OCS Study
BOEM 2015-040

Distribution and Relative Abundance of Marine Mammals in the Eastern Chukchi and Western Beaufort Seas, 2014 Annual Report

U.S. Department of the Interior
Bureau of Ocean Energy Management (BOEM)
Alaska OCS Region
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Anchorage, AK 99503

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Distribution and Relative Abundance of Marine Mammals in the Eastern Chukchi and Western Beaufort Seas, 2014 Final Report

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Prepared under Interagency Agreement M11PG00033

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For
U.S. Department of the Interior
Bureau of Ocean Energy Management
Alaska Outer Continental Shelf Region
Environmental Studies Program
Anchorage, Alaska

September 2015

DISCLAIMER

This study was funded, in part, by the U.S. Department of the Interior, Bureau of Ocean Energy Management, Environmental Studies Program, Washington, D.C., through Interagency Agreement Number M11PG00033 with the Alaska Fisheries Science Center. This report has been technically reviewed by BOEM and it has been approved for publication. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Government, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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CITATION

Clarke, J.T., A.A. Brower, M.C. Ferguson, A.S. Kennedy, and A.L. Willoughby. 2015. Distribution and Relative Abundance of Marine Mammals in the Eastern Chukchi and Western Beaufort Seas, 2014. Annual Report, OCS Study BOEM 2015-040. National Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS, NOAA, 7600 Sand Point Way NE, F/AKC3, Seattle, WA 98115-6349.

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ACKNOWLEDGEMENTS

This study was funded and co-managed by the U.S. Department of the Interior, Bureau of Ocean Energy Management (BOEM, formerly MMS), Alaska Outer Continental Shelf Region, Anchorage, Alaska, through Interagency Agreement No. M11PG00033, as part of the Alaska Environmental Studies Program. We particularly appreciate the support, guidance, and encouragement of Carol Fairfield and Dee Williams.

Numerous NMML personnel participated in the surveys or assisted with technical, administrative, or logistical aspects of the study. Robyn Angliss, Stefan Ball, Phil Clapham, Mary Foote, Nancy Friday, Kim Shelden, and Janice Waite provided logistical and program support. Observers included Corey Accardo, Lisa Barry, Vicki Beaver, Amelia Brower, Cynthia Christman, Janet Clarke, Leah Crowe, Heather Foley, Megan Ferguson, Laura Ganley, Jen Gatzke, Suzie Hanlan, Van Helker, Bob Lynch, Christy Sims, Jess Taylor, and Amy Willoughby.

Mike Hay of XeraGIS provided timely assistance with the data collection program, data analysis, and report preparation.

The Aero Commander aircraft, pilots, and mechanical support were provided by Clearwater Air, Inc., of Soldotna, Alaska, via Intraagency Agreement No. M11PG00032 with the Department of the Interior, Aviation Management Division. The surveys would not be possible without the enthusiastic support of Andy Harcombe. We were especially grateful to fly with Stan Churches, Jim Kopczynski, Alex Shibakov, John Siegel, and Jake Turner. Mary Pratt provided administrative support.

Real-time monitoring via satellite tracking of survey flights was provided by USDOI, Bureau of Land Management, Alaska Interagency Coordination Center, South Zone Dispatch. We especially thank Jerrid Palmatier for coordinating BLM flight followers.

In 2014, the Aerial Surveys of Arctic Marine Mammals (ASAMM) project sparked the interest of the general public. We greatly appreciate the assistance and guidance of Julie Speegle (NOAA Public Affairs Officer), John Callahan (BOEM Public Affairs Officer), and Maureen Clark (U.S. Fish and Wildlife Service Public Affairs Officer) on media relations. We are also grateful to the Alaska Fisheries Science Center's Operations, Management, and Information Division for maintaining the ASAMM website and quickly posting daily reports to the ASAMM website.

Arctic research necessarily relies on cooperation and timely sharing of information to ensure safe and successful operations. We appreciate the cooperation of the agencies, individuals, and entities who assisted or coordinated with the ASAMM team in 2014, including Craig George and Robert Suydam (NSB); Jim Churnside, Paul Flaherty, Brad Fritzler, Phil Hall, and Kevin Wood (NOAA); Willow Hetrick and Sheyna Wisdom (Olgoonik-Fairweather); Charlton Evans and Jeff Kelly (InSitu); Leonard Ligon (ACUASI); Steve Wachowski (Tulugaq); Joel Garlich-Miller and Michelle St. Martin (USFWS); Brian Battaile, Tony Fischbach, and Chad Jay (USGS); King Eider Inn; Deadhorse Aviation Center; MagTec; Black Gold Lodge; and the crews of the RV *Norsemen II, Westward Wind, Aquila,* and *Bristol Explorer*.

Marcia Muto (NMML) reviewed the report. Jim Ballou (NOAA Logistics Operations Division) assisted with preparing this report for publication.

ABSTRACT

This report describes field activities of the Aerial Surveys of Arctic Marine Mammals (ASAMM) project conducted during summer and fall (1 July – 29 October) 2014 and data analyses used to summarize field activities. Surveys were based in Barrow, Alaska, and Deadhorse, Alaska, and targeted the northeastern and southcentral Chukchi and western Beaufort seas, between 67°N and 72°N latitude and 140°W and 169°W longitude.

Sea ice cover in the study area in 2014 was generally light compared with historical (pre-2007) sea ice cover. Sea ice remained in the northern half of the Chukchi Sea study area in early July. By late July, sea ice in the Chukchi Sea had receded to the northernmost regions of the study area. The majority of the nearshore area in the western Alaskan Beaufort Sea had ~1% sea ice in late July, although ~10-100% sea ice cover remained offshore between Camden Bay, Alaska, and Point Barrow, Alaska. Remnant sea ice persisted in the northeastern Chukchi Sea study area through late August, but the western Beaufort Sea study area was ice-free by late August. By 9 September, the entire study area was completely ice-free and remained ice-free until new ice started forming in mid-October.

A total of 90 survey flights were conducted. The Barrow-based aerial survey team conducted surveys from 2 July through 29 October 2014 and the Deadhorse-based aerial survey team conducted surveys from 19 July through 10 October 2014. Total combined flight time was 440 hours, including 207 hours of transect survey effort. Over 110,000 km were flown, with 45,224 km of effort on transect. Surveys were conducted in the western Beaufort Sea in summer (mid-July through August) for the third consecutive year and in block 23 (southcentral Chukchi Sea) for the first time in several decades.

There were 3,657 sightings of 65,080 marine mammals observed during all (transect, search, and circling) survey modes, including:

- 599 sightings of 1,202 bowhead whales (*Balaena mysticetus*),
- 524 sightings of 869 gray whales (*Eschrichtius robustus*),
- 22 sightings of 46 humpback whales (*Megaptera novaeangliae*),
- 17 sightings of 36 fin whales (*Balaenoptera physalus*),
- 2 sightings of 3 minke whales (*Balaenoptera acutorostrata*),
- 922 sightings of 2,330 belugas (*Delphinapterus leucas*),
- 44 sightings of 51 unidentified cetaceans,
- 319 sightings of 56,675 Pacific walruses (*Odobenus rosmarus divergens),*
- 7 sightings of 7 bearded seals (*Erignathus barbatus*),
- 1,156 sightings of 3,665 unidentified pinnipeds, and
- 45 sightings of 196 polar bears (*Ursus maritimus*).

Bowhead whales were seen in all months of the study period and their distribution by depth zone and survey block changed as the season progressed. Distribution in the western Beaufort Sea (140°W-157°W) in July was primarily on the outer continental shelf and slope (51-2,000 m depth), except east of Barrow where bowhead whales were seen primarily in shallow (≤20 m depth) waters very near shore. Bowhead whales were seen on the inner continental shelf (≤50 m depth) in August, September, and October. Sighting rate (whales per transect km) by depth zone

between 140°W and 154°W in the western Beaufort Sea was highest in the 201-2,000 m zone in July, the 21-50 m depth zone in August and October, and the ≤20 m depth zone in September. Sighting rate by depth zone in the Barrow Canyon area (154°W - 157°W) was highest in the ≤20 m depth zone in July and October and in the 21-50 m depth zone in August and September. Bowhead whales sighted in July 2014 were significantly farther from shore and in deeper water than bowhead whales sighted in August 2014; similar differences were observed in 2012 and 2013. Compared to previous years with light sea ice cover (i.e., 1989, 1990, 1993-2013), bowhead whale sightings (not normalized by survey effort) in the western Beaufort Sea were in significantly shallower water in both the East (140°W-148°W) and West (148°W-156°W) regions. In the northeastern Chukchi Sea, few bowhead whales were seen in July and August. The highest sighting rate in September and October was in the 51-200 m North depth zone. The highest overall bowhead whale sighting rate per survey block was block 6 in July, block 4 in August, block 1 in September, and block 12 in October. The eastern Chukchi Sea survey block with the highest overall sighting rate was block 13.

Spatial models of bowhead whale relative abundance (accounting for heterogeneous survey effort) in the western Beaufort Sea were created to examine high-use areas (HUAs) during fall (September-October) 2014 and each month from July through October for the 15-year period from 2000 to 2014. The spatial model for fall 2014 suggested that the median distribution of bowhead whales was located approximately 10 km closer to shore in the East Region compared to the West Region. The spatial model for 2000-2014 suggested that the bowhead whale HUA was located farthest from shore in July compared to August, September, and October. Finally, comparison of the predictions from the two spatial models suggested that bowhead whale HUAs were located considerably closer to shore in the East Region and slightly closer to shore in the West Region in 2014 compared to the 15-year time series from 2000 to 2014.

Sightings of feeding or milling bowhead whales were particularly noteworthy. Feeding and milling were noted for bowhead whales in several locations from July through October, and comprised the behaviors most often observed (57%) of bowhead whales in 2014. Feeding and milling were observed near Demarcation Point (140°W-142°W) from late August to late September, in Camden Bay from late August to late September, from Flaxman Island to Oliktok Point (146°W - 150°W) from late August to early October, in Harrison Bay in late September, and from Smith Bay to Point Barrow from early September to early October. Feeding behavior was documented for bowhead whales in depths ranging from 5 m to 95 m (<1 km to 205 km from shore).

Thirty-seven bowhead whale calves were seen in 2014, including 11 calves seen during July and August in the western Beaufort Sea. The fall bowhead whale calf ratio (number of calves/number of total whales) was within the normal range of calf ratios recorded by ASAMM from 1982 to 2013.

Gray whales were seen in all months of the study period in the northeastern Chukchi Sea and westernmost Alaskan Beaufort Sea (just east of Point Barrow), and one gray whale was seen north of Cross Island, Alaska, in the central Alaskan Beaufort Sea. Gray whale aggregations were primarily observed within ~30 km of the Alaskan coastline between Point Barrow and Point Lay, with scattered sightings up to 120 km offshore. One cow-calf pair was observed approximately 240 km west of Barrow, and several adults and one cow-calf pair were seen near the southern extreme of Hanna Shoal, Alaska. The largest aggregations, however, were seen from July to September in a benthic hotspot in the southcentral Chukchi Sea. The highest sighting rate by depth zone was in the 51-200 m South zone in the southcentral Chukchi Sea. The highest sighting rate by month occurred in August and decreased sharply in September and October. When effort in the southcentral Chukchi Sea was removed from the analysis, the highest sighting rate by depth zone occurred in the ≤35 m zone in summer (July to August) and the 36-50 m zone in fall (September to October). Most gray whales observed (70%) were feeding. One hundred nine gray whale calves were seen, although some calf sightings may have been repeat sightings.

Additional noteworthy results from the 2014 ASAMM field effort included:

- Humpback whales (22 sightings of 46 whales) were sighted in the southcentral Chukchi Sea in September.
- Fin whales (17 sightings of 36 whales) were sighted in the southcentral Chukchi Sea in September.
- Minke whales (two sightings of three whales) were sighted in the northeastern Chukchi Sea and southcentral Chukchi Sea in September.
- Beluga distribution in the western Beaufort Sea in summer and fall was centered over the continental slope and Barrow Canyon, with more sightings than usual in shallow nearshore areas. Beluga sightings were scattered in the northeastern Chukchi Sea in all months. One large group of 200 whales was seen near Kasegaluk Lagoon, Alaska, in July.
- Walruses were observed in the water and hauled out on ice (particularly near Hanna Shoal) and on land. A walrus haulout on land was observed near Point Lay on three occasions from 19 to 27 September, with an estimated maximum group size of 35,000 animals.
- Polar bears were seen from Wainwright, Alaska, on the Chukchi Sea coast to east of Kaktovik, Alaska, on the Beaufort Sea coast. All but one of the polar bears were observed on land or within 1 km of land; one bear was swimming >150 km offshore in the northeastern Chukchi Sea.

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Abbreviations and Acronyms

ADF&G	Alaska Department of Fish and Game
AFSC	Alaska Fisheries Science Center
ARBO	Arctic Region Biological Opinion
ARCWEST	Arctic Whale Ecology Study
ASAMM	Aerial Surveys of Arctic Marine Mammals
BLM	Bureau of Land Management
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BOWFEST	Bowhead Whale Feeding Ecology Study
BSPA	Beaufort Sea Planning Area
BWASP	Bowhead Whale Aerial Survey Project
COMIDA	Chukchi Offshore Monitoring in Drilling Area
CSPA	Chukchi Sea Planning Area
DBO	Distributed Biological Observatory
e.g.	for example
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FR	Federal Register
GAM	Generalized Additive Model
GIS	Geographic Information System
GPS	Global Positioning System
GRS	Geodetic Reference System
hr	hour
HUA	High-Use Area
i.e.	that is
IBCAO	International Bathymetric Chart of the Arctic Ocean
km	kilometer
m	meter
max	maximum
min	minimum

MIZOPEX	Marginal Ice Zone Observations and Processes Experiment
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
n	sample size
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NSB	North Slope Borough
NOAA	National Oceanic and Atmospheric Administration
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
P	probability
PMEL	Pacific Marine Environmental Laboratory
s	second
SD	standard deviation
Tr	transect
TrC	circling from transect
TrSi	transect sightings
Tr+TrC	transect plus circling from transect
UAF	University of Alaska Fairbanks
UAS	unmanned aerial system
UAV	unmanned aerial vehicle
USB	universal serial bus
USC	U.S. Code
USCG	U.S. Coast Guard
USDOC	U.S. Department of Commerce
USDOD	U.S. Department of Defense
USDOI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WHOI	Woods Hole Oceanographic Institute
WPUE	whales per unit effort (index of relative abundance or occurrence)

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INTRODUCTION

In 1953, the Outer Continental Shelf Lands Act (OCSLA) (43 USC 1331-1356) charged the U.S. Secretary of the Interior with the responsibility of administering minerals exploration within and development of the Outer Continental Shelf (OCS). The Act empowered the Secretary to formulate regulations so that its provisions could be met. The OCSLA Amendments of 1978 (43 USC 1802) established a policy for the management of oil and natural gas in the OCS and for protection of the marine and coastal environments. The amended OCSLA states that the Secretary of the Interior shall conduct studies in areas or regions of sales to ascertain the "environmental impacts on the marine and coastal environments of the Outer Continental Shelf and the coastal areas which may be affected by oil and gas development" (43 USC 1346).

Subsequent to the passage of the OCSLA, the Secretary of the Interior designated the Bureau of Land Management (BLM), U.S. Department of the Interior (USDOI), as the administrative agency responsible for leasing submerged federal lands, and the Conservation Division of the U.S. Geological Survey (USGS) for classifying and evaluating submerged federal lands and regulating exploration and production. In 1982, the U.S. Minerals Management Service (MMS) assumed these responsibilities. The MMS was renamed the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) in 2010. In 2011, the Bureau of Ocean Energy Management (BOEM) assumed responsibilities for administering environmentally and economically responsible development of offshore resources.

The history of the management recommendations and decisions relevant to natural resource exploration, development, and production in the OCS and associated effects on marine mammals is summarized here. In June 1978, the BLM entered into a consultation with the National Marine Fisheries Service (NMFS) under Section 7 of the Endangered Species Act (ESA) of 1972 (16 USC 1531-1543). The purpose of the consultation was to determine the likely effects of the proposed Beaufort Sea Oil and Gas Lease Sale on endangered bowhead (*Balaena mysticetus*) and gray (*Eschrichtius robustus*) whales. NMFS determined that insufficient information existed to conclude whether the proposed Beaufort Sea sale was likely to jeopardize the continued existence of bowhead and gray whales. In August 1978, NMFS recommended studies to the BLM that would fill the information needs identified during the Section 7 consultation. Subsequent Biological Opinions for leasing and exploration in the Beaufort Sea (Sales 71, 87, and 97) and the 1988 Arctic Region Biological Opinion (ARBO) used for Beaufort and Chukchi sea sales (Sales 124, 126, 144, and 170) recommended continuing studies of whale distribution and OCS-industry effects on bowhead whales (USDOC, NOAA, NMFS 1982, 1983, 1987, and 1988), in addition to monitoring bowhead whale presence during periods when geophysical exploration and drilling were occurring. The 2006 and 2008 ARBO issued by NMFS for leasing and exploration in the U.S. Beaufort and Chukchi seas, Alaska, and authorizations of small takes under the Marine Mammal Protection Act (MMPA) (USDOC, NOAA, NMFS 2008) recommended the following conservation actions:

> MMS and NMFS should continue research to update environmental inventories of marine mammals for the Chukchi Sea. Marine mammal surveys should be continued. MMS should consider a comprehensive program for this purpose which employs aerial and ship based efforts as well as the use of passive acoustics. In particular, the current BWASP

> [Bowhead Whale Aerial Survey Project] program should be expanded to include Block 13. MMS should particularly engage in research to describe bowhead whale behavior, movements and distribution, and important habitats in these waters. Efforts should be made to obtain photographs of humpback whales within the area for photo-identification.
>
> MMS should continue research to describe the impact of exploration activities on the migrational movements and feeding behavior of the bowhead whale. Specific plans should be developed and implemented to monitor the cumulative effects of exploration, development, and production on the bowhead whale. These research designs and results should be reviewed annually to ensure that the information collected is addressing the concerns of NMFS and the affected Native communities.

The current ARBO, issued by NMFS in 2013 for oil and gas leasing and exploration activities in the U.S. Beaufort and Chukchi seas (USDOC, NOAA, NMFS 2013), includes the following conservation recommendations:

> Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).
>
> 9. Under the BOEM Environmental Studies Program, consider studies to monitor abundance, trends, habitat use, and productivity of listed species to assist with understanding potential effects of human activities on populations;
>
> 10. Under the BOEM Environmental Studies Program, consider specifically [studies] designed to assess abundance, population trends, habitat use, and productivity of ringed and bearded seal populations that may be affected by oil and gas development.

Following several years when drilling was limited to 1 November through 31 March (USDOI, MMS 1979), variable 2-month seasonal drilling restrictions on fall exploratory activity in the joint Federal/State Beaufort Sea sale area were implemented in May 1982. The Diapir Field Sale 87 Notice of Sale (1984) stated that “Bowhead whales will be monitored by the Government, the lessee, or both to determine their locations relative to operational sites as they migrate through or adjacent to the sale area” (USDOI, MMS 1984). Subsequent lease sales in the Beaufort Sea Planning Area (BSPA) (Sales 97, 124, 144, 170, 186, 195, and 202) and Lease Sale 193 in the Chukchi Sea Planning Area (CSPA) did not include a seasonal drilling restriction, but the Notice of Sale for each contained an Information to Lessees clause stating that the “MMS intends to continue its area wide endangered whale monitoring program in the Beaufort Sea during exploration activities” (USDOI, MMS 1988, 1991, 1996, 1998).

To provide information used in Environmental Impact Statements and Environmental Assessments under the National Environmental Policy Act (NEPA) of 1969 (42 USC 4321-4347), and to assure protection of marine mammals under the MMPA of 1972 (16 USC 1361-1407) and the ESA, the BLM (and, later, MMS) funded numerous studies involving acquisition and analysis of marine mammal and other data, including an endangered whale monitoring plan that required aerial surveys. Information gathered during the monitoring program was used to help determine the extent, if any, of adverse effects on the species. From 1979 to 1987, the BLM and then the MMS (Alaska OCS Region) funded annual monitoring of endangered whales via aerial surveys in arctic waters under Interagency Agreements with the Naval Ocean Systems Center and through subcontracts to SEACO, Inc. (Ljungblad et al. 1987). The MMS used agency personnel to perform fieldwork and reporting activities for surveys conducted in the western Beaufort Sea on an annual basis from 1987 to 2006 (referred to as the Bowhead Whale Aerial Survey Project, BWASP) (Treacy 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 2000, 2002a, 2002b; Monnett and Treacy 2005; USDOI, MMS 2008). In 2007, an Interagency Agreement between the MMS (U.S. Department of the Interior) and NMFS (specifically, the Alaska Fisheries Science Center [AFSC], NOAA, U.S. Department of Commerce) was established to authorize the National Marine Mammal Laboratory (NMML, a division of AFSC) to conduct BWASP surveys and assume partial responsibility for the management of the project. In 2008, NMML adopted full responsibility for all aspects of the BWASP surveys and related tasks, with continued funding and co-management by the MMS (now BOEM) (Clarke et al. 2011a, 2011b, 2011c).

The Chukchi Offshore Monitoring in Drilling Area (COMIDA) marine mammal aerial survey component was initiated in 2008, via an Interagency Agreement between the MMS and AFSC. These surveys were a continuation of aerial surveys that were conducted by MMS-sponsored contractors from 1982 to 1991 (Ljungblad et al. 1987; Moore and Clarke 1992) and used similar methodology. The goal of the COMIDA aerial surveys was to investigate the distribution and relative abundance of marine mammals in the CSPA during the open water (ice-free) months of June-October, when various species undertake seasonal migrations through the area. The COMIDA study area encompassed the northeastern Chukchi Sea from the shore seaward, 68°N-72°N and 157°W-169°W, and overlaid Lease Sale 193 (offered in February 2008) (Clarke et al. 2011d).

In 2011, an Interagency Agreement between BOEM and AFSC was established to authorize NMML to continue the BWASP and COMIDA studies under the auspices of a single study, Aerial Surveys of Arctic Marine Mammals (ASAMM). The goal of the ASAMM study is to document the distribution and relative abundance of bowhead, right, fin, and gray whales and other marine mammals in areas of potential seismic surveying, drilling, construction, and production activities in the western Beaufort and northeastern Chukchi seas (Clarke et al. 2012, 2013a, 2014). Data from the project shall be used to relate variation in marine mammal distribution or relative abundance to other variables, such as physical oceanographic conditions, indices of potential prey density, and anthropogenic activities, if information on these variables is available.

The objectives of the ASAMM study are to

1) Describe the annual migration of bowhead whales across the Alaskan Arctic, significant inter-year differences, and long-term trends in the spatial distribution and timing (duration and start date) of the migration.

2) Document relative abundance, spatial and temporal distribution, and behavior (including calving/pupping, feeding, hauling out) of marine mammals (cetaceans, ice seals, walruses, and polar bears) in the Alaskan Arctic.

3) Provide near real-time data and maps to BOEM and NMFS on marine mammals in the Alaskan Arctic, with specific interest in endangered species, such as bowhead whales.

4) Provide an objective wide-area context for understanding marine mammal ecology in the Alaskan Arctic, to help inform management decisions and interpret results of other small-scale studies.

5) Provide, when requested by BOEM's Representative, limited integrative products such as graphics of summarized observations for use by BOEM analysts in NEPA and ESA analyses and documentation.

6) Provide timely information on environmental conditions, including ice conditions, to organizations (e.g., National Ice Center, Alaska Eskimo Whaling Commission, BOEM) as directed by BOEM's Representative.

METHODS AND MATERIALS

Study Area

The study area encompasses the western Beaufort, northeastern Chukchi, and southcentral Chukchi seas (Figure 1). Survey blocks overlay Beaufort Sea and Chukchi Sea oil and gas lease sale areas offshore of Alaska. The study area partially overlaps the CSPA and BSPA but does not completely encompass either. The present study includes survey blocks 1 through 23 between 140°W and 169°W longitude, and between 67°N and 72°N latitude, and encompasses approximately 242,000 km^2. Survey blocks 1 through 12 (140°W-157°W) comprise the western Beaufort Sea (formerly BWASP) study area, while survey blocks 13 through 23 (157°W-169°W) comprise the eastern Chukchi Sea (formerly COMIDA) study area. The inclusion, in 2014, of block 23 (67°N-68°N, 166°W-169°W) was to provide information on marine mammal distribution and relative abundance in a biologically rich area that undergoes regular marine environment sampling as part of the Distributed Biological Observatory (DBO) project (Distributed Biological Observatory 2014).

The Chukchi Sea is largely ice-covered from late fall through winter. In spring, open water leads begin to develop, as ambient temperatures increase and warmer water flows northward from the Pacific Ocean through the Bering Sea and Bering Strait. The most nutrient rich waters flow in the Siberian Coastal Current, west of the ASAMM study area. Two less productive water masses, the Alaska Coastal Water and Bering Shelf Water, are found in the eastern Chukchi Sea (Figure 2). Current flow may be with or against the predominant wind direction.

In the Beaufort Sea, the Beaufort Gyre moves surface waters clockwise in the offshore regions. Underlying the gyre is the eastward-flowing Beaufort Undercurrent, which flows subsurface in areas where bathymetry is 51-2,000 m and undergoes frequent current reversals to the west (Aagaard 1984). In the nearshore shallow waters of the Beaufort inner shelf (≤50 m depth), currents tend to follow local wind patterns. In winter, currents are not substantial, even when winds are strong. In summer, currents are much stronger and may flow either east or west with the prevailing winds. Based on analysis of modeled sea level and ice motion, wind-driven currents in the Arctic were found to alternate between anticyclonic and cyclonic circulation, with each regime persisting from 5 to 7 years (Proshutinsky and Johnson 1997; Johnson et al. 1999). However, the wind-driven regime has been largely anticyclonic since 1997 (Richter-Menge et al. 2011), with a cyclonic regime observed only in 2009. Intra-annual variation was especially noticeable 2011-2012, when large-scale circulation was weakly anticyclonic from September 2011 to August 2012, followed by a very strong cyclone event that occurred in the first week of August 2012 (Jeffries et al. 2012).

Shorefast ice forms during the fall and may eventually extend up to 50 km offshore by the end of winter (Norton and Weller 1984). The pack ice, which may include multiyear ice averaging 4 m in thickness with pressure ridges up to 50 m thick (Norton and Weller 1984), becomes contiguous with new and shorefast ice in late fall. From late November to mid-May, the Beaufort Sea normally remains almost completely covered by ice. In spring, a recurring lead

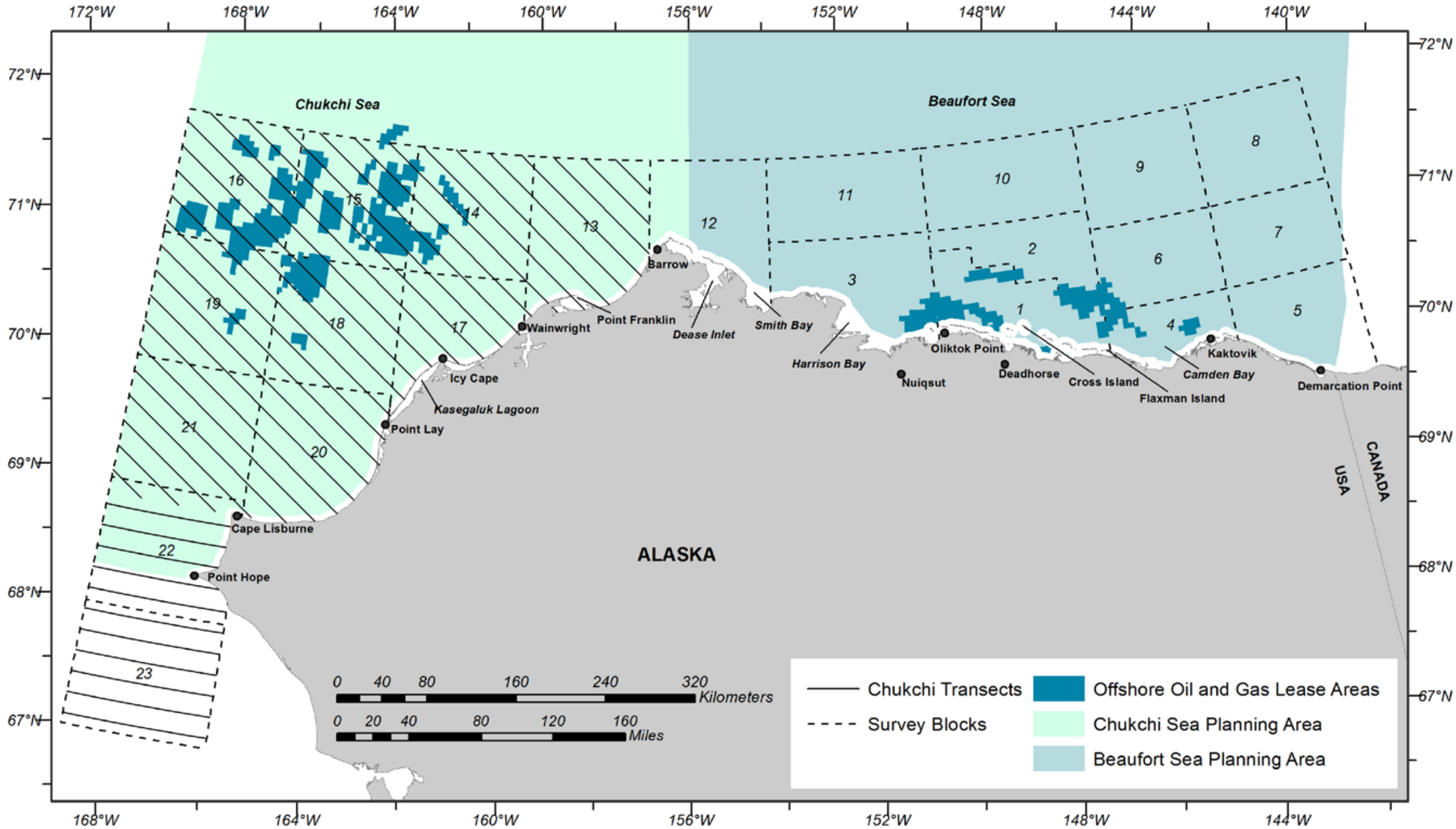

Figure 1. ASAMM study area showing survey blocks, 2014 Chukchi Sea transect lines, Chukchi Sea Planning Area, Beaufort Sea Planning Area, and current lease areas. Transect lines in the Beaufort Sea are generated daily and, therefore, not shown.

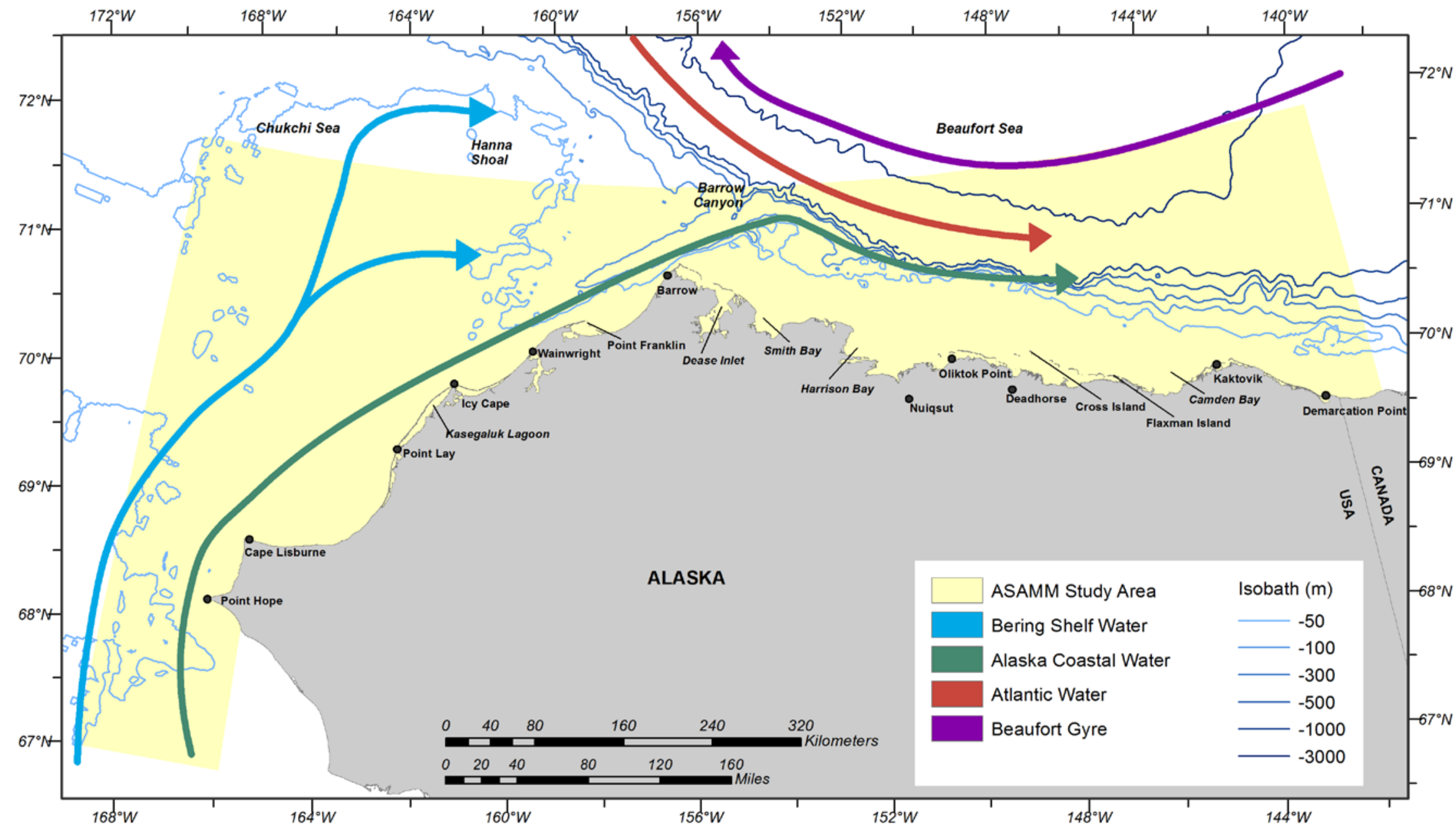

Figure 2. Eastern Chukchi Sea and western Beaufort Sea oceanographic features.

forms just seaward of the stable shorefast ice, followed by decreasing ice concentrations (LaBelle et al. 1983) and large areas of open water in summer. In recent years, the minimum area of the summer ice pack has been shrinking, setting records for new minima in several years, including 2007-2013 (National Snow and Ice Data Center 2007, 2008, 2009, 2010, 2011, 2012, 2013). Since 2007, the open water season has lengthened and the southern edge of the ice pack has been farther from Alaskan coastlines during annual sea ice minima. The decrease in sea ice extent has been correlated with an increase in Arctic Ocean cloud cover (Eastman and Warren 2010).

Local weather patterns affect the frequency and efficacy of all marine aerial surveys. The ASAMM study area is in the Arctic climate zone, with mean air temperatures at western Beaufort Sea coastal locations ranging from -0.9°C to -0.1°C during September and from -9.7°C to -8.5°C during October (Brower et al. 1988). Mean annual air temperatures measured at Barrow from 1972 to 2007 increased by 2.9°C, likely due to circulation changes (increased warm air advection from southern latitudes) or increased infrared back-radiation due to increased cloudiness, water vapor, or carbon dioxide (Wendler et al. 2009). The heaviest precipitation (snow and rain) occurs in September and October (Brower et al. 1988), but the total annual precipitation in the Alaskan Arctic has decreased since the late 1940s (Stafford et al. 2000). Mean wind speed at Barrow and Barter Island, Alaska, is from 5 m/s to 6 m/s during September and 5-7 m/s during October (Brower et al. 1988). Wind speeds in September and October are generally higher than during other times of the year, perhaps because the open water and cooling land mass increase thermal instability (Wendler et al. 2009). Wind direction is predominantly easterly, driving the Beaufort Gyre, but winds occasionally reverse and shift to being westerly. The occurrence of storms during which at least one hourly reading of wind speed was >15 m/s (approximately Beaufort wind force 7) also increased from 1972 to 2007 (Wendler et al. 2009). Mean annual wind speed recorded at Barrow from 1972 to 2007 was 5.6 m/s (Wendler et al. 2009).

Sea state also affects visibility during aerial surveys. Surface waters in the Beaufort and Chukchi seas are influenced primarily by wind. Ocean waves are generally from the north or east during September and October. Prior to 1997, significant wave heights were reduced by a factor of four from heights that would otherwise be expected during the open water season because pack ice limited fetch. Since 1997, large expanses of open water have been present during some or all of the field season. Corresponding wave heights have been considerably higher during periods of strong wind, obscuring visibility of marine mammals due to wave height, whitecaps, and/or spray.

Equipment

Surveys were flown in Aero Commander 690A twin turbine aircraft, provided by Clearwater Air, Inc., and were conducted with highest regard for flight safety. Observers and pilots were linked with a common communication system. The maximum time aloft in the Aero Commander was approximately 6.0 hours, including fuel reserve. Onboard safety equipment included an impact-triggered emergency locator transmitter installed in the aircraft, an 8-person search and rescue life raft equipped with an emergency survival kit, portable personal locator beacons, portable marine and aviation band transceivers, and immersion suits. All personnel participating in the surveys underwent safety trainings, were thoroughly briefed on aircraft operations, and participated in aircraft egress drills. All personnel wore either flight or dry suits and were outfitted with Switliks or other personal floatation devices containing emergency equipment.

Aircraft were equipped with bubble windows that afforded primary observers a complete view of the trackline. A removable side window permitted unobstructed photography. The pilot and copilot had good forward and side viewing. Each observer was issued a hand-held clinometer for measuring the angle of declination to sighting locations. A laptop computing system was used aboard each aircraft to display, store, and analyze flight and observational data. The computer system was connected to a Garmin Global Positioning System (GPS) with an external antenna, independent of the aircraft GPS. Latitude, longitude, and aircraft altitude from the GPS were transmitted to the data recorder's computer through a USB connection. Specialized software developed for ASAMM was used to help prompt data recording. A custom mapping component of the software permitted the data recorder to view sightings along the aircraft's trackline in real time. Data were continually backed up to an onboard external hard drive throughout each flight.

The USDOI, Bureau of Land Management, Alaska Interagency Coordination Center, South Zone Dispatch, used Automated Flight-Following for real-time satellite-tracking of project aircraft. Dispatch personnel monitored current flight status via maps, and hourly updates were communicated from the aircraft to Dispatch via Iridium satellite phones. In addition to these flight-following protocols, onboard transponders were set at discrete identification codes for radar tracking by air-traffic-control personnel.

Survey methods, equipment, and standard procedures have been developed and refined over the duration of the ASAMM project and precursor studies (1979-2013). Additional details of onboard equipment, data collection, and post-field analyses are described in detail elsewhere (e.g., Monnett and Treacy 2005; USDOI, MMS 2008; Clarke et al. 2011a, 2012, 2013a, 2014).

Aerial Survey Design

Surveys were divided into two study areas for logistical reasons and to address objectives specific to each area. Aerial surveys were based out of Barrow to target the eastern Chukchi Sea study area, and out of Deadhorse, Alaska, to target the western Beaufort Sea study area. The field schedule was designed to maximize survey effort during the open water time period in the eastern Chukchi Sea and to monitor bowhead whale habitat use in the western Beaufort Sea during the open water season.

Transects in both study areas were perpendicular to the coastline to cross major bathymetric features, such as Barrow Canyon, Hanna Shoal, and the Beaufort Sea shelf and slope, and bowhead whale and beluga migration paths. Survey design differed slightly between the two study areas. In the Beaufort Sea (140°W-157°W), the survey design focused on survey blocks to maintain consistency to the flight planning protocol established in the Beaufort Sea component of ASAMM in the 1980s. Sets of unique transects were computer-generated prior to each flight for each survey block or set of two survey blocks (for blocks oriented together on a north-south axis). Transects were derived by dividing each survey block into sections that were 30 minutes of longitude across. One of the minute marks along the northern edge of each section was selected at random and then connected by a straight line to a randomly selected endpoint along the southern edge of the same section. This procedure was followed for all sections of the survey block, resulting in a series of transect lines. The transect lines were then alternately connected at their northernmost or southernmost ends to produce one continuous flight path within each survey block. Transect waypoints were randomly generated before each survey, so that different parts of the survey block were covered on each flight. Allocations of survey effort in the Beaufort Sea favored coverage of inshore survey blocks 1 through 7, 11, and 12 because bowhead whales were rarely sighted north of these blocks in three decades of previous aerial surveys, and this bowhead whale distribution pattern has been confirmed by satellite telemetry data (Quakenbush et al. 2010b). The purpose of these survey-effort allocations was to increase the sample size of bowhead whale sightings within high-use areas (HUA), thus increasing the power of statistical analyses within inshore blocks.

In the eastern Chukchi Sea study area (157°W-169°W), 39 transects were generated once at the beginning of the field season and then flown for the duration of the field season (Figure 1). Transects were parallel to each other and spaced 19 km apart to be consistent with the mean distance between transects in the Beaufort Sea study area. The coastal endpoints for the set of Chukchi Sea transects are randomly shifted each year, while maintaining a consistent orientation to the coast. This survey design allows examination of differences in marine mammal distribution and relative density at each unique transect over the course of a field season and theoretically generates uniform coverage throughout the eastern Chukchi Sea study area when multiple years of effort are pooled. The survey design also included a coastal transect located one km offshore between Point Barrow and Point Hope, Alaska. The coastal transect allowed better documentation of nearshore habitat, including pinniped haulouts along the coastline.

The selection of transects or survey blocks to be flown on a given day was nonrandom, based on reported or observed weather conditions over the study area, avoidance of recently surveyed areas, and the need to deconflict airspace with unmanned aerial vehicle (UAV) and other aerial operations. Weather permitting, the project attempted to distribute effort fairly evenly across the entire study area, with the exception of the northeastern Beaufort Sea survey blocks (blocks 8, 9, and 10), as noted above.

Survey Flight Procedures

Each survey flight could be divided into a total of five flight types: 1) deadhead; 2) search; 3) transect; 4) circling from search; and 5) circling from transect. During a typical flight, a search or deadhead leg was flown to the targeted survey block (Beaufort Sea) or transect line (Chukchi Sea). A series of transect lines were then flown, followed by a search or deadhead leg back to the base of operations. Survey speed was generally 213 km/hr. Survey effort over land or in areas with zero visibility was designated as deadhead and not incorporated into further analyses. Data were not collected during deadhead segments. Transects were joined together by short search or deadhead legs. When large cetaceans were encountered, the aircraft usually diverted from the trackline for brief (usually <10 minutes) periods and circled the whales to verify species, observe behavior, obtain better estimates of group size, and determine whether calves were present. Any new sightings of whales made while circling were recorded as sightings "on circling" and were considered on-effort. Sightings made off transect and not while circling were recorded as sightings "on search".

Survey altitudes were chosen to maximize visibility and minimize potential disturbance to marine mammals. Surveys were generally flown at a target altitude of 365 m in the Chukchi Sea and 458 m in the Beaufort Sea but could be flown as low as 305 m in either area. When cloud ceilings were less than 305 m or the wind force was above Beaufort 5, survey flights were redirected to survey blocks or transects with better conditions. Survey flights were aborted when conditions consistently did not meet minimum altitude (305 m) or wind force (Beaufort 5) requirements.

Primary observers (a total of two) were stationed on each side of the aircraft at bubble windows that permitted an unobstructed field of vision from the trackline directly below the aircraft to the horizon. The data recorder was primarily responsible for data entry but also functioned as a secondary observer. Sightings from primary observers during transect effort were recorded as on-effort; sightings by the data recorder, pilots, or an occasional fourth observer during transect effort were considered off-effort. To maintain consistency of data acquisition between 2014 and previous years, all observers underwent training in ASAMM data collection techniques prior to and during the 2014 field season. Data quality was also enhanced by ensuring that at least two observers on each field team had previous experience conducting ASAMM surveys.

Coordination with Manned and Unmanned Aerial Surveys

Detailed communication protocols are currently the only means for deconflicting airspace between UAVs and manned aircraft. Communication protocols were developed to coordinate ASAMM surveys with several UAV operations that were conducted in overlapping airspace in 2014. Protocols included a daily aerial simultaneous operations (SIMOPs) conference call to deconflict airspace. ASAMM flight planning, both before and during surveys, took into consideration the areas in which UAVs were operating and whether reliable communication could be initiated directly with UAV pilots.

Data Entry

Identical protocols were used to collect data in the two study areas. Customized, menu-driven, data-entry software was used to record all data in Microsoft Access database format. Time and location data (date, time, latitude, longitude, altitude, and aircraft heading) and environmental conditions (sky conditions, visibility [km] and visual impediments, percent sea ice cover, ice type, and Beaufort wind force) were recorded at sightings, during transitions in survey mode (transect, search, or circling), when environmental conditions changed, or at 5-minute (in time) intervals. Time and location only (date, time, latitude, longitude, and altitude) were automatically recorded from the GPS feed every 30 seconds (in time) to provide a detailed record of the flight track. Wind force was recorded according to the Beaufort scale outlined in *Piloting, Seamanship, and Small Boat Handling* (Maloney 2006). Ice type was identified using terminology presented in Naval Hydrographic Office Publication Number 609 (USDOD, Navy, Naval Hydrographic Office 1956). Average sea ice cover within the field of view from the aircraft was estimated as a single percentage, regardless of ice type.

All marine mammal sightings were recorded. Common and scientific names used for marine mammals in this report are taken from Rice (1998). The suite of data recorded for cetacean, walrus, and polar bear sightings included time, location, environmental conditions, survey mode, species, initial estimate of total number (low, high, and final estimates of group size were recorded as necessary), observer, swim direction (degrees True; cetaceans only), clinometer angle, number of calves (including bear cubs and pinniped pups), behavior, sighting cue, habitat, swim speed, whether it was a known repeat sighting, and response to the aircraft. Calves were recorded based on several types of information, including relative size of the animal, proximity to a larger adult, behavior, color, and the observer's judgment. Reduced data subsets were sometimes recorded for other marine mammals to expedite data entry but always included time, location, environmental conditions, survey mode, species, total number, and response to aircraft. Marine mammal observers and flight crew watched for and recorded sudden overt changes (e.g., an abrupt dive, course diversion, or cessation of initial observed behavior) in marine mammal behavior that might indicate a response to the survey aircraft.

The behavior and swim direction of observed whales represented what the group was doing at the time it was first sighted. Behaviors were entered into 1 of 16 categories (Table 1). Swim direction was recorded relative to the aircraft's heading and then converted to actual swim direction via a module incorporated into the data collection software. Swim direction was not recorded when the aircraft was circling.

General Data Analyses

Preliminary data analysis was performed in the field after each flight by a customized computer program that provided daily summaries of marine mammal sightings and effort (time and distance on transect, search, circling, and deadhead). The program also provided options for editing the data file and plotting the paths of one or more flights by Beaufort wind force. An additional customized computer program was used for post-season analysis and production of figures and tables. Maps were prepared using ArcGIS 10.2 (Environmental Systems Resource Institute [ESRI 2012], Redlands, CA) based on Universal Transverse Mercator Zone 5 (central meridian = -154.000000°, latitude of origin = 70.000000°, false easting = 500000.000000, false northing = 0.000000, spheroid = GRS 80, scale factor = 0.999600). The Alaskan coastline was

Table 1. ASAMM operational definitions of observed marine mammal behaviors.

Behavior	Definition
Breaching	Animal(s) launching upwards such that half to nearly all of the body is above the surface before falling back into the water, usually on its side, creating an obvious splash.
Dead	Animal(s) in water or on beach that are clearly deceased; carcasses often but not always bloated with sloughing skin and accompanied by oil slicks, feeding birds, or scavenging bears.
Diving	Animal(s) changing swim direction or body orientation relative to the water surface, resulting in submergence; may or may not include lifting the tail out of the water.
Feeding	Animal(s) diving repeatedly in a fixed area, sometimes with mud streaming from the mouth and/or defecation observed upon surfacing; synchronous diving and surfacing or echelon-formations at the surface with swaths of clearer water behind the whale(s), or surface swimming with mouth agape (bowhead whales); mud plumes streaming from mouths while surfacing (gray whales); mouths open and/or throat grooves extended (balaenopterid whales); bubble nets (humpback whales).
Flipper-Slapping	Animal(s) floating on side, striking the water surface with pectoral flipper one or many times; usually seen within groups or when the slapping animal is touching another animal.
Log-Playing	Animal(s) milling or thrashing in association with a floating log.
Mating	Ventral-ventral orientation of two whales, often with one or more other whales present to stabilize the mating pair. Mating is often seen within a group of milling whales. Pairs may appear to hold each other with their pectoral flippers and may entwine their tails.
Milling	Animals moving slowly at the surface in close proximity (within 100 m) to other animals, often with varying headings. Also one animal slowly changing its heading.
Resting	Animal(s) floating at the surface with head, or head and back exposed, showing no movement.
Rolling	Animal(s) rotating on the longitudinal axis, sometimes associated with mating.
Spy-Hopping	Animal(s) extending head vertically out of the water such that up to one-third of the body is above the surface.
Swimming	Animal(s) proceeding forward through the water propelled by tail.
Tail-Slapping	Animal(s) floating horizontally or head-downward in the water, waving tail back and forth above the water and striking the water surface; usually seen in group situations.
Thrashing	Animal(s) exhibiting rapid flexure or gyration in the water.
Underwater-Blowing	Animal(s) exhaling while submerged, thus creating a visible bubble.
Unknown	Behavior not able to be determined, usually due to the sighting occurring at some distance from the aircraft location or inability to resight the animal.

adopted from the World Vector Shoreline produced by the U.S. Defense Mapping Agency, now called the National Imagery and Mapping Agency.

Data from the Beaufort and Chukchi sea study areas were combined into one large dataset for editing and archiving, and were parsed into smaller subsets for various analyses of sighting rates, relative abundance, swimming direction, and HUAs. Survey effort and observed bowhead whale and gray whale distributions were plotted semimonthly over the study area. Beluga and walrus distributions were plotted monthly. Humpback whale, fin whale, minke whale, unidentified cetacean, pinniped, and polar bear distributions were plotted annually (July-October). All sightings were shown on most distribution maps regardless of survey mode (e.g., transect, search, or circling) being conducted, observer type (primary or secondary), or the prevailing environmental conditions (wind force, sea ice cover, etc.) when the sightings were made. As with previous reports in this series (e.g., Monnett and Treacy 2005; USDOI, MMS 2008; Clarke et al. 2012, 2013a, 2014), same-day repeat sightings or sightings of dead marine mammals were not included in summary analyses or maps. Data exclusions are indicated in the captions. Because feeding is likely under-reported or recorded as milling, figures showing cetacean feeding occurrence include all sightings reported as feeding and milling, regardless of survey mode, observer type, or prevailing environmental conditions.

During post-processing of the data, values were estimated for the water depth at each sighting and the sighting's distance from shore. The water depth at each sighting in the ASAMM database was derived from the International Bathymetric Chart of the Arctic Ocean (IBCAO) Version 3.0 (Jakobsson et al. 2013), which had a pixel resolution of 500 m. The shoreline used to calculate a sighting's distance from shore was "normalized" from the actual shoreline to provide a standardization of distance-from-shore measurements regardless of the mapping software being used to depict distribution data (Figure 3). The normalized shoreline was re-defined in 2011 to better represent the actual coastline of Alaska from 140°W (the easternmost part of the ASAMM study area) to 67°N (the southernmost part of the study area) and to improve approximation of bays and barrier islands. The projection used for the normalized shoreline analysis was North American Equidistant Conic, appropriate for distance measurements, with custom projection parameters (central meridian = -154.5°, latitude of origin = 70.5°, standard parallels = 60.5°, 80.5°).

Mean vector headings and circular standard deviations for headings of swimming cetaceans were determined using Oriana statistical software (Rayleigh Test; KCS 2012) for three subareas (Beaufort Sea subarea 140°W-154°W; northeastern Chukchi Sea subarea 69°N-72°N, 154°W-169°W', southcentral Chukchi Sea subarea 67°N-69°N). The 154°W demarcation between the Beaufort and northeastern Chukchi sea subareas for swim direction most closely approximates the natural break between the Beaufort and Chukchi basins. The two subareas delineated for the Chukchi Sea were based on ecosystem differences.

Environmental information, including wind speed and direction, cloud ceiling, visibility, temperature, dew point, sea ice cover, and sea surface temperature, was collected from National Weather Service websites and other weather and climate-related web pages for the duration of the field season. Data were collected and stored electronically for specific locations along the

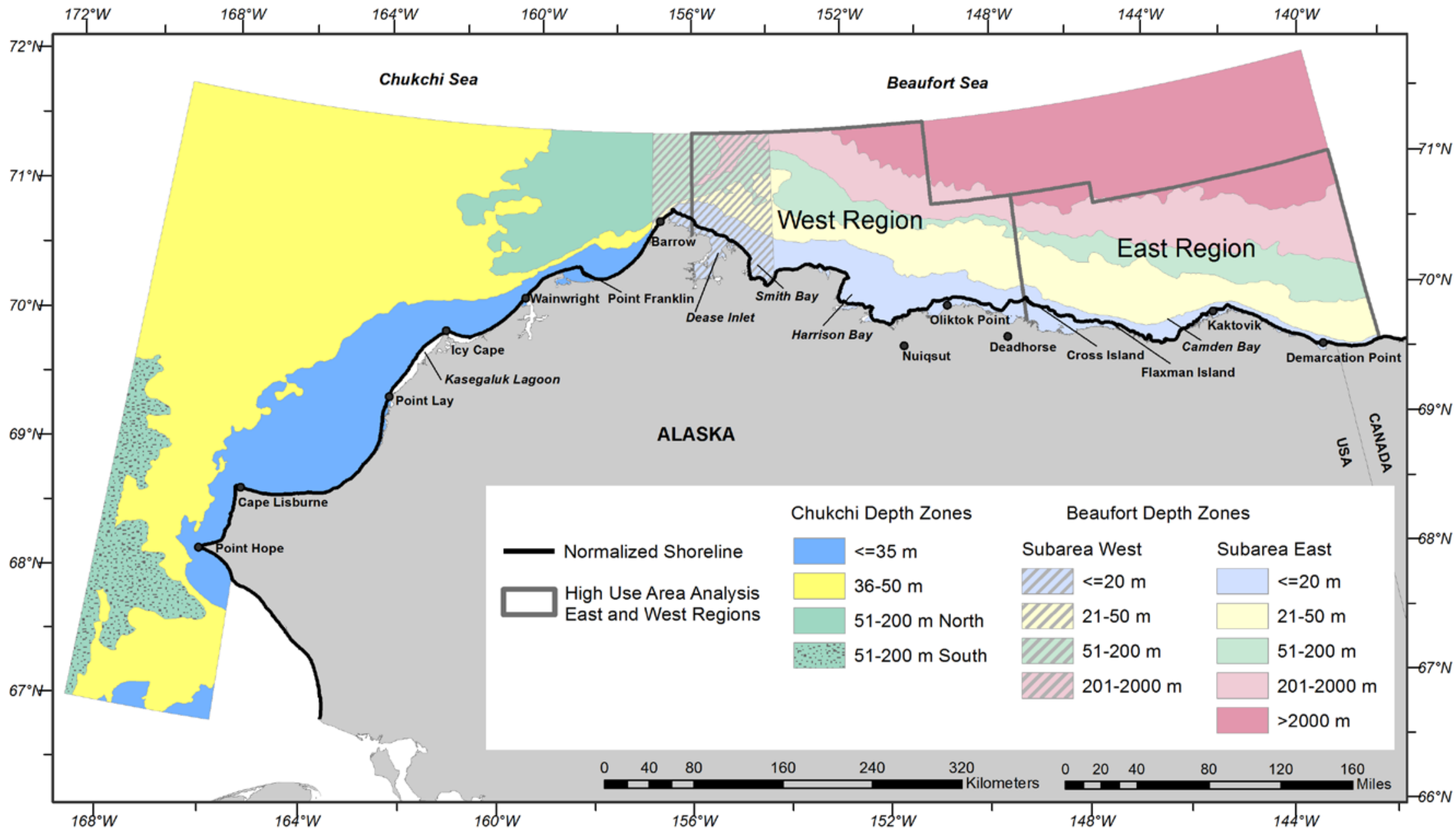

Figure 3. East and West regions and normalized shoreline used in ASAMM bowhead whale high-use area (HUA) analysis, and depth zone subareas used for sighting rate analyses.

northern coast of Alaska (e.g., Point Hope, Cape Lisburne, Point Lay, Wainwright, Barrow, Alpine, Kuparuk, West Dock, Deadhorse, and Barter Island) and for the broader Chukchi and Beaufort sea regions.

Sea ice information was obtained from the U.S. National Ice Center (2014), where it was available as charts or shapefiles. Sea ice analyses by the National Ice Center used data from several sources, including Environmental Satellite (ENVISAT) imagery and Moderate Resolution Imaging Spectroradiometer (MODIS), to show sea ice concentration. Shapefiles for the Beaufort and Chukchi seas were combined to produce biweekly sea ice concentration maps, included in Appendix A.

Data analysis methods used in this report are largely consistent with previous years' reports, dating back to 2008. One exception involves the distinction between sightings made by primary and secondary observers. Data analyses and figures made prior to 2012 using transect data included all transect sightings regardless of observer type (e.g., Clarke et al. 2012). Data denoting primary observers were collected starting in 1989, and the ASAMM historical database was amended in 2012 to include a field specifically denoting whether a sighting was made by a primary or secondary observer. Consequently, in 2014, only sightings made by primary observers only were included in most analyses that used on-effort sightings, including all sighting rate and central tendency analyses.

Sighting Rate and Relative Abundance Analyses

Sighting rates (number of whales or pinnipeds per unit [km] effort, WPUE or PPUE) quantify relative abundance by accounting for heterogeneity in survey effort and group size across the study area. Sighting rates were derived for three different spatial scales, each limited to sightings by primary observers. Sighting rates were not corrected for availability or perception bias (Buckland 2001). To calculate monthly and annual sighting rate per survey block for bowhead whales, gray whales, and belugas, the number of whales observed was divided by effort (km) per survey block. Although survey blocks are arbitrary geographic areas, they provide a basis for inter-annual cross-comparisons. Effort over land, between barrier islands and the mainland, and north of the study area (north of 72°N) was not included in the survey block sighting rate analysis.

To calculate monthly and annual sighting rate per depth zone for bowhead whales, gray whales and belugas, the number of whales observed was divided by effort (km) per depth zone. Depth zone isobaths were defined based on depth data in the International Bathymetric Chart of the Arctic Ocean (IBCAO) Version 2.23 (Jakobsson et al. 2008), which had a pixel resolution of 2 km. Depth zone analysis in the western Beaufort Sea study area was computed for two subareas (Figure 3). One subarea spanned 154°W-157°W and included Barrow Canyon and its surrounding area, which has noticeably different bathymetry than the rest of the Beaufort Sea study area. The other subarea for the western Beaufort Sea depth zone analysis spanned 140°W-154°W, an area incorporating a well-defined continental shelf and slope. Beaufort Sea subareas used depth zones of ≤20 m, 21-50 m, 51-200 m, 201-2,000 m, and >2,000 m. Depth zone analysis in the Chukchi Sea used slightly different depth zones to better reflect the bathymetric features of the area (≤35 m, 36-50 m, and 51-200 m); the 51-200 m depth zone was divided into

North and South regions because they are separated by a large expanse of shallower depths (Figure 3). Sighting rate analyses for survey blocks and depth zones used an Equidistant Conic projection (False_Easting: 0.0; False_Northing: 0.0; Central_Meridian: -154.5°; Standard_Parallel_1: 60.5°; Standard_Parallel_2: 80.5°; Latitude_Of_Origin: 70.5°; Linear Unit: Meter [1.0]).

Finally, sighting rate was calculated for fine-scale (5 minutes latitude by 15 minutes longitude) areas, using a grid consisting of approximately equilateral grid cells (roughly 5 km x 5 km) superimposed across the study area. Seasonal (summer and fall) sighting rates were calculated for bowhead whales and annual sighting rates were calculated for gray whales and belugas for each grid cell. An index of relative abundance of bowhead whale and gray whale feeding and milling behaviors, quantified as WPUE, was also calculated for the fine-scale grid. The fine-scale grid analysis included effort and whales observed within barrier islands and north of 72°N.

Sighting rates were calculated for each of the three spatial scales described above using sightings and effort on transect (Tr) from primary observers, similar to sighting rate analyses in previous years. In 2014, sighting rate analyses were conducted using sightings and effort on transect combined with sightings and effort during circling from transect (Tr+TrC) for bowhead whales and gray whales. While the Tr+TrC analysis is a departure from previous analyses presented in past Annual Reports, it encompasses a more robust analysis of relative abundance because additional whales associated with the initial sighting are often seen after circling commences. The Tr+TrC sighting rate analyses were not extended to belugas because diversions to circling were rarely conducted on beluga sightings.

Analysis of Bowhead Whale High-Use Areas (HUA) in the Beaufort Sea

There is no evidence to suggest that bowhead whales remain in the Beaufort Sea throughout winter; at some point, bowhead whales observed in the Beaufort Sea in summer and fall migrate through the Chukchi Sea to return to wintering areas in the Bering Sea. It was thought that most bowhead whales summered in the Canadian Beaufort Sea then actively migrated westward through the western Beaufort Sea in fall. Previous central tendency analyses (e.g., Treacy 2002a; Monnett and Treacy 2005; Clarke et al. 2011b, 2012) defined results as “migratory corridors”. However, results of satellite telemetry studies have shown that some bowhead whales crisscross the western Beaufort Sea during summer (Quakenbush et al. 2010b). Furthermore, large dynamic groups of bowhead whales have been documented feeding in the western Alaskan Beaufort Sea as early as July and continuing into October. There is no reliable way, via data collected during aerial surveys, to differentiate between whales that were actively undergoing a focused, unidirectional, east-west fall migration and whales that were crisscrossing the western Beaufort Sea prior to undergoing directed migration.

To acknowledge that some bowhead whales observed in the western Beaufort Sea in summer and fall might not be actively migrating, the term “high-use area”, or HUA, is used instead of migratory corridor for this report. HUA designation, in this context, describe areas in the western Beaufort Sea where bowhead whales are expected to occur in greatest densities, based on data collected during ASAMM surveys. HUAs could be considered one component used to interpret the relative biological importance of certain areas within the western Beaufort Sea based on the numbers of whales expected to be present in a given area during a particular month or season. HUAs were not defined based on specific activity states (e.g., migrating or feeding). Two analyses of bowhead whale HUAs in the western Beaufort Sea were undertaken.

Bowhead Whale Central Tendency – Analysis 1

Bowhead whale HUA was examined using the median water depth at, and mean and median distance from shore of whale sightings on transect by primary observers (Houghton et al. 1984). Median distance from shore and depths for bowhead whale sightings in fall 2014, a year with light sea ice cover (NSIDC 2014), were compared with analogous values for combined data from previous years having light sea ice cover (i.e., 1989, 1990, 1993-2013; Treacy 1990, 1991, 1994, 1995, 1996, 1997, 1998, 2000, 2002a, 2002b; Monnett and Treacy 2005; USDOI, MMS 2008; Clarke et al. 2011a, 2011b). Median distance from shore and depths at bowhead whale sightings in summer (July-August) 2014 were compared to bowhead whale sightings in summer 2012 and 2013 and fall (September-October) 2014.

Non-parametric statistical tests were used to examine differences in median depth and distance from shore. Treacy (1998) found that median and mean bowhead whale distance from shore values were only slightly different. Further comparisons of subsets of data were based on statistical analyses of median distance from shore and depth at sighting, via the nonparametric Mann-Whitney *U*-test. The nonparametric test was used for these data because distributions generally did not fit assumptions necessary to use the two-sample *t*-test. The variances were not equal between subsets of data for both depth and distance from shore; in addition, the depth data were considerably skewed and the distance from shore data were slightly skewed, so neither distribution strictly met the assumption of normality. When assumptions of the *t*-test are seriously violated, the Mann-Whitney *U*-test may be more powerful than the two-sample *t*-test (Hodges and Lehmann 1956; Zar 1984). Statistical tests were undertaken using *Statistica*™ StatSoft Version 10.0 and ArcGIS Version 10.1.

All bowhead whale sightings made while on transect (primary observers only), regardless of distance from the transect line, were included in the non-parametric central tendency analyses. Neither group size nor survey effort (km) was taken into account. Because survey effort cannot be incorporated in this analysis, sightings were limited to those on transect only (Tr) and did not include those made while circling from transect (TrC) to limit potential biases.

Distance from shore and water depth at bowhead whale sightings were analyzed separately for two regions (Figure 3), the boundaries of which correspond roughly to oceanographic patterns and the offshore extent of sampling, described in more detail below. The delineation between East and West regions for this analysis occurs at 148°W, based upon association with the general distribution patterns of water masses. Oceanographic patterns common to waters off northern Alaska are reviewed in Moore and DeMaster (1998). In brief, cold saline Bering Shelf Water and warm fresh Alaska Coastal Water enter the western Beaufort Sea through Barrow Canyon. Both water masses are identifiable on the outer shelf (seaward of 50 m) as the eastward flowing Beaufort Undercurrent (Aagaard 1984). Bering Shelf Water has been traced at least as far east as

Barter Island (~143°W), but the Alaska Coastal Water mixes with ambient surface waters as it moves eastward and is not clearly identifiable east of Prudhoe Bay, Alaska (~147°W - 148°W).

The northern extent of each region is based upon historical survey effort. The East Region extends from 140°W to 148°W and northward from shore to 71°10'N, except between 146°W and 148°W where the region extends to 71°20'N. The eastern boundary (140°W) is the easternmost longitude of the survey blocks. The northern boundary for this region corresponds with the boundaries of survey blocks 2, 6, and 7 (Figure 1), blocks with sufficient survey effort to support analyses (Treacy 1998). The West Region extends from 148°W to 156°W and northward from shore to 72°N, except between 148°W and 150°W where the region extends to 71°20'N due to the layout of block 2. The northern boundary for this region corresponds with the boundaries of survey blocks 2, 11, and 12 (Figure 1). The western cutoff at 156°W limits the analysis to bowhead whales seen in the western Beaufort Sea and minimizes the influence of Barrow Canyon on bowhead whale depth distribution.

One caveat to the non-parametric analyses is that analyzing bowhead whale HUAs based only on number of sightings may be biased because survey effort was often variable both within and across years and because sightings of a single animal were weighted equally to sightings of several animals. Therefore, there may have been more sightings in areas with greater transect effort and fewer sightings in areas with less transect effort, even if the density of individuals in the two areas was the same.

Bowhead Whale Central Tendency – Analysis 2

The second method for investigating the central tendency of the fall bowhead whale distribution in the Alaskan Beaufort Sea in 2014 involved a three-step process: 1) constructing spatial models of bowhead whale relative abundance (encounter rate) based on bowhead whale sightings from 2014; 2) applying the spatial relative abundance model to predict the expected number of bowhead whales in every cell of a grid overlying the study area; and 3) using the predicted number of bowhead whales in each cell to compute the median distance from shore of the whales sighted in 2014. As in the central tendency analysis described above, this analysis was based on transect bowhead whale sightings made by primary observers in September and October 2014; this analysis did not account for availability or perception bias. Estimates of median distance from shore were calculated for the East and West regions individually. The analysis was conducted in R version 3.1.2 (R Core Team 2014) using packages *sp* (Pebesma and Bivand 2005; Bivand et al. 2008), *maptools* (Bivand and Lewin-Koh 2015), *raster* (Hijmans 2015), *rgeos* (Bivand and Rundel 2014), *rgdal* (Bivand et al. 2014), *RODBC* (Ripley and Lapsley 2013), and *mgcv* (Wood 2006).

To begin, the western Beaufort Sea study area was partitioned into a 5 km x 5 km grid. This resolution was chosen as a compromise between having adequate survey effort and sightings in each grid cell in order to construct models, versus maximizing the resolution of the distance from shore data. All geospatial data were projected into an Equidistant Conic projection with the following parameterization: first standard parallel 69.5°N; second standard parallel 71.5°N; latitude of origin 70.5°N; central meridian 148.0°W; false easting 0.0; and false northing 0.0. Data extracted for each grid cell included the total number of whales sighted, the projected x and y coordinates of the midpoint of each grid cell, and the shortest distance from that midpoint to the normalized shoreline. Bowhead whale relative abundance was modeled as a generalized additive model (GAM), parameterized by a negative binomial distribution with a natural logarithmic link function. Quasi-Poisson and Tweedie (Tweedie 1984; Dunn and Smith 2005) models were also considered, but examination of model residuals (Ver Hoef and Boveng 2007) suggested that the negative binomial distribution provided a better fit to the data. The model formula can be represented as

$$ln(E(W_i)) = ln(\mu_i) = \alpha + s(X_i, Y_i) + offset(ln(L_i))$$

where

W_i: random variable for the number of individual bowhead whales in grid cell *i*, with W_i referring to the associated observations and $E(W_i)$ the expected value (mean) of W_i;

μ_i: number of individual bowhead whales expected to be observed in grid cell *i*;

α: intercept;

X_i: projected (equidistant conic) longitude of the midpoint of grid cell *i*;

Y_i: projected (equidistant conic) latitude of the midpoint of grid cell *i*;

s( ): smooth function (Wood et al. 2008) of location covariates used to describe bowhead whale relative abundance; this function is parameterized in the model-fitting process;

L_i: length (km) of transect effort in grid cell *i*, which was incorporated into the model as a constant (an "offset") in order to account for spatially heterogeneous survey effort throughout the study area.

The median distance from shore of the fall distribution of bowhead whales was estimated using the spatial model to predict the number of individuals likely to be observed in each grid cell after a uniform amount of transect effort (a constant L_i for all *i*) was covered throughout the portion of the study area contained within the East and West regions. The magnitude of L_i used in the predictions did not affect the resulting median statistic as long as L_i was constant across all cells, thereby eliminating apparent variability in bowhead whale distribution due only to spatial heterogeneity in survey effort. Grid cells were ordered by distance from shore, from closest to farthest. The predicted number of individuals per cell was cumulated, beginning with the closest grid cell and ending with the farthest. The median distance from shore was calculated as the distance corresponding to the midpoint of the grid cell for which one-half of the total predicted number of individuals was assigned to cells located closer to shore and one-half assigned to cells located farther from shore.

This method of estimating the median distance from shore was also applied to ASAMM bowhead whale data from 2000-2014 combined. The analysis for the pooled years used the same data filtering criteria as described above (all bowhead whale sightings made by primary observers on transect) and did not account for availability or perception bias. It included data from July to October, and varying-coefficient generalized additive models (Wood 2006) were used to examine the spatial distribution of bowhead whale relative abundance by month. In essence, the varying-coefficient model structure enables estimation of a separate smooth function for each month, allowing both the location and intensity of areas with high or low relative abundance to vary by month. Median distances from shore for the 15-year time period were calculated for the East and West regions separately.

The median can also be referred to as the 50th percentile or quantile. An additional analysis was undertaken to define the location of bowhead whale HUAs in 2014 alone and in 2000-2014 (all years pooled) based on the locations of the 30th, 40th, 50th, 60th, and 70th percentiles of predicted bowhead whale relative abundance for each column of 5 km x 5 km grid cells in the East and West regions. For example, in this analysis the location of the 30th percentile in a specific column of cells refers to the location where 30% of the predicted number of bowhead whales would be closer to shore and 70% would be farther offshore. Due to the granularity of the spatial grid used for this analysis, adjacent percentiles may overlap in a single grid cell in locations where the predicted distribution of bowhead whales changes rapidly with distance from shore. The midpoints of all cells corresponding to the 30th percentile were connected across the entire region to define a linear boundary across the western Beaufort Sea corresponding to the 30th percentile of bowhead whale HUAs, and similarly for the 40th, 50th, 60th, and 70th percentiles.

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RESULTS

Environmental Conditions

In 2014, sea ice cover in the area surveyed was generally light. When surveys commenced in the eastern Chukchi Sea in early July, sea ice remained in much of the study area north of 71°N (Appendix A, Figure A-1). By late July, sea ice in the Chukchi Sea had receded to the northernmost survey blocks. In the western Beaufort Sea, sea ice remained nearshore from Camden Bay, Alaska, west to Point Barrow, with open water east of Kaktovik, Alaska (Figure A-3). Sea ice was largely absent from the ASAMM study area from mid-August through late September (Figures A-4 to A-7), although a tongue of sea ice persisted in the Hanna Shoal area of the northeastern Chukchi Sea until late August (Figure A-5). By mid-October, new ice was forming in the northern blocks and in shallow nearshore areas in the western Beaufort Sea study area (Figure A-8). The northeastern Chukchi Sea study area remained almost completely ice free through late October, with sea ice present only in shallow nearshore areas (Figure A-9).

Arctic sea ice extent reached the seasonal minimum on 17 September 2014, and sea ice fell to the sixth lowest extent since satellite data were first recorded in 1979 (National Snow and Ice Data Center 2014). To examine interannual variability in bowhead whale and other marine mammal distributions and relative abundance, 2014 data were compared to data from previous years with light sea ice cover.

Observer Experience

Data quality is a direct reflection of the capabilities and experience of the personnel involved. In 2014, seventeen observers participated in ASAMM surveys. All ASAMM observers were experienced field biologists and most (71%) had previous experience with ASAMM surveys, which ensured consistency in data collection among years. Previous ASAMM field experience ranged from 1 to 20 years, with a median of 3 years. Five observers did not have previous ASAMM experience, but most of those observers had aerial survey experience conducting right whale surveys. One observer did not have previous aerial survey experience. Less experienced ASAMM observers were integrated into teams consisting of experienced ASAMM observers and all observers were provided feedback throughout the field season to help maintain data consistency.

Survey Effort

The ASAMM field season commenced 1 July 2014 and ended 30 October 2014; survey flights were conducted from 2 July to 29 October (Table 2), corresponding to the summer and fall months when open-water anthropogenic activities occur. Surveys were conducted from one aircraft based in Barrow from 2 July to 29 October, primarily targeting the northeastern and southcentral Chukchi Sea, and from one aircraft based in Deadhorse from 19 July to 10

Table 2. ASAMM 2014 flight effort in chronological order, 2 July–29 October 2014, by survey flight and semimonthly time period. Semimonthly totals may not exactly match the sum for the time period due to rounding errors.

Day	Flight No.	Transect (km)	Circling (km)	Search (km)	Deadhead (km)	Total (km)	Transect (hr)	Total (hr)
2 Jul	201	335	0	141	181	657	1.5	2.7
5 Jul	202	406	10	1	402	818	1.8	3.1
6 Jul	203	677	57	209	1,463	2,406	3.1	8.4
9 Jul	204	416	63	154	649	1,282	1.9	4.9
12 Jul	205	199	99	52	227	577	0.9	2.4
15 Jul	206	402	17	56	783	1,258	1.8	4.6
16 Jul	207	406	178	17	511	1,112	1.7	4.3
18 Jul	208	87	37	67	424	615	0.4	2.2
19 Jul	209	239	64	194	80	576	1.1	3.1
19 Jul	1	468	64	39	351	922	2.2	3.8
20 Jul	2	667	0	80	198	945	3.3	4.4
21 Jul	3	476	8	71	511	1,066	2.2	4.2
22 Jul	210	378	43	241	621	1,283	1.8	5.3
24 Jul	211	246	0	2	967	1,216	1.2	4.1
25 Jul	212	434	15	92	878	1,418	2.1	5.4
26 Jul	213	617	27	53	384	1,081	2.8	5.1
26 Jul	4	26	0	1	473	500	0.1	1.4
27 Jul	214	372	0	103	263	738	1.8	3.3
27 Jul	5	507	37	28	676	1,247	2.5	4.8
29 Jul	215	740	79	2	617	1,438	3.4	5.7
30 Jul	216	550	35	1	593	1,178	2.5	4.7
31 Jul	217	788	50	162	544	1,544	3.7	6.6
31 Jul	6	751	19	61	189	1,021	3.7	4.7
2 Aug	7	0	0	73	428	500	0.0	1.7
4 Aug	218	896	83	26	1,501	2,506	4.1	9.2
6 Aug	219	677	19	79	317	1,092	3.3	5.4
6 Aug	8	1,027	7	91	684	1,809	4.9	7.8
10 Aug	220	605	0	162	274	1,040	2.8	4.7
11 Aug	9	682	99	56	894	1,731	3.2	6.6
15 Aug	221	371	68	39	830	1,308	1.7	4.9
17 Aug	222	125	35	103	96	358	0.6	2.1
17 Aug	10	792	364	123	567	1,845	3.7	8.2

Day	Flight No	Transect (km)	Circling (km)	Search (km)	Deadhead (km)	Total (km)	Transect (hr)	Total (hr)
18 Aug	11	601	33	10	670	1,313	2.7	4.9
19 Aug	223	76	16	21	338	451	0.4	1.9
19 Aug	12	398	21	40	810	1,269	1.7	4.5
20 Aug	224	318	22	30	608	978	1.5	3.8
20 Aug	13	367	66	46	1,638	2,117	1.7	7.0
21 Aug	225	967	46	4	926	1,942	4.4	7.6
22 Aug	226	472	105	109	345	1,031	2.3	4.5
22 Aug	14	354	37	42	853	1,287	1.6	4.5
23 Aug	15	868	581	31	856	2,336	3.7	9.4
24 Aug	227	193	46	41	1,014	1,294	0.9	4.4
24 Aug	16	41	0	0	410	451	0.2	1.4
27 Aug	228	349	36	0	359	744	1.4	2.7
28 Aug	229	508	0	1	538	1,047	2.3	3.9
28 Aug	17	916	50	113	322	1,402	4.1	5.9
29 Aug	230	438	56	81	301	876	2.0	3.8
30 Aug	18	801	175	26	1,465	2,467	3.4	8.8
31 Aug	19	70	0	1	523	594	0.4	1.9
1 Sep	231	434	0	1	605	1,040	2.0	3.8
1 Sep	20	346	91	39	358	834	1.6	3.4
4 Sep	232	511	520	19	1,519	2,569	2.4	9.7
5 Sep	233	862	13	1	401	1,277	4.0	5.4
6 Sep	234	1,056	207	31	739	2,033	4.9	8.6
8 Sep	21	729	127	185	534	1,575	3.4	6.6
11 Sep	22	723	45	85	355	1,208	3.4	5.2
19 Sep	235	112	13	0	632	758	0.6	2.6
21 Sep	236	1,127	141	101	644	2,013	5.1	9.0
21 Sep	23	342	236	93	410	1,081	1.6	4.7
22 Sep	237	696	106	50	256	1,109	3.2	5.0
22 Sep	24	698	306	90	994	2,087	3.2	9.4
23 Sep	238	1,224	104	11	1,056	2,395	5.5	9.4
23 Sep	25	385	68	21	622	1,096	1.8	4.4
24 Sep	239	634	48	43	1,487	2,212	3.0	8.0
24 Sep	26	41	0	1	775	816	0.2	2.9
25 Sep	27	344	321	32	434	1,132	1.6	5.0
26 Sep	28	654	179	180	709	1,722	3.0	7.2
27 Sep	240	59	0	98	706	863	0.3	3.1

Day	Flight No	Transect (km)	Circling (km)	Search (km)	Deadhead (km)	Total (km)	Transect (hr)	Total (hr)
27 Sep	29	250	34	99	586	970	1.1	3.7
28 Sep	241	384	19	91	768	1,261	1.8	4.8
28 Sep	30	596	151	109	405	1,262	2.7	5.4
1 Oct	242	106	0	38	250	394	0.5	1.6
3 Oct	243	669	107	153	789	1,717	3.1	7.1
4 Oct	31	456	110	79	581	1,226	2.1	4.8
5 Oct	244	575	40	48	242	905	2.6	3.9
5 Oct	32	398	30	32	553	1,013	1.9	3.8
6 Oct	245	782	29	1	303	1,115	3.6	4.8
6 Oct	33	447	43	54	497	1,041	2.1	4.2
7 Oct	246	784	57	16	351	1,207	3.6	5.2
7 Oct	34	441	42	180	500	1,163	2.0	4.7
8 Oct	247	513	55	97	502	1,167	2.4	5.0
9 Oct	248	507	18	1	733	1,258	2.4	4.8
12 Oct	249	68	5	78	300	452	0.3	1.7
13 Oct	250	168	0	1	288	457	0.6	1.6
24 Oct	251	645	15	19	538	1,217	2.7	4.4
25 Oct	252	618	10	59	996	1,683	2.8	6.2
26 Oct	253	811	12	101	647	1,569	3.7	6.3
27 Oct	254	684	0	128	129	941	3.1	4.1
28 Oct	255	561	10	32	676	1,280	2.5	5.0
29 Oct	256	685	23	48	206	962	3.1	4.2
				Semimonthly Effort Summary				
1-15 Jul		2,435	246	613	3,705	6,998	10.9	26.1
16-31 Jul		7,752	656	1,214	8,280	17,900	36.3	73.0
1-15 Aug		4,258	276	526	4,928	9,986	20.0	40.1
16-31 Aug		8,654	1,689	822	12,639	23,802	38.6	90.9
1-15 Sep		4,661	1,003	361	4,511	10,536	21.7	42.7
16-30 Sep		7,546	1,726	1,019	10,484	20,777	34.5	84.3
1-15 Oct		5,914	536	778	5,889	13,115	27.2	53.1
16-29 Oct		4,004	70	387	3,192	7,652	18.0	30.2
Total		**45,224**	**6,202**	**5,720**	**53,628**	**110,766**	**207.2**	**440.4**

October, primarily targeting the western Beaufort Sea. There were 90 survey flights, of which 23 were in July, 26 in August, 22 in September, and 19 in October. Surveys originating on the aircraft based in Barrow were numbered sequentially starting with 201; surveys originating on the aircraft based in Deadhorse were numbered sequentially starting with 1. On 25 occasions, multiple flights in one day were completed by the same survey team to take advantage of favorable survey conditions. Surveys were conducted simultaneously by both survey teams on 21 days. Surveys were conducted on 58% of possible survey days (69 out of 120 possible days). Surveys were not conducted on 42% of the possible survey days (51 out of 120 possible days) due to weather (45 days) or weather and aircraft inspections or other maintenance requirements (6 days).

Survey effort was summarized by hours or kilometers flown in different survey modes. Over 110,000 km were flown during 441.6 hours (Figure 4). A total of 45,362 km of effort on transect was flown during 207.3 hours (Figure 5). Transect effort constituted 41% of the total kilometers flown and 47% of the total flight hours. Thirty-eight percent of total survey effort was flown on deadhead, when no survey data are recorded other than time and aircraft position (latitude, longitude, altitude, and heading. Deadhead flight time typically occurred during transits to and from transects, when observers were not actively searching for marine mammals, and were generally at faster speeds (usually >330 km/h). Deadhead was also recorded during several flights when local weather conditions were not conducive to collecting data; five flights were almost entirely on deadhead due to prevailing poor weather conditions. During an average survey flight, an aerial survey team covered 1,231 km, ranging from 359 km to 2,570 km. The longer distances required 2-3 flights per survey.

Survey effort (transect, search, and circling) is plotted semimonthly in Figure 6. In the northeastern Chukchi Sea study area, transects near active Chukchi Sea lease areas were targeted more often than areas without active lease areas (e.g., survey blocks 20-23). Coverage in early July focused on the northeastern Chukchi Sea study area. From mid-July through the end of September, survey coverage was balanced between the eastern Chukchi Sea and the western Beaufort Sea study areas. Systematic broad-scale coverage of the western Beaufort Sea in summer (mid-July through August) was conducted for the third consecutive year. Survey coverage in the entire ASAMM study area was well distributed throughout July, August, and September. Survey coverage in October was limited to areas closest to Barrow and Deadhorse, due to increasingly inclement weather conditions and reduction of survey teams from two to one, based in Barrow. Survey coverage was greatest in survey blocks 13, 14, and 17 in the Chukchi Sea and survey blocks 1, 3, and 12 in the Beaufort Sea. Surveys in blocks 8 and 9 were not attempted in 2014 because they are lower priority, and conditions were rarely favorable for surveying offshore (e.g., strong winds and low visibility). Flight lines, associated sea states, and sightings on individual flights are shown in Appendix B.

Poor weather impacted survey effort in 2014 as it has in some previous years. Fog and low ceilings curtailed survey effort in early August, when only seven surveys were conducted in the entire ASAMM study area. Strong winds prevented any surveys from being conducted 12-18 September and 14-23 October.

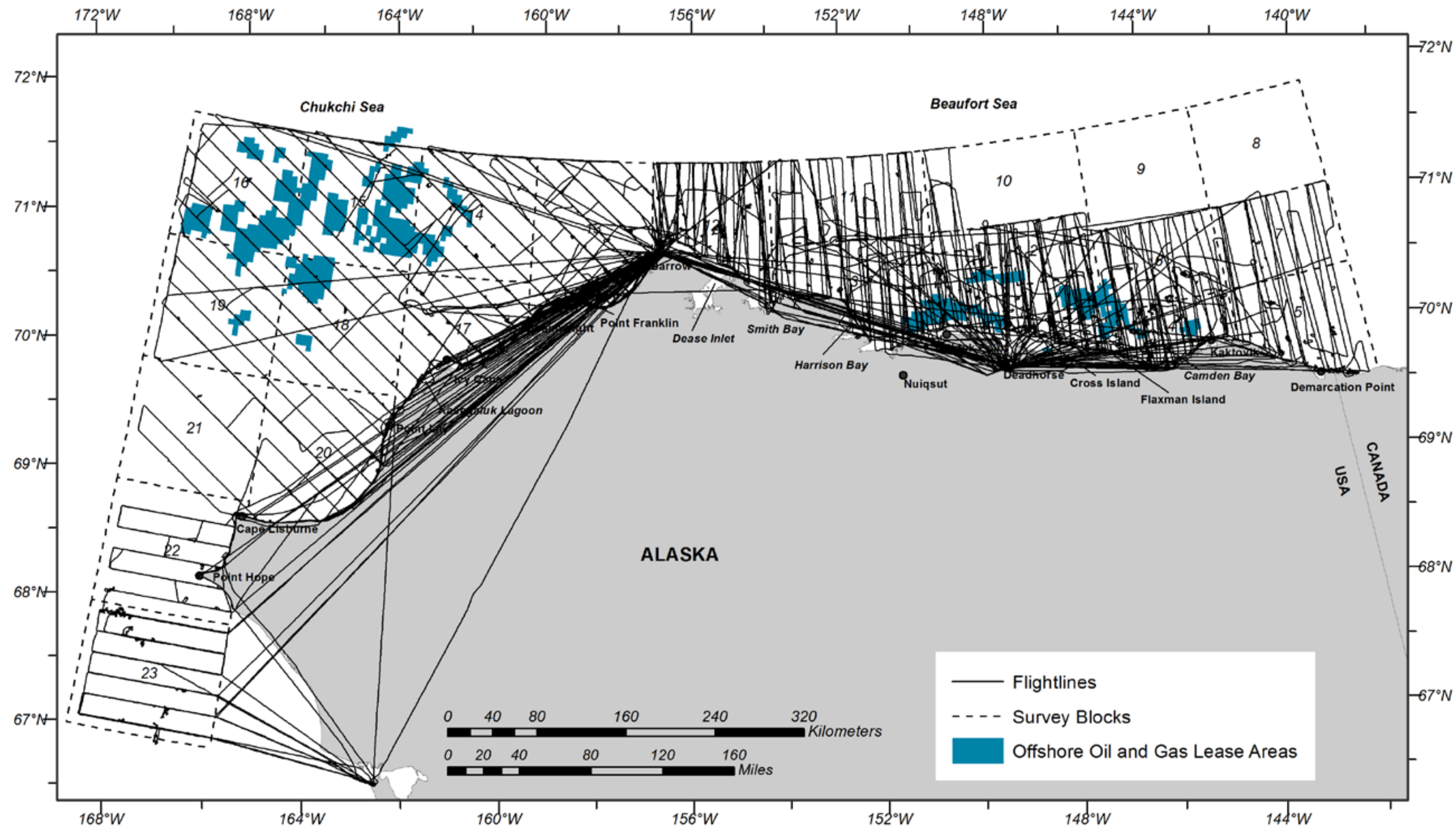


Figure 4. ASAMM 2014 combined flight tracks, all flight types (transect, search, circling, and deadhead).

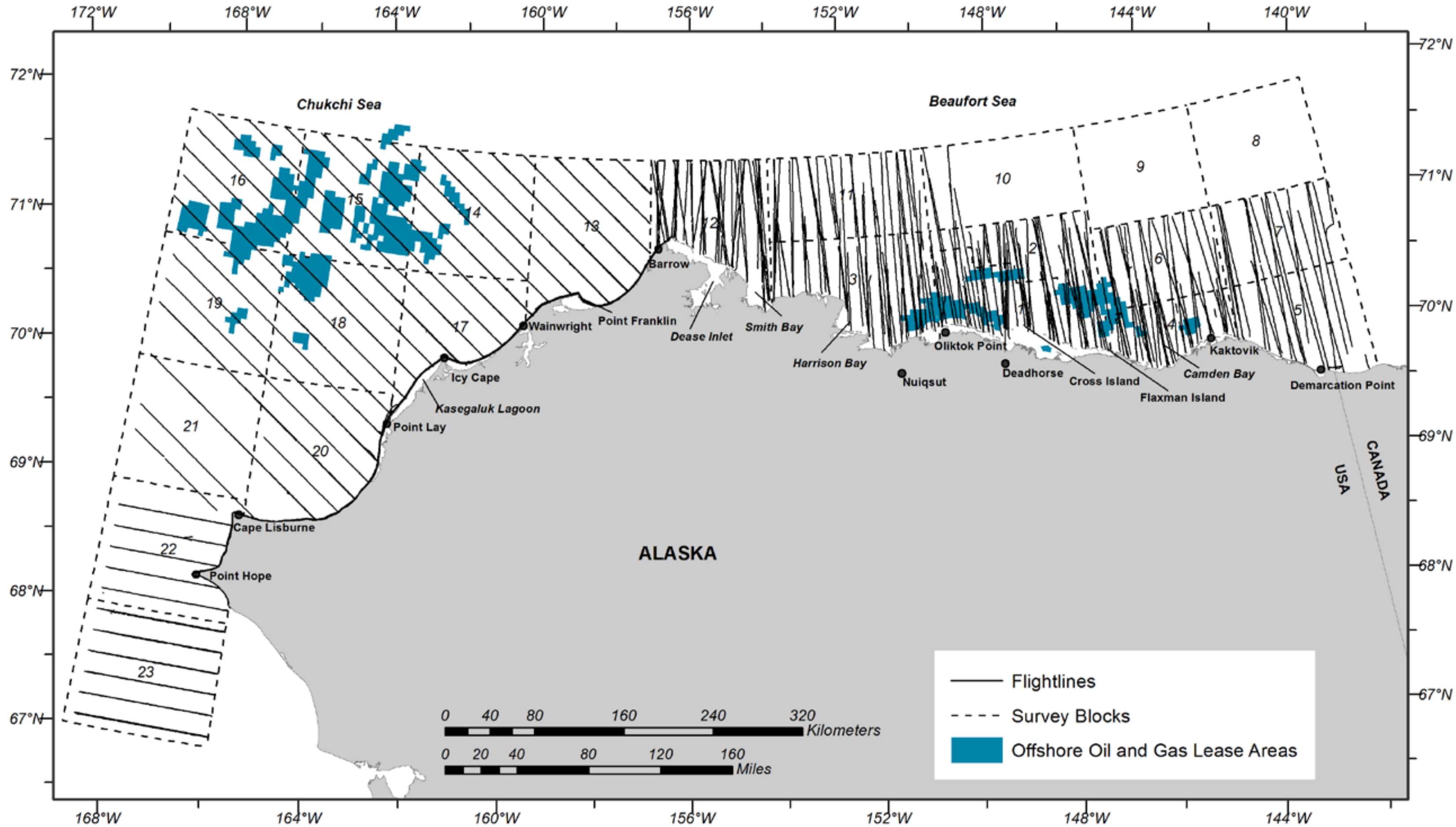


Figure 5. ASAMM 2014 combined flight tracks, transect effort only. No transects were flown north of 72°N.

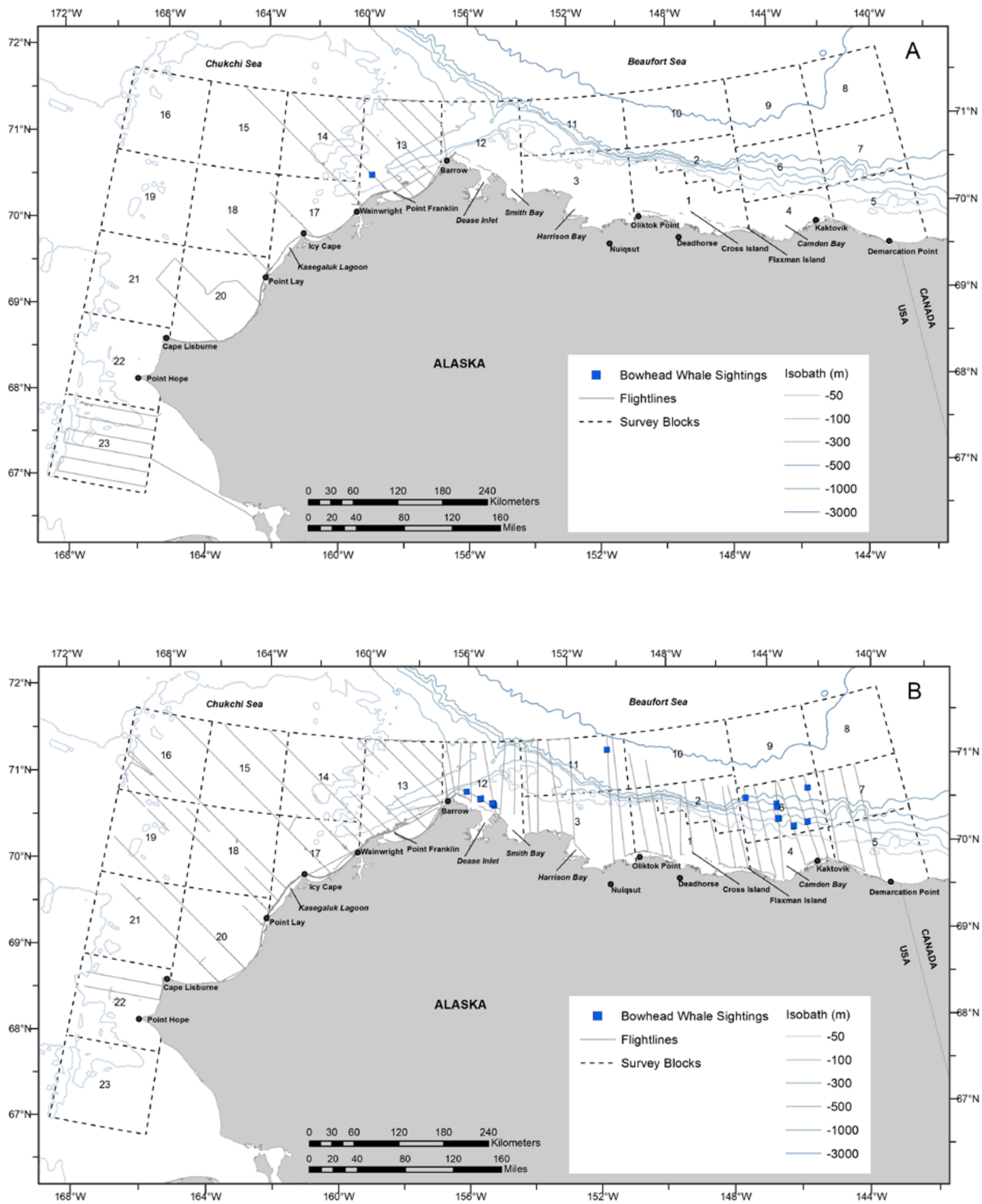


Figure 6. ASAMM 2014 semimonthly bowhead whale sightings, with transect, search, and circling survey effort. A: 2-15 July; B: 16-31 July. Deadhead flight tracks are not shown.

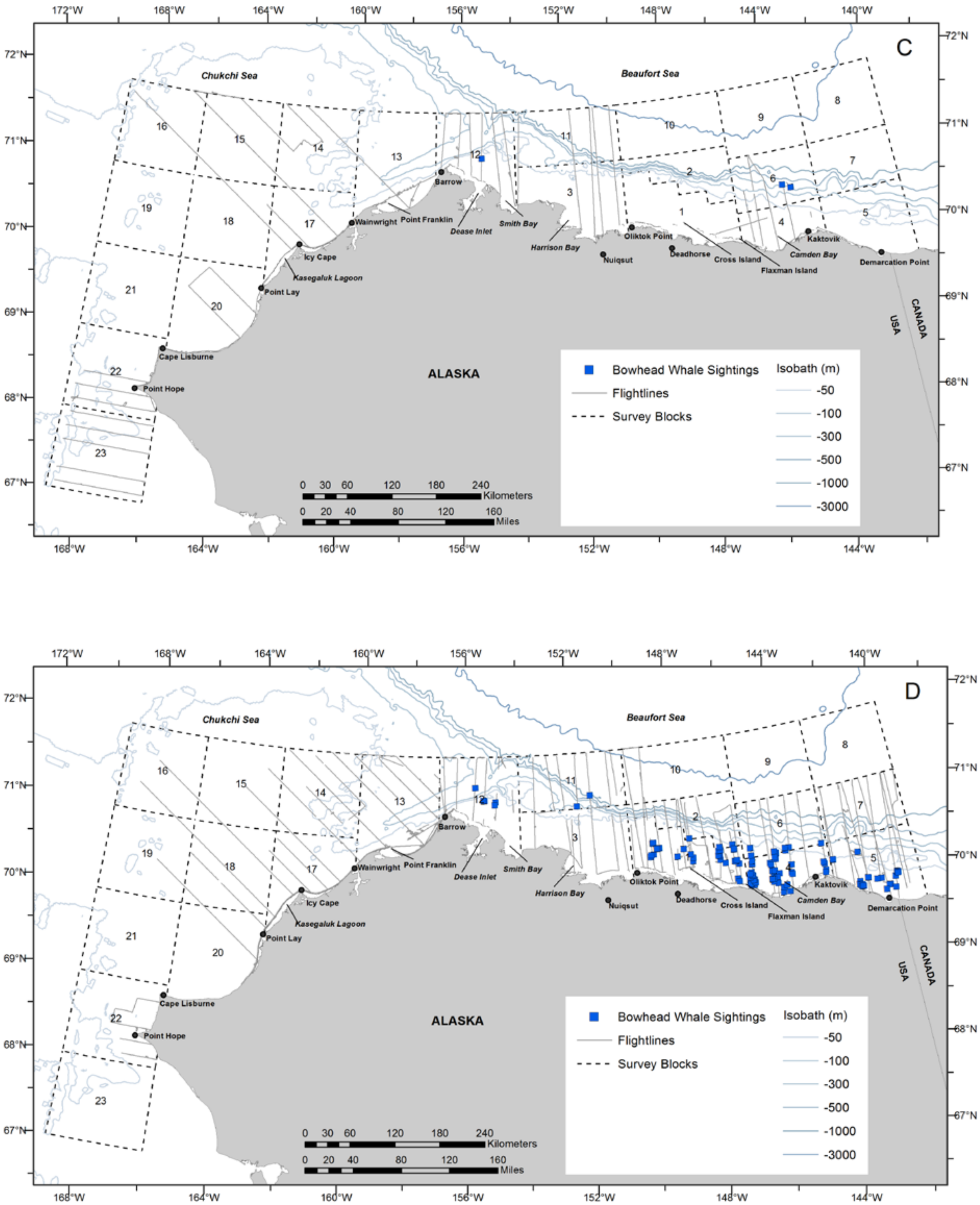
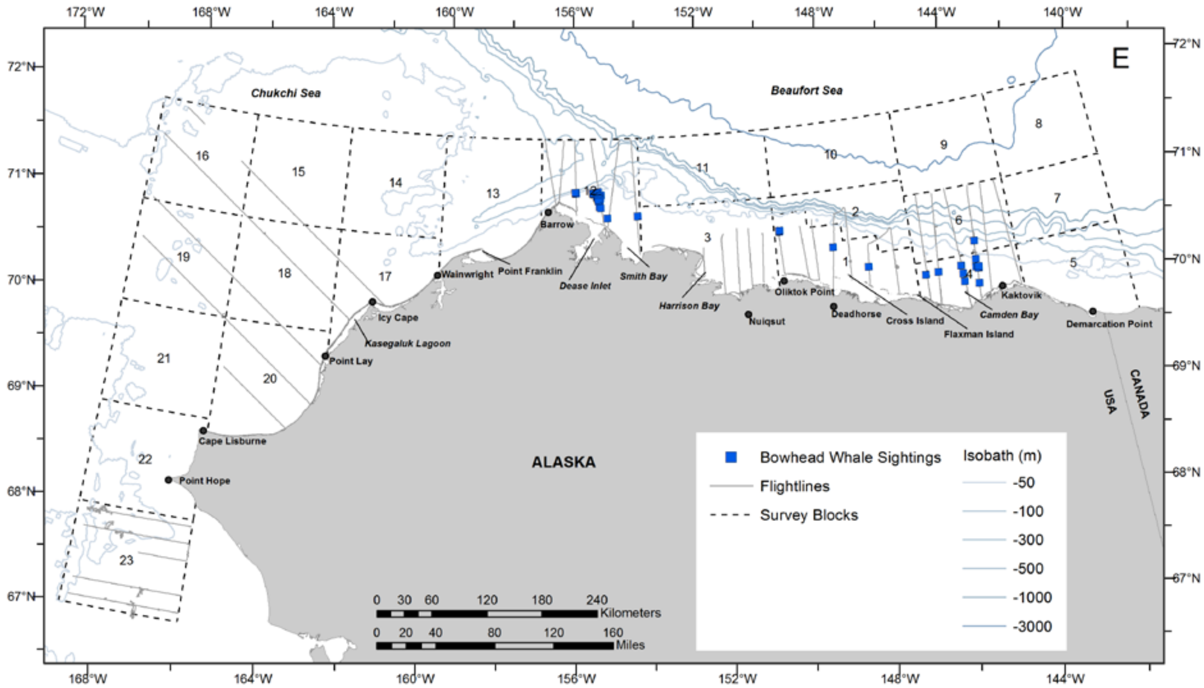


Figure 6 (cont). ASAMM 2014 semimonthly bowhead whale sightings, with transect, search, and circling effort. C: 1-15 August; D: 16-31 August. Deadhead flight tracks are not shown.



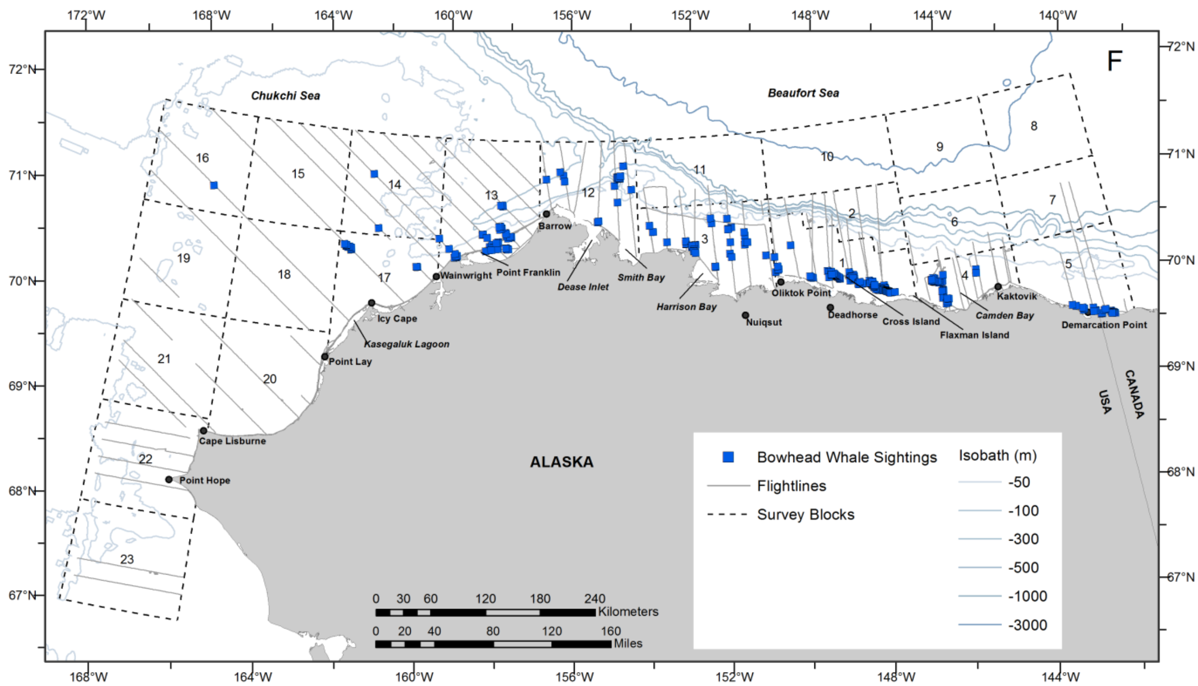
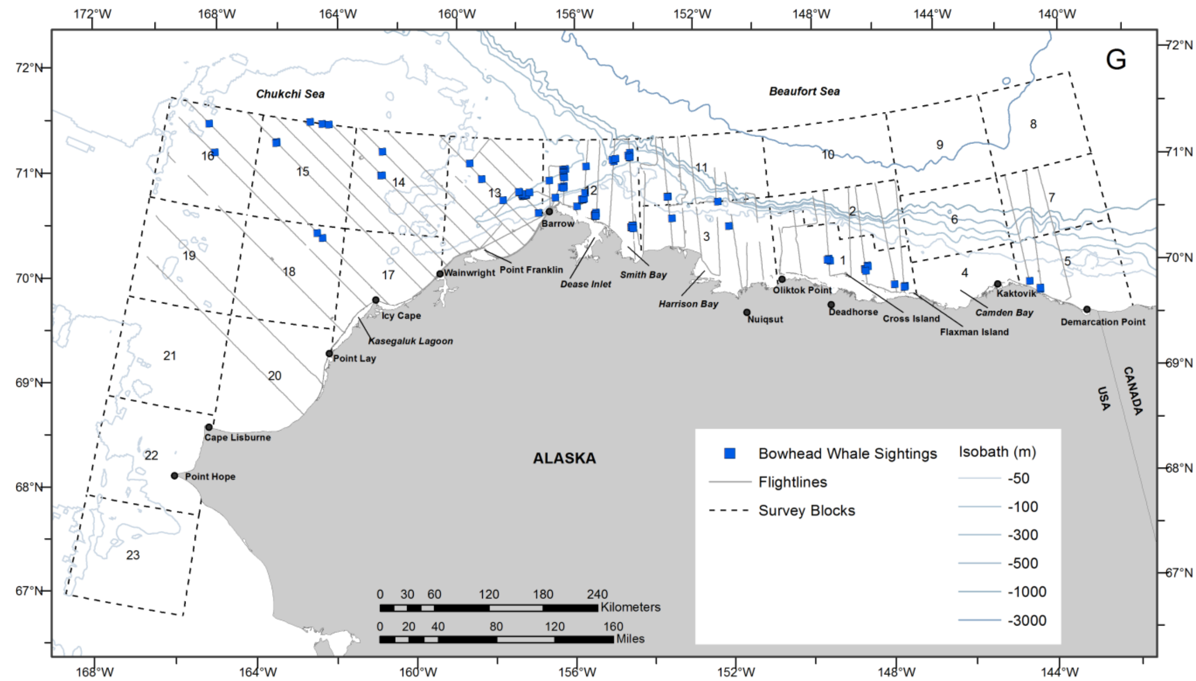


Figure 6 (cont). ASAMM 2014 semimonthly bowhead whale sightings, with transect, search, and circling effort. E: 1-15 September; F: 16-30 September. Deadhead flight tracks are not shown.



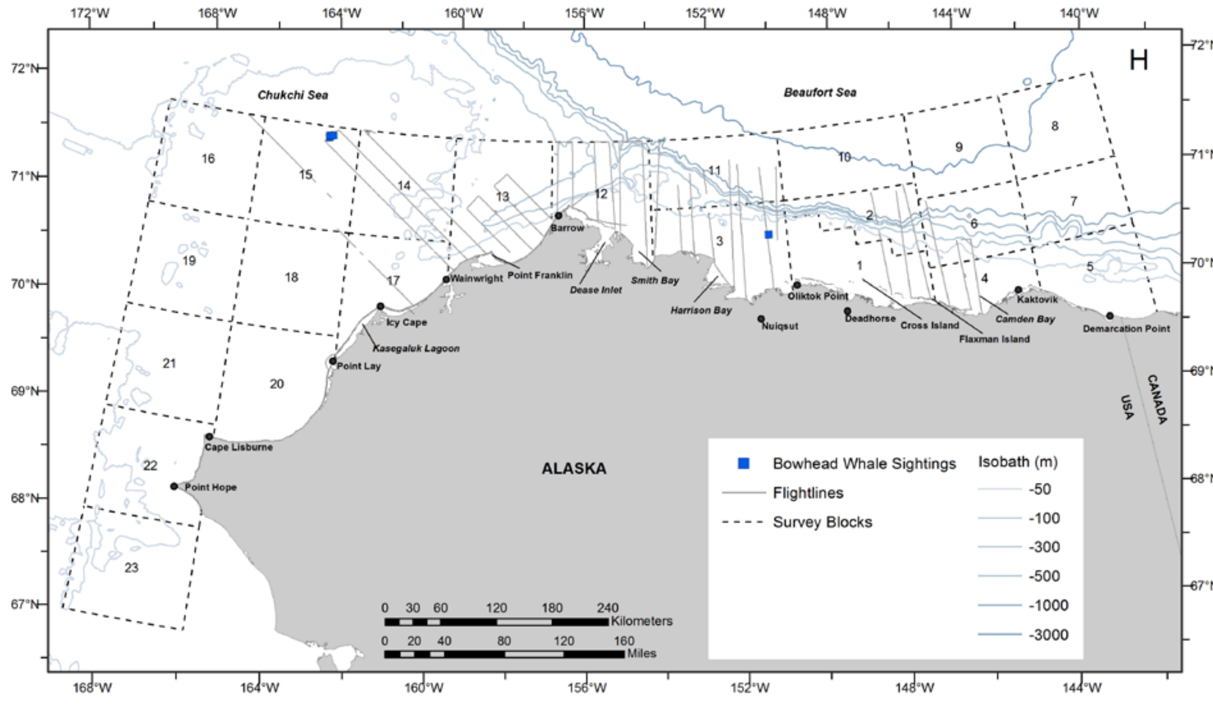


Figure 6 (cont). ASAMM 2014 semimonthly bowhead whale sightings, with transect, search, and circling effort. G: 1-15 October; H: 16-29 October. Deadhead flight tracks are not shown.

Cetaceans

Bowhead Whales

BOWHEAD WHALE SIGHTING SUMMARY

During 2014 ASAMM surveys, 599 sightings of 1,202 bowhead whales (*Balaena mysticetus*) of the Western Arctic (also known as the Bering-Chukchi-Beaufort) stock were observed during transect, search, and circling survey modes (Table 3). This is higher than the number of bowhead whales usually observed in a single year during ASAMM surveys (e.g., Clarke et al. 2012, 2013a, 2014), although more bowhead whales were recorded during ASAMM surveys in 1997 (Treacy 1998). The high number of bowhead whales sighted was due, in part, to surveys conducted in the western Beaufort Sea in late July and August, during which 239 bowhead whales were seen. Of even greater impact were numerous sightings of feeding and milling bowhead whales (212 sightings of 669 whales) observed in the western Beaufort Sea from mid-August through early October. Bowhead whales were seen in July, September, and October in the northeastern Chukchi Sea and from July through October in the western Beaufort Sea (Figure 7).

Sightings in the Chukchi Sea were mostly west of Barrow between 70.7°N and 72°N. In mid-July, two bowhead whales were seen offshore of Point Franklin, Alaska (Figure 6). No bowhead whales were seen in August in the Chukchi Sea. In September, bowhead whale distribution in the Chukchi Sea was mostly southwest of Barrow, with scattered sightings 180-360 km west of Barrow. Bowhead whale distribution in October in the Chukchi Sea was predominantly west-northwest of Barrow. Bowhead whales were not seen south of 70.7°N. The greatest number of bowhead whales were seen in block 13 (n = 102). Bowhead whale sightings in the northeastern Chukchi Sea in September and October 2014 reinforce previous observations from aerial surveys, satellite telemetry (Quakenbush et al. 2010a), and acoustics (Delarue et al. 2011), describing a broad migration route that spreads across the CSPA. Bowhead whales were last observed in the northeastern Chukchi Sea on 28 October when three whales were seen approximately 190 km west-northwest of Barrow.

In the western Beaufort Sea, bowhead whales were seen in two areas in late July: on the outer continental shelf and slope (51-2,000 m depth) primarily north of Camden Bay, and nearshore east of Barrow (Figure 8), with the highest number of whales seen in block 12 (n = 16). Bowhead whales in August were observed across the western Beaufort Sea in both outer and inner shelf waters, with the highest number of whales seen in block 4 (n = 88) and block 1 (n = 53). Distribution in September was primarily on the inner shelf (<50 m depth) from approximately 140°W-157°W (Figure 8), with hundreds of whales observed within 5 km of barrier islands between 146°W and 148.5°W. The highest number of whales seen per survey block in September was in block 1 (n = 355). Bowhead whales were seen in very shallow (≤20 m depth) nearshore waters of the Alaskan Beaufort Sea between 143°W and 156°W in August and September, including areas in Camden Bay; between Flaxman Island and Oliktok Point, Alaska; in Harrison Bay; and between Cape Halkett and Point Barrow. Bowhead whales in

Table 3. ASAMM 2014 marine mammal sightings (number of sightings/number of individuals) during all survey modes (transect, search, and circling) in chronological order, 2 July-29 October 2014, by survey flight and semimonthly time period. Excludes sightings of dead animals and same-day repeat sightings.

Day	Flight No.	Bowhead Whale	Gray Whale	Humpback Whale	Fin Whale	Minke Whale	Beluga	Unidentified Cetacean*	Walrus	Bearded Seal	Unidentified Pinniped**	Polar Bear
2 Jul	201	0	3/4	0	0	0	12/22	0	0	0	0	0
5 Jul	202	0	1/2	0	0	0	1/23	0	7/110	0	5/5	0
6 Jul	203	0	16/35	0	0	0	0	0	0	0	0	0
9 Jul	204	0	23/49	0	0	0	2/204	0	1/1	0	7/7	0
12 Jul	205	0	15/31	0	0	0	0	0	4/372	0	4/5	0
15 Jul	206	1/2	3/6	0	0	0	1/1	0	24/4,592	1/1	2/2	0
16 Jul	207	0	22/52	0	0	0	3/29	0	0	0	2/8	0
18 Jul	208	0	3/4	0	0	0	0	1/1	0	0	0	0
19 Jul	209	0	15/23	0	0	0	3/14	0	4/412	0	10/10	0
19 Jul	1	8/9	0	0	0	0	43/175	0	0	0	3/7	0
20 Jul	2	1/1	0	0	0	0	30/79	0	0	0	2/2	0
21 Jul	3	0	0	0	0	0	27/61	0	0	0	4/5	0
22 Jul	210	0	16/29	0	0	0	2/20	0	9/262	0	7/7	0
24 Jul	211	0	0	0	0	0	0	0	0	0	0	0
25 Jul	212	0	4/4	0	0	0	1/1	0	6/41	0	23/29	1/1
26 Jul	213	0	31/55	0	0	0	1/1	0	0	0	5/7	0
26 Jul	4	0	0	0	0	0	0	0	0	0	0	0
27 Jul	214	0	0	0	0	0	0	0	12/18	0	4/4	0
27 Jul	5	8/13	0	0	0	0	15/83	0	1/1	0	0	0
29 Jul	215	0	3/8	0	0	0	0	0	28/2,894	1/1	112/180	0
30 Jul	216	0	2/4	0	0	0	0	0	0	0	9/10	0
31 Jul	217	3/3	9/15	0	0	0	42/102	1/1	4/70	0	33/34	0
31 Jul	6	1/1	0	0	0	0	21/29	0	0	0	0	0
2 Aug	7	0	0	0	0	0	0	0	0	0	0	0
4 Aug	218	0	53/108	0	0	0	0	0	0	0	35/38	0
6 Aug	219	0	41/57	0	0	0	0	0	1/1	0	2/2	0
6 Aug	8	2/3	0	0	0	0	36/58	0	0	0	0	0

Day	Flight No.	Bowhead Whale	Gray Whale	Humpback Whale	Fin Whale	Minke Whale	Beluga	Unidentified Cetacean*	Walrus	Bearded Seal	Unidentified Pinniped**	Polar Bear
10 Aug	220	0	1/1	0	0	0	4/6	0	32/3194	0	0	0
11 Aug	9	1/1	1/2	0	0	0	9/15	0	0	0	3/3	0
15 Aug	221	0	7/12	0	0	0	0	0	0	0	0	0
17 Aug	222	0	15/25	0	0	0	3/4	0	0	0	15/17	0
17 Aug	10	33/54	0	0	0	0	6/7	2/2	0	0	17/27	3/7
18 Aug	11	4/4	0	0	0	0	13/13	2/2	0	0	5/5	0
19 Aug	223	0	4/6	0	0	0	2/8	1/1	0	0	21/24	0
19 Aug	12	1/1	0	0	0	0	87/208	0	0	0	39/145	0
20 Aug	224	0	3/9	0	0	0	0	0	3/4	0	11/14	0
20 Aug	13	6/8	1/1	0	0	0	37/187	2/2	0	0	9/21	0
21 Aug	225	0	7/8	0	0	0	1/15	0	5/6	3/3	64/88	0
22 Aug	226	0	24/28	0	0	0	1/1	0	1/1	0	27/32	0
22 Aug	14	2/2	0	0	0	0	43/88	0	0	0	43/166	0
23 Aug	15	59/99	0	0	0	0	53/95	8/10	0	0	99/333	2/3
24 Aug	227	0	2/3	0	0	0	0	0	0	0	0	0
24 Aug	16	0	0	0	0	0	7/23	0	0	0	0	0
27 Aug	228	0	2/2	0	0	0	1/10	0	0	0	5/5	0
28 Aug	229	0	0	0	0	0	0	0	4/6	0	0	0
28 Aug	17	1/2	0	0	0	0	25/32	1/1	0	0	52/160	6/27
29 Aug	230	0	18/21	0	0	0	2/2	0	13/822	0	1/1	0
30 Aug	18	16/38	0	0	0	0	53/63	4/4	0	0	60/155	0
31 Aug	19	0	0	0	0	0	0	0	0	0	0	0
1 Sep	231	0	0	0	0	0	0	0	25/148	0	0	0
1 Sep	20	10/12	0	0	0	0	5/6	4/4	0	0	14/61	0
4 Sep	232	0	128/205	21/43	15/31	1/1	0	2/2	1/1	0	44/51	0
5 Sep	233	0	0	0	0	0	0	1/1	12/455	0	7/7	1/1
6 Sep	234	23/62	3/3	0	0	1/2	7/23	1/1	19/76	0	56/63	1/1
8 Sep	21	5/6	1/1	0	0	0	32/65	1/1	0	1/1	42/114	2/2
11 Sep	22	2/2	0	0	0	0	25/35	0	0	0	3/10	7/25
19 Sep	235	0	0	0	0	0	0	0	7/6,511	0	0	0

Day	Flight No.	Bowhead Whale	Gray Whale	Humpback Whale	Fin Whale	Minke Whale	Beluga	Unidentified Cetacean*	Walrus	Bearded Seal	Unidentified Pinniped**	Polar Bear
21 Sep	236	41/58	11/14	0	0	0	11/32	0	25/36	0	10/10	0
21 Sep	23	35/90	0	0	0	0	0	0	0	0	1/1	6/35
22 Sep	237	23/27	8/9	0	0	0	7/11	2/5	15/17	0	18/21	0
22 Sep	24	62/208	0	0	0	0	29/36	2/2	0	1/1	4/5	4/31
23 Sep	238	1/1	0	0	0	0	2/12	0	4/1,533	0	4/1,450	0
23 Sep	25	9/25	0	0	0	0	3/6	0	0	0	2/3	0
24 Sep	239	0	0	1/3	2/5	0	0	0	7/16	0	23/61	0
24 Sep	26	0	0	0	0	0	0	0	0	0	0	0
25 Sep	27	71/224	0	0	0	0	0	0	0	0	0	0
26 Sep	28	24/35	0	0	0	0	17/30	2/4	0	0	0	1/1
27 Sep	240	0	3/3	0	0	0	0	0	1/35,000	0	0	0
27 Sep	29	1/1	0	0	0	0	1/1	1/1	0	0	6/6	4/5
28 Sep	241	1/1	10/12	0	0	0	0	2/2	8/9	0	3/3	1/1
28 Sep	30	43/65	0	0	0	0	2/2	0	0	0	5/5	0
1 Oct	242	1/2	0	0	0	0	0	0	0	0	0	0
3 Oct	243	11/13	4/4	0	0	0	17/28	1/1	1/1	0	18/28	2/51
4 Oct	31	46/75	0	0	0	0	38/128	0	0	0	1/1	1/1
5 Oct	244	15/21	0	0	0	0	9/15	0	2/4	0	0	0
5 Oct	32	3/3	0	0	0	0	9/9	0	0	0	7/7	1/1
6 Oct	245	5/5	0	0	0	0	32/46	0	6/10	0	14/14	0
6 Oct	33	2/2	0	0	0	0	0	0	0	0	0	0
7 Oct	246	7/9	1/1	0	0	0	19/47	0	10/12	0	111/161	0
7 Oct	34	3/3	0	0	0	0	43/85	0	0	0	0	0
8 Oct	247	1/1	10/13	0	0	0	8/9	2/2	11/23	0	10/10	0
9 Oct	248	0	0	0	0	0	0	1/1	6/16	0	8/8	0
12 Oct	249	3/6	0	0	0	0	0	0	0	0	0	0
13 Oct	250	0	0	0	0	0	0	0	0	0	0	0
24 Oct	251	0	0	0	0	0	0	0	0	0	1/3	0
25 Oct	252	0	0	0	0	0	2/2	0	0	0	2/2	0
26 Oct	253	1/1	0	0	0	0	4/7	0	0	0	1/1	1/2

Day	Flight No.	Bowhead Whale	Gray Whale	Humpback Whale	Fin Whale	Minke Whale	Beluga	Unidentified Cetacean*	Walrus	Bearded Seal	Unidentified Pinniped**	Polar Bear
27 Oct	254	0	0	0	0	0	7/7	0	0	0	1/1	0
28 Oct	255	3/3	0	0	0	0	0	0	0	0	0	0
29 Oct	256	0	0	0	0	0	6/9	0	0	0	0	1/1
						Semimonthly Summary						
1-15 Jul		1/2	61/127	0	0	0	16/250	0	36/5,075	1/1	18/19	0
16-31 Jul		21/27	105/194	0	0	0	188/594	2/2	64/3,698	1/1	214/303	1/1
1-15 Aug		3/4	103/180	0	0	0	49/79	0	33/3,195	0	40/43	0
16-31 Aug		122/208	76/103	0	0	0	334/756	20/22	26/839	3/3	468/1,193	11/37
1-15 Sep		40/82	132/209	21/43	15/31	2/3	69/129	9/9	57/680	1/1	166/306	11/29
16-30 Sep		311/735	32/38	1/3	2/5	0	72/130	9/14	67/43,122	1/1	76/1,565	16/73
1-15 Oct		97/140	15/18	0	0	0	175/367	4/4	36/66	0	169/229	4/53
16-29 Oct		4/4	0	0	0	0	19/25	0	0	0	5/7	2/3
TOTAL		599/1,202	524/869	22/46	17/36	2/3	922/2,330	44/51	319/56,675	7/7	1,156/3,665	45/196

* Includes sightings designated as "unidentified cetacean" and "small unidentified cetacean".

** Includes sightings designated as "unidentified pinniped" and "small unidentified pinniped".

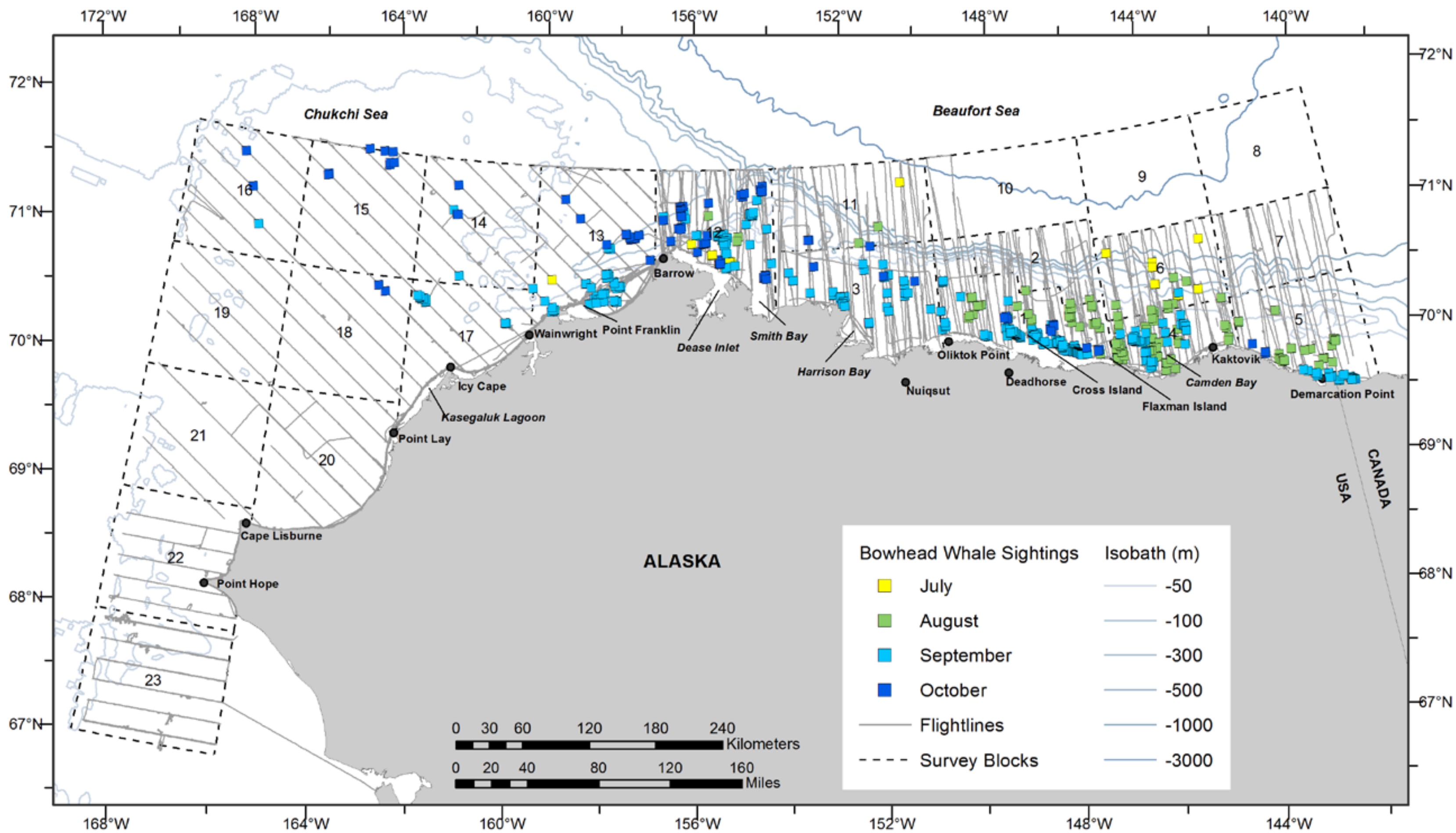


Figure 7. ASAMM 2014 bowhead whale sightings plotted by month, with transect, search, and circling effort. Deadhead flight tracks are not shown.

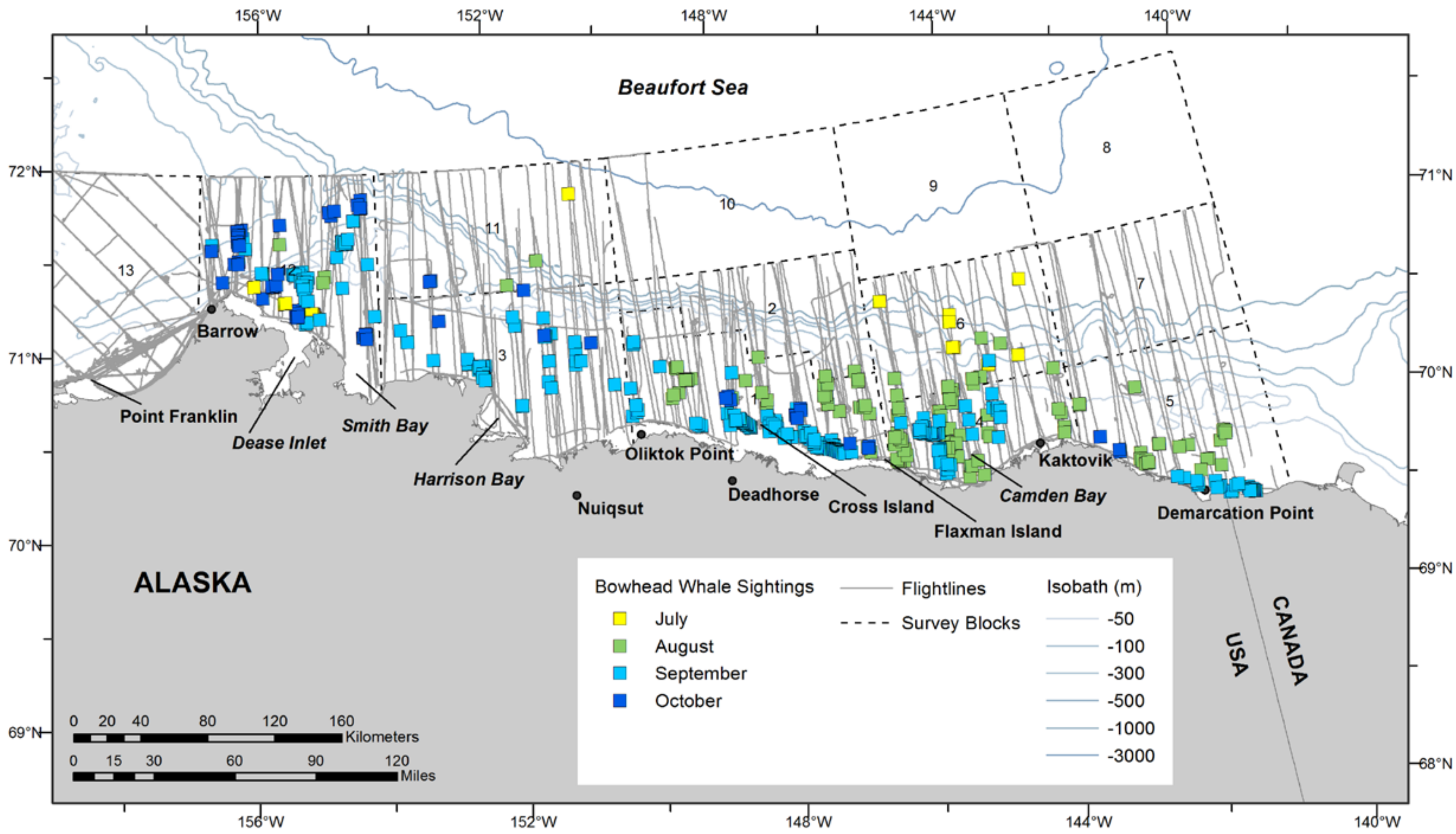


Figure 8. ASAMM 2014 bowhead whale sightings in the western Beaufort Sea, plotted by month, with transect, search, and circling effort. Deadhead flight tracks are not shown.

October were observed primarily from 146°W to 157°W; a few whales were seen east of 146°W and several were seen in Barrow Canyon. The highest number of whales seen per survey block in October was in block 12 (n = 76). The highest numbers of whales per survey block in summer (July-August) were in blocks 4 (n = 88) and 1 (n = 53). The highest numbers of whales per survey block in fall (September-October;) were in blocks 1 (n = 368) and 12 (n = 170). Bowhead whales were not seen between barrier islands and the mainland. Bowhead whales were last observed in the western Beaufort Sea on 26 October during a survey of block 3, when one whale was seen.

BOWHEAD WHALE SIGHTING RATES

In summer and fall 2014, bowhead whales were seen on transect (Tr) throughout the longitudinal extent of the study area, from 140.9°W to 167.7°W. There were 250 sightings of 376 bowhead whales on transect by primary observers, ranging from 1 whale per sighting (n = 182) to 7 whales per sighting (n = 3). The highest number of sightings on transect was in block 12 (51 sightings), followed by block 1 (50 sightings). The largest groups of bowhead whales on transect (7 animals) were observed on 22 September in block 1, 28 September in block 3, and 4 October in block 12. When transect and circling from transect (Tr+TrC sightings) were combined, there were 497 sightings of 976 bowhead whales, ranging from 1 whale per sighting (n = 319) to 37 whales per sightings (n = 1). The highest number of Tr+TrC sightings was in block 1 (146 sightings), followed by block 12 (97 sightings).

Highest fine-scale Tr sighting rates (WPUE, 5 km grid) for summer (July-August) and fall (September-October) were distributed throughout the study area (Figure 9), although there were differences between the seasons. In summer, highest fine-scale Tr sighting rates were east of 143°W (block 5), in Camden Bay (block 4), and in the western Alaskan Beaufort Sea (block 12) (Figure 9A). Unlike 2013 (Clarke et al. 2014), the highest fine-scale Tr sighting rates in summer 2014 were within the 50-m isobath. In fall, nearly all Tr fine-scale cells were close to shore or barrier islands between Flaxman Island and Barrow (Figure 9B). High Tr sighting rates in fall were also observed in Barrow Canyon and scattered across the northeastern Chukchi Sea west and northwest of Barrow, similar to fall 2012 (Clarke et al. 2013a). Comparisons of Tr and Tr+TrC sighting rates for bowhead whales in summer and fall are included in Appendix E (Figures E-1 and E-2). Summer and fall Tr+TrC sighting rates better represent on-effort sightings and effort in 2014 and highlight areas of bowhead whale aggregations, particularly in fall (Appendix E, Figure E-2).

Monthly and seasonal shifts in bowhead whale distribution were also evident in results of the analysis of sighting rates by survey block. For all months combined, the highest Tr sighting rates per survey block were in block 1 (0.033 WPUE), block 4 (0.032 WPUE), and block 12 (0.020 WPUE), with an overall Tr sighting rate of 0.008 WPUE. The Tr sighting rates for summer months (July and August combined) were highest in block 4 (0.044 WPUE), block 6 (0.016 WPUE), and block 5 (0.015 WPUE) (Appendix E, Table E-1), although Tr sighting rates for combined summer months do not completely reflect monthly distribution patterns. Sighting rates (Tr) in July were highest in block 6 (0.018 WPUE) and block 12 (0.012 WPUE) (Figure 10), while Tr sighting rates in August were highest in block 4 (0.069 WPUE) and block 1

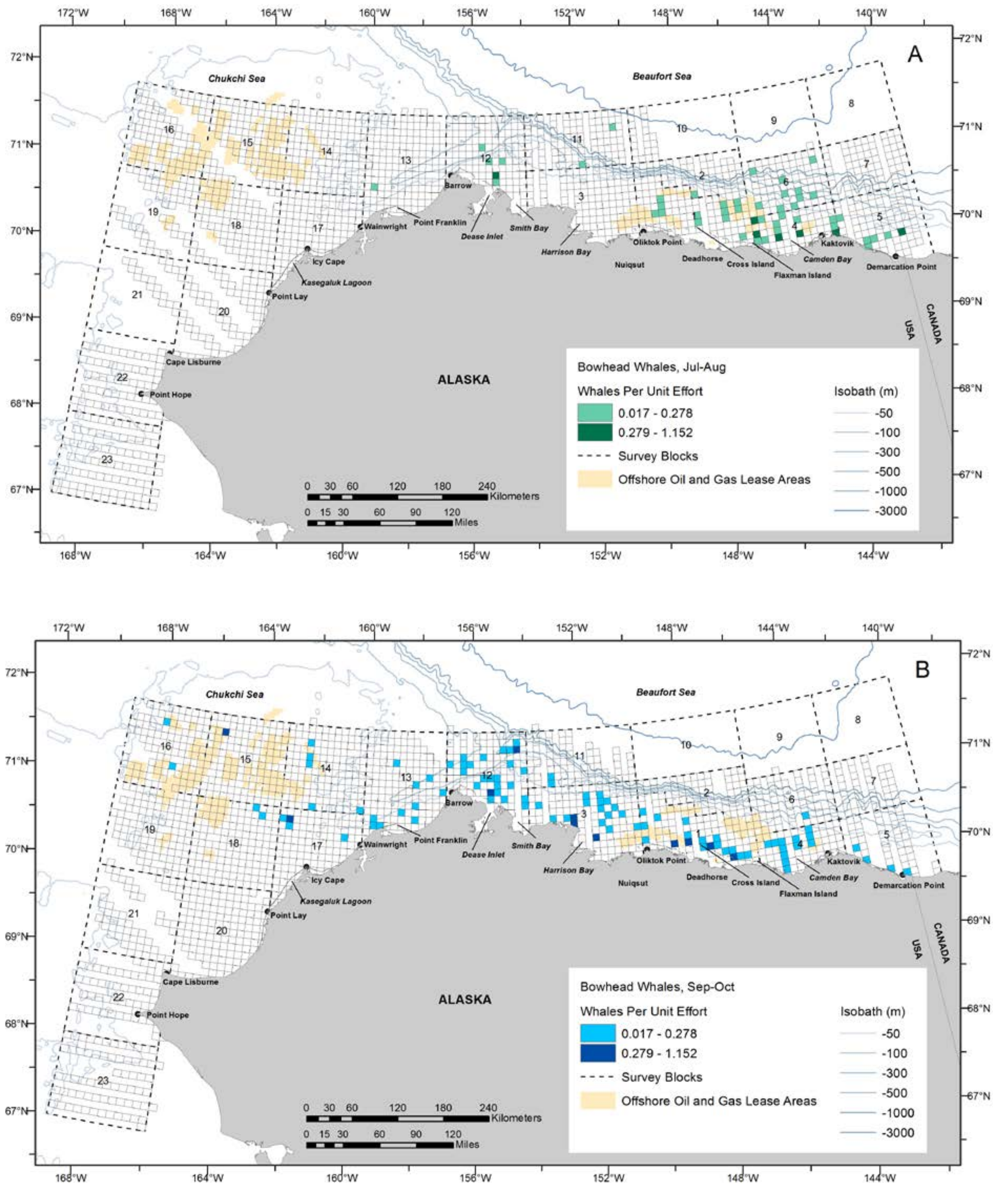


Figure 9. ASAMM 2014 bowhead whale sighting rates (WPUE; transect sightings from primary observers only). A: summer (July-August); B: fall (September-October). Empty grid cells indicate sighting rates of zero. Transect survey effort was not conducted in areas without grid cells.

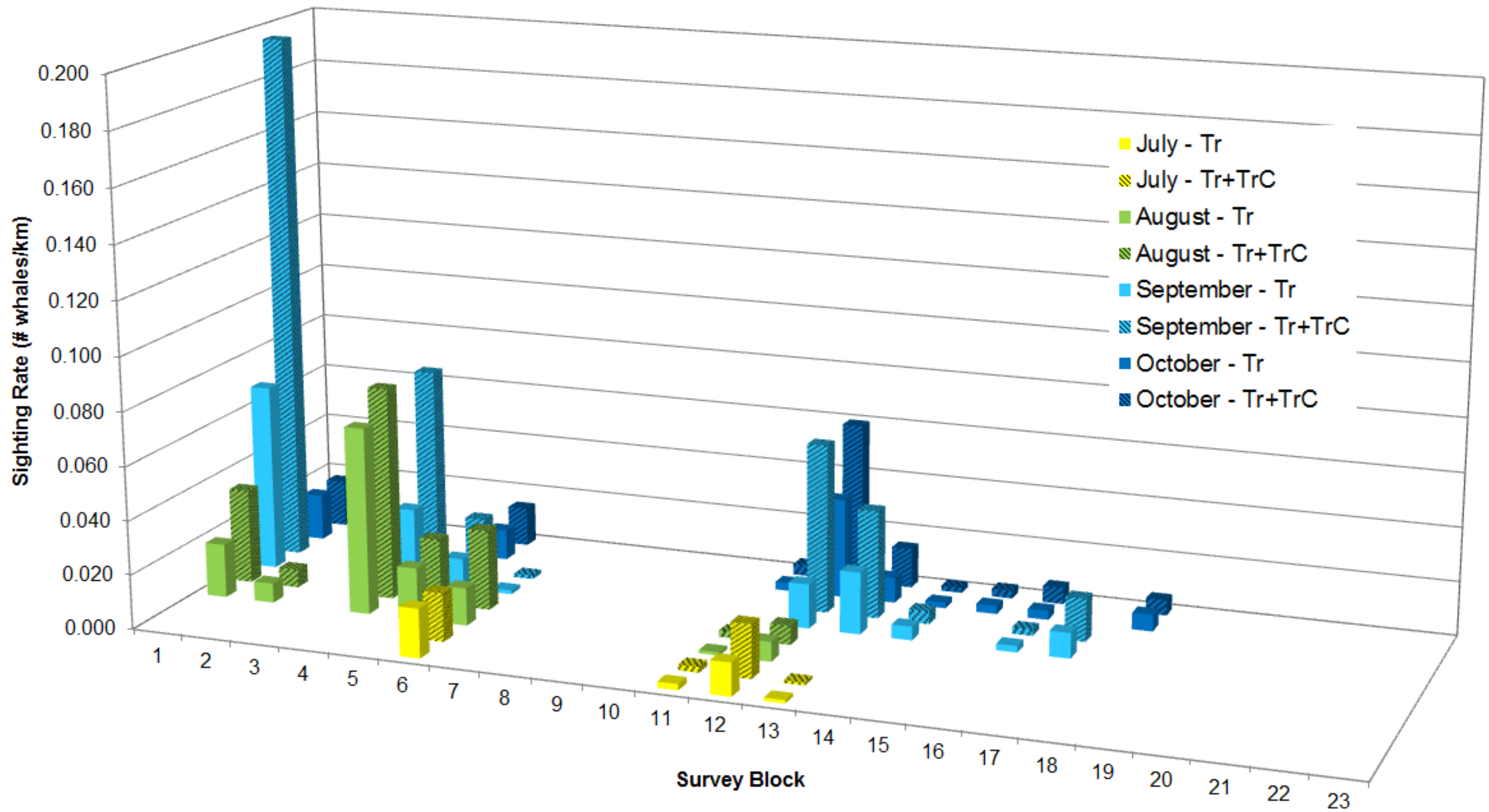


Figure 10. ASAMM 2014 bowhead whale monthly sighting rates (WPUE; sightings from primary observers only) per survey block for sightings and effort on transect (Tr) and sightings and effort on transect and circling from transect (Tr+TrC). Sighting rates of zero were removed from the graph for clarity.

(0.020 WPUE), illustrating the shift in abundance from offshore blocks to nearshore blocks from July to August. Sighting rates (Tr) in summer were relatively low in all Chukchi Sea blocks (Figure 10). Combined Tr sighting rates for fall months (September-October) were highest in block 1 (0.051 WPUE), block 12 (0.027 WPUE), block 3 (0.025 WPUE) and block 4 (0.024 WPUE); overall Tr sighting rate in fall for all blocks combined was 0.012 WPUE (Appendix E, Table E-1).

Monthly Tr sighting rates per survey block in the western Beaufort Sea in September and October 2014 were higher than monthly Tr sighting rates per block for September and October 1989-2013 combined (Figure 11), particularly in blocks 1, 3, and 4 in September and block 12 in October. Relatively few bowhead whales were seen on transect in block 12 in September 2014, resulting in a lower monthly Tr sighting rate compared to previous years combined.

The survey block sighting rate analyses for previous years with light sea ice cover in the 1980s and 1990s (e.g., Ljungblad et al. 1987; Treacy 1988, 1990, 1991, 1994, 1995, 1996, 1997, 1998) analyzed the total number of bowhead whales/survey hour flown and did not remove unsurveyable time periods (due to lack of suitable visibility), time spent surveying inside the barrier islands and north of 72°N, or sightings from secondary observers, so it is difficult to compare 2014 sighting rates with existing analyses of sighting rates from two decades ago. However, one pattern that appears to be consistent across all light sea ice years is that the highest sighting rates per year during fall in the western Beaufort Sea are found in coastal survey blocks (1, 3, 4, 5, and 12) and are usually correlated with large groups of bowhead whales in feeding or milling aggregations.

In the Chukchi Sea in fall, the highest Tr sighting rate was 0.014 WPUE in block 13 (Appendix E, Table E-1), which was higher than the highest Tr sighting rate per survey block observed in fall 2008, 2009, 2010, 2011, or 2013 (Clarke et al. 2011d, 2012, 2014). The overall Tr sighting rate for all Chukchi Sea survey blocks (13-23) in fall was 0.004, which was similar to the overall Tr sighting rate for this area in 2013 (Clarke et al. 2014) and half the Tr sighting rate for this area in 2012 (Clarke et al. 2013a). Sighting rates (Tr) in the western Alaskan Beaufort Sea and eastern Chukchi Sea blocks (12-23) combined were low in summer and increased substantially in fall (Figure 10), reflecting the expected pattern based on the bowhead fall migration.

Sighting rates per block, calculated using sightings and effort on transect combined with sightings and effort from circling from transect (Tr+TrC), are a more accurate reflection of bowhead whale relative abundance because they incorporated all on-effort sightings and effort. Sighting rates (Tr+TrC) were higher in all survey blocks compared to Tr sighting rates (Figure 10). The highest Tr+TrC sighting rate for the entire study area was in block 1 in September (0.197 WPUE), which was twice as high as any other Tr+TrC sighting rate in any block in any month (Appendix E, Table E-2).

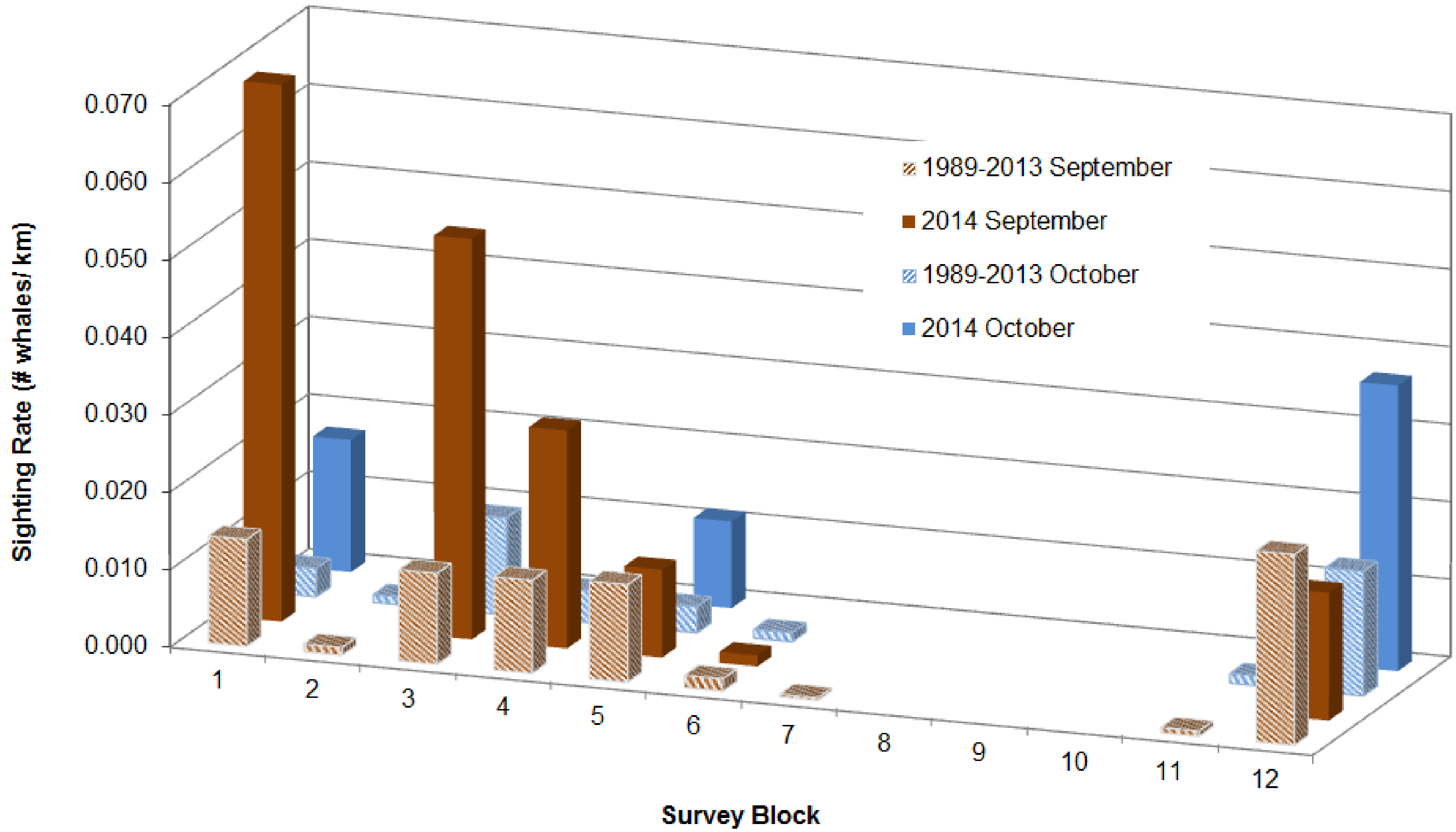


Figure 11. ASAMM bowhead whale sighting rates (WPUE; transect sightings from primary observers only) per survey block in the western Beaufort Sea, September and October 1989-2013 and 2014. Sighting rates of zero were removed from the graph for clarity.

For summer months, the highest Tr sighting rates per depth zone (Appendix E, Table E-3) were as follows:

- 21-50 m depth zone (0.023 WPUE) in the central-eastern (140°W-154°W) Alaskan Beaufort Sea subarea, influenced by sightings in nearshore Camden Bay in August; sighting rates in July alone were highest in the 201-2,000 m depth zone (0.006 WPUE) (Figure 12);
- ≤20 m depth zone (0.024 WPUE) in the western (154°W-157°W) Alaskan Beaufort Sea subarea; and
- 51-200 m North depth zone (0.0010 WPUE) in the eastern Chukchi Sea subarea (157°W-169°W).

The shift from higher Tr sighting rates in offshore, deeper water (201-2,000 m) in July to shallower water (21-50 m) in August in the central-eastern (140°W-154°W) Alaskan Beaufort Sea was also noted in 2012 and 2013 (Clarke et al. 2013a, 2014).

For fall months, the highest Tr sighting rates per depth zone (Appendix E, Table E-3) were as follows:

- ≤20 m depth zone (0.063 WPUE) in the central-eastern (140°W-154°W) Alaskan Beaufort Sea subarea;
- ≤20 m depth zone (0.041 WPUE) in the western (154°W-157°W) Alaskan Beaufort Sea subarea; and
- 51-200 m North depth zone (0.012 WPUE) in the eastern Chukchi Sea subarea (157°W-169°W), influenced by sightings near Barrow Canyon.

Due to the preponderance in 2014 of bowhead whales observed feeding in shallow nearshore waters, depth zone preferences in the Beaufort Sea in fall were shallower compared to past years, when highest Tr sighting rates have been in the 21-50 m depth zone. The high Tr sighting rate in the 51-200 m North depth zone in the northeastern Chukchi Sea reflected bowhead whales seen in Barrow Canyon and well offshore.

Sighting rates per depth zone calculated using sightings and effort on transect and on circling from transect (Tr+TrC) in fall were generally higher in all depth zones compared to Tr sighting rates (Figure 12). Highest Tr+TrC sighting rates were overwhelmingly in the shallowest depth zone (≤20 m) in September in the central-eastern Alaskan Beaufort Sea and in July and October in the western Alaskan Beaufort Sea (Appendix E, Table E-4).

Bowhead Whale Sea Ice Associations

Most bowhead whales (98%, n = 1,179) were observed in 0% sea ice cover (Table 4). Eight bowhead whales (1%) were sighted in 1-15% sea ice cover. Fifteen bowhead whales (1%) were sighted in 55-70% sea ice cover. All bowhead whales observed in areas of sea ice were seen in July or August when sea ice remained in some of the study area, with the exception of one whale seen in late October when new ice was forming in shallow nearshore areas (see Appendix A, Figure A-9).

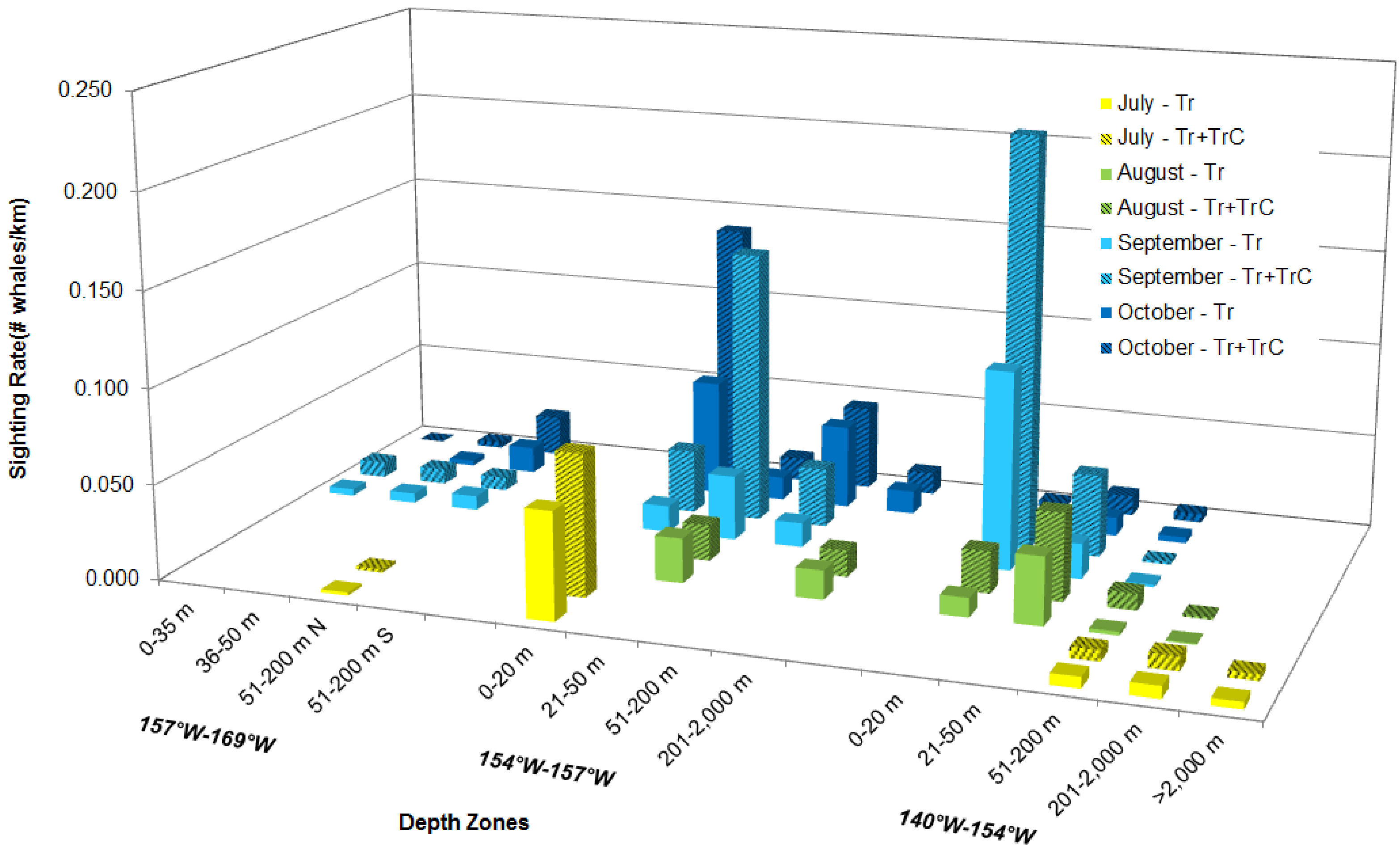


Figure 12. ASAMM 2014 bowhead whale monthly sighting rates (WPUE; sightings from primary observers only) per depth zone for sightings and effort on transect (Tr) and sightings and effort on transect and circling from transect (Tr+TrC). Sighting rates of zero were removed from the graph for clarity.

Table 4. ASAMM 2014 semimonthly summary of bowhead whales (number of sightings/number of individuals) observed during all survey modes (transect, search, and circling), by percent sea ice cover at sighting location. Excludes dead and same-day repeat sightings.

Percent Sea Ice Cover	1-15 Jul	16-31 Jul	1-15 Aug	16-31 Aug	1-15 Sep	16-30 Sep	1-15 Oct	16-29 Oct	Total
0	0	8/9	3/4	120/206	40/82	311/735	97/140	3/3	582/1,179
1-5	0	2/2	0	2/2	0	0	0	0	4/4
6-10	0	0	0	0	0	0	0	1/1	1/1
11-20	0	3/3	0	0	0	0	0	0	3/3
21-30	0	0	0	0	0	0	0	0	0
31-40	0	0	0	0	0	0	0	0	0
41-50	0	0	0	0	0	0	0	0	0
51-60	1/2	1/1	0	0	0	0	0	0	2/3
61-70	0	7/12	0	0	0	0	0	0	7/12
TOTAL	1/2	21/27	3/4	122/208	40/82	311/735	97/140	4/4	599/1,202

Bowhead Whale Behaviors

Behaviors of bowhead whales observed during all survey modes (i.e., transect, search and circling) and by primary and secondary observers in 2014 are summarized in Table 5. The behavior most often recorded was milling (34%, n = 413), followed by swimming (29%, n = 344) and feeding (22%, n = 269). Feeding behavior was likely underreported due to the difficulty of identifying this behavior for animals feeding on benthic or mid-water prey; milling was often recorded in situations where obvious evidence of feeding was not directly observed but was suspected. Milling and feeding were recorded for 682 whales (57%), a higher percentage than in most previous years. Resting was recorded for 113 whales (9%) and diving was recorded for 20 whales (2%). Fourteen whales were recorded exhibiting display behaviors, including breaching (4 whales), flipper slapping (2 whales), tail slapping (6 whales), and log playing (2 whales). Five bowhead whales (<1% of all bowhead whales sighted) appeared to respond to the survey aircraft; all reactions were diving.

Seasonal differences were observed in bowhead whale swim direction. Bowhead whale swim direction was not clustered around any heading in summer in either the northeastern Chukchi or western Beaufort seas. In the western Beaufort Sea, the mean vector swim direction was 97°T, but headings were scattered in all directions (Rayleigh Z = 0.384, P = 0.685); there were too few swim directions for analysis in the northeastern Chukchi Sea in July and August (n = 5). In fall,

Table 5. ASAMM 2014 semimonthly summary of bowhead whales (number of sightings/number of individuals) observed during all survey modes (transect, search, and circling), by behavioral category. Excludes dead and same-day repeat sightings.

Behavior	1-15 Jul	16-31 Jul	1-15 Aug	16-31 Aug	1-15 Sep	16-30 Sep	1-15 Oct	16-29 Oct	Total
Breach	0	0	0	1/1	0	1/1	2/2	0	4/4
Dive	0	1/1	0	7/10	1/1	6/6	2/2	0	17/20
Feed	0	1/1	0	9/33	3/39	36/174	11/22	0	60/269
Flipper slap	0	0	0	1/2	0	0	0	0	1/2
Log play	0	0	0	0	1/1	1/1	0	0	2/2
Mill	0	0	0	2/7	2/2	145/378	10/26	0	159/413
Rest	0	7/12	0	32/51	5/5	18/26	15/16	3/3	80/113
Swim	1/2	12/13	3/4	59/87	28/34	94/137	52/67	0	249/344
Tail slap	0	0	0	3/4	0	1/1	0	1/1	5/6
Unknown	0	0	0	8/13	0	9/11	5/5	0	22/29
TOTAL	1/2	21/27	3/4	122/208	40/82	311/735	97/140	4/4	599/1,202

swim direction in the western Beaufort Sea was significantly clustered around a mean vector of 290°T (n = 35 observations, Rayleigh Z = 11.73, P < 0.0001). Swim direction in the northeastern Chukchi Sea in September and October was significantly clustered around a mean vector of 233°T (n = 61 observations, Rayleigh Z = 5.432, P = 0.004).

Bowhead Whale Calves

Out of the 1,202 bowhead whales sighted, 37 were identified as calves (Figure 13). Calves were seen from mid-July through early October, distributed from 140°W to 160°W. Most calves (92%) were seen in the western Beaufort Sea. Calves were observed with adult bowhead whales that were feeding, milling, resting, and swimming. One calf was observed nursing (Appendix B, Flight 18) and one calf was sighted without an adult nearby (Appendix B, Flight 244). Most calves (84%) were sighted after circling was initiated and likely would not have been observed if circling had not commenced.

Seasonal differences were apparent in bowhead whale distribution and calf ratio. Eleven of the bowhead whale calves (30%) were sighted during summer months in the western Beaufort Sea, distributed between 140°W and 150°W, offshore over the slope in July and more broadly distributed in nearshore and offshore waters in August. The summer calf ratio (number of calves/number of total whales) was 0.046. Twenty-six of the bowhead whale calves (70%)

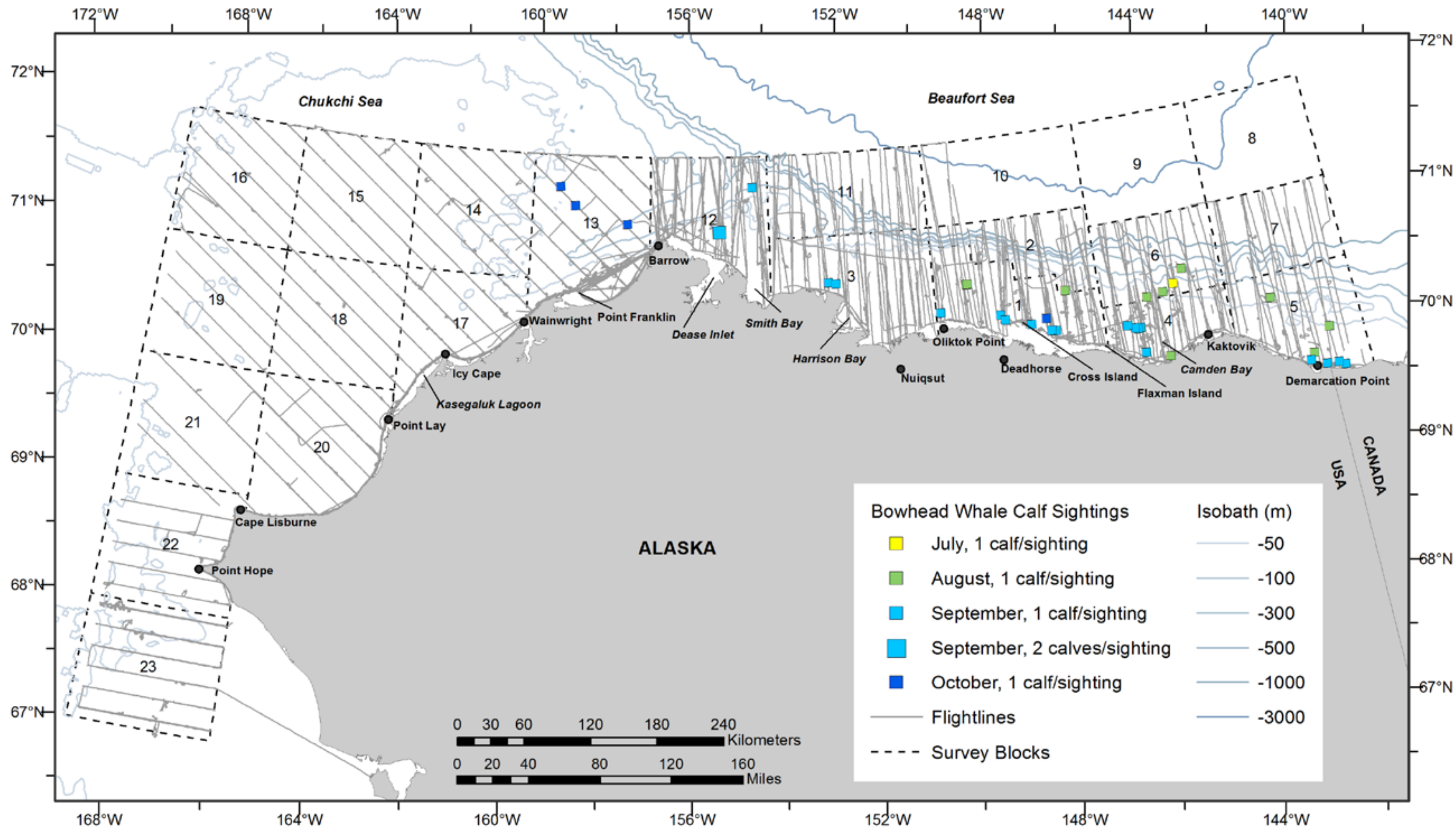


Figure 13. ASAMM 2014 bowhead whale calf sightings plotted by month, with transect, search, and circling effort. Deadhead flight tracks are not shown.

were sighted during fall months, distributed from 140°W to 160°W primarily on the shelf or offshore near Barrow Canyon in the western Beaufort Sea. The calf ratio during fall was 0.027.

Western Beaufort Sea Bowhead Whale Feeding Areas

Bowhead whale feeding behavior, which includes sightings reported as milling, was observed frequently in summer and fall 2014. Indications of bowhead whale feeding included echelon swimming, mouth open, defecation, mud on the rostrum, mud plumes, and birds on the surface (Figure 14). During summer months (July-August), feeding behavior was documented on 4 days in the eastern Alaskan Beaufort Sea (142°W-146°W), at depths ranging from 5 m to 101 m (1-54 km from shore) (Figure 15A). In fall (September-October), feeding behavior was observed on 12 days in the Alaskan Beaufort Sea and 3 days in the northeastern Chukchi Sea (Figure 15B). Water depths at sightings of feeding whales in fall ranged from 5 m to 95 m (<1 km to 205 km from shore).

Surveys were conducted in block 12, a well-documented bowhead whale feeding area (Moore and Reeves 1993; Mocklin et al. 2011) on eight occasions in 2014, between 27 July and 27 October. Feeding behavior was noted during surveys conducted on 6 September (39 whales), 26 September (5 whales), and 4 October (40 whales) (Figure 16). Most of the feeding whales were near Barrow Canyon, with relatively few whales observed in shallow nearshore waters between Smith Bay and Point Barrow, Alaska.

East of block 12 (140°W-154°W), the majority of feeding bowhead whales were very near to shore (or barrier islands). Feeding whales were seen nearshore between Oliktok Point and Flaxman Island on 23 August, 22 and 25 September, and 3 October; in Camden Bay on 30 August and 21 September; and near Demarcation Point, Alaska, on 23 August and 22 and 23 September (Figure 16). Most (82%) of the feeding whales in these areas were within the 20-m isobath; 52% were at ≤10 m water depth. Fine-scale sighting rates for feeding and milling bowhead whales observed on transect (Tr) in summer and fall are shown in Figure 17. Areas of highest Tr sighting rate in fall were all in the Alaskan Beaufort Sea in shallow depths nearshore or just north of barrier islands, including west of Flaxman Island (block 1), north of Harrison Bay (block 3), and north of Dease Inlet, Alaska (block 12). Comparisons of Tr and Tr+TrC sighting rates for feeding and milling whales in summer and fall are included in Appendix E (Figures E-3 and E-4). Fall Tr+TrC sighting rates (Appendix E, Figure E-4) better represent the prevalence of bowhead whale feeding behavior observed in the western Beaufort Sea in 2014.

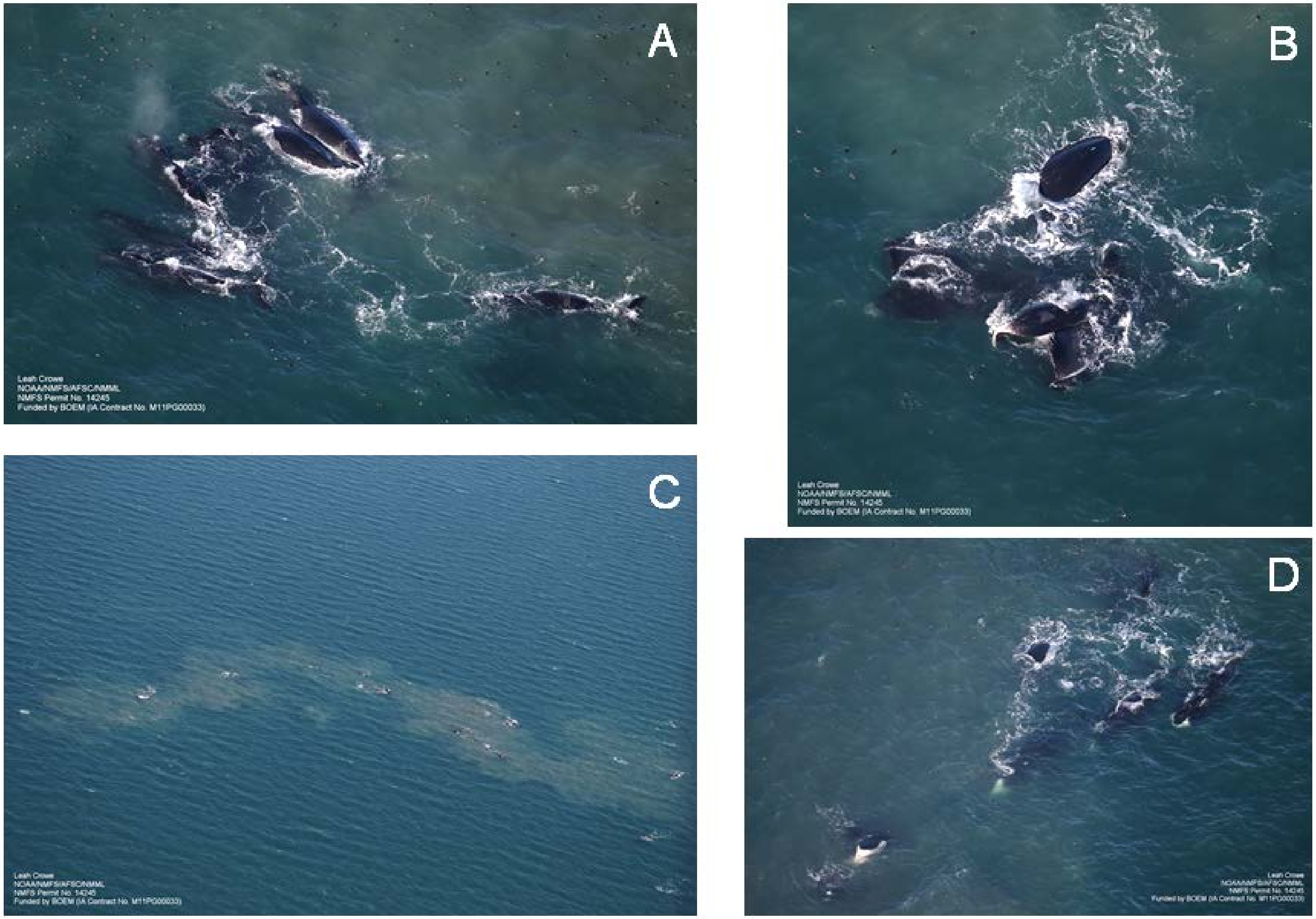


Figure 14. Examples of bowhead whale feeding behavior observed in 2014. A: birds on the surface; B: mouth open at the surface; C: mud plumes; D: echelon formation. Photos by Leah Crowe (NMFS) under NMFS Permit No. 14245.

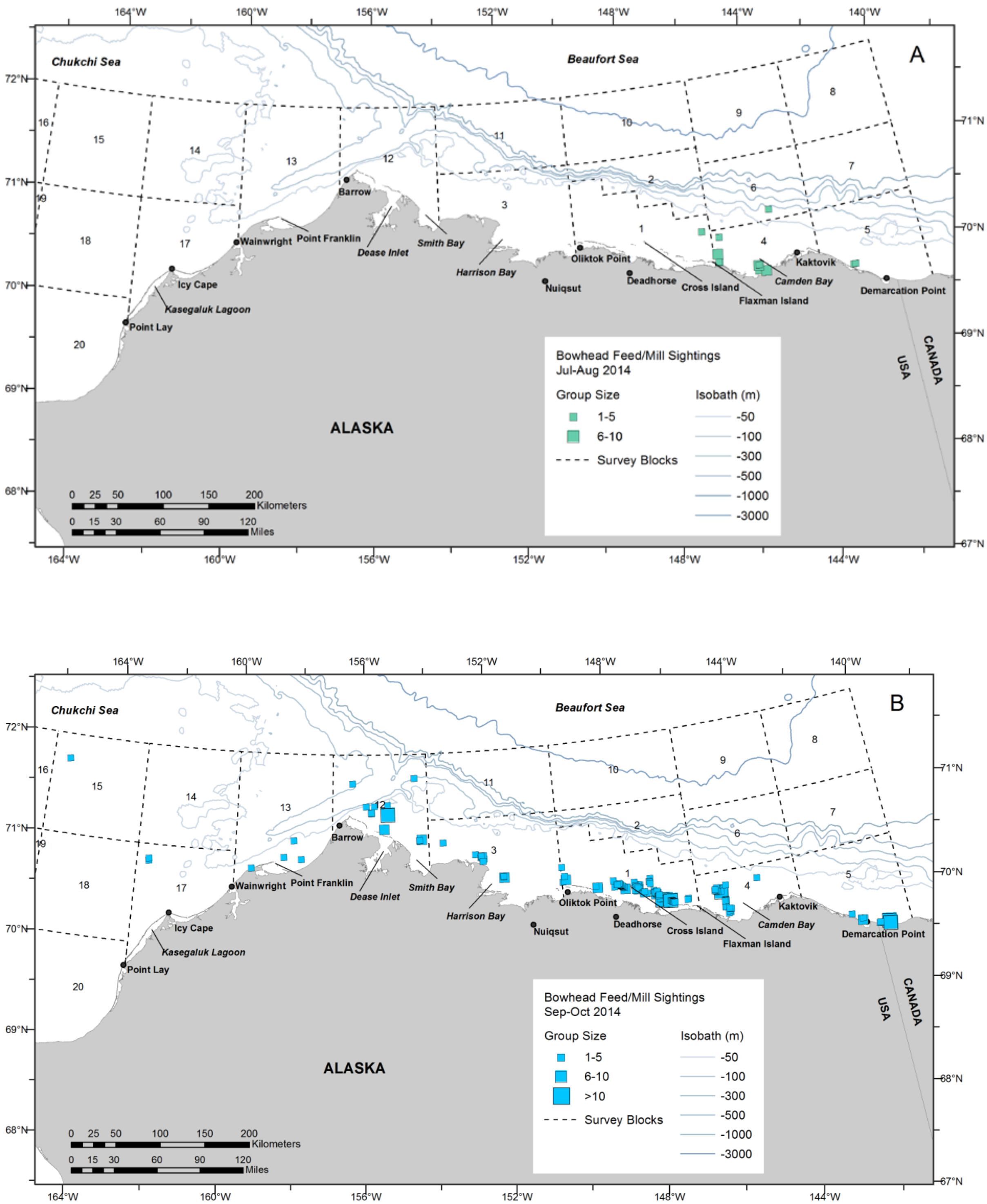


Figure 15. ASAMM 2014 bowhead whale feeding and milling sightings, all survey modes (transect, search, and circling). A: summer (July-August); B: fall (September-October).

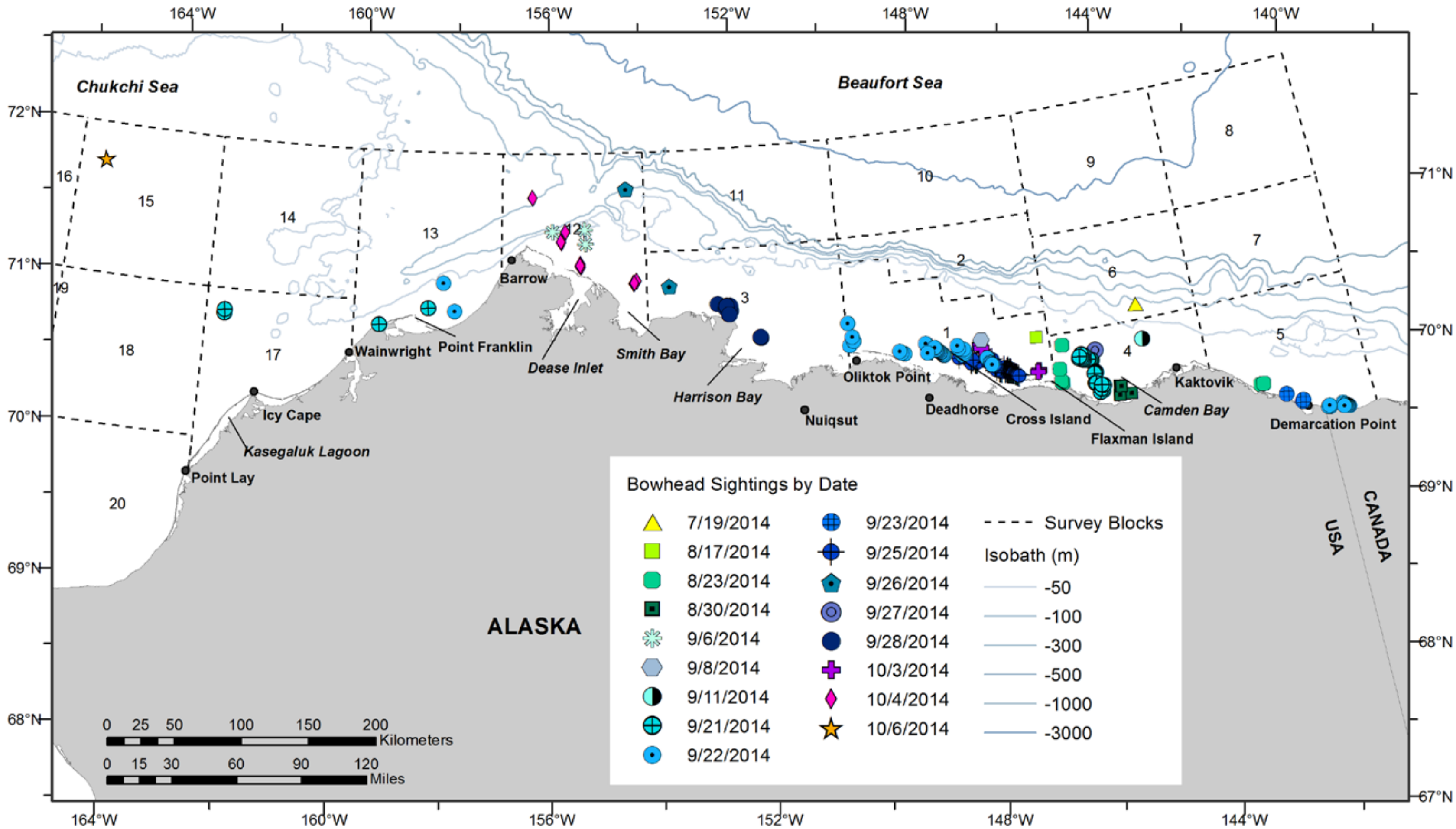


Figure 16. ASAMM 2014 bowhead whale feeding and milling sightings, all survey modes (transect, search, and circling), by date.

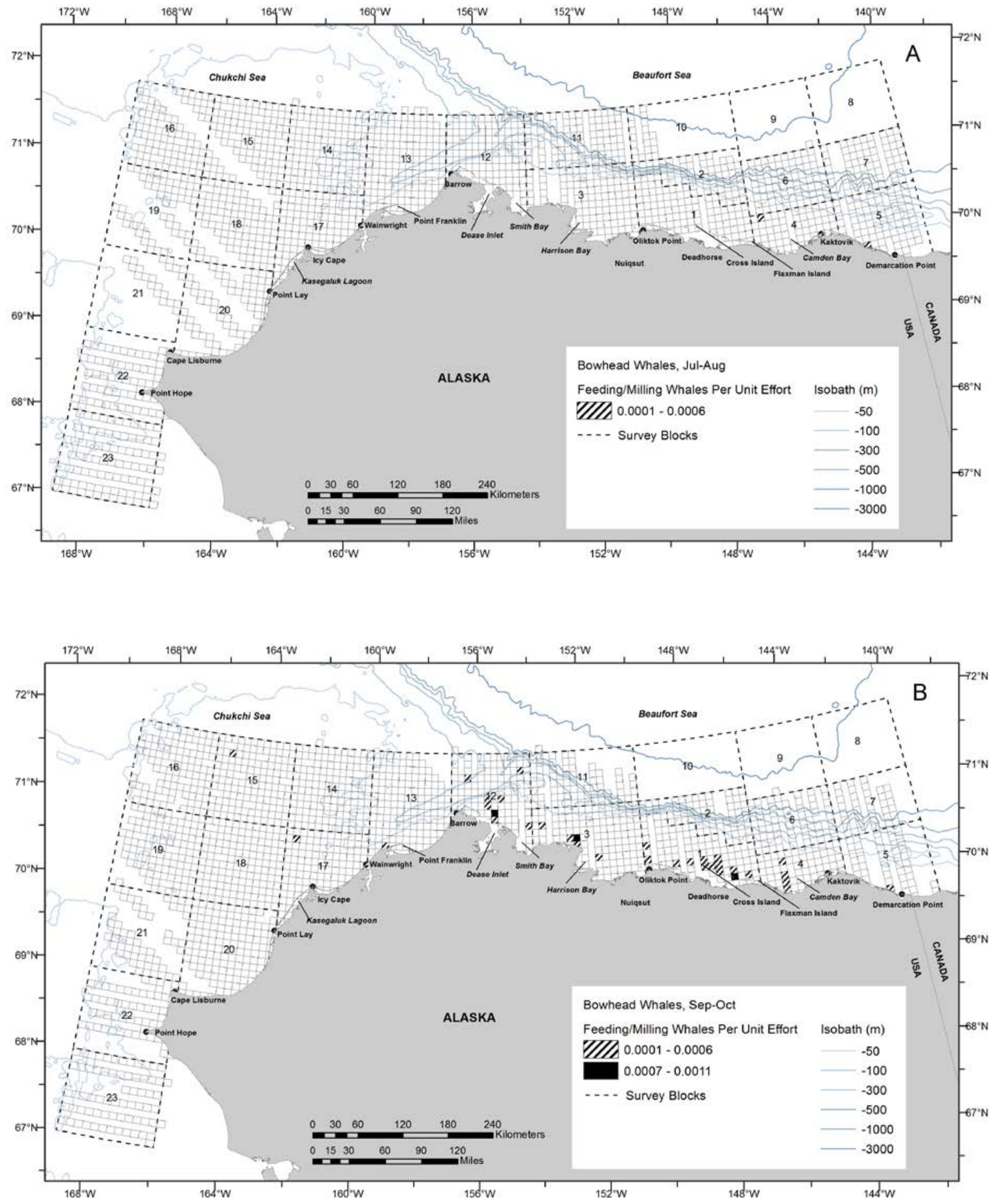


Figure 17. ASAMM 2014 bowhead whale feeding and milling sighting rates (WPUE; transect sightings from primary observers only). A: summer (July-August); B: fall (September-October). Empty grid cells indicate sighting rates of zero. Transect survey effort was not conducted in areas without grid cells.

Bowhead Whale Central Tendency – Analysis 1

Distribution of Bowhead Whales, Summer 2014, Relative to Summer Bowhead Whale Distribution in Previous Years with Light Sea Ice Cover

Bowhead whale distribution in the western Beaufort Sea in summer (July-August) 2014, based on transect sightings (Tr) from primary and secondary observers, did not appear different from the distribution of transect sightings (Tr) observed in summer in previous years having light sea ice cover (i.e., 1982, 1986, 1987, 1989, 1990, 1993-2013) (Figure 18).

In the East Region, mean depth at bowhead whale sightings made on transect by primary observers in summer 2014 was 119 m (SD = 292.4 m, range 10-1,668 m) and median depth was 38 m (Table 6). In the West Region, mean depth was 230 m (SD = 688.9 m, range 13-2,614 m) and median depth was 26.5 m.

In the East Region, mean and median distances to the normalized shoreline from bowhead whale sightings made on transect by primary observers in summer 2014 were 31.7 km (SD = 24.7 km) and 27.5 km, respectively (Table 6). In the West Region, mean and median distances to the normalized shoreline were 33.4 km (SD = 29.4 km) and 28.5 km, respectively.

To evaluate whether significant displacements occurred in the western Beaufort Sea bowhead whale HUAs during summer 2014 compared to previous years with light sea ice cover, estimates of median depth at sightings and distance of sightings from the normalized shoreline were compared with pooled data from previous years. Survey effort during summer in the western Beaufort Sea prior to 2012 was sporadic and inconsistent, so testing for differences was limited to sightings in summer 2012-2013 and 2014. In 2012-2013, median water depth at bowhead whale sightings made on transect by primary observers was 54 m in the East Region and 31 m in the West Region; the median distance from shore was 52.2 km in the East Region and 34.0 km in the West Region (Table 6).

A Mann-Whitney *U*-test of significant difference of medians indicated that bowhead whales sighted on transect by primary observers in summer 2014 in the East Region were in significantly shallower water (median depth = 38 m; $Z = 5.251$, $P < 0.0001$) and significantly closer to shore (median distance from shore = 27.5 km; $Z = 4.694$, $P < 0.0001$) than bowhead whales sighted in 2012-2013 (median depth = 54 m; median distance from shore = 52.2 km) (Table 6). In the West Region, there was no significant difference in median depth or distance from shore of bowhead whale sightings between 2014 (26.5 m depth , 28.5 km from shore) and 2012-2013 (31 m depth , 34 km from shore) (Table 6).

The apparent shift in bowhead whale distribution in summer appears to be between months. A Mann-Whitney *U*-test of significant difference of medians indicated that bowhead whales were significantly farther from shore and in deeper water in July 2014 compared to August 2014. The median depth in July was 237 m compared to 31.5 m in August ($Z = -2.463$, $P = 0.0138$) and the median distance from shore was 72.8 km in July compared to 24.7 km in August ($Z = -2.737$, $P = 0.0057$). Similar results were found in summer 2012 and summer 2013 (Clarke et al. 2014).

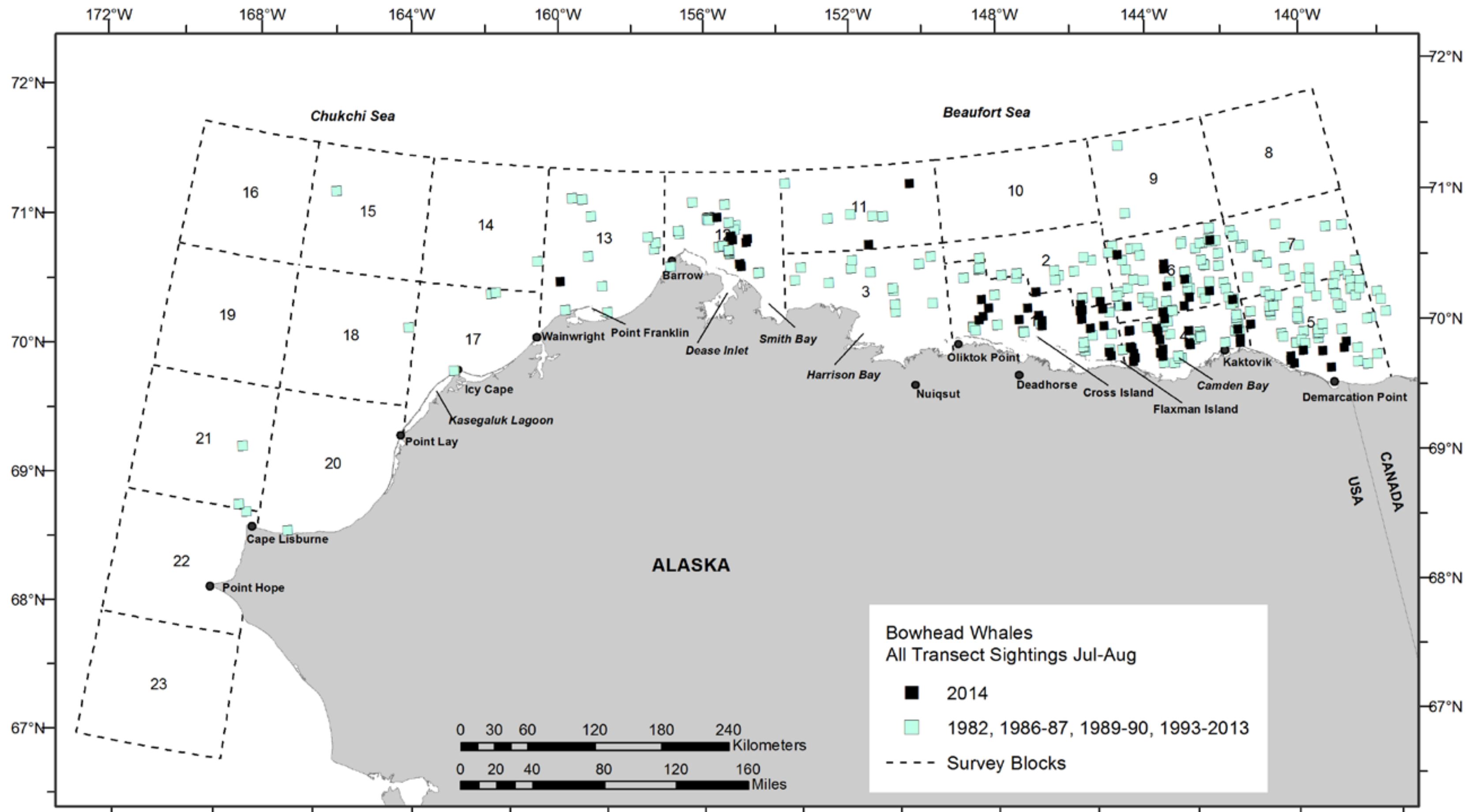


Figure 18. ASAMM bowhead whale sightings on transect, July-August, in years with light sea ice cover: 1982, 1986-87, 1989-90, 1993-2013, and 2014. Includes all sightings on transect made by primary and secondary observers.

Table 6. ASAMM central tendency statistics for depth (m) and distance from shore (km) at bowhead whale transect sightings, by season and region in the western Beaufort Sea, 2012-2014. TrSi = number of transect sightings made by primary observers.

2012-2014 Summer, by Region			DEPTH (M)				DISTANCE FROM SHORE (KM)			
Year/Season	Region	TrSi	Median	Mean	SD	Min-Max	Median	Mean	SD	Min-Max
2014 Summer	East	53	38	119	292.4	10-1,668	27.5	31.7	24.7	1-96
2012-2013 Summer	East	111	54	310	535.4	12-2,266	52.2	52.2	28.1	4-134
2014 Summer	West	14	26.5	230	688.9	13-2,614	28.5	33.4	29.4	9-124
2012-2013 Summer	West	45	31	95	183.0	12-1,052	34.0	34.8	22.2	5-85
2012-2014 Summer, by Month			DEPTH (M)				DISTANCE FROM SHORE (KM)			
Year/Season	Month	TrSi	Median	Mean	SD	Min-Max	Median	Mean	SD	Min-Max
2014 Summer	Jul	11	237	646	850.4	13-2,614	72.8	63.7	39.9	9-124
2014 Summer	Aug	56	31.5	43	57.0	10-394	24.7	25.8	15.9	1-71
2012-2013 Summer	Jul	49	234	501	591.2	33-1985	66.5	67.4	20.5	20-102
2012-2013 Summer	Aug	107	46	133	352.3	12-2,266	34.8	38.0	25.5	4-134
2014 Season, by Region			DEPTH (M)				DISTANCE FROM SHORE (KM)			
Season	Region	TrSi	Median	Mean	SD	Min-Max	Median	Mean	SD	Min-Max
Summer	East	53	38	119	292.4	10-1,668	27.5	31.7	24.7	1-96
Fall	East	49	20	24	19.1	5-124	7.2	13.9	12.9	1-56
Summer	West	14	26.5	230	688.9	13-2,614	28.5	33.4	29.4	9-124
Fall	West	77	19	36	50.5	5-220	22.2	28.6	23	2-84

Distribution of Bowhead Whales During Summer and Fall Months, 2014

Summary statistics for bowhead whale data from the western Beaufort Sea in summer (July-August) 2014 were compared to values for fall (September-October) 2014 (Table 6). In the East Region, bowhead whales sighted on transect in summer were in significantly deeper water (median depth 38 m vs. 20 m, $Z = -4.705$, $P < 0.0001$) and significantly farther from shore (median distance 27.5 km vs. 7.2 km, $Z = -4.320$, $P < 0.0001$) than bowhead whales sighted on transect in fall. In the West Region, median water depth at bowhead whale sightings on transect was also significantly deeper in summer (26.5 m) than fall (19 m; $Z = -2.008$, $P = 0.0447$), but distance from shore was not significantly different (28.5 km in summer; 22.2 km in fall).

Distribution of Bowhead Whales, Fall 2014, Relative to Bowhead Whale Distribution in Previous Years with Light Sea Ice Cover

Summary statistics for bowhead whale data from the western Beaufort Sea in fall (September-October) 1989-2014 are shown in Table 7. Summary statistic results are from sightings made by primary observers only; primary observers were not identified for the earliest years of the ASAMM project (1982-1988). Limiting sightings for this analysis to only primary observers resulted in the exclusion of >800 sightings, but the tighter data constraints result in a more robust analysis.

Bowhead whale distribution in the western Beaufort Sea in September-October 2014, based on transect sightings (Tr) from primary and secondary observers did not appear different from the distribution of transect sightings (Tr) observed in previous years having light sea ice cover (i.e., 1982, 1986, 1987, 1989, 1990, 1993-2013) (Figure 19). With the exception of sightings in Camden Bay (block 4) and sightings offshore in the Chukchi Sea (block 16), bowhead whale transect sightings in 2014 overlaid those from 1982 to 2013.

In the East Region, mean depth at bowhead whale sightings made on transect by primary observers in fall 2014 was 24 m (SD = 19.1 m, range 5-124 m) and median depth was 20 m (Table 7). In the West Region, mean depth was 36 m (SD = 50.4 m, range 5-220 m) and median depth was 19 m. In the East Region, mean and median distances to the normalized shoreline from bowhead whale sightings made on transect by primary observers in September-October 2014 were 13.9 km (SD = 12.9 km) and 7.2 km, respectively (Table 7). In the West Region, mean and median distances to the normalized shoreline were 28.6 km (SD = 23.0 km) and 22.2 km, respectively.

To evaluate whether significant displacements occurred in western Beaufort Sea bowhead whale HUAs during fall 2014 compared to previous years with light sea ice cover, estimates of median depth at sighting and distance of sightings from the normalized shoreline were compared with pooled data from previous years. During previous years with light sea ice cover, median water depth at bowhead whale sightings on transect by primary observers was 39 m in the East Region and 21 m in the West Region; the median distance from shore was 23.6 km in the East Region and 24.2 km in the West Region.

Table 7. ASAMM central tendency statistics for distance from shore (km) and depth (m) at bowhead whale transect sightings (September-October), by year and region in the western Beaufort Sea, 1989-2014. TrSi = number of transect sightings made by primary observers.

			DEPTH (M)				DISTANCE FROM SHORE (KM)			
Year	Region	TrSi	Median	Mean	SD	Min-Max	Median	Mean	SD	Min-Max
1989	East	1	48	48			43.8	43.8		
	West	6	16	16	6.4	7-24	17.7	18.6	13.6	4-35
1990	East	35	45	45	9.8	25-72	32.2	30.8	11.1	11-53
	West	6	32.5	33	11.6	20-50	30.8	34.2	11.7	24-54
1991	East	6	119.5	120	71.8	44-228	60.3	55.6	14.7	36-72
	West	1	383	383			72.8	72.8		
1992	East	6	47.5	48	7.7	40-59	28.9	30.7	5.6	24-40
	West	6	57	66	20.4	52-106	53.1	52.5	6.7	43-63
1993	East	35	40	57	96.7	11-610	25.5	25.8	11.8	6-64
	West	23	20	22	8.9	12-49	24.3	25.6	11.9	11-61
1994	East	17	45	46	9.1	33-64	27.9	33.1	16.7	11-66
	West	2	12.5	12.5	0.7	12-13	15.0	15.0	6.0	11-19
1995	East	57	43	54	76.1	13-604	27.2	29.8	16.0	3-97
	West	22	30	89	272.5	6-1,308	33.9	35.7	18.9	10-102
1996	East	6	40	41	4.4	34-46	27.7	26.5	6.4	19-33
	West	4	33.5	31	7.6	20-37	37.6	33.5	9.3	20-39
1997	East	15	21	21	7.1	13-33	7.7	9.7	6.7	4-24
	West	65	19	25	19.2	5-100	21.9	24.8	11.0	7-52
1998	East	70	31.5	32.8	10.7	13-56	17.0	19.5	11.4	2-49
	West	71	16	48	235.4	7-2,001	17.1	22.7	18.0	3-118
1999	East	58	50	49	14.3	7-83	34.4	33.3	12.3	4-57
	West	43	29	41	41.9	10-211	29.6	31.9	16.8	6-73
2000	East	19	39	46	18.0	28-101	31.7	31.8	11.1	14-55
	West	15	11	24	42.0	5-173	7.7	15.8	19.0	1-73

			DEPTH (M)				DISTANCE FROM SHORE (KM)			
Year	Region	TrSi	Median	Mean	SD	Min-Max	Median	Mean	SD	Min-Max
2001	East	13	46	44	9.1	28-53	31.8	27.9	10.7	12-41
	West	2	42	42	43.8	11-73	29.6	39.6	43.5	9-70
2002	East	9	25	25	14.3	3-48	8.5	15.1	18.2	0-58
	West	20	24.5	30	20.6	11-88	31.2	33.9	12.6	9-56
2003	East	17	36	35	16.0	12-72	28.4	24.4	16.6	3-46
	West	29	20	50	67.3	12-310	27.2	28.9	15.7	2-72
2004	East	53	40	44	42.5	7-337	21.5	23.4	12.0	5-71
	West	47	24	34	36.5	5-206	22.7	23.6	10.6	5-65
2005	East	16	40.5	39	13.0	13-61	21.5	23.0	13.0	5-40
	West	17	33	60	66.3	12-227	37.3	34.6	16.0	6-55
2006	East	29	44	215	524.2	9-1,966	28.0	34.7	22.5	2-89
	West	28	37.5	45	36.2	4-175	37.0	35.7	18.9	1-67
2007	East	46	33.5	43	50.3	17-362	20.7	22.9	13.6	5-69
	West	6	23	24	8.6	13-36	24.0	25.2	6.2	18-33
2008	East	24	32	32	6.0	20-43	18.6	20.5	9.6	7-36
	West	32	16.5	18	6.4	7-40	18.1	19.1	10.2	4-52
2009	East	9	21	29	19.4	11-55	6.3	19.9	22.4	3-58
	West	42	17	30	43.6	8-239	16.7	21.7	16.1	4-81
2010	East	43	30	30	11.1	13-49	11.9	14.2	7.7	3-29
	West	25	20	32	34.2	10-189	20.6	26.3	14.8	3-76
2011	East	12	27	31	8.9	22-50	10.7	13.7	6.8	7-27
	West	28	20	26	23.1	15-141	25.5	26.8	10.4	16-64
2012	East	25	35	51	48.8	11-213	24.9	28.5	19.8	6-76
	West	58	29	51	92.5	11-648	31.0	36.4	18.9	8-76
2013	East	20	35.5	36	6.7	24-54	24.7	25.9	10.8	9-45
	West	37	26	72	75.5	6-258	27.7	37.6	25.8	3-87
2014	East	49	20	24	19.1	5-124	7.2	13.9	12.9	1-56
	West	77	19	36	50.4	5-220	22.2	28.6	23.0	2-84

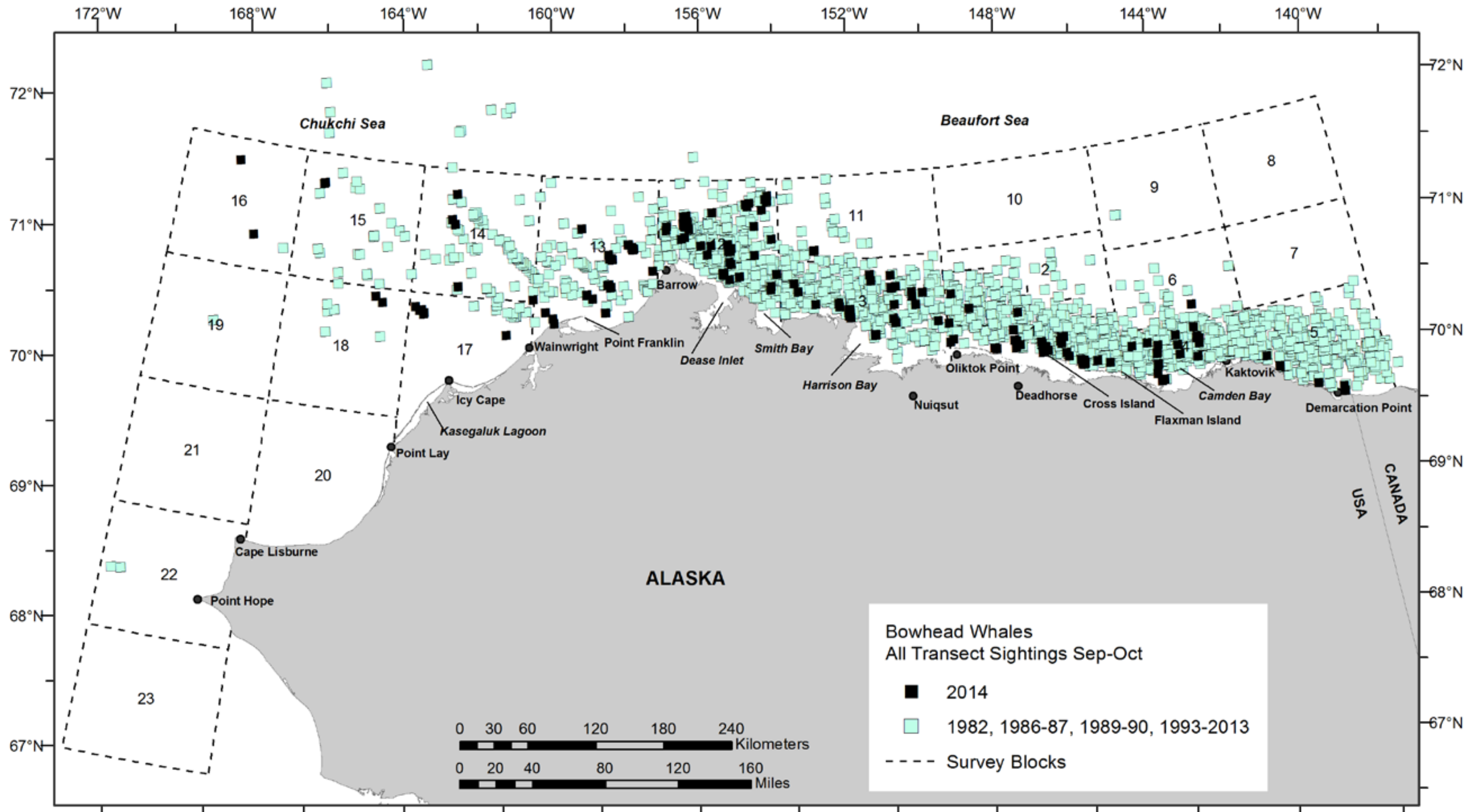


Figure 19. ASAMM bowhead whale sightings on transect, September-October, in years with light sea ice cover: 1982, 1986-87, 1989-90, 1993-2013, and 2014. Includes all sightings on transect made by primary and secondary observers.

In fall (September-October) 2014 in the East Region, bowhead whale sightings were in significantly shallower water (median depth 20 m vs. 39 m; $Z = 7.141$, $P < 0.0001$) and closer to shore (median distance from shore 7.2 m vs. 23.6 km; $Z = 5.637$, $P < 0.0001$) than bowhead whale sightings in previous years with light sea ice cover. In the West Region, bowhead whale sightings were in significantly shallower water in fall 2014 than in previous years with light sea ice cover (median depth 19 m vs. 21 m, $Z = 2.801$, $P = 0.005$). There was no significant difference in median distance from shore of bowhead whale sightings between 2014 (22.2 km) and previous years with light sea ice cover (24.2 km).

BOWHEAD WHALE CENTRAL TENDENCY – ANALYSIS 2

The 2014 spatial relative abundance model (GAM) for fall (September-October) incorporated 140 bowhead whale sightings of 221 total individuals (Figure 20A). Relative abundance predictions resulting from the GAM applied to the 2014 survey data for the western Beaufort Sea are shown in Figure 20B. The highest predicted relative abundance was located just outside the barrier islands from northwest of Deadhorse to east of Flaxman Island (~146.5°W to ~149°W), with relatively high predicted relative abundances northeast of Cape Halkett (~151.5°W-152°W), from Oliktok Point to Camden Bay, and north of Demarcation Point. The HUA was broadest in the western Alaskan Beaufort Sea, due to sightings in and near Barrow Canyon.

The 2000-2014 model (July-October) incorporated 1,136 bowhead whale sightings of 2,055 individuals. In July there were 60 bowhead whale sightings (102 individuals) (Figure 21A), all of which were sighted from 2012 to 2014. The majority of the July sightings were located in the East Region. Limited sample size in the West Region provided minimal information for the spatial model in July (Figure 21B). The spatial model predicted that bowhead whale HUAs were located farthest offshore in July, with relatively high relative abundances located near Dease Inlet, Alaska, and over the outer continental shelf and slope approximately 90 km north of Camden Bay and 80-100 km offshore between Kaktovik and the U.S.-Canada border (Figure 21B). There were a total of 173 bowhead whale sightings (301 individuals) in August (Figure 21C), most of which were from 2012 to 2014. The spatial model predicted that bowhead whale HUAs were closest to shore in the East Region near Kaktovik (Figure 21D). Areas with highest predicted relative abundance in August were all located nearshore, including northeast of Point Barrow, Camden Bay, and west of Demarcation Point. In contrast to the predictions from September and October, the August predictions showed high relative abundances extending up to 120 km offshore near the eastern boundary of the study area (140°W). The model incorporated 661 bowhead whale sightings (1,232 individuals) in September (Figure 21E) and 242 sightings (420 individuals) in October (Figure 21G). The model predicted similar distributions for September and October.

In fall, bowhead whale HUAs were located relatively close to shore from Dease Inlet to near Cape Halkett, just outside the barrier islands from Cross Island to Flaxman Island, and east of Kaktovik (Figures 21F and 21H). The HUA in October was farther offshore north of Camden Bay than in September. In both months, the highest relative abundances were located in shallow waters north of Dease Inlet and east of Kaktovik (Figures 21F and 21H). In September, there was an additional area of high relative abundance just outside the barrier islands from

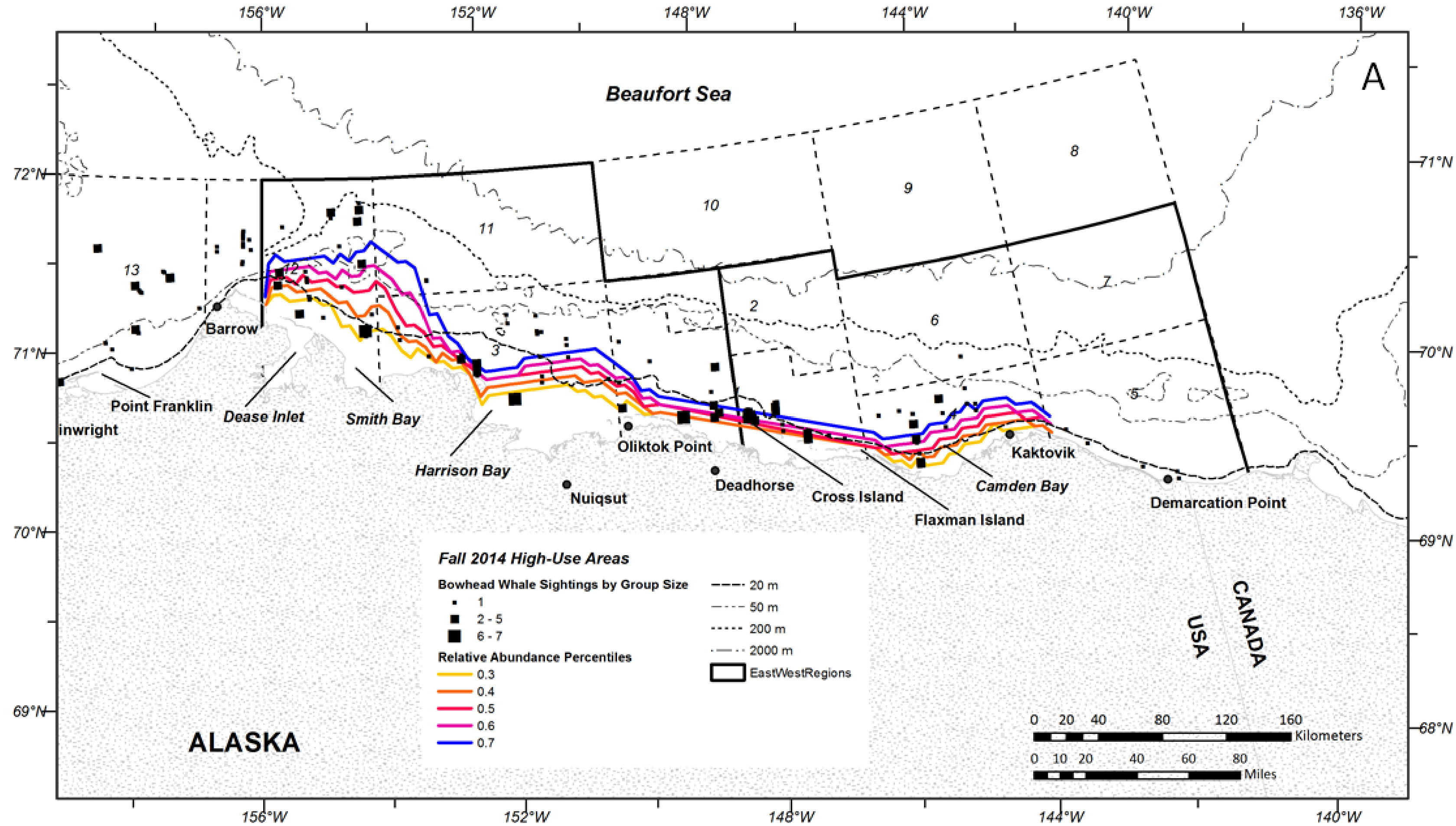


Figure 20. ASAMM September and October 2014 bowhead whale (A) transect sightings (primary observers only) by group size, and (B) predicted relative abundance based on a spatial model that accounted for effort by assuming a uniform 5 km of transect effort in every cell in the western Beaufort Sea. The bowhead whale High-Use Area is represented by distribution percentiles (30th, 40th, 50th, 60th, and 70th), which represent the offshore extent of 30%, 40%, 50%, 60%, and 70% of the predicted number of bowhead whales from the spatial model.

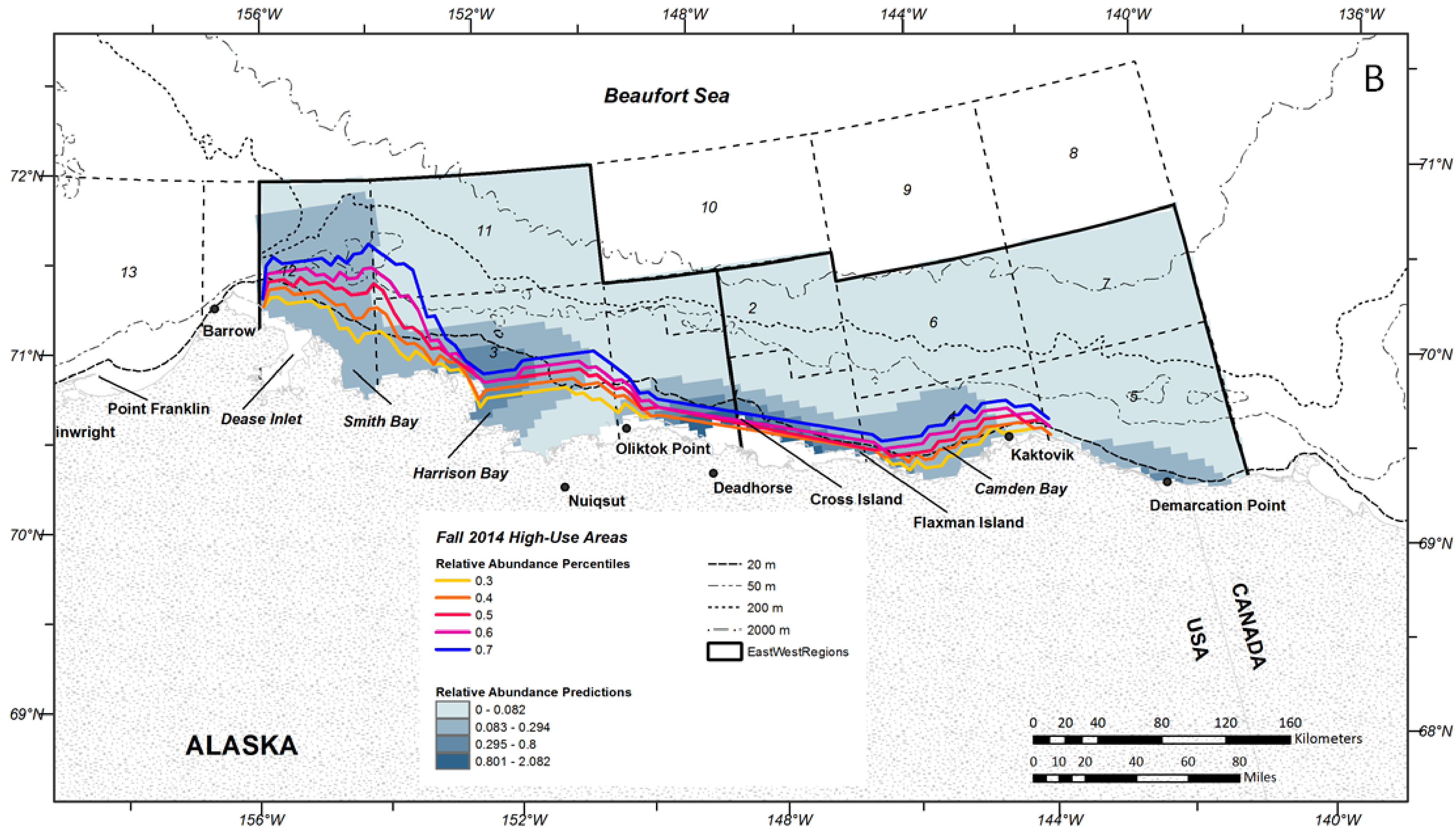


Figure 20 (cont.). ASAMM September and October 2014 bowhead whale (A) transect sightings (primary observers only) by group size, and (B) predicted relative abundance based on a spatial model that accounted for effort by assuming a uniform 5 km of transect effort in every cell in the western Beaufort Sea. The bowhead whale High-Use Area is represented by distribution percentiles (30th, 40th, 50th, 60th, and 70th), which represent the offshore extent of 30%, 40%, 50%, 60%, and 70% of the predicted number of bowhead whales from the spatial model.

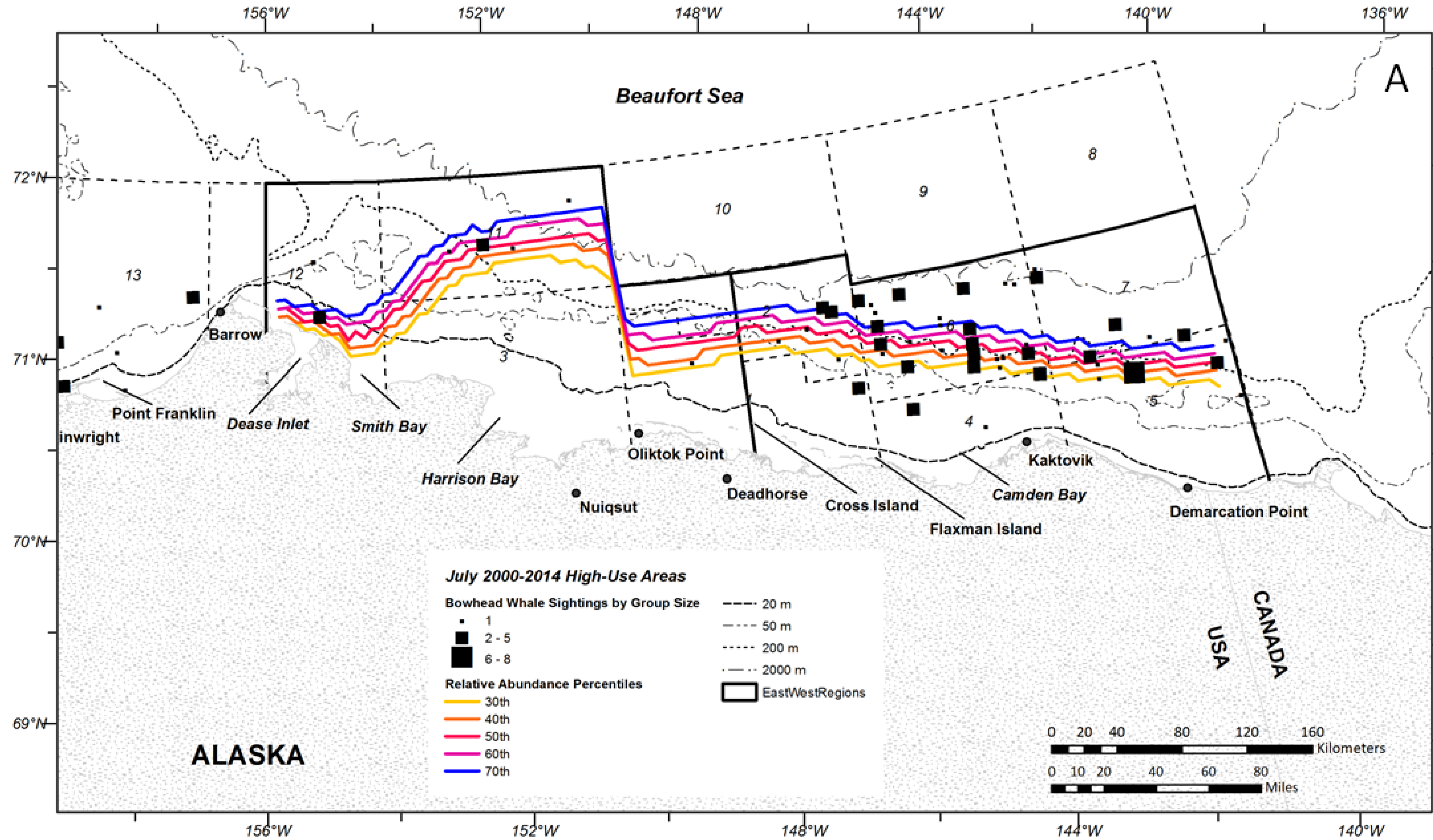


Figure 21. ASAMM 2000-2014 bowhead whale transect sightings (primary observers only) by group size and predicted relative abundance, based on a spatial relative abundance model that accounted for effort by assuming a uniform 5 km of transect effort in every cell in the western Beaufort Sea in July, August, September, and October. A: July sightings. The bowhead whale High-Use Area is represented by distribution percentiles (30th, 40th, 50th, 60th, and 70th), which represent the offshore extent of 30%, 40%, 50%, 60%, and 70% of the predicted number of bowhead whales from the spatial model.

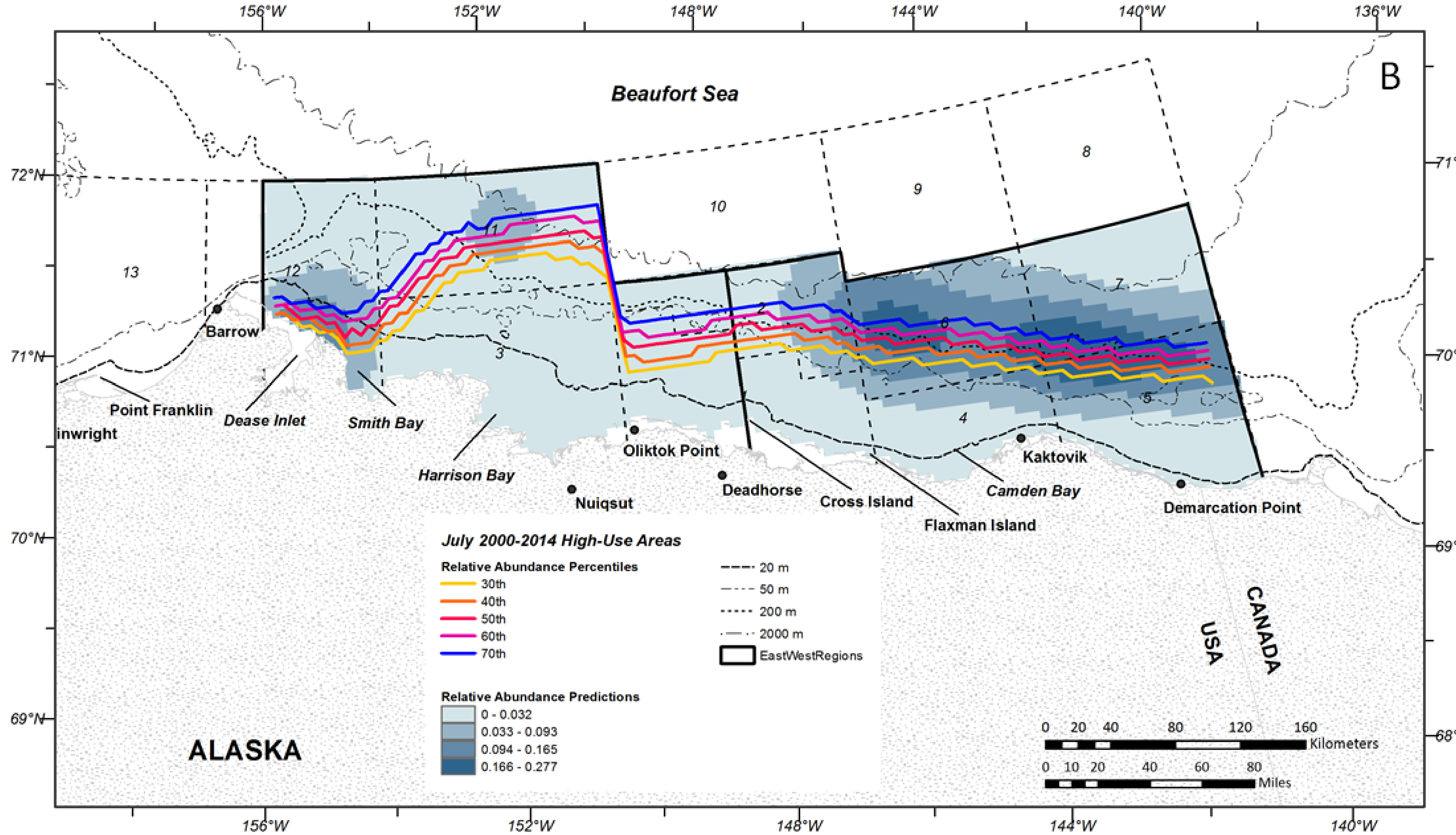


Figure 21 (cont.). ASAMM 2000-2014 bowhead whale transect sightings (primary observers only) by group size and predicted relative abundance, based on a spatial relative abundance model that accounted for effort by assuming a uniform 5 km of transect effort in every cell in the western Beaufort Sea in July, August, September, and October. B: July predicted relative abundance. Predictions are not corrected for perception or availability bias. The bowhead whale High-Use Area is represented by distribution percentiles (30th, 40th, 50th, 60th, and 70th), which represent the offshore extent of 30%, 40%, 50%, 60%, and 70% of the predicted number of bowhead whales from the spatial model.

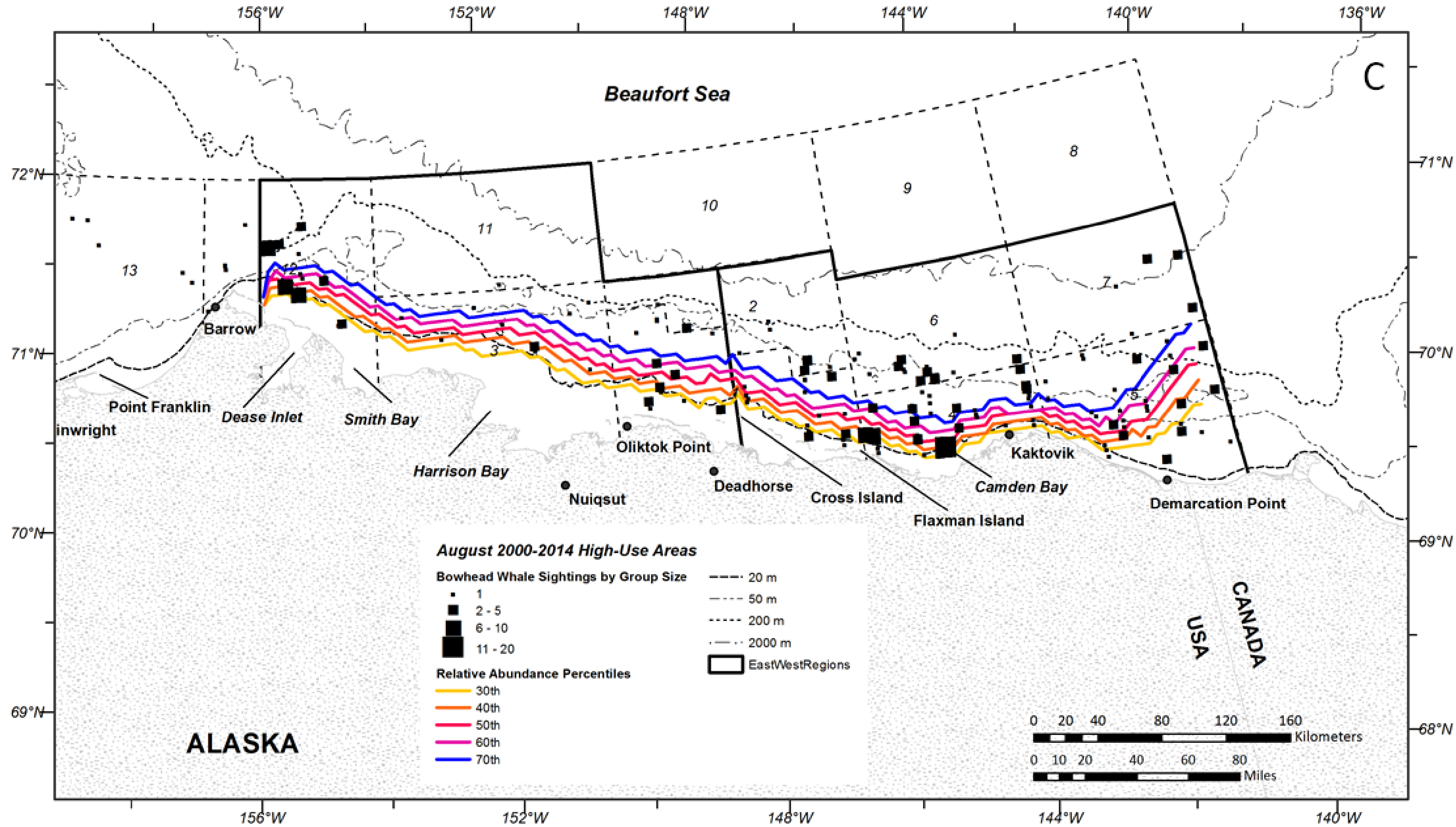


Figure 21 (cont.). ASAMM 2000-2014 bowhead whale transect sightings (primary observers only) by group size and predicted relative abundance, based on a spatial relative abundance model that accounted for effort by assuming a uniform 5 km of transect effort in every cell in the western Beaufort Sea in July, August, September, and October. C: August sightings. The bowhead whale High-Use Area is represented by distribution percentiles (30th, 40th, 50th, 60th, and 70th), which represent the offshore extent of 30%, 40%, 50%, 60%, and 70% of the predicted number of bowhead whales from the spatial model.

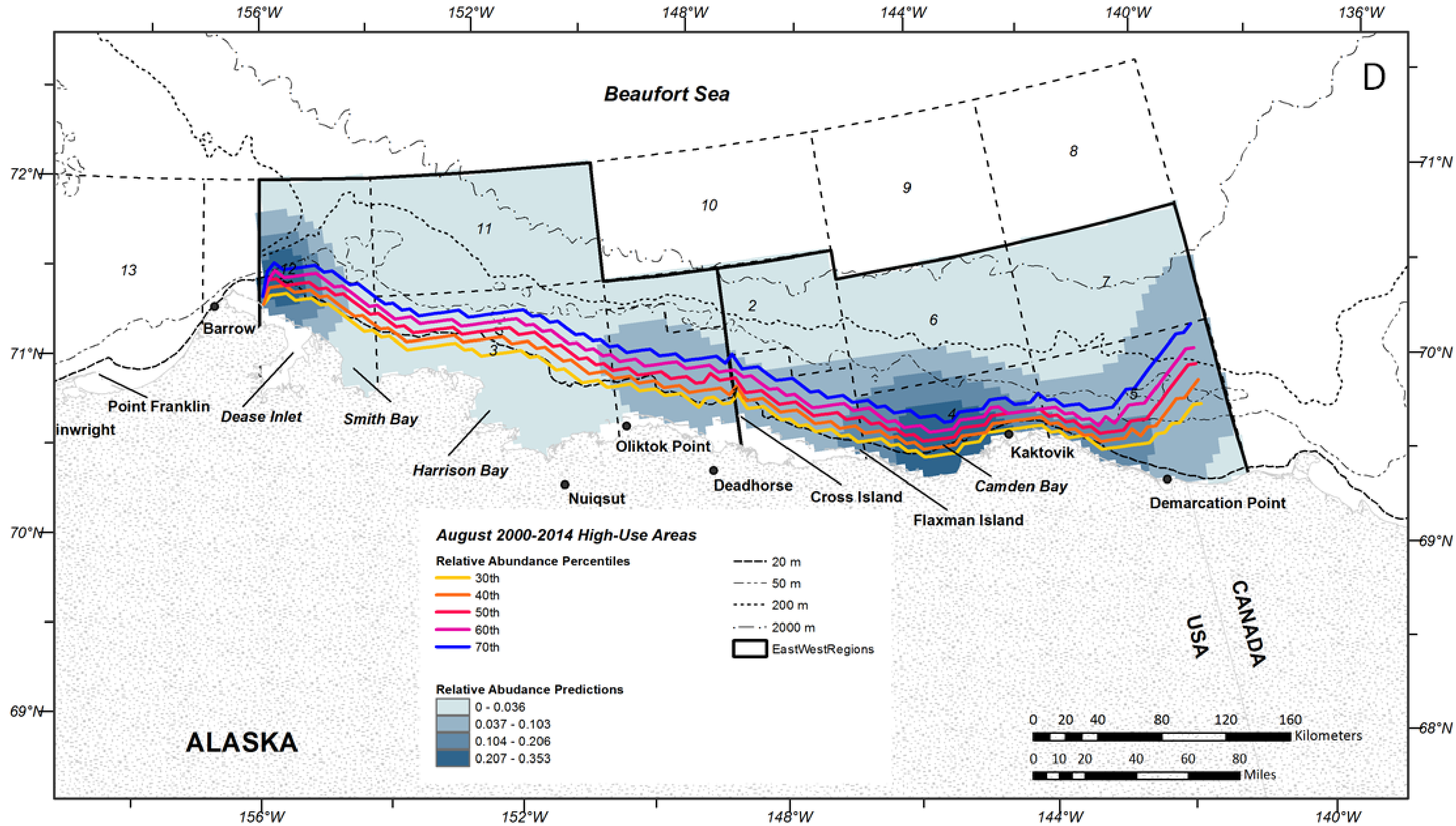


Figure 21 (cont.). ASAMM 2000-2014 bowhead whale transect sightings (primary observers only) by group size and predicted relative abundance, based on a spatial relative abundance model that accounted for effort by assuming a uniform 5 km of transect effort in every cell in the western Beaufort Sea in July, August, September, and October. D: August predicted relative abundance. Predictions are not corrected for perception or availability bias. The bowhead whale High-Use Area is represented by distribution percentiles (30th, 40th, 50th, 60th, and 70th), which represent the offshore extent of 30%, 40%, 50%, 60%, and 70% of the predicted number of bowhead whales from the spatial model.

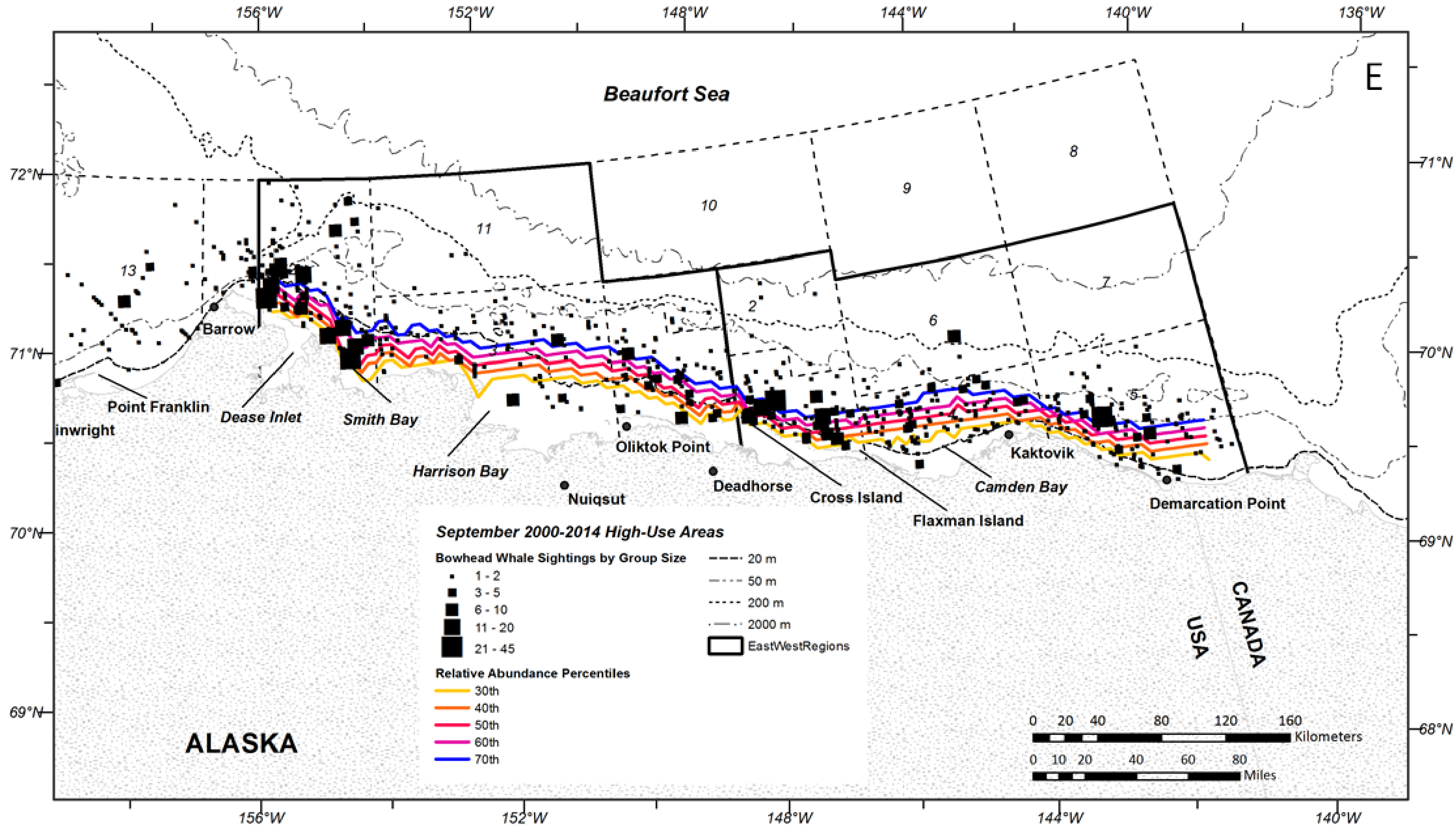


Figure 21 (cont.). ASAMM 2000-2014 bowhead whale transect sightings (primary observers only) by group size and predicted relative abundance, based on a spatial relative abundance model that accounted for effort by assuming a uniform 5 km of transect effort in every cell in the western Beaufort Sea in July, August, September, and October. E: September sightings. The bowhead whale High-Use Area is represented by distribution percentiles (30th, 40th, 50th, 60th, and 70th), which represent the offshore extent of 30%, 40%, 50%, 60%, and 70% of the predicted number of bowhead whales from the spatial model.

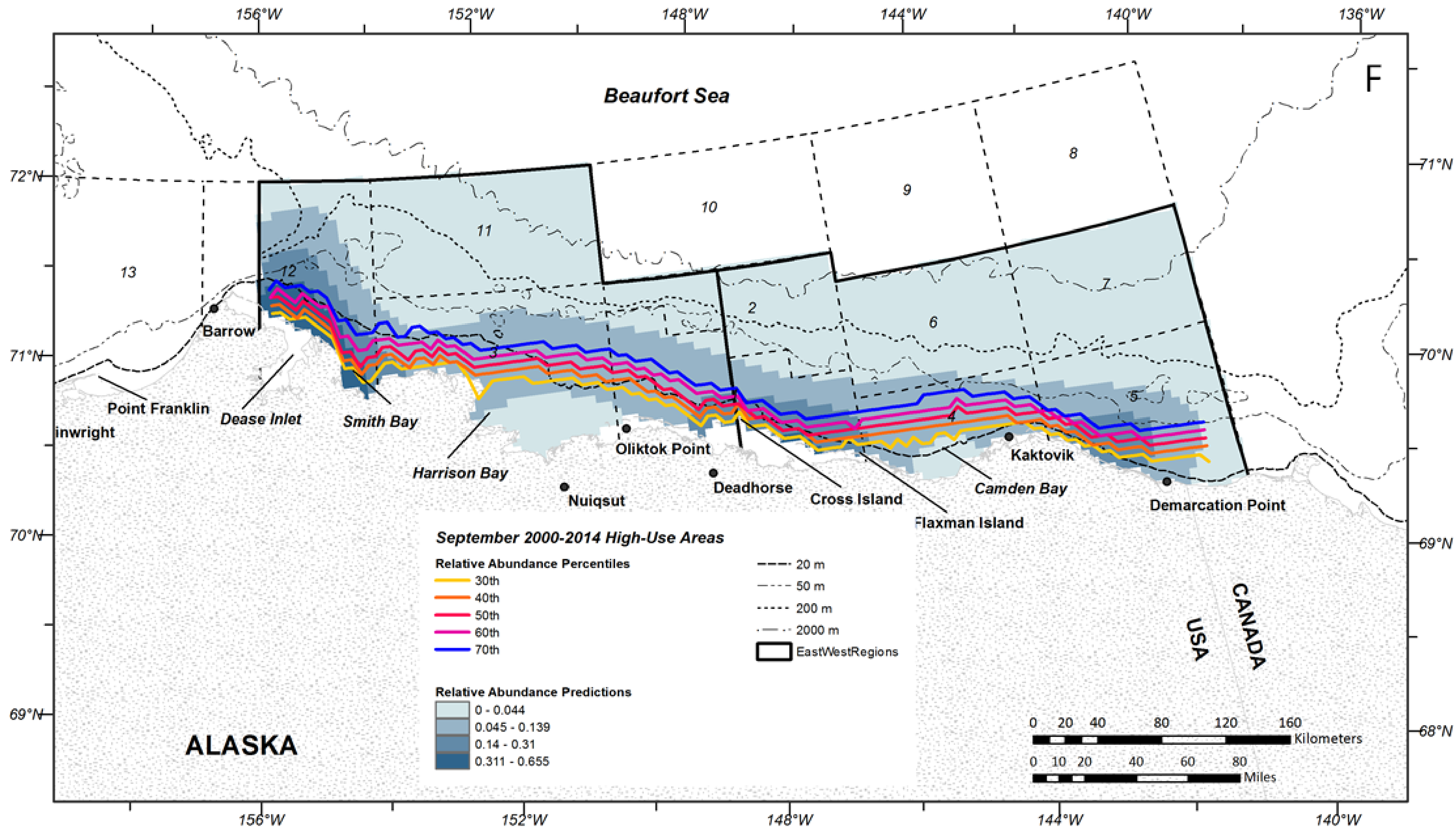


Figure 21 (cont.). ASAMM 2000-2014 bowhead whale transect sightings (primary observers only) by group size and predicted relative abundance, based on a spatial relative abundance model that accounted for effort by assuming a uniform 5 km of transect effort in every cell in the western Beaufort Sea in July, August, September, and October. F: September predicted relative abundance. Predictions are not corrected for perception or availability bias. The bowhead whale High-Use Area is represented by distribution percentiles (30th, 40th, 50th, 60th, and 70th), which represent the offshore extent of 30%, 40%, 50%, 60%, and 70% of the predicted number of bowhead whales from the spatial model.

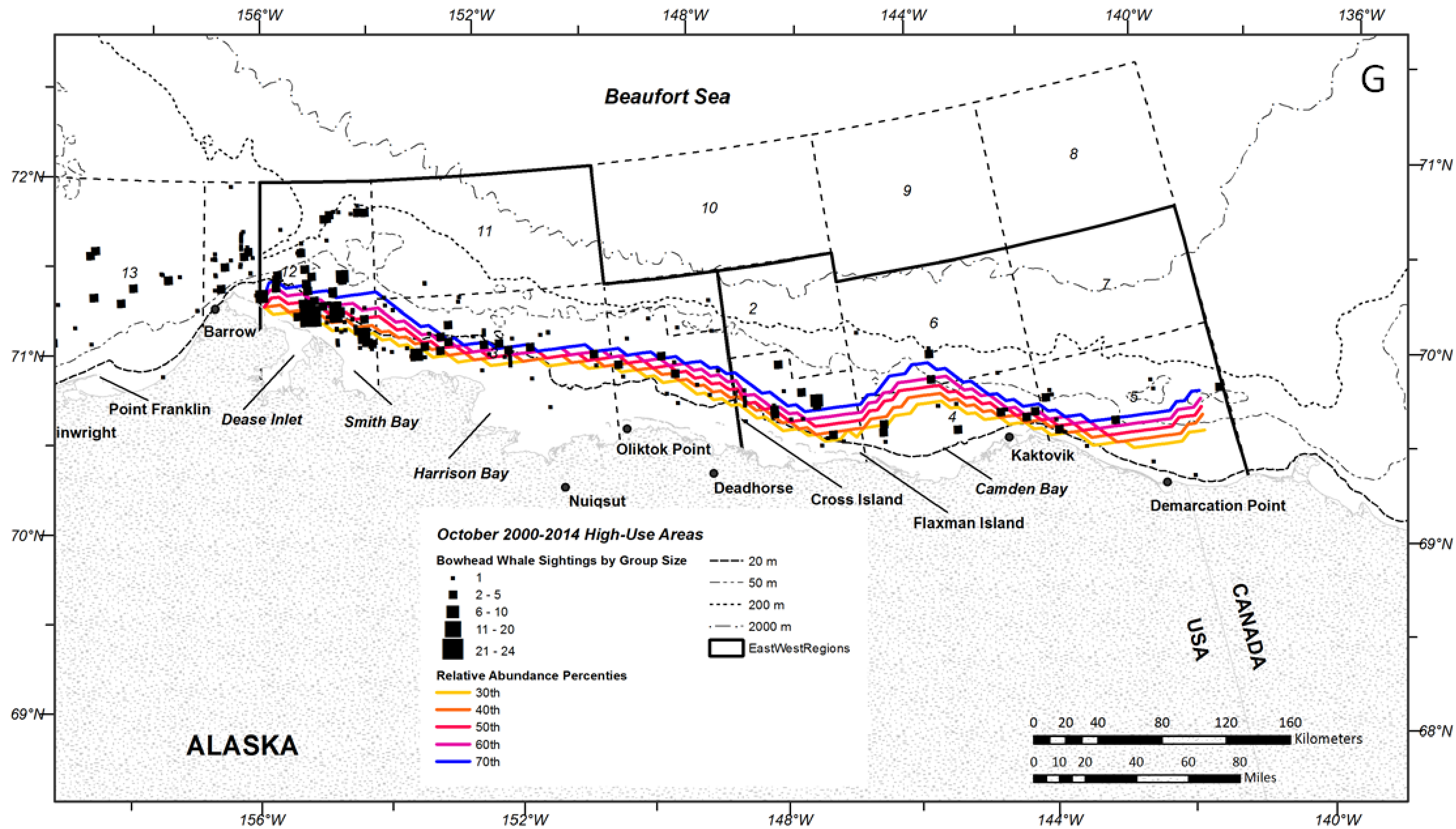


Figure 21 (cont.). ASAMM 2000-2014 bowhead whale transect sightings (primary observers only) by group size and predicted relative abundance, based on a spatial relative abundance model that accounted for effort by assuming a uniform 5 km of transect effort in every cell in the western Beaufort Sea in July, August, September, and October. G: October sightings. The bowhead whale High-Use Area is represented by distribution percentiles (30th, 40th, 50th, 60th, and 70th), which represent the offshore extent of 30%, 40%, 50%, 60%, and 70% of the predicted number of bowhead whales from the spatial model.

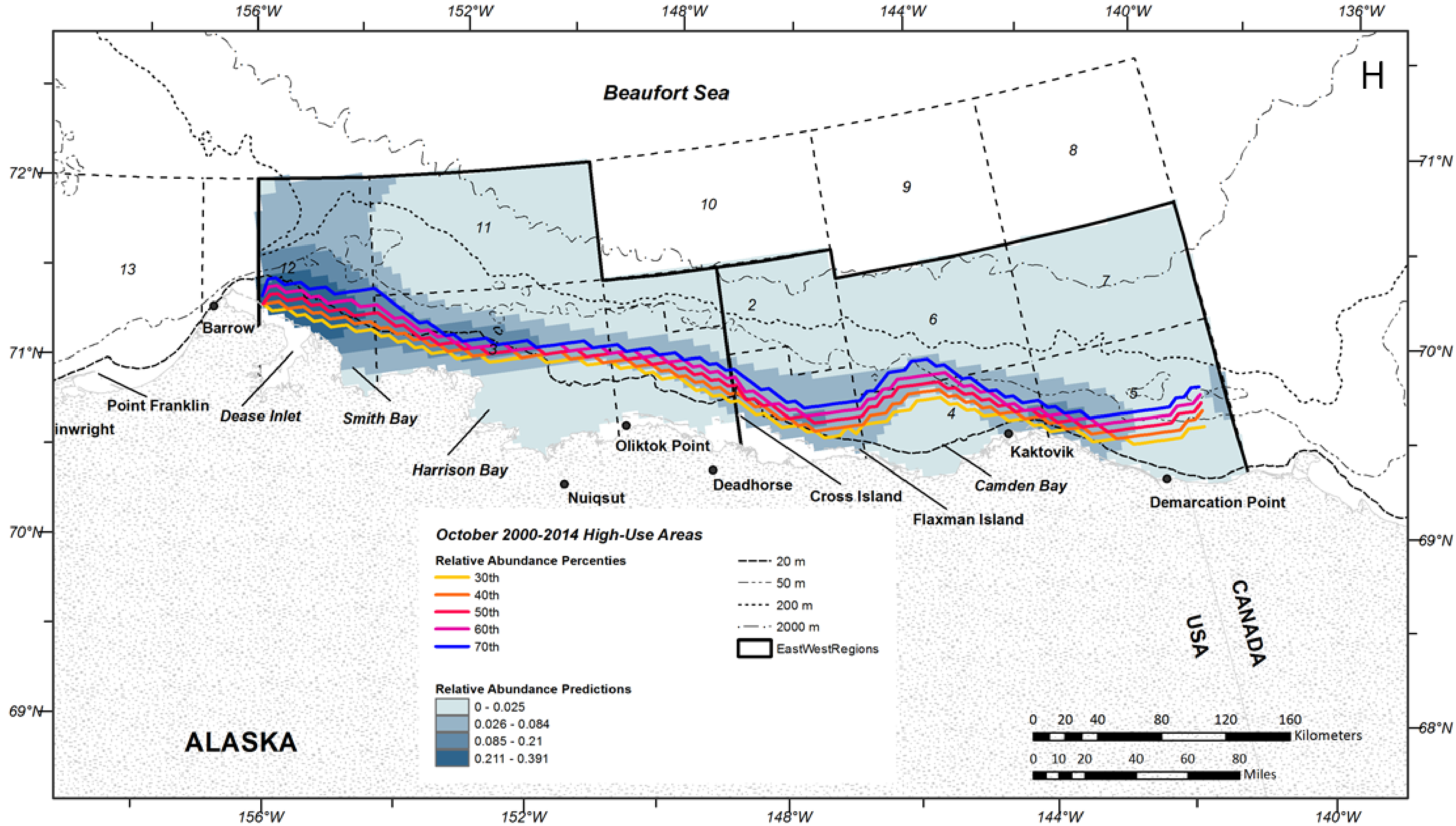


Figure 21 (cont.). ASAMM 2000-2014 bowhead whale transect sightings (primary observers only) by group size and predicted relative abundance, based on a spatial relative abundance model that accounted for effort by assuming a uniform 5 km of transect effort in every cell in the western Beaufort Sea in July, August, September, and October. H: October predicted relative abundance. Predictions are not corrected for perception or availability bias. The bowhead whale High-Use Area is represented by distribution percentiles (30th, 40th, 50th, 60th, and 70th), which represent the offshore extent of 30%, 40%, 50%, 60%, and 70% of the predicted number of bowhead whales from the spatial model.

Table 8. Percentiles of bowhead whale predicted distribution (km) from the spatial model for the West and East regions of the ASAMM study area. For 2014, the predictions correspond to September and October combined. Monthly predictions are provided for 2000-2014.

	WEST REGION (KM)					EAST REGION (KM)				
	2014	2000-2014				2014	2000-2014			
Percentile	Sep-Oct	Jul	Aug	Sep	Oct	Sep-Oct	Jul	Aug	Sep	Oct
30th	9.2	16.1	18.9	9.5	15.4	4.2	55.0	14.0	10.5	14.6
40th	13.1	24.7	23.6	14.1	20.0	6.2	61.2	19.4	14.5	19.0
50th	18.5	35.8	29.0	19.0	24.7	8.4	66.8	25.4	18.9	23.3
60th	24.7	52.7	34.2	24.7	29.3	11.3	73.0	32.2	23.3	28.5
70th	32.3	72.7	39.8	31.9	34.4	14.9	79.6	40.6	28.7	34.7

northeast of Deadhorse to Flaxman Island (Figure 21F). In October, the distribution of high relative abundances extended farther offshore towards the mouth of Barrow Canyon (Figure 21H).

The estimated median distance-from-shore statistics for fall 2014, derived using the spatial model, were 8.4 km for the East Region and 18.5 km for the West Region (Table 8). Compared to results from the analysis of bowhead whale sightings that were unadjusted for transect effort or group size (median values of 7.2 km in the East and 22.2 km in the West; Table 7), the model-derived results placed the median of the bowhead whale distribution slightly farther offshore in the East Region and closer to shore in the West Region.

The estimated median distance-from-shore statistics for the East Region in 2000-2014, derived using the spatial model, decreased from 66.8 km in July to 25.4 km in August, 18.9 km in September, and 23.3 km in October (Table 8). In the West Region, the 2000-2014 model predicted that the median distance from shore decreased from 35.8 km in July to 29.0 km in August, 19.0 km in September, and 24.7 km in October (Table 8). These results suggest that the bowhead whale HUAs were located considerably closer to shore in the East Region and slightly closer to shore in the West Region in 2014 compared to the 15-year time series from 2000 to 2014.

Gray Whales

GRAY WHALE SIGHTING SUMMARY

During the 2014 ASAMM surveys, 524 sightings of 869 gray whales (*Eschrichtius robustus*) of the Eastern North Pacific stock were observed in the study area during all survey modes (transect, search and circling) (Table 3). This is far higher than any annual total observed since ASAMM surveys recommenced in 2008. One-third of all gray whale sightings (183 sightings of 327 gray whales) were in block 23, which was surveyed for the first time since the 1980s. Gray whales were seen in all months in the northeastern Chukchi Sea, and in the southcentral Chukchi Sea and western Beaufort Sea in July, August and September (Figure 22). In the northeastern Chukchi Sea, gray whales were seen primarily nearshore (<30 km) from Point Barrow to south of Point Lay, with scattered sightings up to 121 km offshore between Point Franklin and Icy Cape and one sighting ~240 km from shore. In the southcentral Chukchi Sea, the largest concentrations of gray whales were offshore approximately 65-125 km southwest of Point Hope, a known gray whale and benthic hot spot (Grebmeier et al. 2015; Kuletz et al. 2015), with scattered sightings nearshore between Cape Lisburne and Point Hope. In the western Beaufort Sea, a few gray whales were seen immediately east of Point Barrow, and one gray whale was seen north of Cross Island (~148°W) near Prudhoe Bay. Fewer gray whales were observed offshore (>30 km) between Point Franklin and Icy Cape in late summer and early fall than in 2011, 2012 and 2013. A few gray whales were seen on Hanna Shoal, and one cow-calf pair was 238 km offshore west of Barrow. Locations of gray whale sightings are shown in semimonthly periods in Figure 23.

Gray whale distribution in 2014 (all sightings regardless of survey mode or observer type) was generally similar to that documented from 2008 to 2013 and earlier years with light sea ice coverage, with a few exceptions:

- Gray whales continued to be mostly absent from Hanna Shoal in all months.
- Gray whales were not seen in shallow waters directly south of Point Hope but were seen on several occasions nearshore between Point Hope and Cape Lisburne, particularly in July and August.
- Large groups of gray whales were seen offshore west and southwest of Point Hope, particularly in August and September.
- Gray whales were rarely observed offshore (40-70 km) between Point Franklin and Icy Cape (southeast corner of block 14 and northeastern corner of block 17) in 2014.
- One gray whale was seen in the central Alaskan Beaufort Sea in September.

GRAY WHALE SIGHTING RATES

In summer and fall 2014, gray whales were seen on transect (Tr) from 67.1°N to 71.9°N and 147.9°W to 168.7°W. There were 170 sightings of 297 gray whales on transect by primary

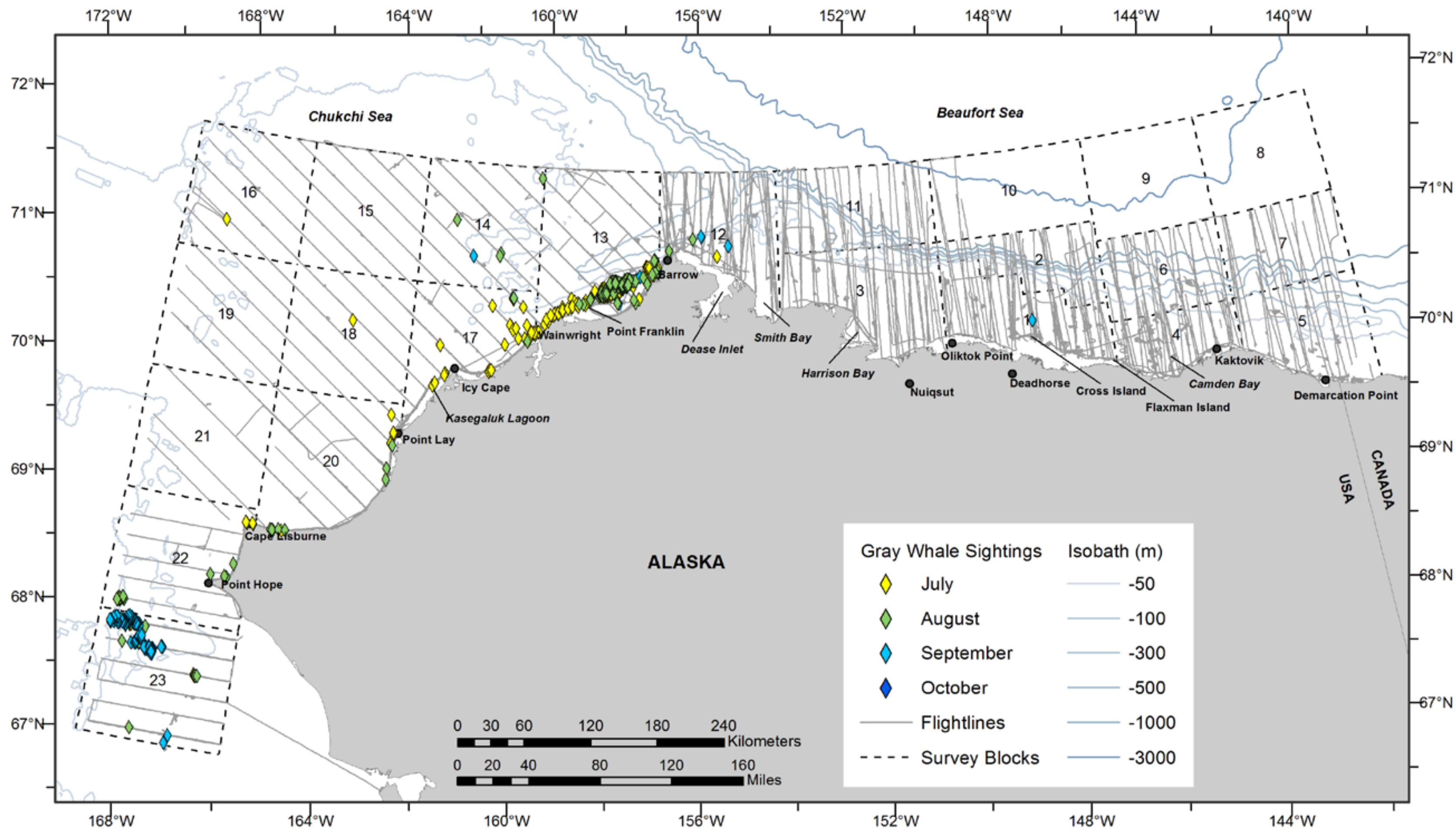


Figure 22. ASAMM 2014 gray whale sightings plotted by month, with transect, search, and circling effort. Deadhead flight tracks are not shown.

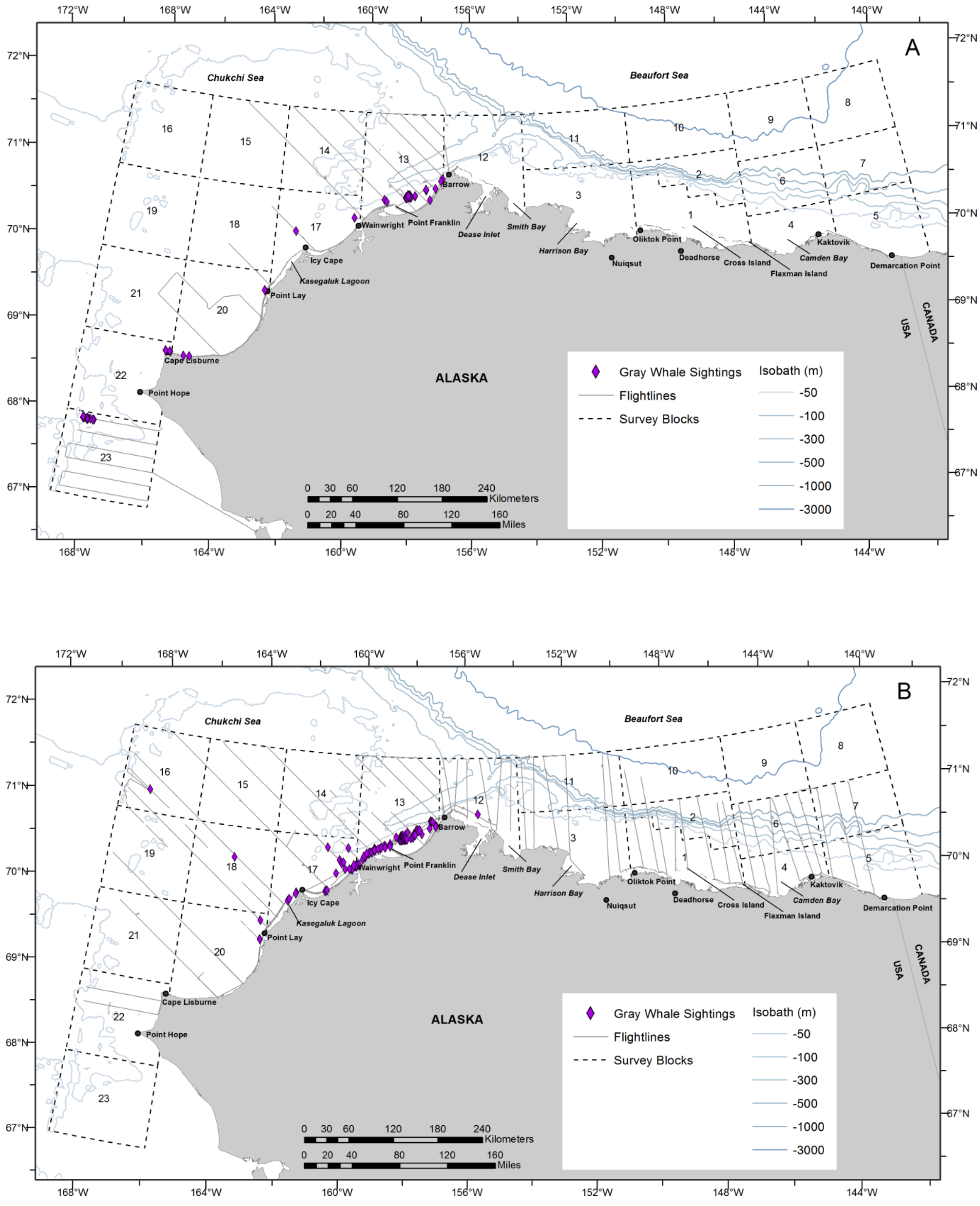
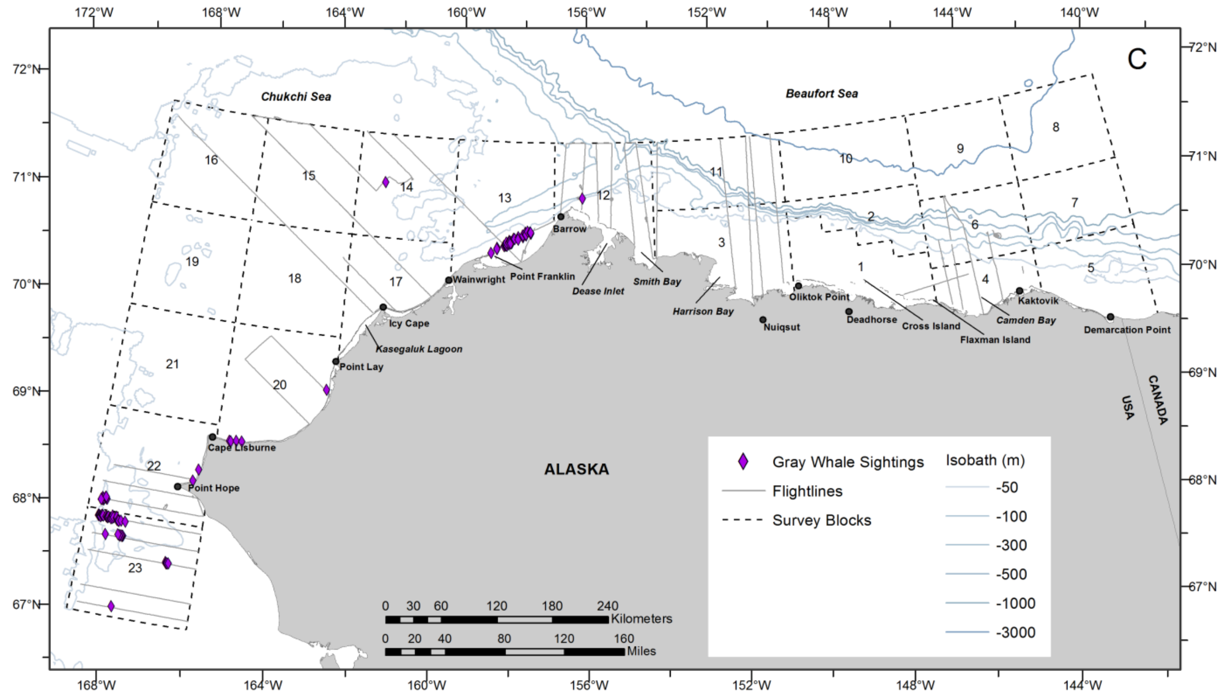


Figure 23. ASAMM 2014 semimonthly gray whale sightings, with transect, search, and circling effort. A: 2-15 July; B: 16-31 July. Deadhead flight tracks are not shown.



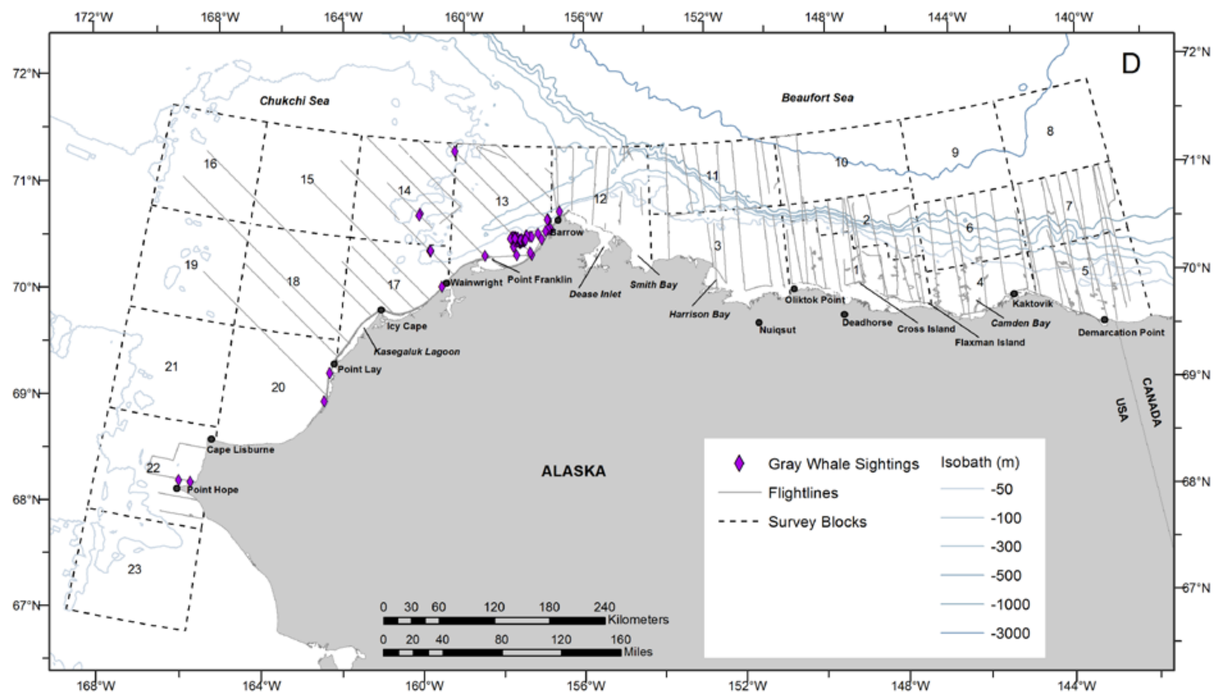


Figure 23 (cont). ASAMM 2014 semimonthly gray whale sightings, with transect, search, and circling effort. C: 1-15 August; D: 16-31 August. Deadhead flight tracks are not shown.

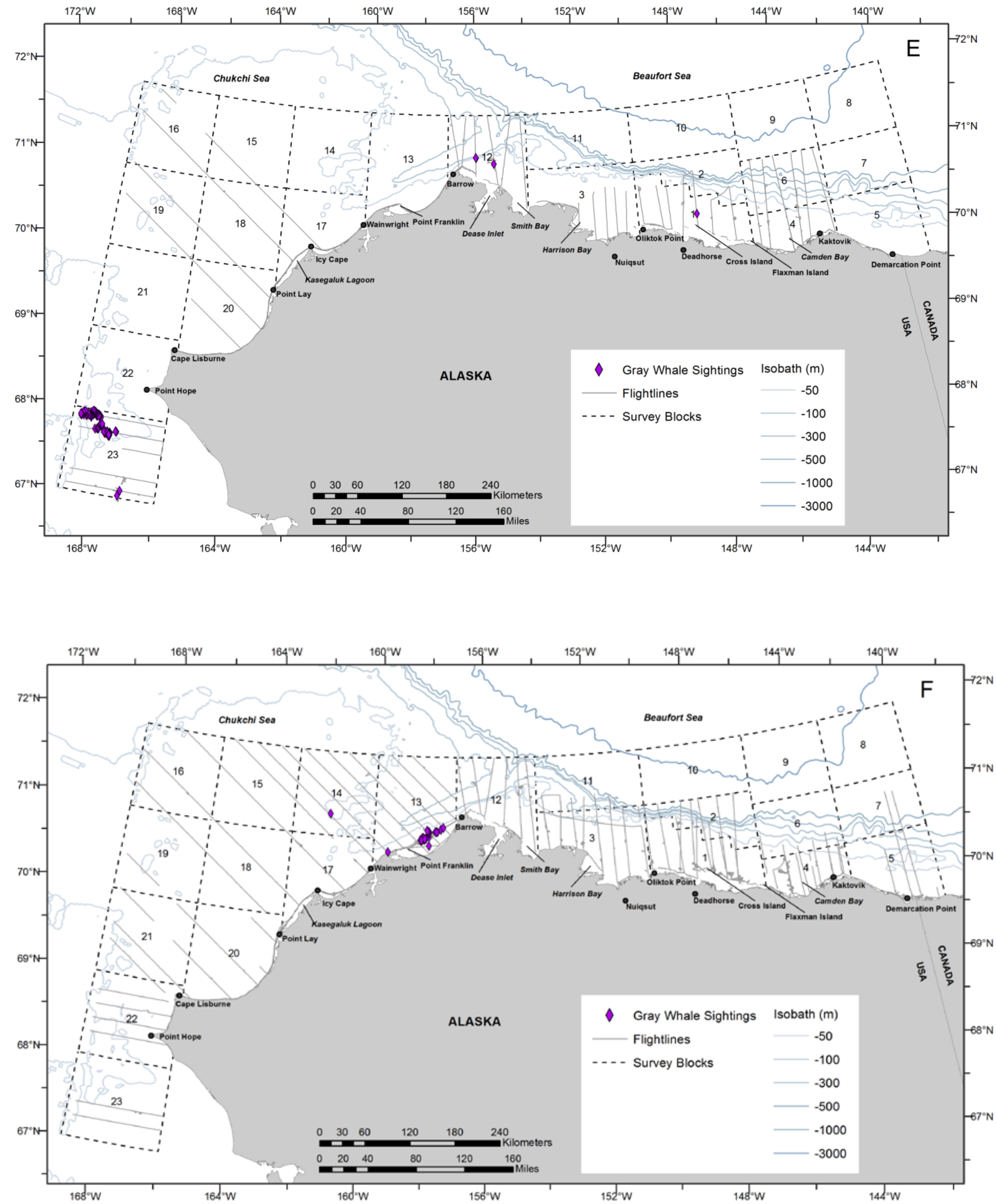
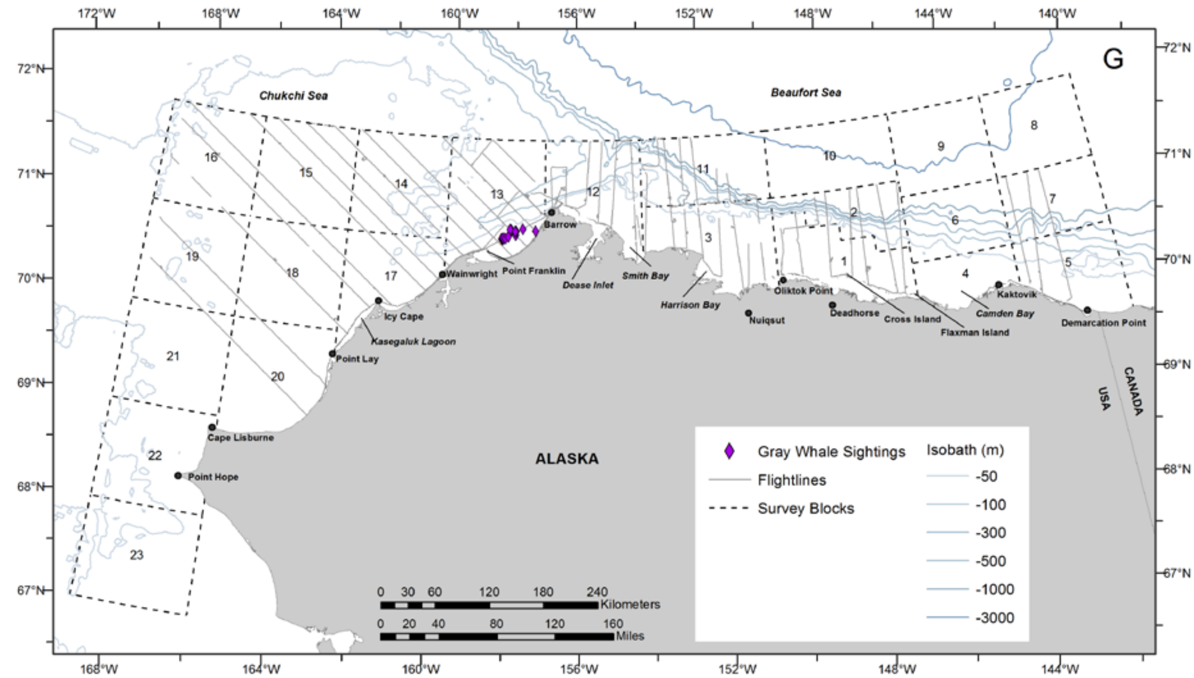


Figure 23 (cont). ASAMM 2014 semimonthly gray whale sightings, with transect, search, and circling effort. E: 1-15 September; F: 16-30 September. Deadhead flight tracks are not shown.



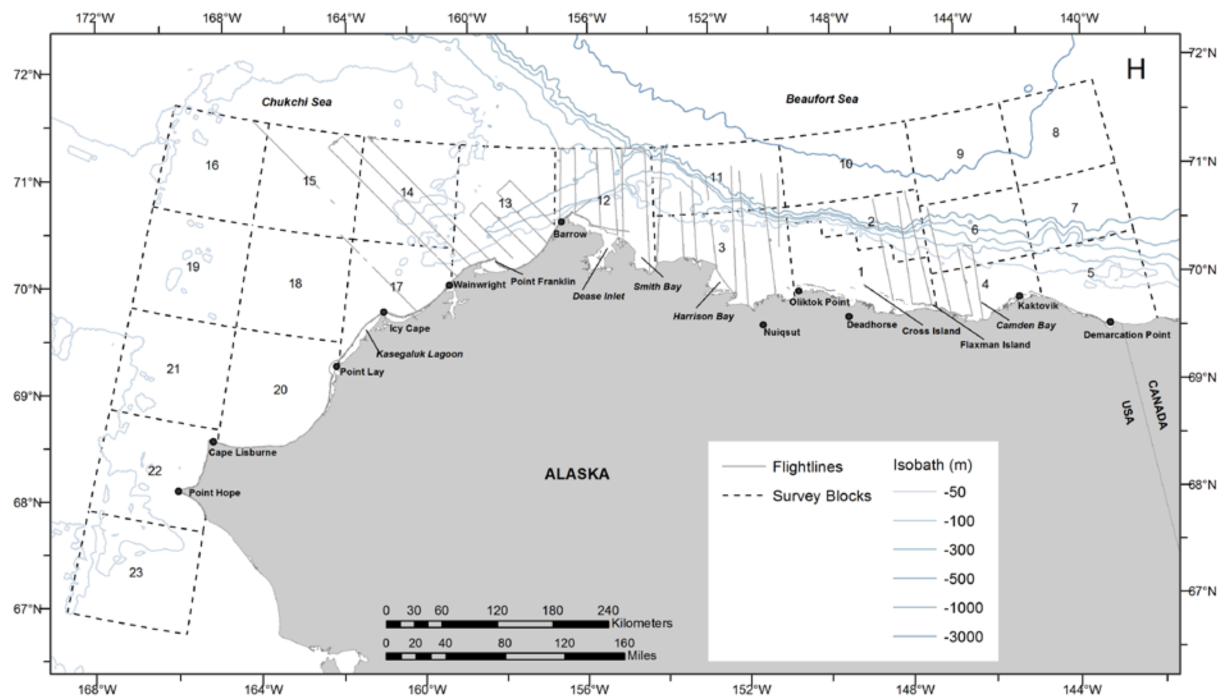


Figure 23 (cont). ASAMM 2014 semimonthly gray whale sightings, with transect, search, and circling effort. G: 1-15 October; H: 16-28 October. Deadhead flight tracks are not shown.

observers (Appendix E, Table E-5), ranging from 1 whale per sighting (n = 94) to 13 whales per sighting (n = 1). The greatest numbers of sightings on transect were in blocks 23 and 13, with 74 and 45 sightings, respectively. When transect and circling from transect (Tr+TrC) sightings were combined, there were 352 sightings of 609 gray whales (Appendix E, Table E-6), ranging from 1 whale per sighting (n = 198) to 13 whales per sighting (n = 1). The highest number of Tr+TrC sightings was in block 23 (181 sightings), followed by block 13 (96 sightings).

The highest gray whale fine-scale Tr sighting rates (WPUE, 5 km grid) were in the southcentral Chukchi Sea, southwest of Point Hope (Figure 24). A comparison of Tr and Tr+TrC sighting rates for gray whales in 2014 is included in Appendix E (Figure E-5). Gray whale Tr+TrC sighting rates better represent on-effort sightings and effort in 2014 and highlight areas of gray whale aggregations in the benthic hot spot in the southcentral Chukchi Sea.

Gray whale sighting rate analyses per survey block and depth zone were limited to the study area west of 154°W to encompass the region where the majority of gray whales were seen in 2014 (and historically). For all months combined, the highest Tr sighting rates per survey block were in block 23 (0.070 WPUE), block 22 (0.014 WPUE), and block 13 (0.014 WPUE). Sighting rates (Tr) were highest in block 17 (0.035 WPUE) and block 13 (0.025 WPUE) in July, but highest in block 23 in August (0.150 WPUE) and September (0.060 WPUE) ((Appendix E, Table E-5; Figure 25). The few gray whales that were seen in October were all in block 13.

Monthly Tr sighting rates in 2014 were higher in July, August, and September compared to monthly sighting rates for those months in 2008-2013, all years combined (Figure 26). The peak monthly gray whale Tr sighting rate in the western part of the study area (154°W-169°W) in 2014 was in August (0.021 WPUE), dropping off considerably in September and October. This contrasts with Tr sighting rates observed in this area from 2008 to 2013, which were highest in July before dropping off in August through October. When Tr sighting rates were calculated separately for the northeastern Chukchi Sea (69°N-72°N, 154°W-169°W) and for the southcentral Chukchi Sea (67°N-69°N, 166°W-169°W) for 2008-2014, similar patterns emerged for gray whale Tr sighting rates in the northeastern Chukchi Sea for 2008-2013 and 2014 (Figure 27A), showing the influence of the numerous gray whale sightings in the benthic hotspot in 2014, particularly in August (Figure 27B).

As with bowhead whale sighting rates, gray whale sighting rates per block using sightings and effort on transect (Tr) combined with sightings and effort from circling from transect (Tr+TrC) are a more accurate reflection of gray whale relative abundance because they incorporate all on-effort sightings and effort. Sighting rates (Tr+TrC) were higher in all survey blocks compared to Tr sighting rates (Figure 25). The highest Tr+TrC sighting rate was in block 23 in September (0.162 WPUE) (Appendix E, Table E-6).

The highest Tr sighting rate per depth zone in the Chukchi Sea (157°W-169°W) for the entire study period was in the 51-200 m South depth zone (0.168 WPUE) (Appendix E, Table E-7). As noted previously, the high numbers of gray whales observed from July to September in the benthic hot spot in the southcentral Chukchi Sea overwhelmed all sighting rate analyses (Figure 28). When the 51-200 m South depth zone was excluded from analysis, the highest Tr sighting

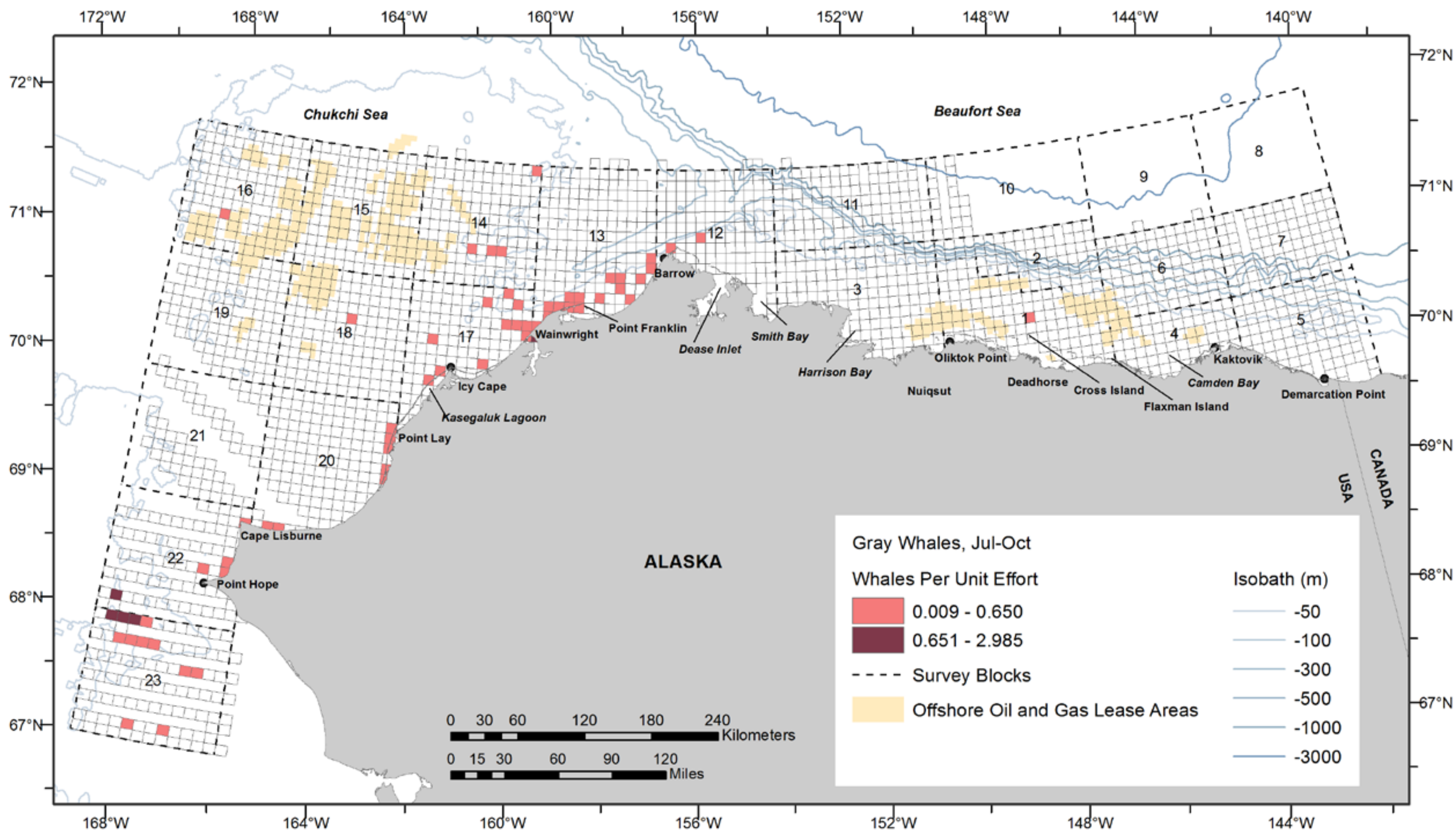


Figure 24. ASAMM 2014 gray whale sighting rates (WPUE; transect sightings from primary observers only), July-October. Empty grid cells indicate sighting rates of zero. Transect survey effort was not conducted in areas without grid cells.

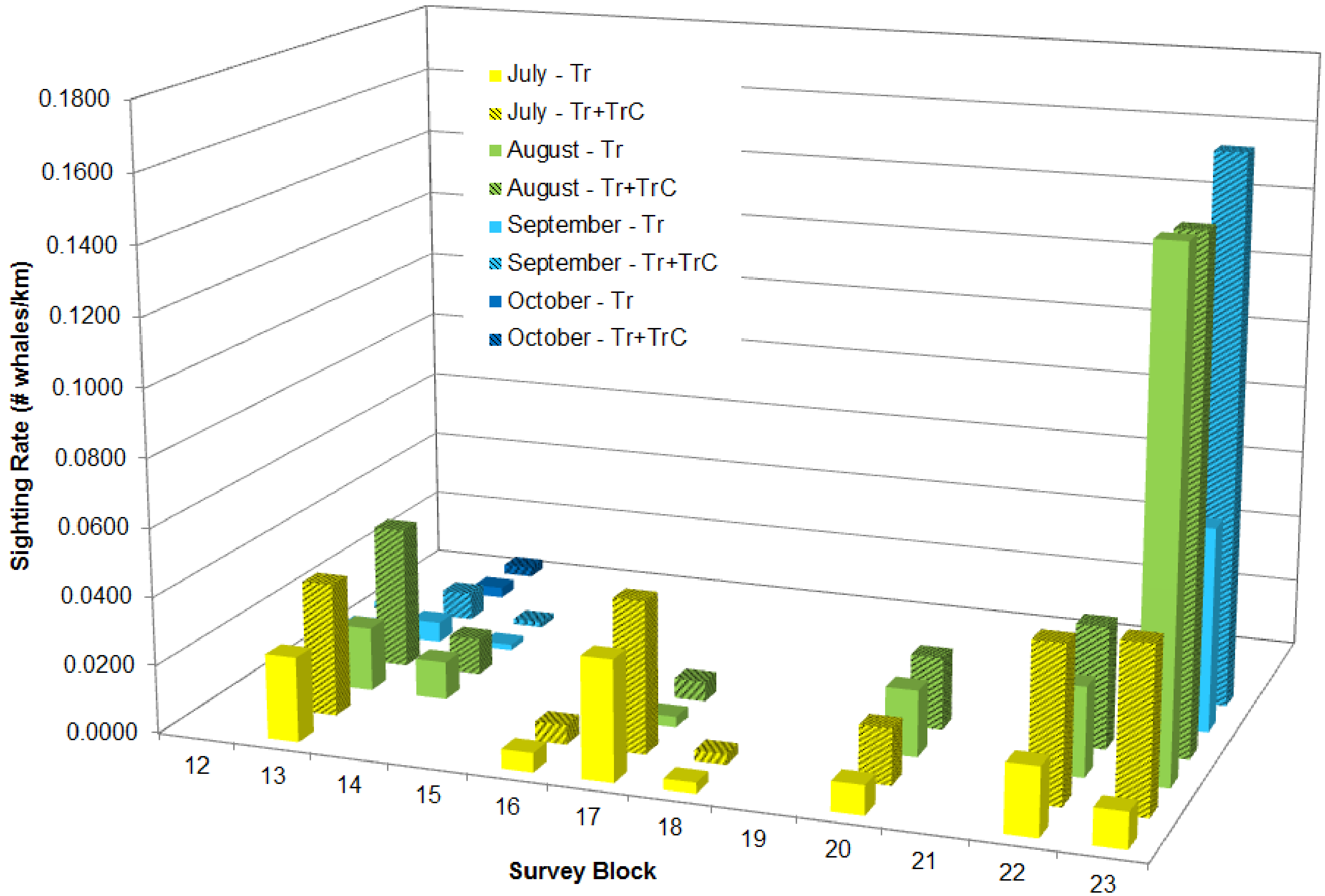


Figure 25. ASAMM 2014 gray whale monthly sighting rates (WPUE; sightings from primary observers only) per survey block for sightings and effort on transect (Tr) and sightings and effort on transect and circling from transect (Tr+TrC). Sighting rates of zero were removed from the graph for clarity.

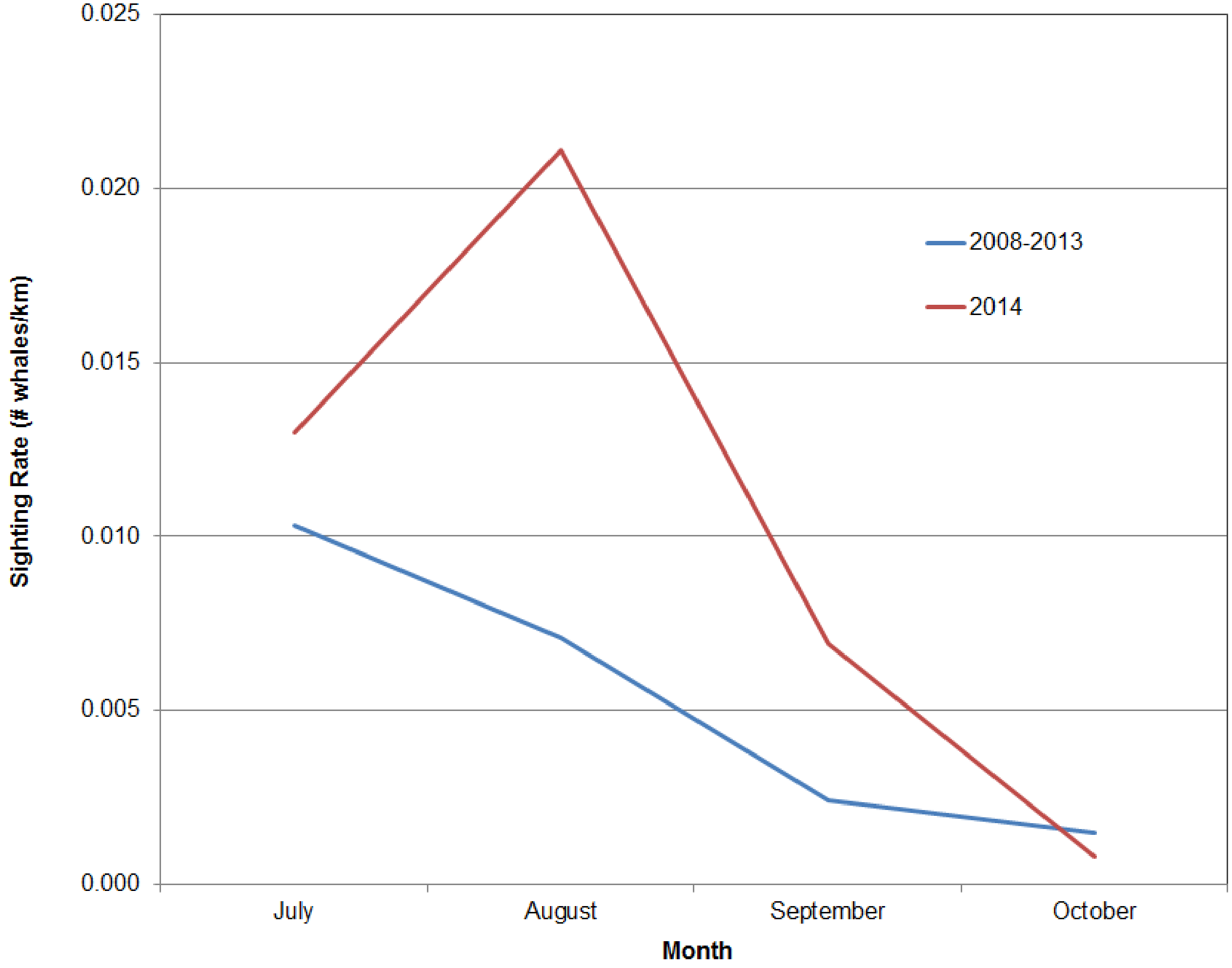


Figure 26. ASAMM gray whale monthly sighting rates (WPUE; transect sightings from primary observers only) in the eastern Chukchi Sea (67°N-72°N, 154°W-169°W), 2008-2013 and 2014.

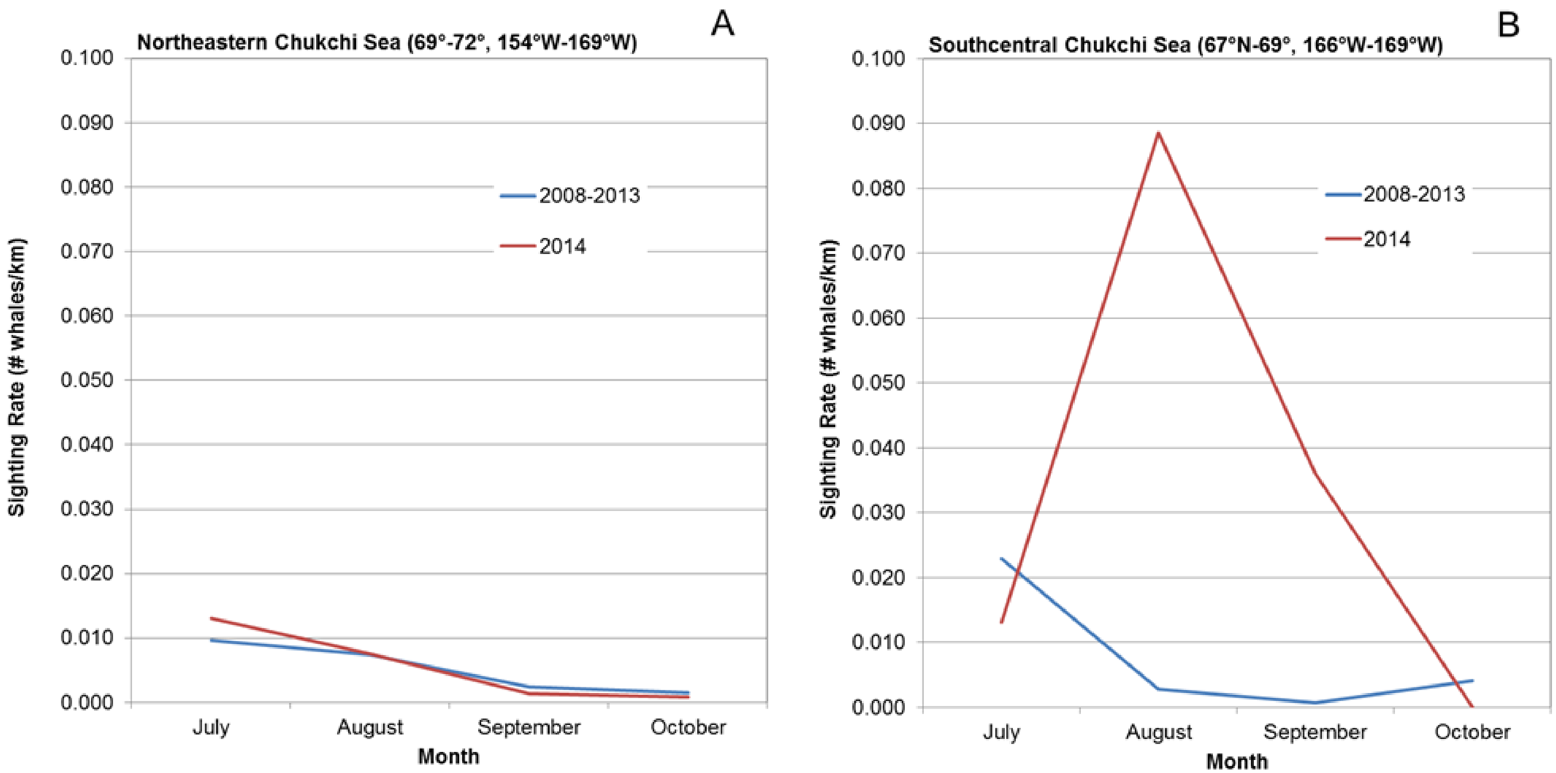


Figure 27. ASAMM gray whale monthly sighting rates (WPUE; transect sightings from primary observers only), 2008-2013 and 2014. A: northeastern Chukchi Sea (69°N-72°N, 154°W-169°W); B: southcentral Chukchi Sea (67°N-69°N, 166°W-169°W).

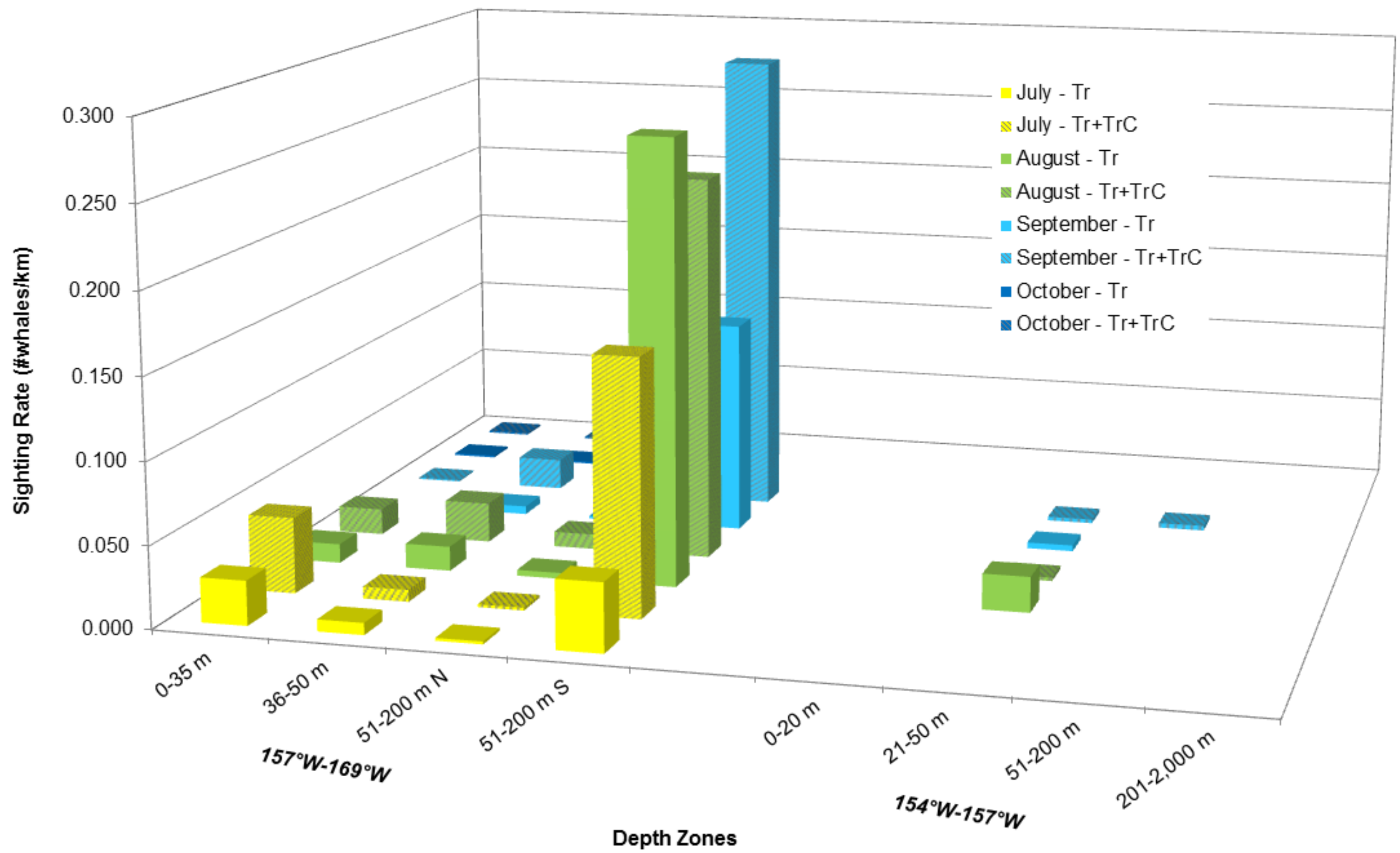


Figure 28. ASAMM 2014 gray whale monthly sighting rates (WPUE; sightings from primary observers only) per depth zone for sightings and effort on transect (Tr) and sightings and effort on transect and circling from transect (Tr+TrC). Sighting rates of zero were removed from the graph for clarity.

rate was in the ≤35 m depth zone (0.020 WPUE) in summer (July-August) and in the 36-50 m depth zone (0.003 WPUE) in fall (September-October). Depth zone preference for shallower water in the northern Chukchi Sea in summer and deeper water in fall follows a trend noted since aerial surveys recommenced in the northeastern Chukchi Sea in 2008 (Clarke et al. 2012, 2013a, 2014).

The highest Tr sighting rate per depth zone in the western Alaskan Beaufort Sea (154°W-157°W) for gray whales for the entire study period was in the 51-200 m zone (0.002 WPUE) (Appendix E, Table E-7). One gray whale was seen east of 154°W in September in the 21-50 m depth zone.

Sighting rates per depth zone calculated using sightings and effort on transect and on circling from transect (Tr+TrC) were generally higher in all depth zones compared to Tr sighting rates (Figure 28, Appendix E, Table E-8). The highest Tr+TrC sighting rates were in the 51-200 m South depth zone in all months except October, when there was no survey effort in that zone.

Gray whale distribution in 2014 using only Tr sightings was not noticeably different from the distribution of Tr sightings observed in previous years having light sea ice cover (Figure 29), with two exceptions. First, the scarcity of gray whales near Hanna Shoal continued. Second, there was a high number of sightings in the southwest corner of block 22 and northwest corner of block 23. Block 23 had not been surveyed since the late 1980s so there are no recent data for comparison.

Gray Whale Sea Ice Associations

Most gray whales (82%, n = 714) were observed in 0% sea ice cover. Gray whales were observed in areas with sea ice in July (1-70% sea ice cover) and August (40% sea ice cover). Sea ice remained in the study area until late August (Appendix A, Figure A-4) but mainly in offshore areas where gray whales were rarely observed. Both feeding behavior and calves were observed in areas of up to 70% sea ice cover. Sea ice cover does not appear to be an impediment to gray whale occurrence.

Gray Whale Behaviors

Behaviors of 854 gray whales observed during all survey modes (transect, search and circling) in 2014 are summarized in Table 9. The behaviors most often recorded were feeding (70%) and swimming (22%). Resting was recorded for 25 whales (3%) and milling was recorded for 18 whales (2%). Other behaviors recorded included mating (n = 4 whales), diving (n = 3 whales), and displaying (n = 5 whales). Behavior was not recorded for 15 whales (2%), most of which were too far away to definitively identify the behavior. Fine-scale Tr sighting rates of feeding and milling gray whales in 2014 are shown in Figure 30, with the highest Tr sighting rates in the southcentral Chukchi Sea. Gray whales observed in the southcentral Chukchi Sea (south of 69°N) were overwhelmingly feeding (79%). The single gray whale sighted in the central Alaskan Beaufort Sea, north of Cross Island, in September was swimming 279°T. No gray whales responded to the survey aircraft.

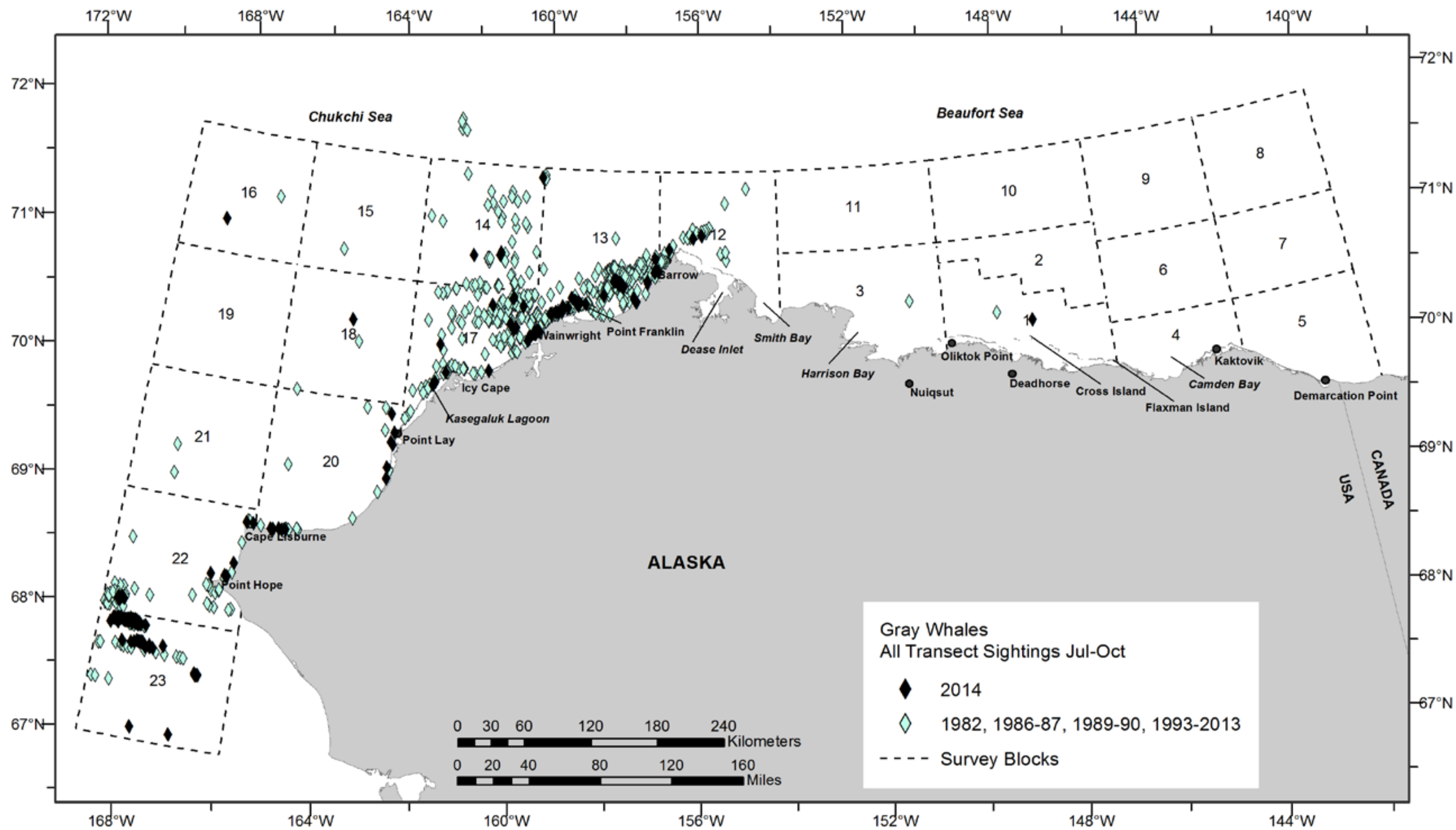


Figure 29. ASAMM gray whale sightings on transect in years with light sea ice cover: 1982, 1986-87, 1989-90, 1993-2013, and 2014. Includes all sightings on transect made by primary and secondary observers.

Table 9. ASAMM 2014 semimonthly summary of gray whales (number of sightings/ number of individuals) observed during all survey modes (transect, search, and circling), by behavioral category. Excludes dead and same-day repeat sightings.

Behavior	1-15 Jul	16-31 Jul	1-15 Aug	16-31 Aug	1-15 Sep	16-30 Sep	1-15 Oct	Total
Breach	0	1/1	1/1	0	0	0	0	2/2
Dive	0	1/1	0	0	2/2	0	0	3/3
Feed	37/88	47/86	77/139	58/82	97/164	25/31	12/15	353/605
Mate	0	0	0	0	2/4	0	0	2/4
Mill	0	2/3	3/7	1/1	4/7	0	0	10/18
Rest	0	11/16	2/5	2/2	2/2	0	0	17/25
Roll	0	0	0	1/1	0	0	0	1/1
Swim	24/39	40/83	18/26	10/12	20/25	6/6	3/3	121/194
Tail slap	0	1/2	0	0	0	0	0	1/2
Unknown	0	2/2	2/2	4/5	5/5	1/1	0	14/15
TOTAL	61/127	105/194	103/180	76/103	132/209	32/38	15/18	524/869

One-hundred nine gray whale calves were seen in 2014 (Figure 31); the calf ratio (number of calves/number of total whales) was 0.125, which is similar to the ratio observed in 2012 (0.120) but far less than the ratio recorded in 2013 (0.203) (Clarke et al. 2014). Calf distribution overlapped that of adult gray whales both temporally and spatially in 2014. Most calves (87%, n = 95) were within 30 km of shore. Twelve calves were sighted offshore in the southcentral Chukchi Sea, and two calves were 120 and 238 km offshore, respectfully, in the northeastern Chukchi Sea. Two calves were seen east of Point Barrow. Eighty-three calves were observed in July, 24 in August, and 2 in September. On 14 occasions, multiple calves were seen in one day, with the highest daily total on 16 July (19 calves). Some calves may have been sighted on more than one day. Even with the possibility that some calves were sighted more than once, gray whale calf occurrence in the eastern Chukchi Sea in 2014 was extraordinary, particularly because it followed high gray whale calf occurrence in 2012 and 2013 (Clarke et al. 2013a, 2014). When calf sightings were corrected for survey effort, the gray whale calf sighting rate in 2014 (calves on transect per transect km) was 0.0018, which is higher than the rate observed in any previous year (1979-2013) in which these broad-scale marine mammal aerial surveys have been conducted (Brower et al. 2013; Clarke et al. 2014). Even when calves and effort in block 23 were excluded from the 2014 analysis (because surveys were not conducted in block 23 prior to 2014), the gray whale calf sighting rate was still higher (0.0011) than that observed in 1979-2013.

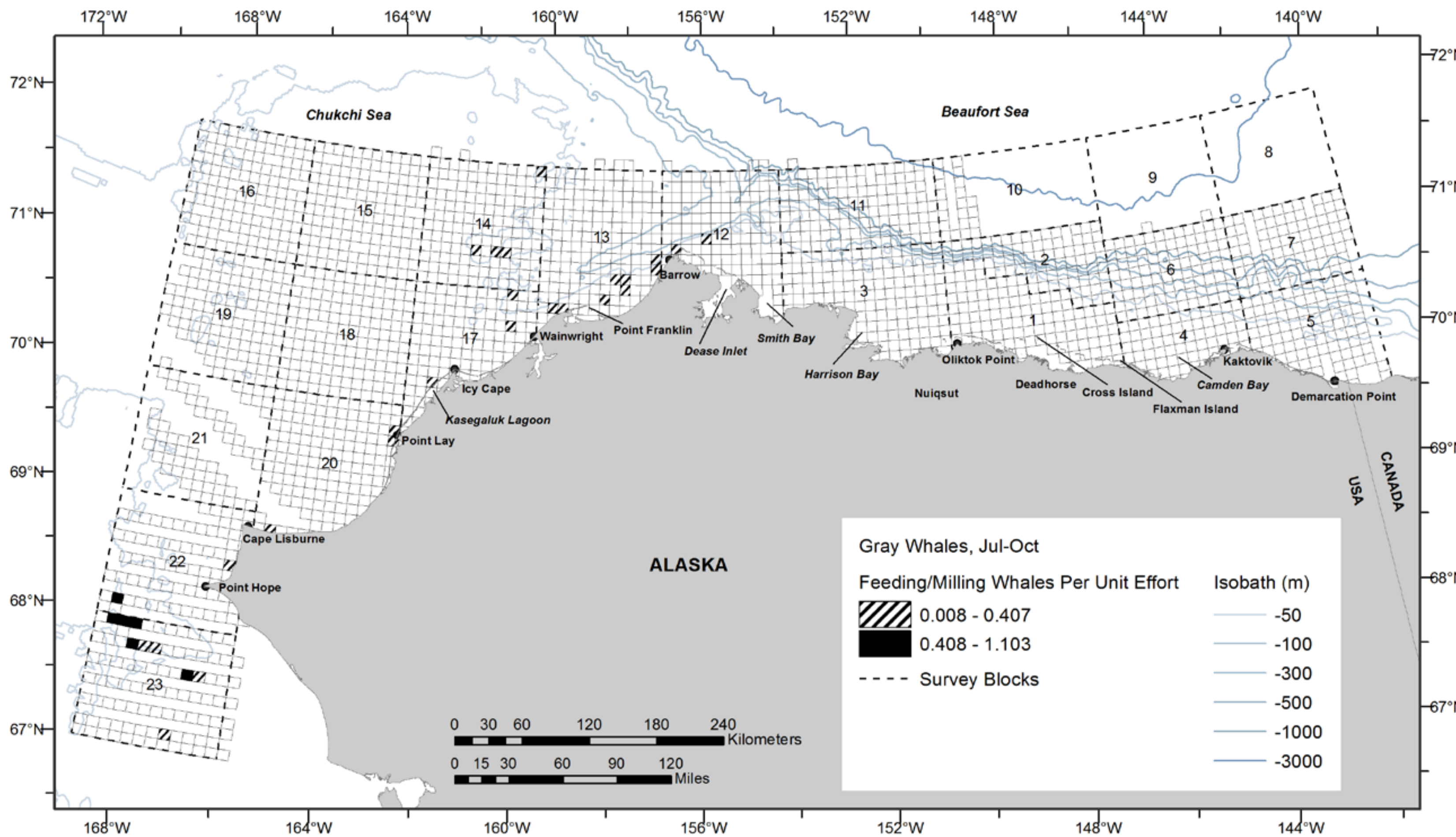


Figure 30. ASAMM 2014 gray whale feeding and milling sighting rates (WPUE; transect sightings from primary observers only). Empty grid cells indicate sighting rates of zero. Transect survey effort was not conducted in areas without grid cells.

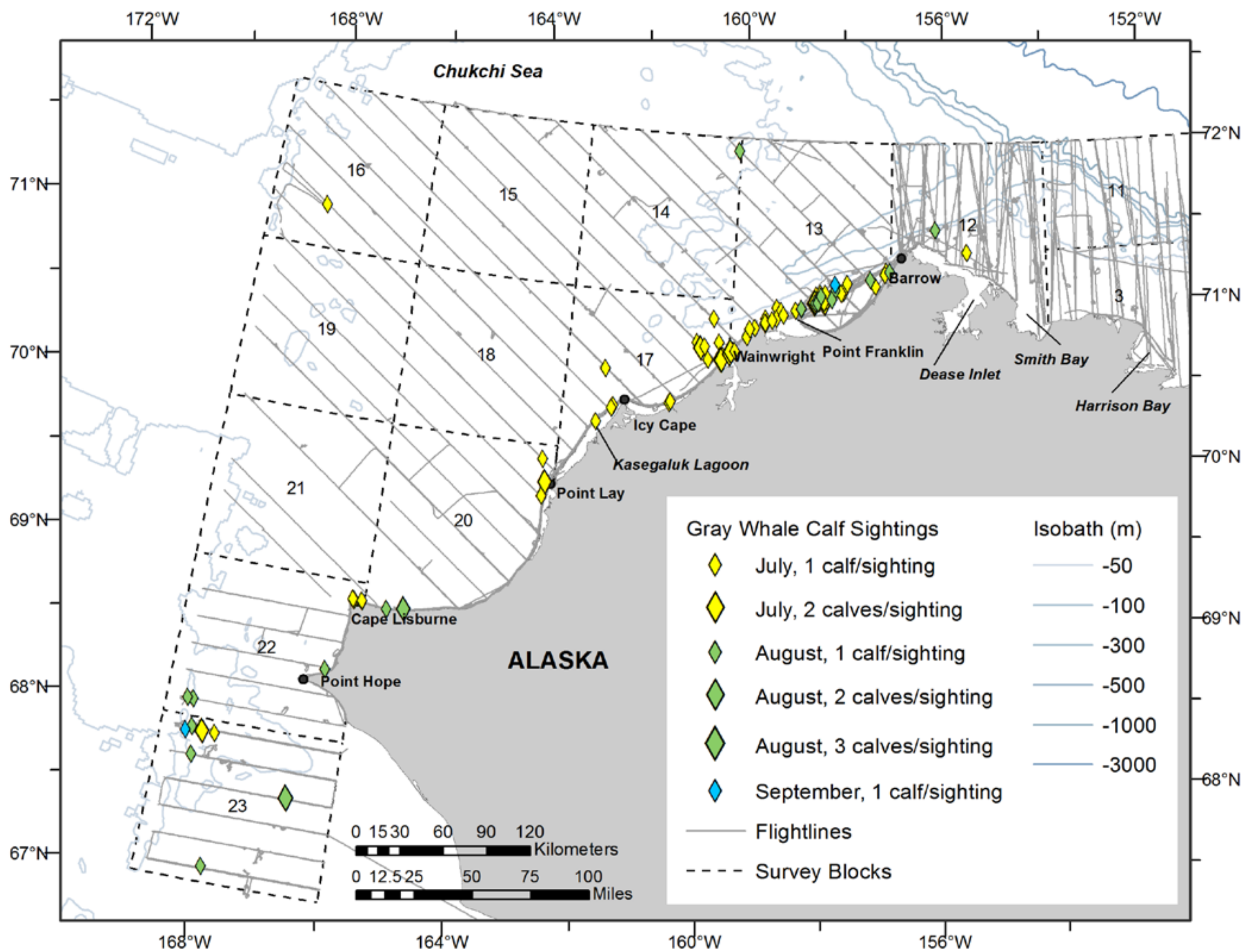


Figure 31. ASAMM 2014 gray whale calf sightings, with transect, search, and circling effort. Deadhead flight tracks are not shown.

Gray whale swim direction in the northeastern Chukchi Sea was significantly clustered about a mean heading of 237°T ($Z = 6.468$, $P = 0.001$) in July, but was not clustered around any heading in August. There were too few data to test for significance in September and October in the northeastern Chukchi Sea or in any month in the southcentral Chukchi Sea. Most gray whales are observed during ASAMM at the far northern extent of the species' range and are feeding, so a lack of directed migratory movement during August is not surprising.

Humpback Whales

There were 22 sightings of 46 humpback whales (*Megaptera novaeangliae*) in 2014, all in the southcentral Chukchi Sea and all in September (Table 3, Figure 32). Stock affiliation of humpback whales in this region is unknown. Most (93%) humpback whales were seen on 4 September in close association with several fin whales and a few gray whales, approximately 90-110 km south of Point Hope (Appendix B, Flight 232). Three humpback whales were seen on 24 September (Appendix B, Flight 239), also closely associated with fin whales. One calf and one juvenile humpback whale were seen. Most (74%) humpback whales were feeding or milling. None of the humpback whales appeared to respond to the survey aircraft.

Fin Whales

There were 17 sightings of 36 fin whales (*Balaenoptera physalus*) of the Northeast Pacific stock in 2014, all in the southcentral Chukchi Sea and all in September (Table 3; Figure 32). Most (86%) fin whales were seen on 4 September in close association with several humpback whales and a few gray whales, approximately 90-110 km south of Point Hope (Appendix B, Flight 232). Five fin whales were seen on 24 September, also closely associated with humpback whales (Appendix B, Flight 239). One small whale was identified as a possible calf. Fin whales were observed feeding and milling (44%) and swimming (56%). None of the fin whales appeared to respond to the survey aircraft.

Minke Whales

There were 2 sightings of 3 minke whales (*Balaenoptera acutorostrata*) of the Alaska stock in 2014 (Table 3; Figure 32). One minke whale was seen on 4 September in the southcentral Chukchi Sea, about 20 km east of the humpback-fin whale group (Appendix B, Flight 232). Two minke whales were observed west of Icy Cape on 6 September (Appendix B, Flight 234). All minke whales sighted were adults. None of the minke whales appeared to respond to the survey aircraft.

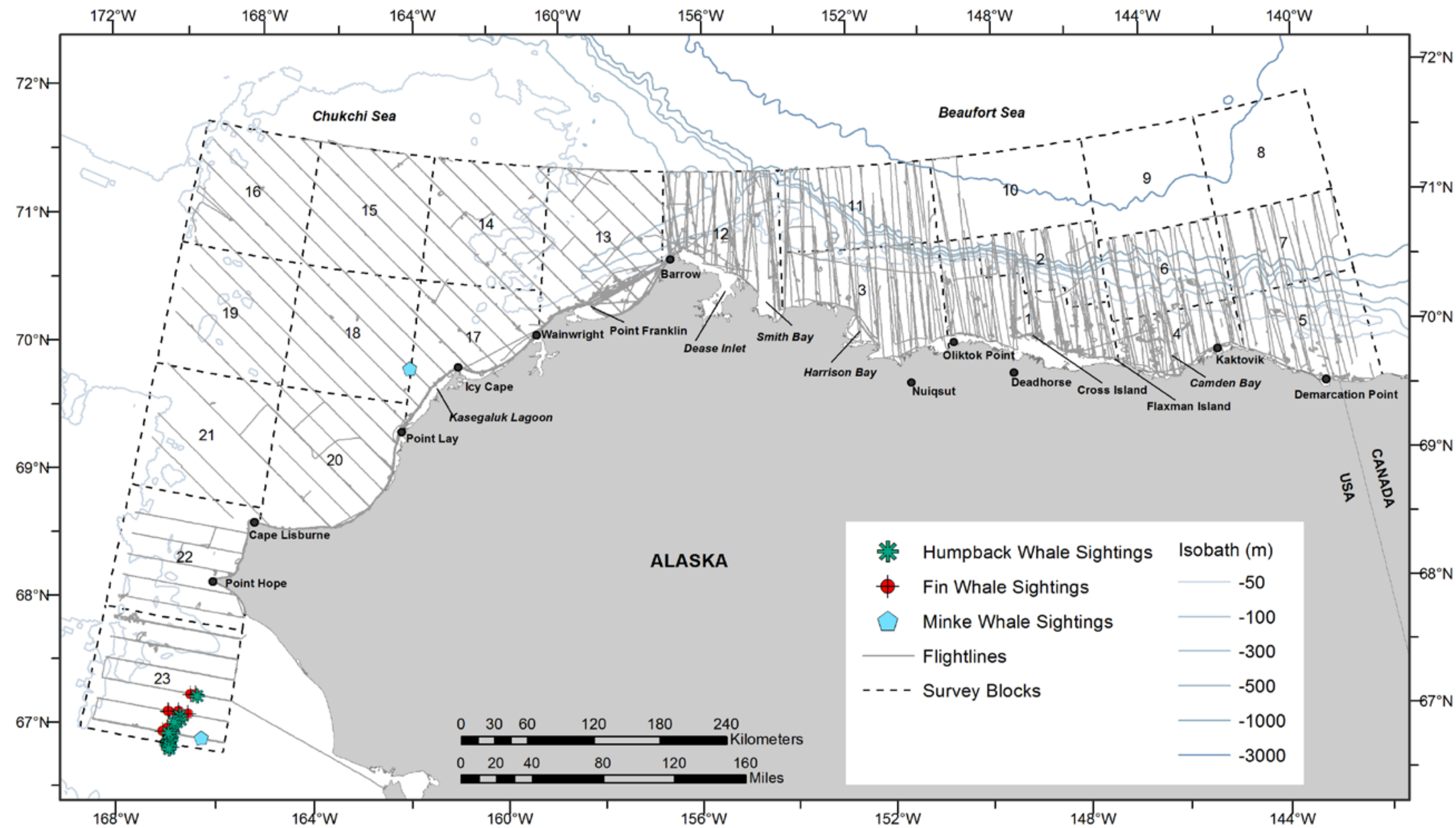


Figure 32. ASAMM 2014 humpback, fin, and minke whale sightings, with transect, search, and circling effort. Deadhead flight tracks are not shown.

Belugas

Beluga Sighting Summary

During the 2014 ASAMM surveys, 922 sightings of 2,330 belugas (*Delphinapterus leucas*) were observed in the study area during all survey modes (transect, search, and circling) (Table 3). Beluga stock affiliation is impossible to determine from aerial surveys, and sightings likely encompassed belugas from the Eastern Chukchi Sea and Beaufort Sea stocks (Hauser et al. 2014). Belugas were seen in the Chukchi Sea in all months (Figure 33). In July, belugas were seen mainly nearshore, with relatively few sightings >30 km offshore. There were few sightings in August, but in September and October sightings were geographically dispersed between 70.8°N and 72°N. In the western Beaufort Sea, belugas were seen along the continental slope in all months surveyed (July-October), with several sightings nearshore, particularly in September. Belugas were also seen near Barrow Canyon from July through October. Beluga distribution in 2014 was generally similar to that documented in previous years with light sea ice cover, particularly in the western Beaufort Sea (Figure 34).

Beluga Sighting Rates

In summer and fall 2014, belugas were seen from 69.4°N to 72°N between 140.2°W and 168.2°W. There were 788 sightings of 2,040 belugas on transect by primary observers, ranging from 1 beluga per sighting (n = 489) to 200 belugas per sighting (n = 1). The highest number of sightings on transect per survey block was in block 11 (168 sightings), followed by block 6 (123 sightings), block 12 (113 sightings), and block 2 (111 sightings). The highest beluga Tr sighting rates in 2014 occurred in July in both the eastern Chukchi Sea and the western Beaufort Sea, decreased in August, remained low in September, and increased slightly in October (Figure 35, Appendix E, Table E-9). Sighting rates likely reflect the presence of the Eastern Chukchi Sea stock in the northeastern Chukchi and western Beaufort seas in summer (July-August) (Hauser et al. 2014). Relatively low Tr sighting rates in the ASAMM study area in fall 2014 might be indicative of greater abundance north (north of 72°N) or east (east of 140°W) of the ASAMM study area. Beluga Tr sighting rates in 2014 were lower compared to observations in 2012, but higher than observations in 2011 and 2013 (Clarke et al. 2013a, 2014).

Areas of highest fine-scale Tr sighting rates in the Beaufort Sea were offshore on the continental slope and in Barrow Canyon (Figure 36). In the northeastern Chukchi Sea, areas of highest fine-scale Tr sighting rates were offshore in block 15 and nearshore south of Point Lay (block 20, based on a single sighting of 200 belugas).

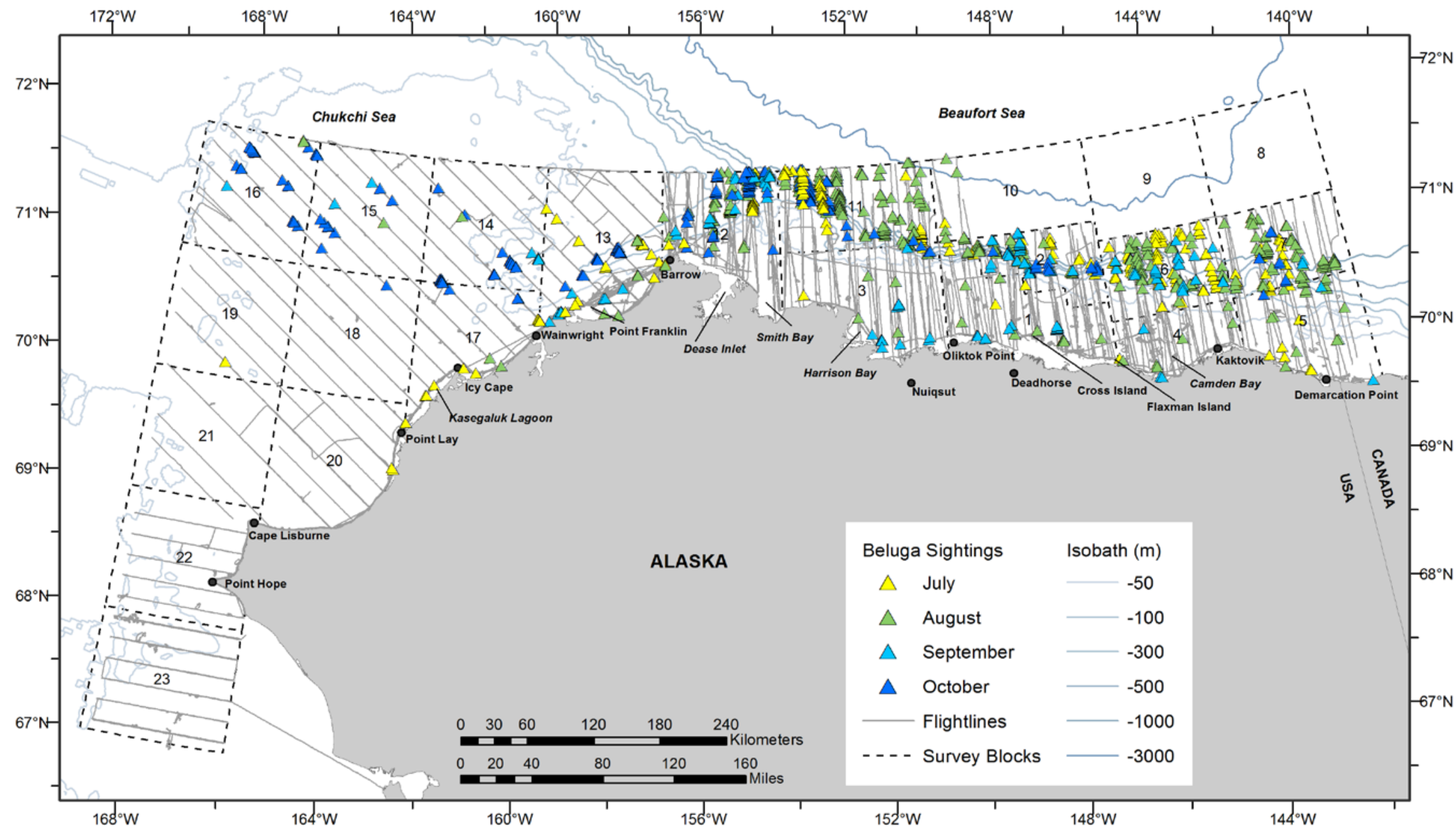


Figure 33. ASAMM 2014 beluga sightings plotted by month, with transect, search, and circling effort. Deadhead flight tracks are not shown.

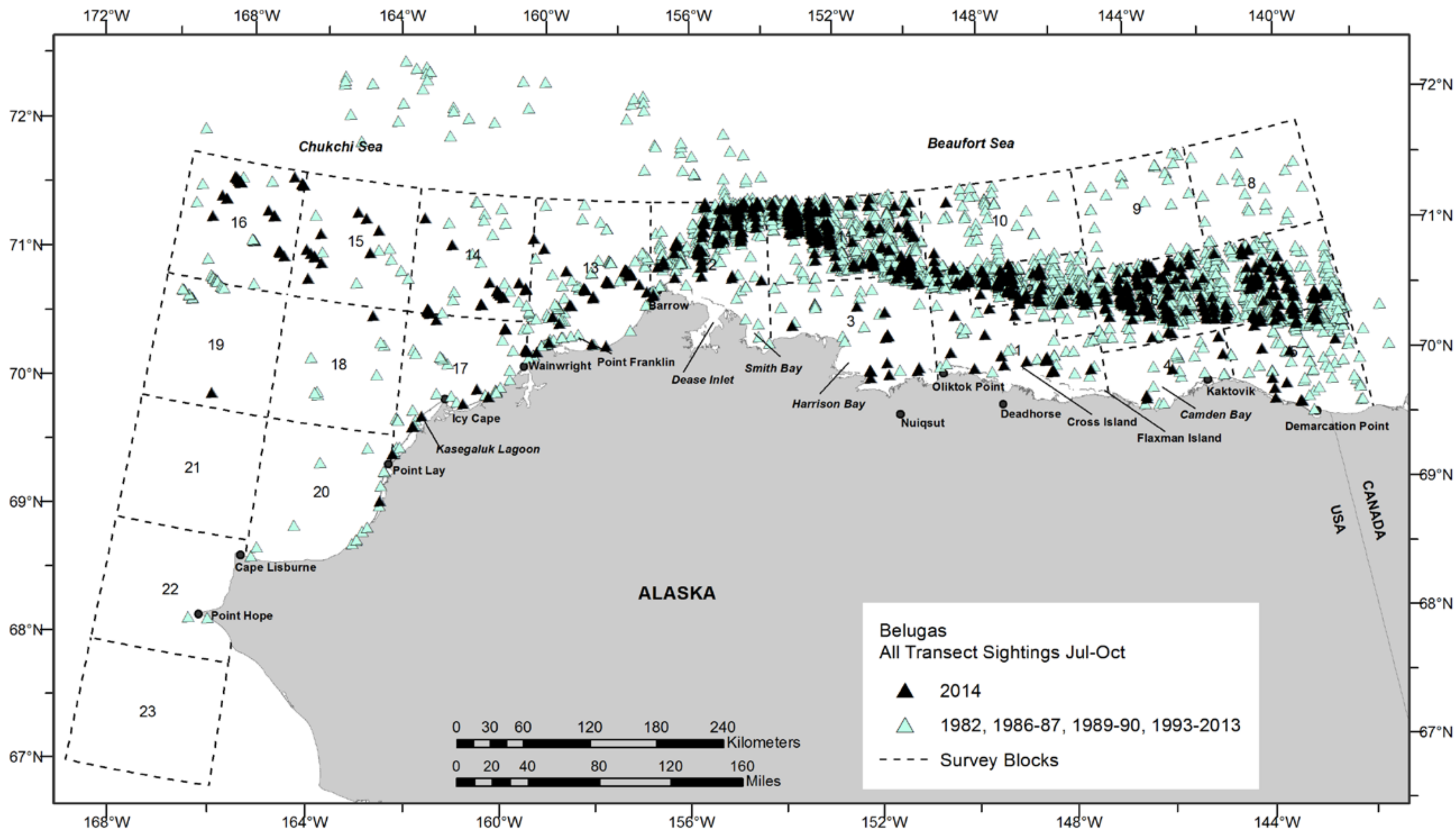


Figure 34. ASAMM beluga sightings on transect in years with light sea ice cover: 1982, 1986-87, 1989-90, 1993-2013, and 2014. Includes all sightings on transect made by primary and secondary observers.

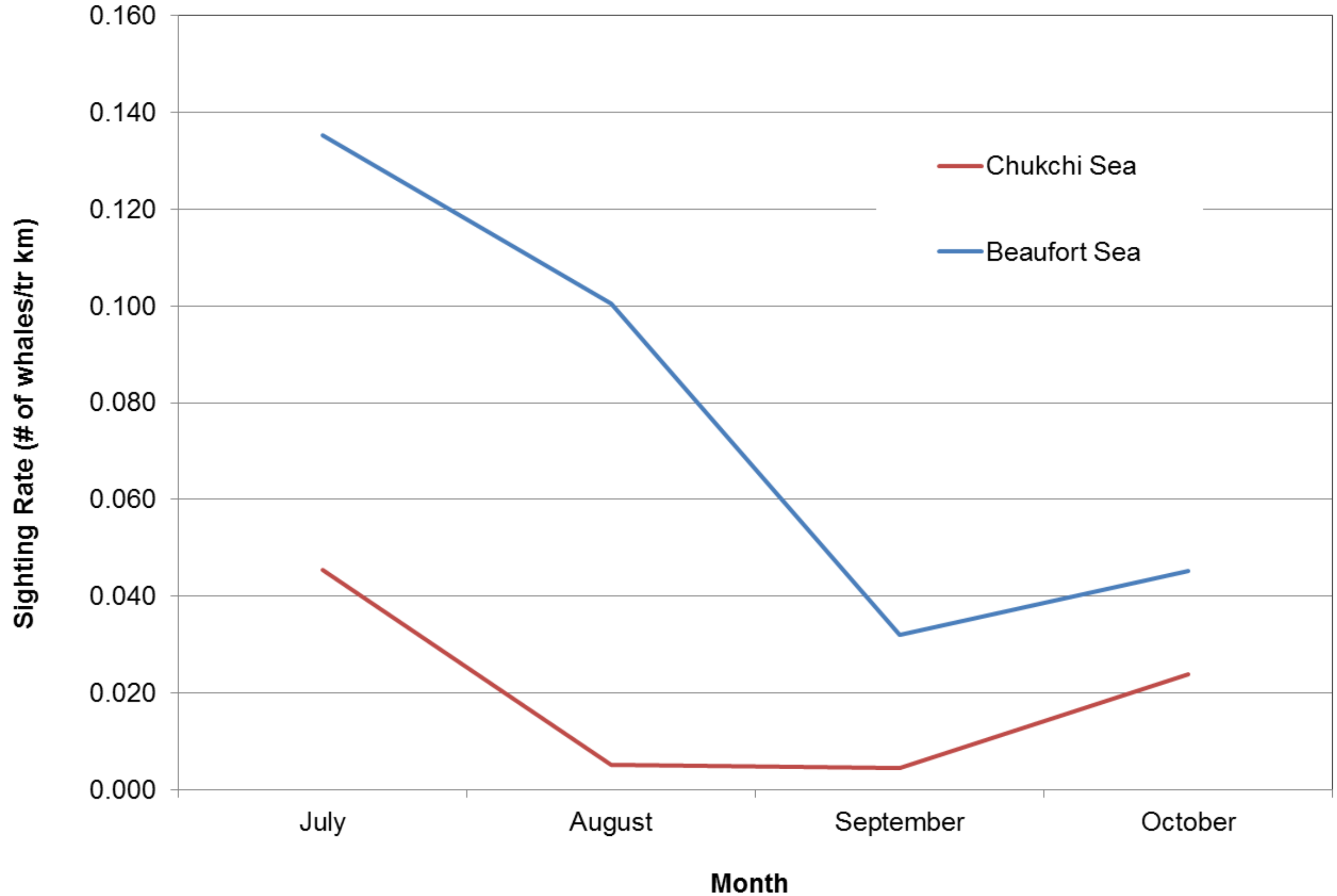


Figure 35. ASAMM 2014 beluga monthly sighting rates (WPUE; transect sightings from primary observers only) in the western Beaufort and eastern Chukchi seas.

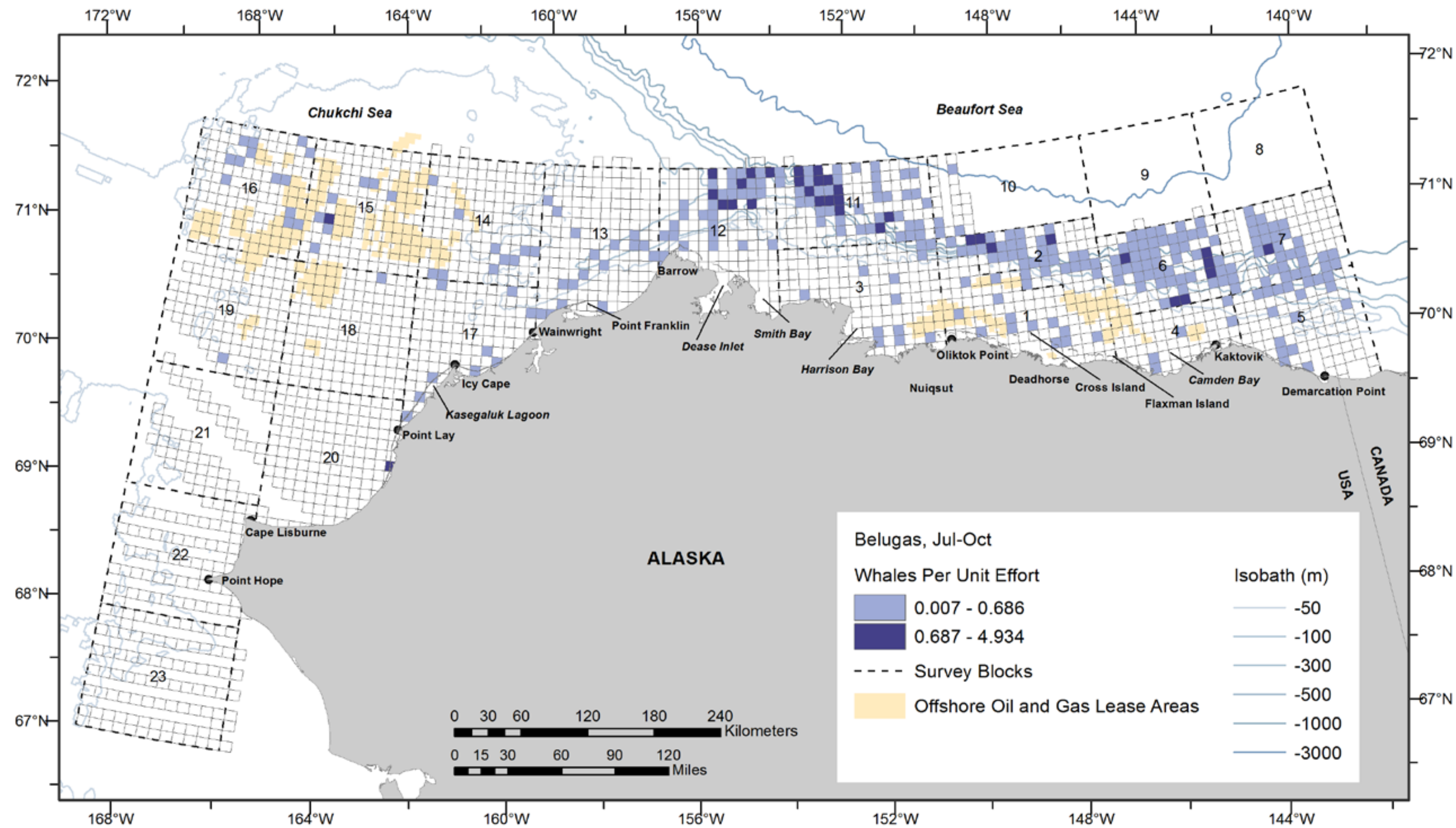


Figure 36. ASAMM 2014 beluga sighting rates (WPUE; transect sightings from primary observers only). Empty grid cells indicate sighting rates of zero. Transect survey effort was not conducted in areas without grid cells.

For all months combined, the highest Tr sighting rates per survey block were in block 6 (0.174 WPUE), block 11 (0.171 WPUE), and block 2 (0.116 WPUE). The combined Tr sighting rate (all survey blocks) in summer (July-August) was nearly three times higher than the combined Tr sighting rate (all survey blocks) in fall (September-October) (Appendix E, Table E-9). Offshore survey blocks in the western Beaufort Sea (i.e., 2, 6, 7, 10, and 11) generally had higher Tr sighting rates than blocks near shore (i.e., 1, 3, 4 and 5) (Figure 37).

Beluga Tr sighting rates per depth zone were highest in the 201-2,000 m depth zone near Barrow Canyon (154°W-157°W) and in the western Beaufort Sea (140°W-154°W) (Figure 38; Appendix E, Table E-10). In the northeastern Chukchi Sea (157°W-169°W), beluga Tr sighting rate per depth zone was highest in the ≤35 m depth zone (Appendix E, Table E-10).

Sighting rates using Tr+TrC sightings and effort were not calculated for belugas because circling from transect was rarely initiated during beluga sightings on transect.

Beluga Sea Ice Associations

Belugas were observed in sea ice cover ranging from no ice to 83% broken floe. Most belugas (87%, n = 2,030) were observed in <10% sea ice cover. Belugas were observed in association with sea ice cover (1-83% sea ice cover) from July through mid-August and towards the end of October when new sea ice was forming. Sea ice was not present in the western Beaufort Sea study area in September (Appendix A, Figure A-6 and A-7), and very few belugas were seen in the northeastern Chukchi Sea where remnant sea ice remained.

Beluga Behaviors

Behaviors of belugas observed during all survey modes (transect, search, and circling) in 2014 are summarized in Table 10. The behavior most often recorded was swimming (59%). Resting was recorded for 488 belugas (21%) and milling was recorded for 434 belugas (19%), including the only large group of belugas seen in 2014. None of the belugas appeared to respond to the survey aircraft.

Swim direction was evaluated for belugas for different regions and time periods. The mean vector swim direction for belugas in the northeastern Chukchi Sea (154°W-169°W, to incorporate Barrow Canyon) in summer (July-August) was not significantly clustered around a mean heading. Swim direction was clustered around a mean heading of 257°T ($Z = 12.267$, $P < 0.0001$) in the northeastern Chukchi Sea in fall (September-October). In the western Beaufort Sea (140°W-154°W), swim direction was significantly clustered around a mean heading of 255°T ($Z = 4.698$, $P = 0.009$) in summer and 274°T ($Z = 15.155$, $P < 0.0001$) in fall.

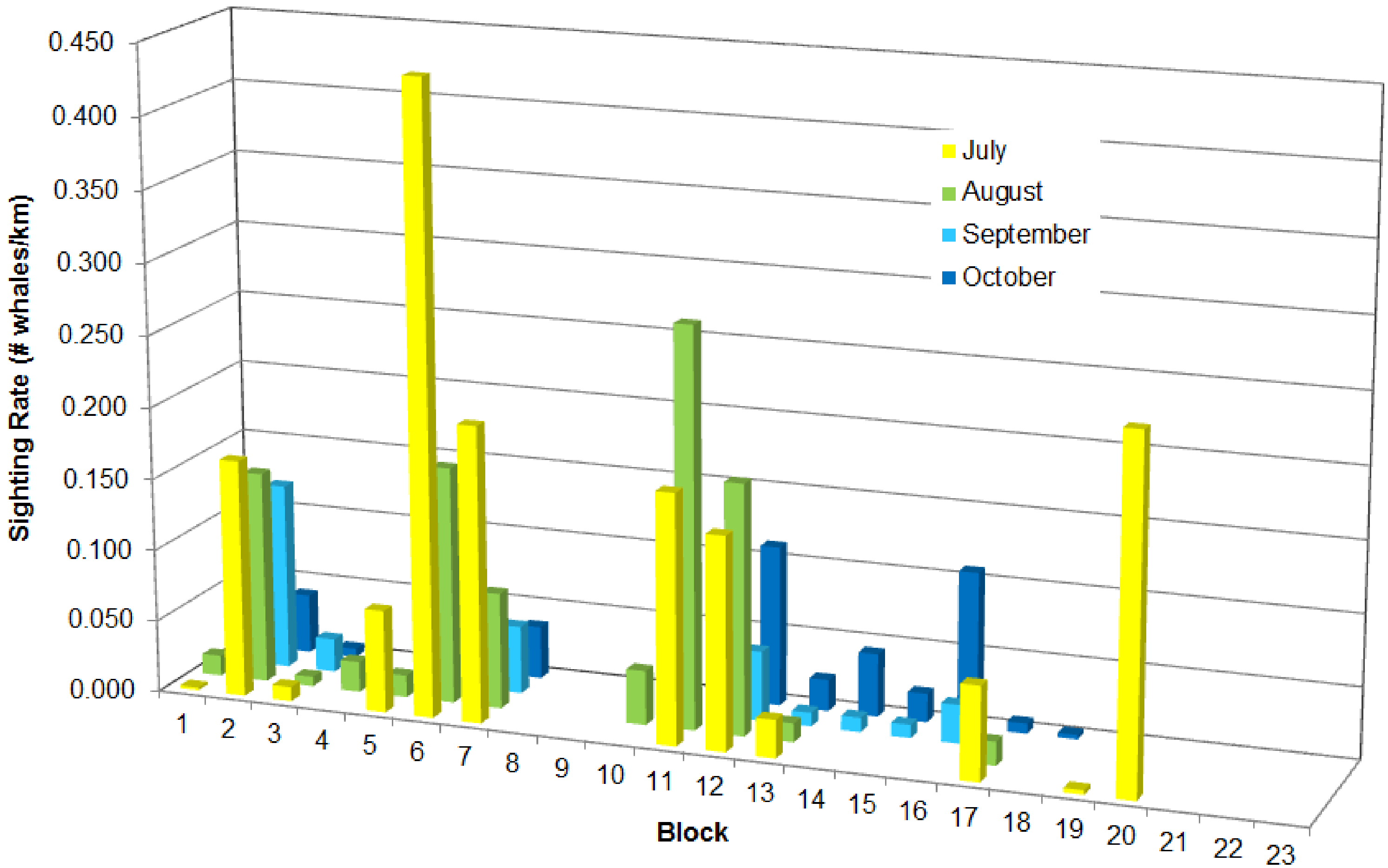


Figure 37. ASAMM 2014 beluga monthly sighting rates (WPUE; sightings from primary observers only) per block for sightings and effort on transect (Tr). Sighting rates of zero were removed from the graph for clarity.

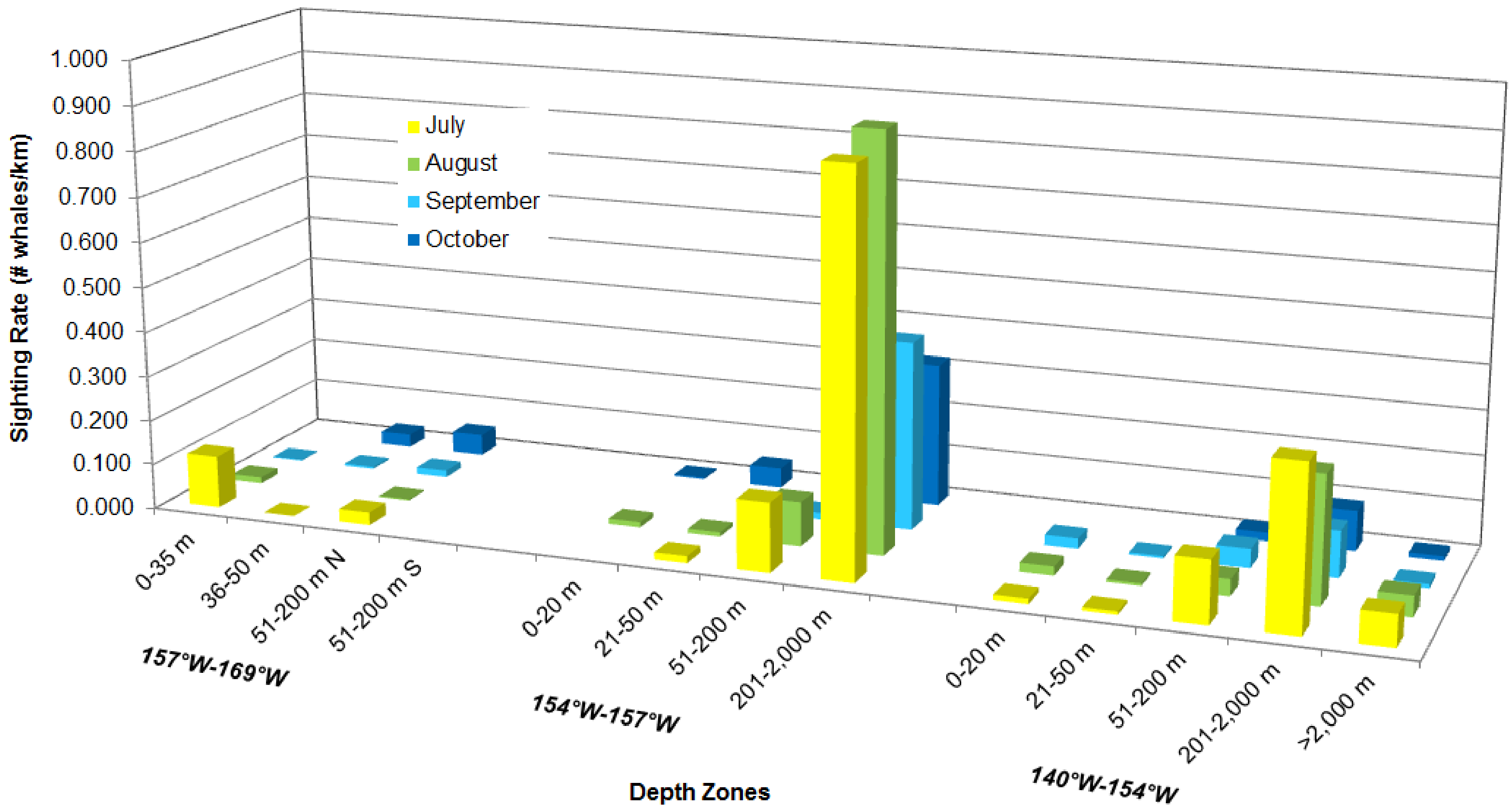


Figure 38. ASAMM 2014 beluga monthly sighting rates (WPUE; sightings from primary observers only) per depth zone for sightings and effort on transect (Tr). Sighting rates of zero were removed from the graph for clarity.

Table 10. ASAMM 2014 semimonthly summary of belugas (number of sightings/ number of individuals) observed during all survey modes (transect, search, and circling), by behavioral category. Excludes dead and same-day repeat sightings.

Behavior	**1-15 Jul**	**16-31 Jul**	**1-15 Aug**	**16-31 Aug**	**1-15 Sep**	**16-30 Sep**	**1-15 Oct**	**16-29 Oct**	**Total**
Dive	0	3/4	3/3	10/10	1/1	0	1/1	0	18/19
Mate	0	1/1	0	0	0	0	0	0	1/1
Mill	2/202	14/40	0	10/66	7/8	18/29	31/89	0	82/434
Rest	4/7	6/9	1/1	164/423	1/3	11/13	20/30	2/2	209/488
Spy hop	0	0	0	1/1	0	0	0	0	1/1
Swim	10/41	163/539	45/75	142/247	60/117	43/88	121/243	17/23	601/1,373
Tail slap	0	1/1	0	0	0	0	1/1	0	2/2
Unknown	0	0	0	7/9	0	0	1/3	0	8/12
TOTAL	16/250	188/594	49/79	334/756	69/129	72/130	175/367	19/25	922/2,330

There were 108 sightings of 145 beluga calves, including 46 cow-calf pairs and 2 calves without adults, observed during all survey modes (transect, search, and circling). Animals identified as calves likely included belugas up to a few years old. Calves nurse for up to 2 years but may remain with their mothers after weaning has occurred (Suydam 2009), often forming triads when a new calf is born. Color is also not a good indication of age because beluga calves lighten progressively over time, changing from charcoal gray at birth to blue-gray then light gray before becoming completely white by 7-9 years of age. Beluga calf sightings were scattered across the western Beaufort Sea slope and the northern survey blocks in the Chukchi Sea (Figure 39), although a few were seen near barrier islands in the Beaufort Sea. Calves were seen throughout summer and fall, with the largest number of calves seen near the southern end of Kasegaluk Lagoon, Alaska, in July. Beluga calves are likely under-represented in the dataset because of their small size and the infrequency of circling over beluga sightings.

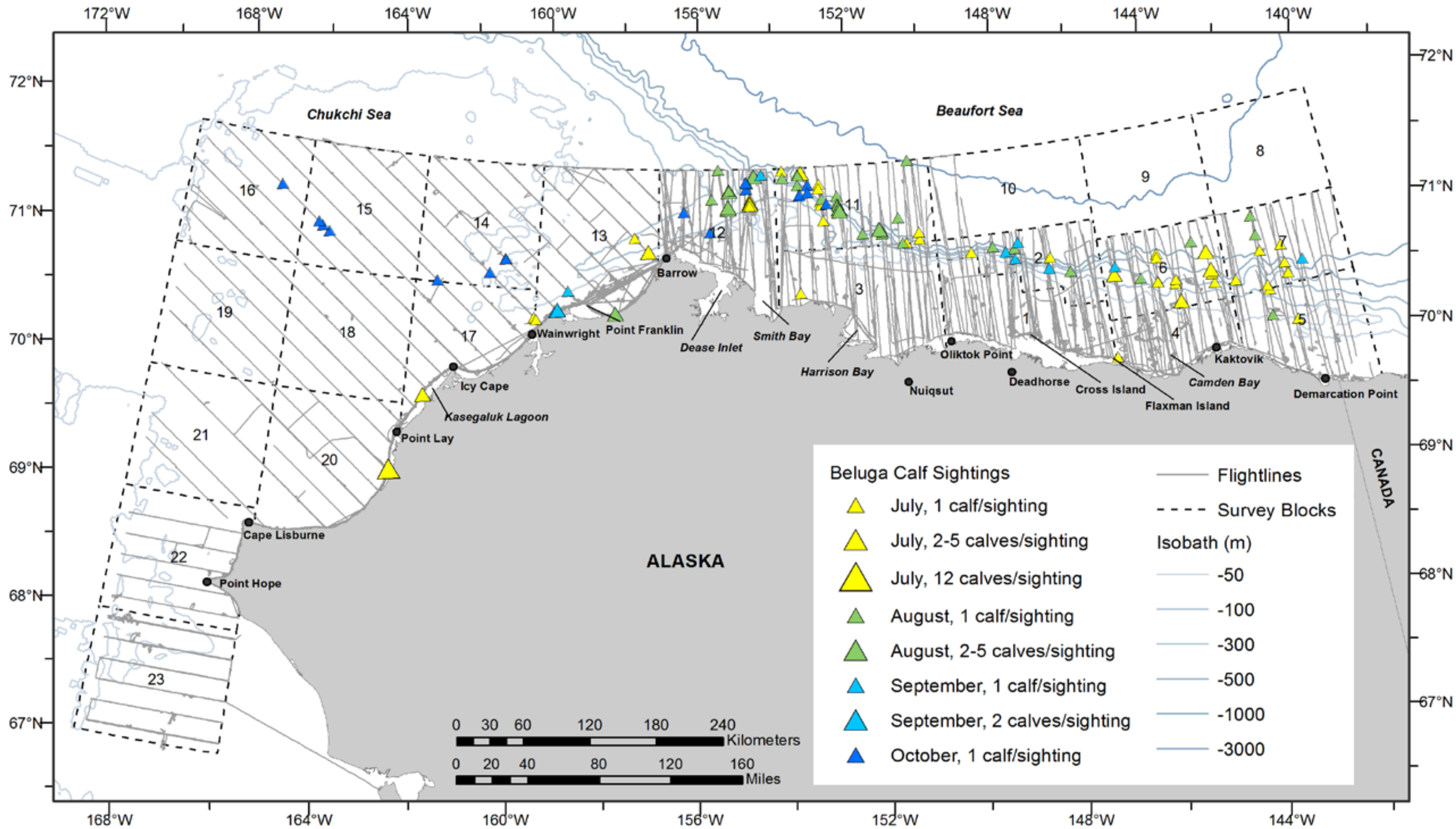


Figure 39. ASAMM 2014 beluga calf sightings, with transect, search, and circling effort. Deadhead flight tracks are not shown.

Unidentified Cetaceans and Unidentified Marine Mammals

Sightings were recorded as unidentified whenever a positive species identification was not possible. This usually occurred when an animal dived and could not be resighted or when environmental conditions such as fog, low cloud ceilings, or glare prevented circling to relocate the initial sighting. There were 44 sightings of 51 unidentified cetaceans in 2014 (Table 3; Figure 40). Fifteen of the unidentified cetaceans were in the eastern Chukchi Sea, and 35 unidentified cetaceans were in the western Beaufort Sea. Three of the unidentified cetaceans were probable bowhead whales, based on their size and darker color. One unidentified cetacean was a possible minke whale, based on size and shape. The majority of unidentified cetacean sightings were not seen clearly enough to identify to species with any probability. There were also four sightings of four single unidentified marine mammals (Figure 40); none of them were seen clearly enough to identify to species with any probability.

None of the unidentified cetaceans or marine mammals appeared to respond to the survey aircraft.

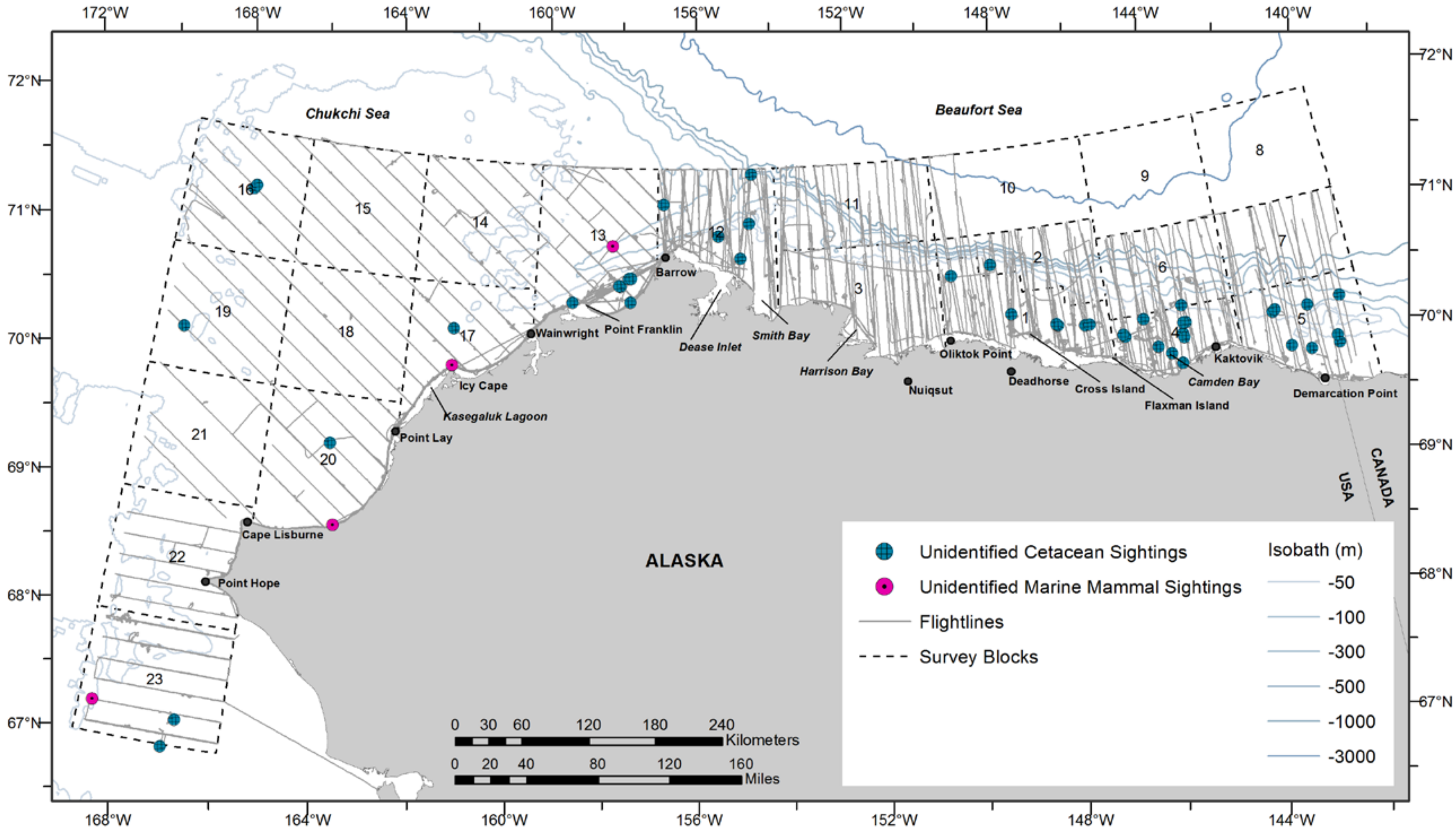


Figure 40. ASAMM 2014 unidentified cetacean and unidentified marine mammal sightings, with transect, search, and circling effort. Deadhead flight tracks are not shown.

Pinnipeds

Walruses

Pacific walruses (*Odobenus rosmarus divergens*) were observed every month in the eastern Chukchi Sea (Figure 41). Excluding dead walruses and walruses that were known to be duplicate sightings within the same day, there were 319 sightings of 56,675 walruses observed from July to October 2014 (Tables 3 and 11). This total is artificially high because it includes resightings of a large, coastal walrus haulout near Point Lay. When only the highest group size estimate of the haulout is taken into account (1 sighting of 35,000 walruses) and resightings of the haulout are excluded, there were 317 sightings of 48,675 walruses in 2014. Excluding all sightings of the Point Lay haulout, most walruses (94%, n = 12,807) were sighted in July and August, with the majority of sightings in the northeastern Chukchi Sea. A few walruses (4 sightings of single animals) were observed in the western Beaufort Sea from Point Barrow east to 154.2°W.

In July and August, when sea ice and shorefast ice were still present in the study area, most walruses were observed hauled out on ice (95% of July-August total walruses observed, 88 sightings of 12,216 walruses). Walruses hauled out on ice were in groups ranging in size from 1 animal to 910 animals. Walruses not hauled out were observed swimming, resting, milling, or diving. In early September, when sea ice had receded north and the study area was essentially ice-free (Appendix A, Figure A-6 and A-7), walruses were observed only in open water and were starting to congregate nearshore. In late September, walruses were sighted offshore on Hanna Shoal, at and near a coastal haulout near Point Lay, in Ledyard Bay, and in the southcentral Chukchi Sea. In October, walrus distribution was similar to September but there were far fewer sightings.

The coastal haulout on a barrier island near Point Lay was first documented by ASAMM on 19 September (Appendix B, Flight 235). The 2014 haulout was located approximately 11 km northeast of Point Lay close to the location of walrus haulouts documented during ASAMM surveys in 2010 (Clarke et al. 2011d), 2011 (Clarke et al. 2012), and 2013 (Clarke et al. 2014). The aggregation was observed on two subsequent surveys in late September (23 and 27 September). Group size estimates ranged from 1,500 to 35,000 individuals (Figure 42). After consultation with USFWS, ASAMM surveys were not conducted near Point Lay after 27 September to avoid any possible impacts to the haulout. Aerial surveys conducted by USGS in 2014 confirmed that the haulout was occupied from at least 12 September through 6 October (B. Battaile, USGS, pers comm to J. Clarke, 5 January 2015). In past years, haulouts on shore have dispersed by early October (Clarke et al. 2012).

There were 814 walruses (representing 1.5% of all walruses sighted) that appeared to respond to the survey aircraft. Reactions included flushing from ice floes into the water (803 walruses) and diving (11 walruses). No walruses in the large coastal haulout appeared to respond to the survey aircraft. Surveys near the haulout maintained a minimum lateral distance of 1 km and minimum altitude of 458 m.

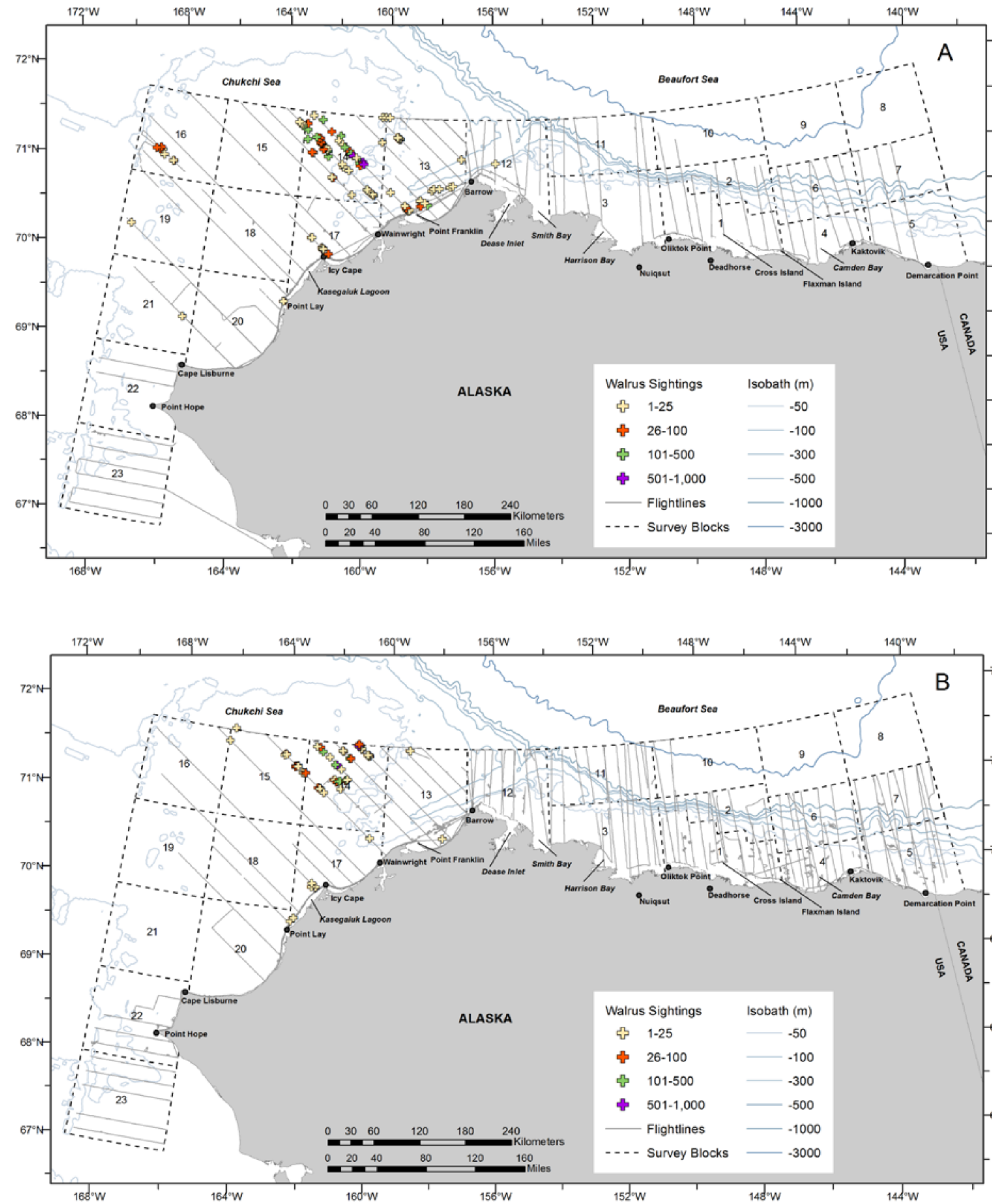


Figure 41. ASAMM 2014 walrus sightings plotted by month, with transect, search, and circling effort. A: July; B: August. Deadhead flight tracks are not shown.

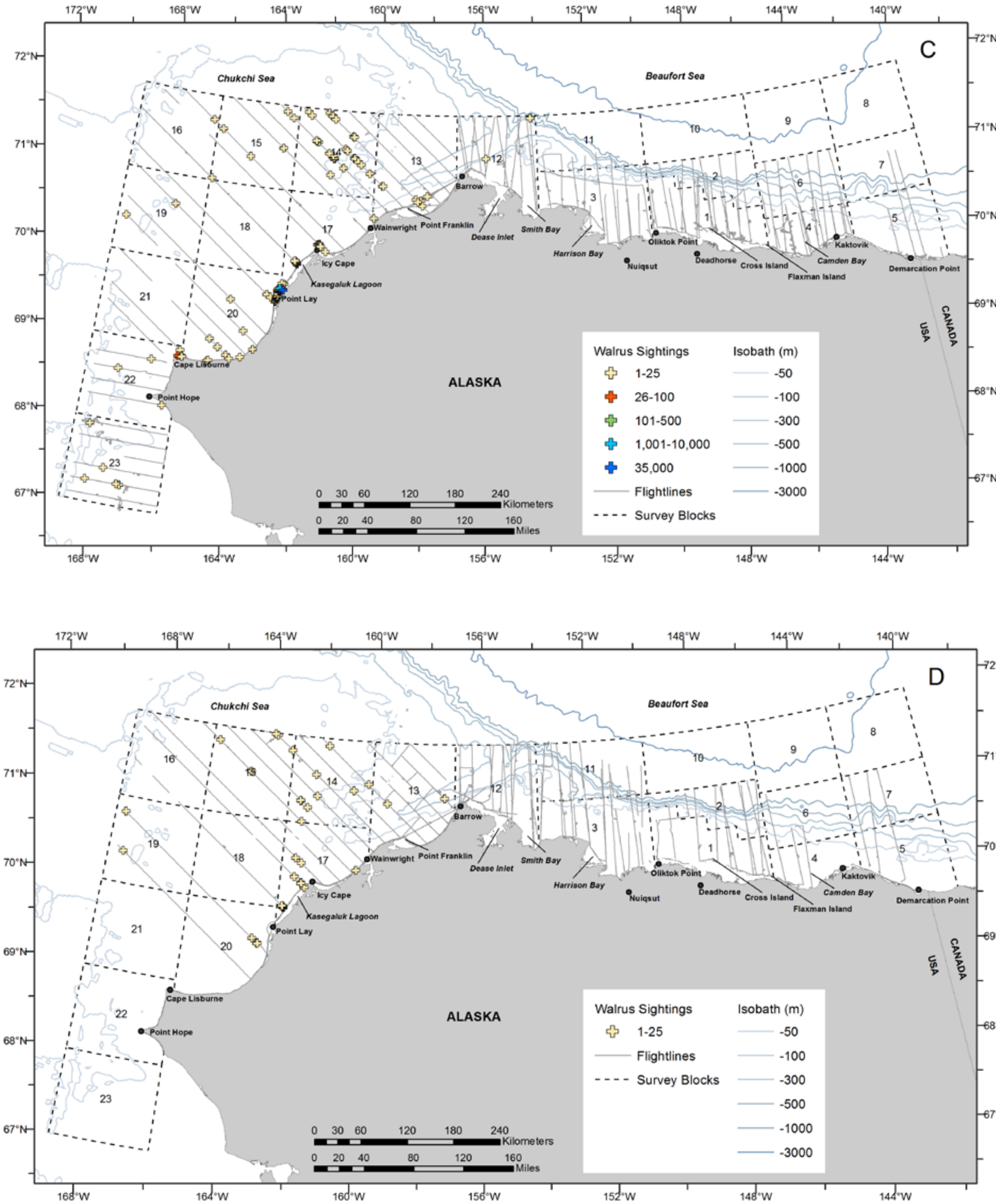


Figure 41 (cont.). ASAMM 2014 walrus sightings plotted by month, with transect, search, and circling effort. C: September; D: October. Deadhead flight tracks are not shown.

Table 11. ASAMM 2014 walrus sightings observed during all survey modes (transect, search, and circling).

	No. Sightings	No. Individuals
Dead*	14	98
Highest estimate of Point Lay haulout**	1	35,000
Total, including all sightings	334	57,973
Total, excluding dead and same-day repeat sightings	319	56,675
Total, excluding dead, same-day repeat, and additional Point Lay haulout sightings***	317	48,675

* May include duplicates of carcasses sighted on different survey dates.

** Highest group size estimate was observed on 9/27/2014.

*** Includes only the highest estimate of the Point Lay haulout.

Figure 42. Walrus haulout near Point Lay, Alaska, 27 September 2014. Photo by Corey Accardo (NMFS) under U.S. Fish and Wildlife Permit No. MA212570.

Other Pinnipeds

Pinnipeds were distributed throughout the extent of the study area, primarily on the continental shelf. Relatively few pinnipeds were seen in Harrison Bay, in the northwesternmost areas of the Chukchi Sea study area (block 16), or in offshore areas of the Chukchi Sea west of Point Lay. Two large groups of unidentified pinnipeds, likely spotted seals, were seen hauled out on a barrier island east of Icy Cape on 23 September (Figure 43). Sighting rates (number of animals per transect km) in 2014 were higher than sighting rates in 2009-2013 (Figure 44). When the two large groups of pinnipeds were excluded from analysis, sighting rates in 2014 were similar to those observed in 2009 (0.044 PPUE).

Bearded seals (*Erignathus barbatus*; 7 sightings of single seals) were observed from mid-July through late September (Figure 45). All bearded seals were in the water; no bearded seals responded to the aircraft.

Other pinnipeds were not identifiable to species and were recorded as unidentified pinnipeds (135 sightings of 160 animals) or small unidentified pinnipeds (1,021 sightings of 3,505 animals) (Figure 45). The unidentified pinniped categories included sightings of pinnipeds that could not be identified to species due to the short amount of time that the animal was visible and the altitude of the survey aircraft (>305 m). Unidentified pinnipeds likely included sightings of ringed (*Pusa hispida*), spotted (*Phoca largha*), and bearded seals, in addition to small walruses. Small unidentified pinnipeds included sightings of small pinnipeds (ringed and spotted seals and possibly juvenile bearded seals) only. The distributions of ringed, spotted and bearded seals overlap in the western Beaufort Sea (Lowry et al. 1998; Angliss and Allen 2009; Boveng et al. 2009); behaviors and physical characteristics observable from the survey altitude of the ASAMM aircraft are not distinguishable enough to allow positive species identification (NMML, unpublished data; D. Rugh and D. Withrow, NMML-AFSC, pers. comm. to J. Clarke, 8 December 2009).

Three hundred twenty-two unidentified pinnipeds (9%) appeared to respond to the aircraft. Most pinnipeds responded by diving, but 170 pinnipeds hauled out near Icy Cape responded by flushing from the haulout and entering the water.

Figure 43. Unidentified pinnipeds (likely spotted seals) hauled out near Icy Cape, Alaska, 23 September 2014. Photo by Corey Accardo (NMFS) under NMFS Permit No. 14245.

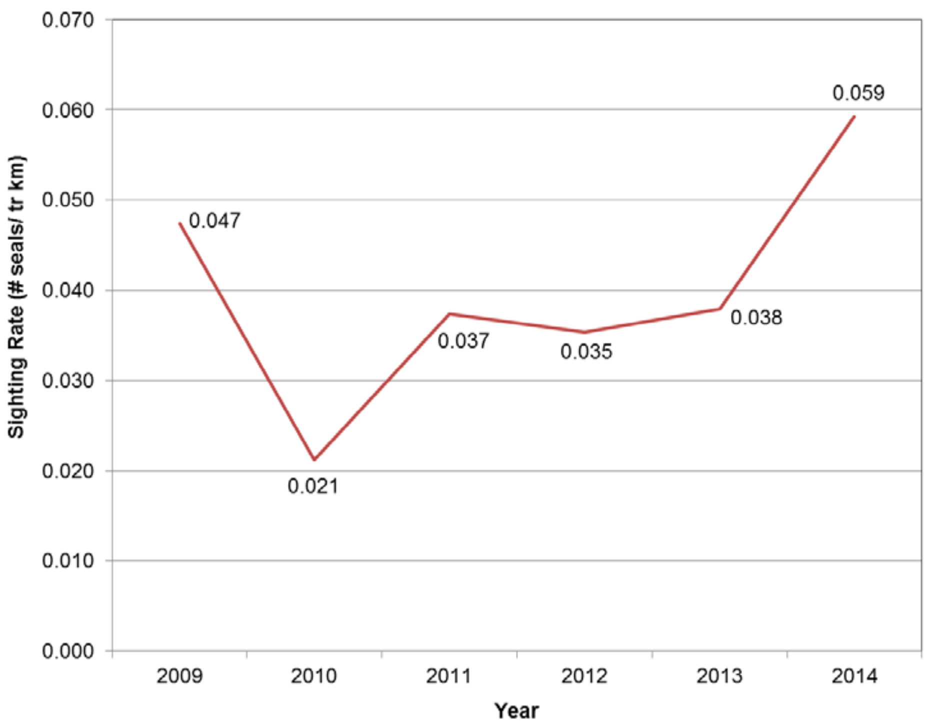


Figure 44. ASAMM unidentified pinniped (includes small unidentified pinnipeds) annual sighting rates (PPUE; transect sightings from primary observers only), 2009-2014.

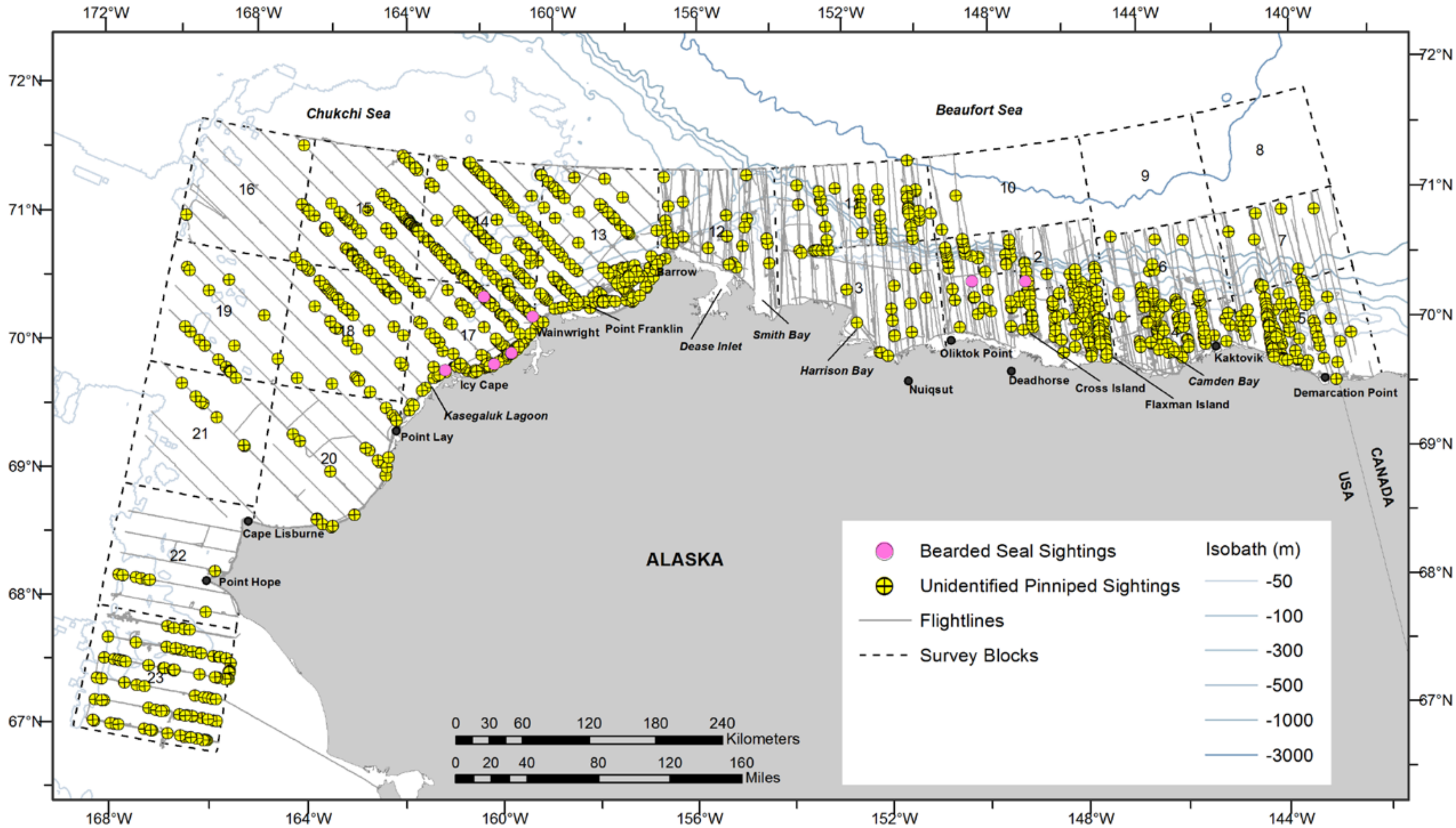


Figure 45. ASAMM 2014 bearded seal and unidentified pinniped sightings, with transect, search, and circling effort. Deadhead flight tracks are not shown.

Polar Bears

There were 45 sightings of 196 polar bears (*Ursus maritimus*) during ASAMM 2014 (Figure 46). In the northeastern Chukchi Sea, 4 sightings of single polar bears were observed. One bear was sighted 153 km from shore, swimming in an area of 50% broken floe sea ice on 25 July. There were 3 sightings of single bears on shore or on barrier islands between Wainwright and Barrow.

In the western Beaufort Sea, most polar bear sighting were from east of Katktovik to Oliktok Point and between Smith Bay and Point Barrow. All polar bear sightings were nearshore; no polar bears were observed swimming offshore. There is no coastal transect in the Beaufort Sea, and transits to and from survey blocks were often on deadhead or over land. Therefore, there is less opportunity to observe polar bears along the Beaufort Sea coastline, where they would most likely be seen when the ice edge has receded offshore, than in the Chukchi Sea where a coastal transect is frequently flown.

Most polar bears (34 sightings of 182 bears) were seen east of Deadhorse, concentrated on Cross Island, northeast of Deadhorse, or near Kaktovik. Cross Island and Kaktovik attract scavenging polar bears because bowhead whale carcasses from fall subsistence harvests are hauled to those locations by villagers from Nuiqsut, Alaska (who base from Cross Island northeast of Deadhorse), and Kaktovik. A few polar bears were also seen on barrier islands between Cross and Flaxman islands.

Bears were seen on Cross Island on 4 days: 3 bears on 17 August, 21 bears on 28 August, 26 bears (including 4 cubs) on 22 September, and 48 bears (including 9 cubs) on 3 October (count verified post-flight from photographs). Bears were seen near Kaktovik on 4 days: 3 bears on 23 August, 23 bears on 11 September, 35 bears (including 2 cubs) on 21 September, and 4 bears on 27 September. Some of these bears may have been repeat sightings.

Polar bears were observed swimming, walking, running, resting, milling, and feeding. In addition to the bear observed offshore in July in the northeastern Chukchi Sea, 3 polar bears were observed swimming within 1 km of shore in the western Beaufort Sea.

The majority of bears (97%) sighted did not respond to the survey aircraft. Six bears (3%) did appear to react to the survey aircraft. Reactions included looking up at the aircraft (5 bears), and changing swimming direction (1 bear). The bear that changed swim direction was 1 km from shore.

Beginning in 2012, photographs were occasionally taken of polar bears on Cross Island and Bernard Spit near Kaktovik and analyzed post-flight to count the total number of bears (Clarke et al. 2013a). In some of these instances, the final group size more than doubled the initial estimate once the photo analysis was completed. In 2014, there were few opportunities to photograph

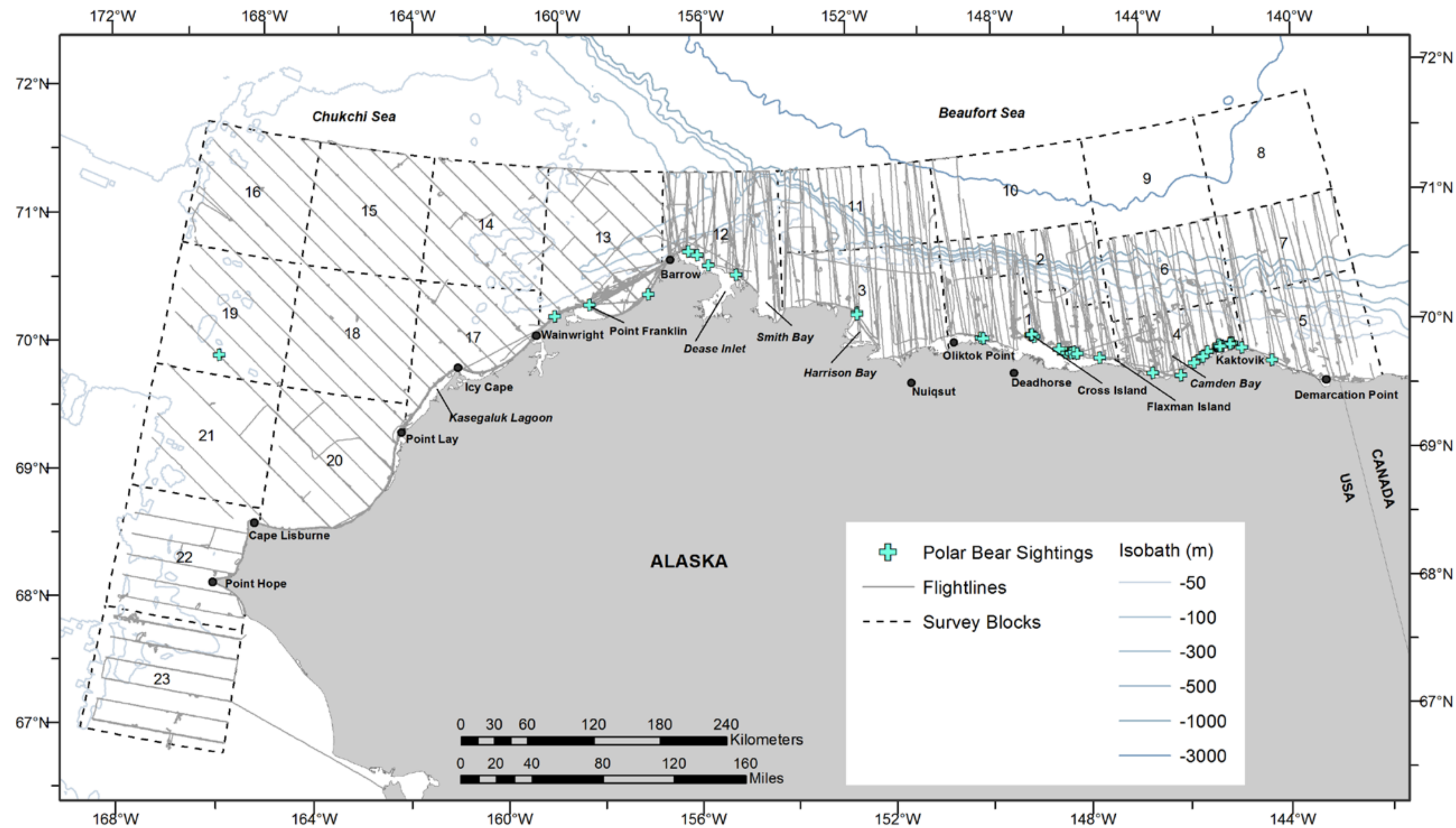


Figure 46. ASAMM 2014 polar bear sightings, with transect, search, and circling effort. Deadhead flight tracks are not shown.

these locations due to inclement weather, survey priorities, or fuel limitations. Photographs were taken of Cross Island on 1 day in 2014 (3 October), and post-flight analysis of the images changed the total number of bears sighted from 22 to 48 polar bears, as indicated in the final group size estimate in the ASAMM database. These results suggest that initial polar bear counts at known polar bear aggregation areas such as Cross Island or near Kaktovik are likely under-estimates. Furthermore, photographic images from the ASAMM aircraft rarely capture the entire area of a location (e.g., all of Cross Island or Bernard Spit), so polar bears that were present at a location but not photographed would not be included in the revised total number.

Dead Marine Mammals

There were 31 sightings of 115 dead marine mammals in 2014 (Table 12), although 8 of the sightings were repeats of earlier observations (Figure 47). Most (85%) of the carcasses observed were walruses, and most of those carcasses were associated with the walrus haulout near Point Lay. Sixteen of the carcasses observed were cetaceans, including gray whales (9 sightings of single animals), belugas (1 sighting of 1 animal), and unidentified cetaceans (6 sightings of single animals). Two carcasses were in advanced state of decomposition and not identifiable beyond “marine mammal”. Eleven of the carcasses were observed in open water and 104 were on the beach.

Level A stranding forms were completed by field teams and forwarded to personnel at the North Slope Borough (NSB) Department of Wildlife Management (all sightings), NMFS (cetaceans and ice seals) and U.S. Fish and Wildlife Service (USFWS; walruses).

Table 12. ASAMM 2014 dead marine mammal sightings, all survey modes (transect, search, and circling).

Flight No.	Date	Latitude (°N)	Longitude (°W)	**Species**	No. Individuals	Habitat
202	5-Jul-14	70.442	162.016	walrus	1	open water
213	26-Jul-14	70.888	159.098	unidentified marine mammal	1	open water
215	29-Jul-14	70.713	160.588	gray whale	1	open water
215	29-Jul-14	70.489	161.372	walrus	1	open water
218	4-Aug-14	68.108	167.038	walrus	1	open water
219	6-Aug-14	70.526	160.359	walrus	1	beach
219	6-Aug-14	70.535	160.277	walrus	1	beach
219	6-Aug-14	70.882	159.092	unidentified marine mammal	1	open water
227	24-Aug-14	68.104	166.305	walrus	1	open water
228	27-Aug-14	71.209	156.991	gray whale	1	beach
228	27-Aug-14	71.283	156.843	gray whale	1	beach
232	4-Sep-14	67.938	168.275	gray whale	1	open water
232	4-Sep-14	67.914	168.524	walrus	1	open water
233	5-Sep-14	69.715	163.110	gray whale	1	beach
233	5-Sep-14	70.131	162.487	unidentified cetacean	1	beach
233	5-Sep-14	70.874	159.228	gray whale	1	beach
233	5-Sep-14	71.210	156.988	gray whale	1	beach
234	6-Sep-14	70.140	162.512	unidentified cetacean	1	beach
235	19-Sep-14	69.116	163.607	unidentified cetacean	1	beach
236	21-Sep-14	71.869	158.251	beluga	1	open water
238	23-Sep-14	69.825	163.008	walrus	50	barrier island
238	23-Sep-14	68.822	166.219	walrus	1	beach
238	23-Sep-14	69.212	167.935	walrus	1	open water
238	23-Sep-14	69.456	163.164	gray whale	1	barrier island
238	23-Sep-14	69.705	163.108	unidentified cetacean	1	barrier island
238	23-Sep-14	70.304	161.362	walrus	1	barrier island
238	23-Sep-14	70.875	159.218	unidentified cetacean	1	barrier island
240	27-Sep-14	69.824	163.027	walrus	36	barrier island
241	28-Sep-14	70.912	158.778	unidentified cetacean	1	barrier island
245	6-Oct-14	70.894	159.011	walrus	1	beach
245	6-Oct-14	71.292	156.813	gray whale	1	beach

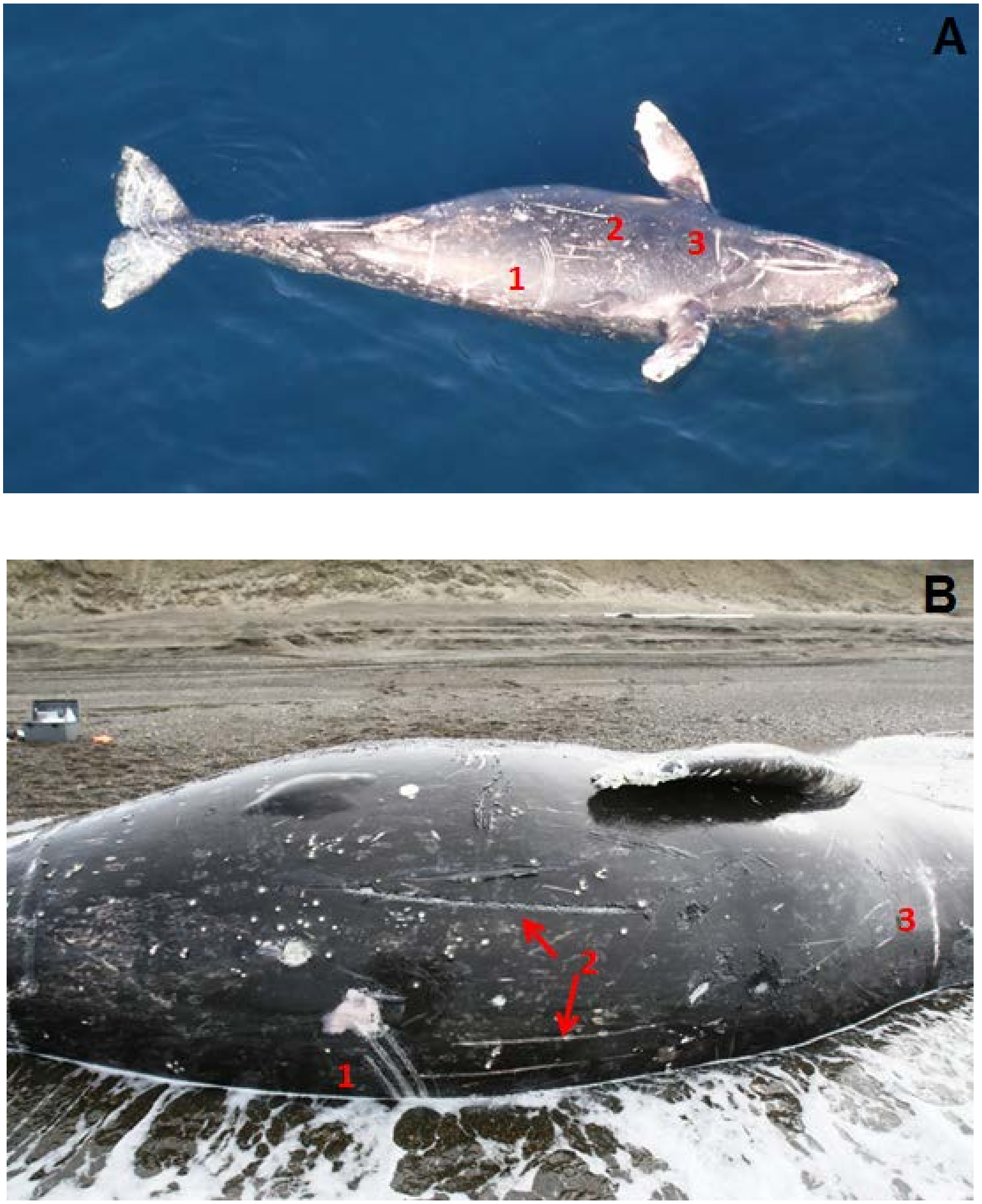


Figure 47. Gray whale carcass sighted in the northeastern Chukchi Sea. A: carcass sighted by ASAMM approximately 20 km northwest of Wainwright, Alaska, on 29 July 2014 (Appendix B, Flight 215) (photo by Cynthia Christman, NMFS); B: same carcass found by the NSB Department of Wildlife Management on the beach just south of the Barrow airport on 2 August 2014 (photo by NSB). The numbers on the photos indicate the scars used to identify the carcass.

Accomplishments and Outreach

ASAMM incorporated walrus reconnaissance surveys into survey effort in mid-July to assist with USGS satellite tagging efforts and coordinated with USGS photographic teams to allow for shared use of the survey aircraft for photography of a walrus haulout at Point Lay.

ASAMM successfully incorporated a new survey block (23) into the existing survey repertoire without sacrificing the efficacy of the overall project.

Data from ASAMM 2014 were shared throughout the field season with researchers and interested parties within BOEM and other agencies:

- Daily reports of flight and sighting information were posted to the ASAMM project website.
- Ice data, including photos of representative sea ice cover, were sent to the National Weather Service Ice Desk, Alaska Center for Climate Assessment and Policy, NOAA National Ocean Service, U.S. Coast Guard (USCG), USFWS, University of Alaska Fairbanks (UAF), Pacific Marine Environmental Laboratory (PMEL), and BOEM.
- Biweekly effort and sighting summary figures were sent to BOEM, NMML, PMEL, Alaska Department of Fish and Game (ADF&G), NSB, and the USCG to provide an overview of data collected.
- Biweekly walrus sighting figures showing distribution and group size were sent to researchers at BOEM, USFWS, USGS, ADF&G, NSB, and the Alaska SeaLife Center.
- Biweekly polar bear sighting figures were sent to BOEM, USFWS, USGS, ADF&G, and NSB.
- Cetacean sighting data were shared with UAF and Woods Hole Oceanographic Institution (WHOI) to assist with underwater glider research.
- All Level A stranding forms (27 total forms) were sent to the relevant agencies: NMFS and NSB received forms for cetaceans and ice seals, and USFWS and NSB received forms for walruses.

Community outreach in 2014 included:

- Developing an ASAMM outreach flyer for distribution to BOEM, NMFS, NSB, Northwest Arctic Borough, Alaska Eskimo Whaling Commission, Alaska Beluga Whale Committee, Native villages and tribal councils, and UAF (included in Appendix C).
- Meeting with the North Slope Borough Search and Rescue to familiarize them with our project.
- Sending the Deadhorse and Kaktovik Whaling Communication Center emails with flight plans prior to and after every survey flight that occurred in the Beaufort Sea during the fall whaling season.
- Pre-season and in-season communication with Principal Investigators of unmanned aircraft projects operating in the study area to minimize risk to both projects.
- Posting daily reports to the NMML website within ~24-48 hrs after completion of each ASAMM flight.

Marine mammal photos taken by ASAMM personnel in 2014 were shared with interested parties in the federal government, media, and non-governmental organizations, including NOAA, BOEM, NSB, USFWS, USGS, and World Wildlife Fund. Media efforts were coordinated through NOAA and BOEM Public Affairs Offices.

ASAMM provided subsets of the 1982-2013 database to several research groups planning or conducting various studies in, or near, the ASAMM study area. These groups included, but were not limited to BOEM, NMFS Alaska Regional Office, PMEL, NMFS Protected Resources Division, USFWS, UAF, World Wildlife Fund, University of Texas, NSB, and USCG.

Results from the 2014 ASAMM field season were presented at several venues, including:

Berchok et al. 2014. DBO presentation. Distributed Biological Observatory Workshop, Seattle, WA, October 2014.

Brower, A., J. Clarke, and M. Ferguson. 2015. Gray whale occurrence in the Beaufort Sea. Poster presented at the Alaska Marine Science Symposium, Anchorage, AK, January 2015.

Clarke, J., A. Brower, M. Ferguson, C. Sims, V. Beaver, J. Gatzke, and B. Lynch. 2015. Large cetacean occurrence in the south-central Chukchi Sea, summer and fall 2014. Poster presented at the Alaska Marine Science Symposium, Anchorage, AK, January 2015.

Ferguson, M., J. Clarke, A. Harcombe, W. Hetrick, and S. Wisdom. 2015. A new bird in the Alaskan Arctic: lessons learned during coordination of manned and unmanned aerial operations in 2013 and 2014. Poster presented at the Alaska Marine Science Symposium, Anchorage, AK, January 2015.

A complete listing of publications, posters and oral presentations from the ASAMM project (and its precursors BWASP and COMIDA) from 2008 to 2014 is included in Appendix C. Also included are PDF copies of 2014 media reports related to ASAMM.

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DISCUSSION

Conclusions

Sea ice conditions in 2014 were similar to conditions observed in most recent years. Sea ice remained in the study area through mid-August before receding north of 72°N. Environmental conditions related to large expanses of relatively warm water overlaid by colder air temperatures include low cloud ceilings, fog, and high sea states. These conditions were often encountered in 2014 and adversely affected survey effort, particularly in early to mid-August, mid-September, and late October.

Broad-scale aerial surveys were conducted regularly in the western Beaufort Sea in summer months (July-August) in 2014 for the third consecutive year. Bowhead whale distributions in July (on the outer continental slope and shelf; 51-2,000 m depth) and August (on the inner and outer continental shelf and slope; 0-2,000 m depth) 2014 were similar to those observed in summer 2012-2013 (Clarke et al. 2013a, 2014), although the number of sightings (Figure 48B) and sighting rates were lower than those observed in summer 2013 (Figure 49). The high sighting rates observed in 2013 in the western Beaufort Sea may have been due to fewer feeding opportunities in the Canadian Beaufort Sea. There are four to five recurrent bowhead whale feeding areas in the Canadian Beaufort Sea (Harwood and Smith 2002), and the shallow shelf offshore of the Tuktoyaktuk Peninsula and Cape Bathurst are areas used most consistently (Harwood et al. 2010). Citta et al. (2015) identified these two areas as core-use areas based on bowhead whale satellite telemetry results from 2006 to 2012. In this area, strong upwelling may occur wherein Pacific-derived, cold, nutrient rich water from Amundsen Gulf is carried onto the Canadian Beaufort Shelf (Walkusz et al. 2012). Upwelling is strongest when a northward-flowing current converges near Cape Bathurst (Williams and Carmack 2008), which is a condition that concentrates bowhead whale prey. In 2013, dispersed sea ice remained present near Cape Bathurst until early September (U.S. National Ice Center 2013), suggesting that the northward-flowing current, and associated upwelling winds, were relatively weak in July and August. One-third of the bowhead whales observed by ASAMM in the western Beaufort Sea in summer 2013 were feeding or milling, suggesting that some bowhead whales left the Canadian Beaufort in summer to search for feeding opportunities elsewhere. Conversely, in summer 2014, sea ice was absent by mid-July in the Canadian Beaufort Sea, including areas near the Tuktoyaktuk Peninsula and Cape Bathurst (U.S. National Ice Center 2014), perhaps indicating the presence of upwelling and good bowhead whale feeding opportunities throughout summer.

Survey coverage in the western Beaufort Sea in summer 2012, 2013, and 2014 was temporally and geographically similar (Figure 48A). Bowhead whale distribution in the western Beaufort Sea (all sightings regardless of effort mode or observer type) in summer 2012, 2013, and 2014 was also generally similar, with the majority of sightings east of 150°W. Differences between summer 2014 and earlier years included relatively few sightings in block 12 (154°W-157°W), large groups of bowhead whales in very shallow depths in Camden Bay, and sightings limited to ≤50 m depth east of Kaktovik (Figure 48B). The presence of bowhead whales in very shallow

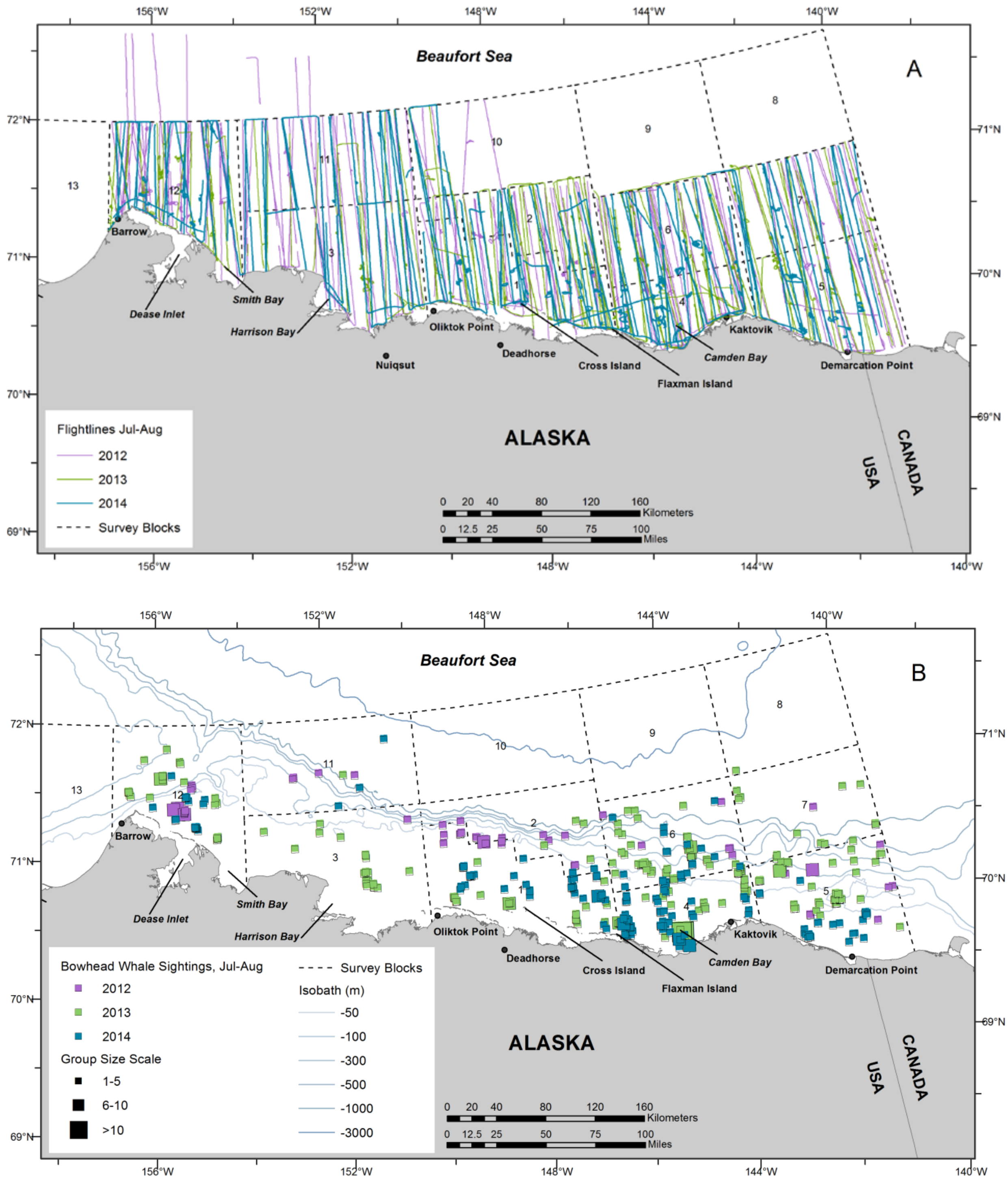

Figure 48. ASAMM 2012-2014 summer (July-August) survey effort and bowhead whale sightings. A: survey effort, all survey modes (transect, search, and circling); B: bowhead whale sightings, by group size, all survey modes.

areas of Camden Bay persisted from mid-August into late September and was correlated with feeding and milling activity there. Sighting rates in the Beaufort Sea were lowest in July, increased into August, peaked in September, and significantly decreased in October (Figure 49).

Bowhead whale distribution in the northeastern Chukchi Sea in summer 2014 was similar to that observed in past years, exemplified by relatively few scattered sightings, mainly nearshore. Bowhead whale occurrence in the northeastern Chukchi Sea in fall 2014 was reminiscent of fall 2012, with respect to distribution and the increasing sighting rate compared to summer months (Figure 49). Bowhead whale visual and acoustic detections during the 2014 Arctic Whale Ecology Study (ARCWEST) complimented ASAMM 2014 bowhead whale visual detections in late September and early October (NMML/RACE/PMEL 2014), suggesting a broad migratory corridor heading southwest across the northeastern Chukchi Sea.

Spatial modeling of bowhead whale HUAs from data collected since 2000, when signs of a regime shift in the Arctic first became apparent (Maslanik et al. 2011; Kortsch et al. 2012; Overland et al. 2013), showed clear monthly differences in bowhead whale distribution across the western Beaufort Sea from July through October. July and August data were primarily collected in 2012-2014 due to the lack of summer surveys in the earlier years of the time series. In July, the HUAs were located over the outer continental shelf and slope, the farthest offshore of the four months examined. The HUAs in August reflected the high densities of bowhead whales observed in Camden Bay in 2014 and, to a lesser extent, 2013. Although the August HUA analysis was predominantly based on data from 2012 to 2014, it reinforces the patterns described by Moore et al. (1989) for data collected during aerial surveys conducted in 1979-1986. The spatial patterns in relative abundance in September were similar to those for October, with the highest predicted values located east of Kaktovik and in the vicinity of Barrow Canyon. There was an area of predicted high relative abundance between Deadhorse and Flaxman Island in September that was not apparent in October. Compared to October, the HUA for September was closer to shore north of Camden Bay. Relative abundance predictions from the spatial model built on only 2014 transect data from September and October (both months pooled) retained the high density areas east of Kaktovik, between Deadhorse and Flaxman Island, and in the vicinity of Barrow Canyon. In addition, the predictions from the 2014 model suggested that the HUAs were considerably closer to shore in the East Region and slightly closer to shore in the West Region compared to the 15-year time series from 2000 to 2014.

Bowhead whales have been observed feeding and milling during summer months in recent years in the western Beaufort Sea (Figure 50A), primarily at water depths ≤50 m, although some feeding whales have been recorded in deeper water (100-500 m). Bowhead whales observed in deeper waters offshore in the eastern Alaskan Beaufort Sea in July and August may be feeding on large copepods that have been found in the colder, more saline water of the outer shelf (Griffiths and Thomson 2002). These larger copepods (including *Calanus glacialis* and *C. hyperboreus*) may descend to overwintering depths (>100 m) in fall and, therefore, not be as available to bowhead whales in offshore areas of the eastern Alaskan Beaufort Sea.

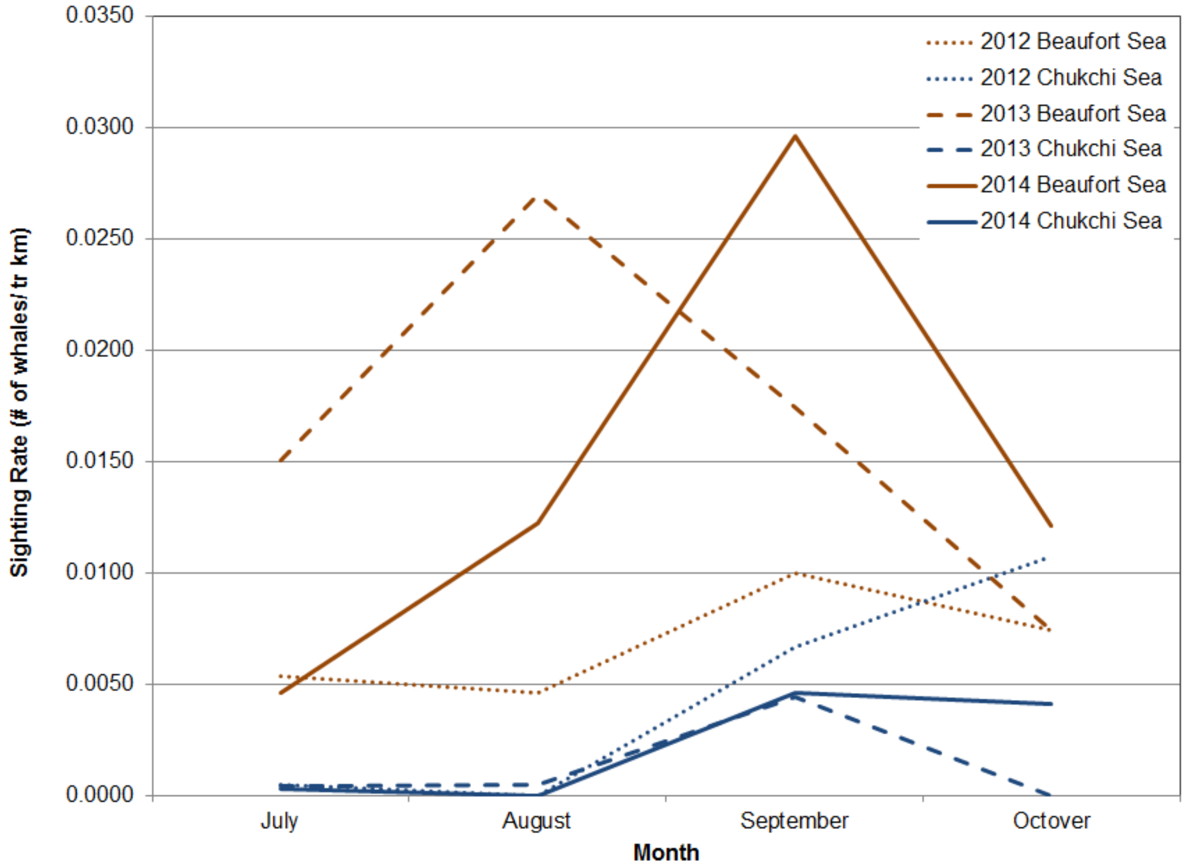

Figure 49. ASAMM bowhead whale monthly sighting rates (WPUE; transect sightings from primary observers only) in the eastern Chukchi and western Beaufort seas, 2012, 2013, and 2014. Note that ASAMM effort was limited in October 2013 due to the partial shutdown of the federal government (Clarke et al. 2014).

Feeding and milling bowhead whales were observed in block 12 (154°W-157°W) infrequently in fall 2014 compared to past years (Figure 50B). This area is a well-documented bowhead whale feeding ground (Moore and Reeves 1993; Mocklin et al. 2011) and the site of the BOEM-sponsored Bowhead Whale Feeding Ecology Study (BOWFEST) conducted from 2007-2011. Results from BOWFEST indicated that krill are advected onto the Beaufort Sea shelf from the Beaufort Sea slope during sustained winds from the east or southeast, or possibly from Barrow Canyon during sustained winds from the north or northeast. This causes the wind-driven, northwestward-flowing shelf current to carry krill toward Barrow (Ashjian et al. 2010). When winds weaken or change to blow from the south, northeastward-flowing Alaska Coastal Water moves adjacent to the southern edge of Barrow Canyon, thereby blocking the off-shelf movement of krill. This phenomenon results in the aggregation of krill at the western end of the Beaufort shelf near Barrow. The oceanographic response to the sequence of upwelling-favorable winds followed by weak or southerly winds produces conditions conducive to energetically efficient feeding by bowhead whales. In 2014, bowhead whale sightings in block 12 did not entirely correspond with predicted oceanographic conditions. For example, winds were easterly and in excess of 20 kts on 15-16 August 2014, then light and variable on 17-20 August 2014,

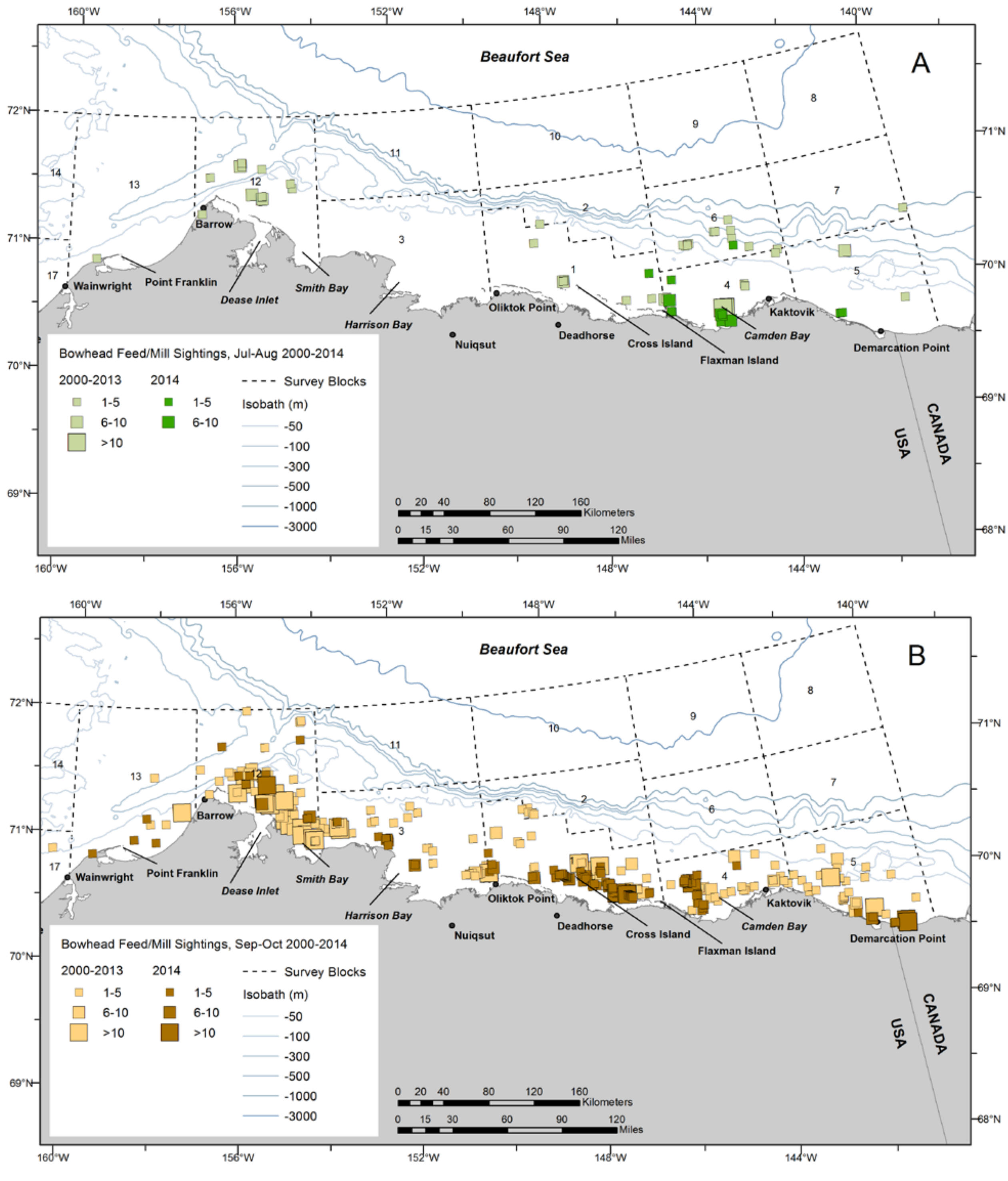

Figure 50. ASAMM 2000-2014 bowhead whale feeding and milling sightings, by group size, all survey modes (transect, search, and circling). A: summer (July-August); B: fall (September-October). There were no feeding or milling sightings in 2001 and 2011.

which would appear to favor upwelling and the formation of the "krill trap". However, during a survey conducted in good conditions on 20 August 2014 (Appendix B, Flight 13), no feeding bowhead whales were seen. Conversely, several (~40) feeding bowhead whales were seen on 6 September 2014 (Appendix B, Flight 234) during a calm wind period that followed strong westerly winds (>25 kts). Variables other than wind speed and direction likely play a role in the formation of the krill trap, and in bowhead whales' abilities to locate those prey.

Feeding and milling behavior has been observed east of block 12 (154°W) within the 50-m isobath in most years (e.g., Ljungblad et al. 1987; Landino et al. 1994; Clarke et al. 2011c, 2013a, 2014), and evidence for feeding in the western Beaufort Sea was also provided from stomach samples collected from bowhead whales harvested from 1979 to 2000 during subsistence hunts at Kaktovik, Cross Island, and Barrow (Lowry et al. 2004). However, based on data collected during ASAMM and analysis of bowhead whale satellite telemetry results (Citta et al. 2015), feeding opportunities appear generally short-lived and ephemeral in this area. Bowhead whale feeding behavior is usually detected in a particular area just one time, both within and between years, despite repeated surveying of the area. In 2014, however, bowhead whale feeding behavior was observed on numerous days in coincident geographic areas, indicating that conditions remained favorable for bowhead whale foraging in the western Alaskan Beaufort Sea for an extended period of time. Some of these areas, including Camden Bay and very nearshore between Prudhoe Bay and Flaxman Island, are not areas where feeding bowhead whales have commonly been seen in past years (Figure 50). Bowhead whale feeding behavior of this magnitude, east of 154°W, has been documented by ASAMM during only two previous years, 1997 and 1998 (Treacy 1998, 2000). In 1997, feeding behavior was observed east of 154°W from 3 September through 18 October, and feeding/milling bowhead whales comprised 58% of all bowhead whales observed (Treacy 1998). In 1998, feeding behavior was observed east of 154°W from 12 September through 11 October, and feeding/milling bowhead whales comprised 46% of all bowhead whales observed (Treacy 2000). In 2014, feeding behavior east of 154°W was observed from 17 August to 3 October, and feeding/milling bowhead whales comprised 68% of all bowhead whales observed. Bowhead whales were also frequently seen from Kaktovik in 2014, and all three bowhead whales taken during Kaktovik's fall subsistence hunt in late August-early September had been feeding (G. Sheffield, University of Alaska Fairbanks, Marine Advisory Program, pers comm. to J. Clarke, 17 February 2015). Furthermore, bowhead whale calls localized from mid-August to early October 2014 by 5 passive acoustic arrays deployed between Barter Island and Harrison Bay were far more prevalent in nearshore shallow waters than calls recorded on the same arrays in 2007-2013 (S. Blackwell, Greeneridge Sciences, pers comm. to J. Clarke, 31 March 2015).

While it can be assumed that conditions in the western Beaufort Sea in August and September 2014 were optimal for bowhead whale foraging, oceanographic conditions in the western Beaufort Sea are not well documented and the exact mechanisms or conditions conducive to bowhead whale foraging are not well understood. Seasonal sea ice retreat positively influences primary productivity in the Arctic, and primary productivity positively influences zooplankton density (Walkusz et al. 2012). Secondary phytoplankton blooms in fall related to the lack of sea ice have been documented throughout the Arctic Ocean (Frey et al. 2014), and this may also produce favorable conditions for bowhead whale prey. Upwelling and advection caused by wind and currents work to redistribute and aggregate zooplankton (Ashjian et al. 2010). There were several storm events (winds >10 m/s or 19.5 kts) in summer and fall 2014, particularly from mid-August through late October. The frequency of storm events, based on wind speeds recorded at Deadhorse and Barter Island airports, was greater in summer and fall 2014 than in summer and fall 2013 (Figure 51), when bowhead whale feeding behavior was rarely observed in the central Alaskan Beaufort Sea (Clarke et al. 2014). Furthermore, winds were predominantly from the east or northeast in 2014. Sousa et al. (2015) reported that surface drifters deployed near Barter Island moved quickly northwestward, exiting the Beaufort Sea over the Chukchi Shelf or through Barrow Canyon. The increased storm activity and prevalence of easterly winds in late summer and early fall may have increased nutrients available to primary producers by decreasing vertical stratification, advected zooplankton from the Tuktoyaktuk shelf feeding area into the Alaskan Beaufort Sea, and increased the frequency of upwelling events which are known to concentrate bowhead whale prey.

The bowhead whale calf ratio (number of calves/number of total whales) in summer 2014 (0.046) was lower than calf ratios observed in summer 2012 (0.093) and summer 2013 (0.074) (Clarke et al. 2013a, 2014) but similar to calf ratios recorded during ASAMM surveys conducted in summer months in the early 1980s (Figure 52). Koski and Miller (2009) reported on bowhead whale size segregation in the central Beaufort Sea (139°W-146°W, shore to 71°N) from photographic data collected from mid-August through early October, 1982-2000, in which small subadult whales were present in their study area from late August through September, and large subadults and cows with calves were most common in early September. Whalers from Kaktovik also report some segregation of age classes during the fall migration, with bowhead whale cow-calf pairs passing by the village later than subadult whales (Braham et al. 1984). Bowhead whale calves were seen during aerial surveys conducted in the western Beaufort Sea in August 1982-1985 (Clarke et al. 1987). Bowhead whale cow-calf pairs may be regular visitors to the western Beaufort Sea in July and August but may not have been detected and reported in previous studies due to the relative lack of survey effort and the whales' distribution farther offshore during this time period. Lower bowhead whale calf occurrence in the western Beaufort Sea in summer 2014 likely reflects annual variation, as suggested by Koski and Miller (2009).

The bowhead whale calf ratio in fall 2014 was within the normal range of calf ratios recorded by ASAMM since 1982 (Figure 52), but low compared to the exceptionally high calf ratio recorded in fall 2013 (Clarke et al. 2014). The Western Arctic bowhead whale stock is in good physical condition (George et al. 2015), as determined from an analysis of body condition of subadult bowhead whales harvested by Inupiat whalers. The Western Arctic stock has also increased in population size in the last decade (Givens et al. 2013), perhaps because increased body condition may have improved rates of survival and reproduction. Increased body condition, rate of survival and reproduction may be related to the overall reduction of summer sea ice, increased duration of open water, changes in upwelling potential and higher primary productivity (Harwood et al. 2015). Continued collection of bowhead whale data in summer and fall in the western Beaufort Sea in future years should shed light on whether the exceptionally high calf ratios of fall 2013 or the relatively low calf ratios of 2014 are more representative of the 'new' Arctic.

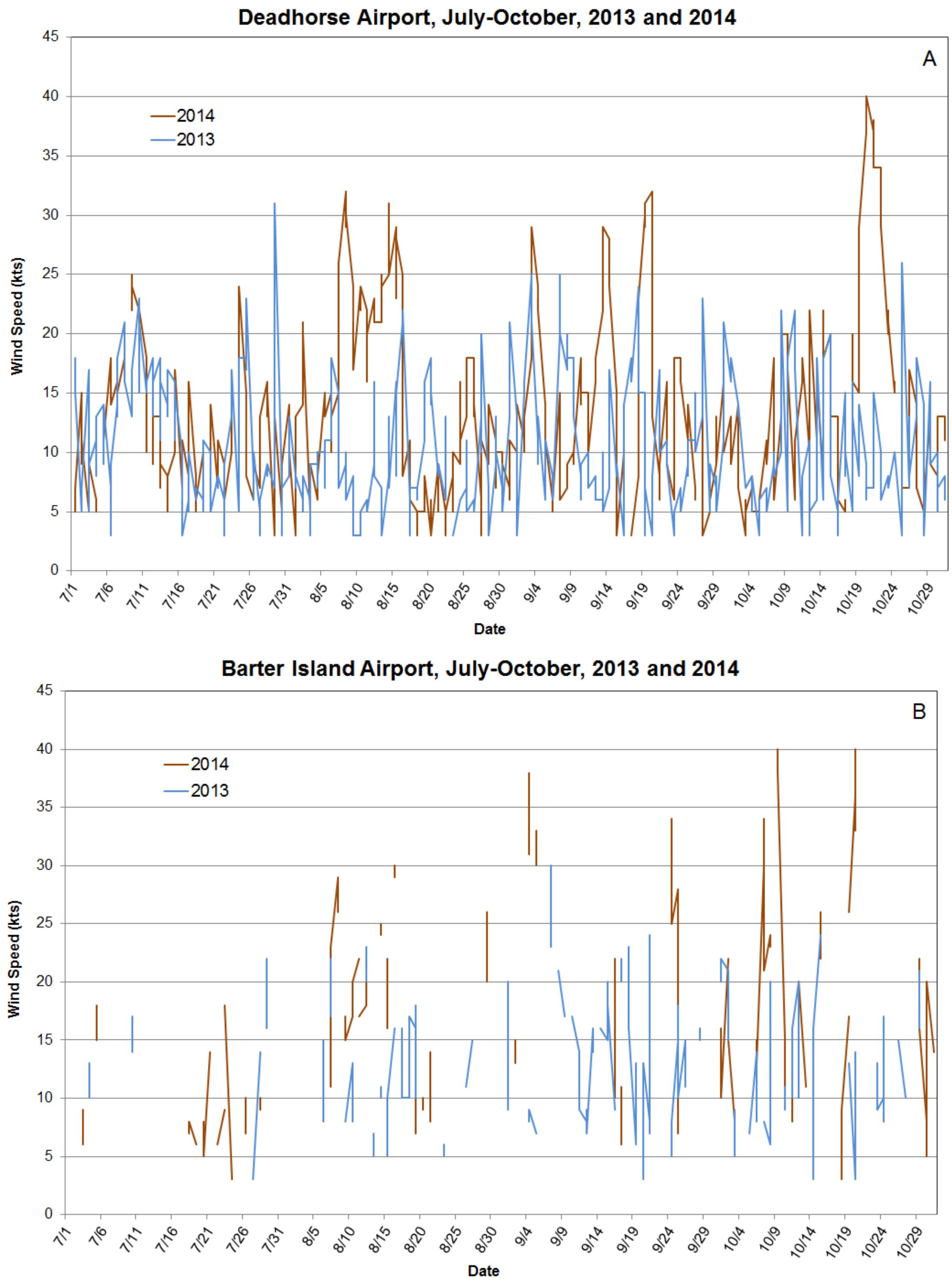

Figure 51. Wind speed (kts) recorded from July to October 2013 and 2014. A: Deadhorse, Alaska; B: Barter Island, Alaska. Wind speeds were collected three times per day (morning, midday and early evening) whenever possible; data from Barter Island were less regularly recorded. Source: National Climate Data Center.

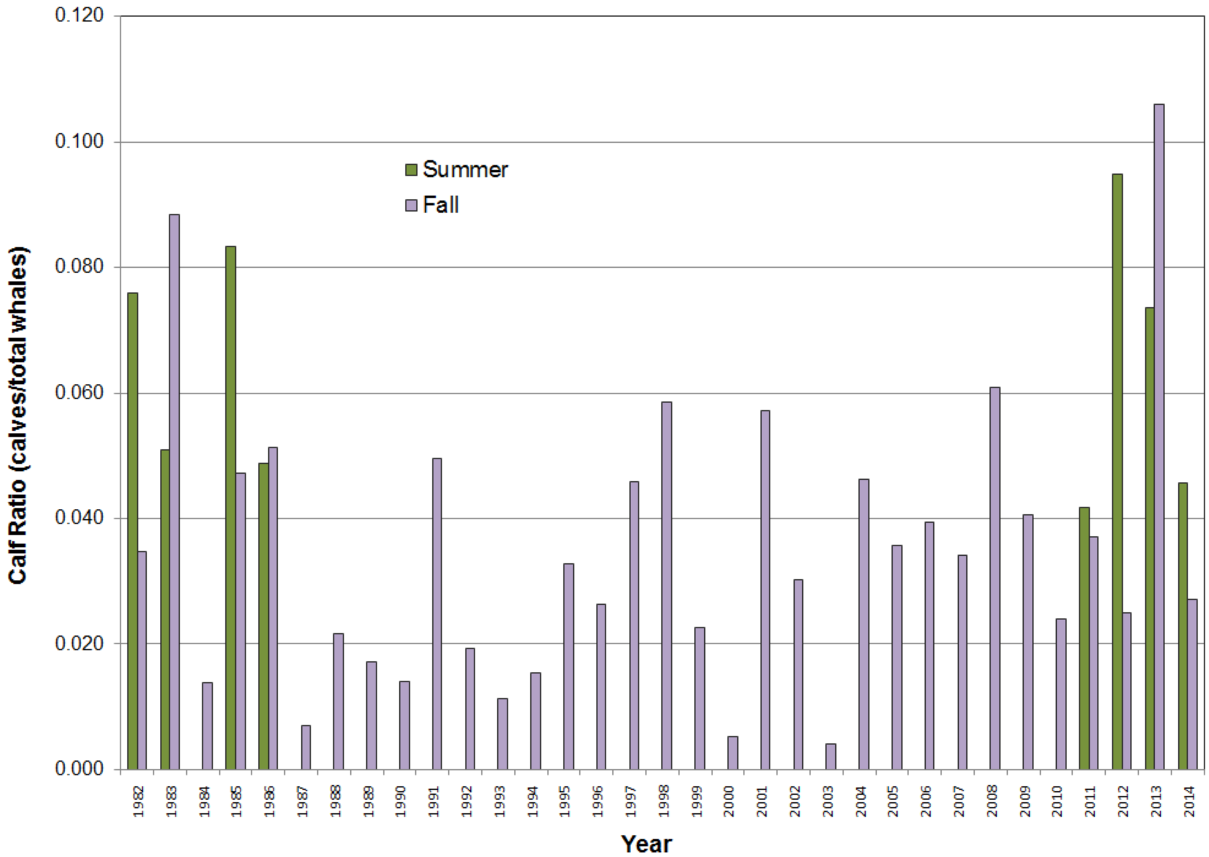

Figure 52. ASAMM bowhead whale calf ratios (number of calves/number of total whales), in summer (July-August) and fall (September-October), 1982-2014.

Gray whale distribution in 2014 was similar to that seen in recent years (2008-2013). However, fewer gray whales were seen offshore between Point Franklin and Icy Cape in late August and September compared to 2012 and 2013 (Clarke et al. 2013a, 2014). Gray whale preference was for shallow (≤35 m) waters in summer (July-August) months (Figure 53A). Prior to 2012, gray whale habitat preference, based on sighting rates per depth zone, was fairly equal between shallow (≤35 m) and deeper (>35 m) waters in summer. In summer 2012, 2013, and 2014, sighting rate analyses showed a clear preference for shallow waters; however, the preference for shallow water does not extend into fall. Gray whale habitat preference in fall in the northeastern Chukchi Sea was for deeper waters (Figure 53B). Habitat preference for deeper water was also evident in 2014 in the southcentral Chukchi Sea. The highest sighting rate per depth zone in both summer and fall 2014 was in the 51-200 m South depth zone (Appendix E, Tables E-7 and E-8). Gray whale use of the northeastern and southcentral Chukchi Sea is likely closely associated with prey availability including, but not limited to, benthic amphipods. The primary behavior of gray whales observed in the eastern Chukchi Sea study area was feeding, more specifically benthic feeding, because non-benthic feeding is difficult to detect via aerial surveys. Intense feeding on dense amphipod patches, for example between Barrow Canyon and the adjacent Alaskan shoreline, in early summer may reduce the density of available gray whale prey there. Unlike amphipods in temperate areas, high latitude amphipods tend to have slow

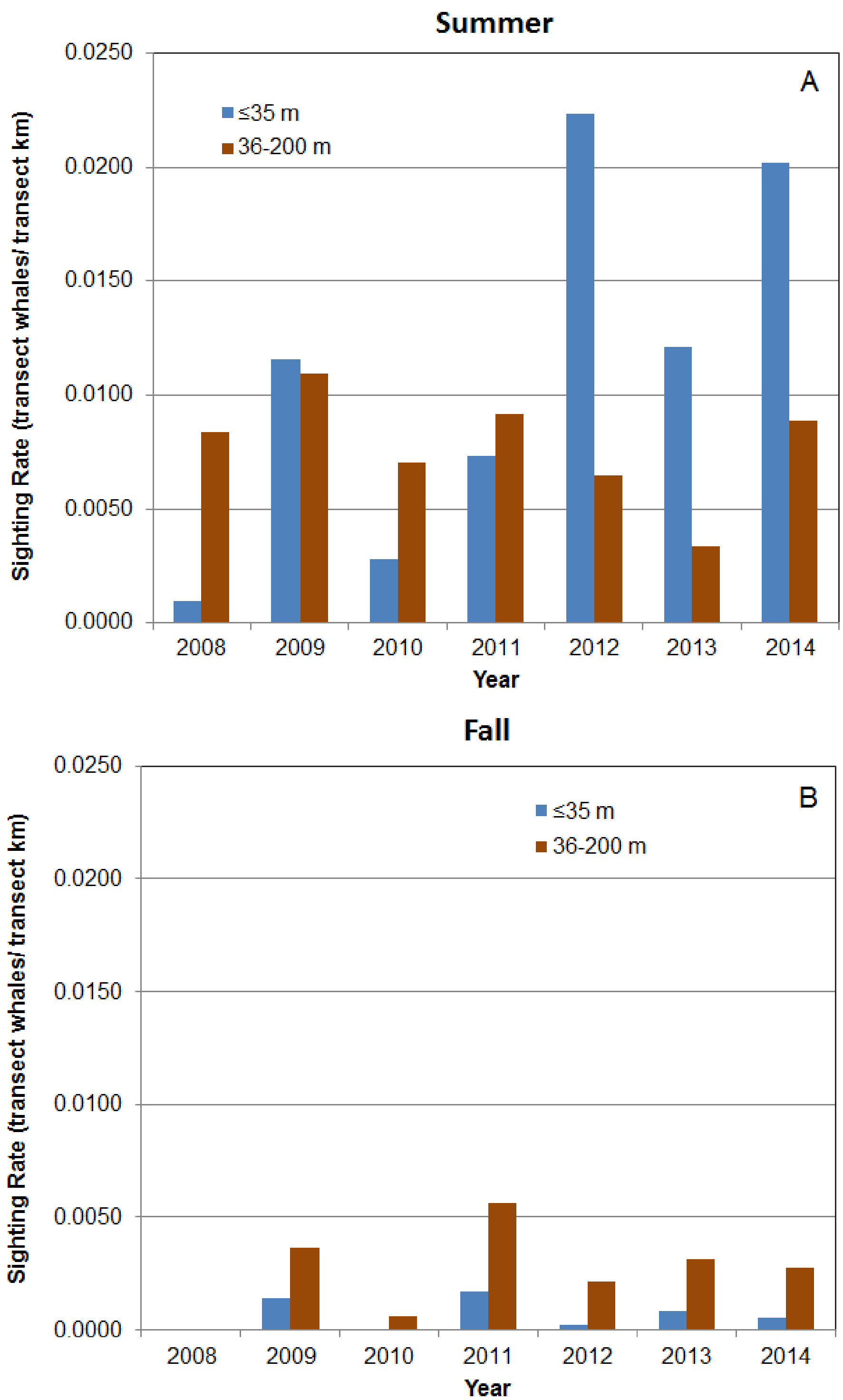

Figure 53. Gray whale sighting rates (WPUE; transect sightings from primary observers only) in shallow (≤35 m) and deep (>35 m) zones of the northeastern Chukchi Sea, 2008-2014. A: summer (July-August); B: fall (September-October). Includes sightings and effort in the ≤35 m, 36-50 m, and 51-200 m North depth zones.

maturation and low growth rates, long generation times, and low production to biomass ratios (Highsmith and Coyle 1992). If amphipod patches between Barrow Canyon and the shoreline are depleted due to gray whale feeding in early summer, gray whales may then disperse to adjacent feeding areas in late summer and fall to take advantage of relatively high density prey patches elsewhere. Gray whales in the southcentral Chukchi Sea were seen in an area where Bluhm et al. (2007) found frontal systems that had high densities of clams, epibenthic megafauna, pelagic crustaceans and Arctic cod (*Boreogadus saida*). Inter- and intra-annual variation in gray whale distribution may be influenced by the relative availability of several prey types, which are in turn dependent on oceanographic phenomena that may vary annually.

In 2014, the ASAMM study area was expanded to include regular surveys in block 23 in July through September, so multiyear comparisons of sighting rates in this area are not yet possible. This area encompasses a known gray whale hotspot (Kuletz et al. 2015) with high benthic biomass (Moore et al. 1993; Bluhm et al. 2007; Grebmeier et al. 2015) and one of the transect lines sampled for the DBO effort. Gray whales have been sighted in this area during aerial and vessel surveys conducted in summer and fall since at least the 1980s (e.g., Moore 2000), but dedicated survey effort has been rare. ASAMM 2014 results showed that gray whales in this area overlapped temporally but not spatially with humpback, fin, and minke whales, with gray whales preferring deeper water than the latter species. Gray whales have previously been recorded in close association with humpback and fin whales in the southern Chukchi Sea (Clarke et al. 2013b) and with humpback and bowhead whales in the northeastern Chukchi Sea (Clarke et al. 2014). In mid-September 2014, the ARCWEST study detected gray, humpback, and fin whale calls simultaneously on sonobuoys deployed in the southcentral Chukchi Sea (NMML/RACE/PMEL 2014). Distribution of large whales in the southcentral Chukchi Sea are likely related to water masses (including Bering Shelf Water, Anadyr Water, and Alaska Coastal Water), which collectively produce sharp temperature and salinity gradients between 166°W and 168°W at ~67.5°N (Eisner et al. 2013). Sharp density gradients can aggregate zooplankton and fishes that feed on zooplankton. Analysis of data from the DBO effort will undoubtedly shed light on oceanographic and biologic parameters that may have influenced gray whale and other large whale distribution and abundance in 2014.

One gray whale was observed in the central Alaskan Beaufort Sea on 8 September 2014, approximately 15 km north of Cross Island (Appendix B, Flight 21). Gray whales have been documented in the Beaufort Sea during ASAMM and other research projects (e.g., Maher 1960; Marquette and Braham 1980; Quakenbush et al. 2013; Rugh and Fraker 1981). One gray whale was sighted in August 2014 north of Smith Bay during the Chukchi Sea Environmental Studies Program (CSESP) (C. Christman, CLC Research, pers. comm. to J. Clarke, 27 February 2015), although gray whale occurrence east of ~155.8°W is rare (Brower et al. 2015). Conlan et al. (2013) suggested that ampeliscid beds under the Cape Bathurst upwelling in the Canadian Beaufort Sea may provide “a stepping stone for gray whales to progress further east into the Canadian Arctic”. Gray whales have been documented far outside their normal range in recent years: single whales were sighted in the Mediterranean Sea in 2010 (Scheinin et al. 2011) and off Namibia in 2013 (Elwen and Gridley 2013). The flexible and opportunistic foraging strategy used by gray whales (Dunham and Duffus 2002; Newell and Cowles 2006; Moore et al. 2007; Feyrer and Duffus 2011) combined with receding summer sea ice may allow gray whales to expand into geographic areas outside their normal range more often than was possible in the past.

The gray whale calf ratio (number of calves per total whales) was relatively high for the third consecutive year (2012 = 0.120; 2013 = 0.203; 2014 = 0.125), and the gray whale calf sighting rate (calves on transect per transect km) was the highest of any year that ASAMM surveys were conducted. July remained the month when most calves were seen. Weaning likely takes place in late summer or early fall (Sumich 1986); therefore, all gray whales identified as calves based on significantly smaller size and close association with an adult were likely calves of the year. It is also possible that small gray whales seen in late August or September that were not closely associated with an adult may have been calves of the year that had already been weaned, but they were not identified as such and were not included in the calf count. Gray whales, including calves, can be individually identified through photographic identification research that is nearly always conducted from vessels (e.g., Calambokidis et al. 2002; Bradford et al. 2011), but identification during systematic aerial surveys is difficult particularly when photographs are not regularly collected. Although some of the calves seen in 2014 were undoubtedly resighted on more than one day, results of annual gray whale calf counts conducted by the NMFS Southwest Fisheries Science Center at Piedras Blancas, California, in late winter-early spring 2014 also suggest that 2014 was a relatively good year for gray whale calves (USDOC, NOAA, NMFS, SWFSC 2014).

Gray whale calf occurrence in the eastern Chukchi Sea has been inconsistent among years. In the 17 years that aerial surveys have been conducted in the region with some regularity (1982-1991, 2008-2014), gray whale calves have been seen in 12 of those years and sightings of more than one gray whale calf per year were recorded in only 7 of the 17 years (Clarke et al. 1989, 2012, 2013a, 2014). Maher (1960) noted that several gray whales taken by hunters in the 1950s from the villages of Wainwright and Barrow were calves of the previous winter, so the importance of the northeastern Chukchi Sea to gray whale calves has likely persevered for several decades.

Beluga distribution in the ASAMM study area, south of 72°N, has remained remarkably similar over the past 30 years (Figure 34). Beluga distribution in the western Beaufort Sea was primarily over the continental slope, regardless of season. In fall 2014, several belugas were also seen in shallow nearshore areas, including Harrison Bay and elsewhere just seaward of barrier islands. Although none were seen during ASAMM, a few belugas were seen inshore of the barrier islands in the central Alaskan Beaufort Sea during oil industry-sponsored marine mammal monitoring from late July to late September (K. Lomac-Macnair, Smultea Environmental Sciences, pers. comm. to J. Clarke, 6 March 2015). Beluga distribution in the northeastern Chukchi Sea documented by ASAMM in 2014 was similar to observations in 2011, when belugas were distributed throughout the Chukchi Sea study area in all months (Clarke et al. 2012).

It is likely that ASAMM effort does not document the full extent of beluga range in the eastern Chukchi and western Beaufort seas. Aerial survey effort conducted north of the current ASAMM study area from 1989 to 1991 (Moore and Clarke 1992), results from beluga satellite telemetry efforts (e.g., Hauser et al. 2014; Suydam et al. 2001), and acoustic detections (Moore et al. 2012) indicate that belugas regularly traverse the eastern Chukchi and western Beaufort seas much farther north than the current ASAMM study area. Satellite telemetry data from both the Eastern Chukchi Sea and Beaufort Sea beluga stocks indicate that belugas venture well north of 72°N (Hauser et al. 2014; Richard et al. 2001; Suydam et al. 2001). Moore et al. (2012) reported beluga calls recorded from May through August 2009 on a passive acoustic recorder moored on the Chukchi Plateau (75.1°N, 168°W), more than 340 km north of the ASAMM study area. Surveys conducted in the late 1980s and early 1990s also suggested that beluga distribution in the Chukchi Sea in fall is bifurcated, with some belugas heading through Barrow Canyon and continuing southwesterly and others heading west-northwest toward the Chukotka coast before heading south (Clarke et al. 1993). Beluga occurrence in Barrow Canyon may be related to the relatively high densities of Arctic cod and other benthic and pelagic fish (Logerwell et al. 2011; Sousa et al. 2014) that comprise beluga diet.

Marine mammal data collected during the 2014 ASAMM field effort provide a vital contribution to the overall understanding of marine mammal ecosystems in the eastern Chukchi and western Beaufort seas. In addition to continuing to document bowhead whale, gray whale, and beluga distribution, relative abundance, and habitat during summer and fall, important information was also obtained in 2014 relating to unique situations and other species.

Minke, humpback, and fin whales seasonally inhabit arctic and subarctic habitats (Higdon and Ferguson 2011; Laidre and Heide-Jørgensen 2012; Clarke et al. 2013b). Observations of these species in 2014 were limited mostly to the southcentral Chukchi Sea. Two minke whales were observed north of 69°N, near Icy Cape, making this the fourth consecutive year that ASAMM has documented minke whales in the northeastern Chukchi Sea (Clarke et al. 2012, 2013a, 2014). Minke whales were also sighted in summer 2009, summer and fall 2012, fall 2013, and summer 2014 in the northeastern Chukchi Sea during marine mammal aerial surveys and vessel-based oceanographic surveys conducted by the oil industry (Brueggeman 2010; Bisson et al. 2013; Smultea et al. 2014; L. Aerts, LAMA Ecological, pers. comm. to J. Clarke, 12 April 2013 and 10 February 2014; C. Christman, CLC Research, pers. comm. to J. Clarke, 27 February 2014). Dave Roseneau, of the U.S. Fish and Wildlife Service (USFWS), reported seeing one to three minke whales per year near Cape Lisburne from 1995 to 2009 (pers. comm. to J. Denton, BOEM, 15 October 2010). Minke whales were encountered from 2010 to 2012 during marine mammal surveys conducted in the southern Chukchi Sea (from the Bering Strait to 69°N) (Clarke et al. 2013b), although less frequently than either humpback or fin whales. One minke whale was sighted southeast of Point Hope during the ARCWEST study in mid-September 2014 (NMML/RACE/PMEL 2014).

Humpback whales have been frequently encountered since 2009 in the southern Chukchi Sea (from Bering Strait to 69°N) (Clarke et al. 2013b), possibly due to increased research in the area, population recovery from commercial whaling, and/or responses to oceanographic changes. During the ARCWEST study, humpback whales were acoustically detected in mid-September 2014 near the location of ASAMM visual sightings in early September 2014, and humpback whales were acoustically and visually detected in the benthic hot spot (NMML/RACE/PMEL 2014). Humpback whales are occasionally observed in the northeastern Chukchi Sea (Hashagen et al. 2009; Clarke et al. 2011d, 2013a), but their occurrence is not regular or frequent. Five humpback whales were seen north of 69°N during ASAMM surveys in 2012 (Clarke et al. 2013a). One humpback whale was seen west of Barrow in summer 2012 during oceanographic surveys conducted by the oil industry (L. Aerts, LAMA Ecological, pers. comm. to J. Clarke, 12

April 2013). Two humpback whales were seen in the northeastern Chukchi Sea by industry observers in fall 2013 (Smultea et al. 2014).

Fin whales occur regularly in the northern Bering Sea (Moore et al. 2002) and have been documented every year since 2010 in the southern Chukchi Sea (from Bering Strait to 69°N) (Clarke et al. 2013b). Fin whales were the most common acoustically detected species in the Chukchi Sea during the September-October 2014 ARCWEST cruise (NMML/RACE/PMEL 2014), with all detections in the southcentral Chukchi Sea. Fin whale occurrence in the northeastern Chukchi Sea remains rare, with 2 sightings in 2013 (Clarke et al. 2014; L. Aerts, LAMA Ecological, pers comm. to J. Clarke, 10 February 2014) and 1 sighting in 2008 (Clarke et al. 2011d).

Humpback, fin, and minke whales were not sighted in the eastern Chukchi Sea study area during aerial surveys conducted in 1982-1991 (Moore and Clarke 1992). Continued sightings of these species in the eastern Chukchi Sea by ASAMM and other researchers reinforce the possibility of the species expanding (or perhaps re-inhabiting) their range in the Arctic. The annual occurrence of humpback, fin, and minke whales in the ASAMM study area underscores the importance of carefully investigating and documenting all cetacean sightings to confirm species identification.

Killer whales have been documented, sporadically, in the eastern Chukchi Sea. Hunters from Barrow and biologists from the North Slope Borough report that a few killer whales are seen each year in the Point Barrow area (George et al. 1994). Killer whales are known predators of gray whale calves (Barrett-Leonard et al. 2011), and a killer whale predatory attack on a gray whale calf was documented by ARCWEST near Wainwright in September 2013 (NMML, unpublished data; B. Rone, NMML-AFSC, pers. comm. to A. Brower, 18 December 2013). Interestingly, there were no sightings of killer whales during ASAMM 2014 nor during CSESP 2014 (C. Christman, CLC Research, pers.comm. to J. Clarke, 27 February 2015) in the northeastern Chukchi Sea, despite the high number of gray whales calves recorded. Killer whales were acoustically detected by ARCWEST in the southcentral Chukchi Sea in September 2014 near the benthic hot spot (NMML/RACE/PMEL 2014), although none were seen. Killer whales were seen by ASAMM near Barrow and northwest of Point Hope in 2012 (Clarke et al. 2013), and detected acoustically at several recorders in the northeastern Chukchi Sea in summer 2010 (Delarue et al. 2011). Killer whales were not seen during aerial surveys conducted nearshore by industry from 2006 to 2010 (Thomas and Koski 2011) nor by CSESP marine mammal observers from 2008 to 2010 (Aerts et al. 2011), but they were seen during CSESP in 2012 (L. Aerts, LAMA Ecological, pers. comm. to J. Clarke, 12 April 2013).

The coastal walrus haulout near Point Lay formed in mid-September 2014, which was considerably later than in 2011, when coastal haulout formation occurred in mid-August, but similarly timed with coastal haulout formation near Point Lay in 2013. Sea ice near Hanna Shoal persisted into late August 2014 and ice recession towards deeper water undoubtedly was a catalyst to the haulout formation. Group size at the haulout was dynamic between 19 September (first haulout observation) and 27 September (last haulout observation). ASAMM has collaborated with USGS and USFWS biologists since 2009 to monitor coastal haulout size and composition, but the location of the haulout near Point Lay makes it difficult to monitor on a regular basis while still meeting ASAMM objectives because of the distance between Point Lay and Barrow. Walruses will likely increase their use of coastal haulouts (Jay et al. 2012), and unmanned aerial systems (UAS) may be a better means of documenting the dynamic nature of walrus haulout formation with greater regularity.

The use of UAS in the Arctic, overlapping temporally and geographically with ASAMM, again presented unique challenges in 2014. The Federal Aviation Administration (FAA) Modernization and Reform Act of 2012 (49 USC 40101 note) was tasked with integrating UAS into the National Airspace System. The act included provisions for instituting a test site program; finding solutions for "sense and avoid"; establishing standards for airworthiness, lost link procedures, and command and control; and interfacing with the air traffic control system; however, none of this was implemented by 2014. UAS are difficult to see and there is currently not a standardized way for UAS and manned aircraft to automatically communicate their position to each other to allow real-time flight tracking. UAS also do not have "sense and avoid" capabilities and rely entirely on operators on ships or land for control and navigation, with no means of "seeing" what else is flying in the same area at or near the same altitude. Three separate UAS programs were active in the Alaskan Arctic concurrent with the ASAMM project. All three projects fortunately agreed that maintaining safety of flight for manned aircraft was first priority, and worked closely with the ASAMM team, NOAA, and BOEM to establish detailed communication protocols that allowed all aerial projects' objectives to be met while successfully deconflicting airspace (Ferguson et al. 2015; Appendix D). Central to this effort were daily SIMOPs calls attended by all airspace users that were organized at the local level. Continuing this degree of cooperation will be absolutely imperative to ensure that manned and unmanned aerial platforms can continue to operate safely in the Arctic.

Changes to the arctic marine environment observed over the past several decades (increasing mean annual temperatures, increasing mean annual wind speed, increasing storm frequency, decreasing annual sea ice thickness and extent; Wendler et al. 2009) accelerated in the 2000s (Walsh 2008), perhaps most noticeably in the record-low sea ice extent observed in 2007 and again in 2012 (National Snow and Ice Data Center 2007, 2012). Future arctic summer and fall seasons are predicted to have continued decreasing sea ice cover and younger ice, and associated climatic impacts (e.g., Simmonds et al. 2008), and these changes have likely impacted or will impact most marine mammal species (Kovacs et al. 2011). Comparisons of marine mammal distributions over time periods spanning three decades (1982-2013) should be interpreted with caution because different ecological mechanisms could have been acting at different time periods over the duration of the study.

Ongoing interest in sea ice distribution and movement, ice forecasting, and the relationship of sea ice to marine mammals and other biological communities has expanded the impact of the ASAMM surveys. Because ASAMM has such a large study area and collects visual data in regions where no one else does, it has become a useful platform for collecting aerial digital photographs of sea ice. These images are shared throughout the field season with multiple institutions to assist with ground-truthing sea ice data from remote sensing. These associations, ongoing since 2010, underscore the multidisciplinary nature of ASAMM and render it more than simply a "marine mammal survey".

Huntington (2009) identified six areas of human influence that will pose threats to arctic marine mammals and their conservation over the next several decades: climate change, environmental contaminants, offshore oil and gas activities, shipping, hunting, and commercial fisheries. He hypothesized the likely effects of each factor on arctic marine mammals in the future:

- Climate change has the greatest potential impact among the factors considered;
- Industrial development is a “tractable” issue, given stringent regulations and strong enforcement;
- The threat from commercial fishing is the least well understood, but examples of conflict between commercial fisheries and marine mammals in other regions warrant that precautionary measures be taken in the Arctic;
- Hunting ranked relatively low because it is “well understood” and existing management structures are already in place;
- Shipping is likely to have a modest impact, but those impacts could be mitigated or minimized with effective regulation; and
- Chronic environmental contaminants do not appear to pose a “substantial threat”, although there are many uncertainties surrounding this issue.

Examined in isolation, each potential threat appears to be manageable. However, Huntington (2009) argues that the combined effects of all six factors “are perhaps the most daunting threat”. Considerable information gaps exist in simply understanding the effects of single stressors on individual marine mammals. The uncertainty is magnified in reality, where inference must be broadened to include the effects of multiple stressors on the interconnected biological, physical, chemical, and acoustic aspects of the ecosystem that interact directly and indirectly to affect marine mammal health and fitness. Given the changes observed to date in the physical environment and marine mammal distributions in the Arctic, and the expected increases in anthropogenic pressures on the arctic ecosystem, effective conservation and management of arctic natural resources will require continuous monitoring of those resources to try to understand variability inherent in the ecosystem, predict potential effects of anthropogenic activities, and detect when changes are occurring. To better understand, manage, and conserve the new Arctic, it is essential to continue to actively study the new Arctic.

Management Use of Real-Time Field Information

BOEM issues various permits to industry for gas and oil exploration, including open water and on-ice seasonal vessel-based geophysical permits for exploration using array(s) of deep-seismic airguns; vessel-based geological-geophysical permits for shallow-seismic exploration using airguns; on-ice geophysical permits using VIBROSEIS technology; both vessel-based and on-ice geological permits for obtaining core samples; and permits to drill for gas and oil. ASAMM aerial survey data were made available to representatives of oil companies, the North Slope Borough Department of Wildlife Management, federal agencies, and the general public on a near real-time basis to encourage data transfer and enhance management via a website maintained by AFSC (USDOC, NOAA, NMFS 2014).

Management Use of Interannual Monitoring

This BOEM-sponsored bowhead whale monitoring study began in 1979 and has continued every year up to the present. While some aspects of this study have been updated, the data recorded have remained remarkably consistent (especially data from 1982 to 2014), thus permitting many direct comparisons across years. Such continuous, long-term, broad-scale, aerial monitoring of a large whale migration and associated marine mammals is indeed unique. In addition to the accomplishments specifically mentioned in the results, the ASAMM historical dataset has been used by industry, government, and academic entities (e.g., Schick and Urban 2000; Manly et al. 2007; Givens et al. 2010; Okkonen et al. 2011; Christman et al. 2013; Clarke et al. 2013b; Schonberg et al. 2013; Stafford et al. 2013; Clarke et al. 2015; Ferguson et al. 2015; Grebmeier et al. 2015; Kuletz et al. 2015) to better understand, manage, and conserve arctic resources.

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APPENDIX A: 2014 ICE CONCENTRATION MAPS

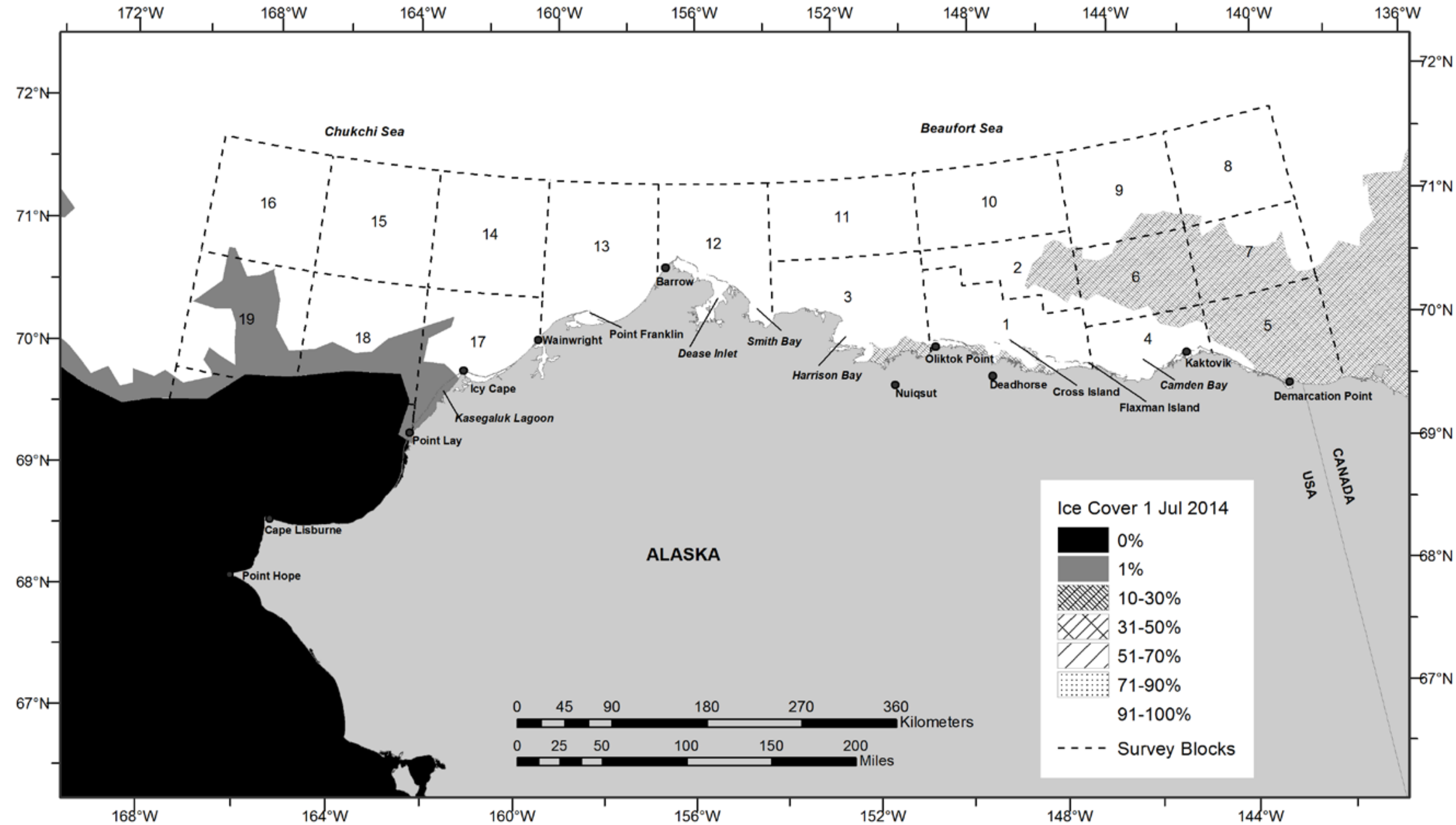

Figure A-1. Ice concentrations in the eastern Chukchi and Alaskan Beaufort seas, 1 July 2014. Sea ice information was obtained from the National Ice Center (U.S. National Ice Center 2014).

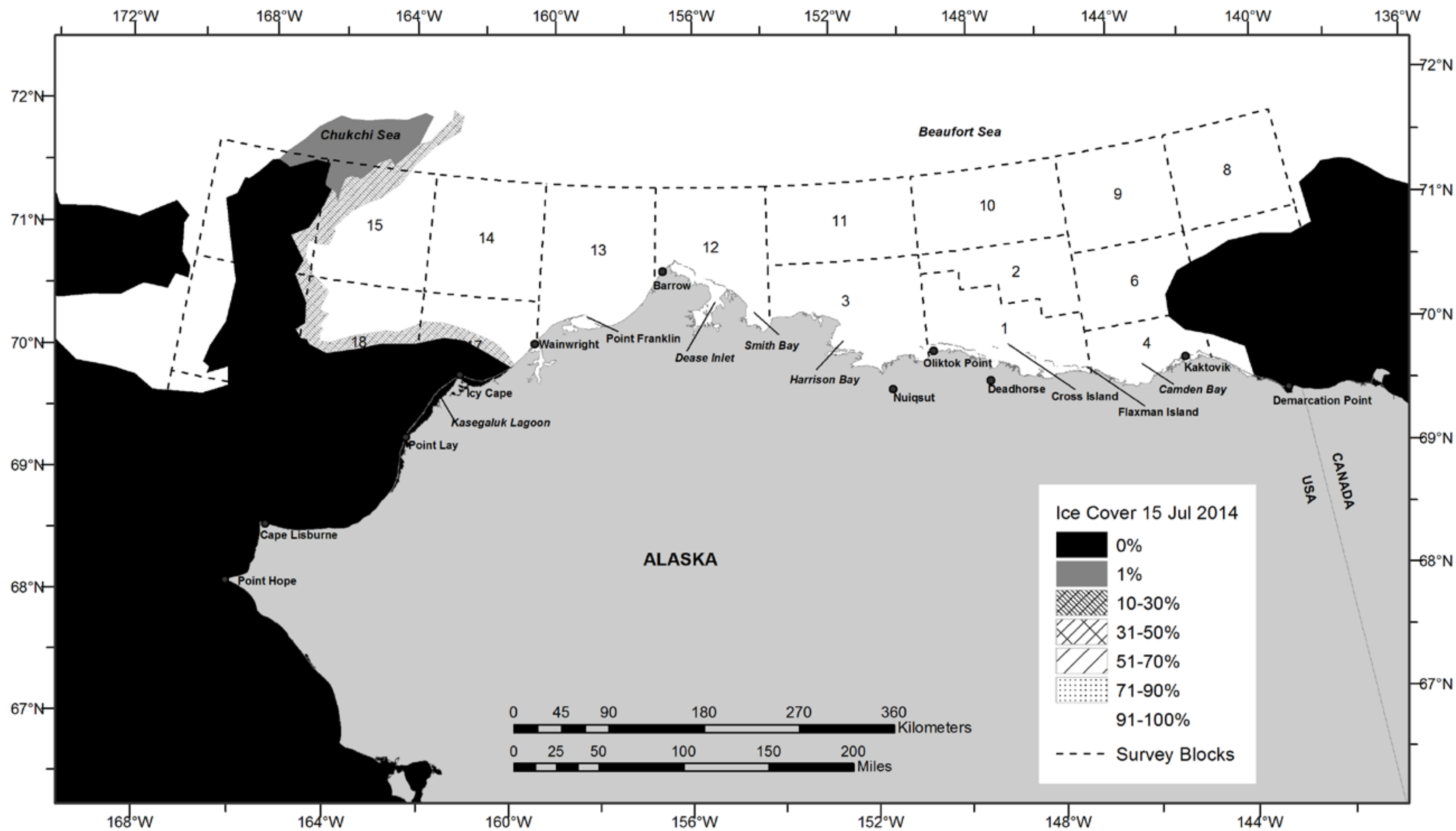

Figure A-2. Ice concentrations in the eastern Chukchi and Alaskan Beaufort seas, 15 July 2014. Sea ice information was obtained from the National Ice Center (U.S. National Ice Center 2014).

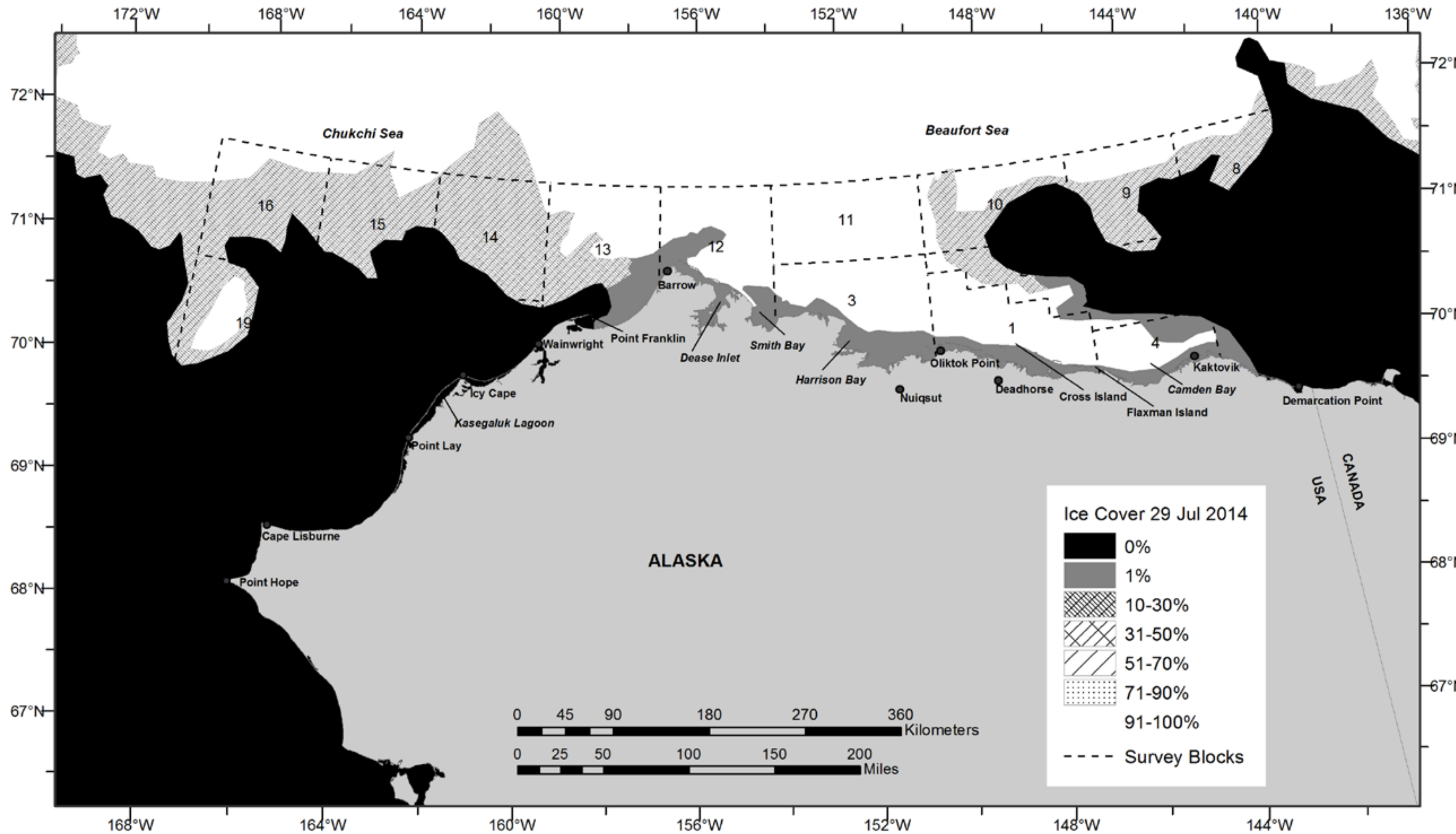

Figure A-3. Ice concentrations in the eastern Chukchi and Alaskan Beaufort seas, 29 July 2014. Sea ice information was obtained from the National Ice Center (U.S. National Ice Center 2014).

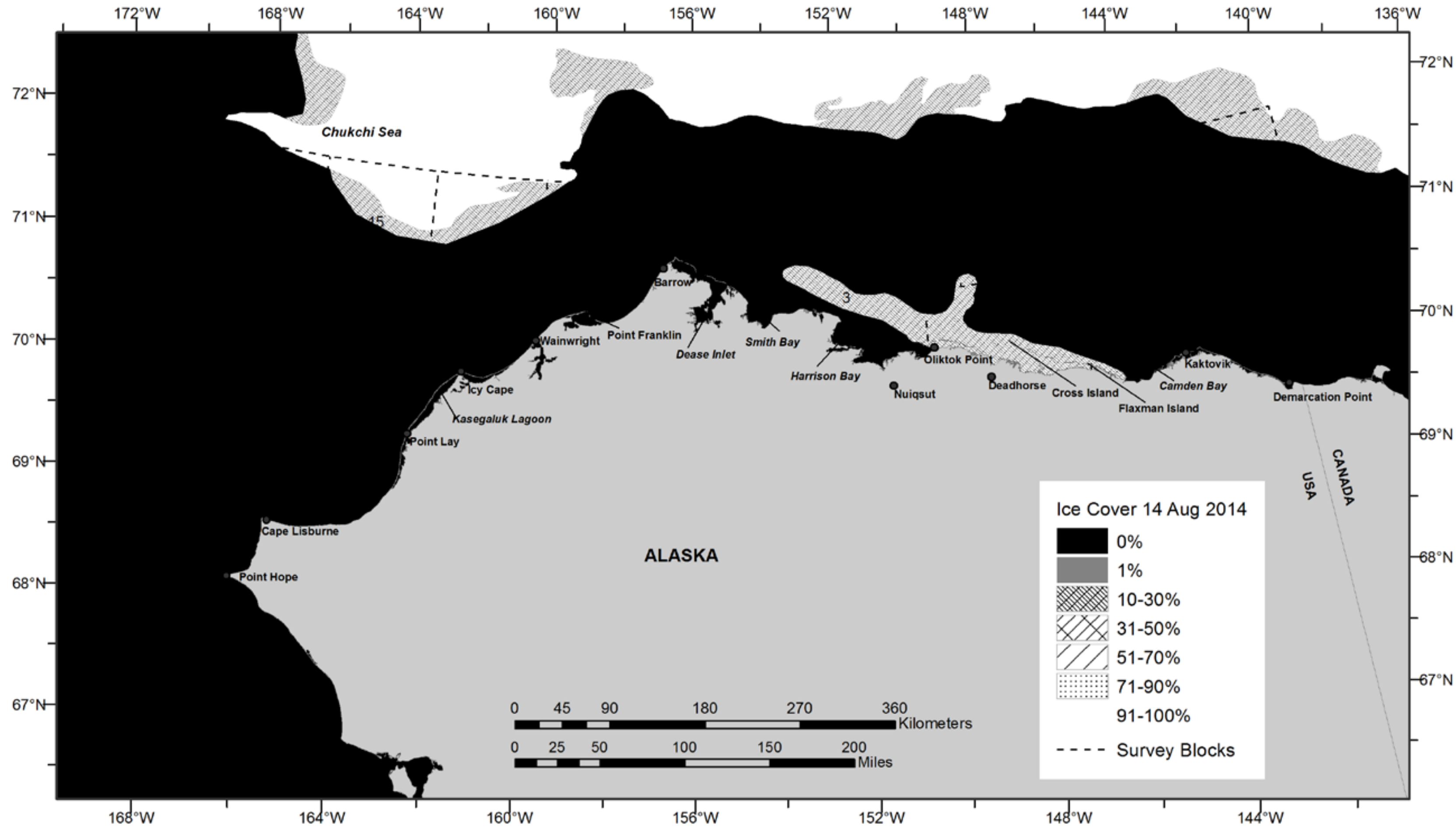

Figure A-4. Ice concentrations in the eastern Chukchi and Alaskan Beaufort seas, 14 August 2014. Sea ice information was obtained from the National Ice Center (U.S. National Ice Center 2014).

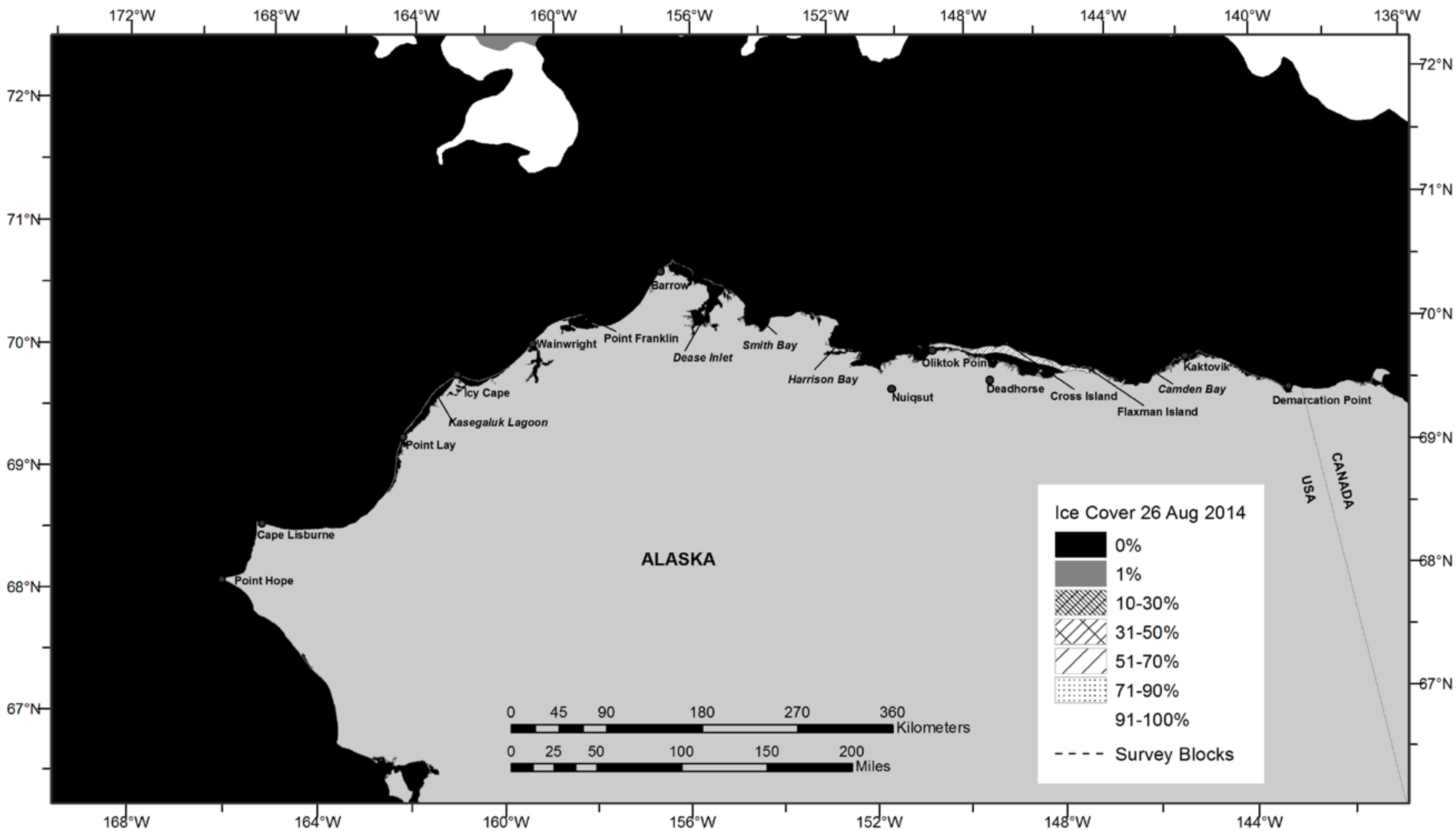

Figure A-5. Ice concentrations in the eastern Chukchi and Alaskan Beaufort seas, 26 August 2014. Sea ice information was obtained from the National Ice Center (U.S. National Ice Center 2014).

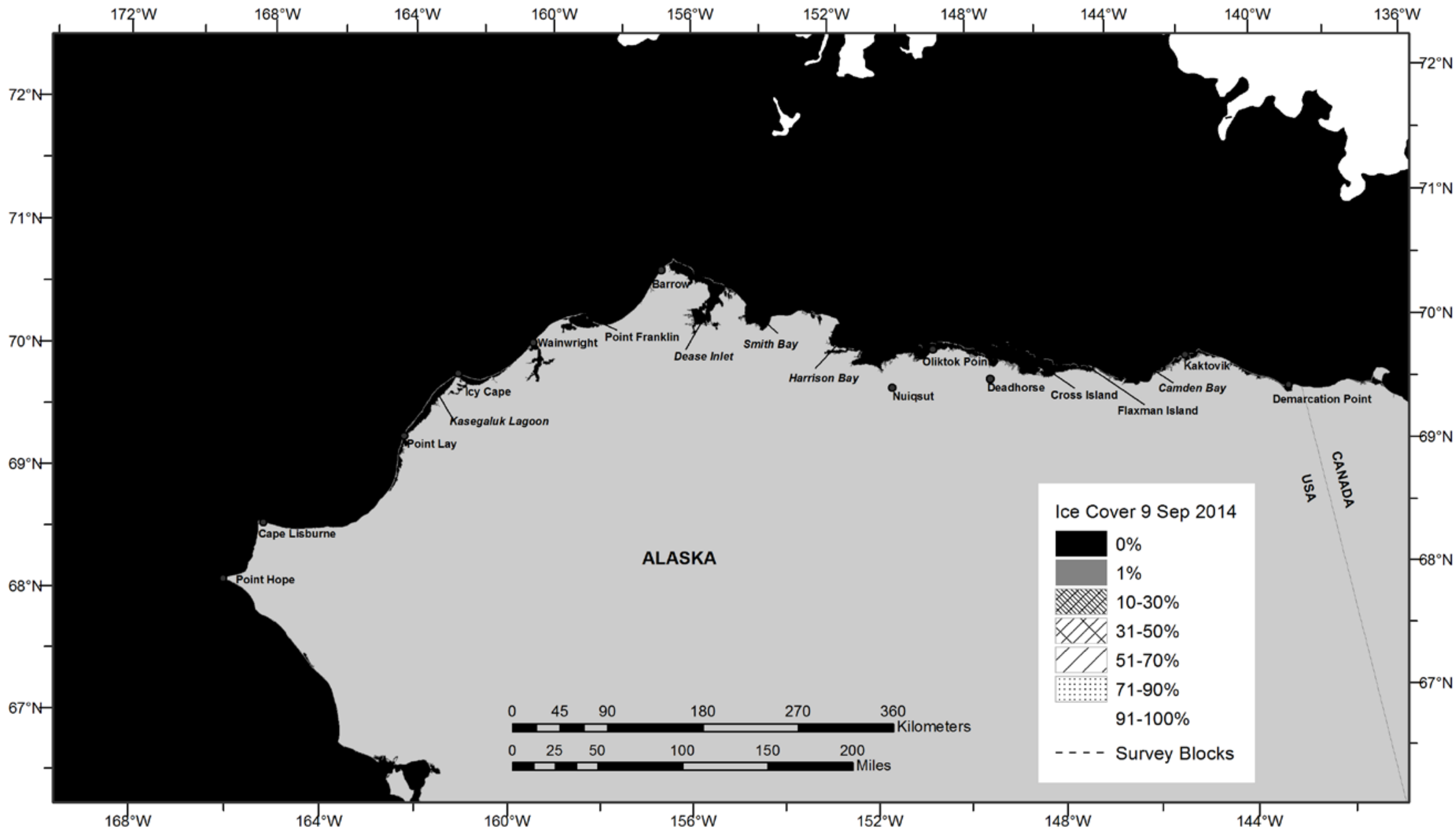

Figure A-6. Ice concentrations in the eastern Chukchi and Alaskan Beaufort seas, 9 September 2014. Sea ice information was obtained from the National Ice Center (U.S. National Ice Center 2014).

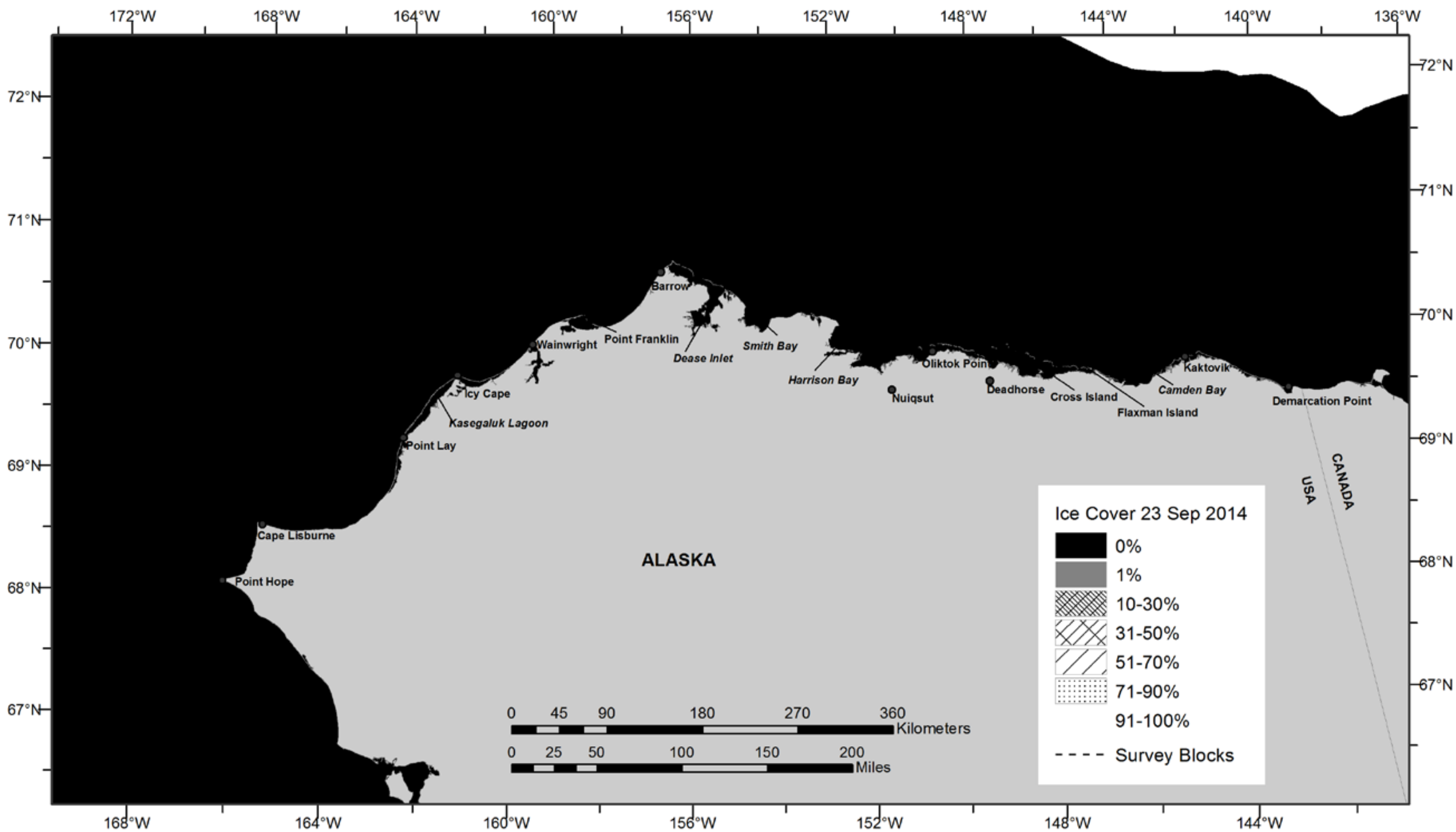

Figure A-7. Ice concentrations in the eastern Chukchi and Alaskan Beaufort seas, 23 September 2014. Sea ice information was obtained from the National Ice Center (U.S. National Ice Center 2014).

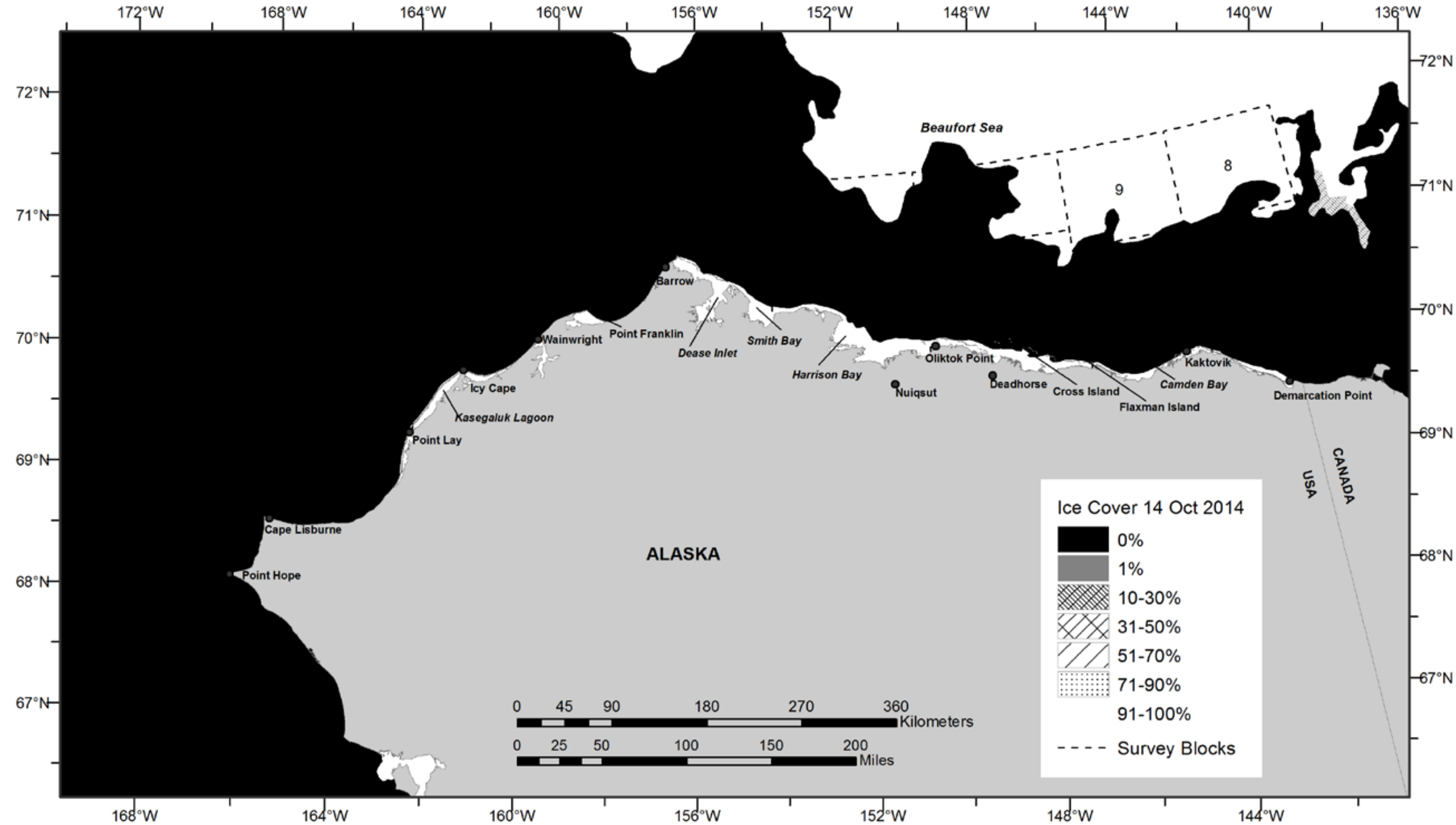

Figure A-8. Ice concentrations in the eastern Chukchi and Alaskan Beaufort seas, 14 October 2014. Sea ice information was obtained from the National Ice Center (U.S. National Ice Center 2014).

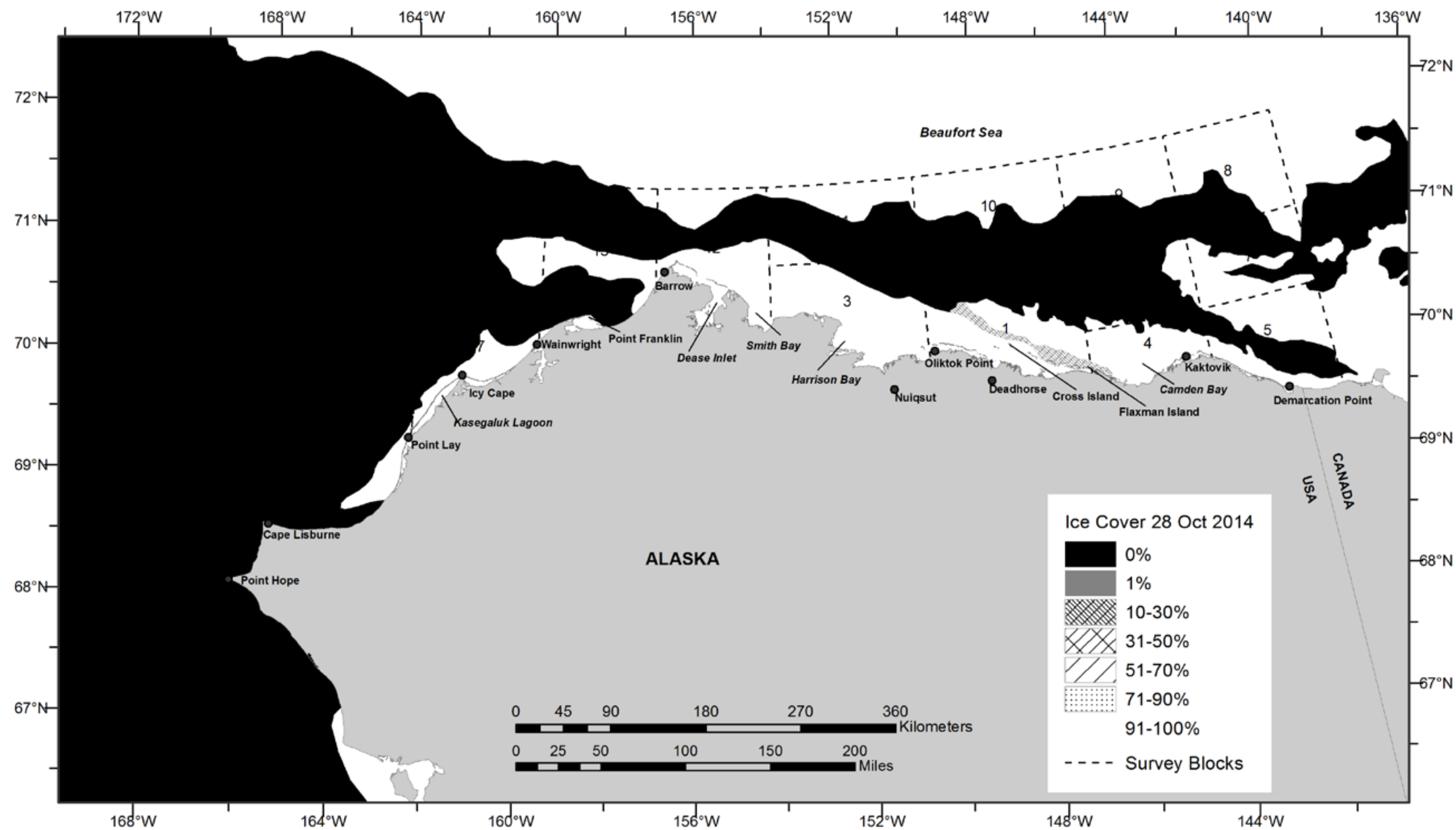

Figure A-9. Ice concentrations in the eastern Chukchi and Alaskan Beaufort seas, 28 October 2014. Sea ice information was obtained from the National Ice Center (U.S. National Ice Center 2014).

APPENDIX B: 2014 DAILY FLIGHT SUMMARIES

2 July 2014, Flight 201

Flight was a complete survey of transects 1, 3, and 5. Survey conditions included partly cloudy to overcast skies, <1 km to unlimited visibility (with low ceiling, fog, glare, haze and precipitation), and Beaufort 1-3 sea states. Sea ice cover was 10-95% pack ice or broken floe in the area surveyed. Sightings included gray whales (including one calf) and belugas (including one calf).

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
201	7/2/14 14:35	71.148	157.180	beluga	mill	2	0	13
201	7/2/14 15:01	71.426	159.119	beluga	rest	4	0	13
201	7/2/14 15:08	71.597	159.707	beluga	rest	1	0	13
201	7/2/14 14:41	70.979	157.475	gray whale	feed	1	0	13
201	7/2/14 15:11	71.674	159.979	beluga	rest	1	0	13
201	7/2/14 13:18	71.418	156.835	beluga	swim	1	0	12
201	7/2/14 14:18	71.445	157.607	beluga	swim	2	1	13
201	7/2/14 14:18	71.440	157.592	beluga	swim	2	0	13
201	7/2/14 14:19	71.419	157.523	beluga	swim	4	0	13
201	7/2/14 14:19	71.414	157.508	beluga	swim	1	0	13
201	7/2/14 14:20	71.410	157.495	beluga	swim	1	0	13
201	7/2/14 14:20	71.409	157.491	beluga	swim	1	0	13
201	7/2/14 14:27	71.277	157.070	beluga	swim	2	0	13
201	7/2/14 14:29	71.232	157.032	gray whale	feed	1	0	13
201	7/2/14 14:30	71.205	157.078	gray whale	swim	2	1	13

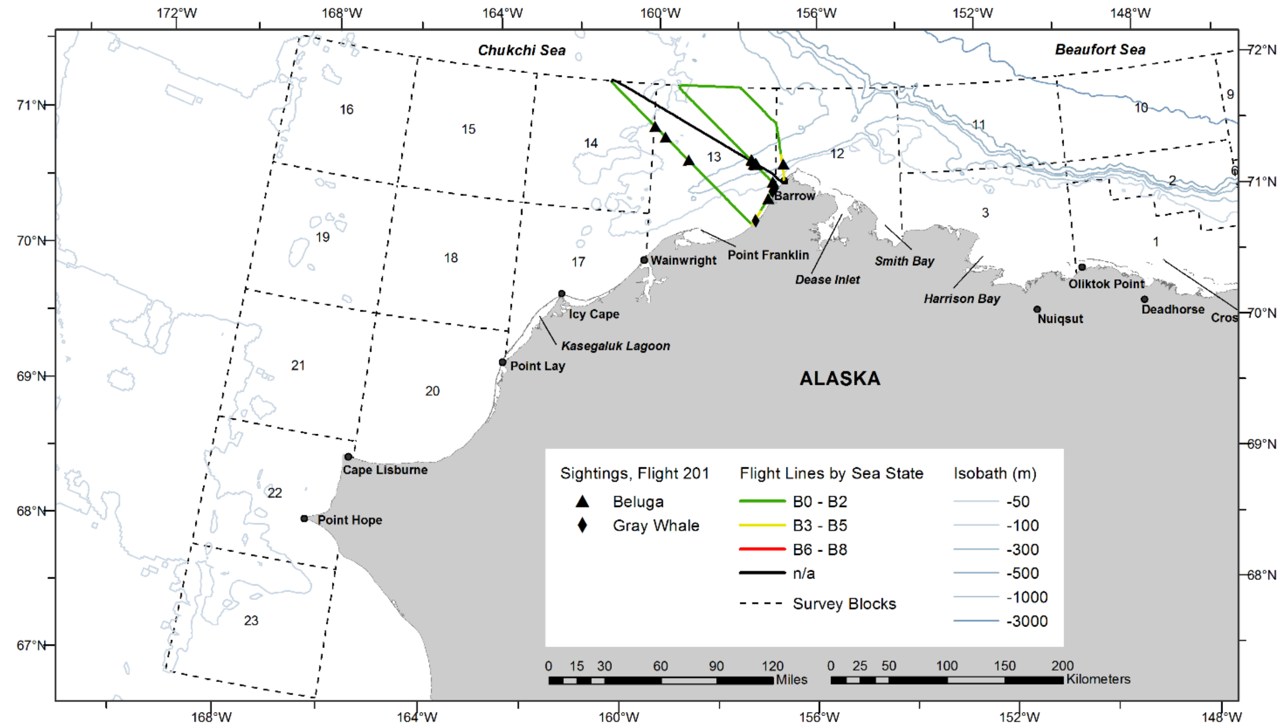

Figure B-1. ASAMM Flight 201 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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5 July 2014, Flight 202

Flight was a partial survey of transects 13 and 17 and the coastal transect from Icy Cape to Point Barrow. Survey conditions included partly cloudy skies, <1 km to unlimited visibility (with low ceiling, haze, and glare), and Beaufort 0-4 sea states. Sea ice cover was 0-97% broken floe in the area surveyed. Sightings included gray whales (including one calf), belugas, walruses (including one carcass), unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
202	7/5/14 10:18	69.840	162.993	beluga	swim	23	0	17
202	7/5/14 11:08	70.514	162.276	gray whale	swim	2	1	17

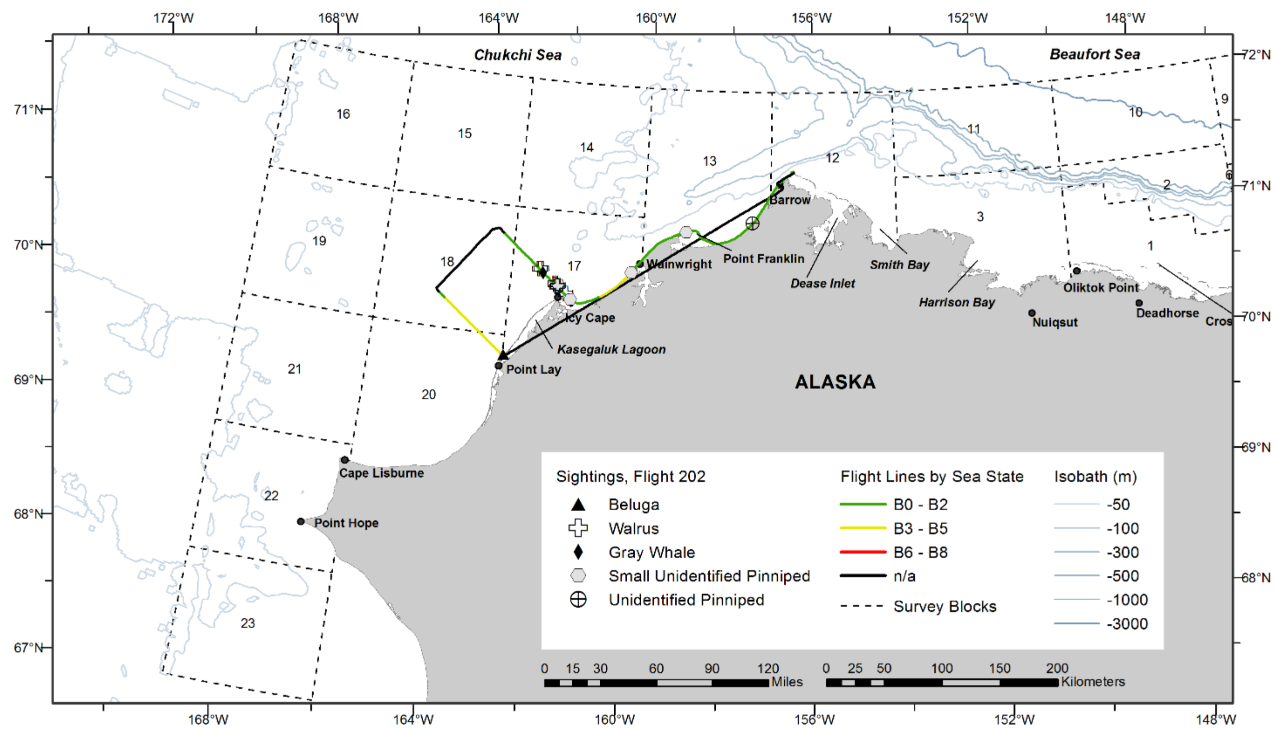


Figure B-2. ASAMM Flight 202 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

6 July 2014, Flight 203

Flight was a complete survey of transects 34, 35, 36, 37, 38, and 39. Survey conditions included partly cloudy to overcast skies, <1 km to unlimited visibility (with low ceilings, haze, precipitation, fog and glare), and Beaufort 1-6 sea states. Sea ice cover was 0-1% broken floe in the area surveyed. Gray whales (including three calves) were sighted.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
203	7/6/14 11:37	67.931	168.110	gray whale	feed	2	1	23
203	7/6/14 11:38	67.917	168.144	gray whale	feed	4	0	23
203	7/6/14 11:40	67.931	168.222	gray whale	feed	2	0	23
203	7/6/14 11:43	67.931	168.301	gray whale	feed	1	0	23
203	7/6/14 11:44	67.922	168.306	gray whale	feed	2	0	23
203	7/6/14 11:45	67.926	168.336	gray whale	feed	1	0	23
203	7/6/14 11:45	67.914	168.334	gray whale	feed	1	0	23
203	7/6/14 11:46	67.918	168.310	gray whale	feed	4	2	23
203	7/6/14 11:47	67.924	168.340	gray whale	feed	2	0	23
203	7/6/14 11:49	67.930	168.436	gray whale	feed	2	0	23
203	7/6/14 11:50	67.937	168.434	gray whale	feed	1	0	23
203	7/6/14 11:50	67.932	168.424	gray whale	feed	4	0	23
203	7/6/14 11:51	67.923	168.432	gray whale	feed	2	0	23
203	7/6/14 11:51	67.922	168.453	gray whale	feed	2	0	23
203	7/6/14 11:51	67.925	168.464	gray whale	feed	4	0	23
203	7/6/14 11:52	67.939	168.458	gray whale	feed	1	0	23

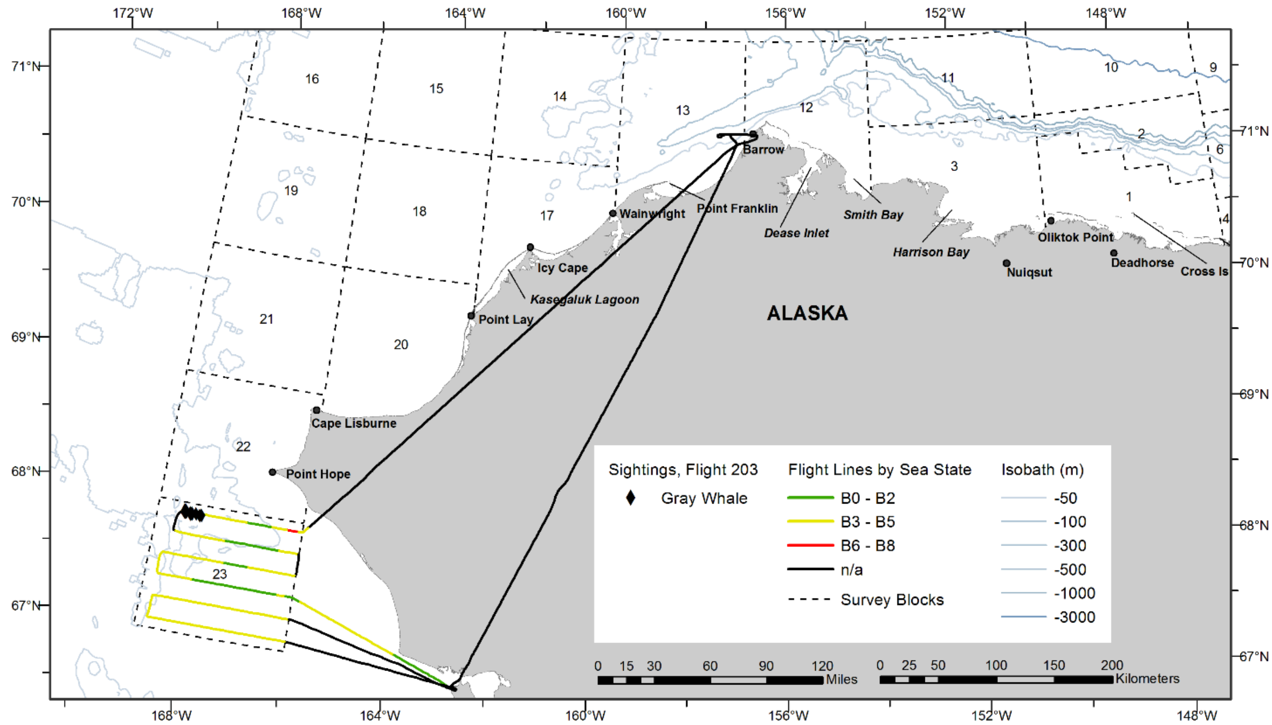


Figure B-3. ASAMM Flight 203 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

9 July 2014, Flight 204

Flight was a partial survey of transects 19, 21, and 23, and the coastal transect from Cape Lisburne to Point Lay. Survey conditions included clear skies, <1-10 km visibility (with low ceiling, haze, fog and glare), and Beaufort 1-6 sea states. Sea ice cover was 0-63% broken floe in the area surveyed. Sightings included gray whales (including 12 calves), belugas (including 12 calves), 1 walrus, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
204	7/9/14 11:43	68.890	166.221	gray whale	swim	3	1	22
204	7/9/14 11:43	68.886	166.189	gray whale	swim	2	1	22
204	7/9/14 11:44	68.891	166.205	gray whale	swim	2	1	22
204	7/9/14 11:46	68.892	166.211	gray whale	swim	2	1	22
204	7/9/14 11:49	68.878	166.056	gray whale	swim	2	1	22
204	7/9/14 11:51	68.889	166.058	gray whale	swim	2	1	22
204	7/9/14 12:00	68.860	165.596	gray whale	swim	1	0	20
204	7/9/14 12:02	68.864	165.405	gray whale	swim	1	0	20
204	7/9/14 12:36	69.455	163.166	beluga	mill	200	12	20
204	7/9/14 12:37	69.471	163.184	beluga	swim	4	0	20
204	7/9/14 12:50	69.757	163.085	gray whale	feed	3	1	20
204	7/9/14 12:52	69.768	163.159	gray whale	feed	5	2	20
204	7/9/14 13:42	70.988	158.227	gray whale	feed	7	2	13
204	7/9/14 13:42	71.000	158.194	gray whale	feed	3	0	13
204	7/9/14 13:43	71.016	158.231	gray whale	feed	2	0	13
204	7/9/14 13:43	71.018	158.249	gray whale	feed	3	0	13
204	7/9/14 13:43	71.016	158.269	gray whale	feed	1	0	13
204	7/9/14 13:43	71.010	158.291	gray whale	feed	1	0	13
204	7/9/14 13:44	71.011	158.246	gray whale	feed	2	1	13
204	7/9/14 13:46	71.030	158.298	gray whale	swim	2	0	13
204	7/9/14 13:51	71.023	158.057	gray whale	feed	1	0	13
204	7/9/14 13:51	71.026	158.041	gray whale	swim	1	0	13
204	7/9/14 13:56	71.107	157.653	gray whale	swim	1	0	13
204	7/9/14 13:56	71.107	157.653	gray whale	feed	1	0	13
204	7/9/14 13:56	71.109	157.642	gray whale	feed	1	0	13

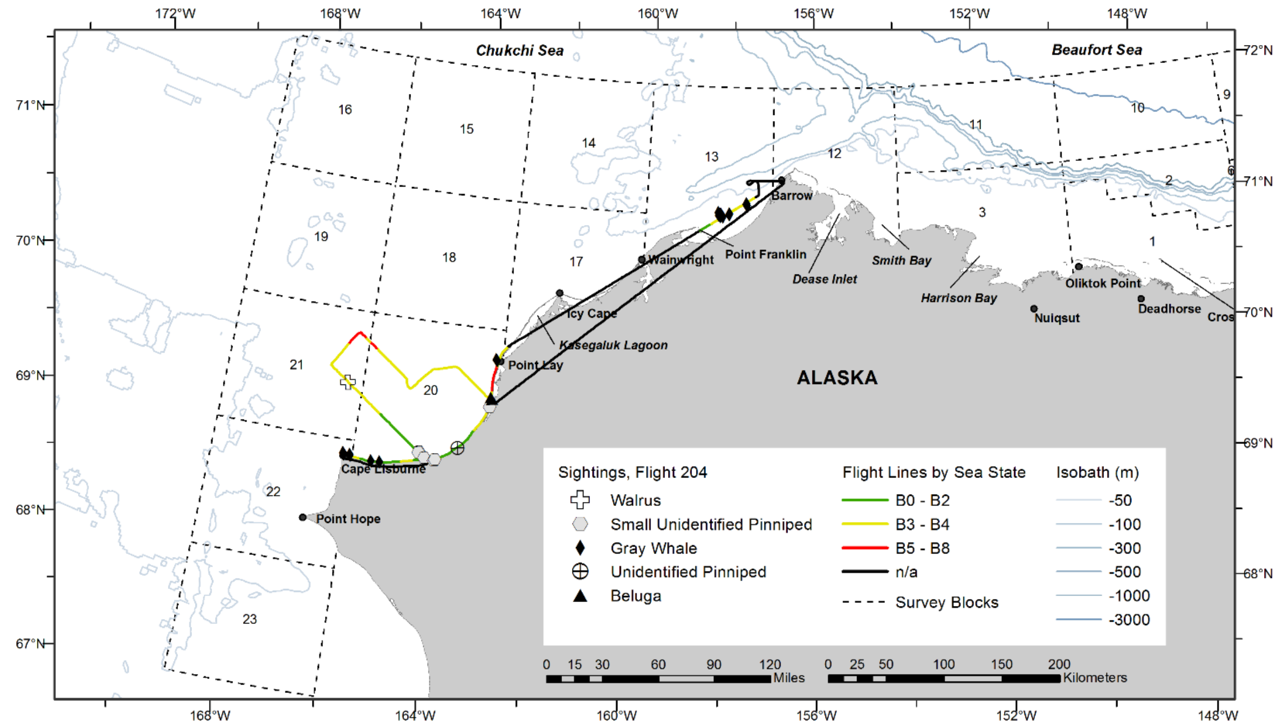


Figure B-4. ASAMM Flight 204 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

12 July 2014, Flight 205

Flight was a complete survey of transect 2 and partial survey of transects 4 and 6. Survey conditions included partly cloudy to overcast skies, <1 km to unlimited visibility (with low ceilings, haze, fog, and glare), and Beaufort 1-4 sea states. Sea ice cover was 1-90% broken floe in the area surveyed. Sightings included gray whales (including five calves), walruses, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
205	7/12/14 14:28	71.112	157.292	gray whale	swim	2	1	13
205	7/12/14 14:47	70.978	158.397	gray whale	feed	1	0	13
205	7/12/14 14:48	71.001	158.377	gray whale	feed	3	0	13
205	7/12/14 14:48	71.003	158.367	gray whale	feed	2	1	13
205	7/12/14 14:48	71.005	158.357	gray whale	feed	2	1	13
205	7/12/14 14:48	71.007	158.351	gray whale	feed	2	0	13
205	7/12/14 14:50	70.993	158.337	gray whale	swim	1	0	13
205	7/12/14 14:51	71.009	158.286	gray whale	feed	10	1	13
205	7/12/14 14:52	71.023	158.279	gray whale	feed	1	0	13
205	7/12/14 14:52	71.030	158.242	gray whale	swim	1	0	13
205	7/12/14 14:52	71.028	158.216	gray whale	swim	1	0	13
205	7/12/14 14:53	71.020	158.204	gray whale	swim	2	1	13
205	7/12/14 14:53	71.014	158.210	gray whale	swim	1	0	13
205	7/12/14 14:53	71.010	158.225	gray whale	swim	1	0	13
205	7/12/14 14:54	71.021	158.271	gray whale	swim	1	0	13

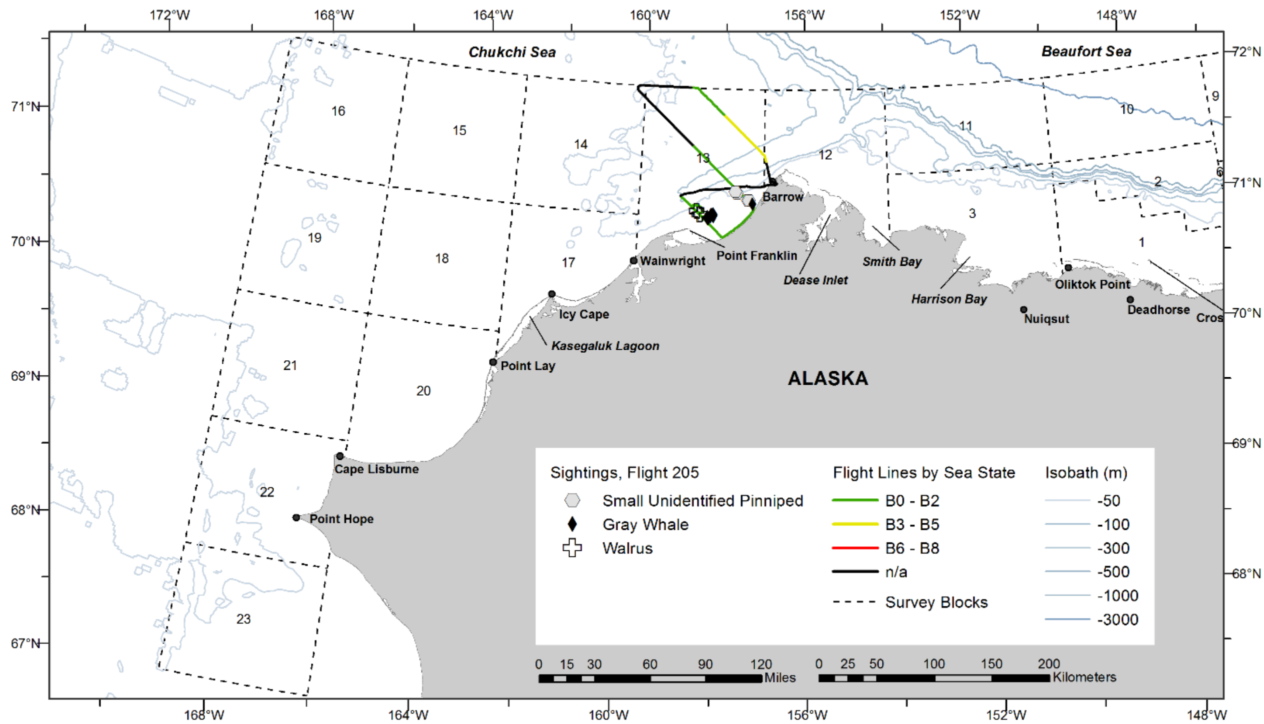


Figure B-5. ASAMM Flight 205 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Gray whale cow and calf nearshore between Barrow, Alaska, and Point Franklin, Alaska, during Flight 205, 12 July 2014.

15 July 2014, Flight 206

Flight was a complete survey of transects 7 and 9, and deadhead effort along the ice edge in support of the USGS walrus satellite-tagging project. Survey conditions included partly cloudy skies, <1 km to unlimited visibility (with low ceilings, haze, fog, and glare), and Beaufort 1-4 sea states. Sea ice cover was 0-90% broken floe in the area surveyed. Sightings included bowhead whales, gray whales (including three calves), one beluga, walruses, one bearded seal, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
206	7/15/14 11:45	70.721	160.208	gray whale	swim	2	1	17
206	7/15/14 13:48	71.094	159.548	bowhead whale	swim	2	0	13
206	7/15/14 13:53	70.970	159.133	gray whale	swim	2	1	13
206	7/15/14 13:57	70.947	159.056	gray whale	swim	2	1	13
206	7/15/14 13:59	70.942	159.079	beluga	rest	1	0	13

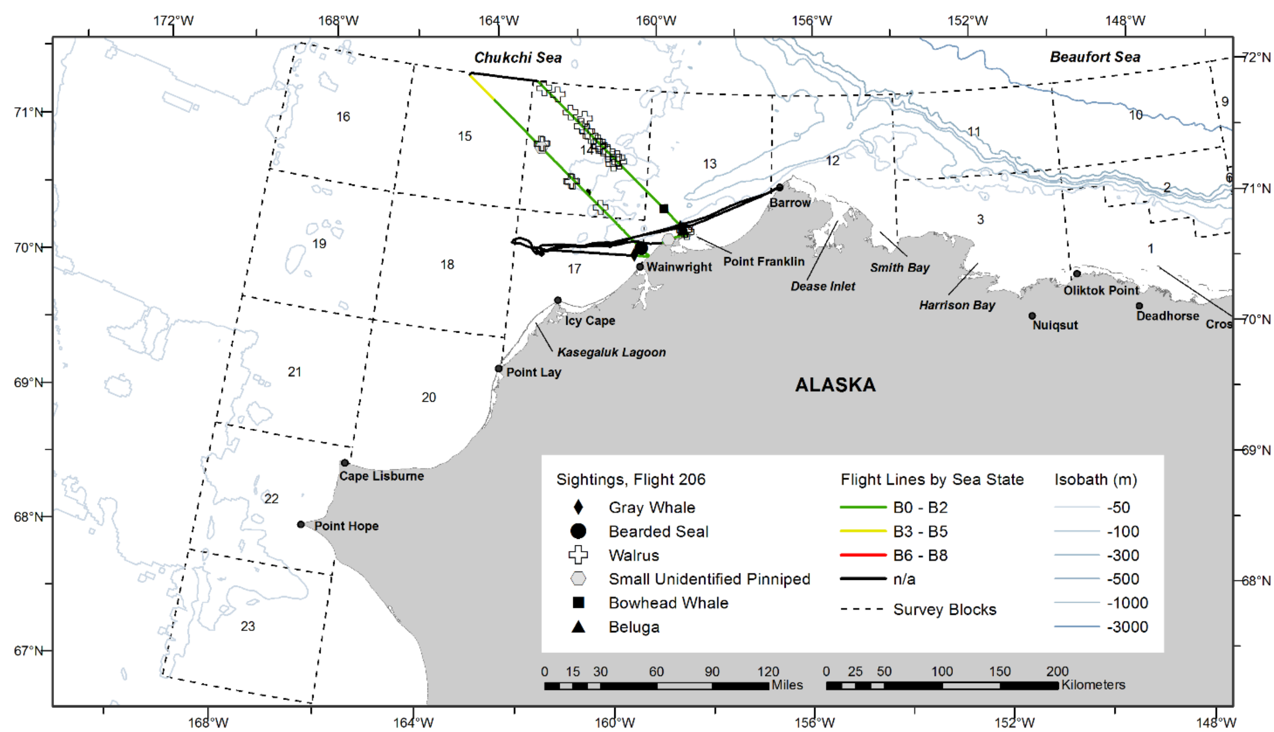
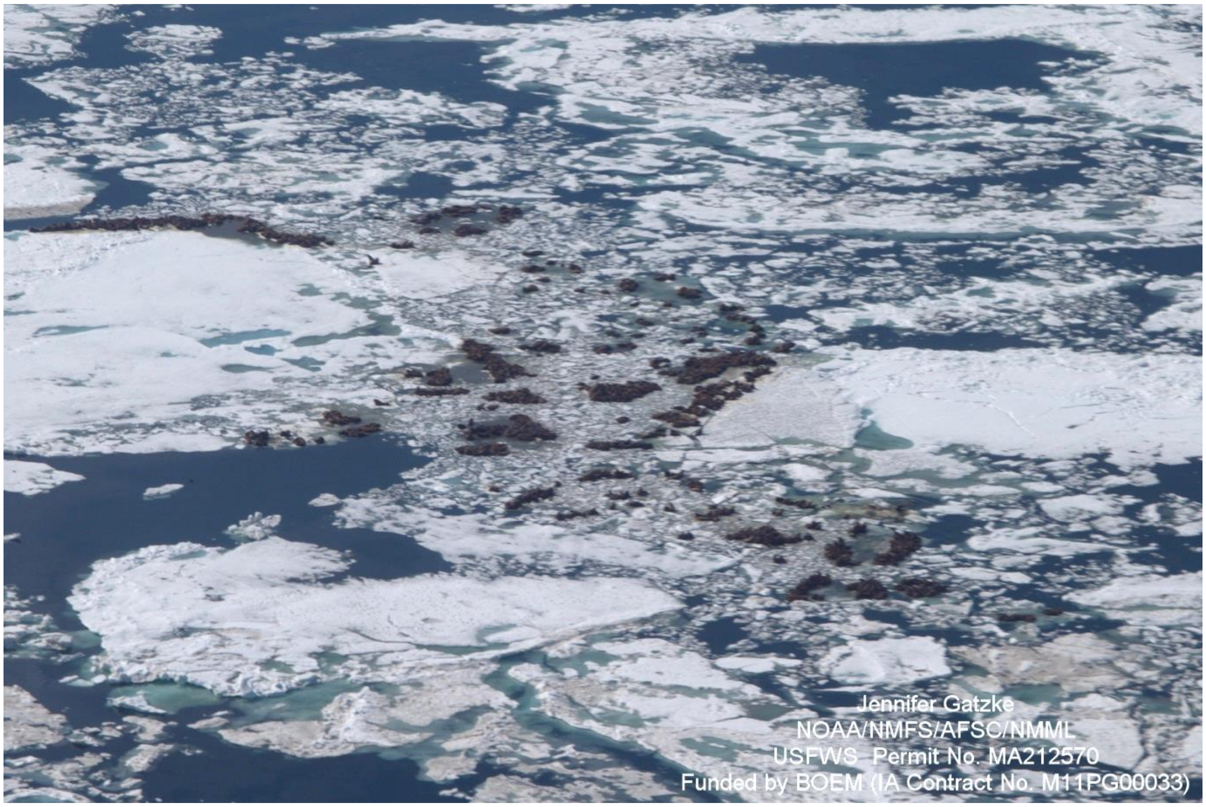


Figure B-6. ASAMM Flight 206 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.



Walruses hauled out on ice near Hanna Shoal during Flight 206, 15 July 2014.

16 July 2014, Flight 207

Flight was a partial survey of transects 21 and 23 and the coastal transect from Ledyard Bay to Barrow. Survey conditions included overcast skies, <1-10 km visibility (with low ceilings and precipitation), and Beaufort 0-7 sea states. Sea ice cover was 0-95% broken floe in the area surveyed. Sightings included gray whales (including 19 calves), belugas (including 2 calves), and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
207	7/16/14 14:51	70.077	162.576	beluga	swim	16	0	17
207	7/16/14 14:51	70.083	162.568	beluga	swim	12	2	17
207	7/16/14 14:54	70.182	162.377	gray whale	swim	2	1	17
207	7/16/14 15:10	70.207	162.316	gray whale	feed	2	0	17
207	7/16/14 15:24	70.304	161.435	beluga	swim	1	0	17
207	7/16/14 15:28	70.337	161.064	gray whale	rest	2	1	17
207	7/16/14 15:28	70.341	161.030	gray whale	rest	2	1	17
207	7/16/14 15:31	70.347	160.991	gray whale	swim	1	0	17
207	7/16/14 15:50	70.625	160.111	gray whale	swim	2	1	17
207	7/16/14 15:51	70.643	160.120	gray whale	feed	4	1	17
207	7/16/14 15:52	70.618	160.155	gray whale	swim	5	2	17
207	7/16/14 15:57	70.616	160.142	gray whale	swim	4	2	17
207	7/16/14 15:57	70.616	160.142	gray whale	swim	4	2	17
207	7/16/14 16:04	70.657	160.011	gray whale	swim	4	2	13
207	7/16/14 16:08	70.675	159.967	gray whale	swim	2	0	13
207	7/16/14 16:08	70.675	159.967	gray whale	swim	2	1	13
207	7/16/14 16:08	70.675	159.967	gray whale	swim	5	2	13
207	7/16/14 16:09	70.675	159.967	gray whale	swim	1	0	17
207	7/16/14 16:09	70.675	159.967	gray whale	swim	2	1	13
207	7/16/14 16:09	70.675	159.967	gray whale	rest	1	0	17
207	7/16/14 16:11	70.771	159.696	gray whale	mill	2	1	13
207	7/16/14 16:12	70.746	159.785	gray whale	mill	1	0	13
207	7/16/14 16:20	70.835	159.515	gray whale	feed	1	0	13
207	7/16/14 16:20	70.841	159.477	gray whale	feed	1	0	13
207	7/16/14 16:22	70.863	159.328	gray whale	swim	2	1	13

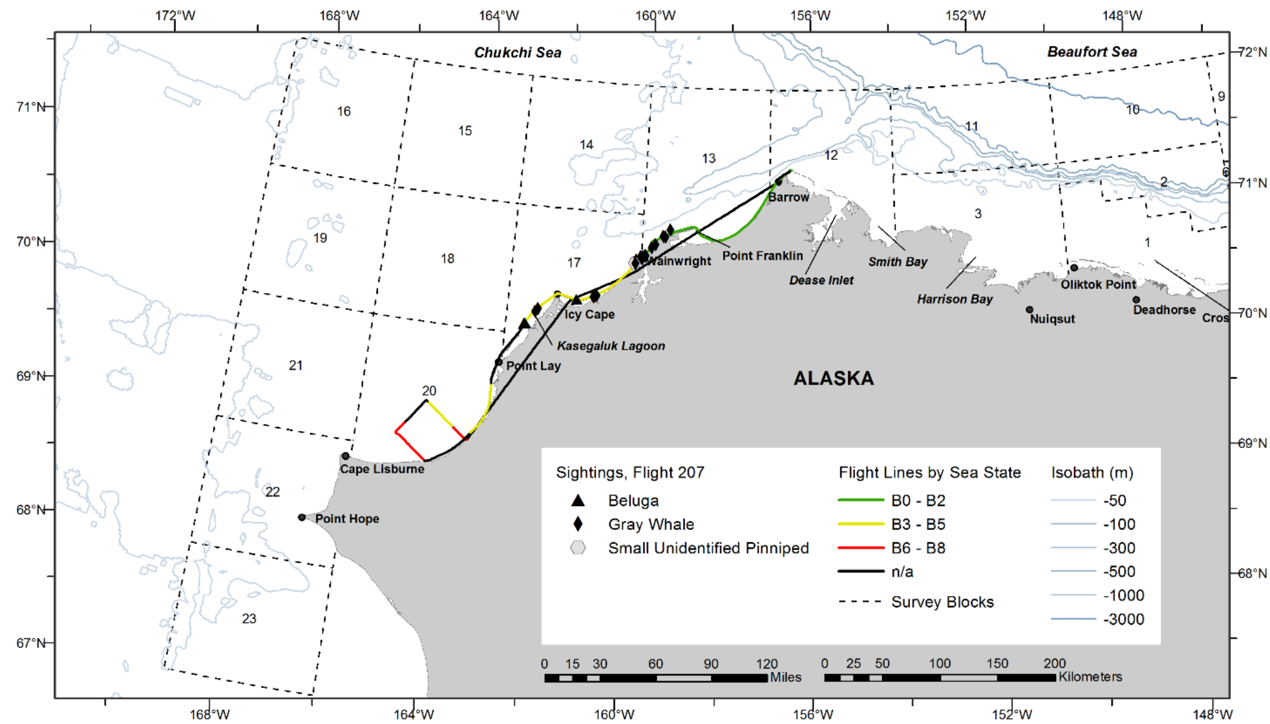


Figure B-7. ASAMM Flight 207 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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18 July 2014, Flight 208

Flight was a partial survey of transects 10 and 12. Survey conditions included partly cloudy to overcast skies, <1-10 km visibility (with low ceilings, fog, and glare), and Beaufort 2-6 sea states. Sea ice cover was 0-90% broken floe in the area surveyed. Sightings included gray whales (including one calf), and one unidentified cetacean.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
208	7/18/14 14:40	70.711	160.594	gray whale	feed	1	0	17
208	7/18/14 14:40	70.720	160.621	gray whale	feed	2	1	17
208	7/18/14 15:15	70.639	161.918	unid cetacean	dive	1	0	17
208	7/18/14 15:46	70.619	160.232	gray whale	feed	1	0	17

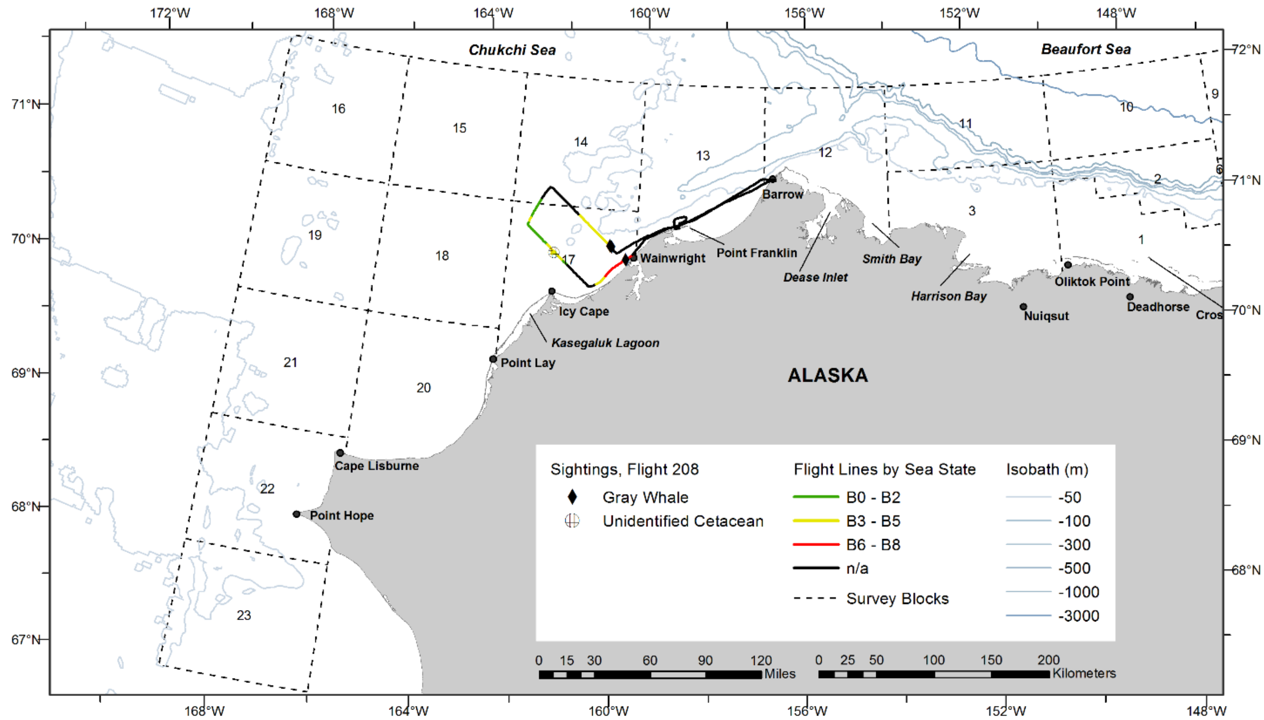

Figure B-8. ASAMM Flight 208 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

19 July 2014, Flight 209

Flight was a complete survey of transects 1 and 3, partial survey of transects 5 and 7, and search effort from Barrow to Point Franklin. Survey conditions included partly cloudy to overcast skies, <1-10 km visibility (with low ceilings, fog, and glare), and Beaufort 1-3 sea states. Sea ice cover was 20-90% broken floe in the area surveyed. Sightings included gray whales (including seven calves), belugas (including two calves), walruses, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
209	7/19/14 16:37	71.338	157.264	beluga	swim	12	2	13
209	7/19/14 16:59	71.068	157.914	gray whale	feed	2	1	13
209	7/19/14 16:59	71.069	157.917	gray whale	feed	2	1	13
209	7/19/14 16:59	71.076	157.941	gray whale	feed	1	0	13
209	7/19/14 17:12	71.072	157.900	gray whale	swim	2	1	13
209	7/19/14 17:22	71.219	158.409	beluga	swim	1	0	13
209	7/19/14 17:22	71.225	158.429	beluga	swim	1	0	13
209	7/19/14 17:44	70.928	158.987	gray whale	swim	1	0	13
209	7/19/14 17:57	70.996	158.373	gray whale	feed	1	0	13
209	7/19/14 18:03	71.048	158.410	gray whale	swim	2	1	13
209	7/19/14 18:04	71.054	158.382	gray whale	feed	1	0	13
209	7/19/14 18:04	71.061	158.336	gray whale	swim	2	1	13
209	7/19/14 18:06	71.063	158.244	gray whale	swim	2	1	13
209	7/19/14 18:07	71.078	158.144	gray whale	feed	2	0	13
209	7/19/14 18:10	71.136	157.830	gray whale	feed	1	0	13
209	7/19/14 18:11	71.127	157.785	gray whale	rest	1	0	13
209	7/19/14 18:12	71.127	157.833	gray whale	feed	2	1	13
209	7/19/14 18:12	71.129	157.810	gray whale	feed	1	0	13

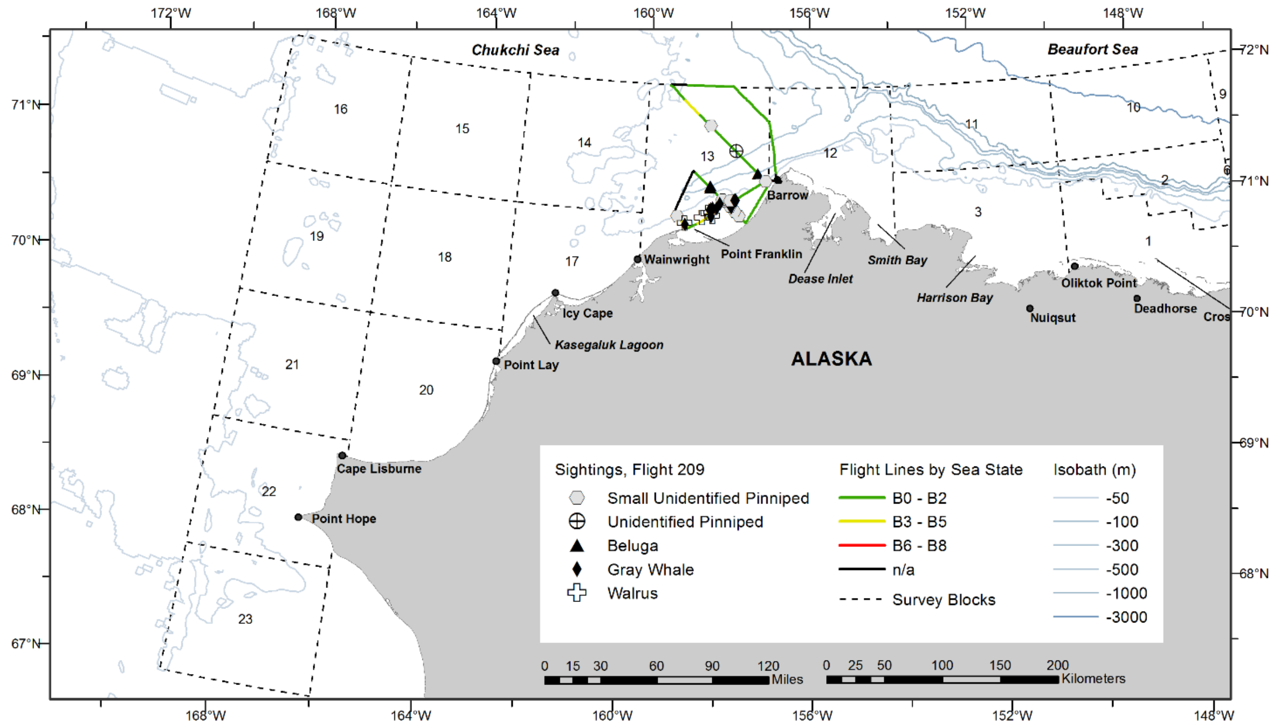

Figure B-9. ASAMM Flight 209 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Feeding gray whale observed between Point Franklin, Alaska, and Barrow, Alaska, during Flight 209, 19 July 2014.

19 July 2014, Flight 1

Flight was a survey of portions of blocks 4 and 6. Survey conditions included partly cloudy skies, no visibility to unlimited visibility (with glare, fog, low ceilings, and precipitation) and Beaufort 2-4 sea states. Sea ice cover was 0-18% broken floe in the area surveyed. Sightings included bowhead whales (including 1 calf), belugas (including 18 calves), and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
1	7/19/14 17:36	70.614	143.342	beluga	swim	1	0	6
1	7/19/14 17:37	70.620	143.342	beluga	swim	1	0	6
1	7/19/14 17:37	70.644	143.345	beluga	swim	2	1	6
1	7/19/14 17:38	70.681	143.356	beluga	rest	1	0	6
1	7/19/14 17:39	70.710	143.361	beluga	swim	1	0	6
1	7/19/14 17:39	70.716	143.361	beluga	swim	44	1	6
1	7/19/14 17:40	70.755	143.370	beluga	swim	11	5	6
1	7/19/14 17:42	70.798	143.381	beluga	swim	1	0	6
1	7/19/14 17:44	70.896	143.404	beluga	swim	4	0	6
1	7/19/14 17:45	70.905	143.408	beluga	swim	4	2	6
1	7/19/14 17:48	71.016	143.431	bowhead whale	swim	1	0	6
1	7/19/14 17:52	71.067	143.452	beluga	swim	1	0	6
1	7/19/14 17:53	71.098	143.456	beluga	swim	1	0	6
1	7/19/14 17:54	71.140	143.464	beluga	swim	1	0	6
1	7/19/14 18:00	71.124	143.944	beluga	swim	1	0	6
1	7/19/14 18:01	71.099	143.930	beluga	swim	1	0	6
1	7/19/14 18:02	71.080	143.923	beluga	mate	1	0	6
1	7/19/14 18:05	70.981	143.878	beluga	swim	2	0	6
1	7/19/14 18:18	70.616	143.726	bowhead whale	swim	1	0	6
1	7/19/14 18:19	70.615	143.674	beluga	swim	1	0	6
1	7/19/14 18:21	70.620	143.670	beluga	swim	2	0	6
1	7/19/14 18:21	70.613	143.673	beluga	swim	1	0	6
1	7/19/14 18:58	70.556	144.214	beluga	swim	45	3	6
1	7/19/14 19:00	70.597	144.232	bowhead whale	swim	2	1	6
1	7/19/14 19:04	70.603	144.183	bowhead whale	feed	1	0	6
1	7/19/14 19:10	70.698	144.272	beluga	mill	3	1	6
1	7/19/14 19:11	70.729	144.285	beluga	swim	2	1	6
1	7/19/14 19:11	70.729	144.285	beluga	swim	2	0	6
1	7/19/14 19:12	70.759	144.297	beluga	swim	6	0	6
1	7/19/14 19:14	70.807	144.318	beluga	swim	1	0	6

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
1	7/19/14 19:21	71.059	144.414	beluga	swim	2	0	6
1	7/19/14 19:22	71.080	144.427	beluga	swim	1	0	6
1	7/19/14 19:23	71.111	144.446	beluga	swim	1	0	6
1	7/19/14 19:23	71.134	144.457	beluga	swim	1	0	6
1	7/19/14 19:25	71.145	144.543	beluga	swim	1	0	6
1	7/19/14 19:26	71.113	144.561	beluga	swim	1	0	6
1	7/19/14 19:27	71.068	144.578	beluga	swim	1	0	6
1	7/19/14 19:30	70.984	144.605	beluga	swim	1	0	6
1	7/19/14 19:30	70.982	144.605	beluga	swim	1	0	6
1	7/19/14 19:31	70.963	144.612	beluga	mill	2	1	6
1	7/19/14 19:32	70.934	144.622	beluga	swim	2	1	6
1	7/19/14 19:33	70.901	144.635	bowhead whale	dive	1	0	6
1	7/19/14 19:34	70.861	144.646	bowhead whale	swim	1	0	6
1	7/19/14 19:39	70.767	144.679	beluga	swim	2	0	6
1	7/19/14 19:39	70.756	144.684	beluga	swim	6	0	6
1	7/19/14 19:40	70.739	144.690	beluga	swim	3	1	6
1	7/19/14 19:40	70.733	144.692	beluga	swim	3	0	6
1	7/19/14 19:40	70.723	144.693	bowhead whale	swim	1	0	6
1	7/19/14 19:42	70.727	144.700	bowhead whale	rest	1	0	6
1	7/19/14 19:47	70.740	144.694	beluga	swim	5	1	6
1	7/19/14 19:52	70.555	144.743	beluga	swim	1	0	6

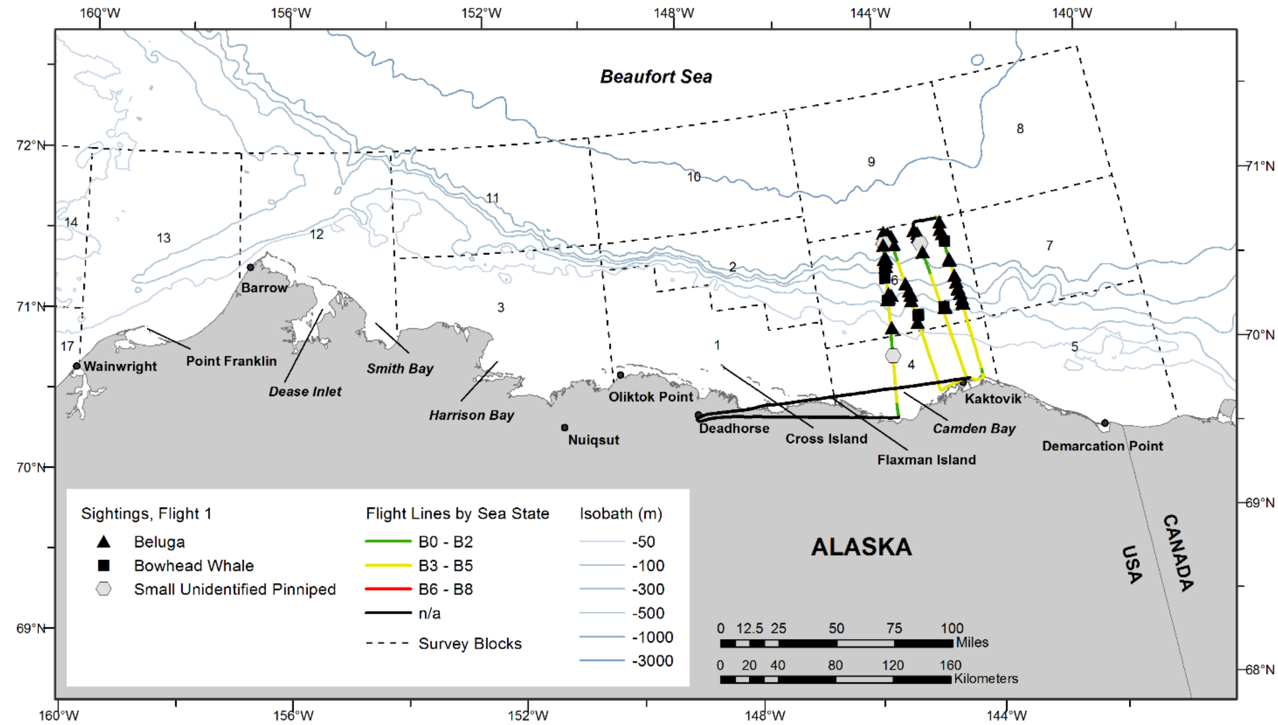

Figure B-10. ASAMM Flight 1 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Bowhead whale cow-calf pair observed north of Camden Bay, Alaska, during Flight 1, 19 July 2014. The cow's white chin can be seen underwater to the right; the calf is above the cow's peduncle and white tail.

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20 July 2014, Flight 2

Flight was a survey of portions of blocks 1, 2, 4, and 6. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with glare, low ceilings, and precipitation), and Beaufort 1-5 sea states. Sea ice cover was 0-80% broken floe in the area surveyed. Sightings included one bowhead whale, belugas (including four calves), and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
2	7/20/14 11:05	70.196	145.969	beluga	swim	5	1	4
2	7/20/14 11:46	70.988	145.324	beluga	swim	1	0	6
2	7/20/14 11:47	71.016	145.328	beluga	swim	1	0	6
2	7/20/14 11:58	71.105	145.735	beluga	swim	2	0	6
2	7/20/14 14:16	71.224	147.206	beluga	swim	2	0	2
2	7/20/14 14:17	71.237	147.212	beluga	swim	8	0	2
2	7/20/14 14:17	71.254	147.217	beluga	swim	2	0	2
2	7/20/14 14:31	71.270	147.910	beluga	swim	1	0	2
2	7/20/14 14:31	71.267	147.911	beluga	swim	1	0	2
2	7/20/14 14:33	71.213	147.912	beluga	swim	1	0	2
2	7/20/14 14:33	71.198	147.912	beluga	swim	2	0	2
2	7/20/14 14:38	71.085	147.913	beluga	swim	5	0	2
2	7/20/14 14:44	70.907	147.919	beluga	swim	1	0	2
2	7/20/14 11:43	70.880	145.304	beluga	swim	2	0	6
2	7/20/14 11:44	70.902	145.306	beluga	swim	2	0	6
2	7/20/14 11:44	70.920	145.310	beluga	swim	1	0	6
2	7/20/14 11:45	70.931	145.314	beluga	swim	3	0	6
2	7/20/14 11:59	71.040	145.726	bowhead whale	swim	1	0	6
2	7/20/14 12:01	70.974	145.724	beluga	swim	8	0	6
2	7/20/14 12:05	70.862	145.717	beluga	swim	6	2	6
2	7/20/14 12:05	70.849	145.716	beluga	swim	1	0	6
2	7/20/14 12:53	70.905	146.236	beluga	swim	2	0	2
2	7/20/14 12:55	70.942	146.245	beluga	swim	1	0	2
2	7/20/14 12:57	71.004	146.263	beluga	rest	1	0	2
2	7/20/14 13:11	71.060	146.528	beluga	swim	6	0	2
2	7/20/14 13:11	71.045	146.525	beluga	swim	1	0	2
2	7/20/14 14:12	71.084	147.180	beluga	swim	4	1	2
2	7/20/14 14:13	71.124	147.187	beluga	swim	2	0	2
2	7/20/14 14:16	71.202	147.200	beluga	swim	5	0	2
2	7/20/14 14:16	71.211	147.202	beluga	swim	1	0	2

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
2	7/20/14 14:16	71.217	147.204	beluga	swim	1	0	2

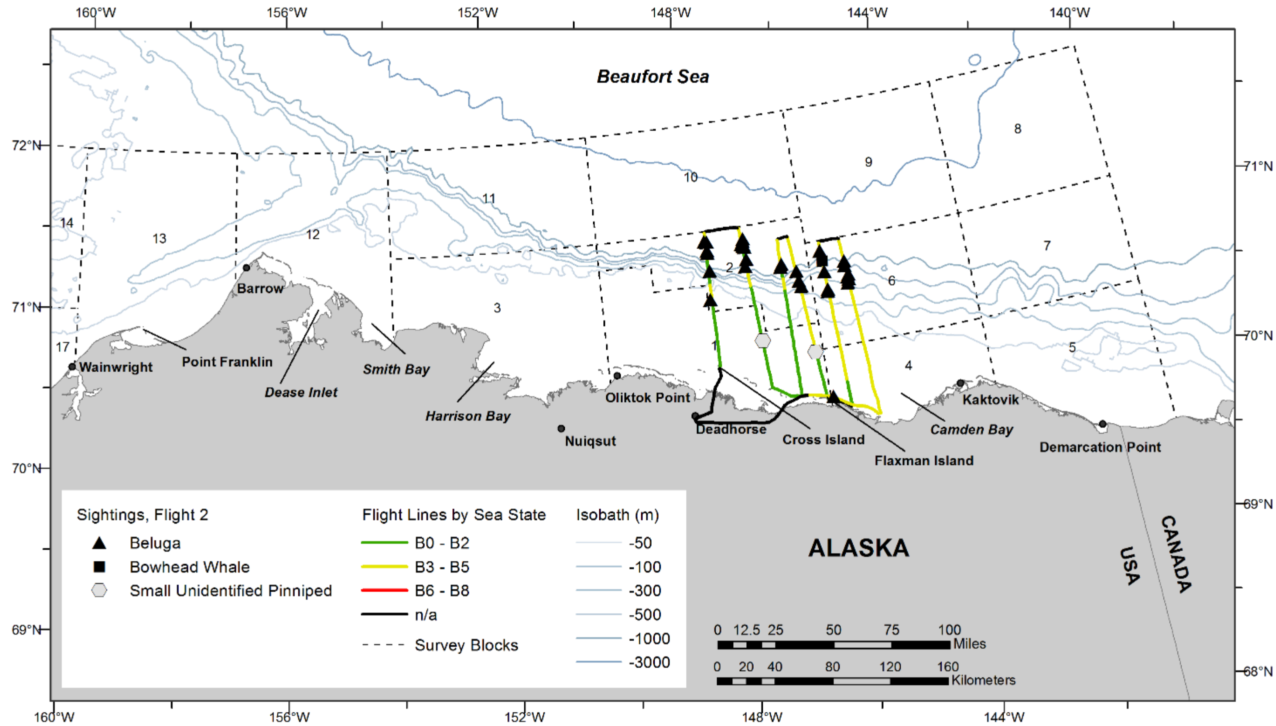

Figure B-11. ASAMM Flight 2 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

21 July 2014, Flight 3

Flight was a survey of portions of blocks 1, 2, 5, and 7. Survey conditions included partly cloudy to overcast skies, <1 km to unlimited visibility (with glare, low ceilings, and precipitation), Beaufort 2-4 sea states. Sea ice cover was 0-72% broken floe in the area surveyed. Sightings included belugas (including eight calves) and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
3	7/21/14 11:31	70.689	142.810	beluga	swim	2	0	7
3	7/21/14 11:33	70.626	142.817	beluga	swim	3	1	7
3	7/21/14 11:33	70.610	142.819	beluga	swim	3	0	7
3	7/21/14 11:54	69.986	142.463	beluga	swim	1	0	5
3	7/21/14 12:01	69.946	142.094	beluga	swim	1	0	5
3	7/21/14 12:04	70.028	142.095	beluga	mill	3	0	5
3	7/21/14 12:18	70.496	142.085	beluga	swim	5	1	5
3	7/21/14 12:19	70.509	142.085	beluga	swim	2	0	7
3	7/21/14 12:19	70.520	142.087	beluga	swim	1	0	7
3	7/21/14 12:19	70.531	142.087	beluga	swim	4	1	7
3	7/21/14 12:20	70.537	142.085	beluga	swim	1	0	7
3	7/21/14 12:24	70.634	142.097	beluga	swim	1	0	7
3	7/21/14 12:29	70.776	142.085	beluga	swim	1	0	7
3	7/21/14 12:29	70.804	142.087	beluga	swim	1	0	7
3	7/21/14 12:30	70.816	142.090	beluga	swim	1	1	7
3	7/21/14 12:31	70.850	142.093	beluga	swim	2	0	7
3	7/21/14 12:54	70.887	141.557	beluga	swim	2	0	7
3	7/21/14 12:54	70.878	141.556	beluga	swim	1	0	7
3	7/21/14 12:56	70.825	141.564	beluga	swim	2	1	7
3	7/21/14 12:58	70.755	141.565	beluga	swim	1	0	7
3	7/21/14 13:00	70.678	141.568	beluga	swim	5	1	7
3	7/21/14 13:00	70.670	141.569	beluga	swim	1	0	7
3	7/21/14 13:03	70.593	141.570	beluga	swim	12	1	7
3	7/21/14 13:06	70.495	141.568	beluga	swim	1	0	5
3	7/21/14 13:15	70.212	141.581	beluga	swim	2	1	5
3	7/21/14 13:29	69.802	141.590	beluga	mill	1	0	5
3	7/21/14 13:29	69.794	141.588	beluga	mill	1	0	5

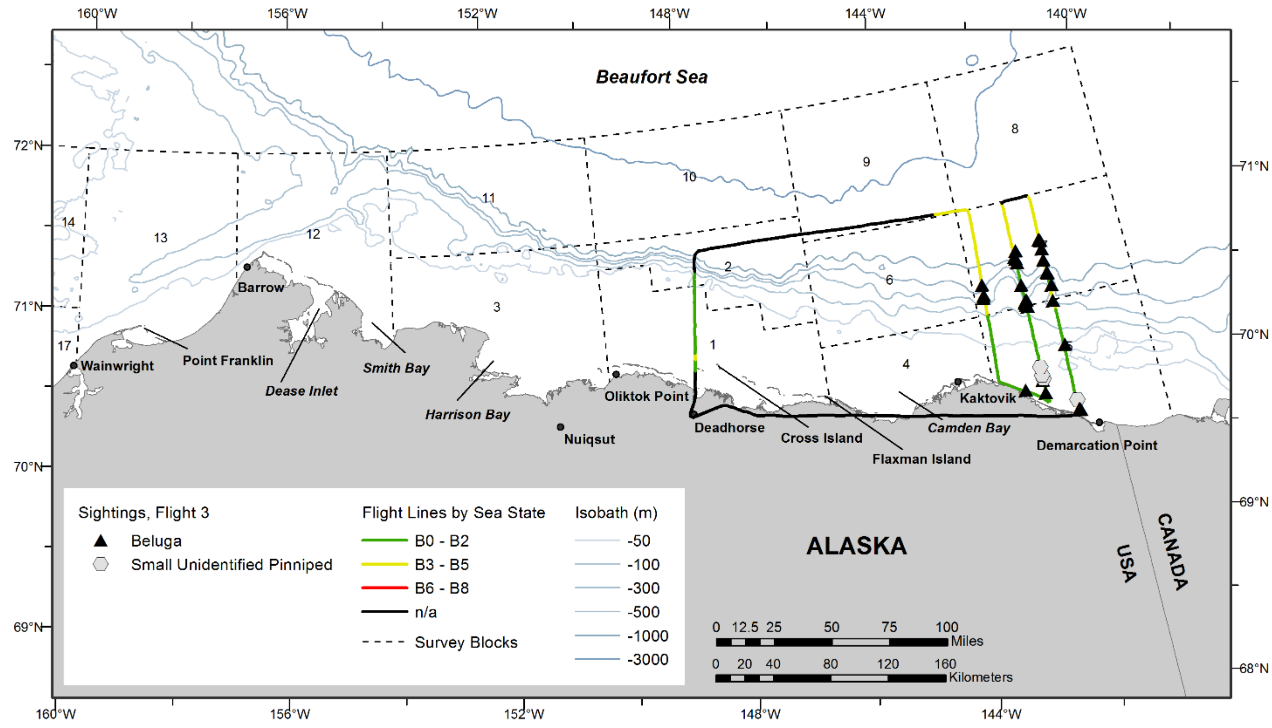

Figure B-12. ASAMM Flight 3 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

22 July 2014, Flight 210

Flight was a partial survey of transects 16 and 18, the coastal transect from Point Lay to Icy Cape, and search effort from Icy Cape to Point Franklin. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with low ceilings, fog, precipitation, and glare), and Beaufort 1-5 sea states. Sea ice cover was 0-80% broken floe in the area surveyed. Sightings included gray whales (including 10 calves), belugas, walruses, unidentified pinnipeds, small unidentified pinnipeds, and 1 small unidentified marine mammal.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
210	7/22/14 11:31	71.269	167.926	gray whale	swim	2	1	16
210	7/22/14 13:14	69.680	163.209	gray whale	feed	2	1	20
210	7/22/14 13:18	69.681	163.199	gray whale	feed	2	1	20
210	7/22/14 13:44	70.285	162.072	gray whale	swim	2	1	17
210	7/22/14 13:45	70.288	162.088	gray whale	swim	1	0	17
210	7/22/14 13:49	70.273	162.106	gray whale	swim	3	1	17
210	7/22/14 13:56	70.336	161.888	small unid marine mammal	unknown	1	0	17
210	7/22/14 13:59	70.333	161.742	beluga	swim	5	0	17
210	7/22/14 14:11	70.547	160.693	gray whale	feed	1	0	17
210	7/22/14 14:14	70.610	160.384	gray whale	swim	2	1	17
210	7/22/14 14:17	70.670	160.087	gray whale	swim	1	0	17
210	7/22/14 14:22	70.779	159.718	gray whale	swim	2	0	13
210	7/22/14 14:24	70.821	159.574	gray whale	dive	1	0	13
210	7/22/14 14:24	70.826	159.545	gray whale	swim	2	1	13
210	7/22/14 14:25	70.842	159.456	gray whale	swim	2	0	13
210	7/22/14 14:26	70.855	159.382	beluga	swim	15	0	13
210	7/22/14 14:26	70.862	159.341	gray whale	swim	2	1	13
210	7/22/14 14:28	70.891	159.149	gray whale	swim	2	1	13
210	7/22/14 14:29	70.906	159.010	gray whale	swim	2	1	13

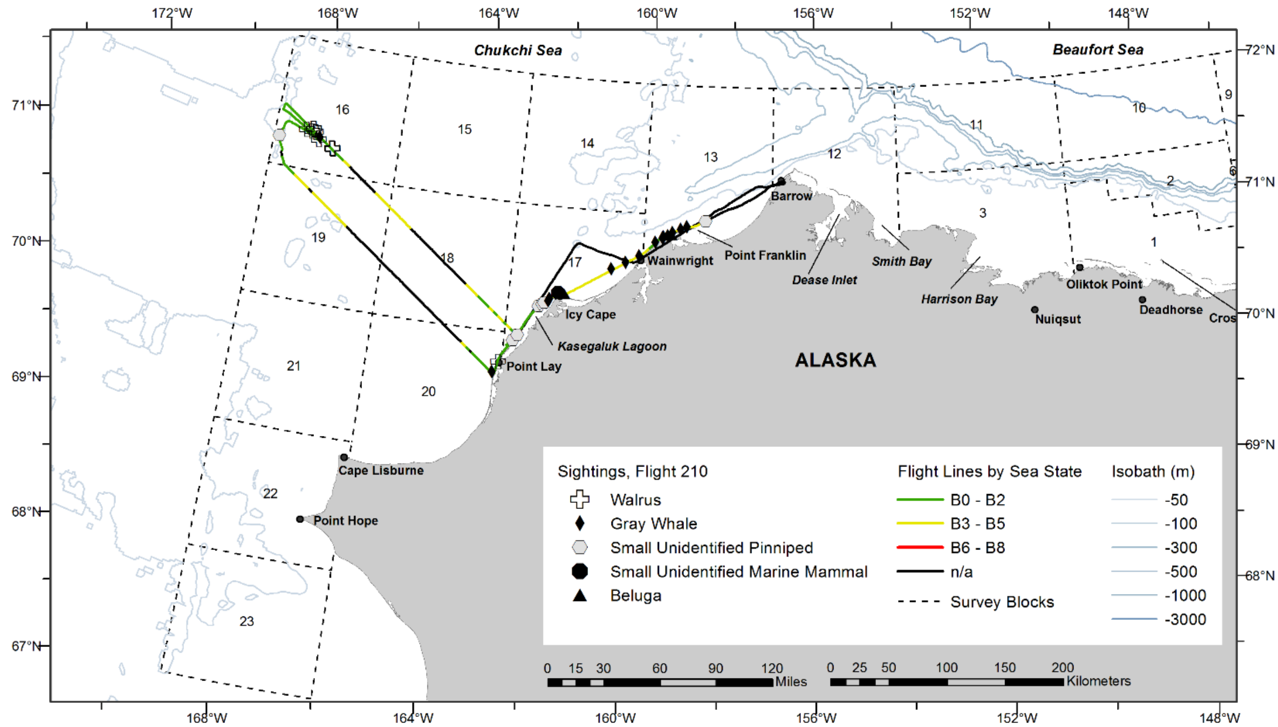

Figure B-13. ASAMM Flight 210 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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24 July 2014, Flight 211

Flight was a complete survey of transects 29 and 30. Survey conditions included overcast skies, <1-10 km visibility (with low ceilings and glare), and Beaufort 5-6 sea states. There was no sea ice observed in the area surveyed. No sightings were observed.

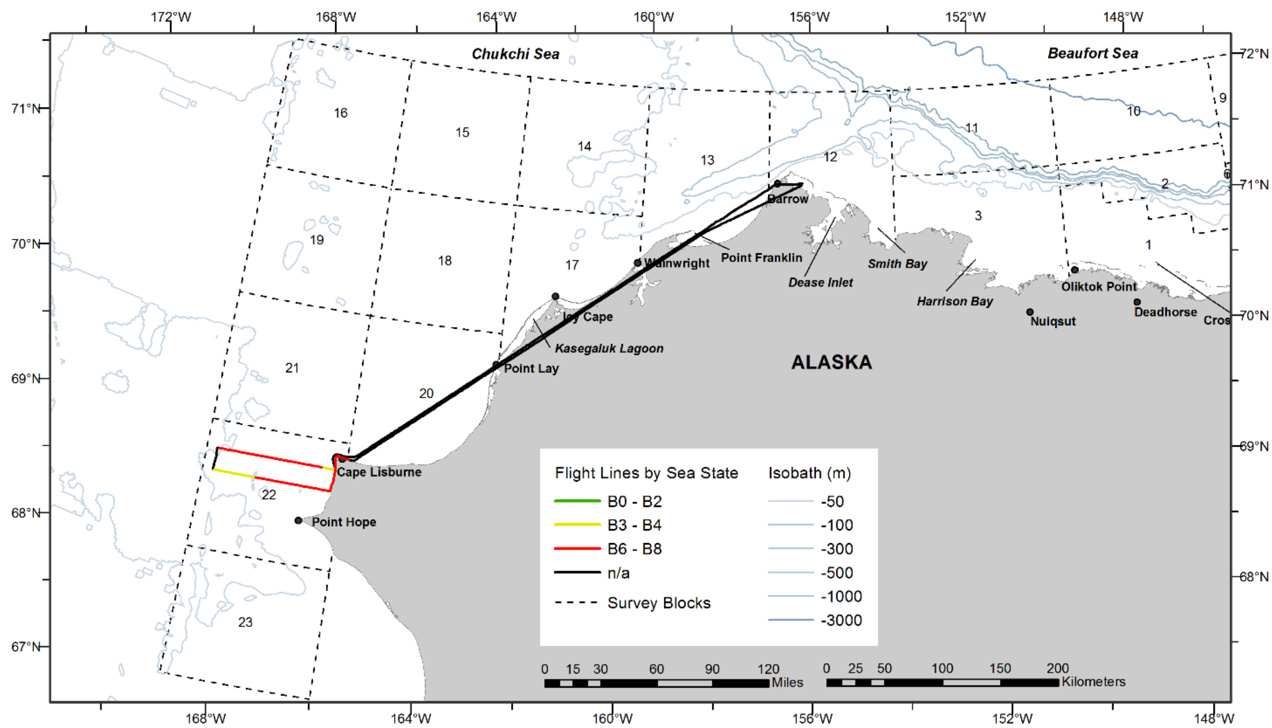

Figure B-14. ASAMM Flight 211 survey track, depicted by sea state.

25 July 2014, Flight 212

Flight was a complete survey of transect 21 and partial survey of transect 23. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with low ceilings and glare), and Beaufort 0-4 sea states. Sea ice cover was 0-50% broken floe in the area surveyed. Sightings included gray whales, one beluga, walruses, unidentified pinnipeds, small unidentified pinnipeds, one small unidentified marine mammal, and one polar bear. The polar bear was swimming approximately 180 km offshore, in an area with 50% new and broken floe ice.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
212	7/25/14 11:30	70.119	167.409	beluga	swim	1	0	19
212	7/25/14 12:33	68.961	164.239	small unid marine mammal	swim	1	0	20
212	7/25/14 15:06	71.242	157.310	gray whale	feed	1	0	13
212	7/25/14 15:07	71.243	157.305	gray whale	feed	1	0	13
212	7/25/14 15:07	71.244	157.287	gray whale	swim	1	0	13
212	7/25/14 15:07	71.247	157.250	gray whale	swim	1	0	13

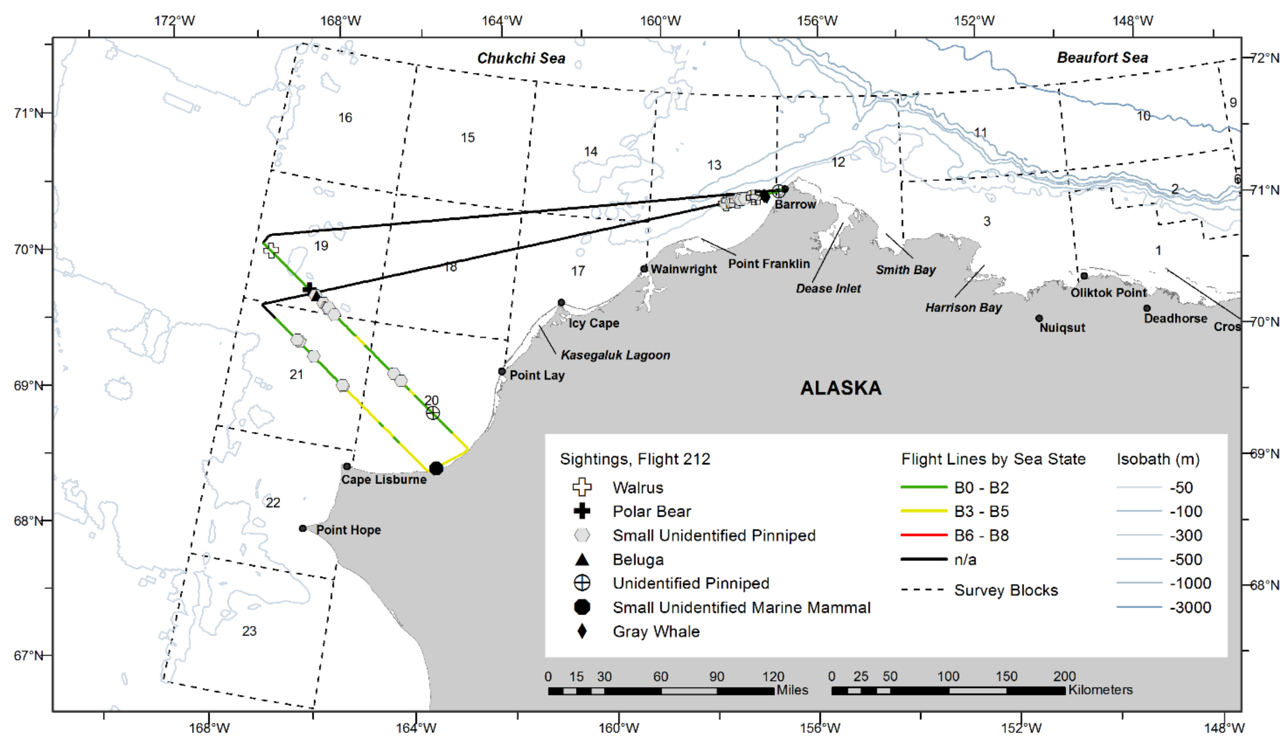

Figure B-15. ASAMM Flight 212 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Walruses hauled out on sea ice approximately 35 km north of Point Franklin, Alaska, during Flight 212, 25 July 2014.

26 July 2014, Flight 213

Flight was a partial survey of transects 15 and 17, the coastal transect from Point Lay to Point Franklin, and search effort from Point Franklin to Barrow. Survey conditions included clear to partly cloudy skies, no visibility to unlimited visibility (with low ceilings and glare), and Beaufort 2-6 sea states. Sea ice cover was 0-15% broken floe in the area surveyed. Sightings included gray whales (including 13 calves), 1 beluga, small unidentified pinnipeds, and 1 unidentified marine mammal carcass.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
213	7/26/14 14:29	70.175	162.414	beluga	swim	1	0	17
213	7/26/14 15:10	70.856	159.365	gray whale	feed	3	1	13
213	7/26/14 15:10	70.865	159.353	gray whale	swim	1	0	13
213	7/26/14 15:10	70.867	159.361	gray whale	swim	2	1	13
213	7/26/14 15:16	70.877	159.224	gray whale	swim	2	1	13
213	7/26/14 15:24	70.932	158.765	gray whale	tail slap	2	1	13
213	7/26/14 15:31	71.005	158.513	gray whale	breach	1	0	13
213	7/26/14 15:51	70.995	158.445	gray whale	feed	6	2	13
213	7/26/14 15:52	71.000	158.429	gray whale	feed	4	2	13
213	7/26/14 15:53	71.009	158.383	gray whale	feed	1	0	13
213	7/26/14 15:56	71.011	158.400	gray whale	feed	1	0	13
213	7/26/14 15:57	71.019	158.356	gray whale	feed	2	1	13
213	7/26/14 15:58	71.019	158.338	gray whale	feed	4	1	13
213	7/26/14 15:58	71.022	158.330	gray whale	feed	1	0	13
213	7/26/14 15:59	71.028	158.350	gray whale	feed	1	0	13
213	7/26/14 16:00	71.020	158.328	gray whale	feed	2	1	13
213	7/26/14 16:02	71.003	158.319	gray whale	feed	2	0	13
213	7/26/14 16:03	71.005	158.267	gray whale	feed	2	1	13
213	7/26/14 16:03	71.013	158.276	gray whale	feed	1	0	13
213	7/26/14 16:04	71.009	158.235	gray whale	feed	1	0	13
213	7/26/14 16:05	71.019	158.212	gray whale	feed	1	0	13
213	7/26/14 16:05	71.022	158.213	gray whale	feed	1	0	13
213	7/26/14 16:05	71.024	158.231	gray whale	feed	1	0	13
213	7/26/14 16:06	71.013	158.186	gray whale	feed	1	0	13
213	7/26/14 16:08	71.042	158.064	gray whale	feed	2	0	13
213	7/26/14 16:08	71.055	157.998	gray whale	feed	2	0	13
213	7/26/14 16:09	71.066	157.939	gray whale	swim	2	1	13
213	7/26/14 16:10	71.074	157.897	gray whale	feed	1	0	13
213	7/26/14 16:11	71.102	157.746	gray whale	feed	2	0	13

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
213	7/26/14 16:12	71.112	157.698	gray whale	unknown	1	0	13
213	7/26/14 16:12	71.113	157.691	gray whale	feed	1	0	13
213	7/26/14 16:16	71.171	157.384	gray whale	unknown	1	0	13

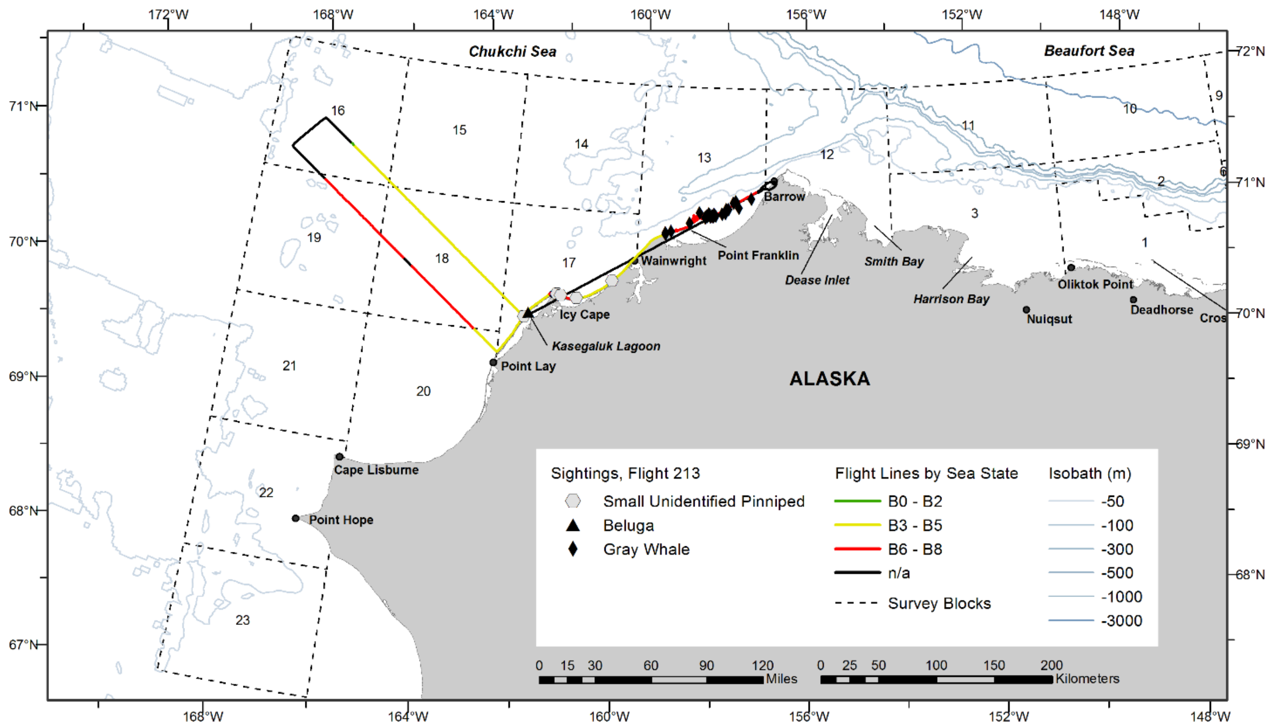

Figure B-16. ASAMM Flight 213 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

26 July 2014, Flight 4

Flight was a survey of portions of block 1. Survey conditions included partly cloudy skies, <1-5 km visibility (with low ceilings), and Beaufort 1 sea state. Sea ice cover was 20-60% broken floe in the area surveyed. There were no sightings.

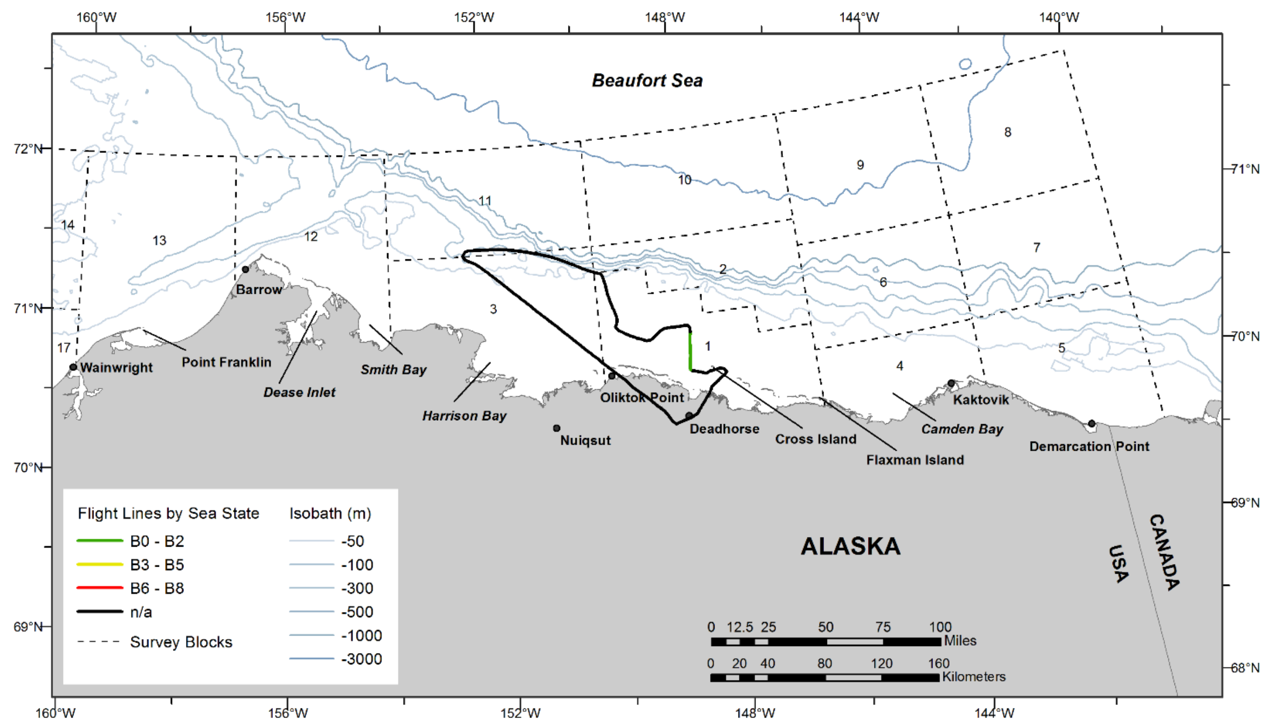

Figure B-17. ASAMM Flight 4 survey track, depicted by sea state.

27 July 2014, Flight 214

Flight was a complete survey of transects 1 and 2 and partial survey of transects 3, 4, 5, and 6. Survey conditions included clear to overcast skies, no visibility to unlimited visibility (with low ceilings, fog, and glare), and Beaufort 1-5 sea states. Sea ice cover was 0-90% broken floe in the area surveyed. Sightings included walruses, unidentified pinnipeds, and small unidentified pinnipeds.

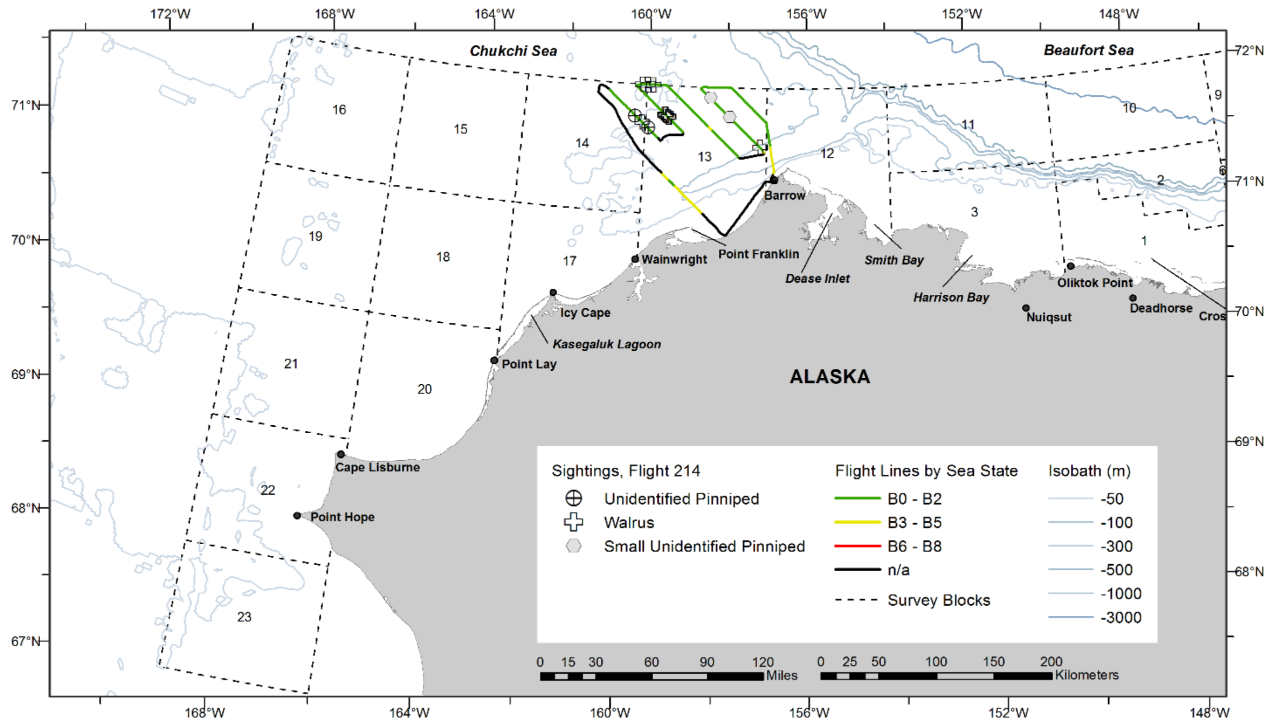

Figure B-18. ASAMM Flight 214 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

27 July 2014, Flight 5

Flight was a survey of portions of block 12. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with low ceilings and glare), and Beaufort 1-4 sea states. Sea ice cover was 1-85% broken floe in the area surveyed. Sightings included bowhead whales, belugas (including seven calves), and one walrus.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
5	7/27/14 14:57	71.995	154.220	beluga	swim	22	0	12
5	7/27/14 15:00	71.990	154.571	beluga	swim	1	0	12
5	7/27/14 15:00	71.989	154.572	beluga	rest	1	0	12
5	7/27/14 15:01	71.957	154.595	beluga	swim	17	0	12
5	7/27/14 15:07	71.765	154.651	beluga	swim	4	0	12
5	7/27/14 15:07	71.760	154.652	beluga	swim	8	1	12
5	7/27/14 15:07	71.759	154.652	beluga	swim	3	0	12
5	7/27/14 15:08	71.745	154.656	beluga	swim	1	0	12
5	7/27/14 15:08	71.735	154.660	beluga	swim	2	1	12
5	7/27/14 15:08	71.728	154.663	beluga	swim	4	2	12
5	7/27/14 15:09	71.718	154.666	beluga	swim	4	0	12
5	7/27/14 15:09	71.717	154.666	beluga	swim	7	2	12
5	7/27/14 15:09	71.705	154.669	beluga	swim	6	1	12
5	7/27/14 15:09	71.693	154.670	beluga	swim	2	0	12
5	7/27/14 15:10	71.685	154.671	beluga	swim	1	0	12
5	7/27/14 15:32	71.238	155.076	bowhead whale	swim	1	0	12
5	7/27/14 15:36	71.259	155.096	bowhead whale	rest	5	0	12
5	7/27/14 15:36	71.259	155.096	bowhead whale	rest	1	0	12
5	7/27/14 15:41	71.262	155.095	bowhead whale	swim	1	0	12
5	7/27/14 15:43	71.253	155.096	bowhead whale	rest	2	0	12
5	7/27/14 15:44	71.260	155.106	bowhead whale	rest	1	0	12
5	7/27/14 15:45	71.264	155.113	bowhead whale	rest	1	0	12
5	7/27/14 15:45	71.262	155.129	bowhead whale	swim	1	0	12

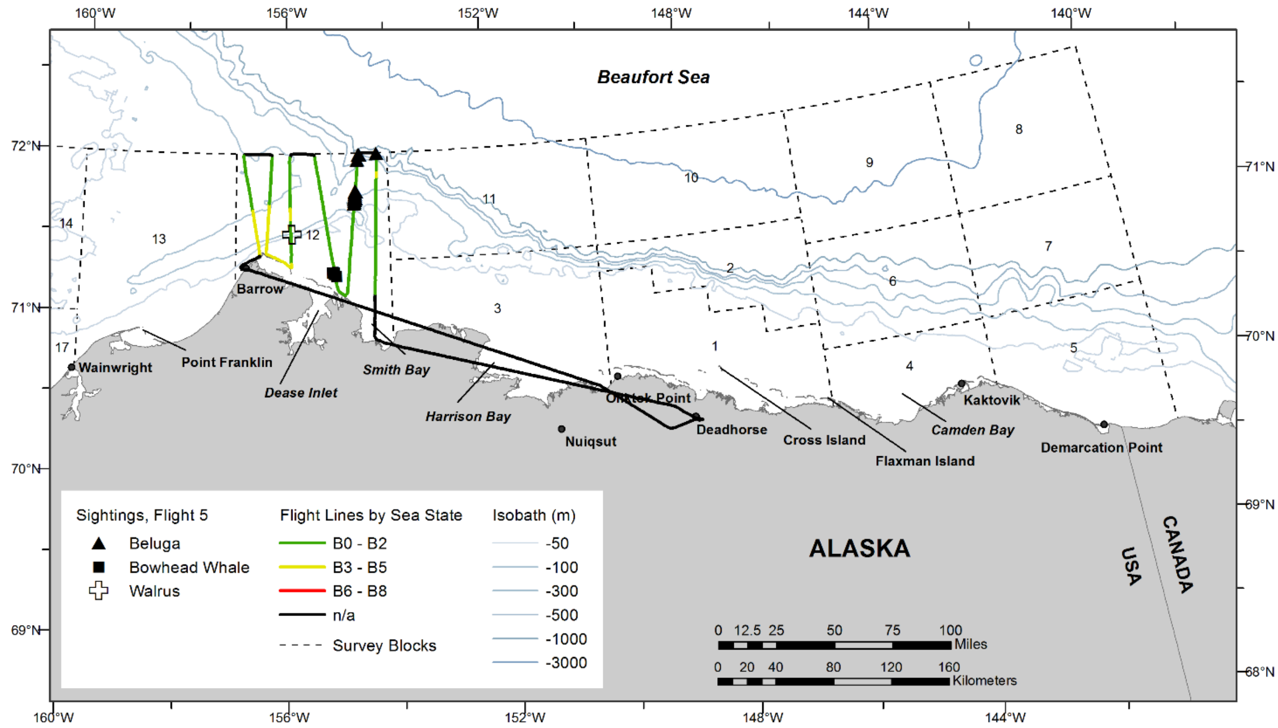

Figure B-19. ASAMM Flight 5 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

29 July 2014, Flight 215

Flight was a complete survey of transects 8, 10, and 12. Survey conditions included clear to partly cloudy skies, 5 km to unlimited visibility (with glare), and Beaufort 0-4 sea states. Sea ice cover was 0-80% broken floe in the area surveyed. Sightings included gray whales (including three calves and one carcass), walruses (including one carcass), one bearded seal, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
215	7/29/14 11:19	70.859	161.098	gray whale	rest	1	0	17
215	7/29/14 11:28	70.713	160.588	gray whale	dead	1	0	17
215	7/29/14 11:33	70.694	160.518	gray whale	feed	5	2	17
215	7/29/14 11:34	70.689	160.502	gray whale	swim	2	1	17

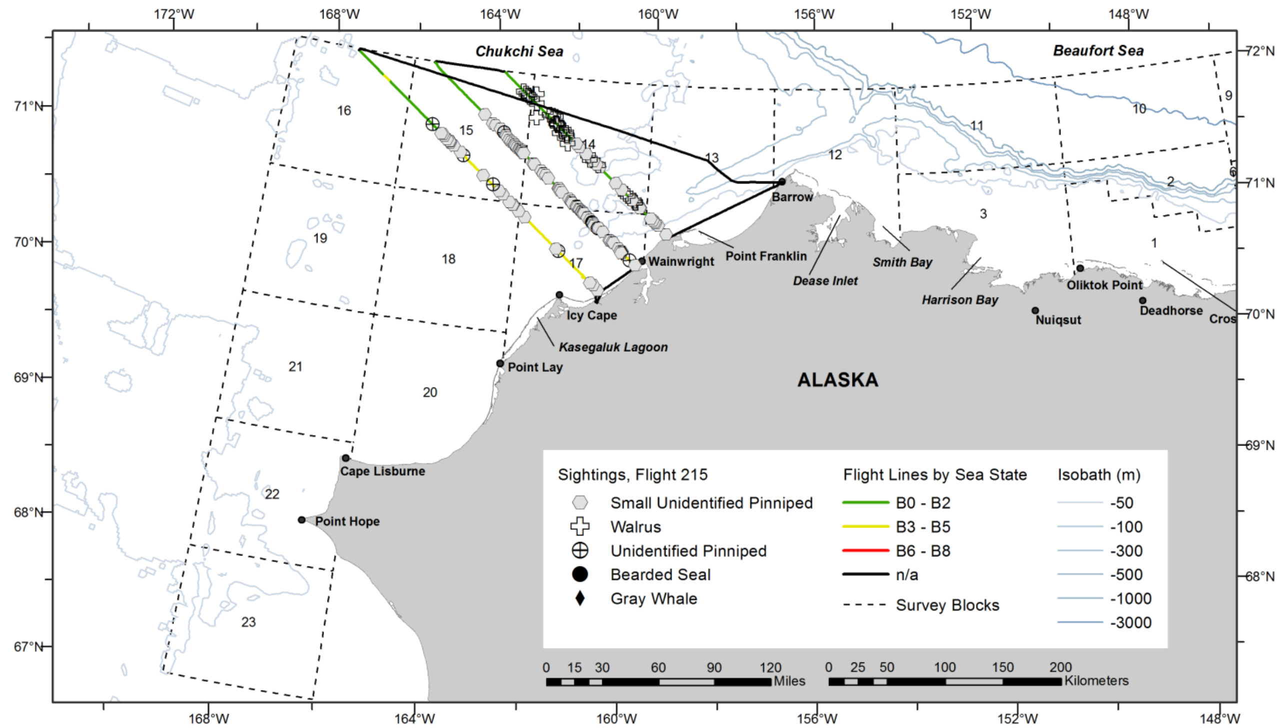

Figure B-20. ASAMM Flight 215 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

30 July 2014, Flight 216

Flight was a complete survey of transects 15 and 17. Survey conditions included partly cloudy to overcast skies, 5 km to unlimited visibility (with glare and haze), and Beaufort 2-5 sea states. Sea ice cover was 0-8% broken floe in the area surveyed. Sightings included gray whales (including one calf), unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
216	7/30/14 13:56	70.648	164.403	gray whale	rest	2	0	18
216	7/30/14 16:27	69.911	163.250	gray whale	feed	2	1	20

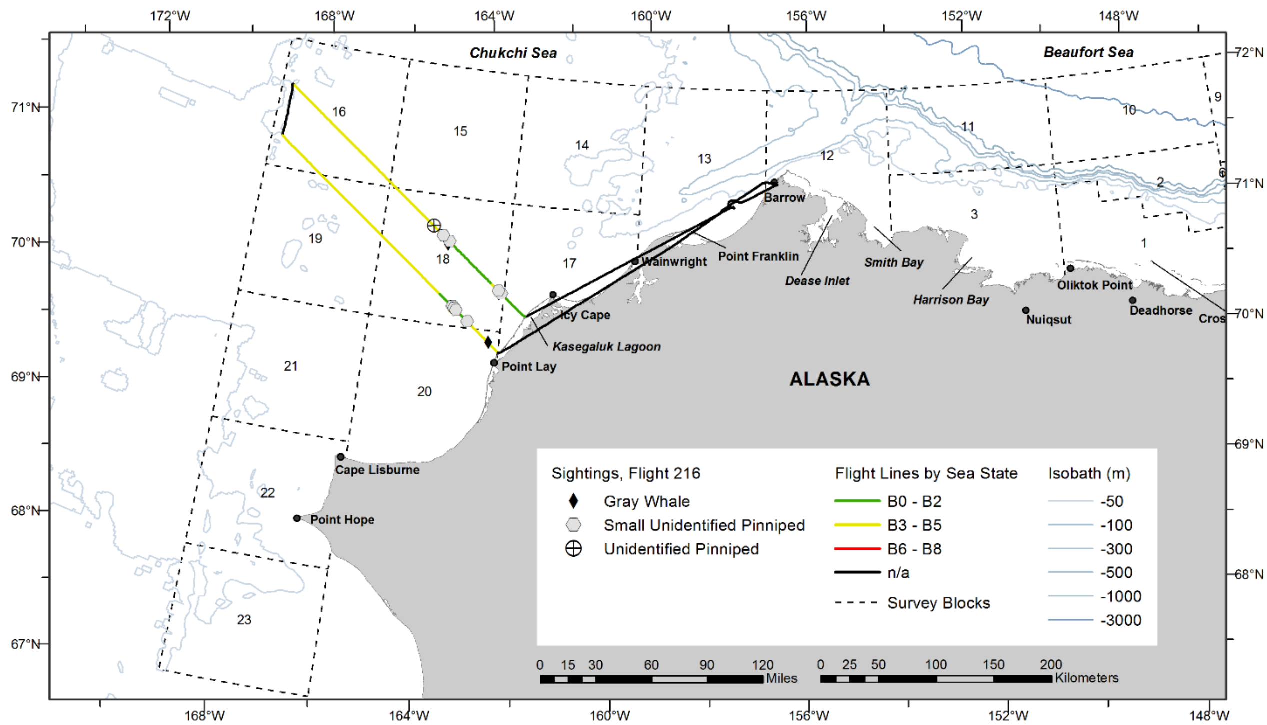

Figure B-21. ASAMM Flight 216 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

31 July 2014, Flight 217

Flight was a survey of portions of blocks 3 and 11, a partial survey of transects 7 and 9, the coastal transect from north of Wainwright to Barrow, and search effort between Smith Bay and Barrow. Survey conditions included overcast skies, 0-10 km visibility (with precipitation, low ceiling, glare, and fog), and Beaufort 0-5 sea states. Sea ice cover was 0-75% broken floe in the area surveyed. Sightings included bowhead whales, gray whales (including 4 calves), belugas (including 11 calves), 1 unidentified cetacean, walruses, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
217	7/31/14 13:02	71.405	156.087	bowhead whale	rest	1	0	12
217	7/31/14 10:34	71.884	152.908	beluga	swim	1	0	11
217	7/31/14 10:35	71.860	152.900	beluga	swim	5	1	11
217	7/31/14 10:36	71.823	152.888	beluga	mill	6	1	11
217	7/31/14 10:37	71.806	152.882	beluga	rest	1	0	11
217	7/31/14 10:37	71.789	152.878	beluga	tail slap	1	0	11
217	7/31/14 10:37	71.786	152.877	beluga	mill	2	0	11
217	7/31/14 10:39	71.738	152.858	beluga	swim	1	0	11
217	7/31/14 10:40	71.727	152.855	beluga	swim	2	0	11
217	7/31/14 10:40	71.722	152.854	beluga	swim	1	0	11
217	7/31/14 10:40	71.718	152.852	beluga	swim	1	0	11
217	7/31/14 10:40	71.717	152.852	beluga	swim	6	1	11
217	7/31/14 10:41	71.694	152.844	beluga	swim	3	1	11
217	7/31/14 10:41	71.688	152.842	beluga	swim	2	0	11
217	7/31/14 10:41	71.681	152.839	beluga	swim	1	0	11
217	7/31/14 10:45	71.564	152.801	beluga	swim	2	1	11
217	7/31/14 10:47	71.506	152.780	beluga	swim	1	0	11
217	7/31/14 11:21	70.989	153.461	beluga	dive	2	1	3
217	7/31/14 11:42	71.727	153.363	beluga	swim	1	0	11
217	7/31/14 11:44	71.802	153.353	beluga	swim	1	0	11
217	7/31/14 11:45	71.819	153.350	beluga	rest	1	0	11
217	7/31/14 15:33	70.870	160.345	gray whale	swim	2	1	17
217	7/31/14 11:46	71.849	153.347	beluga	swim	1	0	11
217	7/31/14 11:46	71.883	153.341	beluga	swim	4	0	11
217	7/31/14 11:47	71.908	153.338	beluga	swim	3	0	11
217	7/31/14 11:47	71.909	153.338	beluga	swim	1	0	11
217	7/31/14 11:48	71.937	153.334	beluga	swim	1	0	11
217	7/31/14 11:48	71.941	153.334	beluga	swim	5	0	11

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
217	7/31/14 11:49	71.958	153.331	beluga	swim	4	2	11
217	7/31/14 15:38	70.776	160.017	beluga	swim	3	1	17
217	7/31/14 15:38	70.773	160.006	beluga	swim	2	0	17
217	7/31/14 15:38	70.767	159.985	beluga	mill	3	0	13
217	7/31/14 15:39	70.762	159.969	beluga	swim	7	1	13
217	7/31/14 11:49	71.988	153.326	beluga	swim	1	0	11
217	7/31/14 11:50	72.001	153.384	beluga	swim	1	0	11
217	7/31/14 11:52	72.000	153.594	beluga	rest	4	0	11
217	7/31/14 11:53	72.000	153.721	beluga	swim	1	0	11
217	7/31/14 11:54	72.000	153.788	beluga	mill	1	0	0
217	7/31/14 15:44	70.818	159.642	gray whale	rest	2	1	13
217	7/31/14 11:55	71.980	153.819	beluga	mill	6	1	11
217	7/31/14 11:55	71.974	153.820	beluga	mill	8	0	11
217	7/31/14 11:55	71.968	153.820	beluga	swim	1	0	11
217	7/31/14 15:50	70.896	159.074	unid cetacean	swim	1	0	13
217	7/31/14 15:54	70.901	159.119	gray whale	swim	1	0	13
217	7/31/14 15:54	70.906	159.130	beluga	dive	1	0	13
217	7/31/14 15:59	70.904	158.986	gray whale	swim	1	0	13
217	7/31/14 16:01	70.916	158.798	gray whale	rest	1	0	13
217	7/31/14 16:26	71.180	157.047	gray whale	feed	4	1	13
217	7/31/14 16:30	71.173	157.123	gray whale	rest	1	0	13
217	7/31/14 16:31	71.175	157.127	gray whale	rest	1	0	13
217	7/31/14 16:35	71.256	156.893	beluga	mill	2	0	12
217	7/31/14 12:50	71.317	155.573	bowhead whale	swim	1	0	12
217	7/31/14 12:51	71.325	155.537	gray whale	rest	2	1	12
217	7/31/14 12:51	71.322	155.554	bowhead whale	swim	1	0	12
217	7/31/14 13:09	71.436	156.439	beluga	swim	1	0	12

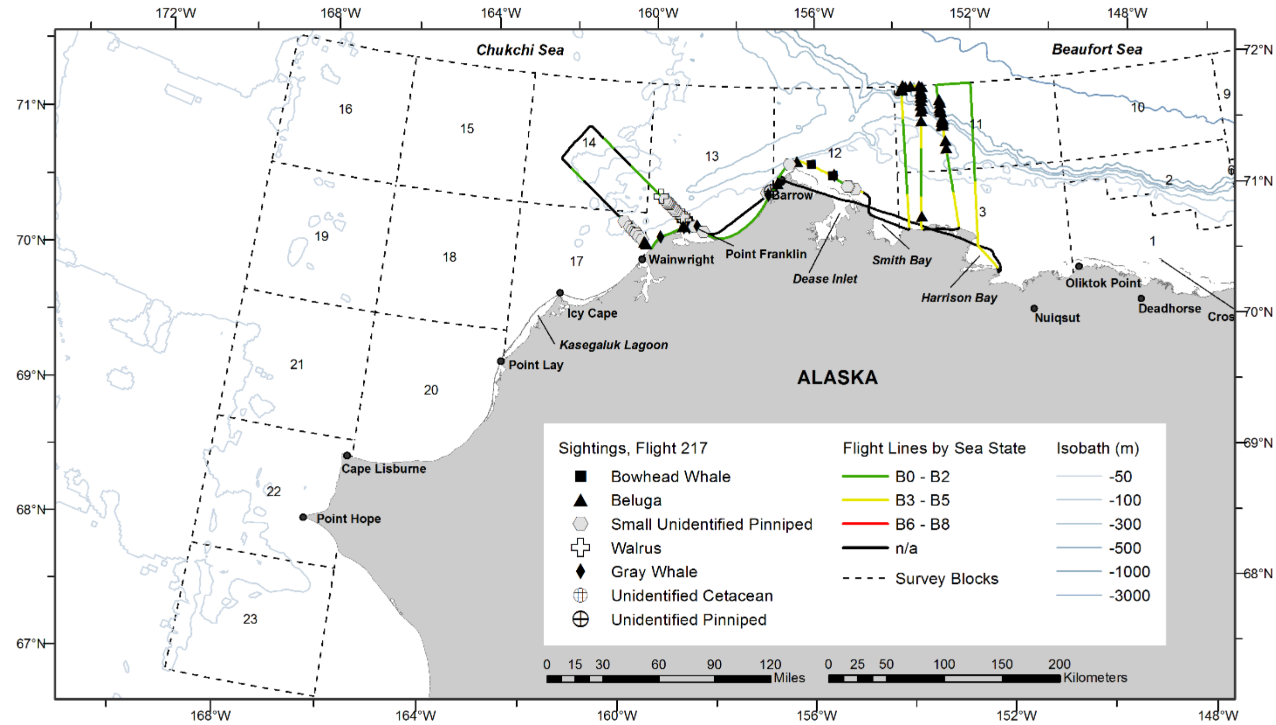

Figure B-22. ASAMM Flight 217 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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31 July 2014, Flight 6

Flight was a survey of portions of blocks 1, 2, 3, 10, and 11. Survey conditions included overcast skies, <1-10 km visibility (with low ceilings, rain, and haze), and Beaufort 2-5 sea states. Sea ice cover was 0-75% broken floe in the area surveyed. Sightings included one bowhead and belugas (including four calves).

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
6	7/31/14 15:28	71.484	149.770	beluga	swim	1	0	10
6	7/31/14 14:20	70.783	148.757	beluga	swim	1	0	1
6	7/31/14 14:58	71.207	149.149	beluga	swim	2	1	2
6	7/31/14 14:59	71.233	149.151	beluga	swim	1	0	2
6	7/31/14 15:34	71.328	149.728	beluga	dive	1	0	2
6	7/31/14 15:36	71.257	149.708	beluga	swim	1	0	2
6	7/31/14 16:35	71.301	150.410	beluga	swim	2	0	3
6	7/31/14 16:37	71.356	150.410	beluga	swim	2	1	11
6	7/31/14 16:37	71.369	150.409	beluga	swim	1	0	11
6	7/31/14 16:38	71.387	150.412	beluga	swim	1	0	11
6	7/31/14 16:38	71.405	150.412	beluga	swim	2	0	11
6	7/31/14 16:38	71.411	150.412	beluga	swim	3	1	11
6	7/31/14 16:38	71.415	150.412	beluga	swim	1	0	11
6	7/31/14 16:39	71.418	150.412	beluga	mill	1	0	11
6	7/31/14 16:39	71.441	150.414	beluga	swim	1	0	11
6	7/31/14 16:39	71.448	150.414	beluga	swim	2	0	11
6	7/31/14 16:40	71.449	150.414	beluga	mill	1	0	11
6	7/31/14 16:40	71.462	150.414	beluga	swim	1	0	11
6	7/31/14 17:01	71.899	150.649	beluga	swim	1	0	11
6	7/31/14 17:03	71.830	150.658	bowhead whale	swim	1	0	11
6	7/31/14 17:25	71.367	150.709	beluga	swim	1	0	11
6	7/31/14 17:26	71.334	150.712	beluga	swim	2	1	11

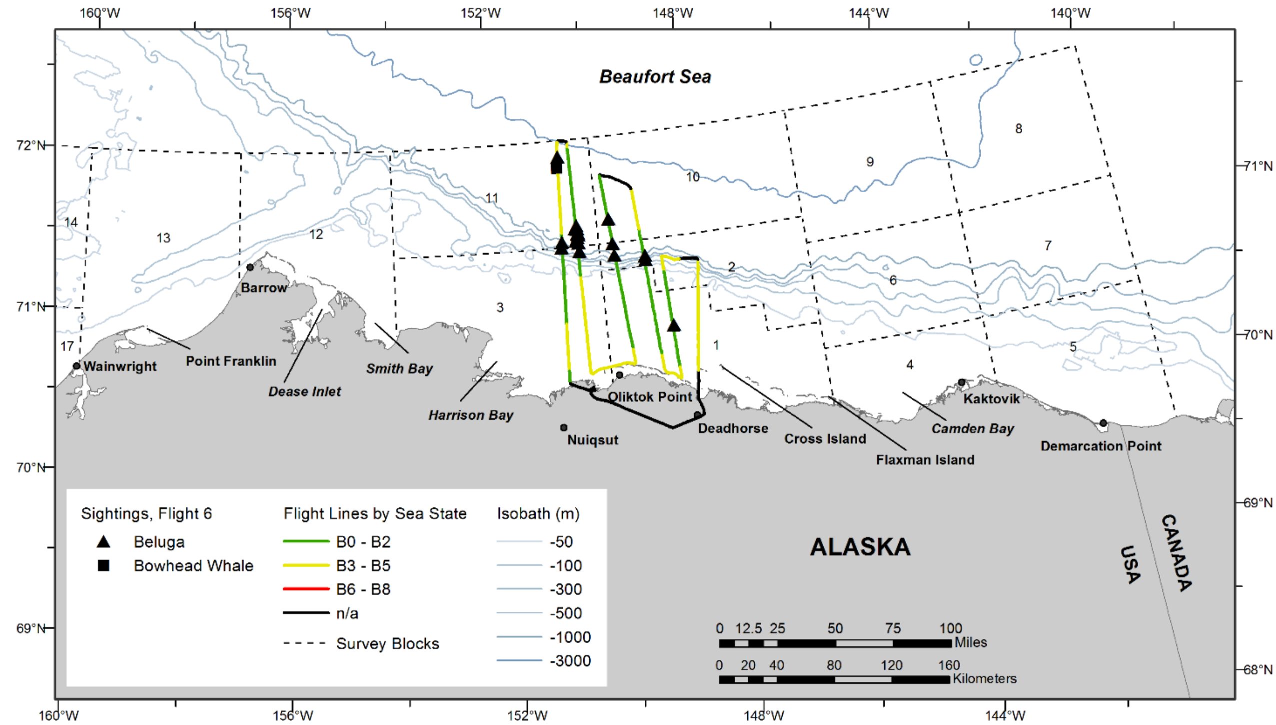

Figure B-23. ASAMM Flight 6 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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2 August 2014, Flight 7

Flight was a survey of portions of blocks 1 and 4. Survey conditions included overcast skies, <1-10 km visibility (with low ceilings), and Beaufort 2-4 sea states. Sea ice cover was 20-55% broken floe in the area surveyed. No sightings were observed.

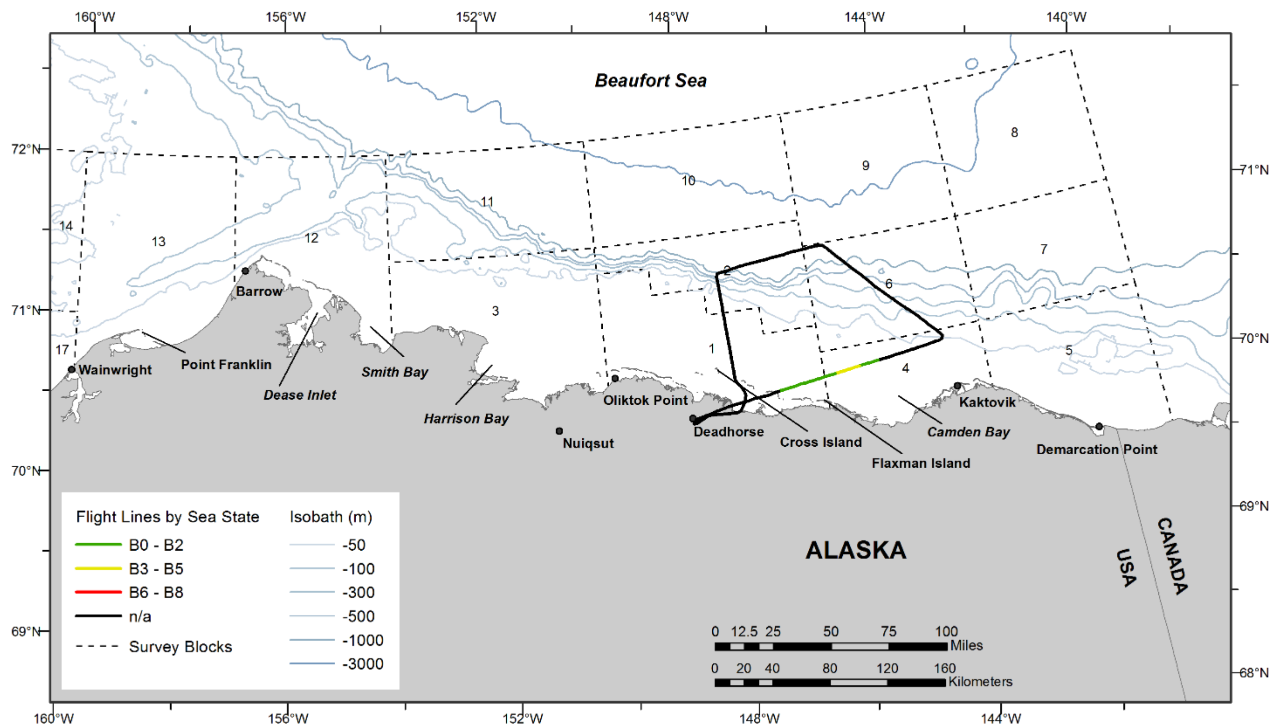

Figure B-24. ASAMM Flight 7 survey track, depicted by sea state.

4 August 2014, Flight 218

Flight was a complete survey of transects 31, 32, 33, 34, 35, 36, 38, and 39. Survey conditions included clear skies, 0-10 km visibility (with low ceiling, glare, and haze), and Beaufort 2-6 sea states. There was no sea ice observed in the area surveyed. Sightings included gray whales (including eight calves), small unidentified pinnipeds, unidentified pinnipeds, and one walrus carcass.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
218	8/4/14 18:12	67.089	167.925	gray whale	swim	2	1	23
218	8/4/14 13:48	68.106	168.557	gray whale	swim	2	1	22
218	8/4/14 13:49	68.105	168.600	gray whale	feed	1	-1	22
218	8/4/14 13:49	68.106	168.632	gray whale	feed	1	-1	22
218	8/4/14 13:49	68.106	168.652	gray whale	feed	3	1	22
218	8/4/14 13:49	68.106	168.664	gray whale	feed	1	-1	22
218	8/4/14 13:49	68.106	168.672	gray whale	feed	1	-1	22
218	8/4/14 13:49	68.106	168.690	gray whale	feed	1	-1	22
218	8/4/14 13:56	68.108	168.635	gray whale	swim	3	-1	22
218	8/4/14 13:58	68.109	168.586	gray whale	breach	1	-1	22
218	8/4/14 13:58	68.110	168.583	gray whale	swim	1	-1	22
218	8/4/14 13:58	68.120	168.588	gray whale	swim	1	-1	22
218	8/4/14 14:00	68.123	168.583	gray whale	swim	1	-1	22
218	8/4/14 14:01	68.123	168.585	gray whale	swim	1	-1	22
218	8/4/14 14:06	68.093	168.701	gray whale	feed	3	-1	22
218	8/4/14 14:11	67.936	168.688	gray whale	feed	1	-1	23
218	8/4/14 14:11	67.936	168.686	gray whale	feed	1	-1	23
218	8/4/14 14:11	67.936	168.683	gray whale	feed	1	-1	23
218	8/4/14 14:11	67.935	168.668	gray whale	feed	2	-1	23
218	8/4/14 14:12	67.935	168.638	gray whale	feed	2	-1	23
218	8/4/14 14:12	67.935	168.627	gray whale	feed	2	-1	23
218	8/4/14 14:12	67.935	168.598	gray whale	feed	1	-1	23
218	8/4/14 14:12	67.936	168.583	gray whale	feed	1	-1	23
218	8/4/14 14:13	67.937	168.565	gray whale	feed	2	-1	23
218	8/4/14 14:14	67.934	168.490	gray whale	feed	3	1	23
218	8/4/14 14:14	67.934	168.465	gray whale	feed	1	-1	23
218	8/4/14 14:14	67.934	168.450	gray whale	feed	2	-1	23
218	8/4/14 14:14	67.934	168.449	gray whale	feed	5	-1	23
218	8/4/14 14:14	67.934	168.421	gray whale	feed	1	-1	23
218	8/4/14 14:15	67.935	168.369	gray whale	feed	1	-1	23

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
218	8/4/14 14:15	67.935	168.359	gray whale	feed	1	-1	23
218	8/4/14 14:16	67.936	168.325	gray whale	feed	2	-1	23
218	8/4/14 14:16	67.936	168.322	gray whale	feed	1	-1	23
218	8/4/14 14:16	67.937	168.294	gray whale	feed	2	-1	23
218	8/4/14 14:17	67.938	168.230	gray whale	feed	1	-1	23
218	8/4/14 14:17	67.939	168.208	gray whale	feed	2	-1	23
218	8/4/14 14:17	67.939	168.204	gray whale	feed	3	-1	23
218	8/4/14 14:18	67.939	168.162	gray whale	feed	1	-1	23
218	8/4/14 14:18	67.939	168.142	gray whale	feed	2	-1	23
218	8/4/14 14:19	67.938	168.086	gray whale	feed	1	-1	23
218	8/4/14 14:20	67.938	167.983	gray whale	unknown	1	-1	23
218	8/4/14 15:10	67.768	167.977	gray whale	feed	1	-1	23
218	8/4/14 15:10	67.768	168.000	gray whale	feed	2	-1	23
218	8/4/14 15:10	67.768	168.017	gray whale	feed	6	-1	23
218	8/4/14 15:11	67.768	168.058	gray whale	feed	3	-1	23
218	8/4/14 15:11	67.768	168.059	gray whale	feed	4	-1	23
218	8/4/14 15:11	67.768	168.108	gray whale	feed	4	-1	23
218	8/4/14 15:15	67.766	168.416	gray whale	swim	2	1	23
218	8/4/14 15:47	67.597	166.787	gray whale	feed	1	-1	23
218	8/4/14 15:47	67.597	166.770	gray whale	feed	2	-1	23
218	8/4/14 15:47	67.597	166.768	gray whale	feed	13	3	23
218	8/4/14 15:48	67.597	166.748	gray whale	feed	3	-1	23
218	8/4/14 15:48	67.597	166.716	gray whale	feed	1	-1	23

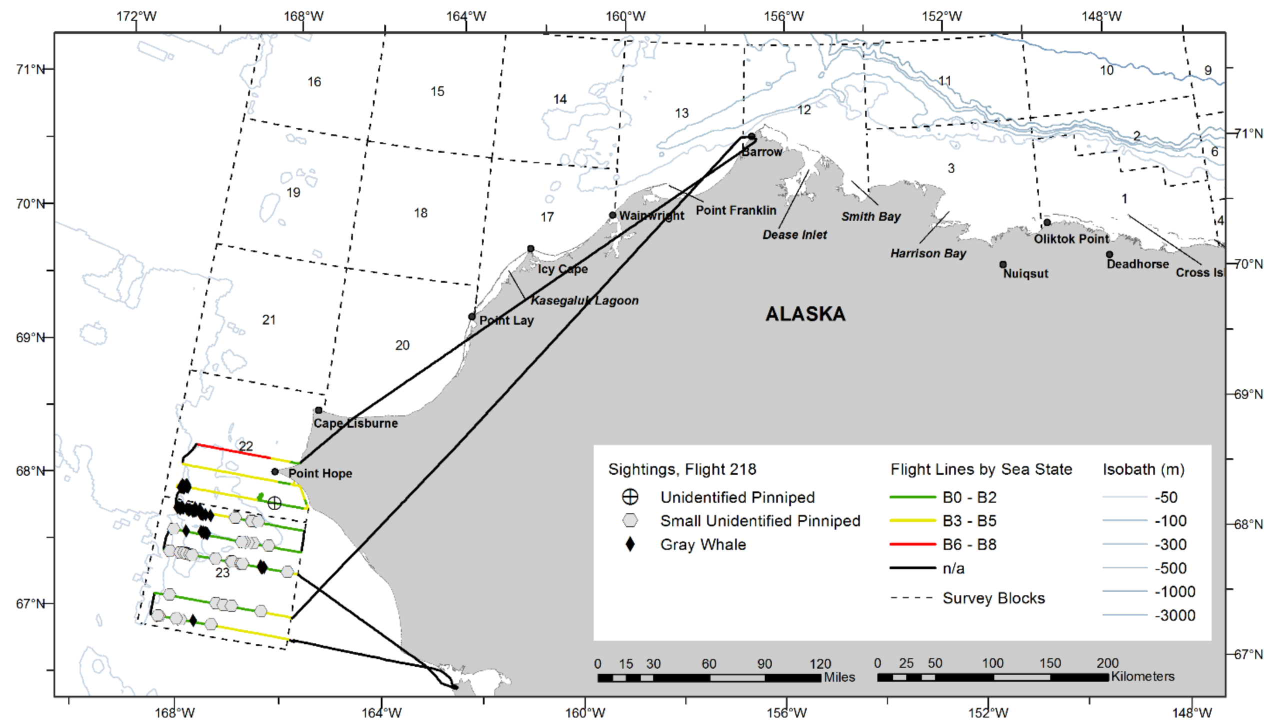

Figure B-25. ASAMM Flight 218 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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6 August 2014, Flight 219

Flight was a complete survey of transects 11 and 14, the coastal transect between Icy Cape and Wainwright, and search effort from Point Franklin to Barrow. Survey conditions included clear to overcast skies, <1 km to unlimited visibility (with low ceiling and glare), and Beaufort 1-7 sea states. Sea ice cover was 0-80% broken floe in the area surveyed. Sightings included gray whales (including seven calves), walruses (including three carcasses), and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
219	8/6/14 16:50	70.924	158.859	gray whale	rest	1	0	13
219	8/6/14 16:56	70.959	158.688	gray whale	mill	4	1	13
219	8/6/14 16:57	70.971	158.677	gray whale	swim	1	0	13
219	8/6/14 16:59	70.962	158.688	gray whale	swim	2	1	13
219	8/6/14 17:02	70.998	158.480	gray whale	feed	1	0	13
219	8/6/14 17:02	70.998	158.450	gray whale	feed	1	0	13
219	8/6/14 17:04	71.000	158.429	gray whale	feed	2	1	13
219	8/6/14 17:06	71.008	158.374	gray whale	feed	1	0	13
219	8/6/14 17:06	71.015	158.378	gray whale	feed	2	1	13
219	8/6/14 17:07	71.009	158.414	gray whale	feed	1	0	13
219	8/6/14 17:07	71.001	158.384	gray whale	feed	2	1	13
219	8/6/14 17:07	70.997	158.394	gray whale	feed	1	0	13
219	8/6/14 17:09	71.016	158.371	gray whale	feed	1	0	13
219	8/6/14 17:10	71.013	158.323	gray whale	feed	1	0	13
219	8/6/14 17:12	71.026	158.407	gray whale	feed	2	0	13
219	8/6/14 17:12	71.026	158.345	gray whale	feed	1	0	13
219	8/6/14 17:12	71.027	158.345	gray whale	feed	1	0	13
219	8/6/14 17:15	71.042	158.322	gray whale	feed	2	0	13
219	8/6/14 17:16	71.043	158.322	gray whale	feed	2	1	13
219	8/6/14 17:17	71.032	158.305	gray whale	feed	1	0	13
219	8/6/14 17:18	71.033	158.276	gray whale	feed	2	0	13
219	8/6/14 17:18	71.032	158.263	gray whale	feed	2	0	13
219	8/6/14 17:18	71.024	158.256	gray whale	feed	1	0	13
219	8/6/14 17:19	71.027	158.272	gray whale	feed	1	0	13
219	8/6/14 17:20	71.021	158.281	gray whale	feed	2	0	13
219	8/6/14 17:21	71.052	158.180	gray whale	feed	1	0	13
219	8/6/14 17:22	71.056	158.153	gray whale	feed	1	0	13
219	8/6/14 17:25	71.072	158.040	gray whale	feed	2	1	13
219	8/6/14 17:27	71.060	158.061	gray whale	feed	1	0	13

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
219	8/6/14 17:29	71.090	157.929	gray whale	feed	1	0	13
219	8/6/14 17:29	71.092	157.920	gray whale	feed	1	0	13
219	8/6/14 17:32	71.102	157.854	gray whale	feed	1	0	13
219	8/6/14 17:32	71.104	157.838	gray whale	feed	1	0	13
219	8/6/14 17:32	71.105	157.829	gray whale	swim	1	0	13
219	8/6/14 17:33	71.127	157.849	gray whale	swim	2	0	13
219	8/6/14 17:34	71.116	157.859	gray whale	swim	1	0	13
219	8/6/14 17:34	71.109	157.831	gray whale	swim	1	0	13
219	8/6/14 17:36	71.121	157.741	gray whale	swim	1	0	13
219	8/6/14 17:36	71.127	157.720	gray whale	swim	2	0	13
219	8/6/14 17:37	71.128	157.717	gray whale	feed	1	0	13
219	8/6/14 17:37	71.131	157.709	gray whale	feed	1	0	13

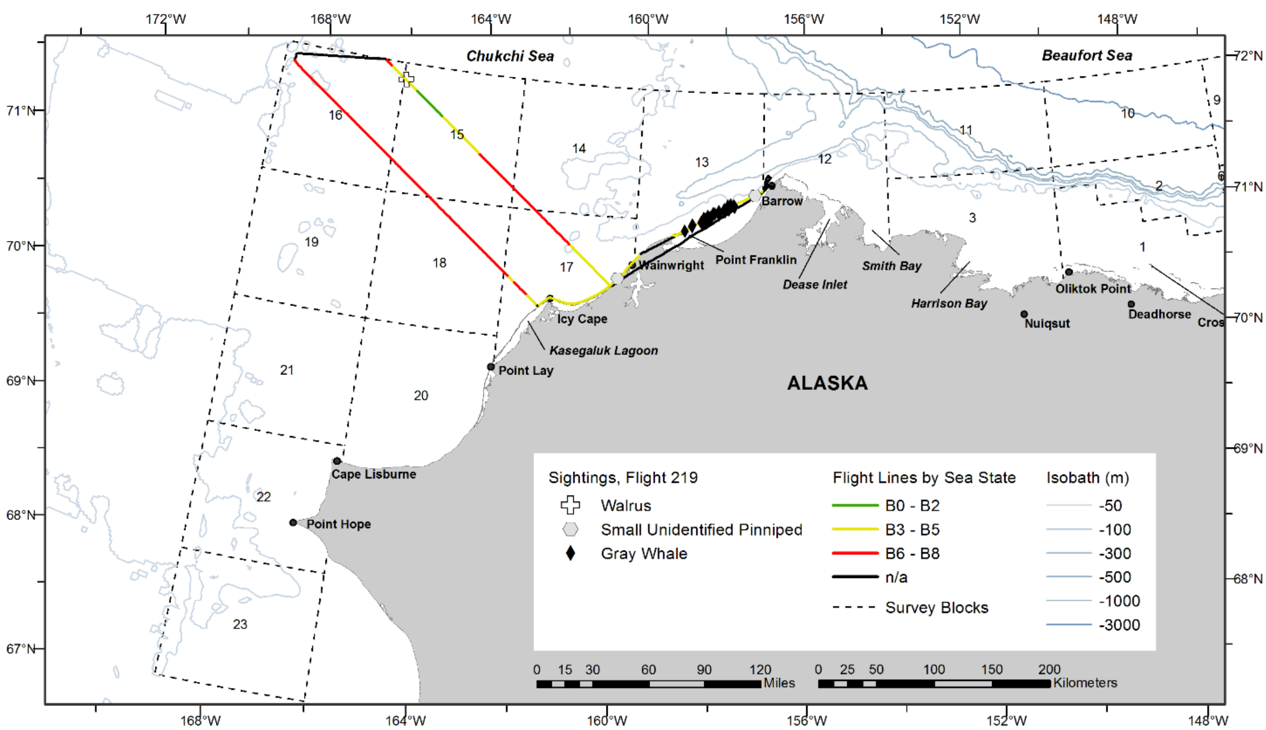

Figure B-26. ASAMM Flight 219 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

6 August 2014, Flight 8

Flight was a survey of portions of blocks 3, 4, 6, and 11. Survey conditions included overcast skies, 0-10 km visibility (with low ceilings, rain, and haze), and Beaufort 1-5 sea states. Sea ice cover was 0-50% broken floe in the area surveyed. Sightings included bowhead whales (including one calf) and belugas (including one calf).

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
8	8/6/14 11:49	71.249	150.280	beluga	swim	1	0	3
8	8/6/14 11:49	71.250	150.280	beluga	swim	2	0	3
8	8/6/14 12:01	71.635	150.276	beluga	swim	1	0	11
8	8/6/14 12:01	71.646	150.275	beluga	swim	1	0	11
8	8/6/14 12:10	71.915	150.269	beluga	swim	1	0	11
8	8/6/14 12:37	71.384	150.911	beluga	swim	1	0	11
8	8/6/14 12:32	71.548	150.906	beluga	swim	1	0	11
8	8/6/14 12:32	71.542	150.906	beluga	swim	2	1	11
8	8/6/14 13:16	70.637	151.192	beluga	dive	1	0	3
8	8/6/14 16:45	70.699	143.930	bowhead whale	swim	2	1	6
8	8/6/14 16:48	70.668	143.904	beluga	swim	2	0	6
8	8/6/14 17:09	70.680	144.181	beluga	swim	1	0	6
8	8/6/14 16:52	70.691	143.879	beluga	swim	1	0	6
8	8/6/14 16:53	70.684	143.940	beluga	swim	1	0	6
8	8/6/14 16:53	70.686	143.947	beluga	swim	1	0	6
8	8/6/14 13:29	71.047	151.143	beluga	dive	1	0	3
8	8/6/14 17:04	70.748	144.183	bowhead whale	swim	1	0	6
8	8/6/14 17:04	70.741	144.182	beluga	swim	1	0	6
8	8/6/14 13:46	71.568	151.081	beluga	swim	1	0	11
8	8/6/14 13:46	71.580	151.078	beluga	swim	6	0	11
8	8/6/14 17:08	70.728	144.181	beluga	swim	1	0	6
8	8/6/14 13:51	71.728	151.059	beluga	swim	3	0	11
8	8/6/14 14:07	71.953	151.828	beluga	swim	2	0	11
8	8/6/14 18:11	71.056	145.109	beluga	swim	1	0	6
8	8/6/14 18:12	71.093	145.166	beluga	swim	1	0	6
8	8/6/14 18:12	71.095	145.168	beluga	swim	1	0	6
8	8/6/14 18:12	71.108	145.182	beluga	rest	1	0	6
8	8/6/14 18:13	71.122	145.199	beluga	swim	2	0	6
8	8/6/14 18:18	71.067	145.271	beluga	swim	1	0	6
8	8/6/14 18:20	70.989	145.271	beluga	swim	3	0	6

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
8	8/6/14 18:21	70.981	145.272	beluga	swim	2	0	6
8	8/6/14 18:21	70.981	145.272	beluga	swim	1	0	6
8	8/6/14 18:21	70.975	145.274	beluga	swim	2	0	6
8	8/6/14 18:21	70.973	145.274	beluga	swim	7	0	6
8	8/6/14 18:23	70.909	145.276	beluga	swim	1	0	6
8	8/6/14 18:24	70.866	145.276	beluga	swim	1	0	6
8	8/6/14 18:24	70.863	145.275	beluga	swim	1	0	6
8	8/6/14 18:25	70.849	145.274	beluga	swim	1	0	6

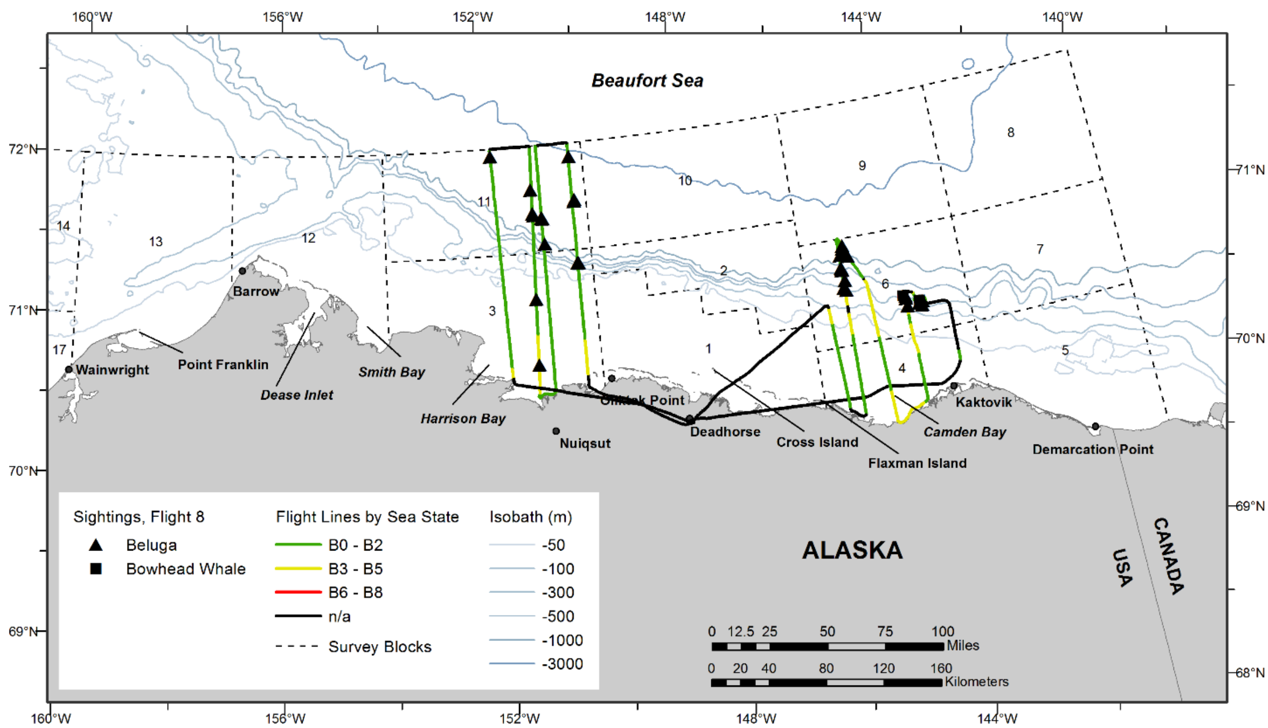

Figure B-27. ASAMM Flight 8 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Bowhead whale cow-calf pair observed north of Camden Bay, Alaska, during Flight 8, 6 August 2014.

10 August 2014, Flight 220

Flight was a complete survey of transect 6 and partial survey of transects 7, 9, 11, and 13. Survey conditions included clear to partly cloudy skies, 5-10 km visibility (with haze and glare), and Beaufort 2-6 sea states. Sea ice cover was 0-67% broken floe in the area surveyed. Sightings included one gray whale, belugas, and walruses.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
220	8/10/14 11:36	71.432	164.097	beluga	swim	3	0	15
220	8/10/14 12:01	71.994	166.460	beluga	swim	1	0	16
220	8/10/14 12:01	71.992	166.446	beluga	swim	1	0	16
220	8/10/14 13:02	71.540	162.196	gray whale	feed	1	0	14
220	8/10/14 13:10	71.554	162.130	beluga	swim	1	0	14

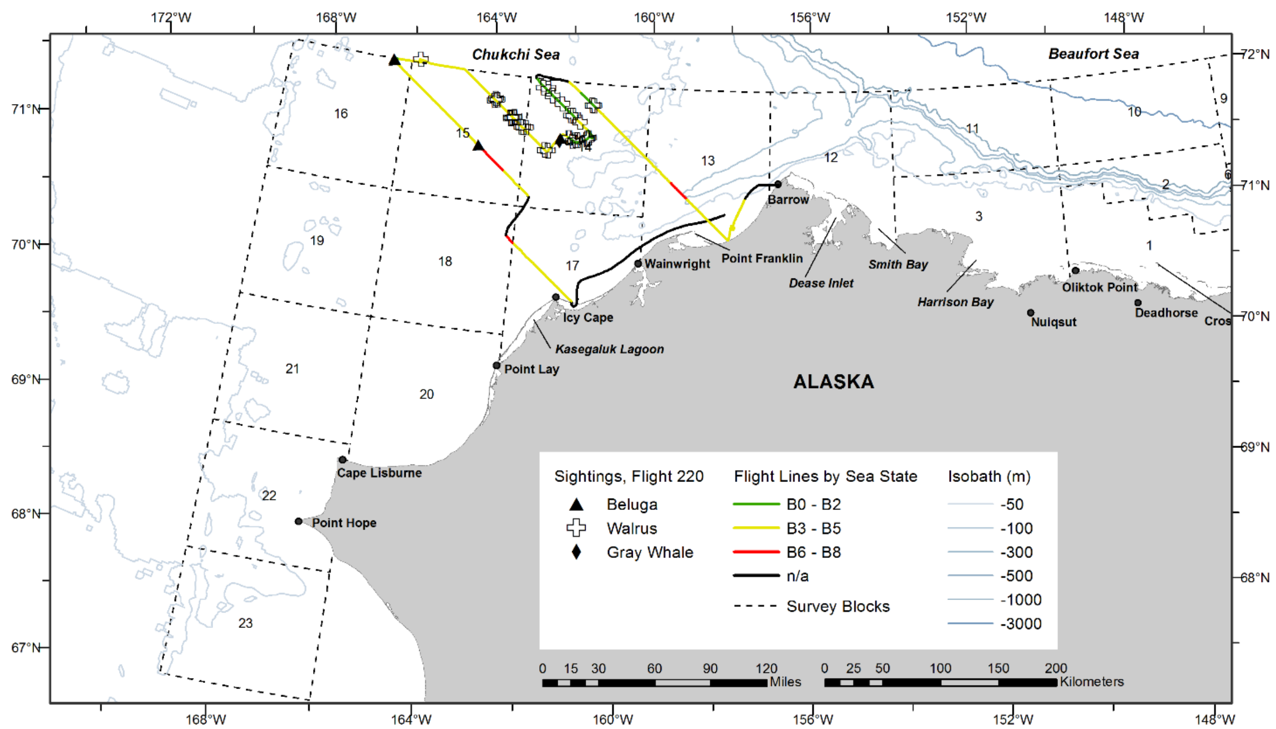

Figure B-28. ASAMM Flight 220 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

11 August 2014, Flight 9

Flight was a survey of block 12 and portions of blocks 3 and 11. Survey conditions included clear skies, 1-10 km visibility (with glare, haze, and low ceilings), and Beaufort 3-7 sea states. Sea ice cover was 0-15% broken floe in the area surveyed. Sightings included one bowhead whale, gray whales (including one calf), belugas (including one calf), one unidentified pinniped, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
9	8/11/14 12:59	71.465	156.144	gray whale	feed	2	1	12
9	8/11/14 13:30	71.606	155.678	beluga	swim	1	0	12
9	8/11/14 13:30	71.613	155.678	beluga	swim	1	0	12
9	8/11/14 13:57	71.697	155.243	beluga	swim	1	0	12
9	8/11/14 14:05	71.452	155.267	bowhead whale	swim	1	0	12
9	8/11/14 15:02	71.810	154.784	beluga	swim	1	0	12
9	8/11/14 15:05	71.894	154.806	beluga	swim	5	0	12
9	8/11/14 15:05	71.907	154.809	beluga	swim	1	0	12
9	8/11/14 15:06	71.941	154.817	beluga	swim	2	0	12
9	8/11/14 16:28	71.885	153.810	beluga	dive	1	0	11
9	8/11/14 16:29	71.920	153.806	beluga	swim	2	1	11

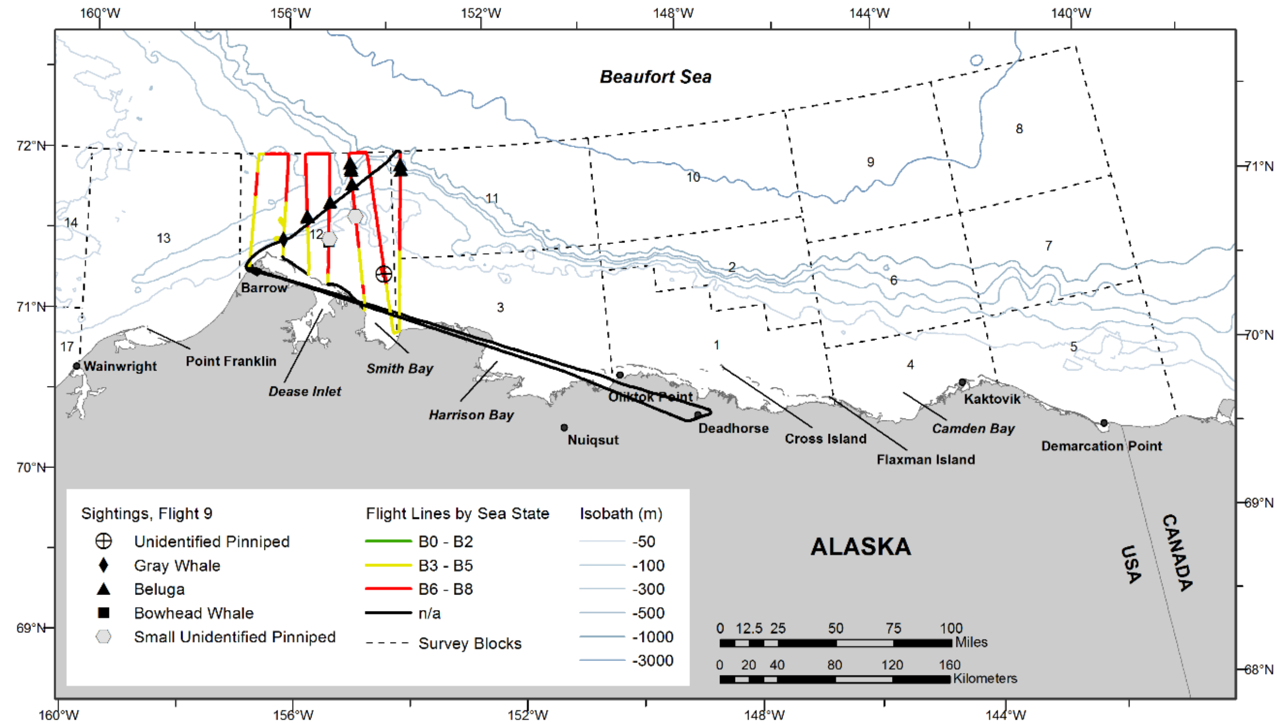

Figure B-29. ASAMM Flight 9 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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15 August 2014, Flight 221

Flight was a partial survey of transects 19 and 21 and the coastal transect from Point Hope to Ledyard Bay. Survey conditions included partly cloudy skies, 5 km to unlimited visibility (with glare), and Beaufort 2-6 sea states. There was no sea ice observed in the area surveyed. Gray whales (including three calves) were sighted.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
221	8/15/14 13:01	68.424	166.435	gray whale	swim	1	0	22
221	8/15/14 13:09	68.541	166.305	gray whale	mill	1	0	22
221	8/15/14 13:34	68.862	165.654	gray whale	feed	2	0	20
221	8/15/14 13:34	68.861	165.619	gray whale	mill	2	1	20
221	8/15/14 13:40	68.865	165.467	gray whale	unknown	1	0	20
221	8/15/14 13:45	68.867	165.324	gray whale	rest	4	2	20
221	8/15/14 15:12	69.470	163.237	gray whale	swim	1	0	20

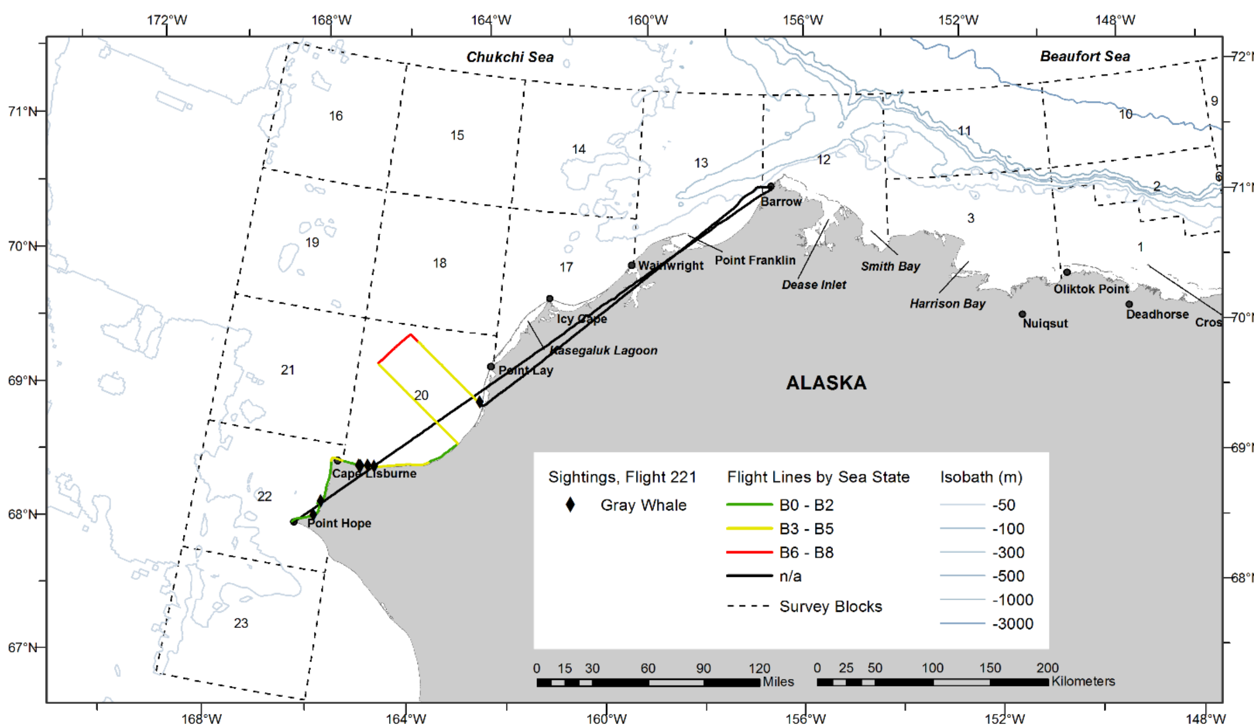

Figure B-30. ASAMM Flight 221 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

17 August 2014, Flight 222

Flight was a partial survey of transects 1 and 2. Survey conditions included overcast to partly cloudy skies, no visibility to unlimited visibility (with fog, haze, and glare), and Beaufort 2-3 sea states. There was no sea ice observed in the area surveyed. Sightings included gray whales (including three calves), belugas, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
222	8/17/14 14:15	71.644	156.956	beluga	swim	1	0	12
222	8/17/14 14:45	71.250	156.926	beluga	swim	1	0	12
222	8/17/14 14:47	71.196	157.025	gray whale	mill	1	0	13
222	8/17/14 14:47	71.194	157.028	gray whale	feed	2	0	13
222	8/17/14 14:49	71.206	157.022	gray whale	feed	3	1	13
222	8/17/14 15:06	70.945	157.563	gray whale	swim	1	0	13
222	8/17/14 15:20	70.842	158.409	beluga	swim	2	0	13
222	8/17/14 15:26	71.014	158.111	gray whale	feed	1	0	13
222	8/17/14 15:28	71.025	158.113	gray whale	feed	2	1	13
222	8/17/14 15:29	71.019	158.107	gray whale	feed	3	0	13
222	8/17/14 15:36	71.052	157.929	gray whale	feed	3	0	13
222	8/17/14 15:37	71.056	157.907	gray whale	feed	2	0	13
222	8/17/14 15:45	71.068	157.826	gray whale	feed	1	0	13
222	8/17/14 15:46	71.082	157.819	gray whale	feed	1	0	13
222	8/17/14 15:53	71.077	157.796	gray whale	feed	1	0	13
222	8/17/14 15:55	71.110	157.613	gray whale	unknown	1	0	13
222	8/17/14 15:56	71.124	157.582	gray whale	unknown	1	0	13
222	8/17/14 16:03	71.156	157.392	gray whale	swim	2	1	13

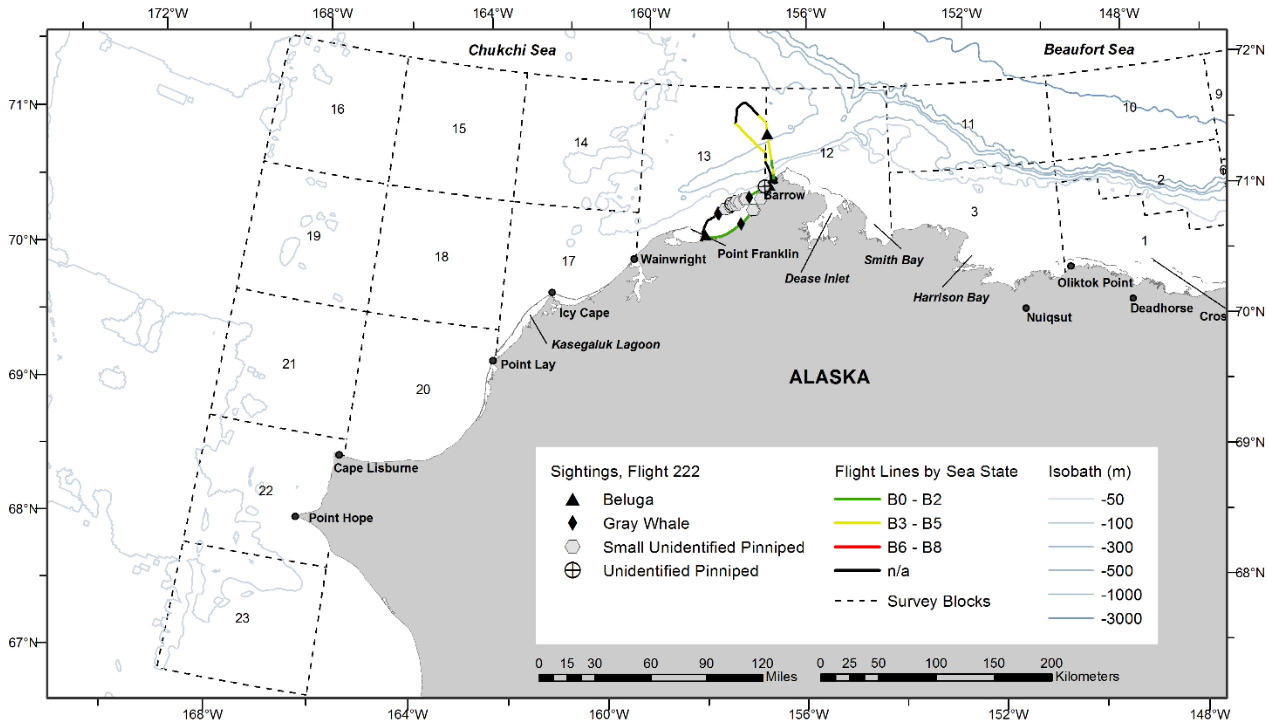

Figure B-31. ASAMM Flight 222 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

17 August 2014, Flight 10

Flight was a survey of portions of blocks 1, 2, 3, and 11. Survey conditions included clear to partly cloudy skies, 0-10 km visibility (with glare, haze, and offshore fog), and Beaufort 2-5 sea states. Sea ice cover was 0-35% broken floe in the area surveyed. Sightings included bowhead whales (including three calves), belugas, one unidentified cetacean, unidentified pinnipeds, small unidentified pinnipeds, and polar bears.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
10	8/17/14 11:09	70.779	152.140	beluga	mill	2	0	3
10	8/17/14 11:30	71.112	151.834	beluga	rest	1	0	3
10	8/17/14 13:28	70.842	149.252	bowhead whale	swim	2	1	1
10	8/17/14 13:32	70.841	149.182	bowhead whale	swim	1	0	1
10	8/17/14 13:32	70.848	149.166	bowhead whale	swim	2	1	1
10	8/17/14 13:50	70.708	149.239	bowhead whale	swim	2	0	1
10	8/17/14 13:59	70.686	149.232	bowhead whale	swim	1	0	1
10	8/17/14 14:01	70.703	149.281	bowhead whale	rest	1	0	1
10	8/17/14 20:46	70.456	146.198	bowhead whale	swim	1	0	1
10	8/17/14 17:54	70.769	148.962	bowhead whale	swim	2	0	1
10	8/17/14 17:56	70.775	148.967	bowhead whale	swim	2	0	1
10	8/17/14 17:58	70.772	149.025	bowhead whale	swim	1	0	1
10	8/17/14 18:04	70.775	149.061	bowhead whale	swim	1	0	1
10	8/17/14 18:04	70.773	149.060	bowhead whale	swim	1	0	1
10	8/17/14 18:30	70.646	148.346	bowhead whale	breach	1	0	1
10	8/17/14 18:44	70.520	148.380	beluga	rest	1	0	1
10	8/17/14 18:52	70.527	147.819	beluga	dive	1	0	1
10	8/17/14 18:54	70.571	147.822	bowhead whale	swim	1	0	1
10	8/17/14 18:58	70.610	147.816	bowhead whale	swim	1	0	1
10	8/17/14 18:59	70.657	147.823	bowhead whale	swim	1	0	1
10	8/17/14 19:19	70.526	147.263	unid cetacean	unknown	1	0	1
10	8/17/14 19:29	70.412	147.274	beluga	swim	1	0	1
10	8/17/14 19:42	70.501	146.849	bowhead whale	unknown	1	0	1
10	8/17/14 19:42	70.501	146.849	unid cetacean	unknown	1	0	1
10	8/17/14 19:47	70.540	146.835	bowhead whale	swim	1	0	1
10	8/17/14 19:53	70.579	146.827	bowhead whale	swim	1	0	1
10	8/17/14 19:54	70.592	146.873	bowhead whale	swim	1	0	1
10	8/17/14 19:55	70.594	146.847	bowhead whale	swim	2	0	1
10	8/17/14 19:56	70.590	146.884	bowhead whale	swim	3	0	1
10	8/17/14 20:03	70.645	146.798	bowhead whale	swim	1	0	1

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
10	8/17/14 20:04	70.650	146.796	bowhead whale	swim	1	0	1
10	8/17/14 20:05	70.691	146.780	bowhead whale	swim	2	1	2
10	8/17/14 20:22	70.695	146.347	bowhead whale	swim	1	0	2
10	8/17/14 20:25	70.634	146.344	bowhead whale	swim	2	0	1
10	8/17/14 20:27	70.644	146.293	bowhead whale	swim	1	0	1
10	8/17/14 20:34	70.498	146.339	bowhead whale	swim	6	0	1
10	8/17/14 20:35	70.494	146.285	bowhead whale	swim	3	0	1
10	8/17/14 20:38	70.503	146.250	bowhead whale	mill	5	0	1
10	8/17/14 20:54	70.385	146.332	beluga	swim	1	0	1
10	8/17/14 20:57	70.282	146.327	bowhead whale	swim	1	0	1
10	8/17/14 20:58	70.251	146.324	bowhead whale	swim	1	0	1

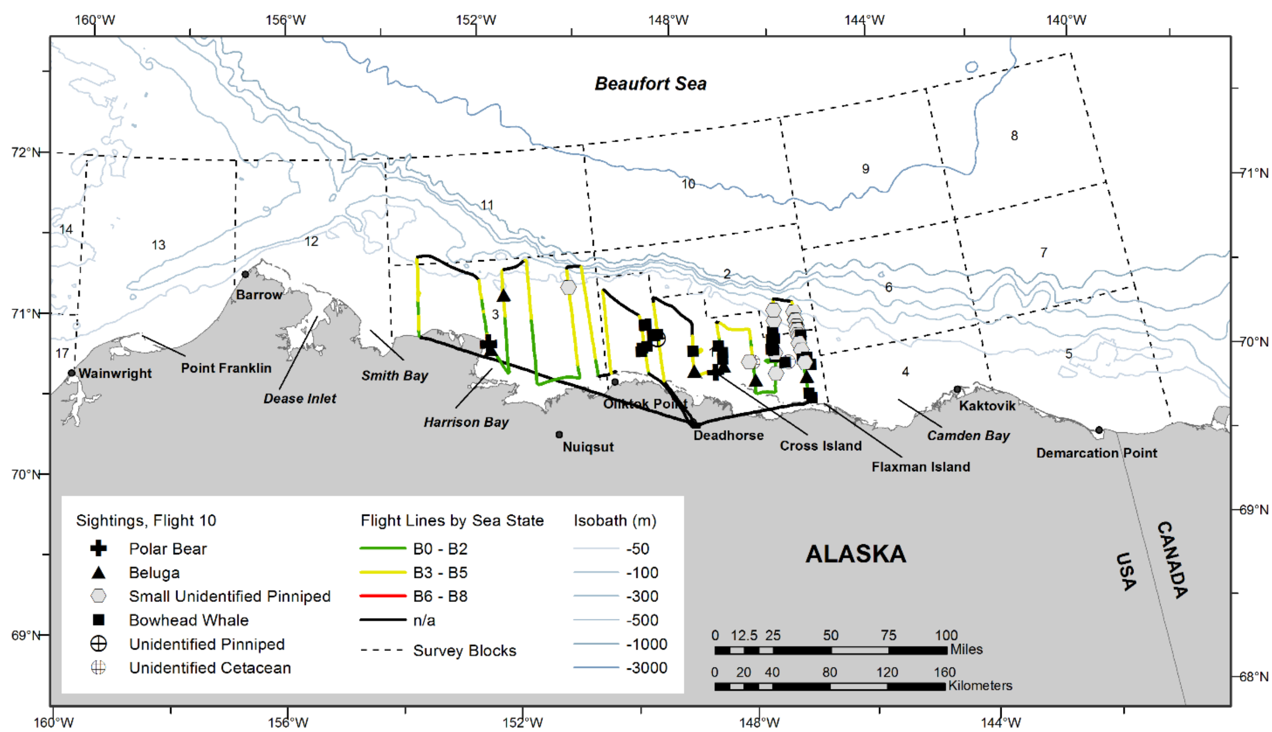

Figure B-32. ASAMM Flight 10 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Bowhead whale cow-calf pair observed in the central Alaskan Beaufort Sea during Flight 10, 17 August 2014.

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18 August 2014, Flight 11

Flight was a survey of portions of blocks 5 and 7. Survey conditions included clear to partly cloudy skies, <1-10 km visibility (with glare, haze, and fog), and Beaufort 2-5 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales, belugas, unidentified cetaceans, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
11	8/18/14 13:35	70.216	140.432	beluga	dive	1	0	5
11	8/18/14 13:45	70.568	140.402	beluga	rest	1	0	7
11	8/18/14 13:46	70.612	140.402	beluga	rest	1	0	7
11	8/18/14 14:34	70.310	140.571	unid cetacean	unknown	1	0	5
11	8/18/14 15:00	69.851	141.121	bowhead whale	rest	1	0	5
11	8/18/14 15:05	69.849	141.155	bowhead whale	swim	1	0	5
11	8/18/14 15:12	69.949	141.417	unid cetacean	unknown	1	0	5
11	8/18/14 15:12	69.949	141.417	bowhead whale	swim	1	0	5
11	8/18/14 15:17	69.949	141.522	bowhead whale	dive	1	0	5
11	8/18/14 15:34	70.414	141.268	beluga	rest	1	0	5
11	8/18/14 15:35	70.435	141.260	beluga	rest	1	0	5
11	8/18/14 15:37	70.491	141.250	beluga	rest	1	0	5
11	8/18/14 15:37	70.502	141.244	beluga	rest	1	0	7
11	8/18/14 15:38	70.532	141.228	beluga	rest	1	0	7
11	8/18/14 15:38	70.533	141.227	beluga	rest	1	0	7
11	8/18/14 15:39	70.558	141.217	beluga	rest	1	0	7
11	8/18/14 15:41	70.631	141.193	beluga	rest	1	0	7
11	8/18/14 15:45	70.768	141.149	beluga	swim	1	0	7
11	8/18/14 16:23	70.478	141.756	beluga	swim	1	0	5

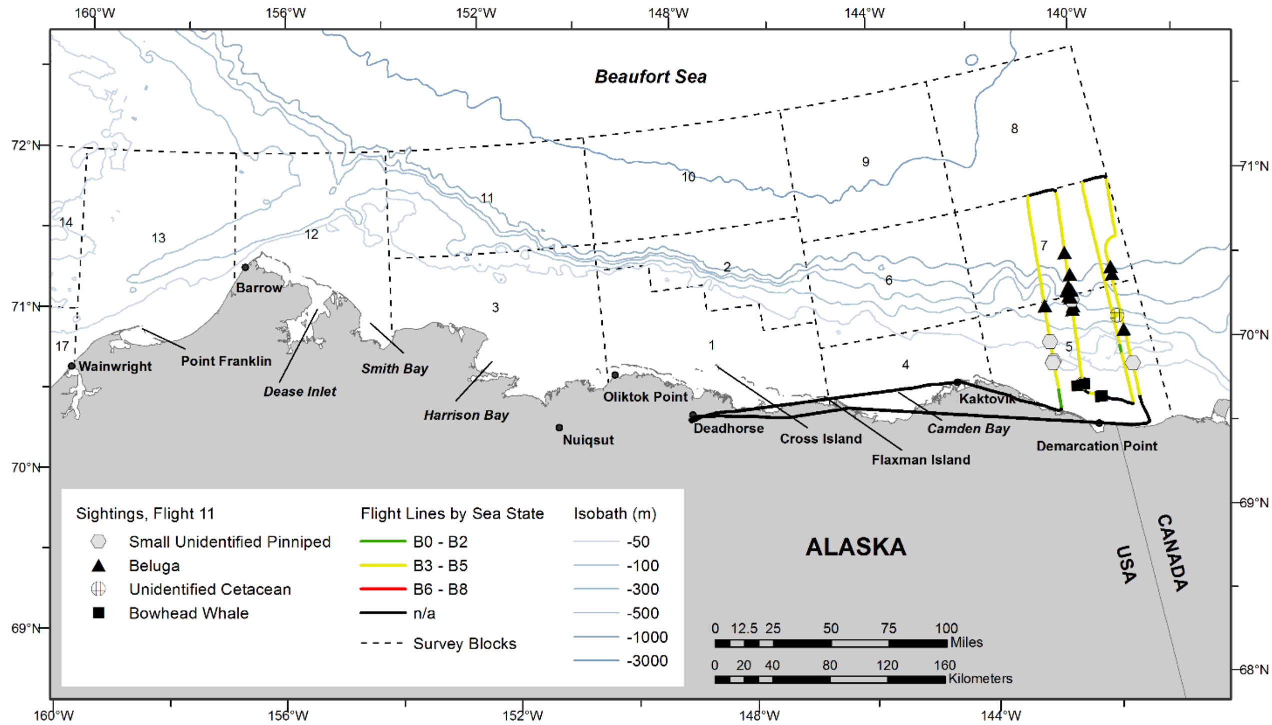

Figure B-33. ASAMM Flight 11 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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19 August 2014, Flight 223

Flight was a partial survey of transects 3 and 5. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with fog), and Beaufort 1-2 sea states. There was no sea ice observed in the area surveyed. Sightings included gray whales, belugas, one unidentified cetacean, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
223	8/19/14 11:18	71.069	157.924	gray whale	feed	3	0	13
223	8/19/14 11:20	71.084	157.917	gray whale	feed	1	0	13
223	8/19/14 11:29	70.934	157.661	unid cetacean	unknown	1	0	13
223	8/19/14 12:02	71.140	157.736	gray whale	feed	1	0	13
223	8/19/14 12:04	71.131	157.721	gray whale	unknown	1	0	13
223	8/19/14 12:08	71.164	157.597	beluga	swim	1	0	13
223	8/19/14 12:08	71.164	157.597	beluga	swim	7	0	13

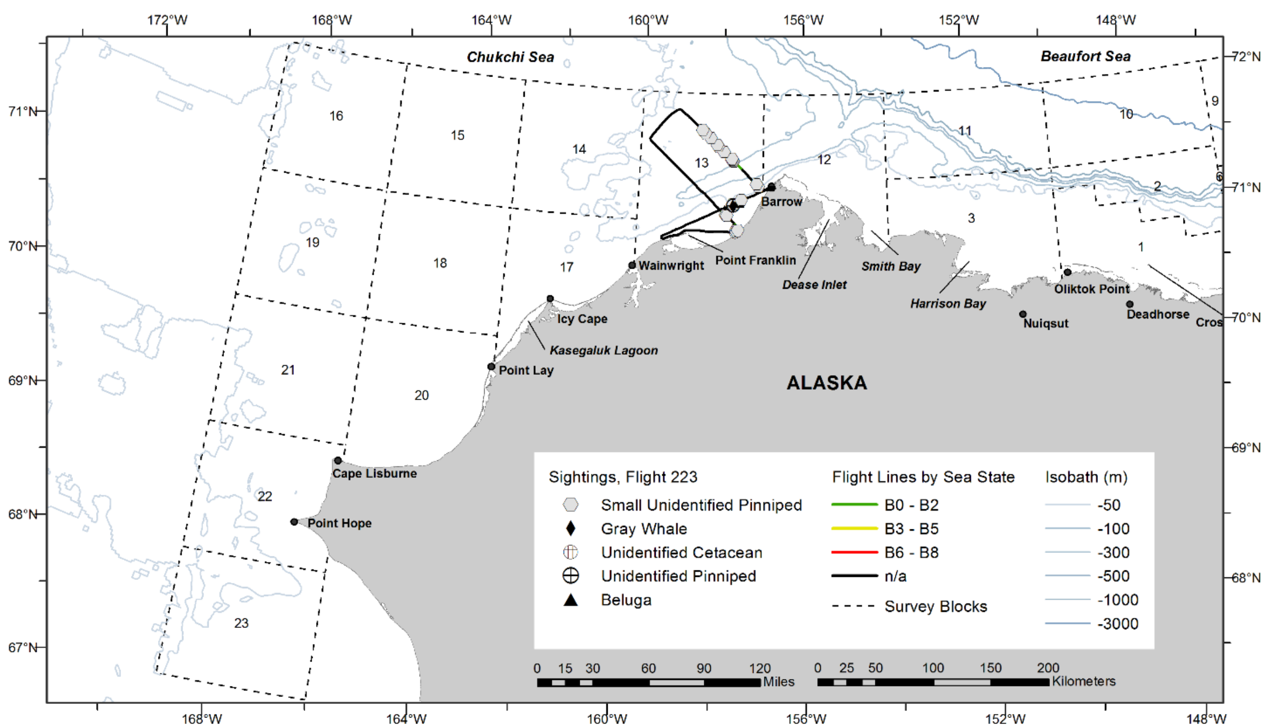

Figure B-34. ASAMM Flight 223 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

19 August 2014, Flight 12

Flight was a survey of portions of blocks 1, 2, 10, and 11. Survey conditions included overcast skies, <1-10 km visibility (with glare, haze, low ceilings, and fog), and Beaufort 2-3 sea states. There was no sea ice observed in the area surveyed. Sightings included 1 bowhead whale, belugas (including 14 calves), and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
12	8/19/14 13:19	71.156	147.852	beluga	rest	2	0	2
12	8/19/14 13:20	71.098	147.843	beluga	rest	1	0	2
12	8/19/14 13:21	71.079	147.840	beluga	rest	1	0	2
12	8/19/14 13:21	71.073	147.840	beluga	rest	1	0	2
12	8/19/14 13:28	70.846	147.828	bowhead whale	rest	1	0	2
12	8/19/14 16:09	71.923	152.903	beluga	mill	4	0	11
12	8/19/14 16:10	71.943	152.912	beluga	rest	1	0	11
12	8/19/14 16:11	71.981	152.924	beluga	mill	7	0	11
12	8/19/14 16:16	71.971	152.485	beluga	rest	1	0	11
12	8/19/14 16:16	71.939	152.480	beluga	rest	1	0	11
12	8/19/14 16:17	71.931	152.478	beluga	swim	4	0	11
12	8/19/14 16:17	71.918	152.475	beluga	rest	4	0	11
12	8/19/14 16:18	71.897	152.466	beluga	rest	1	0	11
12	8/19/14 16:18	71.892	152.464	beluga	rest	1	0	11
12	8/19/14 16:20	71.803	152.443	beluga	rest	1	0	11
12	8/19/14 16:20	71.798	152.441	beluga	rest	4	0	11
12	8/19/14 16:21	71.784	152.436	beluga	swim	1	0	11
12	8/19/14 16:21	71.783	152.435	beluga	mill	9	0	11
12	8/19/14 16:21	71.781	152.435	beluga	rest	2	0	11
12	8/19/14 16:21	71.772	152.433	beluga	rest	2	0	11
12	8/19/14 13:53	71.191	148.169	beluga	rest	1	0	2
12	8/19/14 13:53	71.199	148.166	beluga	rest	1	0	2
12	8/19/14 13:54	71.227	148.154	beluga	rest	1	0	2
12	8/19/14 13:54	71.235	148.152	beluga	rest	1	0	2
12	8/19/14 13:55	71.259	148.146	beluga	rest	1	0	2
12	8/19/14 13:56	71.282	148.137	beluga	rest	1	0	2
12	8/19/14 14:06	71.280	148.992	beluga	rest	9	0	2
12	8/19/14 14:06	71.279	148.991	beluga	rest	1	0	2
12	8/19/14 14:06	71.269	148.982	beluga	rest	1	0	2
12	8/19/14 14:06	71.266	148.981	beluga	rest	1	0	2
12	8/19/14 14:07	71.263	148.980	beluga	rest	1	0	2

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
12	8/19/14 14:07	71.249	148.979	beluga	rest	1	0	2
12	8/19/14 14:07	71.244	148.979	beluga	rest	4	0	2
12	8/19/14 14:08	71.225	148.979	beluga	rest	1	0	2
12	8/19/14 14:08	71.221	148.979	beluga	rest	1	0	2
12	8/19/14 14:26	71.222	149.286	beluga	mill	1	0	2
12	8/19/14 14:26	71.225	149.287	beluga	rest	1	0	2
12	8/19/14 14:26	71.233	149.288	beluga	rest	5	0	2
12	8/19/14 14:29	71.336	149.313	beluga	rest	1	0	10
12	8/19/14 14:29	71.337	149.313	beluga	rest	1	0	10
12	8/19/14 14:29	71.342	149.313	beluga	rest	1	0	10
12	8/19/14 14:29	71.353	149.312	beluga	dive	1	0	10
12	8/19/14 15:28	71.953	153.409	beluga	rest	1	0	11
12	8/19/14 15:28	71.945	153.410	beluga	rest	1	0	11
12	8/19/14 15:28	71.940	153.411	beluga	rest	2	1	11
12	8/19/14 15:28	71.937	153.413	beluga	rest	3	1	11
12	8/19/14 15:29	71.923	153.417	beluga	rest	3	0	11
12	8/19/14 15:29	71.917	153.418	beluga	rest	1	0	11
12	8/19/14 15:29	71.911	153.420	beluga	rest	1	0	11
12	8/19/14 15:29	71.893	153.423	beluga	rest	1	0	11
12	8/19/14 15:30	71.870	153.424	beluga	rest	1	0	11
12	8/19/14 15:30	71.858	153.426	beluga	swim	2	1	11
12	8/19/14 15:31	71.853	153.427	beluga	rest	4	0	11
12	8/19/14 15:31	71.843	153.429	beluga	rest	2	0	11
12	8/19/14 15:31	71.831	153.429	beluga	rest	1	0	11
12	8/19/14 15:32	71.804	153.426	beluga	rest	1	0	11
12	8/19/14 15:34	71.739	153.424	beluga	dive	1	0	11
12	8/19/14 16:02	71.645	152.800	beluga	swim	1	0	11
12	8/19/14 16:02	71.668	152.809	beluga	rest	1	0	11
12	8/19/14 16:04	71.718	152.828	beluga	rest	1	0	11
12	8/19/14 16:04	71.737	152.834	beluga	rest	3	1	11
12	8/19/14 16:04	71.742	152.836	beluga	rest	1	0	11
12	8/19/14 16:04	71.747	152.838	beluga	rest	1	0	11
12	8/19/14 16:05	71.767	152.844	beluga	rest	1	0	11
12	8/19/14 16:07	71.826	152.865	beluga	rest	1	0	11
12	8/19/14 16:07	71.829	152.866	beluga	rest	2	0	11
12	8/19/14 16:07	71.832	152.867	beluga	swim	1	0	11
12	8/19/14 16:08	71.875	152.878	beluga	rest	1	0	11

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
12	8/19/14 16:08	71.878	152.879	beluga	rest	2	0	11
12	8/19/14 16:09	71.894	152.886	beluga	rest	1	0	11
12	8/19/14 16:09	71.898	152.888	beluga	rest	1	0	11
12	8/19/14 16:09	71.901	152.890	beluga	rest	2	0	11
12	8/19/14 16:09	71.907	152.893	beluga	rest	5	0	11
12	8/19/14 16:09	71.915	152.898	beluga	rest	4	0	11
12	8/19/14 16:21	71.759	152.428	beluga	rest	2	0	11
12	8/19/14 16:21	71.755	152.427	beluga	rest	2	1	11
12	8/19/14 16:22	71.752	152.426	beluga	rest	1	0	11
12	8/19/14 16:22	71.749	152.425	beluga	rest	1	0	11
12	8/19/14 16:22	71.721	152.421	beluga	rest	1	0	11
12	8/19/14 16:23	71.707	152.419	beluga	rest	1	0	11
12	8/19/14 16:23	71.693	152.416	beluga	rest	2	1	11
12	8/19/14 16:23	71.684	152.414	beluga	rest	2	1	11
12	8/19/14 16:24	71.679	152.412	beluga	rest	2	1	11
12	8/19/14 16:24	71.671	152.410	beluga	rest	8	0	11
12	8/19/14 16:24	71.658	152.406	beluga	rest	6	1	11
12	8/19/14 16:24	71.652	152.404	beluga	mill	12	3	11
12	8/19/14 16:25	71.633	152.397	beluga	rest	9	2	11
12	8/19/14 16:25	71.619	152.391	beluga	rest	20	0	11

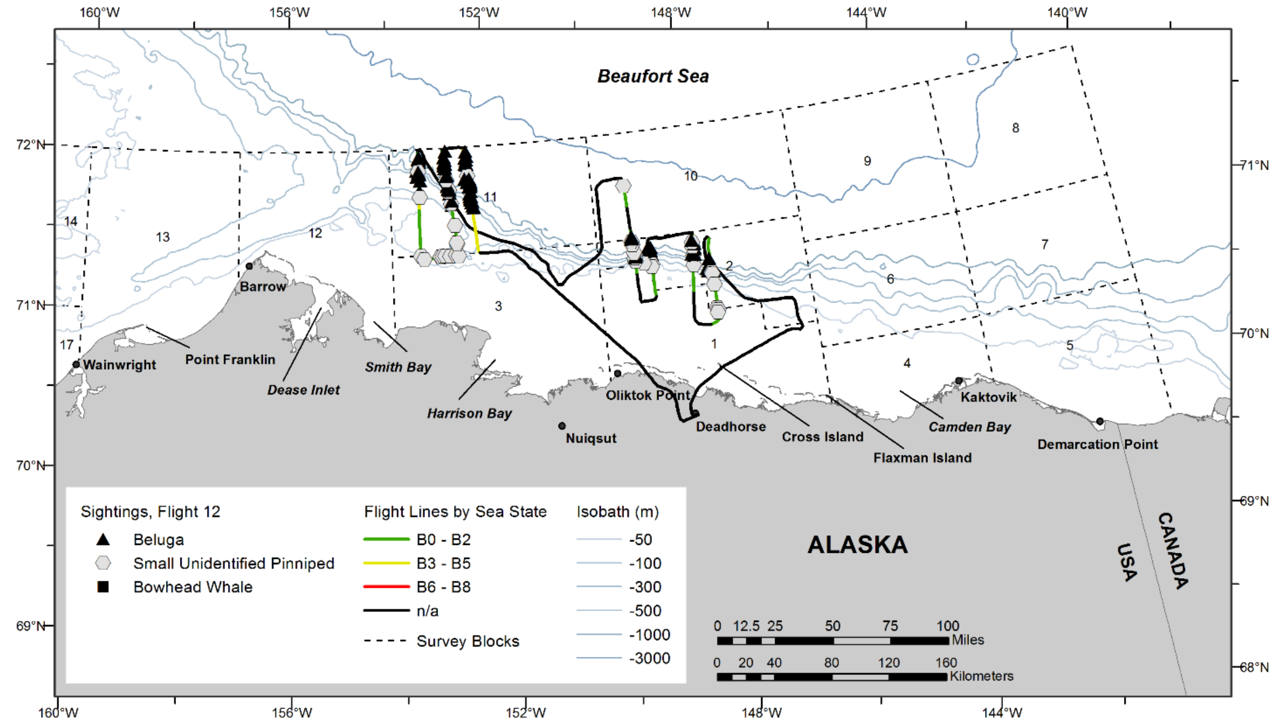

Figure B-35. ASAMM Flight 12 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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20 August 2014, Flight 224

Flight was a partial survey of transects 4, 6, 8, and 13. Survey conditions included partly cloudy to overcast skies, no visibility to unlimited visibility (with fog, haze, and glare), and Beaufort 2-3 sea states. Sea ice cover was 0-1% broken floe in the area surveyed. Sightings included gray whales (including one calf), walruses, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
224	8/20/14 10:42	71.282	161.003	gray whale	feed	1	0	14
224	8/20/14 10:43	71.278	160.989	gray whale	feed	4	0	14
224	8/20/14 11:46	71.922	160.045	gray whale	feed	4	1	14

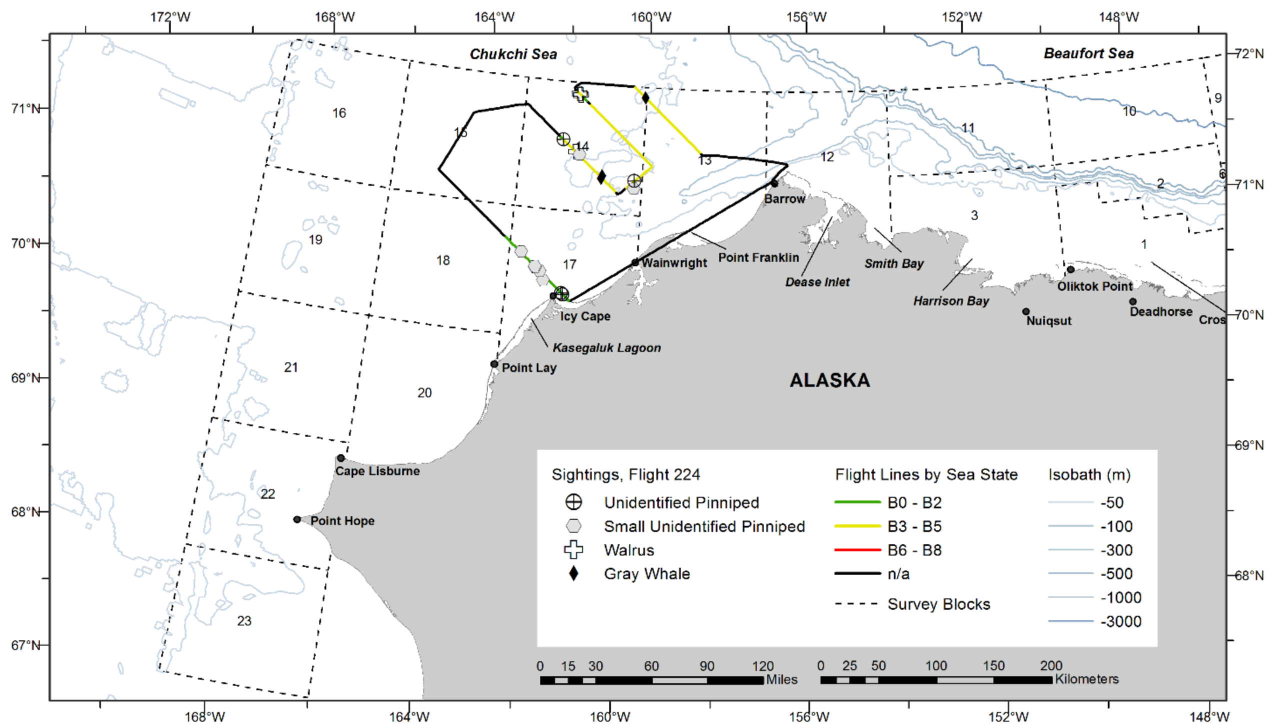

Figure B-36. ASAMM Flight 224 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

20 August 2014, Flight 13

Flight was a survey of portions of block 12. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with glare, fog, and precipitation), and Beaufort 2-4 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales, 1 gray whale, belugas (including 14 calves), unidentified cetaceans, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
13	8/20/14 16:15	71.478	155.304	bowhead whale	swim	1	0	12
13	8/20/14 16:15	71.482	155.303	bowhead whale	swim	1	0	12
13	8/20/14 16:16	71.483	155.336	bowhead whale	swim	1	0	12
13	8/20/14 16:26	71.671	155.259	beluga	rest	5	0	12
13	8/20/14 16:26	71.675	155.258	beluga	rest	9	0	12
13	8/20/14 16:26	71.683	155.257	beluga	rest	4	0	12
13	8/20/14 16:26	71.684	155.257	beluga	rest	15	3	12
13	8/20/14 16:26	71.691	155.257	beluga	rest	4	0	12
13	8/20/14 16:26	71.694	155.257	beluga	rest	12	0	12
13	8/20/14 16:26	71.697	155.256	beluga	rest	20	2	12
13	8/20/14 16:27	71.700	155.256	beluga	rest	6	0	12
13	8/20/14 16:27	71.705	155.255	beluga	rest	2	0	12
13	8/20/14 16:28	71.736	155.251	beluga	swim	8	0	12
13	8/20/14 16:30	71.809	155.231	beluga	rest	2	0	12
13	8/20/14 16:30	71.823	155.228	beluga	rest	1	0	12
13	8/20/14 16:30	71.828	155.226	beluga	rest	11	3	12
13	8/20/14 16:30	71.831	155.225	beluga	rest	5	1	12
13	8/20/14 16:30	71.838	155.223	beluga	rest	4	0	12
13	8/20/14 16:32	71.883	155.213	beluga	swim	1	0	12
13	8/20/14 16:33	71.950	155.194	beluga	rest	2	0	12
13	8/20/14 16:35	71.999	155.285	beluga	rest	2	0	0
13	8/20/14 16:37	71.999	155.471	beluga	rest	8	1	0
13	8/20/14 16:45	71.771	155.635	beluga	swim	9	0	12
13	8/20/14 16:45	71.767	155.635	beluga	rest	2	0	12
13	8/20/14 16:45	71.762	155.636	beluga	swim	12	1	12
13	8/20/14 16:45	71.759	155.636	beluga	rest	9	0	12
13	8/20/14 16:47	71.722	155.644	beluga	swim	2	0	12
13	8/20/14 16:49	71.637	155.667	bowhead whale	swim	2	0	12
13	8/20/14 16:57	71.538	155.688	beluga	rest	2	0	12
13	8/20/14 17:02	71.405	155.714	beluga	spy hop	1	0	12
13	8/20/14 15:25	71.927	154.558	beluga	rest	1	0	12

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
13	8/20/14 15:26	71.947	154.584	beluga	rest	1	0	12
13	8/20/14 15:26	71.951	154.589	beluga	rest	1	0	12
13	8/20/14 15:26	71.956	154.594	unid cetacean	dive	1	0	12
13	8/20/14 15:27	71.954	154.602	beluga	swim	1	0	12
13	8/20/14 15:29	71.924	154.582	beluga	rest	13	0	12
13	8/20/14 15:33	71.940	154.568	beluga	rest	5	3	12
13	8/20/14 15:49	71.460	154.868	bowhead whale	swim	1	0	12
13	8/20/14 15:52	71.430	154.884	bowhead whale	swim	2	0	12
13	8/20/14 15:56	71.406	154.881	beluga	swim	1	0	12
13	8/20/14 15:56	71.386	154.886	beluga	swim	1	0	12
13	8/20/14 16:00	71.279	154.912	unid cetacean	rest	1	0	12
13	8/20/14 17:22	71.662	156.347	beluga	rest	2	0	12
13	8/20/14 17:22	71.684	156.345	beluga	swim	2	0	12
13	8/20/14 17:53	71.481	156.793	beluga	swim	1	0	12
13	8/20/14 17:57	71.372	156.773	gray whale	feed	1	0	12

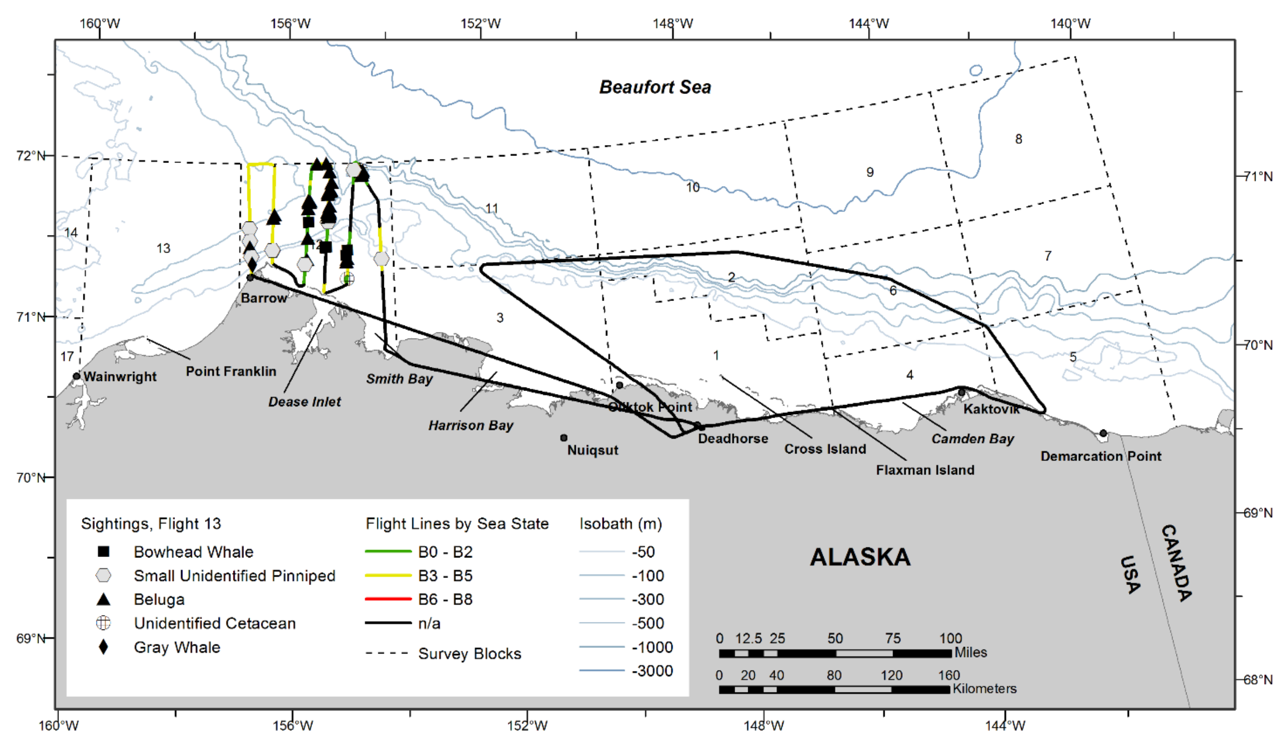

Figure B-37. ASAMM Flight 13 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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21 August 2014, Flight 225

Flight was a partial survey of transects 9, 11, 17, and 19, and the coastal transect from Ledyard Bay to Point Franklin. Survey conditions included partly cloudy to overcast skies, no visibility to unlimited visibility (with fog, haze, low ceilings, precipitation, and glare), and Beaufort 1-6 sea states. There was no sea ice was observed in the area surveyed. Sightings included gray whales, belugas, walruses, bearded seals, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
225	8/21/14 18:51	70.939	160.585	gray whale	swim	1	0	17
225	8/21/14 18:51	70.937	160.578	gray whale	feed	1	0	17
225	8/21/14 18:53	70.942	160.595	gray whale	feed	2	0	17
225	8/21/14 18:53	70.943	160.577	gray whale	feed	1	0	17
225	8/21/14 12:29	69.385	163.199	gray whale	swim	1	0	20
225	8/21/14 14:40	69.667	163.151	gray whale	swim	1	0	20
225	8/21/14 15:13	70.382	160.856	beluga	mill	15	0	17
225	8/21/14 15:22	70.599	160.177	gray whale	swim	1	0	17

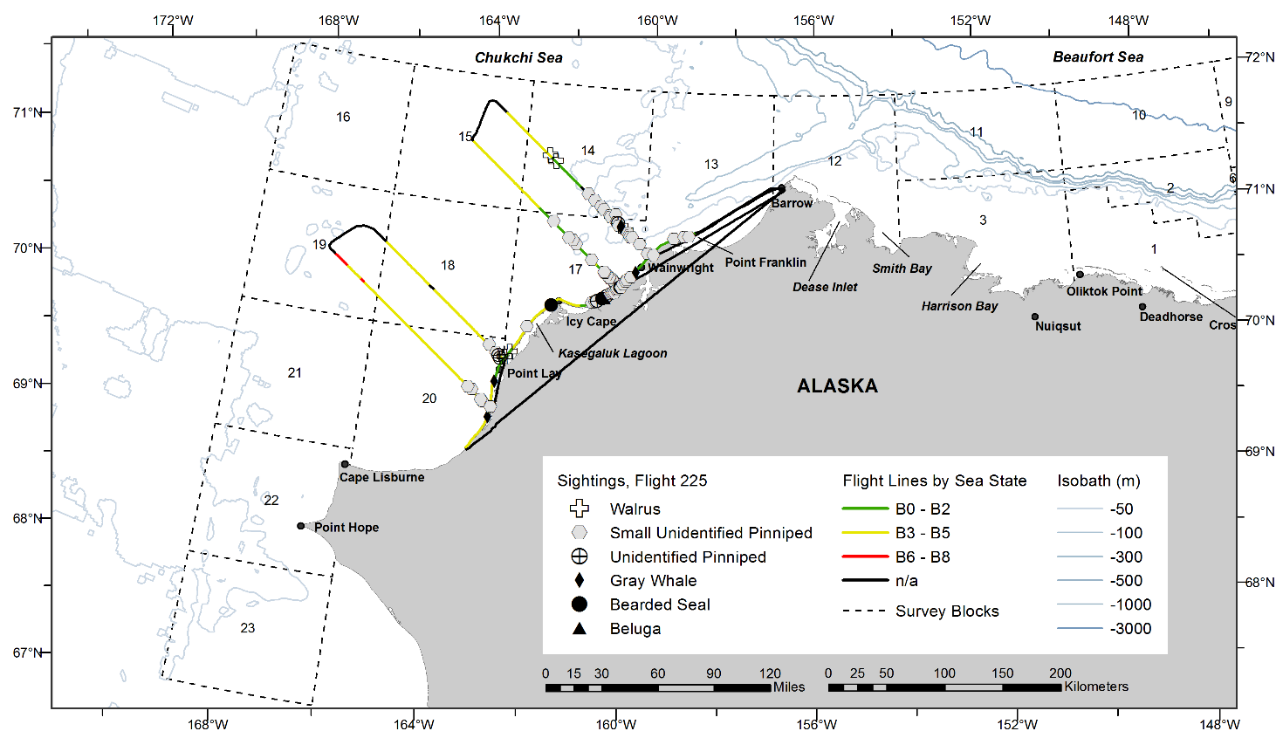

Figure B-38. ASAMM Flight 225 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

22 August 2014, Flight 226

Flight was a complete survey of transects 2 and 5, and partial survey of transects 7 and 12. Survey conditions included partly cloudy to overcast skies, <1 km to unlimited visibility (with fog, haze, low ceilings, precipitation, and glare), and Beaufort 2-6 sea states. Sea ice cover was 0-5% broken floe in the area surveyed. Sightings included gray whales, one beluga, one walrus, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
226	8/22/14 11:18	70.425	161.148	beluga	swim	1	0	17
226	8/22/14 12:47	70.937	158.010	gray whale	swim	1	0	13
226	8/22/14 12:52	70.971	157.608	gray whale	swim	1	0	13
226	8/22/14 12:57	71.072	157.929	gray whale	feed	1	0	13
226	8/22/14 12:57	71.084	157.964	gray whale	unknown	2	0	13
226	8/22/14 12:58	71.093	157.992	gray whale	feed	1	0	13
226	8/22/14 12:58	71.093	157.993	gray whale	feed	1	0	13
226	8/22/14 12:58	71.105	158.034	gray whale	feed	1	0	13
226	8/22/14 12:58	71.108	158.046	gray whale	feed	1	0	13
226	8/22/14 13:01	71.099	158.017	gray whale	rest	1	0	13
226	8/22/14 13:03	71.112	158.044	gray whale	rest	1	0	13
226	8/22/14 13:11	71.108	157.988	gray whale	feed	1	0	13
226	8/22/14 13:12	71.071	158.002	gray whale	feed	2	0	13
226	8/22/14 13:15	71.090	158.054	gray whale	feed	1	0	13
226	8/22/14 13:15	71.080	158.083	gray whale	feed	1	0	13
226	8/22/14 13:18	71.082	157.909	gray whale	feed	1	0	13
226	8/22/14 13:18	71.091	157.894	gray whale	feed	2	0	13
226	8/22/14 13:18	71.098	157.894	gray whale	feed	1	0	13
226	8/22/14 13:19	71.096	157.871	gray whale	feed	1	0	13
226	8/22/14 13:24	71.122	158.093	gray whale	feed	2	0	13
226	8/22/14 13:25	71.115	158.164	gray whale	feed	1	0	13
226	8/22/14 13:26	71.116	158.123	gray whale	feed	1	0	13
226	8/22/14 13:27	71.114	158.132	gray whale	feed	1	0	13
226	8/22/14 13:28	71.103	158.191	gray whale	feed	1	0	13
226	8/22/14 13:29	71.098	158.209	gray whale	feed	1	0	13

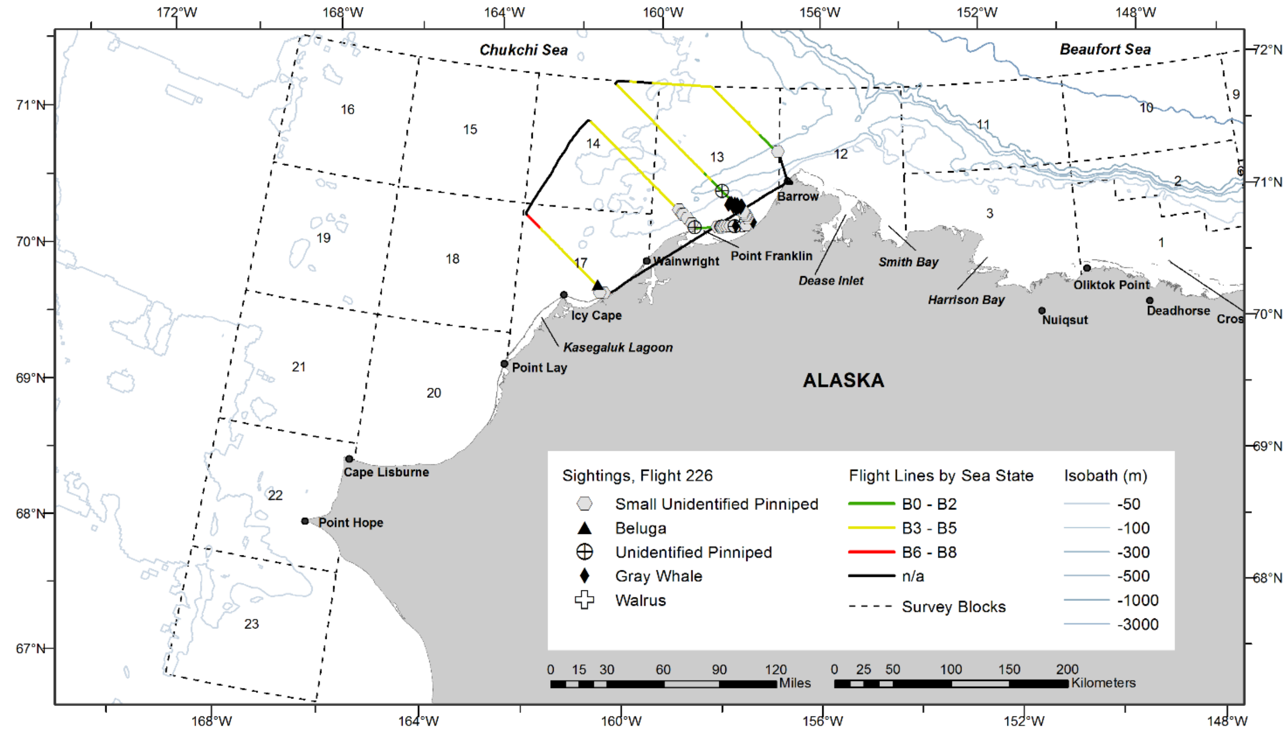

Figure B-39. ASAMM Flight 226 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

22 August 2014, Flight 14

Flight was a survey of portions of blocks 1, 2, 10, and 11. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with glare, haze, low ceilings and fog), and Beaufort 1-3 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales, belugas (including seven calves), one unidentified pinniped, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
14	8/22/14 12:16	71.421	149.803	beluga	rest	1	0	10
14	8/22/14 12:33	71.670	150.353	beluga	rest	1	0	11
14	8/22/14 12:34	71.701	150.358	beluga	rest	1	0	11
14	8/22/14 12:35	71.739	150.365	beluga	rest	1	0	11
14	8/22/14 12:38	71.845	150.387	beluga	swim	1	0	11
14	8/22/14 12:43	71.997	150.530	beluga	rest	1	0	11
14	8/22/14 12:44	71.997	150.543	beluga	rest	3	1	11
14	8/22/14 12:44	71.996	150.577	beluga	rest	1	0	0
14	8/22/14 12:52	71.720	150.605	beluga	swim	1	0	11
14	8/22/14 12:59	71.490	150.588	beluga	rest	1	0	11
14	8/22/14 13:01	71.436	150.582	beluga	swim	1	0	11
14	8/22/14 13:01	71.433	150.582	beluga	swim	1	0	11
14	8/22/14 13:02	71.403	150.582	beluga	unknown	3	0	11
14	8/22/14 13:06	71.333	150.726	beluga	rest	12	0	11
14	8/22/14 13:06	71.333	150.726	beluga	swim	3	0	3
14	8/22/14 13:06	71.333	150.778	beluga	rest	1	0	11
14	8/22/14 13:06	71.333	150.816	beluga	rest	2	0	11
14	8/22/14 13:07	71.333	150.826	beluga	rest	2	1	11
14	8/22/14 13:07	71.333	150.864	beluga	rest	2	0	11
14	8/22/14 13:14	71.425	151.332	beluga	rest	2	1	11
14	8/22/14 13:14	71.435	151.333	beluga	rest	3	0	11
14	8/22/14 13:15	71.441	151.333	beluga	rest	1	1	11
14	8/22/14 13:15	71.446	151.333	beluga	rest	7	0	11
14	8/22/14 13:15	71.464	151.332	beluga	rest	10	2	11
14	8/22/14 13:15	71.468	151.331	beluga	rest	4	0	11
14	8/22/14 13:16	71.479	151.329	beluga	swim	1	0	11
14	8/22/14 13:16	71.490	151.331	bowhead whale	rest	1	0	11
14	8/22/14 13:16	71.496	151.332	beluga	rest	2	0	11
14	8/22/14 13:17	71.491	151.296	beluga	rest	2	0	11
14	8/22/14 13:23	71.504	151.337	beluga	rest	1	0	11

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
14	8/22/14 13:28	71.699	151.334	beluga	unknown	1	0	11
14	8/22/14 13:30	71.753	151.343	beluga	rest	1	0	11
14	8/22/14 13:30	71.762	151.342	beluga	rest	1	0	11
14	8/22/14 13:34	71.914	151.344	beluga	rest	1	0	11
14	8/22/14 13:34	71.915	151.344	beluga	rest	1	0	11
14	8/22/14 13:34	71.918	151.344	beluga	rest	1	0	11
14	8/22/14 13:36	71.972	151.344	beluga	unknown	1	0	11
14	8/22/14 13:42	71.942	151.807	beluga	rest	1	0	11
14	8/22/14 13:43	71.931	151.810	beluga	rest	1	0	11
14	8/22/14 13:51	71.637	151.818	beluga	swim	2	0	11
14	8/22/14 13:57	71.455	151.822	beluga	rest	1	0	11
14	8/22/14 13:57	71.443	151.822	beluga	rest	1	0	11
14	8/22/14 13:57	71.438	151.823	beluga	rest	2	1	11
14	8/22/14 13:58	71.433	151.824	beluga	rest	1	0	11
14	8/22/14 14:00	71.369	151.827	bowhead whale	rest	1	0	11

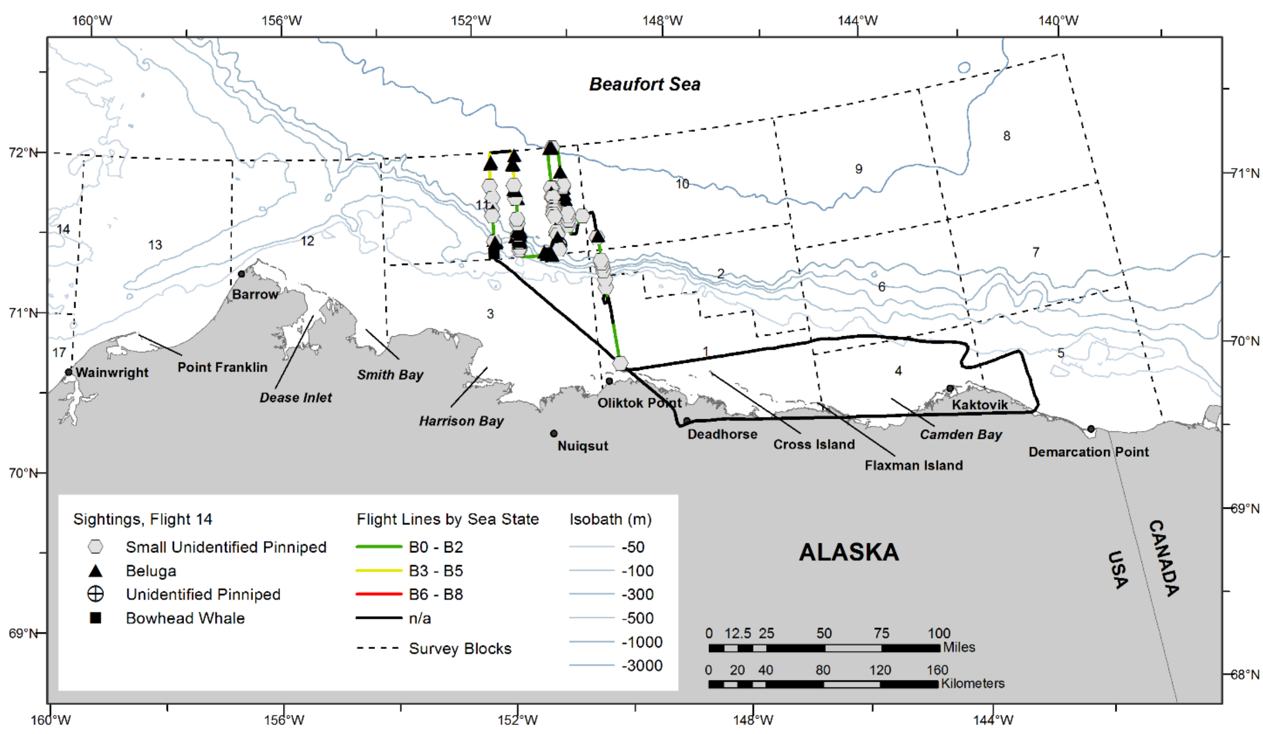

Figure B-40. ASAMM Flight 14 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

23 August 2014, Flight 15

Flight was a survey block 4 and portions of blocks 5, 6, and 7. Survey conditions included clear to overcast skies, 0-10 km visibility (with glare, low ceilings, fog and precipitation), and Beaufort 1-4 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales (including three calves), belugas (including three calves), unidentified cetaceans, unidentified pinnipeds, small unidentified pinnipeds, and polar bears.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
15	8/23/14 10:52	70.303	142.215	unid cetacean	unknown	1	0	5
15	8/23/14 10:53	70.287	142.136	beluga	rest	2	1	5
15	8/23/14 10:58	70.314	141.982	bowhead whale	unknown	2	1	5
15	8/23/14 11:03	70.321	142.079	unid cetacean	swim	1	0	5
15	8/23/14 11:18	70.281	142.204	beluga	swim	1	0	5
15	8/23/14 11:28	69.966	142.145	bowhead whale	unknown	1	0	5
15	8/23/14 11:38	69.937	142.134	bowhead whale	rest	1	0	5
15	8/23/14 11:40	69.923	142.128	bowhead whale	rest	1	0	5
15	8/23/14 11:41	69.923	142.066	bowhead whale	rest	1	0	5
15	8/23/14 17:38	71.014	144.817	beluga	swim	1	0	6
15	8/23/14 17:39	71.031	144.813	beluga	unknown	1	0	6
15	8/23/14 17:39	71.061	144.807	beluga	swim	1	0	6
15	8/23/14 17:40	71.086	144.803	beluga	mill	1	0	6
15	8/23/14 11:46	69.899	142.123	bowhead whale	feed	1	0	5
15	8/23/14 11:47	69.902	142.039	bowhead whale	feed	2	0	5
15	8/23/14 11:48	69.908	142.052	bowhead whale	flipper slap	2	0	5
15	8/23/14 17:47	71.107	145.082	beluga	swim	1	0	6
15	8/23/14 17:50	71.004	145.090	beluga	rest	1	0	6
15	8/23/14 11:59	69.875	142.112	beluga	swim	1	0	5
15	8/23/14 17:51	70.987	145.091	beluga	swim	1	0	6
15	8/23/14 17:52	70.953	145.091	beluga	unknown	1	0	6
15	8/23/14 17:53	70.917	145.094	beluga	swim	1	0	6
15	8/23/14 17:54	70.873	145.097	beluga	swim	3	0	6
15	8/23/14 17:55	70.862	145.095	beluga	swim	2	0	6
15	8/23/14 17:55	70.856	145.095	beluga	swim	2	0	6
15	8/23/14 17:55	70.846	145.095	beluga	rest	3	0	6
15	8/23/14 17:06	70.469	144.908	bowhead whale	swim	1	0	4
15	8/23/14 12:26	70.579	142.911	beluga	swim	1	0	7
15	8/23/14 17:09	70.499	144.834	bowhead whale	rest	1	0	4

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
15	8/23/14 12:27	70.606	142.901	beluga	swim	1	0	7
15	8/23/14 12:27	70.607	142.901	beluga	swim	1	0	7
15	8/23/14 12:28	70.638	142.891	beluga	swim	1	0	7
15	8/23/14 17:12	70.519	144.893	bowhead whale	rest	3	0	6
15	8/23/14 17:13	70.506	144.830	bowhead whale	rest	1	0	6
15	8/23/14 17:14	70.488	144.868	bowhead whale	rest	3	0	4
15	8/23/14 17:19	70.436	144.878	bowhead whale	rest	1	0	4
15	8/23/14 17:22	70.457	144.910	bowhead whale	swim	1	0	4
15	8/23/14 17:24	70.526	144.895	bowhead whale	rest	5	1	6
15	8/23/14 12:41	70.775	143.090	beluga	rest	1	0	6
15	8/23/14 12:42	70.709	143.104	beluga	swim	1	0	6
15	8/23/14 12:43	70.685	143.107	beluga	swim	1	0	6
15	8/23/14 12:45	70.599	143.124	beluga	rest	1	0	6
15	8/23/14 17:32	70.787	144.853	beluga	mill	1	0	6
15	8/23/14 17:56	70.818	145.096	beluga	swim	1	0	6
15	8/23/14 17:56	70.800	145.097	beluga	swim	1	0	6
15	8/23/14 17:57	70.794	145.098	beluga	swim	2	1	6
15	8/23/14 12:48	70.511	143.140	bowhead whale	rest	2	0	6
15	8/23/14 17:35	70.896	144.837	beluga	swim	1	0	6
15	8/23/14 17:37	70.986	144.822	beluga	swim	1	0	6
15	8/23/14 17:59	70.727	145.101	beluga	swim	1	0	6
15	8/23/14 12:55	70.451	143.147	beluga	swim	1	0	4
15	8/23/14 13:02	70.308	143.170	beluga	swim	1	0	4
15	8/23/14 18:08	70.405	145.115	bowhead whale	rest	1	0	4
15	8/23/14 13:03	70.269	143.178	bowhead whale	swim	1	0	4
15	8/23/14 13:06	70.291	143.237	bowhead whale	rest	1	0	4
15	8/23/14 18:09	70.379	145.114	bowhead whale	rest	4	0	4
15	8/23/14 18:15	70.309	145.116	bowhead whale	dive	2	0	4
15	8/23/14 18:16	70.301	145.063	bowhead whale	swim	1	0	4
15	8/23/14 13:10	70.190	143.196	bowhead whale	rest	1	0	4
15	8/23/14 18:18	70.303	144.989	bowhead whale	dive	2	0	4
15	8/23/14 13:11	70.162	143.204	bowhead whale	rest	1	0	4
15	8/23/14 18:21	70.259	144.840	bowhead whale	swim	1	0	4
15	8/23/14 18:32	70.234	145.119	bowhead whale	rest	1	0	4
15	8/23/14 18:35	70.205	145.015	bowhead whale	swim	1	0	4
15	8/23/14 18:37	70.222	144.966	unid cetacean	unknown	1	0	4
15	8/23/14 18:37	70.219	144.932	bowhead whale	swim	1	0	4

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
15	8/23/14 18:40	70.146	144.941	bowhead whale	unknown	1	0	4
15	8/23/14 18:44	70.207	145.120	bowhead whale	rest	2	0	4
15	8/23/14 18:44	70.203	145.121	bowhead whale	unknown	3	0	4
15	8/23/14 18:45	70.174	145.123	bowhead whale	unknown	1	0	4
15	8/23/14 18:48	70.204	145.060	bowhead whale	rest	1	0	4
15	8/23/14 18:49	70.206	145.113	bowhead whale	rest	1	0	4
15	8/23/14 13:36	70.712	143.761	beluga	swim	1	0	6
15	8/23/14 13:44	71.003	143.706	beluga	swim	2	1	6
15	8/23/14 18:53	70.100	145.123	beluga	dive	1	0	4
15	8/23/14 18:54	70.079	145.125	beluga	swim	6	0	4
15	8/23/14 13:46	71.064	143.691	beluga	swim	1	0	6
15	8/23/14 19:05	70.176	145.795	bowhead whale	rest	1	0	4
15	8/23/14 13:58	71.017	144.209	beluga	rest	1	0	6
15	8/23/14 13:58	71.016	144.209	beluga	rest	5	0	6
15	8/23/14 13:58	71.013	144.211	beluga	swim	2	0	6
15	8/23/14 13:58	71.007	144.213	beluga	rest	1	0	6
15	8/23/14 13:58	71.002	144.215	beluga	swim	3	0	6
15	8/23/14 19:08	70.181	145.893	beluga	swim	3	0	4
15	8/23/14 19:09	70.176	145.868	bowhead whale	feed	3	0	4
15	8/23/14 19:09	70.183	145.886	bowhead whale	feed	1	0	4
15	8/23/14 19:10	70.195	145.899	bowhead whale	swim	3	0	4
15	8/23/14 14:05	70.794	144.274	beluga	unknown	1	0	6
15	8/23/14 19:13	70.201	145.792	bowhead whale	swim	1	0	4
15	8/23/14 14:08	70.695	144.295	beluga	swim	1	0	6
15	8/23/14 14:08	70.690	144.297	beluga	swim	1	0	6
15	8/23/14 14:08	70.682	144.301	beluga	swim	1	0	6
15	8/23/14 19:17	70.240	145.785	bowhead whale	rest	2	0	4
15	8/23/14 14:12	70.568	144.332	beluga	swim	13	0	6
15	8/23/14 19:18	70.234	145.767	bowhead whale	rest	1	0	4
15	8/23/14 19:20	70.269	145.889	bowhead whale	feed	6	0	4
15	8/23/14 14:12	70.542	144.335	bowhead whale	rest	1	0	6
15	8/23/14 19:23	70.284	145.774	bowhead whale	rest	2	0	4
15	8/23/14 19:24	70.296	145.773	bowhead whale	swim	1	0	4
15	8/23/14 14:16	70.514	144.483	bowhead whale	unknown	2	0	6
15	8/23/14 14:19	70.544	144.487	bowhead whale	rest	5	1	6
15	8/23/14 19:26	70.329	145.823	bowhead whale	rest	1	0	4
15	8/23/14 19:28	70.310	145.873	bowhead whale	tail slap	1	0	4

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
15	8/23/14 19:34	70.351	145.762	unid cetacean	dive	1	0	4
15	8/23/14 19:37	70.366	145.762	unid cetacean	dive	1	0	4
15	8/23/14 19:38	70.422	145.746	bowhead whale	mill	2	0	4
15	8/23/14 14:38	70.337	144.390	bowhead whale	unknown	2	0	4
15	8/23/14 19:38	70.426	145.746	bowhead whale	rest	1	0	4
15	8/23/14 19:41	70.461	145.730	bowhead whale	tail slap	1	0	4
15	8/23/14 19:45	70.528	145.726	bowhead whale	dive	1	0	6
15	8/23/14 14:46	70.290	144.390	unid cetacean	unknown	1	0	4
15	8/23/14 14:46	70.270	144.398	beluga	unknown	1	0	4
15	8/23/14 14:46	70.262	144.402	unid cetacean	unknown	3	0	4
15	8/23/14 14:47	70.244	144.410	bowhead whale	dive	1	0	4
15	8/23/14 19:49	70.618	145.709	bowhead whale	swim	1	0	6
15	8/23/14 14:47	70.224	144.417	bowhead whale	swim	3	0	4
15	8/23/14 19:53	70.778	145.671	beluga	swim	8	0	6
15	8/23/14 19:56	70.925	145.641	beluga	swim	1	0	6
15	8/23/14 19:57	70.937	145.638	beluga	swim	1	0	6
15	8/23/14 14:52	70.058	144.464	unid cetacean	unknown	1	0	4

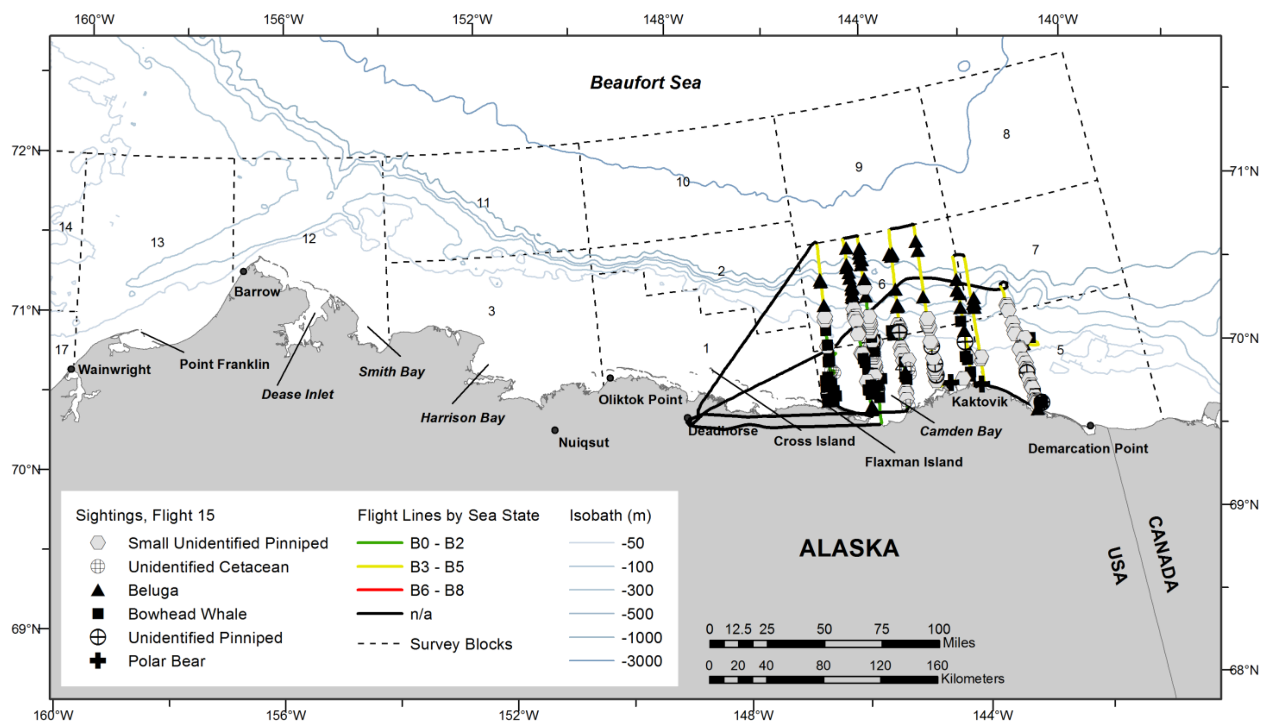

Figure B-41. ASAMM Flight 15 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

24 August 2014, Flight 227

Flight was a partial survey of transects 29, 30, 31, 32, and 33. Survey conditions included partly cloudy skies, no visibility to unlimited visibility (with glare, haze and low ceilings), and Beaufort 2-6 sea states. There was no sea ice observed in the area surveyed. Sightings included gray whales (including one calf) and one walrus carcass.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
227	8/24/14 13:16	68.445	166.796	gray whale	roll	1	0	22
227	8/24/14 13:26	68.443	166.494	gray whale	swim	2	1	22

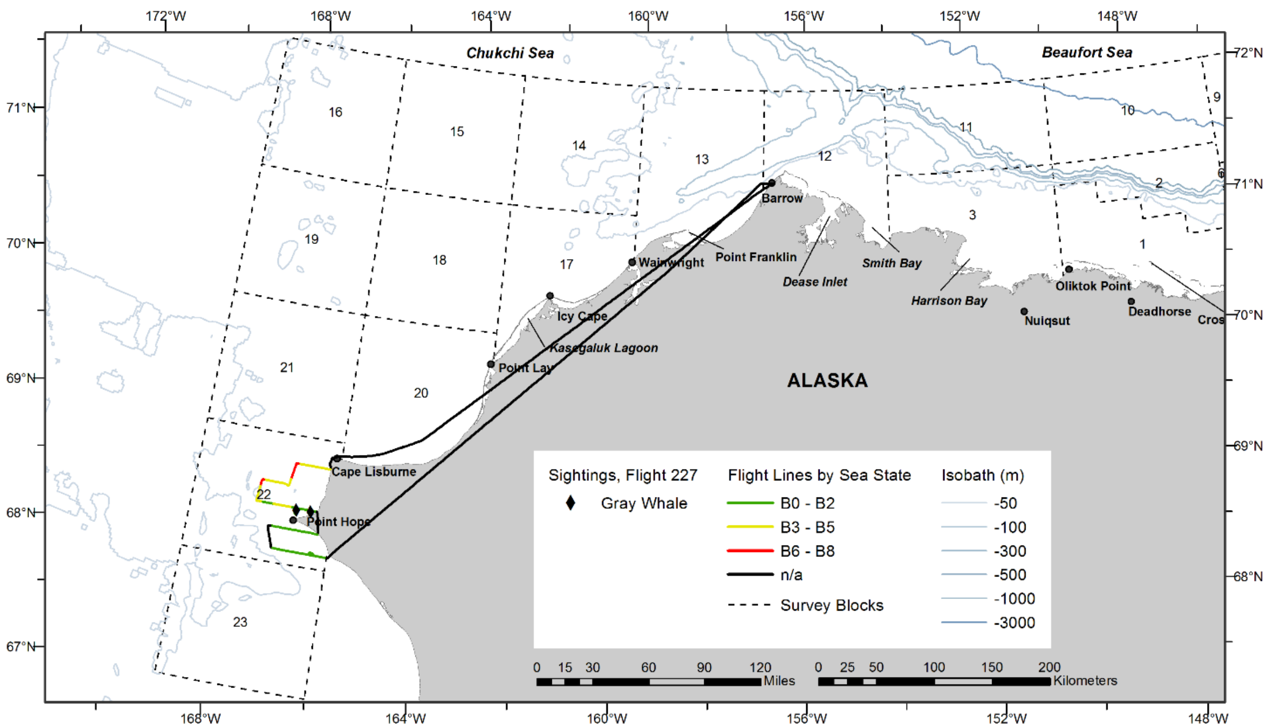

Figure B-42. ASAMM Flight 227 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

24 August 2014, Flight 16

Flight was a survey of portions of blocks 1 and 2. Survey conditions included overcast skies, 0-5 km visibility (with low ceilings), and a Beaufort 4 sea state. There was no sea ice observed in the area surveyed. Sightings included belugas.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
16	8/24/14 14:14	71.238	148.577	beluga	swim	1	0	2
16	8/24/14 14:14	71.231	148.577	beluga	swim	1	0	2
16	8/24/14 14:15	71.208	148.575	beluga	mill	14	0	2
16	8/24/14 14:15	71.205	148.574	beluga	rest	1	0	2
16	8/24/14 14:15	71.195	148.572	beluga	swim	3	0	2
16	8/24/14 14:15	71.188	148.573	beluga	dive	1	0	2
16	8/24/14 14:21	70.989	148.561	beluga	rest	2	0	1

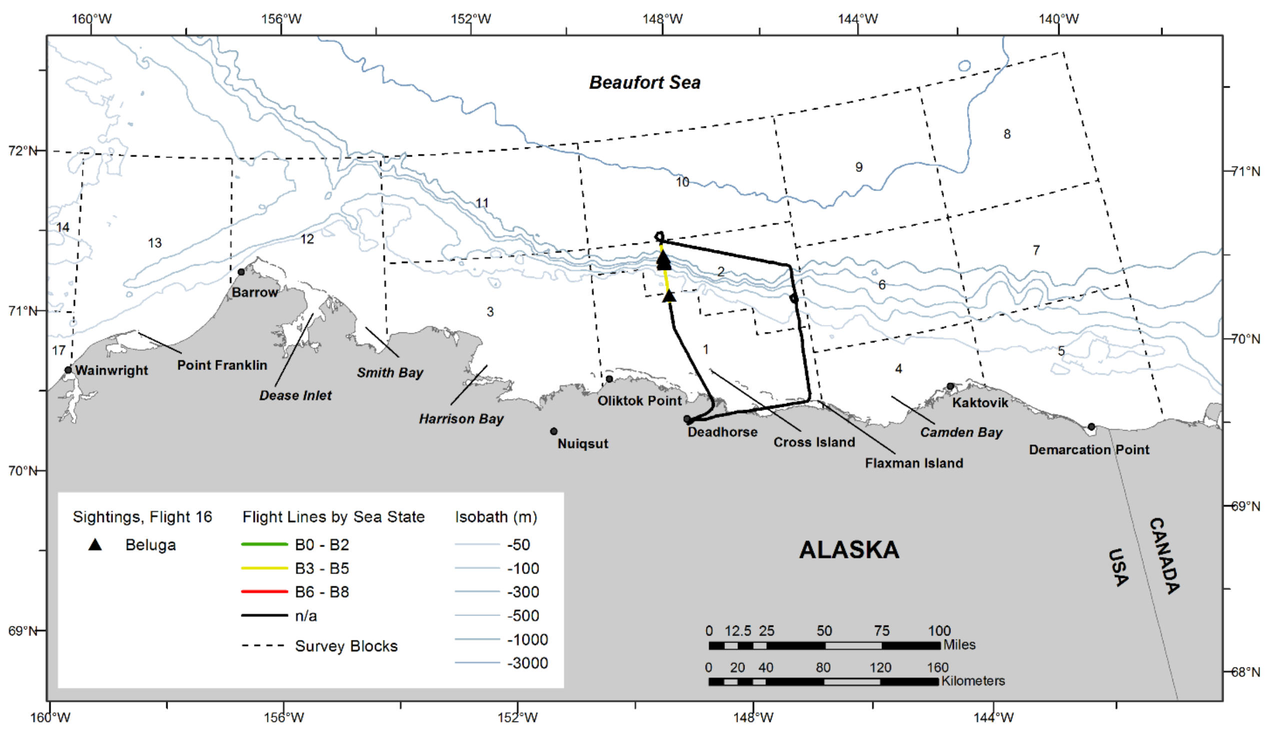

Figure B-43. ASAMM Flight 16 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

27 August 2014, Flight 228

Flight was the coastal transect from south of Point Lay to Barrow. Survey conditions included partly cloudy skies, 5 km to unlimited visibility (with haze and glare), and Beaufort 2-7 sea states. There was no sea ice observed in the area surveyed. Sightings included gray whales (including two carcasses), belugas (including two calves), and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
228	8/27/14 16:36	70.906	158.931	gray whale	swim	1	0	13
228	8/27/14 16:52	70.835	158.060	beluga	swim	10	2	13
228	8/27/14 17:05	71.188	157.034	gray whale	feed	1	0	13
228	8/27/14 17:10	71.209	156.991	gray whale	dead	1	0	12
228	8/27/14 17:14	71.283	156.843	gray whale	dead	1	0	12

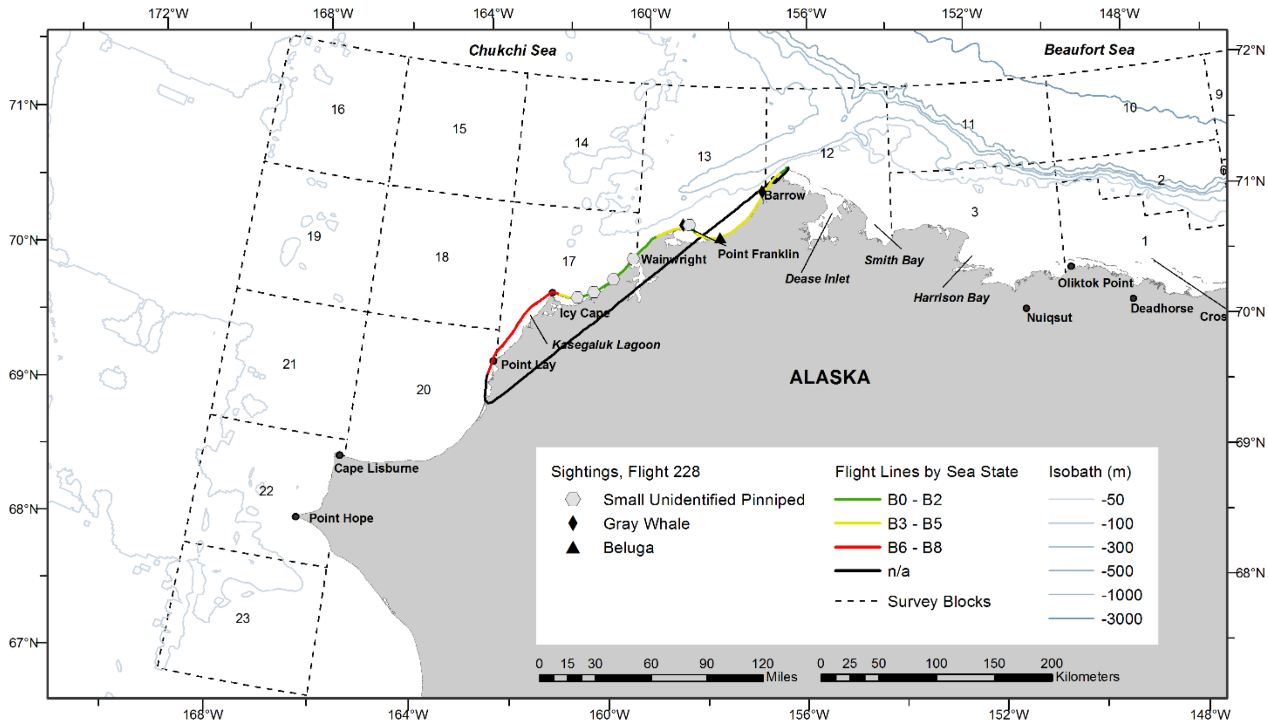

Figure B-44. ASAMM Flight 228 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

28 August 2014, Flight 229

Flight was a partial survey of transects 14 and 16. Survey conditions included partly cloudy to overcast skies, no visibility to unlimited visibility (with low ceilings, precipitation, and glare), and Beaufort 3-5 sea states. There was no sea ice observed in the area surveyed. Sightings included walruses.

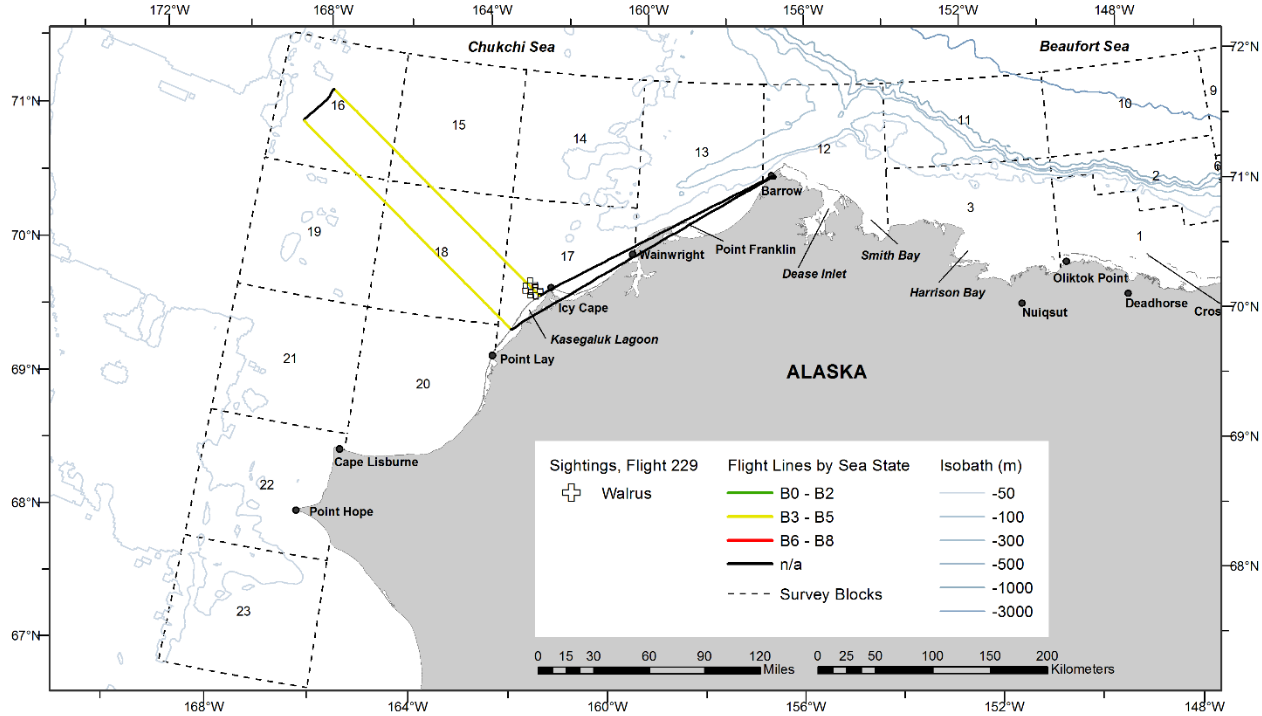

Figure B-45. ASAMM Flight 229 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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28 August 2014, Flight 17

Flight was a survey of block 1 and portions of blocks 2 and 10. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with glare, low ceilings, fog, haze, and precipitation), and Beaufort 1-6 sea states. Sea ice cover was 0-3% broken floe in the area surveyed with 1% shorefast ice near barrier islands. Sightings included bowhead whales, belugas (including three calves), one unidentified cetacean, unidentified pinnipeds, small unidentified pinnipeds, and polar bears.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
17	8/28/14 9:18	70.670	149.636	beluga	swim	1	0	1
17	8/28/14 9:27	71.028	149.710	unid cetacean	tail slap	1	0	1
17	8/28/14 9:35	71.364	149.783	beluga	rest	1	0	10
17	8/28/14 9:54	72.001	149.562	beluga	swim	1	0	10
17	8/28/14 10:00	71.881	149.302	beluga	swim	1	0	10
17	8/28/14 11:30	71.116	148.078	beluga	rest	1	0	2
17	8/28/14 11:31	71.103	148.079	beluga	dive	1	0	2
17	8/28/14 10:32	70.965	149.415	beluga	swim	1	0	1
17	8/28/14 12:54	70.419	147.227	beluga	swim	2	0	1
17	8/28/14 12:54	70.419	147.227	beluga	swim	1	0	1
17	8/28/14 12:54	70.411	147.226	beluga	swim	1	0	1
17	8/28/14 11:43	70.730	148.095	bowhead whale	tail slap	2	0	1
17	8/28/14 11:15	71.207	148.589	beluga	dive	1	0	2
17	8/28/14 11:16	71.227	148.590	beluga	swim	2	1	2
17	8/28/14 11:18	71.285	148.584	beluga	swim	1	0	2
17	8/28/14 11:28	71.190	148.075	beluga	swim	2	1	2
17	8/28/14 14:58	70.942	146.780	beluga	swim	1	0	2
17	8/28/14 14:59	70.945	146.781	beluga	swim	3	1	2
17	8/28/14 14:59	70.955	146.786	beluga	swim	1	0	2
17	8/28/14 14:59	70.960	146.788	beluga	swim	1	0	2
17	8/28/14 14:59	70.964	146.790	beluga	swim	2	0	2
17	8/28/14 12:15	71.095	147.943	beluga	swim	1	0	2
17	8/28/14 12:15	71.105	147.944	beluga	dive	1	0	2
17	8/28/14 12:29	71.222	147.363	beluga	swim	2	0	2
17	8/28/14 12:36	71.019	147.329	beluga	rest	1	0	2
17	8/28/14 12:36	71.017	147.329	beluga	swim	1	0	2
17	8/28/14 15:17	70.923	146.170	beluga	swim	1	0	2

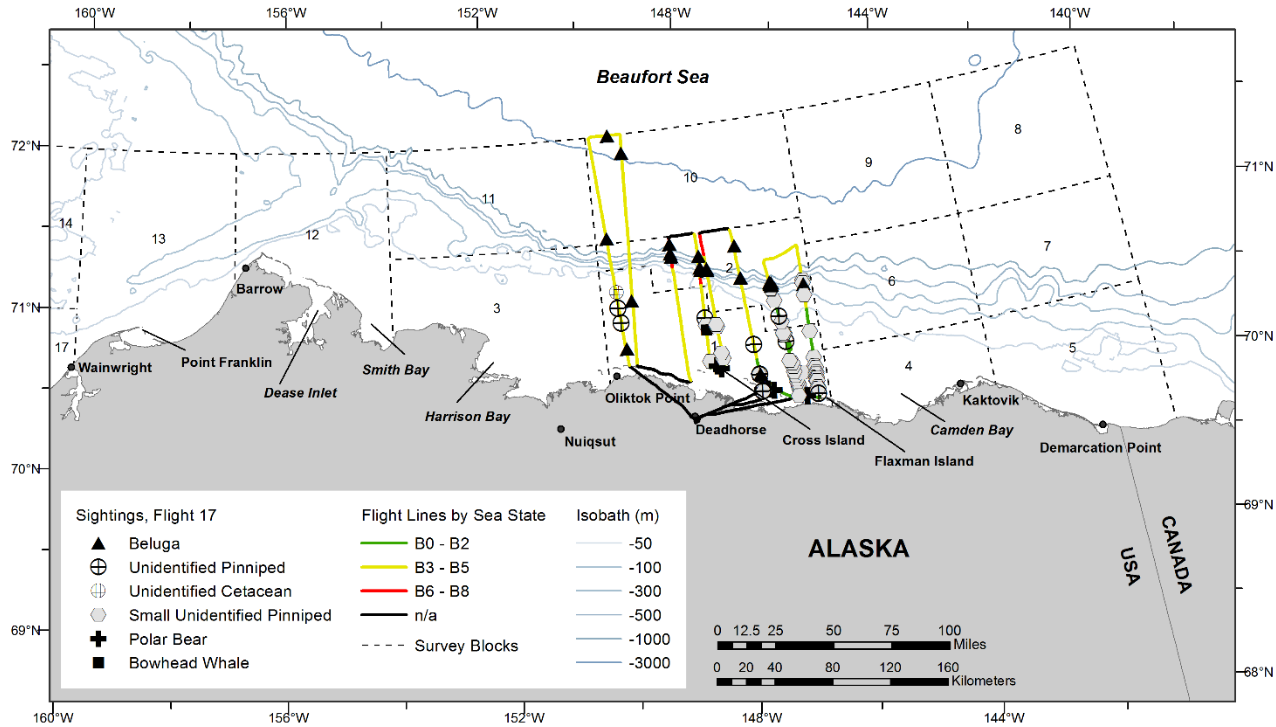

Figure B-46. ASAMM Flight 17 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

29 August 2014, Flight 230

Flight was a complete survey of transects 3 and 7 and partial survey of transect 5. Survey conditions included partly cloudy skies, 0-10 km visibility (with fog, haze, low ceilings, precipitation, and glare), and Beaufort 2-7 sea states. Sea ice cover was 0-30% broken floe in the area surveyed. Sightings included gray whales, belugas, walruses, and one small unidentified pinniped.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
230	8/29/14 10:44	71.452	157.633	beluga	swim	1	0	13
230	8/29/14 10:44	71.447	157.619	beluga	swim	1	0	13
230	8/29/14 10:51	71.290	157.113	gray whale	feed	1	0	13
230	8/29/14 10:52	71.290	157.113	gray whale	feed	2	0	13
230	8/29/14 10:59	71.173	157.146	gray whale	feed	1	0	13
230	8/29/14 11:03	71.100	157.276	gray whale	feed	1	0	13
230	8/29/14 11:14	71.063	157.899	gray whale	feed	2	0	13
230	8/29/14 11:15	71.074	157.905	gray whale	feed	1	0	13
230	8/29/14 11:18	71.079	157.940	gray whale	feed	1	0	13
230	8/29/14 11:18	71.084	157.927	gray whale	feed	1	0	13
230	8/29/14 11:18	71.085	157.916	gray whale	feed	1	0	13
230	8/29/14 11:18	71.087	157.899	gray whale	feed	1	0	13
230	8/29/14 11:20	71.074	157.799	gray whale	feed	2	0	13
230	8/29/14 11:20	71.081	157.802	gray whale	feed	1	0	13
230	8/29/14 11:22	71.088	157.790	gray whale	feed	1	0	13
230	8/29/14 11:23	71.093	157.760	gray whale	feed	1	0	13
230	8/29/14 11:28	71.115	158.069	gray whale	feed	1	0	13
230	8/29/14 11:28	71.116	158.071	gray whale	feed	1	0	13
230	8/29/14 11:32	71.101	158.066	gray whale	feed	1	0	13
230	8/29/14 11:33	71.101	158.080	gray whale	feed	1	0	13

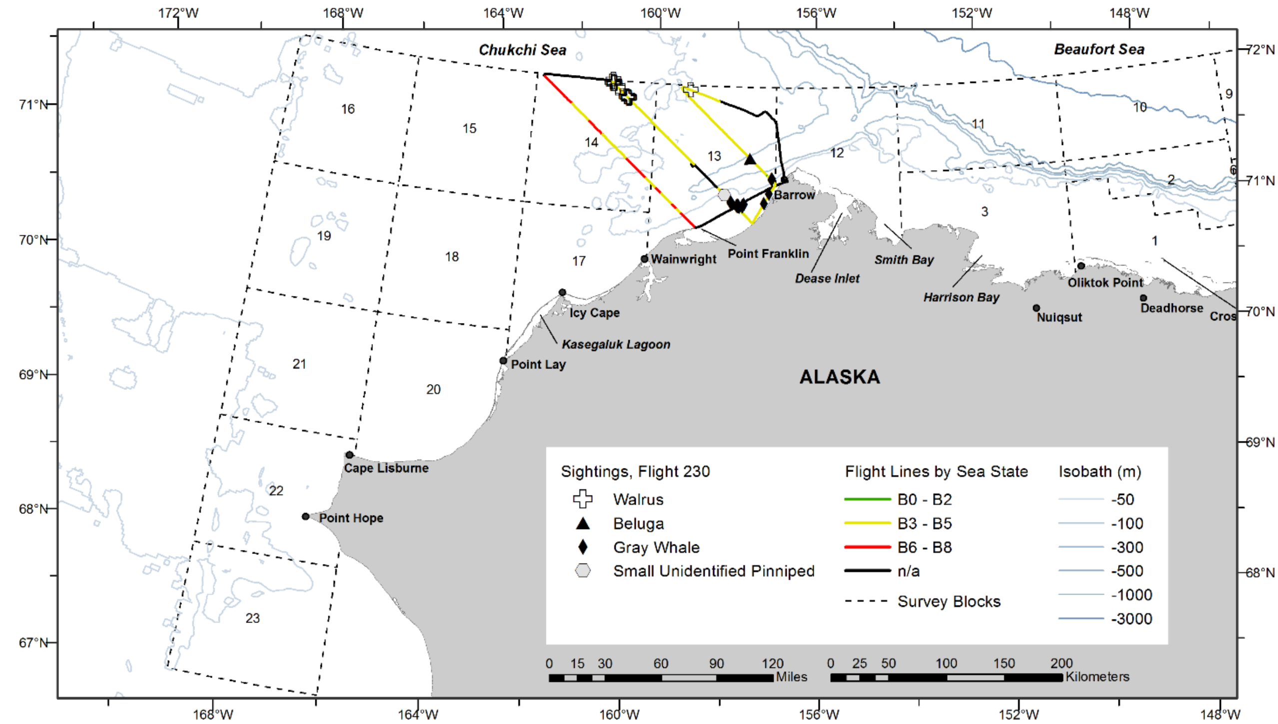

Figure B-47. ASAMM Flight 230 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

30 August 2014, Flight 18

Flight was a survey of portions of blocks 5 and 7. Survey conditions included clear to partly cloudy skies, 5 km to unlimited visibility (with glare and haze), and Beaufort 1-5 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales (including three calves), belugas (including two calves), unidentified cetaceans, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
18	8/30/14 11:25	70.287	142.877	bowhead whale	swim	1	0	5
18	8/30/14 11:25	70.294	142.896	bowhead whale	swim	1	0	5
18	8/30/14 15:25	69.966	141.816	beluga	swim	1	0	5
18	8/30/14 15:26	69.988	141.815	bowhead whale	swim	1	0	5
18	8/30/14 15:26	69.989	141.815	bowhead whale	swim	3	0	5
18	8/30/14 15:29	70.012	141.822	unid cetacean	swim	1	0	5
18	8/30/14 15:54	70.653	141.909	beluga	swim	1	0	7
18	8/30/14 15:57	70.679	141.912	beluga	swim	1	0	7
18	8/30/14 16:00	70.788	141.930	beluga	swim	2	0	7
18	8/30/14 16:00	70.798	141.930	beluga	swim	1	0	7
18	8/30/14 16:00	70.801	141.930	beluga	swim	1	0	7
18	8/30/14 16:00	70.806	141.930	beluga	swim	2	0	7
18	8/30/14 16:00	70.811	141.930	beluga	swim	1	0	7
18	8/30/14 16:01	70.826	141.931	beluga	swim	1	0	7
18	8/30/14 16:01	70.840	141.930	beluga	swim	1	0	7
18	8/30/14 16:02	70.856	141.934	beluga	swim	1	0	7
18	8/30/14 16:04	70.926	141.944	beluga	swim	1	0	7
18	8/30/14 16:04	70.934	141.944	beluga	swim	1	0	7
18	8/30/14 16:07	71.075	141.968	beluga	swim	1	0	7
18	8/30/14 16:08	71.083	141.969	beluga	swim	1	0	7
18	8/30/14 11:50	71.111	142.817	beluga	rest	1	0	7
18	8/30/14 16:20	70.976	141.321	beluga	swim	1	0	7
18	8/30/14 16:20	70.974	141.321	beluga	swim	1	0	7
18	8/30/14 11:59	71.104	142.114	beluga	swim	2	1	7
18	8/30/14 16:23	70.870	141.311	beluga	swim	1	0	7
18	8/30/14 16:24	70.854	141.309	beluga	swim	1	0	7
18	8/30/14 16:24	70.847	141.308	beluga	swim	1	0	7
18	8/30/14 16:25	70.808	141.305	beluga	swim	1	0	7
18	8/30/14 12:02	71.102	142.112	beluga	swim	1	0	7
18	8/30/14 12:03	71.063	142.120	beluga	rest	1	0	7

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
18	8/30/14 16:27	70.726	141.297	beluga	dive	1	0	7
18	8/30/14 16:28	70.705	141.296	beluga	swim	1	0	7
18	8/30/14 12:04	71.051	142.120	beluga	rest	1	0	7
18	8/30/14 12:07	70.946	142.145	beluga	swim	2	1	7
18	8/30/14 12:10	70.854	142.164	beluga	swim	1	0	7
18	8/30/14 16:32	70.553	141.280	beluga	swim	1	0	7
18	8/30/14 12:15	70.834	142.106	beluga	swim	1	0	7
18	8/30/14 16:39	70.298	141.257	unid cetacean	swim	1	0	5
18	8/30/14 12:24	70.562	142.220	beluga	swim	1	0	7
18	8/30/14 12:24	70.560	142.221	beluga	swim	1	0	7
18	8/30/14 12:25	70.545	142.222	beluga	swim	1	0	7
18	8/30/14 17:01	69.802	141.214	bowhead whale	swim	3	1	5
18	8/30/14 17:14	69.801	140.958	bowhead whale	dive	1	0	5
18	8/30/14 12:57	70.026	144.584	bowhead whale	feed	8	1	4
18	8/30/14 17:20	69.930	140.876	bowhead whale	dive	2	0	5
18	8/30/14 17:21	69.950	140.871	unid cetacean	swim	1	0	5
18	8/30/14 13:01	70.028	144.811	bowhead whale	feed	3	0	4
18	8/30/14 13:03	70.088	144.775	bowhead whale	feed	7	0	4
18	8/30/14 13:04	70.085	144.754	bowhead whale	feed	2	0	4
18	8/30/14 13:07	70.107	144.647	bowhead whale	swim	1	0	4
18	8/30/14 17:26	69.978	140.857	bowhead whale	swim	1	0	5
18	8/30/14 17:28	69.980	140.790	bowhead whale	swim	2	1	5
18	8/30/14 17:28	69.981	140.781	beluga	swim	1	0	5
18	8/30/14 17:30	69.970	140.759	bowhead whale	swim	1	0	5
18	8/30/14 17:31	69.961	140.776	bowhead whale	swim	1	0	5
18	8/30/14 17:34	69.979	140.828	beluga	rest	1	0	5
18	8/30/14 17:35	70.008	140.852	unid cetacean	swim	1	0	5
18	8/30/14 17:49	70.402	140.741	beluga	swim	1	0	5
18	8/30/14 17:49	70.422	140.736	beluga	rest	1	0	5
18	8/30/14 17:51	70.472	140.721	beluga	swim	1	0	5
18	8/30/14 17:51	70.486	140.717	beluga	swim	1	0	5
18	8/30/14 17:54	70.569	140.693	beluga	swim	1	0	7
18	8/30/14 17:54	70.580	140.690	beluga	swim	1	0	7
18	8/30/14 17:54	70.581	140.690	beluga	swim	1	0	7
18	8/30/14 17:54	70.598	140.685	beluga	swim	1	0	7
18	8/30/14 17:55	70.606	140.683	beluga	swim	2	0	7
18	8/30/14 17:55	70.625	140.676	beluga	swim	1	0	7

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
18	8/30/14 17:56	70.637	140.672	beluga	swim	1	0	7
18	8/30/14 18:28	70.624	140.401	beluga	swim	1	0	7
18	8/30/14 18:29	70.607	140.400	beluga	swim	6	0	7
18	8/30/14 18:29	70.603	140.401	beluga	swim	1	0	7
18	8/30/14 18:29	70.594	140.402	beluga	swim	1	0	7
18	8/30/14 18:29	70.588	140.403	beluga	swim	1	0	7

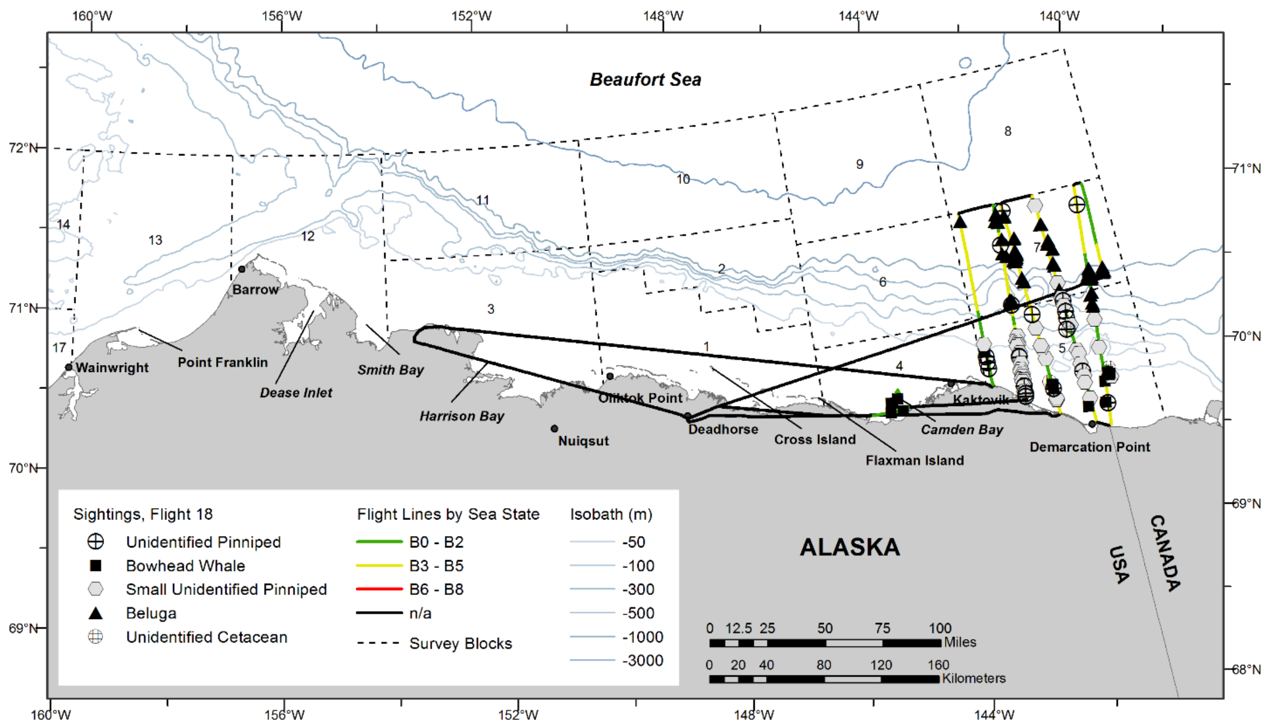

Figure B-48. ASAMM Flight 18 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

31 August 2014, Flight 19

Flight was a survey of a portion of block 3. Survey conditions included partly cloudy skies, 3-10 km visibility (with glare, low ceilings, and haze), and Beaufort 6 sea states. There was no sea ice observed in the area surveyed. No sightings were observed.

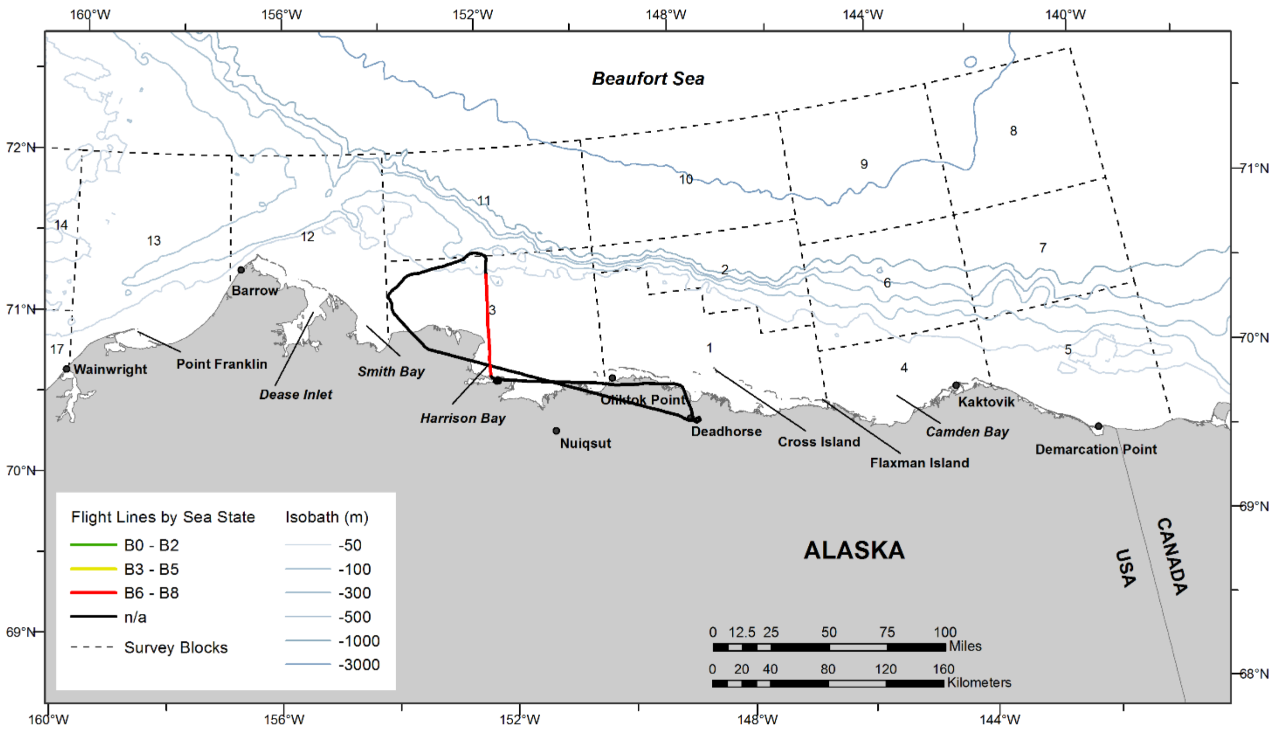

Figure B-49. ASAMM Flight 19 survey track, depicted by sea state.

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1 September 2014, Flight 231

Flight was a partial survey of transect 22 and the coastal transect from Cape Lisburne to Wainwright. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with fog, haze, precipitation, and glare), and Beaufort 4-6 sea states. There was no sea ice observed in the area surveyed. Sightings included walruses.

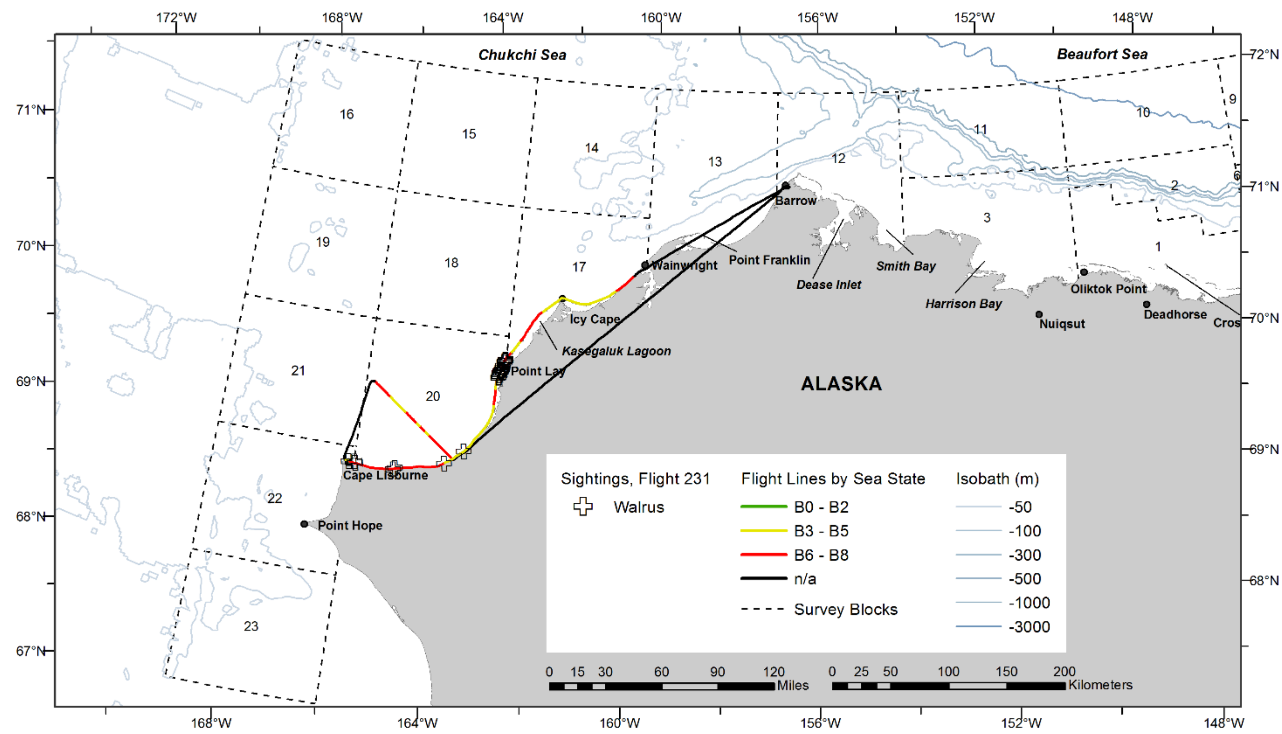

Figure B-50. ASAMM Flight 231 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

1 September 2014, Flight 20

Flight was a survey of portions of blocks 4 and 6. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with glare, low ceilings, precipitation, and haze), and Beaufort 2-5 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales, belugas, unidentified cetaceans, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
20	9/1/14 14:12	70.381	145.700	bowhead whale	rest	1	0	4
20	9/1/14 14:49	70.385	145.353	bowhead whale	swim	1	0	4
20	9/1/14 15:05	69.997	145.091	beluga	swim	1	0	4
20	9/1/14 15:06	69.991	145.046	beluga	swim	1	0	4
20	9/1/14 15:06	69.991	145.043	beluga	swim	1	0	4
20	9/1/14 15:15	70.148	144.631	unid cetacean	swim	1	0	4
20	9/1/14 15:26	70.329	144.654	bowhead whale	rest	1	0	4
20	9/1/14 15:29	70.407	144.666	bowhead whale	swim	2	0	4
20	9/1/14 15:39	70.730	144.704	beluga	swim	2	0	6
20	9/1/14 15:51	70.875	144.122	beluga	swim	1	0	6
20	9/1/14 16:00	70.621	144.176	bowhead whale	swim	1	0	6
20	9/1/14 16:05	70.515	144.200	unid cetacean	dive	1	0	6
20	9/1/14 16:11	70.442	144.210	bowhead whale	dive	1	0	4
20	9/1/14 16:16	70.375	144.223	unid cetacean	dive	1	0	4
20	9/1/14 16:16	70.373	144.223	unid cetacean	swim	1	0	4
20	9/1/14 16:16	70.370	144.256	bowhead whale	swim	2	0	4
20	9/1/14 16:20	70.354	144.224	bowhead whale	swim	1	0	4
20	9/1/14 16:20	70.353	144.224	bowhead whale	swim	1	0	4
20	9/1/14 16:24	70.208	144.256	bowhead whale	swim	1	0	4

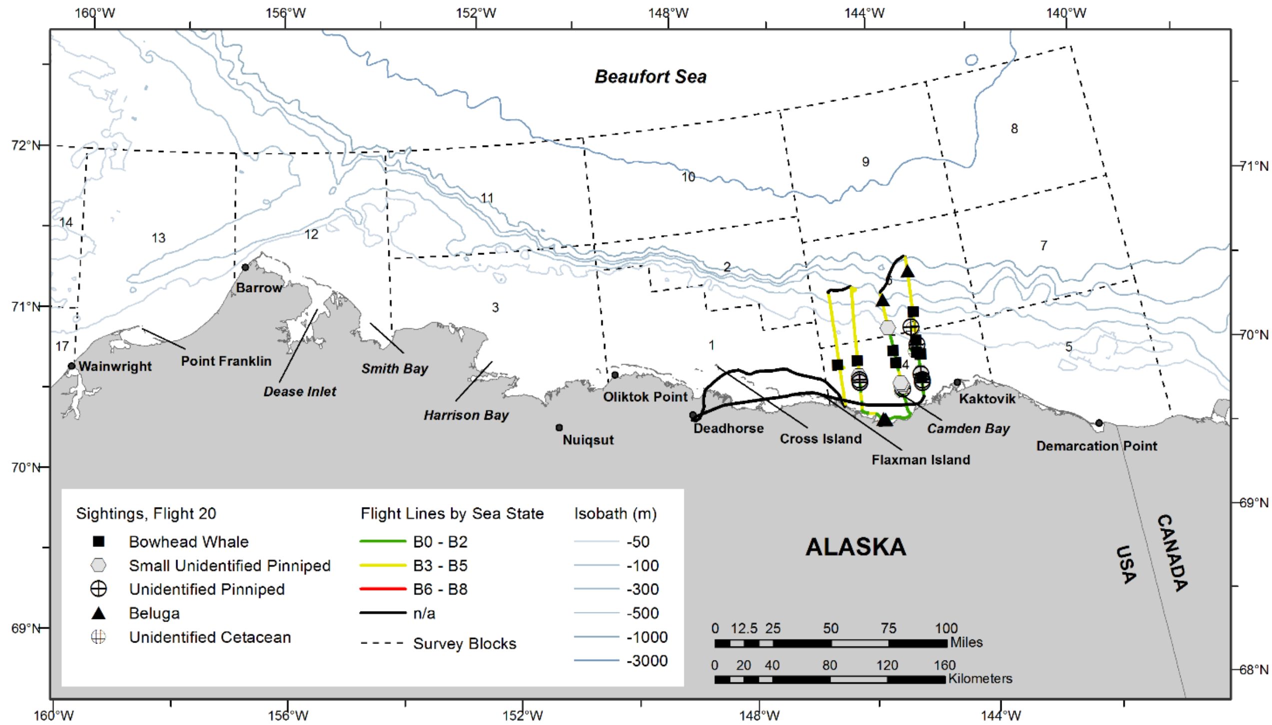

Figure B-51. ASAMM Flight 20 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

4 September 2014, Flight 232

Flight was a complete survey of transects 34, 35, 38, and 39, and partial survey of transect 36. Survey conditions included clear to partly cloudy skies, 1 km to unlimited visibility (with fog, low ceilings, and glare), and Beaufort 1-5 sea states. There was no sea ice observed in the area surveyed. Sightings included gray whales (including one calf and one carcass), fin whales, humpback whales (including one calf), one minke whale, unidentified cetaceans, walruses (including one carcass), unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
232	9/4/14 15:21	67.763	167.901	gray whale	feed	1	0	23
232	9/4/14 15:21	67.771	167.912	gray whale	swim	1	0	23
232	9/4/14 15:23	67.768	167.829	gray whale	mill	3	0	23
232	9/4/14 14:44	67.925	168.729	gray whale	mate	2	0	23
232	9/4/14 14:44	67.922	168.737	gray whale	feed	2	0	23
232	9/4/14 14:46	67.913	168.671	gray whale	swim	1	0	23
232	9/4/14 13:39	67.938	168.127	gray whale	feed	1	0	23
232	9/4/14 13:40	67.914	168.121	gray whale	feed	1	0	23
232	9/4/14 13:40	67.917	168.104	gray whale	feed	2	0	23
232	9/4/14 13:42	67.939	168.144	gray whale	feed	1	0	23
232	9/4/14 13:42	67.939	168.151	gray whale	feed	1	0	23
232	9/4/14 13:42	67.940	168.160	gray whale	feed	1	0	23
232	9/4/14 13:42	67.940	168.169	gray whale	feed	1	0	23
232	9/4/14 13:43	67.941	168.180	gray whale	feed	1	0	23
232	9/4/14 13:43	67.940	168.185	gray whale	feed	2	0	23
232	9/4/14 13:43	67.940	168.190	gray whale	feed	1	0	23
232	9/4/14 13:43	67.940	168.208	gray whale	feed	1	0	23
232	9/4/14 13:43	67.940	168.225	gray whale	feed	1	0	23
232	9/4/14 13:44	67.929	168.257	gray whale	feed	1	0	23
232	9/4/14 13:44	67.927	168.239	gray whale	feed	2	0	23
232	9/4/14 13:47	67.933	168.185	gray whale	feed	2	0	23
232	9/4/14 14:59	67.767	168.230	gray whale	swim	1	0	23
232	9/4/14 13:50	67.938	168.266	gray whale	feed	3	0	23
232	9/4/14 13:50	67.938	168.275	gray whale	dead	1	0	23
232	9/4/14 15:01	67.767	168.157	gray whale	feed	2	0	23
232	9/4/14 13:53	67.956	168.252	gray whale	swim	3	0	23
232	9/4/14 13:54	67.956	168.294	gray whale	swim	1	0	23
232	9/4/14 15:03	67.778	168.120	gray whale	unknown	1	0	23
232	9/4/14 15:03	67.783	168.121	gray whale	feed	1	0	23

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
232	9/4/14 15:03	67.786	168.128	gray whale	feed	2	0	23
232	9/4/14 15:03	67.787	168.132	gray whale	feed	5	0	23
232	9/4/14 15:04	67.788	168.123	gray whale	feed	4	0	23
232	9/4/14 13:55	67.961	168.304	gray whale	swim	1	0	23
232	9/4/14 13:55	67.972	168.294	gray whale	feed	1	0	23
232	9/4/14 13:55	67.973	168.317	gray whale	feed	2	0	23
232	9/4/14 13:56	67.973	168.307	gray whale	dive	1	0	23
232	9/4/14 15:05	67.804	168.120	gray whale	feed	1	0	23
232	9/4/14 15:05	67.804	168.116	gray whale	unknown	1	0	23
232	9/4/14 15:06	67.822	168.085	gray whale	feed	1	0	23
232	9/4/14 15:06	67.828	168.086	gray whale	feed	1	0	23
232	9/4/14 15:06	67.830	168.090	gray whale	feed	3	0	23
232	9/4/14 13:56	67.971	168.339	gray whale	rest	1	0	23
232	9/4/14 13:57	67.983	168.352	gray whale	feed	3	0	23
232	9/4/14 15:07	67.832	168.082	gray whale	feed	2	0	23
232	9/4/14 15:08	67.818	168.038	gray whale	feed	2	0	23
232	9/4/14 15:08	67.819	168.025	gray whale	feed	4	0	23
232	9/4/14 15:08	67.825	168.019	gray whale	feed	1	0	23
232	9/4/14 14:02	67.938	168.355	gray whale	feed	1	0	23
232	9/4/14 14:02	67.938	168.361	gray whale	feed	1	0	23
232	9/4/14 14:02	67.938	168.373	gray whale	feed	1	0	23
232	9/4/14 14:02	67.938	168.373	gray whale	feed	1	0	23
232	9/4/14 14:02	67.938	168.385	gray whale	feed	1	0	23
232	9/4/14 14:02	67.938	168.393	gray whale	feed	1	0	23
232	9/4/14 14:03	67.949	168.408	gray whale	swim	1	0	23
232	9/4/14 15:08	67.828	168.020	gray whale	feed	3	0	23
232	9/4/14 15:09	67.847	168.021	gray whale	swim	1	0	23
232	9/4/14 14:05	67.964	168.377	gray whale	swim	1	0	23
232	9/4/14 14:05	67.965	168.360	gray whale	feed	2	0	23
232	9/4/14 14:06	67.967	168.361	gray whale	feed	1	0	23
232	9/4/14 14:07	67.979	168.385	gray whale	swim	3	0	23
232	9/4/14 14:10	67.955	168.431	gray whale	feed	1	0	23
232	9/4/14 15:16	67.769	167.918	gray whale	feed	1	0	23
232	9/4/14 15:16	67.769	167.911	gray whale	feed	1	0	23
232	9/4/14 15:17	67.764	167.887	gray whale	feed	1	0	23
232	9/4/14 15:17	67.755	167.923	gray whale	feed	2	0	23
232	9/4/14 14:11	67.960	168.429	gray whale	feed	1	0	23

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
232	9/4/14 14:13	67.936	168.418	gray whale	feed	1	0	23
232	9/4/14 15:18	67.744	167.905	gray whale	feed	3	0	23
232	9/4/14 15:19	67.742	167.898	gray whale	feed	2	0	23
232	9/4/14 15:19	67.745	167.867	gray whale	feed	1	0	23
232	9/4/14 15:19	67.749	167.865	gray whale	feed	1	0	23
232	9/4/14 15:19	67.752	167.865	gray whale	feed	3	0	23
232	9/4/14 15:19	67.757	167.874	gray whale	feed	3	0	23
232	9/4/14 15:20	67.749	167.921	gray whale	feed	1	0	23
232	9/4/14 15:20	67.754	167.923	gray whale	feed	1	0	23
232	9/4/14 15:21	67.757	167.930	gray whale	feed	1	0	23
232	9/4/14 14:13	67.936	168.421	gray whale	feed	1	0	23
232	9/4/14 14:14	67.912	168.443	gray whale	feed	1	0	23
232	9/4/14 14:14	67.906	168.432	gray whale	feed	1	0	23
232	9/4/14 14:14	67.901	168.421	gray whale	feed	2	0	23
232	9/4/14 15:23	67.768	167.825	gray whale	feed	3	0	23
232	9/4/14 15:23	67.768	167.817	gray whale	feed	1	0	23
232	9/4/14 14:15	67.915	168.418	gray whale	feed	2	0	23
232	9/4/14 14:16	67.936	168.440	gray whale	feed	2	0	23
232	9/4/14 14:17	67.934	168.453	gray whale	swim	1	0	23
232	9/4/14 15:27	67.769	167.748	gray whale	swim	1	0	23
232	9/4/14 15:28	67.756	167.732	gray whale	feed	4	0	23
232	9/4/14 15:28	67.757	167.752	gray whale	feed	1	0	23
232	9/4/14 15:29	67.749	167.740	gray whale	swim	1	0	23
232	9/4/14 15:29	67.749	167.756	gray whale	rest	1	0	23
232	9/4/14 15:30	67.742	167.746	gray whale	mill	2	0	23
232	9/4/14 15:32	67.726	167.744	gray whale	feed	3	0	23
232	9/4/14 15:33	67.717	167.749	gray whale	feed	2	0	23
232	9/4/14 15:33	67.714	167.742	gray whale	feed	2	0	23
232	9/4/14 15:34	67.728	167.734	gray whale	feed	2	0	23
232	9/4/14 14:18	67.927	168.461	gray whale	feed	1	0	23
232	9/4/14 14:18	67.930	168.488	gray whale	feed	3	0	23
232	9/4/14 14:19	67.921	168.496	gray whale	feed	2	0	23
232	9/4/14 15:34	67.725	167.746	gray whale	swim	1	0	23
232	9/4/14 15:35	67.719	167.764	gray whale	feed	2	0	23
232	9/4/14 15:36	67.721	167.763	gray whale	feed	1	0	23
232	9/4/14 14:20	67.920	168.550	gray whale	feed	2	0	23
232	9/4/14 14:27	67.938	168.537	gray whale	swim	1	0	23

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
232	9/4/14 15:36	67.729	167.755	gray whale	feed	2	0	23
232	9/4/14 15:36	67.734	167.753	gray whale	feed	2	0	23
232	9/4/14 15:36	67.734	167.775	gray whale	swim	1	0	23
232	9/4/14 15:36	67.731	167.781	gray whale	swim	1	0	23
232	9/4/14 15:37	67.722	167.781	gray whale	feed	1	0	23
232	9/4/14 14:28	67.937	168.583	gray whale	swim	1	0	23
232	9/4/14 14:29	67.937	168.591	gray whale	feed	3	1	23
232	9/4/14 14:29	67.925	168.608	gray whale	dive	1	0	23
232	9/4/14 14:31	67.937	168.645	gray whale	mill	1	0	23
232	9/4/14 14:33	67.952	168.663	gray whale	feed	1	0	23
232	9/4/14 14:33	67.955	168.625	gray whale	swim	2	0	23
232	9/4/14 14:34	67.949	168.624	gray whale	feed	1	0	23
232	9/4/14 14:34	67.959	168.631	gray whale	feed	5	0	23
232	9/4/14 14:36	67.935	168.676	gray whale	feed	2	0	23
232	9/4/14 15:37	67.719	167.761	gray whale	feed	2	0	23
232	9/4/14 15:37	67.730	167.763	gray whale	feed	1	0	23
232	9/4/14 15:42	67.770	167.540	gray whale	feed	2	0	23
232	9/4/14 14:37	67.940	168.692	gray whale	feed	1	0	23
232	9/4/14 14:38	67.937	168.742	gray whale	mate	2	0	23
232	9/4/14 14:39	67.919	168.729	gray whale	unknown	1	0	23
232	9/4/14 14:40	67.921	168.755	gray whale	unknown	1	0	23
232	9/4/14 14:40	67.918	168.756	gray whale	unknown	1	0	23
232	9/4/14 15:44	67.789	167.560	gray whale	feed	1	0	23
232	9/4/14 15:45	67.781	167.570	gray whale	feed	1	0	23
232	9/4/14 18:16	67.086	166.508	minke whale	swim	1	0	23
232	9/4/14 18:37	67.088	167.102	humpback whale	unknown	2	0	23
232	9/4/14 18:37	67.088	167.111	gray whale	feed	2	0	23
232	9/4/14 18:39	67.029	167.160	humpback whale	swim	2	1	23
232	9/4/14 18:39	67.024	167.163	gray whale	feed	1	0	23
232	9/4/14 18:39	67.017	167.164	humpback whale	feed	1	0	23
232	9/4/14 18:41	67.019	167.152	humpback whale	feed	1	0	23
232	9/4/14 18:41	67.019	167.133	humpback whale	feed	3	0	23
232	9/4/14 18:41	67.025	167.140	humpback whale	feed	2	0	23
232	9/4/14 18:42	67.006	167.157	fin whale	swim	2	0	23
232	9/4/14 18:44	66.981	167.143	humpback whale	mill	2	0	24
232	9/4/14 18:44	66.974	167.172	humpback whale	rest	2	1	24
232	9/4/14 18:45	66.982	167.171	unid cetacean	unknown	1	0	24

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
232	9/4/14 18:46	66.989	167.172	humpback whale	feed	5	0	24
232	9/4/14 18:47	67.015	167.148	humpback whale	unknown	2	0	23
232	9/4/14 18:48	67.021	167.169	fin whale	feed	2	0	23
232	9/4/14 18:48	67.016	167.154	humpback whale	feed	2	0	23
232	9/4/14 18:49	67.035	167.131	humpback whale	feed	1	0	23
232	9/4/14 18:50	67.025	167.112	humpback whale	dive	1	0	23
232	9/4/14 18:52	66.980	167.117	humpback whale	feed	1	0	24
232	9/4/14 18:52	66.981	167.139	humpback whale	feed	4	0	24
232	9/4/14 18:53	66.977	167.120	humpback whale	feed	3	0	24
232	9/4/14 18:54	66.955	167.115	humpback whale	feed	2	0	24
232	9/4/14 18:56	66.971	167.087	fin whale	feed	3	0	24
232	9/4/14 19:03	67.088	167.151	fin whale	swim	2	0	23
232	9/4/14 19:04	67.109	167.146	fin whale	swim	1	0	23
232	9/4/14 19:05	67.108	167.186	fin whale	swim	1	0	23
232	9/4/14 19:06	67.123	167.223	fin whale	swim	2	0	23
232	9/4/14 19:06	67.117	167.236	fin whale	swim	1	0	23
232	9/4/14 19:09	67.081	167.179	humpback whale	rest	1	0	23
232	9/4/14 19:10	67.080	167.141	fin whale	swim	2	0	23
232	9/4/14 19:13	67.087	167.318	fin whale	swim	3	0	23
232	9/4/14 20:01	67.259	167.260	fin whale	swim	1	0	23
232	9/4/14 20:01	67.257	167.279	fin whale	swim	1	0	23
232	9/4/14 20:05	67.258	167.050	fin whale	mill	6	0	23
232	9/4/14 20:09	67.234	167.008	humpback whale	dive	1	0	23
232	9/4/14 20:12	67.212	166.975	unid cetacean	unknown	1	0	23
232	9/4/14 20:13	67.202	166.991	humpback whale	dive	1	0	23
232	9/4/14 20:15	67.177	167.056	humpback whale	mill	4	0	23
232	9/4/14 20:16	67.173	167.102	humpback whale	dive	2	0	23
232	9/4/14 20:20	67.268	167.065	fin whale	feed	2	0	23
232	9/4/14 20:25	67.257	166.858	fin whale	swim	2	0	23

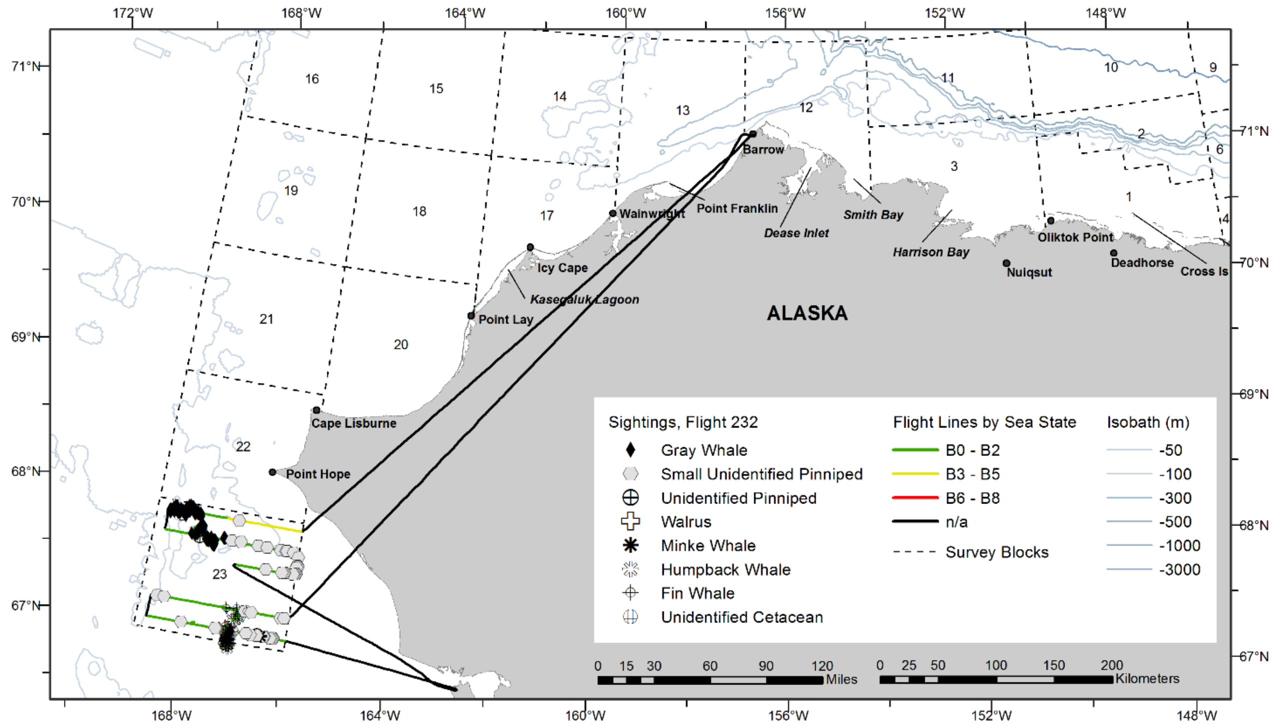

Figure B-52. ASAMM Flight 232 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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5 September 2014, Flight 233

Flight was a complete survey of transects 18 and 20 and the coastal transect from Point Lay to Point Barrow. Survey conditions included clear to overcast skies, 3 km to unlimited visibility (with fog, low ceilings, and glare), and Beaufort 2-5 sea states. There was no sea ice observed in the area surveyed. Sightings included three gray whale carcasses (at least one was a resight from an earlier survey), one unidentified cetacean carcass, one small unidentified cetacean, walruses, small unidentified pinnipeds, and one polar bear. All walruses were sighted in the water, including an estimated 350-400 near Point Lay.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
233	9/5/14 15:31	69.715	163.110	gray whale	dead	1	0	20
233	9/5/14 15:47	70.131	162.487	unid cetacean	dead	1	0	17
233	9/5/14 16:31	70.874	159.228	gray whale	dead	1	0	13
233	9/5/14 16:59	71.210	156.988	gray whale	dead	1	0	12
233	9/5/14 13:07	69.608	164.530	small unid cetacean	unknown	1	0	20

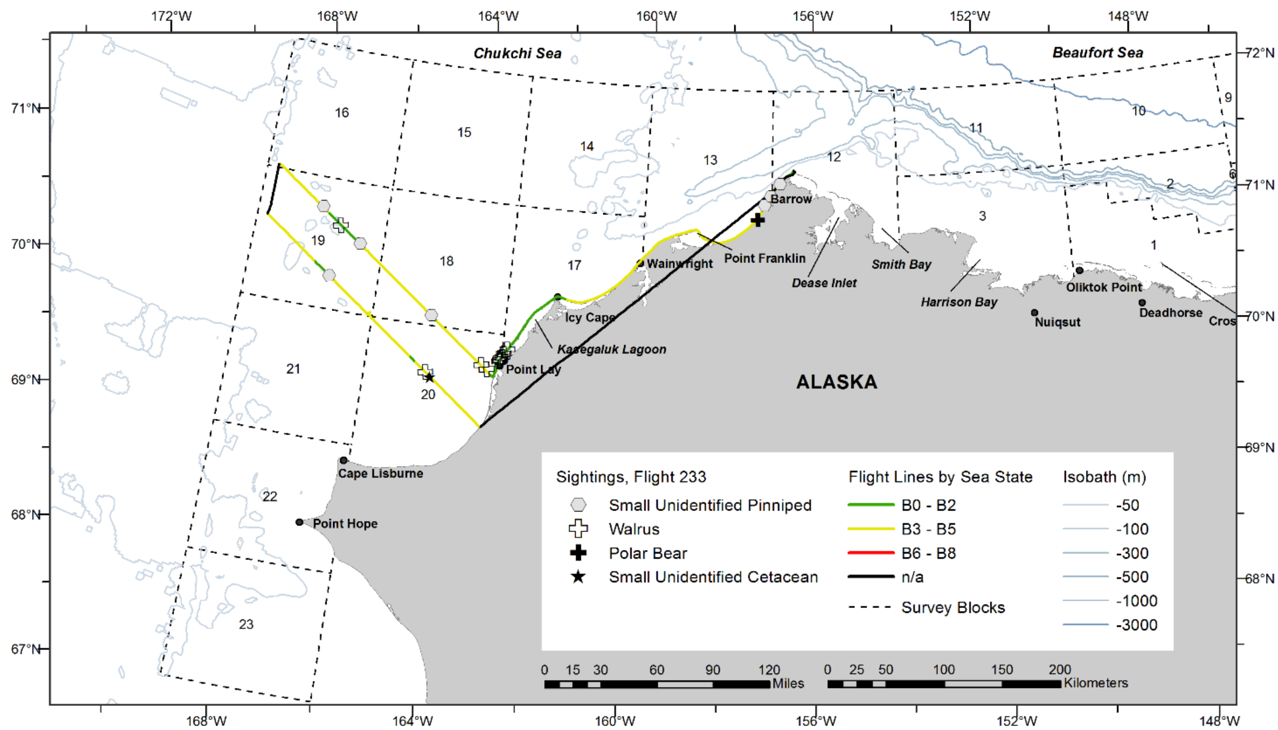


Figure B-53. ASAMM Flight 233 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

6 September 2014, Flight 234

Flight was a complete survey of transect 15, partial survey of transect 13, and a complete survey of block 12. Survey conditions included clear skies, no visibility to unlimited visibility (with low ceilings and glare), and Beaufort 2-6 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales (including two calves), gray whales, minke whales, belugas, unidentified cetaceans (including one carcass), walruses, unidentified pinnipeds, small unidentified pinnipeds, and one polar bear.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
234	9/6/14 9:48	70.140	162.512	unid cetacean	dead	1	0	17
234	9/6/14 15:07	71.499	156.634	beluga	mill	1	0	12
234	9/6/14 9:57	70.286	163.030	minke whale	swim	2	0	18
234	9/6/14 15:08	71.533	156.650	beluga	swim	1	0	12
234	9/6/14 16:00	71.479	155.939	bowhead whale	swim	1	0	12
234	9/6/14 16:01	71.485	155.939	gray whale	feed	1	0	12
234	9/6/14 16:01	71.488	155.939	gray whale	feed	1	0	12
234	9/6/14 16:03	71.477	155.942	bowhead whale	mill	1	0	12
234	9/6/14 16:04	71.483	155.959	bowhead whale	swim	1	0	12
234	9/6/14 16:44	71.488	155.248	bowhead whale	mill	1	0	12
234	9/6/14 16:46	71.467	155.298	bowhead whale	rest	1	0	12
234	9/6/14 16:47	71.481	155.335	bowhead whale	swim	1	0	12
234	9/6/14 16:48	71.478	155.429	bowhead whale	swim	1	0	12
234	9/6/14 16:48	71.472	155.414	bowhead whale	swim	3	0	12
234	9/6/14 16:48	71.473	155.394	bowhead whale	swim	1	0	12
234	9/6/14 16:50	71.461	155.475	unid cetacean	swim	1	0	12
234	9/6/14 16:56	71.437	155.306	bowhead whale	rest	1	0	12
234	9/6/14 16:56	71.438	155.288	bowhead whale	swim	1	0	12
234	9/6/14 16:58	71.449	155.255	bowhead whale	swim	1	0	12
234	9/6/14 17:00	71.453	155.230	bowhead whale	swim	1	0	12
234	9/6/14 17:02	71.436	155.225	bowhead whale	swim	1	0	12
234	9/6/14 17:03	71.429	155.221	bowhead whale	swim	1	0	12
234	9/6/14 17:05	71.412	155.210	bowhead whale	swim	2	0	12
234	9/6/14 17:06	71.417	155.261	bowhead whale	swim	1	0	12
234	9/6/14 17:06	71.416	155.266	bowhead whale	swim	1	0	12
234	9/6/14 17:07	71.397	155.257	bowhead whale	feed	37	2	12
234	9/6/14 17:07	71.408	155.251	gray whale	mill	1	0	12
234	9/6/14 17:15	71.347	155.182	bowhead whale	swim	1	0	12
234	9/6/14 17:16	71.332	155.179	bowhead whale	swim	1	0	12

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
234	9/6/14 17:27	71.230	154.944	bowhead whale	swim	1	0	12
234	9/6/14 17:50	71.958	154.596	beluga	swim	1	0	12
234	9/6/14 17:55	71.984	154.214	beluga	rest	3	0	12
234	9/6/14 17:56	71.969	154.204	beluga	swim	2	0	12
234	9/6/14 17:56	71.964	154.201	beluga	swim	6	0	12
234	9/6/14 17:56	71.956	154.197	beluga	swim	9	0	12
234	9/6/14 18:20	71.242	154.100	bowhead whale	rest	1	0	12

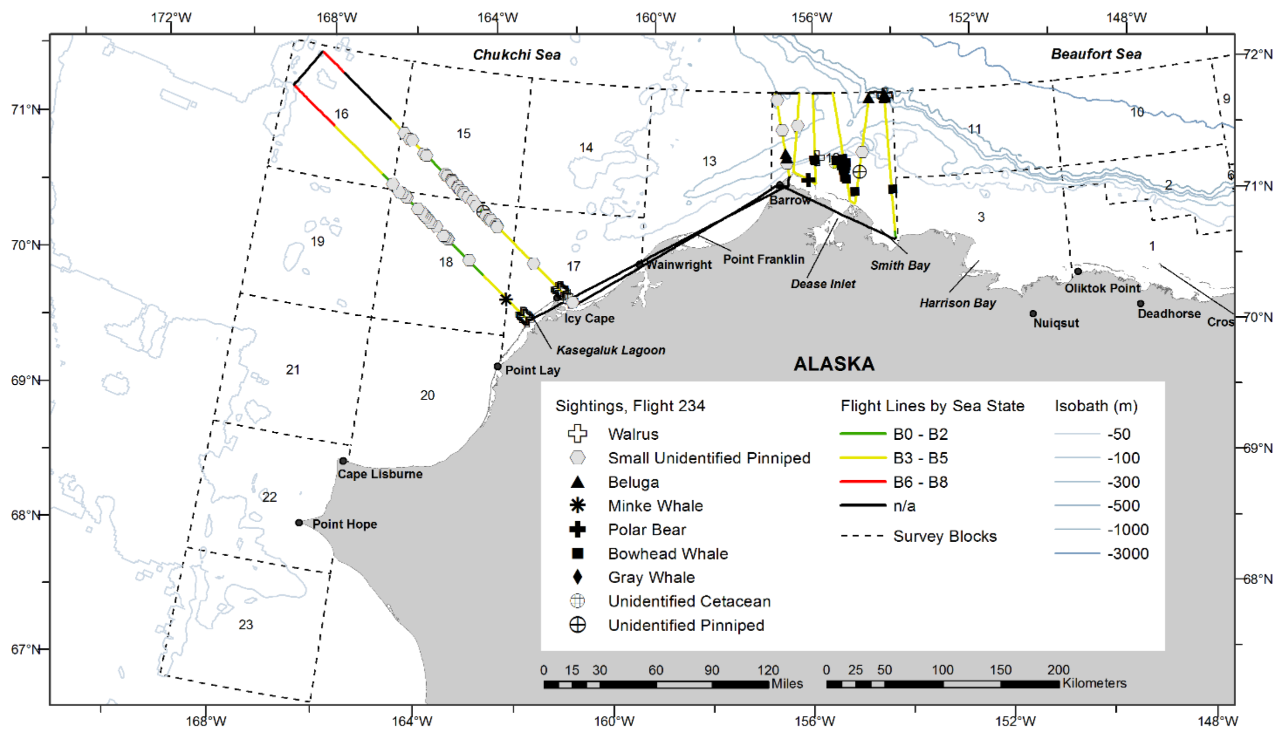
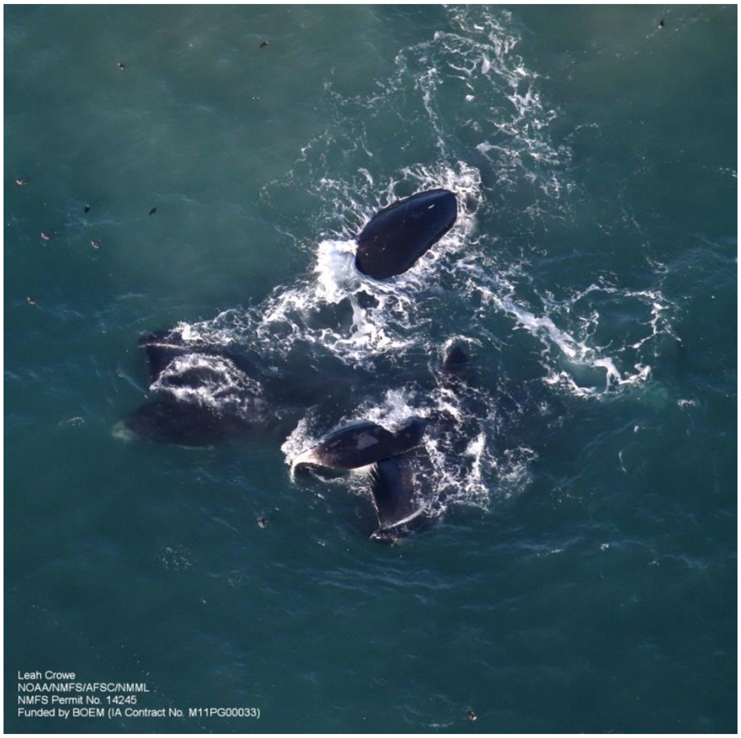


Figure B-54. ASAMM Flight 234 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Bowhead whales surface skim feeding, accompanied by one gray whale (lower left corner), east of Point Barrow, Alaska, during Flight 234, 6 September 2014.



Bowhead whales surface skim feeding during Flight 234, 6 September 2014. Two of the whales are on their sides with their mouths open.

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8 September 2014, Flight 21

Flight was a survey of portions of blocks 1, 2, and 3. Survey conditions included clear to partly cloudy skies, <1 km to unlimited visibility (with glare, haze, fog and low ceilings), and Beaufort 1-3 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales, one gray whale, belugas (including one calf), one unidentified cetacean, one bearded seal, unidentified pinnipeds, small unidentified pinnipeds, and polar bears.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
21	9/8/14 12:36	70.589	151.591	beluga	mill	1	0	3
21	9/8/14 12:36	70.584	151.591	beluga	mill	1	0	3
21	9/8/14 12:36	70.583	151.591	beluga	mill	1	0	3
21	9/8/14 12:36	70.580	151.591	beluga	mill	1	0	3
21	9/8/14 12:38	70.527	151.593	beluga	swim	7	0	3
21	9/8/14 12:49	70.540	151.163	beluga	swim	1	0	3
21	9/8/14 12:58	70.842	151.139	beluga	dive	1	0	3
21	9/8/14 12:58	70.852	151.137	beluga	swim	1	0	3
21	9/8/14 12:58	70.857	151.136	beluga	swim	1	0	3
21	9/8/14 18:30	70.511	147.341	beluga	swim	1	0	1
21	9/8/14 18:30	70.516	147.339	beluga	swim	1	0	1
21	9/8/14 18:30	70.518	147.338	beluga	swim	1	0	1
21	9/8/14 18:30	70.522	147.337	beluga	swim	1	0	1
21	9/8/14 18:30	70.524	147.337	beluga	swim	1	0	1
21	9/8/14 12:59	70.863	151.135	beluga	swim	2	0	3
21	9/8/14 18:30	70.535	147.335	beluga	swim	1	0	1
21	9/8/14 18:31	70.544	147.335	bowhead whale	feed	1	0	1
21	9/8/14 18:35	70.544	147.335	beluga	swim	1	0	1
21	9/8/14 13:32	70.553	150.451	beluga	swim	1	0	3
21	9/8/14 13:33	70.577	150.446	beluga	swim	3	0	3
21	9/8/14 13:52	70.992	149.873	bowhead whale	log play	1	0	1
21	9/8/14 13:56	70.998	149.845	bowhead whale	swim	1	0	1
21	9/8/14 13:57	71.007	149.834	bowhead whale	swim	1	0	1
21	9/8/14 19:03	70.498	146.571	unid cetacean	swim	1	0	1
21	9/8/14 14:21	70.545	149.292	beluga	swim	1	0	1
21	9/8/14 14:21	70.544	149.291	beluga	swim	1	0	1
21	9/8/14 14:21	70.541	149.274	beluga	swim	1	0	1
21	9/8/14 14:23	70.513	149.101	beluga	swim	2	0	1
21	9/8/14 14:24	70.520	149.106	beluga	swim	1	0	1
21	9/8/14 14:24	70.520	149.106	beluga	swim	1	0	1

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
21	9/8/14 15:20	70.781	148.291	bowhead whale	swim	2	0	1
21	9/8/14 15:38	71.105	148.068	beluga	swim	2	1	2
21	9/8/14 15:45	71.040	147.813	beluga	swim	1	0	2
21	9/8/14 15:45	71.015	147.816	beluga	mill	2	0	2
21	9/8/14 15:46	71.002	147.818	beluga	swim	2	0	2
21	9/8/14 15:46	71.000	147.818	beluga	swim	3	0	2
21	9/8/14 15:46	70.996	147.819	beluga	swim	12	0	2
21	9/8/14 15:46	70.994	147.820	beluga	swim	8	0	2
21	9/8/14 15:58	70.622	147.859	gray whale	swim	1	0	1

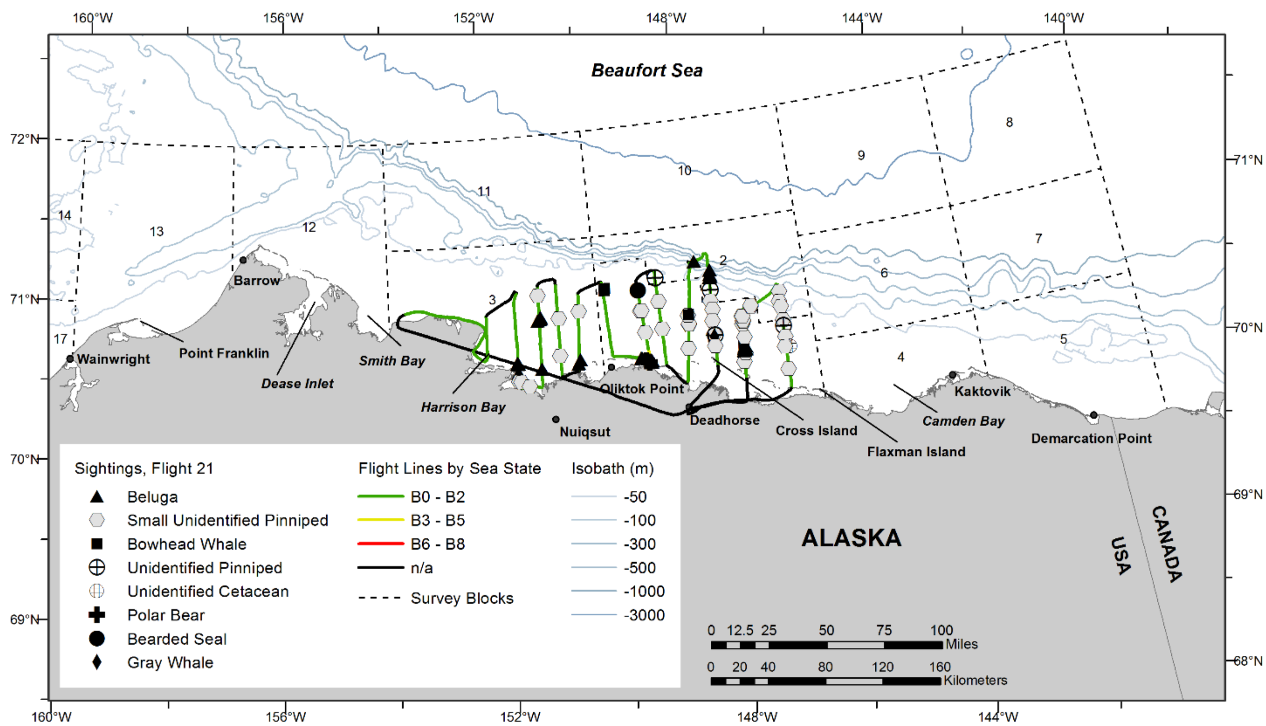

Figure B-55. ASAMM Flight 21 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Gray whale sighted north of Cross Island, Alaska, during Flight 21, 8 September 2014.

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11 September 2014, Flight 22

Flight was a complete survey of blocks 4 and 6. Survey conditions included overcast skies, 0-10 km visibility (with low ceilings), and Beaufort 2-4 sea states. There was no sea ice was observed in the area surveyed. Sightings included bowhead whales, belugas (including one calf), small unidentified pinnipeds, and polar bears.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
22	9/11/14 15:28	70.921	145.660	beluga	swim	3	1	6
22	9/11/14 15:30	70.981	145.656	beluga	swim	2	0	6
22	9/11/14 15:30	70.986	145.655	beluga	swim	1	0	6
22	9/11/14 15:50	70.864	145.235	beluga	swim	1	0	6
22	9/11/14 15:50	70.862	145.236	beluga	swim	1	0	6
22	9/11/14 15:51	70.847	145.241	beluga	swim	1	0	6
22	9/11/14 16:34	70.251	144.644	bowhead whale	swim	1	0	4
22	9/11/14 16:54	70.784	144.713	beluga	swim	1	0	6
22	9/11/14 16:56	70.829	144.721	beluga	swim	1	0	6
22	9/11/14 16:56	70.838	144.722	beluga	swim	1	0	6
22	9/11/14 16:56	70.847	144.723	beluga	swim	3	0	6
22	9/11/14 16:57	70.864	144.725	beluga	swim	2	0	6
22	9/11/14 17:17	71.057	144.091	beluga	swim	1	0	6
22	9/11/14 17:22	70.923	144.118	beluga	swim	1	0	6
22	9/11/14 17:22	70.913	144.120	beluga	mill	1	0	6
22	9/11/14 17:24	70.862	144.125	beluga	swim	3	0	6
22	9/11/14 17:30	70.662	144.166	beluga	swim	1	0	6
22	9/11/14 17:30	70.649	144.169	beluga	swim	1	0	6
22	9/11/14 17:33	70.689	144.127	beluga	swim	1	0	6
22	9/11/14 17:35	70.674	144.166	beluga	swim	2	0	6
22	9/11/14 17:35	70.649	144.167	beluga	swim	2	0	6
22	9/11/14 18:47	70.942	143.205	beluga	swim	1	0	6
22	9/11/14 17:44	70.368	144.224	bowhead whale	feed	1	0	4
22	9/11/14 18:23	70.715	143.789	beluga	swim	1	0	6
22	9/11/14 18:29	70.906	143.735	beluga	swim	1	0	6
22	9/11/14 18:56	70.657	143.158	beluga	swim	1	0	6
22	9/11/14 18:56	70.650	143.157	beluga	swim	1	0	6

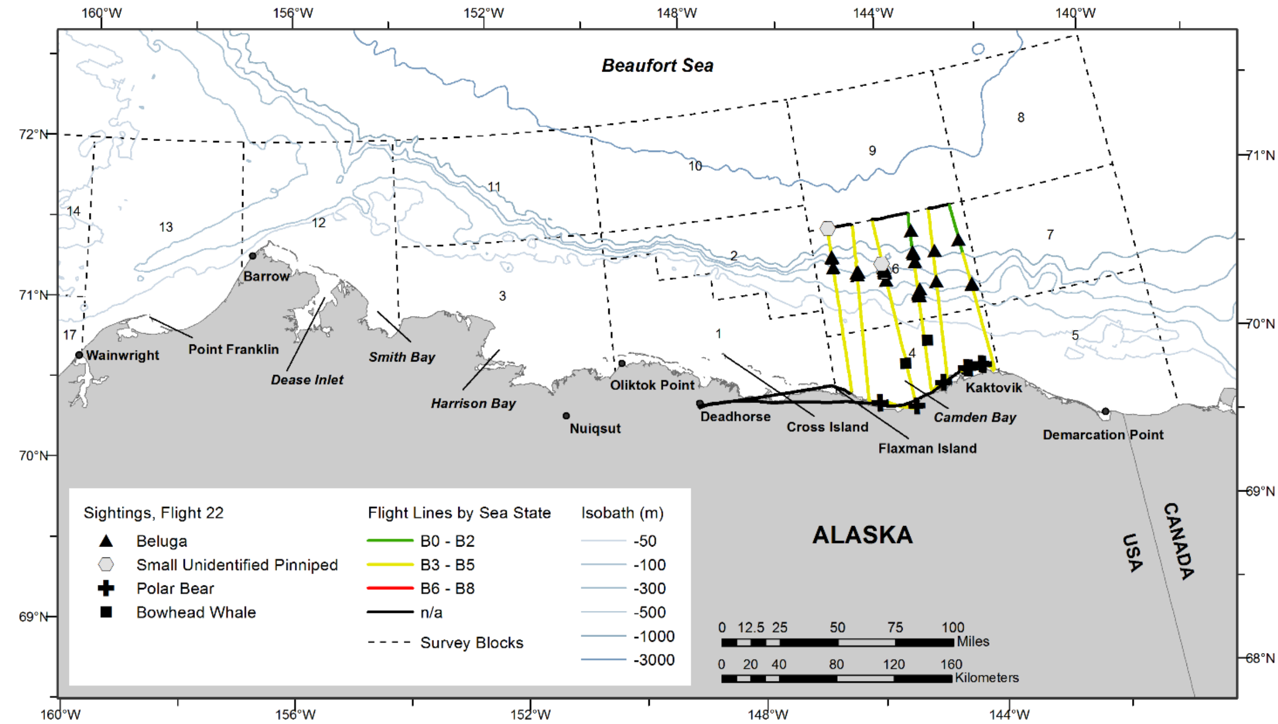

Figure B-56. ASAMM Flight 22 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

19 September 2014, Flight 235

Flight was the coastal transect from Ledyard Bay to Point Lay. Survey conditions included partly cloudy skies, <1-5 km visibility (with low ceilings), and Beaufort 4-6 sea states. There was no sea ice observed in the area surveyed. Sightings included one unidentified cetacean carcass and walruses. A walrus haulout, estimated at 6,500 walruses, was observed on a barrier island near Point Lay.

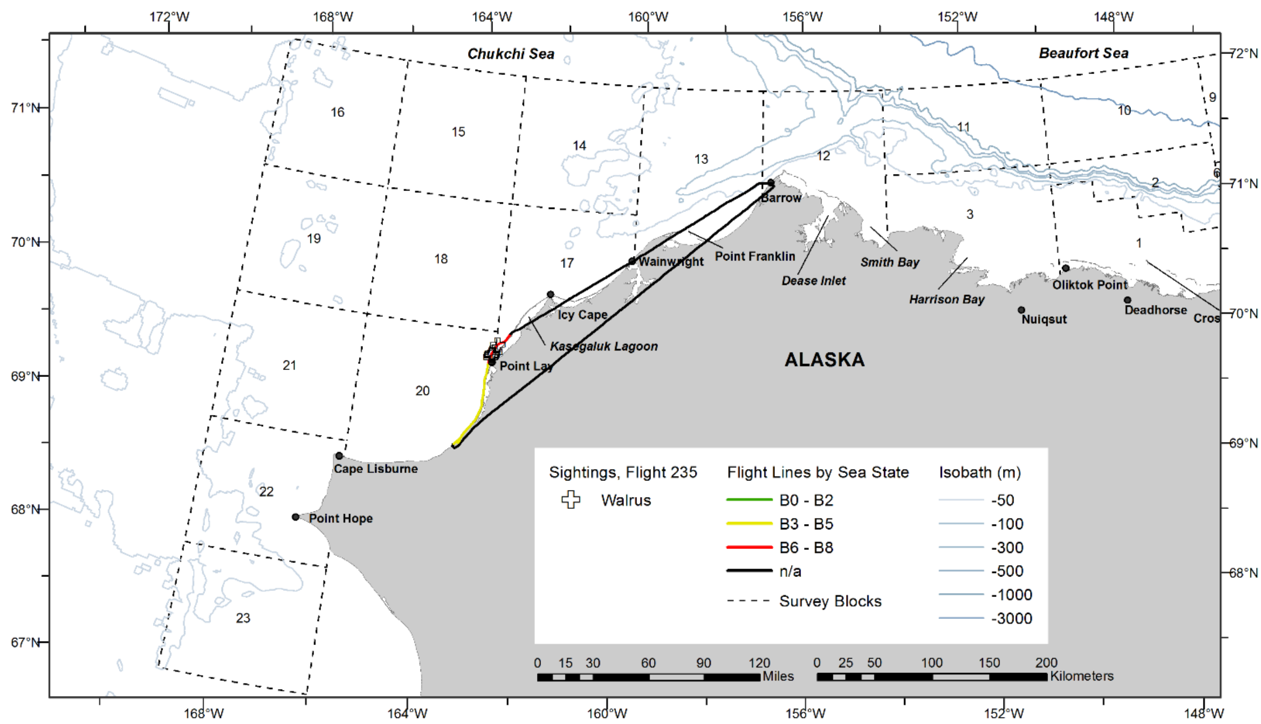

Figure B-57. ASAMM Flight 235 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Cetacean carcass and brown bear sighted on the beach during the coastal transect, during Flight 235, 19 September 2014.

21 September 2014, Flight 236

Flight was a complete survey of transects 2, 4, 6, 8, and 12, and partial survey of transect 10. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with fog, haze, glare, low ceilings, and precipitation), and Beaufort 2-6 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales, gray whales, belugas (including two calves and one carcass), walruses, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
236	9/21/14 11:01	70.834	162.622	bowhead whale	mill	1	0	17
236	9/21/14 11:01	70.837	162.633	bowhead whale	rest	1	0	17
236	9/21/14 11:09	70.853	162.630	bowhead whale	mill	2	0	17
236	9/21/14 11:15	70.856	162.700	bowhead whale	rest	1	0	17
236	9/21/14 11:19	70.861	162.720	bowhead whale	swim	1	0	17
236	9/21/14 11:21	70.866	162.782	bowhead whale	unknown	1	0	17
236	9/21/14 11:22	70.872	162.783	bowhead whale	dive	1	0	17
236	9/21/14 11:23	70.874	162.774	bowhead whale	swim	1	0	17
236	9/21/14 11:25	70.889	162.825	bowhead whale	swim	1	0	17
236	9/21/14 11:59	71.532	165.405	beluga	swim	2	0	15
236	9/21/14 15:59	70.842	159.462	bowhead whale	feed	4	0	13
236	9/21/14 15:59	70.843	159.463	beluga	swim	3	0	13
236	9/21/14 16:00	70.837	159.531	beluga	swim	1	0	13
236	9/21/14 16:00	70.837	159.504	bowhead whale	swim	1	0	13
236	9/21/14 16:01	70.834	159.532	bowhead whale	swim	1	0	13
236	9/21/14 16:01	70.826	159.524	beluga	swim	2	0	13
236	9/21/14 16:01	70.824	159.548	beluga	swim	8	1	13
236	9/21/14 16:05	70.847	159.465	bowhead whale	swim	6	0	13
236	9/21/14 16:06	70.844	159.466	gray whale	swim	1	0	13
236	9/21/14 16:07	70.845	159.478	beluga	mill	5	2	13
236	9/21/14 16:08	70.853	159.454	bowhead whale	swim	1	0	13
236	9/21/14 16:08	70.844	159.469	beluga	swim	5	0	13
236	9/21/14 16:09	70.850	159.494	bowhead whale	swim	1	0	13
236	9/21/14 16:53	71.595	162.168	bowhead whale	rest	1	0	14
236	9/21/14 16:10	70.863	159.541	bowhead whale	swim	1	0	13
236	9/21/14 12:49	71.750	164.521	beluga	swim	2	0	15
236	9/21/14 16:15	70.914	159.715	bowhead whale	swim	1	0	13
236	9/21/14 16:20	71.008	160.033	bowhead whale	swim	1	0	14
236	9/21/14 13:20	71.073	161.868	bowhead whale	swim	1	0	14
236	9/21/14 13:34	70.720	160.611	bowhead whale	rest	2	0	17

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
236	9/21/14 13:35	70.722	160.645	bowhead whale	rest	1	0	17
236	9/21/14 13:37	70.722	160.632	bowhead whale	unknown	1	0	17
236	9/21/14 14:00	70.952	158.463	bowhead whale	swim	1	0	13
236	9/21/14 14:01	70.956	158.486	bowhead whale	mill	3	0	13
236	9/21/14 14:03	70.961	158.424	beluga	swim	1	0	13
236	9/21/14 14:03	70.962	158.420	bowhead whale	unknown	1	0	13
236	9/21/14 14:04	70.979	158.419	bowhead whale	swim	2	0	13
236	9/21/14 14:05	70.968	158.437	beluga	swim	1	0	13
236	9/21/14 14:05	70.968	158.393	beluga	swim	2	0	13
236	9/21/14 14:06	70.950	158.372	bowhead whale	swim	3	0	13
236	9/21/14 14:07	70.954	158.327	bowhead whale	unknown	1	0	13
236	9/21/14 14:10	71.000	158.226	bowhead whale	swim	2	0	13
236	9/21/14 14:10	71.010	158.218	gray whale	feed	1	0	13
236	9/21/14 14:12	70.995	158.231	bowhead whale	swim	1	0	13
236	9/21/14 14:13	71.015	158.252	gray whale	feed	1	0	13
236	9/21/14 14:13	71.022	158.216	gray whale	feed	1	0	13
236	9/21/14 14:14	71.033	158.205	gray whale	feed	2	0	13
236	9/21/14 14:14	71.029	158.179	gray whale	feed	3	0	13
236	9/21/14 14:15	71.009	158.172	gray whale	feed	1	0	13
236	9/21/14 14:15	71.009	158.169	gray whale	feed	1	0	13
236	9/21/14 18:07	71.077	158.713	bowhead whale	swim	1	0	13
236	9/21/14 18:07	71.075	158.708	bowhead whale	swim	1	0	13
236	9/21/14 14:16	71.022	158.097	gray whale	feed	1	0	13
236	9/21/14 14:17	71.043	157.990	gray whale	feed	1	0	13
236	9/21/14 14:19	71.065	157.880	bowhead whale	swim	2	0	13
236	9/21/14 14:20	71.059	157.847	bowhead whale	rest	1	0	13
236	9/21/14 18:09	71.041	158.592	bowhead whale	rest	1	0	13
236	9/21/14 18:13	70.936	158.245	bowhead whale	swim	1	0	13
236	9/21/14 14:24	71.133	157.561	gray whale	swim	1	0	13
236	9/21/14 18:13	70.936	158.245	bowhead whale	swim	1	0	13
236	9/21/14 18:41	71.363	158.118	bowhead whale	swim	1	0	13
236	9/21/14 18:41	71.368	158.135	bowhead whale	swim	1	0	13
236	9/21/14 18:41	71.376	158.161	bowhead whale	swim	1	0	13
236	9/21/14 19:30	71.869	158.251	beluga	dead	1	0	13

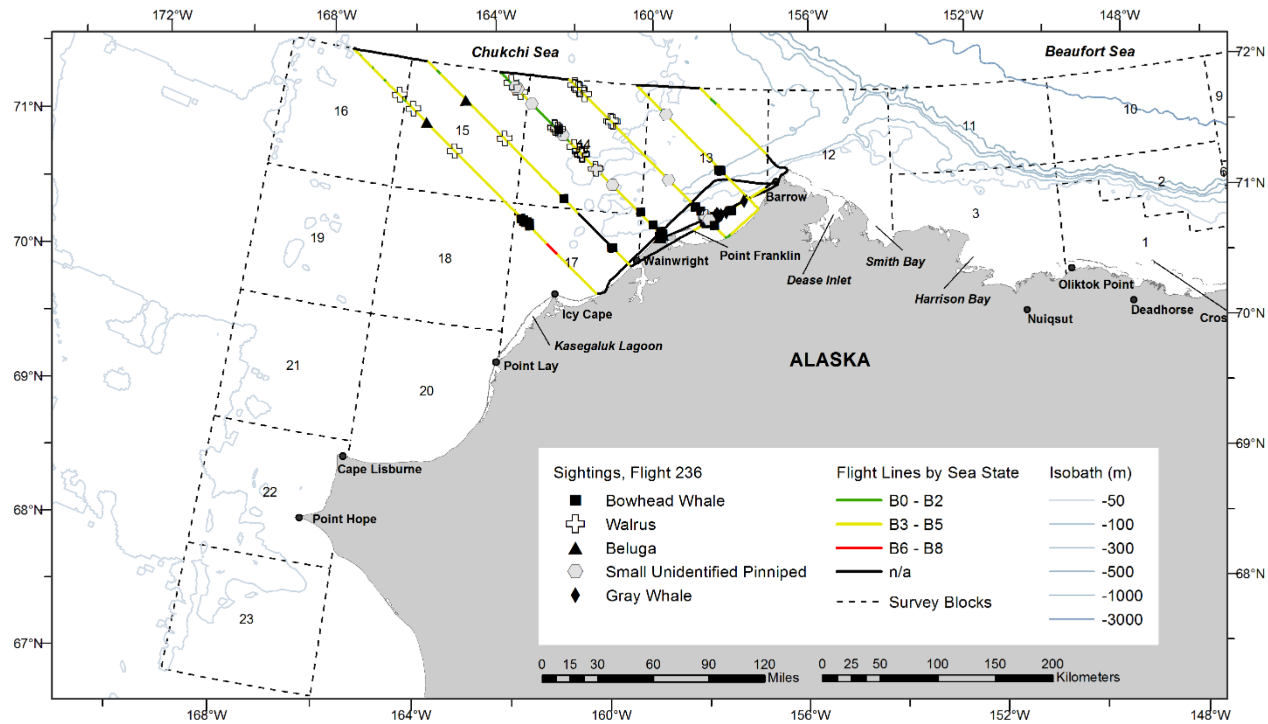

Figure B-58. ASAMM Flight 236 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Bowhead whale observed feeding off Point Franklin, Alaska, during Flight 236, 21 September 2014.

21 September 2014, Flight 23

Flight was a survey of portions of blocks 4 and 6. Survey conditions included partly cloudy skies, 0-10 km visibility (with low ceilings and occasional glare), and Beaufort 2-4 sea states. There was no sea ice observed in the study area. Sightings included bowhead whales (including six calves), one small unidentified pinniped, and polar bears.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
23	9/21/14 13:09	70.296	145.155	bowhead whale	rest	4	1	4
23	9/21/14 13:09	70.289	145.156	bowhead whale	rest	1	0	4
23	9/21/14 13:22	70.290	145.230	bowhead whale	mill	2	1	4
23	9/21/14 13:25	70.285	145.257	bowhead whale	mill	3	0	4
23	9/21/14 13:25	70.287	145.272	bowhead whale	mill	2	0	4
23	9/21/14 13:25	70.297	145.290	bowhead whale	feed	30	0	4
23	9/21/14 13:25	70.300	145.294	bowhead whale	mill	3	1	4
23	9/21/14 13:27	70.327	145.381	bowhead whale	feed	2	0	4
23	9/21/14 13:27	70.332	145.375	bowhead whale	mill	1	0	4
23	9/21/14 13:27	70.332	145.375	bowhead whale	mill	1	0	4
23	9/21/14 13:28	70.327	145.402	bowhead whale	feed	1	0	4
23	9/21/14 13:28	70.329	145.411	bowhead whale	feed	1	0	4
23	9/21/14 13:29	70.330	145.413	bowhead whale	feed	4	0	4
23	9/21/14 13:29	70.341	145.420	bowhead whale	mill	1	0	4
23	9/21/14 13:30	70.328	145.474	bowhead whale	rest	2	1	4
23	9/21/14 13:31	70.319	145.474	bowhead whale	swim	1	0	4
23	9/21/14 13:39	70.300	145.386	bowhead whale	mill	3	0	4
23	9/21/14 13:39	70.303	145.415	bowhead whale	mill	1	0	4
23	9/21/14 13:40	70.310	145.442	bowhead whale	mill	4	0	4
23	9/21/14 13:40	70.314	145.466	bowhead whale	mill	1	0	4
23	9/21/14 13:40	70.314	145.473	bowhead whale	mill	1	0	4
23	9/21/14 13:42	70.327	145.459	bowhead whale	mill	2	1	4
23	9/21/14 13:55	70.210	145.156	bowhead whale	mill	2	0	4
23	9/21/14 13:57	70.201	145.157	bowhead whale	feed	1	0	4
23	9/21/14 13:57	70.194	145.161	bowhead whale	mill	1	0	4
23	9/21/14 14:00	70.198	145.229	bowhead whale	mill	1	0	4
23	9/21/14 14:03	70.133	145.155	bowhead whale	mill	1	0	4
23	9/21/14 14:06	70.133	145.220	bowhead whale	mill	1	0	4
23	9/21/14 14:09	70.079	145.155	bowhead whale	mill	2	0	4
23	9/21/14 14:10	70.069	145.154	bowhead whale	mill	3	0	4
23	9/21/14 14:11	70.089	145.138	bowhead whale	mill	2	1	4

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
23	9/21/14 14:19	70.111	145.082	bowhead whale	mill	1	0	4
23	9/21/14 14:20	70.117	145.121	bowhead whale	mill	2	0	4
23	9/21/14 15:08	70.345	144.091	bowhead whale	rest	1	0	4
23	9/21/14 15:12	70.309	144.097	bowhead whale	rest	1	0	4

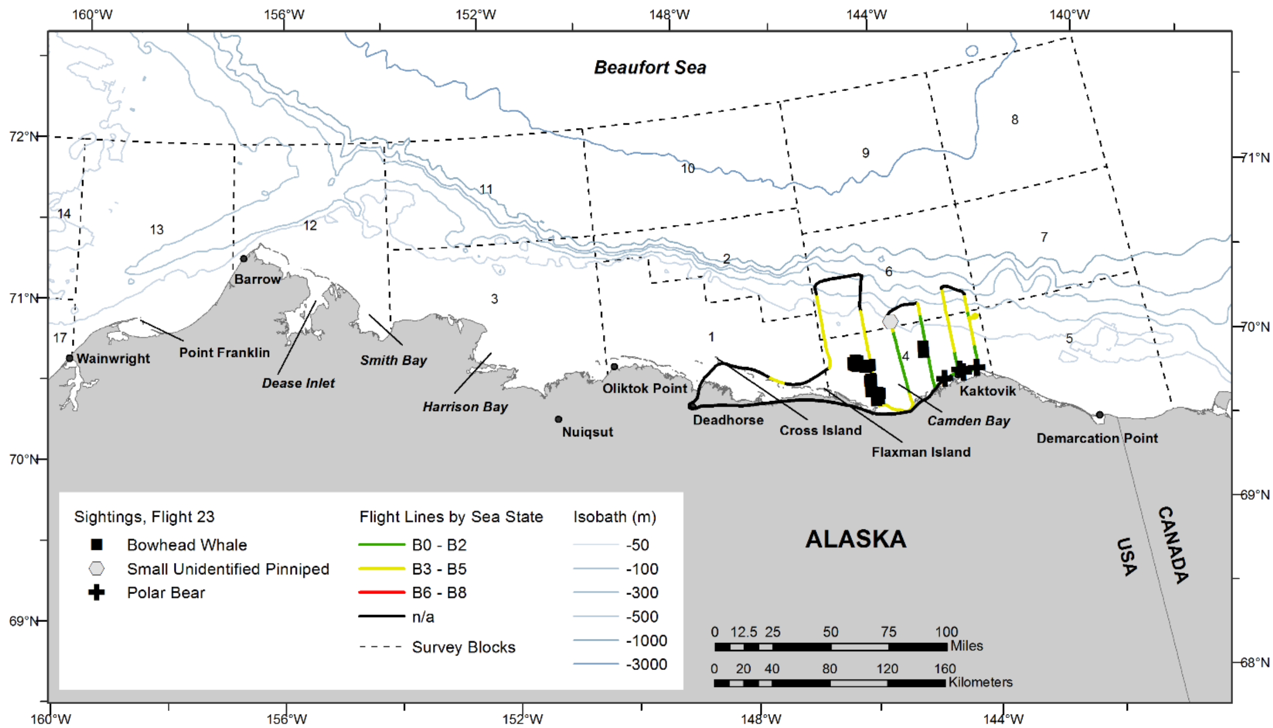

Figure B-59. ASAMM Flight 23 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Bowhead whale in feeding group of 30 whales observed north of Camden Bay, Alaska, during Flight 23, 21 September 2014.

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22 September 2014, Flight 237

Flight was a complete survey of transects 3, 5, 7, and 9. Survey conditions included overcast skies, 0-10 km visibility (with fog, haze, glare, low ceilings, precipitation, and iced windows), and Beaufort 2-4 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales, gray whales (including one calf), belugas (including one calf), unidentified cetaceans, walruses, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
237	9/22/14 11:02	71.244	161.687	gray whale	feed	1	0	14
237	9/22/14 12:27	71.309	160.288	beluga	swim	1	0	14
237	9/22/14 12:29	71.264	160.128	beluga	swim	2	0	14
237	9/22/14 12:29	71.264	160.127	beluga	swim	1	0	14
237	9/22/14 12:29	71.259	160.110	beluga	swim	1	0	14
237	9/22/14 12:29	71.258	160.104	beluga	swim	1	0	14
237	9/22/14 12:41	71.001	159.228	beluga	mill	4	1	13
237	9/22/14 12:48	70.914	158.599	bowhead whale	swim	1	0	13
237	9/22/14 12:50	70.920	158.426	bowhead whale	rest	1	0	13
237	9/22/14 12:57	70.935	157.978	bowhead whale	swim	1	0	13
237	9/22/14 12:57	70.936	157.972	bowhead whale	swim	1	0	13
237	9/22/14 12:57	70.936	157.951	bowhead whale	mill	1	0	13
237	9/22/14 12:57	70.936	157.943	bowhead whale	rest	1	0	13
237	9/22/14 12:57	70.937	157.937	bowhead whale	swim	1	0	13
237	9/22/14 12:57	70.937	157.926	bowhead whale	swim	1	0	13
237	9/22/14 13:00	70.938	157.980	gray whale	swim	1	0	13
237	9/22/14 13:00	70.947	157.985	bowhead whale	swim	2	0	13
237	9/22/14 13:00	70.945	157.999	bowhead whale	swim	1	0	13
237	9/22/14 13:14	71.058	157.890	unid cetacean	swim	2	0	13
237	9/22/14 13:14	71.053	157.944	unid cetacean	unknown	3	0	13
237	9/22/14 13:15	71.046	157.944	bowhead whale	swim	1	0	13
237	9/22/14 13:15	71.045	157.934	bowhead whale	swim	1	0	13
237	9/22/14 13:16	71.065	157.984	bowhead whale	swim	1	0	13
237	9/22/14 13:18	71.053	157.962	beluga	swim	1	0	13
237	9/22/14 13:22	71.062	157.876	bowhead whale	swim	1	0	13
237	9/22/14 13:29	71.091	157.982	gray whale	feed	1	0	13
237	9/22/14 13:29	71.094	157.992	gray whale	feed	1	0	13
237	9/22/14 13:29	71.097	158.008	gray whale	feed	1	0	13
237	9/22/14 13:29	71.096	158.024	bowhead whale	swim	1	0	13
237	9/22/14 13:30	71.086	157.998	bowhead whale	swim	1	0	13

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
237	9/22/14 13:34	71.097	158.010	gray whale	swim	1	0	13
237	9/22/14 13:34	71.106	158.038	gray whale	unknown	1	0	13
237	9/22/14 13:34	71.116	158.068	gray whale	feed	2	1	13
237	9/22/14 13:35	71.138	158.146	bowhead whale	swim	1	0	13
237	9/22/14 13:35	71.139	158.147	bowhead whale	rest	1	0	13
237	9/22/14 13:36	71.135	158.193	bowhead whale	unknown	2	0	13
237	9/22/14 13:42	71.135	158.168	bowhead whale	swim	2	0	13
237	9/22/14 13:44	71.127	158.195	bowhead whale	mill	1	0	13
237	9/22/14 13:46	71.155	158.197	bowhead whale	swim	2	0	13
237	9/22/14 13:46	71.158	158.209	bowhead whale	swim	1	0	13

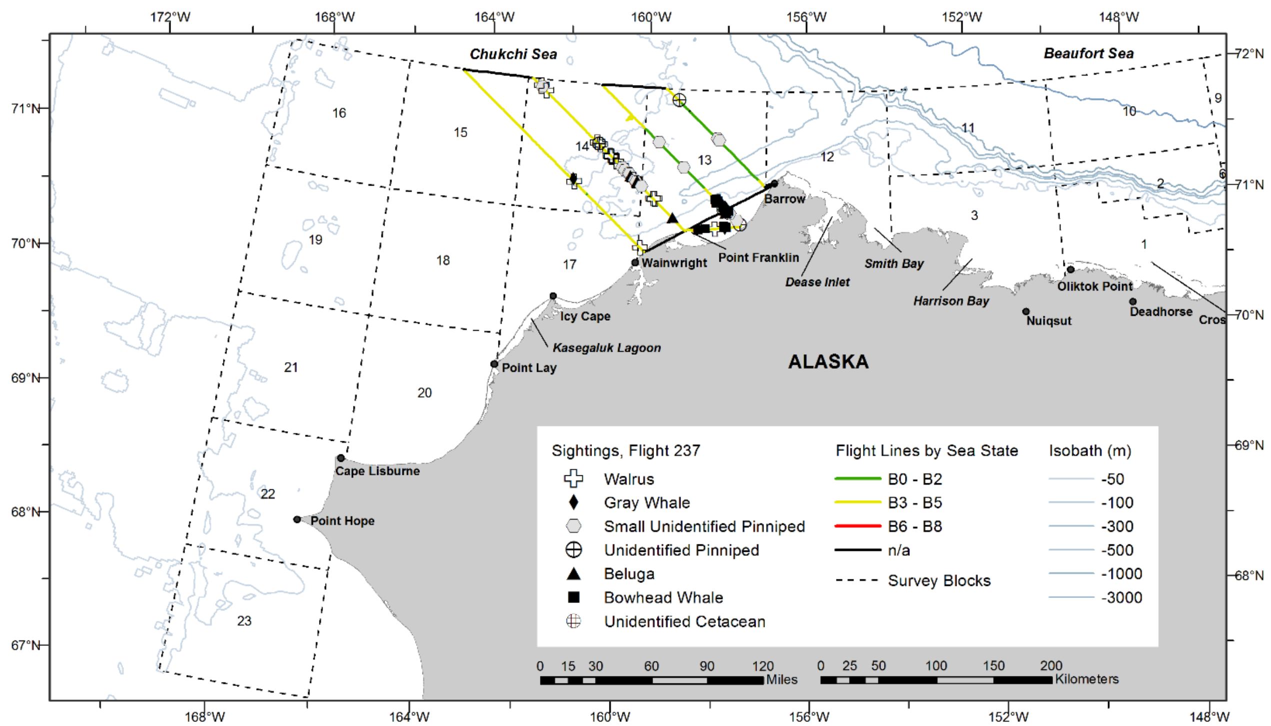


Figure B-60. ASAMM Flight 237 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

22 September 2014, Flight 24

Flight was a survey of portions of blocks 1, 2, and 5. Survey conditions included partly cloudy skies, 0-10 km visibility (with glare, low ceilings, and haze), and Beaufort 2-5 sea states. There was no sea ice observed in the study area. Sightings included bowhead whales (including six calves), belugas (including three calves), unidentified cetaceans, one bearded seal, small unidentified pinnipeds, and polar bears.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
24	9/22/14 10:22	69.642	140.655	bowhead whale	mill	11	1	5
24	9/22/14 10:22	69.640	140.639	bowhead whale	mill	5	0	5
24	9/22/14 10:30	69.634	140.592	bowhead whale	feed	1	0	5
24	9/22/14 10:35	69.628	140.573	bowhead whale	feed	3	0	5
24	9/22/14 18:32	70.417	147.301	bowhead whale	mill	1	0	1
24	9/22/14 10:48	69.619	140.544	bowhead whale	feed	2	0	5
24	9/22/14 10:48	69.621	140.559	bowhead whale	feed	5	0	5
24	9/22/14 10:49	69.623	140.572	bowhead whale	feed	1	0	5
24	9/22/14 10:49	69.624	140.581	bowhead whale	feed	3	0	5
24	9/22/14 10:49	69.625	140.592	bowhead whale	feed	5	0	5
24	9/22/14 10:49	69.625	140.601	bowhead whale	feed	4	0	5
24	9/22/14 10:49	69.627	140.613	bowhead whale	feed	4	0	5
24	9/22/14 10:49	69.627	140.623	bowhead whale	feed	17	0	5
24	9/22/14 10:49	69.628	140.629	bowhead whale	feed	15	0	5
24	9/22/14 10:56	69.616	140.612	bowhead whale	feed	25	0	5
24	9/22/14 15:14	70.520	148.931	bowhead whale	mill	5	0	1
24	9/22/14 15:14	70.525	148.927	bowhead whale	mill	6	0	1
24	9/22/14 11:07	69.595	140.238	beluga	rest	1	0	5
24	9/22/14 18:34	70.385	147.219	bowhead whale	mill	6	1	1
24	9/22/14 18:35	70.380	147.212	bowhead whale	mill	1	0	1
24	9/22/14 18:36	70.373	147.190	bowhead whale	mill	3	0	1
24	9/22/14 18:36	70.370	147.192	bowhead whale	mill	1	0	1
24	9/22/14 11:23	69.654	140.897	bowhead whale	mill	1	0	5
24	9/22/14 11:23	69.656	140.920	bowhead whale	mill	1	0	5
24	9/22/14 11:24	69.654	140.904	bowhead whale	mill	1	0	5
24	9/22/14 11:27	69.684	141.064	bowhead whale	swim	2	1	5
24	9/22/14 15:20	70.538	148.981	bowhead whale	mill	4	0	1
24	9/22/14 11:32	69.691	141.076	bowhead whale	unknown	2	0	5
24	9/22/14 16:25	70.594	148.395	beluga	swim	1	0	1
24	9/22/14 16:26	70.569	148.398	bowhead whale	feed	2	1	1

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
24	9/22/14 19:06	70.963	146.753	beluga	swim	1	0	2
24	9/22/14 19:06	70.965	146.753	beluga	swim	1	0	2
24	9/22/14 16:30	70.573	148.491	beluga	mill	1	0	1
24	9/22/14 16:33	70.557	148.401	bowhead whale	swim	1	0	1
24	9/22/14 15:39	71.082	148.714	unid cetacean	unknown	1	0	2
24	9/22/14 16:39	70.525	148.251	bowhead whale	mill	3	0	1
24	9/22/14 15:46	71.082	148.765	beluga	mill	1	0	2
24	9/22/14 15:49	71.113	148.699	beluga	mill	3	0	2
24	9/22/14 16:43	70.474	148.118	bowhead whale	mill	3	0	1
24	9/22/14 16:43	70.480	148.125	bowhead whale	mill	4	0	1
24	9/22/14 16:43	70.480	148.126	bowhead whale	mill	6	0	1
24	9/22/14 16:43	70.487	148.144	bowhead whale	mill	2	0	1
24	9/22/14 15:55	71.300	148.624	beluga	mill	1	0	2
24	9/22/14 15:55	71.300	148.624	beluga	mill	1	0	2
24	9/22/14 16:03	71.199	148.273	beluga	mill	2	0	2
24	9/22/14 16:03	71.188	148.274	beluga	mill	1	0	2
24	9/22/14 16:04	71.180	148.273	beluga	swim	1	0	2
24	9/22/14 16:44	70.496	148.174	bowhead whale	mill	2	0	1
24	9/22/14 16:44	70.498	148.180	bowhead whale	mill	3	0	1
24	9/22/14 16:44	70.505	148.204	bowhead whale	mill	1	0	1
24	9/22/14 16:44	70.509	148.225	bowhead whale	mill	2	0	1
24	9/22/14 16:44	70.512	148.235	bowhead whale	mill	1	0	1
24	9/22/14 16:44	70.512	148.235	bowhead whale	mill	1	0	1
24	9/22/14 16:04	71.175	148.274	beluga	swim	2	1	2
24	9/22/14 16:04	71.173	148.274	beluga	swim	1	0	2
24	9/22/14 16:04	71.159	148.277	beluga	mill	1	0	2
24	9/22/14 12:40	70.614	149.927	bowhead whale	mill	5	0	1
24	9/22/14 12:40	70.631	149.928	bowhead whale	swim	1	0	1
24	9/22/14 16:45	70.516	148.250	bowhead whale	mill	4	0	1
24	9/22/14 16:45	70.520	148.264	bowhead whale	mill	2	0	1
24	9/22/14 16:45	70.531	148.278	bowhead whale	mill	4	0	1
24	9/22/14 16:45	70.533	148.280	bowhead whale	mill	1	0	1
24	9/22/14 16:46	70.553	148.347	bowhead whale	swim	1	0	1
24	9/22/14 12:46	70.642	149.882	bowhead whale	mill	8	1	1
24	9/22/14 16:51	70.504	148.408	bowhead whale	feed	3	0	1
24	9/22/14 12:57	70.669	149.902	bowhead whale	mill	1	0	1
24	9/22/14 13:05	70.763	149.940	bowhead whale	mill	1	0	1

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
24	9/22/14 17:06	70.480	147.827	bowhead whale	feed	7	0	1
24	9/22/14 17:10	70.470	147.739	bowhead whale	mill	2	0	1
24	9/22/14 17:12	70.464	147.753	bowhead whale	mill	2	0	1
24	9/22/14 17:12	70.469	147.739	bowhead whale	mill	1	0	1
24	9/22/14 17:13	70.459	147.731	bowhead whale	feed	7	1	1
24	9/22/14 17:21	70.466	147.709	bowhead whale	mill	3	0	1
24	9/22/14 17:23	70.481	147.697	bowhead whale	mill	3	0	1
24	9/22/14 17:24	70.497	147.736	bowhead whale	mill	5	0	1
24	9/22/14 17:26	70.496	147.708	bowhead whale	mill	1	0	1
24	9/22/14 17:27	70.506	147.832	bowhead whale	mill	3	0	1
24	9/22/14 17:28	70.527	147.837	bowhead whale	mill	1	0	1
24	9/22/14 13:47	70.865	149.382	bowhead whale	swim	1	0	1
24	9/22/14 17:45	71.082	147.936	beluga	rest	1	0	2
24	9/22/14 17:48	71.189	147.954	beluga	mill	1	0	2
24	9/22/14 17:48	71.189	147.954	beluga	mill	1	0	2
24	9/22/14 17:49	71.210	147.958	beluga	rest	1	0	2
24	9/22/14 17:49	71.225	147.963	beluga	rest	1	0	2
24	9/22/14 17:49	71.232	147.964	beluga	rest	1	0	2
24	9/22/14 17:50	71.238	147.965	beluga	rest	2	1	2
24	9/22/14 17:50	71.248	147.967	beluga	mill	1	0	2
24	9/22/14 17:50	71.257	147.969	beluga	rest	1	0	2
24	9/22/14 17:52	71.321	147.973	beluga	rest	1	0	2
24	9/22/14 17:53	71.334	147.972	beluga	rest	2	0	10
24	9/22/14 18:07	71.087	147.276	beluga	mill	1	0	2
24	9/22/14 18:10	70.993	147.280	beluga	mill	2	1	2
24	9/22/14 18:11	70.989	147.280	beluga	swim	1	0	2
24	9/22/14 18:25	70.538	147.293	unid cetacean	unknown	1	0	1

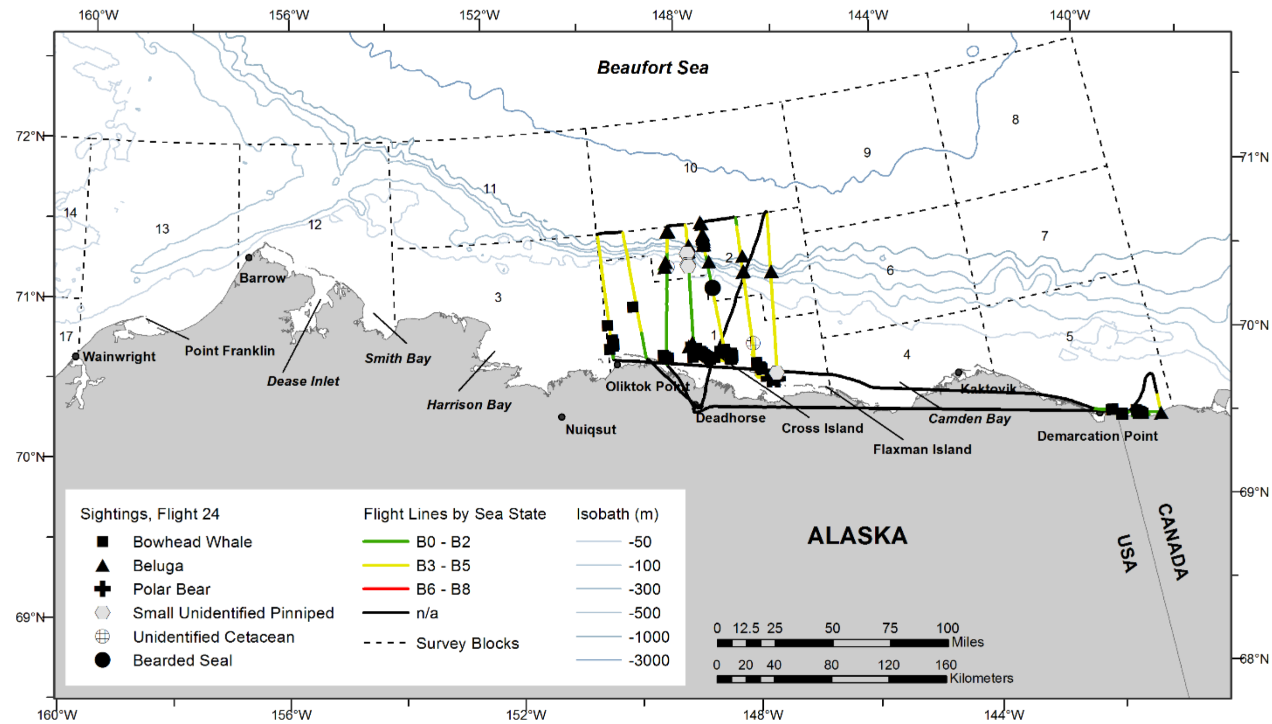
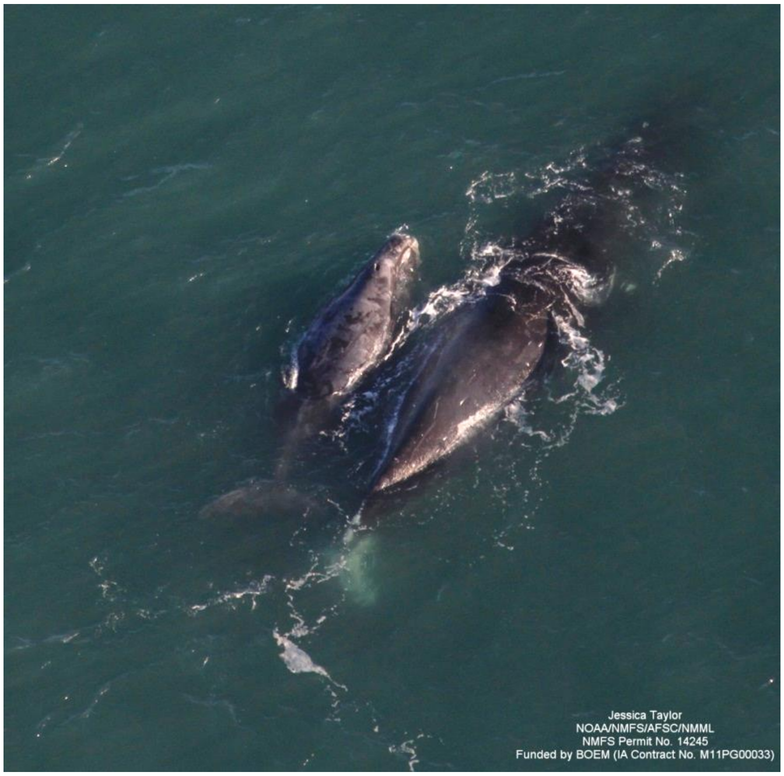


Figure B-61. ASAMM Flight 24 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Bowhead whales feeding near Demarcation Point, Alaska, during Flight 24, 22 September 2014.



Bowhead whale cow-calf pair north of Prudhoe Bay, Alaska, during Flight 24, 22 September 2014.

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23 September 2014, Flight 238

Flight was a complete survey of transects 15, 17, 25, and 26, and the coastal transect from Point Hope to Point Franklin. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with haze, glare, low ceilings, precipitation, and iced windows), and Beaufort 3-7 sea states. There was no sea ice observed in the area surveyed. Sightings included 1 bowhead whale, 1 gray whale carcass, belugas, 2 unidentified cetacean carcasses, walruses (including 53 walrus carcasses), and unidentified pinnipeds. A walrus haulout, estimated at 1,500 walruses, was observed on a barrier island near Point Lay. Two large (~700 seals each) groups of unidentified pinnipeds (likely spotted seals) were observed at haulouts on barrier islands near Icy Cape.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
238	9/23/14 11:11	71.269	166.999	bowhead whale	swim	1	0	16
238	9/23/14 11:29	71.527	168.174	beluga	swim	11	0	16
238	9/23/14 17:46	69.456	163.164	gray whale	dead	1	0	20
238	9/23/14 17:58	69.705	163.108	unid cetacean	dead	1	0	20
238	9/23/14 19:00	70.762	159.747	beluga	swim	1	0	13
238	9/23/14 19:06	70.875	159.218	unid cetacean	dead	1	0	13

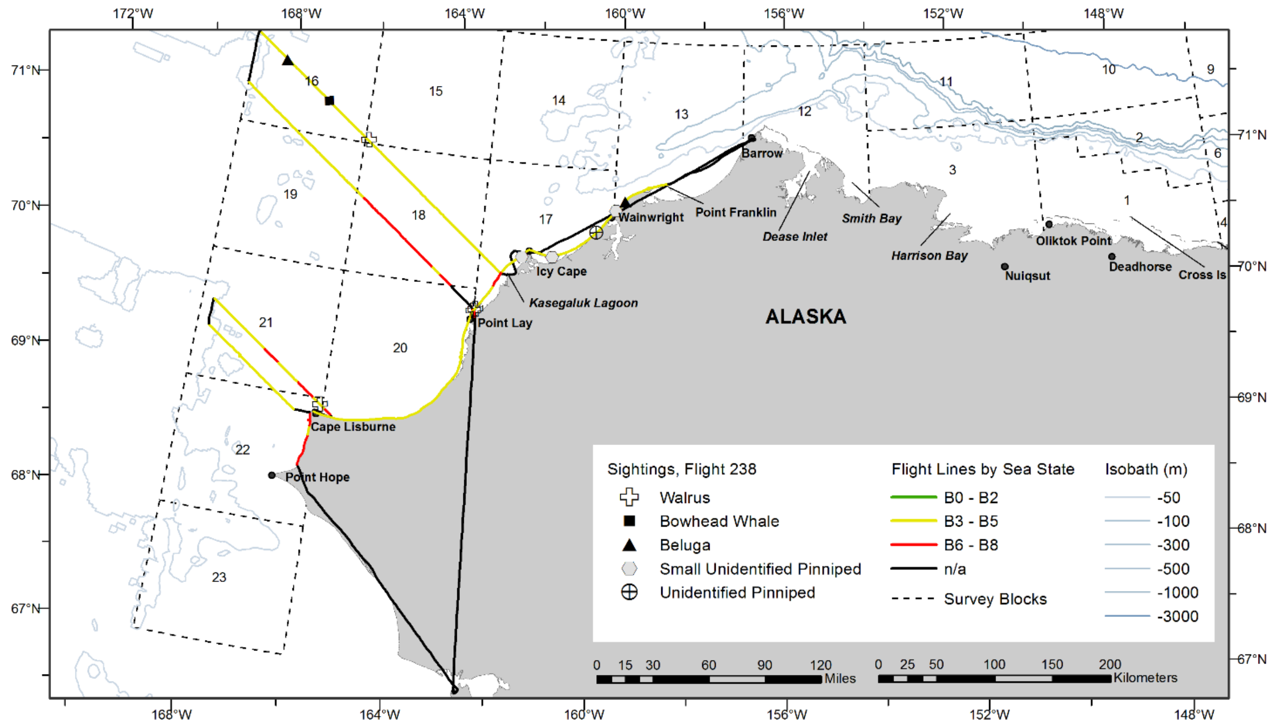

Figure B-62. ASAMM Flight 238 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Dead gray whale south of Point Lay, Alaska, and the luckiest brown bear in the world, during Flight 238, 23 September 2014.

23 September 2014, Flight 25

Flight was a survey of portions of blocks 5 and 7. Survey conditions included overcast skies, 0-10 km visibility (with low ceilings, fog, haze and precipitation), and Beaufort 2-6 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales (including two calves), belugas (including one calf), and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
25	9/23/14 11:28	70.429	140.852	beluga	swim	1	0	5
25	9/23/14 11:59	70.673	141.142	beluga	swim	4	1	7
25	9/23/14 12:00	70.649	141.143	beluga	swim	1	0	7
25	9/23/14 12:29	69.726	141.118	bowhead whale	swim	1	0	5
25	9/23/14 12:37	69.676	140.819	bowhead whale	dive	1	0	5
25	9/23/14 12:38	69.681	140.776	bowhead whale	rest	3	1	5
25	9/23/14 12:53	69.687	141.118	bowhead whale	swim	1	0	5
25	9/23/14 12:58	69.709	141.422	bowhead whale	feed	9	0	5
25	9/23/14 13:01	69.736	141.367	bowhead whale	feed	5	0	5
25	9/23/14 13:05	69.751	141.392	bowhead whale	swim	3	1	5
25	9/23/14 13:08	69.764	141.600	bowhead whale	breach	1	0	5
25	9/23/14 13:15	69.798	141.630	bowhead whale	mill	1	0	5

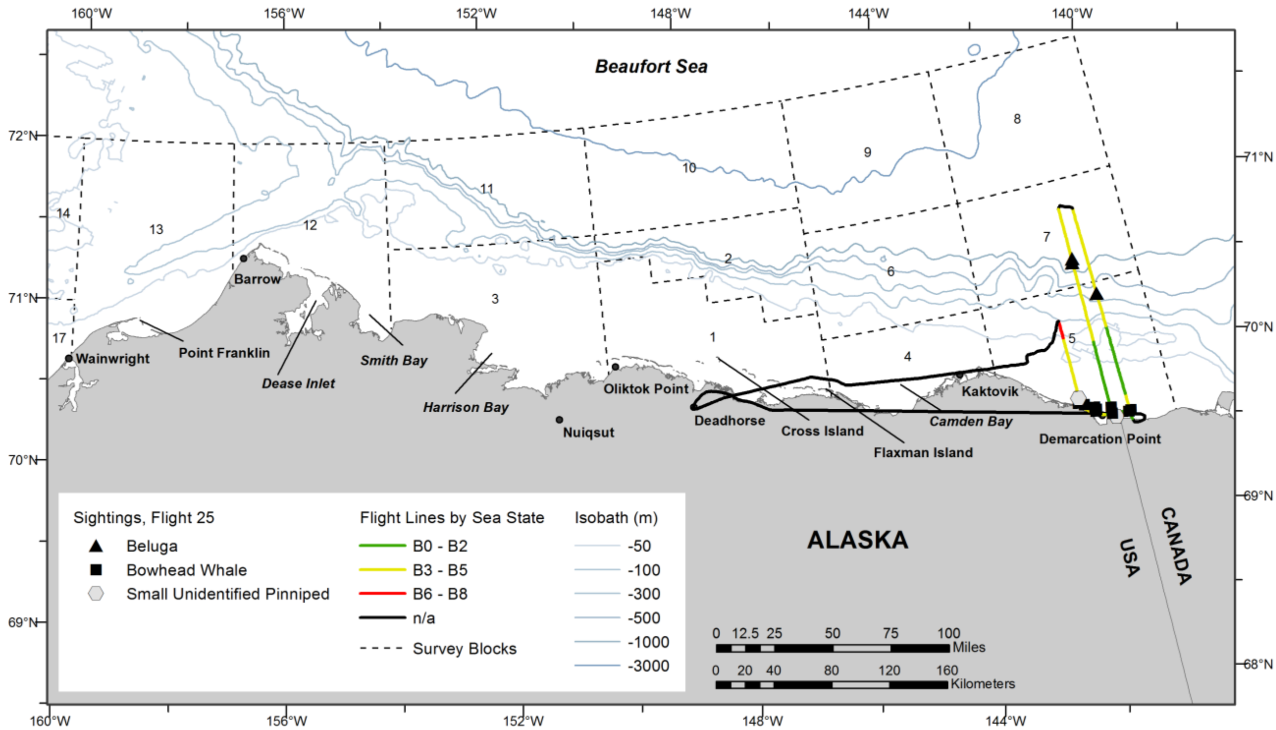

Figure B-63. ASAMM Flight 25 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

24 September 2014, Flight 239

Flight was a complete survey of transects 29, 30, 31, 32, 37, and 38. Survey conditions included overcast skies, 1-10 km visibility (with haze, glare, low ceilings, and precipitation), and Beaufort 2-6 sea states. There was no sea ice observed in the area surveyed. Sightings included humpback whales, fin whales, one small unidentified marine mammal, walruses, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
239	9/24/14 18:19	67.255	168.717	small unid marine mammal	dive	1	0	23
239	9/24/14 18:48	67.428	166.883	fin whale	feed	3	0	23
239	9/24/14 18:58	67.427	166.769	fin whale	swim	2	0	23
239	9/24/14 18:58	67.427	166.730	humpback whale	mill	3	0	23

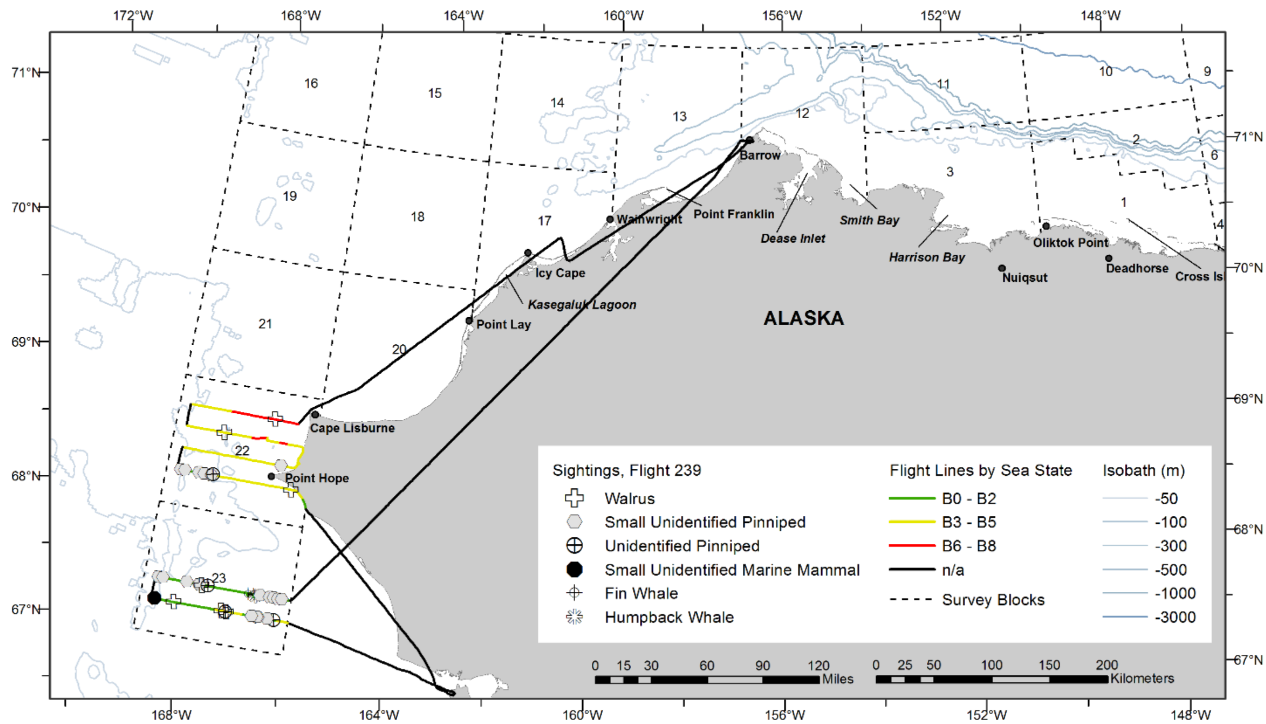

Figure B-64. ASAMM Flight 239 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

24 September 2014, Flight 26

Flight was a survey of a portion of block 3. Survey conditions included overcast skies, <1-5 km visibility (with low ceilings), and Beaufort 6-7 sea states. There was no sea ice observed in the area surveyed. No sightings were observed.

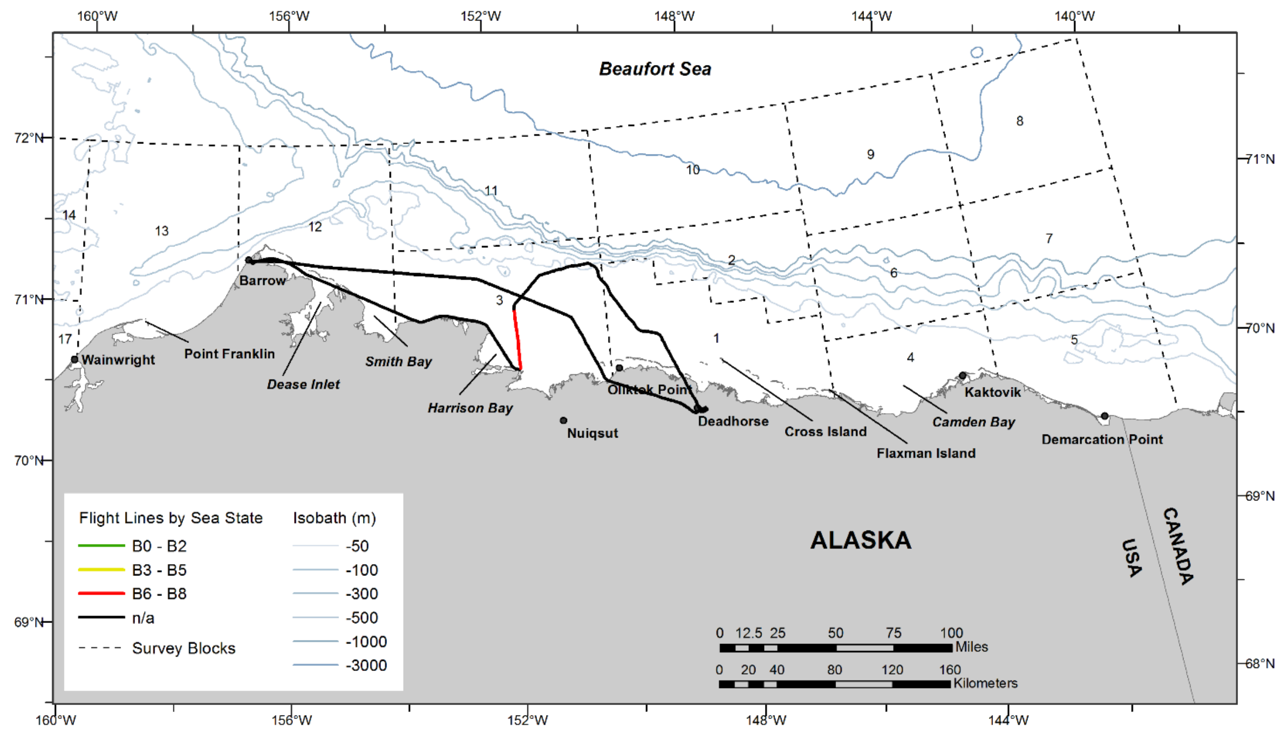

Figure B-65. ASAMM Flight 26 survey track, depicted by sea state.

25 September 2014, Flight 27

Flight was a survey of portions of blocks 1 and 2. Survey conditions included overcast skies, 0-10 km visibility (with fog, glare, low ceilings, haze, and precipitation), and Beaufort 4-6 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales (including three calves).

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
27	9/25/14 11:39	70.525	148.326	bowhead whale	mill	4	1	1
27	9/25/14 11:39	70.526	148.326	bowhead whale	mill	2	0	1
27	9/25/14 12:31	70.485	147.740	bowhead whale	mill	1	0	1
27	9/25/14 12:33	70.474	147.807	bowhead whale	mill	1	0	1
27	9/25/14 12:34	70.470	147.811	bowhead whale	dive	1	0	1
27	9/25/14 12:35	70.479	147.756	bowhead whale	mill	1	0	1
27	9/25/14 12:39	70.454	147.746	bowhead whale	mill	3	0	1
27	9/25/14 12:39	70.443	147.747	bowhead whale	mill	1	0	1
27	9/25/14 12:43	70.460	147.710	bowhead whale	swim	2	0	1
27	9/25/14 12:46	70.463	147.732	bowhead whale	mill	1	0	1
27	9/25/14 12:52	70.404	147.561	bowhead whale	mill	2	0	1
27	9/25/14 12:54	70.400	147.528	bowhead whale	feed	2	0	1
27	9/25/14 12:54	70.396	147.510	bowhead whale	mill	1	0	1
27	9/25/14 12:55	70.396	147.494	bowhead whale	feed	1	0	1
27	9/25/14 12:55	70.397	147.484	bowhead whale	feed	1	0	1
27	9/25/14 12:56	70.417	147.579	bowhead whale	mill	2	0	1
27	9/25/14 12:57	70.408	147.609	bowhead whale	mill	2	0	1
27	9/25/14 12:58	70.398	147.603	bowhead whale	mill	1	0	1
27	9/25/14 13:02	70.417	147.552	bowhead whale	mill	2	0	1
27	9/25/14 13:05	70.382	147.302	bowhead whale	mill	1	0	1
27	9/25/14 13:11	70.404	147.215	bowhead whale	mill	2	0	1
27	9/25/14 13:13	70.383	147.175	bowhead whale	mill	2	1	1
27	9/25/14 13:21	70.389	147.267	bowhead whale	mill	2	1	1
27	9/25/14 13:24	70.393	147.241	bowhead whale	mill	2	0	1
27	9/25/14 13:25	70.404	147.178	bowhead whale	mill	1	0	1
27	9/25/14 14:01	70.342	146.911	bowhead whale	mill	2	0	1
27	9/25/14 14:01	70.333	146.911	bowhead whale	mill	1	0	1
27	9/25/14 14:02	70.326	146.910	bowhead whale	mill	3	0	1
27	9/25/14 14:02	70.319	146.909	bowhead whale	mill	1	0	1
27	9/25/14 14:02	70.314	146.909	bowhead whale	mill	5	0	1
27	9/25/14 14:02	70.309	146.910	bowhead whale	mill	3	0	1

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
27	9/25/14 14:02	70.307	146.910	bowhead whale	mill	1	0	1
27	9/25/14 14:02	70.305	146.910	bowhead whale	mill	1	0	1
27	9/25/14 14:02	70.302	146.909	bowhead whale	mill	1	0	1
27	9/25/14 14:08	70.349	146.869	bowhead whale	swim	1	0	1
27	9/25/14 14:17	70.321	146.850	bowhead whale	mill	1	0	1
27	9/25/14 14:17	70.319	146.856	bowhead whale	mill	1	0	1
27	9/25/14 14:17	70.313	146.838	bowhead whale	mill	1	0	1
27	9/25/14 14:20	70.319	146.878	bowhead whale	mill	3	0	1
27	9/25/14 14:22	70.308	146.924	bowhead whale	mill	10	0	1
27	9/25/14 14:22	70.308	146.927	bowhead whale	mill	7	0	1
27	9/25/14 14:22	70.308	146.959	bowhead whale	feed	13	0	1
27	9/25/14 14:22	70.308	146.967	bowhead whale	mill	4	0	1
27	9/25/14 14:22	70.309	146.986	bowhead whale	swim	14	0	1
27	9/25/14 14:23	70.312	147.027	bowhead whale	mill	3	0	1
27	9/25/14 14:23	70.315	147.050	bowhead whale	mill	12	0	1
27	9/25/14 14:23	70.317	147.063	bowhead whale	mill	12	0	1
27	9/25/14 14:23	70.318	147.070	bowhead whale	mill	4	0	1
27	9/25/14 14:24	70.325	147.122	bowhead whale	mill	1	0	1
27	9/25/14 14:25	70.343	147.162	bowhead whale	swim	1	0	1
27	9/25/14 14:25	70.351	147.151	bowhead whale	swim	2	0	1
27	9/25/14 14:25	70.356	147.146	bowhead whale	mill	1	0	1
27	9/25/14 14:25	70.366	147.134	bowhead whale	mill	1	0	1
27	9/25/14 14:39	70.303	146.917	bowhead whale	mill	10	0	1
27	9/25/14 14:39	70.303	146.914	bowhead whale	mill	4	0	1
27	9/25/14 14:39	70.301	146.891	bowhead whale	mill	4	0	1
27	9/25/14 14:39	70.301	146.884	bowhead whale	mill	2	0	1
27	9/25/14 14:39	70.299	146.865	bowhead whale	mill	3	0	1
27	9/25/14 14:39	70.298	146.851	bowhead whale	mill	2	0	1
27	9/25/14 14:39	70.297	146.843	bowhead whale	mill	5	0	1
27	9/25/14 14:40	70.295	146.833	bowhead whale	mill	5	0	1
27	9/25/14 14:40	70.293	146.822	bowhead whale	mill	17	0	1
27	9/25/14 14:40	70.291	146.812	bowhead whale	mill	1	0	1
27	9/25/14 14:40	70.290	146.807	bowhead whale	feed	3	0	1
27	9/25/14 14:40	70.286	146.782	bowhead whale	feed	3	0	1
27	9/25/14 14:40	70.283	146.767	bowhead whale	feed	2	0	1
27	9/25/14 14:40	70.279	146.750	bowhead whale	feed	2	0	1
27	9/25/14 14:40	70.277	146.737	bowhead whale	feed	3	0	1

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
27	9/25/14 14:41	70.273	146.719	bowhead whale	feed	3	0	1
27	9/25/14 14:41	70.268	146.701	bowhead whale	feed	1	0	1
27	9/25/14 14:43	70.269	146.583	bowhead whale	swim	3	0	1

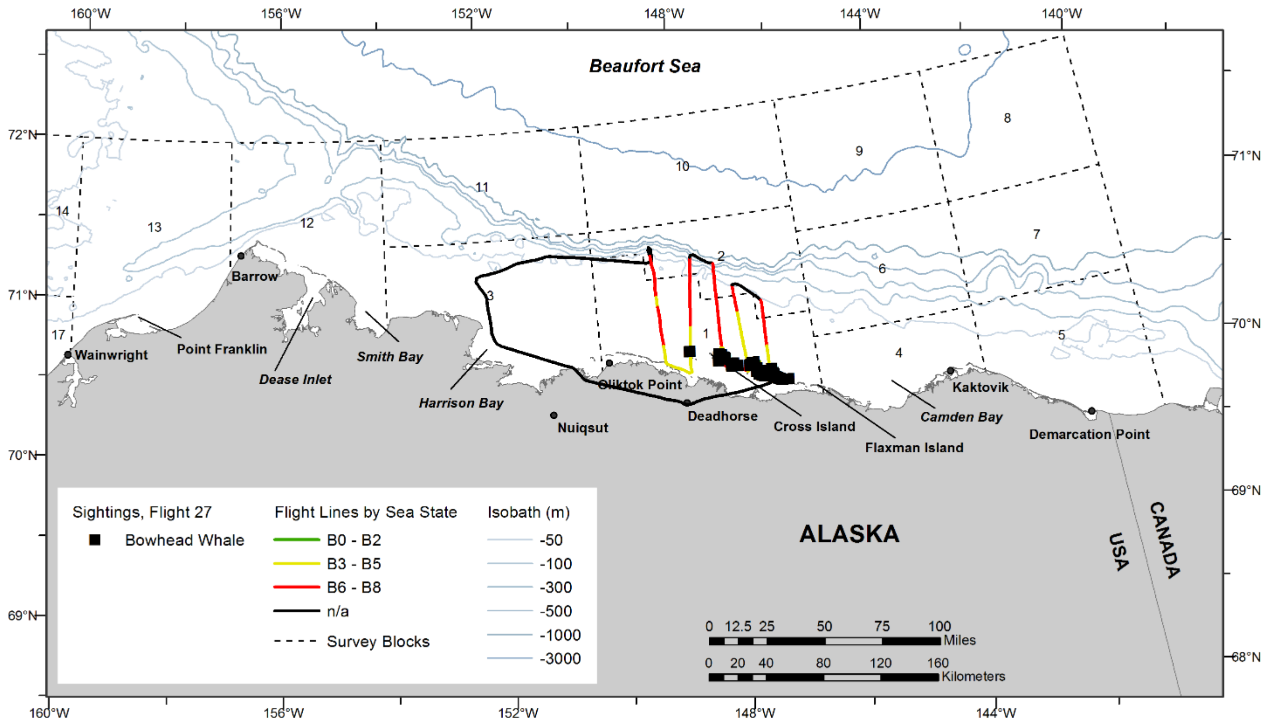

Figure B-66. ASAMM Flight 27 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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26 September 2014, Flight 28

Flight was a survey of block 12 and portions of block 3. Survey conditions included partly cloudy skies, 2-10 km visibility (with glare, haze, and low ceiling), and Beaufort 3-6 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales (including one calf), belugas (including one calf), unidentified cetaceans, and one polar bear.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
28	9/26/14 10:06	71.631	156.803	bowhead whale	swim	1	0	12
28	9/26/14 10:08	71.717	156.845	unid cetacean	unknown	1	0	12
28	9/26/14 10:39	71.670	156.232	bowhead whale	swim	1	0	12
28	9/26/14 10:43	71.704	156.376	bowhead whale	unknown	1	0	12
28	9/26/14 10:50	71.612	156.206	bowhead whale	dive	1	0	12
28	9/26/14 11:10	71.588	155.781	beluga	swim	1	0	12
28	9/26/14 11:10	71.592	155.778	beluga	swim	1	0	12
28	9/26/14 11:10	71.596	155.777	beluga	swim	1	0	12
28	9/26/14 15:40	71.092	153.629	bowhead whale	mill	1	0	3
28	9/26/14 11:11	71.631	155.754	beluga	swim	1	0	12
28	9/26/14 11:11	71.632	155.753	beluga	swim	1	0	12
28	9/26/14 15:42	71.096	153.549	bowhead whale	mill	1	0	3
28	9/26/14 11:28	71.971	155.063	beluga	swim	1	0	12
28	9/26/14 11:29	71.946	155.070	beluga	swim	1	0	12
28	9/26/14 11:34	71.816	155.099	beluga	mill	1	0	12
28	9/26/14 11:38	71.703	155.121	beluga	swim	1	0	12
28	9/26/14 11:54	71.209	155.230	bowhead whale	swim	2	0	12
28	9/26/14 11:56	71.218	155.201	bowhead whale	swim	5	0	12
28	9/26/14 12:22	71.398	154.610	bowhead whale	swim	1	0	12
28	9/26/14 16:37	70.790	150.113	bowhead whale	swim	1	0	3
28	9/26/14 12:28	71.560	154.629	unid cetacean	swim	3	0	12
28	9/26/14 12:34	71.563	154.683	bowhead whale	swim	1	0	12
28	9/26/14 12:37	71.628	154.635	bowhead whale	swim	1	0	12
28	9/26/14 12:40	71.649	154.596	bowhead whale	swim	1	0	12
28	9/26/14 12:42	71.645	154.581	bowhead whale	swim	2	0	12
28	9/26/14 12:44	71.651	154.555	bowhead whale	swim	2	0	12
28	9/26/14 12:47	71.632	154.514	bowhead whale	swim	1	0	12
28	9/26/14 12:47	71.636	154.514	bowhead whale	swim	1	0	12
28	9/26/14 12:47	71.636	154.515	bowhead whale	dive	1	0	12
28	9/26/14 12:48	71.634	154.539	bowhead whale	rest	1	0	12
28	9/26/14 12:50	71.643	154.534	bowhead whale	swim	1	0	12

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
28	9/26/14 12:51	71.658	154.493	bowhead whale	tail slap	1	0	12
28	9/26/14 13:02	71.928	154.671	beluga	swim	6	0	12
28	9/26/14 13:03	71.970	154.672	beluga	rest	1	0	12
28	9/26/14 13:03	71.977	154.673	beluga	rest	1	0	12
28	9/26/14 13:08	71.954	154.345	beluga	swim	7	1	12
28	9/26/14 13:09	71.928	154.334	beluga	swim	1	0	12
28	9/26/14 13:09	71.911	154.327	beluga	swim	3	0	12
28	9/26/14 13:10	71.879	154.319	beluga	mill	1	0	12
28	9/26/14 13:13	71.790	154.301	beluga	swim	1	0	12
28	9/26/14 13:14	71.758	154.294	bowhead whale	mill	3	1	12
28	9/26/14 13:16	71.755	154.392	bowhead whale	mill	2	0	12
28	9/26/14 13:26	71.519	154.238	bowhead whale	swim	2	0	12

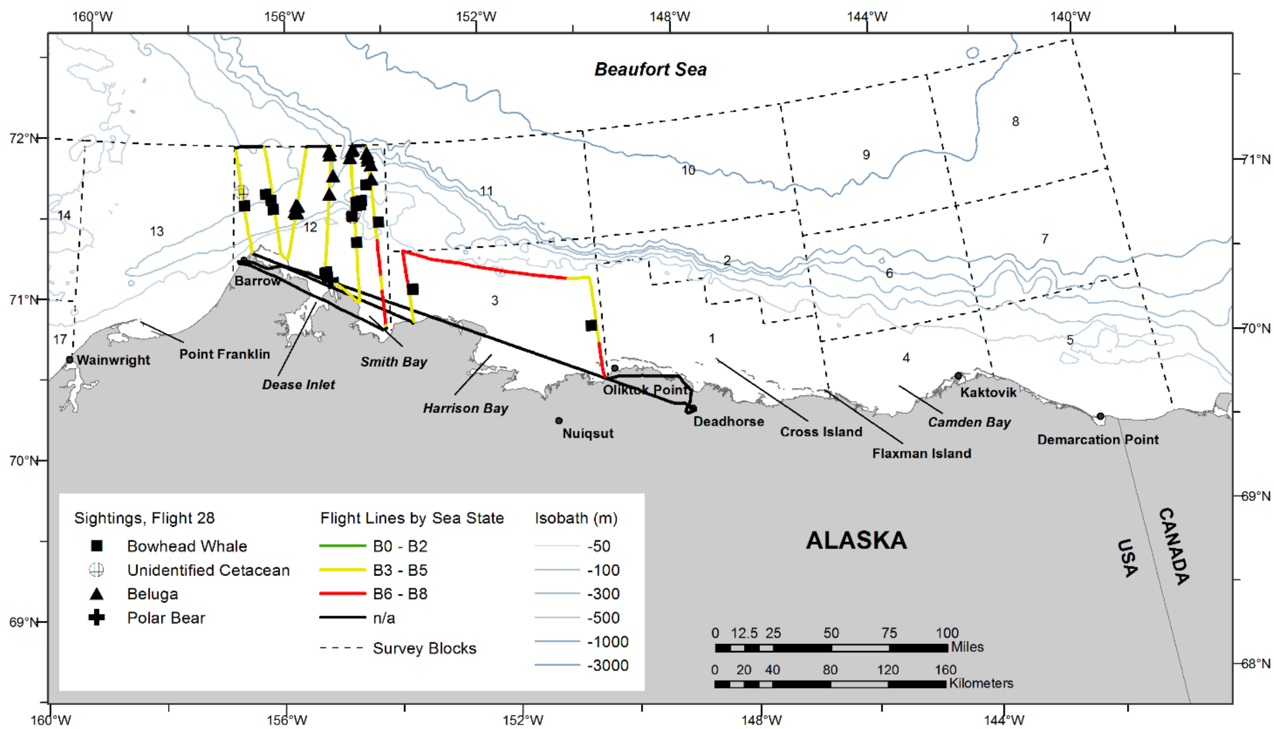

Figure B-67. ASAMM Flight 28 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Well-scarred bowhead whale observed about 90 km north of Smith Bay, Alaska, during Flight 28, 26 September 2014.

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27 September 2014, Flight 240

Flight was a partial survey of transects 18 and 20, and search effort near the Point Lay walrus haulout and between Point Franklin and Barrow. Survey conditions included partly cloudy to overcast skies, 1-10 km visibility (with glare, low ceilings, and precipitation), and Beaufort 3-6 sea states. There was no sea ice observed in the area surveyed. Sightings included gray whales and walruses. The Point Lay walrus haulout was estimated at approximately 35,000 animals, with at least 36 walrus carcasses near the haulout.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
240	9/27/14 12:36	71.020	158.223	gray whale	feed	1	0	13
240	9/27/14 12:38	71.026	158.198	gray whale	feed	1	0	13
240	9/27/14 12:43	71.105	157.763	gray whale	feed	1	0	13

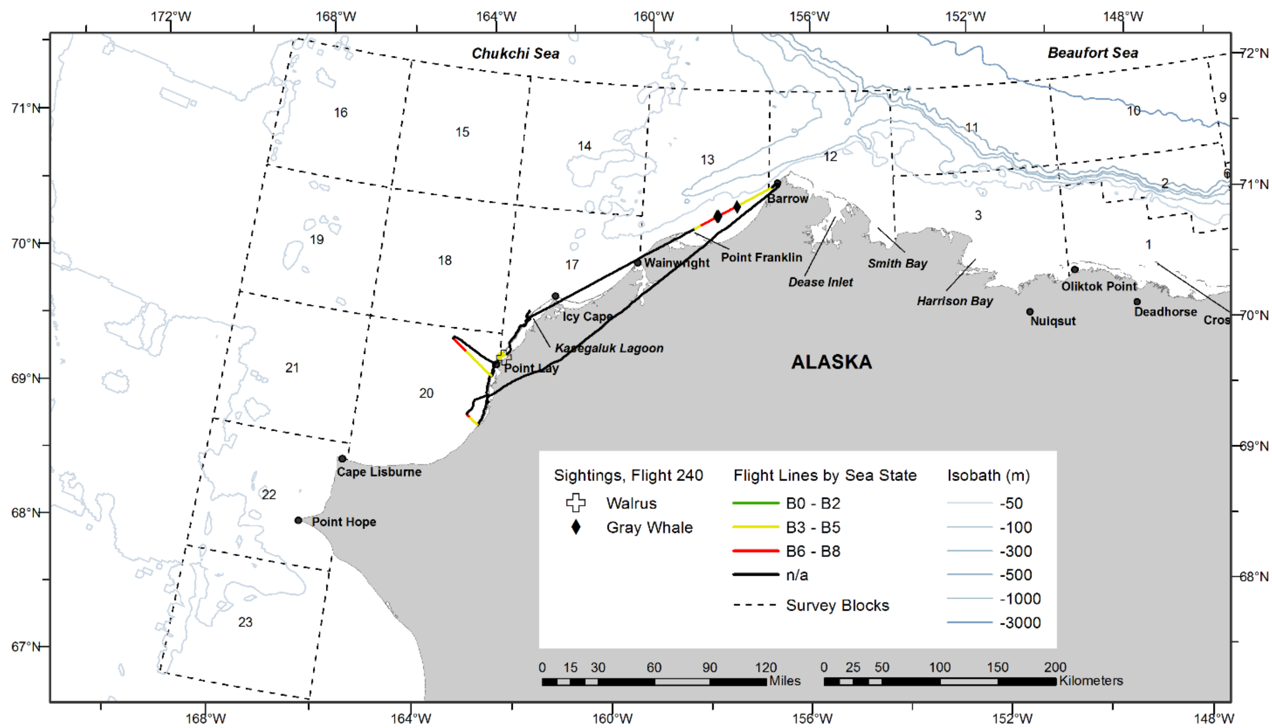

Figure B-68. ASAMM Flight 240 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Walrus haulout on barrier island near Point Lay, Alaska, during Flight 240, 27 September 2014.

Close-up of part of walrus haulout on barrier island near Point Lay, Alaska, during Flight 240, 27 September 2014.

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27 September 2014, Flight 29

Flight was a survey of portions of block 4. Survey conditions included clear skies, no visibility to unlimited visibility (with glare, haze, and low ceiling), and Beaufort 2-6 sea states. There was no sea ice observed in the area surveyed. Sightings included one bowhead whale, one beluga, one unidentified cetacean, small unidentified pinnipeds, and polar bears.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
29	9/27/14 14:43	70.410	145.288	beluga	mill	1	0	4
29	9/27/14 14:44	70.457	145.178	unid cetacean	swim	1	0	4
29	9/27/14 14:59	70.354	145.139	bowhead whale	mill	1	0	4

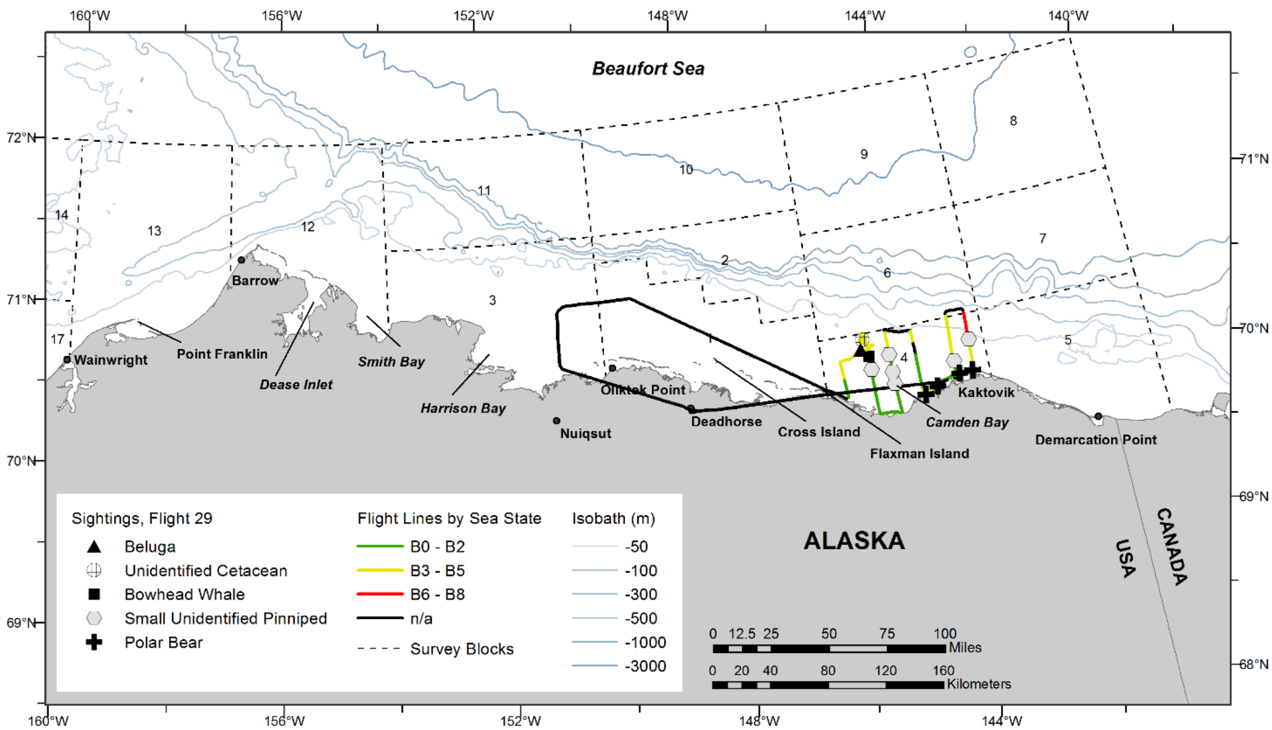


Figure B-69. ASAMM Flight 29 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

28 September 2014, Flight 241

Flight was a partial survey of transects 21 and 23. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with glare, low ceilings, and precipitation), and Beaufort 2-5 sea states. There was no sea ice observed in the area surveyed. Sightings included one bowhead whale, gray whales, unidentified cetaceans (including one carcass), walruses, unidentified pinnipeds, and one polar bear.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
241	9/28/14 14:04	70.912	158.778	unid cetacean	dead	1	0	13
241	9/28/14 14:13	70.995	158.285	gray whale	feed	1	0	13
241	9/28/14 14:13	70.997	158.273	gray whale	feed	1	0	13
241	9/28/14 14:14	71.003	158.256	gray whale	feed	1	0	13
241	9/28/14 14:14	71.003	158.304	gray whale	feed	2	0	13
241	9/28/14 14:15	70.994	158.288	bowhead whale	swim	1	0	13
241	9/28/14 14:17	71.002	158.252	gray whale	swim	1	0	13
241	9/28/14 14:17	71.001	158.259	gray whale	feed	1	0	13
241	9/28/14 14:19	71.022	158.148	gray whale	feed	1	0	13
241	9/28/14 14:24	71.109	157.702	gray whale	feed	2	0	13
241	9/28/14 14:24	71.111	157.693	unid cetacean	feed	1	0	13
241	9/28/14 14:25	71.103	157.707	gray whale	feed	1	0	13
241	9/28/14 14:25	71.117	157.657	unid cetacean	feed	1	0	13
241	9/28/14 14:28	71.154	157.468	gray whale	swim	1	0	13

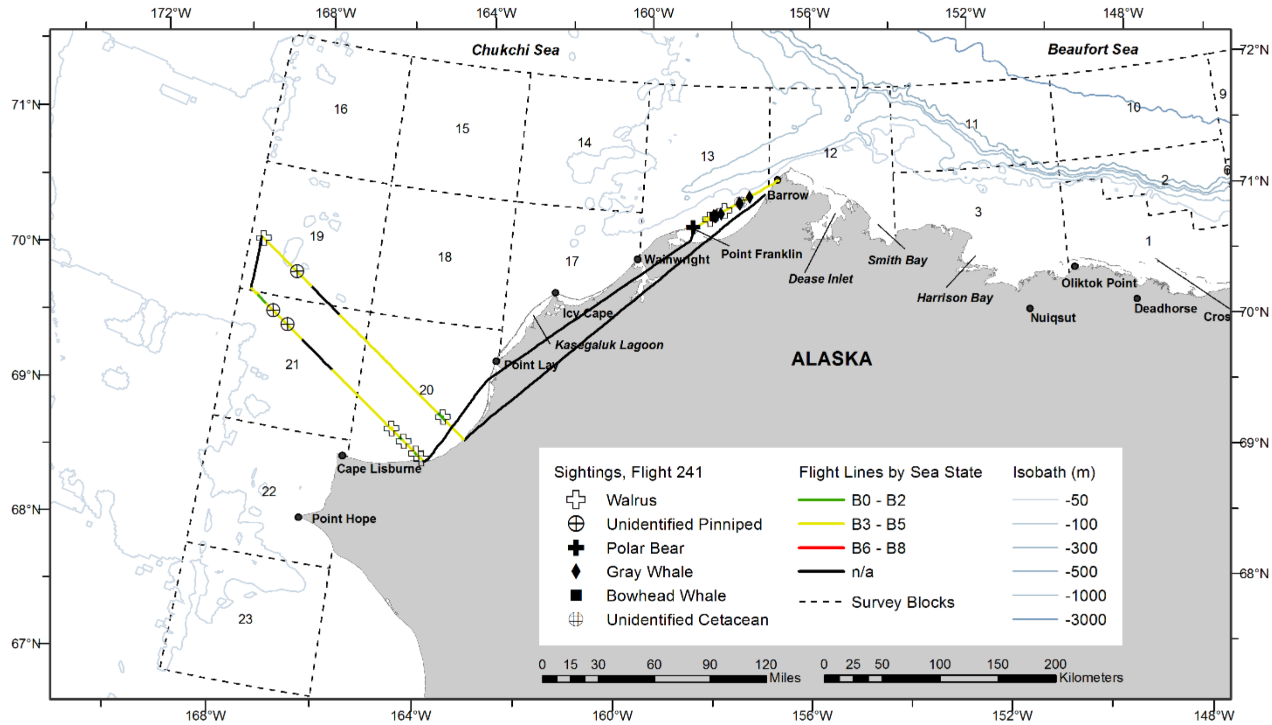


Figure B-70. ASAMM Flight 241 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

28 September 2014, Flight 30

Flight was a survey of portions of blocks 3 and 11. Survey conditions included overcast skies, 2-10 km visibility (with precipitation, fog, and haze), and Beaufort 2-6 sea states. Sea ice cover was 0-20% new ice in the area surveyed and was limited to shallow nearshore areas. Sightings included bowhead whales (including two calves), belugas, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
30	9/28/14 12:20	71.162	153.657	bowhead whale	unknown	1	0	3
30	9/28/14 13:01	70.992	153.148	bowhead whale	unknown	1	0	3
30	9/28/14 13:19	70.961	152.589	bowhead whale	feed	4	1	3
30	9/28/14 13:19	70.963	152.569	bowhead whale	swim	1	0	3
30	9/28/14 13:30	70.990	152.589	bowhead whale	swim	1	0	3
30	9/28/14 14:06	70.934	152.328	bowhead whale	mill	1	0	3
30	9/28/14 14:06	70.932	152.328	bowhead whale	mill	2	0	3
30	9/28/14 14:06	70.931	152.327	bowhead whale	mill	2	0	3
30	9/28/14 14:06	70.929	152.327	bowhead whale	mill	1	0	3
30	9/28/14 14:07	70.914	152.328	bowhead whale	mill	1	0	3
30	9/28/14 14:07	70.911	152.329	bowhead whale	mill	1	0	3
30	9/28/14 14:07	70.903	152.334	bowhead whale	swim	1	0	3
30	9/28/14 14:08	70.889	152.346	bowhead whale	mill	2	0	3
30	9/28/14 14:09	70.931	152.332	bowhead whale	swim	2	0	3
30	9/28/14 14:12	70.946	152.294	bowhead whale	log play	1	0	3
30	9/28/14 14:15	70.940	152.317	bowhead whale	rest	2	0	3
30	9/28/14 14:17	70.945	152.325	bowhead whale	mill	2	0	3
30	9/28/14 14:19	70.928	152.413	bowhead whale	mill	1	0	3
30	9/28/14 14:19	70.936	152.381	bowhead whale	mill	2	0	3
30	9/28/14 14:21	70.947	152.386	bowhead whale	mill	2	1	3
30	9/28/14 14:21	70.944	152.389	bowhead whale	mill	2	0	3
30	9/28/14 14:27	70.906	152.333	bowhead whale	dive	1	0	3
30	9/28/14 14:28	70.888	152.335	bowhead whale	mill	1	0	3
30	9/28/14 14:28	70.885	152.336	bowhead whale	swim	2	0	3
30	9/28/14 14:28	70.869	152.339	bowhead whale	swim	1	0	3
30	9/28/14 14:37	70.636	151.837	beluga	swim	1	0	3
30	9/28/14 14:42	70.718	151.721	bowhead whale	mill	7	0	3
30	9/28/14 14:42	70.722	151.721	bowhead whale	mill	2	0	3
30	9/28/14 14:42	70.722	151.721	bowhead whale	mill	2	0	3
30	9/28/14 14:42	70.723	151.721	bowhead whale	mill	2	0	3
30	9/28/14 14:59	71.149	151.755	bowhead whale	swim	1	0	3

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
30	9/28/14 15:02	71.199	151.762	bowhead whale	swim	1	0	3
30	9/28/14 15:29	71.182	151.255	bowhead whale	swim	1	0	3
30	9/28/14 15:32	71.093	151.258	bowhead whale	swim	1	0	3
30	9/28/14 15:32	71.082	151.256	bowhead whale	swim	1	0	3
30	9/28/14 15:32	71.078	151.255	bowhead whale	swim	1	0	3
30	9/28/14 15:36	70.948	151.240	bowhead whale	swim	1	0	3
30	9/28/14 15:41	70.837	151.234	bowhead whale	swim	1	0	3
30	9/28/14 15:42	70.803	151.238	bowhead whale	swim	1	0	3
30	9/28/14 16:13	70.914	150.814	bowhead whale	swim	1	0	3
30	9/28/14 16:15	70.939	150.800	bowhead whale	swim	1	0	3
30	9/28/14 16:16	70.933	150.763	bowhead whale	swim	1	0	3
30	9/28/14 16:18	71.002	150.773	bowhead whale	swim	1	0	3
30	9/28/14 16:19	71.037	150.775	bowhead whale	swim	1	0	3
30	9/28/14 16:26	71.314	150.782	beluga	swim	1	0	3

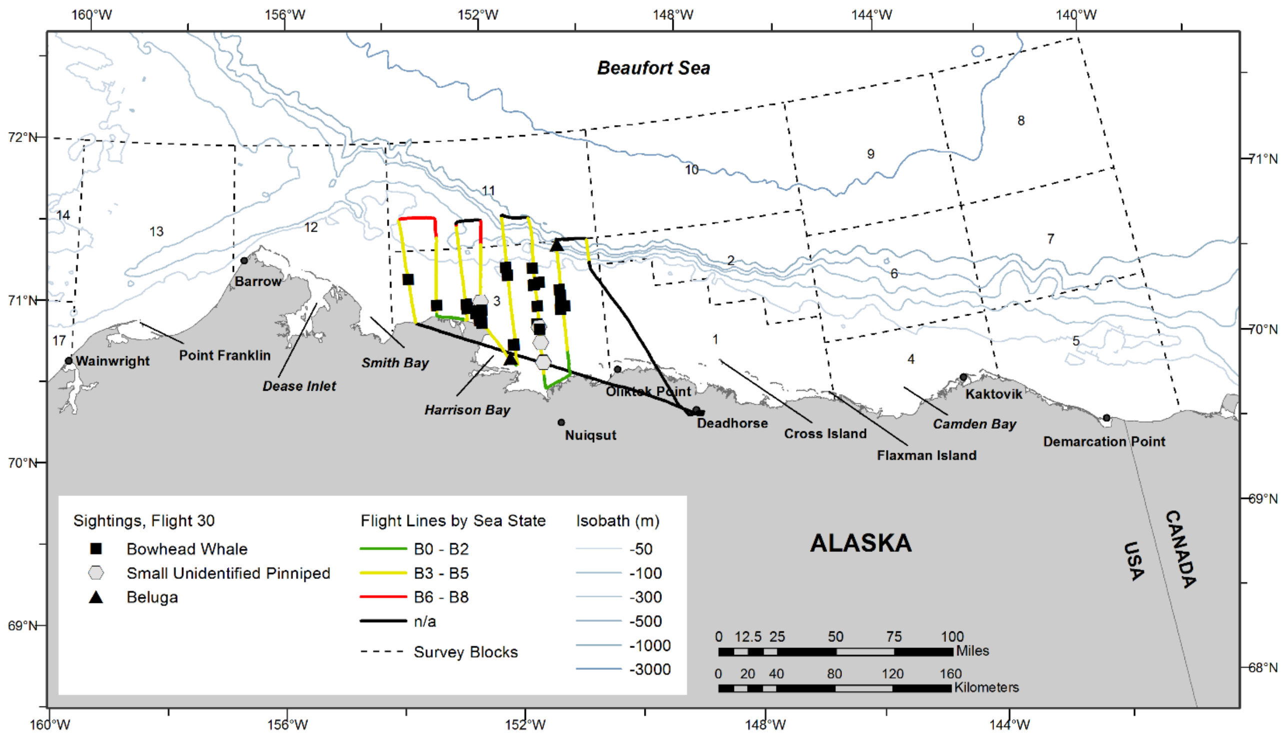


Figure B-71. ASAMM Flight 30 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Bowhead whale playing with a log during Flight 30, 28 September 2014.

1 October 2014, Flight 242

Flight was a partial survey of transects 2 and 4. Survey conditions included overcast skies, 0-10 km visibility (with glare and low ceilings), and Beaufort 3-6 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales (including one calf).

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
242	10/1/14 15:51	71.744	159.308	bowhead whale	swim	2	1	13

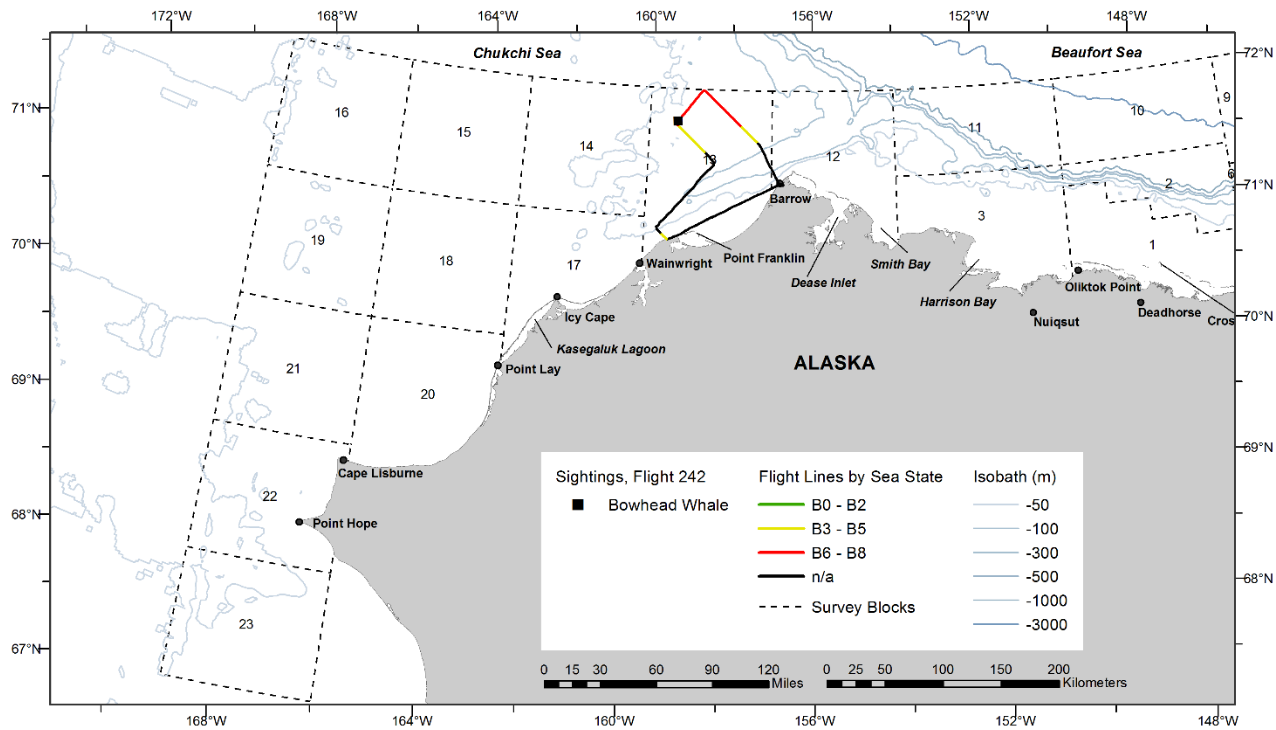


Figure B-72. ASAMM Flight 242 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

3 October 2014, Flight 243

Flight was a survey of portions of blocks 1 and 2 and a partial survey of transects 3 and 5. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with glare, low ceilings, iced windows, and precipitation), and Beaufort 2-6 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales (including one calf), gray whales, belugas, one unidentified cetacean, one walrus, unidentified pinnipeds, small unidentified pinnipeds, and polar bears.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
243	10/3/14 10:55	71.211	148.637	beluga	swim	6	0	2
243	10/3/14 11:23	70.665	148.408	unid cetacean	unknown	1	0	1
243	10/3/14 11:32	70.660	148.406	bowhead whale	swim	1	0	1
243	10/3/14 11:33	70.638	148.374	bowhead whale	swim	1	0	1
243	10/3/14 11:35	70.651	148.415	bowhead whale	swim	1	0	1
243	10/3/14 17:16	71.059	157.890	gray whale	feed	1	0	13
243	10/3/14 17:18	71.103	158.031	gray whale	feed	1	0	13
243	10/3/14 17:18	71.108	158.048	gray whale	feed	1	0	13
243	10/3/14 17:18	71.111	158.058	gray whale	feed	1	0	13
243	10/3/14 17:29	71.362	158.167	beluga	swim	1	0	13
243	10/3/14 17:29	71.370	158.144	beluga	swim	3	0	13
243	10/3/14 17:29	71.376	158.130	beluga	swim	1	0	13
243	10/3/14 17:30	71.380	158.121	beluga	swim	1	0	13
243	10/3/14 17:30	71.389	158.103	beluga	swim	2	0	13
243	10/3/14 12:13	71.026	147.634	beluga	swim	2	0	2
243	10/3/14 12:13	71.031	147.632	beluga	swim	1	0	2
243	10/3/14 12:13	71.037	147.630	beluga	swim	1	0	2
243	10/3/14 12:14	71.064	147.619	beluga	swim	2	0	2
243	10/3/14 17:37	71.449	157.620	beluga	swim	1	0	13
243	10/3/14 12:33	71.055	147.332	beluga	swim	1	0	2
243	10/3/14 12:34	71.015	147.333	beluga	swim	1	0	2
243	10/3/14 12:34	71.001	147.333	beluga	swim	2	0	2
243	10/3/14 12:49	70.544	147.374	bowhead whale	swim	1	0	1
243	10/3/14 12:52	70.513	147.374	bowhead whale	feed	2	0	1
243	10/3/14 12:52	70.508	147.374	bowhead whale	feed	1	0	1
243	10/3/14 13:01	70.532	147.282	bowhead whale	unknown	1	0	1
243	10/3/14 13:06	70.491	147.373	bowhead whale	feed	2	1	1
243	10/3/14 13:28	70.318	146.566	bowhead whale	swim	1	0	1
243	10/3/14 14:17	70.976	146.147	beluga	swim	1	0	2

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
243	10/3/14 14:18	70.951	146.155	beluga	swim	1	0	2
243	10/3/14 14:19	70.933	146.160	beluga	swim	1	0	2
243	10/3/14 14:39	70.284	146.316	bowhead whale	feed	1	0	1
243	10/3/14 14:42	70.275	146.313	bowhead whale	feed	1	0	1

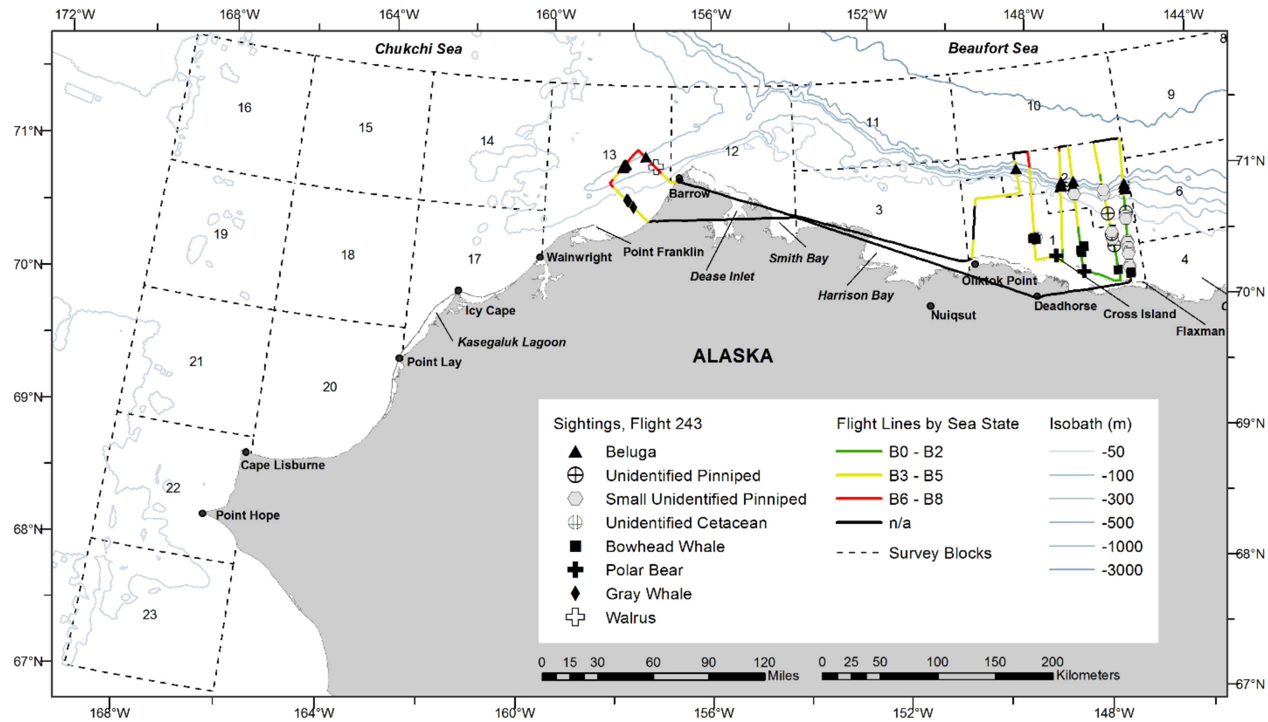
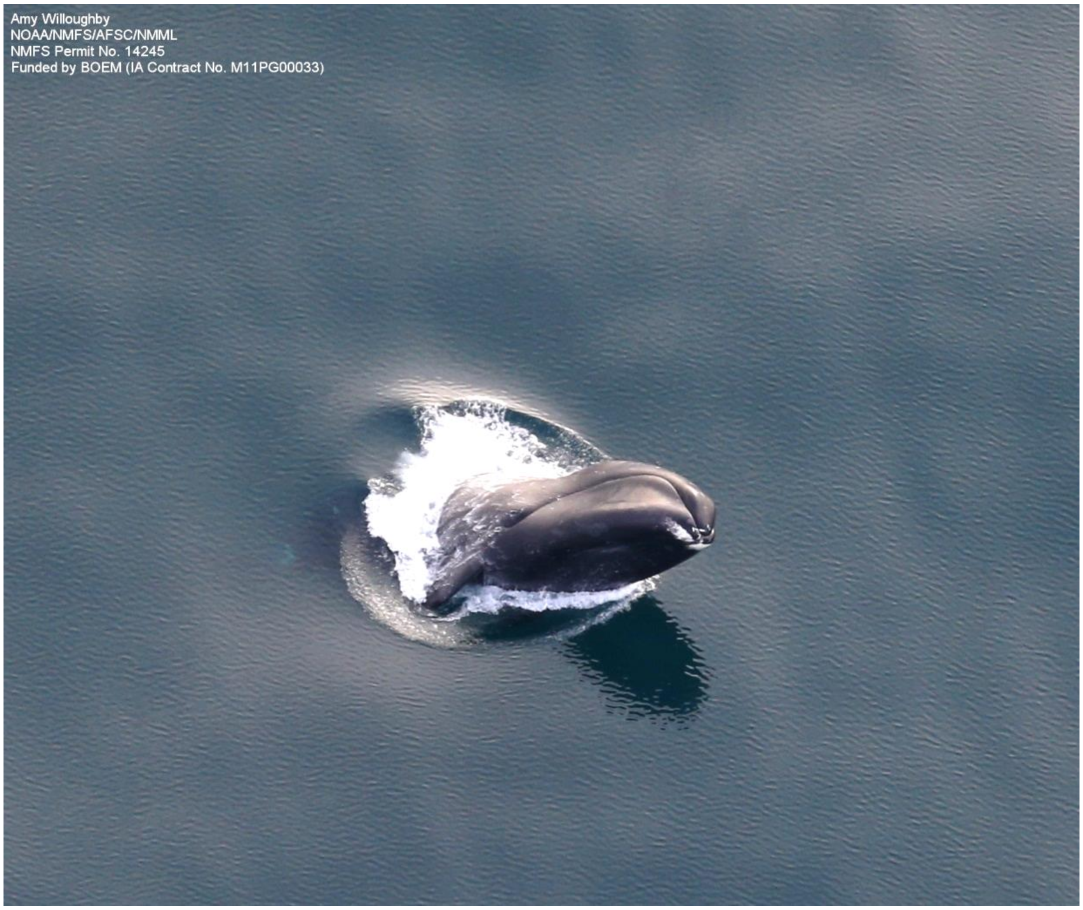


Figure B-73. ASAMM Flight 243 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.



Bowhead whale breaching during Flight 243, 3 October 2014.

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4 October 2014, Flight 31

Flight was a survey of portions of block 12. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with fog, glare, and low ceilings), and Beaufort 2-6 sea states. Sea ice cover was 0-40% new ice in the area surveyed, and was limited to nearshore areas. Sightings included bowhead whales, belugas (including five calves), one small unidentified pinniped, and one polar bear.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
31	10/4/14 11:31	71.718	156.337	bowhead whale	swim	1	0	12
31	10/4/14 11:31	71.707	156.342	bowhead whale	mill	1	0	12
31	10/4/14 11:31	71.691	156.344	bowhead whale	swim	1	0	12
31	10/4/14 11:32	71.685	156.344	bowhead whale	rest	1	0	12
31	10/4/14 11:32	71.675	156.344	beluga	unknown	3	0	12
31	10/4/14 11:32	71.674	156.344	bowhead whale	rest	1	0	12
31	10/4/14 11:21	71.602	156.807	bowhead whale	swim	1	0	12
31	10/4/14 11:32	71.660	156.345	beluga	mill	6	1	12
31	10/4/14 11:33	71.650	156.344	bowhead whale	swim	1	0	12
31	10/4/14 11:33	71.650	156.344	beluga	swim	3	0	12
31	10/4/14 11:33	71.635	156.341	bowhead whale	swim	1	0	12
31	10/4/14 11:33	71.632	156.341	bowhead whale	swim	1	0	12
31	10/4/14 11:34	71.595	156.348	beluga	mill	1	0	12
31	10/4/14 11:35	71.547	156.351	bowhead whale	rest	1	0	12
31	10/4/14 11:36	71.533	156.353	bowhead whale	unknown	1	0	12
31	10/4/14 11:43	71.531	156.348	bowhead whale	rest	1	0	12
31	10/4/14 11:47	71.397	156.356	beluga	swim	1	0	12
31	10/4/14 11:52	71.340	155.926	bowhead whale	rest	1	0	12
31	10/4/14 11:53	71.359	155.825	beluga	swim	2	0	12
31	10/4/14 11:55	71.408	155.724	bowhead whale	mill	2	0	12
31	10/4/14 11:57	71.412	155.743	bowhead whale	unknown	1	0	12
31	10/4/14 11:57	71.416	155.767	bowhead whale	mill	3	0	12
31	10/4/14 11:58	71.413	155.778	bowhead whale	mill	3	0	12
31	10/4/14 12:02	71.420	155.712	bowhead whale	swim	1	0	12
31	10/4/14 12:04	71.478	155.694	beluga	mill	5	0	12
31	10/4/14 12:04	71.478	155.694	bowhead whale	mill	3	0	12
31	10/4/14 12:04	71.482	155.694	beluga	mill	3	0	12
31	10/4/14 12:05	71.496	155.691	beluga	mill	2	1	12
31	10/4/14 12:13	71.741	155.643	bowhead whale	rest	1	0	12
31	10/4/14 12:16	71.829	155.621	beluga	rest	1	0	12

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
31	10/4/14 12:16	71.837	155.619	beluga	rest	6	0	12
31	10/4/14 12:16	71.844	155.618	beluga	mill	3	0	12
31	10/4/14 12:16	71.847	155.618	beluga	rest	1	0	12
31	10/4/14 12:17	71.863	155.612	beluga	mill	1	0	12
31	10/4/14 12:20	71.965	155.587	beluga	swim	1	0	12
31	10/4/14 12:20	71.969	155.587	beluga	swim	23	0	12
31	10/4/14 12:20	71.970	155.586	beluga	swim	6	0	12
31	10/4/14 12:21	71.994	155.577	beluga	rest	3	0	12
31	10/4/14 12:30	71.824	155.227	beluga	mill	3	0	12
31	10/4/14 12:46	71.263	155.345	bowhead whale	feed	1	0	12
31	10/4/14 12:46	71.259	155.346	bowhead whale	feed	1	0	12
31	10/4/14 12:46	71.258	155.346	bowhead whale	feed	1	0	12
31	10/4/14 12:46	71.250	155.348	bowhead whale	feed	3	0	12
31	10/4/14 12:46	71.246	155.349	bowhead whale	feed	1	0	12
31	10/4/14 12:48	71.262	155.373	bowhead whale	mill	3	0	12
31	10/4/14 12:50	71.254	155.379	bowhead whale	feed	8	0	12
31	10/4/14 12:53	71.262	155.371	bowhead whale	unknown	1	0	12
31	10/4/14 12:54	71.273	155.346	bowhead whale	unknown	1	0	12
31	10/4/14 12:54	71.284	155.347	bowhead whale	rest	1	0	12
31	10/4/14 12:56	71.269	155.363	bowhead whale	dive	1	0	12
31	10/4/14 12:57	71.250	155.355	bowhead whale	rest	1	0	12
31	10/4/14 13:24	71.786	154.778	bowhead whale	swim	1	0	12
31	10/4/14 13:25	71.802	154.773	bowhead whale	swim	1	0	12
31	10/4/14 13:25	71.813	154.770	bowhead whale	rest	2	0	12
31	10/4/14 13:31	71.834	154.756	beluga	rest	1	0	12
31	10/4/14 13:31	71.840	154.755	beluga	mill	3	1	12
31	10/4/14 13:31	71.850	154.754	beluga	swim	3	0	12
31	10/4/14 13:31	71.856	154.753	beluga	mill	14	0	12
31	10/4/14 13:32	71.875	154.749	beluga	swim	1	0	12
31	10/4/14 13:32	71.884	154.747	beluga	mill	1	0	12
31	10/4/14 13:32	71.886	154.746	beluga	rest	2	1	12
31	10/4/14 13:33	71.894	154.745	beluga	mill	3	1	12
31	10/4/14 13:33	71.899	154.744	beluga	mill	2	0	12
31	10/4/14 13:33	71.906	154.742	beluga	mill	1	0	12
31	10/4/14 13:33	71.910	154.741	beluga	mill	5	0	12
31	10/4/14 13:34	71.927	154.735	beluga	swim	1	0	12
31	10/4/14 13:34	71.937	154.732	beluga	swim	9	0	12

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
31	10/4/14 13:34	71.942	154.731	beluga	mill	1	0	12
31	10/4/14 13:34	71.950	154.729	beluga	swim	2	0	12
31	10/4/14 13:36	71.995	154.707	beluga	swim	1	0	12
31	10/4/14 13:40	72.002	154.343	beluga	rest	1	0	12
31	10/4/14 13:40	72.002	154.310	beluga	swim	2	0	0
31	10/4/14 13:44	71.866	154.263	bowhead whale	rest	1	0	12
31	10/4/14 13:44	71.841	154.263	bowhead whale	swim	1	0	12
31	10/4/14 13:45	71.833	154.263	beluga	swim	1	0	12
31	10/4/14 13:45	71.822	154.264	bowhead whale	swim	2	0	12
31	10/4/14 13:45	71.821	154.264	bowhead whale	swim	1	0	12
31	10/4/14 13:48	71.824	154.266	bowhead whale	swim	1	0	12
31	10/4/14 14:09	71.144	154.215	bowhead whale	mill	7	0	12
31	10/4/14 14:10	71.148	154.238	bowhead whale	rest	1	0	12
31	10/4/14 14:12	71.129	154.285	bowhead whale	mill	2	0	12
31	10/4/14 14:12	71.131	154.271	bowhead whale	mill	1	0	12
31	10/4/14 14:16	71.145	154.233	bowhead whale	swim	3	0	12
31	10/4/14 14:18	71.119	154.213	bowhead whale	swim	1	0	12

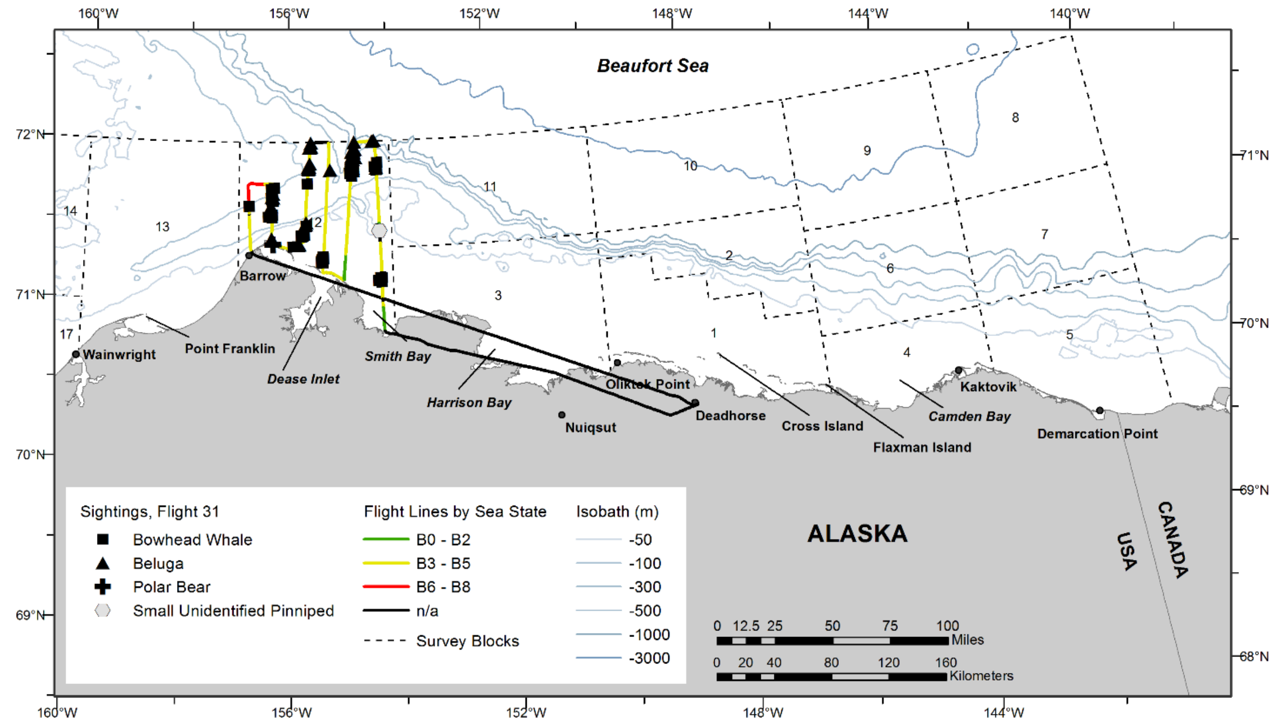

Figure B-74. ASAMM Flight 31 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

Bowhead whale and several Laridae companions southeast of Point Barrow, Alaska, during Flight 31, 4 October 2014.

5 October 2014, Flight 244

Flight was a complete survey of transects 7 and 9 and partial survey of transects 3 and 5. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with glare, haze, low ceilings, iced windows, and precipitation), and Beaufort 3-6 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales (including one calf), belugas (including one calf), and walruses.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
244	10/5/14 10:06	71.445	157.608	bowhead whale	swim	1	0	13
244	10/5/14 10:06	71.445	157.610	bowhead whale	swim	3	0	13
244	10/5/14 10:06	71.449	157.622	bowhead whale	swim	2	0	13
244	10/5/14 10:06	71.451	157.629	bowhead whale	swim	1	0	13
244	10/5/14 10:07	71.461	157.640	bowhead whale	swim	1	0	13
244	10/5/14 10:07	71.461	157.616	bowhead whale	swim	1	0	13
244	10/5/14 10:09	71.450	157.511	bowhead whale	swim	1	0	13
244	10/5/14 10:10	71.459	157.508	bowhead whale	swim	2	0	13
244	10/5/14 10:11	71.464	157.542	bowhead whale	swim	1	0	13
244	10/5/14 10:11	71.460	157.571	bowhead whale	swim	1	1	13
244	10/5/14 10:12	71.453	157.536	bowhead whale	swim	3	0	13
244	10/5/14 10:23	71.460	157.657	bowhead whale	swim	1	0	13
244	10/5/14 10:24	71.481	157.724	bowhead whale	swim	1	0	13
244	10/5/14 10:24	71.486	157.743	bowhead whale	swim	1	0	13
244	10/5/14 11:04	71.293	158.657	beluga	swim	1	0	13
244	10/5/14 11:04	71.286	158.635	beluga	swim	1	0	13
244	10/5/14 11:04	71.283	158.626	beluga	swim	2	0	13
244	10/5/14 11:04	71.281	158.618	beluga	swim	1	0	13
244	10/5/14 11:04	71.278	158.607	beluga	swim	1	0	13
244	10/5/14 11:27	71.054	159.405	beluga	swim	1	0	13
244	10/5/14 12:03	71.798	162.095	bowhead whale	dive	1	0	14
244	10/5/14 13:09	71.113	161.203	beluga	swim	1	0	14
244	10/5/14 13:09	71.110	161.191	beluga	swim	2	1	14
244	10/5/14 13:09	71.108	161.185	beluga	swim	5	0	14

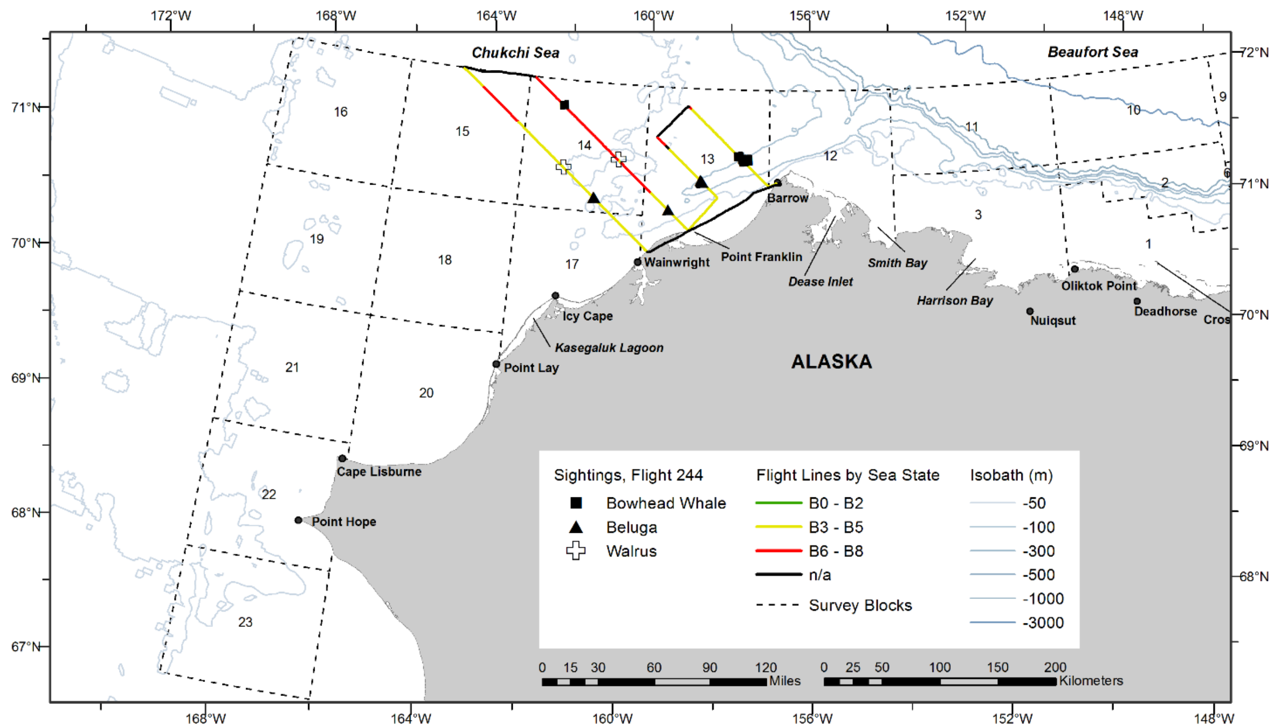

Figure B-75. ASAMM Flight 244 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

5 October 2014, Flight 32

Flight was a survey of portions of blocks 5 and 7. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with low ceilings, glare, and fog), and Beaufort 2-4 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales, belugas, one unidentified pinniped, small unidentified pinnipeds, and one polar bear.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
32	10/5/14 11:12	70.099	142.715	bowhead whale	swim	1	0	5
32	10/5/14 12:03	70.774	142.186	beluga	swim	1	0	7
32	10/5/14 12:03	70.770	142.187	beluga	rest	1	0	7
32	10/5/14 12:12	70.476	142.273	beluga	rest	1	0	5
32	10/5/14 12:28	69.996	142.421	bowhead whale	swim	1	0	5
32	10/5/14 12:29	70.008	142.440	bowhead whale	swim	1	0	5
32	10/5/14 13:09	70.539	141.661	beluga	rest	1	0	7
32	10/5/14 13:10	70.554	141.661	beluga	swim	1	0	7
32	10/5/14 13:14	70.689	141.670	beluga	swim	1	0	7
32	10/5/14 13:14	70.702	141.671	beluga	swim	1	0	7
32	10/5/14 13:23	70.953	141.684	beluga	rest	1	0	7
32	10/5/14 13:23	70.961	141.684	beluga	rest	1	0	7

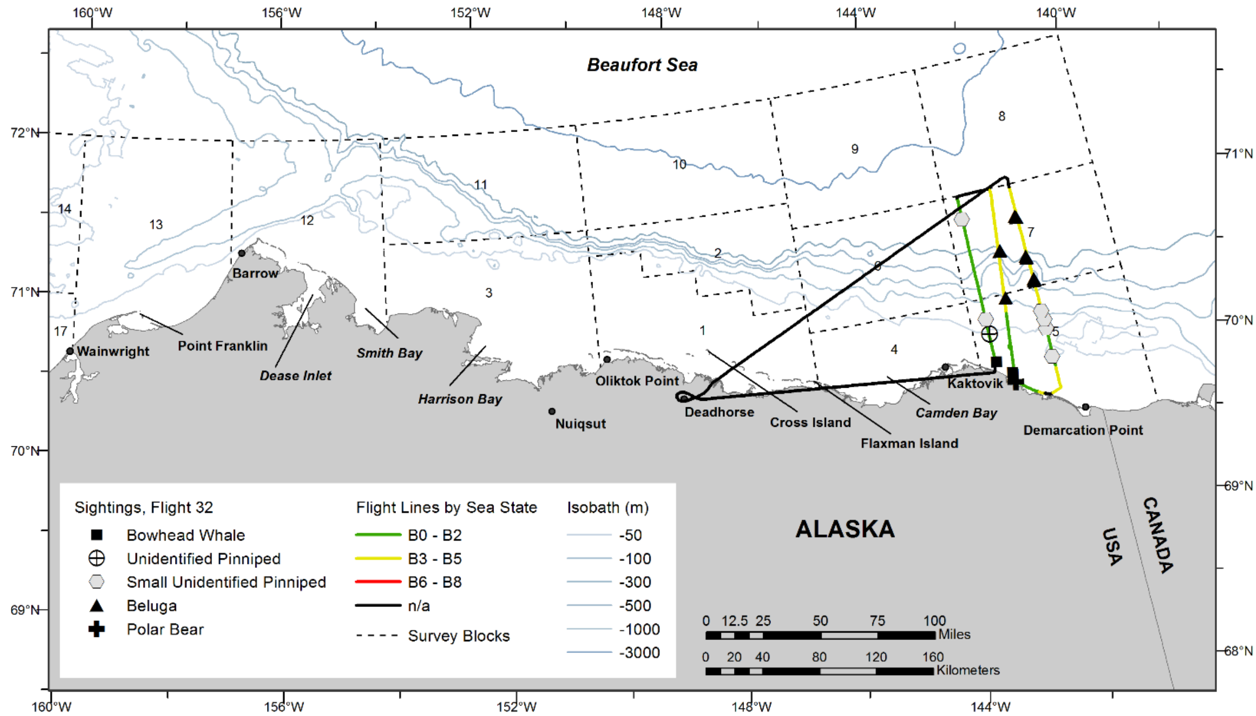

Figure B-76. ASAMM Flight 32 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

6 October 2014, Flight 245

Flight was a complete survey of transects 11 and 13 and the coastal transect from southwest of Wainwright to Point Barrow. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with glare, low ceilings, iced windows, and precipitation), and Beaufort 2-5 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales, one gray whale carcass, belugas (including five calves), walruses (including one carcass), unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
245	10/6/14 15:35	70.885	163.644	bowhead whale	swim	1	0	18
245	10/6/14 15:38	70.930	163.813	bowhead whale	swim	1	0	18
245	10/6/14 15:38	70.933	163.824	beluga	swim	1	0	18
245	10/6/14 15:58	71.293	165.295	beluga	swim	2	1	15
245	10/6/14 16:00	71.337	165.475	beluga	swim	2	1	15
245	10/6/14 16:00	71.340	165.485	beluga	swim	1	0	15
245	10/6/14 16:01	71.362	165.580	beluga	swim	2	1	15
245	10/6/14 16:03	71.389	165.698	beluga	swim	2	0	15
245	10/6/14 16:14	71.608	166.646	beluga	swim	1	0	16
245	10/6/14 16:14	71.609	166.649	beluga	swim	1	0	16
245	10/6/14 16:14	71.610	166.657	beluga	swim	2	1	16
245	10/6/14 16:17	71.648	166.825	beluga	swim	1	0	16
245	10/6/14 16:26	71.825	167.643	beluga	swim	1	0	16
245	10/6/14 16:26	71.827	167.653	bowhead whale	swim	1	0	16
245	10/6/14 16:28	71.859	167.795	beluga	swim	2	0	16
245	10/6/14 16:28	71.864	167.820	beluga	swim	5	0	16
245	10/6/14 16:55	71.901	166.091	beluga	swim	1	0	16
245	10/6/14 16:55	71.897	166.071	beluga	swim	1	0	16
245	10/6/14 16:55	71.895	166.064	beluga	swim	1	0	16
245	10/6/14 16:55	71.890	166.040	beluga	swim	1	0	16
245	10/6/14 17:02	71.757	165.459	bowhead whale	rest	1	0	15
245	10/6/14 16:26	71.829	167.659	beluga	swim	1	0	16
245	10/6/14 16:26	71.831	167.670	beluga	swim	2	0	16
245	10/6/14 16:27	71.833	167.680	beluga	swim	2	0	16
245	10/6/14 16:27	71.841	167.716	beluga	tail slap	1	0	16
245	10/6/14 16:28	71.852	167.762	beluga	swim	1	0	16
245	10/6/14 16:52	71.946	166.295	beluga	rest	1	0	16
245	10/6/14 17:02	71.756	165.452	bowhead whale	mill	1	0	15
245	10/6/14 17:42	71.030	162.531	beluga	swim	2	0	14

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
245	10/6/14 17:43	71.025	162.512	beluga	swim	1	0	14
245	10/6/14 17:43	71.024	162.510	beluga	rest	1	0	14
245	10/6/14 17:46	70.959	162.269	beluga	swim	1	0	17
245	10/6/14 17:43	71.021	162.497	beluga	swim	1	0	14
245	10/6/14 17:43	71.020	162.494	beluga	swim	1	0	14
245	10/6/14 17:43	71.015	162.473	beluga	swim	1	0	14
245	10/6/14 17:43	71.013	162.469	beluga	swim	2	1	14
245	10/6/14 17:43	71.007	162.445	beluga	swim	1	0	14
245	10/6/14 19:05	71.292	156.813	gray whale	dead	1	0	12

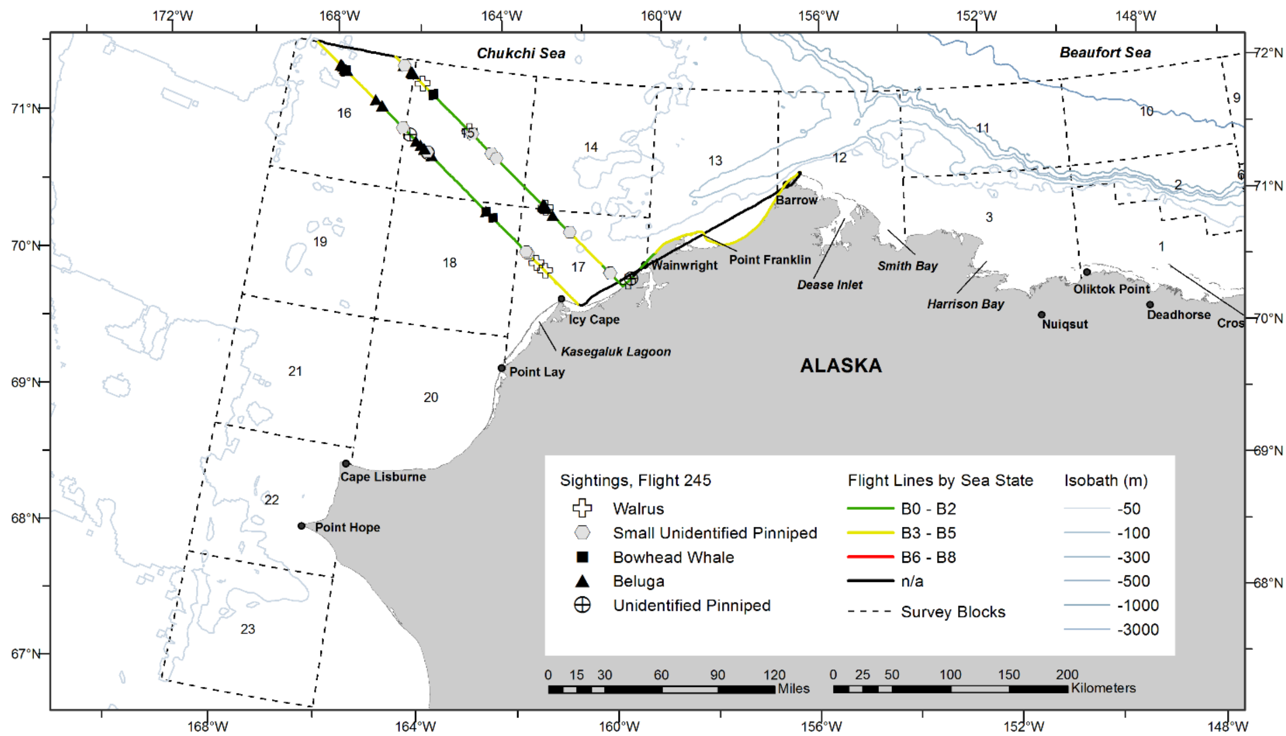

Figure B-77. ASAMM Flight 245 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

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6 October 2014, Flight 33

Flight was a survey of portions of block 3. Survey conditions included partly cloudy skies, 0-10 km visibility (with fog, haze, glare, precipitation, and low ceiling), and Beaufort 3-7 sea states. Sea ice cover was 0-90% new ice in the area surveyed, and was limited to nearshore areas. Sightings included bowhead whales.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
33	10/6/14 12:27	71.201	153.019	bowhead whale	breach	1	0	3
33	10/6/14 13:50	71.086	151.181	bowhead whale	breach	1	0	3

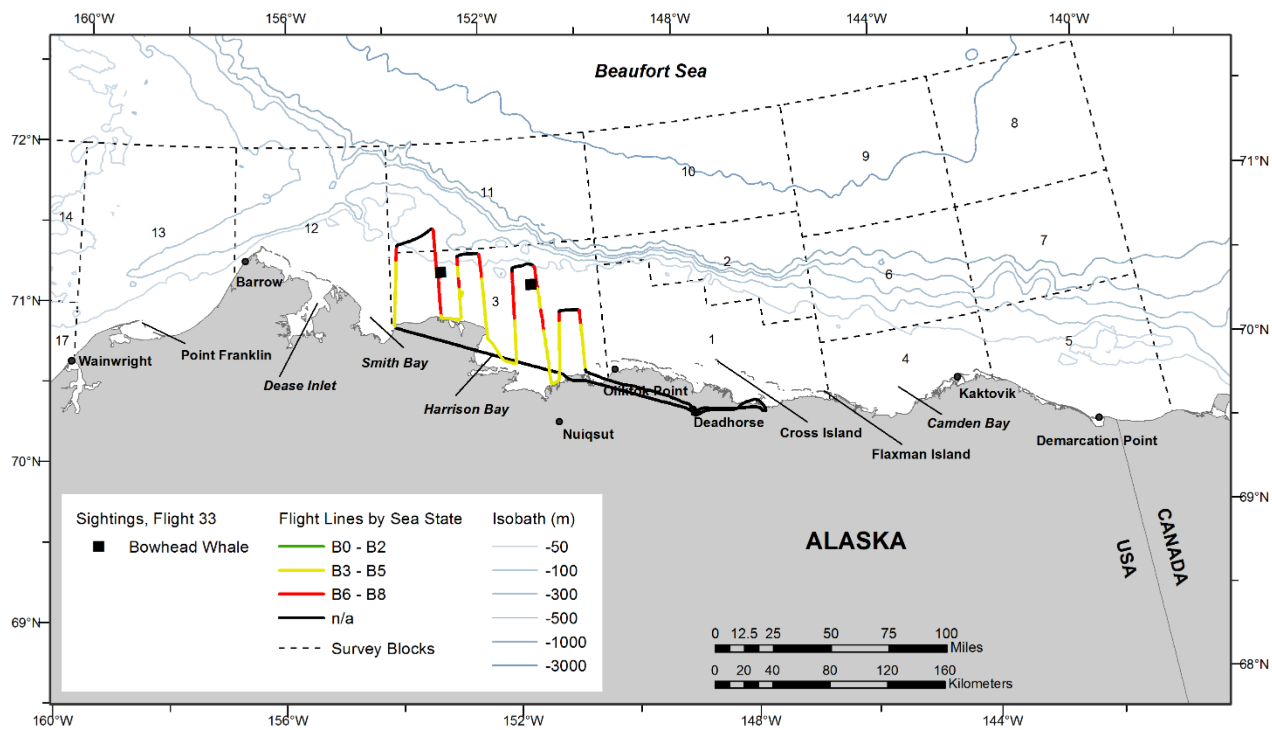

Figure B-78. ASAMM Flight 33 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

7 October 2014, Flight 246

Flight was a complete survey of transects 4, 6, 8, and 10. Survey conditions included clear to overcast skies, 0-10 km visibility (with fog, glare, low ceilings, and precipitation), and Beaufort 2-4 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales (including one calf), one gray whale, belugas (including two calves), walruses, unidentified pinnipeds, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
246	10/7/14 11:01	71.617	163.975	beluga	swim	1	0	15
246	10/7/14 11:05	71.700	164.318	beluga	swim	1	0	15
246	10/7/14 11:32	72.001	164.098	bowhead whale	rest	1	0	0
246	10/7/14 11:33	72.000	163.885	bowhead whale	swim	1	0	0
246	10/7/14 12:01	71.568	162.065	beluga	swim	2	0	14
246	10/7/14 12:01	71.567	162.059	bowhead whale	swim	1	0	14
246	10/7/14 12:07	71.562	162.037	bowhead whale	rest	1	0	14
246	10/7/14 11:29	72.002	164.494	bowhead whale	swim	1	0	0
246	10/7/14 11:46	71.762	162.817	beluga	swim	1	0	14
246	10/7/14 12:22	71.234	160.830	beluga	swim	2	0	14
246	10/7/14 12:22	71.232	160.823	beluga	swim	3	1	14
246	10/7/14 12:23	71.230	160.815	beluga	swim	3	1	14
246	10/7/14 12:23	71.220	160.782	beluga	swim	2	0	14
246	10/7/14 12:20	71.292	161.041	beluga	swim	4	0	14
246	10/7/14 12:23	71.217	160.772	beluga	swim	2	0	14
246	10/7/14 12:24	71.207	160.737	beluga	swim	1	0	14
246	10/7/14 12:25	71.186	160.662	beluga	swim	2	0	14
246	10/7/14 12:25	71.184	160.655	beluga	swim	1	0	14
246	10/7/14 14:29	71.396	158.224	bowhead whale	swim	2	0	13
246	10/7/14 14:32	71.343	158.045	beluga	dive	1	0	13
246	10/7/14 14:32	71.341	158.040	beluga	swim	7	0	13
246	10/7/14 14:19	71.600	158.911	bowhead whale	swim	2	1	13
246	10/7/14 14:31	71.359	158.097	beluga	swim	3	0	13
246	10/7/14 14:31	71.355	158.085	beluga	swim	2	0	13
246	10/7/14 14:31	71.353	158.077	beluga	swim	6	0	13
246	10/7/14 14:31	71.351	158.072	beluga	swim	3	0	13
246	10/7/14 14:42	71.103	157.274	gray whale	swim	1	0	13

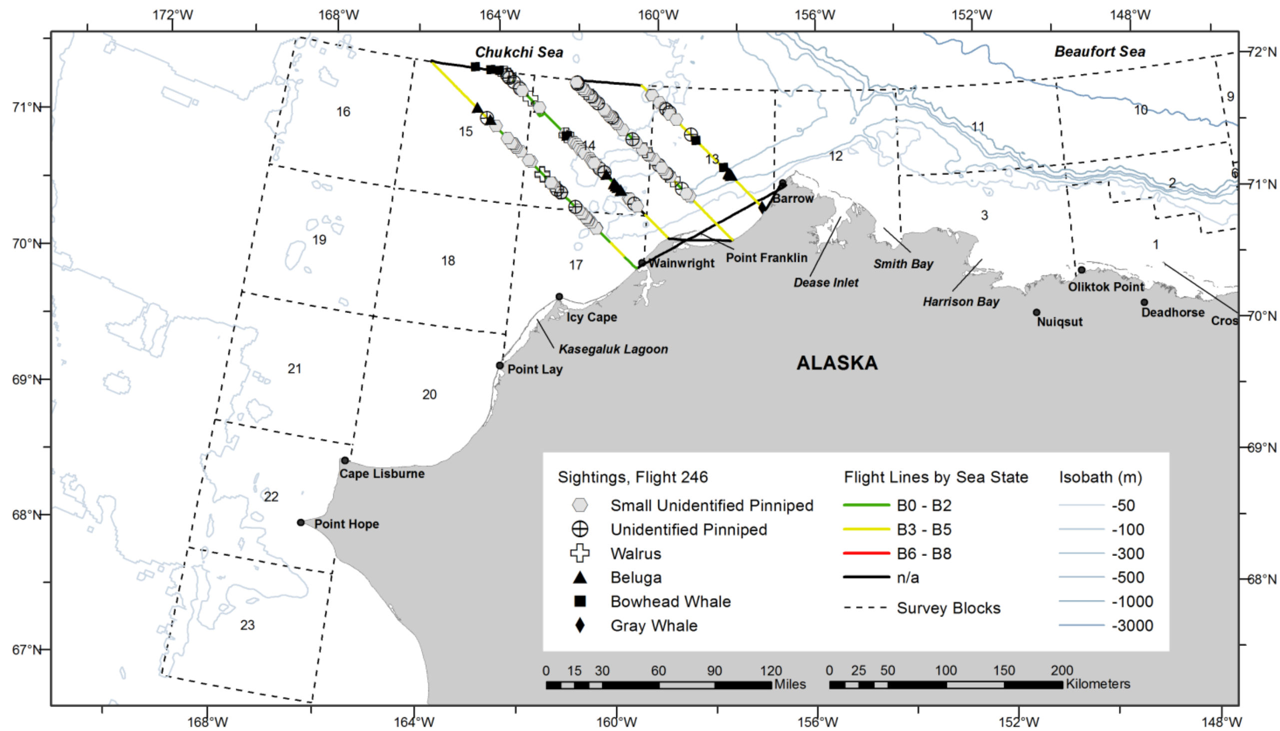

Figure B-79. ASAMM Flight 246 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

7 October 2014, Flight 34

Flight was a survey of portions of blocks 1 and 11. Survey conditions included partly cloudy skies, 0-10 km visibility (with precipitation, low ceilings, glare, haze, and fog), and Beaufort 2-7 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales and belugas (including five calves).

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
34	10/7/14 11:31	71.758	153.397	beluga	swim	2	0	11
34	10/7/14 11:32	71.769	153.387	beluga	swim	1	0	11
34	10/7/14 11:32	71.771	153.385	beluga	mill	12	1	11
34	10/7/14 11:32	71.782	153.382	beluga	swim	6	1	11
34	10/7/14 11:32	71.792	153.383	beluga	mill	4	0	11
34	10/7/14 11:33	71.808	153.387	beluga	swim	1	0	11
34	10/7/14 11:34	71.862	153.404	beluga	swim	1	0	11
34	10/7/14 11:35	71.873	153.404	beluga	mill	2	0	11
34	10/7/14 11:35	71.875	153.404	beluga	mill	2	0	11
34	10/7/14 11:35	71.877	153.405	beluga	mill	3	0	11
34	10/7/14 11:36	71.905	153.410	beluga	mill	1	0	11
34	10/7/14 11:38	71.988	153.412	beluga	swim	3	0	11
34	10/7/14 11:39	72.007	153.398	beluga	mill	1	0	0
34	10/7/14 11:39	72.004	153.363	beluga	mill	1	0	0
34	10/7/14 11:40	72.002	153.343	beluga	mill	1	0	0
34	10/7/14 11:43	71.918	153.204	beluga	mill	1	0	11
34	10/7/14 11:44	71.873	153.198	beluga	swim	2	0	11
34	10/7/14 11:44	71.873	153.198	beluga	swim	2	0	11
34	10/7/14 11:44	71.855	153.194	beluga	rest	2	1	11
34	10/7/14 11:45	71.828	153.189	beluga	swim	2	0	11
34	10/7/14 11:45	71.817	153.187	beluga	swim	1	0	11
34	10/7/14 11:46	71.794	153.182	beluga	swim	2	1	11
34	10/7/14 11:46	71.784	153.181	beluga	swim	1	0	11
34	10/7/14 11:47	71.770	153.180	beluga	rest	1	0	11
34	10/7/14 11:47	71.769	153.179	beluga	mill	1	0	11
34	10/7/14 11:47	71.754	153.178	beluga	swim	2	0	11
34	10/7/14 11:47	71.746	153.177	beluga	swim	1	0	11
34	10/7/14 11:47	71.743	153.176	beluga	swim	1	0	11
34	10/7/14 11:57	71.419	153.126	bowhead whale	swim	1	0	11
34	10/7/14 11:57	71.414	153.125	bowhead whale	swim	1	0	11
34	10/7/14 12:30	71.699	152.698	beluga	rest	2	1	11

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
34	10/7/14 12:30	71.700	152.698	beluga	swim	1	0	11
34	10/7/14 12:30	71.714	152.699	beluga	mill	1	0	11
34	10/7/14 12:31	71.720	152.700	beluga	swim	1	0	11
34	10/7/14 12:31	71.720	152.700	beluga	swim	1	0	11
34	10/7/14 12:37	71.893	152.704	beluga	rest	1	0	11
34	10/7/14 12:37	71.900	152.706	beluga	rest	1	0	11
34	10/7/14 12:29	71.662	152.697	beluga	mill	2	0	11
34	10/7/14 12:29	71.667	152.696	beluga	rest	1	0	11
34	10/7/14 12:29	71.668	152.696	beluga	mill	2	0	11
34	10/7/14 12:31	71.739	152.699	beluga	swim	1	0	11
34	10/7/14 12:37	71.902	152.706	beluga	swim	8	0	11
34	10/7/14 12:57	71.532	152.284	beluga	swim	1	0	11
34	10/7/14 12:59	71.447	152.273	beluga	swim	1	0	11
34	10/7/14 13:10	71.336	151.576	bowhead whale	swim	1	0	11
34	10/7/14 13:48	71.320	150.421	beluga	swim	1	0	3

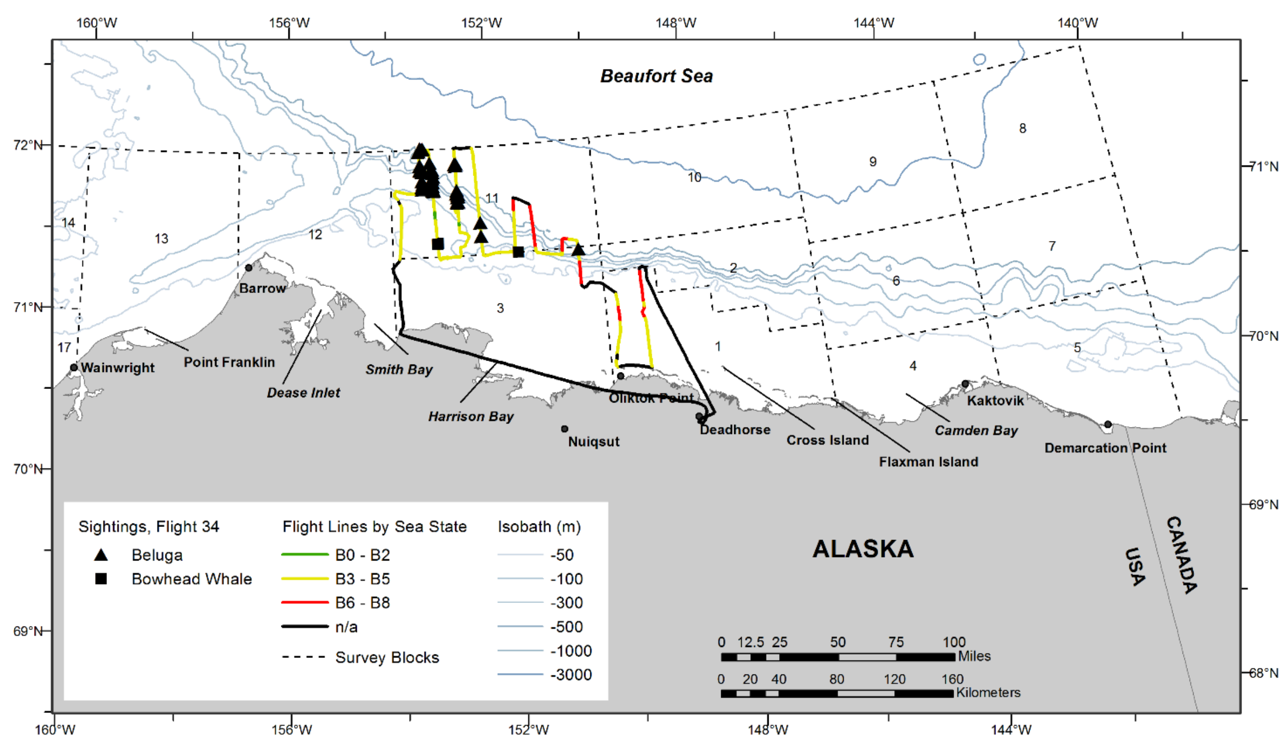

Figure B-80. ASAMM Flight 34 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

8 October 2014, Flight 247

Flight was a complete survey of transects 14 and 16 and search effort from Point Franklin to Barrow. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with glare, haze, low ceilings, iced windows, and precipitation), and Beaufort 2-5 sea states. There was no sea ice observed in the area surveyed. Sightings included one bowhead whale, gray whales, belugas, unidentified cetaceans, walruses, one unidentified pinniped, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
247	10/8/14 12:43	71.702	168.032	beluga	swim	1	0	16
247	10/8/14 12:51	71.541	167.288	unid cetacean	swim	1	0	16
247	10/8/14 12:44	71.679	167.927	beluga	mill	1	0	16
247	10/8/14 12:44	71.677	167.918	beluga	swim	1	0	16
247	10/8/14 13:01	71.557	167.308	bowhead whale	swim	1	0	16
247	10/8/14 13:16	71.305	166.240	beluga	swim	1	0	16
247	10/8/14 13:24	71.149	165.575	beluga	swim	2	0	15
247	10/8/14 13:02	71.561	167.257	unid cetacean	dive	1	0	16
247	10/8/14 13:14	71.339	166.387	beluga	swim	1	0	16
247	10/8/14 13:14	71.334	166.366	beluga	swim	1	0	16
247	10/8/14 13:15	71.330	166.348	beluga	swim	1	0	16
247	10/8/14 14:58	71.124	157.681	gray whale	feed	1	0	13
247	10/8/14 14:46	71.010	158.305	gray whale	feed	1	0	13
247	10/8/14 14:46	71.012	158.295	gray whale	swim	1	0	13
247	10/8/14 14:46	71.016	158.279	gray whale	swim	1	0	13
247	10/8/14 14:46	71.017	158.270	gray whale	feed	2	0	13
247	10/8/14 14:46	71.020	158.256	gray whale	feed	2	0	13
247	10/8/14 14:47	71.027	158.215	gray whale	feed	1	0	13
247	10/8/14 14:48	71.045	158.120	gray whale	feed	1	0	13
247	10/8/14 14:51	71.090	157.868	gray whale	feed	1	0	13
247	10/8/14 14:53	71.093	157.906	gray whale	feed	2	0	13

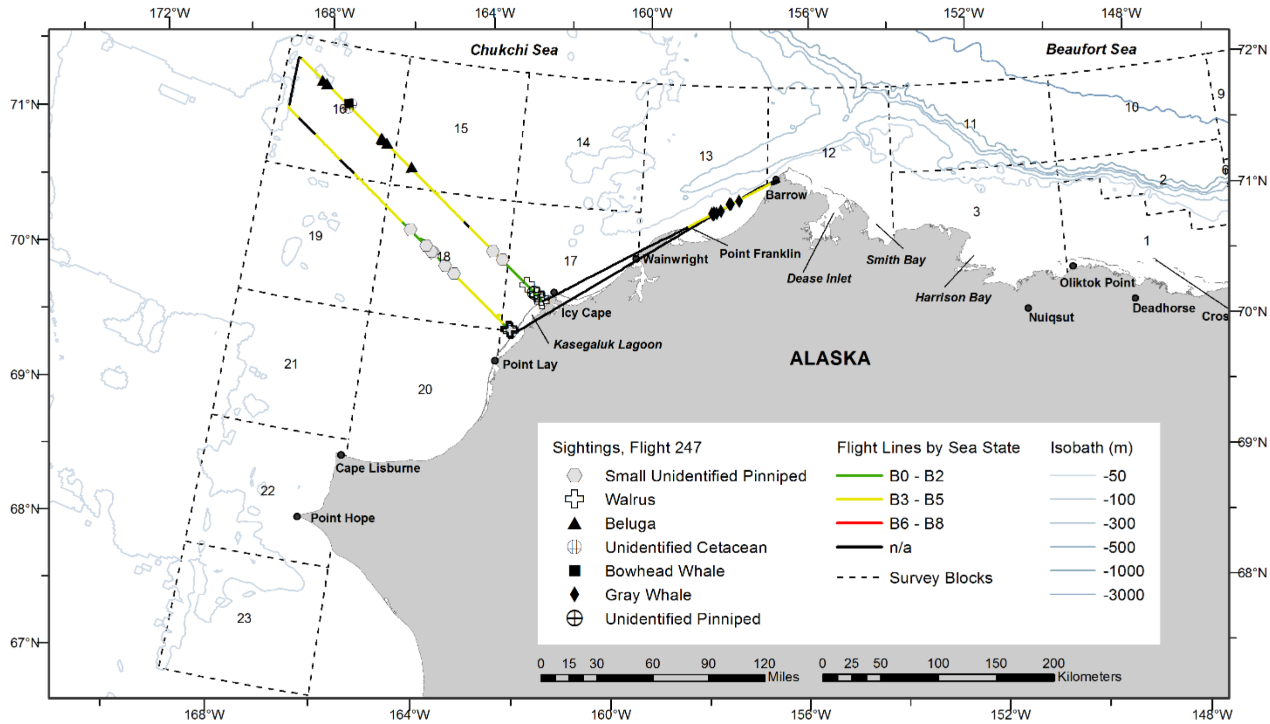

Figure B-81. ASAMM Flight 247 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

9 October 2014, Flight 248

Flight was a complete survey of transects 19 and 20. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with glare, haze, low ceilings, iced windows, and precipitation), and Beaufort 2-5 sea states. There was no sea ice observed in the area surveyed. Sightings included one unidentified cetacean, walruses, one unidentified pinniped, and small unidentified pinnipeds.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
248	10/9/14 13:24	70.340	168.364	unid cetacean	swim	1	0	19

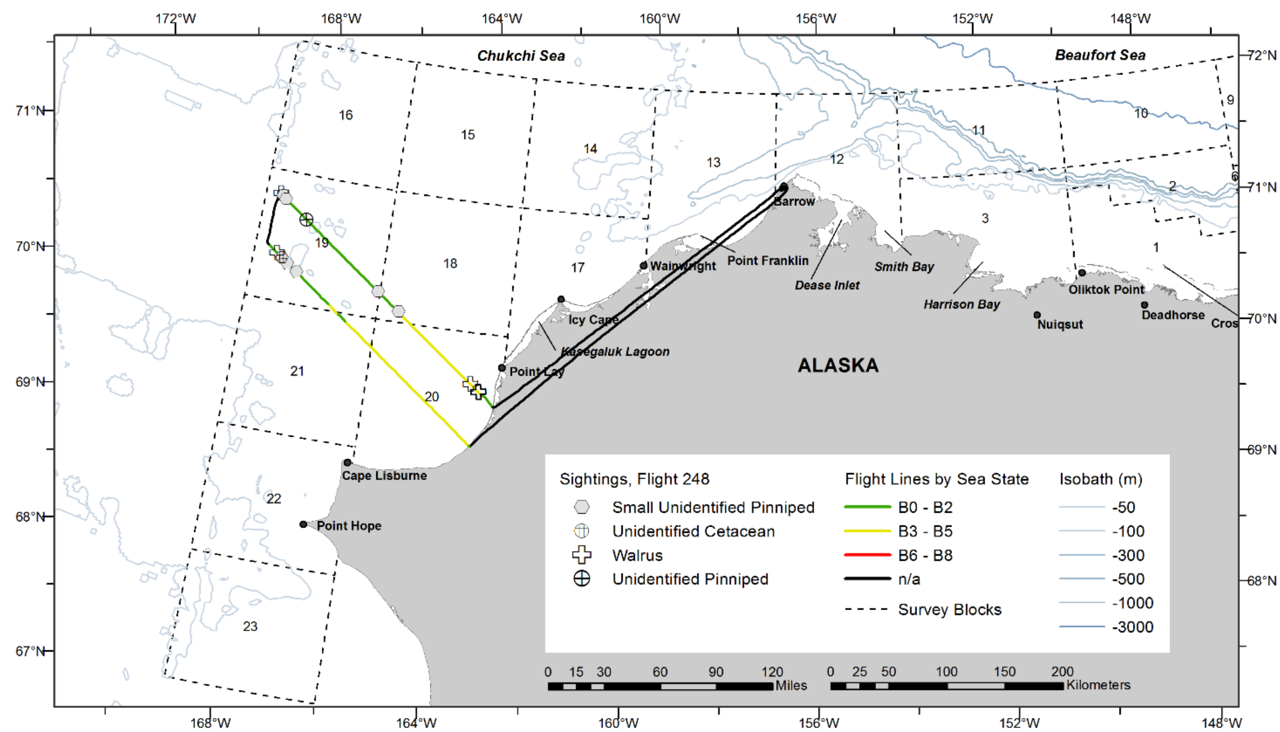

Figure B-82. ASAMM Flight 248 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

12 October 2014, Flight 249

Flight was a partial survey of transect 3 and portions of block 12. Survey conditions included overcast skies, 0-10 km (with low ceilings, iced windows, and precipitation), and Beaufort 4-6 sea states. There was no sea ice observed in the area surveyed. Sightings included bowhead whales.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
249	10/12/14 12:13	71.433	156.602	bowhead whale	swim	1	0	12
249	10/12/14 12:26	71.286	157.100	bowhead whale	rest	1	0	13
249	10/12/14 12:41	71.476	157.407	bowhead whale	swim	4	0	13

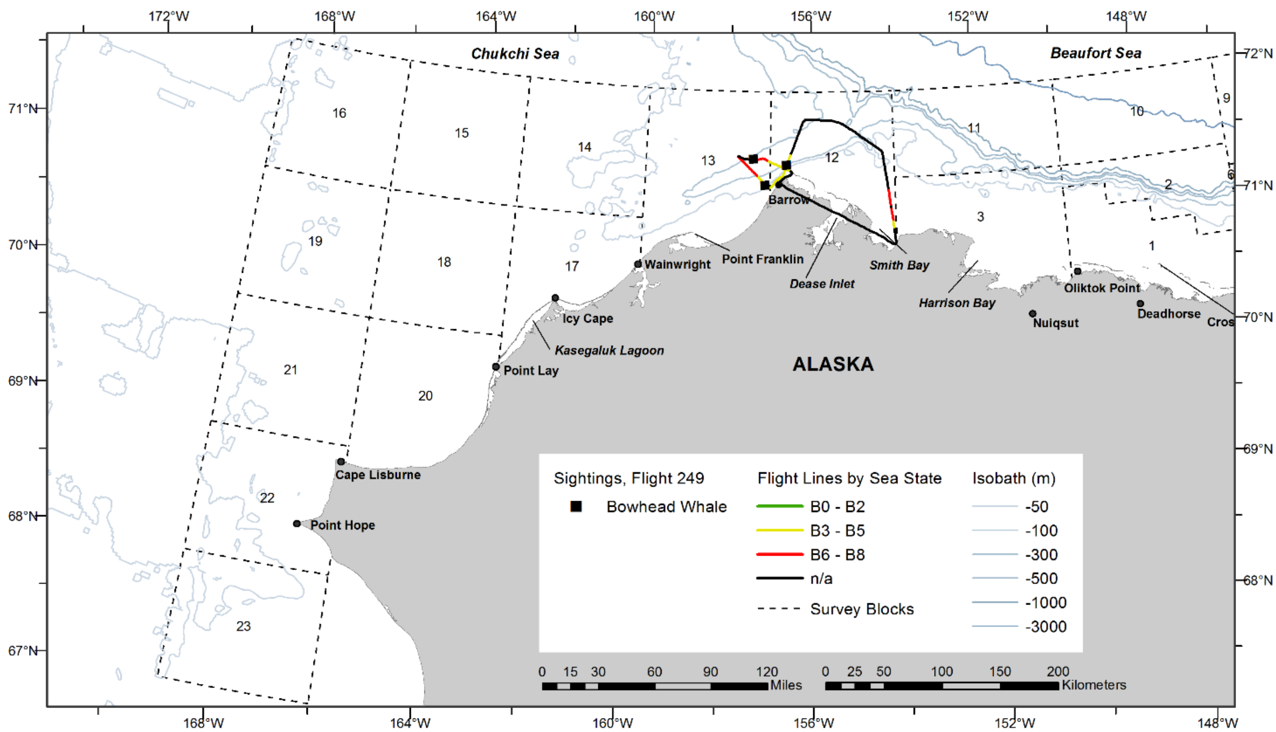

Figure B-83. ASAMM Flight 249 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

13 October 2014, Flight 250

Flight was the coastal transect from Barrow to Icy Cape. Survey conditions included overcast skies, 1-5 km visibility (with low ceilings, iced windows, and precipitation), and Beaufort 4-7 sea states. There was no sea ice observed in the area surveyed. No sightings were observed.

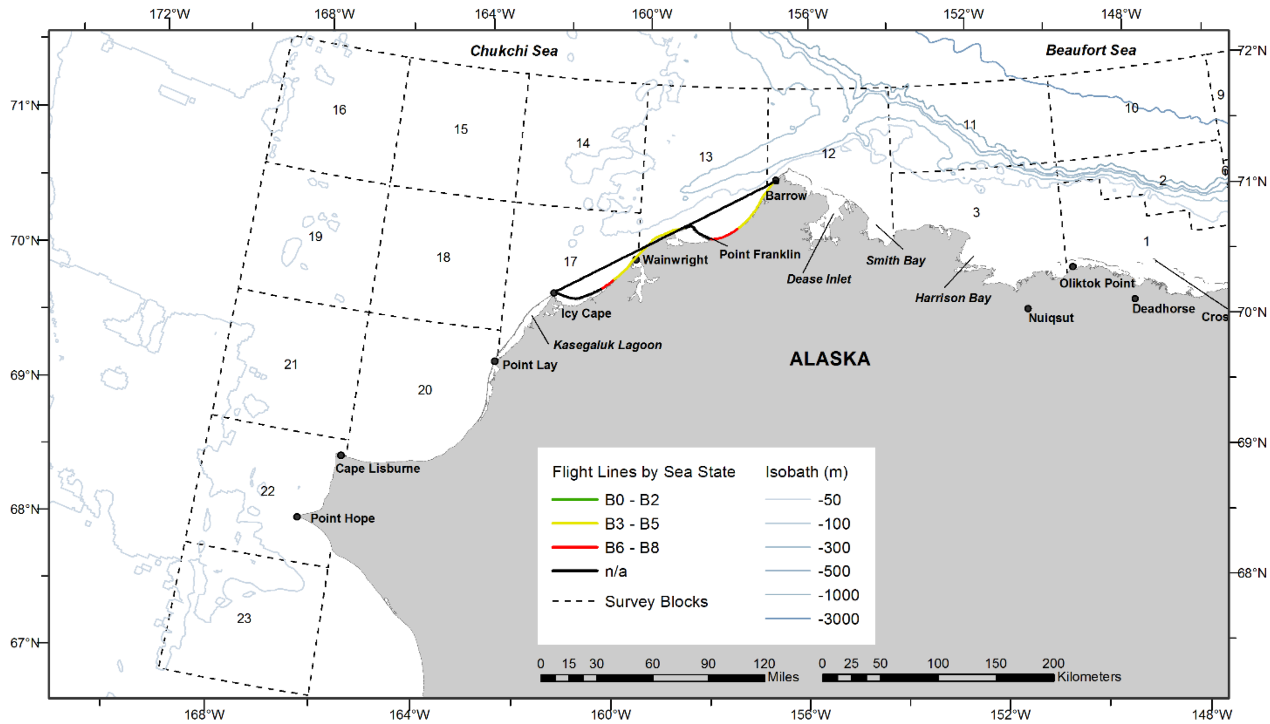

Figure B-84. ASAMM Flight 250 survey track, depicted by sea state.

24 October 2014, Flight 251

Flight was the coastal transect from south of Point Hope to Point Barrow. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with glare, haze, low ceilings, and precipitation), and Beaufort 1-5 sea states. Sea ice cover was 0-95% grease/new and new/broken floe in the area surveyed. Sightings included unidentified pinnipeds.

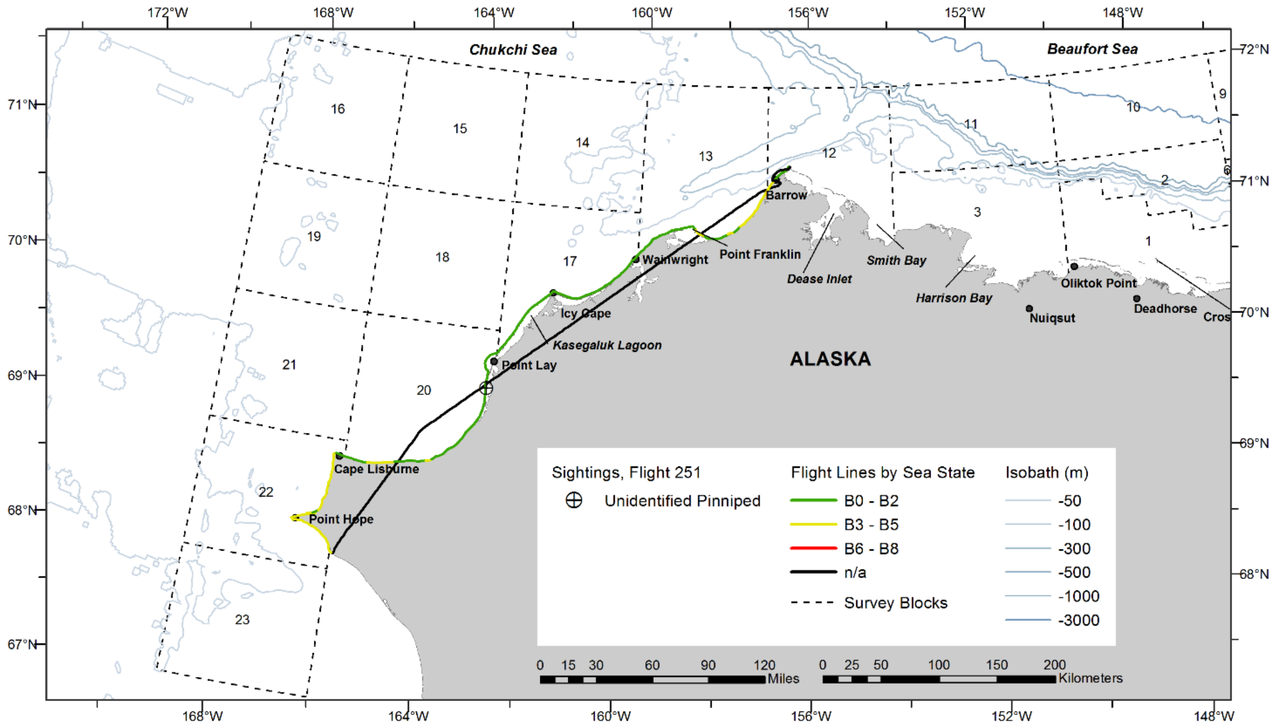

Figure B-85. ASAMM Flight 251 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

25 October 2014, Flight 252

Flight was a survey of portions of blocks 1, 2, 4, and 6. Survey conditions included clear to overcast skies, no visibility to unlimited visibility (with glare, low ceilings, and iced windows), and Beaufort 1-5 sea states. Sea ice cover was 0-98% grease/new and new/broken floe in the area surveyed. Sightings included belugas, one unidentified pinniped, and one small unidentified pinniped.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
252	10/25/14 13:38	70.959	146.282	beluga	swim	1	0	2
252	10/25/14 13:39	70.970	146.285	beluga	swim	1	0	2

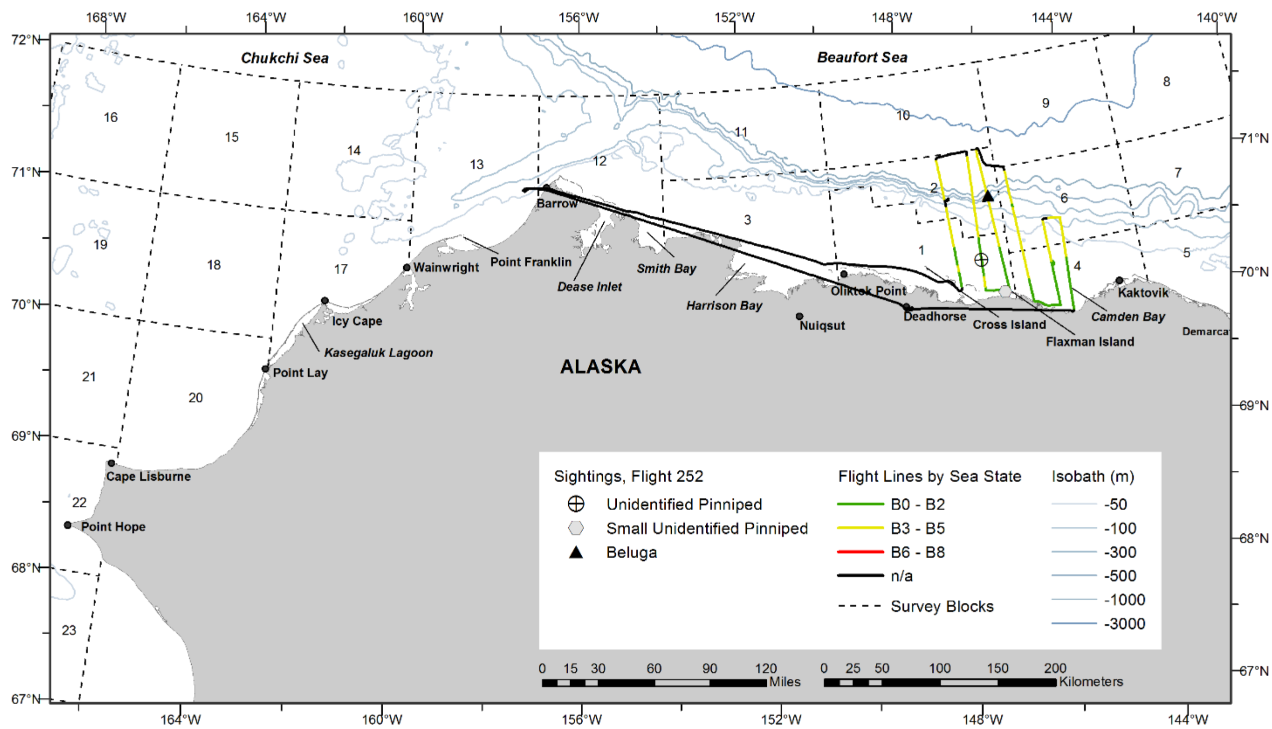

Figure B-86. ASAMM Flight 252 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

26 October 2014, Flight 253

Flight was a survey of portions of blocks 3 and 11. Survey conditions included partly cloudy to overcast skies, 0-10 km (with fog, haze, glare, low ceilings, and precipitation), and Beaufort 0-7 sea states. Sea ice cover was 0-100% grease/new, new/broken floe, and shorefast ice in the area surveyed. Sightings included one bowhead whale, belugas, one small unidentified pinniped, and polar bears.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
253	10/26/14 13:09	71.453	151.587	beluga	rest	1	0	11
253	10/26/14 15:40	71.026	150.589	bowhead whale	tail slap	1	0	3
253	10/26/14 15:56	71.368	150.620	beluga	swim	1	0	11
253	10/26/14 16:23	71.262	150.229	beluga	swim	2	0	3
253	10/26/14 16:23	71.266	150.229	beluga	swim	3	0	3

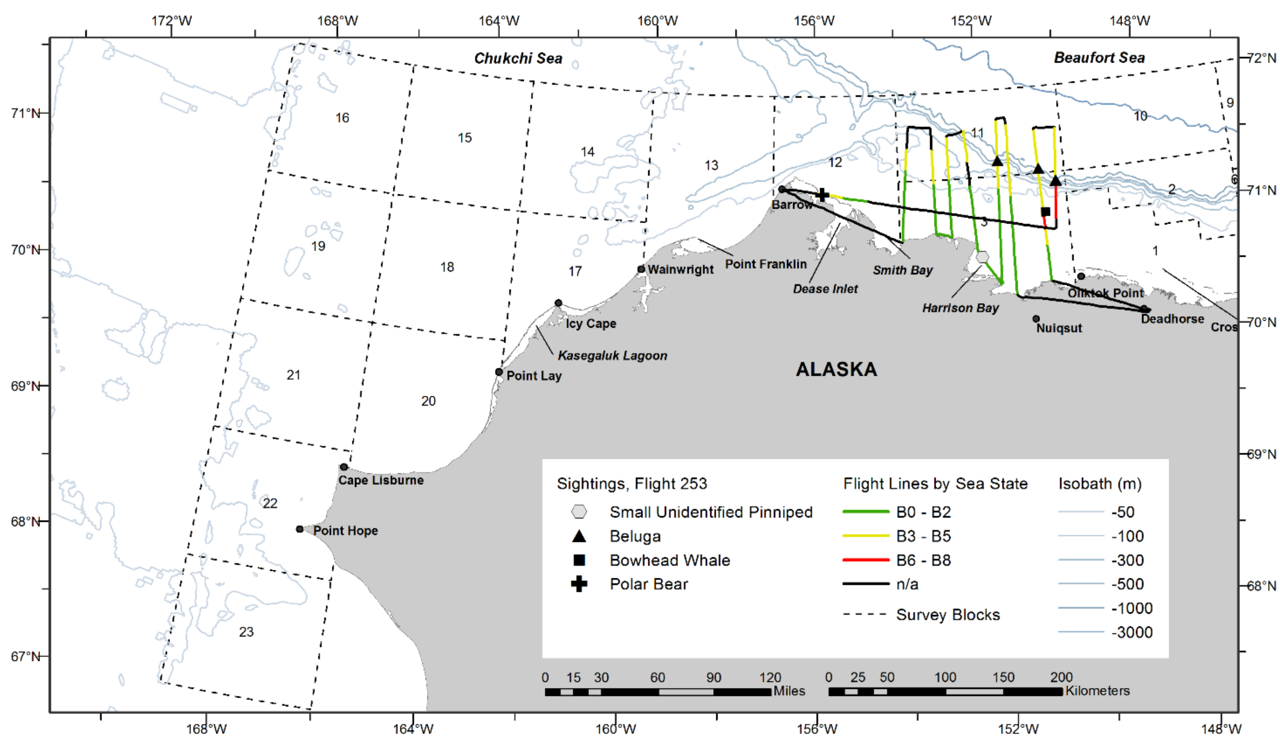

Figure B-87. ASAMM Flight 253 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

27 October 2014, Flight 254

Flight was a survey of portions of blocks 3, 11, and 12. Survey conditions included partly cloudy to overcast skies, <1 km to unlimited visibility (with fog, haze, glare, low ceilings, and precipitation), and Beaufort 1-6 sea states. Sea ice cover was 0-100% grease/new, new/broken floe, and shorefast ice in the area surveyed. Sightings included belugas and one small unidentified pinniped.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
254	10/27/14 13:42	72.001	154.808	beluga	swim	1	0	12
254	10/27/14 13:42	72.000	154.755	beluga	swim	1	0	0
254	10/27/14 13:42	72.000	154.746	beluga	swim	1	0	0
254	10/27/14 13:42	72.000	154.730	beluga	swim	1	0	0
254	10/27/14 14:07	71.366	154.186	beluga	rest	1	0	12
254	10/27/14 13:39	71.952	154.917	beluga	swim	1	0	12
254	10/27/14 13:42	72.001	154.813	beluga	swim	1	0	0

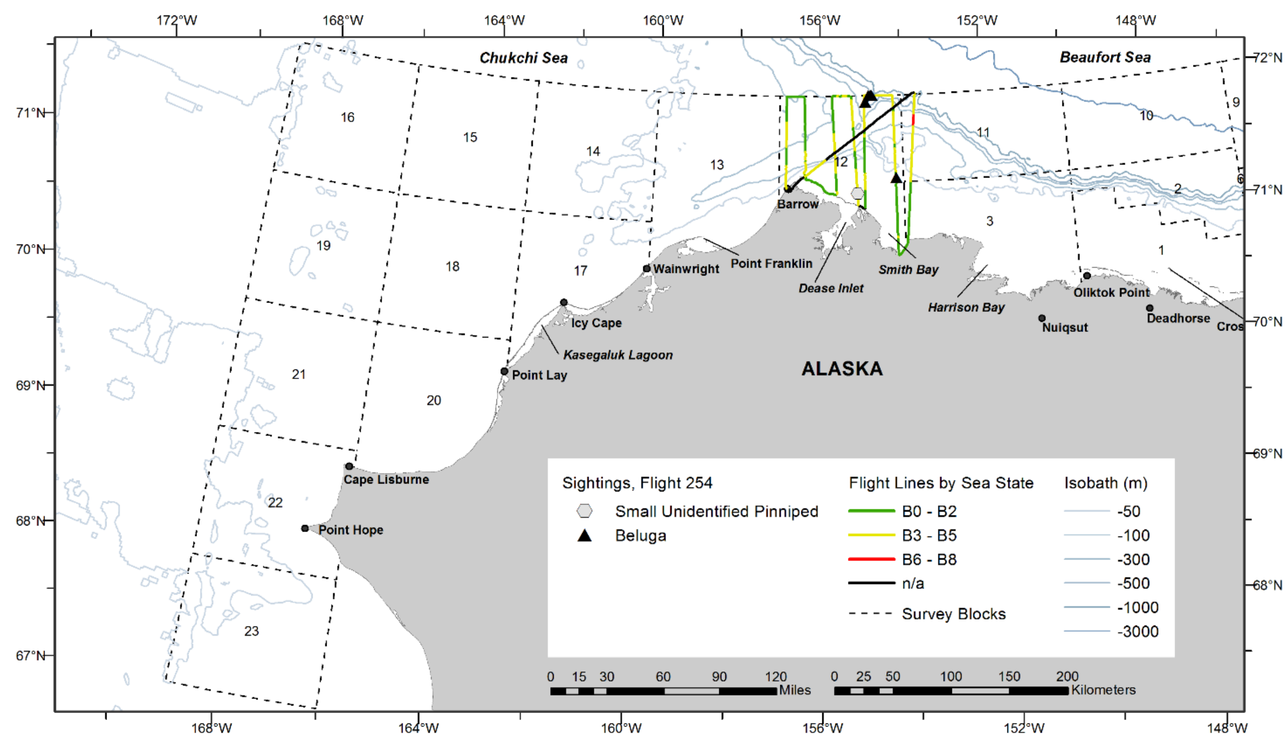

Figure B-88. ASAMM Flight 254 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

28 October 2014, Flight 255

Flight was a complete survey of transect 7 and partial survey of transects 8, 9, and 11. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with fog, haze, glare, low ceilings, iced windows, and precipitation), and Beaufort 3-6 sea states. Sea ice cover was 0-90% grease/new ice in the area surveyed. Sightings included bowhead whales.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
255	10/28/14 13:20	71.899	163.926	bowhead whale	rest	1	0	15
255	10/28/14 13:24	71.917	163.920	bowhead whale	rest	1	0	15
255	10/28/14 13:30	71.921	163.819	bowhead whale	rest	1	0	15

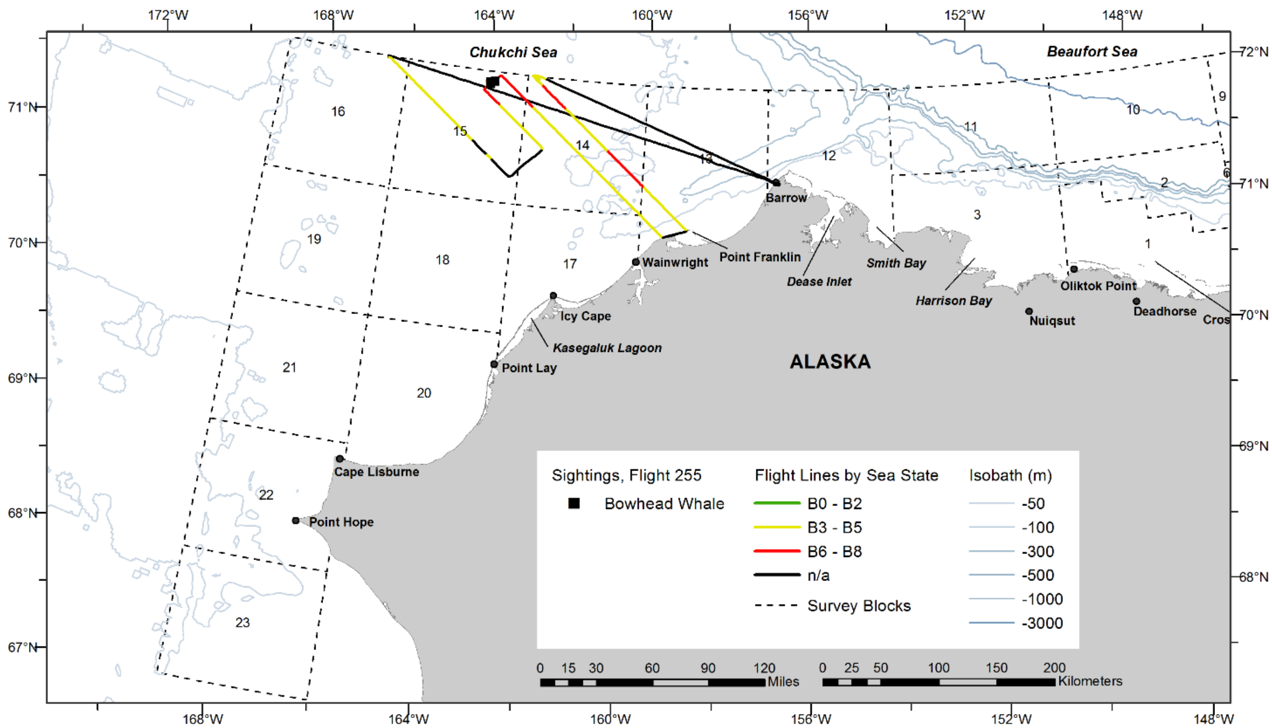

Figure B-89. ASAMM Flight 255 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

29 October 2014, Flight 256

Flight was a partial survey of transects 3, 4, 5, 6, 9, and 12. Survey conditions included partly cloudy to overcast skies, 0-10 km visibility (with haze, glare, low ceilings, iced windows, and precipitation), and Beaufort 1-7 sea states. Sea ice cover was 0-95% grease/new and broken floe ice in the area surveyed. Sightings included belugas, one unidentified marine mammal, and one polar bear.

Cetacean sightings only, all effort (transect, search, circling):

Flight No.	Date/Time (AK Local)	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
256	10/29/14 12:09	71.159	158.983	beluga	swim	1	0	13
256	10/29/14 12:09	71.151	158.960	beluga	swim	3	0	13
256	10/29/14 12:09	71.148	158.948	beluga	swim	1	0	13
256	10/29/14 12:43	70.928	160.545	beluga	swim	2	0	17
256	10/29/14 12:43	70.933	160.560	beluga	swim	1	0	17
256	10/29/14 12:43	70.933	160.560	beluga	swim	1	0	17
256	10/29/14 14:51	71.369	158.132	unid marine mammal	rest	1	0	13

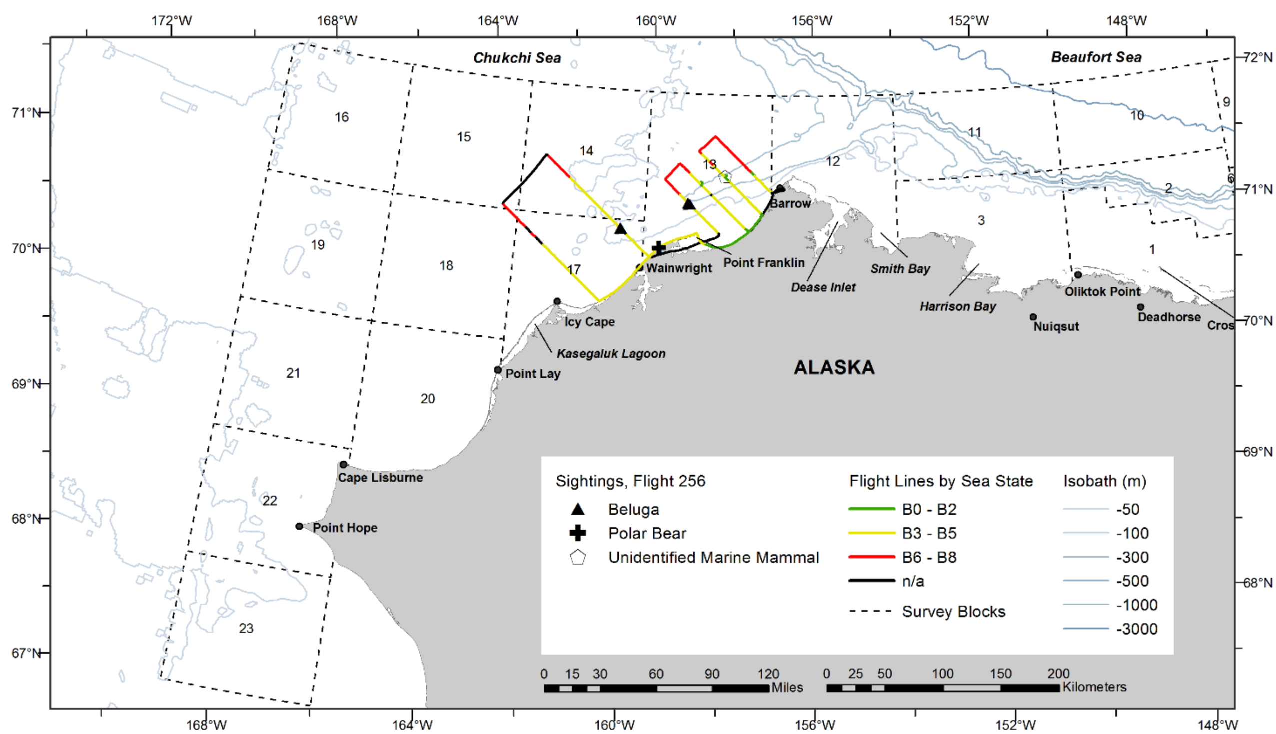

Figure B-90. ASAMM Flight 256 survey track, depicted by sea state, and all marine mammal sightings, excluding carcasses.

APPENDIX C: PUBLICATIONS, POSTERS, and PRESENTATIONS FROM ASAMM 2008-2014, and SNAPSHOTS of MEDIA OUTREACH FROM ASAMM 2014

LIST OF PUBLICATIONS, POSTERS AND PRESENTATIONS

2008

Clarke, J., L. Morse, and D. Rugh. 2008. Marine mammal occurrence in the northeastern Chukchi Sea, Alaska – comparison of data from autumn 1989-91 and autumn 2008. Poster: American Cetacean Society 11th International Conference, Monterey, CA, November 2008.

Clarke, J. 2008. Monitoring the distribution of arctic whales. Presentation: 11th MMS Information Transfer Meeting, Anchorage, AK, October 2008.

Clarke, J. 2008. COMIDA distribution and abundance of marine mammals, aerial surveys. Presentation: 11th MMS Information Transfer Meeting, Anchorage, AK, October 2008.

Morse, L. and J. Clarke. 2008. Swimming polar bears in the Alaskan Chukchi Sea – the REAL story. Poster: American Cetacean Society 11th International Conference, Monterey, CA, November 2008.

2009

Clarke, J. 2009. Bowhead whale aerial survey project (BWASP), 2008. Report: prepared for NMML-NMFS and MMS-Alaska. 15 pp.

Clarke, J. 2009. Chukchi offshore monitoring in drilling area, 2008. Report: prepared for NMML-NMFS and MMS-Alaska. 15 pp.

Clarke, J. 2009. COMIDA and BWASP, aerial surveys conducted by NMML. Presentation: Arctic Seismic Open Water Meeting, Anchorage, AK, April 2009. Similar presentation at BOWFEST workshop, Anchorage, AK, January 2009.

Clarke, J., L. Morse, and D. Rugh. 2009. Marine mammal occurrence in the northeastern Chukchi Sea, Alaska – comparison of data from autumn 1989-91 and autumn 2008. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2009.

Ferguson, M., R. Angliss, D. Rugh, J. Mocklin, and L. Vate Brattström. 2009. Comparison of UASs and manned aircraft for surveying bowhead whale distribution and density. Presentation: Workshop on Using Unmanned Aircraft Systems to Study Marine Mammals and Other Wildlife Species, Quebec City, Canada, October 2009.

Morse, L., J. Clarke, and D. Rugh. 2009. Marine mammal occurrence in the northeastern Chukchi Sea, Alaska – summer 2008. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2009.

2010

Christman, C., M. Ferguson, G. Friedrichsen, B. Rone, and J. Clarke. 2010. Pacific walrus sightings documented by aerial surveys of the northeastern Chukchi Sea in 2009. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2010.

Clarke, J. 2010. Chukchi offshore monitoring in drilling area, 2009. Report: prepared for NMML-NMFS and MMS-Alaska. 26 pp.

Clarke, J., C. Christman, M. Ferguson, and L. Morse. 2010. Bowhead whale aerial survey project (BWASP) status update in 2009. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2010.

Clarke, J. and M. Ferguson. 2010. Aerial surveys of large whales in the Northeastern Chukchi Sea, 2008-2009, with review of 1982-1991 data. Paper: SC/62/BRG13 presented at the International Whaling Commission Scientific Committee Meetings, Morocco, June 2010. 18 pp.

Clarke, J. and M. Ferguson. 2010. Aerial surveys for bowhead whales in the Alaskan Beaufort Sea: BWASP update 2000-2009 with comparisons to historical data. Paper: SC/62/BRG14 presented at the International Whaling Commission Scientific Committee Meetings, Morocco, June 2010. 11 pp.

Clarke, J., M. Ferguson, L. Morse, G. Friedrichsen, B. Rone, and C. Christman. 2010. Aerial survey for marine mammals in the northeastern Chukchi Sea: 2009. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2010.

Clarke, J. and B. Rone. 2010. Annual report for activities conducted by the National Marine Mammal Laboratory under Federal Fish and Wildlife Permit MA212570-0 for calendar year 2009. Report: prepared by the National Marine Mammal Laboratory (NMFS) for U.S. Fish and Wildlife Service. 11 pp.

Ferguson, M. and R. Angliss. 2010. Efficiency of unmanned aircraft systems (UAS) relative to manned aircraft for surveying bowhead whale distribution and density in the Arctic. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2010.

Ferguson, M. and J. Clarke. 2010. COMIDA and BWASP aerial surveys conducted by NMML, 2009. Presentation: Arctic Seismic Open Water Meeting, Anchorage, AK, May 2010. Similar presentation at BOWFEST workshop, Anchorage, AK, January 2010.

2011

Brower, A., J. Clarke, M. Ferguson, C. Christman, and S. Grassia. 2011. Eastern North Pacific gray whale distribution and habitat use in the Chukchi Sea from aerial surveys: 1982-1991, 2008-2010. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2011.

Brower, A., J. Clarke, M. Ferguson, C. Christman, and S. Grassia. 2011. Eastern North Pacific gray whale distribution and habitat use in the Chukchi Sea from aerial surveys: 1982-1991, 2008-2010. Poster: Society for Marine Mammalogy 19th Biennial Conference on the Biology of Marine Mammals, Tampa, FL, November/December 2011.

Christman, C., A. Brower, J. Clarke, M. Ferguson, and S. Grassia. 2011. Pacific walrus sightings documented by COMIDA aerial surveys of the Northeastern Chukchi Sea in 2010. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2011.

Christman, C. and B. Rone. 2011. Annual report for activities conducted by the National Marine Mammal Laboratory under Federal Fish and Wildlife Permit MA212570-0 for calendar year 2010. Report: prepared by the National Marine Mammal Laboratory (NMFS) for U.S. Fish and Wildlife Service. 12 pp.

Clarke, J., C. Christman, A.A. Brower, M.C. Ferguson, and S.L. Grassia. 2011. Aerial surveys of endangered whales in the Beaufort Sea, fall 2010. Report: prepared by the National Marine Mammal Laboratory (NMFS) for the BOEMRE, OCS Study BOEMRE 2011-35. 119 pp.

Clarke, J., C. Christman, M. Ferguson, and S. Grassia. 2011. Aerial surveys of endangered whales in the Beaufort Sea, Fall 2006-2008. Report: prepared by the National Marine Mammal Laboratory (NMFS) for the BOEMRE, OCS Study BOEMRE 2010-42. 240 pp.

Clarke, J., C. Christman, S. Grassia, A. Brower, and M. Ferguson. 2011. Aerial surveys of endangered whales in the Beaufort Sea, fall 2009. Report: prepared by the National Marine Mammal Laboratory (NMFS) for the BOEMRE, OCS Study BOEMRE 2010-40. 92 pp.

Clarke, J., M. Ferguson, C. Christman, S. Grassia, A. Brower, and L. Morse. 2011. Chukchi offshore monitoring in drilling area (COMIDA) distribution and relative abundance of marine mammals: aerial surveys. Report: prepared by the National Marine Mammal Laboratory (NMFS) for the BOEMRE, OCS Study BOEMRE 2011-06. 296 pp.

Ferguson, M., J. Clarke, C. Christman, S. Grassia, and A. Brower. 2011. A tale of two seas: lessons from multi-decadal aerial surveys for cetaceans in the Beaufort and Chukchi seas. Presentation: Alaska Marine Science Symposium, Anchorage, AK, January 2011.

Grassia, S., J. Clarke, M. Ferguson, C. Christman, and A. Brower. 2011. Distribution, relative abundance and behaviors of bowhead whales in the Alaskan Beaufort and Northeastern Chukchi seas – Autumn 2007-2010. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2011.

Lemons, P. and C. Christman. 2011. Pacific walrus (*Odobenus rosmarus divergens*) abundance and use of the northeast Chukchi Sea based on COMIDA aerial surveys. Poster: Society for Marine Mammalogy 19th Biennial Conference on the Biology of Marine Mammals, Tampa, FL, November/December 2011.

Okkonen, S., C. Ashjian, R. Campbell, J. Clarke, S. Moore, and K. Taylor. 2011. Satellite observations of circulation features associated with a bowhead whale feeding 'hotspot' near Barrow, Alaska. *Remote Sensing of Environment* 115: 2168-2174.

2012

Brower, A., C. Christman, M. Ferguson, J. Clarke, S. Grassia, R. Shea, B. Rone, and A. Kennedy. 2012. Eastern North Pacific gray whales and minke whales from aerial surveys in the Alaskan Arctic, summer and fall 2011. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2012.

Christman, C. and B. Rone. 2012. Annual report for activities conducted by the National Marine Mammal Laboratory under Federal Fish and Wildlife Permit MA212570-0 in calendar year 2011. Report: prepared by the National Marine Mammal Laboratory (NMFS) for U.S. Fish and Wildlife Service. 16 pp.

Christman, C., A. Brower, J. Clarke, M. Ferguson, S. Grassia, A. Kennedy, B. Rone, and R. Shea. 2012. Aerial observations of Pacific walruses (*Odobenus rosmarus divergens*) in the northeastern Chukchi Sea, summer and fall 2011. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2012.

Christman, C., M. Ferguson, J. Clarke, and A. Brower. 2012. Marine mammal aerial surveys in the Chukchi Sea. Presentation: Workshop on Assessing Pacific Walrus Population Attributes from Coastal Haul-Outs, Anchorage, AK, March 2012.

Clarke, J. and M. Ferguson. 2012. Beluga distribution from aerial surveys conducted July-October 2012. Presentation: Alaska Beluga Whale Committee 5th Workshop on Research about Beluga Whales, Anchorage, AK, November 2012.

Clarke, J., C. Christman, A. Brower, and M. Ferguson. 2012. Distribution and relative abundance of marine mammals in the Alaskan Chukchi and Beaufort Seas, 2011. Report: prepared by the National Marine Mammal Laboratory (NMFS) for the BOEM, OCS Study BOEMRE 2012-009. 344 pp.

Clarke, J., M. Ferguson, C. Christman, and A. Brower. 2012. Broad-scale aerial surveys of marine mammals in the western Beaufort and northeastern Chukchi Seas, 2011-2012, results from the ASAMM project. Presentation: 2012 United States-Canada Northern Oil and Gas Forum, Anchorage, AK, November 2012.

Clarke, J., M. Ferguson, C. Christman, A. Brower, S. Grassia, R. Shea, B. Rone, and A. Kennedy. 2012. Distribution and relative abundance of belugas (*Delphinapterus leucas*) in the Alaskan arctic, summer and fall 2011. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2012.

Ferguson, M. 2012. Quantifying spatial characteristics of the Bowhead Whale Aerial Survey Project (BWASP) survey design. *Journal of Cetacean Research and Management* 12(1): 39-44.

Ferguson, M., J. Clarke, A. Brower, C. Christman, S. Grassia, A. Kennedy, B. Rone, and R. Shea. 2012. Bowhead whale (*Balaena mysticetus*) distribution and relative abundance in the Alaskan Arctic, summer and autumn 2011. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2012.

Lemons, P. and C. Christman. 2012. Pacific walrus (*Odobenus rosmarus divergens*) abundance and use of the northeast Chukchi Sea based on COMIDA aerial surveys. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2012.

2013

Brower, A., C. Christman, J. Clarke, and M. Ferguson. 2013. Gray whale calf occurrence in the Alaskan Arctic, summer and fall 2012. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2013.

Christman, C., J. Citta, L. Quakenbush, J. Clarke, B. Rone, R. Shea, M. Ferguson, and M. Heide-Jørgensen. 2013. Presence and behavior of bowhead whales (*Balaena mysticetus*) in the Alaskan Beaufort Sea in July 2011. *Polar Biology* 36(12): 1851-1856. DOI 10.1007/s00300-013-1395-4.

Christman, C., M. Ferguson, A. Brower, and J. Clarke. 2013. Aerial sightings of Pacific walruses (*Odobenus rosmarus divergens*) in the Alaskan Arctic, summer and fall 2012, with a comparison to sightings from 2009-2011. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2013.

Christman, C. and B. Rone. 2013. Annual report for activities conducted by the National Marine Mammal Laboratory under Federal Fish and Wildlife Permit MA212570-0 in calendar year 2012. Report: prepared by the National Marine Mammal Laboratory (NMFS) for U.S. Fish and Wildlife Service. 13 pp.

Christman, C. and B. Rone. 2013. Annual report for activities conducted by the National Marine Mammal Laboratory under Federal Fish and Wildlife Permit MA212570-0 in calendar year 2013. Report: prepared by the National Marine Mammal Laboratory (NMFS) for U.S. Fish and Wildlife Service. 10 pp.

Clarke, J., C. Christman, A. Brower, and M. Ferguson. 2013. Distribution and relative abundance of marine mammals in the northeastern Chukchi and western Beaufort Seas, 2012. Report: prepared by the National Marine Mammal Laboratory (NMFS) for the BOEM, OCS Study BOEM 2013-00117. 349 pp.

Clarke, J., M. Ferguson, A. Brower, and C. Christman. 2013. It's not just about bowhead whales – collaborations between ASAMM and other research. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2013.

Clarke, J., M. Ferguson, C. Christman, A. Brower, B. Small, and R. Suydam. 2013. Distribution and relative abundance of belugas (*Delphinapterus leucas*) in the Alaskan Arctic, summer and fall 2012, with comparisons to 2007-2011. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2013.

Ferguson, M. and J. Clarke. 2013. Estimates of detection probability for BWASP bowhead whale, gray whale, and beluga sightings collected from Twin Otter and Aero Commander aircraft, 1989 to 2007 and 2008 to 2011. U.S. Dep. Commer., NOAA Technical Memorandum NMFS-AFSC-261, 52 p.

Ferguson, M., J. Clarke, R. Shea, A. Brower, and C. Christman. 2013. Summer in the western Beaufort Sea: results from aerial surveys of Arctic marine mammals, July and August, 2012. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2013.

Schonberg, S., J. Clarke, and K. Dunton. 2013. Distribution, abundance, biomass and diversity of benthic infauna in the northeast Chukchi Sea, Alaska: Relation to environmental variables and marine mammals. *Deep Sea Research Part II: Topical Studies in Oceanography* DOI 10.1016/j.dsr2.2013.11.004

Sims, C., A. Brower, C. Christman, M. Ferguson, and J. Clarke. 2013. Sightings of humpback, fin, minke, and killer whales in the Alaskan Arctic from aerial surveys in 2012. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2013.

Stafford, K., S. Okkonen, and J. Clarke. 2013. Correlation of a strong Alaska Coastal Current with the presence of beluga whales (*Delphinapterus leucas)* near Barrow, Alaska. *Marine Ecology Progress Series* 474: 287-297.

2014

Berchok, C., K. Kuletz, J. Clarke, and others. DBO presentation. DBO Workshop, Seattle, WA, October 2013

Brower, A. 2014. Gray whale calf occurrence in the Alaskan arctic, summer and fall 2013, with Comparisons to Previous Years. Alaska Fisheries Science Center Quarterly Report Oct-Nov-Dec 2014.

Brower, A., M. Ferguson, C. Christman, and J. Clarke. 2014. Gray whale calf occurrence in the Alaskan arctic, summer and fall 2013, with Comparisons to Previous Years. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2014.

Brower, A., J. Clarke, M. Ferguson, and C. Christman. 2014. Gray whale foraging habitats in the Alaskan arctic, summer and fall 2009-2013. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2014.

Brower, A., M. Ferguson, and J. Clarke. *In prep*. Gray whale distribution in the northeastern Chukchi Sea, 2008-2010, with comparison to historical data.

Christman, C., M. Ferguson, J. Clarke, and A. Brower. 2014. Pacific walrus (*Odobenus rosmarus divergens*) haulouts along the northwestern Alaskan coastline, summer and fall 2009-2013. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2014.

Clarke, J., A. Brower, C. Christman, and M. Ferguson. 2014. Distribution and relative abundance of marine mammals in the northeastern Chukchi and western Beaufort Seas, 2013. Report: prepared by the National Marine Mammal Laboratory (NMFS) for the BOEM, OCS Study BOEM 2014-018.

Clarke, J. and M. Ferguson. *In prep.* Distribution, behavior, and habitat use of bowhead whales (*Balaena mysticetus*) and gray whales (*Eschrichtius robustus*) in summer and autumn in the northeastern Chukchi Sea, 2009-2012.

Clarke, J., M. Ferguson, C. Christman, A. Brower, and V. Beaver. 2014. Why one year is never enough – comparison of bowhead whale distribution, relative abundance, habitat use and behaviors in the western Beaufort Sea in July-August, 2012 and 2013. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2014.

Clarke, J., K. Stafford, S. Moore, B. Rone, and J. Crance. 2014. Subarctic cetaceans in the southern Chukchi Sea: evidence of recovery or response to a changing ecosystem. *Oceanography* 24(4):46-59.

Ferguson, M. and J. Clarke. 2014. Aerial surveys of Arctic marine mammals (ASAMM) (formerly known as BWASP), 1982-2013. Presentation: Camden Bay Collaborative Study Workshop, Fairbanks, AK, July 2014.

Ferguson, M., J. Clarke, A. Brower, and C. Christman. 2014. Modeling Western Arctic bowhead whale high-use areas in the western Beaufort Sea, 2000-2012. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2014.

Ferguson, M.C. and J.T. Clarke. 2013. Estimates of detection probability for BWASP bowhead whale, gray whale, and beluga sightings collected from twin otter and aero commander aircraft, 1989-2007 and 2008-2011. NOAA Technical Memorandum NMFS-AFSC-261.

Ferguson, M. and J. Clarke. *In prep*. Distribution and relative density of bowhead whales and belugas in the Alaskan Beaufort Sea: similarities and differences between 1982-2006 and 2007-2010.

Kuletz, K., M. Ferguson, A. Gall, B. Hurley, E. Labunski, T. Morgan, and R. Day. 2014. Seasonal and spatial patterns of marine-bird and -mammal distributions in the Pacific Arctic: a delineation of biologically important marine areas. Presentation: Alaska Marine Science Symposium, Anchorage, AK, January 2014.

Kuletz, K., M. Ferguson, A. Gall, B. Hurley, E. Labunski, T. Morgan, and R. Day. 2014. Seasonal and spatial patterns of marine bird and mammal distributions in the Pacific Arctic. Poster: Bering Sea Open Science Meeting, Honolulu, HI, February 2014 .

Okkonen, S.R., C.A. Ashjian, R.G. Campbell, K.M. Stafford, and J.T. Clarke. 2014. Variability of late summer oceanographic conditions in Barrow Canyon. Presentation: Ocean Sciences Meeting, Chukchi Sea Region: Physical Forcing and Ecosystem Response in the Pacific Arctic, Honolulu, HI, February 2014.

Stafford, K.M., J.T. Clarke, and S.E. Moore. 2014. Acoustic and visual detections of sub-arctic cetaceans in the southern Chukchi Sea-Bering Strait region, 2009-2012. Presentation: Ocean Sciences Meeting, Chukchi Sea Region: Physical Forcing and Ecosystem Response in the Pacific Arctic, Honolulu, HI, February 2014.

2015

Brower, A., J. Clarke, and M. Ferguson. 2015. Gray Whale Occurrence in the Beaufort Sea. Poster: Alaska Marine Science Symposium, Anchorage, AK, January 2015.

Brower, A., S. Schonberg, J. Clarke, M. Ferguson. *In prep.* Gray whale distribution in the northeastern Chukchi Sea, 2009-2012, with comparison to benthic invertebrate biomass and abundance.

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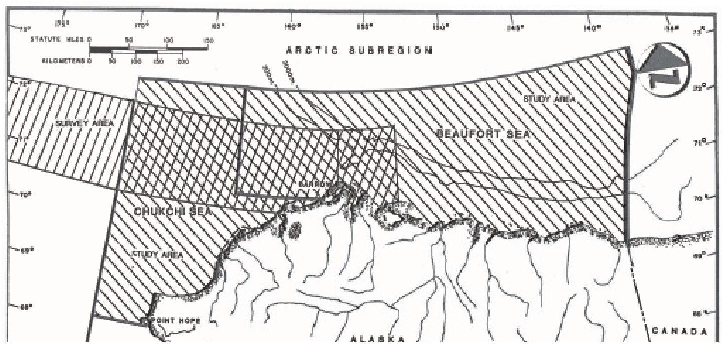
BOEM OCEAN SCIENCE

THE SCIENCE & TECHNOLOGY JOURNAL OF THE BUREAU OF OCEAN ENERGY MANAGEMENT

VOLUME 11 ISSUE 1 • JANUARY/FEBRUARY/MARCH 2014

Modernizing ESPIS Through Digital Mapping with geoESPIS



The Environmental Studies Program Information System (ESPIS) is the repository for more than 40 years worth of BOEM environmental research reports. These reports help the Bureau meet its environmental stewardship responsibilities in developing and managing OCS energy and mineral resources.

ESPIS has evolved over the years, most notably from paper to digital formats. The next stage will be to use the latest Geographic Information System technology to display the geographic areas referenced in ESPIS reports. An information from ESPIS reports needs to be organized in a more structured data architecture.

One capability being tapped for geoESPIS is the MarineCadastre.gov framework's ability to link together relevant information distributed across a variety of sources on the Internet. Relevant research findings may be available in conference proceedings, scientific journal articles, and other sources of scientific data and information. To illustrate this situation, consider the survey records from the Bowhead Whale Aerial Survey Project in Alaska that were documented in a recent ESPIS report (Clarke et al., 2011), which have been developed into mapping products available through the Ocean Biogeographic Information System SEAMAP online GIS database (Figure 3). By cross-referencing ESPIS reports with other sources on the Internet, geoESPIS users may more easily find the scientific data and information that originated from BOEM Environmental Studies research.

As the history of ESPIS indicates, BOEM has pursued a forward-looking approach to the challenges of providing information services. For example, the geographic index used in the late 1980s anticipated the study area concept used in today's geoESPIS project. This anticipation of future technology continues today by focusing on ways to integrate of ESPIS information and provide a capacity to manage a wider variety of information in the MarineCadastre.gov framework. Similar applications could be developed for the dissemination of other BOEM products, such as NEPA analyses and Endangered Species Act consultations, providing a new way of doing business and sharing information with the public.

FOR MORE INFORMATION:

BOEM's Environmental Studies Program Information System (ESPIS)
http://www.data.boem.gov/homepg/data_center/other/espis/espismaster.asp?appid=1

Clarke, J.T., M.C. Ferguson, C.L. Christman, S.L. Grassia, A.A. Bower, and L.J. Morse. 2011. Chukchi Offshore Monitoring in Drilling Area (COMIDA) Distribution and Relative Abundance of Marine Mammals: Aerial Surveys. Final Report. OCS Study BOEMRE 2011-06
http://www.data.boem.gov/PI/PDFImages/ESPIS/5/5206.pdf

Ocean Biogeographic Information System
http://seamap.env.duke.edu/dataset/825

http://www.boem.gov/Ocean-Science-Jan-Feb-Mar-2014/

Hello western and northern Alaskan communities:

The Aerial Surveys of Arctic Marine Mammals (ASAMM) project will be airborne from July to October 2014, as part of a long-term monitoring project that has occurred every year since 1979. ASAMM is designed to provide scientific information on marine mammal ecology in a vast area over Alaskan arctic waters to help manage and conserve marine mammals and their habitat. The project is co-managed by the Bureau of Ocean Energy Management (BOEM) and the National Oceanic and Atmospheric Administration (NOAA).

For additional information, please contact:

Megan Ferguson
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206.526.6274

or

Janet Clarke
janet.clarke@leidos.com
253.205.1176

Daily reports showing effort and sightings are posted at
http://www.afsc.noaa.gov/NMML/cetacean/bwasp/

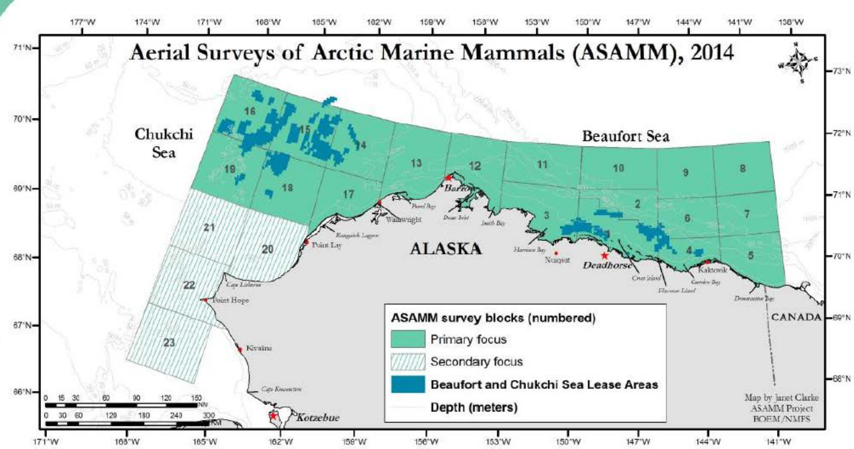
Amelia Brower
NOAA/NMFS/AFSC/NMML
Permit # 789-1719
Funded by BOEM

NOAA FISHERIES

BOEM
Bureau of Ocean Energy Management

ASAMM Goals:

- Document relative abundance, distribution, and behavior of marine mammals, including whales, seals, walrus, and polar bear, in the Alaskan Arctic: How many? Where are they? What are they doing?
- Describe the annual migration of bowhead whales, including variability across years.
- Provide information in near real-time to stakeholders, including local communities, North Slope Borough, Northwest Alaska Borough, BOEM, NOAA Fisheries, and other interested parties.



NOAA FISHERIES

BOEM
Bureau of Ocean Energy Management

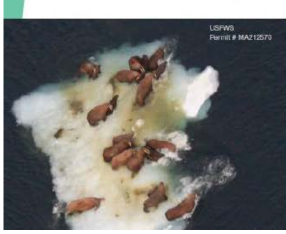
Surveys will be conducted in Aero Commander aircraft flown at an altitude range of 1000 ft to 1500 ft above sea level.

Survey teams will be based in Barrow and Deadhorse.

Effort will be focused on survey blocks 1-19, but occasionally surveys are conducted in the more southerly survey blocks, 20-23.

Survey teams will also fly a coastal transect from Point Barrow to Point Hope, approximately 1 km from shore.

Survey teams will communicate with whaling communication centers during bowhead whale hunts, and will avoid areas where marine-based subsistence activities are actively occurring.



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SECTIONS

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Biologists spot huge gathering of walruses on beach near Point Lay

Yereth Rosen | September 30, 2014

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Close-up of an estimated 35,000 walrus haulout on a barrier island near Pt. Lay on September 27, 2014.

Corey Arrardo / NOAA/NMFS/AFSC/NMML

With floating ice sparse in the Chukchi Sea, an estimated 35,000 walruses were found crowded onto a beach near the Northwest Alaska village of Point Lay, according to federal biologists.

The congregation of walruses, photographed Saturday by biologists flying over the area in a plane contracted by the National Oceanic and Atmospheric Administration, is one of the biggest onshore gatherings of the

http://www.adn.com/article/20140930/biologists-spot-huge-gathering-walruses-beach-near-point-lay

Why 35,000 Walruses Come Ashore in Alaska

ANCHORAGE, Alaska — Sep 30, 2014, 6:13 PM ET

By DAN JOLING Associated Press

Blubber Beach: 35,000 Walruses Swarm Alaska's Shores

NEXT VIDEO

Orphaned Baby Walrus Gets New Home In New York

AUTO START: ON | OFF

AP

Pacific walrus that can't find sea ice for resting in Arctic waters are coming ashore in record numbers on a beach in northwest Alaska.

An estimated 35,000 walrus were photographed Saturday about 5 miles north of Point Lay, according to the National Oceanic and Atmospheric Administration.

Point Lay is an Inupiat Eskimo village 300 miles southwest of Barrow and 700 miles northwest of Anchorage.

The enormous gathering was spotted during NOAA's annual arctic marine mammal aerial survey, spokeswoman Julie Speegle said by email. The survey is conducted with the Bureau of Ocean Energy Management, the agency that oversees offshore lease sales.

Andrea Medeiros, spokeswoman for the U.S. Fish and Wildlife Service, said walrus were first spotted Sept. 13 and have been moving on and off shore. Observers last week saw about 50 carcasses on the beach from animals that may have been killed in a stampede, and the agency was assembly a necropsy team to determine their cause of death.

"They're going to get them out there next week," she said.

The gathering of walrus on shore is a phenomenon that has accompanied the loss of summer sea ice as the climate has warmed.

Pacific walrus spend winters in the Bering Sea. Females give birth on sea ice and use ice as a diving platform to reach snails, clams and worms on the shallow continental shelf.

Unlike seals, walrus cannot swim indefinitely and must rest. They use their tusks to "haul out," or

THE CHRISTIAN SCIENCE MONITOR
ENERGY/ENVIRONMENT LATEST NEWS WIRES

35,000 walrus come ashore as Arctic sea ice retreats

35,000 walrus that can't find Arctic sea ice for resting have come ashore in northwest Alaska, according to the National Oceanic and Atmospheric Administration. The gathering of 35,000 walrus on shore is a phenomenon that has accompanied the loss of summer sea ice as the climate has warmed.

By Dan Joling, Associated Press OCTOBER 1, 2014

View Caption

ANCHORAGE, ALASKA — Pacific walrus that can't find sea ice for resting in Arctic waters are coming ashore in record numbers on a beach in northwest Alaska.

http://www.csmonitor.com/Environment/Latest-News-Wires/2014/1001/35-000-walrus-in-Alaska Why-they-came-ashore-video

(http://www.huffingtonpost.com/moby/moby-meat_b_5889850.html)
Moby: This Is Your Planet on Meat (http://www.huffingtonpost.com/moby/moby-meat_b_5889850.html)

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Antarctic Sea Ice Just Hit A New Maximum (http://www.huffingtonpost.com/2014/10/01/antarctic-sea-ice-_n_5915800.html)

(http://www.huffingtonpost.com/2014/09/30/frac-sand-mining-boom-risks_n_5902022.html)
The Fracking Boom's Hidden Threat (http://www.huffingtonpost.com/2014/09/30/frac-sand-mining-boom-risks_n_5902022.html)

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35,000 Walrus Come Ashore In Northwest Alaska

Posted: 10/01/2014 5:36 pm EDT | Updated: 2 hours ago

ANCHORAGE, Alaska (AP) — Pacific walrus that can't find sea ice for resting in Arctic waters are coming ashore in record numbers on a beach in northwest Alaska.

An estimated 35,000 walrus were photographed Saturday about 5 miles north of Point Lay, according to the National Oceanic and Atmospheric Administration.

Point Lay is an Inupiat Eskimo village 300 miles southwest of Barrow and 700 miles northwest of Anchorage.

http://www.huffingtonpost.com/2014/10/01/walrus-alaska_n_5916676.html

Environmentalists sue feds to protect Pacific walruses from oil drilling

Lisa Demer | November 10, 2014

Photos: Walrus mass haul out

PLAY

Close-up of a 1,500 walrus haulout on a barrier island near Pt. Lay on September 23, 2014.

Corey Arrardo / NOAA/NMFS/AFSC/NMML

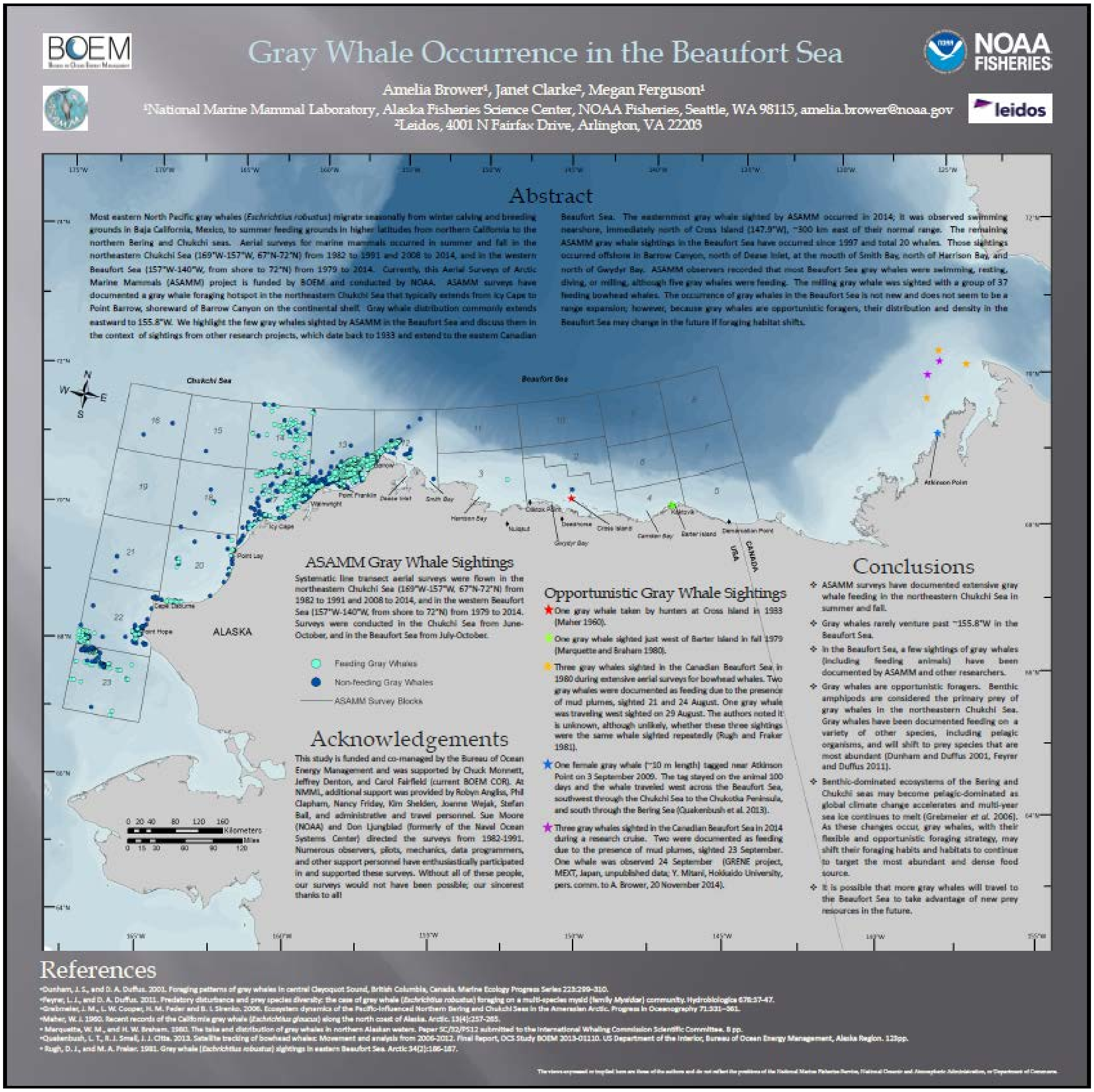
Environmental groups on Monday sued the federal government over a rule that would allow Arctic oil exploration in areas that could hurt Pacific walruses, which already are struggling from the loss of sea ice.

Earthjustice brought the suit against the U.S. Fish and Wildlife Service on behalf of a coalition of conservation groups that have long been opposed to Arctic drilling.

"In recent years, sea ice in the Chukchi Sea has been melting at unprecedented rates due to human-induced climate change," the suit says. "These changes profoundly affect walruses, which now come ashore in the tens of thousands

http://www.adn.com/article/20141110/environmentalists-sue-feds-protect-pacific-walruses-oil-drilling

POSTER PRESENTATIONS:



Large Cetacean Occurrence in the South-Central Chukchi Sea, Summer and Fall 2014

Janet Clarke[1], Amelia Brower[2], Megan Ferguson[2], Christy Sims[2], Vicki Beaver[2], Jennifer Gatzke[2], Bob Lynch[2]

[1] Leidos, Arlington, VA, 253.205.1176, janet.clarke@leidos.com; [2] National Marine Mammal Laboratory, AFSC, NOAA, Seattle, WA

ABSTRACT

Systematic aerial surveys were conducted in the south-central Chukchi Sea (67°-69°N, 166°-169°W) in summer and fall 2014 as part of the Aerial Surveys of Arctic Marine Mammals (ASAMM) project, funded by BOEM and conducted by NOAA. Surveys were conducted on nine days (three each in July, August and September), for a total of approximately 20 hours and 3300 km on transect. Three hundred sixty-six gray whales (*Eschrichtius robustus*) were seen from July through September, including 19 calves. Large groups of gray whales were seen on several occasions feeding at a previously documented benthic "hot spot" near the International Date Line; gray whales were also observed nearshore north of Pt. Hope and east of Cape Lisburne. Forty-six humpback whales (*Megaptera novaeangliae*) and 36 fin whales (*Balaenoptera physalus*) were seen in early and late September centered near 67.3°N, 167°W. One humpback whale calf was seen; several whales were feeding. One minke whale (*Balaenoptera acutorostrata*) was seen in early September. Fin, humpback and minke whales are known to have occurred historically in the Pacific Arctic, particularly near the Chukotka Peninsula, and recent visual and acoustic detections in the south-central Chukchi Sea suggest that use of this area may be increasing. Increased occurrence may be due to each population's abundance and range recovering from commercial whaling, or it may reflect responses to ongoing climate change. Data collected via the Distributed Biological Observatory (DBO) project provide complementary information on oceanographic parameters that may be linked to large whale distribution, behavior, and occurrence in the southern Chukchi Sea.

SUMMARY

- Gray whales in 2014 frequented the 'hot spot' that has been identified as having high benthic biomass (Bluhm et al., 2007). Gray whales have been sighted in this area during aerial and vessel surveys conducted in summer and fall since at least the early 1980s (e.g., Moore, 2000).
- In 2014, humpback, fin and minke whales appeared to prefer shallower regions of the south-central Chukchi Sea. In previous years, fin whales have been sighted in deeper water areas, but humpback whale sightings have mostly been limited to shallower depths (Clarke et al., 2013).
- Gray whales overlapped temporally but not spatially with fin, humpback and minke whales in the south-central Chukchi Sea in 2014. Gray whales have previously been recorded in close association with humpback and fin whales in the southern Chukchi Sea (Clarke et al., 2013) and with humpback and bowhead whales in the northeastern Chukchi Sea (e.g., Clarke et al., 2014).
- Distribution of large whales in the South-Central Chukchi Sea may be related to water masses (including Bering Shelf Water, Anadyr Water and Alaska Coastal Water), which collectively produce sharp temperature and salinity gradients between 166°W and 168°W at ~67.5°N (Eisner et al., 2013). Sharp density gradients can aggregate zooplankton and fishes that feed on zooplankton (also known as "prey" to large whales).
- Results from Distributed Biological Observatory (DBO) sampling conducted in 2014 in the southern Chukchi Sea (DBO Line 3) will undoubtedly shed light on oceanographic and biologic parameters that may have influenced large whale aggregations.

Figure 5
Humpback whale, September 2014.

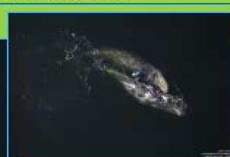


Figure 6
Pair of gray whales exhibiting mating behavior, September 2014.

Figure 7
Adult and immature fin whale, September 2014.

Figure 1
South-central Chukchi Sea study area, part of the larger ASAMM study area (inset), and survey effort, July-September 2014.

METHODS

- Southernmost part of larger ASAMM study area (Figure 1)
- Line transect aerial surveys
- Twin turbine, high wing aircraft
- 1200' (366 m) survey altitude
- Fly every day, weather permitting, 2 July through 30 September
- Two primary marine mammal observers, one data recorder
- Circle on most cetacean sightings to get positive species ID, determine group size, and look for calves

RESULTS

- Surveys conducted: 6, 9 and 24 July; 4, 15 and 24 August; and 4, 23 and 24 September.
- On-effort (transect and circling on transect) kilometers: 3,900 (Figure 1).
- On-effort (transect and circling on transect) sightings: 207 sightings of 366 gray whales (Figure 2), 17 sightings of 36 fin whales (Figure 3), 22 sightings of 46 humpback whales (Figure 3), and 1 sighting of 1 minke whale (Figure 3)

Figure 2
On-effort gray whale sightings, July-September 2014.

Figure 3
On-effort fin, humpback and minke whale sightings, September 2014.

Table 1
Species Comparison

2014	Gray Whale	Humpback, Fin and Minke Whale	Figure
Spatial and Temporal Distribution	Observed in July, August and September. A few were sighted nearshore between Cape Lisburne and Point Hope, but most gray whales were observed in a known hot spot approximately 100-125 km southwest of Point Hope.	Observed in September only. All were distributed approximately 100-150 km south of Point Hope.	Figures 2, 3
Sighting Rate	Sighting rate increased from July to September; sighting rate was highest in the deepest depth zone (51-200 m) in all months.	Highest in 35-50 m depth zone (fin and humpback whales only).	Figure 4
Habitat Preference	Depth at sightings ranged from 2-14 m for gray whales between Point Hope and Cape Lisburne, and 32-60 m for gray whales in the hot spot.	Depth at sightings ranged from 35-43 m for humpback and fin whales. The minke whale was seen in 32 m depth.	
Behavior	Most gray whales were feeding (79% of all individuals seen) or swimming (14%). Two pairs of gray whales exhibited mating behavior. There were too few swim headings to test for clustering around a mean.	Most humpback whales were feeding (54% of all individuals seen) or milling (20%). Most fin whales were swimming (56%) or feeding (28%). The lone minke whale was swimming. There were too few swim headings to test for clustering around a mean.	Figures 5, 6, 7
Calves	Nineteen calves were seen: nine in July, nine in August and one in September.	One humpback whale calf was seen, and there was one sighting of a smaller animal that may have been a calf. One possible fin whale calf was seen, as well as one smaller whale that was likely an immature.	

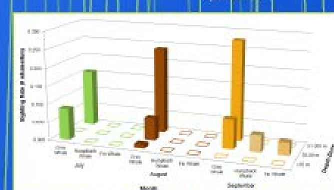


Figure 4
Monthly sighting rates per depth zone for gray, humpback and fin whales, 2014. Empty bars indicate sighting rate of 0.

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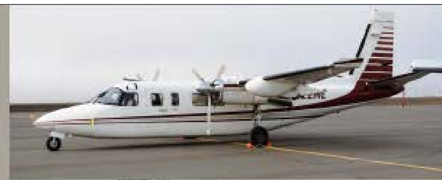
ACKNOWLEDGEMENTS

We gratefully acknowledge the individuals and organizations without whom these aerial surveys would be grounded. Literally. The Bureau of Ocean Energy Management (BOEM) funds and co-manages ASAMM (and has done so since 1979), and we especially appreciate the support and advice from Carol Fairfield. The National Marine Mammal Laboratory (NOAA Fisheries) co-manages and conducts ASAMM, with significant support from Robyn Angliss, Stefan Ball, Phil Clapham, Mary Foote, Nancy Friday, Kim Shelden, and Janice Waite. Observers extraordinaire (provided via NOAA Fisheries) include Corey Accardo, Lisa Barry, Cynthia Christman, Leah Crowe, Heather Foley, Laura [illegible], Suzie Hanlan, [illegible], Jess Taylor, and Amy Willoughby. Mike Hay ([illegible]) provided timely software support. Surveys were once again safely and efficiently flown in Turbo Aero Commanders operated and flown by Clearwater Air, Inc., under the direction of Andrew Harcombe and pilots Stan Churches, Jim [illegible], [illegible], John Siegel, and Jake Turner. Flight following was provided by BLM, Alaska Interagency Coordination Center. Amy Kennedy (NMML) provided analysis support. Our thanks to all.






A New Bird in the Alaskan Arctic:
Lessons learned during coordination of manned and unmanned aerial operations in 2013 and 2014

Megan Ferguson, National Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS/NOAA
Janet Clarke, Leidos
Andrew Harcombe, Clearwater Air, Inc.
Willow Hetrick, Olgoonik Fairweather
Sheyna Wisdom, Olgoonik Fairweather

Abstract

Airspace over the northeastern Chukchi and western Beaufort seas is one of three locations in the Arctic where the Federal Aviation Administration (FAA) plans to establish permanent operational areas and corridor routes (to access coastal launch sites) for operating small UAS (sUAS) for research and commercial purposes. This action would enable over-water flights from the surface to at least 2,000 ft ACL. The airspace in this Alaskan Arctic area has been used for decades by manned aircraft transporting passengers and cargo, conducting scientific research, military missions, search and rescue operations, and other activities. The level of sUAS activity in the Alaskan Arctic has increased in recent years and is expected to continue to increase in the future; however, this increased UAS traffic precedes the development and standardization of UAS technology to detect and avoid other aircraft. While the FAA is working to develop rules, standards, and regulations specific to UAS operations, the arctic airspace user community is proactively working to develop protocols to create an environment where a variety of aerial operations can occur safely, efficiently, and successfully. In 2013 and 2014, the airspace users worked together and with the FAA to deconflict the Alaskan Arctic airspace. We report on the lessons learned during the coordination of aerial operations in 2013 and 2014. Some of the achievements made during these years were: 1) creation of an Arctic Aerial Survey Coordination Group (AASCG), that included representatives from manned and unmanned aerial projects; 2) daily simultaneous operations ("SIMOPs") phone calls to allow the AASCG to communicate directly with field teams; 3) distribution of detailed flight plans throughout the AASCG; and 4) evaluation and revision of communication protocols once projects commenced. Recommendations for improving coordination among manned and unmanned aircraft projects in the Alaskan Arctic in the future include designating a central authority to coordinate all flights in the sUAS airspace, developing a grid-based system that can be referenced when communicating flight plans, and requiring that all airspace operators distribute detailed information about their proposed projects to airspace users well in advance of project start dates.

Background information

The FAA Modernization and Reform Act of 2012 required the FAA to:

Initiate a process to work with relevant Federal agencies and national and international communities to designate permanent areas in the Arctic where small unmanned aircraft may operate 24 hours per day for research and commercial purposes and Search and Rescue (SAR) operations. The plan for operations in these permanent areas shall include the development of processes to facilitate the safe operation of unmanned aircraft beyond line of sight (BLOS). Such areas shall enable over-water flights from the surface to at least 2,000 feet in altitude, with ingress and egress routes from selected coastal launch sites. (https://www.faa.gov/uas/legislative_programs/arctic/)

Figure 1. The FAA plans to establish three permanent Arctic areas to comply with the Act: 1) Southern Arctic Area; 2) Bering Strait Area; 3) Northern Arctic Area.

We focus on the Northern Arctic Area, which includes airspace that has been used for decades by aerial surveys and other general aviation traffic for transporting people and things.

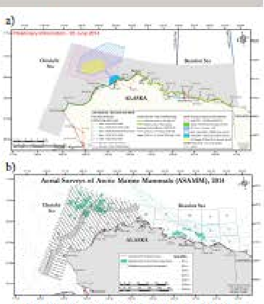


Figure 2. a) Examples of potential airspace users in the Northern Arctic Area during summer and fall of 2014. b) ASAMM study area showing survey blocks, 2014 Chukchi Sea transect lines, and current lease areas. Transect lines in the Beaufort Sea are generated daily and, therefore, not shown.

Concerns

- How to deconflict the airspace among all of the manned aircraft and sUAS?
- sUAS have limited detect and avoid capabilities
- FAA relies on theoretical analyses of the probability of collision
- Expected increase in the number of sUAS operations in the Arctic in the near future
- Larger areas of sUAS operation require more coordination and communication among airspace users because they are more difficult to avoid
- FAA regulations must be followed; however, they are not necessarily sufficient for promoting an environment where multiple airspace users can safely and successfully operate. If gaps exist between FAA regulations and what is necessary for safe and successful operations, airspace users should implement additional risk mitigation measures.

Figure 3. Example of detailed sUAS flight plan, shown as a radius around the research vessel used for launch and recovery. The sUAS flight plan is shown relative to the ASAMM study area.

Achievements in 2013 and 2014

- During summer and fall of each year, 2013 and 2014, 3 UAS operations and 1 broad-scale aerial survey project safely and successfully shared the Northern Arctic Airspace
- The deconfliction processes included senior staff with authority in their fields who were knowledgeable about the manned and unmanned aerial projects and aviation
- Arctic Aerial Survey Coordination Group
  - Established in 2014
  - Enables information to be shared among airspace users, including commercial manned aircraft pilots, sUAS pilots, research groups (private, governmental, and academic), and FAA
- Daily simultaneous operations ("SIMOPs") calls
  - Enables airspace users to communicate directly to ask questions or solve problems
    - Pertinent details about sUAS and manned aircraft operations changed over the course of the field seasons. The SIMOPs calls provided a way to efficiently address issues in order to revise protocols, as necessary.
- Distribution of detailed flight plans (map or radius around ship) using a widely available communication systems like telephone and email
  - How many sUAS will be flying?
  - Where will sUAS be flying relative to others in the AASCG?
    - Due to existing limitations in sUAS ability to detect and avoid, the Aerial Surveys of Arctic Marine Mammals (ASAMM) project chose to avoid the sUAS operation areas each day sUAS were flying
- Redundant communication systems
  - Test communication systems in the field
  - VHF radio, marine band radio, satellite phones, and email can all go down, sometimes simultaneously.
    - ASAMM decided it was not acceptable to fly if the sUAS or manned aircraft pilots could not communicate flight plans, changes to flight plans, or emergency situations with other airspace users.

Acknowledgments

We thank the representatives from the following entities for participating in the daily SIMOPs calls: Olgoonik Fairweather, ACUASI, ConocoPhillips, Shell, Insitu, R/V Westward Wind, Federal Aviation Administration, US Fish and Wildlife Service, Bureau of Ocean Energy Management (BOEM), and NOAA UAS Program Office. In addition, the Aerial Surveys of Arctic Marine Mammals project thanks BOEM for funding (IAA M11PG00033) and their efforts to ensure that the surveys are conducted safely. Phil Hall and Brad Fritzler (NOAA Office of Marine and Aviation Operations) provided invaluable assistance in coordinating the airspace users in 2013 and 2014. We are very grateful to Rebecca White (Alaska Fisheries Science Center, NOAA Fisheries) for designing this poster.

Recommendations for improvement

- Organize and authorize a centralized coordination system, like the system used to coordinate airplanes flying through hurricanes
- Implement a grid system to help communicate the location of daily flight plans
- Ensure that all airspace users, manned and unmanned, participate in the AASCG and SIMOPs calls.
- Provide detailed information about sUAS projects at least 7 days prior to the start of operations, including:
  - Location of study area (coordinates or GIS file)
  - Date of operations
  - Maximum number of sUAS authorized to operate simultaneously
  - Typical time and duration of flights
  - Flight altitudes
  - Point contact for questions arising prior to or during field operations
  - In-field communication information:
    - VHF and marine band radio frequencies
    - Phone numbers
    - Email addresses
    - Websites
  - Study overview or concept of operations
  - Instructions for viewing the real-time location of the sUAS (if possible)
  - Communications protocol

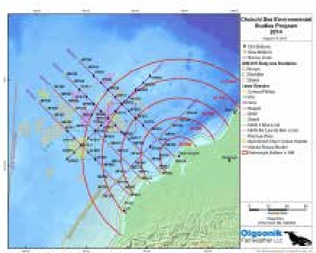


Figure 4. Chukchi Sea Environmental Studies Program operations in 2014. Radial distances ("bullies") from the sUAS launch and recovery site at Wainwright are shown in red.

GOAL

Safe, efficient, and successful operations for all airspace users

APPENDIX D: 2014 OPERATIONS PROTOCOL FOR UNMANNED AERIAL VEHICLES (UAV) IN THE ALASKAN ARCTIC

Attachment 4

INSITU / CONOCO PHILLIPS SCANEAGLE X200

CHUKCHI SEA OPERATIONS COMMUNICATIONS PLAN

SATCOM TELEPHONE NUMBER: Radio Call Sign: WCX9055
USCG #: 595289 Vessel Phone:907-331-4268 VSAT 881631434273 Iridium

A. 10 Days prior: When operating within Control Area 1485L, Insitu email an ALTRV request to CARF (7-AWA-CARF@FAA.GOV) with a copy to Anchorage ARTCC (ZAN) (AALZANATTMU@FAA.GOV)

B. 7 Days prior: Insitu release email to appropriate U.S. Government Activities (US Coast Guard, NOAA, DoD Etc.) and Commercial aircraft operators

C. 72 Hours in Advance: Contact Barrow FSS and request a NOTAM be issued for the operation

D. 1 Day prior (NLT 2200 hours): Provide manned aircraft operators schedule for next day

E. By 0830 hours on day of flight: Manned aircraft operators will confirm flight plan(s)

F. 1 Hour prior:

   a. Insitu file a DVFR flight plan through Barrow (BRW) Flight Service Station (FSS)

   b. Receive Weather briefing, review NOTAMS, determine if there are any other DVFR flight plans on file for the operating area

   c. Check Receiver Autonomous Integrity monitoring (RAIM) notices http://www.nstb.tc.faa.gov/24Hr_RAIM.htm

   d. Contact Anchorage ARTCC (ZAN) via SATCOM to confirm ALTRV is Active (907) 269-1103

G. 10 Minutes prior to ScanEagle X200 Launch: In preparation for launch, broadcast a warning announcement on Marine Common FM Ch 16 and VHF 122.9 MHz (CTAF) "UAS flight operations are commencing from (LAT /LONG of research vessel). Maintain a listening watch on VHF 122.9 (CTAF) and 135.5 MHz for any traffic

H. During flight operations announcements: Periodically broadcast a warning announcement on Marine Common FM Ch 16 and VHF 122.9 MHz (CTAF) that… "UAS operations are in effect between the surface and 2000 feet within 10 nautical miles of Latitude /Longitude"

I. Lost Link/Lost Comms with the ScanEagle X2090 (Emergency Comms): PIC will comply with the lost link/lost comms procedures stipulated in the COA. Insitu will immediately broadcast on Marine Common FM Ch 16, VHF 122.9 MHz (CTAF) and VHF 135.5 MHz that "UAS flight operations are commencing emergency return at 500 feet AGL."

J. US Coast Guard Protocols: Insitu / research vessel will maintain continuous listening watch on Marine Common FM Ch16 and the VHF and UHF 121.5 & 243.0 guard frequencies.

To be Distributed to all concerned

Version 2.1: June 2012

APPENDIX E: 2014 SIGHTING RATE TABLES AND FIGURES

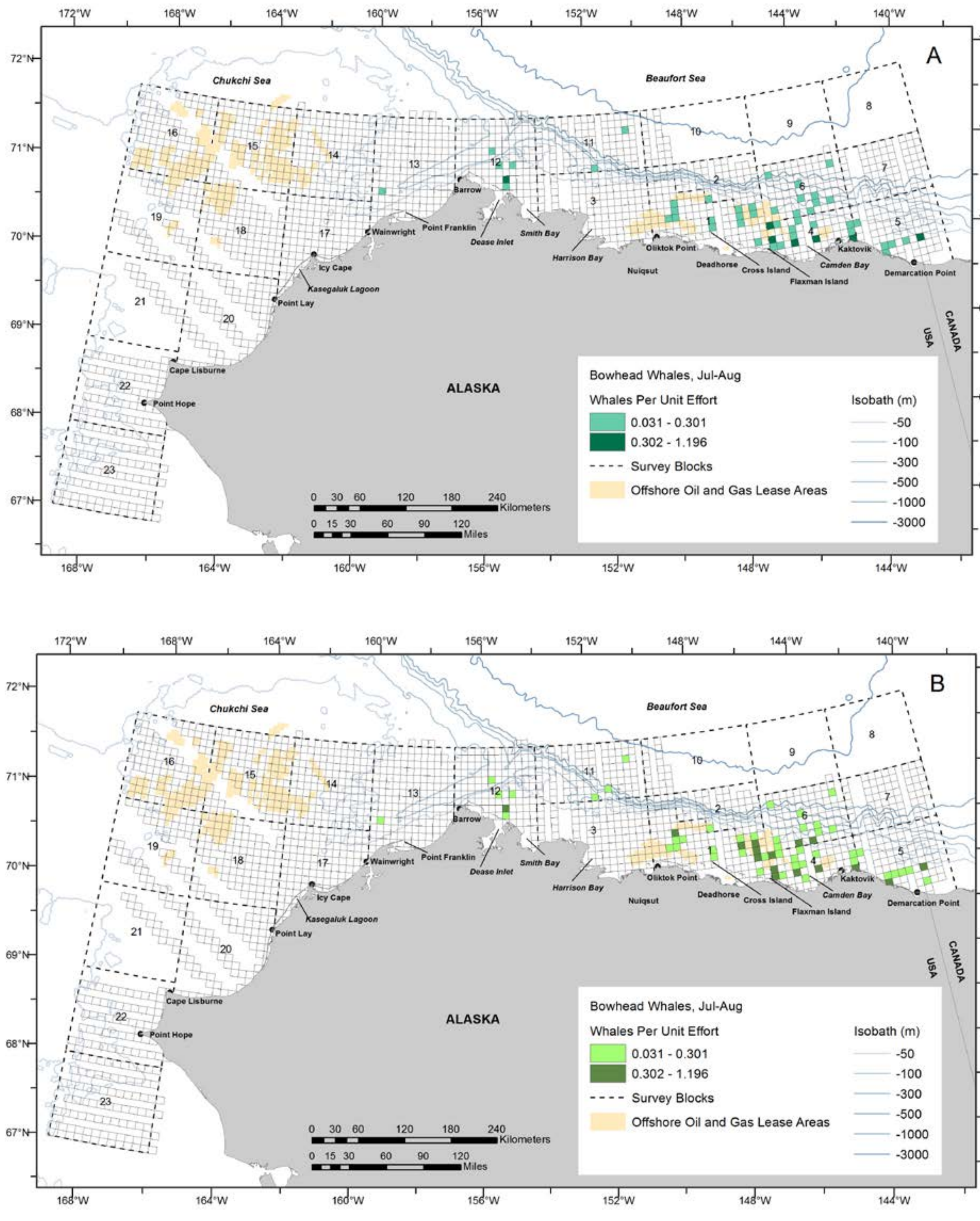


Figure E-1. ASAMM 2014 summer (July-August) bowhead whale sighting rates (WPUE; primary observers only). A: transect (Tr); B: transect and circling from transect (Tr+TrC). Empty grid cells indicate sighting rates of zero. Transect survey effort was not conducted in areas without grid cells.

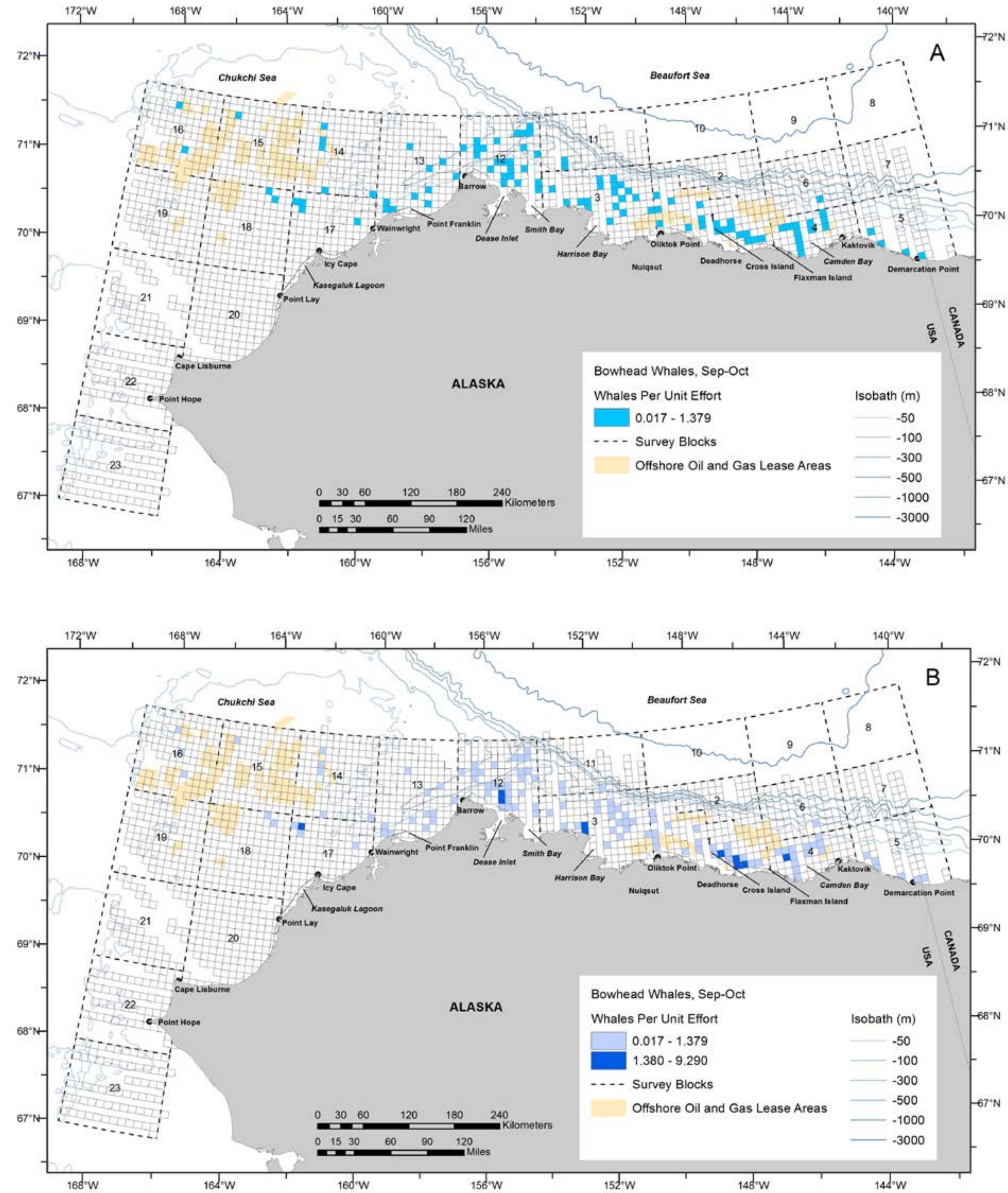


Figure E-2. ASAMM 2014 fall (September-October) bowhead whale sighting rates (WPUE; primary observers only). A: transect (Tr); B: transect and circling from transect (Tr+TrC). Empty grid cells indicate sighting rates of zero. Transect survey effort was not conducted in areas without grid cells.

Table E-1. ASAMM 2014 transect (Tr) effort (km), bowhead whale transect sightings (primary observers only), and bowhead whale sighting rate (WPUE = bowhead whales per transect km surveyed) per survey block per month. NA – surveys were not conducted. Minor discrepancies within the table are due to rounding error.

	JUL				AUG				SUMMER			
BLOCK	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**
1	540	0	0	0.0000	853	13	17	0.0199	1,393	13	17	0.0122
2	314	0	0	0.0000	555	3	4	0.0072	869	3	4	0.0046
3	396	0	0	0.0000	894	0	0	0.0000	1,290	0	0	0.0000
4	267	0	0	0.0000	477	20	33	0.0692	744	20	33	0.0444
5	196	0	0	0.0000	783	10	15	0.0192	979	10	15	0.0153
6	439	7	8	0.0182	576	4	8	0.0139	1,015	11	16	0.0158
7	218	0	0	0.0000	794	0	0	0.0000	1,012	0	0	0.0000
8	0	0	0	NA	0	0	0	NA	0	0	0	NA
9	0	0	0	NA	0	0	0	NA	0	0	0	NA
10	83	0	0	0.0000	185	0	0	0.0000	268	0	0	0.0000
11	442	1	1	0.0023	868	1	1	0.0012	1,310	2	2	0.0015
12	572	3	7	0.0122	963	5	7	0.0073	1,535	8	14	0.0091
13	1,616	1	2	0.0012	1,076	0	0	0.0000	2,692	1	2	0.0007
14	592	0	0	0.0000	814	0	0	0.0000	1,406	0	0	0.0000
15	349	0	0	0.0000	516	0	0	0.0000	865	0	0	0.0000
16	350	0	0	0.0000	298	0	0	0.0000	648	0	0	0.0000
17	881	0	0	0.0000	963	0	0	0.0000	1,844	0	0	0.0000
18	625	0	0	0.0000	479	0	0	0.0000	1,104	0	0	0.0000
19	312	0	0	0.0000	83	0	0	0.0000	395	0	0	0.0000
20	813	0	0	0.0000	515	0	0	0.0000	1,328	0	0	0.0000
21	193	0	0	0.0000	0	0	0	NA	193	0	0	0.0000
22	251	0	0	0.0000	575	0	0	0.0000	826	0	0	0.0000
23	666	0	0	0.0000	579	0	0	0.0000	1,245	0	0	0.0000
Total	**10,114**	**12**	**18**	**0.0018**	**12,844**	**56**	**85**	**0.0066**	**22,958**	**68**	**103**	**0.0045**

	SEP				OCT				FALL			
BLOCK	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**
1	1,011	30	70	0.0692	527	7	9	0.0171	1,538	37	79	0.0514
2	448	0	0	0.0000	512	0	0	0.0000	960	0	0	0.0000
3	910	32	47	0.0516	1,017	1	1	0.0010	1,927	33	48	0.0249
4	960	19	27	0.0281	154	0	0	0.0000	1,114	19	27	0.0242
5	265	3	3	0.0113	179	2	2	0.0112	444	5	5	0.0113
6	700	1	1	0.0014	117	0	0	0.0000	818	1	1	0.0012
7	106	0	0	0.0000	218	0	0	0.0000	325	0	0	0.0000
8	0	0	0	NA	0	0	0	NA	0	0	0	NA
9	0	0	0	NA	0	0	0	NA	0	0	0	NA
10	0	0	0	NA	0	0	0	NA	0	0	0	NA
11	116	0	0	0.0000	701	2	2	0.0029	817	2	2	0.0024
12	1,093	15	18	0.0165	1,113	28	41	0.0368	2,207	43	59	0.0267
13	829	15	19	0.0229	1,608	10	15	0.0093	2,437	25	34	0.0140
14	593	3	3	0.0051	933	2	2	0.0021	1,526	5	5	0.0033
15	441	0	0	0.0000	650	2	2	0.0031	1,091	2	2	0.0018
16	410	1	1	0.0024	298	1	1	0.0034	707	2	2	0.0028
17	745	6	7	0.0094	715	0	0	0.0000	1,460	6	7	0.0048
18	515	0	0	0.0000	322	2	2	0.0062	836	2	2	0.0024
19	373	0	0	0.0000	235	0	0	0.0000	608	0	0	0.0000
20	1038	0	0	0.0000	394	0	0	0.0000	1,433	0	0	0.0000
21	318	0	0	0.0000	43	0	0	0.0000	360	0	0	0.0000
22	488	0	0	0.0000	133	0	0	0.0000	621	0	0	0.0000
23	736	0	0	0.0000	0	0	0	NA	736	0	0	0.0000
Total	**12,095**	**125**	**196**	**0.0162**	**9,870**	**57**	**77**	**0.0078**	**21,965**	**182**	**273**	**0.0125**

Total transect effort (Tr Km) may differ from values in Tables 2 and E-3 because effort between barrier islands and the mainland was not included in the sighting rate per survey block analysis.

Table E-2. ASAMM 2014 transect (Tr) and circling from transect (TrC) effort (km), bowhead whale transect and circling from transect sightings (primary observers only), and bowhead whale sighting rate (WPUE = bowhead whales per Tr and TrC km surveyed) per survey block per month. NA – surveys were not conducted. Minor discrepancies within the table are due to rounding error.

	JUL				AUG				SUMMER			
BLOCK	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**
1	540	0	0	0.0000	1,230	28	43	0.0350	1,770	28	43	0.0243
2	314	0	0	0.0000	591	3	4	0.0068	905	3	4	0.0044
3	396	0	0	0.0000	912	0	0	0.0000	1,307	0	0	0.0000
4	267	0	0	0.0000	798	38	63	0.0789	1,064	38	63	0.0592
5	196	0	0	0.0000	1,111	19	27	0.0243	1,307	19	27	0.0207
6	502	8	9	0.0179	676	9	20	0.0296	1,179	17	29	0.0246
7	226	0	0	0.0000	834	0	0	0.0000	1,060	0	0	0.0000
8	0	0	0	NA	0	0	0	NA	0	0	0	NA
9	0	0	0	NA	0	0	0	NA	0	0	0	NA
10	83	0	0	0.0000	185	0	0	0.0000	267	0	0	0.0000
11	461	1	1	0.0022	905	2	2	0.0022	1,366	3	3	0.0022
12	608	7	12	0.0197	1,134	6	8	0.0071	1,742	13	20	0.0115
13	1,926	1	2	0.0010	1,315	0	0	0.0000	3,241	1	2	0.0006
14	592	0	0	0.0000	836	0	0	0.0000	1,428	0	0	0.0000
15	361	0	0	0.0000	516	0	0	0.0000	877	0	0	0.0000
16	350	0	0	0.0000	298	0	0	0.0000	648	0	0	0.0000
17	1,148	0	0	0.0000	1,012	0	0	0.0000	2,160	0	0	0.0000
18	651	0	0	0.0000	479	0	0	0.0000	1,130	0	0	0.0000
19	312	0	0	0.0000	83	0	0	0.0000	395	0	0	0.0000
20	861	0	0	0.0000	565	0	0	0.0000	1,426	0	0	0.0000
21	208	0	0	0.0000	0	0	0	NA	208	0	0	0.0000
22	284	0	0	0.0000	729	0	0	0.0000	1,012	0	0	0.0000
23	723	0	0	0.0000	586	0	0	0.0000	1,309	0	0	0.0000
Total	**11,009**	**17**	**24**	**0.0022**	**14,794**	**105**	**167**	**0.0113**	**25,803**	**122**	**191**	**0.0074**

	SEP				OCT				FALL			
BLOCK	Tr+TrC Km	Tr+TrC Sightings	Tr+TrC Whales	WPUE	Tr+TrC Km	Tr+TrC Sightings	Tr+TrC Whales	WPUE	Tr+TrC Km	Tr+TrC Sightings	Tr+TrC Whales	WPUE
1	1,720	109	338	0.1965	633	9	11	0.0174	2,353	118	349	0.1483
2	486	0	0	0.0000	512	0	0	0.0000	998	0	0	0.0000
3	1,088	46	68	0.0625	1,079	2	2	0.0019	2,167	48	70	0.0323
4	1,325	44	100	0.0755	164	0	0	0.0000	1,489	44	100	0.0672
5	333	5	7	0.0210	209	3	3	0.0144	542	8	10	0.0185
6	739	1	1	0.0014	117	0	0	0.0000	856	1	1	0.0012
7	106	0	0	0.0000	218	0	0	0.0000	325	0	0	0.0000
8	0	0	0	NA	0	0	0	NA	0	0	0	NA
9	0	0	0	NA	0	0	0	NA	0	0	0	NA
10	0	0	0	NA	0	0	0	NA	0	0	0	NA
11	116	0	0	0.0000	735	3	3	0.0041	851	3	3	0.0035
12	1,425	40	89	0.0625	1,222	44	73	0.0597	2,647	84	162	0.0612
13	975	28	39	0.0400	1,703	17	25	0.0147	2,678	45	64	0.0239
14	629	3	3	0.0048	987	2	2	0.0020	1,616	5	5	0.0031
15	441	0	0	0.0000	657	2	2	0.0030	1,098	2	2	0.0018
16	422	1	1	0.0024	327	2	2	0.0061	749	3	3	0.0040
17	881	12	14	0.0159	719	0	0	0.0000	1,600	12	14	0.0088
18	532	0	0	0.0000	350	2	2	0.0057	883	2	2	0.0023
19	381	0	0	0.0000	252	0	0	0.0000	633	0	0	0.0000
20	1,084	0	0	0.0000	394	0	0	0.0000	1,478	0	0	0.0000
21	328	0	0	0.0000	43	0	0	0.0000	371	0	0	0.0000
22	498	0	0	0.0000	147	0	0	0.0000	646	0	0	0.0000
23	1,259	0	0	0.0000	0	0	0	NA	1,259	0	0	0.0000
Total	**14,768**	**289**	**660**	**0.0447**	**10,470**	**86**	**125**	**0.0119**	**25,238**	**375**	**785**	**0.0311**

Total (Tr+TrC Km) may differ from values in Table E-4 because effort between barrier islands and the mainland was not included in the sighting rate per survey block analysis.

Table E-3. ASAMM 2014 transect (Tr) effort (km), bowhead whale Tr sightings (primary observers only), and bowhead whale sighting rate (WPUE = bowhead whales per Tr km surveyed) per depth zone per month. NA – surveys were not conducted. Minor discrepancies within the table are due to rounding error.

	JUL				AUG				SUMMER			
	Tr Km	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**
157°W-169°W												
0-35 m	2,307	0	0	0.0000	2,031	0	0	0.0000	4,339	0	0	0.0000
36-50 m	3,021	0	0	0.0000	2,766	0	0	0.0000	5,788	0	0	0.0000
51-200 m North	1,154	1	2	0.0017	827	0	0	0.0000	1,981	1	2	0.0010
51-200 m South	166	0	0	0.0000	273	0	0	0.0000	439	0	0	0.0000
154°W-157°W												
0-20 m	124	3	7	0.0566	171	0	0	0.0000	295	3	7	0.0237
21-50 m	128	0	0	0.0000	212	4	5	0.0236	340	4	5	0.0147
51-200 m	273	0	0	0.0000	448	0	0	0.0000	722	0	0	0.0000
201-2,000 m	47	0	0	0.0000	131	1	2	0.0153	178	1	2	0.0113
140°W-154°W												
0-20 m	342	0	0	0.0000	795	8	8	0.0101	1,137	8	8	0.0070
21-50 m	986	0	0	0.0000	1,875	40	67	0.0357	2,861	40	67	0.0234
51-200 m	512	2	3	0.0059	1,007	2	2	0.0020	1,519	4	5	0.0033
201-2,000 m	785	5	5	0.0064	1,537	1	1	0.0007	2,322	6	6	0.0026
>2,000 m	269	1	1	0.0037	775	0	0	0.0000	1,043	1	1	0.0010
TOTAL	**10,115**	**12**	**18**	**0.0018**	**12,848**	**56**	**85**	**0.0066**	**22,963**	**68**	**103**	**0.0045**

	SEP				OCT				FALL			
	Tr Km	Tr Sightings	Tr Whales	WPUE	Tr Km	Tr Sightings	Tr Whales	WPUE	Tr Km	Tr Sightings	Tr Whales	WPUE
157°W-169°W												
0-35 m	2,250	5	8	0.0036	1,682	0	0	0.0000	3,932	5	8	0.0020
36-50 m	3,337	15	17	0.0051	2,572	7	7	0.0027	5,909	22	24	0.0041
51-200 m North	657	5	5	0.0076	1,076	10	15	0.0139	1,733	15	20	0.0115
51-200 m South	241	0	0	0.0000	0	0	0	NA	241	0	0	0.0000
154°W-157°W												
0-20 m	212	3	3	0.0142	274	8	17	0.0620	486	11	20	0.0411
21-50 m	233	7	8	0.0344	245	1	3	0.0122	478	8	11	0.0230
51-200 m	541	5	7	0.0129	428	17	19	0.0444	969	22	26	0.0268
201-2,000 m	108	0	0	0.0000	166	2	2	0.0121	274	2	2	0.0073
140°W-154°W												
0-20 m	1,029	51	108	0.1050	710	1	1	0.0014	1,739	52	109	0.0627
21-50 m	2,084	33	39	0.0187	1,135	9	11	0.0097	3,219	42	50	0.0155
51-200 m	704	1	1	0.0014	627	2	2	0.0032	1,330	3	3	0.0023
201-2,000 m	614	0	0	0.0000	752	0	0	0.0000	1,366	0	0	0.0000
>2,000 m	105	0	0	0.0000	200	0	0	0.0000	305	0	0	0.0000
TOTAL	**12,114**	**125**	**196**	**0.0162**	**9,868**	**57**	**77**	**0.0078**	**21,982**	**182**	**273**	**0.0124**

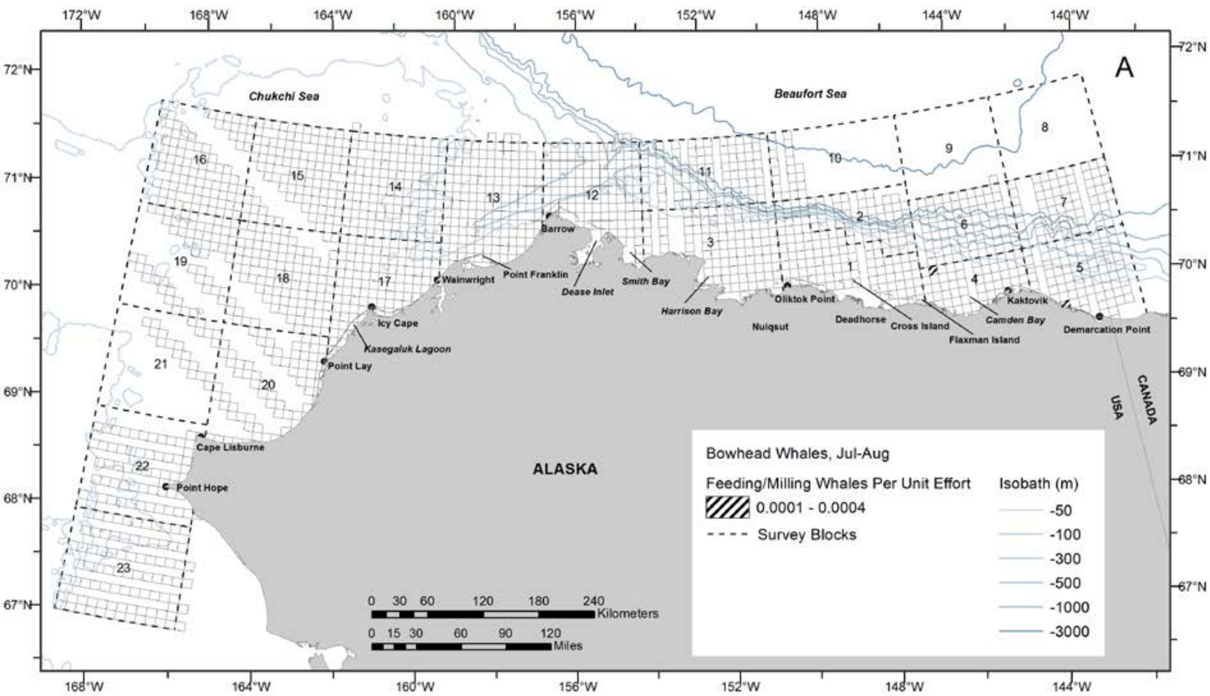
Total transect effort (Tr Km) may differ from values in Tables 2 and E-1 because effort between barrier islands and the mainland was included in the sighting rate per depth zone analysis.

Table E-4. ASAMM 2014 transect (Tr) and circling from transect (TrC) effort (km), bowhead whale transect and circling from transect sightings (primary observers only), and bowhead whale sighting rate (WPUE = bowhead whales per Tr and TrC km surveyed) per depth zone per month. NA – surveys were not conducted. Minor discrepancies within the table are due to rounding error.

	JUL				AUG				SUMMER			
	Tr+TrC Km	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**
157°W-169°W												
0-35 m	2,803	0	0	0.0000	2,279	0	0	0.0000	5082	0	0	0.0000
36-50 m	3,226	0	0	0.0000	2,956	0	0	0.0000	6182	0	0	0.0000
51-200 m North	1,163	1	2	0.0017	860	0	0	0.0000	2023	1	2	0.0010
51-200 m South	223	0	0	0.0000	323	0	0	0.0000	546	0	0	0.0000
154°W-157°W												
0-20 m	161	7	12	0.0747	186	0	0	0.0000	347	7	12	0.0346
21-50 m	128	0	0	0.0000	317	5	6	0.0189	445	5	6	0.0135
51-200 m	273	0	0	0.0000	487	0	0	0.0000	761	0	0	0.0000
201-2,000 m	47	0	0	0.0000	143	1	2	0.0140	190	1	2	0.0106
140°W-154°W												
0-20 m	342	0	0	0.0000	904	14	20	0.0221	1247	14	20	0.0160
21-50 m	986	0	0	0.0000	2,721	78	126	0.0463	3707	78	126	0.0340
51-200 m	543	2	3	0.0055	1,241	5	11	0.0089	1784	7	14	0.0078
201-2,000 m	826	6	6	0.0073	1,594	2	2	0.0013	2420	8	8	0.0033
>2,000 m	288	1	1	0.0035	787	0	0	0.0000	1075	1	1	0.0009
TOTAL	**11,008**	**17**	**24**	**0.0022**	**14,798**	**105**	**167**	**0.0113**	**25,806**	**122**	**191**	**0.0074**

	SEP				OCT				FALL			
	Tr+TrC Km	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**
157°W-169°W												
0-35 m	2,509	13	21	0.0084	1,729	0	0	0.0000	4,238	13	21	0.0050
36-50 m	3,764	26	31	0.0082	2,691	8	8	0.0030	6,456	34	39	0.0060
51-200 m North	688	5	5	0.0073	1,159	17	25	0.0216	1,847	22	30	0.0162
51-200 m South	469	0	0	0.0000	0	0	0	NA	469	0	0	0.0000
154°W-157°W												
0-20 m	238	4	8	0.0337	337	22	47	0.1394	575	26	55	0.0957
21-50 m	414	20	60	0.1450	245	1	3	0.0122	659	21	63	0.0956
51-200 m	666	16	21	0.0316	469	19	21	0.0448	1,135	35	42	0.0370
201-2,000 m	108	0	0	0.0000	171	2	2	0.0117	279	2	2	0.0072
140°W-154°W												
0-20 m	1,819	143	398	0.2188	736	2	2	0.0027	2,555	145	400	0.1565
21-50 m	2,638	61	115	0.0436	1,310	12	14	0.0107	3,948	73	129	0.0327
51-200 m	748	1	1	0.0013	668	3	3	0.0045	1,416	4	4	0.0028
201-2,000 m	625	0	0	0.0000	752	0	0	0.0000	1,377	0	0	0.0000
>2,000 m	105	0	0	0.0000	200	0	0	0.0000	305	0	0	0.0000
TOTAL	**14,790**	**289**	**660**	**0.0446**	**10,468**	**86**	**125**	**0.0119**	**25,258**	**375**	**785**	**0.0311**

Total (Tr+TrC Km) may differ from values in Table E-2 because effort between barrier islands and the mainland was included in the sighting rate per depth zone analysis.



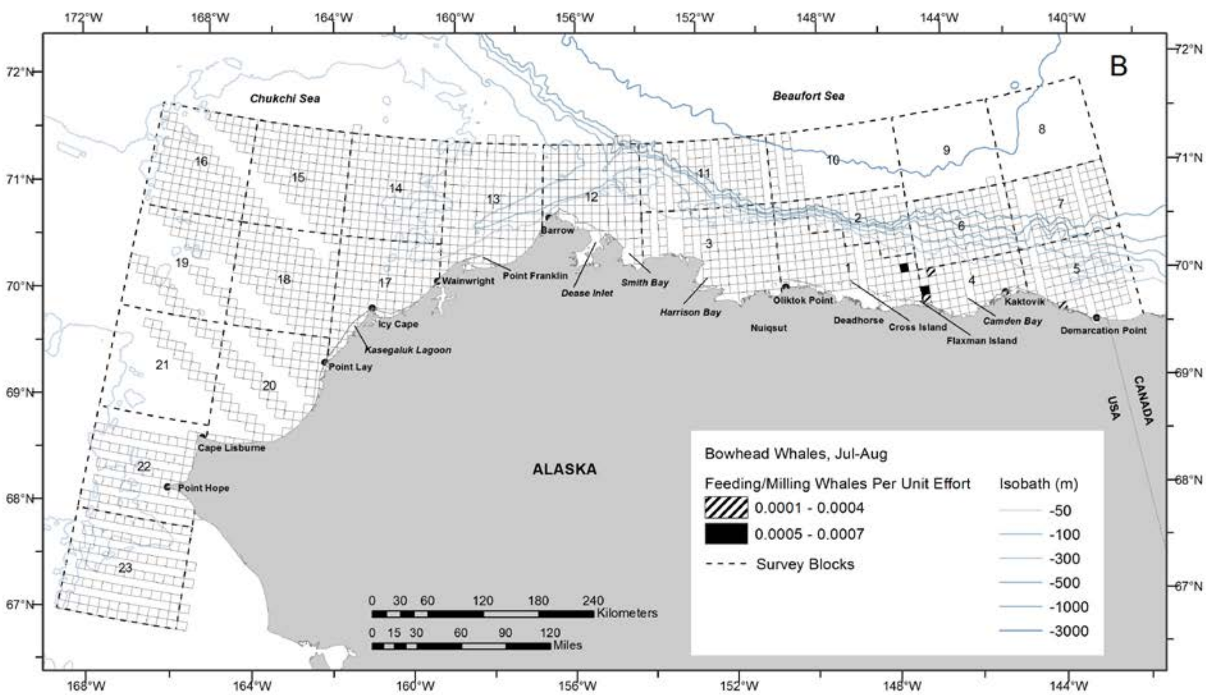


Figure E-3. ASAMM 2014 summer (July-August) feeding and milling bowhead whale sighting rates (WPUE from primary observers only). A: transect (Tr); B: transect and circling from transect (Tr+TrC). Empty grid cells indicate sighting rates of zero. Transect survey effort was not conducted in areas without grid cells.

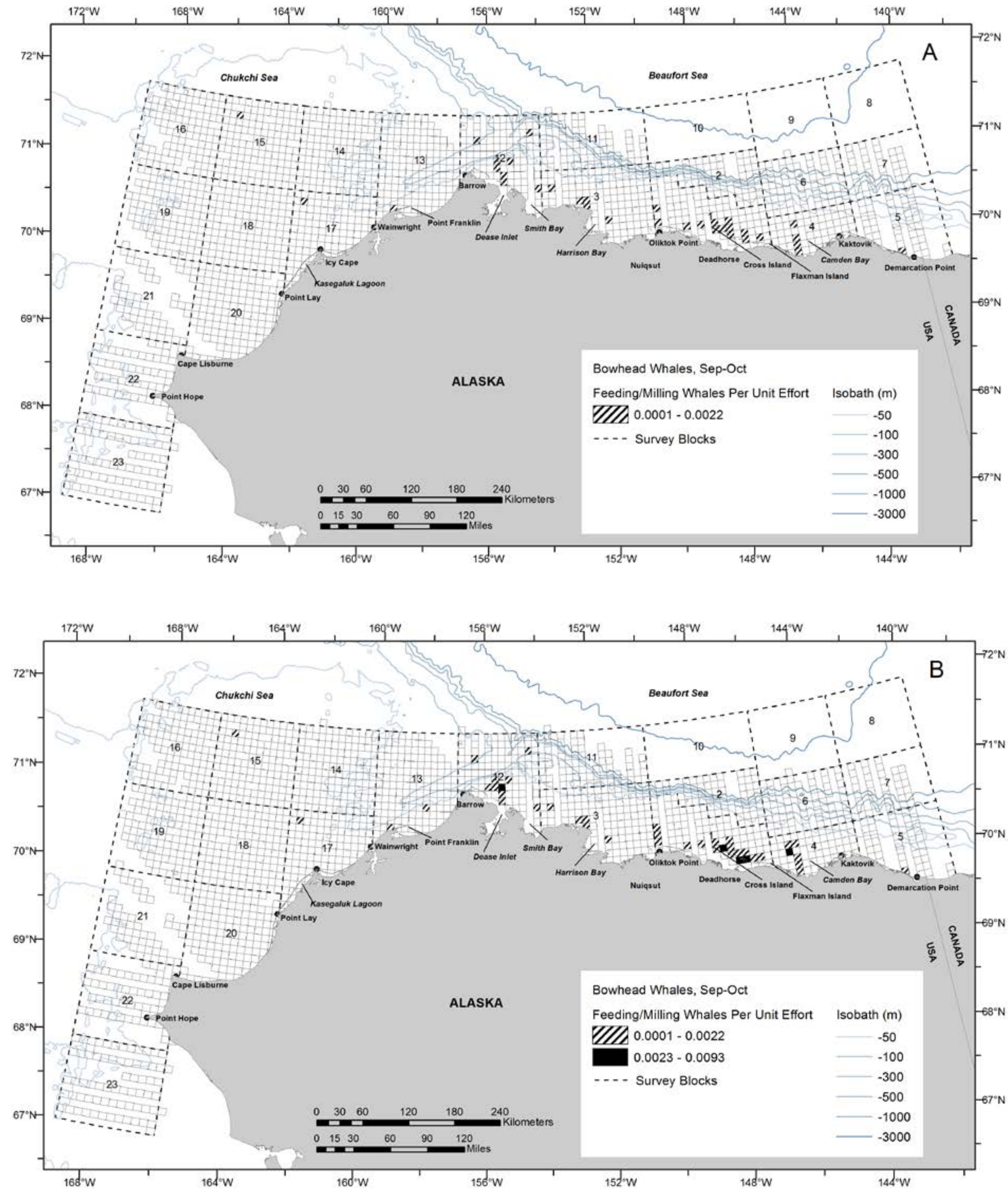


Figure E-4. ASAMM 2014 fall (September-October) feeding and milling bowhead whale sighting rates (WPUE; primary observers only). A: transect (Tr); B: transect and circling from transect (Tr+TrC). Empty grid cells indicate sighting rates of zero. Transect survey effort was not conducted in areas without grid cells.

Table E-5. ASAMM 2014 transect (Tr) effort (km), gray whale transect sightings (primary observers only), and gray whale sighting rate (WPUE = gray whales per transect km surveyed) per survey block per month. NA – surveys were not conducted. Minor discrepancies within the table are due to rounding error.

	JUL				AUG				SUMMER			
BLOCK	Tr Km	Tr Sightings	Tr Whales	WPUE	Tr Km	Tr Sightings	Tr Whales	WPUE	Tr Km	Tr Sightings	Tr Whales	WPUE
12	572	0	0	0.0000	963	1	1	0.0010	1,534	1	1	0.0007
13	1,616	20	40	0.0248	1,076	16	20	0.0186	2,692	36	60	0.0223
14	592	0	0	0.0000	814	3	9	0.0111	1,406	3	9	0.0064
15	349	0	0	0.0000	516	0	0	0.0000	865	0	0	0.0000
16	350	1	2	0.0057	298	0	0	0.0000	648	1	2	0.0031
17	881	15	31	0.0352	963	3	3	0.0031	1,844	18	34	0.0184
18	625	1	2	0.0032	479	0	0	0.0000	1,104	1	2	0.0018
19	312	0	0	0.0000	83	0	0	0.0000	395	0	0	0.0000
20	813	4	7	0.0086	515	6	10	0.0194	1,328	10	17	0.0128
21	193	0	0	0.0000	0	0	0	NA	193	0	0	0.0000
22	251	2	5	0.0199	575	11	15	0.0261	826	13	20	0.0242
23	666	4	7	0.0105	579	39	87	0.1503	1,245	43	94	0.0755
Total	**7,220**	**47**	**94**	**0.0130**	**6,860**	**79**	**145**	**0.0211**	**14,081**	**126**	**239**	**0.0170**

	SEP				OCT				FALL			
BLOCK	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**
12	1,093	2	2	0.0018	1,113	0	0	0.0000	2,207	2	2	0.0009
13	829	4	5	0.0060	1,608	5	5	0.0031	2,437	9	10	0.0041
14	593	1	1	0.0017	933	0	0	0.0000	1,527	1	1	0.0007
15	441	0	0	0.0000	650	0	0	0.0000	1,091	0	0	0.0000
16	410	0	0	0.0000	298	0	0	0.0000	708	0	0	0.0000
17	745	0	0	0.0000	715	0	0	0.0000	1,460	0	0	0.0000
18	515	0	0	0.0000	322	0	0	0.0000	836	0	0	0.0000
19	373	0	0	0.0000	235	0	0	0.0000	608	0	0	0.0000
20	1,038	0	0	0.0000	394	0	0	0.0000	1,433	0	0	0.0000
21	318	0	0	0.0000	43	0	0	0.0000	360	0	0	0.0000
22	488	0	0	0.0000	133	0	0	0.0000	621	0	0	0.0000
23	736	31	44	0.0598	0	0	0	NA	736	31	44	0.0598
Total	**7,579**	**38**	**52**	**0.0069**	**6,444**	**5**	**5**	**0.0008**	**14,023**	**43**	**57**	**0.0041**

Does not include one sighting of one gray whale in Block 1.
Total transect effort (Tr Km) may differ from values in Tables 2 and E-7 because effort between barrier islands and the mainland was not included in the sighting rate per survey block analysis.

Table E-6. ASAMM 2014 transect (Tr) and circling from transect (TrC) effort (km), gray whale transect and circling from transect sightings (primary observers only), and gray whale sighting rate (WPUE = gray whales per Tr and TrC km surveyed) per survey block per month. NA – surveys were not conducted. Minor discrepancies within the table are due to rounding error.

	JUL				AUG				SUMMER			
BLOCK	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**
12	608	0	0	0.0000	1,134	1	1	0.0009	1,742	1	1	0.0006
13	1,926	39	75	0.0389	1,315	45	55	0.0418	3,241	84	130	0.0401
14	592	0	0	0.0000	836	3	9	0.0108	1,428	3	9	0.0063
15	361	0	0	0.0000	516	0	0	0.0000	877	0	0	0.0000
16	350	1	2	0.0057	298	0	0	0.0000	648	1	2	0.0031
17	1,148	22	51	0.0444	1,012	5	6	0.0059	2,160	27	57	0.0264
18	651	1	2	0.0031	479	0	0	0.0000	1,130	1	2	0.0018
19	312	0	0	0.0000	83	0	0	0.0000	395	0	0	0.0000
20	861	6	14	0.0163	565	7	12	0.0212	1,426	13	26	0.0182
21	208	0	0	0.0000	0	0	0	NA	208	0	0	0.0000
22	284	6	13	0.0458	729	18	26	0.0357	1,012	24	39	0.0385
23	723	16	35	0.0484	586	39	87	0.1484	1,309	55	122	0.0932
Total	**8,025**	**91**	**192**	0.0239	**7,552**	**118**	**196**	0.0260	**15,577**	**209**	**388**	0.0249

	SEP				OCT				FALL			
BLOCK	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**
12	1,425	3	3	0.0021	1,222	0	0	0.0000	2,647	3	3	0.0011
13	975	7	8	0.0082	1,703	5	5	0.0029	2,678	12	13	0.0049
14	629	1	1	0.0016	987	0	0	0.0000	1,616	1	1	0.0006
15	441	0	0	0.0000	657	0	0	0.0000	1,098	0	0	0.0000
16	422	0	0	0.0000	327	0	0	0.0000	749	0	0	0.0000
17	881	0	0	0.0000	719	0	0	0.0000	1,600	0	0	0.0000
18	532	0	0	0.0000	350	0	0	0.0000	883	0	0	0.0000
19	381	0	0	0.0000	252	0	0	0.0000	633	0	0	0.0000
20	1,084	0	0	0.0000	394	0	0	0.0000	1,478	0	0	0.0000
21	328	0	0	0.0000	43	0	0	0.0000	371	0	0	0.0000
22	498	0	0	0.0000	147	0	0	0.0000	646	0	0	0.0000
23	1,259	126	203	0.1612	0	0	0	NA	1,259	126	203	0.1612
Total	**8,855**	**137**	**215**	0.0243	**6,802**	**5**	**5**	0.0007	**15,657**	**142**	**220**	0.0141

Does not include one sighting of one gray whale in Block 1.
Total (Tr+TrC Km) may differ from values in Table E-8 because effort between barrier islands and the mainland was not included in the sighting rate per survey block analysis.

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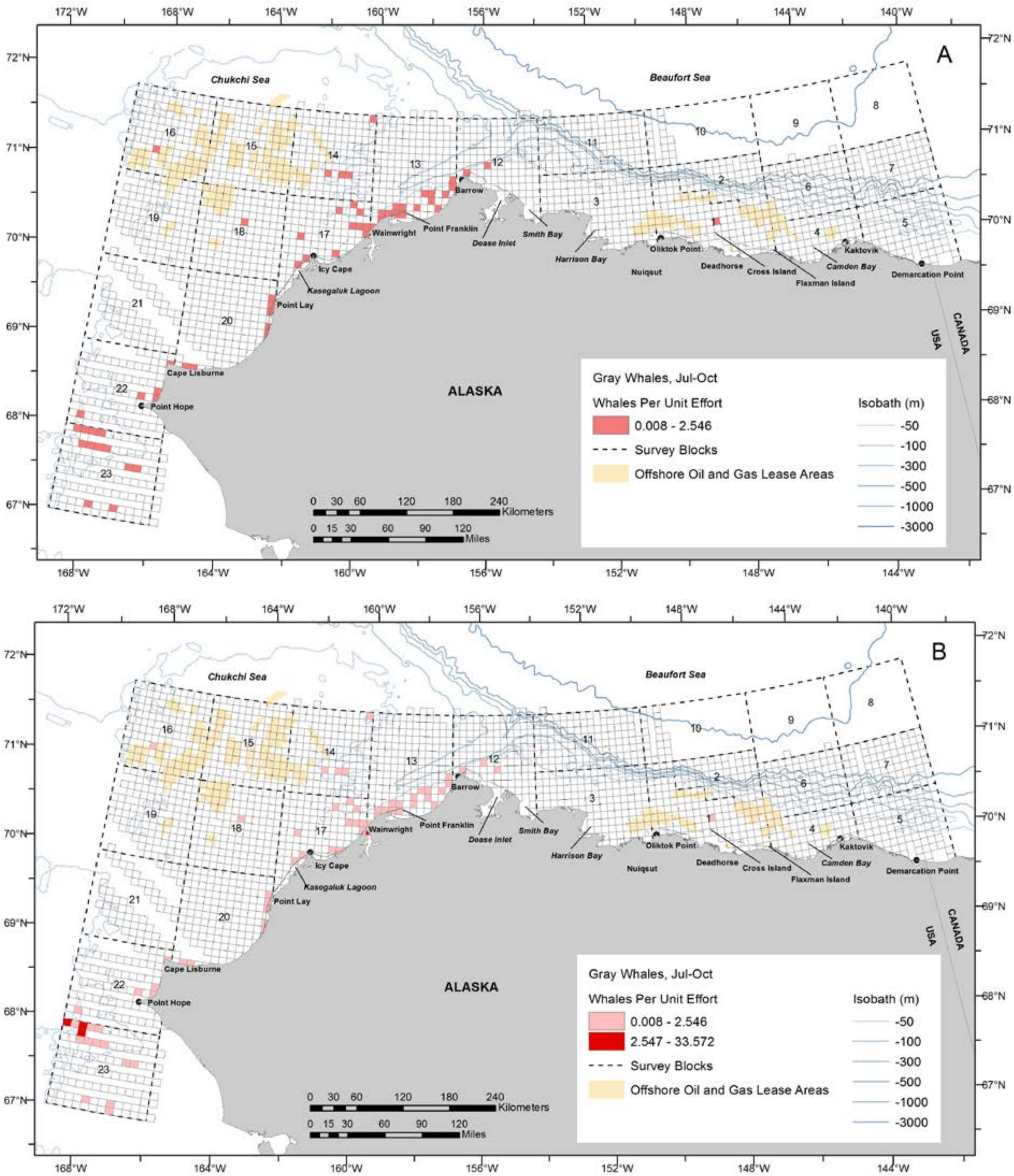

Figure E-5. ASAMM 2014 gray whale sighting rates (WPUE; primary observers only). A: transect (Tr); B: transect and circling from transect (Tr+TrC). Empty grid cells indicate sighting rates of zero. Transect survey effort was not conducted in areas without grid cells.

Table E-7. ASAMM 2014 transect (Tr) effort (km), gray whale transect sightings (primary observers only), and gray whale sighting rate (WPUE = gray whales per transect km surveyed) per depth zone per month. NA – surveys were not conducted. Minor discrepancies within the table are due to rounding error.

	JUL				AUG				SUMMER			
Depth Zone	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**
157°W-169°W												
0-35 m	2,307	31	63	0.0273	2,031	17	24	0.0118	4,339	48	87	0.0201
36-50 m	3,021	11	22	0.0073	2,766	18	42	0.0152	5,788	29	64	0.0111
51-200 m North	1,154	1	2	0.0017	827	3	3	0.0036	1,981	4	5	0.0025
51-200 m South	166	4	7	0.0421	273	40	75	0.2750	439	44	82	0.1866
154°W-157°W												
0-20 m	124	0	0	0.0000	171	0	0	0.0000	295	0	0	0.0000
21-50 m	128	0	0	0.0000	212	0	0	0.0000	340	0	0	0.0000
51-200 m	273	0	0	0.0000	448	1	1	0.0022	722	1	1	0.0014
201-2,000 m	47	0	0	0.0000	131	0	0	0.0000	178	0	0	0.0000
Total*	**7,220**	**47**	**94**	**0.0130**	**6,859**	**79**	**145**	**0.0211**	**14,079**	**126**	**239**	**0.0170**

	SEP				OCT				FALL			
Depth Zone	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**
157°W-169°W												
0-35 m	2250	0	0	0.0000	1682	2	2	0.0012	3933	2	2	0.0005
36-50 m	3337	11	17	0.0051	2572	3	3	0.0012	5909	14	20	0.0034
51-200 m North	657	1	1	0.0015	1076	0	0	0.0000	1739	1	1	0.0006
51-200 m South	241	24	32	0.1329	0	0	0	NA	241	24	32	0.1329
154°W-157°W												
0-20 m	212	0	0	0.0000	274	0	0	0.0000	486	0	0	0.0000
21-50 m	233	0	0	0.0000	245	0	0	0.0000	478	0	0	**0.0000**
51-200 m	541	2	2	0.0037	428	0	0	0.0000	968	2	2	0.0021
201-2,000 m	108	0	0	0.0000	166	0	0	0.0000	274	0	0	0.0000
Total*	**7,579**	**38**	**52**	0.0069	**6,444**	**5**	**5**	0.0008	**14,021**	**43**	**57**	0.0041

Does not include one sighting of one gray whale east of 154°W.
Total transect effort (Tr km) may differ from values in Tables 2 and E-5 because effort between barrier islands and the mainland was included in the sighting rate per depth zone analysis.

Table E-8. ASAMM 2014 transect (Tr) and circling from transect (TrC) effort (km), gray whale transect and circling from transect sightings (primary observers only), and gray whale sighting rate (WPUE = gray whales per Tr and TrC km surveyed) per depth zone per month. NA – surveys were not conducted. Minor discrepancies within the table are due to rounding error.

	JUL				AUG				SUMMER			
	Tr+TrC Km	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**
157°W-169°W												
0-35 m	2,803	62	131	0.0467	2,279	20	31	0.0136	5,082	82	162	0.0319
36-50 m	3,226	12	24	0.0074	2,956	44	70	0.0237	6,181	56	94	0.0152
51-200 m North	1,163	1	2	0.0017	860	6	8	0.0093	2,023	7	10	0.0049
51-200 m South	223	16	35	0.1571	323	47	86	0.2659	546	63	121	0.2216
154°W-157°W												
0-20 m	161	0	0	0.0000	186	0	0	0.0000	347	0	0	0.0000
21-50 m	128	0	0	0.0000	317	0	0	0.0000	445	0	0	0.0000
51-200 m	273	0	0	0.0000	487	1	1	0.0021	761	1	1	0.0013
201-2,000 m	47	0	0	0.0000	143	0	0	0.0000	190	0	0	0.0000
140°W-154°W												
0-20 m	342	0	0	0.0000	904	0	0	0.0000	1,246	0	0	0.0000
21-50 m	986	0	0	0.0000	2,721	0	0	0.0000	3,707	0	0	0.0000
51-200 m	543	0	0	0.0000	1,241	0	0	0.0000	1,784	0	0	0.0000
201-2,000 m	826	0	0	0.0000	1,594	0	0	0.0000	2,420	0	0	0.0000
>2,000 m	288	0	0	0.0000	787	0	0	0.0000	1,075	0	0	0.0000
Total*	**11,008**	**91**	**192**	0.0174	**14,798**	**118**	**196**	0.0132	25,806	**209**	**388**	0.0150

	SEP				OCT				FALL			
	Tr+TrC Km	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**	**Tr+TrC Km**	**Tr+TrC Sightings**	**Tr+TrC Whales**	**WPUE**
157°W-169°W												
0-35 m	2,509	1	1	0.0004	1,729	2	2	0.0012	4,238	3	3	0.0007
36-50 m	3,764	46	73	0.0194	2,691	3	3	0.0011	6,456	49	76	0.0118
51-200 m North	688	1	1	0.0015	1,159	0	0	0.0000	1,847	1	1	0.0005
51-200 m South	469	86	137	0.2923	0	0	0	NA	469	86	137	0.2923
154°W-157°W												
0-20 m	238	0	0	0.0000	337	0	0	0.0000	575	0	0	0.0000
21-50 m	414	1	1	0.0024	245	0	0	0.0000	659	1	1	0.0015
51-200 m	666	2	2	0.0030	469	0	0	0.0000	1,135	2	2	0.0018
201-2,000 m	108	0	0	0.0000	171	0	0	0.0000	279	0	0	0.0000
140°W-154°W												
0-20 m	1,819	0	0	0.0000	736	0	0	0.0000	2,555	0	0	0.0000
21-50 m	2,638	1	1	0.0004	1,310	0	0	0.0000	3,948	1	1	0.0003
51-200 m	748	0	0	0.0000	668	0	0	0.0000	1,416	0	0	0.0000
201-2,000 m	625	0	0	0.0000	752	0	0	0.0000	1,377	0	0	0.0000
>2,000 m	105	0	0	0.0000	200	0	0	0.0000	305	0	0	0.0000
Total*	**14,790**	**138**	**216**	0.0146	**10,468**	**5**	**5**	0.0005	**25,258**	**143**	**221**	0.0088

Total (Tr+TrC Km) may differ from values in Table E-6 because effort between barrier islands and the mainland was included in the sighting rate per depth zone analysis.

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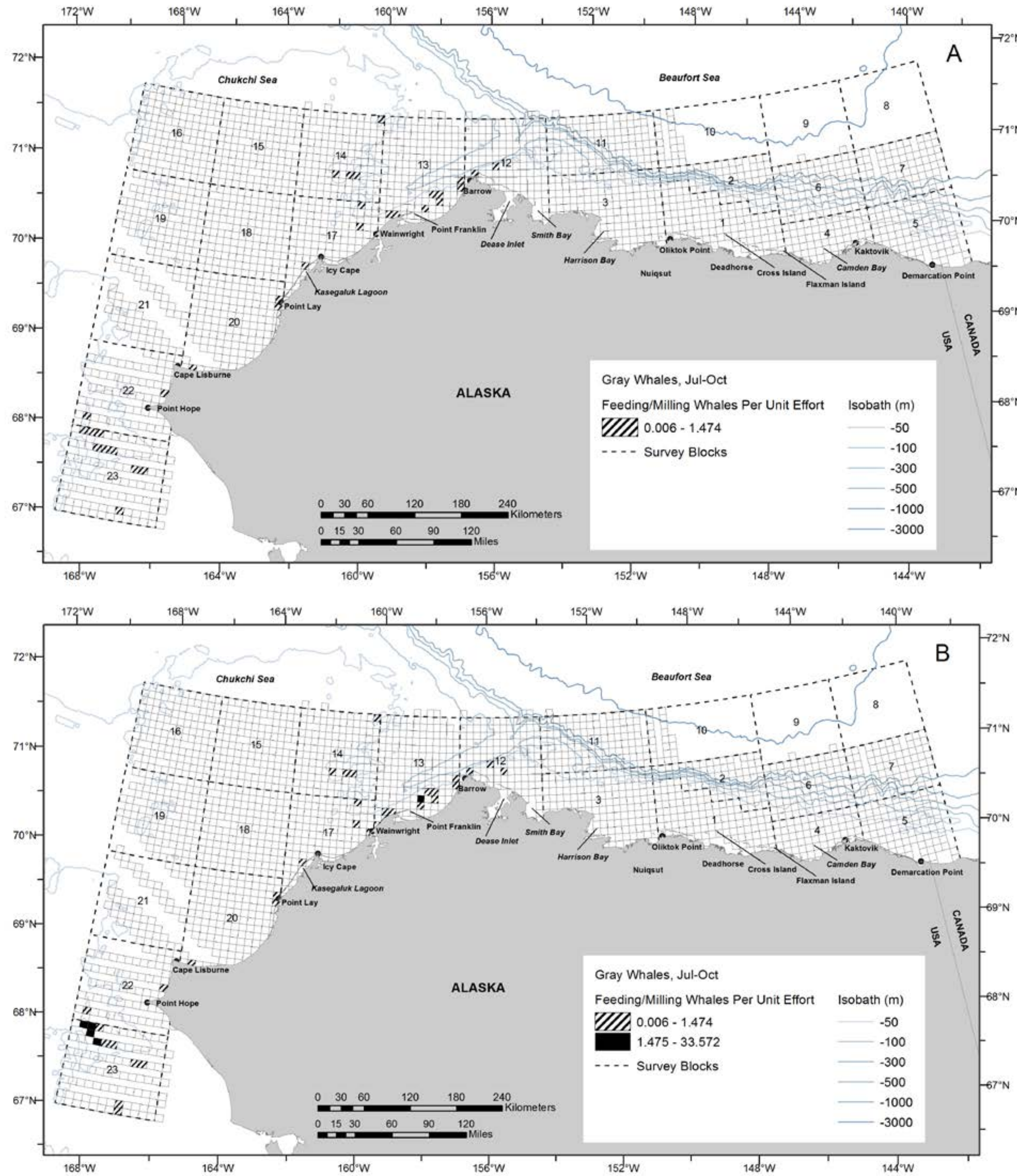

Figure E-6. ASAMM 2014 feeding and milling gray whale sighting rates (WPUE; primary observers only). A: transect (Tr); B: transect and circling from transect (Tr+TrC). Empty grid cells indicate sighting rates of zero. Transect survey effort was not conducted in areas without grid cells.

Table E-9. ASAMM 2014 transect (Tr) effort (km), beluga transect sightings (primary observers only), and beluga sighting rate (WPUE = belugas per transect km surveyed) per survey block per month. NA – surveys were not conducted. Minor discrepancies within the table are due to rounding error.

	JUL				AUG				SUMMER			
BLOCK	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**
1	540	1	1	0.0019	853	10	12	0.0141	1,393	11	13	0.0093
2	314	23	52	0.1657	555	45	82	0.1479	868	68	134	0.1543
3	396	2	4	0.0101	894	5	6	0.0067	1,290	7	10	0.0078
4	267	0	0	0.0000	477	5	10	0.0210	743	5	10	0.0135
5	196	7	14	0.0714	783	12	12	0.0153	980	19	26	0.0265
6	439	48	191	0.4353	576	51	95	0.1648	1,015	99	286	0.2817
7	218	18	45	0.2064	794	54	64	0.0806	1,012	72	109	0.1077
8	0	0	0	NA	0	0	0	NA	0	0	0	NA
9	0	0	0	0.0000	0	0	0	NA	0	0	0	0.0000
10	83	0	0	0.0000	185	7	7	0.0379	267	7	7	0.0262
11	442	37	77	0.1743	868	102	242	0.2789	1,309	139	319	0.2436
12	572	16	85	0.1487	963	37	168	0.1745	1,534	53	253	0.1649
13	1,616	15	43	0.0266	1,076	4	14	0.0130	2,692	19	57	0.0212
14	592	0	0	0.0000	814	0	0	0.0000	1,406	0	0	0.0000
15	349	0	0	0.0000	516	0	0	0.0000	865	0	0	0.0000
16	350	0	0	0.0000	298	0	0	0.0000	648	0	0	0.0000
17	881	7	58	0.0658	963	2	16	0.0166	1,844	9	74	0.0401
18	625	0	0	0.0000	479	0	0	0.0000	1,104	0	0	0.0000
19	312	1	1	0.0032	83	0	0	0.0000	395	1	1	0.0025
20	813	1	200	0.2461	515	0	0	0.0000	1,328	1	200	0.1506
21	193	0	0	0.0000	0	0	0	NA	193	0	0	0.0000
22	251	0	0	0.0000	575	0	0	0.0000	826	0	0	0.0000
23	666	0	0	0.0000	579	0	0	0.0000	1,245	0	0	0.0000
Total	**10,114**	**176**	**771**	**0.0762**	**12,844**	**334**	**728**	**0.0567**	**22,958**	**510**	**1,499**	**0.0653**

	SEP				OCT				FALL			
BLOCK	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**
1	1,011	9	9	0.0089	527	0	0	0.0000	1,538	9	9	0.0059
2	448	30	58	0.1295	512	13	21	0.0410	960	43	79	0.0823
3	910	12	21	0.0231	1,017	3	6	0.0059	1,927	15	27	0.0140
4	960	0	0	0.0000	154	0	0	0.0000	1,114	0	0	0.0000
5	265	1	1	0.0038	179	1	1	0.0056	444	2	2	0.0045
6	700	24	33	0.0471	117	0	0	0.0000	818	24	33	0.0404
7	106	2	5	0.0470	218	8	8	0.0366	325	10	13	0.0400
8	0	0	0	NA	0	0	0	NA	0	0	0	NA
9	0	0	0	0.0000	0	0	0	NA	0	0	0	0.0000
10	0	0	0	NA	0	0	0	NA	0	0	0	NA
11	116	0	0	0.0000	701	29	45	0.0642	817	29	45	0.0551
12	1,093	24	53	0.0485	1,113	36	124	0.1114	2,207	60	177	0.0802
13	829	3	8	0.0096	1,608	16	35	0.0218	2,437	19	43	0.0176
14	593	5	6	0.0101	933	22	41	0.0439	1,527	27	47	0.0308
15	441	2	4	0.0091	650	8	13	0.0200	1,091	10	17	0.0156
16	410	1	11	0.0269	298	24	32	0.1075	707	25	43	0.0608
17	745	0	0	0.0000	715	4	5	0.0070	1,460	4	5	0.0034
18	515	0	0	0.0000	322	1	1	0.0031	836	1	1	0.0012
19	373	0	0	0.0000	235	0	0	0.0000	608	0	0	0.0000
20	1,038	0	0	0.0000	394	0	0	0.0000	1,433	0	0	0.0000
21	318	0	0	0.0000	43	0	0	0.0000	360	0	0	0.0000
22	488	0	0	0.0000	133	0	0	0.0000	621	0	0	0.0000
23	736	0	0	0.0000	0	0	0	NA	736	0	0	0.0000
Total	**12,095**	**113**	**209**	**0.0173**	**9,869**	**165**	**332**	**0.0336**	**21,965**	**278**	**541**	**0.0246**

Total transect effort (Tr Km) may differ from values in Tables 2 and E-10 because effort between barrier islands and the mainland was not included in the sighting rate per survey block analysis.

Table E-10. ASAMM 2014 transect (Tr) effort (km), beluga Tr sightings (primary observers only), and beluga sighting rate (WPUE = bowhead whales per Tr km surveyed) per depth zone per month. NA – surveys were not conducted. Minor discrepancies within the table are due to rounding error.

	JUL				**AUG**				**SUMMER**			
	Tr Km	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**	**Tr Km**	**Tr Sightings**	**Tr Whales**	**WPUE**
157°W-169°W												
0-35 m	2,307	10	268	0.1162	2,031	4	28	0.0138	4,339	14	296	0.0682
36-50 m	3,021	1	1	0.0003	2,766	0	0	0.0000	5,788	1	1	0.0002
51-200 m North	1,154	13	33	0.0286	827	2	2	0.0024	1,981	15	35	0.0177
51-200 m South	166	0	0	0.0000	273	0	0	0.0000	439	0	0	0.0000
154°W-157°W												
0-20 m	124	0	0	0.0000	171	2	2	0.0117	295	2	2	0.0068
21-50 m	128	1	2	0.0156	212	2	2	0.0094	340	3	4	0.0118
51-200 m	273	11	42	0.1536	448	11	44	0.0981	722	22	86	0.1191
201-2,000 m	47	4	41	0.8813	131	22	120	0.9161	178	26	161	0.9069
140°W-154°W												
0-20 m	342	3	4	0.0117	795	10	16	0.0201	1,137	13	20	0.0176
21-50 m	986	5	7	0.0071	1,875	9	10	0.0053	2,861	14	17	0.0059
51-200 m	512	14	71	0.1386	1,007	18	37	0.0368	1,519	32	108	0.0711
201-2,000 m	785	105	283	0.3603	1,537	223	431	0.2805	2,322	328	714	0.3075
>2,000 m	269	9	19	0.0707	775	31	36	0.0465	1,043	40	55	0.0527
TOTAL	**10,115**	**176**	**771**	**0.0762**	**12,847**	**334**	**728**	**0.0567**	**22,963**	**510**	**1,499**	**0.0653**

	SEP				OCT				FALL			
	Tr Km	Tr Sightings	Tr Whales	WPUE	Tr Km	Tr Sightings	Tr Whales	WPUE	Tr Km	Tr Sightings	Tr Whales	WPUE
157°W-169°W												
0-35 m	2,250	2	4	0.0018	1,682	0	0	0.0000	3,932	2	4	0.0010
36-50 m	3,337	3	15	0.0045	2,572	51	76	0.0295	5,909	54	91	0.0154
51-200 m North	657	6	10	0.0152	1,076	24	51	0.0474	1,734	30	61	0.0352
51-200 m South	241	0	0	0.0000	0	0	0	NA	241	0	0	0.0000
154°W-157°W												
0-20 m	212	0	0	0.0000	274	1	1	0.0036	486	1	1	0.0021
21-50 m	233	0	0	0.0000	245	4	11	0.0449	478	4	11	0.0230
51-200 m	541	6	8	0.0148	428	14	59	0.1379	969	20	67	0.0692
201-2,000 m	108	18	45	0.4179	166	17	53	0.3194	274	35	98	0.3582
140°W-154°W												
0-20 m	1,029	14	23	0.0224	710	0	0	0.0000	1,739	14	23	0.0132
21-50 m	2,084	8	10	0.0048	1,135	0	0	0.0000	3,219	8	10	0.0031
51-200 m	704	8	30	0.0426	627	9	12	0.0191	1,330	17	42	0.0316
201-2,000 m	614	47	63	0.1027	752	43	67	0.0891	1,366	90	130	0.0952
>2,000 m	105	1	1	0.0095	200	2	2	0.0100	305	3	3	0.0098
TOTAL	**12,114**	**113**	**209**	0.0173	**9,868**	**165**	**332**	0.0336	**21,982**	278	541	0.0246

Total transect effort (Tr Km) may differ from values in Tables 2 and E-9 because effort between barrier islands and the mainland was included in the sighting rate per depth zone analysis.

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under US administration.

The Bureau of Ocean Energy Management

As a bureau of the Department of the Interior, the Bureau of Ocean Energy (BOEM) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS) in an environmentally sound and safe manner.

The BOEM Environmental Studies Program

The mission of the Environmental Studies Program (ESP) is to provide the information needed to predict, assess, and manage impacts from offshore energy and marine mineral exploration, development, and production activities on human, marine, and coastal environments.