, and behavior of walrus and polar bear sightings in relation to date, location, ice conditions, and operational state;

(iv) Estimates of take based on the number of animals encountered/kilometer of vessel and aircraft operations by behavioral response (no response, moved away, dove, etc.), and animals encountered per day by behavioral response for stationary drilling operations; and

(v) Raw data in electronic format (i.e., Excel spreadsheet) as specified by the Service in consultation with Industry representatives.

c) A report on the Plan of Cooperation, including the notification of the affected communities, measures taken to ensure that exploratory activities did not interfere with subsistence activities, and follow-up notification after the season, shall be submitted to the Service MMM no later than 90 days after the expiration of this LOA. A copy of the report shall be sent to affected local subsistence communities, the Alaska Nanuuq Commission, the Eskimo Walrus Commission, and the North Slope Borough Wildlife Department as well as to the Service MMM.

9. Additional mitigation measures for activities within the HSWUA.

a) Within the HSWUA this LOA authorizes incidental take of Pacific walruses between July 1 and September 30 only for activities that are outside of the Pacific walrus monthly 50 percent utilization distribution areas[1] (UDs) during July, August, and September, respectively. After September 30 this mitigation measure no longer applies.

b) Shell must provide the Service MMM at least 48 hours notice prior to vessels entering into any area within the outer boundary of the HSWUA through September 30, 2015.

c) Shell must notify the Service MMM within 48 hours when vessels have departed the HSWUA.

d) Shell must increase observation for Pacific walruses to include a 360° observation radius around all vessels and report on the behavior of observable walruses within that radius with particular attention to behavior before, during and after a vessel moves past observed walruses.

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[1] The 50 percent UDs are described in 78 FR 35364 (June 12, 2013) and based on Jay, C.V., A.S. Fischbach, and A.A. Kochnev. 2012. Walrus areas of use in the Chukchi Sea during sparse sea ice cover. Marine Ecology Progress Series Vol. 468: 1–13, 2012 (GIS files available at https://erma.noaa.gov/arctic/erma.html).

e) Shell must notify the Service within 24 hours if walruses are observed within 1/4 mile (402 meters) of a vessel.
f) Shell must notify the Service within 24 hours if 500 or more walruses are observed within 1 mi (1.6 kilometers) within a 24 hour period (each 24 hour period beginning at midnight of a calendar day) of a vessel.
g) Activities within the HSWUA may proceed only when weather and visibility conditions allow full implementation of all required mitigation measures.
h) If Shell does not implement a mitigation measure when required, the Service must be notified immediately (or as soon as possible) for each incident.
i) Failure to implement required mitigation measures may result in the imposition of additional mitigation measures, the suspension or revocation of the HSWUA variance, and/or suspension or revocation of this LOA.

The Service has completed intra-Service consultation for polar bears, and conference for Pacific walruses, under the Endangered Species Act of 1973, as amended (ESA), and has determined that issuance of this LOA is not likely to jeopardize the continuing existence of polar bears and Pacific walruses. No additional authorization under the ESA is required.

Activities related to the monitoring described in this authorization do not require a separate scientific research permit issued under Section 104 of the Marine Mammal Protection Act.

If you have any questions, please contact Mr. Michael Hendrick or Mr. Christopher Putnam at (907) 786-3479 or (907) 786-3844, respectively.

Regional Director

6/30/15
Date

APPENDIX C: DETAILS OF MONITORING, MITIGATION, AND ANALYSIS METHODS

This appendix provides details on the standard visual monitoring methods and data analysis techniques implemented for this project. Five protected species observers (PSOs) were aboard each of the drilling units, *Polar Pioneer* and *Noble Discoverer,* and also aboard each of the ice management vessels, *Nordica* and *Fennica*. There were four PSOs on the anchor handling vessels, *Tor Viking, Ross,* and *Aiviq*. The remaining support vessels were staffed with one to three PSOs. The PSOs stationed on each vessel were a combination of professional biologists with experience in marine mammal identification and observation methods, and local Inupiat residents with experience identifying Arctic marine mammals through subsistence activities. PSOs generally worked 2–4 h shifts for up to 12 h per day.

All PSOs participated in extensive safety training and a 7 day observer training course designed to familiarize them with the operational and data recording procedures, reporting protocols, and permit stipulations. PSO duties included:

- recording environmental and sighting conditions;
- searching for and identifying marine mammals, and recording their numbers, distances from the vessel, and behavior;
- recording possible reactions of marine mammals to the drilling and ice management operations;
- requesting mitigation measures when appropriate; and
- contacting local-village communication centers every six h to report vessel location, activity, etc.

Visual Monitoring for Marine Mammals

As specified in permits, PSOs monitored for marine mammals around the *Polar Pioneer* during all drilling operations. The *Noble Discoverer* did not engage in drilling activities in 2015. PSOs also monitored all ice management activities in the Chukchi Sea from the *Nordica, Aiviq,* and *Tor Viking*. PSOs monitored during all anchor handling activities in the Chukchi Sea from the *Aiviq, Ross,* and *Tor Viking.* No zero-offset vertical seismic profiling (ZVSP) operations with airguns took place during the 2015 season, and so mitigation for seismic activities was unnecessary. In general, observations for marine mammals were conducted using the following guidelines:

- Observations during daylight hours were conducted by two PSOs during all active drilling, anchor handling, and ice management activities.
- PSOs monitored for marine mammals aboard all vessels during transit periods to obtain baseline data on marine mammal distribution and (in the case of less experienced observers) to become more familiar with observation protocols. PSO schedules were adjusted throughout the season to maximize watches during daylight hours and with two PSOs on duty as much as possible.
- PSOs also recorded locations and movements of vessels when on watch; information regarding vessels as well as marine mammals was recorded in a database.

Aboard all vessels, PSO(s) systematically scanned the area around the vessel in a sweeping pattern, usually alternating scan sweeps between reticle binoculars (e.g., Fujinon 7 × 50) and the unaided eye during the daytime. Observations were focused forward and to the sides of moving vessels in an arc of ~210º, but PSOs also regularly checked for the presence of marine mammals astern of the vessel. Night vision devices were used aboard drill rigs, ice management vessels, and anchor handling vessels during non-daylight hours using a similar sweep search pattern. PSOs on the *Nordica* monitored using forward-looking infrared (FLIR) and night vision devices during nighttime.

The duration of a single visual shift was no longer than 4 h to minimize observer fatigue. In addition to the dedicated PSOs aboard a given vessel, bridge personnel were responsible for detecting marine mammals and implementing mitigation requirements when PSOs were not present on the bridge per Shell's 2015 IHA and LOA.

While on watch, PSOs kept systematic electronic records of the vessel's position, activity, and environmental conditions. These data were entered directly into an electronic database using a notebook-style computer. Vessel and environmental data were recorded in the database every 30 min or whenever observation conditions changed significantly. Additional data were recorded whenever marine mammals were observed. For all records, the date and time, vessel position (longitude and latitude), and environmental conditions were recorded. The database was constructed to prevent entry of out-of-range values, and an extensive series of data validations were built into the program to reduce errors made by PSOs when collecting data. The program also prompted PSOs with "mitigation reminders" whenever data were entered that were consistent with sightings that required mitigation (e.g., whales within or approach 274 m [300 yd] of the vessel]. All data entries were checked visually by the PSO who recorded the data, the lead PSO in the field, personnel in the Anchorage office, and post-season in the Anchorage office through a sequential series of manual checks and computerized validation programs.

The following information was recorded for each marine mammal sighting: date, time, vessel location, vessel activity, species, total number of individuals, number of juveniles, bearing relative to vessel's heading, direction of movement relative to the vessel, distance from the vessel, behavior when sighted, whether animal was in the water or hauled out on ice or land, behavioral pace, potential reaction to the vessel, water depth, observer initials, species identification reliability, closest point of approach (CPA), time of CPA, the type of mitigation requested, and the time that mitigation measures were requested (if necessary) and subsequently implemented by the vessel operator. Distance to marine mammals was measured from the PSO's location on the bridge rather than from the nominal center of each vessel. The bearing from the vessel to individual or groups of marine mammals was estimated using positions on a clock face, with the bow of the vessel considered to be 12 o'clock and the stern 6 o'clock.

PSOs regularly recorded vessel activity. Intra-ship communication was conducted via radio, email, or telephone or by personnel on the bridge. The position of the vessel was logged every 60 sec by GPS and these data were integrated with the marine mammal database to check for data recording errors.

Marine Mammal Mitigation During Operations

The following mitigation measures were adopted for marine mammal sightings during the exploratory drilling program: reduction in speed, course alterations, and special mitigation measures for specific vessel activities.

Reduction of Speed

Vessels reduced speed to ≤ 5 kt (5.8 mph) within 274 m (300 yds) of whales. Both of these measures were aimed at reducing the risk of ship-whale collisions.

Course Alteration

Vessels made course alterations to avoid both individual whales and groups when this was safe and practicable (i.e. it was not possible for the *Polar Pioneer* to change course while moored at the drilling site or during towing). When groups of whales were encountered, vessels did not make frequent changes in course. During periods of reduced visibility, changes in vessel speed were made to reduce the risks of whale-ship collisions.

Mitigation Measures during Specific Activities

Ice scouting and management activities in the Chukchi Sea during 2015 involved significant communication between PSOs and vessel operators. Whenever possible, these activities were restricted to periods with good visibility conditions to allow for large detection distances of marine mammals in the area prior to approaching sea ice. The location of these animals was communicated to vessel operators and shore-based project managers, and distances from animals were maintained or increased. Only small amounts of hazardous ice were managed in the Chukchi Sea Activity Area. All operational decisions related to ice scouting and management involved significant assessment of the distribution of marine mammals known to be in the area prior to any detailed instructions being delivered from Shell's shore-based management team in Anchorage to vessels. Seven mitigation measures were requested by PSOs during ice scouting activities (five speed reductions, two course alterations), and one mitigation measure was requested during ice management activities. Beyond requirements associated with routine vessel activities, the IHA and LOA did not include specific distances within which marine mammal sightings would have required a temporary reduction or stoppage of drilling, mudline cellar construction, or anchor handling activities. PSOs on vessels actively engaged in drilling, mudline cellar construction, or anchor handling did record sightings, but none of these sightings caused PSOs to request proactive mitigation measures or mitigation measures required during routine vessel activities.

Analyses

Marine Mammal Monitoring

This section describes the analyses of the marine mammal sightings and survey effort recorded during this project.

The sightings and effort data from all vessels were analyzed together. Data were first grouped into two categories, or bins, based on whether the vessel was moving or stationary at the time of data collection. Activity scenario categories were designed to distinguish potential differences in distribution, abundance, and behavior of marine mammals associated with different activity scenarios. Data were further grouped based on the whether or not drilling operations, ice management activity, anchor handling activity, or general vessel operations were occurring Data were also analyzed by received sound level (RSL): ≥120 dB (rms SPL) and <120 dB (rms SPL).

Estimating the Number of Individuals Potentially Exposed

Estimates of the number of individual marine mammals potentially exposed to continuous sound levels ≥120 dB (rms) were considered using two primary methods. The first of these was a summary of all marine mammals observed during activity scenario periods relative to the estimated RSL in the water at the location of the sighting.

The second method used to estimate the numbers of marine mammals potentially exposed to RSLs ≥120 dB (rms) from vessel activities was calculated by multiplying the area of water ensonified to that sound level by the estimated density of marine mammals. Chapter 3 described three different methods used to calculate acoustic footprints produced by 2015 exploration drilling and support vessel activities. The three methods used different radial distances from the drill sites to determine whether support vessel activities were included in the modeled footprints. The first method, which included the drilling operations, support vessel activities within 1 km of the drill sites, and all ice management activities, is most consistent with the modeling approach used in the IHA Application. Therefore, the ensonified areas used in the calculations are from the first acoustic footprint calculation method (Method 1) described in Chapter 3.

NMFS and USFWS practices in situations with intermittent impulsive sounds like seismic pulses has been to assume that "take by harassment" (Level B harassment) may occur if marine mammals are exposed

to received sound levels exceeding 160 dB re 1 μPa rms (NMFS 2005, 2006; USFWS 2008). For continuous sounds, like those created by drilling and ice-management activities, Level B harassment is assumed to occur at received levels ≥120 dB re 1 μPa rms.

Two methods were used to estimate the number of pinnipeds and cetaceans exposed to sound levels that may have caused disturbance or other effects. The methods were:

(A) estimates based on direct observations during drilling and related support-vessel activities; and

(B) estimates based on pinniped and cetacean densities utilized in Shell's 2015 IHA application multiplied by the area ensonified to ≥120 dB (rms) during activity scenarios

Density-based exposure estimates were calculated for activity scenarios as prescribed by Shell's 2015 IHA and the subsequent authorization from NMFS of Level-B "takes" of cetaceans and seals from these activities. This method involved multiplying the following values:

- daily average footprints predicted to be ≥120 dB re 1 μPa (rms SPL) by the Method 1 acoustic modeling described in Chapter 3 which reflects the activity scenarios described in the IHA and LOA applications, within each sea during Jul–Aug and Sep–Oct.
- expected densities of marine mammals from the best available data

This density-based exposure method is a modified version of the approach originally developed to estimate numbers of seals potentially affected by seismic surveys in the Alaskan Beaufort Sea conducted under previous IHAs (e.g., Harris et al. 2001; Funk et al. 2008; Ireland et al. 2007a,b; Patterson et al. 2007; Reiser et al. 2010; Reiser et al. 2011).

Literature Cited

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APPENDIX D: BEAUFORT WIND FORCE DEFINITIONS

Wind Speed		Beaufort Wind Force	World Meteorological Organization Terms	Wave Height (m)	Description
Knots	m/s				
<1	<0.5	0	Calm	0	Glassy like a mirror
1-3	0.5-1.5	1	Light air	<0.1	Ripples with the appearance of scales but no whitecaps or foam crests
4-6	2.1-3.1	2	Light breeze	0-0.1	Small wavelets, crests have a glassy appearance but do not break (no whitecaps)
7-10	3.6-5.1	3	Gentle breeze	0.1-0.5	Smooth large wavelets, crests begin to break, occasional/scattered whitecaps
11-16	5.7-8.2	4	Moderate breeze	0.5-1.2	Slight; small fairly frequent whitecaps
17-21	8.7-10.8	5	Fresh breeze	1.2-2.4	Moderate waves becoming longer, some spray, frequent moderate whitecaps
22-27	11.3-13.9	6	Strong breeze	2.4-4	Rough, larger waves, longer-formed waves, many large whitecaps
28-33	14.4-17.0	7	Near gale	4-6	Very rough, large waves forming, white foam crests everywhere, spray is present
34-40	17.5-20.6	8	Gale		
41-47	21.1-24.2	9	Strong gale		
48-55	24.7-28.3	10	Storm	6-9	High
56-63	28.8-32.4	11	Violent storm	11-14	Very high

APPENDIX E: CHUKCHI SEA VESSEL – BASED MARINE MAMMAL MONITORING

Part 1: Tables and Figures Referenced from Chapter 4

TABLE E.1. Marine mammal observer effort (in km and h) that met the criteria for being able to reliably detect marine mammals (See Chapter 4, Data Analyses, and Appendix C) during Shell's exploratory drilling operations in the Chukchi Sea, 2015. Effort data are categorized by vessel activity period and Beaufort wind force.

Vessel Activity for Moving (km) for Stationary (h)	**Beaufort Wind Force**						
	0	**1**	**2**	**3**	**4**	**5**	***Total***
Drilling	69	1027	4252	5127	2917	2021	***15414***
MLC	35	247	963	993	686	570	***3493***
MLC + Anchor Handling	38	315	798	925	616	234	***2927***
Anchor Handling	–	13	447	2023	1477	855	***4814***
Anchor Handling + Drilling	18	148	758	1646	1337	821	***4727***
Routine Vessel Activities	65	1076	2614	4025	3189	4241	***15209***
Moving Overall	***225***	***2826***	***9830***	***14739***	***10221***	***8742***	***46584***
Drilling	67	392	1059	1198	659	357	***3733***
MLC	2	71	231	223	156	79	***763***
MLC + Anchor Handling	18	117	321	371	260	123	***1210***
Anchor Handling	–	1	169	448	221	34	***874***
Anchor Handling + Drilling	4	91	363	579	299	210	***1546***
Routine Vessel Activities	47	210	513	658	505	390	***2323***
Stationary Overall	***138***	***882***	***2656***	***3478***	***2099***	***1194***	***10448***

TABLE E.2. Cetacean sightings from periods that met the criteria for being able to reliably detect cetaceans (See Chapter 4, Data Analyses, and Appendix C) during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Cetacean Sightings from Moving and Stationary Vessels	**Beaufort Wind Force**						
	0	**1**	**2**	**3**	**4**	**5**	***Total***
Drilling	–	1	16	5	4	2	***28***
MLC	–	–	4	3	–	–	***7***
MLC + Anchor Handling	–	1	–	4	–	–	***5***
Anchor Handling	–	–	–	–	1	1	***2***
Anchor Handling + Drilling	–	–	2	–	2	1	***5***
Routine Vessel Activities	–	5	4	10	5	7	***31***
Moving Overall	***–***	***7***	***26***	***22***	***12***	***11***	***78***
Drilling	2	2	9	9	4	1	***27***
MLC	–	–	2	–	1	1	***4***
MLC + Anchor Handling	–	–	4	2	1	1	***8***
Anchor Handling	–	–	–	1	–	–	***1***
Anchor Handling + Drilling	–	1	2	5	3	–	***11***
Routine Vessel Activities	–	3	2	9	12	4	***30***
Stationary Overall	***2***	***6***	***19***	***26***	***21***	***7***	***81***

TABLE E.3. Seal sightings from periods that met the criteria for being able to reliably detect cetaceans (See Chapter 4, Data Analyses, and Appendix C) during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Seal Sightings from Moving and Stationary Vessels	**Beaufort Wind Force**						
	0	**1**	**2**	**3**	**4**	**5**	***Total***
Drilling	14	30	77	45	23	9	***198***
MLC	10	5	13	3	6	1	***38***
MLC + Anchor Handling	4	26	15	11	4	2	***62***
Anchor Handling	–	–	3	13	6	1	***23***
Anchor Handling + Drilling	4	8	31	18	7	4	***72***
Routine Vessel Activities	13	60	55	39	21	43	***231***
Moving Overall	***45***	***129***	***194***	***129***	***67***	***60***	***624***
Drilling	26	60	65	66	20	8	***245***
MLC	*1*	*20*	*24*	*24*	*7*	–	***76***
MLC + Anchor Handling	*3*	*34*	*22*	*21*	*13*	*2*	***95***
Anchor Handling	–	–	*5*	*20*	*7*	–	***32***
Anchor Handling + Drilling	–	*21*	*44*	*46*	*16*	*9*	***136***
Routine Vessel Activities	*25*	*70*	*80*	*48*	*32*	*20*	***275***
Stationary Overall	***55***	***205***	***240***	***225***	***95***	***39***	***859***

TABLE E.4. Pacific Walrus sightings from periods that met the criteria for being able to reliably detect cetaceans (See Chapter 4, Data Analyses, and Appendix C) during Shell's exploratory drilling operations in the Chukchi Sea, 2015.

Pacific Walrus Sightings from Moving and Stationary Vessels	**Beaufort Wind Force**						
	0	**1**	**2**	**3**	**4**	**5**	***Total***
Drilling	5	7	16	19	4	5	***56***
MLC	–	1	–	1	1	1	***4***
MLC + Anchor Handling	–	–	–	–	–	–	–
Anchor Handling	–	–	–	3	–	–	***3***
Anchor Handling + Drilling	–	1	6	6	7	3	***23***
Routine Vessel Activities	4	7	13	14	3	15	***56***
Moving Overall	***9***	***16***	***35***	***43***	***15***	***24***	***142***
Drilling	1	15	43	19	13	3	***94***
MLC	–	*3*	*3*	*2*	*1*	–	***9***
MLC + Anchor Handling	–	–	–	–	–	–	–
Anchor Handling	–	–	*1*	–	–	–	***1***
Anchor Handling + Drilling	–	*16*	*29*	*38*	*12*	*2*	***97***
Routine Vessel Activities	*6*	*20*	*20*	*18*	*9*	*6*	***79***
Stationary Overall	***7***	***54***	***96***	***77***	***35***	***11***	***280***

There were no Polar Bear sightings from periods that met the criteria for being able to reliably detect Polar Bears (See Chapter 4 and Appendix C).

Part 2: Weekly Sighting Maps

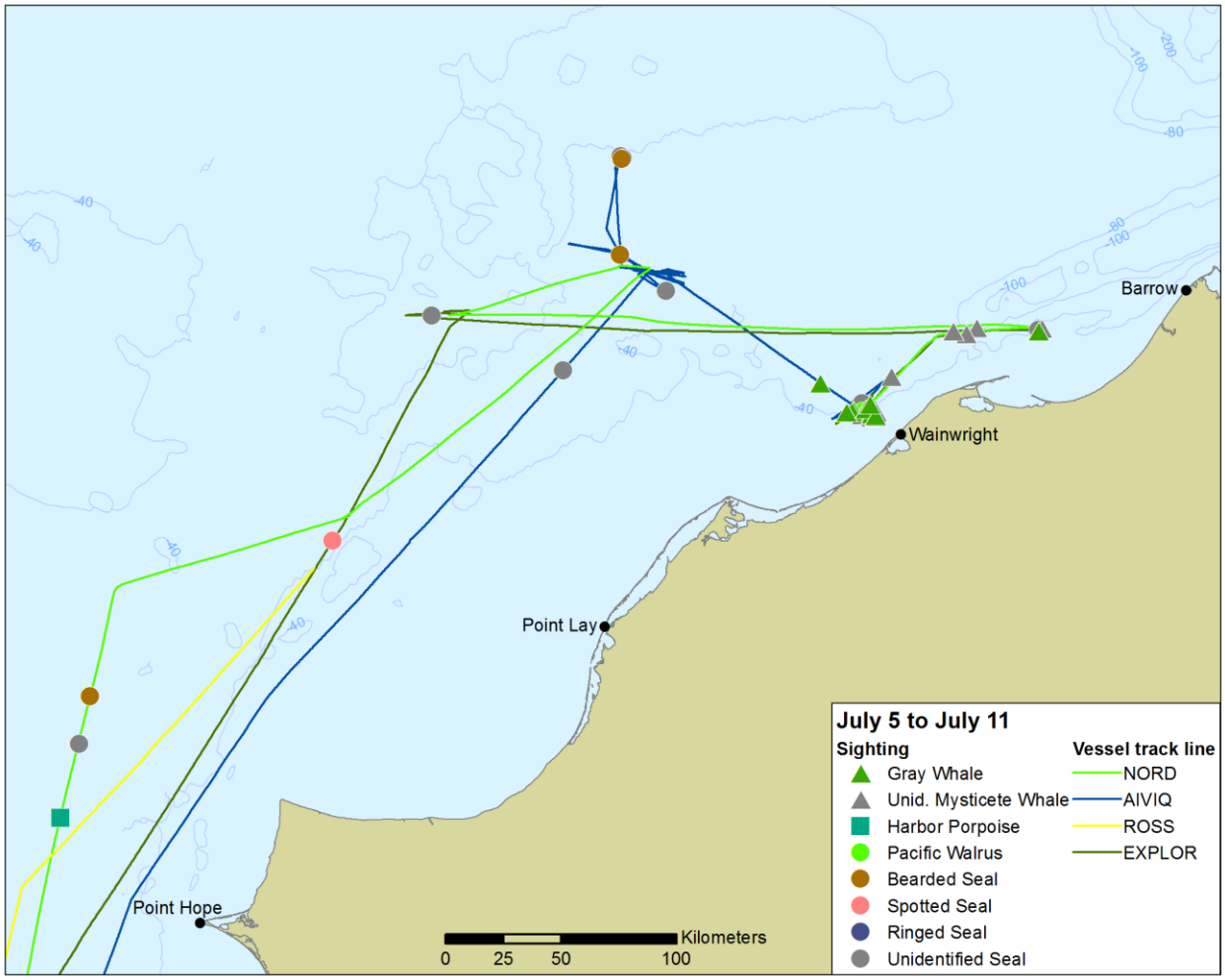

FIGURE E.1. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 5 Jul – 11 Jul 2015.

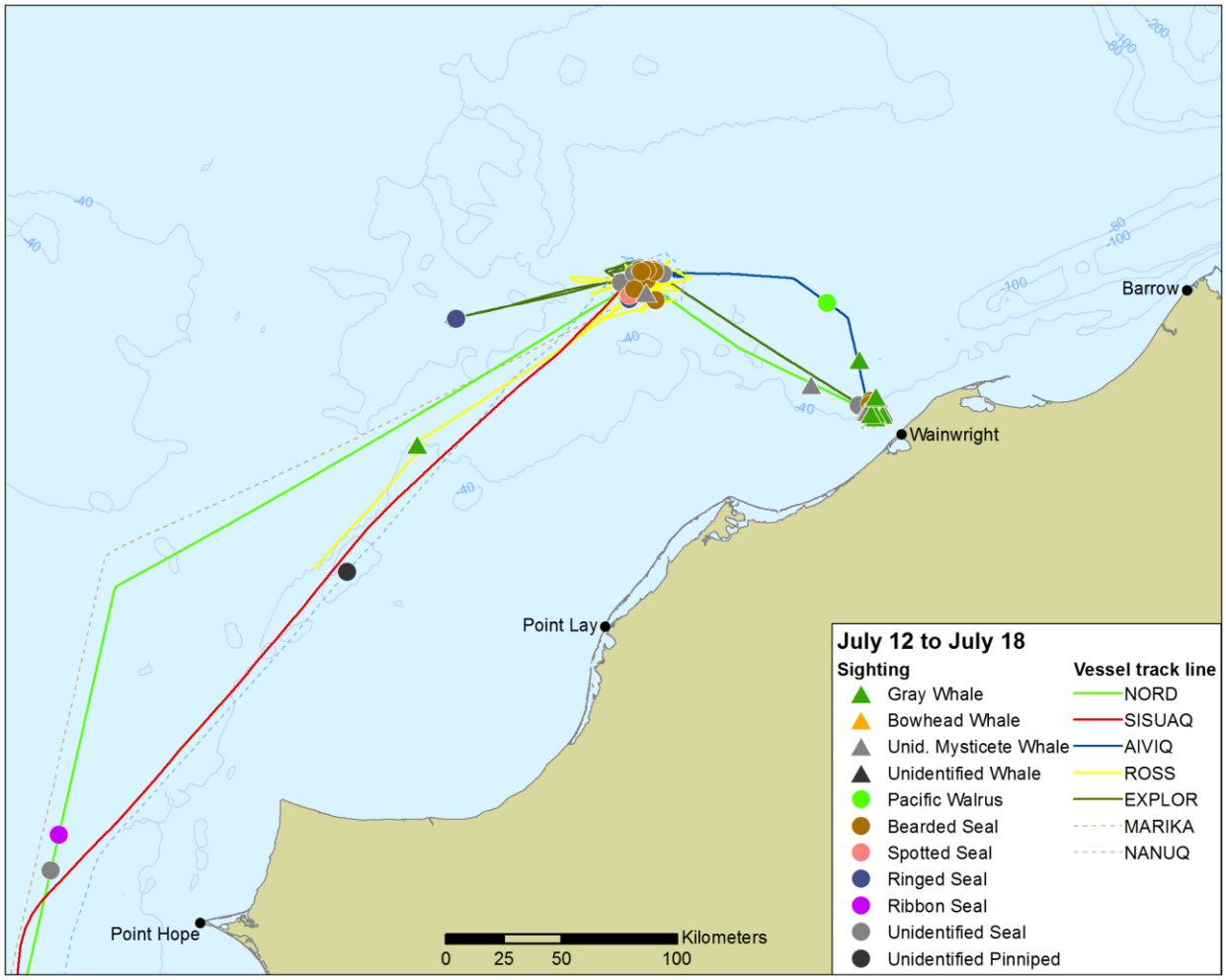

FIGURE E.2. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 12 Jul – 18 Jul 2015.

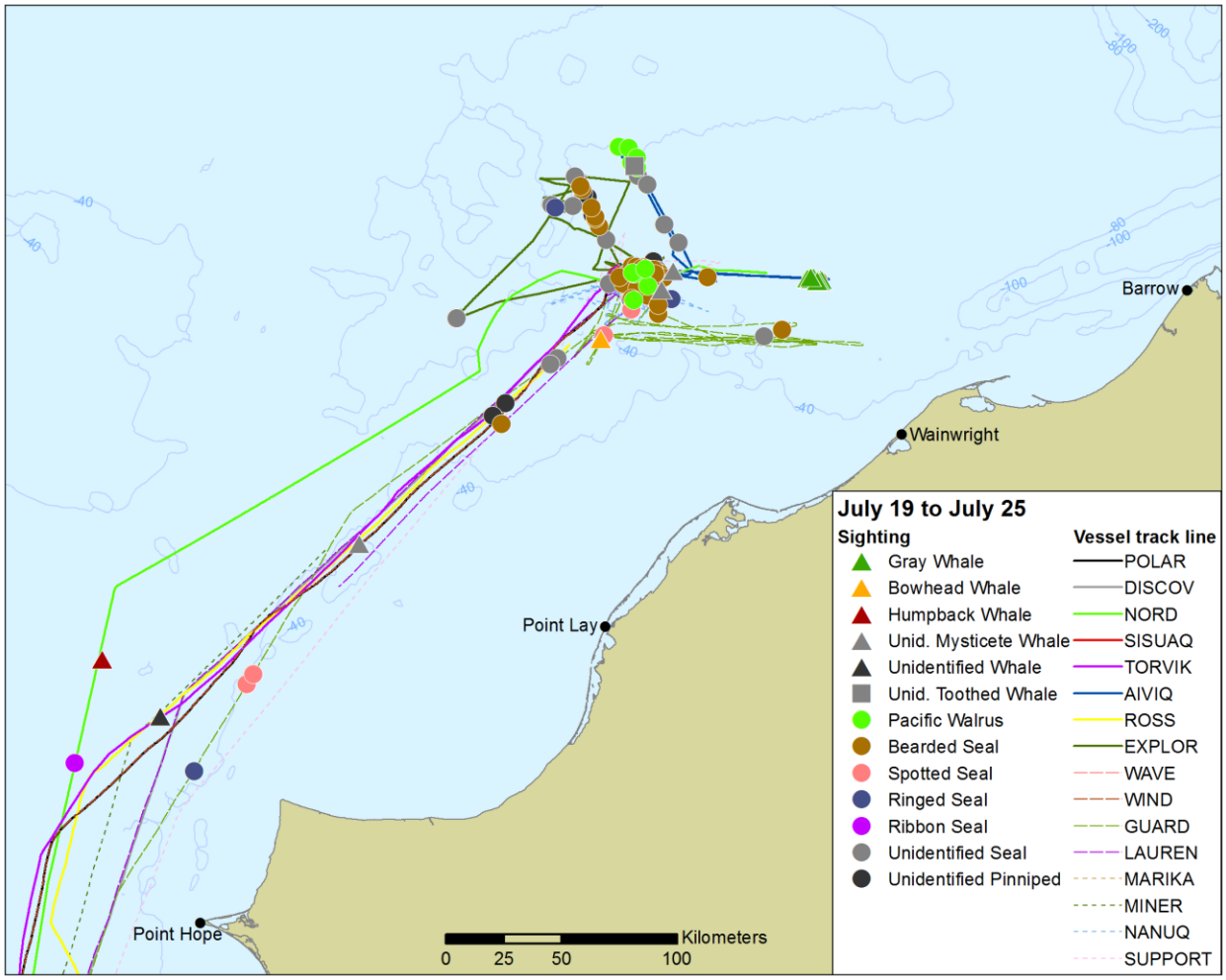

FIGURE E.3. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 19 Jul – 25 Jul 2015.

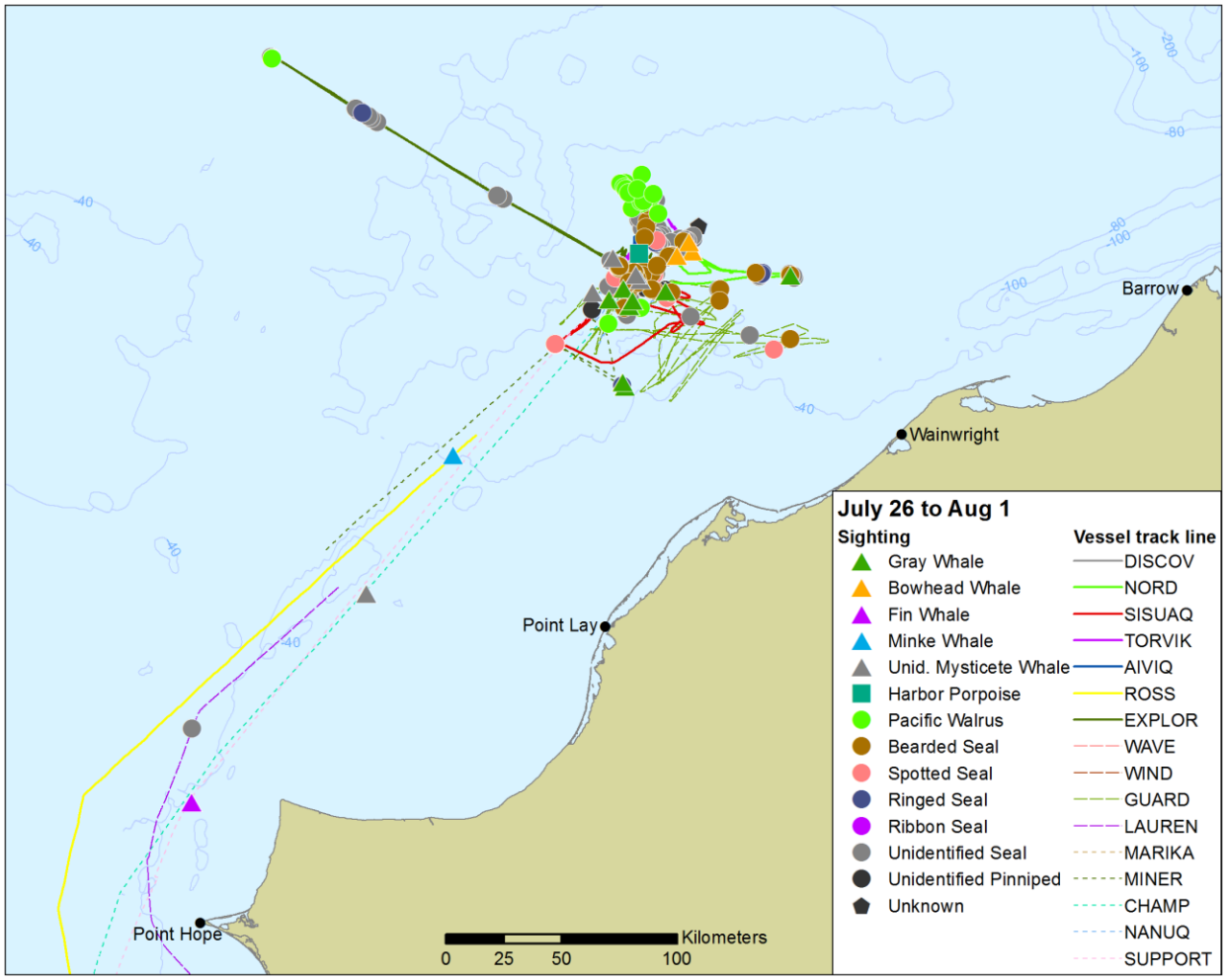

FIGURE E.4. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 26 Jul – 1 Aug 2015.

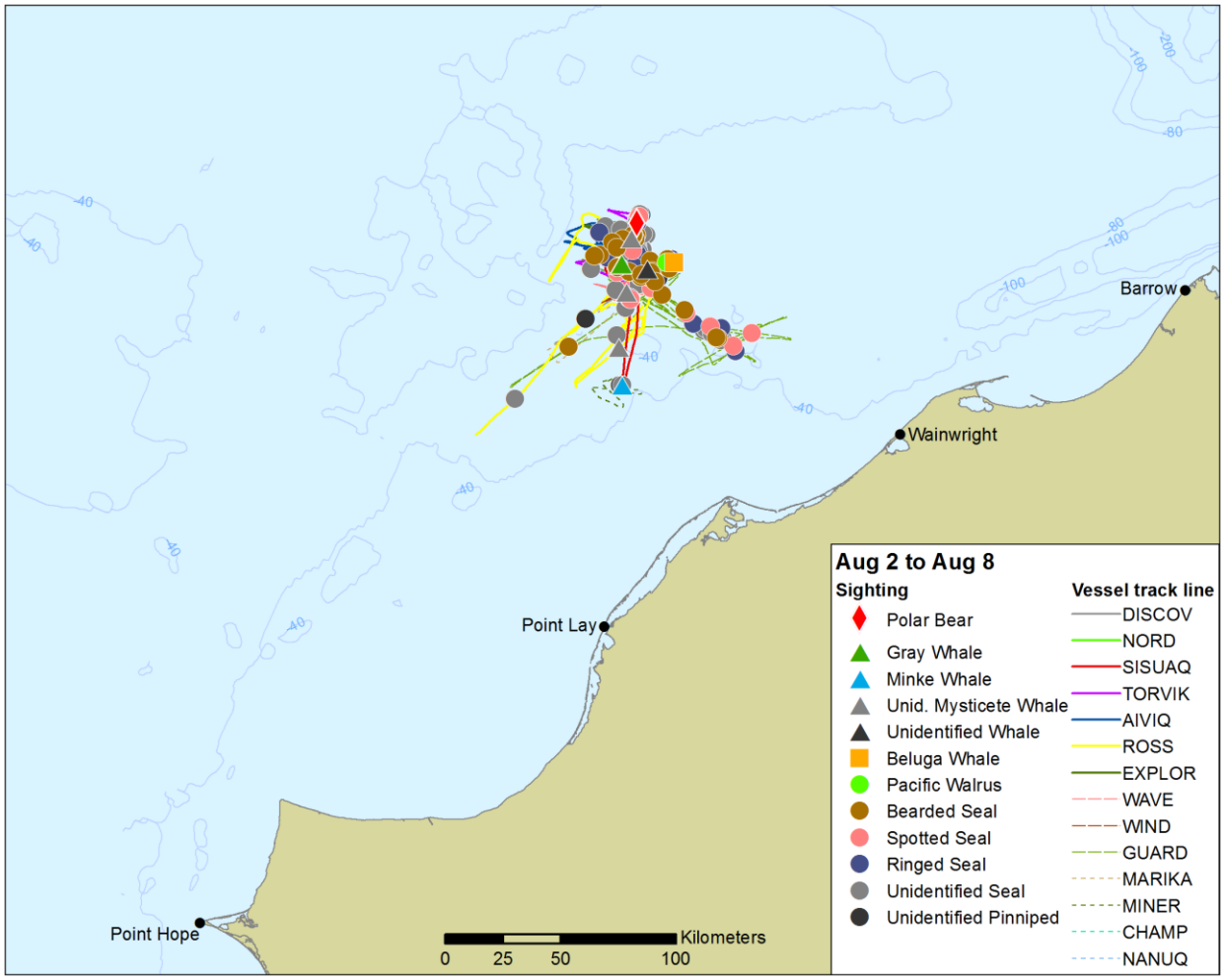

FIGURE E.5. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 2 Aug – 8 Aug 2015.

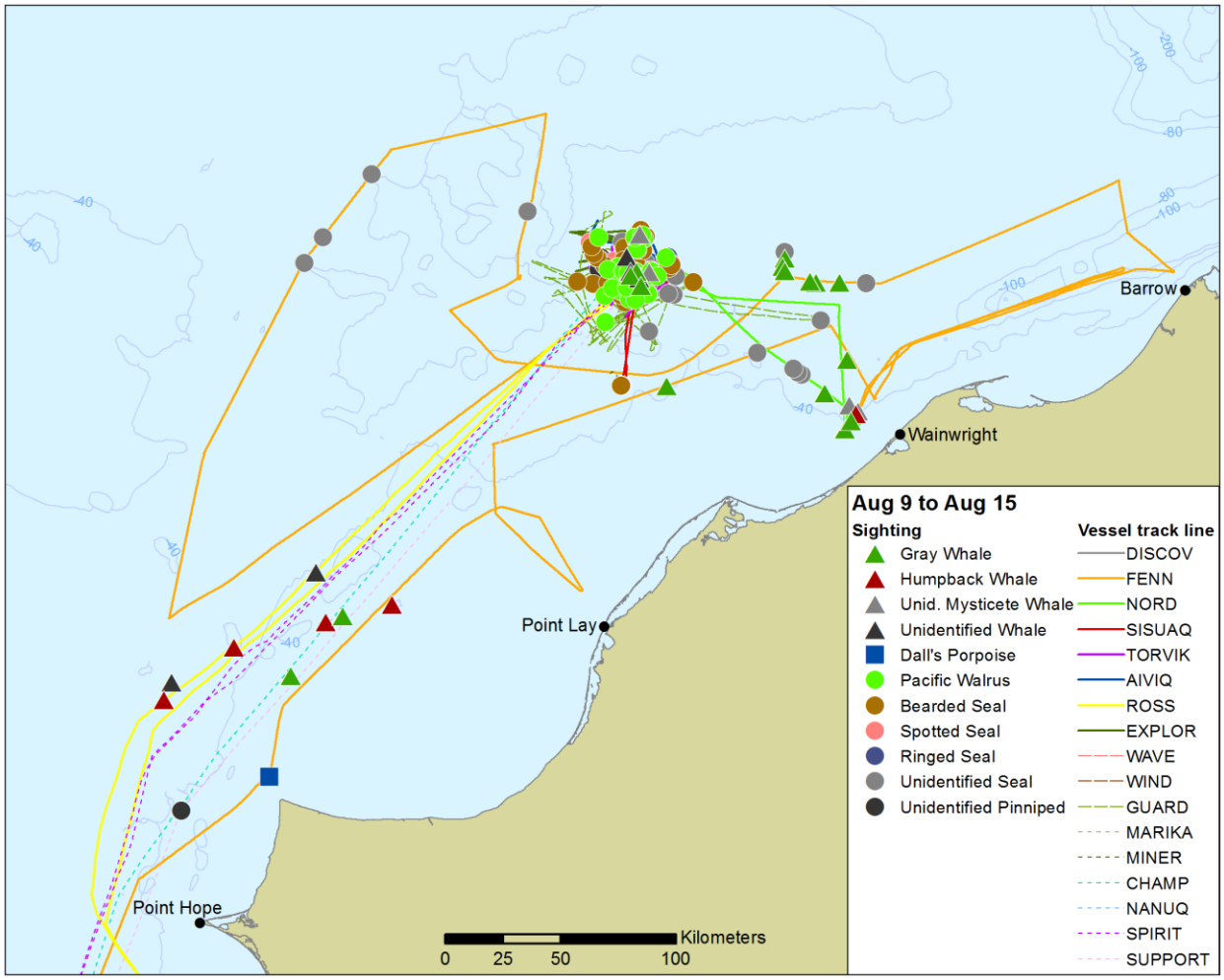

FIGURE E.6. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 9 Aug – 15 Aug 2015.

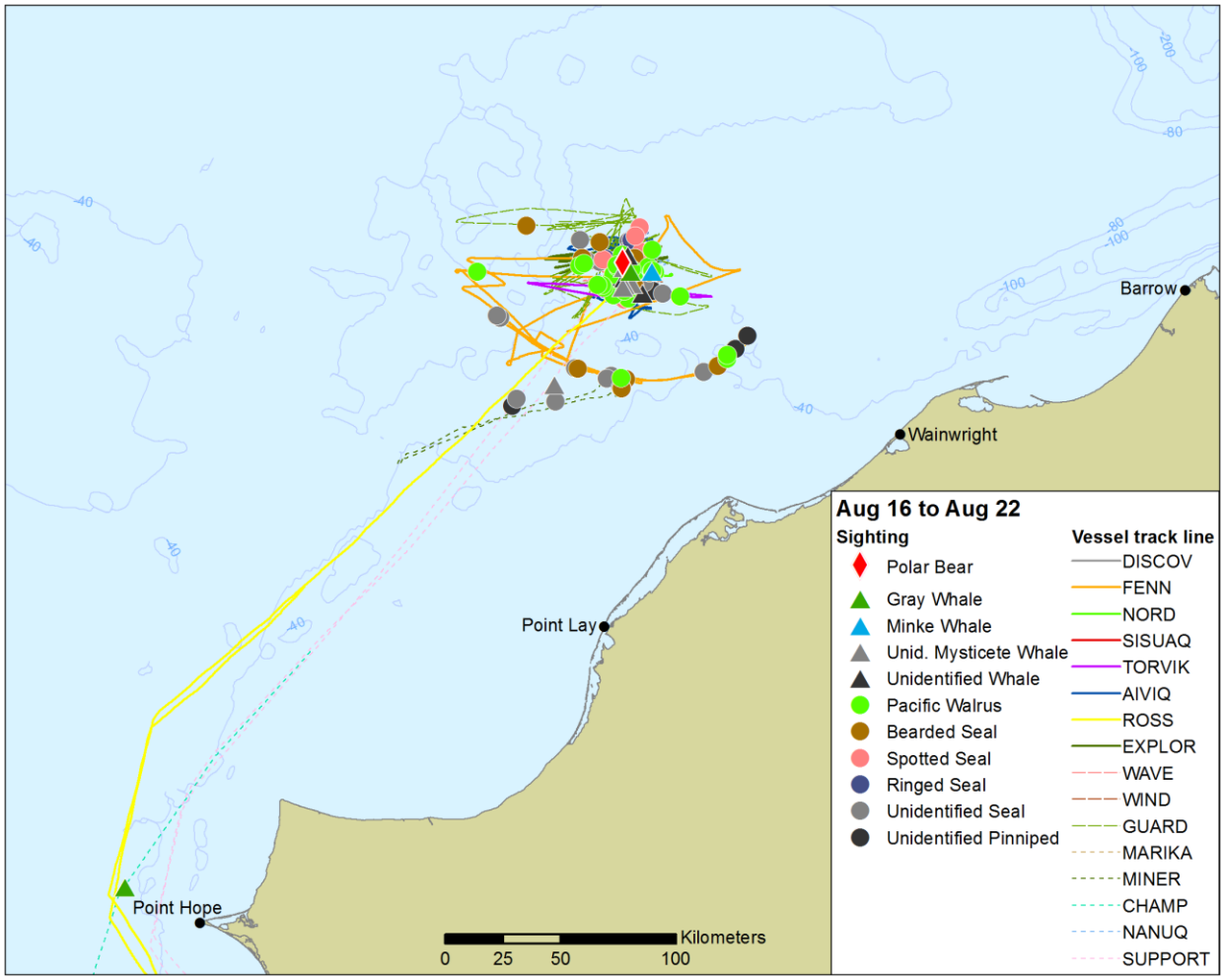

FIGURE E.7. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 16 Aug – 22 Aug 2015.

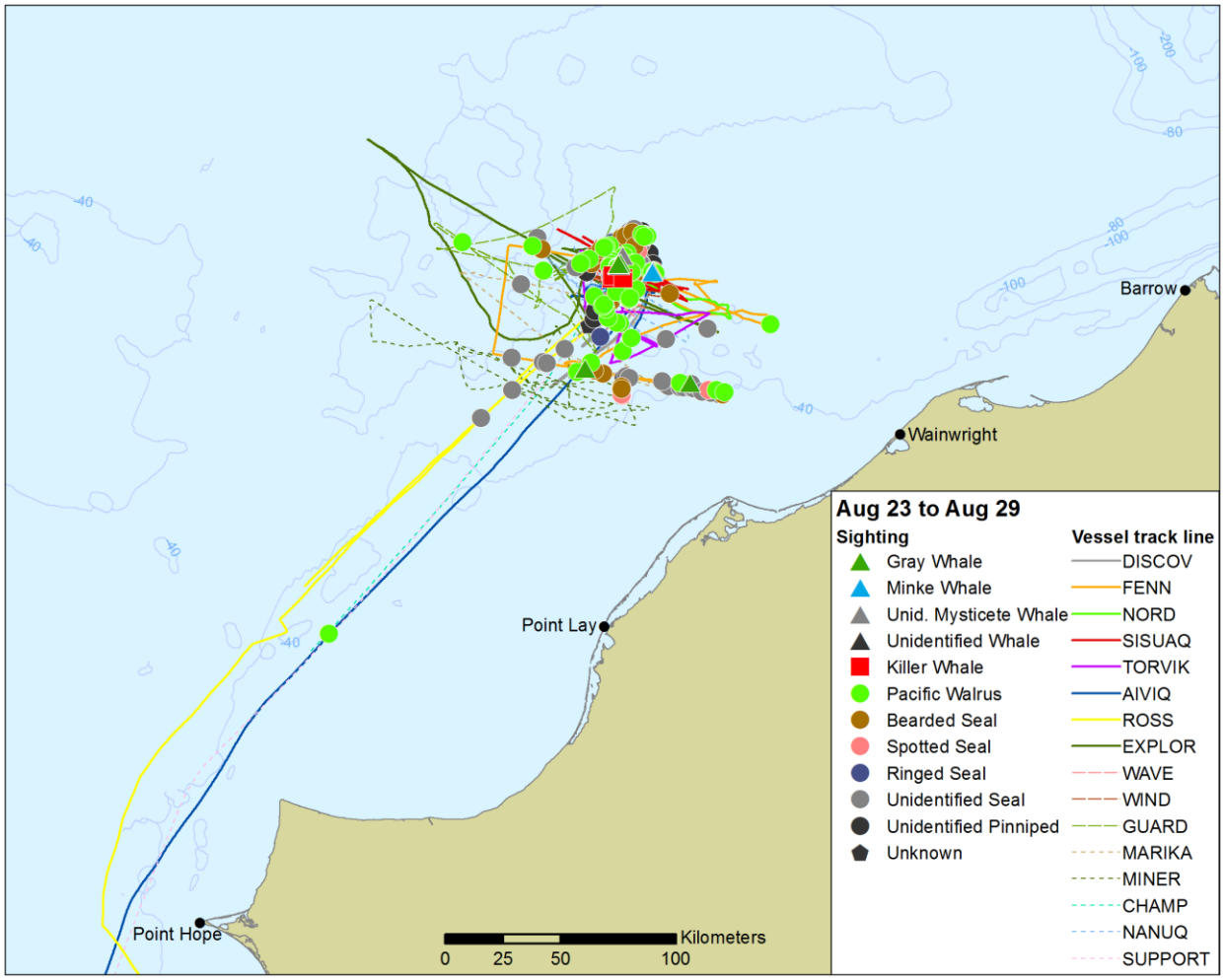

FIGURE E.8. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 23 Aug – 29 Aug 2015.

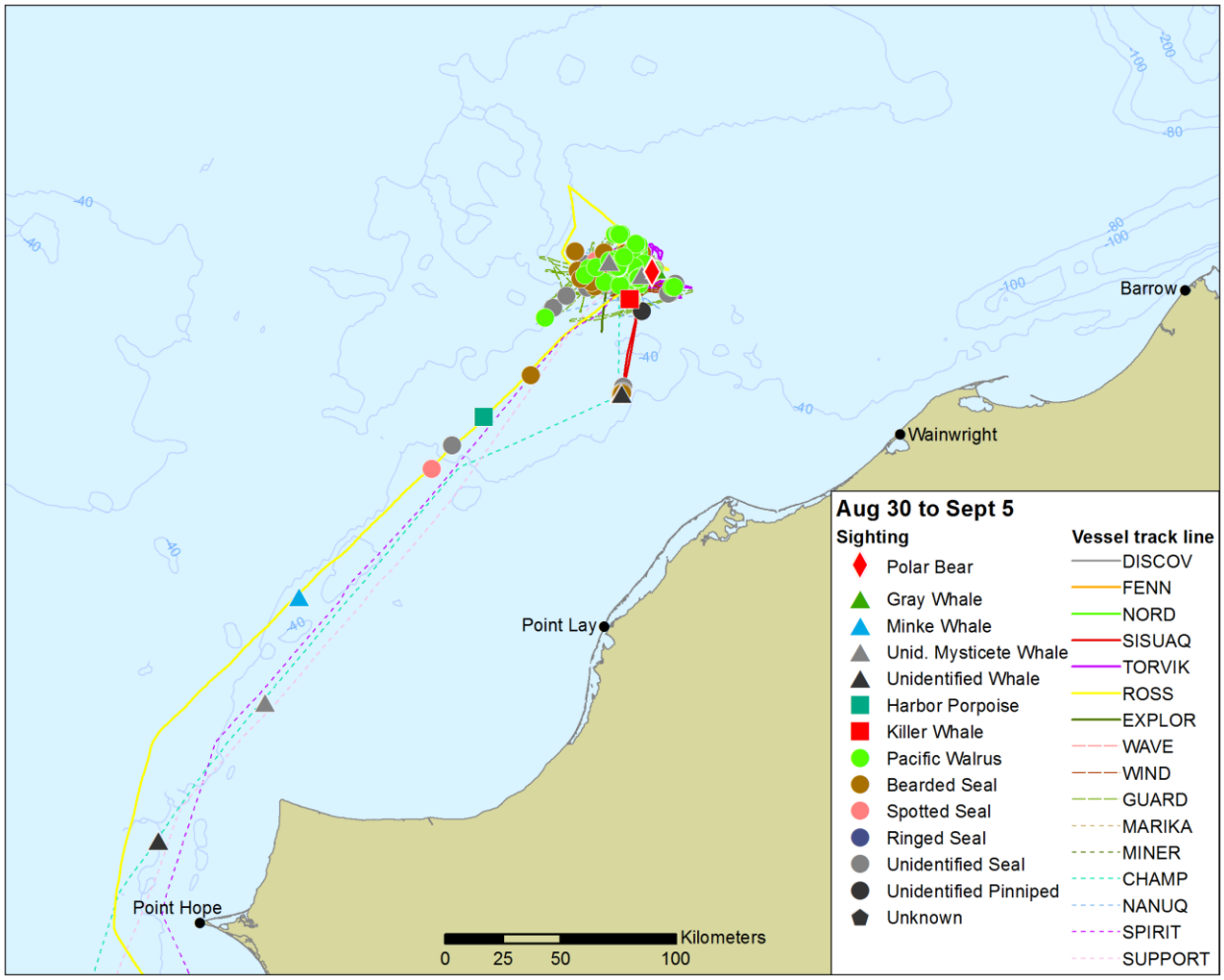

FIGURE E.9. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 30 Aug – 5 Sep 2015.

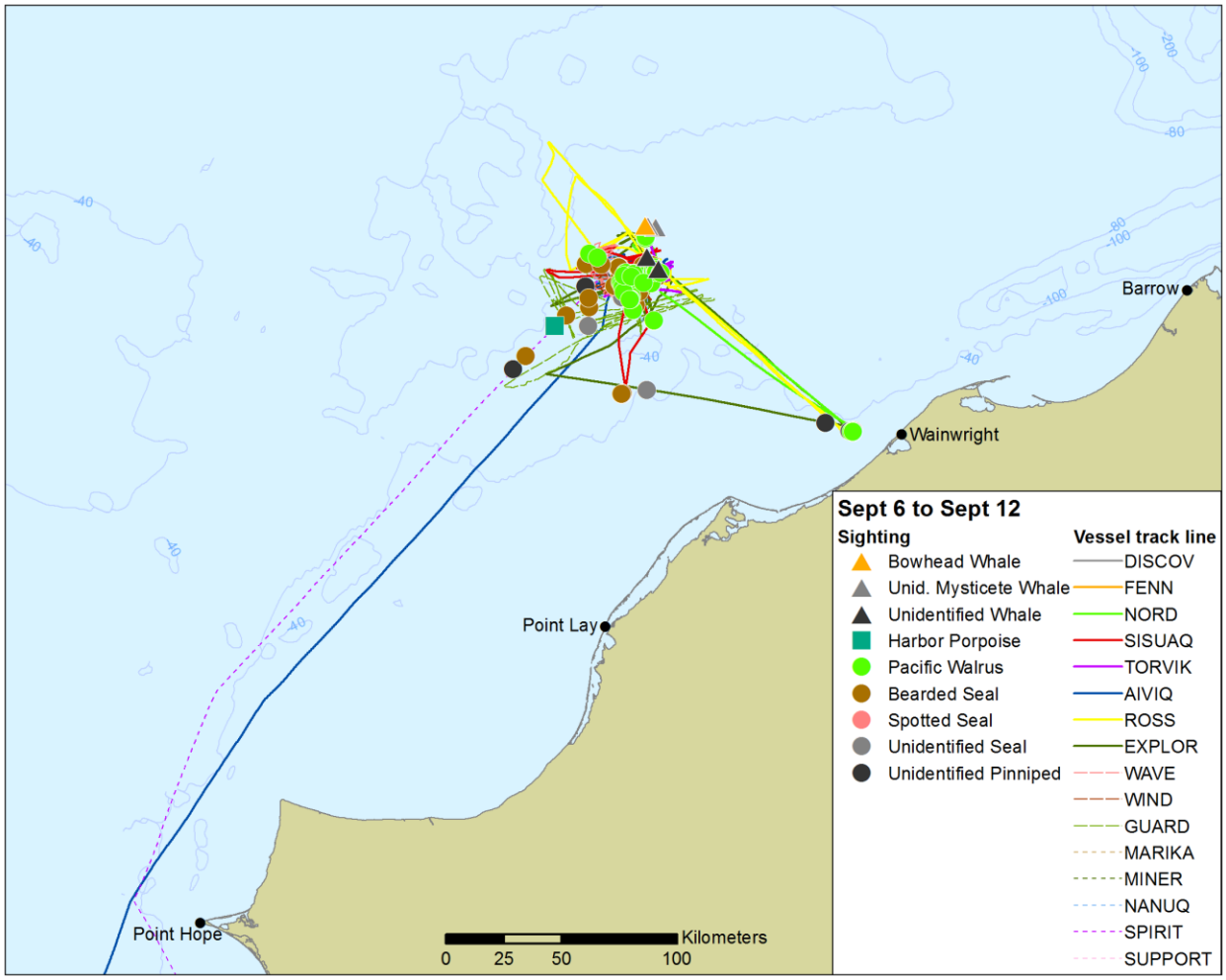

FIGURE E.10. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 6 Sep – 12 Sep 2015.

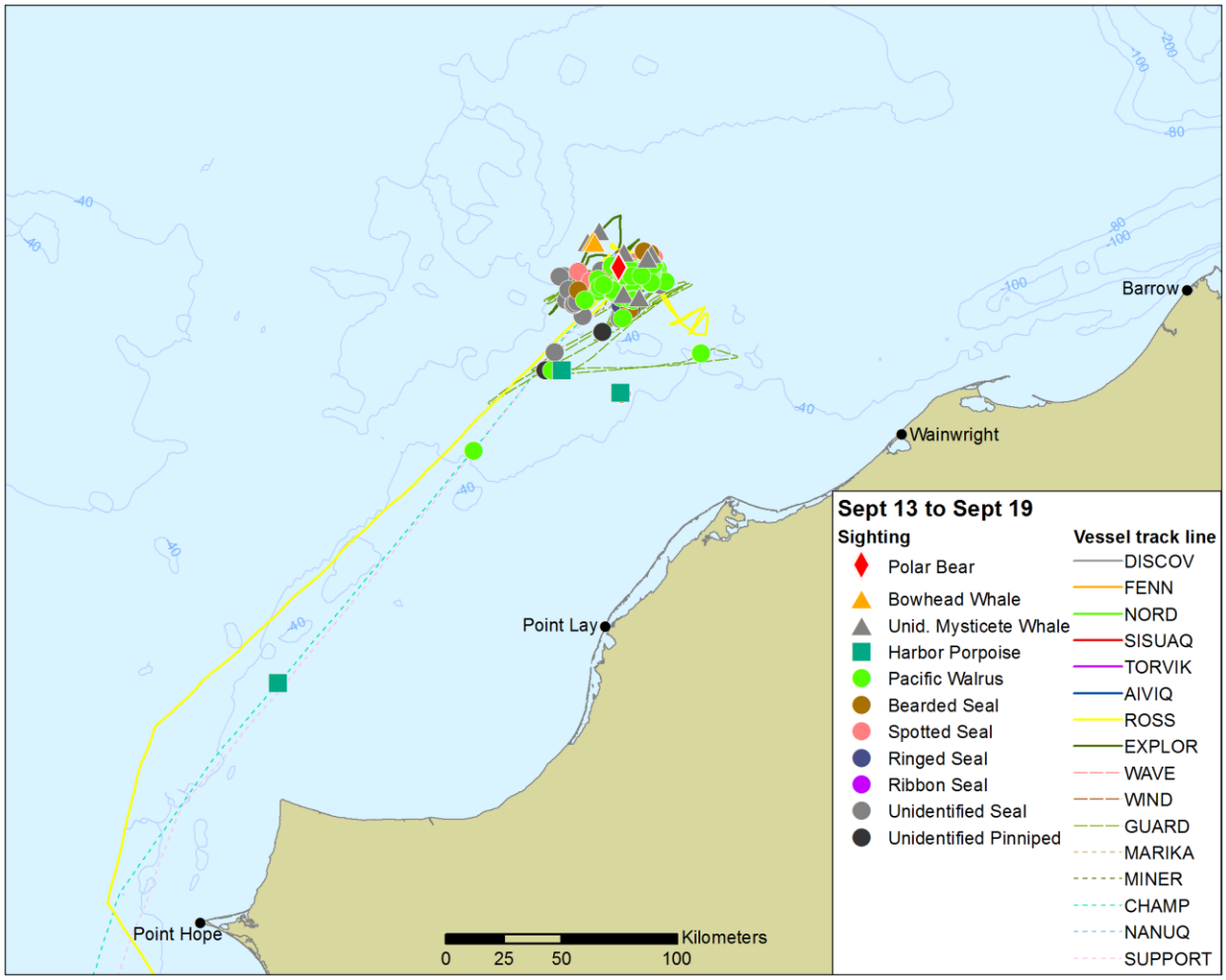

FIGURE E.11. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 13 Sep – 19 Sep 2015.

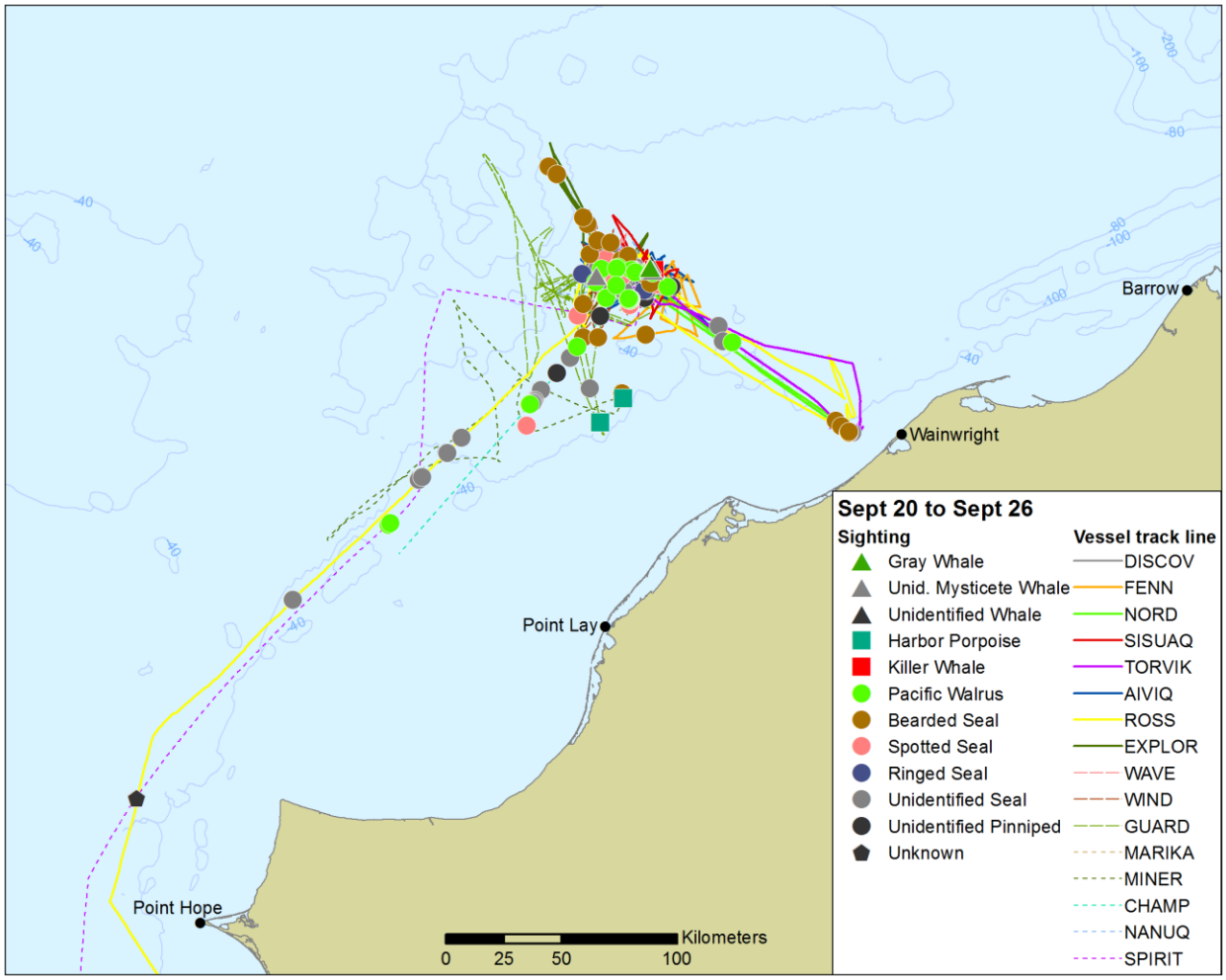

FIGURE E.12. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 20 Sep – 26 Sep 2015.

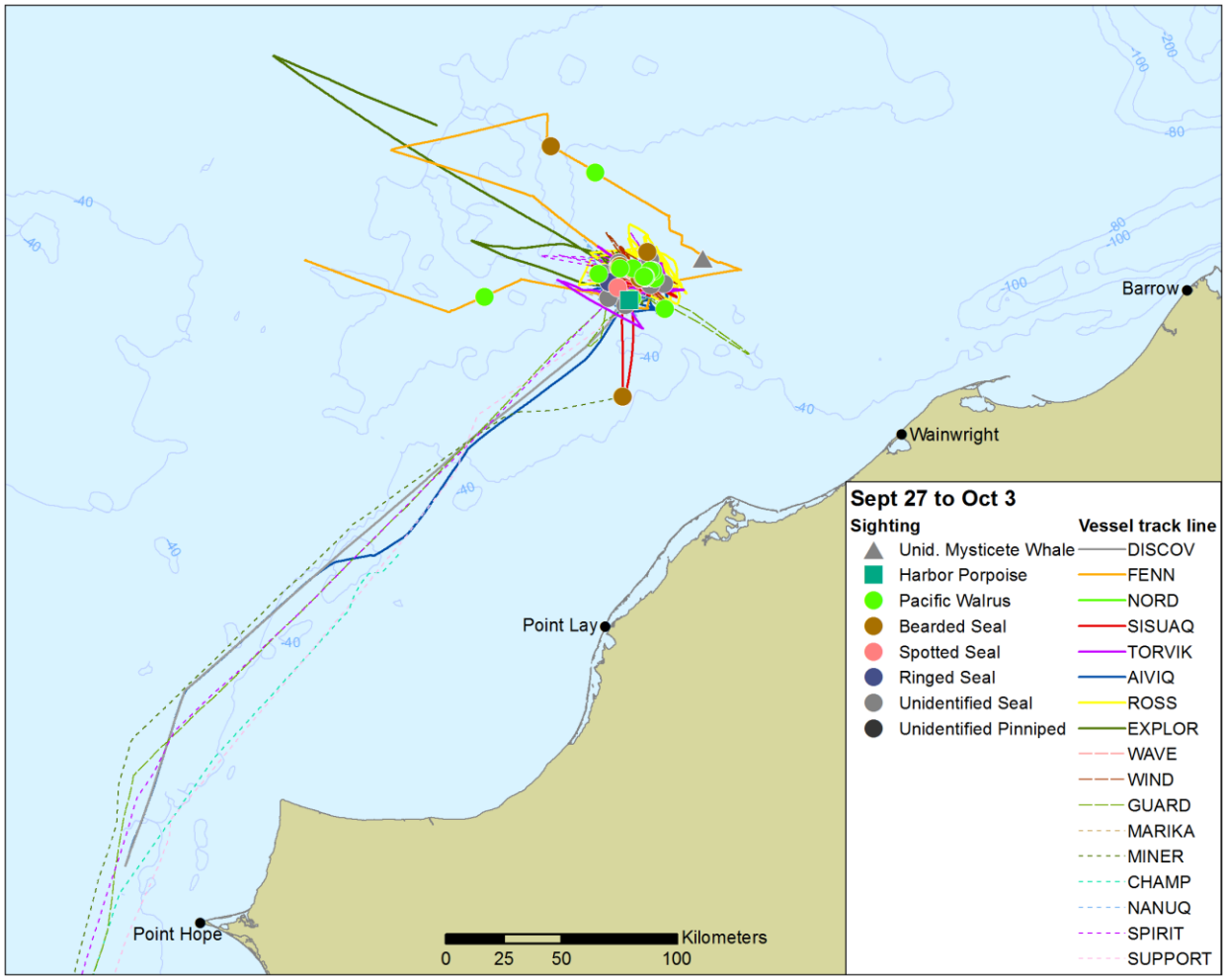

FIGURE E.13. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 27 Sep – 3 Oct 2015.

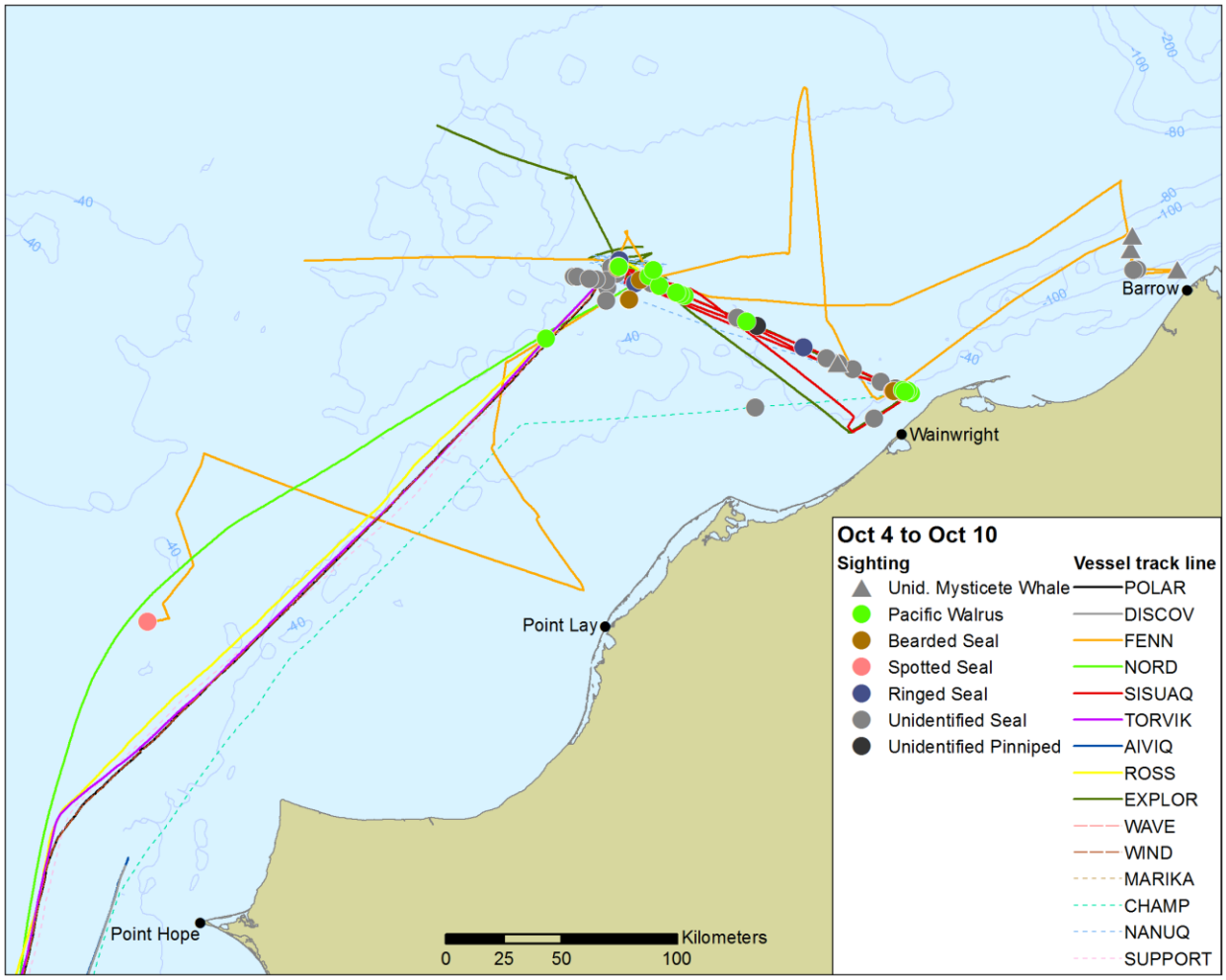

FIGURE E.14. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 4 Oct – 10 Oct 2015.

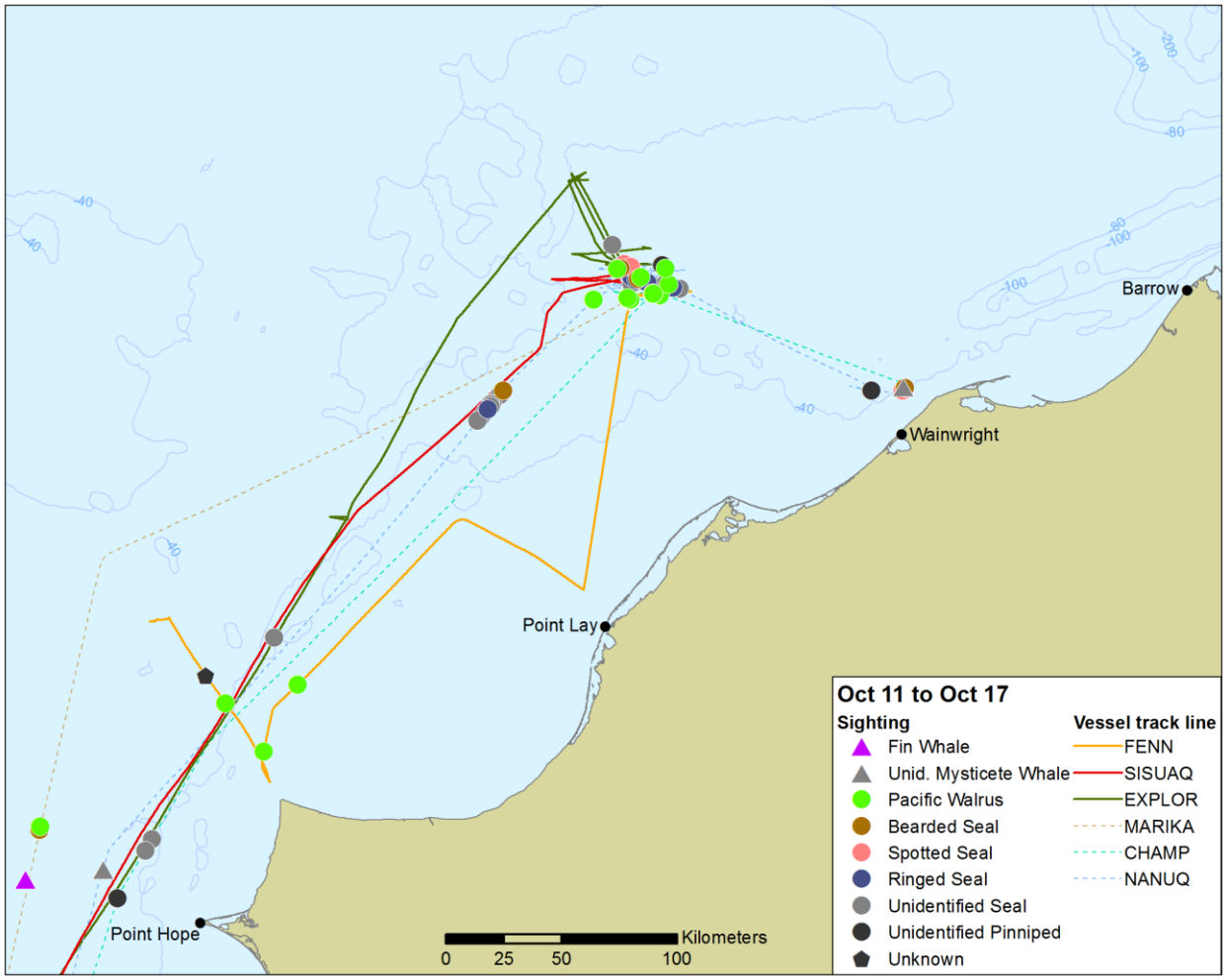

FIGURE E.15. Vessel tracklines and all marine mammal detections in the Chukchi Sea from 11 Oct – 17 Oct 2015.

Part 3: All Marine Mammal Detections

TABLE E.5. All marine mammal detections in the Chukchi Sea Activity Area during Shell's Exploratory Drilling Activities, 2015.

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NORD201536	HP	3	0	7/6/15 11:30	68.6392	-168.4742	150	NO	TR	<120	RVA
NORD201537	US	1	0	7/6/15 13:45	68.9343	-168.4581	700	NO	LO	<120	RVA
NORD201538	BS	1	0	7/6/15 15:10	69.1287	-168.4422	150	LO	TH	<120	RVA
EXPLOR201557	SS	1	0	7/7/15 6:16	69.9206	-166.1856	10	IS	LO	<120	RVA
AIVIQ201572	US	1	0	7/7/15 9:07	70.7352	-163.9353	75	CD	SW	<120	RVA
AIVIQ201573	BS	1	0	7/7/15 18:48	71.5999	-163.6246	300	IS	LO	≥120	RVA
AIVIQ201574	RS	1	1	7/7/15 18:53	71.6040	-163.6064	75	LO	LO	≥120	RVA
AIVIQ201575	US	1	0	7/7/15 19:06	71.6119	-163.6374	50	CD	LO	≥120	RVA
EXPLOR201558	US	1	0	7/8/15 20:22	70.8680	-165.5375	200	NO	LO	<120	RVA
AIVIQ201576	US	1	0	7/8/15 3:16	71.1068	-162.8813	20	IS	SW	≥120	RVA
AIVIQ201577	BS	1	0	7/8/15 11:22	71.2227	-163.4718	100	LO	LO	≥120	RVA
AIVIQ201578	UNK	1	0	7/9/15 17:46	70.9230	-161.5393	10	NO	DE	≥120	RVA
AIVIQ201579	GW	2	0	7/9/15 19:19	70.8178	-160.9826	400	CD	FL	<120	RVA
EXPLOR201559	US	1	0	7/9/15 13:18	71.1000	-158.5012	60	NO	SW	<120	RVA
EXPLOR201560	UMW	2	0	7/9/15 15:50	71.1028	-158.4950	1500	NO	BL	<120	RVA
NORD201539	GW	2	1	7/9/15 14:51	71.1017	-158.5019	467	CD	FL	<120	RVA
NORD201540	UMW	1	0	7/9/15 19:15	71.0790	-159.2012	1392	NO	LG	<120	RVA
NORD201541	UMW	1	0	7/9/15 19:32	71.0717	-159.3161	1000	NO	BL	<120	RVA
NORD201542	UMW	1	0	7/9/15 19:52	71.0624	-159.4601	1500	NO	BL	<120	RVA
NORD201543	UMW	2	0	7/9/15 21:58	70.8685	-160.1057	1084	NO	BL	≥120	RVA
EXPLOR201561	US	1	0	7/10/15 18:41	70.7535	-160.4728	30	NO	SW	≥120	RVA
EXPLOR201562	GW	1	0	7/10/15 19:48	70.7230	-160.5605	75	NO	BL	≥120	RVA
EXPLOR201563	GW	1	0	7/10/15 19:59	70.7181	-160.5746	250	NO	FE	≥120	RVA
AIVIQ201580	GW	1	0	7/10/15 5:06	70.7268	-160.6368	1250	NO	BL	≥120	RVA
NORD201544	GW	1	0	7/10/15 11:49	70.7251	-160.4359	300	NO	BR	≥120	RVA
EXPLOR201564	GW	2	0	7/11/15 14:05	70.7029	-160.3456	1812	NO	BL	≥120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
EXPLOR201565	UMW	1	0	7/11/15 18:27	70.7039	-160.3410	2912	NO	BL	≥120	RVA
EXPLOR201566	UMW	1	0	7/11/15 21:50	70.7065	-160.3236	1043	NO	BL	≥120	RVA
NORD201545	GW	1	0	7/11/15 10:40	70.7007	-160.3500	5686	NO	FL	≥120	RVA
NORD201546	GW	1	0	7/11/15 14:11	70.7008	-160.3500	1084	NO	SW	≥120	RVA
NORD201547	UMW	1	0	7/11/15 15:42	70.7008	-160.3502	3500	NO	BL	≥120	RVA
NORD201548	UMW	1	0	7/11/15 22:08	70.7095	-160.3452	888	NO	BL	≥120	RVA
NORD201549	UMW	2	0	7/11/15 23:31	70.7095	-160.3450	1623	NO	BL	≥120	RVA
NORD201550	UMW	1	0	7/12/15 10:00	70.7096	-160.3450	3262	NO	BL	≥120	RVA
NORD201551	UMW	2	1	7/12/15 10:11	70.7095	-160.3452	1000	NO	BL	≥120	RVA
NORD201552	GW	3	1	7/12/15 10:45	70.7095	-160.3452	1946	NO	BL	≥120	RVA
NORD201553	GW	2	1	7/12/15 11:12	70.7096	-160.3451	888	NO	FL	≥120	RVA
NORD201554	UMW	2	1	7/12/15 11:51	70.7094	-160.3452	2435	NO	BL	≥120	RVA
NORD201555	UMW	1	0	7/12/15 12:00	70.7096	-160.3451	5015	NO	FL	≥120	RVA
NORD201556	GW	1	0	7/12/15 17:17	70.7097	-160.3447	1084	NO	BL	≥120	RVA
NORD201557	RS	1	0	7/12/15 19:15	70.7098	-160.3446	25	LO	LO	≥120	RVA
NORD201558	BHW	2	0	7/12/15 19:33	70.7118	-160.3348	1084	NO	BR	≥120	RVA
NORD201559	US	1	0	7/12/15 21:02	70.7371	-160.5057	752	NO	SW	≥120	RVA
NORD201560	UMW	1	0	7/12/15 22:20	70.8073	-161.0603	815	NO	FL	<120	RVA
EXPLOR201567	US	1	0	7/12/15 7:52	70.6939	-160.3198	25	NO	SW	≥120	RVA
EXPLOR201568	US	1	0	7/12/15 8:15	70.6988	-160.3048	25	NO	DI	≥120	RVA
EXPLOR201569	GW	2	0	7/12/15 9:37	70.7188	-160.2536	750	NO	DI	≥120	RVA
EXPLOR201571	GW	2	0	7/12/15 10:06	70.7093	-160.2913	1000	NO	BR	≥120	RVA
EXPLOR201572	UW	2	0	7/12/15 11:32	70.7061	-160.3337	1043	NO	SW	≥120	RVA
EXPLOR201573	GW	1	0	7/12/15 13:19	70.7061	-160.3336	1500	NO	FL	≥120	RVA
EXPLOR201574	PWA	1	0	7/12/15 13:32	70.7061	-160.3335	850	NO	SW	≥120	RVA
AIVIQ201583	UMW	2	1	7/12/15 2:48	70.7168	-160.4544	750	NO	SH	≥120	RVA
AIVIQ201584	GW	1	0	7/12/15 11:24	70.7712	-160.3378	1257	NO	BL	≥120	RVA
AIVIQ201585	GW	2	1	7/12/15 11:30	70.7751	-160.3331	500	NO	FE	≥120	RVA
AIVIQ201586	GW	1	0	7/12/15 11:49	70.7891	-160.3228	350	NO	FE	≥120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
AIVIQ201587	BS	1	1	7/12/15 12:38	70.7653	-160.3768	75	LO	LO	≥120	RVA
AIVIQ201588	BS	1	0	7/12/15 12:53	70.7530	-160.3879	150	LO	LO	≥120	RVA
AIVIQ201589	UMW	1	0	7/12/15 17:10	70.7220	-160.3918	677	NO	DI	≥120	RVA
AIVIQ201590	GW	4	1	7/12/15 20:50	70.9184	-160.5770	880	NO	TR	≥120	RVA
AIVIQ201591	PWA	1	0	7/12/15 23:34	71.1331	-160.9959	20	CD	LO	≥120	RVA
ROSS201561	GW	3	0	7/13/15 0:29	70.3646	-165.4181	500	NO	BR	≥120	AH
EXPLOR201575	US	1	0	7/14/15 8:18	71.1136	-163.4182	25	NO	DI	<120	AH
AIVIQ201592	BS	1	0	7/14/15 9:28	71.1695	-163.0912	25	LO	LO	≥120	AH
AIVIQ201593	US	1	0	7/14/15 22:09	71.1763	-163.0445	50	LO	LO	≥120	AH
ROSS201562	UMW	2	0	7/14/15 18:09	71.0890	-163.1667	2000	NO	BL	≥120	AH
NORD201561	BS	1	0	7/14/15 4:49	71.0943	-163.2468	250	NO	SW	≥120	AH
EXPLOR201576	US	1	0	7/15/15 8:27	70.8669	-165.2584	75	NO	FB	<120	AH
NORD201562	BS	1	0	7/15/15 14:51	71.1533	-163.1139	300	NO	LO	≥120	AH
NORD201563	UP	1	0	7/15/15 19:33	70.8141	-164.3348	100	NO	DE	<120	AH
AIVIQ201594	RS	2	0	7/15/15 2:57	71.1826	-163.0533	30	LO	LO	≥120	AH
AIVIQ201596	RS	2	0	7/15/15 8:22	71.1814	-163.0665	50	NO	FB	≥120	AH
AIVIQ201597	US	2	0	7/15/15 9:35	71.1852	-163.0738	75	LO	LO	≥120	AH
AIVIQ201598	SS	1	0	7/15/15 9:52	71.1850	-163.0736	150	LO	LO	≥120	AH
AIVIQ201599	RS	1	0	7/15/15 9:52	71.1850	-163.0736	75	LO	FB	≥120	AH
AIVIQ2015100	US	1	0	7/15/15 16:01	71.1815	-163.0726	120	LO	LO	≥120	AH
AIVIQ2015101	BS	1	0	7/15/15 17:24	71.1819	-163.0732	300	NO	LO	≥120	AH
AIVIQ2015102	RS	1	0	7/15/15 17:32	71.1833	-163.0733	300	LO	LO	≥120	AH
AIVIQ2015103	RS	2	0	7/15/15 17:54	71.1834	-163.0736	120	LO	FB	≥120	AH
AIVIQ2015104	US	1	0	7/15/15 19:33	71.1835	-163.0828	150	NO	FB	≥120	AH
AIVIQ2015105	RS	1	0	7/15/15 23:14	71.1698	-163.0519	50	LO	LO	≥120	AH
MARIKA201542	RS	1	0	7/16/15 11:27	71.0533	-163.3005	20	LO	LO	<120	AH
EXPLOR201577	US	1	0	7/16/15 6:54	70.8720	-165.2472	200	LO	LO	≥120	AH
NANUQ201554	UP	1	0	7/16/15 14:04	69.8110	-165.9668	10	NO	DI	<120	AH
ROSS201563	US	1	0	7/16/15 15:49	71.1667	-163.1177	300	LO	FB	≥120	AH

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
ROSS201564	US	1	0	7/16/15 19:05	71.1661	-163.1201	500	NO	DI	≥120	AH
AIVIQ2015106	BS	1	0	7/16/15 3:12	71.1735	-163.0503	20	LO	LO	≥120	AH
AIVIQ2015107	SS	1	0	7/16/15 9:53	71.1671	-163.1155	40	LO	FB	≥120	AH
AIVIQ2015108	US	1	0	7/16/15 12:42	71.1674	-163.1151	75	LO	FB	≥120	AH
AIVIQ2015114	BS	1	0	7/16/15 16:50	71.1673	-163.1152	200	LO	LO	≥120	AH
AIVIQ2015115	BS	1	0	7/16/15 18:28	71.1673	-163.1152	50	LO	LO	≥120	AH
NORD201564	UW	1	0	7/16/15 5:09	69.5400	-168.4363	650	NO	DE	<120	AH
NORD201565	RBS	1	0	7/16/15 10:20	68.5732	-168.4493	50	LO	LO	<120	AH
NORD201566	US	1	0	7/16/15 11:12	68.4316	-168.4516	50	CD	DI	<120	AH
AIVIQ2015116	US	1	0	7/17/15 4:42	71.1701	-162.9475	20	LO	LO	≥120	RVA
EXPLOR201580	US	2	0	7/17/15 20:32	70.8723	-165.2470	150	NO	FB	≥120	RVA
NANUQ201555	SS	1	0	7/18/15 15:35	71.0688	-163.3036	1	LO	LO	<120	RVA
NANUQ201556	BS	1	0	7/18/15 20:47	71.1376	-163.1233	5	LO	DI	≥120	RVA
NANUQ201557	BS	1	0	7/18/15 23:26	71.0656	-162.9978	200	LO	LO	≥120	RVA
ROSS201565	BS	1	0	7/18/15 18:40	71.1770	-163.1471	20	NO	FB	≥120	RVA
EXPLOR201581	RS	1	0	7/18/15 0:43	70.8723	-165.2469	70	NO	SW	≥120	RVA
EXPLOR201582	US	1	0	7/18/15 2:00	70.8723	-165.2469	100	NO	SI	≥120	RVA
EXPLOR201583	US	1	0	7/18/15 2:36	70.8723	-165.2469	30	LO	SW	≥120	RVA
EXPLOR201584	US	1	0	7/18/15 3:39	70.8723	-165.2469	100	LO	SW	≥120	RVA
EXPLOR201585	RS	1	0	7/18/15 6:23	70.8724	-165.2471	50	NO	FB	≥120	RVA
EXPLOR201586	RS	1	0	7/18/15 16:08	71.1773	-163.1429	30	NO	FB	≥120	RVA
EXPLOR201587	US	1	0	7/18/15 18:58	71.1858	-163.1096	75	NO	SW	≥120	RVA
EXPLOR201588	US	1	0	7/18/15 23:11	71.1566	-163.2826	50	NO	FB	≥120	RVA
AIVIQ2015121	BS	1	0	7/18/15 12:45	71.1780	-163.1458	75	NO	LO	≥120	RVA
AIVIQ2015122	US	1	0	7/18/15 13:19	71.1780	-163.1461	30	NO	FB	≥120	RVA
AIVIQ2015123	US	1	0	7/18/15 13:24	71.1779	-163.1461	200	NO	FB	≥120	RVA
AIVIQ2015124	BS	1	0	7/18/15 13:25	71.1779	-163.1461	175	LO	LO	≥120	RVA
AIVIQ2015125	US	1	0	7/18/15 13:47	71.1779	-163.1461	25	NO	FB	≥120	RVA
AIVIQ2015126	US	1	0	7/18/15 14:16	71.1780	-163.1462	50	NO	FB	≥120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
AIVIQ2015127	SS	1	0	7/18/15 14:34	71.1779	-163.1461	30	NO	FB	≥120	RVA
AIVIQ2015128	BS	1	0	7/18/15 15:03	71.1779	-163.1461	30	LO	LO	≥120	RVA
AIVIQ2015129	RS	2	0	7/18/15 15:03	71.1779	-163.1461	75	NO	FB	≥120	RVA
AIVIQ2015130	SS	1	0	7/18/15 15:03	71.1779	-163.1461	100	LO	FB	≥120	RVA
AIVIQ2015131	RS	1	0	7/18/15 15:59	71.1779	-163.1456	25	NO	FB	≥120	RVA
AIVIQ2015132	RS	1	0	7/18/15 16:26	71.1779	-163.1459	100	LO	FB	≥120	RVA
AIVIQ2015133	US	1	0	7/18/15 16:55	71.1778	-163.1457	120	NO	FB	≥120	RVA
AIVIQ2015134	US	1	0	7/18/15 17:05	71.1779	-163.1457	250	IS	PO	≥120	RVA
GUARD20157	RS	1	0	7/19/15 12:40	68.9275	-167.1942	200	NO	ST	<120	RVA
GUARD20158	SS	1	0	7/19/15 16:36	69.3025	-166.8163	20	LO	LO	<120	RVA
GUARD20159	SS	1	0	7/19/15 17:00	69.3426	-166.7739	300	LO	LO	≥120	RVA
NANUQ201558	BS	1	0	7/19/15 8:54	71.0563	-163.2678	30	NO	SW	≥120	RVA
NANUQ201559	US	1	0	7/19/15 11:13	71.0563	-163.2670	90	NO	SW	≥120	RVA
NANUQ201560	PWA	1	0	7/19/15 12:00	71.0561	-163.2668	800	NO	SW	≥120	RVA
NANUQ201561	US	1	0	7/19/15 14:13	71.1724	-163.0559	200	NO	DI	≥120	RVA
NANUQ201562	US	2	0	7/19/15 14:33	71.1725	-163.0559	300	LO	DI	≥120	RVA
NANUQ201563	US	1	0	7/19/15 15:01	71.1725	-163.0557	50	LO	DI	≥120	RVA
NANUQ201564	US	2	0	7/19/15 15:13	71.1728	-163.0582	1184	NO	DI	≥120	RVA
NANUQ201565	RS	1	0	7/19/15 15:26	71.1736	-163.0665	30	LO	LO	≥120	RVA
NANUQ201566	RS	1	0	7/19/15 15:55	71.1747	-163.0661	8	NO	FB	≥120	RVA
NANUQ201567	RS	2	0	7/19/15 17:21	71.1740	-163.0593	3	LO	DI	≥120	RVA
NANUQ201568	BS	1	0	7/19/15 22:43	71.0076	-162.9367	500	NO	DI	≥120	RVA
NANUQ201569	BS	1	0	7/19/15 23:24	71.0403	-162.9520	400	NO	LO	≥120	RVA
ROSS201566	US	1	0	7/19/15 0:44	70.7818	-164.0296	300	NO	SA	<120	RVA
ROSS201567	US	1	0	7/19/15 1:04	70.7557	-164.0899	500	LO	LO	<120	RVA
ROSS201568	UP	1	0	7/19/15 3:34	70.5746	-164.5230	400	NO	SA	<120	RVA
EXPLOR201589	US	1	0	7/19/15 7:50	71.0568	-163.3008	75	NO	FB	≥120	RVA
EXPLOR201590	RS	1	0	7/19/15 12:55	71.0712	-163.2877	150	NO	DI	≥120	RVA
EXPLOR201591	US	1	0	7/19/15 15:15	71.2732	-163.6648	30	IS	SW	<120	RVA

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EXPLOR201592	BS	1	0	7/19/15 15:38	71.3229	-163.7695	75	NO	SW	<120	RVA
EXPLOR201593	BS	1	0	7/19/15 15:48	71.3440	-163.8143	30	LO	DI	<120	RVA
EXPLOR201594	BS	1	0	7/19/15 15:52	71.3546	-163.8363	40	LO	DI	<120	RVA
EXPLOR201595	UP	1	0	7/19/15 15:58	71.3664	-163.8610	300	NO	DI	<120	RVA
EXPLOR201596	BS	2	0	7/19/15 16:06	71.3838	-163.8967	250	LO	DI	<120	RVA
EXPLOR201597	UP	2	0	7/19/15 16:12	71.3969	-163.9250	700	LO	DI	<120	RVA
EXPLOR201598	UP	2	0	7/19/15 16:16	71.4059	-163.9437	300	NO	DI	<120	RVA
EXPLOR201599	UP	3	0	7/19/15 16:20	71.4131	-163.9583	2000	NO	DI	<120	RVA
EXPLOR2015100	UP	2	0	7/19/15 16:25	71.4251	-163.9821	1000	LO	LO	<120	RVA
EXPLOR2015101	UP	1	0	7/19/15 16:30	71.4350	-164.0017	1000	LO	DI	<120	RVA
EXPLOR2015102	BS	1	0	7/19/15 16:36	71.4493	-164.0304	800	LO	LO	<120	RVA
EXPLOR2015103	BS	1	0	7/19/15 16:43	71.4625	-164.0569	750	LO	DI	<120	RVA
EXPLOR2015104	UP	1	0	7/19/15 16:56	71.4910	-164.1091	600	NO	DI	<120	RVA
EXPLOR2015105	US	1	0	7/19/15 18:52	71.5019	-164.1326	350	NO	DI	≥120	RVA
EXPLOR2015106	US	1	0	7/19/15 19:09	71.5020	-164.1326	296	NO	DI	≥120	RVA
EXPLOR2015107	RS	1	0	7/19/15 23:46	71.3706	-164.3132	20	LO	LO	<120	RVA
AIVIQ2015138	BS	1	0	7/19/15 3:48	71.1846	-163.1951	130	LO	SW	≥120	RVA
AIVIQ2015139	BS	1	0	7/19/15 8:53	71.1835	-163.3182	125	SP	FS	≥120	RVA
AIVIQ2015140	BS	1	0	7/19/15 9:37	71.1830	-163.2787	250	NO	SW	≥120	RVA
AIVIQ2015141	RS	1	0	7/19/15 9:48	71.1832	-163.2476	125	NO	LO	≥120	RVA
AIVIQ2015142	RS	1	0	7/19/15 9:54	71.1834	-163.2291	200	NO	LO	≥120	RVA
AIVIQ2015143	US	1	0	7/19/15 10:19	71.1840	-163.1614	250	NO	SW	≥120	RVA
AIVIQ2015144	US	1	0	7/19/15 10:21	71.1841	-163.1551	25	SP	FB	≥120	RVA
AIVIQ2015145	BS	1	0	7/19/15 10:55	71.1840	-163.0610	100	NO	DI	≥120	RVA
AIVIQ2015146	US	1	0	7/19/15 11:10	71.1838	-163.0168	200	NO	SW	≥120	RVA
AIVIQ2015147	BS	1	0	7/19/15 12:45	71.1570	-162.9303	100	LO	FS	≥120	RVA
AIVIQ2015148	BS	1	0	7/19/15 13:14	71.1653	-163.0365	200	SP	PO	≥120	RVA
AIVIQ2015149	BS	1	0	7/19/15 13:15	71.1661	-163.0393	150	NO	LO	≥120	RVA
AIVIQ2015150	RS	1	0	7/19/15 13:42	71.1751	-163.0665	150	NO	LO	≥120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
AIVIQ2015151	RS	1	0	7/19/15 14:37	71.1751	-163.0667	50	LO	LO	≥120	RVA
AIVIQ2015152	US	2	0	7/19/15 14:37	71.1751	-163.0667	250	NO	FB	≥120	RVA
AIVIQ2015153	BS	1	0	7/19/15 14:41	71.1751	-163.0666	300	LO	LO	≥120	RVA
AIVIQ2015154	US	1	0	7/19/15 15:07	71.1751	-163.0667	200	SP	PO	≥120	RVA
AIVIQ2015155	US	1	0	7/19/15 16:38	71.1750	-163.0666	200	LO	FB	≥120	RVA
AIVIQ2015156	US	1	0	7/19/15 17:12	71.1751	-163.0667	100	LO	LO	≥120	RVA
AIVIQ2015157	US	1	0	7/19/15 20:38	71.1751	-163.0667	80	NO	FB	≥120	RVA
AIVIQ2015158	RS	2	0	7/19/15 21:18	71.1750	-163.0666	80	LO	FB	≥120	RVA
AIVIQ2015159	RS	2	0	7/19/15 22:19	71.1750	-163.0667	25	LO	FB	≥120	RVA
AIVIQ2015160	BS	1	0	7/19/15 23:54	71.1751	-163.0667	125	NO	SW	≥120	RVA
MARIKA201543	RS	1	0	7/19/15 6:27	71.0547	-163.2879	300	LO	LO	≥120	RVA
MARIKA201544	US	1	0	7/19/15 11:43	71.0533	-163.2865	522	SP	LO	≥120	RVA
MARIKA201545	US	1	0	7/19/15 23:55	71.0528	-163.2875	37	LO	LO	≥120	RVA
SISUAQ201533	PWA	1	0	7/19/15 11:25	71.1548	-163.2873	100	LO	LO	≥120	RVA
SISUAQ201534	SS	1	0	7/19/15 11:50	71.1548	-163.2871	50	LO	FB	≥120	RVA
SISUAQ201535	US	1	0	7/19/15 14:48	71.1549	-163.2871	800	LO	FB	≥120	RVA
SISUAQ201536	PWA	1	0	7/19/15 15:46	71.1549	-163.2872	750	NO	DI	≥120	RVA
SISUAQ201538	US	1	0	7/19/15 16:43	71.1548	-163.2873	200	NO	DI	≥120	RVA
SISUAQ201537	US	1	0	7/19/15 16:56	71.1548	-163.2874	100	NO	DI	≥120	RVA
SISUAQ201539	US	1	0	7/19/15 17:50	71.1551	-163.2870	300	NO	DI	≥120	RVA
SISUAQ201540	US	1	0	7/19/15 18:51	71.1548	-163.2874	20	NO	FB	≥120	RVA
SISUAQ201541	RS	1	0	7/19/15 19:50	71.1548	-163.2873	75	NO	FB	≥120	RVA
SISUAQ201542	SS	1	0	7/19/15 22:17	71.1548	-163.2872	20	LO	LO	≥120	RVA
GUARD201510	BS	1	1	7/20/15 20:22	71.1134	-163.3787	500	LO	LO	≥120	RVA
GUARD201511	SS	1	0	7/20/15 23:37	70.8975	-163.5214	200	NO	SA	<120	RVA
GUARD201512	BHW	1	0	7/20/15 23:53	70.8812	-163.5399	800	NO	ST	≥120	RVA
NANUQ201570	US	1	0	7/20/15 0:10	71.0815	-162.9679	75	NO	SW	≥120	RVA
NANUQ201571	US	1	0	7/20/15 13:37	71.0552	-163.2679	750	NO	FB	≥120	RVA
NANUQ201572	US	1	0	7/20/15 13:48	71.0553	-163.2681	15	NO	DI	≥120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NANUQ201574	PWA	1	1	7/20/15 20:37	71.1153	-163.0923	400	LO	LO	≥120	RVA
NANUQ201575	BS	1	0	7/20/15 21:16	71.0805	-163.0796	300	NO	LO	≥120	RVA
NANUQ201576	BS	1	0	7/20/15 22:10	71.1197	-163.0705	300	NO	DI	≥120	RVA
EXPLOR2015108	US	1	0	7/20/15 13:47	70.8720	-165.2482	75	NO	LO	<120	RVA
EXPLOR2015109	US	1	0	7/20/15 15:23	70.8721	-165.2486	100	NO	FB	<120	RVA
EXPLOR2015110	US	1	0	7/20/15 22:19	71.1514	-163.3854	600	LO	LO	≥120	RVA
AIVIQ2015162	BS	1	0	7/20/15 0:00	71.1751	-163.0666	100	LO	DI	≥120	RVA
AIVIQ2015161	RS	3	0	7/20/15 0:03	71.1752	-163.0669	80	NO	FB	≥120	RVA
AIVIQ2015163	RS	1	0	7/20/15 0:23	71.1752	-163.0668	200	LO	FB	≥120	RVA
AIVIQ2015164	US	3	0	7/20/15 0:29	71.1752	-163.0665	100	NO	FB	≥120	RVA
AIVIQ2015165	BS	1	0	7/20/15 0:59	71.1751	-163.0667	180	LO	FB	≥120	RVA
AIVIQ2015166	SS	1	0	7/20/15 1:02	71.1751	-163.0666	80	LO	FB	≥120	RVA
AIVIQ2015167	BS	1	0	7/20/15 2:18	71.1751	-163.0667	150	NO	SW	≥120	RVA
AIVIQ2015168	BS	1	0	7/20/15 3:14	71.1751	-163.0664	80	LO	DI	≥120	RVA
AIVIQ2015169	RS	2	0	7/20/15 3:44	71.1752	-163.0664	100	LO	FB	≥120	RVA
AIVIQ2015170	BS	1	0	7/20/15 6:35	71.1029	-163.2149	200	NO	LO	≥120	RVA
AIVIQ2015171	BS	1	0	7/20/15 17:24	71.1744	-162.9939	150	NO	DI	≥120	RVA
AIVIQ2015172	BS	1	0	7/20/15 19:20	71.1767	-162.4248	400	NO	SW	<120	RVA
AIVIQ2015173	US	1	0	7/20/15 21:41	71.3655	-163.0110	50	SP	TH	<120	RVA
AIVIQ2015174	US	1	0	7/20/15 23:23	71.5415	-163.3919	150	LO	LO	≥120	RVA
AIVIQ2015175	PWA	2	0	7/20/15 23:36	71.5644	-163.4398	1000	NO	SW	≥120	RVA
AIVIQ2015176	UTW	1	0	7/20/15 23:45	71.5738	-163.4614	850	NO	SW	≥120	RVA
MARIKA201546	RS	1	0	7/20/15 1:40	71.0528	-163.2873	20	LO	LO	≥120	RVA
MARIKA201547	RS	2	0	7/20/15 8:50	71.0540	-163.2867	175	LO	LO	≥120	RVA
MARIKA201548	US	1	0	7/20/15 9:30	71.0538	-163.2865	140	LO	LO	≥120	RVA
MARIKA201549	US	1	0	7/20/15 20:26	71.0550	-163.2860	300	NO	SW	≥120	RVA
NANUQ201577	US	1	0	7/21/15 2:09	71.1104	-163.2648	200	NO	SW	≥120	RVA
NANUQ201578	UP	1	0	7/21/15 2:47	71.1366	-163.1506	800	NO	DI	≥120	RVA
NANUQ201579	UMW	1	0	7/21/15 15:12	71.0899	-162.9995	3000	NO	BL	≥120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NANUQ201580	US	1	0	7/21/15 21:57	71.1013	-163.1070	400	NO	SW	≥120	RVA
EXPLOR2015111	RS	1	0	7/21/15 5:28	71.1757	-163.2670	100	NO	SW	≥120	RVA
MARIKA201550	RS	1	0	7/21/15 1:54	71.0554	-163.2870	439	LO	LO	≥120	RVA
AIVIQ2015180	PWA	5	0	7/21/15 9:23	71.6456	-163.6479	977	NO	TR	<120	RVA
AIVIQ2015181	PWA	1	0	7/21/15 12:08	71.5903	-163.5119	400	NO	SW	≥120	RVA
AIVIQ2015182	PWA	4	0	7/21/15 12:42	71.6448	-163.5532	250	LO	TR	<120	RVA
AIVIQ2015183	US	1	0	7/21/15 17:43	71.5147	-163.2757	80	IS	PO	≥120	RVA
AIVIQ2015184	US	1	0	7/21/15 21:59	71.3020	-162.8144	50	NO	SW	≥120	RVA
GUARD201513	BS	1	1	7/22/15 2:30	71.0105	-161.4861	40	LO	LO	<120	RVA
GUARD201514	US	1	0	7/22/15 3:27	70.9744	-161.6883	70	LO	LO	<120	RVA
AIVIQ2015185	BS	1	0	7/22/15 8:37	71.1806	-163.0822	150	NO	DI	≥120	RVA
AIVIQ2015186	BS	1	1	7/22/15 9:24	71.1797	-163.2035	200	LO	LO	≥120	RVA
NANUQ201581	RS	1	0	7/23/15 21:19	71.0792	-162.8077	300	LO	LO	<120	RVA
AIVIQ2015187	PWA	1	1	7/23/15 7:40	71.1803	-163.1618	10	LO	WR	≥120	RVA
EXPLOR2015112	US	1	0	7/24/15 14:49	71.3877	-164.1086	75	LO	DI	<120	RVA
EXPLOR2015113	US	1	0	7/24/15 19:33	71.3785	-164.3676	125	IS	DI	<120	RVA
TORVIK2015181	UW	2	0	7/24/15 4:48	69.1006	-167.6749	993	NO	BL	≥120	RVA
NORD2015137	UP	1	0	7/24/15 16:36	68.5487	-168.4498	50	NO	DE	<120	RVA
NORD2015138	RBS	1	0	7/24/15 18:16	68.8604	-168.4458	30	LO	LO	<120	RVA
NORD2015139	HW	2	0	7/24/15 20:30	69.2809	-168.4397	1500	NO	FL	<120	RVA
AIVIQ2015188	GW	1	0	7/24/15 2:59	71.2244	-161.2119	30	NO	DI	≥120	RVA
AIVIQ2015189	GW	1	0	7/24/15 3:22	71.2243	-161.2120	200	NO	DI	≥120	RVA
AIVIQ2015190	GW	2	0	7/24/15 4:16	71.2243	-161.2120	50	CD	BR	≥120	RVA
AIVIQ2015191	UMW	1	0	7/24/15 6:21	71.2243	-161.2118	500	NO	BL	≥120	RVA
AIVIQ2015192	GW	1	1	7/24/15 6:44	71.2243	-161.2118	30	NO	BL	≥120	RVA
AIVIQ2015193	PWA	1	0	7/24/15 8:38	71.2243	-161.2117	100	NO	SW	≥120	RVA
AIVIQ2015194	GW	2	0	7/24/15 9:42	71.2243	-161.2117	400	NO	BL	≥120	RVA
AIVIQ2015195	GW	2	1	7/24/15 9:52	71.2242	-161.2117	1000	NO	FE	≥120	RVA
AIVIQ2015196	GW	2	0	7/24/15 10:16	71.2243	-161.2119	800	NO	FE	≥120	RVA

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AIVIQ2015197	GW	1	0	7/24/15 10:19	71.2242	-161.2118	1763	NO	FE	≥120	RVA
AIVIQ2015198	PWA	1	0	7/24/15 10:24	71.2243	-161.2118	100	LO	LO	≥120	RVA
AIVIQ2015200	UP	1	0	7/24/15 11:50	71.2279	-161.1407	150	NO	DE	≥120	RVA
AIVIQ2015199	GW	1	0	7/24/15 11:52	71.2280	-161.1347	800	NO	FE	≥120	RVA
AIVIQ2015201	GW	1	0	7/24/15 11:57	71.2283	-161.1182	1000	NO	FE	≥120	RVA
AIVIQ2015202	GW	1	0	7/24/15 13:06	71.2223	-161.1132	500	NO	FL	≥120	RVA
AIVIQ2015203	BS	1	0	7/24/15 13:09	71.2223	-161.1288	325	NO	LO	≥120	RVA
AIVIQ2015204	GW	1	0	7/24/15 13:10	71.2222	-161.1354	400	NO	FL	≥120	RVA
AIVIQ2015205	GW	1	0	7/24/15 13:31	71.2303	-161.2342	250	NO	BR	≥120	RVA
AIVIQ2015208	UMW	1	0	7/24/15 18:43	71.1901	-162.7916	1467	NO	BL	≥120	RVA
NANUQ201582	BS	1	0	7/25/15 21:03	71.1341	-163.4490	15	LO	TR	≥120	AH
NANUQ201583	US	1	0	7/25/15 22:06	71.1011	-163.5584	100	NO	DI	≥120	AH
LAUREN201528	SS	1	0	7/25/15 11:43	71.0127	-163.2544	40	NO	LO	<120	AH
LAUREN201529	BS	1	0	7/25/15 17:48	70.4893	-164.5320	75	LO	LO	<120	AH
SUPPORT201562	UP	1	0	7/25/15 0:56	71.2156	-163.0826	24	LO	LO	≥120	AH
NANUQ201584	BS	1	0	7/26/15 12:37	71.0907	-163.3102	25	LO	SI	≥120	AH
AIVIQ2015209	BS	1	0	7/26/15 14:20	71.1624	-163.2860	200	LO	LO	≥120	AH
AIVIQ2015210	BS	1	0	7/26/15 14:43	71.1624	-163.2859	250	LO	LO	≥120	AH
NORD2015141	US	2	0	7/26/15 17:41	71.2280	-161.4584	1750	NO	RE	≥120	AH
NORD2015142	US	1	0	7/26/15 17:41	71.2280	-161.4584	600	NO	SI	≥120	AH
GUARD201515	US	1	0	7/26/15 19:03	70.9734	-161.8567	125	LO	LO	≥120	AH
NANUQ201585	UP	1	0	7/27/15 18:22	70.9923	-163.6949	646	NO	SW	≥120	AH
AIVIQ2015211	BS	1	0	7/27/15 0:24	71.1624	-163.2857	150	NO	DI	≥120	AH
EXPLOR2015114	RS	1	0	7/27/15 22:36	71.1725	-163.4726	100	NO	LO	≥120	AH
EXPLOR2015115	US	1	0	7/27/15 23:26	71.1725	-163.4728	150	NO	SW	≥120	AH
NORD2015144	SS	1	0	7/27/15 2:35	71.2288	-161.4647	130	LO	LO	≥120	AH
NORD2015145	SS	1	0	7/27/15 2:43	71.2287	-161.4641	45	LO	LO	≥120	AH
NORD2015146	SS	1	0	7/27/15 3:36	71.2283	-161.4627	150	NO	SW	≥120	AH
NORD2015147	BS	1	0	7/27/15 4:47	71.2282	-161.4626	20	LO	LO	≥120	AH

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NORD2015148	GW	1	0	7/27/15 5:48	71.2284	-161.4635	150	NO	FL	≥120	AH
NORD2015149	US	1	0	7/27/15 6:00	71.2280	-161.4621	5	NO	DI	≥120	AH
NORD2015150	SS	1	0	7/27/15 6:57	71.2278	-161.4605	50	LO	LO	≥120	AH
NORD2015151	SS	1	0	7/27/15 7:13	71.2280	-161.4615	50	NO	LO	≥120	AH
NORD2015152	SS	1	0	7/27/15 7:27	71.2280	-161.4622	50	NO	LO	≥120	AH
POLAR201583	US	1	0	7/27/15 15:55	71.1733	-163.4718	250	NO	DI	≥120	AH
SUPPORT201564	US	1	0	7/27/15 17:38	71.1750	-163.4671	100	NO	SI	≥120	AH
WIND201562	SS	1	0	7/27/15 17:16	71.1468	-163.3185	450	LO	LO	≥120	AH
GUARD201516	SS	1	0	7/27/15 2:07	70.9270	-161.5520	70	LO	LO	<120	AH
GUARD201517	BS	1	0	7/27/15 7:27	70.9746	-161.3863	100	LO	LO	<120	AH
EXPLOR2015116	RS	1	0	7/28/15 1:16	71.1724	-163.4732	100	NO	SW	≥120	RVA
EXPLOR2015117	RS	1	0	7/28/15 3:22	71.1724	-163.4726	150	NO	FB	≥120	RVA
NANUQ201586	PWA	1	1	7/28/15 11:05	70.9445	-163.4978	3	LO	DI	<120	RVA
NANUQ201587	PWA	1	1	7/28/15 15:01	71.0259	-163.1511	3	LO	DI	≥120	RVA
POLAR201584	RS	1	0	7/28/15 6:14	71.1733	-163.4718	20	LO	LO	≥120	RVA
POLAR201585	RS	1	0	7/28/15 9:14	71.1733	-163.4718	30	LO	FB	≥120	RVA
POLAR201586	BS	1	1	7/28/15 10:10	71.1733	-163.4718	25	LO	LO	≥120	RVA
POLAR201587	RS	1	0	7/28/15 11:40	71.1733	-163.4718	50	LO	FB	≥120	RVA
POLAR201588	BS	1	0	7/28/15 18:55	71.1733	-163.4718	100	NO	DI	≥120	RVA
POLAR201589	RS	1	0	7/28/15 19:37	71.1733	-163.4718	20	NO	FB	≥120	RVA
POLAR201590	RBS	1	0	7/28/15 21:22	71.1733	-163.4718	75	LO	LO	≥120	RVA
NORD2015153	BS	1	0	7/28/15 13:45	71.2222	-161.8707	0	LO	LO	<120	RVA
NORD2015154	US	3	0	7/28/15 17:22	71.2079	-161.8330	150	LO	OT	≥120	RVA
NORD2015155	RS	1	0	7/28/15 17:37	71.2242	-161.7876	100	LO	LO	≥120	RVA
NORD2015156	US	2	0	7/28/15 21:00	71.2183	-161.7783	1500	NO	RE	≥120	RVA
NORD2015157	US	1	0	7/28/15 21:26	71.2184	-161.7803	1750	NO	DI	≥120	RVA
NORD2015158	RS	5	1	7/28/15 22:12	71.2199	-161.8016	50	LO	RE	≥120	RVA
DISCOV201527	BS	1	0	7/28/15 16:58	71.1764	-163.0718	40	NO	MI	≥120	RVA
TORVIK2015183	UNK	1	0	7/28/15 7:25	71.1839	-163.1793	50	NO	SA	≥120	RVA

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TORVIK2015184	US	1	0	7/28/15 16:14	71.3011	-162.6909	1401	NO	RE	≥120	RVA
SUPPORT201565	US	1	0	7/28/15 10:40	71.1739	-163.0641	70	LO	LO	≥120	RVA
MINER201558	SS	1	0	7/28/15 4:02	70.8322	-164.0673	30	LO	FB	<120	RVA
MINER201559	US	1	0	7/28/15 16:00	70.8319	-164.0654	100	NO	FB	<120	RVA
AIVIQ2015212	PWA	2	0	7/28/15 13:58	71.3807	-163.3335	3765	NO	RE	<120	RVA
AIVIQ2015213	PWA	1	0	7/28/15 14:24	71.4089	-163.2483	6750	NO	RE	<120	RVA
AIVIQ2015214	PWA	1	0	7/28/15 14:41	71.4087	-163.2490	5750	NO	RE	<120	RVA
AIVIQ2015215	PWA	1	0	7/28/15 15:24	71.4183	-163.3022	2750	NO	RE	<120	RVA
AIVIQ2015216	PWA	90	0	7/28/15 18:03	71.4798	-163.4668	2400	NO	RE	≥120	RVA
AIVIQ2015217	PWA	2	0	7/28/15 18:11	71.4865	-163.4599	2600	NO	RE	≥120	RVA
AIVIQ2015218	PWA	125	0	7/28/15 18:15	71.4905	-163.4546	2735	NO	RE	≥120	RVA
AIVIQ2015219	PWA	100	0	7/28/15 18:35	71.4997	-163.4487	6000	NO	RE	≥120	RVA
AIVIQ2015220	PWA	60	0	7/28/15 22:38	71.4556	-163.4288	4600	NO	RE	≥120	RVA
GUARD201518	BS	1	0	7/29/15 13:20	71.1359	-162.2526	400	NO	ST	<120	RVA
GUARD201519	BS	1	0	7/29/15 14:17	71.0947	-162.2526	50	LO	LO	<120	RVA
GUARD201520	SS	1	0	7/29/15 16:38	71.0787	-162.8586	50	LO	LO	<120	RVA
EXPLOR2015121	US	1	0	7/29/15 14:11	71.5917	-166.6334	750	NO	DI	<120	RVA
EXPLOR2015122	US	1	0	7/29/15 14:25	71.5987	-166.6878	150	NO	SW	<120	RVA
EXPLOR2015123	RS	1	0	7/29/15 14:45	71.6087	-166.7641	20	NO	LO	<120	RVA
EXPLOR2015124	US	1	0	7/29/15 14:50	71.6112	-166.7823	500	NO	DI	<120	RVA
EXPLOR2015125	US	2	0	7/29/15 14:53	71.6125	-166.7937	300	NO	FB	<120	RVA
EXPLOR2015130	US	2	0	7/29/15 23:45	71.7491	-167.9646	150	NO	SW	≥120	RVA
MARIKA201551	GW	1	0	7/29/15 15:17	71.0523	-163.2992	2690	NO	FL	≥120	RVA
NANUQ201588	UP	1	0	7/29/15 12:34	71.1507	-163.3404	646	NO	DI	≥120	RVA
NANUQ201589	BS	1	0	7/29/15 15:21	71.1087	-163.0409	20	NO	DI	≥120	RVA
NANUQ201590	BS	1	0	7/29/15 16:42	71.1078	-162.8446	100	NO	DI	≥120	RVA
NANUQ201591	GW	1	0	7/29/15 20:23	71.1016	-163.3345	1498	NO	FL	≥120	RVA
WAVE201569	UP	1	0	7/29/15 21:34	71.1700	-163.1599	2247	NO	DI	≥120	RVA
NORD2015159	BHW	1	0	7/29/15 9:33	71.3052	-162.7505	5015	NO	TR	≥120	RVA

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NORD2015160	BS	1	0	7/29/15 14:16	71.3053	-162.7526	500	NO	DI	≥120	RVA
NORD2015161	UNK	1	0	7/29/15 14:27	71.3047	-162.7507	10000	NO	RE	<120	RVA
NORD2015165	US	1	0	7/29/15 17:17	71.2508	-162.9004	50	NO	SW	≥120	RVA
NORD2015166	US	1	0	7/29/15 19:29	71.2490	-162.9005	300	NO	LO	≥120	RVA
NORD2015167	US	1	0	7/29/15 19:43	71.2490	-162.9005	1392	NO	SW	≥120	RVA
NORD2015168	US	2	0	7/29/15 20:50	71.2499	-162.9028	3045	NO	LO	≥120	RVA
NORD2015169	US	1	0	7/29/15 21:09	71.2498	-162.9026	75	LO	SW	≥120	RVA
NORD2015170	US	1	0	7/29/15 21:12	71.2498	-162.9027	3938	NO	LO	≥120	RVA
DISCOV201528	BS	1	0	7/29/15 12:20	71.1526	-163.1878	125	LO	TR	≥120	RVA
DISCOV201529	US	1	0	7/29/15 18:39	71.1527	-163.1875	360	NO	LO	≥120	RVA
DISCOV201530	US	2	0	7/29/15 23:59	71.1528	-163.1876	606	NO	DI	≥120	RVA
POLAR201591	BS	1	0	7/29/15 3:00	71.1733	-163.4718	200	LO	LO	≥120	RVA
POLAR201592	RS	1	0	7/29/15 4:35	71.1733	-163.4718	50	LO	LO	≥120	RVA
POLAR201593	RS	1	0	7/29/15 9:24	71.1733	-163.4718	30	NO	DI	≥120	RVA
POLAR201597	BS	1	0	7/29/15 11:37	71.1733	-163.4718	25	NO	DI	≥120	RVA
POLAR201594	US	1	0	7/29/15 14:59	71.1733	-163.4718	150	NO	TH	≥120	RVA
POLAR201595	US	1	0	7/29/15 15:09	71.1733	-163.4718	200	NO	DI	≥120	RVA
POLAR201599	RS	1	0	7/29/15 16:28	71.1733	-163.4718	100	LO	LO	≥120	RVA
POLAR2015100	BS	1	0	7/29/15 19:15	71.1733	-163.4718	175	NO	DI	≥120	RVA
POLAR2015101	BS	1	1	7/29/15 21:46	71.1733	-163.4718	100	NO	DI	≥120	RVA
POLAR2015102	BS	1	0	7/29/15 22:10	71.1733	-163.4718	250	NO	LO	≥120	RVA
POLAR2015103	US	2	0	7/29/15 23:45	71.1733	-163.4718	1000	NO	SW	≥120	RVA
AIVIQ2015222	PWA	40	0	7/29/15 4:50	71.4557	-163.4287	2500	NO	RE	≥120	RVA
AIVIQ2015223	PWA	1	0	7/29/15 7:48	71.4457	-163.3225	977	NO	RE	≥120	RVA
AIVIQ2015224	PWA	243	0	7/29/15 12:34	71.4363	-163.2355	8178	NO	RE	≥120	RVA
AIVIQ2015225	BS	1	0	7/29/15 13:16	71.4363	-163.2357	125	NO	DI	≥120	RVA
AIVIQ2015226	PWA	2	0	7/29/15 14:06	71.4459	-163.1943	1700	NO	RE	≥120	RVA
AIVIQ2015227	US	1	0	7/29/15 14:53	71.4545	-163.1443	75	CD	PO	≥120	RVA
AIVIQ2015228	UP	1	0	7/29/15 15:39	71.4309	-163.1569	2000	LO	LO	≥120	RVA

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AIVIQ2015232	BS	1	0	7/29/15 16:37	71.3497	-163.2154	350	LO	LO	≥120	RVA
AIVIQ2015233	US	1	0	7/29/15 21:12	71.3431	-163.2167	846	NO	DI	≥120	RVA
MINER201560	US	1	0	7/29/15 23:47	70.8336	-164.0696	150	NO	LO	<120	RVA
TORVIK2015185	US	1	0	7/29/15 7:44	71.3187	-162.8087	10	NO	LO	≥120	RVA
TORVIK2015186	US	1	0	7/29/15 9:07	71.3186	-162.8088	2029	NO	ST	≥120	RVA
TORVIK2015187	US	1	0	7/29/15 13:20	71.3241	-162.7198	531	NO	LO	≥120	RVA
TORVIK2015188	US	1	0	7/29/15 14:00	71.3241	-162.7204	2495	NO	RE	≥120	RVA
TORVIK2015189	US	1	0	7/29/15 14:00	71.3241	-162.7204	2495	NO	RE	≥120	RVA
TORVIK2015190	US	2	0	7/29/15 15:22	71.3159	-162.7679	362	NO	ST	≥120	RVA
TORVIK2015191	US	1	0	7/29/15 15:54	71.3158	-162.7680	853	NO	SA	≥120	RVA
TORVIK2015195	US	1	0	7/29/15 17:44	71.2916	-163.0716	769	NO	ST	≥120	RVA
TORVIK2015196	US	1	0	7/29/15 17:45	71.2920	-163.0723	1388	LO	SA	≥120	RVA
TORVIK2015200	US	2	0	7/29/15 19:07	71.2920	-163.0880	3257	NO	ST	≥120	RVA
TORVIK2015201	US	1	0	7/29/15 19:53	71.2920	-163.0880	6411	NO	RE	≥120	RVA
TORVIK2015202	US	1	0	7/29/15 22:54	71.2919	-163.0881	531	LO	SA	≥120	RVA
TORVIK2015203	US	1	0	7/29/15 23:38	71.2920	-163.0880	3861	NO	RE	≥120	RVA
TORVIK2015204	US	1	0	7/29/15 23:41	71.2920	-163.0880	2495	NO	ST	≥120	RVA
WIND201563	SS	1	0	7/29/15 9:54	71.1835	-163.0986	300	LO	LO	≥120	RVA
WIND201564	BS	1	0	7/29/15 14:12	71.1840	-163.0966	50	NO	LO	≥120	RVA
WIND201565	RS	1	0	7/29/15 15:21	71.1840	-163.0966	50	NO	RE	≥120	RVA
WIND201566	BS	2	0	7/29/15 15:51	71.1840	-163.0964	50	NO	LO	≥120	RVA
WIND201567	BS	1	0	7/29/15 16:48	71.1832	-163.0971	20	LO	SW	≥120	RVA
SUPPORT201566	BS	1	0	7/29/15 13:22	71.1659	-163.0579	784	NO	SW	≥120	RVA
SUPPORT201567	UP	1	0	7/29/15 14:58	71.1659	-163.0579	100	NO	SW	≥120	RVA
SUPPORT201568	US	1	0	7/29/15 17:10	71.1659	-163.0577	784	NO	DI	≥120	RVA
SUPPORT201569	US	1	0	7/29/15 17:33	71.1659	-163.0578	469	NO	DI	≥120	RVA
SUPPORT201570	US	1	0	7/29/15 18:30	71.1659	-163.0579	1012	NO	SI	≥120	RVA
SUPPORT201571	US	1	0	7/29/15 18:49	71.1658	-163.0577	705	NO	LO	≥120	RVA
SUPPORT201572	US	1	0	7/29/15 19:32	71.1659	-163.0580	1000	NO	SW	≥120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
SUPPORT201573	UMW	1	0	7/29/15 21:24	71.1431	-163.1361	2438	NO	FL	≥120	RVA
SISUAQ201543	US	1	0	7/29/15 9:26	71.0182	-162.5614	10	IS	LO	<120	RVA
SISUAQ201544	BS	1	0	7/29/15 13:28	71.1658	-163.0574	999	NO	LO	≥120	RVA
SISUAQ201545	SS	1	0	7/29/15 13:54	71.1617	-163.0502	150	NO	DI	≥120	RVA
SISUAQ201546	UMW	1	0	7/29/15 21:53	71.1548	-163.2855	750	NO	BL	≥120	RVA
WIND201572	BS	1	0	7/30/15 7:10	71.1927	-163.2151	1441	NO	LO	≥120	DR
WIND201573	BS	1	0	7/30/15 7:35	71.1942	-163.2195	573	NO	DI	≥120	DR
WIND201574	US	1	0	7/30/15 17:07	71.1364	-163.2106	70	SP	DI	≥120	DR
DISCOV201531	US	1	0	7/30/15 2:29	71.1526	-163.1880	785	NO	DI	≥120	DR
DISCOV201532	BS	1	0	7/30/15 3:14	71.1527	-163.1877	417	NO	LO	≥120	DR
DISCOV201534	US	1	1	7/30/15 3:52	71.1527	-163.1875	417	NO	SI	≥120	DR
DISCOV201535	US	1	0	7/30/15 4:47	71.1528	-163.1870	1114	NO	MI	≥120	DR
DISCOV201536	BS	1	0	7/30/15 5:13	71.1528	-163.1875	452	NO	RE	≥120	DR
DISCOV201538	US	1	0	7/30/15 7:02	71.1530	-163.1871	1960	NO	SW	≥120	DR
DISCOV201539	US	1	0	7/30/15 7:13	71.1527	-163.1873	1114	NO	SW	≥120	DR
DISCOV201540	BS	1	0	7/30/15 7:21	71.1529	-163.1873	494	NO	RE	≥120	DR
DISCOV201541	US	1	0	7/30/15 10:48	71.1533	-163.1873	318	NO	FB	≥120	DR
DISCOV201542	US	1	0	7/30/15 13:46	71.1537	-163.1912	225	NO	SW	≥120	DR
NORD2015172	BS	1	0	7/30/15 0:24	71.2502	-162.9027	800	NO	SW	≥120	DR
NORD2015173	US	2	0	7/30/15 1:44	71.2496	-162.9036	500	NO	LO	≥120	DR
NORD2015175	US	1	0	7/30/15 3:02	71.2501	-162.9036	3938	NO	SW	≥120	DR
NORD2015174	US	1	0	7/30/15 3:27	71.2501	-162.9039	1500	NO	SW	≥120	DR
NORD2015176	US	1	0	7/30/15 4:50	71.2501	-162.9039	699	NO	DI	≥120	DR
NORD2015177	US	1	0	7/30/15 5:05	71.2500	-162.9042	1084	NO	SW	≥120	DR
NORD2015178	BHW	1	0	7/30/15 5:43	71.2501	-162.9038	2435	NO	FL	≥120	DR
NORD2015179	BS	1	0	7/30/15 6:53	71.2494	-162.9048	752	LO	LO	≥120	DR
NORD2015180	US	1	0	7/30/15 7:07	71.2492	-162.9053	750	NO	SW	≥120	DR
POLAR2015104	BS	1	0	7/30/15 0:51	71.1733	-163.4718	40	LO	TH	≥120	DR
POLAR2015105	BS	1	0	7/30/15 2:28	71.1733	-163.4718	250	NO	SW	≥120	DR

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POLAR2015106	BS	1	0	7/30/15 2:57	71.1733	-163.4718	700	NO	SW	≥120	DR
POLAR2015107	BS	1	0	7/30/15 3:23	71.1733	-163.4718	150	LO	LO	≥120	DR
POLAR2015108	US	1	0	7/30/15 3:57	71.1733	-163.4718	659	NO	LO	≥120	DR
POLAR2015109	BS	1	0	7/30/15 5:35	71.1733	-163.4718	100	NO	LO	≥120	DR
POLAR2015110	RS	1	0	7/30/15 7:02	71.1733	-163.4718	100	LO	TH	≥120	DR
POLAR2015111	BS	1	0	7/30/15 7:27	71.1733	-163.4718	100	LO	LO	≥120	DR
POLAR2015112	BS	1	0	7/30/15 14:27	71.1733	-163.4718	150	LO	DI	≥120	DR
POLAR2015113	US	1	0	7/30/15 18:55	71.1733	-163.4718	100	NO	DI	≥120	DR
EXPLOR2015131	PWA	1	0	7/30/15 0:15	71.7486	-167.9633	10	LO	LO	≥120	DR
AIVIQ2015234	UP	1	0	7/30/15 0:37	71.3430	-163.2166	2770	NO	DI	≥120	DR
AIVIQ2015235	US	1	0	7/30/15 1:51	71.3430	-163.2169	1075	NO	DI	≥120	DR
AIVIQ2015236	PWA	5	0	7/30/15 3:45	71.3430	-163.2166	8178	NO	RE	≥120	DR
AIVIQ2015237	US	1	0	7/30/15 3:56	71.3430	-163.2166	464	NO	DI	≥120	DR
GUARD201521	US	1	0	7/30/15 7:10	71.1387	-162.2784	75	LO	LO	<120	DR
GUARD201522	UMW	1	0	7/30/15 21:28	71.0629	-163.7427	500	NO	BL	<120	DR
NANUQ201592	UP	1	0	7/30/15 1:55	71.1026	-163.1543	444	NO	SI	≥120	DR
NANUQ201593	BS	1	0	7/30/15 2:46	71.1041	-163.0270	384	LO	DI	≥120	DR
NANUQ201594	UP	1	0	7/30/15 3:47	71.1119	-162.8818	835	NO	DI	≥120	DR
NANUQ201595	GW	2	1	7/30/15 3:55	71.1115	-162.8946	500	NO	MI	≥120	DR
NANUQ201599	UP	1	0	7/30/15 7:30	71.1109	-163.3015	1184	NO	SW	≥120	DR
NANUQ2015100	US	1	0	7/30/15 11:54	71.0986	-163.3815	600	NO	LO	≥120	DR
NANUQ2015101	BS	1	0	7/30/15 13:48	71.0184	-163.3414	213	LO	DI	<120	DR
NANUQ2015102	US	1	0	7/30/15 15:03	70.9902	-163.2970	25	LO	LO	<120	DR
NANUQ2015103	SS	1	0	7/30/15 18:21	71.1302	-163.4948	5	LO	SI	≥120	DR
NANUQ2015104	US	1	0	7/30/15 19:49	71.1932	-163.5788	2	SP	TH	≥120	DR
NANUQ2015105	UP	1	0	7/30/15 23:38	71.1030	-163.4528	384	LO	DI	≥120	DR
CHAMP201543	UMW	1	0	7/30/15 10:59	69.7402	-165.7432	1000	NO	BL	<120	DR
CHAMP201544	GW	2	0	7/30/15 19:53	71.0069	-163.4962	1000	NO	BL	<120	DR
WAVE201570	UP	1	0	7/30/15 5:27	71.1893	-163.2323	500	NO	DI	≥120	DR

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WAVE201571	US	1	0	7/30/15 6:04	71.1921	-163.2382	674	NO	SW	≥120	DR
WAVE201572	US	1	0	7/30/15 6:50	71.1952	-163.2473	327	NO	RE	≥120	DR
SISUAQ201547	BS	1	1	7/30/15 6:26	71.1549	-163.2856	10	LO	LO	≥120	DR
SISUAQ201548	BS	1	1	7/30/15 11:23	71.1549	-163.2853	150	LO	SW	≥120	DR
SISUAQ201549	US	1	0	7/30/15 15:46	71.0912	-163.5573	70	NO	DI	≥120	DR
SISUAQ201550	BS	1	1	7/30/15 19:18	71.1571	-163.2720	30	NO	DI	≥120	DR
MARIKA201552	US	1	0	7/30/15 18:01	71.0556	-163.2926	15	LO	SI	≥120	DR
MARIKA201553	GW	2	0	7/30/15 18:19	71.0555	-163.2925	1200	NO	ST	≥120	DR
TORVIK2015205	US	1	0	7/30/15 3:12	71.2920	-163.0882	1712	NO	SA	≥120	DR
TORVIK2015206	US	1	0	7/30/15 3:37	71.2920	-163.0881	2029	NO	SA	≥120	DR
TORVIK2015207	US	1	0	7/30/15 4:54	71.2919	-163.0880	4776	NO	RE	≥120	DR
TORVIK2015208	RS	1	0	7/30/15 7:17	71.2920	-163.0880	10	CD	SW	≥120	DR
TORVIK2015209	US	1	0	7/30/15 10:00	71.2953	-163.0964	822	NO	SA	≥120	DR
TORVIK2015210	US	1	0	7/30/15 10:48	71.3133	-163.1128	460	NO	SW	≥120	DR
TORVIK2015211	RS	1	0	7/30/15 22:37	71.2894	-163.0822	100	NO	DI	≥120	DR
MINER201561	SS	1	0	7/30/15 4:57	70.8358	-164.0663	150	NO	FB	<120	DR
MINER201562	GW	2	0	7/30/15 17:16	70.7097	-163.2451	1700	NO	TR	<120	DR
MINER201563	RS	1	0	7/30/15 19:37	70.7096	-163.2449	40	NO	DI	<120	DR
MINER201564	GW	1	0	7/30/15 20:50	70.7093	-163.2460	986	NO	DI	<120	DR
EXPLOR2015132	UMW	2	0	7/31/15 5:49	71.2014	-163.5646	566	NO	TR	≥120	DR
POLAR2015114	BS	1	0	7/31/15 13:21	71.1733	-163.4718	75	LO	DI	≥120	DR
NORD2015181	BS	1	0	7/31/15 5:57	71.2419	-162.9070	15	LO	LO	≥120	DR
TORVIK2015212	US	1	0	7/31/15 20:06	71.3840	-163.2909	531	NO	DI	≥120	DR
NANUQ2015106	UP	1	0	8/1/15 23:57	71.1451	-163.2579	800	LO	LO	≥120	DR
DISCOV201543	US	1	0	8/1/15 20:24	71.1541	-163.1833	1114	NO	LO	≥120	DR
NORD2015183	BS	1	0	8/1/15 13:52	71.1991	-163.0257	20	LO	LO	≥120	DR
EXPLOR2015133	RS	1	0	8/1/15 13:33	71.1648	-163.1567	75	NO	DI	≥120	DR
EXPLOR2015134	US	1	0	8/1/15 14:39	71.1628	-163.1257	300	NO	DI	≥120	DR
EXPLOR2015135	US	1	0	8/1/15 21:49	71.1639	-163.2433	218	NO	LO	≥120	DR

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GUARD201523	BS	1	0	8/1/15 12:48	71.1207	-163.3283	40	LO	LO	≥120	DR
GUARD201524	US	1	0	8/1/15 16:10	71.0924	-163.3192	70	NO	SW	≥120	DR
GUARD201525	BS	1	0	8/1/15 19:36	71.1237	-163.2085	500	LO	LO	≥120	DR
GUARD201526	BS	1	0	8/1/15 19:52	71.1384	-163.2396	25	LO	LO	≥120	DR
ROSS201575	US	1	0	8/1/15 12:14	68.6404	-168.2780	5	NO	DE	<120	DR
ROSS201576	MW	1	0	8/1/15 23:21	70.3339	-165.0257	350	NO	SW	<120	DR
TORVIK2015213	US	1	0	8/1/15 0:00	71.3863	-163.2920	200	NO	DI	≥120	DR
TORVIK2015214	US	4	0	8/1/15 20:00	71.3364	-163.2782	400	NO	LO	≥120	DR
TORVIK2015215	US	1	0	8/1/15 21:11	71.3817	-163.3034	300	NO	LO	≥120	DR
TORVIK2015216	US	1	0	8/1/15 21:54	71.3808	-163.3050	100	NO	LO	≥120	DR
TORVIK2015217	US	1	0	8/1/15 22:20	71.3785	-163.3114	100	LO	LO	≥120	DR
TORVIK2015218	US	1	0	8/1/15 23:52	71.3724	-163.3243	100	NO	SI	≥120	DR
MARIKA201554	US	1	0	8/1/15 11:20	71.0530	-163.2849	20	IS	FB	≥120	DR
MARIKA201555	US	1	0	8/1/15 18:44	71.0545	-163.2842	50	IS	FB	≥120	DR
MARIKA201556	UP	1	0	8/1/15 21:40	71.0542	-163.2836	576	NO	ST	≥120	DR
AIVIQ2015238	HP	3	0	8/1/15 18:49	71.2314	-163.2421	677	NO	TR	≥120	DR
AIVIQ2015239	BS	1	0	8/1/15 19:26	71.3032	-163.2159	100	SP	SW	≥120	DR
POLAR2015115	RS	1	0	8/2/15 15:47	71.1733	-163.4718	40	NO	DI	≥120	DR
EXPLOR2015136	RS	1	0	8/2/15 13:34	71.2363	-163.2670	50	NO	LO	≥120	DR
AIVIQ2015241	US	1	0	8/2/15 14:10	71.3156	-163.1946	150	NO	SI	≥120	DR
ROSS201577	US	1	0	8/2/15 1:07	70.5945	-164.4233	30	SP	DI	<120	DR
ROSS201578	US	1	0	8/2/15 7:32	71.0826	-163.4586	5	LO	SW	≥120	DR
MARIKA201557	RS	1	0	8/2/15 0:51	71.0552	-163.2853	30	LO	LO	≥120	DR
GUARD201527	SS	1	0	8/2/15 15:22	70.9821	-161.8204	50	LO	LO	<120	DR
NORD2015184	BS	1	0	8/2/15 14:09	71.2160	-163.1038	25	LO	LO	≥120	DR
TORVIK2015219	US	1	0	8/2/15 0:25	71.3736	-163.3279	100	NO	SI	≥120	DR
TORVIK2015222	SS	1	0	8/2/15 2:06	71.3813	-163.3033	100	NO	FB	≥120	DR
TORVIK2015223	SS	1	0	8/2/15 3:11	71.3854	-163.3076	50	NO	ST	≥120	DR
TORVIK2015224	UP	1	0	8/2/15 4:37	71.3935	-163.3029	800	NO	SI	≥120	DR

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TORVIK2015225	US	1	0	8/2/15 5:18	71.3934	-163.3025	50	NO	SI	≥120	DR
TORVIK2015226	RS	1	0	8/2/15 10:31	71.3581	-163.3219	25	LO	LO	≥120	DR
TORVIK2015227	PB	1	0	8/2/15 10:35	71.3581	-163.3222	20	NO	SW	≥120	DR
WIND201575	US	1	0	8/2/15 7:58	71.1174	-163.1992	20	LO	SI	≥120	DR
WIND201576	UP	1	0	8/2/15 8:25	71.1174	-163.1994	200	NO	LO	≥120	DR
WAVE201573	BS	1	0	8/3/15 11:20	71.1356	-163.0147	100	LO	LO	≥120	MLC
NANUQ2015107	BS	1	0	8/3/15 10:59	71.1579	-163.1826	70	NO	SA	≥120	MLC
AIVIQ2015242	BS	1	0	8/3/15 9:01	71.2495	-163.5137	50	LO	LO	≥120	MLC
WIND201578	UP	1	0	8/3/15 14:43	71.1516	-162.9842	75	NO	LO	≥120	MLC
MARIKA201559	UP	1	0	8/3/15 9:16	70.9504	-163.7616	250	NO	SW	<120	MLC
POLAR2015116	BS	1	0	8/3/15 5:44	71.1733	-163.4718	100	LO	LO	≥120	MLC
POLAR2015117	BS	1	0	8/3/15 6:13	71.1733	-163.4718	50	LO	LO	≥120	MLC
POLAR2015118	BS	1	0	8/3/15 6:47	71.1733	-163.4718	25	NO	DI	≥120	MLC
TORVIK2015228	RS	1	0	8/3/15 13:09	71.2056	-163.6168	200	LO	LO	≥120	MLC
ROSS201579	UMW	1	0	8/3/15 0:29	70.8580	-163.3209	300	SP	BR	<120	MLC
EXPLOR2015137	US	1	0	8/4/15 10:27	71.3273	-163.2989	15	LO	LO	≥120	MLC
NORD2015185	BS	1	0	8/4/15 7:01	71.2324	-162.9007	23	NO	SI	≥120	MLC
NORD2015186	PWA	1	0	8/4/15 14:02	71.2227	-162.9225	500	NO	DI	≥120	MLC
NORD2015187	BW	3	0	8/4/15 20:36	71.2231	-162.8524	1084	NO	TR	≥120	MLC
POLAR2015120	BS	1	0	8/4/15 2:33	71.1733	-163.4718	150	LO	LO	≥120	MLC
POLAR2015121	RS	1	0	8/4/15 3:23	71.1733	-163.4718	25	LO	LO	≥120	MLC
TORVIK2015229	US	1	0	8/4/15 0:07	71.1528	-163.7826	200	LO	LO	≥120	MLC
MARIKA201560	RS	1	0	8/4/15 23:59	71.0547	-163.2705	10	LO	LO	≥120	MLC
CHAMP201545	UP	1	0	8/5/15 8:36	71.2193	-163.5253	290	NO	DE	≥120	MLC + AH
CHAMP201546	US	1	0	8/5/15 18:52	71.2122	-163.5135	330	LO	SI	≥120	MLC + AH
CHAMP201547	US	1	0	8/5/15 21:44	71.2041	-163.5169	400	NO	DI	≥120	MLC + AH
EXPLOR2015139	SS	1	0	8/5/15 17:00	71.2487	-163.3322	250	NO	RE	≥120	MLC + AH
EXPLOR2015140	US	1	0	8/5/15 17:24	71.2506	-163.2922	800	NO	RE	≥120	MLC + AH
EXPLOR2015141	US	1	0	8/5/15 17:36	71.2516	-163.2701	1043	NO	RE	≥120	MLC + AH

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EXPLOR2015142	US	1	0	8/5/15 18:13	71.2550	-163.2076	400	NO	LO	≥120	MLC + AH
EXPLOR2015143	US	1	0	8/5/15 18:18	71.2559	-163.2168	265	LO	LO	≥120	MLC + AH
EXPLOR2015144	US	1	0	8/5/15 18:43	71.2643	-163.2600	461	NO	LO	≥120	MLC + AH
EXPLOR2015145	US	1	0	8/5/15 18:53	71.2675	-163.2751	461	NO	SW	≥120	MLC + AH
EXPLOR2015146	US	1	0	8/5/15 19:24	71.2796	-163.3213	639	NO	DI	≥120	MLC + AH
EXPLOR2015147	UMW	1	0	8/5/15 19:49	71.2869	-163.3560	750	NO	FL	≥120	MLC + AH
EXPLOR2015148	US	2	0	8/5/15 20:09	71.2870	-163.3882	700	NO	RE	≥120	MLC + AH
EXPLOR2015149	RS	1	0	8/5/15 20:44	71.2846	-163.4515	150	NO	SW	≥120	MLC + AH
EXPLOR2015150	US	1	1	8/5/15 23:07	71.2786	-163.3820	75	NO	SW	≥120	MLC + AH
GUARD201528	SS	1	0	8/5/15 11:39	71.1093	-163.0469	50	LO	LO	≥120	MLC + AH
GUARD201529	SS	1	0	8/5/15 13:38	71.0309	-162.6066	10	NO	LG	<120	MLC + AH
GUARD201530	US	1	0	8/5/15 15:41	70.9498	-162.1512	70	NO	SW	<120	MLC + AH
GUARD201531	SS	1	0	8/5/15 16:18	70.9248	-162.0182	90	LO	LO	<120	MLC + AH
GUARD201532	RS	1	0	8/5/15 18:51	70.9052	-161.9747	75	LO	LO	<120	MLC + AH
GUARD201533	US	1	0	8/5/15 19:50	70.9387	-162.1658	100	SP	LO	<120	MLC + AH
GUARD201534	BS	1	0	8/5/15 20:01	70.9456	-162.2001	50	LO	LO	≥120	MLC + AH
GUARD201535	BS	1	0	8/5/15 20:06	70.9488	-162.2156	75	LO	LO	<120	MLC + AH
GUARD201536	US	1	0	8/5/15 20:21	70.9593	-162.2640	450	LO	LO	<120	MLC + AH
GUARD201537	US	1	0	8/5/15 20:40	70.9714	-162.3220	100	LO	LG	<120	MLC + AH
GUARD201538	US	1	0	8/5/15 20:48	70.9771	-162.3491	100	LO	LO	<120	MLC + AH
GUARD201539	SS	2	1	8/5/15 22:11	71.0338	-162.6095	100	LO	LO	<120	MLC + AH
GUARD201540	BS	1	0	8/5/15 22:16	71.0376	-162.6273	200	LO	LO	<120	MLC + AH
GUARD201541	BS	1	0	8/5/15 23:43	71.0905	-162.9060	400	LO	LG	≥120	MLC + AH
NORD2015188	US	1	0	8/5/15 12:19	71.2129	-162.8405	500	NO	SW	≥120	MLC + AH
NORD2015189	BS	1	0	8/5/15 14:06	71.1986	-162.8782	50	LO	LO	≥120	MLC + AH
NORD2015190	BS	1	0	8/5/15 15:47	71.2018	-162.8781	100	NO	LO	≥120	MLC + AH
NORD2015191	BS	1	0	8/5/15 17:37	71.1980	-162.8740	250	NO	LO	≥120	MLC + AH
NORD2015192	US	1	0	8/5/15 21:07	71.2215	-162.9173	250	LO	LO	≥120	MLC + AH
NORD2015193	RS	1	0	8/5/15 22:46	71.2174	-162.8969	25	NO	LO	≥120	MLC + AH

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NORD2015194	BS	1	0	8/5/15 23:49	71.2149	-162.8853	300	LO	LO	≥120	MLC + AH
TORVIK2015230	US	1	0	8/5/15 19:42	71.1772	-163.0768	3257	NO	LO	≥120	MLC + AH
TORVIK2015231	SS	1	0	8/5/15 21:46	71.1772	-163.0767	1057	NO	LO	≥120	MLC + AH
MARIKA201561	RS	1	0	8/5/15 1:39	71.0545	-163.2713	40	LO	LO	≥120	MLC + AH
MARIKA201562	UMW	1	0	8/5/15 12:58	71.0544	-163.2712	1500	NO	TR	≥120	MLC + AH
MARIKA201563	US	1	0	8/5/15 18:02	71.0550	-163.2707	100	NO	LO	≥120	MLC + AH
MARIKA201564	US	1	0	8/5/15 20:41	71.0553	-163.2710	400	LO	LO	≥120	MLC + AH
MARIKA201565	RS	2	0	8/5/15 22:11	71.0552	-163.2705	40	NO	FB	≥120	MLC + AH
MARIKA201566	UP	1	0	8/5/15 22:51	71.0553	-163.2704	350	LO	DI	≥120	MLC + AH
MARIKA201567	SS	1	1	8/5/15 23:12	71.0552	-163.2700	10	LO	SW	≥120	MLC + AH
MARIKA201568	US	3	0	8/5/15 23:40	71.0553	-163.2701	30	LO	LO	≥120	MLC + AH
SISUAQ201551	UP	1	0	8/5/15 8:45	71.2198	-163.5264	140	NO	DE	≥120	MLC + AH
DISCOV201544	BS	1	0	8/5/15 12:38	71.1761	-163.0714	150	LO	LO	≥120	MLC + AH
POLAR2015122	US	1	0	8/5/15 14:49	71.1733	-163.4718	100	NO	FB	≥120	MLC + AH
POLAR2015123	US	1	0	8/5/15 17:25	71.1733	-163.4718	250	LO	LO	≥120	MLC + AH
POLAR2015124	US	1	0	8/5/15 18:46	71.1733	-163.4718	200	LO	LO	≥120	MLC + AH
POLAR2015125	RS	1	0	8/5/15 19:14	71.1733	-163.4718	75	LO	LO	≥120	MLC + AH
POLAR2015126	US	1	0	8/5/15 19:18	71.1733	-163.4718	140	LO	SW	≥120	MLC + AH
POLAR2015127	SS	3	0	8/5/15 21:17	71.1733	-163.4718	75	LO	LO	≥120	MLC + AH
POLAR2015128	US	1	0	8/5/15 22:23	71.1733	-163.4718	250	NO	FB	≥120	MLC + AH
POLAR2015131	US	3	0	8/5/15 22:46	71.1733	-163.4718	200	LO	LO	≥120	MLC + AH
POLAR2015129	US	1	0	8/5/15 23:58	71.1733	-163.4718	100	NO	DI	≥120	MLC + AH
MINER201565	UP	1	0	8/5/15 18:37	70.7086	-163.2247	986	NO	SW	<120	MLC + AH
NANUQ2015112	US	1	0	8/5/15 18:38	71.1728	-163.4547	75	LO	SA	≥120	MLC + AH
NANUQ2015113	US	4	0	8/5/15 20:10	71.1727	-163.4546	75	LO	SI	≥120	MLC + AH
NANUQ2015114	SS	1	0	8/5/15 20:53	71.1728	-163.4546	15	NO	SA	≥120	MLC + AH
NANUQ2015115	SS	1	0	8/5/15 20:58	71.1728	-163.4545	100	NO	DI	≥120	MLC + AH
NANUQ2015116	SS	1	0	8/5/15 22:08	71.1727	-163.4550	40	NO	SA	≥120	MLC + AH
NANUQ2015117	SS	2	0	8/5/15 22:10	71.1727	-163.4549	75	NO	SA	≥120	MLC + AH

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NANUQ2015118	SS	1	0	8/5/15 23:01	71.1728	-163.4549	100	NO	FB	≥120	MLC + AH
NANUQ2015119	US	1	0	8/5/15 23:50	71.1705	-163.4553	100	NO	SA	≥120	MLC + AH
WAVE201574	BS	1	0	8/5/15 12:06	71.1493	-163.1921	30	LO	LO	≥120	MLC + AH
WAVE201575	BS	1	0	8/5/15 14:26	71.1493	-163.1922	75	LO	LO	≥120	MLC + AH
WAVE201576	BS	1	0	8/5/15 15:38	71.1493	-163.1919	60	LO	SW	≥120	MLC + AH
WAVE201577	RS	1	0	8/5/15 16:13	71.1492	-163.1920	50	NO	FB	≥120	MLC + AH
WAVE201578	RS	1	0	8/5/15 16:30	71.1492	-163.1920	75	LO	FB	≥120	MLC + AH
WAVE201579	BS	1	0	8/5/15 17:42	71.1494	-163.1924	50	LO	LO	≥120	MLC + AH
WAVE201580	RS	2	0	8/5/15 18:13	71.1494	-163.1924	50	NO	LO	≥120	MLC + AH
WAVE201581	BS	1	0	8/5/15 19:10	71.1493	-163.1924	143	LO	LO	≥120	MLC + AH
ROSS201580	BS	1	0	8/5/15 10:13	71.1738	-163.0757	100	CD	SW	≥120	MLC + AH
ROSS201581	UP	1	0	8/5/15 19:14	71.1795	-163.0721	1658	NO	SW	≥120	MLC + AH
ROSS201582	SS	1	0	8/5/15 21:28	71.1723	-163.0922	100	NO	SW	≥120	MLC + AH
NANUQ2015120	SS	1	0	8/6/15 2:14	71.1520	-163.4696	10	LO	FB	≥120	MLC + AH
NANUQ2015121	SS	1	0	8/6/15 17:11	71.1732	-163.4792	20	NO	FB	≥120	MLC + AH
NANUQ2015122	BS	1	0	8/6/15 17:25	71.1732	-163.4793	45	LO	LO	≥120	MLC + AH
NANUQ2015123	SS	1	0	8/6/15 22:19	71.1732	-163.4792	50	NO	FB	≥120	MLC + AH
POLAR2015132	BS	1	0	8/6/15 7:55	71.1733	-163.4718	45	LO	LO	≥120	MLC + AH
POLAR2015133	BS	1	0	8/6/15 10:45	71.1733	-163.4718	200	NO	SW	≥120	MLC + AH
POLAR2015134	BS	1	0	8/6/15 12:04	71.1733	-163.4718	50	NO	RE	≥120	MLC + AH
POLAR2015136	BS	1	0	8/6/15 12:47	71.1733	-163.4718	100	NO	SW	≥120	MLC + AH
POLAR2015135	BS	1	0	8/6/15 13:27	71.1733	-163.4718	100	LO	LO	≥120	MLC + AH
POLAR2015137	US	1	0	8/6/15 15:23	71.1733	-163.4718	30	LO	LO	≥120	MLC + AH
POLAR2015138	US	1	0	8/6/15 18:59	71.1733	-163.4718	125	LO	LO	≥120	MLC + AH
POLAR2015139	RS	1	0	8/6/15 19:16	71.1733	-163.4718	85	LO	LO	≥120	MLC + AH
EXPLOR2015151	US	1	0	8/6/15 0:17	71.2737	-163.3584	30	NO	SW	≥120	MLC + AH
EXPLOR2015153	US	1	0	8/6/15 23:20	71.2960	-163.4843	75	NO	SW	≥120	MLC + AH
WIND201579	US	1	0	8/5/15 14:03	71.1772	-163.0656	200	NO	LO	≥120	MLC + AH
NORD2015195	US	1	0	8/6/15 23:26	71.2308	-162.8825	500	NO	LO	≥120	MLC + AH

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
DISCOV201545	US	1	0	8/6/15 4:47	71.1760	-163.0714	50	NO	SI	≥120	MLC + AH
DISCOV201546	US	1	0	8/6/15 19:07	71.1755	-163.0720	200	NO	DI	≥120	MLC + AH
MARIKA201569	RS	1	0	8/6/15 5:52	71.0580	-163.2801	2	LO	LO	≥120	MLC + AH
MARIKA201570	RS	1	1	8/6/15 6:21	71.0592	-163.2796	7	LO	RE	≥120	MLC + AH
MARIKA201571	US	1	0	8/6/15 8:14	71.0592	-163.2791	100	NO	ST	≥120	MLC + AH
MARIKA201572	US	1	0	8/6/15 17:01	71.0590	-163.2850	10	NO	SA	≥120	MLC + AH
MARIKA201573	RS	1	0	8/6/15 20:19	71.0591	-163.2796	30	NO	RE	≥120	MLC + AH
MARIKA201574	RS	1	0	8/6/15 22:05	71.0579	-163.2751	10	NO	RE	≥120	MLC + AH
GUARD201542	RS	1	0	8/6/15 13:40	71.1829	-163.2836	200	SP	TH	≥120	MLC + AH
GUARD201543	US	1	0	8/6/15 14:24	71.2175	-163.3945	150	LO	LO	≥120	MLC + AH
GUARD201544	RS	1	0	8/6/15 22:35	70.9890	-162.5101	272	LO	LO	<120	MLC + AH
GUARD201545	SS	1	0	8/6/15 23:25	70.9877	-162.3076	10	LO	LO	<120	MLC + AH
GUARD201546	RS	1	0	8/6/15 23:56	70.9867	-162.1806	141	LO	LG	≥120	MLC + AH
TORVIK2015232	US	1	0	8/6/15 3:23	71.1775	-163.0755	460	NO	TR	≥120	MLC + AH
TORVIK2015233	SS	1	0	8/6/15 11:23	71.1772	-163.0751	40	NO	SA	≥120	MLC + AH
WAVE201582	RS	1	0	8/6/15 19:54	71.1518	-163.0937	60	LO	FB	≥120	MLC + AH
WAVE201583	SS	1	0	8/6/15 21:05	71.1518	-163.0937	35	NO	FB	≥120	MLC + AH
MINER201566	US	1	0	8/6/15 19:42	70.7131	-163.2320	50	NO	FB	<120	MLC + AH
MINER201567	MW	1	0	8/6/15 19:55	70.7134	-163.2316	60	NO	SW	<120	MLC + AH
NANUQ2015124	BS	1	0	8/7/15 17:10	71.1613	-163.3233	150	NO	SW	≥120	MLC + AH
CHAMP201548	BS	1	0	8/7/15 18:44	71.1747	-163.4589	70	LO	LO	≥120	MLC + AH
POLAR2015140	BS	1	0	8/7/15 1:57	71.1733	-163.4718	25	NO	RE	≥120	MLC + AH
POLAR2015141	US	1	0	8/7/15 17:52	71.1733	-163.4718	150	NO	SW	≥120	MLC + AH
EXPLOR2015154	US	1	0	8/7/15 1:27	71.2529	-163.2462	20	NO	DI	≥120	MLC + AH
EXPLOR2015155	RS	1	0	8/7/15 7:45	71.2985	-163.7470	15	NO	DI	<120	MLC + AH
EXPLOR2015156	US	1	0	8/7/15 11:55	71.3265	-163.6888	30	NO	DI	<120	MLC + AH
EXPLOR2015157	US	1	0	8/7/15 13:11	71.3225	-163.5043	150	NO	DI	≥120	MLC + AH
EXPLOR2015158	US	1	0	8/7/15 15:11	71.3189	-163.2341	75	NO	OT	≥120	MLC + AH
EXPLOR2015159	BS	1	0	8/7/15 16:02	71.3118	-163.3037	100	NO	LO	≥120	MLC + AH

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GUARD201547	US	1	0	8/7/15 19:51	70.9066	-163.3649	100	CD	LO	≥120	MLC + AH
NORD2015196	RS	1	0	8/7/15 0:37	71.2345	-162.8723	393	LO	LO	≥120	MLC + AH
TORVIK2015234	US	1	0	8/7/15 0:40	71.2079	-163.0414	100	LO	LO	≥120	MLC + AH
AIVIQ2015243	BS	1	0	8/5/15 7:55	71.2773	-163.4838	150	NO	SW	≥120	MLC + AH
AIVIQ2015244	BS	1	0	8/5/15 13:23	71.2932	-163.3148	50	LO	LO	≥120	MLC + AH
AIVIQ2015245	BS	1	0	8/5/15 14:18	71.3068	-163.3207	950	NO	DI	≥120	MLC + AH
AIVIQ2015246	BS	1	0	8/5/15 14:33	71.3112	-163.3377	150	LO	DI	≥120	MLC + AH
AIVIQ2015247	BS	1	0	8/5/15 14:36	71.3121	-163.3413	518	NO	DI	≥120	MLC + AH
AIVIQ2015248	BS	1	0	8/5/15 15:51	71.2948	-163.4433	950	NO	LO	≥120	MLC + AH
AIVIQ2015249	BS	1	0	8/5/15 17:21	71.2714	-163.5621	587	NO	DI	≥120	MLC + AH
AIVIQ2015250	BS	1	0	8/6/15 0:00	71.2038	-163.7585	200	LO	LO	≥120	MLC + AH
AIVIQ2015251	BS	1	0	8/6/15 0:44	71.2109	-163.7074	200	NO	DI	≥120	MLC + AH
NANUQ2015125	UP	1	0	8/8/15 22:15	71.1780	-163.4880	125	LO	SI	≥120	MLC + AH
CHAMP201549	GW	1	0	8/8/15 15:38	71.1740	-163.4617	982	NO	BL	≥120	MLC + AH
WIND201580	UW	1	0	8/8/15 11:53	71.1746	-163.0817	1700	NO	BL	≥120	MLC + AH
GUARD201548	BS	1	1	8/8/15 11:20	70.8319	-163.9042	50	NO	LG	≥120	MLC + AH
GUARD201549	US	1	0	8/8/15 14:21	71.0166	-163.3155	100	NO	LO	≥120	MLC + AH
POLAR2015142	UMW	1	0	8/8/15 15:50	71.1733	-163.4718	1000	NO	BL	≥120	MLC + AH
POLAR2015144	US	1	0	8/8/15 18:03	71.1733	-163.4718	90	LO	LO	≥120	MLC + AH
ROSS201583	UP	1	0	8/6/15 5:56	71.1753	-163.0657	100	LO	LO	≥120	MLC + AH
CHAMP201550	GW	2	1	8/9/15 7:20	71.1680	-163.3004	1600	NO	BL	≥120	MLC + AH
CHAMP201551	UP	1	0	8/9/15 15:39	71.1694	-163.2949	320	NO	LO	≥120	MLC + AH
CHAMP201552	US	1	0	8/9/15 22:55	71.1743	-163.3379	80	LO	LO	≥120	MLC + AH
NANUQ2015126	US	1	0	8/9/15 1:22	71.1737	-163.6326	200	NO	LO	≥120	MLC + AH
NANUQ2015127	UP	1	0	8/9/15 7:28	71.1543	-163.6878	50	LO	DI	≥120	MLC + AH
NANUQ2015128	UP	1	0	8/9/15 8:29	71.1791	-163.5455	100	LO	LO	≥120	MLC + AH
NANUQ2015129	UW	1	0	8/9/15 11:11	71.2150	-163.3755	800	NO	ST	≥120	MLC + AH
NANUQ2015131	US	1	0	8/9/15 11:36	71.2028	-163.4010	800	NO	SA	≥120	MLC + AH
MARIKA201576	RS	1	0	8/9/15 12:44	71.0588	-163.2742	20	NO	FB	≥120	MLC + AH

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
EXPLOR2015160	US	1	0	8/9/15 5:42	71.1632	-163.3075	80	NO	RE	≥120	MLC + AH
EXPLOR2015161	GW	2	1	8/9/15 7:47	71.1632	-163.3075	1500	NO	FL	≥120	MLC + AH
EXPLOR2015162	BS	1	0	8/9/15 19:21	71.1607	-163.3176	100	NO	DI	≥120	MLC + AH
EXPLOR2015163	BS	1	0	8/9/15 22:21	71.2001	-163.2703	100	NO	DI	≥120	MLC + AH
GUARD201550	US	1	0	8/9/15 6:06	71.1725	-162.7744	175	LO	LO	≥120	MLC + AH
POLAR2015145	US	1	0	8/9/15 13:18	71.1733	-163.4718	60	NO	DI	≥120	MLC + AH
POLAR2015146	SS	1	0	8/9/15 14:38	71.1733	-163.4718	45	LO	LO	≥120	MLC + AH
SISUAQ201552	UW	1	0	8/9/15 7:48	71.1656	-163.3157	200	NO	ST	≥120	MLC + AH
NORD2015198	BS	1	0	8/9/15 9:08	71.2226	-162.8963	150	NO	LO	≥120	MLC + AH
NORD2015199	US	1	0	8/9/15 10:11	71.2199	-162.8901	450	NO	LO	≥120	MLC + AH
DISCOV201547	US	1	0	8/9/15 0:05	71.1758	-163.0743	50	NO	DI	≥120	MLC + AH
WAVE201584	BS	1	1	8/9/15 6:17	71.1034	-163.3703	50	NO	LG	≥120	MLC + AH
NORD2015200	RS	2	1	8/10/15 10:59	71.2288	-162.9282	50	CD	LO	≥120	MLC
NORD2015201	PWA	2	0	8/10/15 12:47	71.2422	-162.9243	516	NO	BL	≥120	MLC
NORD2015202	US	1	0	8/10/15 13:48	71.2428	-162.9181	450	NO	DI	≥120	MLC
NORD2015203	RS	1	0	8/10/15 15:22	71.2416	-162.9031	40	LO	LO	≥120	MLC
NORD2015204	US	1	0	8/10/15 19:40	71.2166	-162.8593	300	NO	DI	≥120	MLC
CHAMP201553	BS	1	0	8/10/15 14:16	71.1588	-163.3228	300	LO	DI	≥120	MLC
CHAMP201554	US	1	0	8/10/15 16:18	71.1438	-163.3415	200	NO	SI	≥120	MLC
CHAMP201555	US	2	0	8/10/15 18:22	71.1437	-163.5005	700	NO	DI	≥120	MLC
CHAMP201556	BS	1	0	8/10/15 18:25	71.1355	-163.5109	400	NO	DI	≥120	MLC
FENN201589	DP	1	0	8/10/15 8:19	68.9597	-166.3850	250	NO	SW	<120	MLC
FENN201590	HW	1	0	8/10/15 12:49	69.6978	-165.5258	3273	NO	LT	<120	MLC
NANUQ2015136	US	1	0	8/10/15 5:57	71.0420	-163.2814	600	NO	TR	≥120	MLC
NANUQ2015137	US	1	0	8/10/15 13:14	71.0704	-163.2443	800	NO	SA	≥120	MLC
NANUQ2015138	UP	2	0	8/10/15 13:43	71.0908	-163.3153	1000	NO	TR	≥120	MLC
NANUQ2015139	BS	1	0	8/10/15 13:52	71.0966	-163.3354	10	LO	LO	≥120	MLC
NANUQ2015140	US	2	0	8/10/15 14:12	71.1081	-163.3788	800	NO	ST	≥120	MLC
NANUQ2015141	BS	1	0	8/10/15 14:18	71.1114	-163.3916	100	NO	TR	≥120	MLC

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NANUQ2015142	BS	1	0	8/10/15 14:28	71.1175	-163.4142	500	NO	SA	≥120	MLC
NANUQ2015143	BS	1	0	8/10/15 15:26	71.1506	-163.5472	200	NO	ST	≥120	MLC
NANUQ2015144	US	2	0	8/10/15 15:49	71.1631	-163.5917	150	LO	SA	≥120	MLC
NANUQ2015145	BS	1	0	8/10/15 16:49	71.1969	-163.7252	150	NO	SA	≥120	MLC
NANUQ2015146	UP	1	0	8/10/15 17:58	71.2034	-163.7079	800	LO	LO	≥120	MLC
NANUQ2015147	US	1	0	8/10/15 19:03	71.1736	-163.6007	300	NO	SW	≥120	MLC
NANUQ2015148	PWA	1	0	8/10/15 21:06	71.1280	-163.4168	75	CD	SA	≥120	MLC
WIND201581	US	1	0	8/10/15 13:14	71.1443	-163.3496	150	NO	LO	≥120	MLC
WIND201582	PWA	1	0	8/10/15 13:28	71.1444	-163.3495	200	NO	DI	≥120	MLC
WIND201583	PWA	1	0	8/10/15 13:35	71.1445	-163.3495	200	NO	DI	≥120	MLC
WIND201584	SS	1	0	8/10/15 13:57	71.1444	-163.3495	80	NO	SW	≥120	MLC
WIND201585	US	1	0	8/10/15 14:08	71.1444	-163.3495	175	NO	LO	≥120	MLC
WIND201586	SS	1	0	8/10/15 14:14	71.1445	-163.3494	75	NO	LO	≥120	MLC
WIND201587	US	1	0	8/10/15 16:36	71.1444	-163.3494	100	NO	LO	≥120	MLC
EXPLOR2015164	US	1	0	8/10/15 7:39	71.1936	-163.3797	200	NO	FB	≥120	MLC
EXPLOR2015165	UP	1	0	8/10/15 14:16	71.1596	-163.3259	75	NO	SW	≥120	MLC
EXPLOR2015166	US	1	0	8/10/15 14:50	71.1596	-163.3260	800	NO	DI	≥120	MLC
EXPLOR2015167	US	1	0	8/10/15 15:44	71.1596	-163.3262	733	NO	DI	≥120	MLC
MARIKA201577	RS	2	0	8/10/15 1:59	71.0550	-163.2724	4	NO	SW	≥120	MLC
MARIKA201578	BS	1	0	8/10/15 6:39	71.0558	-163.2715	9	LO	LO	≥120	MLC
MARIKA201579	UP	1	0	8/10/15 14:10	71.0575	-163.2723	300	LO	ST	≥120	MLC
MARIKA201580	RS	1	0	8/10/15 15:47	71.0574	-163.2719	50	NO	TR	≥120	MLC
MARIKA201581	RS	1	0	8/10/15 16:33	71.0570	-163.2713	30	NO	FB	≥120	MLC
POLAR2015147	RS	1	0	8/10/15 11:32	71.1733	-163.4718	70	NO	FB	≥120	MLC
POLAR2015148	US	1	0	8/10/15 12:09	71.1733	-163.4718	4000	NO	SW	≥120	MLC
POLAR2015149	RS	1	0	8/10/15 12:16	71.1733	-163.4718	200	NO	FB	≥120	MLC
POLAR2015150	PWA	1	0	8/10/15 12:48	71.1733	-163.4718	350	LO	LO	≥120	MLC
POLAR2015151	RS	1	0	8/10/15 13:16	71.1733	-163.4718	150	LO	LO	≥120	MLC
POLAR2015152	BS	1	1	8/10/15 16:55	71.1733	-163.4718	150	LO	LO	≥120	MLC

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
SISUAQ201553	PWA	1	0	8/10/15 13:35	71.1596	-163.3230	600	NO	SW	≥120	MLC
GUARD201551	PWA	2	0	8/10/15 13:43	71.0978	-163.3296	221	LO	SW	≥120	MLC
GUARD201552	US	1	0	8/10/15 14:21	71.1205	-163.4133	150	NO	LO	≥120	MLC
GUARD201553	UP	1	0	8/10/15 14:57	71.1414	-163.4948	250	NO	LO	≥120	MLC
GUARD201554	US	1	0	8/10/15 15:05	71.1452	-163.5119	200	NO	SI	≥120	MLC
GUARD201555	BS	1	0	8/10/15 15:52	71.1717	-163.6153	150	NO	LO	≥120	MLC
GUARD201556	UP	1	0	8/10/15 16:02	71.1769	-163.6345	325	NO	LO	≥120	MLC
GUARD201557	US	1	0	8/10/15 16:28	71.1909	-163.6903	350	NO	LO	≥120	MLC
GUARD201558	BS	1	0	8/10/15 16:42	71.1986	-163.7213	225	NO	LO	≥120	MLC
GUARD201559	BS	1	0	8/10/15 17:03	71.2118	-163.7690	150	NO	LO	≥120	MLC
GUARD201560	BS	1	0	8/10/15 17:28	71.2379	-163.8166	175	NO	SW	≥120	MLC
GUARD201561	SS	1	0	8/10/15 17:43	71.2549	-163.8412	125	NO	LO	≥120	MLC
DISCOV201548	BS	1	0	8/10/15 8:20	71.1758	-163.0739	50	NO	LO	≥120	MLC
DISCOV201549	UMW	2	0	8/10/15 11:51	71.1760	-163.0739	1114	NO	TR	≥120	MLC
DISCOV201550	UP	1	0	8/10/15 12:06	71.1759	-163.0740	1007	NO	MI	≥120	MLC
DISCOV201551	US	1	0	8/10/15 14:06	71.1760	-163.0741	1114	NO	LO	≥120	MLC
WAVE201585	SS	1	0	8/10/15 7:29	71.1142	-163.1833	50	NO	FB	≥120	MLC
WAVE201586	SS	1	0	8/10/15 13:40	71.1142	-163.1829	100	NO	FB	≥120	MLC
WAVE201587	SS	1	0	8/10/15 14:24	71.1142	-163.1830	75	NO	FB	≥120	MLC
SPIRIT20157	PWA	1	0	8/10/15 13:39	71.1473	-163.3214	406	NO	TR	≥120	MLC
SPIRIT20158	US	1	0	8/10/15 13:47	71.1480	-163.3221	50	NO	SW	≥120	MLC
SPIRIT20159	BS	1	0	8/10/15 14:42	71.1531	-163.3234	260	NO	SA	≥120	MLC
TORVIK2015235	SS	1	0	8/10/15 14:49	71.0727	-163.4117	40	LO	LO	≥120	MLC
TORVIK2015236	US	1	0	8/10/15 15:08	71.0766	-163.4164	1057	NO	LO	≥120	MLC
TORVIK2015237	UP	1	0	8/10/15 15:08	71.0767	-163.4164	1481	NO	SA	≥120	MLC
TORVIK2015238	US	1	0	8/10/15 16:32	71.0808	-163.3912	275	LO	LO	≥120	MLC
TORVIK2015239	PWA	1	0	8/10/15 16:38	71.0808	-163.3871	200	NO	SA	≥120	MLC
AIVIQ2015257	US	1	0	8/10/15 11:33	71.3008	-163.2080	350	NO	SW	≥120	MLC
AIVIQ2015258	US	1	0	8/10/15 12:09	71.3005	-163.2095	50	NO	SW	≥120	MLC

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
AIVIQ2015259	US	1	0	8/10/15 13:42	71.3001	-163.2280	225	LO	FB	≥120	MLC
AIVIQ2015260	BS	1	0	8/10/15 14:14	71.3004	-163.2273	100	LO	LO	≥120	MLC
AIVIQ2015261	BS	1	0	8/10/15 14:18	71.3007	-163.2271	50	LO	LO	≥120	MLC
AIVIQ2015262	BS	1	1	8/10/15 14:56	71.3010	-163.2266	100	NO	DI	≥120	MLC
AIVIQ2015263	BS	1	1	8/10/15 16:29	71.3001	-163.2274	100	LO	LO	≥120	MLC
AIVIQ2015264	BS	1	0	8/10/15 17:16	71.2988	-163.2285	250	NO	DI	≥120	MLC
AIVIQ2015265	PWA	2	0	8/10/15 17:58	71.2995	-163.2259	175	NO	SW	≥120	MLC
AIVIQ2015269	BS	1	0	8/10/15 22:09	71.3050	-163.2224	10	LO	LO	≥120	MLC
AIVIQ2015270	BS	1	0	8/10/15 23:46	71.3068	-163.2236	300	NO	DI	≥120	MLC
AIVIQ2015253	US	1	0	8/8/15 20:26	71.1702	-163.0570	225	NO	FB	≥120	MLC + AH
AIVIQ2015254	US	1	0	8/8/15 21:51	71.1707	-163.0559	325	NO	FB	≥120	MLC + AH
AIVIQ2015252	RS	1	0	8/7/15 14:45	71.1833	-163.0836	50	NO	FB	≥120	MLC + AH
DISCOV201553	UP	1	0	8/11/15 0:43	71.1756	-163.0718	169	LO	LO	≥120	MLC
DISCOV201554	UW	1	0	8/11/15 20:34	71.1758	-163.0717	6000	NO	BL	≥120	MLC
NANUQ2015149	PWA	1	0	8/11/15 10:06	71.1577	-163.5839	30	LO	SW	≥120	MLC
FENN201591	GW	2	0	8/11/15 7:55	70.7226	-162.7827	400	NO	DI	<120	MLC
FENN201592	US	1	0	8/11/15 9:59	70.9075	-161.7255	80	NO	SW	<120	MLC
FENN201593	GW	8	1	8/11/15 12:56	70.9494	-160.6897	469	NO	ST	<120	MLC
CHAMP201557	GW	2	0	8/11/15 8:00	69.6473	-165.9833	2684	NO	BL	<120	MLC
CHAMP201558	HW	1	0	8/11/15 8:16	69.6075	-166.0495	60	NO	BL	<120	MLC
CHAMP201559	GW	1	0	8/11/15 9:48	69.3887	-166.3967	2500	NO	BL	<120	MLC
EXPLOR2015168	RS	1	0	8/11/15 5:41	71.1567	-163.3313	50	NO	DI	≥120	MLC
GUARD201562	PWA	1	0	8/11/15 4:04	70.9144	-163.0229	100	NO	DE	≥120	MLC
GUARD201563	US	1	0	8/11/15 5:39	70.9359	-163.0024	150	IS	FS	≥120	MLC
GUARD201565	PWA	1	0	8/11/15 8:36	71.0533	-163.5709	50	LO	LO	≥120	MLC
GUARD201566	BS	1	1	8/11/15 10:07	71.0926	-163.9162	25	LO	TH	≥120	MLC
POLAR2015153	BS	1	0	8/11/15 7:09	71.1733	-163.4718	15	LO	LO	≥120	MLC
POLAR2015154	US	1	0	8/11/15 9:39	71.1733	-163.4718	10	LO	LO	≥120	MLC
POLAR2015155	BS	1	0	8/11/15 10:14	71.1733	-163.4718	20	NO	SW	≥120	MLC

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
AIVIQ2015272	BS	1	0	8/11/15 8:34	71.3128	-163.2311	10	LO	LO	≥120	MLC
AIVIQ2015273	US	1	0	8/11/15 13:53	71.3076	-163.2299	200	NO	FB	≥120	MLC
AIVIQ2015274	BS	1	0	8/11/15 14:30	71.3078	-163.2273	100	NO	DI	≥120	MLC
AIVIQ2015275	US	1	0	8/11/15 14:44	71.3078	-163.2274	75	LO	FB	≥120	MLC
AIVIQ2015276	RS	1	0	8/11/15 16:49	71.3071	-163.2476	75	NO	DI	≥120	MLC
AIVIQ2015277	US	1	0	8/11/15 19:19	71.3062	-163.2410	100	NO	FB	≥120	MLC
MARIKA201582	RS	2	0	8/11/15 6:26	71.0566	-163.2724	10	LO	LO	≥120	MLC
WAVE201588	BS	1	0	8/11/15 10:23	71.1141	-163.1829	45	NO	SW	≥120	MLC
WAVE201589	RS	1	0	8/11/15 11:19	71.1140	-163.1832	50	NO	FB	≥120	MLC
WAVE201590	RS	1	0	8/11/15 12:36	71.1141	-163.1833	100	NO	LO	≥120	MLC
WAVE201591	BS	1	0	8/11/15 13:52	71.1142	-163.1829	100	NO	SW	≥120	MLC
WAVE201592	RS	1	0	8/11/15 14:19	71.1141	-163.1831	50	LO	LO	≥120	MLC
WAVE201593	GW	1	0	8/11/15 18:17	71.1140	-163.1833	302	NO	TR	≥120	MLC
WAVE201594	BS	1	0	8/11/15 19:31	71.1141	-163.1830	30	NO	SW	≥120	MLC
MINER201568	SS	2	0	8/11/15 0:33	70.7113	-163.2345	2	NO	SW	<120	MLC
MINER201569	UP	1	0	8/11/15 3:36	70.7123	-163.2309	3	NO	BL	<120	MLC
MINER201570	US	1	0	8/11/15 6:45	70.7124	-163.2280	30	NO	FB	<120	MLC
MINER201571	SS	1	0	8/11/15 7:26	70.7126	-163.2298	150	LO	SW	<120	MLC
ROSS201584	UW	1	0	8/9/15 19:06	69.7916	-166.3004	500	NO	TR	<120	MLC + AH
ROSS201586	HW	3	0	8/9/15 21:29	69.4467	-167.0045	250	NO	FL	<120	MLC + AH
ROSS201587	UW	2	0	8/9/15 22:54	69.2640	-167.4425	2262	NO	BL	<120	MLC + AH
ROSS201588	HW	2	0	8/9/15 23:29	69.1812	-167.6365	800	NO	BL	<120	MLC + AH
NANUQ2015150	SS	1	0	8/12/15 20:05	71.1794	-163.0854	20	NO	FB	≥120	DR
FENN201594	GW	1	0	8/12/15 6:53	70.6772	-160.5316	1200	NO	BL	<120	DR
FENN201595	PWA	1	1	8/12/15 11:00	70.6772	-160.5311	50	LO	ST	≥120	DR
FENN201597	UMW	2	0	8/12/15 13:11	70.6773	-160.5316	5031	NO	BL	<120	DR
AIVIQ2015278	US	1	0	8/12/15 11:27	71.2751	-163.4677	100	NO	SI	≥120	DR
AIVIQ2015279	BS	1	0	8/12/15 18:08	71.2525	-163.2022	30	IS	SW	≥120	DR
AIVIQ2015280	BS	1	0	8/12/15 18:44	71.2555	-163.2733	250	NO	DI	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
AIVIQ2015281	PWA	1	0	8/12/15 18:46	71.2557	-163.2778	15	CD	LO	≥120	DR
GUARD201567	US	1	0	8/12/15 7:46	71.0638	-161.0354	50	NO	LO	<120	DR
GUARD201568	US	1	0	8/12/15 15:45	71.0958	-162.7755	75	NO	SW	<120	DR
GUARD201569	US	1	0	8/12/15 16:02	71.0962	-162.8386	125	NO	LO	≥120	DR
DISCOV201555	RS	1	0	8/12/15 21:22	71.1758	-163.0717	70	NO	SW	≥120	DR
POLAR2015157	US	1	0	8/12/15 11:44	71.1733	-163.4718	150	NO	FB	≥120	DR
POLAR2015158	US	1	0	8/12/15 12:20	71.1733	-163.4718	150	NO	FB	≥120	DR
POLAR2015159	SS	1	0	8/12/15 20:43	71.1733	-163.4718	15	LO	FB	≥120	DR
POLAR2015161	SS	1	0	8/12/15 22:45	71.1733	-163.4718	40	LO	LO	≥120	DR
SUPPORT2015121	UP	1	0	8/12/15 23:28	68.7635	-167.2399	260	NO	SA	<120	DR
NORD2015205	GW	2	1	8/12/15 4:42	70.6527	-160.6375	250	NO	FL	≥120	DR
NORD2015206	PWA	1	0	8/12/15 10:50	70.6956	-160.5350	1	LO	LO	<120	DR
NORD2015207	HW	1	0	8/12/15 13:16	70.7030	-160.5385	1000	NO	SA	<120	DR
NORD2015208	UMW	2	0	8/12/15 13:55	70.7032	-160.5383	5015	NO	BL	<120	DR
NORD2015209	GW	1	0	8/12/15 20:54	70.7829	-160.8881	500	NO	SW	<120	DR
NORD2015210	US	1	0	8/12/15 22:13	70.8410	-161.1899	30	NO	SW	<120	DR
NORD2015211	US	1	0	8/12/15 22:24	70.8491	-161.2318	200	LO	LO	<120	DR
NORD2015212	US	1	0	8/12/15 22:40	70.8602	-161.2898	20	NO	SI	<120	DR
SPIRIT201510	BS	1	0	8/12/15 9:11	71.1757	-163.0730	40	NO	LO	≥120	DR
MARIKA201583	US	1	0	8/12/15 9:51	71.0573	-163.2912	35	LO	LO	≥120	DR
TORVIK2015240	BS	1	0	8/12/15 12:00	71.1406	-163.2761	100	LO	LO	≥120	DR
MINER201572	US	1	0	8/12/15 15:28	70.7117	-163.2418	100	NO	DI	<120	DR
MINER201573	UP	1	0	8/12/15 15:45	70.7120	-163.2412	5	NO	DI	<120	DR
EXPLOR2015169	PWA	2	0	8/12/15 8:35	71.2804	-163.7472	25	LO	MI	≥120	DR
NANUQ2015151	US	1	0	8/13/15 9:22	71.1446	-163.3571	250	NO	SA	≥120	DR
NANUQ2015152	PWA	1	0	8/13/15 15:25	71.0904	-163.5003	300	NO	DI	≥120	DR
NANUQ2015153	SS	1	0	8/13/15 21:31	71.1961	-163.5184	20	LO	SA	≥120	DR
ROSS201599	RS	1	0	8/13/15 7:07	71.1476	-163.2616	50	CD	LO	≥120	DR
ROSS2015100	UW	1	0	8/13/15 8:21	71.1476	-163.2616	1500	NO	BL	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
ROSS2015101	US	1	0	8/13/15 11:08	71.1640	-163.2964	50	LO	LO	≥120	DR
ROSS2015102	US	1	0	8/13/15 11:20	71.1621	-163.2998	692	NO	ST	≥120	DR
ROSS2015103	SS	1	0	8/13/15 11:48	71.1670	-163.3167	50	LO	LO	≥120	DR
ROSS2015104	BS	1	0	8/13/15 19:28	71.1664	-163.3325	100	LO	SI	≥120	DR
FENN201598	US	1	0	8/13/15 14:55	71.2287	-160.5394	100	SP	TH	<120	DR
FENN201599	GW	7	0	8/13/15 15:25	71.2224	-160.8257	150	NO	FE	<120	DR
FENN2015100	GW	1	0	8/13/15 16:06	71.2175	-161.1138	892	NO	BL	<120	DR
FENN2015101	GW	1	0	8/13/15 16:24	71.2180	-161.2316	755	NO	DI	<120	DR
FENN2015102	GW	12	0	8/13/15 17:07	71.2246	-161.5129	469	NO	FE	<120	DR
FENN2015103	US	1	0	8/13/15 18:40	71.3164	-161.5454	150	LO	DI	≥120	DR
FENN2015104	GW	1	0	8/13/15 23:02	71.2996	-161.5266	655	NO	FE	<120	DR
FENN2015105	GW	2	0	8/13/15 23:12	71.2758	-161.5222	1954	NO	BL	<120	DR
FENN2015106	GW	1	0	8/13/15 23:24	71.2505	-161.5188	755	NO	FE	<120	DR
POLAR2015162	SS	1	0	8/13/15 2:17	71.1733	-163.4718	40	NO	FB	≥120	DR
POLAR2015165	US	1	0	8/13/15 22:25	71.1733	-163.4718	10	LO	LO	≥120	DR
EXPLOR2015170	US	1	0	8/13/15 13:11	71.2598	-163.3484	10	SP	DI	≥120	DR
AIVIQ2015283	BS	1	0	8/13/15 9:12	71.3307	-163.2614	150	IS	TH	≥120	DR
AIVIQ2015284	BS	1	0	8/13/15 10:33	71.2884	-163.2956	400	NO	DI	≥120	DR
DISCOV201556	US	1	0	8/13/15 15:57	71.1759	-163.0743	45	NO	TH	≥120	DR
NORD2015213	SS	1	0	8/13/15 8:22	71.2162	-162.8543	100	LO	LO	≥120	DR
NORD2015214	BS	1	0	8/13/15 12:47	71.2076	-162.8508	300	LO	LO	≥120	DR
FENN2015107	US	1	0	8/14/15 14:04	71.3370	-164.6176	150	LO	LO	<120	DR
FENN2015108	US	1	0	8/14/15 21:06	71.3775	-166.5147	75	LO	LO	<120	DR
FENN2015109	US	1	0	8/14/15 22:47	71.0953	-166.9399	100	LO	LO	<120	DR
FENN2015110	US	1	0	8/14/15 23:57	70.9798	-167.1020	394	LO	LO	<120	DR
NORD2015215	BS	1	0	8/14/15 8:21	71.2016	-162.8639	467	LO	LO	≥120	DR
NORD2015216	US	1	0	8/14/15 10:53	71.1994	-162.8730	20	LO	LO	≥120	DR
POLAR2015166	RS	1	0	8/14/15 3:05	71.1733	-163.4718	20	NO	RE	≥120	DR
POLAR2015167	SS	1	0	8/14/15 6:32	71.1733	-163.4718	15	LO	LO	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
POLAR2015168	US	1	0	8/14/15 14:48	71.1733	-163.4718	100	LO	LO	≥120	DR
POLAR2015169	US	1	0	8/14/15 15:05	71.1733	-163.4718	50	LO	RE	≥120	DR
POLAR2015171	RS	1	0	8/14/15 17:56	71.1733	-163.4718	8	LO	LO	≥120	DR
POLAR2015170	PWA	1	0	8/14/15 19:25	71.1733	-163.4718	30	LO	LO	≥120	DR
POLAR2015173	RS	1	0	8/14/15 23:37	71.1733	-163.4718	15	LO	LO	≥120	DR
EXPLOR2015171	US	1	0	8/14/15 6:56	71.2225	-163.3550	100	NO	SW	≥120	DR
EXPLOR2015172	PWA	1	0	8/14/15 12:43	71.1601	-163.1033	10	NO	DE	≥120	DR
EXPLOR2015173	US	1	1	8/14/15 20:28	71.2090	-163.1599	75	NO	PO	≥120	DR
DISCOV201557	PWA	3	0	8/14/15 19:55	71.1759	-163.0736	150	NO	ST	≥120	DR
AIVIQ2015285	BS	1	0	8/14/15 11:15	71.1663	-163.2527	100	LO	DI	≥120	DR
AIVIQ2015286	BS	1	0	8/14/15 11:30	71.1558	-163.2270	100	NO	DI	≥120	DR
AIVIQ2015287	US	1	0	8/14/15 13:53	71.1111	-163.1130	50	NO	DI	≥120	DR
AIVIQ2015288	UP	1	0	8/14/15 19:13	71.1836	-163.1360	30	NO	DE	≥120	DR
GUARD201572	BS	1	0	8/14/15 21:39	71.0952	-163.7215	200	LO	LO	≥120	DR
TORVIK2015241	US	1	0	8/13/15 22:18	71.1639	-163.3133	531	NO	SI	≥120	DR
SUPPORT2015122	RS	1	0	8/14/15 12:42	71.1724	-163.4723	10	NO	RE	≥120	DR
SUPPORT2015123	UP	1	0	8/14/15 13:57	71.1725	-163.4723	500	NO	DI	≥120	DR
SUPPORT2015124	UP	1	0	8/14/15 22:39	71.1824	-163.1367	200	LO	LO	≥120	DR
WAVE201595	PWA	2	0	8/14/15 14:38	71.1091	-163.1314	819	NO	TR	≥120	DR
WAVE201596	PWA	4	0	8/14/15 20:42	71.1630	-163.0011	300	CD	SW	≥120	DR
WIND201589	BS	1	0	8/14/15 8:51	71.1057	-163.5569	70	LO	LO	≥120	DR
WIND201590	PWA	1	0	8/14/15 19:53	71.1598	-163.4007	50	NO	LO	≥120	DR
SPIRIT201511	PWA	1	0	8/14/15 12:16	71.1621	-163.2983	200	LO	LO	≥120	DR
SISUAQ201554	PWA	1	0	8/14/15 19:51	71.1614	-163.4032	80	NO	SW	≥120	DR
NANUQ2015154	SS	1	0	8/14/15 0:47	71.1951	-163.3035	50	LO	LO	≥120	DR
TORVIK2015243	PWA	1	0	8/14/15 16:32	71.1584	-163.2950	500	NO	DI	≥120	DR
TORVIK2015244	PWA	1	0	8/14/15 17:56	71.1581	-163.2803	362	NO	DI	≥120	DR
POLAR2015175	BS	1	0	8/15/15 9:46	71.1733	-163.4718	45	LO	LO	≥120	DR
POLAR2015176	RS	1	0	8/15/15 10:34	71.1733	-163.4718	30	LO	FB	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NANUQ2015156	US	1	0	8/15/15 6:48	71.0969	-163.2021	100	NO	ST	≥120	DR
NANUQ2015157	BS	1	1	8/15/15 14:30	71.1850	-163.3732	150	NO	SA	≥120	DR
NANUQ2015158	SS	1	0	8/15/15 15:48	71.0788	-163.3757	50	LO	SI	≥120	DR
NANUQ2015159	BS	1	0	8/15/15 16:12	71.0639	-163.3853	75	LO	LO	≥120	DR
TORVIK2015246	US	1	0	8/15/15 5:11	71.1827	-163.5471	30	SP	TH	≥120	DR
ROSS2015106	US	1	0	8/15/15 5:12	71.3104	-163.2194	100	LO	LO	≥120	DR
ROSS2015107	UMW	1	0	8/15/15 9:14	71.3129	-163.2318	1500	NO	DI	≥120	DR
ROSS2015108	PWA	1	0	8/15/15 9:19	71.3129	-163.2318	500	LO	LO	≥120	DR
SUPPORT2015125	UP	1	0	8/15/15 7:59	71.1804	-163.1126	150	NO	DI	≥120	DR
SUPPORT2015126	RS	1	0	8/15/15 10:57	71.1804	-163.1127	150	LO	LO	≥120	DR
NORD2015217	PWA	2	0	8/15/15 7:50	71.0592	-163.2144	576	NO	BL	≥120	DR
AIVIQ2015290	PWA	1	0	8/15/15 15:11	71.3012	-163.3259	75	LO	LO	≥120	DR
GUARD201573	BS	1	0	8/15/15 17:33	71.1690	-163.3752	308	LO	LO	≥120	DR
WAVE201597	PWA	1	0	8/15/15 9:38	71.0842	-163.0605	573	NO	TR	≥120	DR
WAVE201598	BS	1	0	8/15/15 10:42	71.0866	-163.0706	200	LO	SW	≥120	DR
WIND201592	BS	1	0	8/15/15 11:56	71.1390	-163.3504	75	LO	SW	≥120	DR
WIND201593	UP	1	0	8/15/15 18:16	71.1014	-163.4587	150	IS	DI	≥120	DR
MARIKA201584	BS	1	0	8/15/15 6:18	71.0564	-163.2761	300	LO	LO	≥120	DR
MARIKA201585	PWA	1	0	8/15/15 7:42	71.0564	-163.2759	300	LO	TR	≥120	DR
MARIKA201586	BS	1	0	8/15/15 10:22	71.0556	-163.2785	30	LO	LO	≥120	DR
MARIKA201587	US	1	0	8/15/15 13:09	71.0553	-163.2840	439	LO	LO	≥120	DR
MINER201574	BS	1	1	8/15/15 16:48	70.7092	-163.2374	80	LO	LO	<120	DR
TORVIK2015247	SS	1	0	8/16/15 0:15	71.0502	-163.3379	50	NO	FB	≥120	DR
FENN2015111	PWA	2	0	8/16/15 11:04	71.2644	-163.0930	400	NO	SW	≥120	DR
POLAR2015178	PWA	1	0	8/16/15 8:48	71.1733	-163.4718	40	LO	LO	≥120	DR
SUPPORT2015127	BS	1	0	8/16/15 8:21	71.1697	-163.0991	40	LO	LO	≥120	DR
SUPPORT2015128	BS	1	0	8/16/15 11:25	71.1697	-163.0995	100	NO	DI	≥120	DR
WIND201594	US	1	0	8/16/15 11:51	71.1266	-163.1370	190	NO	SW	≥120	DR
GUARD201574	US	1	0	8/16/15 14:15	71.2610	-163.9529	200	NO	SW	<120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
EXPLOR2015174	PWA	3	0	8/16/15 7:05	71.2136	-163.4097	75	NO	TR	≥120	DR
EXPLOR2015175	RS	1	0	8/16/15 8:58	71.1999	-163.6322	25	LO	LO	≥120	DR
MINER201575	US	1	0	8/16/15 0:28	70.7297	-163.4171	120	LO	LO	<120	DR
MINER201576	US	1	0	8/16/15 11:41	70.6103	-163.9599	50	NO	LO	<120	DR
ROSS2015109	SS	1	0	8/16/15 0:05	71.3050	-163.3220	55	NO	LO	≥120	DR
FENN2015112	BS	1	0	8/17/15 6:59	71.1752	-163.3199	100	LO	SW	≥120	DR
NANUQ2015161	BS	1	0	8/17/15 7:32	71.1883	-163.8975	50	LO	SA	<120	DR
NANUQ2015162	SS	1	0	8/17/15 22:05	71.1941	-163.6556	50	LO	DI	≥120	DR
POLAR2015180	RS	1	0	8/17/15 4:16	71.1733	-163.4718	20	NO	DI	≥120	DR
GUARD201575	BS	1	0	8/17/15 10:55	71.2841	-164.6076	221	LO	LO	<120	DR
WIND201595	UP	1	0	8/17/15 14:25	71.0914	-163.4474	170	NO	DI	≥120	DR
TORVIK2015248	PWA	1	0	8/18/15 6:42	71.0916	-162.6983	2	LO	LO	≥120	DR
TORVIK2015249	US	1	0	8/18/15 8:07	71.0926	-162.9101	30	NO	DI	≥120	DR
TORVIK2015250	PWA	1	0	8/18/15 19:37	71.0667	-163.3463	299	LO	LO	≥120	DR
NANUQ2015163	BS	1	0	8/18/15 6:48	71.1889	-163.1917	20	NO	ST	≥120	DR
POLAR2015181	RS	1	0	8/18/15 0:24	71.1733	-163.4718	25	LO	LO	≥120	DR
WIND201597	PWA	1	0	8/18/15 6:06	71.0844	-163.3518	100	NO	SW	≥120	DR
WIND201598	BS	1	0	8/18/15 18:24	71.1076	-163.2401	125	LO	SW	≥120	DR
TORVIK2015251	PWA	1	0	8/19/15 5:18	71.0664	-163.3454	100	NO	TR	≥120	DR
TORVIK2015252	PWA	1	0	8/19/15 22:38	71.0667	-163.3458	328	LO	LO	≥120	DR
NANUQ2015166	PWA	1	0	8/19/15 4:26	71.0600	-163.4749	90	LO	TR	≥120	DR
NANUQ2015167	US	1	0	8/19/15 8:33	71.0527	-163.3047	50	NO	SA	≥120	DR
FENN2015113	PWA	1	0	8/19/15 19:42	71.0680	-165.0923	200	LO	TR	<120	DR
WIND201599	UP	1	0	8/19/15 7:33	71.1006	-163.0362	358	NO	TR	≥120	DR
GUARD201576	US	1	0	8/19/15 19:15	71.2429	-163.3784	175	LO	LO	≥120	DR
POLAR2015183	RS	1	0	8/19/15 8:35	71.1733	-163.4718	3	LO	LO	≥120	DR
POLAR2015184	US	1	0	8/19/15 15:54	71.1733	-163.4718	60	NO	SW	≥120	DR
POLAR2015185	BS	1	0	8/19/15 17:45	71.1733	-163.4718	125	LO	LO	≥120	DR
POLAR2015186	BS	1	0	8/19/15 19:21	71.1733	-163.4718	40	LO	LO	≥120	DR

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POLAR2015188	BS	1	0	8/19/15 22:03	71.1733	-163.4718	25	LO	LO	≥120	DR
POLAR2015189	BS	1	0	8/19/15 22:17	71.1733	-163.4718	35	LO	LO	≥120	DR
POLAR2015190	BS	1	0	8/19/15 22:49	71.1733	-163.4718	30	LO	LO	≥120	DR
NORD2015218	UMW	1	0	8/19/15 15:43	71.1175	-163.2628	500	NO	BL	≥120	DR
SISUAQ201555	PWA	3	0	8/19/15 10:43	71.1586	-163.2631	100	NO	LO	≥120	DR
SUPPORT2015129	UW	1	0	8/19/15 9:13	70.7383	-163.9667	20	NO	DE	<120	DR
SUPPORT2015130	UMW	1	0	8/19/15 9:33	70.6932	-164.0189	2000	NO	BL	<120	DR
EXPLOR2015177	RS	1	0	8/19/15 10:39	71.2893	-163.3567	100	LO	LO	≥120	DR
EXPLOR2015178	US	1	0	8/19/15 17:15	71.1830	-163.8501	50	NO	SW	≥120	DR
MINER201577	US	1	0	8/19/15 18:27	70.7016	-163.2393	70	NO	SW	<120	DR
MINER201578	US	1	0	8/19/15 19:46	70.7016	-163.2391	100	NO	DI	<120	DR
DISCOV201558	UP	1	0	8/19/15 12:21	71.1762	-163.0713	318	NO	DE	≥120	DR
TORVIK2015253	US	1	0	8/20/15 9:21	71.0667	-163.3457	100	NO	TR	≥120	DR
TORVIK2015254	BS	1	1	8/20/15 20:42	71.0667	-163.3457	100	NO	LO	≥120	DR
POLAR2015191	BS	1	0	8/20/15 5:26	71.1733	-163.4718	30	LO	LO	≥120	DR
FENN2015114	US	1	0	8/20/15 13:29	70.8038	-162.3224	300	LO	LO	<120	DR
FENN2015117	PWA	2	0	8/20/15 15:13	70.8833	-162.0588	450	NO	TR	<120	DR
FENN2015118	UP	1	0	8/20/15 15:39	70.9085	-162.0057	600	SP	TH	<120	DR
FENN2015119	UP	1	0	8/20/15 16:48	70.9682	-161.8622	300	NO	DI	<120	DR
FENN2015120	PWA	1	0	8/20/15 19:10	70.8683	-162.0595	300	NO	DI	<120	DR
AIVIQ2015292	PWA	2	0	8/20/15 17:07	71.1754	-163.0740	200	LO	LO	≥120	DR
AIVIQ2015293	UW	1	0	8/20/15 23:15	71.0906	-163.1425	750	NO	SW	≥120	DR
NANUQ2015168	PWA	2	0	8/20/15 17:08	71.1713	-163.0857	750	LO	LO	≥120	DR
NANUQ2015169	PWA	2	0	8/20/15 20:52	71.1937	-163.1436	1000	NO	TR	≥120	DR
NANUQ2015170	SS	1	0	8/20/15 22:05	71.2477	-163.2175	150	LO	LO	≥120	DR
GUARD201577	SS	1	0	8/20/15 12:48	71.3389	-163.2864	356	LO	LO	<120	DR
DISCOV201559	PWA	2	1	8/20/15 17:01	71.1759	-163.0714	200	CD	LO	≥120	DR
TORVIK2015255	UMW	1	0	8/21/15 12:20	71.0667	-163.3453	3771	NO	BL	≥120	DR
NANUQ2015171	PWA	1	1	8/21/15 6:00	71.2236	-163.4418	30	NO	ST	≥120	DR

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NANUQ2015172	UW	1	0	8/21/15 6:27	71.2207	-163.3750	550	NO	TR	≥120	DR
NANUQ2015173	BS	1	0	8/21/15 7:00	71.2180	-163.2905	100	NO	ST	≥120	DR
NANUQ2015174	UP	1	0	8/21/15 7:59	71.2149	-163.1466	400	NO	SA	≥120	DR
FENN2015121	US	1	0	8/21/15 9:17	70.9032	-164.7322	150	SP	DI	<120	DR
FENN2015122	US	1	0	8/21/15 9:31	70.9089	-164.7770	250	LO	LO	<120	DR
FENN2015123	US	1	0	8/21/15 16:29	70.7521	-163.7938	100	LO	SW	<120	DR
FENN2015124	BS	1	1	8/21/15 16:39	70.7508	-163.7648	75	LO	SW	<120	DR
FENN2015125	US	1	0	8/21/15 18:45	70.7420	-163.3689	50	SP	PO	<120	DR
FENN2015126	PWA	3	0	8/21/15 19:15	70.7411	-163.2694	400	LO	TR	<120	DR
FENN2015127	BS	1	0	8/21/15 21:27	70.7364	-163.1957	200	LO	LO	<120	DR
GUARD201578	PWA	2	0	8/21/15 14:55	71.1682	-163.8732	200	LO	SI	<120	DR
GUARD201579	BS	1	0	8/21/15 21:25	71.2603	-163.7208	200	LO	LO	<120	DR
DISCOV201561	MW	1	0	8/21/15 10:02	71.1759	-163.0713	10	NO	TR	≥120	DR
DISCOV201560	PWA	2	0	8/21/15 10:11	71.1759	-163.0713	1500	NO	TR	≥120	DR
DISCOV201562	PWA	1	1	8/21/15 12:07	71.1759	-163.0713	10	DS	LO	≥120	DR
TORVIK2015256	US	1	0	8/22/15 15:24	71.0665	-163.3451	200	NO	LO	≥120	DR
CHAMP2015119	GW	1	0	8/22/15 16:49	68.4305	-167.6634	400	NO	DI	<120	DR
FENN2015128	US	1	0	8/22/15 7:28	71.1753	-163.3144	400	NO	LO	≥120	DR
FENN2015129	US	1	0	8/22/15 9:18	71.1759	-163.3110	75	NO	PO	≥120	DR
FENN2015130	PWA	1	1	8/22/15 10:06	71.1758	-163.3109	10	LO	TR	≥120	DR
FENN2015131	GW	2	0	8/22/15 10:59	71.1757	-163.3109	1397	NO	FL	≥120	DR
FENN2015132	US	1	0	8/22/15 22:32	71.1925	-163.5871	300	NO	DI	≥120	DR
POLAR2015192	BS	1	0	8/22/15 7:58	71.1733	-163.4718	50	LO	LO	≥120	DR
POLAR2015193	BS	1	0	8/22/15 18:32	71.1733	-163.4718	10	LO	LO	≥120	DR
POLAR2015195	BS	1	0	8/22/15 21:56	71.1733	-163.4718	45	LO	LO	≥120	DR
AIVIQ2015294	UMW	1	0	8/22/15 22:51	71.1110	-163.3674	450	NO	BL	≥120	DR
MINER201579	BS	1	1	8/21/15 16:05	70.6998	-163.2322	10	NO	DI	<120	DR
GUARD201580	PWA	2	0	8/22/15 2:26	71.1564	-163.9236	110	IS	PO	≥120	DR
GUARD201581	UW	3	1	8/22/15 11:35	71.1397	-163.3055	923	CD	BL	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NORD2015219	PWA	3	1	8/22/15 6:17	71.1824	-163.4842	50	LO	ST	≥120	DR
NORD2015220	BS	1	0	8/22/15 18:40	71.1826	-163.4836	250	NO	SI	≥120	DR
NORD2015221	BS	1	0	8/22/15 21:18	71.1827	-163.4836	50	LO	LO	≥120	DR
DISCOV201564	PWA	2	0	8/22/15 19:45	71.1762	-163.0715	300	NO	ST	≥120	DR
MINER201581	US	1	0	8/22/15 10:38	70.6995	-163.2303	50	IS	DI	<120	DR
MINER201582	BS	1	0	8/22/15 14:27	70.6995	-163.2304	60	LO	SW	<120	DR
MINER201583	BS	1	0	8/22/15 15:40	70.6997	-163.2313	50	NO	SW	<120	DR
MINER201584	SS	1	0	8/22/15 16:53	70.6998	-163.2317	30	IS	LO	<120	DR
MINER201585	BS	1	0	8/22/15 17:55	70.7001	-163.2319	110	NO	SW	<120	DR
MINER201586	BS	2	1	8/22/15 18:45	70.6996	-163.2312	40	NO	LO	<120	DR
SUPPORT2015138	UP	1	0	8/22/15 19:26	70.5688	-164.4485	400	NO	DI	<120	DR
SUPPORT2015139	US	1	0	8/22/15 19:36	70.5953	-164.4052	100	IS	DI	<120	DR
NANUQ2015175	PWA	1	0	8/22/15 20:09	71.0856	-163.5966	50	LO	ST	≥120	DR
NANUQ2015176	PWA	2	0	8/22/15 20:22	71.0883	-163.6249	412	NO	ST	≥120	DR
NANUQ2015177	PWA	3	0	8/22/15 20:45	71.0930	-163.6706	50	LO	ST	≥120	DR
NANUQ2015178	PWA	2	0	8/22/15 23:41	71.1420	-163.5173	300	NO	ST	≥120	DR
WIND2015100	UW	1	0	8/22/15 11:29	71.1428	-163.3716	850	NO	BL	≥120	DR
WIND2015101	US	1	0	8/22/15 13:05	71.1479	-163.2602	70	SP	LO	≥120	DR
GUARD201582	PWA	2	0	8/23/15 7:38	71.1781	-163.8715	100	NO	SW	≥120	DR
GUARD201583	US	1	0	8/23/15 8:03	71.1958	-163.8017	50	NO	LO	≥120	DR
GUARD201584	US	1	0	8/23/15 10:38	71.3191	-163.3729	150	NO	SW	<120	DR
GUARD201585	US	1	0	8/23/15 11:09	71.3337	-163.3433	100	NO	DI	<120	DR
GUARD201586	RS	1	0	8/23/15 12:00	71.2654	-163.5814	100	NO	SW	≥120	DR
GUARD201587	PWA	4	0	8/23/15 12:27	71.2433	-163.6599	75	LO	SW	≥120	DR
GUARD201588	US	1	0	8/23/15 14:13	71.1512	-163.9649	300	NO	LO	≥120	DR
GUARD201590	US	1	0	8/23/15 16:52	71.1727	-163.9059	80	NO	SI	≥120	DR
GUARD201591	BS	1	0	8/23/15 18:02	71.2319	-163.7015	200	NO	SI	≥120	DR
GUARD201592	PWA	2	0	8/23/15 18:18	71.2452	-163.6521	150	LO	LO	≥120	DR
GUARD201593	BS	1	0	8/23/15 19:14	71.2885	-163.4773	50	LO	LO	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
GUARD201594	BS	1	0	8/23/15 19:27	71.2989	-163.4355	75	NO	LO	≥120	DR
GUARD201595	US	1	0	8/23/15 19:33	71.3031	-163.4183	400	NO	LO	≥120	DR
GUARD201596	US	1	0	8/23/15 19:44	71.3120	-163.3874	800	NO	LO	≥120	DR
GUARD201597	BS	3	0	8/23/15 19:52	71.3194	-163.3656	275	NO	LO	≥120	DR
GUARD201598	UP	2	0	8/23/15 20:05	71.3124	-163.4059	700	NO	SW	≥120	DR
GUARD201599	BS	1	0	8/23/15 20:27	71.2933	-163.4670	25	NO	LO	≥120	DR
GUARD2015100	US	1	0	8/23/15 20:33	71.2881	-163.4846	75	NO	SW	≥120	DR
GUARD2015101	PWA	1	0	8/23/15 21:12	71.2545	-163.5997	100	LO	LO	≥120	DR
GUARD2015102	BS	1	1	8/23/15 22:10	71.2035	-163.7698	5	LO	SW	≥120	DR
GUARD2015103	PWA	1	0	8/23/15 22:24	71.1909	-163.8128	272	LO	SW	≥120	DR
GUARD2015104	PWA	1	0	8/23/15 22:52	71.1668	-163.8973	356	NO	SW	≥120	DR
TORVIK2015257	PWA	2	1	8/23/15 11:25	71.0666	-163.3457	100	LO	DI	≥120	DR
TORVIK2015258	US	1	0	8/23/15 17:20	71.0672	-163.3373	100	NO	DI	≥120	DR
TORVIK2015259	UP	1	0	8/23/15 19:47	71.0669	-163.3402	531	NO	TR	≥120	DR
CHAMP2015120	PWA	2	0	8/23/15 19:13	71.1587	-163.2997	700	NO	LO	≥120	DR
CHAMP2015121	PWA	1	0	8/23/15 20:02	71.1631	-163.3105	300	NO	DI	≥120	DR
CHAMP2015122	US	1	0	8/23/15 23:15	71.1646	-163.3138	30	NO	LG	≥120	DR
AIVIQ2015295	PWA	1	0	8/23/15 8:36	71.1654	-163.4753	350	CD	LO	≥120	DR
AIVIQ2015296	PWA	1	0	8/23/15 11:32	71.1671	-163.4008	300	NO	SW	≥120	DR
AIVIQ2015297	BS	1	0	8/23/15 21:34	71.1718	-163.4698	75	LO	LO	≥120	DR
NANUQ2015179	PWA	4	1	8/23/15 7:00	71.1730	-163.4350	800	CD	TR	≥120	DR
NANUQ2015180	PWA	3	0	8/23/15 7:23	71.1730	-163.4351	50	NO	TR	≥120	DR
NANUQ2015181	PWA	4	0	8/23/15 7:48	71.1730	-163.4351	200	NO	TR	≥120	DR
NANUQ2015182	PWA	3	0	8/23/15 7:53	71.1730	-163.4350	200	NO	TR	≥120	DR
NANUQ2015183	UW	1	0	8/23/15 7:54	71.1730	-163.4350	1450	NO	TR	≥120	DR
NANUQ2015184	PWA	1	0	8/23/15 9:11	71.1730	-163.4351	75	LO	LO	≥120	DR
NANUQ2015185	PWA	2	0	8/23/15 12:22	71.1730	-163.4351	175	LO	TR	≥120	DR
NANUQ2015186	UP	1	0	8/23/15 15:37	71.1730	-163.4352	100	NO	SA	≥120	DR
NANUQ2015187	PWA	3	0	8/23/15 16:51	71.1658	-163.4683	835	NO	ST	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NANUQ2015188	UP	1	0	8/23/15 22:03	71.1659	-163.4681	350	NO	SW	≥120	DR
SUPPORT2015140	PWA	4	0	8/23/15 6:42	71.1630	-163.4369	300	LO	DI	≥120	DR
SUPPORT2015141	PWA	4	0	8/23/15 7:37	71.1631	-163.4371	150	NO	TR	≥120	DR
SUPPORT2015142	GW	1	0	8/23/15 7:55	71.1631	-163.4368	3000	NO	BL	≥120	DR
SUPPORT2015143	PWA	1	0	8/23/15 8:07	71.1631	-163.4370	1000	NO	TR	≥120	DR
SUPPORT2015144	PWA	1	0	8/23/15 9:08	71.1696	-163.4581	300	NO	TR	≥120	DR
SUPPORT2015145	BS	1	0	8/23/15 19:05	71.1647	-163.3138	350	NO	DI	≥120	DR
SUPPORT2015146	US	1	0	8/23/15 19:53	71.1164	-163.3926	400	NO	DI	≥120	DR
SUPPORT2015147	UP	1	0	8/23/15 20:03	71.0898	-163.4394	500	NO	DI	≥120	DR
POLAR2015196	PWA	2	0	8/23/15 7:06	71.1733	-163.4718	899	NO	SW	≥120	DR
POLAR2015198	BS	1	0	8/23/15 7:48	71.1733	-163.4718	50	NO	DI	≥120	DR
POLAR2015197	GW	1	0	8/23/15 7:49	71.1733	-163.4718	1000	NO	BL	≥120	DR
POLAR2015199	PWA	1	0	8/23/15 8:53	71.1733	-163.4718	5	LO	LO	≥120	DR
POLAR2015200	BS	1	0	8/23/15 9:25	71.1733	-163.4718	30	LO	LO	≥120	DR
POLAR2015201	PWA	3	1	8/23/15 16:41	71.1733	-163.4718	650	NO	DI	≥120	DR
POLAR2015202	US	1	0	8/23/15 21:34	71.1733	-163.4718	150	NO	DI	≥120	DR
POLAR2015203	PWA	1	0	8/23/15 22:33	71.1733	-163.4718	500	NO	SW	≥120	DR
POLAR2015204	BS	1	0	8/23/15 23:24	71.1733	-163.4718	148	LO	SW	≥120	DR
DISCOV201565	PWA	7	2	8/23/15 8:57	71.1762	-163.0715	250	LO	LO	≥120	DR
DISCOV201566	PWA	3	1	8/23/15 15:13	71.1762	-163.0715	417	LO	LO	≥120	DR
DISCOV201567	PWA	4	2	8/23/15 17:29	71.1762	-163.0716	1444	NO	ST	≥120	DR
DISCOV201568	BS	1	0	8/23/15 17:51	71.1762	-163.0716	1072	NO	LO	≥120	DR
DISCOV201570	PWA	1	0	8/23/15 21:12	71.1762	-163.0716	350	NO	DI	≥120	DR
MARIKA201588	PWA	2	1	8/23/15 10:59	71.0544	-163.2885	10	CD	TR	≥120	DR
MARIKA201589	US	1	0	8/23/15 13:58	71.0543	-163.2887	50	LO	DI	≥120	DR
MARIKA201590	RS	1	0	8/23/15 14:37	71.0539	-163.2873	25	NO	FB	≥120	DR
MARIKA201591	UP	2	0	8/23/15 18:55	71.0539	-163.2850	1547	NO	SW	≥120	DR
MARIKA201592	UP	1	0	8/23/15 19:03	71.0539	-163.2842	839	NO	TR	≥120	DR
MARIKA201593	PWA	3	0	8/23/15 19:19	71.0540	-163.2836	50	LO	TR	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
EXPLOR2015179	PWA	2	0	8/23/15 6:51	71.2000	-163.3096	326	LO	SI	≥120	DR
EXPLOR2015180	PWA	2	0	8/23/15 7:18	71.2000	-163.2701	50	LO	TR	≥120	DR
EXPLOR2015181	US	1	0	8/23/15 7:42	71.2005	-163.2307	250	LO	RE	≥120	DR
EXPLOR2015182	US	1	0	8/23/15 13:20	71.1520	-163.2611	326	LO	RE	≥120	DR
EXPLOR2015183	US	1	0	8/23/15 18:42	71.1971	-163.2013	387	LO	SW	≥120	DR
EXPLOR2015184	UP	1	0	8/23/15 18:51	71.1987	-163.1867	650	LO	SW	≥120	DR
EXPLOR2015185	UP	1	0	8/23/15 19:47	71.2120	-163.0953	1000	NO	RE	≥120	DR
ROSS2015152	US	1	1	8/23/15 8:05	70.6280	-164.4712	10	SP	SW	<120	DR
ROSS2015153	US	1	0	8/23/15 9:58	70.8243	-163.9652	993	NO	LO	<120	DR
ROSS2015154	UNK	1	0	8/23/15 10:48	70.9082	-163.7219	2396	NO	DI	<120	DR
ROSS2015158	PWA	2	0	8/23/15 11:40	71.0196	-163.5869	692	NO	LG	≥120	DR
ROSS2015159	PWA	1	0	8/23/15 12:22	71.0797	-163.4662	800	NO	SW	≥120	DR
ROSS2015160	UP	1	0	8/23/15 12:29	71.0937	-163.4432	692	NO	DI	≥120	DR
ROSS2015161	US	1	0	8/23/15 12:35	71.1072	-163.4226	50	NO	DI	≥120	DR
ROSS2015162	UP	1	0	8/23/15 13:25	71.1692	-163.3866	150	NO	DI	≥120	DR
ROSS2015163	SS	1	0	8/23/15 15:24	71.2450	-163.2624	150	LO	LO	≥120	DR
ROSS2015165	BS	1	0	8/23/15 16:46	71.3170	-163.2296	30	LO	LO	≥120	DR
ROSS2015164	US	1	0	8/23/15 17:05	71.2990	-163.2575	300	NO	TR	≥120	DR
ROSS2015166	US	1	0	8/23/15 17:07	71.2963	-163.2618	344	LO	LO	≥120	DR
ROSS2015167	UP	1	1	8/23/15 17:17	71.2857	-163.2836	867	NO	DI	≥120	DR
ROSS2015168	US	1	0	8/23/15 17:21	71.2812	-163.2936	867	NO	TR	≥120	DR
ROSS2015169	US	1	0	8/23/15 17:26	71.2762	-163.3055	628	NO	TR	≥120	DR
ROSS2015170	US	1	0	8/23/15 17:35	71.2670	-163.3287	493	NO	SW	≥120	DR
ROSS2015171	PWA	1	0	8/23/15 17:53	71.2483	-163.3796	1766	NO	SW	≥120	DR
ROSS2015172	PWA	1	0	8/23/15 18:55	71.2209	-163.4558	531	NO	SW	≥120	DR
ROSS2015173	US	1	0	8/23/15 19:08	71.2332	-163.4129	628	NO	FB	≥120	DR
ROSS2015174	BS	1	0	8/23/15 19:41	71.2652	-163.3167	328	NO	SW	≥120	DR
ROSS2015175	SS	1	0	8/23/15 19:47	71.2710	-163.3038	50	LO	SW	≥120	DR
ROSS2015176	US	1	0	8/23/15 20:07	71.2816	-163.2767	1500	NO	SW	≥120	DR

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ROSS2015177	PWA	3	0	8/23/15 20:23	71.3020	-163.2108	1500	NO	SW	≥120	DR
ROSS2015178	SS	1	0	8/23/15 20:39	71.3084	-163.2065	493	IS	SW	≥120	DR
ROSS2015179	US	1	0	8/23/15 21:25	71.3099	-163.2149	700	NO	SW	≥120	DR
ROSS2015180	PWA	2	1	8/23/15 21:34	71.3099	-163.2150	1200	NO	SW	≥120	DR
ROSS2015181	PWA	1	0	8/23/15 21:42	71.3099	-163.2149	250	LO	SW	≥120	DR
ROSS2015182	UP	1	0	8/23/15 22:42	71.3099	-163.2149	2396	NO	TR	≥120	DR
MINER201587	SS	1	0	8/23/15 10:18	70.6997	-163.2310	100	NO	FB	<120	DR
MINER201588	BS	1	0	8/23/15 13:55	70.6995	-163.2303	100	NO	LO	<120	DR
MINER201589	BS	1	0	8/23/15 15:55	70.6996	-163.2310	80	NO	LO	<120	DR
MINER201590	BS	1	0	8/23/15 16:22	70.6996	-163.2307	120	NO	SW	<120	DR
MINER201591	SS	1	0	8/23/15 17:13	70.7001	-163.2325	40	NO	FB	<120	DR
MINER201592	SS	1	0	8/23/15 17:31	70.7000	-163.2317	300	NO	DI	<120	DR
MINER201593	SS	1	0	8/23/15 17:39	70.7000	-163.2318	250	NO	DI	<120	DR
NORD2015222	PWA	2	0	8/23/15 7:02	71.1824	-163.4844	1084	NO	ST	≥120	DR
NORD2015223	UMW	1	0	8/23/15 7:13	71.1808	-163.4819	5015	NO	FL	≥120	DR
NORD2015224	GW	1	0	8/23/15 7:54	71.1785	-163.4775	815	NO	FL	≥120	DR
NORD2015225	PWA	2	0	8/23/15 7:59	71.1785	-163.4775	200	NO	SW	≥120	DR
NORD2015226	US	1	0	8/23/15 8:24	71.1785	-163.4775	600	NO	SW	≥120	DR
NORD2015227	PWA	2	0	8/23/15 12:22	71.1751	-163.4733	976	NO	BL	≥120	DR
NORD2015228	PWA	3	0	8/23/15 16:42	71.1740	-163.4733	393	CD	ST	≥120	DR
NORD2015229	UNK	1	0	8/23/15 20:20	71.1740	-163.4730	300	NO	DE	≥120	DR
WIND2015103	PWA	1	0	8/23/15 10:19	71.1529	-163.3281	1441	NO	SW	≥120	DR
WIND2015104	BS	1	0	8/23/15 11:16	71.1548	-163.3275	185	NO	SW	≥120	DR
WIND2015105	US	2	0	8/23/15 17:03	71.1104	-163.3863	358	NO	SW	≥120	DR
WIND2015106	US	1	0	8/23/15 18:26	71.1060	-163.3931	302	NO	SW	≥120	DR
WIND2015107	US	1	0	8/23/15 19:25	71.1005	-163.3958	819	NO	SW	≥120	DR
WIND2015108	PWA	1	0	8/23/15 20:08	71.0962	-163.3984	441	NO	SW	≥120	DR
WIND2015109	BS	1	0	8/23/15 21:24	71.1177	-163.3563	229	NO	SW	≥120	DR
WIND2015110	BS	1	0	8/23/15 21:51	71.1387	-163.3369	674	NO	SW	≥120	DR

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WAVE201599	BS	1	0	8/23/15 18:29	71.1191	-163.3406	498	NO	DI	≥120	DR
WAVE2015100	BS	1	0	8/23/15 19:44	71.1177	-163.3448	400	NO	FB	≥120	DR
WAVE2015101	BS	1	0	8/23/15 21:05	71.1137	-163.3407	100	LO	LO	≥120	DR
FENN2015133	US	1	0	8/23/15 12:03	70.7566	-164.5439	100	LO	LO	<120	DR
FENN2015135	US	1	0	8/23/15 13:56	70.7558	-164.1731	75	LO	LO	<120	DR
FENN2015136	US	1	0	8/23/15 14:10	70.7551	-164.1274	50	NO	DI	<120	DR
FENN2015137	PWA	1	0	8/23/15 15:51	70.7481	-163.7773	10	NO	DE	<120	DR
FENN2015138	GW	1	0	8/23/15 16:39	70.7478	-163.6821	1088	NO	DI	<120	DR
FENN2015139	BS	1	1	8/23/15 17:43	70.7472	-163.4763	100	LO	TH	≥120	DR
FENN2015140	US	1	0	8/23/15 19:05	70.7468	-163.2046	200	LO	LO	<120	DR
FENN2015141	US	1	0	8/23/15 21:01	70.7482	-162.7868	250	LO	LO	<120	DR
FENN2015142	PWA	2	0	8/23/15 21:57	70.7490	-162.5882	755	NO	TR	<120	DR
FENN2015143	GW	1	0	8/23/15 22:26	70.7493	-162.4866	1224	NO	BL	<120	DR
FENN2015144	US	1	0	8/23/15 22:45	70.7498	-162.4188	980	NO	DI	<120	DR
GUARD2015105	PWA	3	0	8/24/15 5:55	71.1955	-163.5395	150	LO	LO	≥120	DR
GUARD2015106	PWA	2	0	8/24/15 6:32	71.1485	-163.5477	300	NO	LO	≥120	DR
GUARD2015107	US	1	0	8/24/15 6:39	71.1399	-163.5468	200	LO	LO	≥120	DR
GUARD2015108	BS	1	0	8/24/15 6:54	71.1287	-163.4974	300	NO	SW	≥120	DR
GUARD2015109	US	1	0	8/24/15 7:15	71.1196	-163.4184	200	LO	LO	≥120	DR
GUARD2015110	US	1	0	8/24/15 7:20	71.1178	-163.3988	175	NO	SW	≥120	DR
GUARD2015111	BS	1	0	8/24/15 7:44	71.1098	-163.3028	90	NO	LO	≥120	DR
GUARD2015112	US	1	0	8/24/15 8:05	71.1301	-163.2799	150	LO	LO	≥120	DR
GUARD2015113	BS	1	0	8/24/15 11:39	71.1396	-163.2979	100	LO	SW	≥120	DR
NANUQ2015189	US	1	0	8/24/15 6:31	71.1673	-163.4658	400	NO	SA	≥120	DR
NANUQ2015190	SS	1	0	8/24/15 7:24	71.1669	-163.4715	150	LO	SA	≥120	DR
NANUQ2015191	PWA	2	0	8/24/15 7:31	71.1668	-163.4715	300	NO	ST	≥120	DR
NANUQ2015192	PWA	1	0	8/24/15 9:46	71.1668	-163.4714	30	CD	ST	≥120	DR
NANUQ2015193	UP	1	0	8/24/15 20:49	71.1359	-163.8206	100	NO	ST	≥120	DR
FENN2015145	US	1	0	8/24/15 5:44	70.7332	-162.7171	70	NO	SW	<120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
FENN2015146	US	1	0	8/24/15 5:48	70.7332	-162.6990	100	LO	LO	<120	DR
FENN2015147	US	1	0	8/24/15 6:25	70.7342	-162.5649	50	NO	DI	<120	DR
FENN2015148	US	1	0	8/24/15 6:36	70.7349	-162.5270	50	NO	SW	<120	DR
FENN2015149	US	1	0	8/24/15 7:03	70.7368	-162.4272	100	NO	DI	<120	DR
FENN2015150	US	1	0	8/24/15 7:10	70.7371	-162.4057	100	NO	DI	<120	DR
FENN2015151	SS	1	0	8/24/15 8:03	70.7387	-162.2339	40	LO	LO	<120	DR
FENN2015152	PWA	1	0	8/24/15 8:26	70.7388	-162.1599	300	LO	SI	<120	DR
FENN2015153	PWA	2	1	8/24/15 8:58	70.7392	-162.0587	150	NO	TR	<120	DR
FENN2015154	US	1	0	8/24/15 9:01	70.7379	-162.0495	50	NO	DI	<120	DR
FENN2015155	BS	1	0	8/24/15 9:16	70.7269	-162.0588	250	LO	LO	<120	DR
FENN2015156	US	1	0	8/24/15 9:36	70.7270	-162.1202	100	NO	DI	<120	DR
FENN2015157	US	1	0	8/24/15 10:04	70.7274	-162.2058	60	NO	SW	<120	DR
FENN2015158	US	1	0	8/24/15 10:35	70.7287	-162.3092	40	LO	LO	<120	DR
FENN2015159	US	1	0	8/24/15 14:42	70.7457	-163.1586	75	LO	LO	<120	DR
FENN2015160	BS	1	0	8/24/15 16:36	70.7555	-163.5619	250	LO	LO	<120	DR
ROSS2015183	PWA	2	1	8/24/15 6:08	71.3138	-163.2146	20	CD	TR	≥120	DR
ROSS2015184	PWA	1	0	8/24/15 6:38	71.3139	-163.2144	1401	NO	TR	≥120	DR
ROSS2015185	UP	1	0	8/24/15 7:20	71.3139	-163.2144	628	NO	LO	≥120	DR
ROSS2015186	BS	1	0	8/24/15 7:37	71.3139	-163.2144	100	LO	LO	≥120	DR
ROSS2015187	BS	1	0	8/24/15 12:05	71.3141	-163.2171	362	NO	TR	≥120	DR
ROSS2015188	US	1	0	8/24/15 19:49	70.5005	-164.7670	40	IS	DI	<120	DR
CHAMP2015123	BS	1	0	8/24/15 6:40	71.1645	-163.3132	40	NO	LO	≥120	DR
CHAMP2015124	US	1	0	8/24/15 9:08	71.1623	-163.3152	180	NO	DI	≥120	DR
CHAMP2015125	PWA	2	0	8/24/15 11:27	71.1662	-163.4480	100	CD	DI	≥120	DR
AIVIQ2015298	BS	1	0	8/24/15 9:45	71.1718	-163.4698	250	LO	LO	≥120	DR
AIVIQ2015299	PWA	1	0	8/24/15 9:48	71.1717	-163.4697	75	LO	LO	≥120	DR
POLAR2015205	UP	2	0	8/24/15 7:24	71.1733	-163.4718	1750	NO	SW	≥120	DR
POLAR2015206	US	1	0	8/24/15 9:51	71.1733	-163.4718	100	NO	SW	≥120	DR
DISCOV201571	UMW	1	0	8/24/15 0:23	71.1762	-163.0714	600	NO	DI	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
DISCOV201572	MW	1	0	8/24/15 8:14	71.1762	-163.0715	500	NO	TR	≥120	DR
EXPLOR2015186	UP	1	0	8/24/15 6:43	71.2437	-163.1641	1547	NO	RE	≥120	DR
EXPLOR2015187	SS	1	0	8/24/15 12:46	71.2295	-163.4758	175	NO	RE	≥120	DR
MINER201594	US	1	0	8/24/15 5:53	70.6995	-163.2298	50	NO	FB	<120	DR
MINER201595	SS	1	0	8/24/15 6:55	70.7018	-163.2334	60	NO	FB	<120	DR
MINER201596	BS	1	0	8/24/15 9:36	70.7025	-163.2337	250	NO	DI	<120	DR
SISUAQ201558	US	1	0	8/24/15 6:45	71.1652	-163.3146	150	NO	SW	≥120	DR
WAVE2015102	BS	1	0	8/24/15 6:58	71.1391	-163.2667	498	NO	SW	≥120	DR
WIND2015111	SS	1	0	8/24/15 5:53	71.1524	-163.2501	5	LO	DI	≥120	DR
WIND2015113	UP	1	0	8/24/15 8:45	71.1519	-163.2286	498	NO	DI	≥120	DR
WIND2015114	BS	1	0	8/24/15 8:54	71.1518	-163.2293	441	NO	RE	≥120	DR
WIND2015116	BS	1	0	8/24/15 19:20	71.1724	-163.7795	40	NO	SW	≥120	DR
NANUQ2015194	US	1	0	8/25/15 12:52	71.1148	-163.3673	200	LO	LO	≥120	RVA
FENN2015161	PWA	1	0	8/25/15 13:49	70.7400	-163.7615	100	NO	SW	<120	RVA
FENN2015163	PWA	1	0	8/25/15 20:55	70.7839	-163.6173	100	LO	LO	≥120	RVA
EXPLOR2015188	US	1	0	8/25/15 13:57	71.2454	-163.5510	75	NO	RE	≥120	RVA
WIND2015117	BS	1	0	8/25/15 13:38	71.0962	-162.8252	120	NO	SW	<120	RVA
GUARD2015114	PWA	1	0	8/26/15 22:27	71.1155	-164.3284	75	NO	SW	≥120	RVA
TORVIK2015260	US	1	0	8/26/15 8:24	70.9156	-162.8004	150	NO	DI	<120	RVA
AIVIQ2015301	PWA	1	0	8/26/15 6:54	70.8450	-163.2753	1	BR	WR	≥120	RVA
AIVIQ2015302	PWA	1	0	8/26/15 8:51	70.9032	-163.1983	0	BR	WR	≥120	RVA
AIVIQ2015303	PWA	1	0	8/26/15 12:40	70.9553	-163.3497	25	LO	LO	≥120	RVA
AIVIQ2015305	PWA	1	0	8/26/15 14:41	70.9545	-163.3922	0	BR	WR	≥120	RVA
AIVIQ2015306	PWA	1	0	8/26/15 16:33	70.9680	-163.5002	1	LO	LO	≥120	RVA
AIVIQ2015307	PWA	1	0	8/26/15 18:20	71.0014	-163.5418	2	BR	WR	≥120	RVA
AIVIQ2015308	PWA	1	0	8/26/15 19:32	71.0223	-163.5588	450	NO	SW	≥120	RVA
AIVIQ2015309	PWA	1	0	8/26/15 22:13	71.0444	-163.6975	60	BR	WR	≥120	RVA
FENN2015164	PWA	1	0	8/28/15 15:12	71.0268	-161.6105	70	LO	LO	<120	RVA
EXPLOR2015189	US	1	0	8/28/15 15:50	70.9796	-162.3356	60	LO	LO	<120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
AIVIQ2015310	PWA	1	0	8/28/15 8:33	69.5577	-166.0331	100	CD	LO	<120	RVA
MARIKA201594	UP	1	0	8/28/15 16:33	70.7440	-163.2210	175	NO	TR	<120	RVA
NANUQ2015195	PWA	1	0	8/28/15 21:07	71.2052	-164.5027	50	NO	SW	≥120	RVA
FENN2015165	UNK	1	0	8/29/15 12:04	71.1167	-163.1903	10	NO	DE	≥120	RVA
FENN2015166	KW	4	1	8/29/15 13:24	71.1380	-163.5301	1088	NO	MI	≥120	RVA
FENN2015167	UP	1	0	8/29/15 19:07	71.1395	-163.5271	100	NO	DI	≥120	RVA
WAVE2015103	KW	4	0	8/29/15 12:35	71.1332	-163.5173	400	NO	ST	≥120	RVA
TORVIK2015262	PWA	2	0	8/29/15 6:56	71.1655	-163.5349	10	LO	TR	≥120	RVA
TORVIK2015263	BS	1	0	8/29/15 9:28	71.1473	-163.4448	50	NO	DI	≥120	RVA
TORVIK2015264	PWA	1	0	8/29/15 16:40	71.1807	-163.5532	100	LO	BL	≥120	RVA
TORVIK2015265	PWA	1	0	8/29/15 20:00	71.1688	-163.5635	100	LO	WR	≥120	RVA
CHAMP2015126	PWA	2	0	8/29/15 8:15	71.1739	-163.4531	749	NO	DI	≥120	RVA
CHAMP2015127	SS	1	0	8/29/15 13:21	71.1713	-163.4641	150	NO	DI	≥120	RVA
CHAMP2015128	US	1	0	8/29/15 15:30	71.1713	-163.4641	30	NO	DI	≥120	RVA
POLAR2015207	PWA	2	0	8/29/15 8:11	71.1733	-163.4718	50	NO	BL	≥120	RVA
POLAR2015208	PWA	1	0	8/29/15 14:23	71.1733	-163.4718	200	NO	DI	≥120	RVA
DISCOV201574	BS	1	0	8/29/15 12:06	71.0339	-163.4887	100	NO	ST	≥120	RVA
DISCOV201575	BS	1	0	8/29/15 17:43	71.1443	-163.2215	215	NO	SA	≥120	RVA
NORD2015232	KW	6	1	8/29/15 12:05	71.1306	-163.3969	50	CD	ST	≥120	RVA
EXPLOR2015190	BS	1	0	8/29/15 13:55	71.1975	-164.3780	80	LO	SW	<120	RVA
EXPLOR2015191	US	1	0	8/29/15 15:08	71.2410	-164.4598	70	SP	SA	<120	RVA
EXPLOR2015193	RS	1	0	8/29/15 23:27	70.8883	-163.5584	50	NO	SW	<120	RVA
MARIKA201595	UP	1	0	8/29/15 15:37	71.0531	-163.2758	50	NO	SW	≥120	RVA
MINER201597	SS	1	0	8/29/15 18:38	70.6760	-163.2150	50	NO	TR	<120	RVA
MINER201598	SS	1	0	8/29/15 19:30	70.6759	-163.2149	70	NO	LO	<120	RVA
GUARD2015115	PWA	1	0	8/29/15 11:05	71.1754	-165.3247	50	LO	SW	<120	RVA
GUARD2015116	US	1	0	8/29/15 14:09	71.0474	-164.5620	100	NO	LO	≥120	RVA
SISUAQ201560	UNK	1	0	8/29/15 6:39	71.1549	-163.1681	80	NO	DE	≥120	RVA
GUARD2015117	US	1	0	8/30/15 23:11	71.1934	-163.2091	513	NO	SW	≥120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
CHAMP2015129	PWA	1	0	8/30/15 15:57	71.1711	-163.4734	20	LO	LO	≥120	RVA
NANUQ2015196	UP	1	0	8/30/15 15:20	71.0134	-163.1258	200	NO	SA	≥120	RVA
NANUQ2015197	BS	1	0	8/30/15 20:51	71.1557	-163.2818	40	NO	SW	≥120	RVA
POLAR2015209	PWA	1	0	8/30/15 16:24	71.1733	-163.4718	70	LO	BL	≥120	RVA
DISCOV201576	BS	1	0	8/30/15 14:48	71.1493	-163.1895	100	NO	SA	≥120	RVA
DISCOV201577	PWA	1	0	8/30/15 23:48	71.1492	-163.1866	20	LO	LO	≥120	RVA
NORD2015233	US	1	0	8/30/15 16:03	71.1746	-163.4720	75	LO	LO	≥120	RVA
NORD2015234	PWA	1	0	8/30/15 16:23	71.1746	-163.4720	50	LO	LO	≥120	RVA
NORD2015235	PWA	2	0	8/30/15 21:41	71.1744	-163.4720	500	NO	SW	≥120	RVA
FENN2015168	PWA	1	1	8/30/15 8:17	71.1785	-163.3707	20	LO	SW	≥120	RVA
FENN2015169	PWA	1	1	8/30/15 13:18	71.1786	-163.3702	5	LO	LO	≥120	RVA
FENN2015170	BS	1	0	8/30/15 20:21	71.1781	-163.3646	50	LO	SW	≥120	RVA
MARIKA201596	PWA	1	0	8/30/15 20:28	71.0524	-163.2802	70	LO	TR	≥120	RVA
MARIKA201597	US	1	0	8/30/15 20:49	71.0527	-163.2787	150	LO	LO	≥120	RVA
MARIKA201598	PWA	1	0	8/30/15 22:40	71.0525	-163.2790	50	LO	MI	≥120	RVA
MINER201599	US	1	0	8/30/15 18:51	70.6754	-163.2200	210	NO	LO	<120	RVA
WIND2015118	PWA	3	0	8/30/15 7:56	71.1059	-163.6048	229	LO	SW	≥120	RVA
TORVIK2015266	PWA	1	1	8/30/15 6:58	71.2020	-163.5002	25	LO	TR	≥120	RVA
TORVIK2015267	PWA	1	1	8/30/15 13:26	71.1757	-163.3750	100	LO	TR	≥120	RVA
GUARD2015118	PWA	1	0	8/31/15 7:25	71.1999	-163.1763	50	IS	SI	≥120	RVA
GUARD2015119	US	1	0	8/31/15 11:06	71.1206	-163.6205	356	NO	SW	≥120	RVA
GUARD2015120	BS	1	0	8/31/15 11:15	71.1144	-163.6497	100	NO	LO	≥120	RVA
GUARD2015121	US	1	0	8/31/15 12:15	71.0769	-163.7936	100	NO	LO	<120	RVA
GUARD2015122	BS	1	0	8/31/15 12:36	71.0820	-163.7060	185	NO	SW	≥120	RVA
GUARD2015123	US	3	0	8/31/15 14:13	71.1034	-163.3118	659	NO	SI	≥120	RVA
GUARD2015124	US	1	0	8/31/15 16:24	71.1375	-162.7807	356	NO	SW	<120	RVA
GUARD2015128	BS	1	0	8/31/15 21:42	71.1369	-163.9273	3	LO	LO	<120	RVA
FENN2015171	US	1	0	8/31/15 6:34	71.1336	-163.4484	150	NO	SW	≥120	RVA
FENN2015172	US	1	0	8/31/15 10:54	71.1517	-163.4975	300	NO	SW	≥120	RVA

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FENN2015173	UP	1	0	8/31/15 11:04	71.1723	-163.5010	428	LO	SW	≥120	RVA
FENN2015174	UP	1	0	8/31/15 11:24	71.1779	-163.4865	2444	NO	RE	≥120	RVA
FENN2015175	US	1	0	8/31/15 11:41	71.1797	-163.4786	892	NO	RE	≥120	RVA
FENN2015176	PWA	1	0	8/31/15 12:37	71.1817	-163.4591	579	LO	SW	≥120	RVA
FENN2015177	PWA	2	2	8/31/15 12:46	71.1792	-163.4423	150	LO	SW	≥120	RVA
FENN2015178	PWA	2	1	8/31/15 14:10	71.1904	-163.0583	655	NO	SW	≥120	RVA
FENN2015179	UP	1	0	8/31/15 14:11	71.1900	-163.0544	200	NO	BL	≥120	RVA
FENN2015180	BS	1	0	8/31/15 15:06	71.1881	-163.0419	150	LO	PO	≥120	RVA
FENN2015181	US	1	0	8/31/15 15:28	71.1880	-163.0417	900	NO	SW	≥120	RVA
FENN2015182	UP	1	0	8/31/15 15:31	71.1881	-163.0415	975	NO	SW	≥120	RVA
FENN2015183	BS	1	0	8/31/15 15:54	71.1865	-163.0401	800	NO	SW	≥120	RVA
FENN2015184	US	1	0	8/31/15 16:33	71.1865	-163.0400	75	LO	SW	≥120	RVA
FENN2015185	US	1	0	8/31/15 16:44	71.1864	-163.0406	400	NO	SW	≥120	RVA
FENN2015186	GW	1	0	8/31/15 17:25	71.1819	-163.0401	700	NO	TR	≥120	RVA
FENN2015187	PWA	1	0	8/31/15 19:16	71.1761	-163.0424	50	NO	DI	≥120	RVA
FENN2015188	US	1	0	8/31/15 21:44	71.1763	-163.0418	100	LO	LO	≥120	RVA
WAVE2015104	BS	1	0	8/31/15 8:41	71.2070	-163.2569	200	NO	TR	≥120	RVA
WAVE2015112	BS	1	0	8/31/15 12:56	71.1978	-163.2393	200	NO	ST	≥120	RVA
WAVE2015107	PWA	2	0	8/31/15 13:47	71.2152	-163.3964	819	LO	LO	≥120	RVA
WAVE2015108	BS	1	1	8/31/15 14:32	71.2149	-163.3824	200	LO	LO	≥120	RVA
WAVE2015109	BS	1	0	8/31/15 14:57	71.2157	-163.3753	90	NO	TR	≥120	RVA
WAVE2015110	BS	1	1	8/31/15 15:17	71.2166	-163.3709	1	LO	FB	≥120	RVA
WAVE2015111	BS	1	0	8/31/15 16:24	71.2204	-163.3609	300	NO	DI	≥120	RVA
WAVE2015113	PWA	2	0	8/31/15 19:52	71.2401	-163.3375	10	LO	TR	≥120	RVA
TORVIK2015268	PWA	1	0	8/31/15 8:11	71.1334	-163.4178	300	LO	TR	≥120	RVA
TORVIK2015269	UP	1	0	8/31/15 10:24	71.1477	-163.3755	531	NO	SA	≥120	RVA
TORVIK2015270	US	1	0	8/31/15 10:37	71.1731	-163.3011	531	NO	SA	≥120	RVA
TORVIK2015271	PWA	3	0	8/31/15 11:59	71.1742	-163.2892	250	LO	ST	≥120	RVA
TORVIK2015272	BS	1	0	8/31/15 15:06	71.1952	-163.2233	300	NO	SA	≥120	RVA

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TORVIK2015273	RS	1	1	8/31/15 15:29	71.1969	-163.2221	1	LO	ST	≥120	RVA
NANUQ2015198	PWA	3	0	8/31/15 12:11	71.1662	-163.2910	1000	NO	ST	≥120	RVA
NANUQ2015199	PWA	1	0	8/31/15 13:21	71.1682	-163.2839	300	NO	TR	≥120	RVA
NANUQ2015200	US	1	0	8/31/15 14:18	71.1692	-163.2828	280	NO	ST	≥120	RVA
NANUQ2015201	UP	1	0	8/31/15 14:30	71.1691	-163.2826	300	NO	TR	≥120	RVA
NANUQ2015202	UP	1	0	8/31/15 14:38	71.1691	-163.2827	700	NO	ST	≥120	RVA
NANUQ2015203	US	1	0	8/31/15 14:43	71.1668	-163.2831	250	NO	SA	≥120	RVA
NANUQ2015204	US	1	0	8/31/15 15:39	71.1698	-163.2873	500	NO	SA	≥120	RVA
NANUQ2015205	UP	1	0	8/31/15 17:04	71.0594	-163.2888	526	NO	ST	≥120	RVA
NANUQ2015206	PWA	1	1	8/31/15 19:21	71.0560	-163.2908	75	CD	SA	≥120	RVA
NANUQ2015207	PWA	1	0	8/31/15 20:15	71.0551	-163.2806	30	LO	ST	≥120	RVA
NANUQ2015208	PWA	1	0	8/31/15 22:05	71.0553	-163.2819	150	LO	ST	≥120	RVA
DISCOV201578	PWA	1	0	8/31/15 7:33	71.1496	-163.1851	300	LO	SA	≥120	RVA
DISCOV201579	PWA	1	0	8/31/15 12:39	71.1496	-163.1851	921	NO	ST	≥120	RVA
DISCOV201580	RS	1	1	8/31/15 14:15	71.1497	-163.1849	20	NO	SA	≥120	RVA
DISCOV201582	US	1	0	8/31/15 14:16	71.1497	-163.1850	606	NO	SA	≥120	RVA
DISCOV201581	BS	1	0	8/31/15 15:12	71.1497	-163.1859	20	NO	SA	≥120	RVA
CHAMP2015130	PWA	1	0	8/31/15 8:53	71.1501	-163.1839	350	NO	LO	≥120	RVA
CHAMP2015131	PWA	1	0	8/31/15 12:37	71.1501	-163.1841	833	NO	LO	≥120	RVA
CHAMP2015132	RS	1	1	8/31/15 14:00	71.1499	-163.1840	10	LO	LO	≥120	RVA
MARIKA2015100	PWA	1	0	8/31/15 13:21	71.0539	-163.2767	40	NO	TR	≥120	RVA
MARIKA2015101	PWA	1	0	8/31/15 14:43	71.0541	-163.2767	200	NO	TR	≥120	RVA
MARIKA2015102	PWA	1	0	8/31/15 15:30	71.0549	-163.2768	175	NO	TR	≥120	RVA
MARIKA2015103	PWA	1	0	8/31/15 19:13	71.0565	-163.2838	10	CD	MI	≥120	RVA
MARIKA2015104	PWA	1	0	8/31/15 20:12	71.0557	-163.2773	10	NO	MI	≥120	RVA
MARIKA2015105	US	1	0	8/31/15 22:38	71.0562	-163.2792	30	NO	DI	≥120	RVA
POLAR2015211	UP	1	0	8/31/15 2:29	71.1733	-163.4718	10	NO	SW	≥120	RVA
POLAR2015212	US	1	0	8/31/15 7:51	71.1733	-163.4718	750	NO	SW	≥120	RVA
POLAR2015213	PWA	1	0	8/31/15 8:44	71.1733	-163.4718	200	NO	BL	≥120	RVA

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POLAR2015214	PWA	1	0	8/31/15 10:56	71.1733	-163.4718	300	NO	DI	≥120	RVA
POLAR2015215	PWA	2	0	8/31/15 12:31	71.1733	-163.4718	500	LO	LO	≥120	RVA
POLAR2015216	UP	1	0	8/31/15 12:53	71.1733	-163.4718	3500	NO	DI	≥120	RVA
POLAR2015217	PWA	1	0	8/31/15 14:26	71.1733	-163.4718	1000	NO	DI	≥120	RVA
POLAR2015218	UP	1	0	8/31/15 15:15	71.1733	-163.4718	3200	NO	DI	≥120	RVA
POLAR2015219	US	1	0	8/31/15 15:19	71.1733	-163.4718	75	NO	DI	≥120	RVA
POLAR2015220	US	1	0	8/31/15 15:26	71.1733	-163.4718	2000	NO	DI	≥120	RVA
POLAR2015221	BS	1	0	8/31/15 18:59	71.1733	-163.4718	30	NO	RE	≥120	RVA
POLAR2015222	BS	1	0	8/31/15 20:05	71.1733	-163.4718	50	NO	RE	≥120	RVA
EXPLOR2015194	UP	1	0	8/31/15 12:12	71.1775	-163.2400	957	LO	RE	≥120	RVA
EXPLOR2015195	PWA	1	0	8/31/15 13:13	71.1701	-163.2873	698	LO	SA	≥120	RVA
SISUAQ201561	PWA	1	0	8/31/15 7:26	71.2002	-163.1742	150	NO	SW	≥120	RVA
SISUAQ201562	UP	1	0	8/31/15 8:48	71.1706	-163.2905	1284	NO	SW	≥120	RVA
SISUAQ201563	US	1	0	8/31/15 10:22	71.1706	-163.2906	692	NO	SW	≥120	RVA
SISUAQ201564	PWA	2	0	8/31/15 12:12	71.1706	-163.2904	250	NO	SW	≥120	RVA
SISUAQ201565	PWA	1	0	8/31/15 13:17	71.1702	-163.2875	500	NO	SW	≥120	RVA
SISUAQ201566	PWA	1	0	8/31/15 13:28	71.1700	-163.2887	200	NO	SW	≥120	RVA
SISUAQ201567	RS	1	0	8/31/15 14:20	71.1699	-163.2896	2	NO	SW	≥120	RVA
WIND2015122	BS	1	0	8/31/15 12:52	71.1337	-163.2933	441	NO	SW	≥120	RVA
WIND2015123	UP	1	0	8/31/15 14:18	71.1153	-163.3114	1043	NO	DI	≥120	RVA
WIND2015124	BS	1	0	8/31/15 15:24	71.1145	-163.3112	261	NO	SW	≥120	RVA
NORD2015236	PWA	1	0	8/31/15 8:50	71.1754	-163.4728	250	LO	LO	≥120	RVA
NORD2015237	PWA	1	0	8/31/15 9:26	71.1753	-163.4727	1946	NO	RE	≥120	RVA
NORD2015238	US	2	0	8/31/15 12:35	71.1774	-163.4760	888	NO	DI	≥120	RVA
NORD2015239	PWA	2	0	8/31/15 12:41	71.1775	-163.4763	467	NO	DI	≥120	RVA
NORD2015240	PWA	1	0	8/31/15 15:02	71.1769	-163.4753	976	NO	LO	≥120	RVA
MINER2015101	US	1	0	8/31/15 7:33	70.6771	-163.2146	90	NO	SI	<120	RVA
MINER2015102	BS	1	0	8/31/15 8:19	70.6776	-163.2144	50	NO	DI	<120	RVA
MINER2015103	BS	1	0	8/31/15 12:24	70.6776	-163.2145	574	LO	LO	<120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
MINER2015104	US	1	0	8/31/15 12:35	70.6774	-163.2140	1084	NO	FB	<120	RVA
MINER2015105	UP	1	0	8/31/15 14:07	70.6777	-163.2145	986	LO	LO	<120	RVA
MINER2015106	BS	1	0	8/31/15 14:23	70.6780	-163.2144	70	NO	LO	<120	RVA
MINER2015107	UW	1	0	8/31/15 19:20	70.6799	-163.2170	250	NO	PO	<120	RVA
MINER2015108	BS	1	1	8/31/15 20:06	70.6798	-163.2168	50	NO	DI	<120	RVA
GUARD2015129	US	1	0	9/1/15 7:03	71.1645	-163.7262	200	LO	LO	≥120	RVA
GUARD2015130	PWA	1	0	9/1/15 9:56	71.3017	-163.5532	100	NO	SW	<120	RVA
GUARD2015131	US	1	0	9/1/15 12:22	71.1693	-163.8427	400	NO	SW	<120	RVA
GUARD2015132	PWA	1	0	9/1/15 18:49	71.3070	-163.5235	90	NO	SI	≥120	RVA
GUARD2015133	PWA	2	0	9/1/15 19:04	71.3091	-163.4967	400	NO	BL	≥120	RVA
GUARD2015134	PWA	1	0	9/1/15 19:10	71.3031	-163.5099	175	NO	SW	≥120	RVA
GUARD2015135	SS	1	0	9/1/15 21:07	71.1855	-163.7403	50	IS	LO	≥120	RVA
GUARD2015136	UP	1	0	9/1/15 21:26	71.1656	-163.7773	900	NO	LO	≥120	RVA
GUARD2015137	PWA	1	0	9/1/15 21:38	71.1540	-163.7974	450	CD	LO	≥120	RVA
GUARD2015138	PWA	1	0	9/1/15 22:04	71.1271	-163.8457	513	NO	LO	≥120	RVA
GUARD2015139	BS	1	0	9/1/15 22:20	71.1104	-163.8751	200	NO	LO	<120	RVA
GUARD2015140	US	1	0	9/1/15 23:34	71.0335	-164.0094	400	NO	LO	<120	RVA
NORD2015241	PWA	1	0	9/1/15 4:39	71.1751	-163.4716	10	CD	LO	≥120	RVA
WAVE2015115	PWA	2	1	9/1/15 16:54	71.2437	-163.2604	50	LO	TR	≥120	RVA
WAVE2015116	BS	1	0	9/1/15 18:18	71.2448	-163.2179	250	NO	DI	≥120	RVA
CHAMP2015134	PWA	2	1	9/1/15 0:11	71.1943	-163.3928	10	LO	LO	≥120	RVA
CHAMP2015135	US	1	0	9/1/15 17:55	70.7081	-163.2237	300	NO	LG	<120	RVA
TORVIK2015277	PWA	1	0	9/1/15 19:59	71.2649	-163.3036	300	LO	ST	≥120	RVA
TORVIK2015278	PWA	6	0	9/1/15 20:29	71.2664	-163.2898	362	LO	ST	≥120	RVA
SISUAQ201569	BS	1	0	9/1/15 21:52	71.1600	-163.3085	300	NO	SW	≥120	RVA
FENN2015189	PWA	1	1	9/1/15 12:53	71.1760	-163.0473	350	LO	ST	≥120	RVA
FENN2015190	US	1	0	9/1/15 21:47	71.1755	-163.0660	1000	NO	DI	≥120	RVA
ROSS2015196	MW	1	0	9/1/15 14:32	69.6839	-166.4568	1000	NO	TR	<120	RVA
ROSS2015197	SS	1	0	9/1/15 18:19	70.2698	-165.2407	500	LO	LO	<120	RVA

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ROSS2015198	US	1	0	9/1/15 18:56	70.3671	-165.0402	700	NO	FB	≥120	RVA
ROSS2015199	HP	3	0	9/1/15 19:48	70.4990	-164.7424	700	NO	TR	<120	RVA
POLAR2015223	PWA	1	0	9/1/15 4:37	71.1733	-163.4718	10	LO	DI	≥120	RVA
SPIRIT201552	BS	1	0	9/1/15 8:33	71.1365	-163.3305	20	LO	LO	≥120	RVA
SPIRIT201553	BS	1	0	9/1/15 8:36	71.1359	-163.3373	30	LO	LO	≥120	RVA
SPIRIT201554	BS	1	0	9/1/15 12:19	71.1308	-163.3739	75	CD	DI	≥120	RVA
SPIRIT201555	UP	1	0	9/1/15 14:59	71.1466	-163.2088	100	LO	DI	≥120	RVA
SPIRIT201556	BS	1	0	9/1/15 18:42	71.1502	-163.2074	100	LO	SW	≥120	RVA
NANUQ2015209	PWA	1	0	9/1/15 12:09	71.0584	-163.2574	75	NO	SA	≥120	RVA
NANUQ2015212	PWA	1	0	9/1/15 19:58	71.0582	-163.2567	350	LO	LO	≥120	RVA
NANUQ2015213	US	1	0	9/1/15 20:07	71.0582	-163.2565	500	NO	ST	≥120	RVA
NANUQ2015217	RS	1	0	9/1/15 22:14	71.0596	-163.2706	10	LO	ST	≥120	RVA
NANUQ2015218	PWA	1	0	9/1/15 22:32	71.0596	-163.2694	340	NO	ST	≥120	RVA
MINER2015109	UP	1	0	9/1/15 7:39	70.6788	-163.2130	90	NO	LO	<120	RVA
WIND2015125	PWA	1	1	9/1/15 8:23	71.1005	-163.3000	2	LO	SW	≥120	RVA
EXPLOR2015199	UP	1	0	9/1/15 18:43	71.1899	-163.6458	310	LO	RE	≥120	RVA
EXPLOR2015200	US	1	0	9/1/15 19:40	71.1933	-163.6225	238	NO	RE	≥120	RVA
EXPLOR2015201	UP	1	0	9/1/15 19:48	71.1935	-163.6186	698	NO	RE	≥120	RVA
EXPLOR2015202	US	1	0	9/1/15 19:50	71.1936	-163.6175	410	LO	RE	≥120	RVA
EXPLOR2015203	SS	1	0	9/1/15 19:54	71.1938	-163.6152	40	LO	LO	≥120	RVA
EXPLOR2015204	PWA	2	0	9/1/15 20:26	71.1953	-163.5997	25	CD	TR	≥120	RVA
EXPLOR2015205	UMW	1	1	9/1/15 20:29	71.1954	-163.5983	698	NO	TR	≥120	RVA
EXPLOR2015206	UP	2	0	9/1/15 20:41	71.1963	-163.5914	600	NO	TR	≥120	RVA
EXPLOR2015207	US	1	0	9/1/15 21:14	71.1982	-163.5747	192	LO	LO	≥120	RVA
MARIKA2015106	PWA	1	1	9/1/15 20:22	71.0563	-163.2754	130	LO	TR	≥120	RVA
GUARD2015141	BS	1	0	9/2/15 7:29	71.2242	-163.6518	125	LO	LO	≥120	RVA
GUARD2015142	PWA	1	0	9/2/15 8:35	71.1596	-163.7253	90	NO	DI	≥120	RVA
GUARD2015143	PWA	2	0	9/2/15 14:01	70.9316	-164.2232	50	NO	SW	<120	RVA
GUARD2015144	BS	1	0	9/2/15 18:59	71.1465	-163.6270	100	LO	LO	≥120	RVA

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NANUQ2015219	US	1	0	9/2/15 13:07	70.9760	-164.1450	10	SP	SA	<120	RVA
ROSS2015200	PB	1	0	9/2/15 22:43	71.1764	-163.0716	300	LO	LO	≥120	RVA
POLAR2015224	UP	1	0	9/2/15 4:35	71.1733	-163.4718	30	NO	TR	≥120	RVA
EXPLOR2015208	US	1	0	9/2/15 7:23	71.1705	-163.4501	100	NO	RE	≥120	RVA
EXPLOR2015209	US	1	0	9/2/15 15:22	71.1670	-163.4483	35	LO	RE	≥120	RVA
EXPLOR2015210	US	1	0	9/2/15 18:06	71.1578	-163.5768	50	NO	SW	≥120	RVA
EXPLOR2015211	US	1	0	9/2/15 18:25	71.1579	-163.6132	435	NO	TR	≥120	RVA
WIND2015128	US	1	0	9/2/15 17:08	71.1054	-163.3929	500	NO	LO	≥120	RVA
WIND2015129	PWA	1	0	9/2/15 18:43	71.1028	-163.4135	50	LO	DI	≥120	RVA
FENN2015191	PB	1	0	9/2/15 22:38	71.1754	-163.0660	50	LO	LO	≥120	RVA
TORVIK2015279	US	1	0	9/3/15 11:55	71.1303	-163.3559	200	NO	ST	≥120	RVA
TORVIK2015280	PWA	1	0	9/3/15 18:24	71.1239	-162.7880	200	NO	TR	≥120	RVA
TORVIK2015281	US	1	0	9/3/15 21:23	71.1222	-163.3095	300	NO	ST	≥120	RVA
EXPLOR2015212	US	1	0	9/3/15 11:35	71.1814	-163.5185	80	NO	DI	≥120	RVA
EXPLOR2015213	BS	1	0	9/3/15 15:00	71.1643	-163.4679	90	NO	TR	≥120	RVA
EXPLOR2015214	SS	1	0	9/3/15 15:18	71.1688	-163.5020	60	LO	SW	≥120	RVA
EXPLOR2015215	US	1	0	9/3/15 18:54	71.1823	-163.4704	90	NO	SW	≥120	RVA
MARIKA2015107	KW	5	3	9/3/15 20:49	71.0544	-163.2947	30	NO	TR	≥120	RVA
NANUQ2015220	BS	1	0	9/3/15 15:14	71.2104	-163.9964	50	NO	SA	<120	RVA
POLAR2015226	UNK	1	0	9/3/15 19:42	71.1733	-163.4718	10	NO	SW	≥120	RVA
POLAR2015225	US	1	0	9/3/15 23:05	71.1733	-163.4718	10	NO	DI	≥120	RVA
NORD2015244	US	1	0	9/3/15 16:31	71.1762	-163.4888	25	NO	DI	≥120	RVA
MINER2015110	US	2	0	9/3/15 11:00	70.6781	-163.2318	1084	NO	LO	<120	RVA
MINER2015111	UW	1	0	9/3/15 19:48	70.6764	-163.2337	120	NO	SA	<120	RVA
WAVE2015117	RS	1	1	9/4/15 17:41	71.1196	-163.5130	80	LO	LO	≥120	DR
WAVE2015118	BS	1	0	9/4/15 21:04	71.0983	-163.7505	5	SP	LO	≥120	DR
FENN2015192	BS	1	0	9/4/15 9:37	71.1656	-163.3516	50	LO	SW	≥120	DR
FENN2015193	PWA	1	0	9/4/15 12:45	71.1655	-163.3514	400	NO	SW	≥120	DR
POLAR2015227	US	1	0	9/4/15 7:10	71.1733	-163.4718	10	LO	LO	≥120	DR

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POLAR2015228	BS	1	1	9/4/15 12:36	71.1733	-163.4718	30	LO	LO	≥120	DR
MINER2015112	UP	1	0	9/4/15 19:27	70.6775	-163.2337	90	NO	SI	<120	DR
FENN2015194	US	1	0	9/5/15 10:07	71.1672	-163.1909	120	NO	RE	≥120	DR
FENN2015196	PWA	1	0	9/5/15 16:25	71.1652	-163.4613	400	NO	SW	≥120	DR
POLAR2015229	BS	1	0	9/5/15 17:24	71.1733	-163.4718	100	LO	LO	≥120	DR
POLAR2015230	BS	1	1	9/5/15 18:11	71.1733	-163.4718	35	LO	LO	≥120	DR
DISCOV201583	BS	1	0	9/5/15 18:56	71.1509	-163.1963	215	NO	SA	≥120	DR
DISCOV201584	UMW	1	0	9/5/15 21:56	71.1507	-163.1960	1000	NO	TR	≥120	DR
EXPLOR2015216	PWA	1	0	9/5/15 16:00	71.1745	-163.4506	313	NO	TR	≥120	DR
MINER2015113	SS	1	0	9/5/15 17:18	70.6761	-163.2308	90	LO	FB	<120	DR
MINER2015114	BS	1	0	9/5/15 19:17	70.6757	-163.2292	210	NO	LO	<120	DR
SPIRIT201557	BS	1	0	9/5/15 18:40	71.1506	-163.1970	2	LO	DI	≥120	DR
SPIRIT201558	PWA	1	0	9/5/15 21:18	71.1414	-163.1885	2	LO	LO	≥120	DR
WIND2015130	US	1	1	9/5/15 13:25	71.0971	-162.8218	30	LO	LO	≥120	DR
WIND2015131	US	1	0	9/5/15 13:36	71.0967	-162.8439	20	LO	LO	≥120	DR
TORVIK2015282	PWA	1	0	9/5/15 8:33	71.1071	-163.4231	405	NO	DI	≥120	DR
TORVIK2015283	PWA	1	0	9/5/15 20:31	71.1379	-163.2218	5	LO	DI	≥120	DR
GUARD2015145	BS	1	0	9/6/15 13:15	71.1953	-163.1890	400	NO	LO	≥120	AH + DR
GUARD2015146	US	1	0	9/6/15 13:25	71.1860	-163.2013	800	NO	PO	≥120	AH + DR
GUARD2015147	BS	1	0	9/6/15 17:52	71.1229	-163.2412	150	NO	LO	≥120	AH + DR
NANUQ2015221	US	1	0	9/6/15 8:59	71.1156	-163.2851	150	NO	SA	≥120	AH + DR
TORVIK2015284	PWA	1	0	9/6/15 7:13	71.1365	-163.3013	10	LO	TR	≥120	AH + DR
TORVIK2015285	US	1	0	9/6/15 12:59	71.1303	-163.0701	460	NO	DI	≥120	AH + DR
SPIRIT201559	HP	1	0	9/6/15 12:34	70.9038	-164.1052	100	NO	DI	<120	AH + DR
SPIRIT201560	BS	1	0	9/6/15 13:38	70.7700	-164.3838	20	NO	DI	<120	AH + DR
SPIRIT201561	UP	1	0	9/6/15 14:07	70.7104	-164.5046	1	SP	DI	<120	AH + DR
FENN2015197	PWA	1	0	9/6/15 14:06	71.1509	-163.3867	550	NO	MI	≥120	AH + DR
FENN2015198	US	1	0	9/6/15 16:12	71.1510	-163.3864	1000	NO	LO	≥120	AH + DR
SISUAQ201570	PWA	1	0	9/6/15 7:16	71.1485	-163.2929	50	NO	SW	≥120	AH + DR

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SISUAQ201571	PWA	1	0	9/6/15 11:46	71.1486	-163.2936	50	NO	TR	≥120	AH + DR
SISUAQ201572	US	1	0	9/6/15 19:37	71.1135	-163.3188	350	NO	LO	≥120	AH + DR
ROSS2015202	PWA	1	0	9/6/15 8:51	71.1586	-163.3082	300	LO	LO	≥120	AH + DR
ROSS2015203	PWA	1	0	9/6/15 12:47	71.1777	-163.0706	0	LO	DI	≥120	AH + DR
POLAR2015231	BS	1	0	9/6/15 4:42	71.1733	-163.4718	10	NO	RE	≥120	AH + DR
POLAR2015232	BS	1	0	9/6/15 8:33	71.1733	-163.4718	150	LO	LO	≥120	AH + DR
POLAR2015233	US	1	0	9/6/15 8:57	71.1733	-163.4718	25	NO	DI	≥120	AH + DR
POLAR2015234	BS	1	1	9/6/15 14:28	71.1733	-163.4718	15	LO	LO	≥120	AH + DR
POLAR2015235	BS	1	0	9/6/15 17:19	71.1733	-163.4718	500	LO	LO	≥120	AH + DR
DISCOV201586	PWA	1	0	9/6/15 7:36	71.1507	-163.1950	5	CD	LO	≥120	AH + DR
NORD2015245	PWA	2	0	9/6/15 8:15	71.1911	-163.0666	50	NO	SW	≥120	AH + DR
NORD2015246	PWA	1	0	9/6/15 17:10	71.1834	-163.0655	250	LO	LO	≥120	AH + DR
NORD2015247	PWA	3	0	9/6/15 17:56	71.1833	-163.0656	300	CD	LO	≥120	AH + DR
EXPLOR2015217	PWA	1	0	9/6/15 14:06	71.1552	-163.3843	35	LO	TR	≥120	AH + DR
SUPPORT2015197	BS	1	0	9/6/15 8:11	71.1731	-163.4704	60	NO	DI	≥120	AH + DR
SUPPORT2015198	BS	1	0	9/6/15 10:52	71.1731	-163.4703	100	NO	DI	≥120	AH + DR
MINER2015115	BS	1	0	9/6/15 13:20	70.6761	-163.2249	40	LO	LO	<120	AH + DR
MINER2015116	BS	1	1	9/6/15 16:33	70.6768	-163.2224	60	LO	LO	≥120	AH + DR
WIND2015134	PWA	1	0	9/6/15 17:11	71.1063	-163.4110	20	LO	LO	≥120	AH + DR
WIND2015135	PWA	1	0	9/6/15 18:12	71.0989	-163.3992	5	LO	LO	≥120	AH + DR
WIND2015136	PWA	1	0	9/6/15 20:44	71.0784	-163.3707	143	LO	SW	≥120	AH + DR
GUARD2015148	PWA	2	0	9/7/15 9:45	71.0120	-163.2289	140	LO	LO	≥120	AH + DR
GUARD2015149	BS	1	0	9/7/15 14:26	71.1661	-163.8602	60	NO	SW	<120	AH + DR
GUARD2015150	BS	1	0	9/7/15 16:36	70.9998	-163.7460	95	NO	SI	<120	AH + DR
TORVIK2015286	PWA	1	0	9/7/15 18:01	71.1283	-163.0689	1	LO	TR	≥120	AH + DR
DISCOV201587	BS	1	0	9/7/15 10:23	71.1504	-163.1912	200	NO	SA	≥120	AH + DR
POLAR2015236	BS	1	1	9/7/15 9:05	71.1733	-163.4718	15	LO	LO	≥120	AH + DR
POLAR2015238	BS	1	1	9/7/15 20:32	71.1733	-163.4718	25	NO	RE	≥120	AH + DR
POLAR2015237	BS	1	0	9/7/15 20:52	71.1733	-163.4718	15	LO	LO	≥120	AH + DR

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ROSS2015204	UW	1	0	9/7/15 19:55	71.2257	-163.1656	600	NO	BL	≥120	AH + DR
NORD2015248	US	1	0	9/7/15 9:52	71.1764	-163.0160	225	LO	LO	≥120	AH + DR
NORD2015249	BS	1	0	9/7/15 11:25	71.1515	-163.0196	15	LO	LO	≥120	AH + DR
EXPLOR2015220	PWA	1	0	9/7/15 13:02	70.9836	-162.9829	25	CD	LO	<120	AH + DR
EXPLOR2015221	UP	1	0	9/7/15 16:01	71.1568	-163.2964	320	LO	SW	≥120	AH + DR
MINER2015117	BS	1	1	9/7/15 18:27	70.6755	-163.2237	240	NO	SW	<120	AH + DR
MINER2015118	BS	1	1	9/7/15 18:47	70.6758	-163.2216	80	LO	SW	<120	AH + DR
GUARD2015151	BS	1	0	9/8/15 9:12	70.9565	-164.0044	300	NO	LO	<120	AH + DR
NANUQ2015222	PWA	1	0	9/8/15 13:43	71.1539	-163.2875	100	CD	SA	≥120	AH + DR
WAVE2015119	BS	1	0	9/8/15 8:52	71.1726	-163.6815	20	LO	TR	≥120	AH + DR
TORVIK2015287	BS	1	0	9/8/15 10:03	71.1287	-163.0672	100	NO	SA	≥120	AH + DR
TORVIK2015288	US	1	0	9/8/15 12:13	71.1679	-163.0472	275	NO	TR	≥120	AH + DR
TORVIK2015289	PWA	1	0	9/8/15 18:13	71.1740	-163.0307	5	LO	TR	≥120	AH + DR
TORVIK2015290	PWA	1	0	9/8/15 19:28	71.1740	-163.0305	50	LO	TH	≥120	AH + DR
FENN2015199	PWA	1	1	9/8/15 16:10	71.1767	-163.0679	2	CD	SW	≥120	AH + DR
SUPPORT2015199	BS	1	0	9/8/15 8:10	71.1729	-163.4695	30	NO	DI	≥120	AH + DR
POLAR2015239	US	1	0	9/8/15 4:36	71.1733	-163.4718	70	NO	DI	≥120	AH + DR
POLAR2015240	BS	1	0	9/8/15 7:08	71.1733	-163.4718	10	LO	LO	≥120	AH + DR
POLAR2015241	BS	1	1	9/8/15 8:17	71.1733	-163.4718	20	LO	LO	≥120	AH + DR
POLAR2015242	UP	1	0	9/8/15 9:34	71.1733	-163.4718	50	LO	LO	≥120	AH + DR
SISUAQ201573	PWA	1	0	9/8/15 10:01	71.0669	-163.2773	10	LO	TR	≥120	AH + DR
SISUAQ201574	PWA	1	0	9/8/15 13:47	71.1566	-163.2921	10	LO	LO	≥120	AH + DR
DISCOV201588	PWA	1	0	9/8/15 15:01	71.1517	-163.1869	100	NO	SA	≥120	AH + DR
DISCOV201589	BS	1	0	9/8/15 17:14	71.1522	-163.1874	40	LO	LO	≥120	AH + DR
ROSS2015205	PWA	1	0	9/8/15 16:07	71.1764	-163.0748	300	NO	SA	≥120	AH + DR
EXPLOR2015222	UP	1	0	9/8/15 14:10	71.1516	-163.4803	410	NO	TR	≥120	AH + DR
NORD2015251	PWA	1	0	9/8/15 8:47	71.3084	-163.2097	30	LO	LO	≥120	AH + DR
NORD2015252	UMW	1	0	9/8/15 14:37	71.3089	-163.2104	5015	NO	BL	<120	AH + DR
NORD2015253	BHW	2	0	9/8/15 17:26	71.3087	-163.2095	5015	NO	FL	≥120	AH + DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NORD2015254	UMW	1	0	9/8/15 18:10	71.3086	-163.2094	6000	NO	BL	≥120	AH + DR
MARIKA2015108	PWA	1	0	9/8/15 7:56	71.0529	-163.2800	5	LO	TR	≥120	AH + DR
MINER2015119	BS	1	0	9/8/15 16:54	70.6787	-163.2205	80	NO	SA	<120	AH + DR
WIND2015137	BS	1	0	9/8/15 9:27	71.1290	-163.4434	20	LO	SW	≥120	AH + DR
GUARD2015152	US	1	0	9/9/15 14:45	70.9247	-163.7244	25	NO	SW	<120	DR
WAVE2015120	BS	1	0	9/9/15 9:19	71.0974	-163.4916	10	LO	TR	≥120	DR
POLAR2015243	BS	1	1	9/9/15 13:38	71.1733	-163.4718	25	LO	LO	≥120	DR
NORD2015255	BS	1	0	9/9/15 10:10	71.3067	-163.2127	250	LO	LO	≥120	DR
MINER2015120	SS	1	0	9/9/15 16:53	70.6753	-163.2322	80	LO	LO	<120	DR
TORVIK2015291	US	1	0	9/10/15 16:30	71.0530	-163.3705	400	NO	ST	≥120	DR
SUPPORT2015200	BS	1	0	9/10/15 20:43	71.1686	-163.4810	20	NO	DI	≥120	DR
POLAR2015244	BS	1	0	9/10/15 5:10	71.1733	-163.4718	5	NO	FE	≥120	DR
POLAR2015245	BS	1	1	9/10/15 16:38	71.1733	-163.4718	0	NO	RE	≥120	DR
ROSS2015206	PWA	1	0	9/10/15 10:05	70.6381	-160.5692	300	NO	TR	≥120	DR
ROSS2015207	PWA	1	1	9/10/15 14:44	70.6367	-160.5667	10	LO	LO	≥120	DR
ROSS2015208	UP	1	0	9/10/15 18:14	70.6367	-160.5667	700	NO	SW	≥120	DR
ROSS2015209	UP	1	0	9/10/15 18:24	70.6367	-160.5665	769	NO	SW	≥120	DR
EXPLOR2015223	UP	1	0	9/10/15 12:10	70.6627	-160.8625	238	LO	TR	<120	DR
EXPLOR2015225	US	1	0	9/10/15 19:51	70.7068	-162.9505	80	LO	LO	<120	DR
NORD2015256	PWA	1	0	9/10/15 11:07	70.6385	-160.5518	5	LO	LO	≥120	DR
NORD2015257	PWA	1	0	9/10/15 14:56	70.6386	-160.5521	200	NO	SW	≥120	DR
POLAR2015246	BS	1	1	9/11/15 6:25	71.1733	-163.4718	8	LO	LO	≥120	DR
SUPPORT2015201	US	1	0	9/11/15 14:40	71.1686	-163.4814	500	NO	DI	≥120	DR
SUPPORT2015202	US	1	0	9/11/15 16:55	71.1685	-163.4813	50	NO	DI	≥120	DR
AIVIQ2015423	PWA	1	0	9/11/15 18:24	71.1837	-163.0536	300	LO	LO	≥120	DR
NORD2015258	BS	1	0	9/11/15 9:06	70.6397	-160.5480	200	NO	SW	≥120	DR
WAVE2015121	PWA	3	0	9/11/15 13:02	71.2034	-163.8278	700	LO	LO	≥120	DR
EXPLOR2015226	US	1	0	9/11/15 19:47	71.0922	-163.2311	120	LO	LO	≥120	DR
SISUAQ201575	PWA	1	0	9/11/15 18:12	71.1990	-163.7394	25	LO	LO	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
GUARD2015153	BS	1	1	9/12/15 15:13	71.0319	-163.2133	30	NO	LO	≥120	AH + DR
GUARD2015154	BS	1	0	9/12/15 19:22	71.0873	-163.1924	75	LO	LO	≥120	AH + DR
GUARD2015155	BS	1	0	9/12/15 21:58	71.0353	-163.7636	185	NO	LO	≥120	AH + DR
AIVIQ2015424	PWA	1	0	9/12/15 10:15	71.1710	-162.9738	250	NO	LO	≥120	AH + DR
EXPLOR2015227	PWA	1	0	9/12/15 8:49	71.1277	-163.1608	40	LO	TR	≥120	AH + DR
EXPLOR2015228	UP	1	0	9/12/15 20:53	71.0721	-163.8444	200	LO	RE	≥120	AH + DR
SUPPORT2015203	US	1	0	9/12/15 21:13	71.1515	-163.1962	250	NO	DI	≥120	AH + DR
POLAR2015247	SS	1	0	9/12/15 16:22	71.1733	-163.4718	100	LO	LO	≥120	AH + DR
DISCOV201590	BS	1	0	9/12/15 9:50	71.1506	-163.1969	75	NO	SA	≥120	AH + DR
DISCOV201591	PWA	1	0	9/12/15 16:30	71.1512	-163.1972	5	NO	TR	≥120	AH + DR
MARIKA2015110	US	1	0	9/12/15 16:06	71.0544	-163.2944	20	LO	LO	≥120	AH + DR
MARIKA2015111	PWA	2	0	9/12/15 16:14	71.0542	-163.2945	20	LO	LO	≥120	AH + DR
MARIKA2015112	US	1	0	9/12/15 18:20	71.0544	-163.2945	60	LO	LO	≥120	AH + DR
MARIKA2015113	PWA	1	0	9/12/15 20:38	71.0543	-163.2944	250	LO	TR	≥120	AH + DR
MINER2015122	US	1	0	9/12/15 18:18	70.6770	-163.2338	90	NO	SI	<120	AH + DR
MINER2015121	BS	1	1	9/12/15 17:08	70.6762	-163.2338	75	LO	LO	<120	AH + DR
WIND2015138	PWA	1	0	9/12/15 14:02	71.1426	-163.4043	261	LO	LO	≥120	AH + DR
GUARD2015156	PWA	2	0	9/13/15 8:31	71.0810	-163.5116	175	NO	RA	≥120	AH + DR
GUARD2015157	BS	1	1	9/13/15 9:28	71.1291	-163.4465	15	CD	SW	≥120	AH + DR
GUARD2015161	US	1	0	9/13/15 15:29	71.1074	-163.6465	100	NO	DI	≥120	AH + DR
GUARD2015162	US	1	0	9/13/15 15:37	71.1005	-163.6743	125	NO	LO	≥120	AH + DR
GUARD2015163	US	1	0	9/13/15 17:27	71.0137	-164.0228	70	LO	LO	≥120	AH + DR
GUARD2015164	PWA	1	1	9/13/15 20:40	71.0674	-163.4755	150	LO	LO	≥120	AH + DR
TORVIK2015292	US	1	0	9/13/15 8:15	71.1303	-163.0773	405	NO	ST	≥120	AH + DR
TORVIK2015293	PWA	2	0	9/13/15 15:20	71.1300	-163.0766	362	NO	SA	≥120	AH + DR
TORVIK2015294	PWA	2	0	9/13/15 20:10	71.1299	-163.0762	100	LO	ST	≥120	AH + DR
FENN2015202	US	1	0	9/13/15 10:22	71.1681	-163.2423	400	NO	SW	≥120	AH + DR
FENN2015203	UP	1	0	9/13/15 10:33	71.1681	-163.2422	450	NO	SI	≥120	AH + DR
FENN2015204	PWA	1	0	9/13/15 11:22	71.1681	-163.2424	1088	NO	SI	≥120	AH + DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
FENN2015205	US	1	0	9/13/15 11:35	71.1680	-163.2425	1954	NO	SW	≥120	AH + DR
FENN2015206	US	1	0	9/13/15 17:00	71.1686	-163.2426	1088	NO	SI	≥120	AH + DR
FENN2015207	US	1	0	9/13/15 17:12	71.1686	-163.2424	150	NO	SW	≥120	AH + DR
FENN2015208	PWA	2	1	9/13/15 17:48	71.1696	-163.2463	755	NO	TR	≥120	AH + DR
FENN2015209	SS	1	0	9/13/15 21:13	71.1645	-163.2422	30	NO	LO	≥120	AH + DR
SISUAQ201577	PWA	6	0	9/13/15 9:48	71.1703	-163.3190	999	NO	TR	≥120	AH + DR
SISUAQ201578	US	1	0	9/13/15 10:00	71.1702	-163.3198	400	NO	SW	≥120	AH + DR
SISUAQ201579	PWA	1	0	9/13/15 10:49	71.1705	-163.3189	500	NO	SW	≥120	AH + DR
SISUAQ201580	US	1	0	9/13/15 12:42	71.1705	-163.3188	1500	NO	LO	≥120	AH + DR
SISUAQ201581	BS	1	0	9/13/15 13:40	71.1776	-163.2684	30	LO	LO	≥120	AH + DR
SISUAQ201582	UP	1	0	9/13/15 13:59	71.1664	-163.3028	1200	NO	SW	≥120	AH + DR
SUPPORT2015204	BS	1	0	9/13/15 8:46	71.1696	-163.4662	120	LO	LO	≥120	AH + DR
SUPPORT2015205	RBS	1	0	9/13/15 11:21	71.1696	-163.4663	200	NO	LO	≥120	AH + DR
POLAR2015249	SS	1	0	9/13/15 0:02	71.1733	-163.4718	0	LO	LO	≥120	AH + DR
POLAR2015250	SS	1	0	9/13/15 8:52	71.1733	-163.4718	30	LO	LO	≥120	AH + DR
POLAR2015251	US	1	0	9/13/15 10:00	71.1733	-163.4718	70	NO	DI	≥120	AH + DR
POLAR2015252	US	1	0	9/13/15 10:27	71.1733	-163.4718	500	NO	RE	≥120	AH + DR
POLAR2015253	PWA	1	0	9/13/15 11:16	71.1733	-163.4718	100	CD	LO	≥120	AH + DR
POLAR2015254	PWA	1	0	9/13/15 13:09	71.1733	-163.4718	100	NO	BL	≥120	AH + DR
ROSS2015211	UP	1	0	9/13/15 14:12	71.1768	-163.0769	600	NO	DI	≥120	AH + DR
ROSS2015212	PWA	1	0	9/13/15 18:46	71.1549	-163.1255	900	NO	SW	≥120	AH + DR
NORD2015261	PWA	1	0	9/13/15 7:07	71.1867	-163.0124	50	NO	LO	≥120	AH + DR
NORD2015265	BS	1	0	9/13/15 15:46	71.2520	-163.2022	250	NO	LO	≥120	AH + DR
EXPLOR2015230	US	1	0	9/13/15 9:17	71.1686	-163.4909	270	LO	LO	≥120	AH + DR
EXPLOR2015232	US	1	0	9/13/15 12:02	71.1664	-163.4840	238	LO	SW	≥120	AH + DR
EXPLOR2015233	US	1	0	9/13/15 17:38	71.2039	-163.1603	200	IS	SW	≥120	AH + DR
EXPLOR2015234	US	1	0	9/13/15 17:51	71.2085	-163.1453	140	LO	TR	≥120	AH + DR
EXPLOR2015235	SS	3	0	9/13/15 19:16	71.2309	-163.0753	80	LO	LO	≥120	AH + DR
EXPLOR2015236	US	1	0	9/13/15 19:45	71.2209	-163.1191	90	IS	FB	≥120	AH + DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
EXPLOR2015237	US	1	0	9/13/15 20:19	71.2098	-163.1708	250	LO	SW	≥120	AH + DR
WAVE2015122	US	1	0	9/13/15 7:19	71.0978	-163.6847	229	NO	FB	≥120	AH + DR
WAVE2015123	BS	1	0	9/13/15 7:40	71.1008	-163.6677	358	NO	DI	≥120	AH + DR
WAVE2015124	BS	1	0	9/13/15 7:58	71.1033	-163.6530	350	NO	FB	≥120	AH + DR
MARIKA2015114	BS	1	0	9/13/15 10:07	71.0535	-163.2906	30	LO	LO	≥120	AH + DR
MARIKA2015115	BS	1	0	9/13/15 14:52	71.0533	-163.2894	10	LO	LO	≥120	AH + DR
MINER2015123	BS	1	1	9/13/15 8:00	70.6752	-163.2288	60	LO	LO	<120	AH + DR
MINER2015124	HP	1	0	9/13/15 8:18	70.6752	-163.2284	905	NO	DI	<120	AH + DR
MINER2015125	BS	1	0	9/13/15 14:03	70.6754	-163.2303	40	LO	SW	<120	AH + DR
MINER2015126	US	1	0	9/13/15 15:48	70.6756	-163.2325	40	NO	SI	<120	AH + DR
MINER2015127	BS	1	1	9/13/15 16:06	70.6755	-163.2321	50	CD	SW	<120	AH + DR
WIND2015139	PWA	2	0	9/13/15 8:09	71.0953	-163.6231	169	NO	OT	≥120	AH + DR
WIND2015140	BS	1	0	9/13/15 10:08	71.1642	-163.3267	302	NO	SI	≥120	AH + DR
WIND2015141	PWA	1	0	9/13/15 10:50	71.1730	-163.3268	573	NO	DI	≥120	AH + DR
WIND2015142	BS	1	0	9/13/15 12:37	71.1604	-163.3025	155	NO	SW	≥120	AH + DR
TORVIK2015295	PWA	3	0	9/14/15 11:16	71.1291	-163.0763	200	NO	ST	≥120	AH + DR
EXPLOR2015238	BS	1	0	9/14/15 8:38	71.0582	-163.9046	50	LO	RE	<120	AH + DR
EXPLOR2015239	SS	1	0	9/14/15 11:15	71.1015	-163.7733	100	LO	FB	≥120	AH + DR
EXPLOR2015240	US	1	0	9/14/15 20:12	71.1721	-163.5497	192	LO	SW	≥120	AH + DR
EXPLOR2015241	BS	1	0	9/14/15 20:12	71.1720	-163.5499	320	NO	RE	≥120	AH + DR
SUPPORT2015206	SS	1	0	9/14/15 21:10	71.1696	-163.4666	20	LO	LO	≥120	AH + DR
DISCOV201592	BS	1	0	9/14/15 19:14	71.1504	-163.1942	199	NO	LO	≥120	AH + DR
MINER2015128	US	1	0	9/14/15 7:55	70.6761	-163.2344	100	NO	DI	<120	AH + DR
MINER2015129	BS	1	0	9/14/15 15:30	70.6754	-163.2320	100	LO	LO	<120	AH + DR
MINER2015130	BS	1	0	9/14/15 16:44	70.6756	-163.2331	110	NO	LO	<120	AH + DR
WIND2015143	PWA	1	0	9/14/15 9:51	71.0866	-163.4719	70	NO	SW	≥120	AH + DR
GUARD2015165	US	1	0	9/15/15 17:15	70.8018	-164.0584	100	LO	LO	<120	AH + DR
GUARD2015166	UP	1	0	9/15/15 19:58	70.7256	-164.1392	50	LO	LO	≥120	AH + DR
GUARD2015167	PWA	1	0	9/15/15 20:33	70.7302	-164.0631	30	LO	LO	<120	AH + DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
GUARD2015168	HP	1	0	9/15/15 21:25	70.7364	-163.9487	10	IS	PO	<120	AH + DR
AIVIQ2015425	PWA	2	0	9/15/15 11:05	71.0912	-163.3800	200	NO	DI	≥120	AH + DR
AIVIQ2015426	PWA	2	0	9/15/15 17:47	71.1423	-163.1178	50	LO	LO	≥120	AH + DR
NANUQ2015224	PWA	2	0	9/15/15 11:41	71.1152	-163.6926	350	NO	ST	≥120	AH + DR
SUPPORT2015207	BS	1	0	9/15/15 13:34	71.1722	-163.4892	60	NO	DI	≥120	AH + DR
EXPLOR2015242	PWA	2	0	9/15/15 14:27	71.0275	-163.8019	250	LO	ST	<120	AH + DR
EXPLOR2015243	US	1	0	9/15/15 15:27	71.0031	-163.9222	60	LO	LO	<120	AH + DR
EXPLOR2015244	US	1	0	9/15/15 15:45	71.0005	-163.9369	90	SP	SA	<120	AH + DR
EXPLOR2015245	US	1	0	9/15/15 15:54	71.0043	-163.9217	100	LO	LO	<120	AH + DR
EXPLOR2015246	US	1	0	9/15/15 16:11	71.0118	-163.8913	80	NO	SI	<120	AH + DR
POLAR2015255	US	1	0	9/15/15 2:46	71.1733	-163.4718	30	NO	LO	≥120	AH + DR
POLAR2015256	BS	1	1	9/15/15 19:00	71.1733	-163.4718	60	LO	LO	≥120	AH + DR
POLAR2015257	SS	1	0	9/15/15 20:26	71.1733	-163.4718	45	LO	LO	≥120	AH + DR
CHAMP2015236	HP	1	0	9/15/15 13:49	69.3306	-166.4837	10	CD	TR	<120	AH + DR
MARIKA2015116	BS	1	0	9/15/15 14:41	71.0532	-163.2919	40	LO	LO	≥120	AH + DR
MINER2015131	BS	1	1	9/15/15 16:19	70.6753	-163.2325	60	NO	LO	<120	AH + DR
DISCOV201593	BS	1	0	9/15/15 13:07	71.1508	-163.1950	80	NO	ST	≥120	AH + DR
NANUQ2015226	PWA	1	0	9/16/15 18:08	71.0509	-163.3080	2044	LO	TR	≥120	AH + DR
FENN2015210	PWA	1	0	9/16/15 15:11	71.1789	-163.1169	469	NO	MI	≥120	AH + DR
FENN2015211	PWA	2	1	9/16/15 16:33	71.1763	-163.1290	300	NO	MI	≥120	AH + DR
POLAR2015258	US	1	0	9/16/15 0:48	71.1733	-163.4718	30	NO	LO	≥120	AH + DR
POLAR2015259	BS	1	1	9/16/15 11:39	71.1733	-163.4718	45	LO	OT	≥120	AH + DR
POLAR2015260	BS	1	0	9/16/15 17:53	71.1733	-163.4718	50	LO	LO	≥120	AH + DR
POLAR2015261	PWA	1	0	9/16/15 19:05	71.1733	-163.4718	60	LO	LO	≥120	AH + DR
WIND2015145	BS	1	0	9/16/15 11:27	71.1198	-163.6040	75	LO	RE	≥120	AH + DR
SISUAQ201584	BS	1	0	9/16/15 15:37	71.1451	-163.3004	5	LO	DI	≥120	AH + DR
WAVE2015128	RS	2	0	9/16/15 15:04	71.0784	-163.5564	30	LO	LO	≥120	AH + DR
WAVE2015129	US	1	1	9/16/15 16:02	71.0866	-163.4784	40	LO	LO	≥120	AH + DR
WAVE2015130	RS	1	0	9/16/15 19:33	71.1152	-163.2179	20	NO	LO	≥120	AH + DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
AIVIQ2015427	PWA	2	0	9/16/15 13:33	71.1816	-163.0888	977	NO	DI	≥120	AH + DR
AIVIQ2015428	PWA	1	0	9/16/15 14:32	71.1816	-163.0887	100	CD	DI	≥120	AH + DR
AIVIQ2015429	PWA	1	0	9/16/15 15:06	71.1816	-163.0888	733	NO	DI	≥120	AH + DR
ROSS2015213	PWA	1	0	9/16/15 5:24	71.1652	-163.0767	75	LO	TR	≥120	AH + DR
ROSS2015214	US	1	0	9/16/15 9:13	71.1651	-163.0762	200	NO	SW	≥120	AH + DR
ROSS2015215	PWA	1	1	9/16/15 10:31	71.1652	-163.0764	300	NO	LO	≥120	AH + DR
ROSS2015216	PWA	2	0	9/16/15 14:29	71.0618	-163.3003	700	NO	SW	≥120	AH + DR
ROSS2015217	PWA	1	0	9/16/15 17:57	71.0537	-163.2884	150	LO	SW	≥120	AH + DR
ROSS2015218	PWA	1	1	9/16/15 19:10	71.0538	-163.2887	5	LO	LO	≥120	AH + DR
ROSS2015219	PWA	1	0	9/16/15 19:33	71.0692	-163.3129	1000	NO	SW	≥120	AH + DR
NORD2015266	PWA	1	0	9/16/15 14:03	71.1837	-163.0545	300	LO	LO	≥120	AH + DR
SUPPORT2015208	PWA	2	0	9/16/15 14:37	71.1163	-163.3981	15	NO	DI	≥120	AH + DR
SUPPORT2015209	PWA	1	0	9/16/15 20:27	70.3673	-164.8008	50	NO	DI	<120	AH + DR
EXPLOR2015247	US	1	0	9/16/15 9:37	71.1082	-164.0866	238	LO	LO	<120	AH + DR
EXPLOR2015248	US	1	0	9/16/15 10:05	71.1016	-164.1366	100	LO	DI	<120	AH + DR
EXPLOR2015249	US	1	0	9/16/15 13:44	71.1499	-163.6720	120	SP	SA	≥120	AH + DR
MARIKA2015117	PWA	1	0	9/16/15 18:02	71.0532	-163.2919	50	LO	SA	≥120	AH + DR
CHAMP2015237	BS	1	0	9/16/15 15:37	71.1452	-163.3008	80	LO	LO	≥120	AH + DR
CHAMP2015238	PWA	1	0	9/16/15 18:04	71.1452	-163.3008	749	LO	DI	≥120	AH + DR
CHAMP2015239	BS	1	0	9/16/15 18:13	71.1452	-163.3008	440	NO	DI	≥120	AH + DR
CHAMP2015240	PWA	2	0	9/16/15 18:32	71.1451	-163.3007	10	LO	LG	≥120	AH + DR
DISCOV201594	RS	1	0	9/16/15 12:46	71.1508	-163.1948	30	LO	LO	≥120	AH + DR
DISCOV201595	BS	1	0	9/16/15 14:16	71.1504	-163.1947	100	LO	LO	≥120	AH + DR
DISCOV201596	BS	1	0	9/16/15 19:00	71.1508	-163.1940	3	LO	LO	≥120	AH + DR
MINER2015132	BS	1	0	9/16/15 13:20	70.6763	-163.2343	45	LO	LO	<120	AH + DR
MINER2015133	BS	1	0	9/16/15 15:04	70.6768	-163.2354	85	LO	LO	<120	AH + DR
GUARD2015173	US	1	0	9/17/15 10:44	70.9711	-163.3744	50	IS	DI	≥120	AH + DR
GUARD2015174	UP	1	0	9/17/15 11:49	70.9055	-163.5384	513	NO	DI	<120	AH + DR
GUARD2015175	PWA	2	0	9/17/15 19:27	71.0562	-163.3977	100	NO	SW	≥120	AH + DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
GUARD2015176	RS	1	0	9/17/15 19:50	71.0269	-163.3898	250	LO	LO	≥120	AH + DR
NANUQ2015227	PWA	2	0	9/17/15 16:03	71.0491	-163.2978	400	NO	ST	≥120	AH + DR
NANUQ2015228	PWA	4	0	9/17/15 21:50	71.1389	-163.4375	1000	NO	ST	≥120	AH + DR
ROSS2015220	PWA	1	0	9/17/15 12:48	71.1639	-163.3432	600	NO	SW	≥120	AH + DR
ROSS2015221	PWA	1	0	9/17/15 13:10	71.1640	-163.3430	5	LO	LO	≥120	AH + DR
ROSS2015222	PWA	2	0	9/17/15 17:09	71.1553	-163.3472	769	NO	SW	≥120	AH + DR
ROSS2015223	PWA	2	0	9/17/15 18:15	71.1571	-163.3570	75	CD	MI	≥120	AH + DR
ROSS2015224	BS	1	0	9/17/15 20:45	71.1783	-163.3194	150	NO	SW	≥120	AH + DR
ROSS2015225	SS	1	0	9/17/15 21:22	71.2003	-163.3096	500	NO	SW	≥120	AH + DR
EXPLOR2015250	SS	1	0	9/17/15 9:54	71.1371	-163.3288	120	LO	LO	≥120	AH + DR
EXPLOR2015251	PWA	2	0	9/17/15 15:59	71.1532	-163.3197	60	CD	TR	≥120	AH + DR
EXPLOR2015252	BS	1	0	9/17/15 20:08	71.2449	-163.1286	30	SP	TR	≥120	AH + DR
WAVE2015131	US	1	0	9/17/15 8:59	71.0758	-163.7026	100	NO	LO	≥120	AH + DR
WAVE2015132	US	1	0	9/17/15 9:49	71.0728	-163.7228	229	NO	SW	≥120	AH + DR
WAVE2015134	SS	1	0	9/17/15 13:59	71.0771	-163.6677	70	NO	SW	≥120	AH + DR
WAVE2015135	US	1	0	9/17/15 16:51	71.0810	-163.7002	244	LO	LO	≥120	AH + DR
WAVE2015136	PWA	1	0	9/17/15 18:44	71.0808	-163.6378	300	NO	BL	≥120	AH + DR
WAVE2015137	PWA	1	0	9/17/15 21:27	71.0689	-163.6508	300	NO	ST	≥120	AH + DR
FENN2015212	PWA	1	0	9/17/15 12:41	71.1652	-163.3427	150	LO	LO	≥120	AH + DR
FENN2015213	PWA	1	0	9/17/15 13:13	71.1651	-163.3426	50	LO	LO	≥120	AH + DR
FENN2015214	PWA	3	0	9/17/15 15:10	71.1652	-163.3426	655	NO	TR	≥120	AH + DR
FENN2015215	PWA	2	1	9/17/15 17:28	71.1652	-163.3427	5	NO	LO	≥120	AH + DR
FENN2015216	PWA	1	0	9/17/15 17:55	71.1651	-163.3426	40	NO	LO	≥120	AH + DR
FENN2015217	UP	1	0	9/17/15 18:27	71.1651	-163.3428	20	NO	SW	≥120	AH + DR
FENN2015218	PWA	1	0	9/17/15 18:44	71.1651	-163.3429	30	NO	TR	≥120	AH + DR
SISUAQ201585	PWA	3	0	9/17/15 15:46	71.0539	-163.2880	1284	NO	LO	≥120	AH + DR
SISUAQ201586	RS	1	1	9/17/15 20:05	71.0439	-163.2974	1	LO	LO	≥120	AH + DR
SISUAQ201587	US	1	1	9/17/15 20:16	71.0439	-163.2973	100	LO	DI	≥120	AH + DR
NORD2015267	PWA	1	0	9/17/15 15:22	71.2013	-163.0706	20	CD	SW	≥120	AH + DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
DISCOV201598	PWA	1	0	9/17/15 12:05	71.1501	-163.1918	200	LO	SA	≥120	AH + DR
DISCOV2015100	RS	1	0	9/17/15 17:27	71.1501	-163.1922	0	LO	SA	≥120	AH + DR
DISCOV2015101	RS	1	1	9/17/15 19:21	71.1503	-163.1919	215	NO	TR	≥120	AH + DR
POLAR2015262	PWA	3	0	9/17/15 3:59	71.1733	-163.4718	40	NO	SW	≥120	AH + DR
POLAR2015263	BS	1	1	9/17/15 6:06	71.1733	-163.4718	15	LO	OT	≥120	AH + DR
POLAR2015264	PWA	1	0	9/17/15 11:17	71.1733	-163.4718	15	LO	LO	≥120	AH + DR
POLAR2015265	UP	1	0	9/17/15 11:28	71.1733	-163.4718	100	NO	BL	≥120	AH + DR
POLAR2015266	UMW	1	0	9/17/15 14:40	71.1733	-163.4718	7000	NO	BL	≥120	AH + DR
POLAR2015268	PWA	1	0	9/17/15 18:49	71.1733	-163.4718	600	NO	SW	≥120	AH + DR
POLAR2015267	BS	1	0	9/17/15 18:49	71.1733	-163.4718	60	LO	LO	≥120	AH + DR
POLAR2015269	UP	1	0	9/17/15 19:23	71.1733	-163.4718	75	LO	LO	≥120	AH + DR
POLAR2015270	PWA	1	0	9/17/15 21:57	71.1733	-163.4718	40	LO	BL	≥120	AH + DR
MARIKA2015118	UMW	1	0	9/17/15 16:21	71.0532	-163.2910	3590	NO	BL	≥120	AH + DR
MINER2015134	US	1	0	9/17/15 15:35	70.6753	-163.2315	120	NO	LO	<120	AH + DR
MINER2015135	US	1	0	9/17/15 15:54	70.6749	-163.2292	60	NO	LO	<120	AH + DR
MINER2015136	BS	1	0	9/17/15 16:07	70.6750	-163.2302	60	NO	LO	<120	AH + DR
MINER2015137	SS	1	0	9/17/15 16:25	70.6752	-163.2314	50	LO	SW	<120	AH + DR
MINER2015138	BS	1	0	9/17/15 16:53	70.6750	-163.2302	90	NO	RE	<120	AH + DR
MINER2015139	US	1	0	9/17/15 17:39	70.6749	-163.2294	100	NO	RE	<120	AH + DR
MINER2015140	BS	2	0	9/17/15 17:49	70.6748	-163.2295	100	NO	LO	<120	AH + DR
MINER2015141	US	1	0	9/17/15 18:22	70.6750	-163.2302	50	LO	LO	<120	AH + DR
MINER2015142	BS	1	0	9/17/15 19:02	70.6752	-163.2306	100	NO	SW	<120	AH + DR
MINER2015143	US	1	0	9/17/15 19:11	70.6751	-163.2311	200	NO	LO	<120	AH + DR
MINER2015144	BS	1	0	9/17/15 19:14	70.6752	-163.2314	50	NO	RE	<120	AH + DR
MINER2015145	BS	1	0	9/17/15 20:32	70.6756	-163.2326	100	LO	LO	<120	AH + DR
TORVIK2015297	PWA	1	0	9/17/15 10:54	71.1281	-163.0789	50	LO	ST	≥120	AH + DR
CHAMP2015241	PWA	1	0	9/17/15 10:44	71.1495	-163.1931	10	LO	LO	≥120	AH + DR
CHAMP2015242	PWA	1	0	9/17/15 12:11	71.1490	-163.1915	15	CD	LO	≥120	AH + DR
CHAMP2015243	UP	1	0	9/17/15 17:32	71.1725	-163.4718	400	LO	LO	≥120	AH + DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
CHAMP2015244	PB	1	0	9/17/15 18:18	71.1725	-163.4717	150	LO	LO	≥120	AH + DR
CHAMP2015245	PWA	1	0	9/17/15 18:30	71.1724	-163.4714	200	CD	TH	≥120	AH + DR
CHAMP2015247	PWA	1	0	9/17/15 21:51	71.1726	-163.4719	30	LO	LO	≥120	AH + DR
CHAMP2015248	PWA	1	0	9/17/15 23:45	71.1726	-163.4717	70	NO	LO	≥120	AH + DR
AIVIQ2015430	PWA	1	0	9/17/15 7:26	71.1762	-163.0763	30	LO	LO	≥120	AH + DR
AIVIQ2015431	PWA	1	0	9/17/15 7:54	71.1761	-163.0762	10	LO	LO	≥120	AH + DR
AIVIQ2015432	PWA	1	0	9/17/15 12:57	71.1579	-163.3579	50	LO	LO	≥120	AH + DR
AIVIQ2015433	PWA	2	0	9/17/15 17:05	71.1581	-163.3574	100	LO	LO	≥120	AH + DR
AIVIQ2015434	PWA	2	0	9/17/15 18:20	71.1580	-163.3574	100	LO	LO	≥120	AH + DR
AIVIQ2015435	PWA	1	0	9/17/15 19:54	71.1581	-163.3572	518	NO	LO	≥120	AH + DR
AIVIQ2015436	PWA	1	0	9/17/15 22:34	71.1763	-163.4593	10	LO	LO	≥120	AH + DR
FENN2015219	BS	1	0	9/18/15 12:53	71.1183	-163.2614	10	LO	LO	≥120	DR
FENN2015220	BS	1	0	9/18/15 18:40	71.1196	-163.2656	75	NO	LO	≥120	DR
POLAR2015271	US	1	0	9/18/15 6:34	71.1733	-163.4718	15	NO	LO	≥120	DR
POLAR2015272	BS	1	0	9/18/15 8:01	71.1733	-163.4718	20	NO	RE	≥120	DR
POLAR2015273	BS	1	1	9/18/15 14:48	71.1733	-163.4718	30	LO	LO	≥120	DR
NANUQ2015229	PWA	1	0	9/18/15 9:44	71.1428	-163.4108	30	LO	LO	≥120	DR
NANUQ2015230	BS	1	0	9/18/15 12:54	71.1181	-163.2647	20	LO	LO	≥120	DR
ROSS2015226	PWA	6	0	9/18/15 11:57	71.1788	-163.5613	400	NO	MI	≥120	DR
ROSS2015227	UP	1	0	9/18/15 12:09	71.1682	-163.5576	250	NO	SW	≥120	DR
ROSS2015228	BS	1	0	9/18/15 13:02	71.1271	-163.5445	200	NO	SW	≥120	DR
ROSS2015229	BS	1	0	9/18/15 13:29	71.1166	-163.4495	405	NO	SW	≥120	DR
ROSS2015230	PWA	3	0	9/18/15 15:07	71.1431	-163.4070	50	CD	MI	≥120	DR
ROSS2015231	PWA	1	0	9/18/15 16:46	71.1438	-163.3920	400	NO	SW	≥120	DR
ROSS2015232	PWA	2	1	9/18/15 19:33	71.1310	-163.4011	100	LO	LO	≥120	DR
ROSS2015233	US	1	0	9/18/15 20:43	70.9643	-163.8094	200	NO	SW	<120	DR
MINER2015146	BS	1	0	9/18/15 13:47	70.6747	-163.2294	150	NO	LO	<120	DR
MINER2015147	BS	1	0	9/18/15 14:01	70.6744	-163.2266	150	LO	LO	<120	DR
MINER2015148	US	1	0	9/18/15 18:31	70.6748	-163.2297	70	NO	LO	<120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
WAVE2015138	PWA	3	2	9/18/15 16:12	71.0824	-163.5364	270	LO	TR	≥120	DR
GUARD2015177	BS	1	0	9/18/15 9:29	71.1176	-163.3628	60	LO	LO	≥120	DR
GUARD2015178	PWA	2	0	9/18/15 18:31	70.9734	-163.3431	90	LO	LO	≥120	DR
GUARD2015179	BS	1	0	9/18/15 19:14	71.0106	-163.2814	60	LO	LO	≥120	DR
NORD2015268	UMW	1	0	9/18/15 10:35	71.2013	-163.0705	5015	NO	BL	≥120	DR
NORD2015269	UMW	1	0	9/18/15 10:51	71.2010	-163.0706	4000	NO	BL	≥120	DR
CHAMP2015249	PWA	2	0	9/18/15 21:13	71.1362	-163.2380	300	LO	FB	≥120	DR
DISCOV2015102	PWA	1	0	9/18/15 9:57	71.1498	-163.1923	100	LO	DI	≥120	DR
EXPLOR2015253	US	1	0	9/18/15 13:28	71.0548	-164.0199	80	CD	LO	<120	DR
EXPLOR2015254	SS	1	0	9/18/15 15:28	71.1318	-163.9397	170	LO	LO	<120	DR
EXPLOR2015255	UMW	2	0	9/18/15 17:59	71.2350	-163.8540	2427	NO	BL	<120	DR
EXPLOR2015256	BHW	3	1	9/18/15 18:10	71.2432	-163.8476	750	NO	TR	≥120	DR
EXPLOR2015257	BHW	3	0	9/18/15 18:11	71.2445	-163.8466	1080	NO	TR	≥120	DR
EXPLOR2015258	UMW	1	0	9/18/15 19:28	71.2762	-163.8102	3615	NO	BL	<120	DR
AIVIQ2015437	PWA	1	0	9/18/15 8:52	71.1455	-163.4087	100	LO	LO	≥120	DR
AIVIQ2015438	PWA	1	0	9/18/15 9:51	71.1452	-163.4077	125	NO	SW	≥120	DR
AIVIQ2015439	PWA	1	0	9/18/15 10:36	71.1455	-163.4091	275	IS	LO	≥120	DR
AIVIQ2015440	PWA	1	0	9/18/15 11:04	71.1455	-163.4090	304	NO	DI	≥120	DR
AIVIQ2015441	PWA	1	0	9/18/15 11:15	71.1456	-163.4089	30	NO	SW	≥120	DR
AIVIQ2015442	PWA	3	0	9/18/15 15:20	71.1455	-163.4087	250	LO	LO	≥120	DR
AIVIQ2015444	PWA	2	0	9/19/15 10:54	71.1845	-163.0950	200	LO	LO	≥120	AH + DR
AIVIQ2015445	PWA	1	0	9/19/15 11:37	71.1845	-163.0950	300	LO	LO	≥120	AH + DR
FENN2015221	UP	1	0	9/19/15 12:17	71.1259	-163.2910	25	NO	DI	≥120	AH + DR
FENN2015222	UMW	2	0	9/19/15 15:20	71.1296	-163.2967	8000	NO	BL	≥120	AH + DR
DISCOV2015104	PWA	2	1	9/19/15 10:10	71.1506	-163.1944	955	NO	LO	≥120	AH + DR
DISCOV2015105	BS	1	0	9/19/15 15:37	71.1741	-163.0749	10	LO	LO	≥120	AH + DR
DISCOV2015106	PWA	1	0	9/19/15 19:42	71.1762	-163.0716	40	CD	LO	≥120	AH + DR
WIND2015146	US	1	0	9/19/15 15:47	71.1777	-163.0661	20	LO	LO	≥120	AH + DR
WIND2015147	PWA	1	0	9/19/15 19:44	71.1776	-163.0653	70	LO	LO	≥120	AH + DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
POLAR2015274	US	1	0	9/19/15 3:19	71.1733	-163.4718	60	NO	DI	≥120	AH + DR
POLAR2015275	US	1	0	9/19/15 4:52	71.1733	-163.4718	40	NO	RE	≥120	AH + DR
POLAR2015276	BS	1	1	9/19/15 6:17	71.1733	-163.4718	7	NO	OT	≥120	AH + DR
POLAR2015277	SS	1	0	9/19/15 6:26	71.1733	-163.4718	7	NO	RE	≥120	AH + DR
POLAR2015278	BS	1	0	9/19/15 21:21	71.1733	-163.4718	55	LO	LO	≥120	AH + DR
MINER2015149	BS	1	0	9/19/15 9:46	70.6762	-163.2329	130	LO	LO	<120	AH + DR
MINER2015150	US	1	0	9/19/15 10:56	70.6763	-163.2328	150	NO	LO	<120	AH + DR
MINER2015151	UP	1	0	9/19/15 13:06	70.6766	-163.2333	200	NO	RE	<120	AH + DR
MINER2015152	BS	1	0	9/19/15 18:05	70.6759	-163.2325	150	NO	LO	<120	AH + DR
EXPLOR2015259	PWA	3	1	9/19/15 12:59	71.1664	-163.3270	120	LO	TR	≥120	AH + DR
EXPLOR2015260	PWA	1	0	9/19/15 14:17	71.1679	-163.3172	50	LO	OT	≥120	AH + DR
EXPLOR2015261	PWA	1	0	9/19/15 14:44	71.1683	-163.3160	192	NO	DI	≥120	AH + DR
SISUAQ201588	PWA	1	0	9/19/15 14:14	71.1683	-163.3129	75	LO	LO	≥120	AH + DR
WAVE2015139	PWA	1	0	9/19/15 14:11	71.1647	-163.3226	60	NO	LO	≥120	AH + DR
AIVIQ2015447	GW	1	0	9/20/15 11:08	71.1783	-163.0733	1763	NO	FL	≥120	AH + DR
AIVIQ2015448	US	1	0	9/20/15 12:48	71.1741	-163.0830	150	CD	LO	≥120	AH + DR
AIVIQ2015449	PWA	1	0	9/20/15 16:30	71.1789	-163.0686	400	NO	DI	≥120	AH + DR
AIVIQ2015450	PWA	1	0	9/20/15 17:00	71.1776	-163.0636	950	LO	LO	≥120	AH + DR
FENN2015223	UP	1	0	9/20/15 11:43	71.0535	-163.2884	600	NO	RE	≥120	AH + DR
SISUAQ201589	UP	1	0	9/20/15 11:57	71.1696	-163.3092	4	LO	LO	≥120	AH + DR
SISUAQ201590	UP	1	0	9/20/15 13:08	71.1696	-163.3093	1800	NO	SW	≥120	AH + DR
SISUAQ201591	US	1	0	9/20/15 14:37	71.1696	-163.3095	25	NO	SI	≥120	AH + DR
SISUAQ201592	US	1	0	9/20/15 15:13	71.1696	-163.3093	1284	NO	SW	≥120	AH + DR
SISUAQ201593	US	1	0	9/20/15 15:46	71.1696	-163.3094	999	NO	SW	≥120	AH + DR
SISUAQ201594	US	1	0	9/20/15 16:08	71.1695	-163.3093	1800	NO	DI	≥120	AH + DR
SISUAQ201595	BS	1	0	9/20/15 16:39	71.1695	-163.3094	5	LO	LO	≥120	AH + DR
SISUAQ201596	PWA	1	0	9/20/15 18:47	71.1696	-163.3094	10	LO	LO	≥120	AH + DR
SISUAQ201597	UP	1	0	9/20/15 19:25	71.1696	-163.3095	600	NO	SW	≥120	AH + DR
DISCOV2015107	UW	1	0	9/20/15 11:10	71.1762	-163.0713	3086	NO	TR	≥120	AH + DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
DISCOV2015108	PWA	1	1	9/20/15 14:59	71.1760	-163.0711	100	LO	ST	≥120	AH + DR
DISCOV2015109	SS	1	0	9/20/15 15:51	71.1759	-163.0712	100	LO	LO	≥120	AH + DR
POLAR2015279	BS	1	1	9/20/15 6:18	71.1733	-163.4718	10	NO	OT	≥120	AH + DR
POLAR2015280	SS	1	0	9/20/15 6:59	71.1733	-163.4718	10	NO	RE	≥120	AH + DR
POLAR2015281	US	1	0	9/20/15 16:52	71.1733	-163.4718	200	NO	DI	≥120	AH + DR
MARIKA2015119	RS	1	0	9/20/15 14:22	71.0533	-163.2915	30	LO	LO	≥120	AH + DR
MARIKA2015120	BS	1	0	9/20/15 15:54	71.0531	-163.2911	40	LO	LO	≥120	AH + DR
MARIKA2015121	BS	1	0	9/20/15 16:45	71.0530	-163.2907	20	NO	RE	≥120	AH + DR
MARIKA2015122	BS	1	0	9/20/15 20:40	71.0534	-163.2920	40	NO	RE	≥120	AH + DR
EXPLOR2015262	SS	1	0	9/20/15 9:34	71.1272	-163.0086	80	LO	LO	≥120	AH + DR
EXPLOR2015263	UP	1	0	9/20/15 13:49	71.1244	-162.8314	238	NO	SI	≥120	AH + DR
EXPLOR2015264	PWA	1	0	9/20/15 14:09	71.1241	-162.8679	371	NO	SI	≥120	AH + DR
EXPLOR2015265	UP	1	0	9/20/15 15:41	71.1263	-163.0389	238	NO	SW	≥120	AH + DR
EXPLOR2015266	BS	1	0	9/20/15 15:58	71.1284	-163.0719	50	LO	LO	≥120	AH + DR
EXPLOR2015267	UP	1	0	9/20/15 16:23	71.1319	-163.1171	371	LO	LO	≥120	AH + DR
EXPLOR2015268	US	1	0	9/20/15 16:30	71.1327	-163.1299	238	LO	LO	≥120	AH + DR
EXPLOR2015269	US	1	0	9/20/15 16:31	71.1328	-163.1310	313	NO	SI	≥120	AH + DR
EXPLOR2015270	US	1	0	9/20/15 16:56	71.1363	-163.1759	45	CD	FS	≥120	AH + DR
EXPLOR2015271	UP	1	0	9/20/15 17:05	71.1369	-163.1922	170	LO	DI	≥120	AH + DR
EXPLOR2015273	UP	1	0	9/20/15 20:41	71.1456	-163.5610	192	LO	LO	≥120	AH + DR
EXPLOR2015274	US	1	0	9/20/15 20:48	71.1459	-163.5742	192	NO	DI	≥120	AH + DR
MINER2015153	BS	1	0	9/20/15 13:52	70.6774	-163.2336	50	LO	RE	<120	AH + DR
MINER2015154	UP	1	0	9/20/15 14:53	70.6774	-163.2336	150	NO	DI	<120	AH + DR
MINER2015155	BS	1	0	9/20/15 15:09	70.6773	-163.2338	100	LO	LO	<120	AH + DR
MINER2015156	BS	1	0	9/20/15 16:31	70.6762	-163.2336	300	LO	LO	<120	AH + DR
MINER2015157	BS	2	1	9/20/15 18:12	70.6759	-163.2328	35	LO	LO	<120	AH + DR
MINER2015158	BS	1	0	9/20/15 18:19	70.6759	-163.2326	85	NO	LO	<120	AH + DR
MINER2015159	BS	1	0	9/20/15 19:22	70.6757	-163.2319	85	NO	LO	<120	AH + DR
GUARD2015180	RS	1	0	9/20/15 18:17	71.1246	-163.8810	60	LO	LO	≥120	AH + DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
WIND2015148	UMW	1	0	9/20/15 11:14	71.1768	-163.0638	573	NO	DI	≥120	AH + DR
WIND2015149	BS	1	0	9/20/15 13:16	71.1772	-163.0646	261	NO	SW	≥120	AH + DR
WIND2015150	PWA	1	0	9/20/15 15:00	71.1771	-163.0644	50	LO	SA	≥120	AH + DR
WIND2015151	PWA	1	0	9/20/15 18:51	71.1693	-163.3314	229	NO	DI	≥120	AH + DR
NANUQ2015231	BS	1	0	9/20/15 12:26	71.0499	-163.2965	250	LO	LO	≥120	AH + DR
NANUQ2015232	UMW	1	0	9/20/15 17:53	71.1331	-163.6269	1184	NO	FL	≥120	AH + DR
CHAMP2015250	US	1	0	9/20/15 11:53	71.1728	-163.4911	12	LO	LO	≥120	AH + DR
CHAMP2015251	US	1	0	9/20/15 16:43	71.1728	-163.4908	85	LO	LO	≥120	AH + DR
CHAMP2015252	US	1	0	9/20/15 18:09	71.1728	-163.4905	200	NO	LG	≥120	AH + DR
CHAMP2015253	US	1	0	9/20/15 18:41	71.1727	-163.4906	624	NO	LO	≥120	AH + DR
CHAMP2015254	US	1	0	9/20/15 18:43	71.1727	-163.4907	280	NO	SW	≥120	AH + DR
CHAMP2015255	US	1	0	9/20/15 18:51	71.1726	-163.4903	70	NO	DI	≥120	AH + DR
CHAMP2015256	US	1	0	9/20/15 19:42	71.1716	-163.4775	1800	NO	DI	≥120	AH + DR
TORVIK2015299	UW	1	0	9/20/15 11:23	71.1776	-163.0785	500	NO	BL	≥120	AH + DR
TORVIK2015300	US	1	0	9/20/15 13:06	71.1816	-163.0867	400	LO	LO	≥120	AH + DR
TORVIK2015301	PWA	1	0	9/20/15 15:01	71.1813	-163.0910	600	NO	SW	≥120	AH + DR
TORVIK2015302	PWA	1	0	9/20/15 16:21	71.1813	-163.0909	50	NO	SW	≥120	AH + DR
TORVIK2015303	US	1	0	9/20/15 16:49	71.1813	-163.0910	100	NO	FB	≥120	AH + DR
TORVIK2015304	PWA	1	0	9/20/15 17:16	71.1813	-163.0908	50	NO	ST	≥120	AH + DR
GUARD2015181	BS	1	0	9/21/15 19:04	71.0079	-163.8220	50	LO	LO	≥120	DR
AIVIQ2015451	BS	1	0	9/21/15 10:07	71.1572	-163.1470	275	LO	FB	≥120	DR
AIVIQ2015452	PWA	1	0	9/21/15 14:26	71.0513	-163.3093	5	LO	LO	≥120	DR
AIVIQ2015453	PWA	1	0	9/21/15 19:45	71.0552	-163.2897	175	NO	DI	≥120	DR
TORVIK2015305	PWA	1	0	9/21/15 10:00	71.0544	-163.2901	65	LO	LO	≥120	DR
TORVIK2015306	PWA	1	0	9/21/15 11:07	71.0547	-163.2902	500	LO	TR	≥120	DR
TORVIK2015307	PWA	1	0	9/21/15 11:21	71.0547	-163.2902	769	LO	FB	≥120	DR
TORVIK2015308	PWA	1	0	9/21/15 11:36	71.0548	-163.2901	30	CD	LO	≥120	DR
TORVIK2015309	US	1	0	9/21/15 20:31	71.1347	-163.0925	150	NO	SA	≥120	DR
SISUAQ201598	RS	1	0	9/21/15 17:10	71.1697	-163.3077	6	LO	LO	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
SISUAQ201599	US	1	0	9/21/15 18:35	71.1790	-163.1164	350	NO	RE	≥120	DR
SISUAQ2015100	BS	1	0	9/21/15 19:37	71.1735	-163.0891	300	NO	RE	≥120	DR
FENN2015224	US	1	0	9/21/15 17:17	71.1007	-163.1004	250	NO	SW	≥120	DR
POLAR2015282	SS	1	0	9/21/15 0:29	71.1733	-163.4718	35	NO	RE	≥120	DR
POLAR2015283	SS	1	0	9/21/15 5:47	71.1733	-163.4718	15	NO	RE	≥120	DR
POLAR2015284	BS	1	1	9/21/15 6:02	71.1733	-163.4718	10	LO	OT	≥120	DR
WIND2015152	PWA	1	0	9/21/15 11:40	71.0489	-163.5632	441	LO	LO	≥120	DR
WIND2015153	PWA	1	0	9/21/15 17:55	71.1569	-163.6698	20	NO	SI	≥120	DR
CHAMP2015258	BS	1	0	9/21/15 18:39	71.1738	-163.0790	70	NO	LG	≥120	DR
WAVE2015140	US	1	0	9/21/15 11:11	71.1015	-163.6724	100	LO	LO	≥120	DR
WAVE2015141	PWA	1	0	9/21/15 13:50	71.1034	-163.7168	358	NO	TR	≥120	DR
DISCOV2015110	US	1	0	9/21/15 11:35	71.1761	-163.0712	75	LO	TR	≥120	DR
DISCOV2015111	BS	1	0	9/21/15 12:03	71.1759	-163.0712	20	LO	SA	≥120	DR
MARIKA2015123	PWA	2	0	9/21/15 11:09	71.0549	-163.2935	200	LO	ST	≥120	DR
MARIKA2015124	PWA	1	0	9/21/15 12:19	71.0549	-163.2934	5	LO	MI	≥120	DR
NANUQ2015233	PWA	2	0	9/21/15 11:05	71.0543	-163.3041	140	NO	ST	≥120	DR
NANUQ2015234	PWA	1	1	9/21/15 11:50	71.0557	-163.3045	10	LO	ST	≥120	DR
NANUQ2015235	PWA	2	0	9/21/15 11:57	71.0563	-163.3049	339	LO	LO	≥120	DR
NANUQ2015236	PWA	1	0	9/21/15 14:06	71.0562	-163.3050	835	CD	LO	≥120	DR
NANUQ2015237	PWA	1	0	9/21/15 17:50	71.0589	-163.3014	500	LO	LO	≥120	DR
MINER2015160	SS	1	0	9/21/15 9:58	70.6770	-163.2337	75	LO	LO	<120	DR
MINER2015161	BS	1	0	9/21/15 11:19	70.6772	-163.2339	35	LO	LO	<120	DR
MINER2015162	BS	1	0	9/21/15 14:09	70.6781	-163.2329	80	LO	SW	<120	DR
MINER2015163	SS	1	0	9/21/15 14:30	70.6777	-163.2335	70	NO	SW	<120	DR
MINER2015164	BS	1	0	9/21/15 14:41	70.6778	-163.2332	50	LO	LO	<120	DR
MINER2015165	SS	1	0	9/21/15 14:57	70.6778	-163.2332	120	LO	LO	<120	DR
MINER2015166	SS	1	0	9/21/15 15:48	70.6772	-163.2339	20	NO	SW	<120	DR
MINER2015167	BS	1	0	9/21/15 16:07	70.6772	-163.2341	200	LO	LO	<120	DR
MINER2015168	US	1	0	9/21/15 17:36	70.6765	-163.2339	90	NO	DI	<120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
MINER2015169	SS	1	0	9/21/15 18:28	70.6769	-163.2336	100	NO	LO	<120	DR
MINER2015170	US	1	0	9/21/15 21:19	70.6772	-163.2338	70	LO	LO	<120	DR
GUARD2015182	BS	1	1	9/22/15 9:25	70.8765	-163.7651	30	NO	ST	<120	DR
GUARD2015183	BS	1	0	9/22/15 13:48	71.2063	-163.8227	250	NO	DI	≥120	DR
TORVIK2015310	US	1	0	9/22/15 17:04	71.1350	-163.0901	100	NO	FB	≥120	DR
AIVIQ2015454	BS	1	0	9/22/15 17:16	71.1722	-163.4712	225	NO	PO	≥120	DR
EXPLOR2015275	US	1	0	9/22/15 12:01	71.1914	-163.5218	30	LO	LO	≥120	DR
EXPLOR2015276	BS	1	0	9/22/15 14:11	71.2044	-163.4507	80	LO	TR	≥120	DR
EXPLOR2015277	BS	1	0	9/22/15 16:21	71.2247	-163.3838	140	LO	TR	≥120	DR
POLAR2015285	BS	1	0	9/22/15 9:13	71.1733	-163.4718	7	LO	LO	≥120	DR
POLAR2015286	BS	1	0	9/22/15 19:48	71.1733	-163.4718	25	LO	LO	≥120	DR
NANUQ2015238	PWA	1	0	9/22/15 7:50	71.1666	-163.4970	80	NO	DI	≥120	DR
NANUQ2015239	BS	1	0	9/22/15 10:36	71.1768	-163.4807	70	NO	DI	≥120	DR
NANUQ2015240	RS	1	0	9/22/15 14:24	71.1767	-163.4810	20	LO	LO	≥120	DR
NANUQ2015241	BS	1	0	9/22/15 16:58	71.1768	-163.4812	50	LO	LO	≥120	DR
NANUQ2015242	SS	1	0	9/22/15 18:31	71.1292	-163.4851	100	LO	DI	≥120	DR
NANUQ2015243	US	1	0	9/22/15 20:41	71.1558	-163.7013	444	NO	ST	≥120	DR
ROSS2015237	UNK	1	0	9/22/15 10:02	68.7773	-167.7224	200	NO	U	<120	DR
ROSS2015238	US	1	0	9/22/15 16:02	69.6623	-166.4974	150	NO	SW	<120	DR
ROSS2015239	US	1	0	9/22/15 19:44	70.2161	-165.3558	5	LO	DI	<120	DR
ROSS2015240	US	1	0	9/22/15 19:49	70.2292	-165.3317	120	LO	LO	<120	DR
ROSS2015241	US	1	0	9/22/15 20:33	70.3411	-165.0921	20	SP	TH	<120	DR
ROSS2015242	US	1	0	9/22/15 20:59	70.4094	-164.9589	200	NO	TH	≥120	DR
WAVE2015142	SS	1	0	9/22/15 15:53	71.1952	-163.6294	358	NO	DI	≥120	DR
DISCOV2015113	BS	1	0	9/22/15 15:15	71.1755	-163.0730	75	LO	TR	≥120	DR
DISCOV2015114	BS	1	0	9/22/15 17:37	71.1756	-163.0730	494	NO	DI	≥120	DR
DISCOV2015115	SS	1	0	9/22/15 18:07	71.1756	-163.0730	100	NO	DI	≥120	DR
DISCOV2015116	KW	9	4	9/22/15 18:31	71.1756	-163.0730	1000	NO	MI	≥120	DR
DISCOV2015117	BS	1	0	9/22/15 19:18	71.1756	-163.0730	50	LO	DI	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
MINER2015171	BS	1	0	9/22/15 9:14	70.6788	-163.2242	86	LO	SW	<120	DR
MINER2015172	SS	1	0	9/22/15 13:39	70.6784	-163.2223	60	NO	SW	<120	DR
MINER2015173	BS	1	0	9/22/15 18:01	70.6793	-163.2262	80	LO	LO	<120	DR
MINER2015174	SS	1	0	9/22/15 18:54	70.6792	-163.2250	30	NO	OT	<120	DR
MINER2015175	SS	1	0	9/22/15 18:59	70.6793	-163.2249	45	LO	SW	<120	DR
MINER2015176	BS	1	1	9/22/15 20:54	70.6792	-163.2286	50	LO	LO	<120	DR
CHAMP2015259	US	1	0	9/22/15 14:52	71.1573	-163.4507	15	LO	DI	≥120	DR
CHAMP2015260	BS	1	0	9/22/15 19:39	71.1742	-163.4711	20	CD	DI	≥120	DR
CHAMP2015261	US	1	0	9/22/15 19:54	71.1742	-163.4711	30	CD	DI	≥120	DR
CHAMP2015263	UP	1	0	9/22/15 22:11	71.1775	-163.4754	90	NO	LO	≥120	DR
WIND2015154	US	1	0	9/22/15 18:12	71.1329	-163.6264	49	LO	LO	≥120	DR
ROSS2015243	SS	1	0	9/23/15 14:47	70.9593	-163.8633	50	LO	LO	<120	RVA
EXPLOR2015279	BS	1	0	9/23/15 13:03	71.3248	-163.9059	50	NO	SW	<120	RVA
EXPLOR2015280	BS	1	0	9/23/15 13:44	71.3474	-163.9705	139	NO	SW	<120	RVA
EXPLOR2015281	BS	1	0	9/23/15 19:03	71.5277	-164.4712	30	SP	TH	≥120	RVA
EXPLOR2015282	BS	1	0	9/23/15 20:13	71.5020	-164.3609	50	LO	LO	<120	RVA
POLAR2015287	US	1	0	9/23/15 3:25	71.1733	-163.4718	30	NO	RE	≥120	RVA
POLAR2015292	BS	1	0	9/23/15 13:41	71.1733	-163.4718	20	LO	LO	≥120	RVA
POLAR2015293	BS	1	0	9/23/15 18:46	71.1733	-163.4718	25	NO	RE	≥120	RVA
POLAR2015294	US	1	0	9/23/15 21:27	71.1733	-163.4718	30	NO	DI	≥120	RVA
DISCOV2015120	BS	1	0	9/23/15 19:26	71.1755	-163.0718	338	LO	LO	≥120	RVA
MINER2015178	SS	1	0	9/23/15 14:15	70.4976	-164.2453	250	LO	LO	<120	RVA
FENN2015225	BS	1	0	9/24/15 18:06	70.9234	-163.0473	100	NO	DI	<120	RVA
EXPLOR2015283	US	1	0	9/24/15 12:55	71.0743	-163.5771	50	NO	SW	≥120	RVA
EXPLOR2015284	US	1	0	9/24/15 15:16	71.1820	-163.4003	200	NO	SW	≥120	RVA
POLAR2015295	US	1	0	9/24/15 0:23	71.1733	-163.4718	50	NO	RE	≥120	RVA
POLAR2015296	US	1	0	9/24/15 1:16	71.1733	-163.4718	40	NO	RE	≥120	RVA
POLAR2015297	BS	1	1	9/24/15 16:02	71.1733	-163.4718	20	LO	LO	≥120	RVA
NORD2015270	US	1	0	9/24/15 10:56	70.6310	-160.5926	400	LO	LO	≥120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NORD2015271	BS	1	0	9/24/15 17:25	70.6327	-160.5947	200	LO	LO	≥120	RVA
NORD2015272	BS	1	0	9/24/15 17:26	70.6327	-160.5947	250	NO	SW	≥120	RVA
NORD2015274	US	1	0	9/24/15 19:27	70.6325	-160.5942	150	LO	LO	≥120	RVA
NORD2015273	BS	1	0	9/24/15 19:27	70.6325	-160.5942	250	LO	LO	≥120	RVA
CHAMP2015264	UP	1	0	9/24/15 10:46	71.1779	-163.4750	100	NO	DI	≥120	RVA
GUARD2015184	HP	1	0	9/25/15 19:20	70.5534	-163.4280	20	NO	PO	<120	RVA
EXPLOR2015285	SS	1	0	9/25/15 8:35	71.1365	-163.4304	60	LO	SW	≥120	RVA
TORVIK2015311	BS	1	0	9/25/15 18:54	70.6743	-160.7575	30	LO	SA	≥120	RVA
TORVIK2015312	BS	1	0	9/25/15 19:19	70.6532	-160.6941	175	LO	SA	≥120	RVA
ROSS2015244	US	1	0	9/25/15 15:22	70.6336	-160.5814	900	NO	SW	≥120	RVA
NANUQ2015244	PWA	1	0	9/25/15 9:30	71.1642	-163.2640	339	NO	SA	≥120	RVA
NANUQ2015245	US	1	0	9/25/15 12:55	71.1164	-163.1311	100	NO	DI	≥120	RVA
SPIRIT201593	PWA	1	0	9/25/15 9:49	70.0221	-165.6075	75	LO	LO	<120	RVA
SPIRIT201594	PWA	1	0	9/25/15 9:52	70.0295	-165.5908	75	NO	LO	<120	RVA
NORD2015275	BS	1	0	9/25/15 9:30	70.6324	-160.5988	20	LO	LO	≥120	RVA
NORD2015276	US	1	0	9/25/15 10:17	70.6323	-160.5989	200	LO	LO	≥120	RVA
WAVE2015143	UP	1	0	9/25/15 16:55	71.0665	-163.1206	200	NO	SW	≥120	RVA
POLAR2015298	BS	1	0	9/25/15 12:10	71.1733	-163.4718	50	NO	DI	≥120	RVA
TORVIK2015316	SS	1	0	9/26/15 20:25	71.1330	-163.0613	150	NO	DI	≥120	RVA
TORVIK2015317	US	1	0	9/26/15 20:45	71.1330	-163.0614	100	NO	LO	≥120	RVA
EXPLOR2015286	BS	1	0	9/26/15 11:42	71.2673	-163.7627	212	LO	LO	<120	RVA
EXPLOR2015287	UP	1	0	9/26/15 13:06	71.1824	-163.6114	516	NO	DI	≥120	RVA
EXPLOR2015288	UP	1	0	9/26/15 13:39	71.1638	-163.5777	238	NO	DI	≥120	RVA
NANUQ2015247	US	1	0	9/26/15 14:23	71.1223	-162.9734	100	LO	LO	≥120	RVA
MARIKA2015125	US	1	0	9/26/15 16:05	71.0524	-163.2822	45	LO	LO	≥120	RVA
MARIKA2015126	BS	1	0	9/26/15 18:18	71.0527	-163.2817	100	CD	SA	≥120	RVA
SPIRIT201595	UP	1	0	9/26/15 21:24	71.1702	-163.0960	50	NO	RE	≥120	RVA
DISCOV2015122	BS	1	1	9/26/15 10:30	71.1764	-163.0732	50	LO	LO	≥120	RVA
DISCOV2015123	BS	1	0	9/26/15 14:05	71.1764	-163.0732	75	LO	LO	≥120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
DISCOV2015124	US	1	0	9/26/15 17:40	71.1765	-163.0732	25	NO	DI	≥120	RVA
WIND2015155	UP	1	0	9/26/15 17:16	71.2533	-163.6113	441	NO	SI	≥120	RVA
WIND2015156	BS	1	0	9/26/15 17:35	71.2635	-163.6099	216	LO	LO	≥120	RVA
NORD2015277	US	1	0	9/26/15 11:55	70.9355	-162.1522	15	SP	DI	<120	RVA
WAVE2015144	RS	1	0	9/26/15 10:27	71.1400	-163.1142	100	LO	SW	≥120	RVA
WAVE2015145	RS	1	0	9/26/15 16:23	71.1268	-163.1384	40	LO	LO	≥120	RVA
WAVE2015146	RS	1	0	9/26/15 17:43	71.0958	-163.1391	45	LO	LO	≥120	RVA
MINER2015179	HP	1	0	9/26/15 10:23	70.6623	-163.2088	100	NO	SW	<120	RVA
MINER2015180	US	1	0	9/26/15 12:12	70.6622	-163.2086	80	LO	RE	<120	RVA
MINER2015181	RS	1	0	9/26/15 12:59	70.6624	-163.2086	50	LO	LO	<120	RVA
MINER2015182	BS	1	1	9/26/15 13:12	70.6622	-163.2095	40	LO	SW	<120	RVA
MINER2015183	BS	1	0	9/26/15 16:04	70.6626	-163.2077	150	LO	LO	<120	RVA
GUARD2015185	US	1	0	9/26/15 15:28	70.6800	-163.6017	75	NO	SW	<120	RVA
GUARD2015186	BS	1	0	9/26/15 18:17	70.8848	-163.5952	50	LO	LO	<120	RVA
CHAMP2015266	US	1	0	9/26/15 12:58	71.1380	-163.3551	576	NO	DI	≥120	RVA
CHAMP2015267	US	1	0	9/26/15 13:14	71.1432	-163.3732	100	LO	LO	≥120	RVA
CHAMP2015268	US	1	0	9/26/15 14:05	71.1499	-163.3987	100	LO	LO	≥120	RVA
CHAMP2015269	UP	1	0	9/26/15 14:14	71.1497	-163.3993	393	LO	LO	≥120	RVA
CHAMP2015271	UP	1	0	9/26/15 15:55	70.9716	-163.6044	200	LO	LO	<120	RVA
CHAMP2015272	PWA	1	0	9/26/15 16:55	70.8362	-163.7948	800	LO	LO	<120	RVA
CHAMP2015273	US	1	0	9/26/15 17:16	70.7923	-163.8782	100	LO	LO	<120	RVA
CHAMP2015274	UP	1	0	9/26/15 17:48	70.7247	-163.9992	200	LO	LO	<120	RVA
CHAMP2015275	US	1	0	9/26/15 18:24	70.6464	-164.1386	576	LO	LO	<120	RVA
CHAMP2015276	US	1	0	9/26/15 18:44	70.6031	-164.2152	356	NO	LO	<120	RVA
CHAMP2015277	US	1	0	9/26/15 18:47	70.5977	-164.2251	440	LO	LO	<120	RVA
CHAMP2015278	US	1	0	9/26/15 18:50	70.5914	-164.2365	450	NO	LG	<120	RVA
CHAMP2015279	PWA	3	1	9/26/15 18:53	70.5838	-164.2505	95	IS	DI	<120	RVA
SISUAQ2015101	US	1	0	9/26/15 15:54	71.1715	-163.2896	300	NO	SW	≥120	RVA
ROSS2015245	US	1	0	9/26/15 11:34	70.9941	-162.2177	350	NO	SW	<120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NANUQ2015248	US	1	0	9/27/15 20:18	71.2190	-163.1221	20	LO	LO	≥120	RVA
AIVIQ2015456	PWA	1	0	9/27/15 19:07	71.1759	-163.0706	275	LO	LO	≥120	RVA
MINER2015184	BS	1	0	9/27/15 11:33	70.6660	-163.2064	87	NO	SW	<120	RVA
MINER2015185	BS	1	0	9/27/15 14:50	70.6668	-163.2124	150	NO	SW	<120	RVA
MINER2015186	US	1	0	9/27/15 20:36	70.6661	-163.2143	100	NO	LO	<120	RVA
FENN2015226	US	1	0	9/27/15 11:48	71.1326	-162.9204	50	LO	MI	≥120	RVA
POLAR2015300	US	1	0	9/27/15 6:47	71.1733	-163.4718	40	NO	RE	≥120	RVA
POLAR2015301	BS	1	0	9/27/15 12:47	71.1733	-163.4718	20	LO	LO	≥120	RVA
EXPLOR2015291	UP	1	0	9/27/15 17:37	71.1696	-163.3713	50	NO	SW	≥120	RVA
EXPLOR2015292	US	1	0	9/27/15 17:49	71.1743	-163.3976	250	NO	LO	≥120	RVA
GUARD2015187	PWA	2	1	9/28/15 8:40	71.0321	-162.8860	500	LO	LO	≥120	RVA
NANUQ2015250	PWA	2	1	9/28/15 12:08	71.0567	-163.2657	10	LO	TR	≥120	RVA
POLAR2015302	UP	1	0	9/28/15 0:56	71.1733	-163.4718	55	NO	SW	≥120	RVA
POLAR2015303	US	1	0	9/28/15 2:22	71.1733	-163.4718	60	NO	DI	≥120	RVA
POLAR2015304	US	1	0	9/28/15 2:58	71.1733	-163.4718	30	NO	RE	≥120	RVA
POLAR2015305	US	1	0	9/28/15 5:54	71.1733	-163.4718	200	NO	DI	≥120	RVA
AIVIQ2015457	BS	1	0	9/28/15 9:13	71.0546	-163.2827	75	LO	LO	≥120	RVA
EXPLOR2015293	BS	1	0	9/28/15 15:18	71.1797	-163.4668	50	LO	LO	≥120	RVA
NORD2015278	US	1	0	9/28/15 8:21	71.1500	-163.1494	10	NO	SW	≥120	RVA
FENN2015228	PWA	1	1	9/28/15 10:25	71.1756	-163.1021	10	LO	MI	≥120	RVA
DISCOV2015125	PWA	1	1	9/28/15 6:02	71.1763	-163.0734	0	NO	RE	≥120	RVA
DISCOV2015126	RS	1	0	9/28/15 10:29	71.1764	-163.0733	50	LO	TR	≥120	RVA
SPIRIT201596	UP	1	0	9/29/15 21:28	71.1297	-163.0964	75	NO	RE	≥120	RVA
NORD2015279	PWA	1	1	9/29/15 18:18	71.1508	-163.1504	2	LO	RE	≥120	RVA
NORD2015280	PWA	1	0	9/30/15 17:54	71.1497	-163.1432	200	NO	SW	≥120	RVA
NORD2015281	PWA	1	1	9/30/15 18:08	71.1496	-163.1442	100	NO	RE	≥120	RVA
EXPLOR2015294	US	1	0	9/30/15 13:52	71.1680	-163.4571	50	NO	SW	≥120	RVA
EXPLOR2015295	US	1	0	9/30/15 16:04	71.1660	-163.4934	50	NO	DI	≥120	RVA
WAVE2015149	BS	1	0	9/30/15 11:52	71.1499	-163.2248	150	NO	DI	≥120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
POLAR2015306	BS	1	0	9/30/15 15:00	71.1733	-163.4718	35	NO	DI	≥120	RVA
ROSS2015247	BS	1	0	9/30/15 19:58	71.2499	-163.1689	200	SP	LO	≥120	RVA
SUPPORT2015226	SS	1	0	9/30/15 10:55	71.1700	-163.4617	245	LO	SW	≥120	RVA
NANUQ2015251	US	1	0	10/1/15 14:38	71.1431	-163.6291	250	NO	TR	≥120	AH
TORVIK2015319	BS	1	0	10/1/15 19:47	71.1764	-163.4609	50	LO	SA	≥120	AH
AIVIQ2015459	BS	1	0	10/1/15 9:39	71.1485	-163.1914	500	LO	LO	≥120	AH
AIVIQ2015458	PWA	2	0	10/1/15 9:41	71.1473	-163.1855	800	LO	LO	≥120	AH
POLAR2015307	US	1	0	10/1/15 0:20	71.1733	-163.4718	30	NO	RE	≥120	AH
POLAR2015308	BS	1	0	10/1/15 0:57	71.1733	-163.4718	20	LO	LO	≥120	AH
POLAR2015309	US	1	0	10/1/15 2:50	71.1733	-163.4718	12	NO	RE	≥120	AH
POLAR2015310	BS	1	0	10/1/15 8:52	71.1733	-163.4718	15	LO	LO	≥120	AH
DISCOV2015129	RS	1	0	10/1/15 17:02	71.1761	-163.0738	50	LO	LO	≥120	AH
FENN2015230	UMW	1	0	10/2/15 12:26	71.2719	-162.5795	3273	NO	BL	<120	AH
FENN2015231	PWA	9	1	10/2/15 17:58	71.5287	-163.8965	100	SP	TR	≥120	AH
FENN2015232	BS	1	0	10/2/15 19:03	71.6086	-164.4757	100	LO	LO	<120	AH
AIVIQ2015460	BS	1	0	10/2/15 8:27	71.1738	-163.0718	200	NO	DI	≥120	AH
ROSS2015249	US	1	0	10/2/15 16:21	71.1758	-163.0775	805	NO	SW	≥120	AH
POLAR2015311	BS	1	0	10/2/15 5:57	71.1733	-163.4718	60	NO	RE	≥120	AH
POLAR2015312	US	1	0	10/2/15 7:37	71.1733	-163.4718	15	NO	RE	≥120	AH
POLAR2015313	BS	1	0	10/2/15 8:21	71.1733	-163.4718	35	NO	RE	≥120	AH
POLAR2015314	US	1	0	10/2/15 11:00	71.1733	-163.4718	100	NO	DI	≥120	AH
POLAR2015315	US	1	0	10/2/15 12:57	71.1733	-163.4718	30	LO	LO	≥120	AH
EXPLOR2015297	US	1	0	10/2/15 9:46	71.1886	-163.4790	20	LO	LO	≥120	AH
EXPLOR2015298	US	1	0	10/2/15 17:39	71.1679	-163.2922	50	LO	LO	≥120	AH
NORD2015283	BS	1	0	10/2/15 16:52	71.1485	-163.1391	150	NO	LO	≥120	AH
NORD2015284	BS	1	0	10/2/15 18:00	71.1485	-163.1391	90	LO	LO	≥120	AH
WAVE2015150	RS	1	0	10/2/15 16:58	71.1097	-163.5587	100	LO	LO	≥120	AH
FENN2015234	US	1	0	10/3/15 14:42	71.0276	-163.3203	200	SP	TH	≥120	AH
FENN2015235	US	1	0	10/3/15 15:05	71.0460	-163.5378	100	SP	TH	≥120	AH

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FENN2015237	PWA	1	0	10/3/15 18:26	70.9801	-164.9534	500	NO	SI	<120	AH
MARIKA2015128	HP	1	0	10/3/15 12:42	71.0500	-163.2946	30	NO	DI	≥120	AH
MARIKA2015129	BS	1	0	10/3/15 15:08	71.0498	-163.2948	50	LO	LO	≥120	AH
MARIKA2015130	RS	1	0	10/3/15 15:51	71.0500	-163.2947	30	LO	LO	≥120	AH
MARIKA2015131	US	1	0	10/3/15 17:38	71.0497	-163.2945	50	NO	SI	≥120	AH
POLAR2015316	BS	1	0	10/3/15 10:52	71.1733	-163.4718	5	NO	RE	≥120	AH
NORD2015287	BS	1	0	10/3/15 20:15	71.1483	-163.1398	50	LO	LO	≥120	AH
SUPPORT2015228	RS	1	0	10/3/15 15:40	71.1650	-163.2939	40	NO	FB	≥120	AH
SUPPORT2015229	SS	1	0	10/3/15 16:24	71.1650	-163.2939	150	LO	LO	≥120	AH
SUPPORT2015230	SS	1	0	10/3/15 16:39	71.1650	-163.2940	300	LO	LO	≥120	AH
ROSS2015250	BS	1	0	10/4/15 12:30	71.1705	-163.4851	100	SP	LO	≥120	AH
POLAR2015317	UP	1	0	10/4/15 3:47	71.1733	-163.4718	100	NO	DI	≥120	AH
EXPLOR2015299	US	1	0	10/4/15 14:15	71.1444	-163.4924	30	NO	SW	≥120	AH
EXPLOR2015300	US	1	0	10/4/15 20:14	71.1669	-163.5596	50	LO	LO	≥120	AH
NORD2015288	US	1	0	10/4/15 13:48	71.1543	-163.1190	100	NO	LO	≥120	AH
FENN2015238	PWA	2	1	10/5/15 8:58	71.1560	-163.1039	5	CD	SW	≥120	RVA
MARIKA2015132	RS	1	0	10/5/15 17:18	71.0513	-163.3005	5	NO	DI	<120	RVA
MARIKA2015133	BS	1	0	10/5/15 17:58	71.0515	-163.3003	5	LO	LO	<120	RVA
EXPLOR2015301	US	1	0	10/5/15 17:12	71.1512	-163.1467	50	LO	LO	≥120	RVA
EXPLOR2015302	US	1	0	10/5/15 17:21	71.1463	-163.1571	20	NO	SW	≥120	RVA
EXPLOR2015303	US	1	0	10/5/15 17:37	71.1373	-163.1146	10	NO	SW	≥120	RVA
EXPLOR2015304	US	1	0	10/5/15 17:53	71.1283	-163.0686	75	LO	LO	≥120	RVA
EXPLOR2015305	US	1	0	10/7/15 18:45	70.8092	-159.9239	100	NO	DI	≥120	RVA
FENN2015239	UMW	1	0	10/7/15 9:34	71.3628	-156.9454	400	NO	BL	<120	RVA
FENN2015240	US	1	0	10/7/15 13:04	71.3643	-157.3921	30	NO	SW	<120	RVA
FENN2015241	US	1	0	10/7/15 13:49	71.3593	-157.4424	120	LO	SW	<120	RVA
FENN2015242	UMW	3	0	10/7/15 17:14	71.4317	-157.4760	1000	NO	BL	<120	RVA
FENN2015243	UMW	5	1	10/7/15 17:29	71.4717	-157.5032	3273	NO	BL	<120	RVA
SISUAQ2015102	US	1	0	10/7/15 13:17	70.6962	-160.3206	45	NO	SW	<120	RVA

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NORD2015289	US	1	0	10/7/15 19:16	71.1738	-163.4704	100	LO	LO	≥120	RVA
FENN2015244	PWA	2	1	10/8/15 11:13	70.8517	-164.1868	75	IS	TH	<120	RVA
MARIKA2015136	US	1	0	10/8/15 13:43	71.0508	-163.2998	100	CD	DI	<120	RVA
MARIKA2015137	US	1	0	10/8/15 16:48	71.0502	-163.2989	80	LO	LO	<120	RVA
EXPLOR2015306	UP	1	0	10/8/15 10:45	70.8123	-160.0636	313	LO	LO	≥120	RVA
EXPLOR2015307	US	1	0	10/8/15 11:19	70.8109	-160.0200	192	LO	LO	≥120	RVA
EXPLOR2015308	PWA	1	0	10/8/15 12:21	70.8077	-159.9354	250	NO	LO	≥120	RVA
EXPLOR2015309	US	1	0	10/8/15 14:51	70.8111	-160.0486	100	LO	LO	≥120	RVA
EXPLOR2015310	SS	1	0	10/8/15 16:46	70.8095	-160.0255	50	LO	LO	≥120	RVA
EXPLOR2015311	BS	1	0	10/8/15 17:09	70.8118	-160.1178	161	LO	LO	≥120	RVA
EXPLOR2015312	SS	1	0	10/8/15 17:15	70.8125	-160.1362	20	NO	SW	≥120	RVA
EXPLOR2015313	US	1	0	10/8/15 19:44	70.8102	-159.9897	50	NO	SI	≥120	RVA
NANUQ2015254	PWA	2	1	10/8/15 10:51	71.1221	-162.9636	140	NO	SW	<120	RVA
NANUQ2015255	RS	1	0	10/8/15 12:07	71.1179	-163.2525	50	SP	LO	<120	RVA
NANUQ2015256	US	1	0	10/8/15 13:37	71.1131	-163.5929	20	SP	FB	<120	RVA
NANUQ2015257	US	1	0	10/8/15 14:07	71.1119	-163.7117	50	LO	TR	<120	RVA
NANUQ2015258	US	1	0	10/8/15 14:28	71.1111	-163.7902	55	NO	LO	<120	RVA
NANUQ2015261	US	1	0	10/8/15 17:51	71.0873	-163.5697	40	SP	DI	<120	RVA
NANUQ2015262	BHW	1	1	10/8/15 18:21	71.0748	-163.3722	20	NO	DE	<120	RVA
SISUAQ2015103	US	1	0	10/8/15 16:29	71.0307	-162.0166	15	SP	TR	<120	RVA
NORD2015290	PWA	2	0	10/8/15 9:43	71.1749	-163.4705	100	LO	LO	≥120	RVA
NORD2015291	BS	1	0	10/8/15 12:51	71.1749	-163.4706	50	LO	LO	≥120	RVA
NORD2015292	BS	1	0	10/8/15 13:21	71.1748	-163.4707	20	NO	LO	≥120	RVA
NORD2015293	BS	1	0	10/8/15 16:39	71.1748	-163.4707	100	LO	LO	≥120	RVA
NORD2015294	US	1	0	10/8/15 17:44	71.1748	-163.4707	25	LO	OT	≥120	RVA
NORD2015295	PWA	1	0	10/8/15 18:02	71.1748	-163.4704	5	LO	LO	≥120	RVA
NORD2015296	SS	1	0	10/8/15 18:29	71.1750	-163.4704	300	LO	LO	≥120	RVA
MARIKA2015139	UP	1	0	10/9/15 17:04	71.0507	-163.2997	220	NO	LO	<120	RVA
NORD2015299	PWA	1	1	10/9/15 11:03	71.1808	-163.0673	4	LO	LO	≥120	RVA

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NORD2015301	US	1	0	10/9/15 18:08	71.0375	-163.5516	475	LO	LO	<120	RVA
SISUAQ2015105	US	1	0	10/9/15 13:45	70.8116	-159.9544	300	NO	RE	≥120	RVA
EXPLOR2015314	US	1	0	10/9/15 11:57	70.8100	-159.9699	149	LO	LO	≥120	RVA
EXPLOR2015315	US	1	0	10/9/15 12:46	70.8235	-160.1066	50	NO	FB	≥120	RVA
EXPLOR2015316	US	1	0	10/9/15 13:12	70.8444	-160.2817	60	NO	LO	<120	RVA
EXPLOR2015317	US	1	0	10/9/15 14:02	70.8834	-160.6185	10	SP	TH	<120	RVA
EXPLOR2015318	UMW	2	0	10/9/15 14:28	70.9018	-160.7895	200	NO	BR	<120	RVA
EXPLOR2015319	US	1	0	10/9/15 14:29	70.9025	-160.7962	150	NO	LO	<120	RVA
EXPLOR2015320	US	1	0	10/9/15 14:52	70.9163	-160.9327	200	LO	LO	<120	RVA
EXPLOR2015321	RS	1	0	10/9/15 15:38	70.9486	-161.2171	50	LO	LO	<120	RVA
EXPLOR2015323	UP	1	0	10/9/15 17:04	71.0116	-161.7807	50	LO	LO	<120	RVA
EXPLOR2015324	PWA	1	0	10/9/15 17:24	71.0244	-161.9096	30	NO	SW	<120	RVA
EXPLOR2015325	US	1	0	10/9/15 17:28	71.0271	-161.9383	20	NO	DI	<120	RVA
EXPLOR2015326	US	1	0	10/9/15 17:32	71.0296	-161.9656	20	LO	FB	<120	RVA
EXPLOR2015328	US	1	0	10/9/15 17:41	71.0350	-162.0238	50	LO	FB	<120	RVA
EXPLOR2015329	PWA	2	0	10/9/15 19:17	71.0952	-162.6638	30	NO	TR	<120	RVA
EXPLOR2015330	PWA	1	0	10/9/15 19:25	71.1003	-162.7166	30	NO	DI	<120	RVA
EXPLOR2015331	PWA	2	1	10/9/15 19:31	71.1039	-162.7570	50	NO	MI	<120	RVA
CHAMP2015382	US	1	0	10/9/15 12:51	70.6913	-161.6926	50	NO	ST	<120	RVA
NANUQ2015263	PWA	1	0	10/10/15 14:56	70.8155	-159.9511	175	NO	TR	≥120	RVA
FENN2015245	SS	1	0	10/10/15 13:00	69.4652	-168.0039	50	LO	LO	<120	RVA
MARIKA2015140	UP	1	0	10/10/15 14:29	71.0507	-163.3000	20	NO	SI	<120	RVA
CHAMP2015383	PWA	2	1	10/10/15 14:01	70.8117	-159.9875	200	LO	ST	≥120	RVA
CHAMP2015384	US	1	0	10/10/15 15:15	70.8136	-159.9861	350	NO	LO	≥120	RVA
CHAMP2015385	PWA	1	1	10/10/15 19:32	70.8155	-159.9934	25	LO	LO	≥120	RVA
FENN2015246	UNK	1	0	10/11/15 13:05	69.3070	-167.2755	250	NO	DI	<120	RVA
FENN2015247	PWA	1	0	10/11/15 13:48	69.2135	-167.0021	25	LO	LO	<120	RVA
FENN2015248	PWA	1	0	10/11/15 17:08	69.0548	-166.4996	200	LO	RE	<120	RVA
FENN2015249	PWA	1	1	10/11/15 18:35	69.3350	-166.2791	75	CD	LO	<120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
EXPLOR2015332	SS	1	0	10/11/15 13:23	71.1874	-163.4109	10	LO	LO	<120	RVA
EXPLOR2015333	UP	1	0	10/11/15 17:23	71.2050	-162.9750	100	NO	DI	<120	RVA
CHAMP2015386	SS	1	0	10/11/15 11:29	70.8180	-160.0227	100	NO	LO	≥120	RVA
CHAMP2015387	US	1	0	10/11/15 13:28	70.8253	-159.9963	100	NO	LO	≥120	RVA
CHAMP2015388	US	1	0	10/11/15 14:35	70.8276	-159.9988	65	NO	LO	≥120	RVA
CHAMP2015389	UMW	1	0	10/11/15 14:45	70.8276	-159.9986	938	NO	LG	≥120	RVA
CHAMP2015390	BS	1	0	10/11/15 15:09	70.8295	-159.9977	95	LO	LO	≥120	RVA
FENN2015250	US	1	1	10/12/15 10:59	71.1232	-163.2582	50	NO	LO	<120	RVA
FENN2015251	RS	1	0	10/12/15 14:40	71.1332	-163.2512	50	LO	FB	<120	RVA
FENN2015252	US	1	0	10/12/15 16:19	71.1335	-163.2504	250	NO	DI	≥120	RVA
FENN2015253	RS	1	0	10/12/15 17:32	71.1374	-163.2291	100	LO	LO	≥120	RVA
FENN2015254	BS	1	0	10/12/15 17:40	71.1380	-163.2265	100	LO	DI	≥120	RVA
NANUQ2015265	BS	1	0	10/12/15 15:32	71.1687	-163.4485	100	NO	TR	≥120	RVA
EXPLOR2015334	US	1	0	10/12/15 10:47	71.1726	-163.4722	139	LO	LO	≥120	RVA
EXPLOR2015335	US	1	0	10/12/15 19:07	71.1728	-163.4586	10	LO	LO	≥120	RVA
MARIKA2015142	RS	1	0	10/12/15 11:50	71.0505	-163.2997	30	LO	LO	<120	RVA
MARIKA2015143	UP	1	0	10/12/15 12:53	71.0503	-163.2993	500	LO	LO	<120	RVA
MARIKA2015144	PWA	1	0	10/12/15 13:01	71.0503	-163.2992	820	CD	DI	<120	RVA
MARIKA2015145	RS	1	0	10/12/15 14:38	71.0502	-163.2993	30	LO	LO	<120	RVA
MARIKA2015146	BS	1	0	10/12/15 14:51	71.0502	-163.2993	60	LO	LO	<120	RVA
MARIKA2015147	BS	1	0	10/12/15 15:51	71.0502	-163.2990	50	NO	LG	<120	RVA
MARIKA2015148	RS	1	0	10/12/15 16:02	71.0502	-163.2990	15	LO	LO	<120	RVA
MARIKA2015149	BS	1	0	10/12/15 18:35	71.0502	-163.2994	25	LO	LO	<120	RVA
SISUAQ2015106	SS	1	0	10/12/15 12:41	71.1809	-163.3333	35	NO	MI	≥120	RVA
SISUAQ2015107	US	1	0	10/12/15 19:09	71.1810	-163.3335	40	NO	LO	≥120	RVA
SISUAQ2015108	US	1	0	10/12/15 20:18	71.1809	-163.3335	2	LO	LO	≥120	RVA
CHAMP2015391	US	1	0	10/12/15 18:37	71.1156	-163.2923	130	LO	LO	≥120	RVA
FENN2015255	RS	1	0	10/13/15 12:43	71.1286	-163.1187	100	NO	FB	≥120	RVA
FENN2015256	US	1	0	10/13/15 16:47	71.1218	-163.0599	180	LO	RE	≥120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
MARIKA2015150	UP	1	0	10/13/15 10:24	71.0490	-163.2929	80	LO	LO	<120	RVA
EXPLOR2015338	US	1	0	10/14/15 12:20	71.2582	-163.5857	40	NO	LO	<120	RVA
EXPLOR2015339	US	1	0	10/14/15 16:00	71.1398	-163.3108	200	NO	SW	≥120	RVA
EXPLOR2015340	UP	1	0	10/14/15 17:21	71.1398	-163.3109	75	LO	LO	≥120	RVA
MARIKA2015151	US	1	1	10/14/15 14:16	71.0506	-163.2833	50	LO	LO	<120	RVA
MARIKA2015152	US	1	0	10/14/15 16:57	71.0506	-163.2833	30	LO	LO	≥120	RVA
MARIKA2015153	RS	1	0	10/14/15 18:01	71.0507	-163.2831	10	LO	LO	≥120	RVA
FENN2015260	RS	1	0	10/14/15 17:14	71.1217	-162.8073	15	NO	LO	≥120	RVA
SISUAQ2015110	RS	1	0	10/14/15 10:10	71.1414	-163.3101	30	NO	RE	≥120	RVA
SISUAQ2015111	US	1	0	10/14/15 10:50	71.1412	-163.3102	60	LO	LO	≥120	RVA
SISUAQ2015112	US	1	0	10/14/15 17:38	71.1444	-163.3097	50	LO	LO	≥120	RVA
CHAMP2015392	US	1	0	10/14/15 13:42	71.1262	-162.8748	325	NO	LO	<120	RVA
CHAMP2015393	US	1	0	10/14/15 14:25	71.1263	-162.8758	250	NO	FB	<120	RVA
CHAMP2015395	UP	1	0	10/14/15 15:08	71.1271	-162.8780	534	NO	LO	<120	RVA
CHAMP2015396	PWA	2	0	10/14/15 15:43	71.1275	-162.8837	681	NO	ST	<120	RVA
CHAMP2015397	UP	1	0	10/14/15 16:05	71.1278	-162.8874	400	LO	LO	≥120	RVA
CHAMP2015398	US	1	0	10/14/15 17:10	71.1306	-162.9018	100	LO	LO	≥120	RVA
CHAMP2015399	US	1	0	10/14/15 17:40	71.1320	-162.9111	75	LO	LO	≥120	RVA
NANUQ2015268	PWA	2	1	10/15/15 12:36	71.0346	-163.7011	30	LO	LO	<120	RVA
NANUQ2015269	BS	1	1	10/15/15 16:14	70.6219	-164.5800	40	LO	LO	<120	RVA
NANUQ2015270	US	1	0	10/15/15 16:17	70.6171	-164.5881	213	NO	LO	<120	RVA
NANUQ2015271	US	1	0	10/15/15 16:24	70.6035	-164.6107	150	LO	LO	<120	RVA
NANUQ2015272	US	1	0	10/15/15 16:43	70.5649	-164.6768	30	SP	TH	<120	RVA
NANUQ2015274	US	1	0	10/15/15 16:46	70.5581	-164.6886	303	NO	SW	<120	RVA
NANUQ2015273	US	1	0	10/15/15 16:48	70.5528	-164.6977	300	NO	LO	<120	RVA
NANUQ2015275	RS	1	0	10/15/15 16:55	70.5396	-164.7205	50	LO	LO	<120	RVA
NANUQ2015276	US	1	0	10/15/15 16:57	70.5359	-164.7266	80	LO	LO	≥120	RVA
NANUQ2015277	US	1	0	10/15/15 17:01	70.5278	-164.7402	200	NO	LO	≥120	RVA
NANUQ2015278	US	1	0	10/15/15 17:15	70.4994	-164.7880	100	LO	LO	<120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NANUQ2015279	US	1	0	10/15/15 17:21	70.4872	-164.8082	120	LO	LO	<120	RVA
MARIKA2015154	PWA	1	1	10/15/15 10:06	71.0527	-163.2840	10	CD	LO	≥120	RVA
MARIKA2015155	SS	1	0	10/15/15 14:22	71.0522	-163.2833	30	NO	FB	≥120	RVA
FENN2015261	US	1	0	10/15/15 11:15	71.0876	-163.0291	75	LO	FB	≥120	RVA
FENN2015262	PWA	1	1	10/15/15 11:16	71.0876	-163.0291	150	NO	RE	≥120	RVA
FENN2015263	PWA	1	1	10/15/15 12:32	71.0876	-163.0291	5	LO	SW	≥120	RVA
FENN2015264	BS	1	1	10/15/15 14:22	71.0877	-163.0292	50	LO	LO	≥120	RVA
CHAMP2015400	PWA	2	0	10/15/15 10:07	71.0868	-162.9470	150	IS	ST	≥120	RVA
CHAMP2015404	BS	1	0	10/15/15 15:13	71.0902	-163.0350	100	NO	FB	≥120	RVA
CHAMP2015405	US	1	0	10/15/15 15:15	71.0905	-163.0353	150	NO	LO	≥120	RVA
CHAMP2015406	US	1	0	10/15/15 15:52	71.0929	-163.0359	576	NO	OT	≥120	RVA
EXPLOR2015341	US	1	0	10/16/15 15:11	69.5027	-166.6179	20	LO	LO	<120	RVA
NANUQ2015280	UMW	1	0	10/16/15 10:09	68.4783	-167.9192	15	NO	BL	<120	RVA
MARIKA2015158	FW	2	0	10/16/15 13:47	68.3892	-168.6537	1500	NO	DI	<120	RVA
CHAMP2015407	US	1	0	10/16/15 10:47	68.6328	-167.4865	125	IS	LO	<120	RVA
CHAMP2015408	US	1	0	10/16/15 11:06	68.5847	-167.5302	150	NO	TR	<120	RVA
CHAMP2015409	UP	1	0	10/16/15 12:21	68.3864	-167.7027	800	NO	LO	<120	RVA
FENN2015227	PWA	3	0	9/27/15 19:52	71.1489	-163.0320	50	LO	LO	≥120	RVA
POLAR2015299	US	1	0	9/27/15 4:55	71.1733	-163.4718	50	NO	RE	≥120	RVA
NANUQ2015266	PWA	1	0	10/13/15 10:51	71.1461	-163.1988	5	LO	LO	≥120	RVA
NANUQ2015267	PWA	1	0	10/13/15 13:19	71.1950	-162.9286	80	LO	LO	≥120	RVA
FENN2015257	US	1	0	10/14/15 13:01	71.1218	-162.7338	50	NO	LO	<120	RVA
FENN2015258	US	1	0	10/14/15 16:15	71.1203	-162.8153	518	NO	RE	≥120	RVA
FENN2015259	RS	1	0	10/14/15 16:23	71.1205	-162.8141	10	LO	RE	≥120	RVA
AIVIQ201581	UMW	2	1	7/11/15 11:23	70.7167	-160.4544	900	NO	FL	≥120	RVA
AIVIQ201582	PWA	4	0	7/11/15 13:53	70.7168	-160.4546	353	LO	TR	≥120	RVA
POLAR201596	BS	1	0	7/29/15 15:18	71.1733	-163.4718	125	NO	SW	≥120	RVA
POLAR201598	US	1	0	7/29/15 16:03	71.1733	-163.4718	100	NO	DI	≥120	RVA
TORVIK2015197	SS	1	0	7/29/15 17:51	71.2933	-163.0723	531	LO	PO	≥120	RVA

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TORVIK2015198	UP	1	0	7/29/15 18:44	71.2919	-163.0880	1710	NO	SW	≥120	RVA
TORVIK2015199	US	1	0	7/29/15 19:00	71.2919	-163.0879	100	LO	ST	≥120	RVA
TORVIK2015220	US	1	0	8/2/15 0:36	71.3740	-163.3241	100	NO	FB	≥120	DR
TORVIK2015221	US	1	0	8/2/15 0:48	71.3753	-163.3201	275	NO	SA	≥120	DR
NANUQ2015130	US	1	0	8/9/15 11:36	71.2028	-163.4010	500	NO	DE	≥120	MLC + AH
TORVIK2015274	PWA	1	0	9/1/15 10:47	71.1959	-163.1686	628	NO	SA	≥120	RVA
TORVIK2015275	PWA	2	0	9/1/15 16:08	71.2726	-163.2822	531	NO	ST	≥120	RVA
CHAMP2015136	UMW	1	1	9/2/15 10:30	69.2533	-166.6099	20	NO	DE	<120	RVA
CHAMP2015137	UMW	1	0	9/2/15 10:54	69.2519	-166.6143	1512	NO	DI	<120	RVA
CHAMP2015138	UW	1	0	9/2/15 15:08	68.6358	-167.4279	600	NO	TH	<120	RVA
EXPLOR2015231	US	1	0	9/13/15 11:06	71.1692	-163.4889	371	LO	DI	≥120	AH + DR
WAVE2015125	BS	1	0	9/13/15 9:38	71.1388	-163.4686	200	NO	TR	≥120	AH + DR
WAVE2015126	US	1	0	9/13/15 14:06	71.1374	-163.4291	120	LO	LO	≥120	AH + DR
WAVE2015127	UP	1	0	9/13/15 18:27	71.1580	-163.3544	261	NO	LO	≥120	AH + DR
WIND2015144	PWA	1	0	9/15/15 16:56	71.0835	-163.6607	50	NO	BL	≥120	AH + DR
SISUAQ201583	PWA	1	0	9/15/15 19:54	71.0824	-163.2622	200	LO	LO	≥120	AH + DR
GUARD2015169	PWA	1	0	9/16/15 11:28	70.8755	-162.3814	450	NO	DI	<120	AH + DR
SUPPORT2015231	US	1	0	10/3/15 16:48	71.1650	-163.2940	75	LO	SW	≥120	AH
NANUQ2015109	PWA	1	0	8/5/15 12:54	71.1731	-163.4551	20	NO	DE	≥120	MLC + AH
NANUQ2015110	US	1	0	8/5/15 15:38	71.1728	-163.4548	20	LO	SA	≥120	MLC + AH
NANUQ2015111	SS	1	0	8/5/15 17:24	71.1727	-163.4545	20	LO	SA	≥120	MLC + AH
WIND2015132	PWA	1	0	9/6/15 10:45	71.1413	-163.3340	205	LO	LO	≥120	AH + DR
WIND2015133	PWA	1	0	9/6/15 15:33	71.1161	-163.4271	10	LO	LO	≥120	AH + DR
NORD2015285	US	1	0	10/3/15 19:13	71.1485	-163.1396	500	LO	LO	≥120	AH
NORD2015286	US	1	0	10/3/15 19:38	71.1458	-163.1450	100	NO	LO	≥120	AH
AIVIQ2015111	SS	1	0	7/16/15 14:06	71.1673	-163.1151	130	LO	FB	≥120	AH
AIVIQ2015112	RS	1	0	7/16/15 14:56	71.1674	-163.1152	200	LO	FB	≥120	AH
AIVIQ2015113	US	1	0	7/16/15 16:45	71.1673	-163.1152	150	NO	FB	≥120	AH
AIVIQ2015300	PWA	1	0	8/25/15 8:59	71.0961	-163.2182	10	BR	WR	≥120	RVA

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WIND201568	RS	1	0	7/29/15 17:07	71.1832	-163.0973	15	NO	LO	≥120	RVA
WIND201569	US	1	0	7/29/15 17:45	71.1775	-163.1379	90	IS	LO	≥120	RVA
WIND201570	BS	1	0	7/29/15 19:54	71.1750	-163.1637	40	LO	SW	≥120	RVA
WAVE2015105	PWA	2	0	8/31/15 12:14	71.1703	-163.2829	819	NO	DI	≥120	RVA
WAVE2015106	PWA	2	0	8/31/15 12:56	71.1978	-163.2393	819	NO	TR	≥120	RVA
MARIKA2015134	US	1	0	10/6/15 11:08	71.0511	-163.3005	50	LO	LO	<120	RVA
NANUQ2015253	RS	1	0	10/7/15 11:34	71.2009	-163.4768	70	LO	LO	≥120	RVA
MARIKA2015135	BS	1	0	10/7/15 17:01	71.0508	-163.3001	70	LO	LO	<120	RVA
AIVIQ2015118	BS	1	0	7/18/15 7:41	71.1759	-163.2187	75	LO	LO	≥120	RVA
AIVIQ2015119	US	1	0	7/18/15 10:29	71.1780	-163.1459	30	NO	FB	≥120	RVA
AIVIQ2015120	BS	1	0	7/18/15 11:51	71.1779	-163.1460	50	LO	LO	≥120	RVA
NORD2015143	US	1	0	7/26/15 18:05	71.2268	-161.4558	350	LO	RE	≥120	AH
EXPLOR2015119	US	1	0	7/29/15 9:32	71.3803	-165.0131	45	NO	TH	<120	RVA
EXPLOR2015120	US	2	0	7/29/15 13:56	71.5825	-166.5609	500	NO	DI	<120	RVA
AIVIQ2015229	BS	1	0	7/29/15 15:54	71.4151	-163.1802	50	NO	DI	≥120	RVA
AIVIQ2015230	BS	1	0	7/29/15 16:06	71.3996	-163.1964	50	NO	DI	≥120	RVA
AIVIQ2015231	BS	1	0	7/29/15 16:27	71.3647	-163.2110	464	NO	DI	≥120	RVA
GUARD201570	PWA	1	0	8/13/15 15:18	70.9491	-163.5202	125	LO	TH	<120	DR
GUARD201571	BS	1	0	8/13/15 20:59	71.1535	-162.5717	100	LO	LO	≥120	DR
POLAR2015248	SS	1	0	9/12/15 23:17	71.1733	-163.4718	5	NO	RE	≥120	AH + DR
ROSS2015210	BS	1	0	9/12/15 15:01	71.1978	-163.1042	600	NO	SW	≥120	AH + DR
NORD2015259	UW	1	0	9/12/15 20:46	71.1867	-163.0123	250	NO	BL	≥120	AH + DR
POLAR2015288	US	1	0	9/23/15 4:51	71.1733	-163.4718	75	NO	DI	≥120	RVA
POLAR2015289	BS	1	0	9/23/15 6:15	71.1733	-163.4718	20	LO	LO	≥120	RVA
EXPLOR2015296	PWA	1	0	10/1/15 20:00	71.1684	-163.4576	40	LO	LO	≥120	AH
ROSS2015248	US	1	0	10/1/15 11:38	71.1493	-163.0623	150	LO	LO	≥120	AH
NORD2015282	US	1	0	10/1/15 16:42	71.1482	-163.1390	75	LO	LO	≥120	AH
AIVIQ2015177	PWA	1	0	7/21/15 0:20	71.5803	-163.4709	1000	LO	LO	≥120	RVA
AIVIQ2015178	UP	1	0	7/21/15 1:48	71.5890	-163.4716	400	LO	LO	≥120	RVA

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AIVIQ2015179	BS	1	1	7/21/15 3:18	71.5954	-163.4700	15	LO	LO	≥120	RVA
NANUQ2015134	BS	1	0	8/9/15 22:48	71.2550	-163.4262	50	LO	DI	≥120	MLC + AH
NANUQ2015135	BS	2	0	8/9/15 23:48	71.2040	-163.4142	100	LO	LO	≥120	MLC + AH
MARIKA201575	BS	1	0	8/9/15 5:41	71.0581	-163.2706	3	LO	LO	≥120	MLC + AH
NORD2015250	PWA	2	0	9/7/15 15:17	71.3002	-163.1969	400	NO	SW	<120	AH + DR
EXPLOR2015219	PWA	1	0	9/7/15 11:14	70.9835	-162.9826	30	CD	SI	<120	AH + DR
ROSS201569	UP	1	0	7/19/15 4:20	70.5172	-164.6505	100	LO	DI	<120	RVA
ROSS201570	UMW	1	0	7/19/15 11:51	69.9512	-165.8907	2396	NO	BL	<120	RVA
EXPLOR2015126	US	1	0	7/29/15 14:57	71.6143	-166.8095	200	NO	DI	<120	RVA
EXPLOR2015127	US	1	0	7/29/15 15:09	71.6202	-166.8578	100	NO	SW	<120	RVA
EXPLOR2015129	US	3	0	7/29/15 22:27	71.7517	-167.9646	300	NO	SW	≥120	RVA
TORVIK2015192	US	2	0	7/29/15 17:05	71.2918	-162.9149	993	LO	SA	≥120	RVA
TORVIK2015193	US	1	0	7/29/15 17:22	71.2760	-163.0036	531	NO	SA	≥120	RVA
TORVIK2015194	US	1	0	7/29/15 17:28	71.2794	-163.0323	769	LO	SA	≥120	RVA
NANUQ2015160	PB	1	0	8/16/15 15:45	71.1957	-163.4233	50	LO	LO	≥120	DR
POLAR2015177	RS	1	0	8/16/15 6:00	71.1733	-163.4718	20	LO	LO	≥120	DR
NANUQ2015164	PWA	1	0	8/18/15 12:44	71.0517	-163.3101	400	NO	ST	≥120	DR
NANUQ2015165	US	1	0	8/18/15 18:52	71.0517	-163.3103	600	NO	SA	≥120	DR
CHAMP2015265	US	1	0	9/26/15 14:23	71.1500	-163.3996	100	LO	LO	≥120	RVA
CHAMP2015270	PWA	1	0	9/26/15 14:59	71.1045	-163.4576	200	LO	TR	≥120	RVA
NANUQ2015210	PWA	1	0	9/1/15 13:18	71.0583	-163.2572	200	NO	ST	≥120	RVA
NANUQ2015211	US	1	0	9/1/15 19:43	71.0582	-163.2564	100	NO	SI	≥120	RVA
POLAR201582	US	1	0	7/26/15 6:50	71.1733	-163.4718	20	LO	LO	≥120	AH
LAUREN201530	US	1	0	7/26/15 5:55	69.0918	-167.2988	143	LO	LO	<120	AH
EXPLOR2015118	US	1	0	7/29/15 9:18	71.3706	-164.9379	75	NO	DI	<120	RVA
AIVIQ2015117	BS	1	0	7/17/15 9:07	71.1684	-163.2049	75	LO	LO	≥120	RVA
EXPLOR201578	US	1	0	7/17/15 11:27	70.8722	-165.2469	200	NO	SW	≥120	RVA
EXPLOR201579	RS	1	0	7/17/15 13:11	70.8722	-165.2467	75	NO	FB	≥120	RVA
NANUQ201596	UP	1	0	7/30/15 4:29	71.1096	-162.9724	25	NO	TR	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NANUQ201597	BS	1	0	7/30/15 5:03	71.1066	-163.0453	320	NO	ST	≥120	DR
NANUQ201598	BS	1	0	7/30/15 7:23	71.1094	-163.2892	15	NO	DI	≥120	DR
AIVIQ2015266	RS	1	0	8/10/15 19:20	71.3039	-163.2119	50	LO	FB	≥120	MLC
AIVIQ2015267	BS	1	0	8/10/15 19:58	71.3038	-163.2118	480	NO	SW	≥120	MLC
AIVIQ2015268	BS	1	0	8/10/15 21:19	71.3039	-163.2162	400	NO	DI	≥120	MLC
GUARD2015158	BS	1	0	9/13/15 9:51	71.1474	-163.3932	513	NO	SW	≥120	AH + DR
GUARD2015159	US	1	0	9/13/15 11:11	71.1632	-163.3812	500	NO	SW	≥120	AH + DR
GUARD2015160	UP	3	0	9/13/15 11:21	71.1539	-163.3849	1552	NO	LO	≥120	AH + DR
NORD2015262	PWA	1	0	9/13/15 11:26	71.1715	-163.2425	80	LO	LO	≥120	AH + DR
NORD2015263	US	1	0	9/13/15 12:46	71.2194	-163.2178	350	NO	LO	≥120	AH + DR
NORD2015264	SS	1	0	9/13/15 12:57	71.2364	-163.2073	50	NO	DI	≥120	AH + DR
EXPLOR2015289	SS	1	0	9/26/15 17:35	71.0285	-163.2834	40	NO	DI	≥120	RVA
EXPLOR2015290	US	1	0	9/26/15 19:57	71.0819	-163.3625	270	NO	SW	≥120	RVA
NANUQ2015246	US	1	0	9/26/15 13:39	71.1222	-162.9736	200	NO	TR	≥120	RVA
WAVE2015147	RS	1	0	9/29/15 18:19	71.1056	-163.5544	100	LO	LO	≥120	RVA
WAVE2015148	SS	1	0	9/29/15 18:56	71.0914	-163.4529	75	LO	LO	≥120	RVA
TORVIK2015318	PWA	2	0	9/30/15 15:55	71.1345	-163.6920	25	NO	SA	≥120	RVA
GUARD2015125	PWA	1	0	8/31/15 16:45	71.1279	-162.8218	500	NO	SW	≥120	RVA
GUARD2015126	PWA	1	0	8/31/15 18:29	71.1204	-163.2039	500	NO	SW	≥120	RVA
AIVIQ2015109	RS	1	0	7/16/15 13:35	71.1673	-163.1152	150	NO	FB	≥120	AH
AIVIQ2015110	BS	1	0	7/16/15 14:05	71.1673	-163.1152	50	LO	LO	≥120	AH
POLAR2015156	US	1	0	8/11/15 19:36	71.1733	-163.4718	200	LO	LO	≥120	MLC
AIVIQ2015271	US	1	0	8/11/15 0:14	71.3068	-163.2247	240	NO	FB	≥120	MLC
SISUAQ201556	PWA	1	0	8/23/15 10:23	71.1654	-163.3136	450	NO	DI	≥120	DR
SISUAQ201557	US	1	0	8/23/15 23:10	71.1651	-163.3147	150	NO	SW	≥120	DR
NANUQ2015223	PWA	3	0	9/12/15 17:43	71.1417	-163.3394	1000	NO	SA	≥120	AH + DR
FENN2015201	SS	1	0	9/12/15 16:20	71.1889	-163.1404	20	NO	LO	≥120	AH + DR
GUARD2015170	PWA	2	1	9/17/15 7:37	71.1388	-162.9167	450	NO	LO	≥120	AH + DR
GUARD2015171	US	1	0	9/17/15 8:11	71.1258	-162.9650	50	NO	DI	≥120	AH + DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
GUARD2015172	UP	1	0	9/17/15 9:59	71.0159	-163.2574	50	LO	LO	≥120	AH + DR
SUPPORT201574	FW	1	0	7/30/15 17:20	68.8088	-167.1725	1000	NO	BL	<120	DR
SUPPORT201575	UNK	1	0	7/30/15 19:32	68.4889	-167.3528	25	NO	DE	<120	DR
WIND201571	BS	1	0	7/30/15 6:30	71.1908	-163.2091	10	NO	DI	≥120	DR
TORVIK2015245	PWA	1	0	8/14/15 20:09	71.1529	-163.3560	200	CD	DI	≥120	DR
POLAR2015174	SS	1	0	8/15/15 5:50	71.1733	-163.4718	55	NO	DI	≥120	DR
FENN2015115	BS	1	0	8/20/15 14:21	70.8332	-162.1707	200	LO	RE	<120	DR
FENN2015116	UP	1	0	8/20/15 15:06	70.8761	-162.0737	400	SP	TH	<120	DR
CHAMP2015133	US	1	0	8/31/15 14:50	71.1496	-163.1845	120	LO	LO	≥120	RVA
SPIRIT201551	BS	1	0	8/31/15 20:33	70.6974	-164.2851	10	LO	LO	<120	RVA
MARIKA201599	BS	1	0	8/31/15 7:44	71.0538	-163.2762	75	NO	TR	≥120	RVA
NORD2015242	US	1	0	9/1/15 19:17	71.1588	-163.3492	150	LO	LO	≥120	RVA
NORD2015243	US	1	0	9/1/15 19:50	71.1604	-163.3059	1000	NO	DI	≥120	RVA
WAVE2015114	BS	1	0	9/1/15 7:32	71.2335	-163.4024	100	LO	LO	≥120	RVA
WIND2015126	PWA	1	0	9/1/15 20:22	71.0559	-163.2779	229	NO	LO	≥120	RVA
WIND2015127	BS	1	0	9/1/15 22:00	71.0559	-163.2779	5	NO	LO	≥120	RVA
EXPLOR2015198	BS	1	0	9/1/15 8:35	71.1752	-163.4940	50	LO	RE	≥120	RVA
WAVE2015133	SS	1	0	9/17/15 12:57	71.0771	-163.6676	30	LO	LO	≥120	AH + DR
TORVIK2015313	PWA	2	0	9/26/15 9:57	70.9361	-162.0461	75	NO	DI	<120	RVA
TORVIK2015314	US	1	0	9/26/15 13:50	71.1592	-163.1603	15	NO	SW	≥120	RVA
TORVIK2015315	BS	1	0	9/26/15 18:20	71.1593	-163.1643	30	NO	SA	≥120	RVA
ROSS2015246	PWA	1	0	9/28/15 10:54	71.1756	-163.3197	628	NO	TR	≥120	RVA
MARIKA2015127	US	1	0	9/28/15 9:15	71.0539	-163.2789	30	NO	DI	≥120	RVA
NANUQ2015249	US	2	0	9/28/15 9:03	71.0519	-163.2682	350	NO	TR	≥120	RVA
AIVIQ2015255	BS	1	1	8/9/15 14:30	71.3097	-163.1953	10	LO	TH	≥120	MLC + AH
AIVIQ2015256	UP	1	0	8/9/15 15:34	71.3097	-163.1952	150	NO	DI	≥120	MLC + AH
POLAR2015163	RS	1	0	8/13/15 6:20	71.1733	-163.4718	75	LO	LO	≥120	DR
POLAR2015164	US	1	0	8/13/15 20:20	71.1733	-163.4718	50	NO	FB	≥120	DR
NANUQ2015155	US	1	0	8/14/15 18:25	71.1289	-163.0790	50	LO	SA	≥120	DR

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
TORVIK2015242	PWA	1	0	8/14/15 14:55	71.1638	-163.2727	400	NO	DI	≥120	DR
NANUQ2015132	BS	1	0	8/9/15 15:19	71.0393	-163.3334	50	LO	LO	≥120	MLC + AH
NANUQ2015133	BS	1	0	8/9/15 21:16	71.2450	-163.4213	50	IS	DI	≥120	MLC + AH
AIVIQ2015135	BS	1	0	7/18/15 17:39	71.1779	-163.1462	150	NO	SW	≥120	RVA
AIVIQ2015136	RS	1	0	7/18/15 18:01	71.1778	-163.1462	100	NO	FB	≥120	RVA
AIVIQ2015137	BS	2	0	7/18/15 19:04	71.1781	-163.1447	100	NO	LO	≥120	RVA
NORD2015162	BHW	1	0	7/29/15 16:39	71.3025	-162.7401	1946	NO	SW	≥120	RVA
NORD2015163	US	1	0	7/29/15 16:49	71.2903	-162.7740	20	NO	DI	≥120	RVA
NORD2015164	US	1	0	7/29/15 17:15	71.2524	-162.8959	653	NO	LO	≥120	RVA
NORD2015230	UP	1	0	8/24/15 7:23	71.1743	-163.4724	888	NO	SW	≥120	DR
NORD2015231	UP	1	0	8/24/15 9:50	71.1743	-163.4724	200	NO	SW	≥120	DR
WIND2015119	PWA	1	0	8/31/15 7:29	71.1118	-163.3329	280	NO	BL	≥120	RVA
WIND2015120	BS	1	0	8/31/15 7:45	71.1382	-163.3056	100	NO	RE	≥120	RVA
WIND2015121	PWA	3	0	8/31/15 11:59	71.1667	-163.2748	573	NO	DI	≥120	RVA
NANUQ2015214	PWA	1	0	9/1/15 20:57	71.0583	-163.2566	600	NO	ST	≥120	RVA
NANUQ2015215	PWA	1	0	9/1/15 21:08	71.0583	-163.2569	600	NO	MI	≥120	RVA
NANUQ2015216	US	1	0	9/1/15 21:24	71.0597	-163.2703	300	NO	LO	≥120	RVA
CHAMP2015257	PWA	1	1	9/20/15 19:56	71.1718	-163.4756	10	LO	LO	≥120	AH + DR
TORVIK2015298	UW	1	0	9/20/15 11:12	71.1777	-163.0785	750	NO	BL	≥120	AH + DR
NANUQ2015252	BS	1	0	10/3/15 16:17	71.1402	-163.2099	50	DS	PO	≥120	AH
FENN2015233	US	1	0	10/3/15 12:00	71.1217	-163.0733	70	LO	SW	≥120	AH
ROSS2015155	UP	1	0	8/23/15 11:06	70.9473	-163.6730	993	LO	DI	<120	DR
ROSS2015156	UP	1	0	8/23/15 11:22	70.9820	-163.6349	867	NO	ST	≥120	DR
ROSS2015157	PWA	2	0	8/23/15 11:33	71.0044	-163.6065	1162	LO	LO	≥120	DR
POLAR2015182	UMW	1	0	8/18/15 15:21	71.1733	-163.4718	800	NO	BL	≥120	DR
AIVIQ2015291	US	1	0	8/18/15 9:13	71.2808	-163.3892	150	NO	SW	≥120	DR
EXPLOR2015176	US	1	0	8/18/15 19:06	71.1837	-163.6847	150	LO	LO	≥120	DR
POLAR2015290	US	1	0	9/23/15 10:33	71.1733	-163.4718	30	NO	LO	≥120	RVA
POLAR2015291	BS	1	1	9/23/15 11:36	71.1733	-163.4718	20	LO	FE	≥120	RVA

Sighting ID[a]	Species[b]	No.[c]	Juv.[d]	Date (AKDT, DD/MM/YY) and Time	Lat. (°N)	Long. (°W)	Final Distance To PSO[e] (m)	Rxn[f]	Behav.[g]	Final Exp. Level[h]	Activity Scenario[i]
NORD2015297	BS	1	0	10/8/15 19:01	71.1749	-163.4705	100	LO	LO	≥120	RVA
NORD2015298	BS	1	0	10/8/15 20:10	71.1748	-163.4704	100	LO	LO	≥120	RVA
MARIKA2015138	BS	1	0	10/9/15 12:36	71.0502	-163.2991	80	LO	LO	<120	RVA
NORD2015300	BS	1	0	10/9/15 17:28	71.1380	-163.1934	300	CD	LO	<120	RVA
EXPLOR2015336	US	1	0	10/13/15 12:33	71.1415	-163.3332	10	LO	LO	≥120	RVA
EXPLOR2015337	PWA	1	0	10/13/15 18:48	71.1653	-163.4838	2	LO	LO	≥120	RVA
CHAMP2015401	PWA	1	0	10/15/15 11:16	71.0897	-163.0271	356	NO	TR	≥120	RVA
CHAMP2015402	UP	1	1	10/15/15 12:18	71.0879	-163.0291	576	NO	LO	≥120	RVA
CHAMP2015403	PWA	1	0	10/15/15 12:33	71.0879	-163.0292	35	LO	LO	≥120	RVA
NANUQ2015259	US	1	0	10/8/15 15:14	71.1101	-163.9683	40	LO	TR	<120	RVA
NANUQ2015260	US	1	0	10/8/15 16:31	71.1116	-163.9379	100	LO	LO	≥120	RVA
MARIKA2015156	PWA	3	1	10/16/15 12:45	68.5876	-168.6548	230	LO	LO	<120	RVA
MARIKA2015157	BS	1	0	10/16/15 12:49	68.5762	-168.6544	40	NO	SW	<120	RVA
NANUQ2015264	UP	1	0	10/11/15 14:25	70.8065	-160.3812	50	NO	DI	<120	RVA
MARIKA2015141	US	1	0	10/11/15 15:48	71.0509	-163.3004	30	NO	SI	<120	RVA

[a] Sighting ID = Vessel name, year (2015) and sequential number given to sighting by PSOs. AIVIQ = *Aiviq*, CHAMP = *Harvey Champion*, DISCOV = *Noble Discoverer*, EXPLOR = *Harvey Explorer*, FENN = *Fennica*, GUARD = *Guardsman*, MARIKA = *Marika*, MINER = *Minerva*, NANUQ = *Nanuq*, NORD = *Nordica*, POLAR = *Polar Pioneer*, ROSS = *Ross Chouest*, SISUAQ = *Sisuaq*¸ SPIRIT = *Harvey Spirit*, SUPPORT = *Harvey Supporter*, TORVIK = *Tor Viking*, WAVE = *Ocean Wave*, WIND = *Ocean Wind*

[b] Species = Species of marine mammal recorded during sighting. BHW = Bowhead Whale, BS = Bearded Seal, BW = Beluga Whale, DP = Dall's Porpoise, FW = Fin Whale, GW = Gray Whale, HP = Harbor Porpoise, HW = Humpback Whale, KW = Killer Whale, MW = Minke Whale, PB = Polar Bear, PWA = Pacific Walrus, RBS = Ribbon Seal, RS = Ringed Seal, SS = Spotted Seal, UMW = Unidentified Mysticete Whale, UTW = Unidentified Toothed Whale, UNK = Unknown, UP = Unidentified Pinniped, US = Unidentified Seal, UW = Unidentified Whale

[c] No. = Number of individual marine mammals observed during sighting.

[d] Juv. = Number of juvenile marine mammals observed during sighting.

[e] Final Dist. to PSO = Sighting distance (m) of marine mammal(s) from the PSO at the marine mammal(s) closest point of approach.

[f] Reaction to Vessel = Reaction of marine mammal(s) to vessel observed by PSOs. Codes: CD = Change in Direction; IS = Increase in Speed; LO = Look at Vessel; NO = No reaction; SP = Splash.

[g] Behavior = Behavior of marine mammal(s) observed by PSOs. Codes: BL = Blow; BR=Breach; DE=Dead; DI = Dive; FB=Floating on Back; FE=Feeding; FL = Fluking; LG = Logging; LO = Look; MI = Milling; OT=Other; PO=Porpoising; RE = Resting; SA = Surface Active; SI = Sink; ST = Surface Active Travel; SW = Swim; TH = Thrash; TR = Travelling; WK = Walking; U = UNK.

[h] Final Exp. Level = Received sound level at location of sighting (dB re 1 µPa rms SPL) based on Method 3 (see Chapter 3)

[i] Activity Scenario = Activity scenario occurring at the time of the initial detection (See Chapter 4 for additional detail). Codes: AH=Anchor Handling; DR=Drilling; RVA=Routine Vessel Activities; MLC=Mud Line Cellar Excavation; AH+MLC=Anchor Handling and Mud Line Cellar Construction operating concurrently; AH+DR=Anchor Handling and Drilling operating concurrently

APPENDIX F: CHUKCHI SEA AERIAL SURVEY PROGRAM RESULTS

Part 1: Sighting Summary Tables

TABLE F.1. Summary of offshore aerial survey effort (km) and number of cetacean sightings (numbers of individuals) in the Alaskan Chukchi Sea, 2015. Includes on-transect, off-transect, and lower confidence level sightings. There are twelve surveys that have not yet been reviewed.

			All Sightings					
Date in 2015	**Survey No.**	**Total Effort**	**Bowhead Whale**	**Humpback Whale**	**Unidentified Mysticete Whale**	**Beluga Whale**	**Unidentified Odontocete Whale**	**Harbor Porpoise**
7-Jul	1	635	-	-	-	-	-	-
29-Jul	4	539	0	0	0	1 (1)	0	3 (3)
30-Jul	5	538	0	0	0	1 (1)	1 (4)	0
7-Aug	6	586	-	-	-	-	-	-
8-Aug	7	573	-	-	-	-	-	-
9-Aug	8	636	-	-	-	-	-	-
11-Aug	9	639	-	-	-	-	-	-
18-Aug	10	541	-	-	-	-	-	-
19-Aug	11	480	-	-	-	-	-	-
31-Aug	12	573	0	1 (2)	0	0	0	0
16-Sep	13	490	-	-	-	-	-	-
17-Sep	14	577	0	0	1 (1)	0	0	0
18-Sep	15	539	-	-	-	-	-	-
20-Sep*	16	482	0	0	0	0	0	0
21-Sep*	17	490	0	0	0	0	0	0
22-Sep	18	636	1 (1)	0	1 (1)	0	0	0
27-Sep	19	636	-	-	-	-	-	-
28-Sep	20	486	-	-	-	-	-	-
1-Oct*	21	636	0	0	0	0	0	0
2-Oct	22	636	-	-	-	-	-	-
Total		***11,350***	***1 (1)***	***1 (2)***	***2 (2)***	***2 (2)***	***1 (4)***	***3 (3)***

* Indicates survey was analyzed with the quick review method

TABLE F.2. Summary of offshore aerial survey effort (km) and number of pinniped sightings (numbers of individuals) in the Alaskan Chukchi Sea, 2015. Includes on-transect, off-transect, and lower confidence level sightings. There are twelve surveys that have not yet been reviewed.

			All Sightings			
Date in 2015	**Survey No.**	**Total Effort**	**Pacific Walrus**	**Bearded Seal**	**Walrus or Bearded Seal**	**Unidentified Phocid Seal**
7-Jul	1	635	-	-	-	-
29-Jul	4	539	232 (4,059)	17 (17)	28 (29)	54 (54)
30-Jul	5	538	73 (1,077)	6 (6)	14 (14)	19 (23)
7-Aug	6	586	-	-	-	-
8-Aug	7	573	-	-	-	-
9-Aug	8	636	-	-	-	-
11-Aug	9	639	-	-	-	-
18-Aug	10	541	-	-	-	-
19-Aug	11	480	-	-	-	-
31-Aug	12	573	19 (25)	6 (6)	6 (6)	25 (28)
16-Sep	13	490	-	-	-	-
17-Sep	14	577	33 (51)	0	1 (1)	5 (5)
18-Sep	15	539	-	-	-	-
20-Sep*	16	482	4 (9)	0	0	6 (6)
21-Sep*	17	490	0	0	0	0
22-Sep	18	636	8 (11)	0	0	1 (1)
27-Sep	19	636	-	-	-	-
28-Sep	20	486	-	-	-	-
1-Oct*	21	636	0	0	2 (2)	0
2-Oct	22	636	-	-	-	-
Total		***11,350***	***369 (5,232)***	***30 (30)***	***51 (52)***	***110 (117)***

* Indicates survey was analyzed with the quick review method

Part 2: Sighting Maps for each Survey

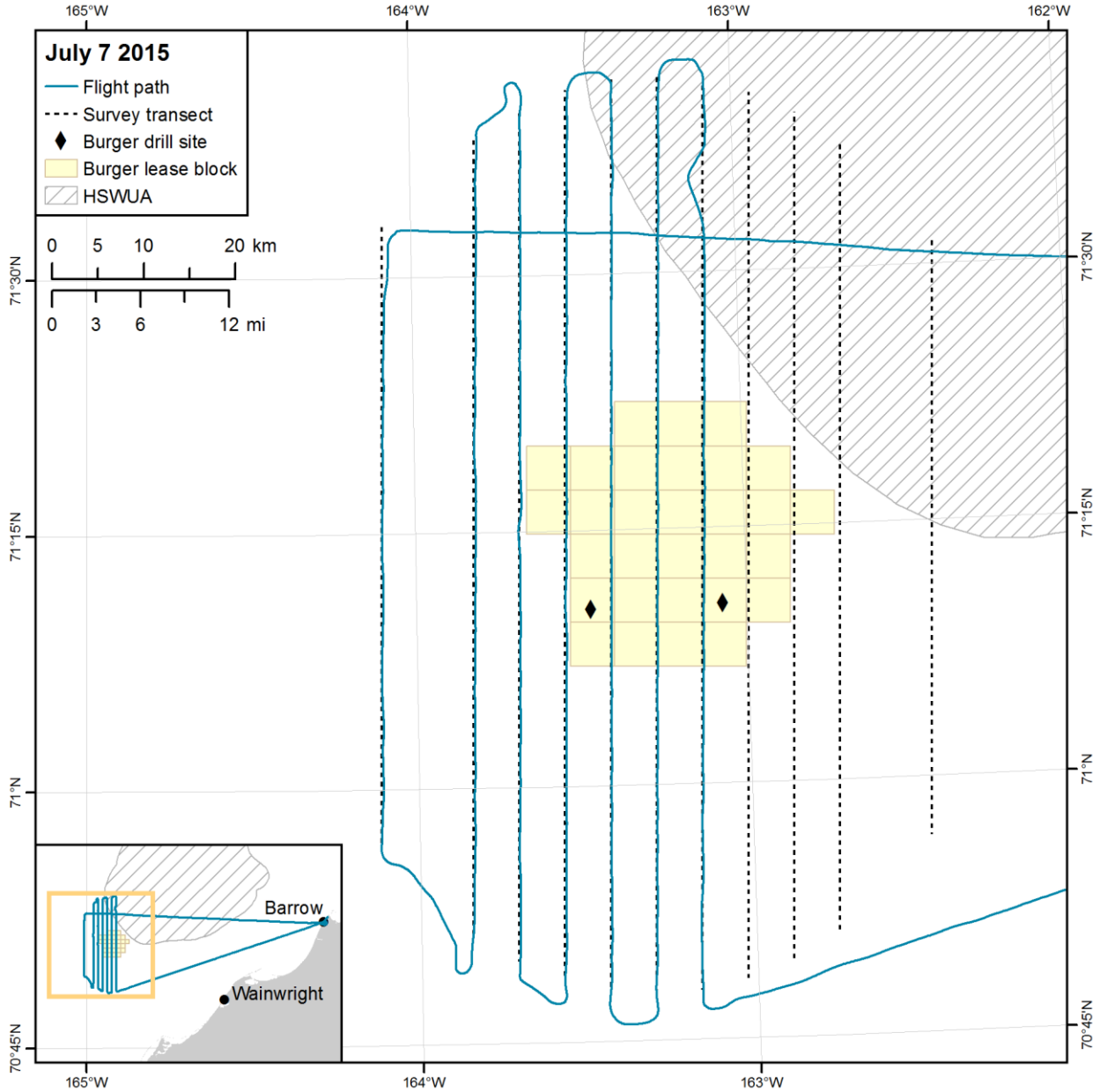

FIGURE F.1. Survey effort over the initial survey design in the northeastern Chukchi Sea at a minimum altitude of 1,500 ft. Images from this survey have not yet been reviewed.

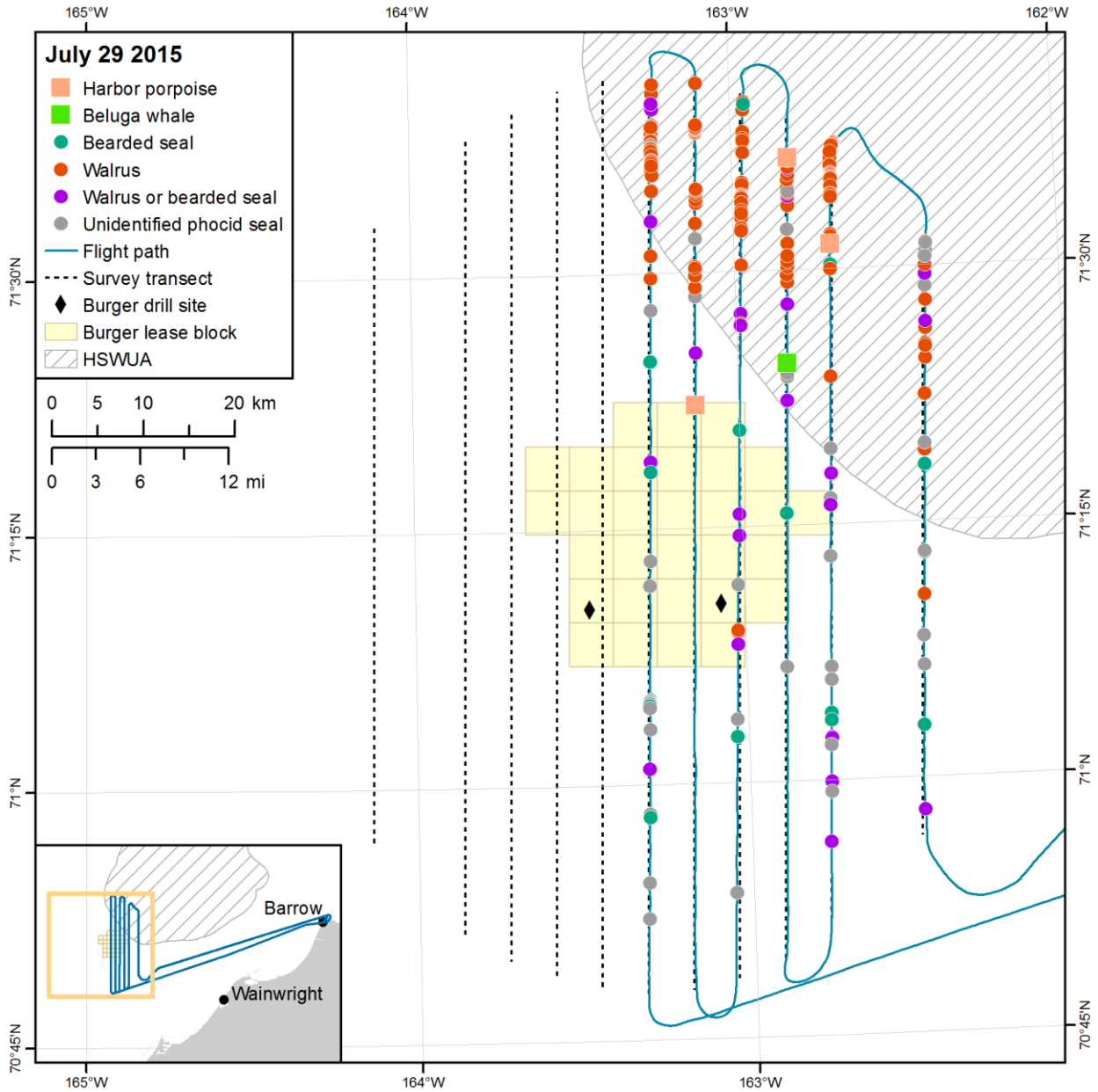

FIGURE F.2. Survey effort and locations of marine mammal sightings over the initial survey design in the northeastern Chukchi Sea at a minimum altitude of 1,500 ft. On-transect, off-transect, and lower confidence level sightings are shown on this map. Images were reviewed by the detailed manual analysis method.

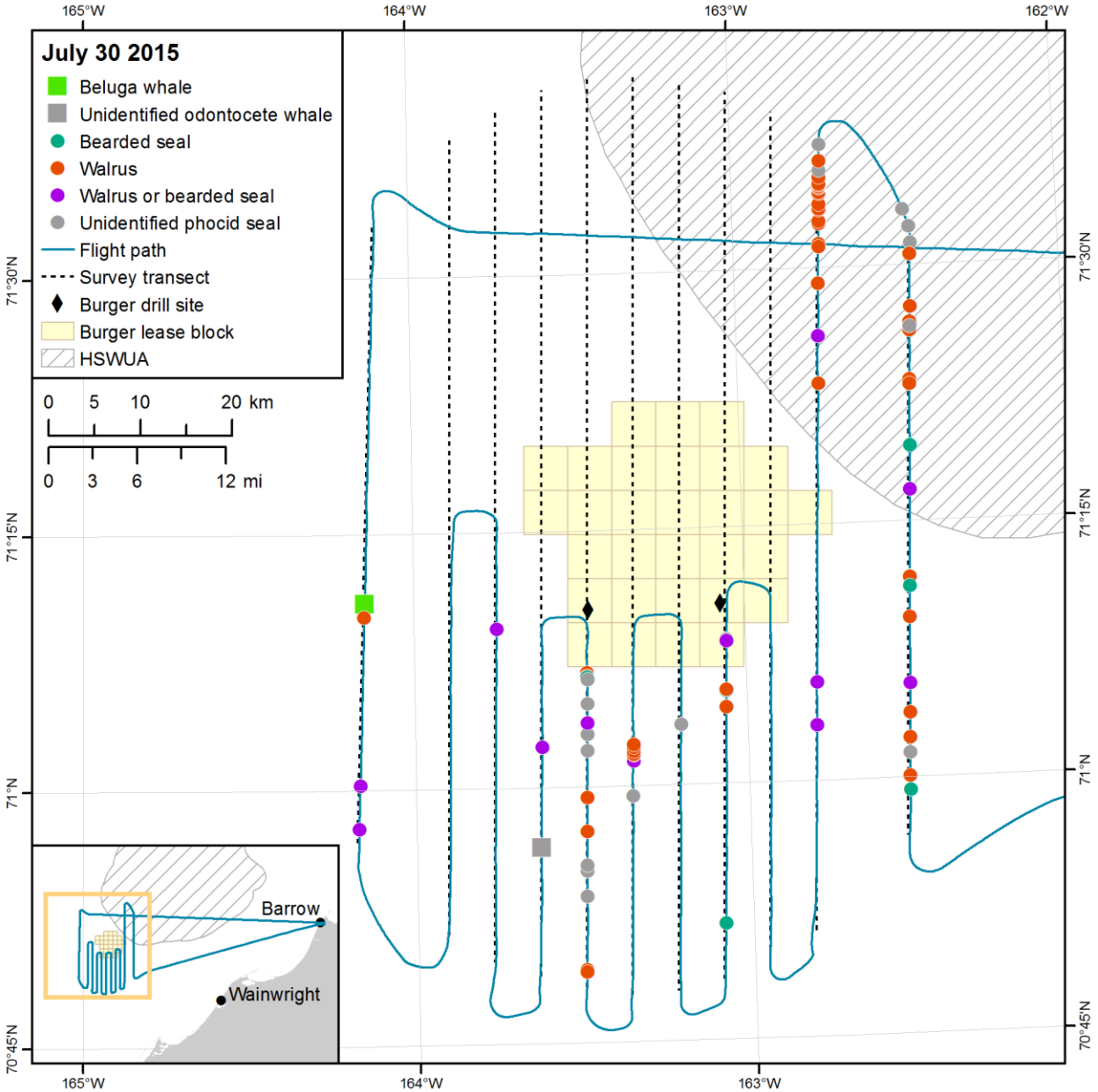

FIGURE F.3. Survey effort and locations of marine mammal sightings over the initial survey design in the northeastern Chukchi Sea at a minimum altitude of 1,500 ft. On-transect, off-transect, and lower confidence level sightings are shown on this map. Images were reviewed by the detailed manual analysis method.

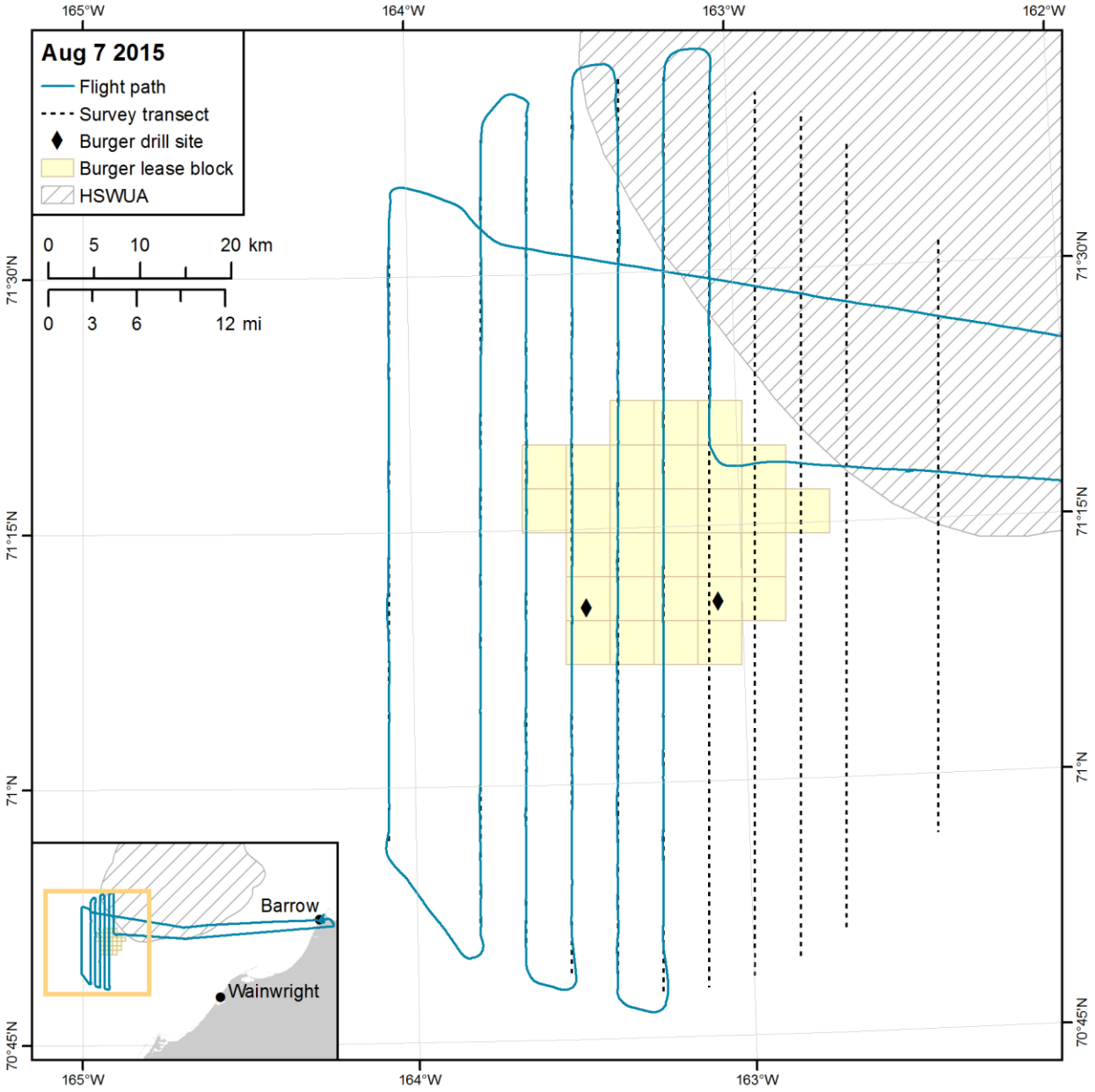

FIGURE F.4. Survey effort over the initial survey design in the northeastern Chukchi Sea at a minimum altitude of 1,500 ft. Images from this survey have not yet been reviewed.

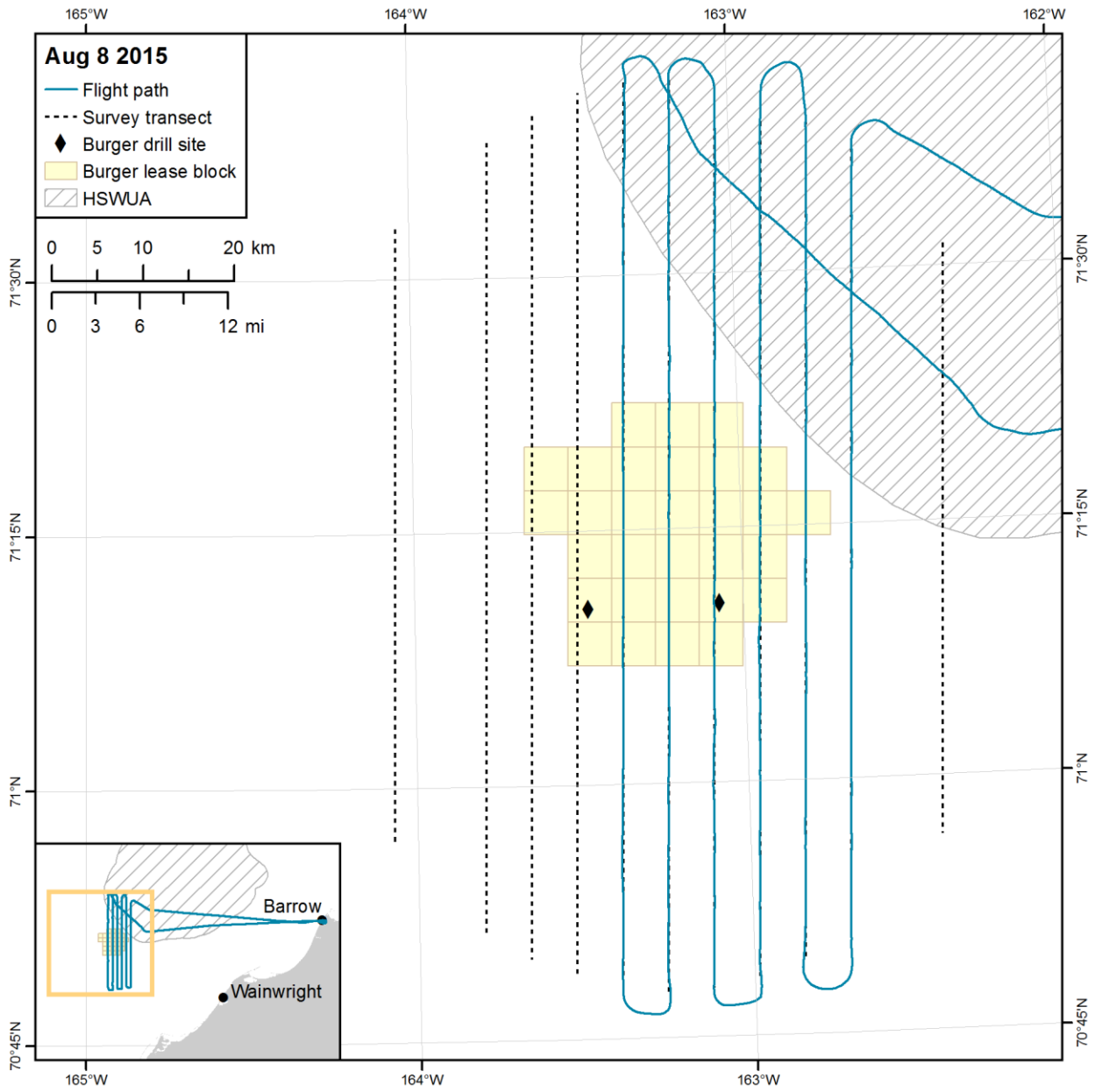

FIGURE F.5. Survey effort over the initial survey design in the northeastern Chukchi Sea at a minimum altitude of 1,500 ft. Images from this survey have not yet been reviewed.

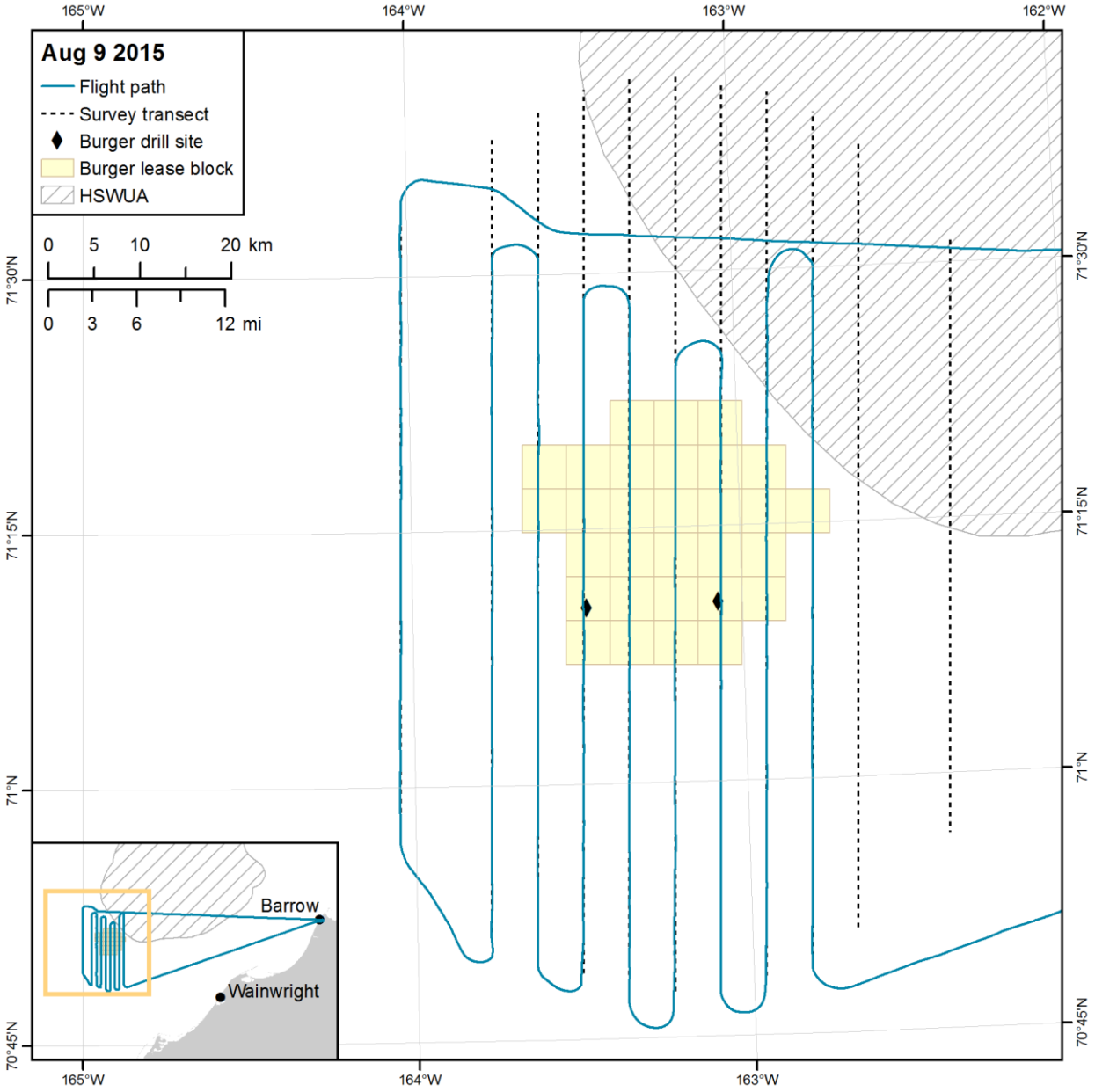

FIGURE F.6. Survey effort over the initial survey design in the northeastern Chukchi Sea at a minimum altitude of 1,500 ft. Images from this survey have not yet been reviewed.

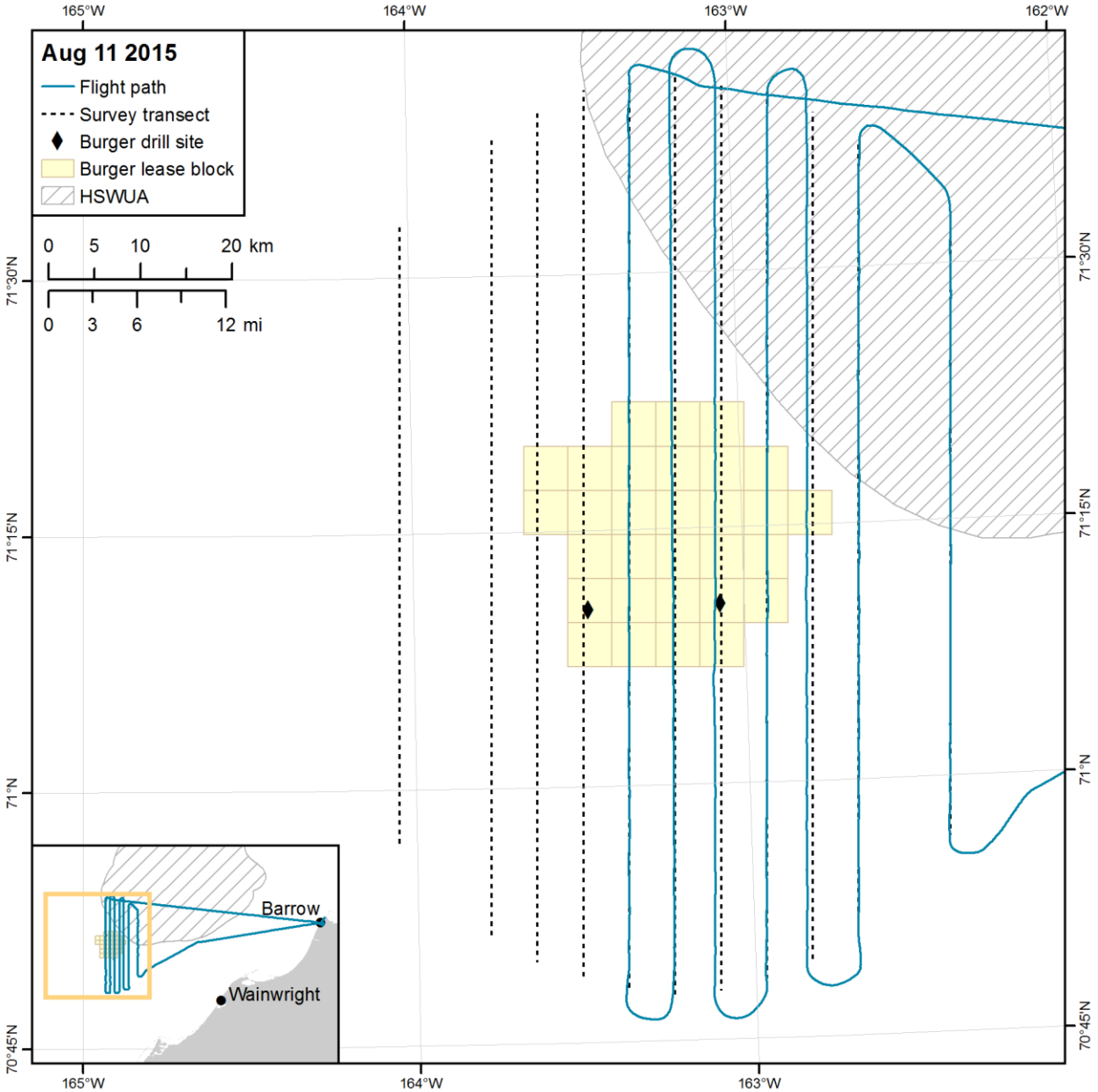

FIGURE F.7. Survey effort over the initial survey design in the northeastern Chukchi Sea at a minimum altitude of 1,500 ft. Images from this survey have not yet been reviewed.

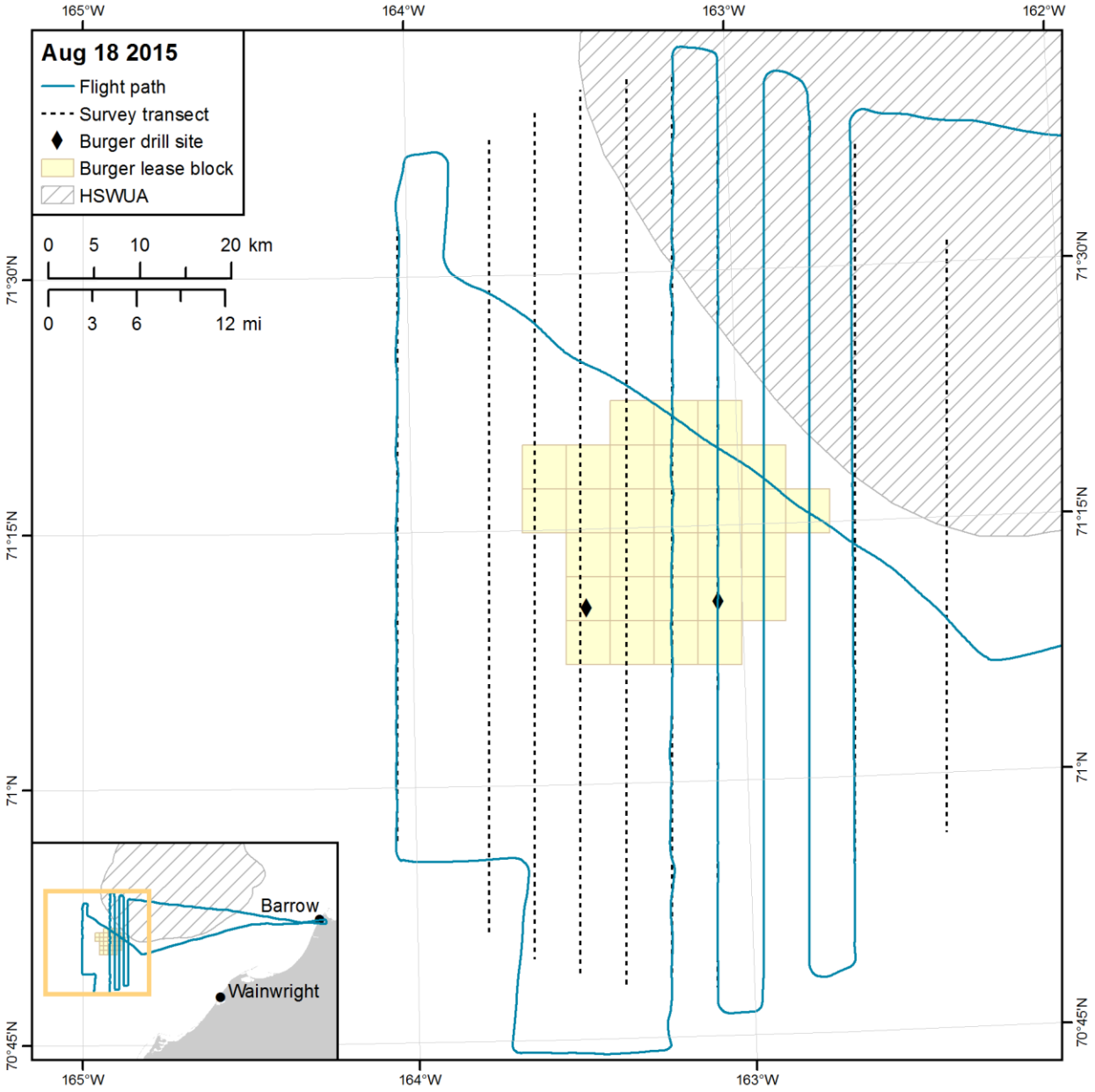

FIGURE F.8. Survey effort over the initial survey design in the northeastern Chukchi Sea at a minimum altitude of 1,500 ft. Images from this survey have not yet been reviewed.

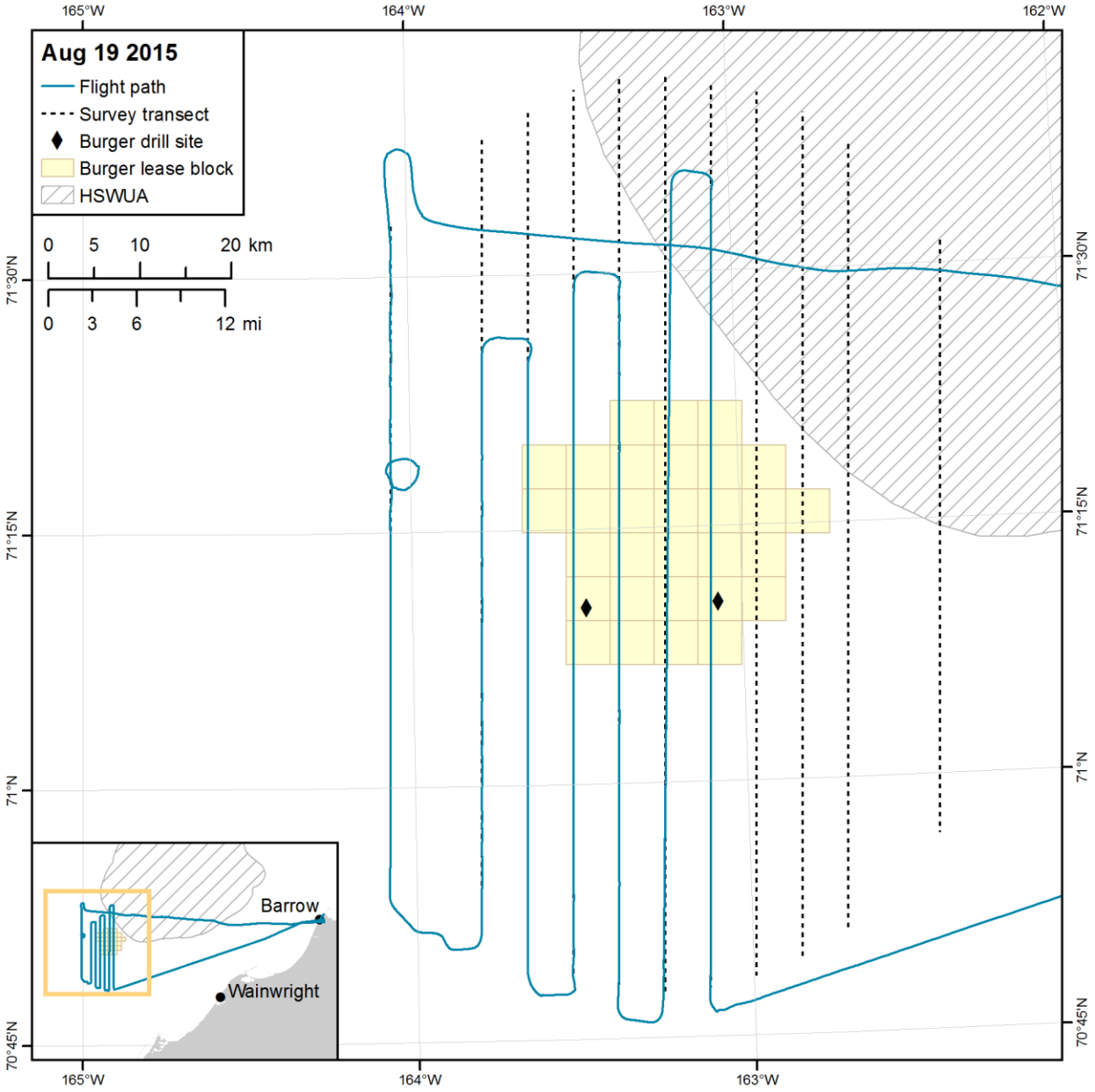

FIGURE F.9. Survey effort over the initial survey design in the northeastern Chukchi Sea at a minimum altitude of 1,500 ft. Images from this survey have not yet been reviewed.

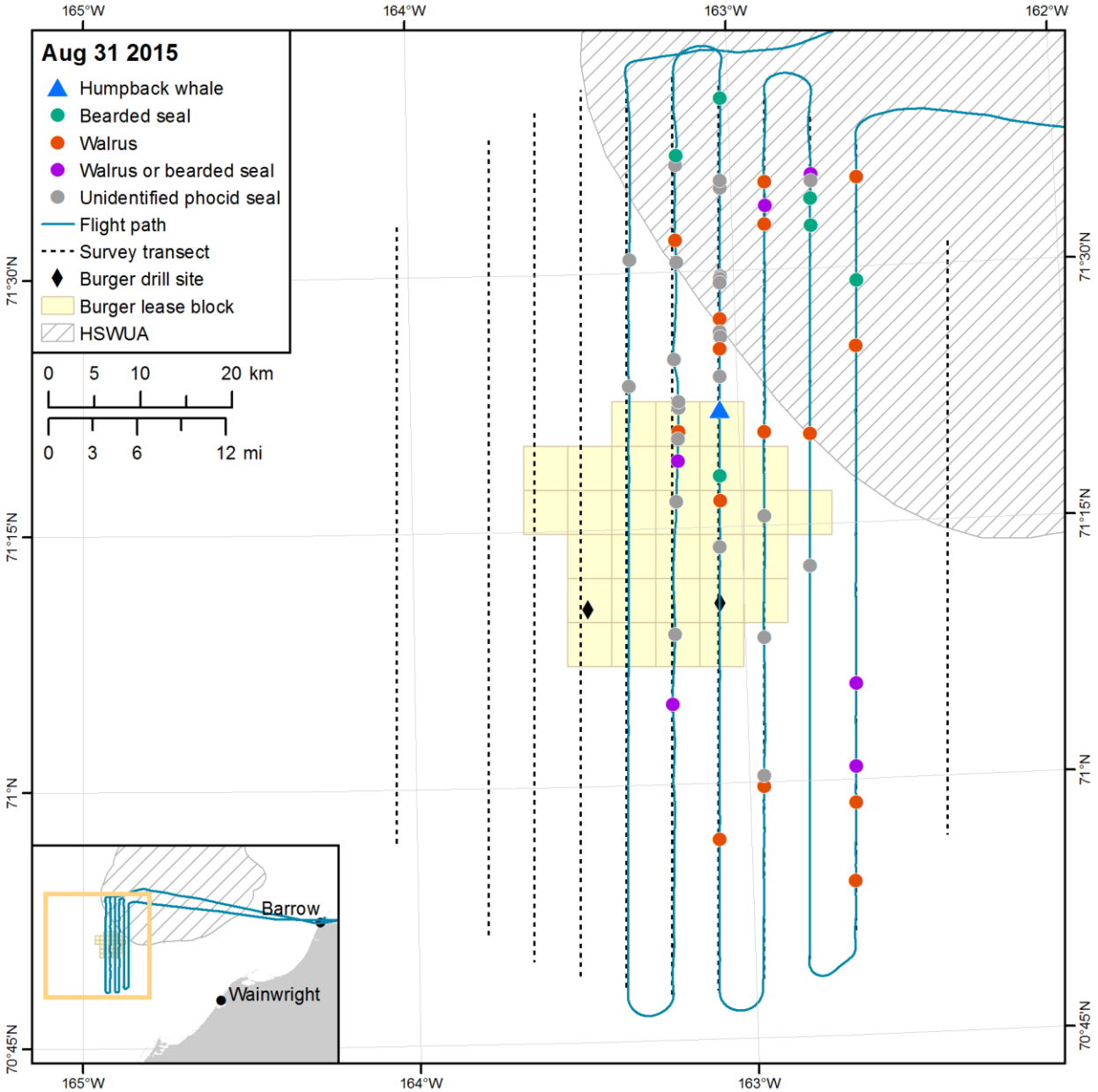

FIGURE F.10. Survey effort and locations of marine mammal sightings over the initial survey design in the northeastern Chukchi Sea at a minimum altitude of 1,500 ft. On-transect, off-transect, and lower confidence level sightings are shown on this map. Images were reviewed by the detailed manual analysis method.

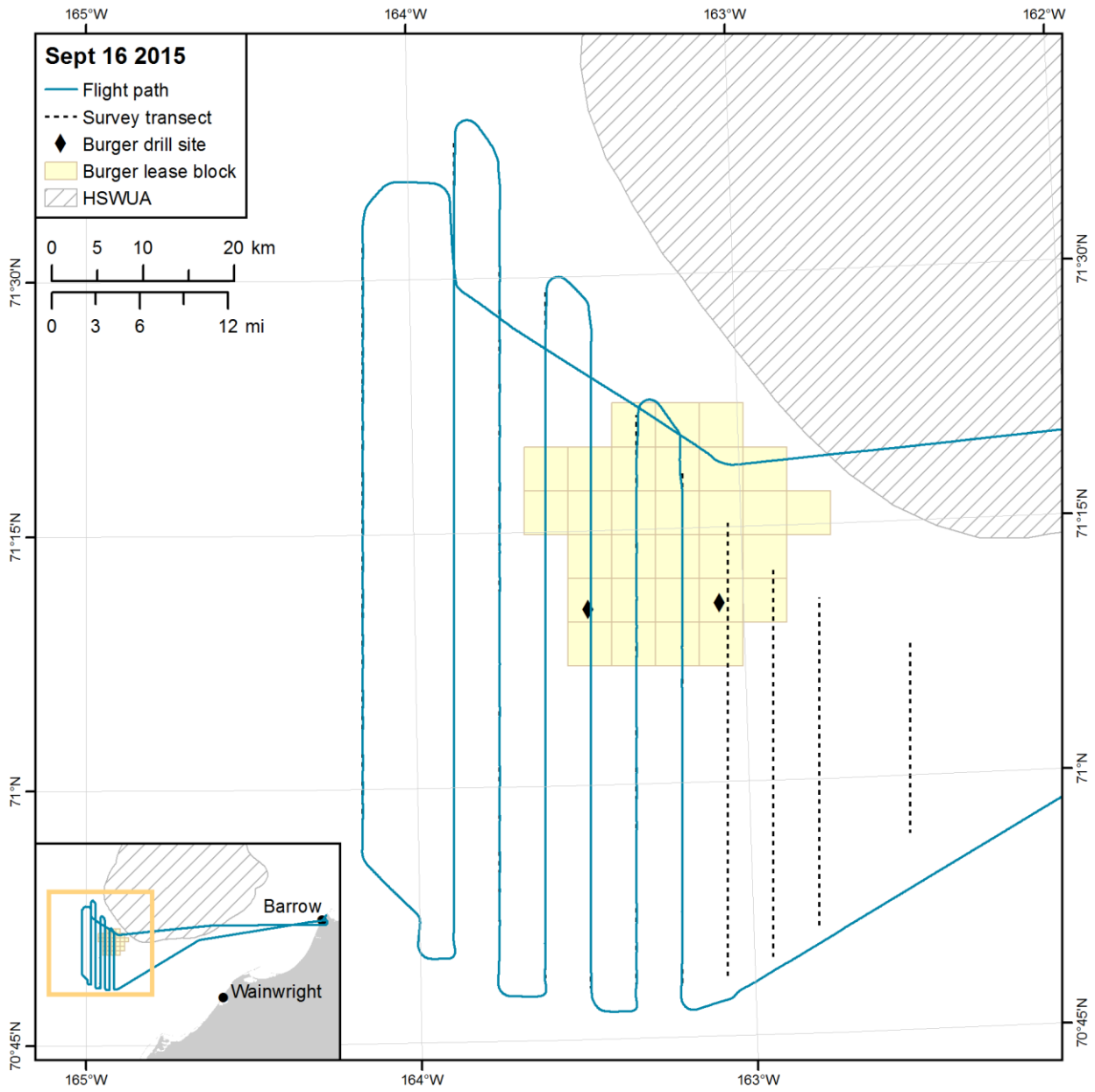

FIGURE F.11. Survey effort over the revised survey design in the northeastern Chukchi Sea at a minimum altitude of 1,000 ft. Images from this survey have not yet been reviewed.

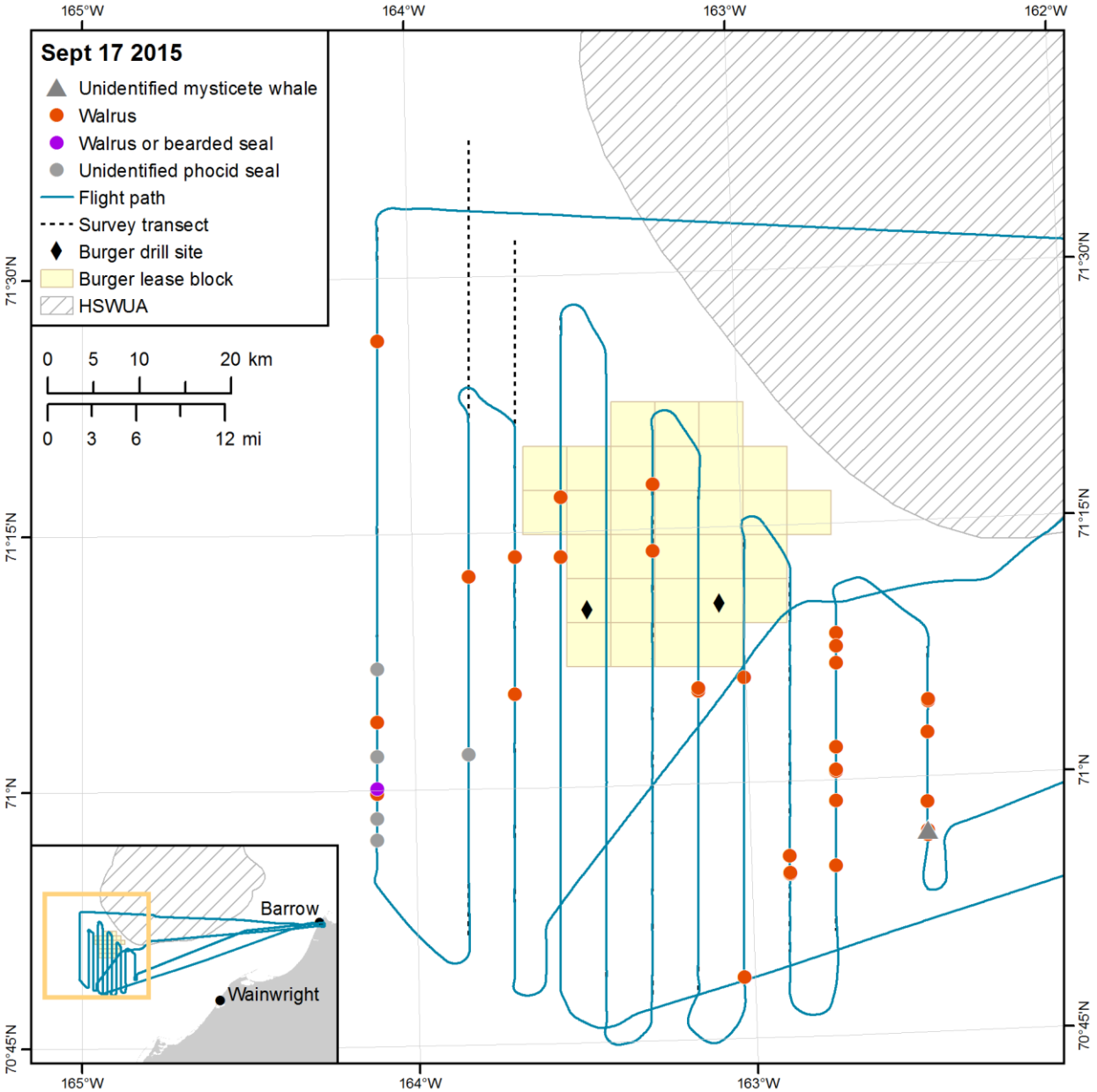

FIGURE F.12. Survey effort and locations of marine mammal sightings over the revised survey design in the northeastern Chukchi Sea at a minimum altitude of 1,000 ft. On-transect, off-transect, and lower confidence level sightings are shown on this map. Images were reviewed by the detailed manual analysis method.

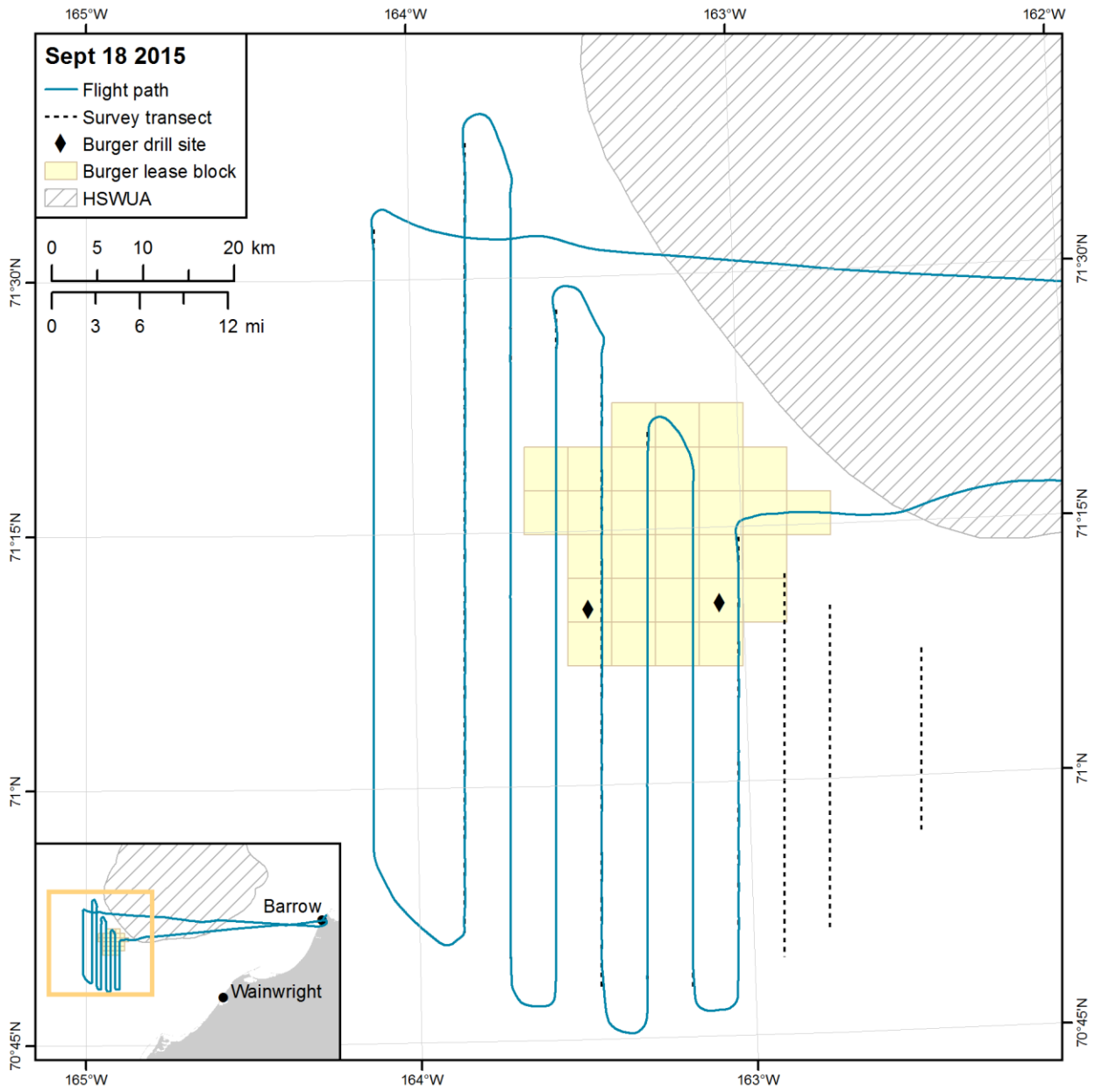

FIGURE F.13. Survey effort over the revised survey design in the northeastern Chukchi Sea at a minimum altitude of 1,000 ft. Images from this survey have not yet been reviewed.

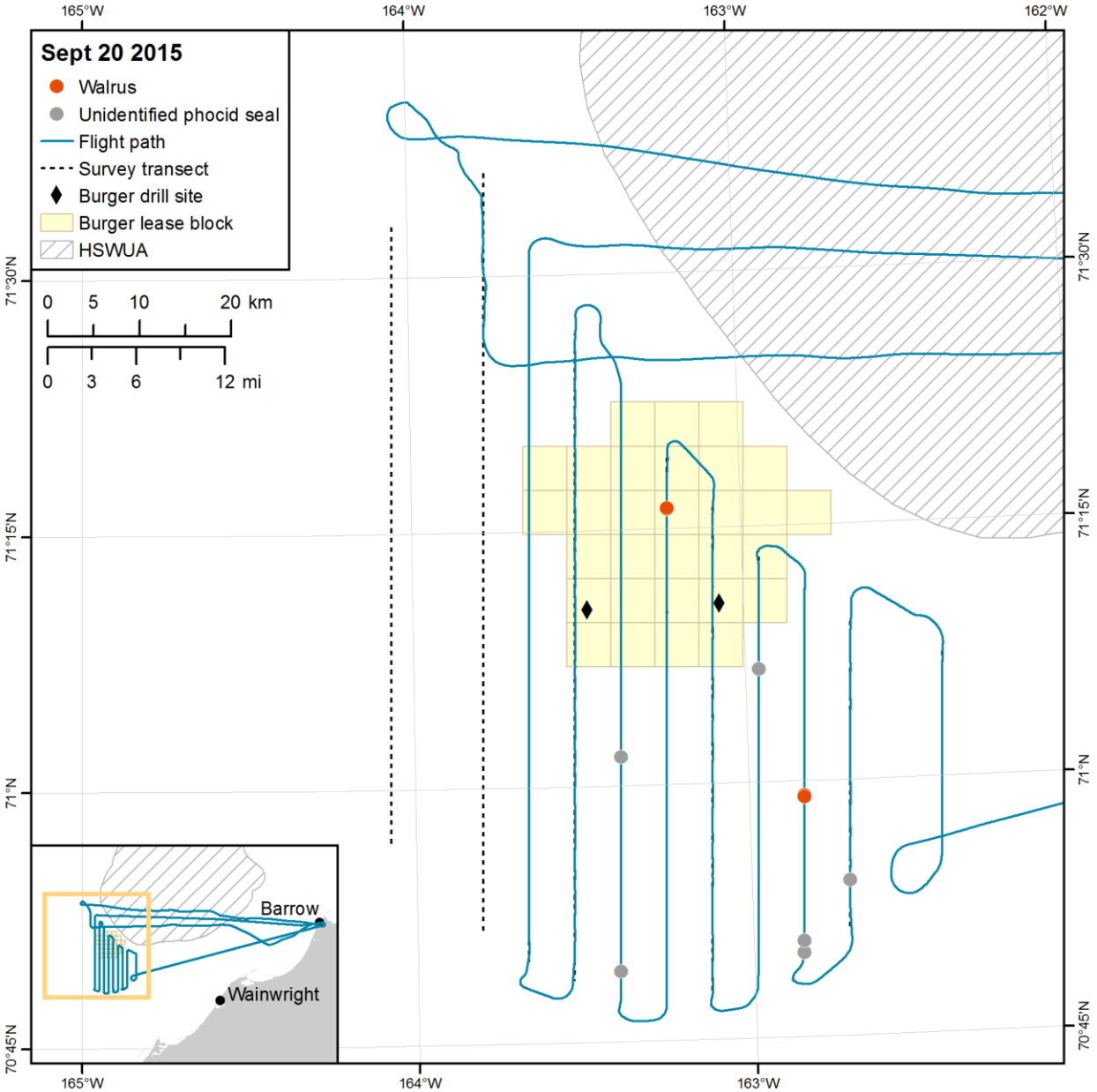

FIGURE F.14. Survey effort and locations of marine mammal sightings over the revised survey design in the northeastern Chukchi Sea at a minimum altitude of 1,000 ft. On-transect, off-transect, and lower confidence level sightings are shown on this map. Images were reviewed by the quick review method.

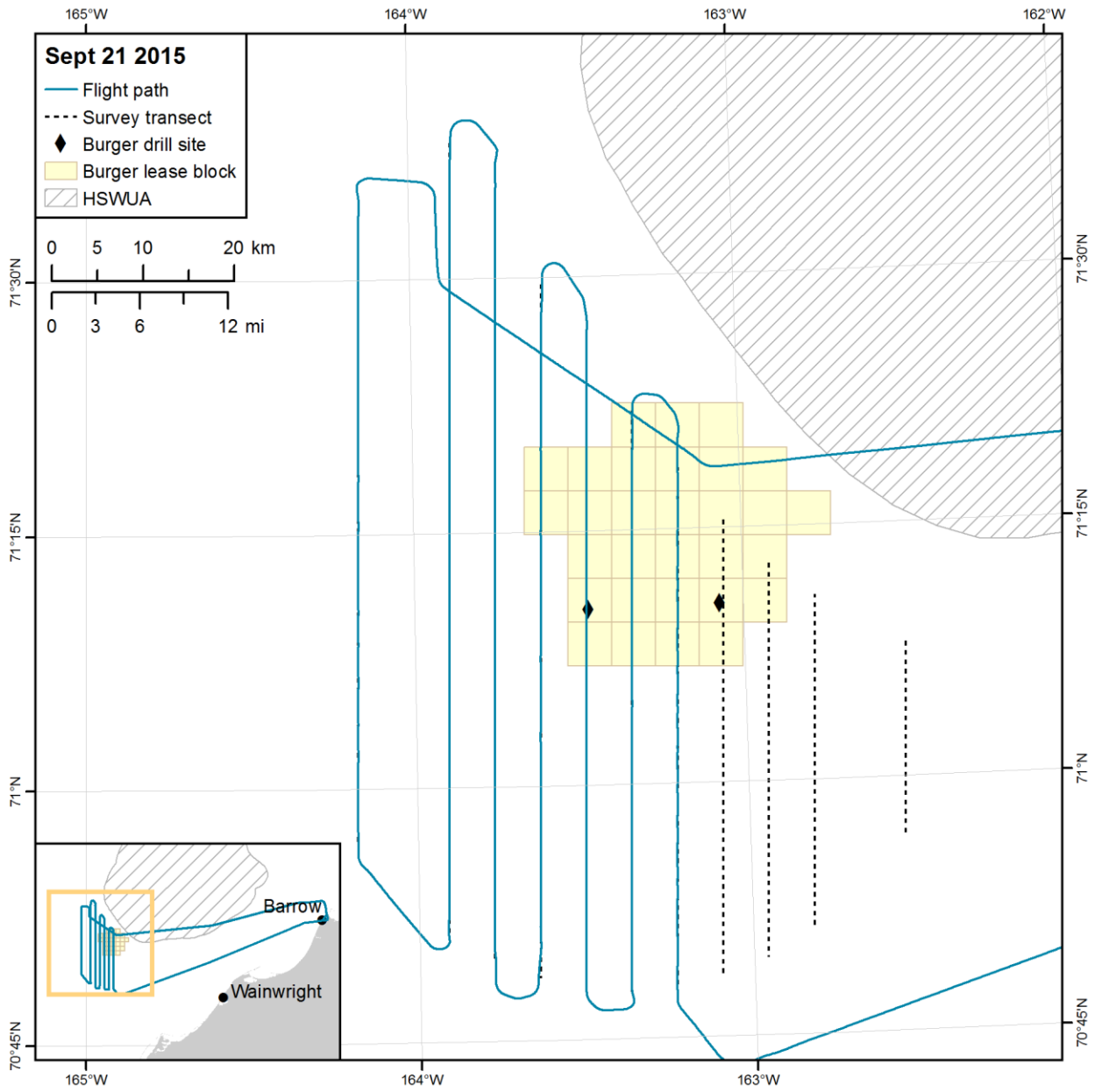

FIGURE F.15. Survey effort over the revised survey design in the northeastern Chukchi Sea at a minimum altitude of 1,000 ft. Images from this survey were reviewed and no sightings were detected. Images were reviewed by the quick review method.

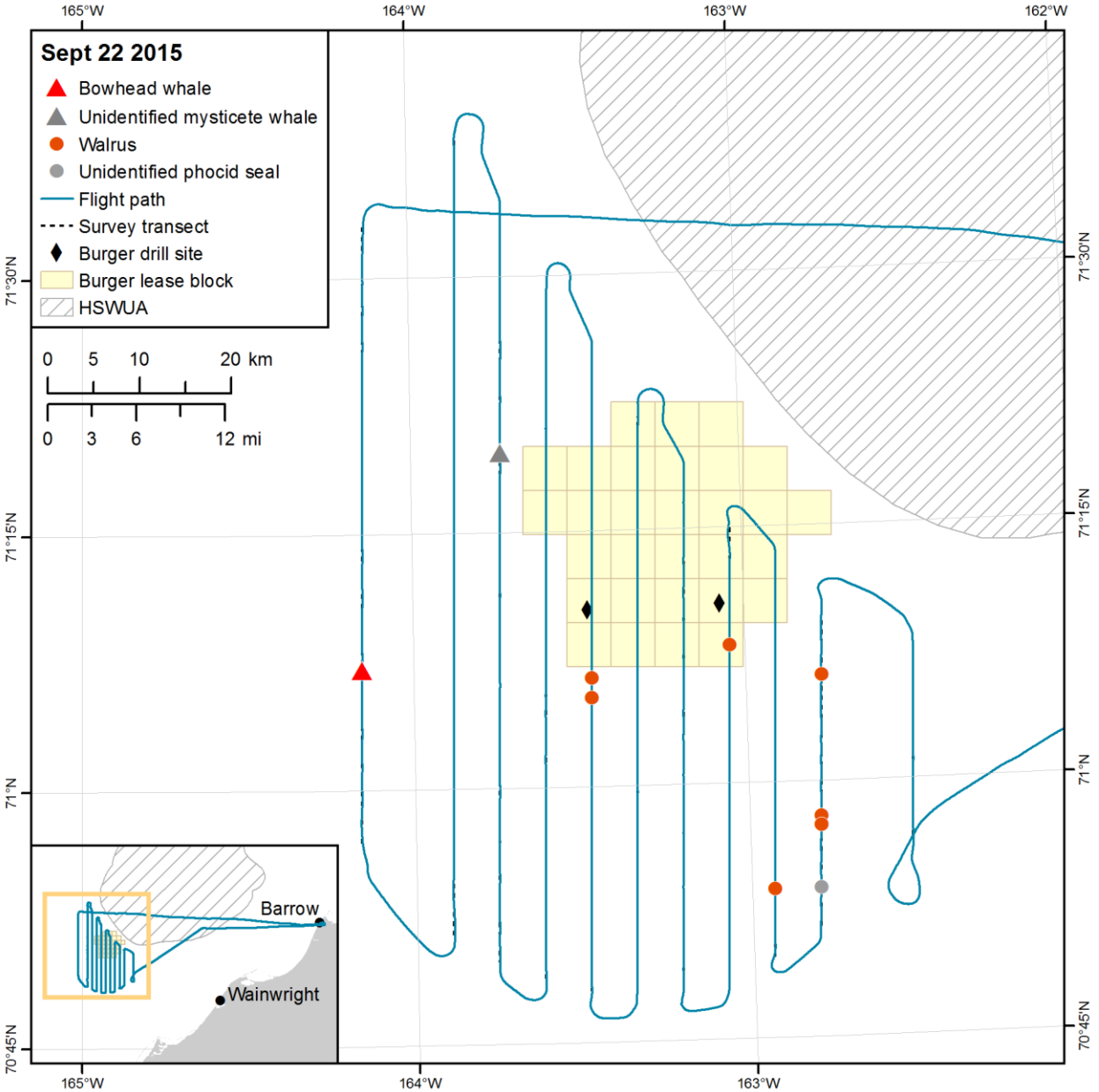

FIGURE F.16. Survey effort and locations of marine mammal sightings over the revised survey design in the northeastern Chukchi Sea at a minimum altitude of 1,000 ft. On-transect, off-transect, and lower confidence level sightings are shown on this map. Images were reviewed by the detailed manual analysis method.

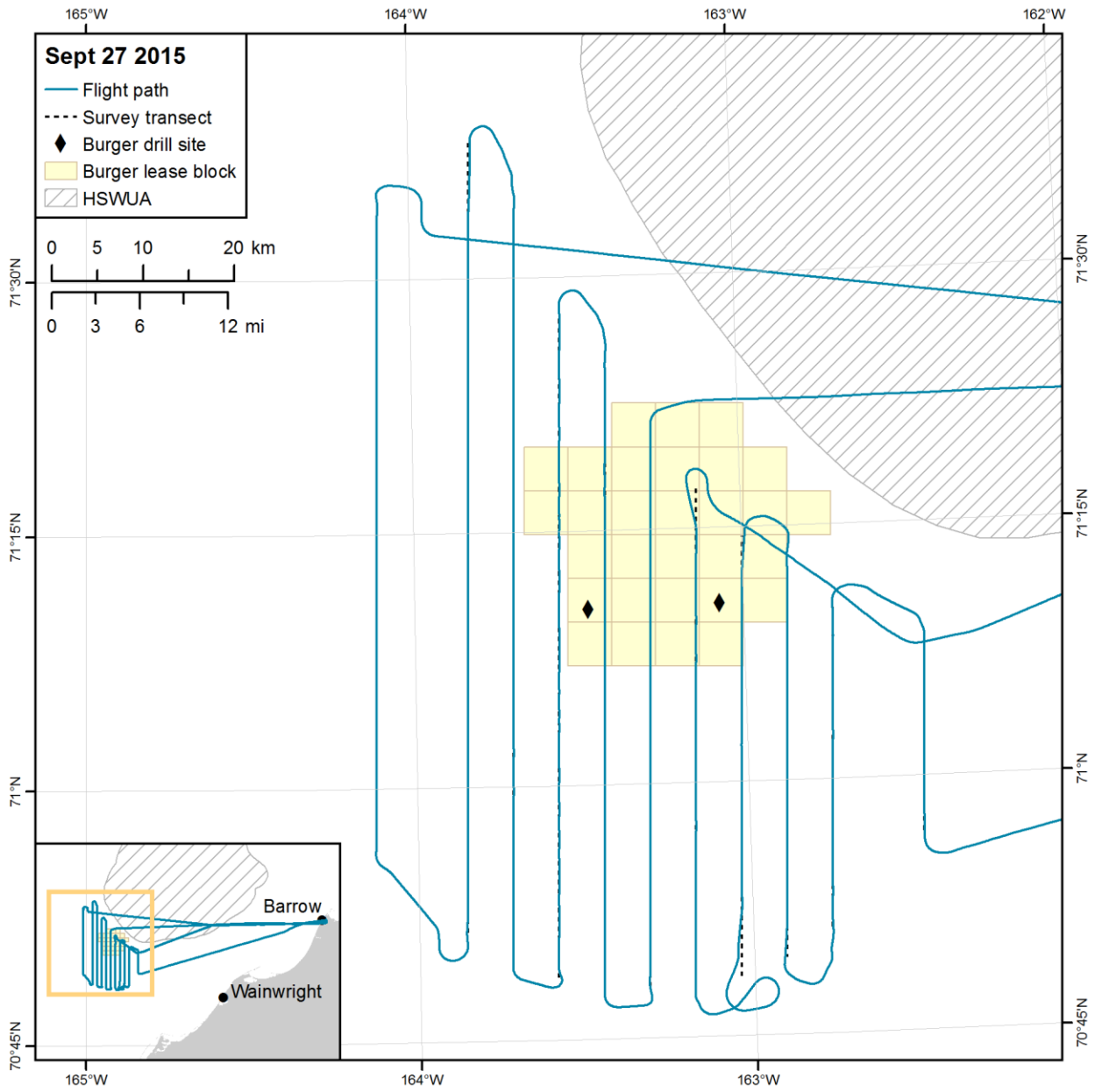

FIGURE F.17. Survey effort over the revised survey design in the northeastern Chukchi Sea at a minimum altitude of 1,000 ft. Images from this survey have not yet been reviewed.

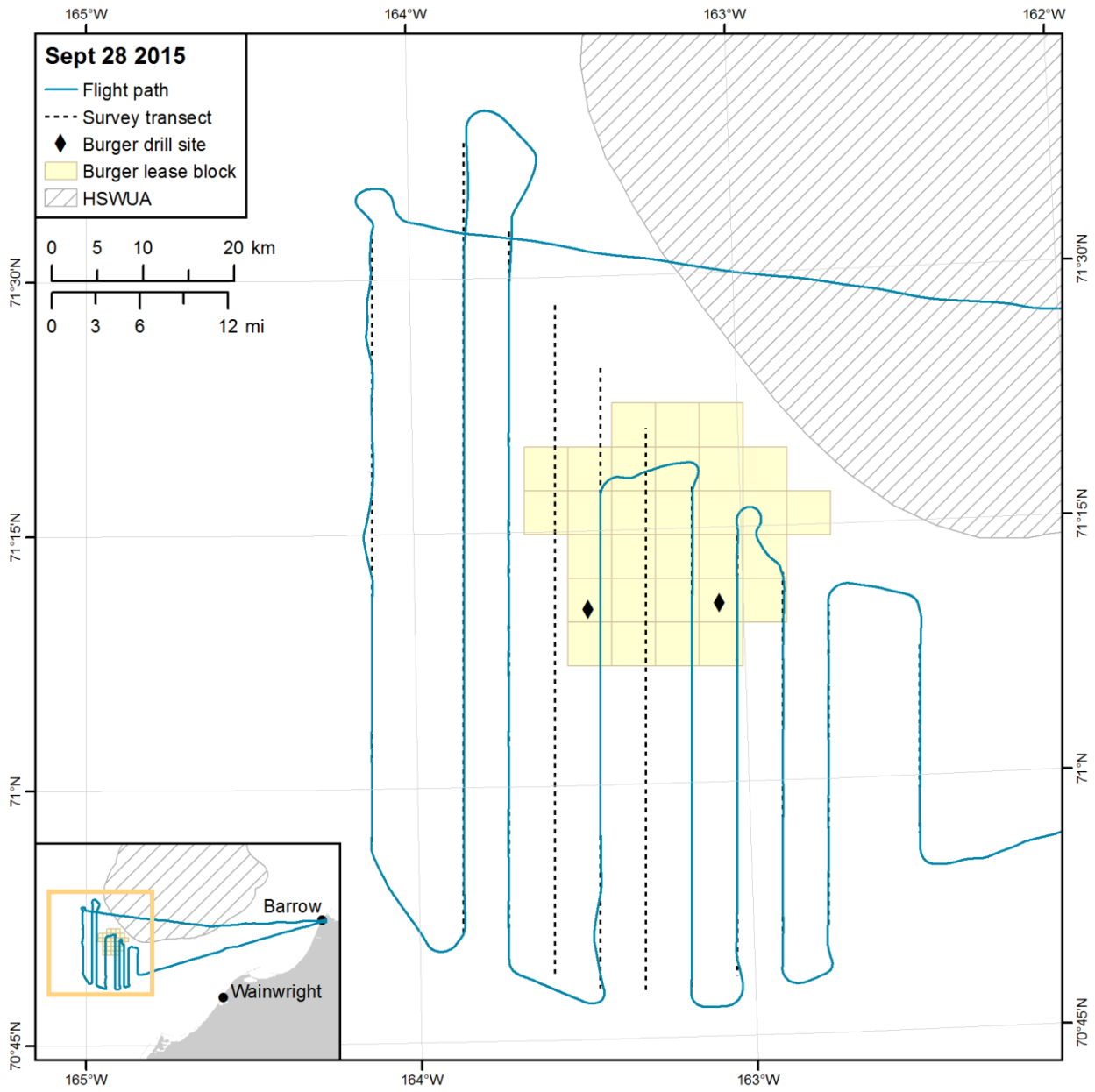

FIGURE F.18. Survey effort over the revised survey design in the northeastern Chukchi Sea at a minimum altitude of 1,000 ft. Images from this survey have not yet been reviewed.

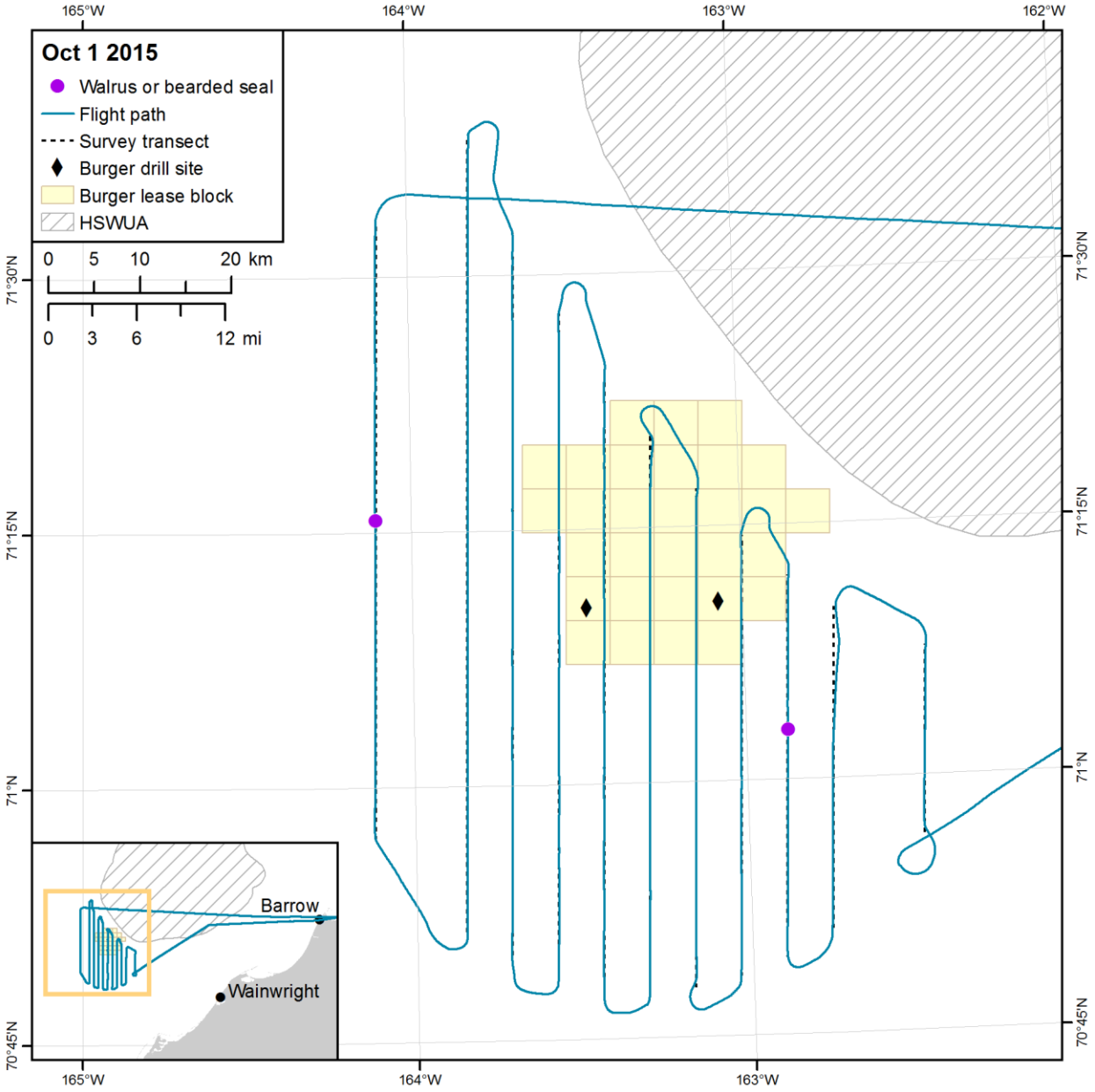

FIGURE F.19. Survey effort and locations of marine mammal sightings over the revised survey design in the northeastern Chukchi Sea at a minimum altitude of 1,000 ft. On-transect, off-transect, and lower confidence level sightings are shown on this map. Images were reviewed by the quick review method.

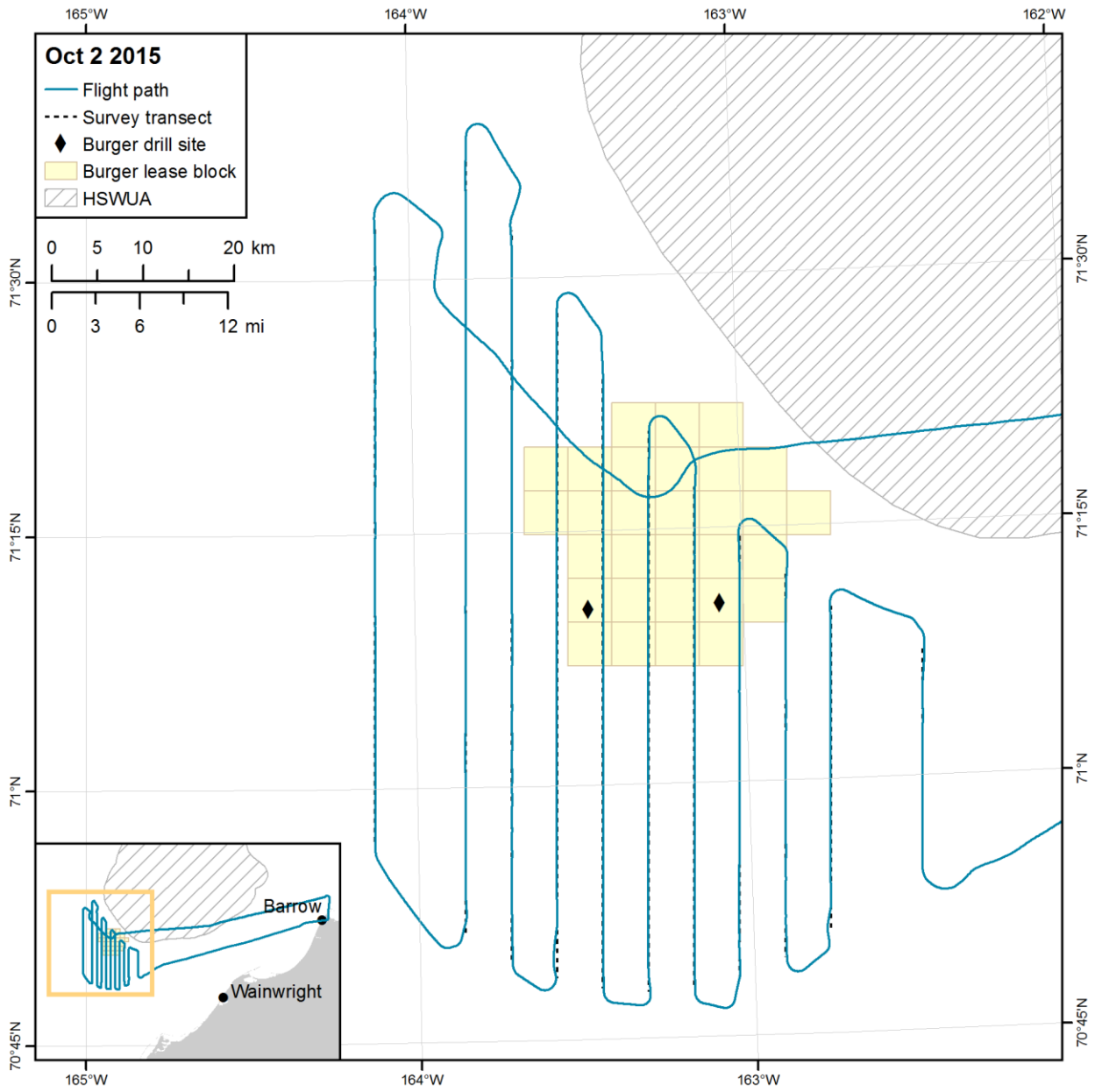

FIGURE F.20. Survey effort over the revised survey design in the northeastern Chukchi Sea at a minimum altitude of 1,000 ft. Images from this survey have not yet been reviewed.