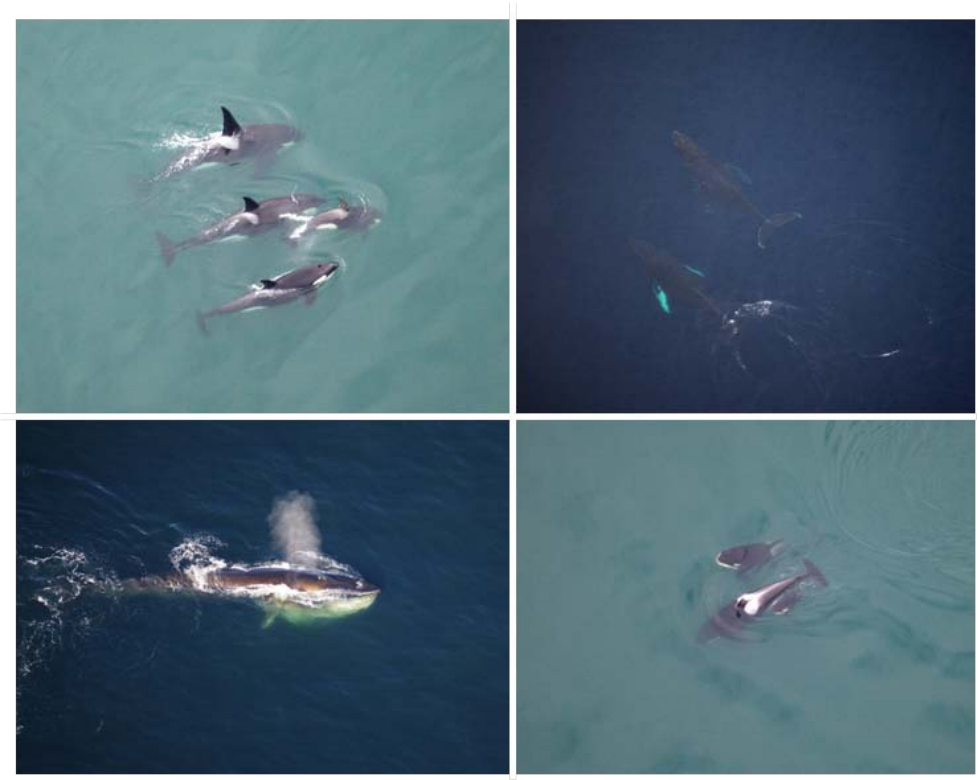
OCS Study
BOEM 2013-00117

Distribution and Relative Abundance of Marine Mammals in the Northeastern Chukchi and Western Beaufort Seas, 2012



Annual Report

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Killer Whales, near Barrow, Alaska, August 2012

Allison Henry, Northeast Fisheries Science Center
Fin Whale, south of Point Hope, Alaska, September 2012

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Distribution and Relative Abundance of Marine Mammals in the Northeastern Chukchi and Western Beaufort Seas, 2012

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ABSTRACT

This report describes field activities and data analyses for the Aerial Surveys of Arctic Marine Mammals (ASAMM) project conducted during summer and fall 2012 (30 June – 28 October). Surveys were based in Barrow and Deadhorse, Alaska, and targeted the northeastern Chukchi and western Beaufort seas, between 68°N and 72°N, 140°W and 169°W.

Sea ice cover in the study area in 2012 was extremely light when compared with historical (pre-2007) sea ice cover. Sea ice remained in most of the Chukchi Sea study area in early July, with shorefast ice present from Point Barrow to Cape Lisburne. By mid-July, sea ice in the Chukchi Sea had receded to the northernmost survey blocks, but remained in much of the western Beaufort Sea. Most of the study area was sea ice free by mid-August, with the exception of the Hanna Shoal area where up to 70% sea ice cover remained. Remnant sea ice floes remained in the northeastern Chukchi Sea as late as mid-September, but the entire study area was completely sea ice free by late September. New ice was forming in shallow nearshore areas and offshore in the northeastern Chukchi Sea in late October when the 2012 field season ended.

A total of 132 survey flights were conducted, and survey effort far surpassed previous annual ASAMM efforts. Two aerial survey teams conducted surveys from early July through mid-October. Total combined flight time was 550 hours, which included 264 hours of transect survey effort. Over 140,000 km were flown, with 56,007 km of effort on transect. Surveys were conducted in the western Beaufort Sea in summer (mid-July through August) for the first time since the mid-1980s.

There were 433 sightings of 648 bowhead whales (*Balaena mysticetus*), 310 sightings of 558 gray whales (*Eschrichtius robustus*), 20 sightings of 29 humpback whales (*Megaptera novaeangliae*), 3 sightings of 5 fin whales (*Balaenoptera physalus*), 6 sightings of 7 minke whales (*Balaenoptera acutorostrata*), 72 sightings of 82 unidentified cetaceans, 506 sightings of 4,188 belugas (*Delphinapterus leucas*), and 2 sightings of 18 killer whales (*Orcinus orca*) observed during all (transect, search and circling) survey modes. Non-cetacean species included 470 sightings of 12,892 Pacific walruses (*Odobenus rosmarus divergens)*, 24 sightings of 25 bearded seals (*Erignathus barbatus*), 1,220 sightings of 2,036 unidentified pinnipeds, and 65 sightings of 277 polar bears (*Ursus maritimus*) observed during all (transect, search and circling) survey modes.

Bowhead whales were seen in all months of the study period. Distribution in the western Beaufort Sea was primarily offshore in summer (July and August) and nearshore in fall (September and October). In the northeastern Chukchi Sea, bowhead whales were scattered near shore in July and were not sighted in August, with the majority of sightings occurring in fall west of Barrow between 71°N and 72°N. Fall sighting rates (number of whales per km surveyed) of bowhead whales on transect in the western Beaufort Sea were comparable to sighting rates in recent years. The survey block with the highest overall sighting rate in the entire study area was block 14 in the northeastern Chukchi Sea. Sighting rate per depth zone between 140°W and 154°W in the western Beaufort Sea was highest in the 51-200 m depth zone in summer and the 21-50 m depth zone in fall. Sighting rates in summer and fall were highest in the ≤20 m depth

zone in the Barrow Canyon area (154°W to 157°W) and in the 51-200 m North depth zone in the northeastern Chukchi Sea. Compared to previous years with light sea ice cover (i.e., 1989, 1990, 1993-2011), bowhead whale sightings in the western Beaufort Sea in fall 2012 were significantly closer to shore and in shallower water in the West Region (148°W-156°W); no significant difference was noted in distance from shore or water depth at sighting locations in the East Region (140°W-148°W). Bowhead whales sighted in summer 2012 were significantly farther from shore and in deeper water than bowhead whales sighted in fall 2012 in the East Region; no significant difference was noted between summer and fall 2012 bowhead whale sightings in the West Region. Twenty-four bowhead whale calves were seen in 2012, including eleven calves seen during July and August. Feeding and milling were noted for bowhead whales in several locations, including east and southeast of Point Barrow (block 12), although no exceptionally large feeding aggregations were noted.

Gray whales were seen in all months of the study period in the northeastern Chukchi Sea and westernmost Alaskan Beaufort Sea. Gray whale aggregations were observed within ~40 km of the Alaskan coastline between Point Barrow and Wainwright and very nearshore (<5 km) from Icy Cape to Cape Lisburne, particularly in July. Few gray whales were seen on Hanna Shoal (~72°N, 162°W), but sightings were offshore (up to 100 km) between Point Franklin and Icy Cape. Gray whales were also seen in the Barrow Canyon area and very nearshore east of Barrow. Sighting rate per depth zone was highest in the ≤35 m depth zone in the northeastern Chukchi Sea; highest sighting rate per month occurred in July and decreased sharply in August, September and October. Most gray whales (57%) were feeding. Sixty-seven gray whale calves were seen, although some calf sightings may have been repeat sightings.

Additional noteworthy results from the 2012 ASAMM field effort included:

- Humpback whales (20 sightings of 29 whales) in the Chukchi Sea, including 24 whales observed south and west of Point Hope. Several of the humpback whales were feeding.
- Fin whales (3 sightings of 5 whales) in the southern Chukchi Sea, south of Point Hope. Two of the fin whales were calves; all adult fin whales were feeding.
- Minke whales (6 sightings of 7 whales) in the Chukchi Sea. Most of the minke whales were in the northern part of the Chukchi Sea study area, and at least two whales were lunge feeding.
- Beluga distribution in the western Beaufort Sea in summer and fall centered over the continental slope, with few sightings nearshore. In the northeastern Chukchi Sea, belugas were seen very nearshore (<5 km) in early July, particularly in and near passes into Kasegaluk Lagoon; very few belugas were seen in the Chukchi Sea in fall.
- Killer whales (2 sightings of 18 whales) in the Chukchi Sea. One sighting of 13 whales was near Barrow; one sighting of 5 whales was west of Point Hope.
- Walruses observed in the water and hauled out on ice, particularly near Hanna Shoal. Walrus haulouts on land were not seen in 2012.

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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 for 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), Department of the Interior (DOI), as the administrative agency responsible for leasing submerged federal lands, and the Conservation Division of the U.S. Geological Survey (USGS) for classification and evaluation of submerged federal lands and regulation of 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.

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 Marine Mammal Protection Act (MMPA) of 1972 (16 USC 1361-1407) and the Endangered Species Act (ESA) of 1973 (16 USC 1531-1543), the BLM (and, later, MMS) funded numerous studies involving acquisition and analysis of marine mammal and other environmental data.

In June 1978, the BLM entered into an Endangered Species Act Section 7 consultation with the National Marine Fisheries Service (NMFS). 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 whales (*Eschrichtius robustus*). 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 ARBO and the current ARBO issued by NMFS in 2008 for leasing and exploration in the U.S. Beaufort and Chukchi seas, Alaska, and authorizations of small takes under the Marine Mammal Protection Act (USDOC, NOAA, NMFS 2008) recommended the following conservation recommendations:

> 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.

Following several years when drilling was limited to the period 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 MMS (Alaska OCS Region) adopted an endangered whale monitoring plan that required aerial surveys. 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, and 1998). 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 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; and 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]) 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 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 1982-1991 (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 to 72°N and 157°W to 169°W, and overlaid Lease Sale 193 (offered in February 2008).

In 2011, an Interagency Agreement between the 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. 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.

In 2012, Shell Offshore Inc. began exploratory drilling operations at two offshore locations within the ASAMM study area (Bisson et al. 2013). In the northeastern Chukchi Sea, drilling was undertaken via drillship at the Burger Prospect, located approximately 130 km northwest of Wainwright. In the Alaskan Beaufort Sea, drilling was undertaken via drillship at the Sivuliq Prospect, located approximately 30 km north of Flaxman Island. This was the first occurrence of offshore drilling in the northeastern Chukchi or western Beaufort seas in over two decades. There was more than one drilling location per prospect, and the locations are included on all maps in this report to show their relative location to marine mammal sightings. Speculation about the potential impacts of a single year of drilling on marine mammal distribution and habitat use is premature and not included in this report.

METHODS AND MATERIALS

Study Area

The study area encompasses the western Beaufort and northeastern 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 22 between 140°W and 169°W, and between 68°N and 72°N, and encompasses approximately 230,000 km^2. Survey blocks 1 through 12 (140°W to 157°W) comprise the western Beaufort Sea study area, while survey blocks 13 through 22 (157°W to 169°W) comprise the northeastern Chukchi Sea study area.

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 (ACW) and Bering Shelf Water (BSW), are found in the northeastern Chukchi Sea (Figure 2). Current flow may be with or opposite that of predominant winds. In the Beaufort Sea, the Beaufort Gyre moves surface waters clockwise from the Canadian Basin in the offshore regions. Underlying the gyre is the eastward-flowing Beaufort Undercurrent, which flows subsurface in areas where bathymetry is 51 to 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, depending on prevailing winds. Based on analysis of modeled sea level and ice motion, wind-driven motion in the Arctic was 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).

In the Beaufort Sea, 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 early November to mid-May, the Beaufort Sea normally remains almost completely covered by ice. In spring, a recurring lead forms just seaward of the stable fast 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 minimums in several years, including 2007-2011 (National Snow and Ice Data Center 2007, 2008, 2009, 2010, 2011). Arctic summer sea ice extent continued to decline in 2012, reaching its lowest extent on record (National Snow and Ice Data Center 2012). 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).

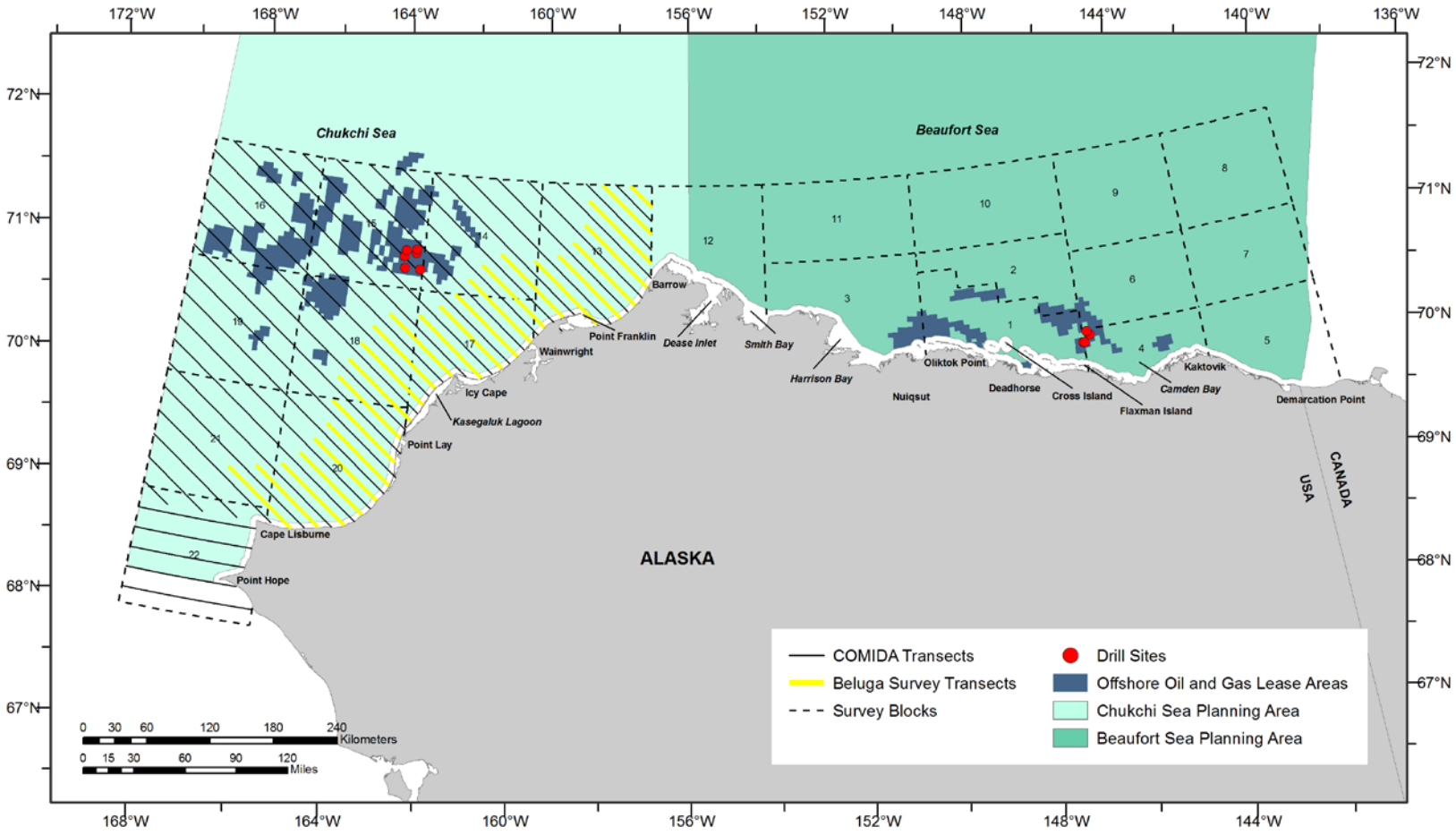


Figure 1. ASAMM study area showing survey blocks, 2012 Chukchi Sea (COMIDA) transect lines, beluga survey transect lines, Chukchi Sea Planning Area, Beaufort Sea Planning Area, current lease areas, and 2012 drilling sites. Transect lines in the Beaufort Sea are generated daily and, therefore, not shown.

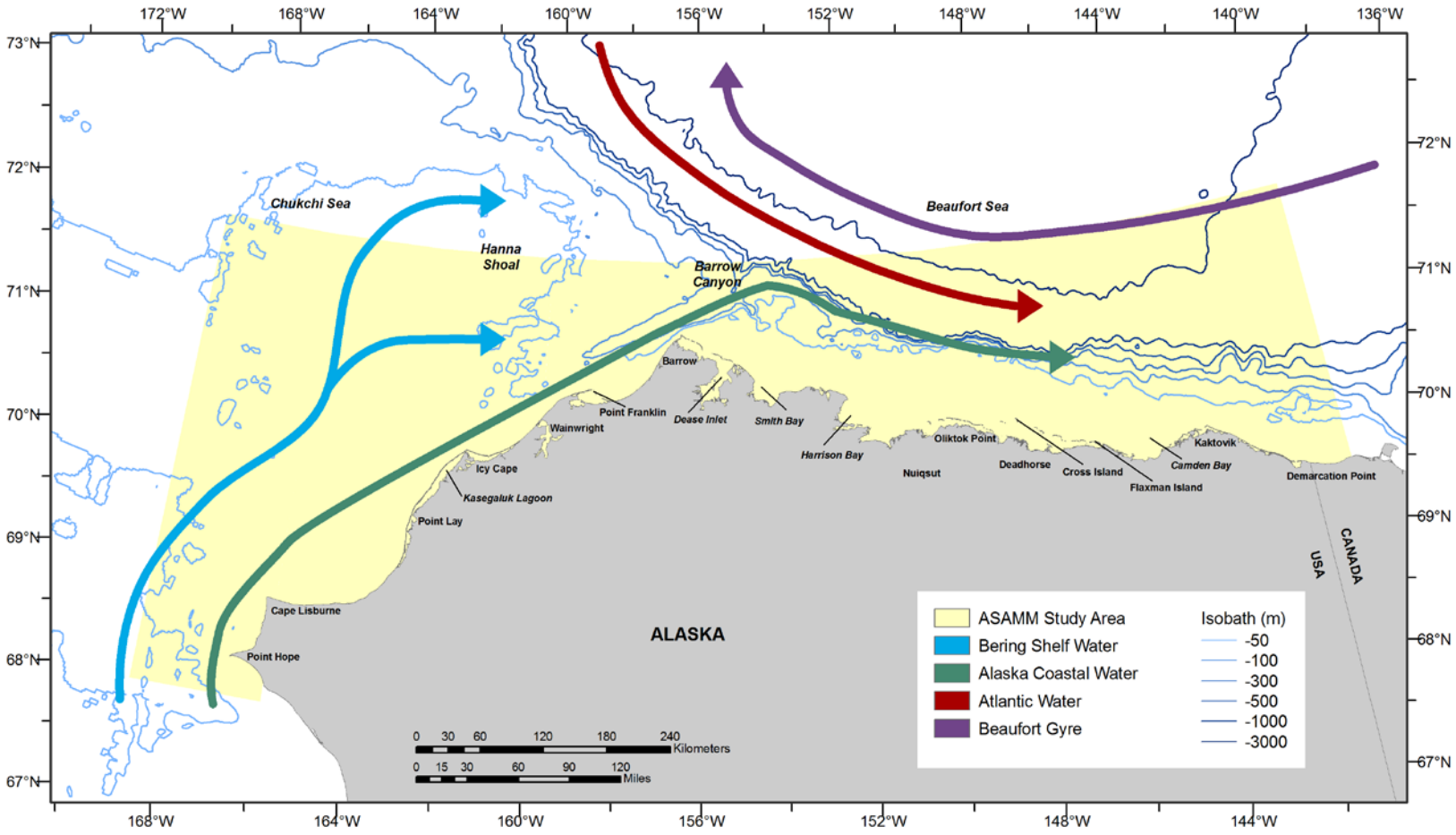


Figure 2. Northeastern Chukchi Sea and western Beaufort Sea major currents and isobaths.

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, Alaska, since 1972 have 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 to 6 m/s during September and 5 to 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) has also increased since 1972 (Wendler et al. 2009). Highest annual mean wind speeds at Barrow were recorded since the early 1990s; the mean annual wind speed in 2006 was approximately 5.2 m/s (Figure 3 in Wendler et al. 2009).

Sea state may affect visibility during aerial surveys. Surface waters in the Beaufort and Chukchi seas are driven primarily by wind. Ocean waves are generally from northerly or easterly directions during September and October. Prior to 1997, significant wave heights were reduced by a factor of 4 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. All aircraft were equipped with bubble windows that afforded primary observers a complete view of the trackline. The pilot and copilot had good forward and side viewing. Each observer was issued a hand-held clinometer for measuring the angle of inclination to sighting locations. Observers and pilots were linked with a common communication system. The maximum time aloft in the Aero Commander was approximately 5.5 hours, including fuel reserve.

A laptop computing system was used aboard each aircraft to 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 computer through a standard serial connection. Specialized software developed specifically for ASAMM was used to help prompt recording of specific data. A custom mapping component of the software permitted the data recorder to view sightings and the aircraft's trackline in real time. Data were backed up to an onboard external hard drive.

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, a portable personal locator beacon, portable marine and aviation band transceivers, and orange 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.

The DOI, National Business Center, Aviation Management Division "Automated Flight Following" (AFF) system was used by Anchorage-based Aviation Management Division personnel for "satellite-tracking" project aircraft. Aviation Management obtained current flight information from maps of real-time satellite tracking of survey aircraft. Iridium satellite phones were used to communicate aircraft position to Aviation Management each hour. In addition to these flight-following systems, onboard transponders were set at discrete identification codes for radar tracking by air-traffic-control personnel.

Methodologies, equipment and standard procedures have been developed and refined over the duration of the ASAMM project and precursor studies (1979-2011). 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).

Aerial Survey Design

Aerial surveys were based out of Barrow, Alaska, to target the northeastern 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 northeastern Chukchi Sea and monitor the progress of the bowhead whale migration across the western Beaufort Sea. In 2012, dedicated surveys in the western Beaufort Sea commenced in mid-July, earlier than in any previous year, to document use of this region by bowhead whales and other marine mammals during the summer months when open-water anthropogenic activities occur. All marine mammal sightings were recorded.

Survey design differed between the two study areas. In the northeastern Chukchi Sea (157°W to 169°W), 32 numbered transects (Figure 1) were generated once at the beginning of the season and then flown for the duration of the field season. Transects were perpendicular to the coastline and spaced 19 km apart. The perpendicular transects crossed major bathymetric features, such as Barrow Canyon and Hanna Shoal, and bowhead whale and beluga migration paths. The survey design also included a coastal transect located 1 km offshore between Point Barrow and Point Hope, Alaska. The coastal transect allowed better documentation of nearshore habitat, including pinniped haulouts along the coastline. Twenty-eight shorter (83 km) perpendicular transects (referred to as beluga transects) were spaced midway between the longer transects to specifically focus on areas in which the Eastern Chukchi Sea Stock of belugas would likely be seen in summer. The shorter transects were designed to focus on potential beluga habitat, and were surveyed in early July 2012.

In the Beaufort Sea (140°W to 157°W), daily flight patterns were based on sets of unique transects, 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 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 similarly 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. Transects changed each time a survey block was surveyed, so that unique 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 pattern has been confirmed by satellite tag 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.

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 and avoidance of recently surveyed areas. Weather permitting, the project attempted to distribute effort fairly evenly across the entire study area, with the exception of the northeasternmost Beaufort Sea survey blocks (blocks 8, 9, and 10), as noted above, and the southern Chukchi Sea survey blocks (blocks 20, 21, and 22) because they are south of the CSPA.

Survey Flight Procedures

During a typical flight, a search or deadhead leg was flown to the targeted survey block or transect line, whereby a series of transect lines were flown, followed by a search or deadhead leg back to the base of operations. Data were not collected during deadhead segments. Transects were joined together by short search or deadhead legs. Circling was initiated to further investigate cetacean sightings, as described below. Surveys were generally flown at a target altitude of 365 m in the northeastern Chukchi Sea and 458 m in the Beaufort Sea, but could be flown as low as 305 m in either area. Weather permitting, higher altitudes were maintained to maximize visibility and minimize potential disturbance to marine mammals. 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. Survey speed was generally 204 km/h.

Primary observers (two total) were stationed on either 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 were recorded as on-effort; sightings by the data recorder, pilots, or occasional fourth observer were secondary and considered off-effort.

When cetaceans were encountered, the aircraft usually diverted from the trackline for brief (<10 minute) 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". Sightings made off transect and not while circling were recorded as sightings "on search".

Survey effort over land or in areas with zero visibility was designated as deadhead and not incorporated into further analyses.

Data Entry

Data were collected similarly in the two study areas. Customized, menu-driven data entry software was used to record all data in database format (Microsoft Access). Location data (date, time, latitude, longitude, altitude, and aircraft heading) and environmental conditions (sky conditions, visibility, and visual impediments, percent sea ice cover, ice type, and Beaufort wind force) were recorded at sightings, during transitions in flight type (transect, search, or circling), when environmental conditions changed, or otherwise at intervals of 5 minutes (in time). The complete suite of data was recorded for cetacean, walrus and polar bear sightings, including location data, environmental conditions, survey mode, species, total number (as well as low, high, and best estimate of group size, as necessary), observer, swim direction (°T; cetaceans only), clinometer angle, number of calves, behavior, sighting cue, habitat, swim speed, whether it was a repeat sighting, and response to aircraft. Reduced data subsets were often recorded for other marine mammals to expedite data entry. Position data 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.

The behavior, swim speed, and swim direction of observed whales represent what the pod as a whole was doing at the time it was first sighted. Behaviors were entered into one of 15 categories (Table 1). The default behavior was "swimming", entered whenever an alternate behavior was not observed. Feeding behavior was likely underreported due to the difficulty of identifying this behavior for animals that may feed on benthic or mid-water prey; milling was often recorded in situations where obvious evidence of feeding was not directly observed but was suspected. Swimming speed was subjectively estimated by observing the time it took a whale to swim one body length. An observed swimming rate of one body length per minute corresponded to an estimated speed of 1 km/hr, one body length per 30 seconds was estimated at 2 km/hr, and so on. Swimming speed was recorded by relative category (i.e., still, 0 km/hr; slow, 0-2 km/hr; medium, 2-4 km/hr; or fast, > 4 km/hr). 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.

Marine mammal observers and flight crew watched for sudden overt changes (e.g., an abrupt dive, course diversion, or cessation of initial observed behavior) in marine mammal behavior that may indicate a response to the survey aircraft.

Table 1. ASAMM operational definitions of observed whale behaviors.

Behavior	Definition
Breaching	Whale(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.
Cow-Calf	Calf nursing; cow-calf pairs swimming within 20 m of each other.
Diving	Whale(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	Whale(s) diving repeatedly in a fixed area, sometimes with mud streaming from the mouth and/or defecation observed upon surfacing. Feeding behavior is further indicated by synchronous diving and surfacing or echelon-formations at the surface with swaths of clearer water behind the whale(s), or by surface swimming with mouth agape.
Flipper-Slapping	Whale(s) floating on side, striking the water surface with pectoral flipper one or many times; usually seen within groups or when the slapping whale is touching another whale.
Log-Playing	Whale(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	Whales moving slowly at the surface in close proximity (within 100 m) to other whales, often with varying headings. Also one whale slowly changing its heading.
Resting	Whale(s) floating at the surface with head, or head and back exposed, showing no movement; more commonly observed in heavy ice conditions than in open water.
Rolling	Whale(s) rotating on the longitudinal axis, sometimes associated with mating.

Spy-Hopping	Whale(s) extending head vertically out of the water such that up to one-third of the body, including the eye, is above the surface.
Swimming	Whale(s) proceeding forward through the water propelled by tail.
Tail-Slapping	Whale(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	Whale(s) exhibiting rapid flexure or gyration in the water.
Underwater-Blowing	Whale(s) exhaling while submerged, thus creating a visible bubble.

Wind force was recorded according to the Beaufort scale outlined in *Piloting, Seamanship, and Small Boat Handling* (Chapman 1971). 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.

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 mammals observed 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.

Data from the western Beaufort Sea and northeastern Chukchi Sea study areas, including surveys focusing on nearshore beluga habitat, were combined into one large dataset for editing and archiving, and were parsed into smaller subsets for various analyses of sighting rates, relative occurrence, swimming direction, and HUA.

Maps were prepared using ESRI ArcGIS 9.3 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 adopted from the World Vector Shoreline produced by the U.S. Defense Mapping Agency, now called the National Imagery and Mapping Agency.

Survey effort and observed bowhead whale and gray whale distributions were plotted semimonthly over the study area. Beluga and walrus distributions were plotted monthly, with humpback whale, fin whale, minke whale, killer whale, pinniped and polar bear distributions

plotted annually (July to 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), same-day repeat sightings or sightings of dead marine mammals were not included in summary analyses or maps. Where tables and figures exclude certain data, such exclusions are indicated in the captions. Because feeding is likely underreported 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. Common and scientific names used for marine mammals in this report are taken from Rice (1998).

The water depth at each bowhead whale sighting in the ASAMM database was derived from the International Bathymetric Chart of the Arctic Ocean Version 2.23 (IBCAO; http://www.ngdc.noaa.gov/mgg/bathymetry/arctic/arctic.html), which had a spatial resolution of 2 km; the spatial resolution after geoprocessing was 2.037 km. 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 (DFS) measurements regardless of the mapping software being used to depict the distribution data. The normalized shoreline was re-defined in 2011 to better represent the actual coastline of Alaska from 140°W (in the easternmost part of the ASAMM study area) to 68°N (in 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 two subareas (Beaufort Sea subarea 140°W-154°W; Chukchi Sea subarea 154°W-169°W). The 154°W demarcation between subareas for swim direction most closely approximates the natural break between the Beaufort and Chukchi basins.

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

Sea ice information was obtained from the National Ice Center (http://www.natice.noaa.gov), where it is available as charts or shapefiles. Sea ice analyses were performed by the National Ice Center two days per week, using data from several sources including ENVISAT Imagery and 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.

Previous analyses and figures using on-effort data included all on-transect sightings regardless of observer type (e.g., Clarke et al. 2012). However, sightings made by primary observers represent the most consistently collected data: the sole responsibility of primary observers was searching for marine mammals while secondary observers had other duties including data recording or flying the aircraft. Data denoting primary observers was 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 2012, only sightings made by primary observers were included in most analyses that use on-effort sightings, including sighting rate and central tendency analyses.

Sighting Rate and Relative Occurrence Analyses

Sighting rates quantify relative occurrence while accounting for heterogeneity in survey effort and sighting group size across the study area. Sighting rates were derived for three different spatial scales. Only sightings obtained on-effort (i.e., on transect, primary observers only) were used for sighting rate and relative occurrence analyses. Estimated transect effort (km) per survey block was calculated to determine monthly and annual sighting rates (number of whales per unit effort, WPUE) for bowhead whales and gray whales. 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 this sighting rate analysis. Estimated transect effort (km) per depth zone was calculated to determine monthly and annual sighting rates (WPUE) for bowhead whales, gray whales and belugas. Depth zone analysis (≤20 m, 21-50 m, 51-200 m, and 201-2,000 m) was computed for two subareas in the western Beaufort Sea study area (Figure 3). One subarea spanned from 154°W to 157°W, and included Barrow Canyon and its surrounding area, which has noticeably different bathymetry than the rest of the Beaufort study area. The other subarea for the western Beaufort Sea depth zone analysis spanned 140°W to 154°W, an area incorporating a well-defined continental shelf and slope. Depth zone analysis in the northeastern 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 segments 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]). An additional sighting rate analysis was conducted at a finer-scale (5' latitude by 15' longitude), using a grid matrix consisting of approximately equilateral grid cells (roughly 5 km x 5 km) superimposed across the study area. Bowhead whale, gray whale and beluga sighting rates on this finer scale were calculated as the number of whales per unit transect effort (WPUE) for each grid cell. An index of relative occurrence of bowhead whale and gray whale feeding and milling behaviors, quantified as WPUE, was also calculated for the finer scale grid. The finer-scale grid analysis included transect effort within barrier islands and north of 72°N. Sighting rates were not corrected for availability or perception bias (Buckland 2001).

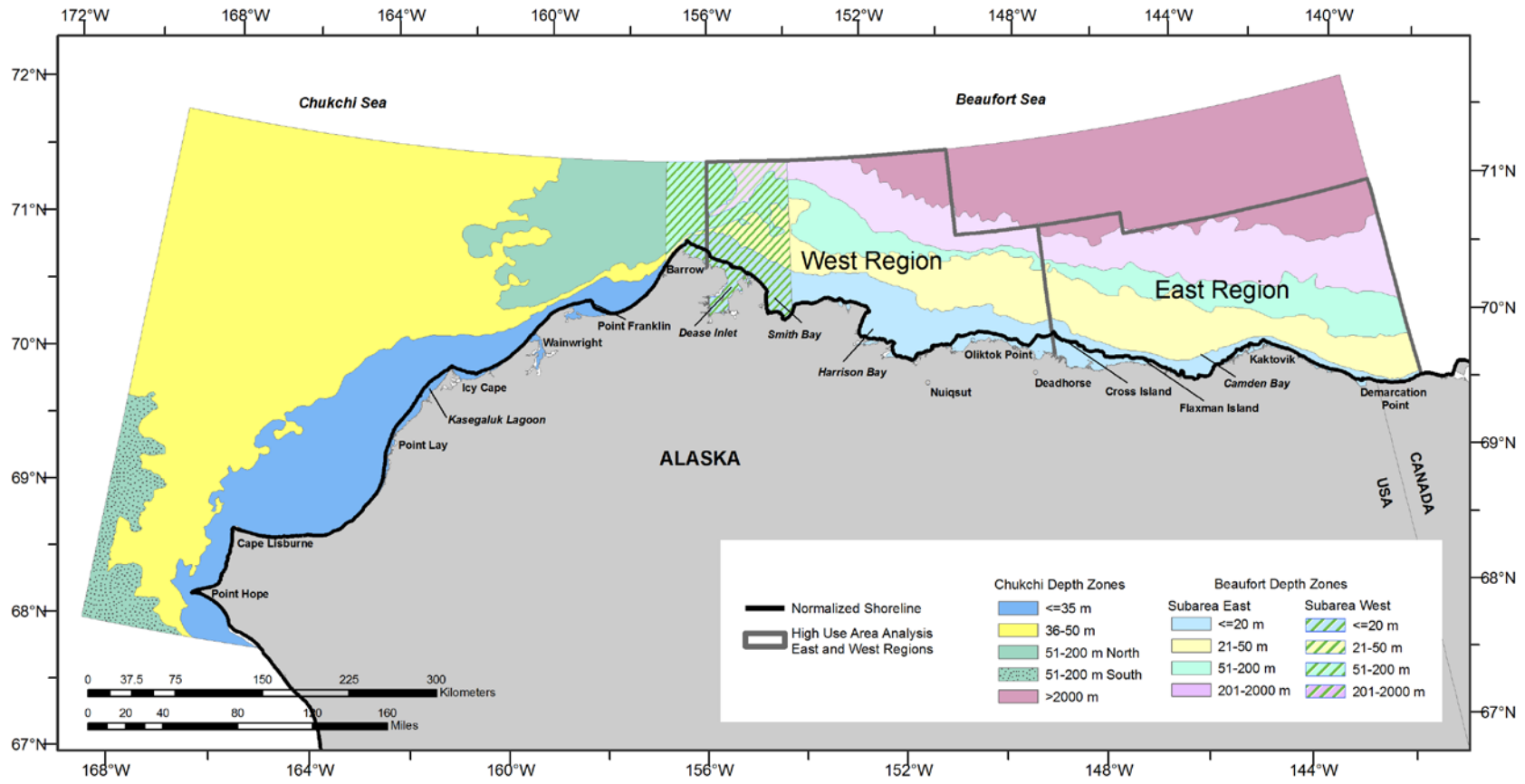


Figure 3. East and west regions and normalized shoreline used in ASAMM bowhead whale high use area (HUA) analysis, and depth zone subareas used for sighting rate analyses.

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, and previous Central Tendency analyses (e.g., Treacy 2002a, Monnett and Treacy 2005; Clarke et al. 2011b; Clarke et al. 2012) have defined results as "migratory corridors". However, results of satellite tagging have shown that some bowhead whales crisscross the western Beaufort Sea during the 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 directed, 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, we use the term "high use area" instead of "migratory corridor" for this report.

BOWHEAD WHALE CENTRAL TENDENCY – ANALYSIS 1

Two analyses of bowhead whale fall (September-October) HUAs (previously referred to as "migratory corridors") in the western Beaufort Sea were undertaken. One analysis was similar to that conducted for previous BWASP annual reports, in which the bowhead whale fall HUA was examined using the mean and median distance from shore of, and the median depth at, whale sightings on transect by primary observers (Houghton et al. 1984). 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*^{TM} StatSoft, Version 10.0 and ArcGIS, Version 9.3. Median distance from shore and depths for bowhead whale sightings in 2012, a year with light sea ice cover, were compared with analogous values for combined data from previous years having light sea ice cover (i.e., 1989, 1990, 1993-2011). Median distance from shore and depths for bowhead whale sightings in summer (July-August) 2012 were also compared to bowhead whale sightings in fall (September-October) 2012.

All bowhead whale sightings made while on-effort (primary observers only), regardless of distance from the transect line, were included in this analysis. Neither group size nor survey effort (km) was taken into account. Distance from shore and water depth at bowhead whale sightings were analyzed 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 (1997). In brief, cold saline Bering Sea 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 Sea 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 (~147°W-148°W).

The northern extent of each region is based upon survey effort. The East Region extends from 140°W to 148°W and northward from the shore to 71°10'N, except between 146°W and 148°W where the region extends to 71°20'N. 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 eastern boundary (140°W) is the easternmost longitude of the survey blocks. 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.

Two subsets of data from fall 2012 were analyzed and are described below:

- All bowhead whale sightings by primary observers on-effort, regardless of behavior recorded. The analysis of this subset assumed that *all* bowhead whales in the western Beaufort Sea were actively migrating from the Canadian Beaufort Sea, where most bowhead whales are assumed to spend summer months, through the Alaskan Beaufort Sea en route to wintering areas in the Bering Sea. Under this assumption, any feeding, milling, or resting behavior observed was considered temporary, and did not affect overall whale distribution related to the HUA.
- All bowhead whale sightings by primary observers on effort, *excluding* whales that were observed feeding, milling, or resting. These behaviors might be considered "non-migratory" and may influence, at least temporarily, use of HUAs.

One caveat to this analysis 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 be 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 is the same.

BOWHEAD WHALE CENTRAL TENDENCY – ANALYSIS 2

The second method for investigating the central tendency of the fall bowhead whale distribution in the western Beaufort Sea in 2012 involved a three step process: 1) constructing spatial models of bowhead whale encounter rate (relative abundance) based on bowhead whale sightings from

2012; 2) applying the spatial encounter rate model to predict the expected number (relative abundance) 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 2012. 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, 2012; 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 2.15.2 (R Core Team 2012) using packages *sp* (Pebesma and Bivand 2005; Bivand et al. 2008), *maptools* (Lewin-Koh et al. 2012), *raster* (Hijmans and van Etten 2012), *rgeos* (Bivand and Rundel 2012), *rgdal* (Keitt et al. 2012), and *mgcv* (Wood 2006).

To begin, the western Beaufort Sea study area was partitioned into a 5 km x 5 km grid, which 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 =60.5°N; second standard parallel =80.5°N; latitude of origin =70.5°N; central meridian =154.5°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 (see **General Data Analysis**). Bowhead whale encounter rate (number of whales per kilometer of transect surveyed) 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

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

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

$so( )$: soap film smooth function (Wood et al. 2008) of location covariates used to describe bowhead whale encounter rate; 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, and then the associated 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 2007-2012 combined. The analysis for the pooled years used the same data filtering criteria as described above (all transect bowhead whale sightings made by primary observers in September and October), and did not account for availability or perception bias. Median distances from shore for the 6-year time period were calculated for East and West regions separately.

The median can also be referred to as the 50^{th} percentile or quantile. An additional analysis was undertaken to define the location of bowhead whale HUAs in 2012 alone and in 2007-2012 (all years pooled) based on the locations of the 30^{th}, 40^{th}, 50^{th}, 60^{th}, and 70^{th} quantiles 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 30^{th} quantile 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 quantiles 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 30^{th} quantile were connected across the entire region to define a linear boundary across the western Beaufort Sea corresponding to the 30^{th} quantile of bowhead whale HUAs, and similarly for the 40^{th}, 50^{th}, 60^{th}, and 70^{th} quantiles.

RESULTS

Environmental Conditions

In 2012, sea ice cover in the area surveyed was generally light. When surveys commenced in the northeastern Chukchi Sea in late June, sea ice remained in most of the study area, with shorefast ice present from Point Barrow to Cape Lisburne (Appendix A, Figure A-1). By mid-July, sea ice in the Chukchi Sea had receded to the northernmost survey blocks, but remained in much of the western Beaufort Sea (Figure A-2). By late August, most of the study area was sea ice free, with the exception of the Hanna Shoal area where up to 70% sea ice cover remained (Figure A-5). Remnant sea ice floes remained in the northeastern Chukchi Sea as late as 10 September (Figure A-6), but by 24 September the entire study area was completely sea ice free (Figure A-7). New ice was forming in shallow nearshore areas and offshore in the northeastern Chukchi Sea in late October when the 2012 field season ended (Figure A-9).

Arctic sea ice extent was at the seasonal minimum on 16 September 2012. Sea ice fell to the lowest extent since satellite data were first recorded in 1979 (National Snow and Ice Data Center 2012). Sea ice loss in the Beaufort Sea was greater than in the Chukchi Sea. To examine interannual variability in bowhead whale and other marine mammal distributions and relative abundance, 2012 data were compared to data from previous years with light sea ice cover.

Survey Effort

The ASAMM field season commenced 29 June 2012 and ended 28 October 2012; flights were conducted from 30 June to 28 October (Table 2). Surveys were conducted from one aircraft based in Barrow from 3 July to 28 October primarily targeting the northeastern Chukchi Sea, and from one aircraft based in Deadhorse from 19 July to 18 October targeting primarily the western Beaufort Sea. An additional aircraft was based in Barrow from 29 June to 12 July to survey coastal and nearshore areas of the northeastern Chukchi Sea (beluga transects) to target Eastern Chukchi Sea belugas. There were 132 survey flights, of which 1 was in June, 35 in July, 31 in August, 38 in September, and 27 in October. Flights originating on the survey aircraft based in Barrow were numbered sequentially starting with 201 or 301 (for surveys in early July to assess beluga occurrence); flights originating on the survey aircraft based in Deadhorse were numbered sequentially starting with 1. On 13 days, two flights were completed by the same survey team to take advantage of favorable survey conditions. Surveys were conducted in tandem by two survey teams on 39 days. Surveys were conducted on 76% of the days in the field season (93 out of 122 possible days). Surveys were not conducted on 24% of the days in the field season (29 out of 122 possible days) due to weather alone (19 days) or weather combined with aircraft inspections or other equipment issues (10 days).

Over 140,000 km were flown during 549.8 hours (Figure 4). A total of 56,007 km of effort on transect was flown during 264 hours (Figure 5). Transect effort constituted 40% of the total kilometers flown and 48% of the total flight hours. Fifty-two percent of total survey effort was

Table 2. ASAMM aerial survey flight effort in chronological order, 30 June-28 October 2012, by survey flight and semimonthly time period. Semimonthly totals may not exactly match the sum for the time period due to rounding error.

Day	Flight No	Transect (km)	Circling (km)	Search (km)	Deadhead (km)	Total (km)	Transect (hr)	Total (hr)
30 Jun	301	423	69	21	479	992	2.0	3.9
1 Jul	302	149	26	11	564	750	0.7	2.7
2 Jul	303	393	47	21	787	1,249	1.8	4.5
3 Jul	304	58	61	8	388	516	0.2	1.8
4 Jul	201	327	21	101	301	750	1.8	3.7
5 Jul	202	402	103	1	435	941	2.0	4.0
6 Jul	203	692	47	9	1,222	1,969	3.3	7.3
6 Jul	305	609	137	47	1,184	1,977	3.0	7.5
8 Jul	204	509	8	17	349	882	2.7	4.0
8 Jul	306	683	14	3	289	988	3.1	4.2
10 Jul	205	452	53	3	1,678	2,185	2.2	7.5
10 Jul	307	284	94	1	727	1,105	1.3	3.8
11 Jul	206	185	0	1	907	1,092	0.9	3.7
11 Jul	308	158	0	11	462	630	0.7	2.2
12 Jul	207	0	18	284	859	1,161	0.0	3.8
12 Jul	309	422	168	2	527	1,119	1.9	4.3
13 Jul	208	394	20	70	746	1,230	1.9	4.7
14 Jul	209	318	81	4	825	1,228	1.5	4.5
15 Jul	210	524	82	0	865	1,471	2.2	5.3
19 Jul	1	472	41	31	376	919	2.3	3.8
19 Jul	211	564	0	2	590	1,156	2.7	4.5
20 Jul	2	623	43	5	304	975	3.0	4.3
20 Jul	212	229	0	4	301	534	1.1	2.2
21 Jul	3	161	30	87	683	961	0.8	3.3
21 Jul	213	628	96	4	624	1,351	2.8	5.3
22 Jul	4	563	94	2	736	1,394	2.7	5.3
22 Jul	214	575	93	1	457	1,126	2.6	4.6
23 Jul	5	853	50	6	414	1,323	4.1	5.7
23 Jul	215	681	35	3	380	1,099	3.1	4.7
24 Jul	6	337	0	55	187	579	1.6	2.5
25 Jul	216	567	93	2	653	1,315	2.6	5.1
26 Jul	7	77	0	40	409	526	0.4	2.0
26 Jul	217	551	139	3	540	1,233	2.6	4.9
28 Jul	218	180	20	7	408	615	0.9	2.3
29 Jul	8	91	0	24	717	832	0.4	2.6
30 Jul	219	0	0	0	876	876	0.0	2.6
1 Aug	9	366	0	2	681	1,048	1.7	3.9
4 Aug	10	272	25	3	681	981	1.3	3.5
4 Aug	220	0	57	40	593	690	0.0	2.3
5 Aug	11	739	15	9	474	1,237	3.6	5.3
5 Aug	221	806	6	2	510	1,324	3.5	5.2
6 Aug	222	481	23	5	323	832	2.3	3.7
7 Aug	12	72	0	2	507	581	0.3	2.0

Day	Flight No	Transect (km)	Circling (km)	Search (km)	Deadhead (km)	Total (km)	Transect (hr)	Total (hr)
9 Aug	13	695	13	59	393	1,159	3.4	4.9
11 Aug	14	526	101	43	645	1,315	2.5	5.3
12 Aug	15	606	7	46	556	1,215	2.9	4.9
12 Aug	223	269	122	137	661	1,189	1.3	4.9
13 Aug	16	666	17	30	210	924	3.2	4.2
13 Aug	224	531	31	2	508	1,071	2.6	4.3
14 Aug	225	314	69	125	539	1,046	1.5	4.2
15 Aug	17	1,191	29	68	959	2,247	5.5	9.1
16 Aug	226	281	55	19	271	627	1.3	2.8
17 Aug	18	1,118	25	83	839	2,065	5.2	8.4
17 Aug	227	0	0	0	480	480	0.0	1.5
18 Aug	19	677	0	48	486	1,212	3.1	4.9
18 Aug	228	281	56	3	826	1,166	1.3	4.4
19 Aug	20	375	40	1	1,216	1,633	1.8	5.4
19 Aug	229	534	57	1	943	1,535	2.4	5.6
20 Aug	230	544	312	18	245	1,119	2.7	5.6
21 Aug	231	430	34	21	337	822	2.4	3.8
23 Aug	232	550	180	1	407	1,137	2.7	5.1
25 Aug	21	745	246	87	223	1,301	3.3	5.7
25 Aug	233	519	72	1	626	1,218	2.5	4.9
26 Aug	22	668	29	25	632	1,354	3.1	5.2
26 Aug	234	475	0	1	669	1,145	2.3	4.3
29 Aug	23	521	62	60	358	1,001	2.4	4.1
29 Aug	235	97	0	1	573	672	0.5	2.4
1 Sep	236	117	70	43	415	645	0.5	2.5
2 Sep	24	36	0	0	483	519	0.2	1.6
3 Sep	237	615	126	6	435	1,182	3.2	5.3
5 Sep	25	428	81	60	538	1,106	1.9	4.3
6 Sep	26	281	50	68	384	784	1.3	3.2
6 Sep	238	52	0	16	220	288	0.3	1.2
7 Sep	239	572	0	12	551	1,135	2.6	4.2
8 Sep	27	126	30	1	526	683	0.6	2.3
8 Sep	240	568	59	70	416	1,114	2.7	4.8
9 Sep	241	555	0	2	596	1,154	2.5	4.3
10 Sep	28	635	71	17	531	1,253	3.0	5.2
10 Sep	242	543	14	47	438	1,041	2.6	4.2
11 Sep	29	311	63	81	678	1,132	1.5	4.4
11 Sep	243	451	141	34	1,391	2,017	2.0	6.8
12 Sep	30	99	0	21	258	378	0.5	1.5
13 Sep	244	49	19	2	211	281	0.3	1.3
14 Sep	31	312	0	98	409	818	1.4	3.3
14 Sep	245	652	26	98	148	924	3.1	4.2
15 Sep	32	513	129	81	534	1,256	2.4	5.1
15 Sep	246	424	7	2	587	1,021	2.0	3.9
16 Sep	247	355	0	1	789	1,145	1.6	3.9
17 Sep	33	65	13	1	646	724	0.3	2.3
18 Sep	34	903	55	3	1,194	2,154	4.2	8.2

Day	Flight No	Transect (km)	Circling (km)	Search (km)	Deadhead (km)	Total (km)	Transect (hr)	Total (hr)
18 Sep	248	482	153	2	310	947	2.2	4.1
19 Sep	35	717	70	31	749	1,566	3.3	6.4
19 Sep	249	485	94	130	249	958	2.3	4.2
21 Sep	36	190	34	1	384	609	0.9	2.1
23 Sep	37	613	56	22	409	1,099	2.9	4.6
24 Sep	38	18	0	1	746	765	0.1	2.1
24 Sep	250	319	85	0	314	718	1.8	3.0
25 Sep	39	16	0	37	470	523	0.1	1.8
25 Sep	251	121	11	232	487	851	0.7	3.4
26 Sep	252	382	117	138	442	1,079	1.7	4.4
28 Sep	40	522	114	63	637	1,337	2.3	5.0
28 Sep	253	433	48	51	263	796	2.1	3.6
29 Sep	41	485	0	4	680	1,169	2.1	4.4
29 Sep	254	645	39	113	448	1,245	3.0	5.2
30 Sep	255	260	65	96	702	1,123	1.4	4.4
1 Oct	256	508	326	2	342	1,179	2.4	5.4
2 Oct	42	216	40	118	319	693	0.9	2.9
2 Oct	257	565	64	1	393	1,023	2.6	4.3
3 Oct	43	797	12	8	656	1,474	3.5	5.5
4 Oct	44	532	0	70	589	1,192	2.5	4.5
5 Oct	45	770	34	64	340	1,208	3.5	5.2
5 Oct	258	586	223	5	762	1,575	2.8	6.3
6 Oct	46	513	151	42	591	1,295	2.3	4.9
6 Oct	259	627	66	2	602	1,297	3.0	5.3
7 Oct	47	241	14	2	372	629	1.1	2.3
8 Oct	260	245	0	2	182	430	1.2	1.8
10 Oct	48	207	11	38	434	691	0.9	2.4
10 Oct	261	540	14	1	708	1,262	2.7	4.9
11 Oct	49	7	0	24	451	483	0.0	1.5
11 Oct	262	224	16	1	1,039	1,280	1.1	4.4
13 Oct	263	317	32	2	319	669	1.7	2.9
14 Oct	50	165	0	112	257	534	0.7	2.0
14 Oct	264	175	0	100	59	333	0.8	1.6
15 Oct	265	920	174	97	417	1,608	4.5	7.4
18 Oct	266	650	5	31	533	1,219	3.2	5.0
19 Oct	267	601	146	174	194	1,114	3.0	5.2
20 Oct	268	363	89	43	364	859	1.8	3.7
21 Oct	269	481	37	49	936	1,504	2.3	5.6
22 Oct	270	716	84	67	755	1,622	3.4	6.5
24 Oct	271	468	0	63	556	1,086	2.2	4.2
26 Oct	272	478	0	163	320	961	2.2	3.8
28 Oct	273	262	5	26	893	1,186	1.3	4.2

Day	Flight No	Transect (km)	Circling (km)	Search (km)	Deadhead (km)	Total (km)	Transect (hr)	Total (hr)
				Semimonthly Effort Summary				
30 Jun		423	69	21	479	992	2.0	3.9
1-15 Jul		6,559	980	594	13,115	21,243	31.0	79.4
16-31 Jul		7,152	734	276	8,655	16,814	33.5	65.8
1-15 Aug		7,534	515	573	8,240	16,859	35.5	67.3
16-31 Aug		7,815	1,168	370	9,131	18,487	37.0	73.9
1-15 Sep		7,339	886	759	9,749	18,731	34.4	73.1
16-30 Sep		7,011	954	926	9,919	18,808	32.8	73.1
1-15 Oct		8,155	1,177	691	8,832	18,855	38.2	75.3
16-28 Oct		4,019	366	616	4,551	9,551	19.5	38.0
TOTAL		**56,007**	**6,849**	**4,826**	**72,671**	**140,340**	**264.0**	**549.8**

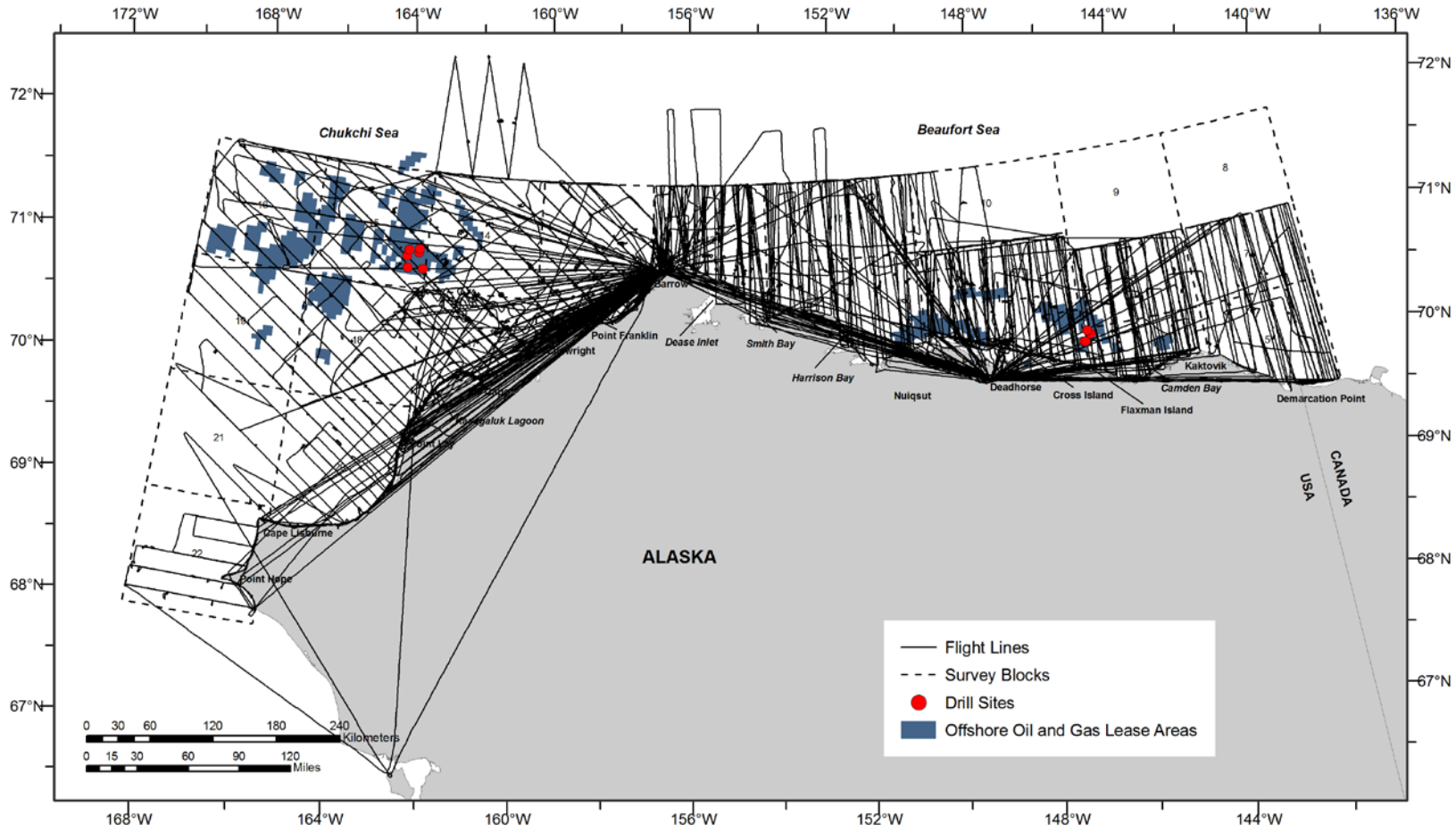


Figure 4. ASAMM combined flight tracks, all flight types (transect, search, circling and deadhead), 2012.

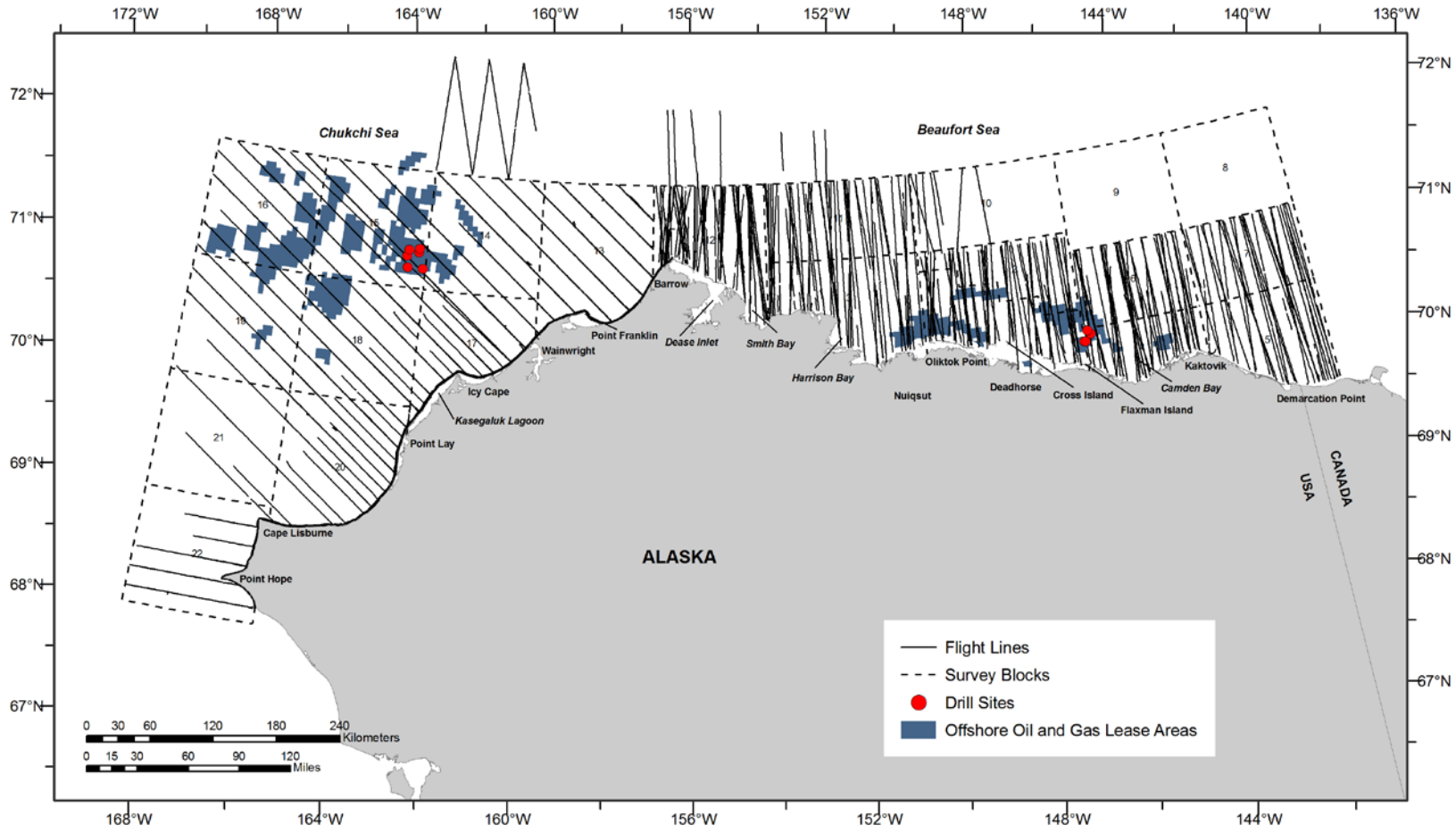


Figure 5. ASAMM combined flight tracks, transect effort only, 2012.

on deadhead (non-usable flight time), flown during transits to and from transects when the observers were not actively searching for marine mammals. Deadhead was also recorded during several flights when local weather conditions were not conducive to collecting data; two flights were entirely or almost entirely on deadhead due to prevailing poor weather conditions. The average survey flight covered 1,063 km, ranging from 281 km to 2,247 km.

Survey effort (transect, search, and circling) is summarized semimonthly in Figure 6. In the northeastern Chukchi Sea, transects near active Chukchi Sea lease areas were targeted more often than areas without active lease areas (e.g., survey blocks 20-22). Coverage in early July focused on the northeastern Chukchi Sea, with some survey effort in the westernmost Alaskan Beaufort Sea to assess habitat use of Barrow Canyon by belugas. From mid-July through the end of October, survey coverage was balanced between the northeastern Chukchi Sea and the western Beaufort Sea. Systematic broad-scale coverage of the western Beaufort Sea in mid-July is unprecedented, and was attempted in 2012 based in part on information about bowhead whale movements obtained via satellite tracking (e.g., Quakenbush et al. 2010a, 2010b) and from a single ASAMM flight in July 2011 (Clarke et al. 2012) that indicated that bowhead whales might be regularly present in this area in July. Survey coverage in the ASAMM study area was well distributed throughout July, August and September, and lowest in October when only one survey aircraft was present for the last third of the month. Despite this, over 113 hours were flown in October; the Barrow-based aircraft and crew that remained after 18 October successfully completed transect coverage in both the Beaufort and Chukchi seas. The last survey was conducted on 28 October. Survey coverage was greatest in survey blocks 13, 17, and 20 in the Chukchi Sea and survey blocks 12, 1, and 11 in the Beaufort Sea. Surveys in blocks 8 and 9 were not attempted in 2012 because conditions were not favorable for surveying offshore (e.g., strong winds and low visibility). One survey was conducted in early September north of the ASAMM study area to assess walrus use of sea ice habitats on a day when strong winds throughout the ASAMM study area precluded survey flights elsewhere. Flight lines, associated sea states, and sightings on individual flights are shown in Appendix B.

Unlike past years, there were few extended periods of time in 2012 when surveys were not possible due to poor weather. In mid-July, the Chukchi Sea survey team was grounded for three days due to strong winds and low ceilings; the Beaufort Sea survey team had not yet arrived on the slope. In late August, there was a five-day period when surveys were conducted on only one day. From 10-18 October, conditions in the western Beaufort Sea were sub-optimal, with fog, strong winds, blowing snow and low visibility, and only three surveys were attempted in the Beaufort Sea, for a total of <6 hours of survey time. However, other than those time periods, weather conditions were fairly favorable in at least some part of the ASAMM study area, allowing for at least one survey flight on most days.

Remnant sea ice in the northeastern Chukchi part of the study area throughout much of the field season (Appendix A) may have had a positive impact on overall survey effort there by dampening sea states. Sea ice was largely absent from the western Beaufort Sea part of the study area after mid-August, which may have negatively impacted overall survey effort there.

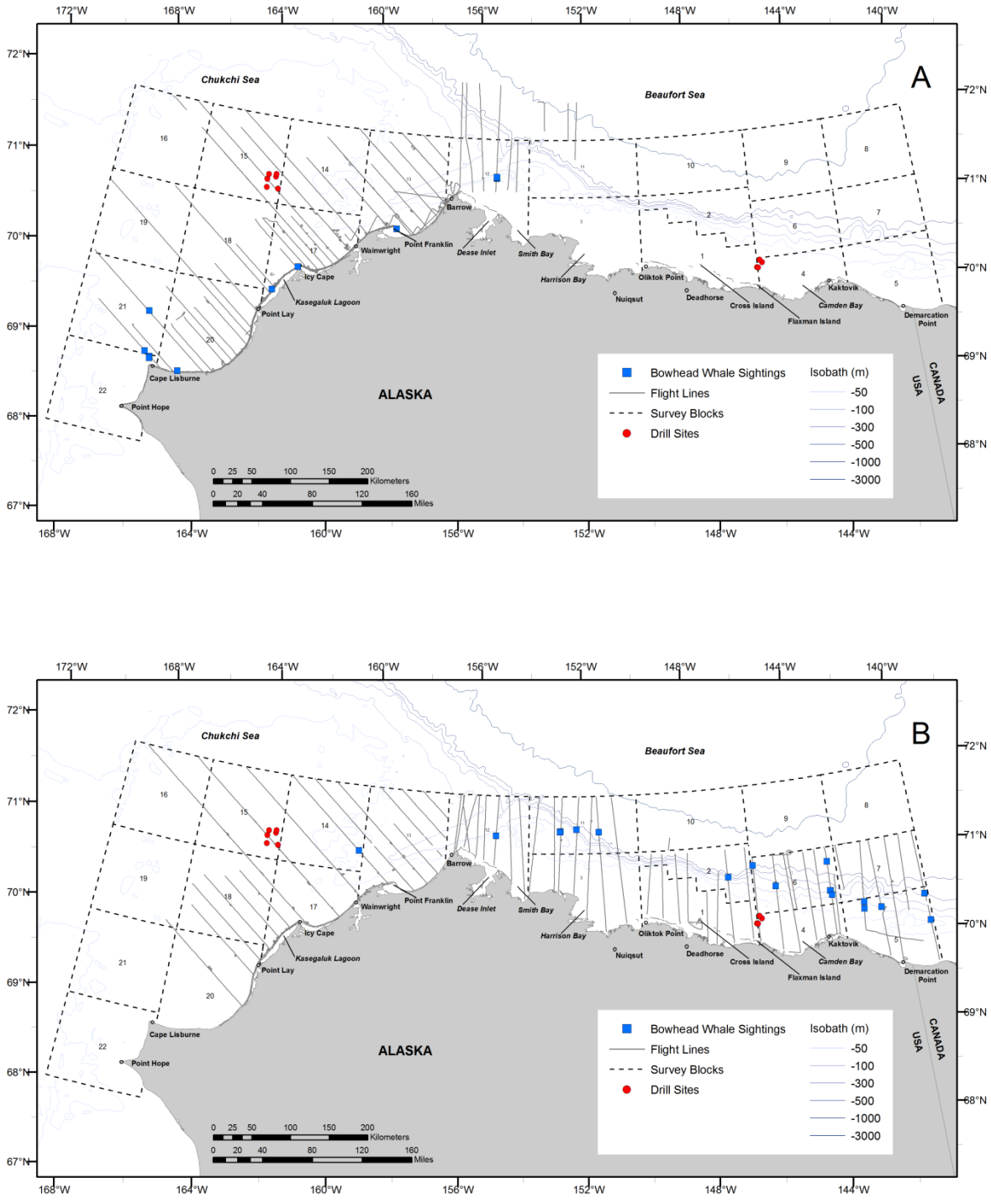
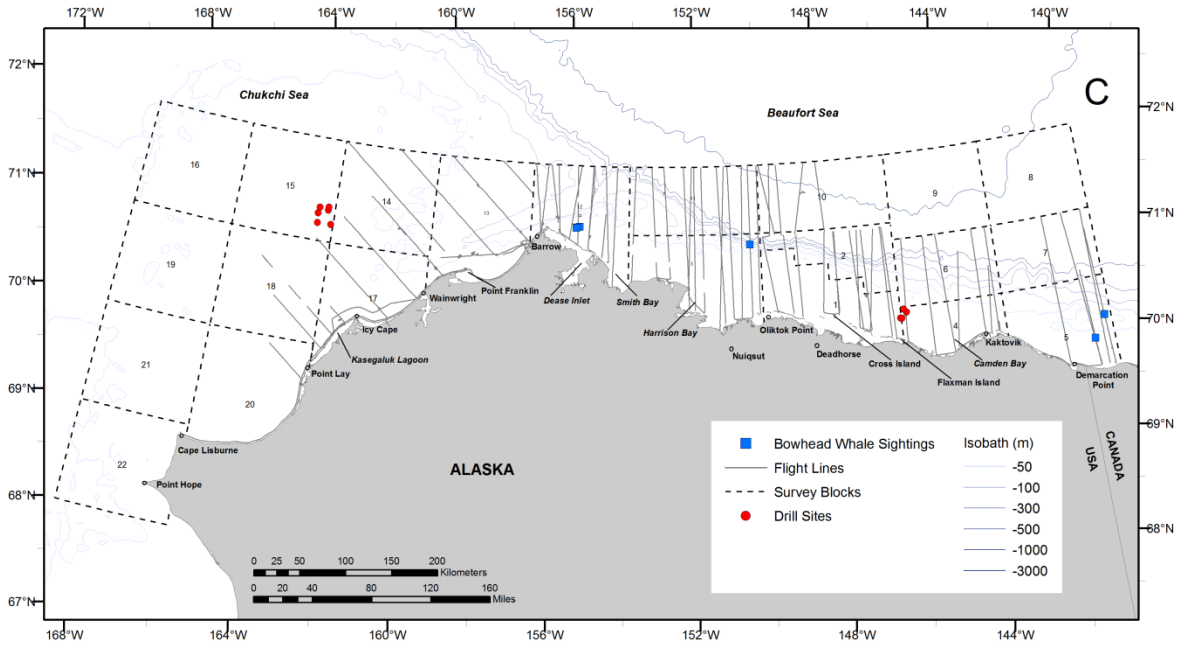


Figure 6. ASAMM semimonthly bowhead whale sightings, with transect, search and circling survey effort, 2012. Deadhead flight tracks are not shown. A: 30 June-15 July; B: 16-31 July.



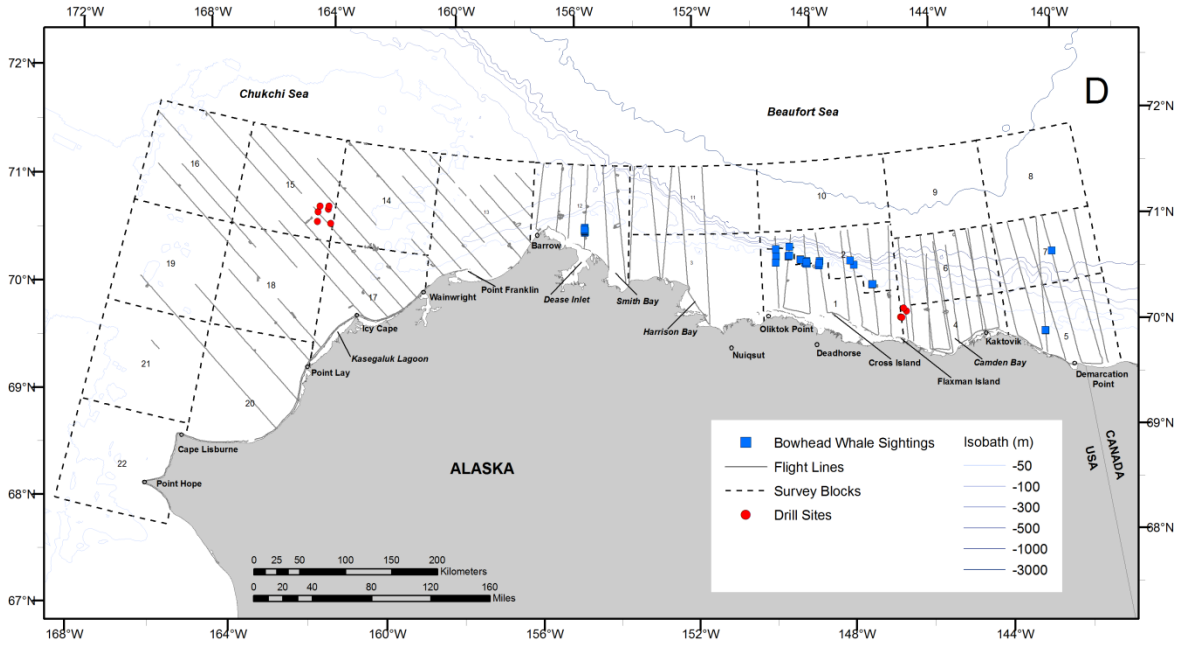
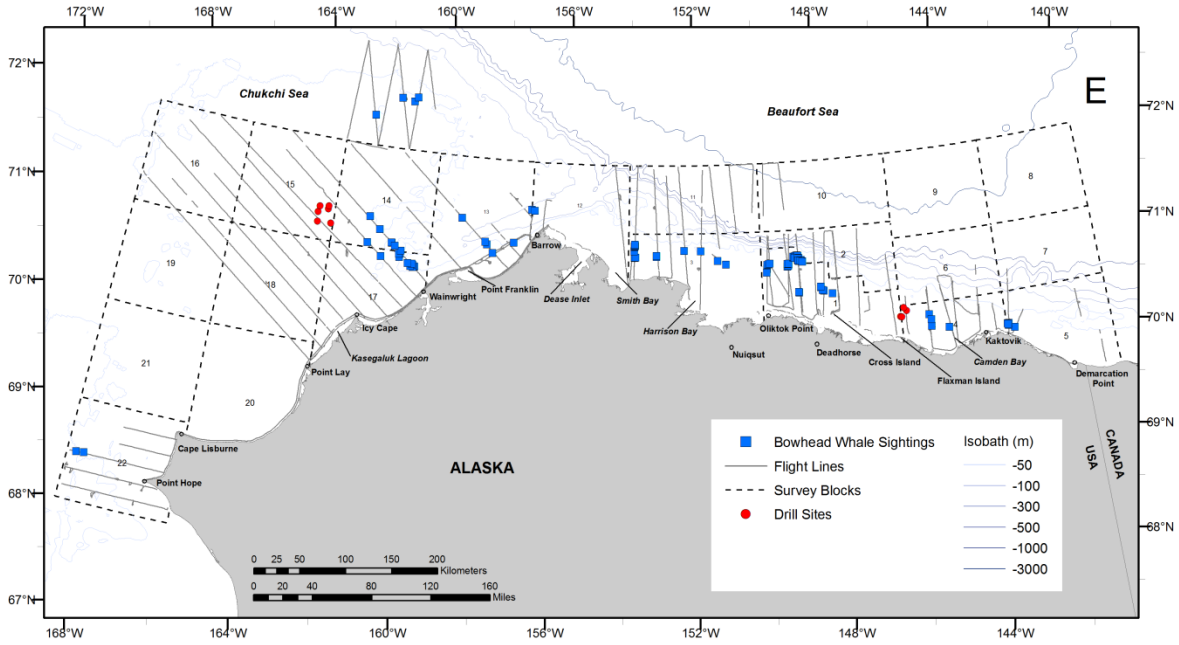


Figure 6 (cont). ASAMM semimonthly bowhead whale sightings, with transect, search and circling effort, 2012. Deadhead flight tracks are not shown. C: 1-15 August; D: 16-31 August.



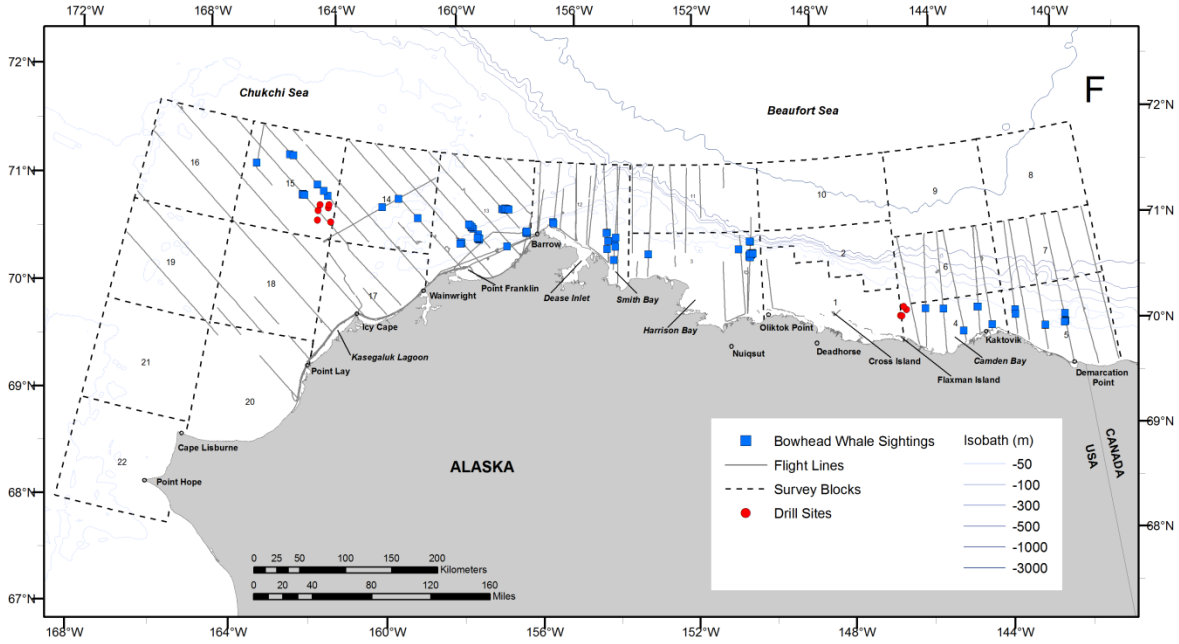
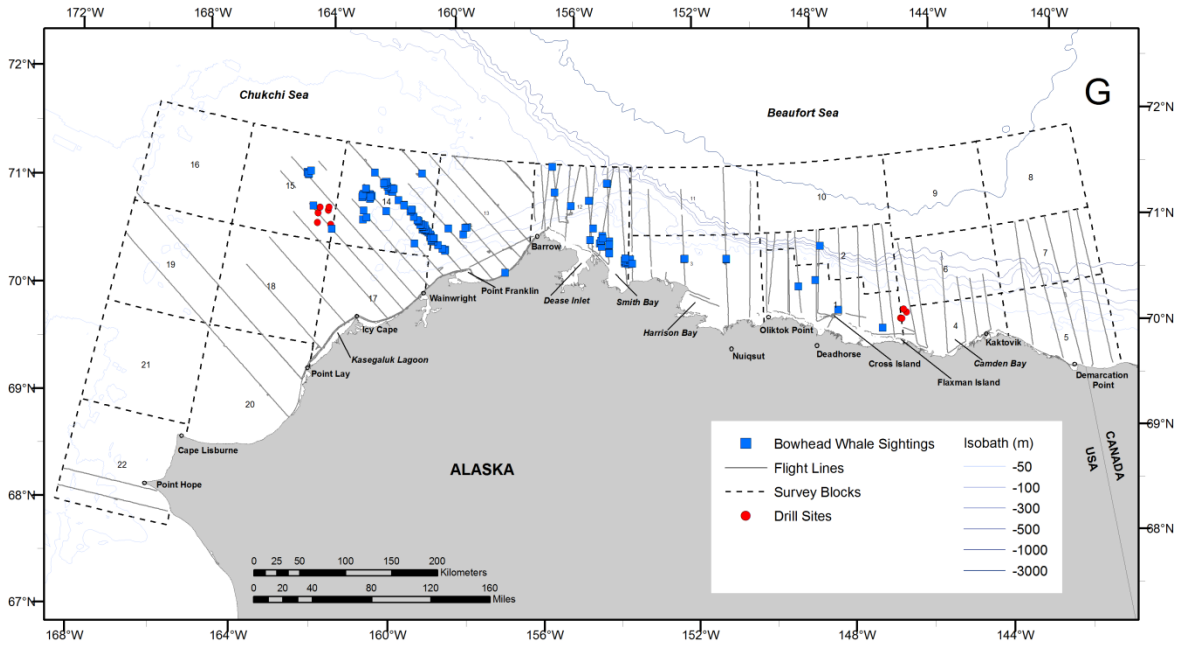


Figure 6 (cont). ASAMM semimonthly bowhead whale sightings, with transect, search and circling effort, 2012. Deadhead flight tracks are not shown. E: 1-15 September; F: 16-30 September.



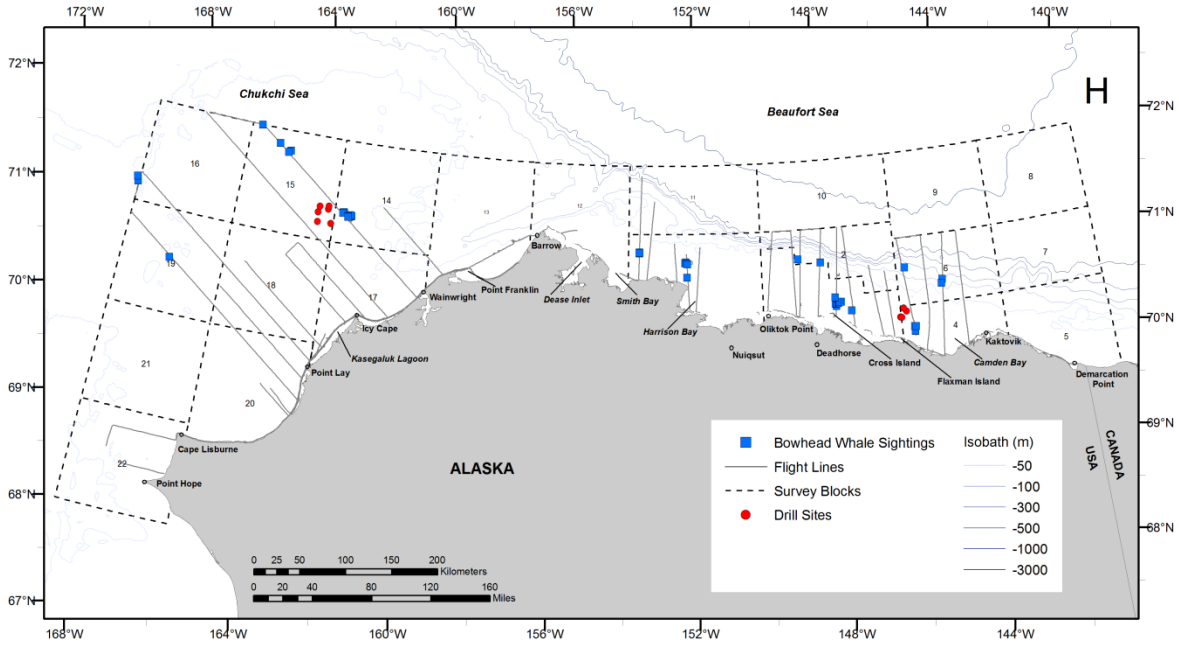


Figure 6 (cont). ASAMM semimonthly bowhead whale sightings, with transect, search and circling effort, 2012. Deadhead flight tracks are not shown. G: 1-15 October; H: 16-28 October.

Cetaceans

Bowhead Whales

BOWHEAD WHALE SIGHTING SUMMARY

During 2012 ASAMM surveys, 433 sightings of 648 bowhead whales (*Balaena mysticetus*) were observed during transect, search and circling survey modes (Table 3). This is higher than the number of bowhead whales normally observed in a single year during ASAMM surveys (e.g., Clarke et al. 2012). The high number of bowhead whale sightings was due, in part, to surveys conducted in the western Beaufort Sea in late July and August, during which 118 bowhead whales were seen. There were also greater numbers of bowhead whales observed in the northeastern Chukchi Sea in September and October compared to recent years. The increased number of bowhead whale sightings may have been somewhat influenced by an increase in the amount of time spent circling on sightings (12% of total non-deadhead survey time in 2012 versus 5% in 2011), although circling alone likely did not account for the increase in sightings. Bowhead whales were seen in every month except August 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 71°N and 72°N, including near the 2012 Shell drilling sites. In late June and early July, single bowhead whales were seen scattered nearshore from Point Franklin to Cape Lisburne, with one sighting approximately 40 km north of Cape Lisburne. In September and October, distribution in the Chukchi Sea was mostly west of Barrow in the northern part of the study area, with scattered sightings north of the study area and west of Point Hope. The greatest number of whales seen was in block 14 (n=100). The mean distance from shore for bowhead whale sightings in September-October 2012 was 77 km (range 1-205 km), which was farther than the mean distance from shore for bowhead whale sightings in September-October 2009-2011 (63 km, range 3-136 km). Bowhead whale sightings in fall 2012 reinforce previous observations from aerial surveys, satellite tracking (Quakenbush et al. 2010a), and acoustics (Delarue et al. 2011), describing a migration path that spreads across the CSPA.

In the western Beaufort Sea, bowhead whales were seen on the outer shelf (51-200 m) in late July and August, with the highest number of whales seen (transect, search and circling modes) in blocks 12 (n=41) and 2 (n=32). Distribution in September remained scattered across the entire study area, primarily on the inner shelf (36-50 m) north and east of Camden Bay, north of Deadhorse, and west of Harrison Bay; from approximately 148°W to 152°W, bowhead whales were also observed on the outer Beaufort Sea shelf. Several bowhead whales were seen in shallow nearshore waters from ~153°W and 156°W. Bowhead whales were not seen in Camden Bay, Harrison Bay, or inside barrier islands. In October, bowhead whales were distributed from ~144°W to Point Barrow. Highest numbers of whales per survey block in fall (September-October; transect, search and circling modes) were in blocks 12 (n=87) and 1 (n=76).

Bowhead whales were last observed in the northeastern Chukchi Sea on 19 October when 17 whales were seen approximately 120-180 km west-northwest of Barrow. Bowhead whales were

Table 3. Summary of ASAMM marine mammal sightings (number of sightings/number of individuals) during all survey modes (transect, search and circling) in chronological order, 30 June-28 October, 2012, by survey flight and semimonthly time period. Excludes dead and repeat sightings.

Day	Flight No	Bowhead Whale	Gray Whale	Humpback Whale	Fin Whale	Minke Whale	Killer Whale	Beluga	Unidentified Cetacean*	Bearded Seal	Walrus	Unidentified Pinniped**	Polar Bear
30 Jun	301	1/1	0	0	0	0	0	7/275	0	0	12/573	4/5	0
1 Jul	302	0	3/4	0	0	0	0	0	1/1	0	2/90	0	0
2 Jul	303	1/1	1/1	0	0	0	0	1/20	2/3	1/1	6/222	4/4	0
3 Jul	304	0	0	0	0	0	0	2/400	0	0	0	0	0
4 Jul	201	0	0	0	0	0	0	0	1/1	0	2/8	11/13	0
5 Jul	202	0	9/20	0	0	0	0	1/1	3/3	0	8/123	5/6	0
6 Jul	203	0	6/15	0	0	0	0	0	0	0	11/26	6/7	0
6 Jul	305	1/1	3/4	0	0	0	0	6/687	0	0	2/501	25/32	0
8 Jul	204	0	1/3	0	0	0	0	0	0	0	19/48	3/5	0
8 Jul	306	3/3	0	0	0	0	0	9/32	0	0	0	6/6	0
10 Jul	205	4/4	0	0	0	0	0	0	1/2	0	15/61	10/20	0
10 Jul	307	0	6/13	0	0	0	0	1/27	1/2	0	0	15/15	0
11 Jul	206	0	0	0	0	0	0	0	0	0	6/35	21/29	0
11 Jul	308	0	0	0	0	0	0	0	0	0	0	2/2	0
12 Jul	207	0	29/52	0	0	0	0	0	1/1	0	5/178	0	0
12 Jul	309	1/1	21/32	0	0	1/1	0	2/4	0	0	0	24/38	0
13 Jul	208	0	1/1	0	0	0	0	0	0	0	17/4,153	6/6	0
14 Jul	209	0	10/27	0	0	0	0	1/6	0	0	9/215	9/10	0
15 Jul	210	0	14/26	0	0	0	0	1/300	2/2	0	0	30/40	0
19 Jul	1	4/5	0	0	0	0	0	24/85	0	0	0	1/1	0
19 Jul	211	0	0	0	0	0	0	0	0	0	1/1	9/9	0
20 Jul	2	3/4	0	0	0	0	0	37/89	1/1	0	0	4/5	0
20 Jul	212	0	0	0	0	0	0	1/1	0	0	0	0	0
21 Jul	3	2/2	0	0	0	0	0	24/70	0	0	0	3/3	0
21 Jul	213	0	1/1	0	0	0	0	0	2/2	1/1	2/6	17/30	0
22 Jul	4	3/10	0	0	0	0	0	64/148	1/1	0	0	15/15	0

Day	Flight No	Bowhead Whale	Gray Whale	Humpback Whale	Fin Whale	Minke Whale	Killer Whale	Beluga	Unidentified Cetacean*	Bearded Seal	Walrus	Unidentified Pinniped**	Polar Bear
22 Jul	214	1/1	7/12	0	0	0	0	7/17	0	0	28/221	12/18	1/1
23 Jul	5	4/6	0	0	0	0	0	38/84	1/1	0	0	2/2	0
23 Jul	215	1/1	0	0	0	0	0	7/13	0	0	1/1	2/2	0
24 Jul	6	0	0	0	0	0	0	8/20	0	0	0	3/3	0
25 Jul	216	0	7/11	0	0	0	0	0	0	0	3/7	3/5	0
26 Jul	7	0	0	0	0	0	0	8/59	0	0	0	0	0
26 Jul	217	0	26/54	1/1	0	0	0	0	1/1	0	2/3	2/2	0
28 Jul	218	0	2/2	0	0	0	0	0	0	0	12/28	3/3	0
29 Jul	8	0	0	0	0	0	0	6/9	0	0	0	0	0
30 Jul	219	0	0	0	0	0	0	0	0	0	0	0	0
1 Aug	9	0	0	0	0	0	0	16/39	0	0	0	0	0
4 Aug	10	2/3	0	0	0	0	0	18/41	0	0	0	20/65	0
4 Aug	220	0	3/4	1/1	0	0	0	0	0	0	0	1/1	0
5 Aug	11	0	0	0	0	0	0	7/23	0	1/1	0	3/3	2/5
5 Aug	221	0	0	0	0	0	0	5/17	0	0	0	3/3	0
6 Aug	222	0	1/1	0	0	0	0	0	0	0	35/261	7/7	0
7 Aug	12	0	0	0	0	0	0	3/3	0	0	0	0	0
9 Aug	13	0	0	0	0	0	0	0	0	1/1	0	15/15	0
11 Aug	14	3/14	5/10	0	0	0	0	14/153	1/1	0	9/262	21/23	0
12 Aug	15	0	0	0	0	0	0	28/66	0	0	2/26	26/45	0
12 Aug	223	0	11/21	1/2	0	2/3	0	4/7	2/3	0	2/2	9/9	0
13 Aug	16	1/1	0	0	0	0	0	21/51	0	1/1	0	7/8	0
13 Aug	224	0	5/6	0	0	0	0	0	1/1	0	0	12/23	0
14 Aug	225	0	6/19	0	0	2/2	0	0	0	0	16/385	26/38	0
15 Aug	17	0	0	0	0	0	0	10/18	1/1	0	0	17/41	3/8
16 Aug	226	0	6/6	0	0	0	0	0	0	1/1	4/47	3/5	0
17 Aug	18	2/3	0	0	0	0	0	12/43	0	7/7	0	42/74	4/4
17 Aug	227	0	0	0	0	0	0	0	0	0	0	0	0
18 Aug	19	0	0	0	0	0	0	12/29	0	0	0	15/40	0
18 Aug	228	0	2/2	0	0	0	0	0	0	0	16/743	10/10	0
19 Aug	20	0	6/12	0	0	0	0	0	0	0	0	11/12	0
19 Aug	229	0	0	0	0	0	0	0	2/2	0	0	6/6	0

Day	Flight No	Bowhead Whale	Gray Whale	Humpback Whale	Fin Whale	Minke Whale	Killer Whale	Beluga	Unidentified Cetacean*	Bearded Seal	Walrus	Unidentified Pinniped**	Polar Bear
20 Aug	230	8/23	14/35	0	0	0	1/13	5/1,102	4/4	0	16/634	86/153	0
21 Aug	231	0	1/1	0	0	0	0	0	0	0	41/1,798	1/1	0
23 Aug	232	0	16/37	1/1	0	0	0	0	1/1	0	0	44/56	0
25 Aug	21	24/42	0	0	0	0	0	0	4/4	0	0	4/5	2/11
25 Aug	233	0	0	0	0	0	0	0	0	1/1	0	5/5	0
26 Aug	22	1/1	0	0	0	0	0	13/37	1/1	0	0	21/27	0
26 Aug	234	0	0	0	0	0	0	0	0	0	0	0	0
29 Aug	23	0	0	0	0	0	0	5/21	2/2	0	0	12/27	0
29 Aug	235	0	0	0	0	0	0	0	0	0	7/242	0	0
1 Sep	236	2/2	0	0	0	0	0	0	0	0	0	0	0
2 Sep	24	0	0	0	0	0	0	0	0	0	0	0	0
3 Sep	237	4/5	0	0	0	0	0	0	1/2	0	12/50	0	0
5 Sep	25	4/5	0	0	0	0	0	1/3	1/1	0	0	13/30	2/5
6 Sep	26	3/3	0	0	0	0	0	0	1/1	0	0	0	0
6 Sep	238	0	0	0	0	0	0	0	0	0	0	0	1/1
7 Sep	239	0	0	0	0	0	0	0	0	0	0	1/1	2/2
8 Sep	27	0	0	0	0	0	0	0	0	0	0	0	0
8 Sep	240	1/1	10/19	0	0	0	0	0	1/1	0	4/9	3/3	0
9 Sep	241	0	0	0	0	0	0	0	0	0	0	0	0
10 Sep	28	13/16	0	0	0	0	0	10/29	1/1	0	0	28/182	0
10 Sep	242	20/22	5/8	0	0	0	0	0	0	0	32/1,637	3/5	0
11 Sep	29	6/10	0	0	0	0	0	0	5/8	0	0	8/8	0
11 Sep	243	2/2	0	16/24	3/5	1/1	1/5	0	1/1	0	0	1/1	0
12 Sep	30	0	0	0	0	0	0	0	0	0	0	5/6	0
13 Sep	244	0	0	0	0	0	0	0	0	0	0	0	0
14 Sep	31	0	0	0	0	0	0	0	0	0	0	0	0
14 Sep	245	2/2	6/7	0	0	0	0	0	1/1	0	7/105	1/1	2/3
15 Sep	32	44/67	0	0	0	0	0	1/1	2/2	0	0	59/139	1/12
15 Sep	246	0	0	0	0	0	0	0	0	0	2/3	7/7	0
16 Sep	247	0	0	0	0	0	0	0	0	0	0	0	0
17 Sep	33	0	0	0	0	0	0	0	0	0	0	0	0
18 Sep	34	8/10	0	0	0	0	0	0	1/2	1/1	0	23/29	0

Day	Flight No	Bowhead Whale	Gray Whale	Humpback Whale	Fin Whale	Minke Whale	Killer Whale	Beluga	Unidentified Cetacean*	Bearded Seal	Walrus	Unidentified Pinniped**	Polar Bear
18 Sep	248	19/32	2/2	0	0	0	0	0	1/1	0	4/20	0	1/1
19 Sep	35	19/25	4/5	0	0	0	0	0	0	0	0	23/38	0
19 Sep	249	5/6	3/3	0	0	0	0	0	1/1	0	6/21	2/7	0
21 Sep	36	1/1	0	0	0	0	0	0	1/1	0	0	0	0
23 Sep	37	5/6	0	0	0	0	0	7/56	0	0	0	32/37	3/27
24 Sep	38	0	0	0	0	0	0	0	0	0	0	0	0
24 Sep	250	0	0	0	0	0	0	0	0	0	0	0	8/12
25 Sep	39	0	0	0	0	0	0	0	0	0	0	0	0
25 Sep	251	2/2	0	0	0	0	0	0	0	0	0	0	0
26 Sep	252	0	7/12	0	0	0	0	0	0	0	18/40	0	4/6
28 Sep	40	9/11	1/1	0	0	0	0	0	1/1	0	0	0	0
28 Sep	253	7/7	0	0	0	0	0	0	1/1	0	0	1/2	0
29 Sep	41	1/1	0	0	0	0	0	5/6	0	0	0	0	0
29 Sep	254	0	0	0	0	0	0	0	1/1	1/2	36/54	6/8	0
30 Sep	255	6/7	1/1	0	0	0	0	0	0	0	0	0	0
1 Oct	256	35/47	6/11	0	0	0	0	0	2/2	0	2/3	0	1/2
2 Oct	42	3/4	0	0	0	0	0	0	1/1	0	0	0	1/34
2 Oct	257	1/1	0	0	0	0	0	0	0	0	17/21	1/3	3/3
3 Oct	43	0	0	0	0	0	0	1/1	0	0	0	140/246	2/4
4 Oct	44	0	0	0	0	0	0	0	0	5/5	0	35/56	6/51
5 Oct	45	4/5	0	0	0	0	0	0	0	3/3	0	8/10	1/34
5 Oct	258	21/24	4/6	0	0	0	0	0	0	0	4/4	13/18	0
6 Oct	46	28/39	9/10	0	0	0	0	20/37	3/3	0	0	0	0
6 Oct	259	14/17	1/1	0	0	0	0	0	0	0	8/16	27/28	0
7 Oct	47	2/2	0	0	0	0	0	8/18	0	0	0	0	0
8 Oct	260	0	0	0	0	0	0	0	0	0	0	0	0
10 Oct	48	1/1	0	0	0	0	0	0	0	0	0	0	0
10 Oct	261	0	0	0	0	0	0	0	0	0	4/5	3/3	0
11 Oct	49	0	0	0	0	0	0	0	0	0	0	0	0
11 Oct	262	0	1/2	0	0	0	0	0	0	0	3/4	2/2	0
13 Oct	263	0	0	0	0	0	0	0	0	0	0	0	3/5
14 Oct	50	0	0	0	0	0	0	0	0	0	0	0	1/32

Day	Flight No	Bowhead Whale	Gray Whale	Humpback Whale	Fin Whale	Minke Whale	Killer Whale	Beluga	Unidentified Cetacean*	Bearded Seal	Walrus	Unidentified Pinniped**	Polar Bear
14 Oct	264	0	0	0	0	0	0	0	0	0	0	0	0
15 Oct	265	28/57	12/17	0	0	0	0	2/4	2/2	0	0	14/14	3/3
18 Oct	266	3/3	0	0	0	0	0	12/15	0	0	0	15/15	1/1
19 Oct	267	14/17	13/19	0	0	0	0	2/2	2/3	0	0	11/13	1/1
20 Oct	268	8/12	1/1	0	0	0	0	1/1	3/3	0	0	0	1/2
21 Oct	269	6/8	0	0	0	0	0	2/2	0	0	0	16/40	1/1
22 Oct	270	12/41	0	0	0	0	0	1/2	1/1	0	0	31/42	1/3
24 Oct	271	0	0	0	0	0	0	0	0	0	0	0	0
26 Oct	272	0	0	0	0	0	0	4/13	0	0	0	2/2	2/2
28 Oct	273	0	1/1	0	0	0	0	1/1	0	0	0	2/2	1/1
						Semimonthly Summary							
30 Jun		1/1	0	0	0	0	0	7/275	0	0	12/573	4/5	0
1-15 Jul		10/10	104/198	0	0	1/1	0	24/1,477	12/15	1/1	102/5,660	177/233	0
16-31 Jul		18/29	43/80	1/1	0	0	0	224/595	6/6	1/1	49/267	76/98	1/1
1-15 Aug		6/18	31/61	2/3	0	4/5	0	126/418	5/6	3/3	64/936	167/281	5/13
16-31 Aug		35/69	45/93	1/1	0	0	1/13	47/1,232	14/14	9/9	84/3,464	260/421	6/15
1-15 Sep		101/135	21/34	16/24	3/5	1/1	1/5	12/33	14/18	0	57/1,804	129/383	8/23
16-30 Sep		82/108	18/24	0	0	0	0	12/62	7/8	2/3	64/135	87/121	16/46
1-15 Oct		137/197	33/47	0	0	0	0	31/60	8/8	8/8	38/53	243/380	21/168
16-28 Oct		43/81	15/21	0	0	0	0	23/36	6/7	0	0	77/114	8/11
TOTAL		433/648	310/558	20/29	3/5	6/7	2/18	506/4,188	72/82	24/25	470/12,892	1,220/2,036	65/277

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

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

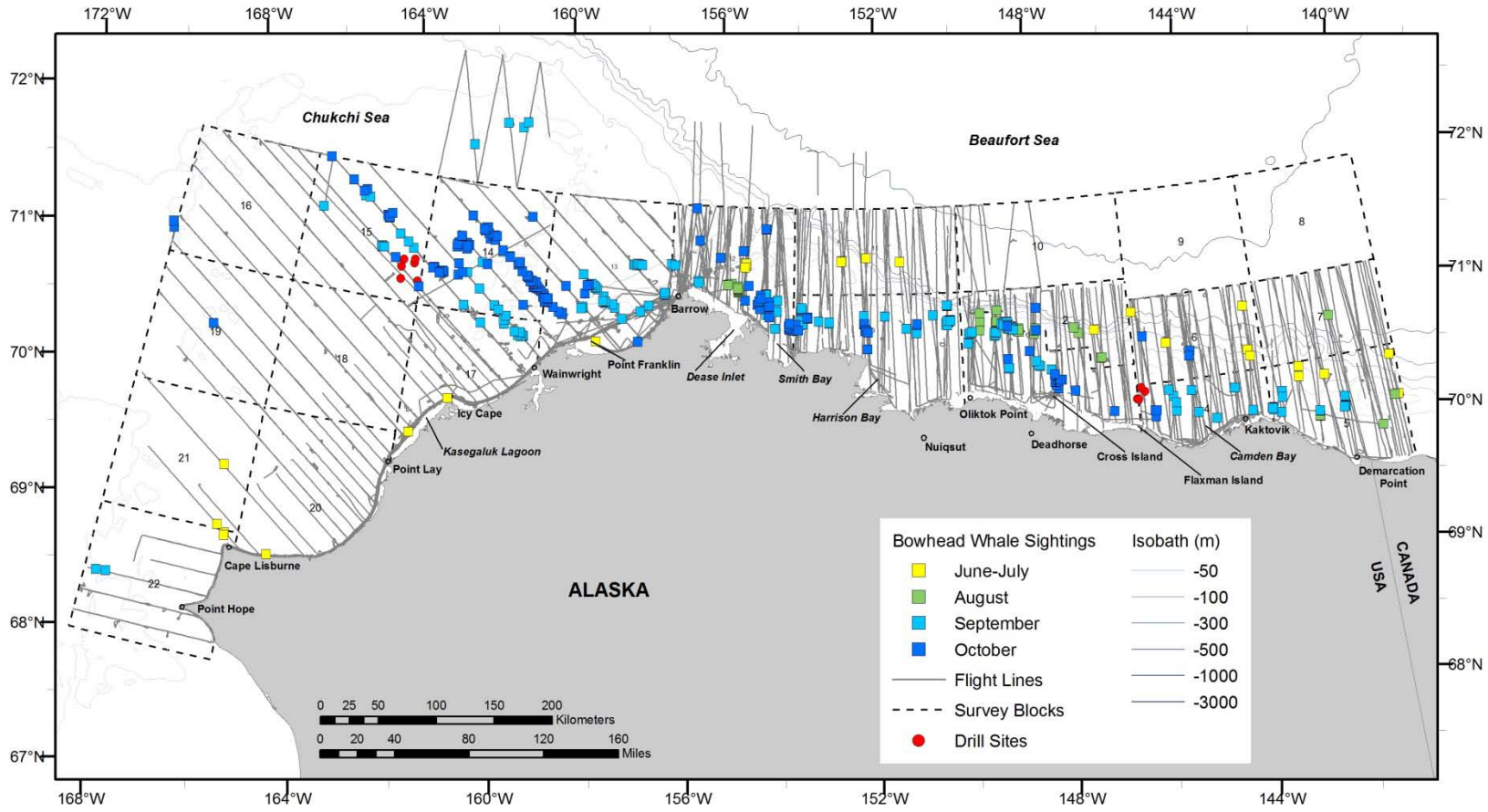


Figure 7. ASAMM bowhead whale sightings plotted by month, with transect, search and circling effort, 2012. Deadhead flight tracks are not shown.

last observed in the western Beaufort Sea on 22 October during a survey of blocks 1 and 2, when 41 whales were seen. Observations of whales in the central Alaskan Beaufort Sea in late October indicates that significant numbers of whales may have still been present in the western Beaufort Sea after ASAMM surveys ended.

Bowhead whale distribution in summer (July-August) 2012 in the western Beaufort Sea (all sightings regardless of effort mode or observer type) was similar to that observed during the few surveys that have been conducted during this time period in previous years with light ice cover (1982, 1986, 1994, 1998, 2002, 2011) (Ljungblad et al. 1987; Clarke et al. 2012). Unlike previous years, survey effort in summer 2012 was widespread across the western Beaufort Sea, and bowhead whales were observed scattered from 140°W to 157°W. Distribution in the northeastern Chukchi Sea in summer 2012 was generally similar to that observed from 2008-2011 (Clarke et al. 2011d, 2012), although bowhead whales were observed in the southern portion of the Chukchi Sea study area where they have not previously been seen during ASAMM surveys. Distribution in fall (September-October) was similar to that observed in previous years with light ice cover (1982, 1986, 1987, 1989, 1990 and 1992-2011). Similar to 2009, bowhead whales were observed in block 12 from August through October.

Bowhead whales observed in the northeastern Chukchi Sea during an industry-sponsored oceanographic cruise (L. Aerts, LAMA Ecological, pers. comm. to J. Clarke, 12 April 2013) and in the western Beaufort Sea during industry-sponsored aerial surveys (Bisson et al. 2013) in summer and fall 2012 largely overlapped those observed during ASAMM surveys, although several of the vessel-based sightings were north of the ASAMM study area, between 160°W and 164°W.

BOWHEAD WHALE SIGHTING RATES

In summer and fall 2012, bowhead whales on transect were seen from 140°W to 169°W. There were 232 sightings of 304 bowhead whales on transect by primary observers, ranging from 1 whale per sighting (n = 183) to 8 whales per sighting (n = 1). The highest number of sightings on transect was in block 14 (47 sightings), followed by block 12 (33 sightings). The largest group of bowhead whales on transect (8 animals) was observed on 22 July in block 5, and included 4 calves. Highest fine-scale sighting rates (number of whales on transect/transect km surveyed in 5 km x 5 km grid cells) for summer (June-August) and fall (September-October) were scattered across the study area (Figure 8), although there were notable differences between the seasons. In summer, fine-scale grid cells near and offshore of the 100 m isobath in the eastern Alaskan Beaufort Sea predominated, with few grid cells populated elsewhere in the study area. In fall, fine-scale cells were populated nearer to shore within the 50 m isobath in the western Beaufort Sea and scattered across the northeastern Chukchi Sea west and northwest of Barrow. Areas of highest fine-scale sighting rates in fall were east of Kaktovik (block 5), north of Deadhorse (block 1), north of Harrison Bay (block 3), and nearshore between Smith Bay and Barrow (block 12).

For all months combined, the highest sighting rates per survey block were in block 14 (0.017 WPUE), blocks 5 and 12 (0.011 WPUE), and block 3 (0.009 WPUE), with an overall sighting rate of 0.005 WPUE (Table 4). Combined sighting rate for summer months (June-August) was

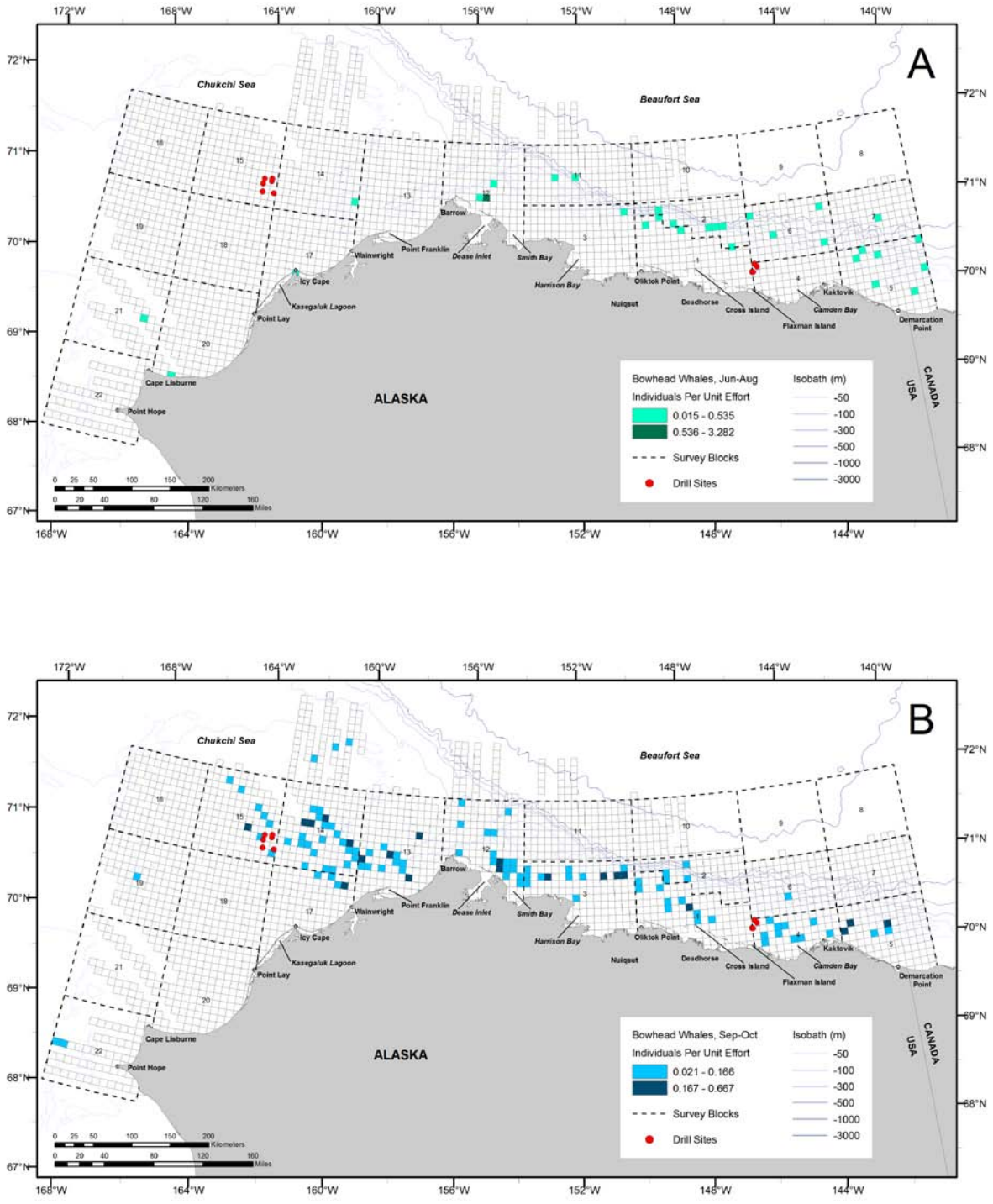


Figure 8. ASAMM bowhead whale sighting rates (whales on transect/km of transect surveyed), (A) summer (June-August); and (B) fall (September-October), 2012. Transect sightings from primary observers only. Empty grid cells have sighting rates of zero; transect survey effort was not conducted in areas without grid cells.

Table 4. ASAMM 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, 2012. NA – surveys were not conducted. Does not include sightings north of 72°N.

BLOCK	JUN Tr Km	Tr Sightings	Tr Whales	WPUE	JUL Tr Km	Tr Sightings	Tr Whales	WPUE	AUG Tr Km	Tr Sightings	Tr Whales	WPUE
1	0	NA	NA	NA	442	0	0	0.0000	1,051	5	5	0.0048
2	0	NA	NA	NA	252	1	1	0.0040	931	6	9	0.0097
3	0	NA	NA	NA	471	0	0	0.0000	1,271	1	1	0.0008
4	0	NA	NA	NA	298	0	0	0.0000	812	0	0	0.0000
5	0	NA	NA	NA	320	5	12	0.0374	1,035	4	6	0.0058
6	0	NA	NA	NA	555	5	7	0.0126	1,193	0	0	0.0000
7	0	NA	NA	NA	424	0	0	0.0000	805	1	1	0.0012
8	0	NA	NA	NA	0	NA	NA	NA	0	NA	NA	NA
9	0	NA	NA	NA	1	0	0	0.0000	0	NA	NA	NA
10	0	NA	NA	NA	14	0	0	0.0000	371	0	0	0.0000
11	0	NA	NA	NA	539	2	3	0.0056	1,328	0	0	0.0000
12	0	NA	NA	NA	1,208	1	1	0.0008	1,481	8	25	0.0169
13	15	0	0	0.0000	1,746	0	0	0.0000	989	0	0	0.0000
14	0	NA	NA	NA	932	1	1	0.0011	803	0	0	0.0000
15	0	NA	NA	NA	876	0	0	0.0000	455	0	0	0.0000
16	0	NA	NA	NA	186	0	0	0.0000	352	0	0	0.0000
17	145	0	0	0.0000	1,711	1	1	0.0006	944	0	0	0.0000
18	0	NA	NA	NA	836	0	0	0.0000	536	0	0	0.0000
19	0	NA	NA	NA	183	0	0	0.0000	124	0	0	0.0000
20	262	0	0	0.0000	1,886	1	1	0.0005	669	0	0	0.0000
21	0	NA	NA	NA	291	1	1	0.0034	58	0	0	0.0000
22	0	NA	NA	NA	143	0	0	0.0000	130	0	0	0.0000
Total	**422**	**0**	**0**	**0.0000**	**13,313**	**18**	**28**	**0.0021**	**15,337**	**25**	**47**	**0.0031**

BLOCK	SEP Tr Km	Tr Sightings	Tr Whales	WPUE	OCT Tr Km	Tr Sightings	Tr Whales	WPUE	TOTAL Tr Km*	Tr Sightings	Tr Whales	WPUE
1	670	8	11	0.0164	1,026	6	6	0.0058	3,188	19	22	0.0069
2	377	3	4	0.0106	707	3	3	0.0042	2,268	13	17	0.0075
3	783	17	21	0.0268	605	5	5	0.0083	3,130	23	27	0.0086
4	621	9	10	0.0161	456	2	3	0.0066	2,187	11	13	0.0059
5	570	6	8	0.0140	426	0	0	0.0000	2,352	15	26	0.0111
6	660	0	0	0.0000	562	3	4	0.0071	2,970	8	11	0.0037
7	463	0	0	0.0000	368	0	0	0.0000	2,060	1	1	0.0005
8	0	NA	NA	NA	0	NA	NA	NA	1	0	0	0.0000
9	0	NA	NA	NA	0	NA	NA	NA	1	0	0	0.0000
10	106	0	0	0.0000	0	NA	NA	NA	491	0	0	0.0000
11	922	0	0	0.0000	353	0	0	0.0000	3,142	2	3	0.0010
12	1,222	7	9	0.0074	937	17	19	0.0203	4,848	33	54	0.0111
13	1,405	15	19	0.0135	1,641	11	15	0.0091	5,796	26	34	0.0059
14	850	8	8	0.0094	933	38	50	0.0536	3,518	47	59	0.0168
15	940	8	8	0.0085	423	5	6	0.0142	2,695	13	14	0.0052
16	637	0	0	0.0000	132	0	0	0.0000	1,307	0	0	0.0000
17	1,322	11	12	0.0091	1,235	0	0	0.0000	5,358	12	13	0.0024
18	878	0	0	0.0000	762	0	0	0.0000	3,013	0	0	0.0000
19	349	0	0	0.0000	457	1	1	0.0022	1,112	1	1	0.0009
20	417	0	0	0.0000	730	0	0	0.0000	3,964	1	1	0.0003
21	7	0	0	0.0000	7	0	0	0.0000	362	1	1	0.0028
22	527	2	2	0.0038	347	0	0	0.0000	1,146	2	2	0.0017
Total	**13,726**	**94**	**112**	**0.0082**	**12,109**	**91**	**112**	**0.0092**	**54,907**	**228**	**299**	**0.0054**

* Total transect effort (Tr km) differs from values in Tables 2 and 5 because effort between barrier islands and the mainland was not included in the sighting rate per survey block analysis.

highest in block 5 (WPUE = 0.013), block 12 (WPUE = 0.010) and block 2 (WPUE = 0.009), and relatively low in all Chukchi Sea blocks; overall sighting rate in summer was 0.003 WPUE. Combined sighting rate for fall months (September-October) was highest in block 14 (WPUE = 0.033), block 3 (WPUE = 0.019) and block 12 (WPUE = 0.013); overall sighting rate in fall was 0.009 WPUE. Combined sighting rate for fall months for the western Beaufort Sea only was 0.009 WPUE, which is higher than that observed in 2011, but lower than those observed from 2006-2010 (Clarke et al. 2011a, 2011b, 2011c, 2012). 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 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 2012 sighting rates with existing analyses of sighting rates from two decades ago. However, the pattern of highest sighting rates per year in fall in western Beaufort coastal survey blocks (1, 3, 4, 5, and 12), usually correlated with large groups of bowhead whales in feeding or milling aggregations, remained the same in 2012.

In the Chukchi Sea, the high sighting rate in block 14 was unprecedented. By comparison, only seven bowhead whales were seen in block 14 during ~9,400 km of survey effort in 2008-2011, for a WPUE of 0.001 (Clarke et al. 2011d, 2012). From 2008-2010, the highest sighting rate in the Chukchi Sea was in block 13 (Clarke et al. 2011d); in 2011 the highest sighting rate in the Chukchi Sea was in block 18, although this actually represented just one sighting of two bowhead whales observed during minimal transect effort (Clarke et al. 2012).

Monthly sighting rates per survey block in the western Beaufort Sea in September and October 2012 were equal to or higher than combined sighting rates for September and October 1989-2011 (Figure 9) for most survey blocks. One exception to this was in block 12, where the monthly sighting rates for both September and October were substantially lower in 2012. Bowhead whales were regularly seen in block 12, but not in large groups as have occurred in past years (e.g., 2009).

For all months combined, the highest bowhead whale sighting rates per depth zone (Table 5) were in the:

- 21-50 m depth zone (0.010 WPUE) in the central-eastern (140°W-154°W) Alaskan Beaufort Sea region;
- ≤20 m depth zone (0.047 WPUE) in the western (154°W-157°W) Alaskan Beaufort Sea region, similar to 2009 and 2010 when feeding whales were observed in the western Alaskan Beaufort Sea; and
- 51-200 m North depth zone (0.013 WPUE) in the northeastern Chukchi Sea subarea (157°-169°W).

Sighting rates in the central-eastern Alaskan Beaufort Sea region in summer were highest in the 51-200 m depth zone (0.007 WPUE) and in the 21-50 m depth zone (0.016 WPUE) in fall. Sighting rates in other regions were consistent in summer and fall months: highest sighting rates were in the ≤20 m depth zone in the western Alaskan Beaufort Sea and in the 51-200 m North depth zone in the northeastern Chukchi Sea.

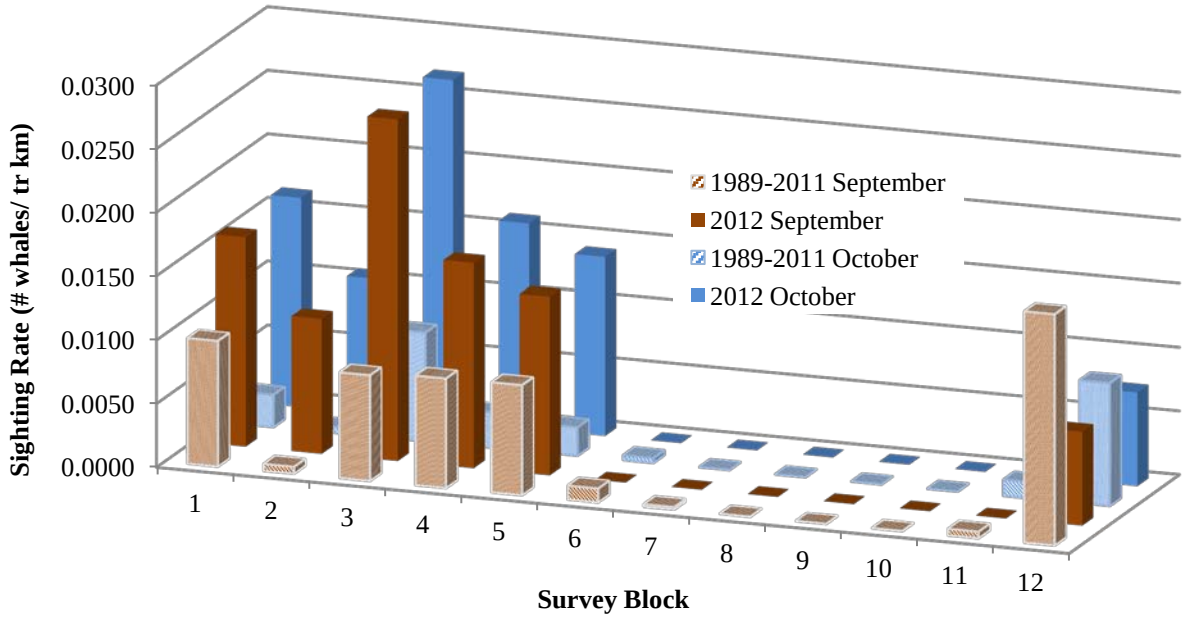


Figure 9. ASAMM September and October sighting rates (whales per transect km) of bowhead whales on transect (primary observers only) in the western Beaufort Sea per survey block, 1989-2011 and 2012.

BOWHEAD WHALE HABITAT ASSOCIATIONS

Biweekly sea ice cover maps for the western Beaufort Sea during 2012 are included in Appendix A. Most bowhead whales (90%, n = 584) were observed in 0% sea ice cover (Table 6). Forty-two bowhead whales (6%) were sighted in 1-20% sea ice cover, either in July and early August when sea ice remnants remained in some of the study area, or in late October when new ice was forming in shallow nearshore areas.

BOWHEAD WHALE BEHAVIORS

Behaviors of 648 bowhead whales observed during all survey modes (i.e., transect, search and circling) and by primary and secondary observers in 2012 are summarized in Table 7. The behavior most often recorded (74%) was swimming. Milling and feeding were recorded for 105 whales (16%) and resting was recorded for 43 whales (7%). Five whales were recorded breaching and one whale was tail slapping. Sighting rates of milling and feeding whales observed on transect are shown in Figure 10.

Out of the 648 bowhead whales sighted, 24 were identified as calves (Figure 11). Nearly half (n=11) of the calves were sighted during summer months in the western Beaufort Sea, including four seen in one group on 22 July (Appendix B, Flight 4). Two calves were observed in the northeastern Chukchi Sea. The resulting calf ratio (number of calves/number of total whales)

Table 5. ASAMM transect (Tr) effort (km), bowhead whale transect sightings (primary observers only) and bowhead whale sighting rate (WPUE = bowhead whales per transect km surveyed) per depth zone per month, 2012. NA – surveys were not conducted. Does not include sightings north of 72°N.

	JUN Tr Km	Tr Sightings	Tr Whales	WPUE	JUL Tr Km	Tr Sightings	Tr Whales	WPUE	AUG Tr Km	Tr Sightings	Tr Whales	WPUE
157W-169W												
0-35 m	420	0	0	0.0000	3,731	2	2	0.0005	1,675	0	0	0.0000
36-50 m	0	NA	NA	NA	3,512	1	1	0.0003	2,448	0	0	0.0000
51-200 m N	0	NA	NA	NA	1,387	1	1	0.0007	888	0	0	0.0000
51-200 m S	0	NA	NA	NA	0	NA	NA	NA	0	NA	NA	NA
154W-157W												
0-20 m	0	NA	NA	NA	174	0	0	0.0000	298	8	25	0.0838
21-50 m	0	NA	NA	NA	200	0	0	0.0000	303	0	0	0.0000
51-200 m	0	NA	NA	NA	695	1	1	0.0014	717	0	0	0.0000
201-2,000 m	0	NA	NA	NA	139	0	0	0.0000	162	0	0	0.0000
140W-154W												
0-20 m	0	NA	NA	NA	430	0	0	0.0000	1,001	0	0	0.0000
21-50 m	0	NA	NA	NA	943	1	1	0.0011	2,627	12	17	0.0065
51-200 m	0	NA	NA	NA	622	5	13	0.0209	1,577	3	3	0.0019
201-2,000 m	0	NA	NA	NA	1,025	7	9	0.0088	2,442	2	2	0.0008
>2,000 m	0	NA	NA	NA	334	0	0	0.0000	1,146	0	0	0.0000
Total	**420**	**0**	**0**	**0.0000**	**13,192**	**18**	**28**	**0.0021**	**15,285**	**25**	**47**	**0.0031**

	SEP Tr Km	Tr Sightings	Tr Whales	WPUE	OCT Tr Km	Tr Sightings	Tr Whales	WPUE	TOTAL Tr Km*	Tr Sightings	Tr Whales	WPUE
157W-169W												
0-35 m	2,343	0	0	0.0000	2,357	1	1	0.0004	10,527	3	3	0.0003
36-50 m	3,982	20	21	0.0053	2,947	33	43	0.0146	12,888	54	65	0.0050
51-200 m N	884	23	27	0.0305	1,225	21	28	0.0229	4,384	45	56	0.0128
51-200 m S	121	1	1	0.0082	102	0	0	0.0000	223	1	1	0.0045
154W-157W												
0-20 m	271	4	6	0.0221	153	10	11	0.0717	897	22	42	0.0468
21-50 m	299	3	3	0.0100	186	2	3	0.0162	987	5	6	0.0061
51-200 m	514	0	0	0.0000	504	4	4	0.0079	2,430	5	5	0.0021
201-2,000 m	139	0	0	0.0000	94	1	1	0.0107	533	1	1	0.0019
140W-154W												
0-20 m	654	4	6	0.0092	636	5	5	0.0079	2,720	9	11	0.0040
21-50 m	1,783	37	46	0.0258	1,795	9	10	0.0056	7,147	59	74	0.0104
51-200 m	993	1	1	0.0010	816	3	4	0.0049	4,008	12	21	0.0052
201-2,000 m	1,250	1	1	0.0008	966	2	2	0.0021	5,683	12	14	0.0025
>2,000 m	491	0	0	0.0000	294	0	0	0.0000	2,264	0	0	0.0000
TOTAL	**13,722**	**94**	**112**	**0.0082**	**12,073**	**91**	**112**	**0.0093**	**54,693**	**228**	**299**	**0.0055**

* Total transect effort (Tr km) differs from values in Tables 2 and 4 because effort between barrier islands and the mainland was included in the sighting rate per depth zone analysis.

Table 6. ASAMM 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, 2012. Excludes dead and repeat sightings.

Percent Sea Ice Cover	30 Jun	1-15 Jul	16-31 Jul	1-15 Aug	16-31 Aug	1-15 Sep	16-30 Sep	1-15 Oct	16-28 Oct	Total
0	0	1/1	0	2/3	35/69	98/132	82/108	137/197	38/74	393/584 (90%)
1-5	0	4/4	6/13	0	0	3/3	0	0	2/3	15/23 (4%)
6-10	1/1	1/1	1/1	0	0	0	0	0	0	3/3 (<1%)
11-20	0	1/1	0	4/15	0	0	0	0	0	5/16 (2%)
21-30	0	0	4/5	0	0	0	0	0	3/4	7/9 (1%)
31-40	0	0	1/2	0	0	0	0	0	0	1/2 (<1%)
41-50	0	0	1/1	0	0	0	0	0	0	1/1 (<1%)
51-60	0	0	3/5	0	0	0	0	0	0	3/5 (1%)
61-70	0	3/3	1/1	0	0	0	0	0	0	4/4 (1%)
71-80	0	0	1/1	0	0	0	0	0	0	1/1 (<1%)
TOTAL	1/1	10/10	18/29	6/18	35/69	101/135	82/108	137/197	43/81	433/648

Table 7. ASAMM semimonthly summary of bowhead whales (number of sightings/number of individuals) observed during all survey modes (transect, search and circling), by behavioral category, 2012. Excludes dead and repeat sightings.

Behavior	30 Jun	1-15 Jul	16-31 Jul	1-15 Aug	16-31 Aug	1-15 Sep	16-30 Sep	1-15 Oct	16-28 Oct	Total
Breach	0	0	2/3	0	0	2/2	0	0	0	4/5 (<1%)
Dive	0	1/1	1/2	0	0	3/3	1/1	3/3	0	9/10 (2%)
Feed	0	1/1	0	0	2/4	1/1	0	0	0	4/6 (<1%)
Mill	0	0	1/8	2/8	5/14	7/15	0	4/22	3/32	22/99 (15%)
Rest	0	1/1	3/4	1/6	2/4	6/7	8/9	9/11	1/1	31/43 (7%)
Swim	1/1	7/7	11/12	3/4	26/47	78/102	73/98	120/159	38/47	357/477 (74%)
Tail Slap	0	0	0	0	0	1/1	0	0	0	1/1 (<1%)
Unknown	0	0	0	0	0	3/4	0	1/2	1/1	5/7 (1%)
TOTAL	1/1	10/10	18/29	6/18	35/69	101/135	82/108	137/197	43/81	433/648

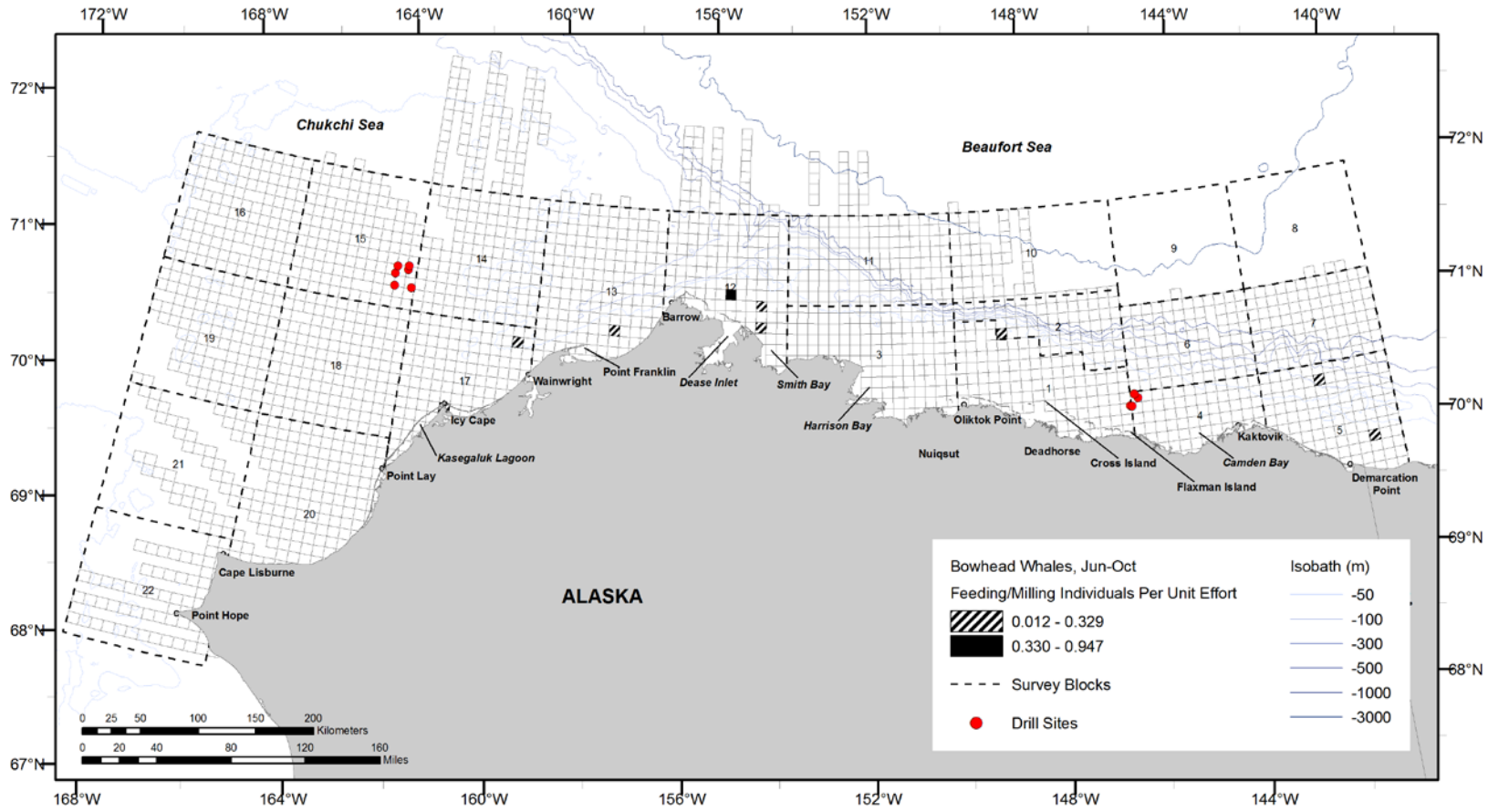


Figure 10. ASAMM feeding and milling bowhead whale sighting rates (whales on transect/km of transect surveyed), 2012. Empty grid cells have sighting rates of zero; transect survey effort was not conducted in areas without grid cells. Transect sightings from primary observers only.

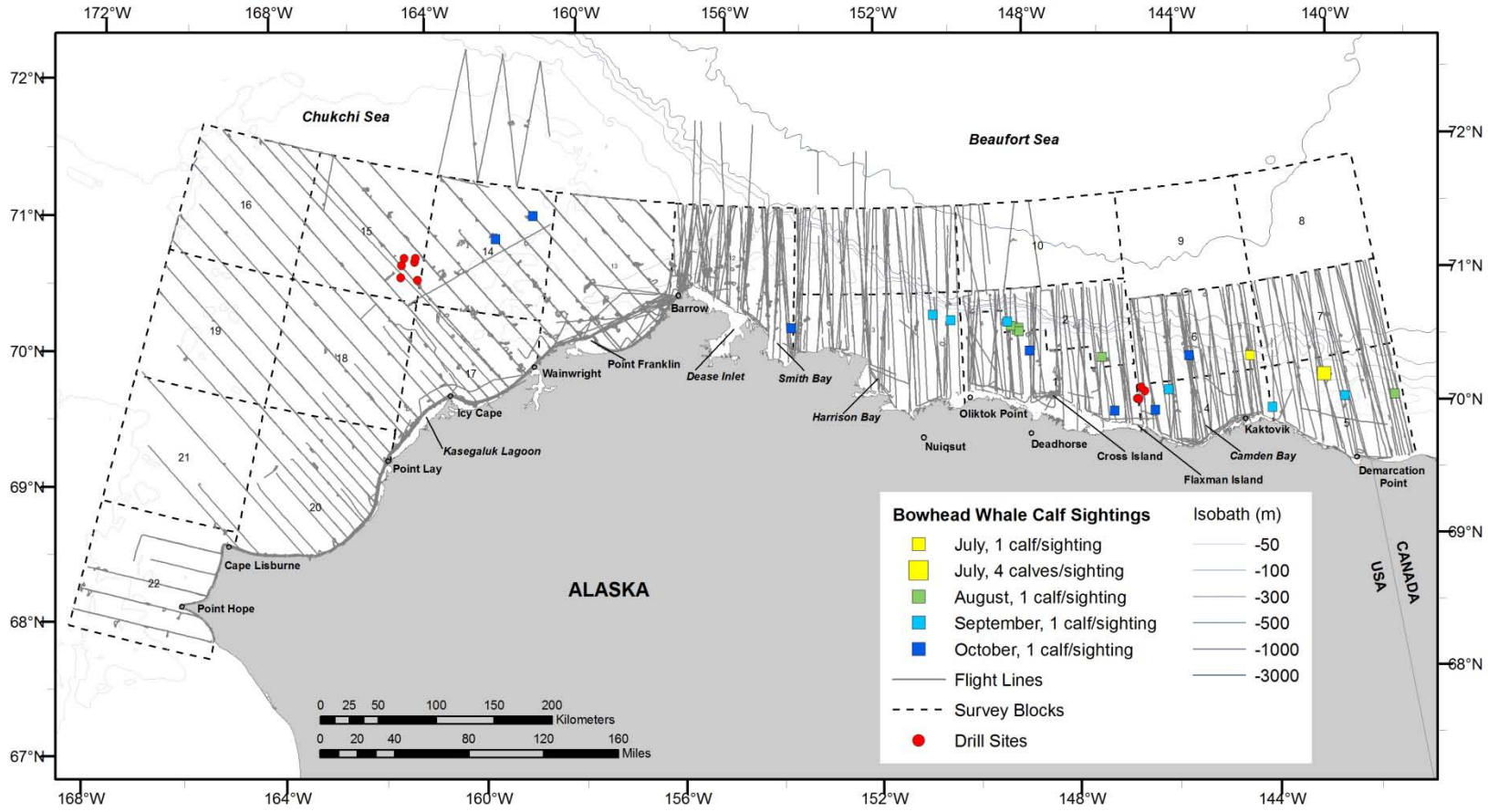


Figure 11. ASAMM bowhead whale calf sightings plotted by month, with transect, search and circling effort, 2012. Deadhead flight tracks are not shown.

was 0.037, which is similar to calf ratios observed during these surveys in recent years (0.022 to 0.058; 2006-2011; Clarke et al. 2012).

In the western Beaufort Sea in July and August, swimming direction was significantly clustered around a mean vector of 274°T (n = 22 observations, Rayleigh Z = 9.92, $p < 0.0001$). Although sample size was small, >70% of swimming bowhead whales were heading between 226°T and 315°T. In September and October, swimming direction in the western Beaufort Sea was significantly clustered around a mean vector of 272°T (n = 41 observations, Rayleigh Z = 5.38, p = 0.004). Most (54%) swimming bowhead whales were heading between 226°T and 315°T, although 15% were heading between 46°T and 90°T. Swim direction in the Chukchi Sea in September and October was significantly clustered around a mean vector of 275°T (n = 90 observations, Rayleigh Z = 5.63, p = 0.004), although the distribution of headings was more scattered than in the Beaufort Sea. There were too few observations to test for mean swimming direction in July and August in the Chukchi Sea.

Nine bowhead whales (1% of all bowhead whales sighted) appeared to respond to the survey aircraft.

Western Beaufort Sea Bowhead Whale Feeding Areas

Bowhead whale feeding behavior (which includes sightings reported as milling) has been observed during ASAMM surveys throughout the western Beaufort Sea within the 50 m isobath (e.g., Ljungblad et al. 1987; Landino et al. 1994; Clarke et al. 2011c). With the exception of block 12 (154°W to 157°W), however, feeding opportunities appear to be short-lived, ephemeral and transient, and show both intra- and inter-year variability (Figure 12). Feeding behavior was often detected in a particular area just one time, both within and between years, despite repeated surveying of the area. For example, several bowhead whales were observed feeding on two consecutive days in September 2003 northwest of Oliktok Point (Figure 12, dark green squares), but were not observed feeding in that area at any other time in 2003 or in any other recent year (2000-2012). Large groups (>10 whales) of feeding bowhead whales were recorded northeast of Deadhorse on two days in late September 2007 (Figure 12, large yellow squares) and one day in late October 2012 (Figure 12, indigo square), but were not observed feeding in that area at any other time in 2007 or 2012, or in any other recent year (2000-2012). The widespread distribution of observed bowhead whale feeding in the western Beaufort Sea, combined with the apparent transient nature of those feeding opportunities, may indicate that opportunistic bowhead whale feeding in the western Beaufort Sea occurs much more often than currently documented via aerial surveys. Evidence for bowhead whale feeding in the western Beaufort Sea was also provided from stomach samples collected from bowhead whales harvested from 1979-2000 during subsistence hunts based at Kaktovik, Cross Island (Nuiqsut whalers), and Barrow (Lowry et al. 2004). Over 70% of bowhead whales harvested during the fall subsistence hunt were considered to have been feeding, based on stomach content analysis. Whales taken during fall whaling have presumably been feeding in the eastern, central and western Beaufort Sea.

As indicated above, large groups of feeding bowhead whales have been regularly observed in block 12 (154°W to 157°W) in recent years (Figure 12). This area is a well-documented bowhead whale feeding ground (Moore and Reeves 1993; Mocklin et al. 2011) and the site of the

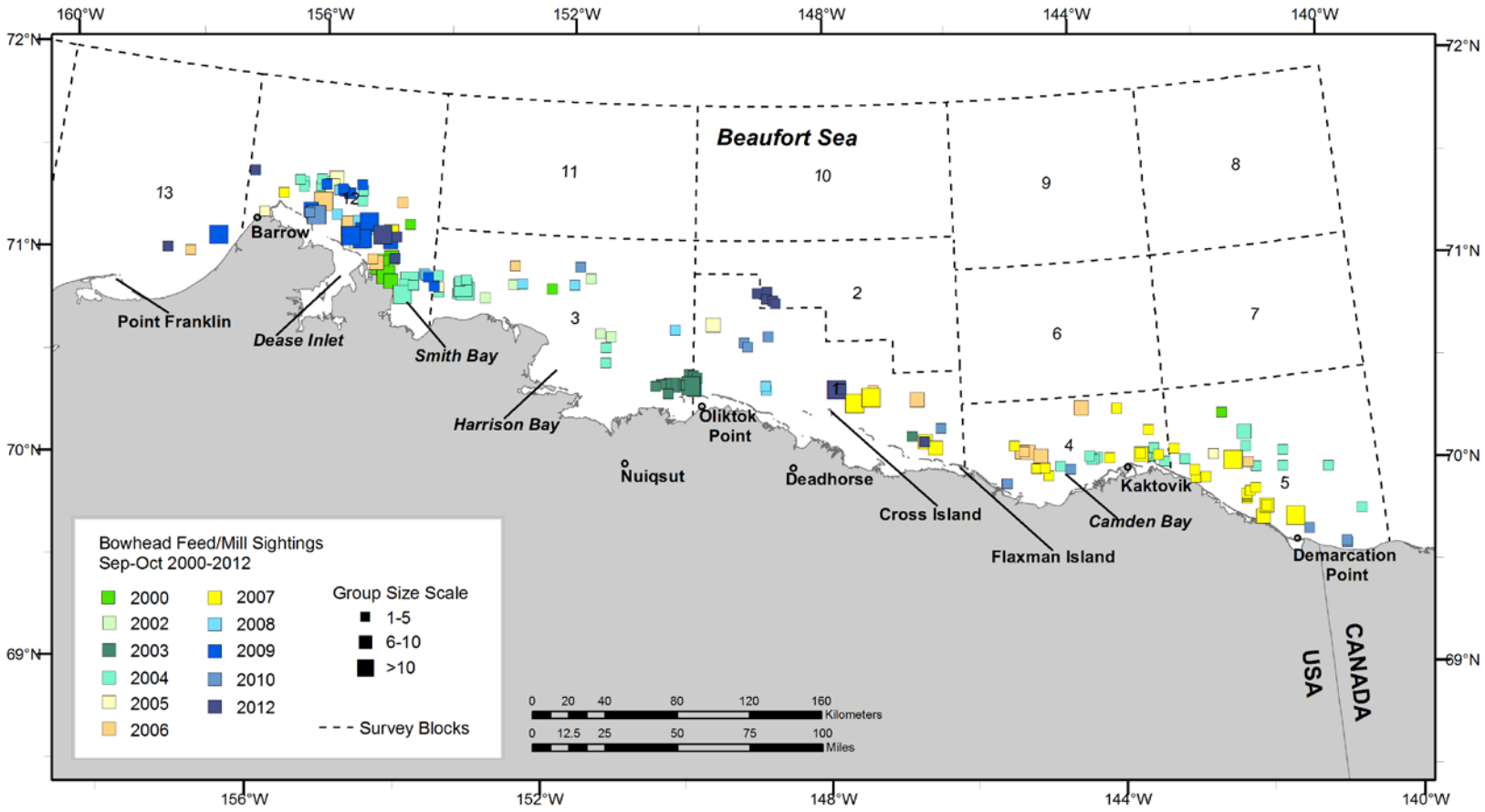


Figure 12. ASAMM bowhead whale feeding and milling sightings, all survey modes (transect, search, and circling), 2000-2012. There were no feeding or milling sightings in 2001 and 2011.

BOEM-sponsored Bowhead Whale Feeding Ecology Study (BOWFEST 2007-2011). Preliminary results from BOWFEST indicate 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 the krill toward Barrow (Ashjian et al. 2010). When winds weaken or change to blow from the south, the northeastward-flowing Alaska Coastal Current 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 2012, surveys were conducted in block 12 on nine occasions during ASAMM, and bowhead whales were seen during eight surveys (Figure 13). Surveys in block 12 were not pre-planned based on wind conditions (in other words, surveys were not preferentially conducted on days on which there was a high likelihood of seeing bowhead whales based on recent wind conditions so that data would not be biased), but overall weather conditions did impact when the area was surveyed. For example, weather was not suitable for surveying block 12 in the first half of September so there was a nearly one-month gap in coverage of this area. Surveys in block 12 were conducted on:

- 8 July: three bowhead whales were seen near Barrow Canyon during good survey conditions (Beaufort 1-3, 5-10 km visibility); sea ice cover in the area surveyed was 65-90% broken floe.
- 23 July: one bowhead whale was seen near Barrow Canyon during good survey conditions (Beaufort 0-1, <1-10 km visibility); significant sea ice cover (up to 95% broken floe) remained in the area.
- 1 August: no bowhead whales were observed during good survey conditions (Beaufort 2-4, <1-10 km visibility). Sea ice remained in the north half of the block.
- 11 August: 14 bowhead whales, including one group of 6 whales and one group of 7 whales in close proximity to each other, were seen in shallow (<20 m) depths during a survey in good conditions (Beaufort 0-3, <1-10 km visibility). Sea ice remained in the northern part of the area surveyed. The group of six whales was initially seen in a "daisy" formation, with heads inward and one whale upside down in the middle of the formation. The group of seven was milling.
- 20 August: 23 bowhead whales were observed along a short section of transect near the location of the 14 whales seen on 11 August; survey conditions were good (Beaufort 1-3, 2-10 km visibility). Seventeen of the whales were reported milling or feeding. Sea ice was mostly absent from the area.
- 19 September: two bowhead whales were seen during a survey in fair conditions (Beaufort 1-7, 0-10 km visibility). Sea ice was absent from the area.
- 28 September: 11 bowhead whales were observed scattered north of Smith Bay and Point Barrow during fair survey conditions (Beaufort 2-6, 0-10 km visibility); all of the whales were either swimming or resting.

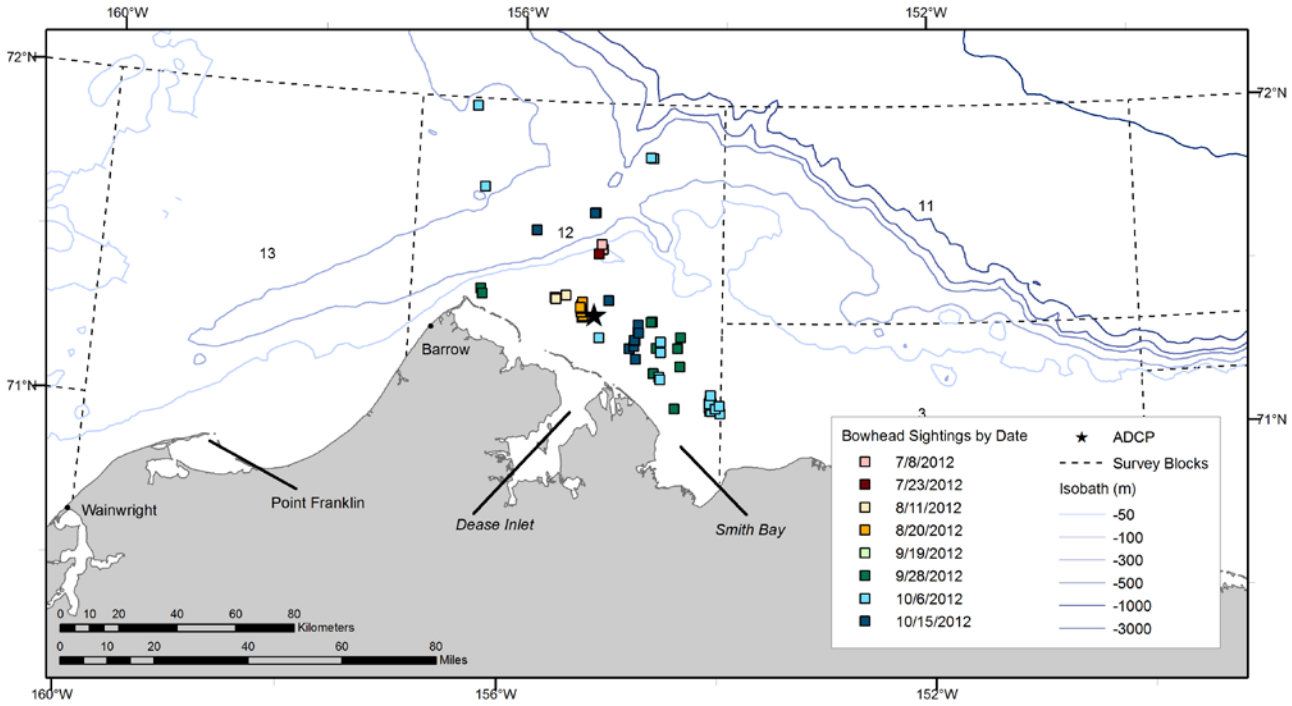


Figure 13. ASAMM bowhead whale sightings in block 12, all survey modes (transect, search, and circling), 2012. ADCP – Acoustic Doppler Current Profiler.

- 6 October: 35 bowhead whales were observed during excellent survey conditions (Beaufort 2-6, 5 km to unlimited visibility), scattered from Smith Bay to north of Point Barrow. Most of the whales were swimming, but three whales were milling.
- 15 October: 38 bowhead whales were observed during good survey conditions (Beaufort 2-5, 0-10 km visibility); one group of seventeen was observed milling.

Information on wind speed, wind direction, and other environmental variables, was collected three times per day for Barrow from the National Weather Service, Alaska Aviation Weather Unit web site (http://aawu.arh.noaa.gov/), and plotted for the several days immediately preceding ASAMM surveys in block 12 (Figure 14). On all of the days on which feeding or milling whales were seen (11 and 20 August, 6 and 15 October), winds were stronger in the days prior to the observations and calmed considerably by the time the survey was conducted. On three of the days on which bowheads were not seen or not observed feeding or milling (8 July, 1 August, 19 September), winds were fairly high (12-15 kts) which may have allowed krill to move off the shelf where they were less accessible to whales. On two of the days when whales were not observed feeding or milling (23 July and 28 September), wind conditions appeared to favor feeding opportunities. In late July, much of this part of the study area was still covered with sea ice, which may have impacted the movement of krill as well.

Bowhead whale groups were observed foraging in shelf waters near Barrow by North Slope Borough (NSB) boat-based observers on multiple days in 2012 (C. George, NSB, pers. comm. to J. Clarke, 23 August 2012), but none were observed in September or early October in 2011 (C. George, NSB, pers. comm. to J. Clarke, 10 October 2011). Acoustic measurements acquired by

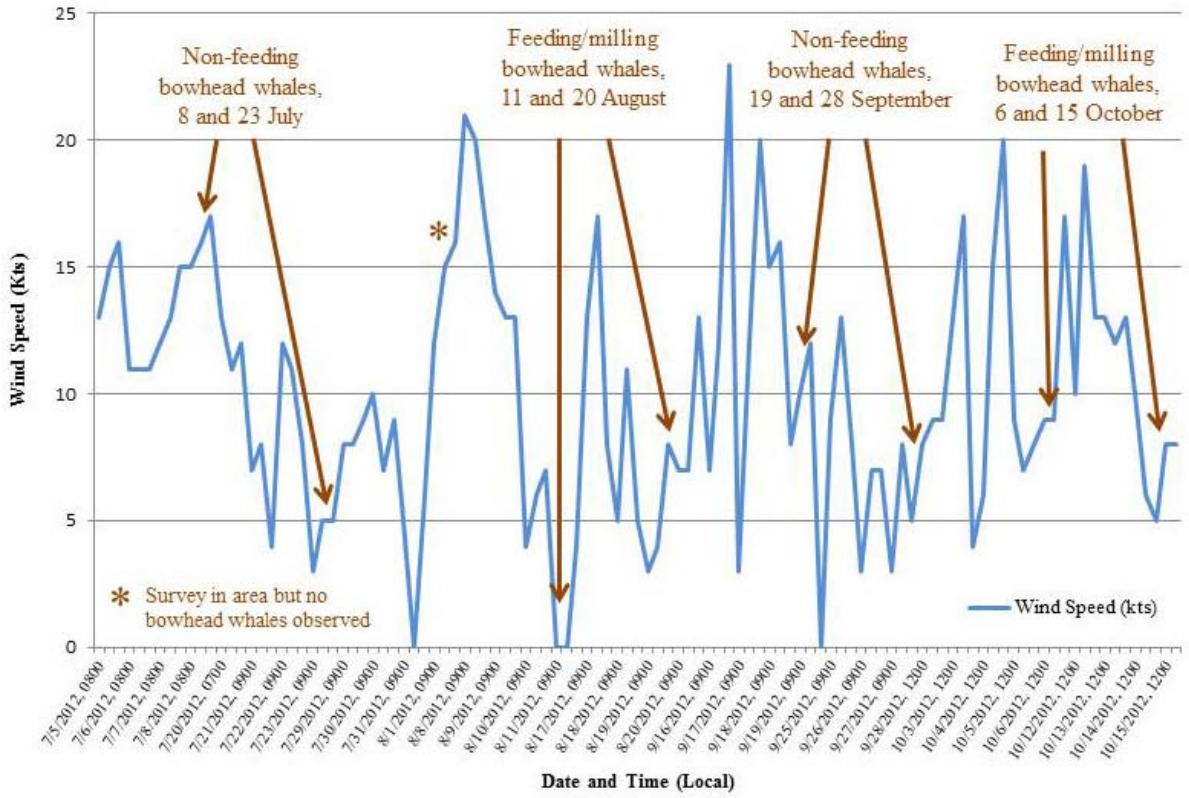


Figure 14. ASAMM bowhead whale occurrence in block 12 (all survey modes) and wind speeds measured at Barrow, Alaska, July to October 2012.

an oceanographic mooring deployed on the western Beaufort shelf (2009-2012) indicated that the numbers of krill arriving on the shelf in late summer were highest in 2009 and lowest in 2011, with 2012 appearing to be moderately productive (Figure 15) (S. Okkonen, University of Alaska Fairbanks, pers. comm. to J. Clarke, 9 January 2011).

BOWHEAD WHALE CENTRAL TENDENCY – ANALYSIS 1

Summary statistics for bowhead whale data from the western Beaufort Sea in September-October 1989-2012 are shown in Table 8. This table differs from previous Annual Reports (e.g., Clarke et al. 2012) because summary statistics no longer incorporate sightings made by secondary observers. Primary observers were not identified for the earliest years of the ASAMM project, so data from 1982-1988 are no longer included. In the 1990s, sample sizes and summary statistics changed appreciably from values previously reported because numerous sightings on transect were seen by pilots or data recorders, who were part-time observers due to other duties. Despite the loss of >800 sightings, the central tendency analysis using historical data is more robust due to the tighter data constraints.

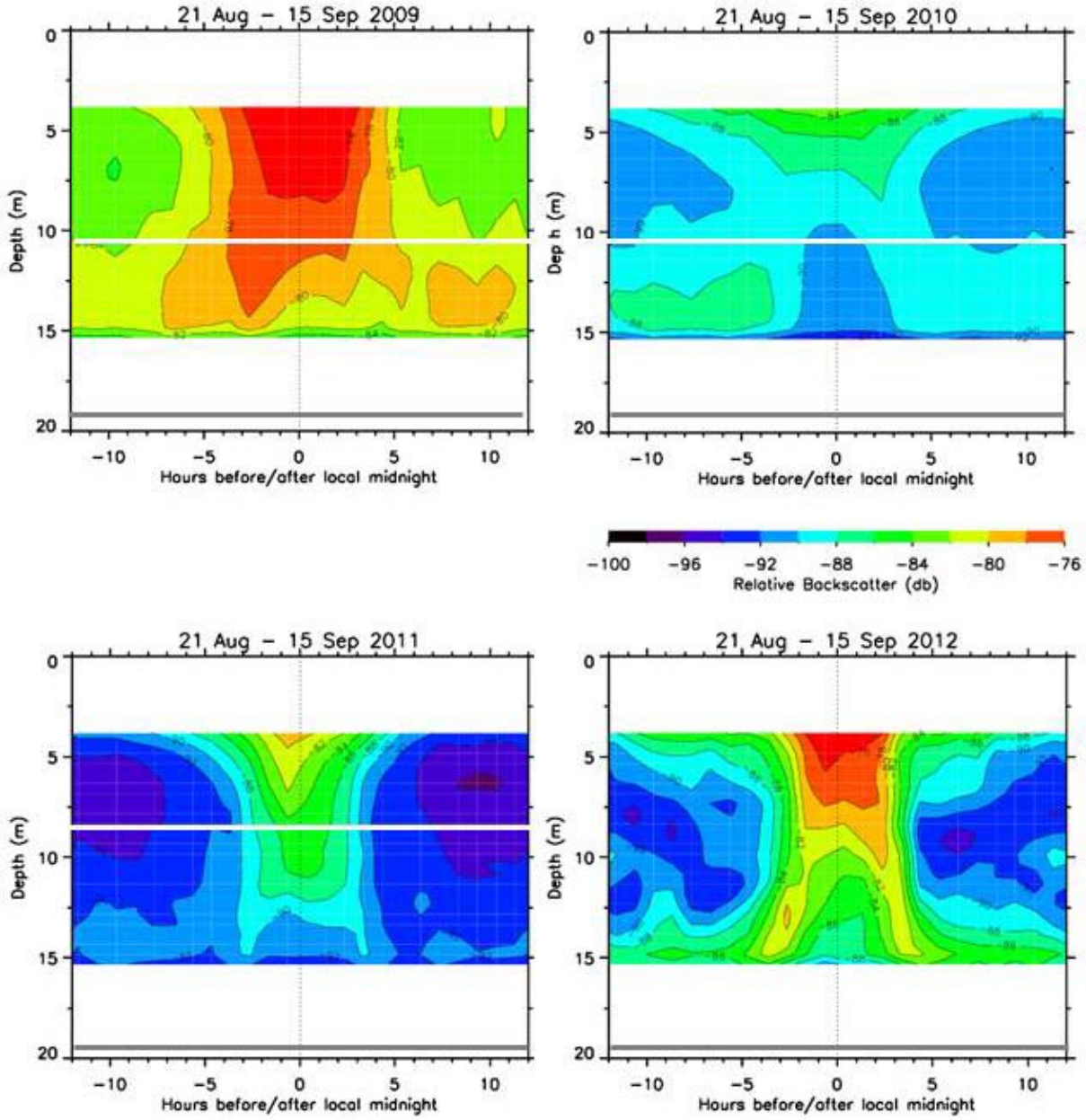


Figure 15. Time-averaged, Acoustic Doppler Current Profiler (ADCP) measured backscatter at a Beaufort Shelf mooring site east of Point Barrow from 21 August-15 September, 2009, 2010, 2011 and 2012. The mooring site is shown on Figure 13. Greater backscatter (inferred greater zooplankton abundance) is indicated by red coloration. Provided by S. Okkonen, University of Alaska Fairbanks.

Table 8. 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, 1989-2012. TrSi = transect sightings from 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	NA	NA	43.8	43.8	NA	NA
	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	NA	NA	72.8	72.8	NA	NA
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	6-1308	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	7-2001	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
2001	East	13	46	44	9.1	28-53	31.8	27.9	10.7	12-41

			DEPTH (M)				DISTANCE FROM SHORE (KM)			
Year	Region	TrSi	Median	Mean	SD	Min-Max	Median	Mean	SD	Min-Max
	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	9-1966	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

Depth at Sighting, 2012

In the East Region, mean depth at *all* bowhead whale sightings on transect in September-October 2012 was 51 m (SD = 48.8, range 11-213 m) and median depth was 35 m (Table 8). In the West Region, mean depth was 51 m (SD = 92.5, range 11-648 m) and median depth was 29 m. Mean and median depth of "migrating" bowhead whales on transect (i.e., excluding sightings of feeding, milling, or resting whales) were 52 m (SD = 49.1, range 16-213 m) and 37 m, respectively, in the East Region. Mean and median depth of "migrating" bowhead whales on transect in the West Region were 54 m (SD = 99.3, range 11-648 m) and 28 m, respectively. A Mann-Whitney *U*-test of significant difference of medians indicated no difference between median depths of all sightings versus only those sightings considered "migrating" in the East (Z = 0.230, P = 0.8181) or West (Z = -0.117, P = 0.9068) regions.

Distance from Shore, 2012

In the East Region, mean and median distances to the normalized shoreline of *all* bowhead whale sightings on transect from primary observers in September-October 2012 were 28.5 km (SD = 19.8) and 24.9 km, respectively (Table 8). In the West Region, mean and median distances to the normalized shoreline were 36.4 km (SD = 18.9) and 31.0 km, respectively. Mean and median distance of locations of "migrating" bowhead whale sightings on transect (i.e., excluding sightings of feeding, milling, or resting whales) from primary observers were 29.4 km (SD = 19.8) and 25.2 km in the East Region, respectively, and 36.3 km (SD = 18.7) and 32.6 km, respectively, in the West Region. A Mann-Whitney *U*-test of significant difference between medians indicated no difference between median distances of all sightings versus only those sightings considered "migrating" in the East (Z = -0.190, P = 0.8493) or West (Z = 0.058, P = 0.9533) regions.

Based on the lack of significant difference between all bowhead whale sightings in 2012 and sightings limited to whales considered "migrating," additional analyses of bowhead whale HUAs incorporated all sightings and were not limited to only those animals considered actively "migrating".

Distribution of Bowhead Whales, 2012, Relative to Bowhead Whale Distribution in Previous Years with Light Sea Ice Cover

Bowhead whale distribution in the western Beaufort Sea in September-October 2012 using sightings on transect from primary and secondary observers did not appear to differ noticeably from the distribution of transect-only sightings observed in previous years having light sea ice cover (i.e., 1982, 1986, 1987, 1989, 1990, 1993-2011) (Figure 16). With the exception of sightings in blocks 15, 19 and 22 and lack of sightings in block 18, bowhead whale transect sightings in 2012 overlay those from 1982-2011.

To evaluate whether significant displacements occurred in the western Beaufort Sea bowhead whale HUAs during fall 2012 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

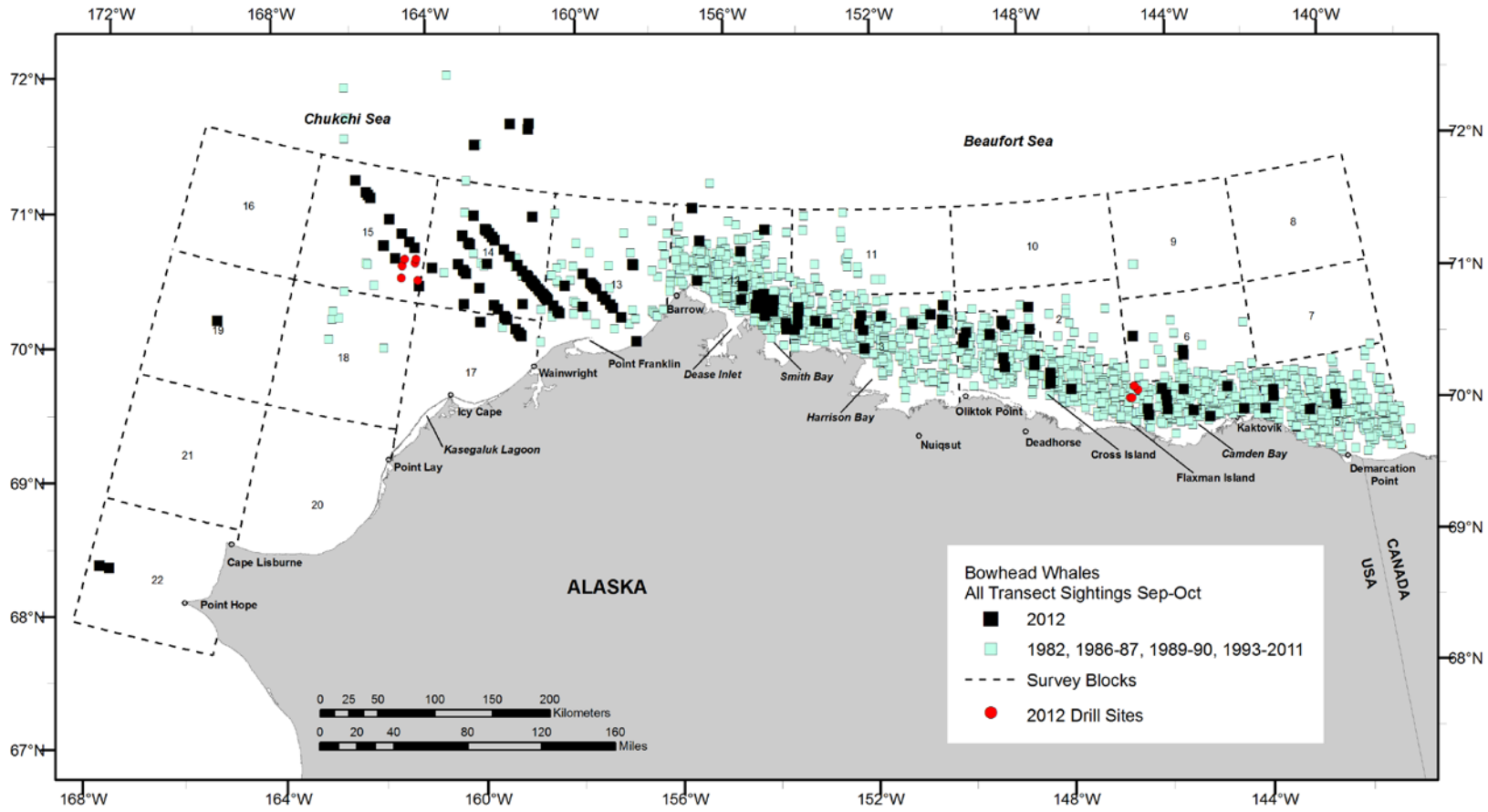


Figure 16. ASAMM bowhead whale sightings on transect, September-October, in years with light sea ice cover: 1982, 1986-87, 1989-90, 1993-2011, and 2012. Includes all sightings on transect, from primary and secondary observers.

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 20 m in the West Region; the median distance from shore was 23.6 km in the East Region and 23.5 km in the West Region.

In fall (September-October) in the East Region, there was no significant difference in median distance from shore of bowhead whale sightings between 2012 (24.9 km) and previous yearswith light sea ice cover (23.6 km), nor was there any significant difference in depth at bowhead whale sightings between 2012 (35 m) and previous years with light sea ice cover (39 m). In the West Region, bowhead whales sighted on transect by primary observers were in significantly deeper water in fall 2012 (29 m vs. 20 m, $Z = -3.020$, $P = 0.0025$) and significantly farther from shore in 2012 (median distance 31.0 km vs. 23.5 km, $Z = -3.775$, $P = 0.0002$) than in previous years with light sea ice cover.

Distribution of Bowhead Whales, 2012, During Summer and Fall Months

Bowhead whale distribution in the western Beaufort Sea in summer (June-August) 2012 using sightings on transect from primary and secondary observers did not appear to differ noticeably from the distribution of transect sightings observed in previous years having light sea ice cover (i.e., 1982, 1986, 1987, 1989, 1990, 1993-2011) (Figure 17). Survey effort in summer in the western Beaufort Sea in previous years has been sporadic and inconsistent, so testing for differences between 2012 and historical years was not possible. However, because surveys were consistently conducted from mid-July through late October 2012, intra-year comparisons between the distribution of bowhead whales in summer and fall 2012 were possible. Summary statistics for bowhead whale data from the western Beaufort Sea in July-August 2012 were compared to values for September-October 2012 (Table 9). In the East Region, bowhead whales sighted on transect in summer were in significantly deeper water (median depth 114 m vs. 35 m, $Z = 4.237$, $P = 0.00002$) and significantly farther from shore (median distance 56.2 km vs. 24.9 km, $Z = -3.986$, $P = 0.00007$) than bowheads sighted on transect in fall. Median depth and distance from shore for bowhead whale sightings on transect in the West Region were not significantly different between summer (depth = 42 m, distance from shore = 51.4 km) and fall (depth = 29 m, distance from shore = 31.0 km).

BOWHEAD WHALE CENTRAL TENDENCY – ANALYSIS 2

The fall 2012 spatial encounter rate model (GAM) was built on 83 bowhead whale sightings of 100 total individuals; the fall 2007-2012 model was built on 348 sightings of 689 individuals. Encounter rate predictions resulting from the GAM applied to fall 2012 survey data for the western Beaufort Sea are shown in Figure 18; the highest predicted encounter rates were located east of Point Barrow (north of Dease Inlet and Smith Bay) and north of Harrison Bay (approximately 50 km offshore). The highest predicted encounter rates for the 6-year analysis (2007-2012) were located in the area east of Point Barrow, north of Dease Inlet and Smith Bay (Figure 19).

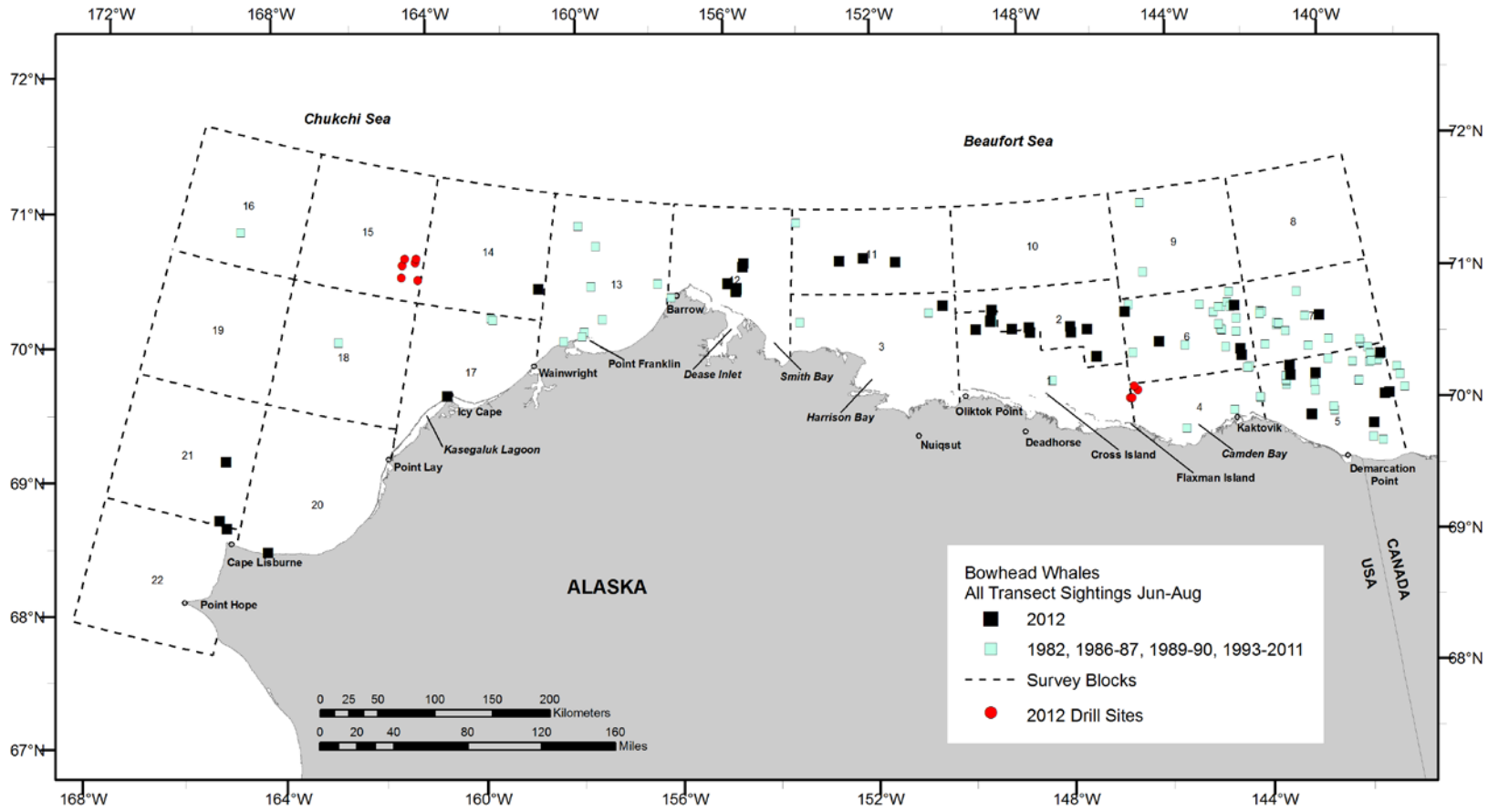


Figure 17. ASAMM bowhead whale sightings on transect, June-August, in years with light sea ice cover: 1982, 1986-87, 1989-90, 1993-2011, and 2012. Includes all sightings on transect, from primary and secondary observers.

Table 9. ASAMM central tendency statistics for depth (m) and distance from shore (km) at bowhead whale transect sightings, summer (July-August) and fall (September-October) in the western Beaufort Sea, 2012. TrSi = transect sightings from primary observers

		East Region		West Region	
		2012 Summer	2012 Fall	2012 Summer	2012 Fall
	TrSi	20	25	19	58
Depth	Median	114	35	42	29
	Mean	389	51	77	51
	SD	597.9	48.8	147.5	92.5
	Min-Max	39-1,986	11-213	18-663	11-648
Distance from Shore	Median	56.2	24.9	51.4	31.0
	Mean	58.9	28.5	43.3	36.4
	SD	22.7	19.84	25	18.9
	Min-Max	22-101	6-75	15-82	8-76

The estimated median distance from shore statistics for 2012 derived using the spatial model were 26.1 km for the East Region and 35.3 km for the West Region. Compared to the results from the analysis of bowhead whale sightings that were unadjusted for transect effort or group size (median values of 24.9 km in the East and 31.0 km in the West, summarized in BOWHEAD WHALE CENTRAL TENDENCY – ANALYSIS 1), the model-derived results placed the median of the bowhead whale distribution slightly farther offshore in both the East and West regions. The interaction of three factors likely contributed to these differences. First, the spatial model had a 5-km resolution; therefore, the model could not identify differences in distance from shore that were smaller than 5 km. Second, group sizes of bowhead whale transect sightings tended to be larger offshore. The spatial model effectively placed more weight on sightings with larger group sizes, resulting in a larger median distance from shore based on this factor alone. Finally, due to logistical and weather constraints, there was greater survey effort in the nearshore areas of the western Beaufort Sea study area compared to the offshore areas. Because the spatial model weighted the observed number of individuals by the inverse of the survey effort in the associated grid cell, each sighting in a grid cell having relatively little survey effort counted for more in the model-derived median statistics.

The estimated median distance from shore statistics for 2007-2012 derived using the spatial model were 17.3 km for the East Region and 18.0 km for the West Region. These results suggest that bowhead whales were farther offshore in 2012 compared to the most recent six years combined. This difference is evident in the relative abundance quantile lines, which show the location of bowhead whale HUAs (as defined by the 30^{th}, 40^{th}, 50^{th}, 60^{th}, and 70^{th} quantiles of the expected relative abundance) closer to shore, particularly east of Harrison Bay and in the easternmost part of the study area, in the 6-year combined analysis (Figure 19) compared to 2012 (Figure 18).

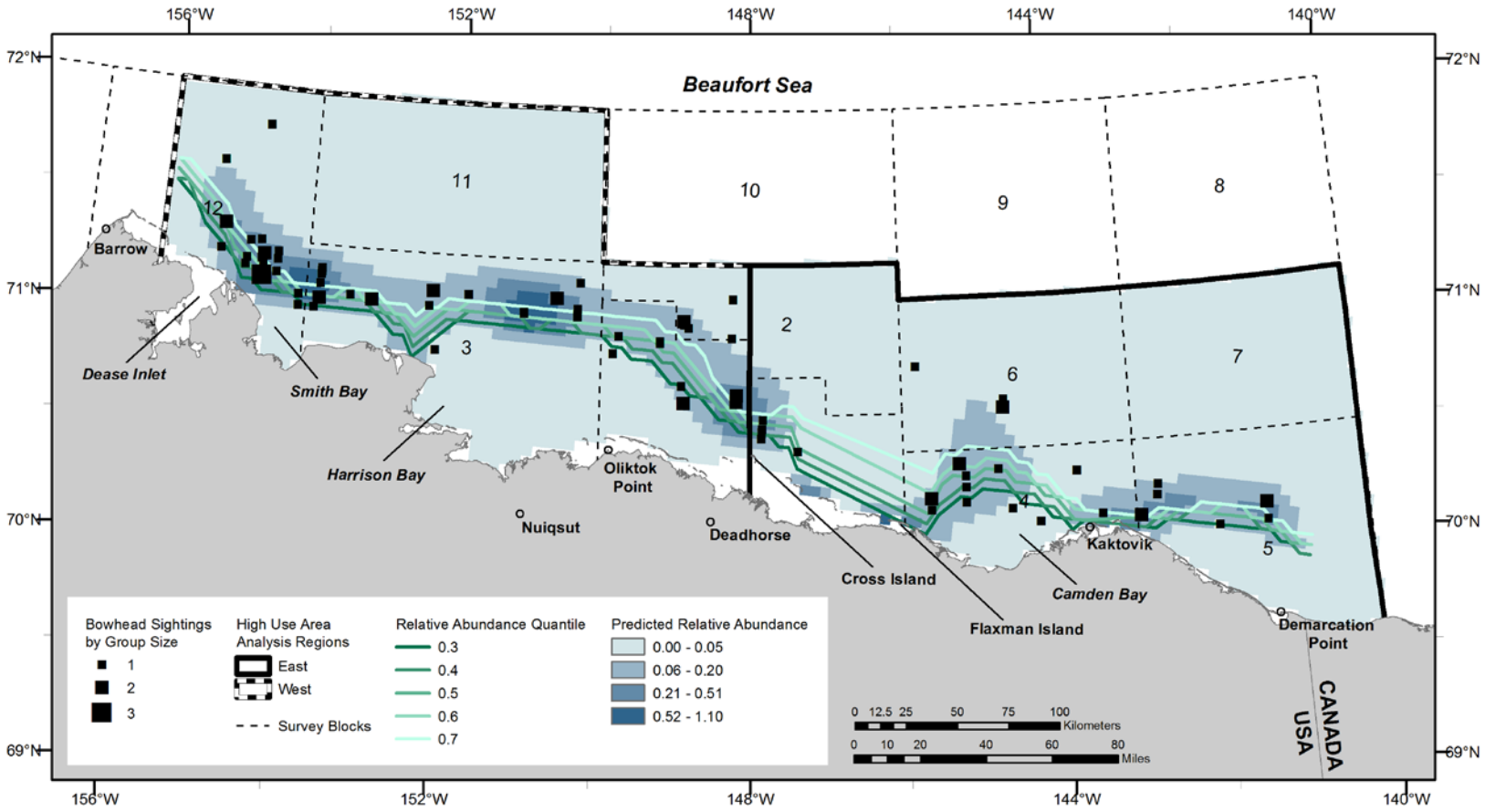


Figure 18. ASAMM observed 2012 bowhead whale transect sightings (primary observers only) by group size and predicted relative abundance of bowhead whales in the western Beaufort Sea in September and October, based on the spatial encounter rate model that accounted for effort by assuming a uniform 5 km of transect effort in every cell. Predictions are not corrected for perception or availability bias. The bowhead whale high use area is represented by distribution quantiles (0.3, 0.4, 0.5, 0.6, and 0.7), which represent the offshore extent of 30%, 40%, 50%, 60%, and 70% of the predicted number of bowhead whales from the spatial model.

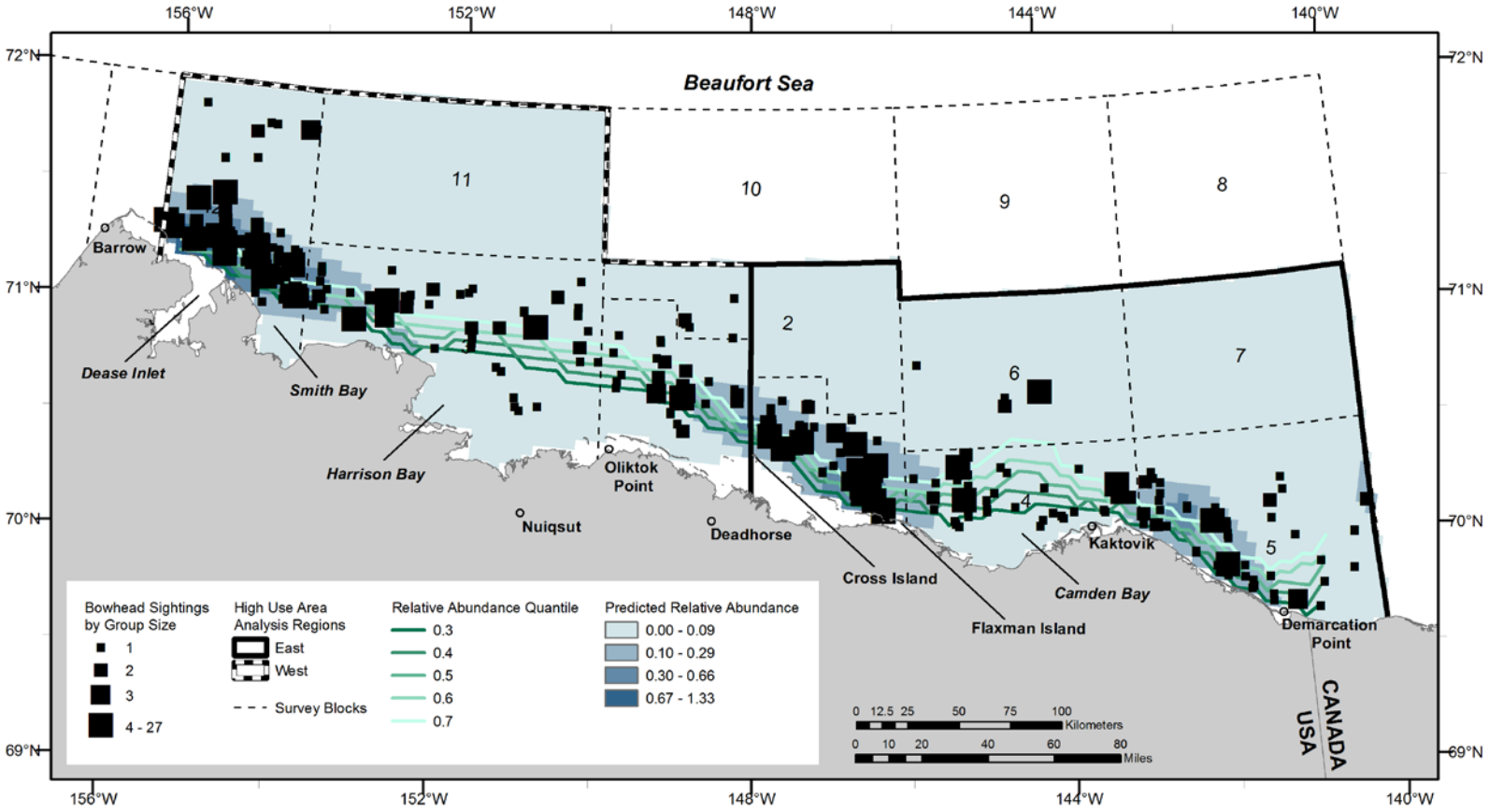


Figure 19. ASAMM observed 2007-2012 bowhead whale transect sightings (primary observers only) by group size and predicted relative abundance of bowhead whales in the western Beaufort Sea in September and October, based on the spatial encounter rate model that accounted for effort by assuming a uniform 5 km of transect effort in every cell. Predictions are not corrected for perception or availability bias. The bowhead whale high use area is represented by distribution quantiles (0.3, 0.4, 0.5, 0.6, and 0.7), which represent the offshore extent of 30%, 40%, 50%, 60%, and 70% of the predicted number of bowhead whales from the spatial model.

Gray Whales

GRAY WHALE SIGHTING SUMMARY

During 2012 ASAMM surveys, 310 sightings of 558 gray whales (*Eschrichtius robustus*) were observed during all survey modes (transect, search and circling) in the study area (Table 3). Gray whales were seen in every month surveyed in the northeastern Chukchi Sea, with the exception of the single survey conducted on 30 June (Figure 20); they were also seen east of Point Barrow in August, September and October. Gray whales were seen primarily nearshore (<50 km) between Point Barrow and Point Lay, and up to 100 km offshore between Point Franklin and Icy Cape. There were scattered sightings offshore (>100 km) and nearshore between Cape Lisburne and Point Hope. Some gray whales appeared to be distributed farther offshore between Point Franklin and Icy Cape in late summer and early fall; few gray whales were seen near Hanna Shoal and offshore west of Point Hope. Locations of gray whale sightings are shown in semimonthly periods in Figure 21.

Gray whale distribution in 2012 (all sightings regardless of survey mode or observer type) was generally similar to that documented in previous years with light sea ice cover, with a few exceptions.

- Gray whales continued to be mostly absent from Hanna Shoal in all months in 2012, as has been documented since 2008 (Clarke et al. 2012). Gray whales were frequently observed feeding near Hanna Shoal in the 1980s and early 1990s (Moore 2000).
- Gray whales were observed very close to shore from east of Cape Lisburne to just south of Point Hope, particularly in July 2012. While gray whales were often seen in this area in the late 1980s to early 1990s (Moore 2000) and 2011 (Clarke et al. 2012), they were not observed there in 2008-2010 (Clarke et al. 2011d).
- Very few gray whales were seen offshore west of Point Hope in 2012, which differs from 2008-2010 when gray whales were seen in that area nearly every month surveys were conducted.
- Gray whales were observed 50-100 km offshore between Point Franklin and Icy Cape (southeast corner of block 14 and northeasternmost area of block 17) in 2012 in an area where few gray whales were seen in 2008-2010, but where several were seen in 2011 (Clarke et al. 2012).
- Gray whales were frequently observed within approximately 1 km of shore, from Point Barrow to Point Lay, particularly in early July (there was also increased survey effort in this region due to the beluga surveys).
- Gray whales were observed east of Point Barrow from August to October; most gray whales east of Point Barrow were near Barrow Canyon, although one whale was seen immediately north of Smith Bay.

Gray whales observed in the northeastern Chukchi Sea during an industry-sponsored oceanographic cruise (L. Aerts, LAMA Ecological, pers. comm. to J. Clarke, 12 April 2013) and an industry-sponsored aerial survey conducted within 40 km of shore (Bisson et al. 2013) in summer and fall 2012 largely overlapped those observed during ASAMM surveys. Most of the vessel-based sightings were near Barrow and Wainwright, and occurred when the vessels were transiting to and from their study area; there were scattered sightings offshore near Hanna Shoal.

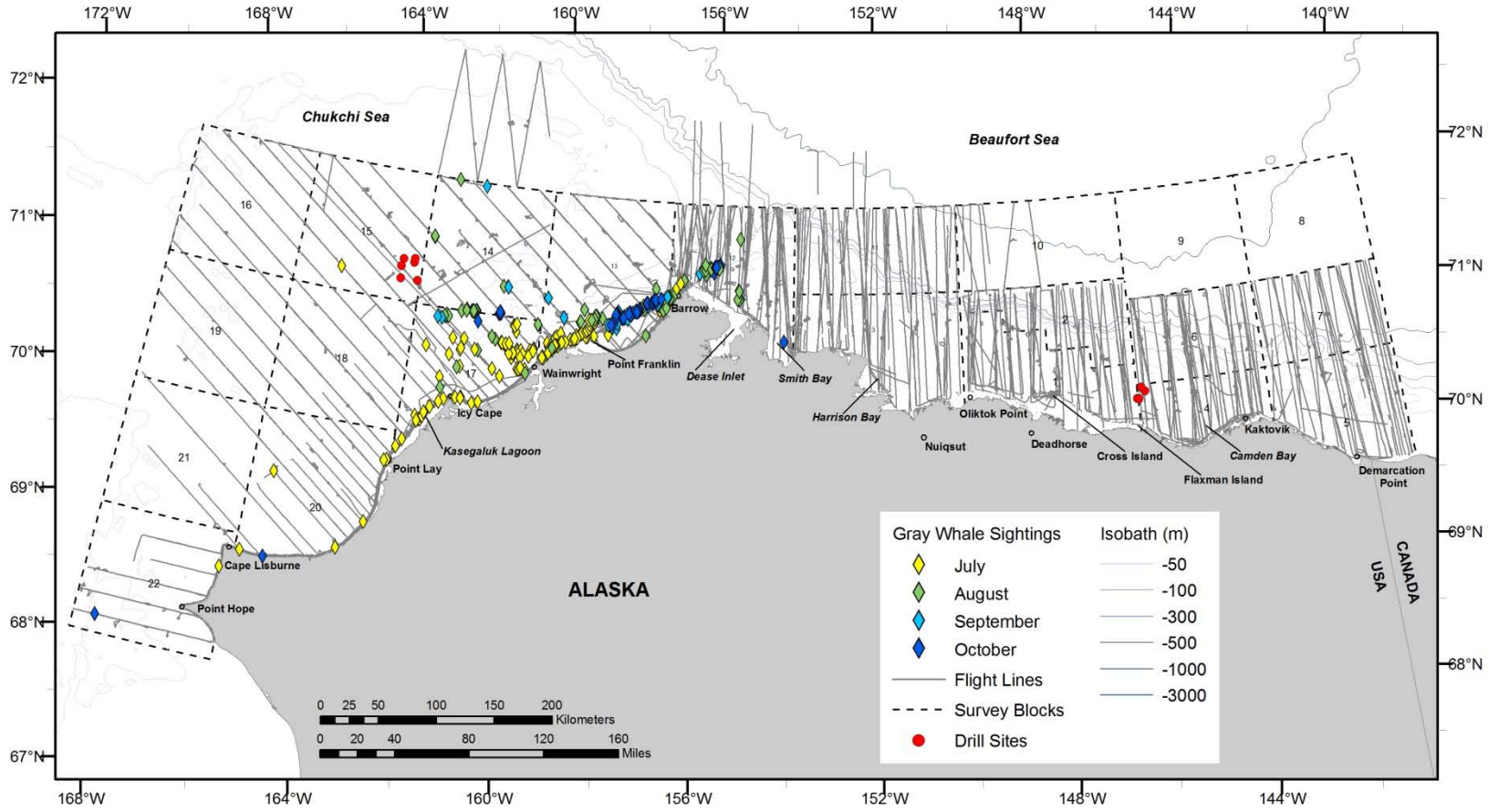


Figure 20. ASAMM gray whale sightings plotted by month, with transect, search and circling effort, 2012. Gray whales were not seen during a survey on 30 June. Deadhead flight tracks are not shown.

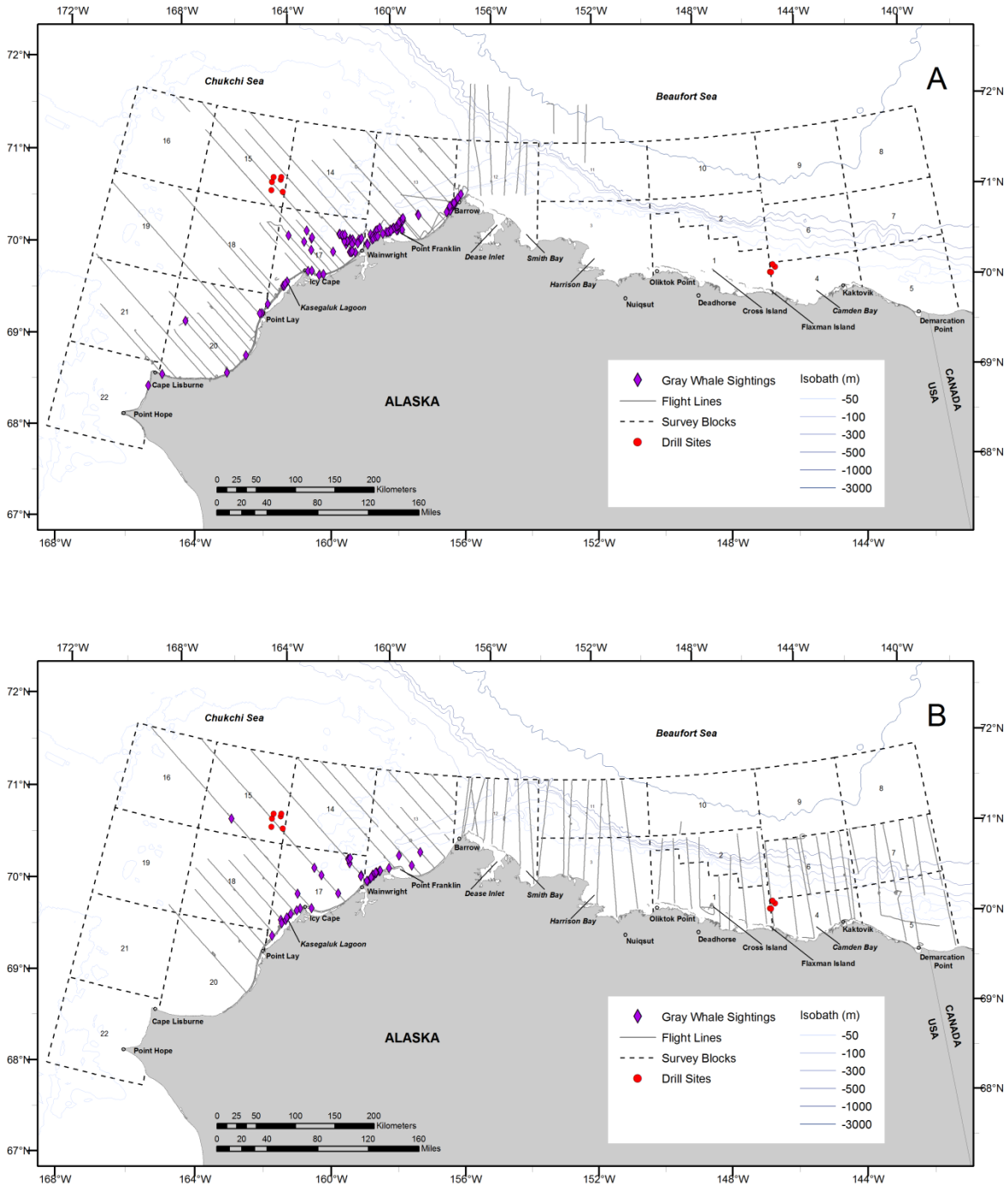
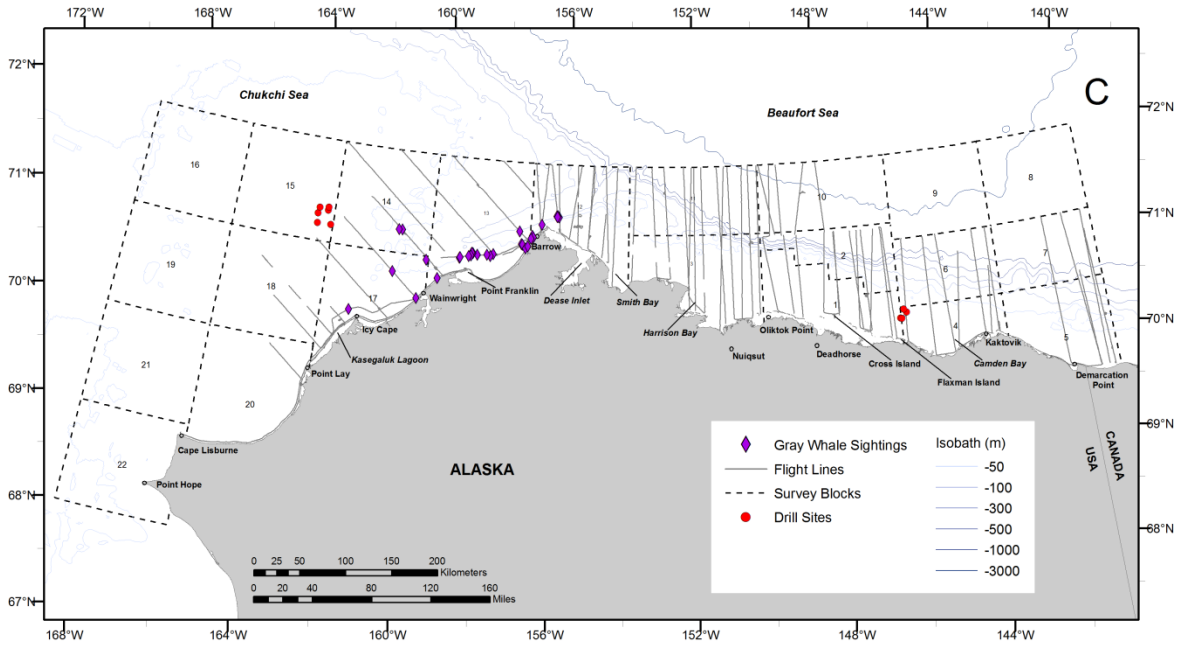


Figure 21. ASAMM semimonthly gray whale sightings, with transect, search and circling effort, 2012. Deadhead flight tracks are not shown. A: 30 June-15 July; B: 16-31 July.



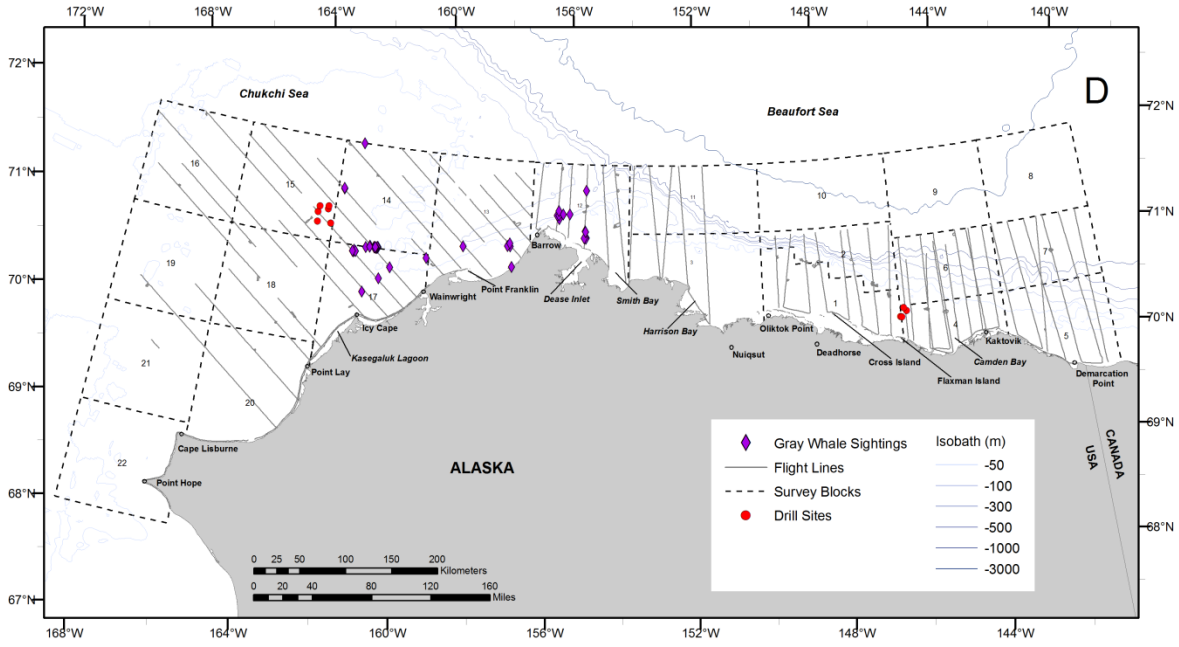


Figure 21 (cont). ASAMM semimonthly gray whale sightings, with transect, search and circling effort, 2012. Deadhead flight tracks are not shown. C: 1-15 August; D: 16-31 August.

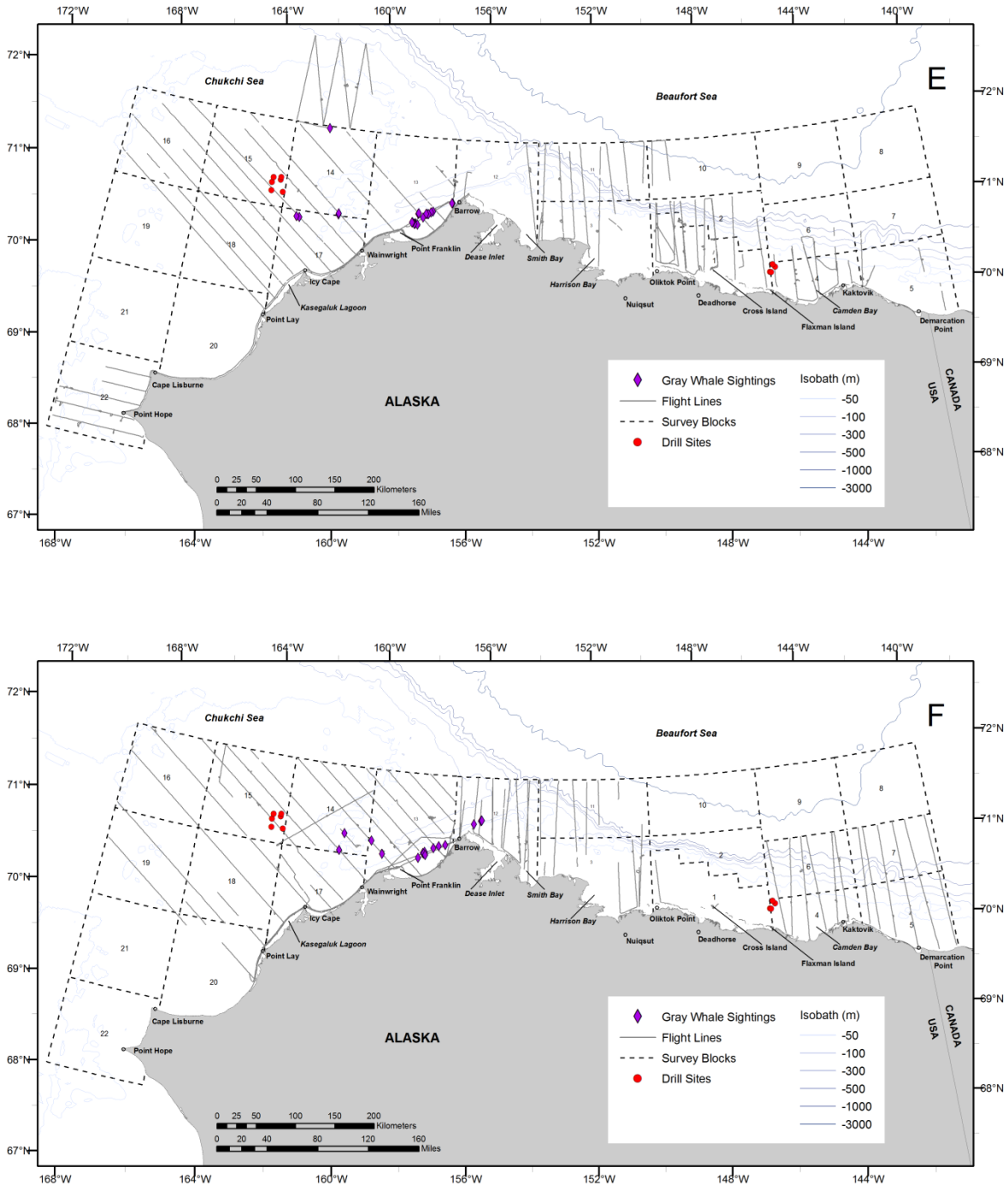


Figure 21 (cont). ASAMM semimonthly gray whale sightings, with transect, search and circling effort, 2012. Deadhead flight tracks are not shown. E: 1-15 September; F: 16-30 September.

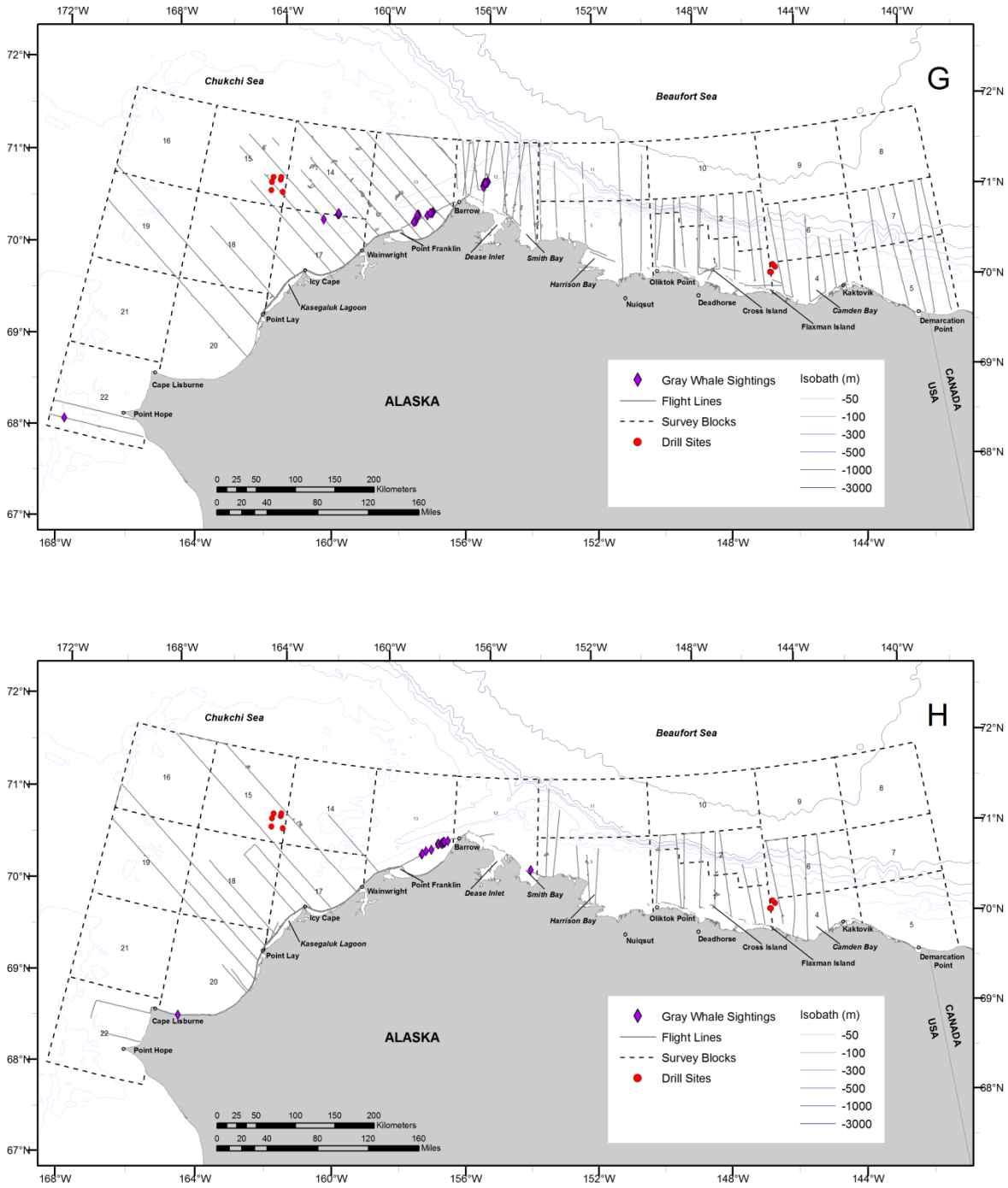


Figure 21 (cont). ASAMM semimonthly gray whale sightings, with transect, search and circling effort, 2012. Deadhead flight tracks are not shown. G: 1-15 October; H: 16-28 October.

GRAY WHALE SIGHTING RATES

In summer and fall 2012, gray whales were seen on transect from 68°N to 72°N and 154°W to 169°W. There were 132 gray whale sightings on transect, ranging from one whale per sighting (n = 70) to eight whales per sighting (n = 2). The greatest number of sightings on transect was in block 13 with 52 sightings, followed by block 17 with 44 sightings. The highest sighting rates per survey block for the entire study period were in block 13 (0.017 WPUE) and block 17 (0.014 WPUE) (Table 10). However, highest sighting rate was in block 12 in August (0.018 WPUE) and block 14 in September (0.006 WPUE), blocks that generally have not had high sighting rates since ASAMM aerial surveys commenced in 2008. The highest monthly sighting rate was in July (0.015 WPUE); monthly sighting rate decreased through August and September and was lowest in October (0.001 WPUE).

The highest sighting rate per depth zone in the northeastern Chukchi Sea (157°W-169°W) for the entire study period was in the ≤35 m zone (0.012 WPUE), mainly due to the large numbers of gray whales seen in shallow nearshore waters in July (Table 11). The sighting rate in August was highest in the 36-50 m depth zone (0.007 WPUE), in September it was highest in the 51-200 m North depth zone (0.005 WPUE), and in October it was highest in the 51-200 m South depth zone (0.020 WPUE).

The highest 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 depth zone (0.010 WPUE); few gray whales were seen in depths <51 m east of 157°W.

Areas of highest fine-scale sighting rates (number of whales on transect/transect km surveyed in 5 km grid cells) were northeast and west of Barrow (in block 12), and offshore between Point Franklin and Icy Cape (in blocks 13, 14 and 17) (Figure 22).

Overall, the 2012 gray whale sighting rate of 0.0070 gray whales on transect/transect km flown was higher than that calculated for 1982-1991 combined (0.0052 WPUE) and 2008-2010 combined (0.0052 WPUE), and similar to that calculated in 2011 (0.0067 WPUE) (Clarke et al. 2012). Note that sighting rate analyses conducted prior to 2011 included transect sightings from both primary and secondary observers whereas sighting rate analyses in 2011 and 2012 exclude sightings from secondary observers.

Also similar to 2011, the peak monthly sighting rate in 2012 was in July (Figure 23), dropping off substantially in August, September and October. Depth zone preference was for shallower water (≤35 m in the northeastern Chukchi Sea and ≤20 m in the western Beaufort Sea) than has been observed in recent years, although deeper water areas were preferred in August through October, which is a trend noted since aerial surveys recommenced in the northeastern Chukchi Sea in 2008 (Clarke et al. 2012). Gray whale distribution in 2012 using sightings on transect only did not appear to differ noticeably from the distribution of transect-only sightings observed in previous years having light sea ice cover, except for the lack of sightings near Hanna Shoal (Figure 24).

Table 10. ASAMM 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, 2012. NA – surveys were not conducted.

BLOCK	JUN Tr Km	Tr Sightings	Tr Whales	WPUE	JUL Tr Km	Tr Sightings	Tr Whales	WPUE	AUG Tr Km	Tr Sightings	Tr Whales	WPUE
12	0	NA	NA	NA	1,208	1	1	0.0008	1,481	14	27	0.0182
13	15	0	0	0.0000	1,746	43	87	0.0498	989	5	6	0.0061
14	0	NA	NA	NA	932	0	0	0.0000	803	5	7	0.0087
15	0	NA	NA	NA	876	1	1	0.0011	455	0	0	0.0000
16	0	NA	NA	NA	186	0	0	0.0000	352	0	0	0.0000
17	145	0	0	0.0000	1,711	33	57	0.0333	944	8	13	0.0138
18	0	NA	NA	NA	836	0	0	0.0000	536	0	0	0.0000
19	0	NA	NA	NA	183	0	0	0.0000	124	0	0	0.0000
20	262	0	0	0.0000	1,886	2	2	0.0011	669	0	0	0.0000
21	0	NA	NA	NA	291	0	0	0.0000	58	0	0	0.0000
22	0	NA	NA	NA	143	1	4	0.0280	130	0	0	0.0000
TOTAL	**422**	**0**	**0**	**0.0000**	**9,996**	**81**	**152**	**0.0153**	**6,541**	**32**	**53**	**0.0081**

BLOCK	SEP Tr Km	Tr Sightings	Tr Whales	WPUE	OCT Tr Km	Tr Sightings	Tr Whales	WPUE	TOTAL Tr Km*	Tr Sightings	Tr Whales	WPUE
12	1,222	2	2	0.0016	937	3	3	0.0032	4,848	20	33	0.0068
13	1,405	3	5	0.0036	1,641	1	2	0.0012	5,796	52	100	0.0173
14	850	4	5	0.0059	933	1	2	0.0021	3,518	10	14	0.0040
15	940	0	0	0.0000	423	0	0	0.0000	2,695	1	1	0.0004
16	637	0	0	0.0000	132	0	0	0.0000	1,307	0	0	0.0000
17	1,322	2	4	0.0030	1,235	1	1	0.0008	5,358	44	75	0.0140
18	878	0	0	0.0000	762	0	0	0.0000	3,013	0	0	0.0000
19	349	0	0	0.0000	457	0	0	0.0000	1,112	0	0	0.0000
20	417	0	0	0.0000	730	1	1	0.0014	3,964	3	3	0.0008
21	7	0	0	0.0000	7	0	0	0.0000	362	0	0	0.0000
22	527	0	0	0.0000	347	1	2	0.0058	1,146	2	6	0.0052
TOTAL	**8,554**	**11**	**16**	**0.0019**	**7,605**	**8**	**11**	**0.0014**	**33,118**	**132**	**232**	**0.0070**

* Total transect effort (Tr km) differs from values in Tables 2 and 11 because effort between barrier islands and the mainland was not included in the sighting rate per survey block analysis.

Table 11. ASAMM 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, 2012. NA – surveys were not conducted.

	JUN Tr Km	Tr Sightings	Tr Whales	WPUE	JUL Tr Km	Tr Sightings	Tr Whales	WPUE	AUG Tr Km	Tr Sightings	Tr Whales	WPUE
157W-169W												
0-35 m	420	0	0	0.0000	3,731	65	125	0.0335	1,675	3	4	0.0024
36-50 m	0	NA	NA	NA	3,512	12	21	0.0060	2,448	11	18	0.0074
51-200 m N	0	NA	NA	NA	1,387	3	5	0.0036	888	4	4	0.0045
51-200 m S	0	NA	NA	NA	0	NA	NA	NA	0	NA	NA	NA
154W-157W												
0-20 m	0	NA	NA	NA	174	0	0	0.0000	298	2	3	0.0101
21-50 m	0	NA	NA	NA	200	1	1	0.0050	303	3	3	0.0099
51-200 m	0	NA	NA	NA	695	0	0	0.0000	717	8	20	0.0279
201-2,000 m	0	NA	NA	NA	139	0	0	0.0000	162	1	1	0.0062
TOTAL	**420**	**0**	**0**	**0.0000**	**9,839**	**81**	**152**	**0.0154**	**6,492**	**32**	**53**	**0.0082**

	SEP Tr Km	Tr Sightings	Tr Whales	WPUE	OCT Tr Km	Tr Whales	Tr Whales	WPUE	TOTAL Tr Km	Tr Sightings	Tr Whales	WPUE
157W-169W												
0-35 m	2,343	0	0	0.0000	2,357	1	1	0.0004	10,527	69	130	0.0123
36-50 m	3,982	6	10	0.0025	2,947	2	3	0.0010	12,888	31	52	0.0040
51-200 m N	884	3	4	0.0045	1,225	1	2	0.0016	4,384	11	15	0.0034
51-200 m S	121	0	0	0.0000	102	1	2	0.0197	223	1	2	0.0090
154W-157W												
0-20 m	271	0	0	0.0000	153	0	0	0.0000	897	2	3	0.0033
21-50 m	299	0	0	0.0000	186	0	0	0.0000	987	4	4	0.0041
51-200 m	514	2	2	0.0039	504	3	3	0.0060	2,430	13	25	0.0103
201-2,000 m	139	0	0	0.0000	94	0	0	0.0000	533	1	1	0.0019
TOTAL	**8,552**	**11**	**16**	**0.0019**	**7,567**	**8**	**11**	**0.0015**	**32,869**	**132**	**232**	**0.0071**

* Total transect effort (Tr km) differs from values in Tables 2 and 9 because effort between barrier islands and the mainland was included in the sighting rate per depth zone analysis.

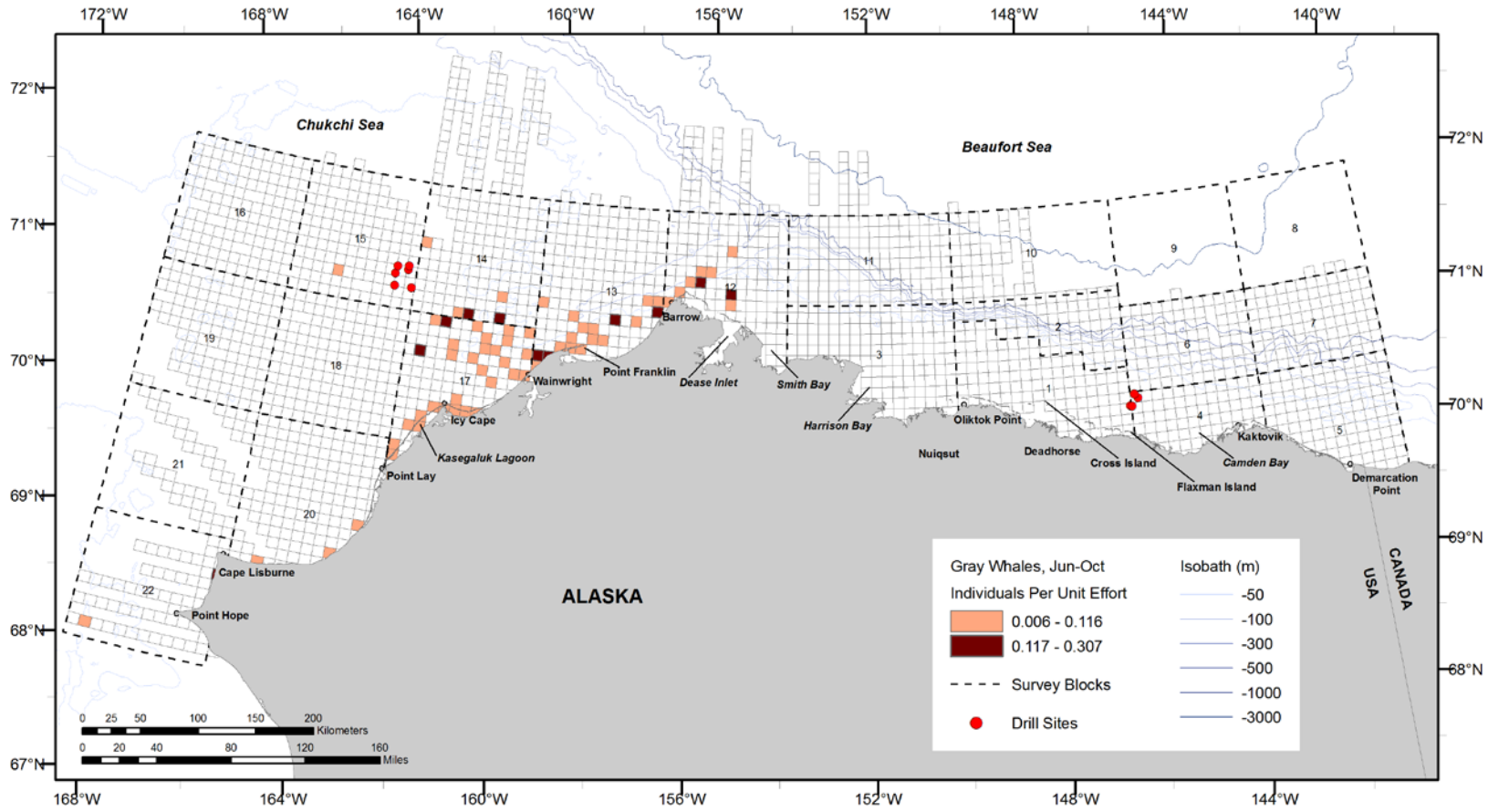


Figure 22. ASAMM gray whale sighting rates (whales on transect/km of transect surveyed), 2012. Empty grid cells have sighting rates of zero; transect survey effort was not conducted in areas without grid cells. Transect sightings from primary observers only.

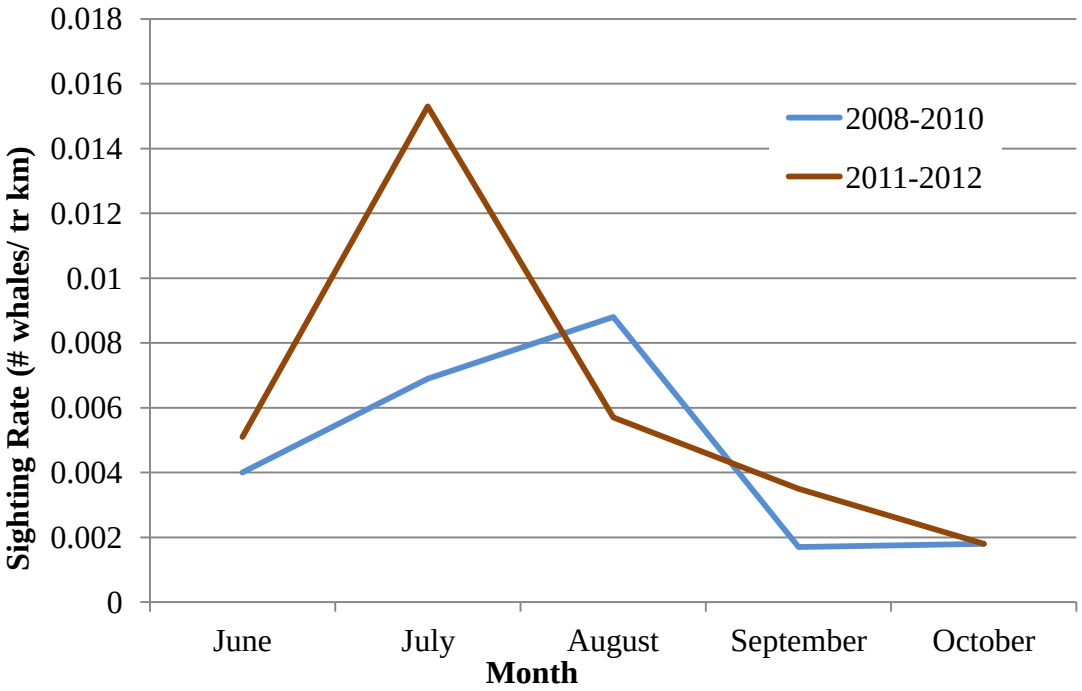


Figure 23. ASAMM monthly sighting rates (# whales per transect km) of gray whales in the northeastern Chukchi Sea, 2008-2010 and 2011-2012.

GRAY WHALE HABITAT ASSOCIATIONS

Most gray whales (71%) were observed in 0% sea ice cover. Gray whales were observed in areas with sea ice in July (1-90% sea ice cover) and early August (1-20% sea ice cover). Sea ice remained in the study area until late September (Appendix A) but mainly in offshore areas where gray whales were rarely observed. Feeding behavior was observed in areas of up to 90% sea ice cover and calves were observed in areas of up to 50% sea ice cover. Sea ice cover does not appear to be an impediment to gray whale occurrence.

GRAY WHALE BEHAVIORS

Behaviors of 558 gray whales observed during all survey modes (transect, search and circling) in 2012 are summarized in Table 12. The behaviors most often recorded were feeding (57%) and swimming (32%). Resting was recorded for 35 whales (6%) and display behavior (including breach and roll) was recorded for 3 whales (1%). Fine-scale sighting rates of feeding and milling gray whales observed on transect in 2012 are shown in Figure 25.

Sixty-seven gray whale calves were seen in 2012 (Figure 26); the calf ratio (number of calves/number of total whales) was 0.120, which is more than twice that observed in any recent year (2008 = 0.005; 2009 = 0.026; 2010 = 0.000; 2011 = 0.055) (Clarke et al. 2011d, 2012). Calf distribution overlapped that of adult gray whales both temporally and spatially in 2012. Most calves (n = 56) were within 25 km of shore, but 11 calves were 30-69 km offshore. Fifty-seven calves were observed in July and 10 calves were seen in August; gray whale calves were not

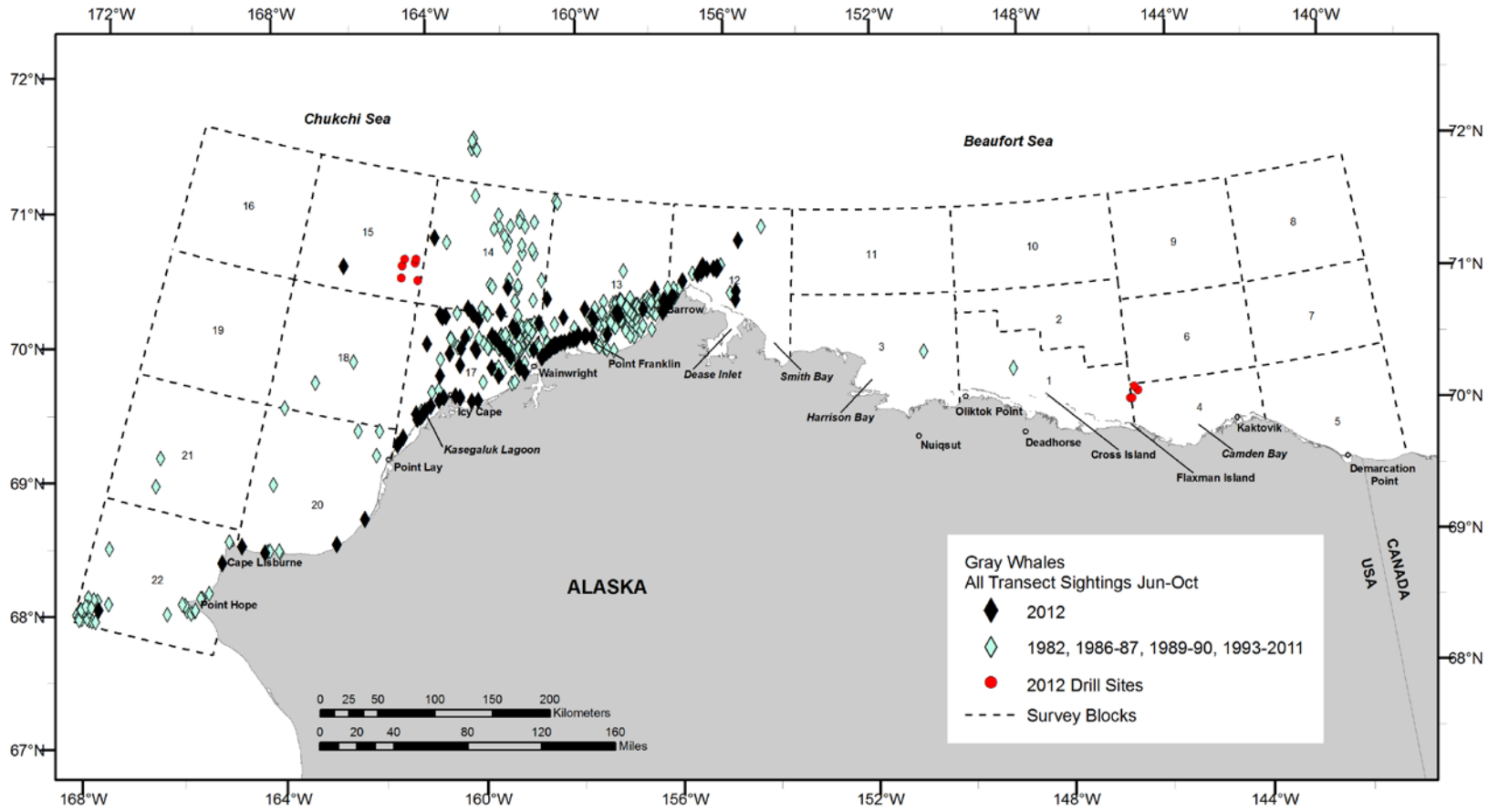


Figure 24. ASAMM gray whale sightings on transect in years with light sea ice cover: 1982, 1986-87, 1989-90, 1993-2011, and 2012. Includes all sightings on transect, from primary and secondary observers.

Table 12. ASAMM semimonthly summary of gray whales (number of sightings/number of individuals) observed during all survey modes (transect, search and circling), by behavioral category, 2012. Gray whales were not seen during survey on 30 June. Excludes dead and repeat sightings.

Behavior	1-15 Jul	16-31 Jul	1-15 Aug	16-31 Aug	1-15 Sep	16-30 Sep	1-15 Oct	16-28 Oct	Total
Breach	1/1	0	0	1/1	0	0	0	0	2/2 (<1%)
Cow/Calf	1/2	0	0	0	0	0	0	0	1/2 (<1%)
Dive	1/1	0	1/1	1/2	0	0	1/1	1/1	5/6 (1%)
Feed	54/112	12/30	16/37	30/72	14/27	10/15	17/24	3/5	155/319 (57%)
Mill	0	0	1/1	1/3	0	0	1/1	0	3/5 (1%)
Rest	11/19	6/10	1/3	2/2	0	0	1/1	0	21/35 (6%)
Roll	0	0	1/1	0	0	0	0	0	1/1 (<1%)
Swim	29/52	25/40	11/18	10/13	7/7	8/9	13/20	11/15	115/177 (32%)
Unknown	7/11	0	0	0	0	0	0	0	7/11 (2%)
TOTAL	104/198	43/80	31/61	45/93	21/34	18/24	33/47	15/21	310/558

seen after 20 August 2012. On nine occasions, multiple calves were seen in one day, with the highest daily total on 12 July (17 calves). Some calves may have been sighted on more than one day and, on two days (6 and 12 July), may have been sighted more than once in the same day. The high calf count may also have been partially due to the increased survey coverage in the northeastern Chukchi Sea in July 2012 (almost twice the amount of transect effort compared with the same month in 2011). However, even with the possibility that some calves were sighted more than once and survey effort was increased in July, gray whale calf occurrence in the northeastern Chukchi Sea in 2012 was unprecedented. When calf sightings were corrected for survey effort, gray whale calf sighting rate in 2012 (calves on transect per transect km) was 0.0012, which is three times higher than any previous year in which broad-scale surveys have been conducted (Brower et al. 2013).

Gray whale calf occurrence in the northeastern Chukchi Sea has been inconsistent among years. In the 15 years that aerial surveys have been conducted with some regularity (1982-1991, 2008-2012), gray whale calves have been seen in 10 of those years and more than one gray whale calf per year has been documented in only five of the 15 years (Clarke et al. 1989; Clarke et al. 2012). 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.

Gray whale swim direction was significantly clustered about a mean heading of 245°T (Z=3.009, P=0.048) in summer (July-August), but not clustered around any heading in fall (September-

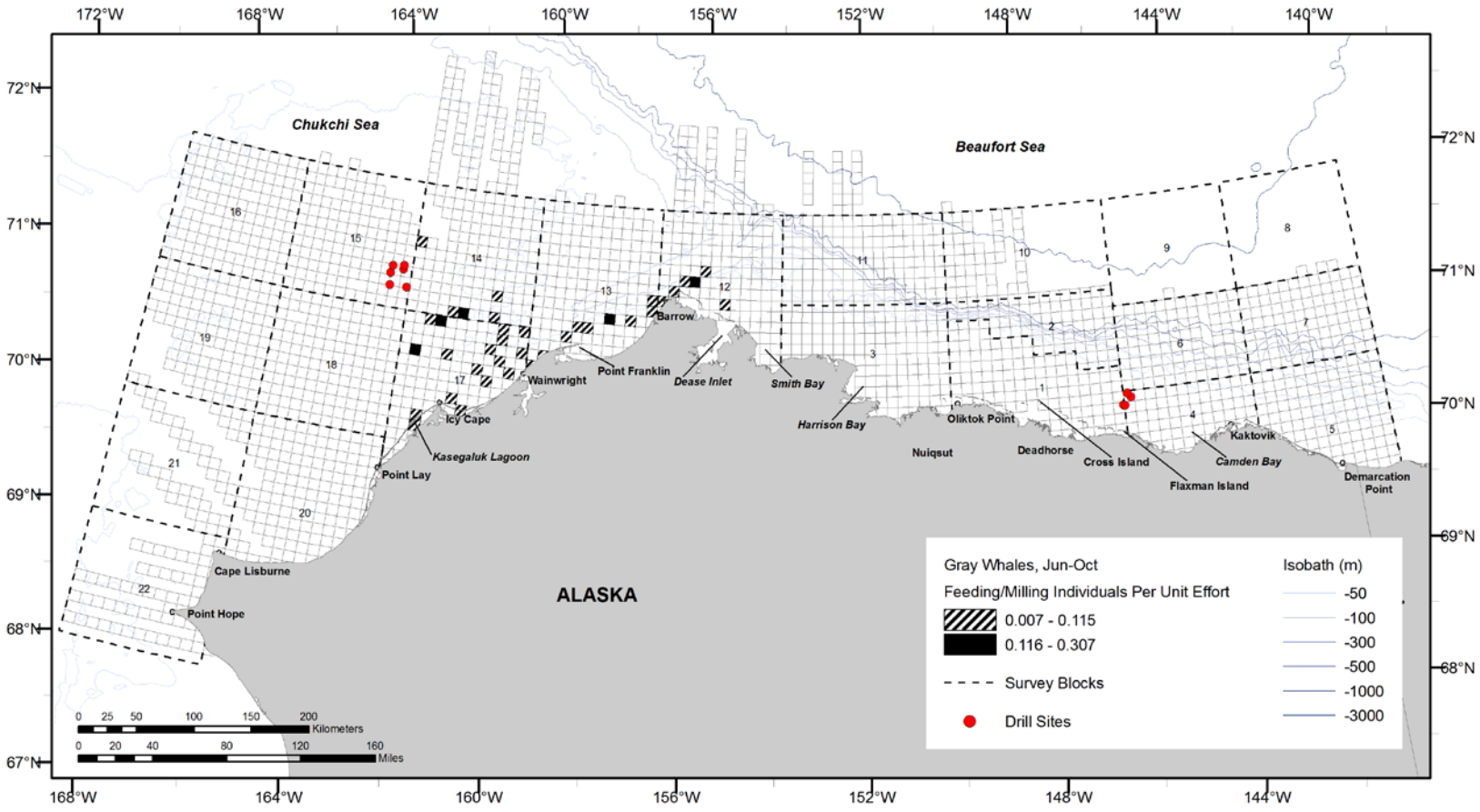


Figure 25. ASAMM feeding and milling gray whale sighting rates (whales on transect/km of transect surveyed), 2012. Empty grid cells have sighting rates of zero; transect survey effort was not conducted in areas without grid cells. Transect sightings from primary observers only.

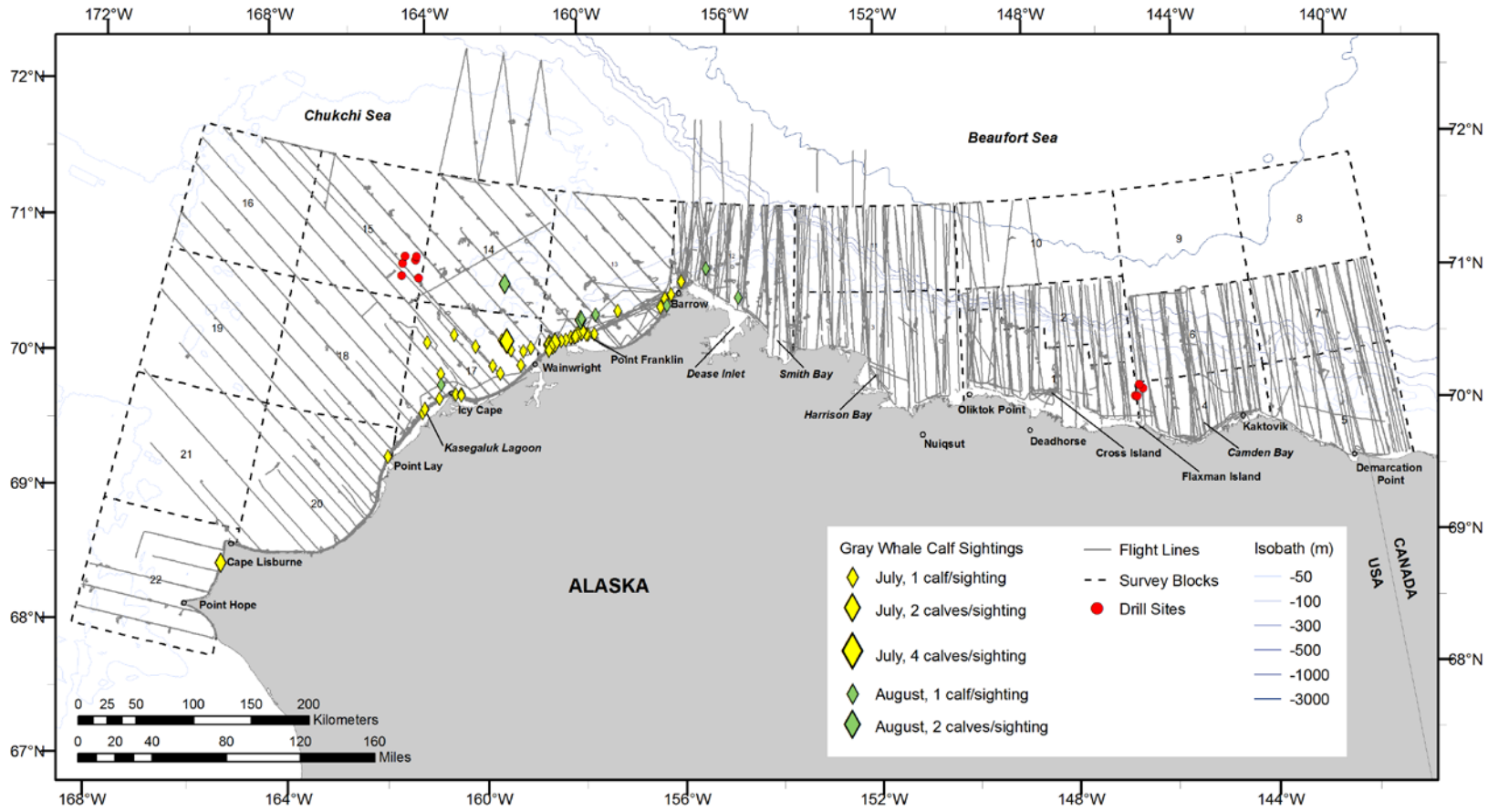


Figure 26. ASAMM gray whale calves, with transect, search, and circling effort, 2012. Deadhead flight tracks are not shown.

October). Most gray whales observed during ASAMM are at the far northern extent of the species' range and are feeding, so a lack of directed migratory movement is not surprising.

Two gray whales appeared to respond to the survey aircraft.

Humpback Whales

There were 20 sightings of 29 humpback whales (*Megaptera novaeangliae*) in 2012, all in the northeastern Chukchi Sea (Figure 27). Single humpback whales were seen on 26 July, 4 August and 23 August, and a pair of humpback whales was seen on 12 August, nearshore between Barrow and Icy Cape. One of these humpback whales was feeding (26 July), one was rolling within a body's length of a rolling gray whale (4 August), and the pair was observed within 2.5 km of a minke whale (12 August). Twenty-four humpback whales were seen during a single survey on 11 September in block 22. Sightings were scattered in an area approximately 600 km^2 in size, extending from immediately south of Point Hope west to the International Dateline (169°W) (Appendix B, Flight 243). Several of the whales sighted in block 22 were feeding or milling, and at least one bubble net was seen. One of the whales, in a group of four, was a juvenile; other than the one juvenile sighted, all humpback whales observed in 2012 were adults. None of the humpback whales appeared to respond to the survey aircraft.

Humpback whales have occasionally been observed in the northeastern Chukchi Sea (Hashagen et al. 2009; Clarke et al. 2011d), but their occurrence is not regular or frequent. 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). Humpback whales have been recorded during research cruises in the southern Chukchi Sea since 2009 (B. Rone, NMML, pers. comm. to J. Clarke, 13 December 2013; K. Stafford, PMEL, pers comm. to J. Clarke, 13 December 2013) but this is the first occurrence of humpback whales in block 22 during systematic ASAMM surveys. The area in which most of the humpback whales were observed has, in past years, been a reliable area for feeding gray whales, and is likely an oceanographically productive area due to transport from the Bering Sea.

Fin Whales

There were three sightings of five fin whales (*Balaenoptera physalus*) in 2012 (Figure 27), all of which occurred on 11 September during the same survey on which most of the humpback whales were seen (Appendix B, Flight 243). One single adult and two cows with calves were seen approximately 25-30 km south and southwest of Point Hope. Two of the adult fin whales were lunge feeding. None of the fin whales appeared to respond to the survey aircraft.

This is the first occurrence of fin whales in block 22 during systematic ASAMM surveys. Prior to these sightings, one fin whale had been seen during ASAMM surveys, in July 2008, east of Point Lay (Clarke et al. 2011d). Fin whales occur regularly in the northern Bering Sea (Moore et al. 2002), but their occurrence in the northeastern Chukchi Sea is not well documented. Fin whales have been recorded during research cruises in the southern Chukchi Sea since 2009 (B.

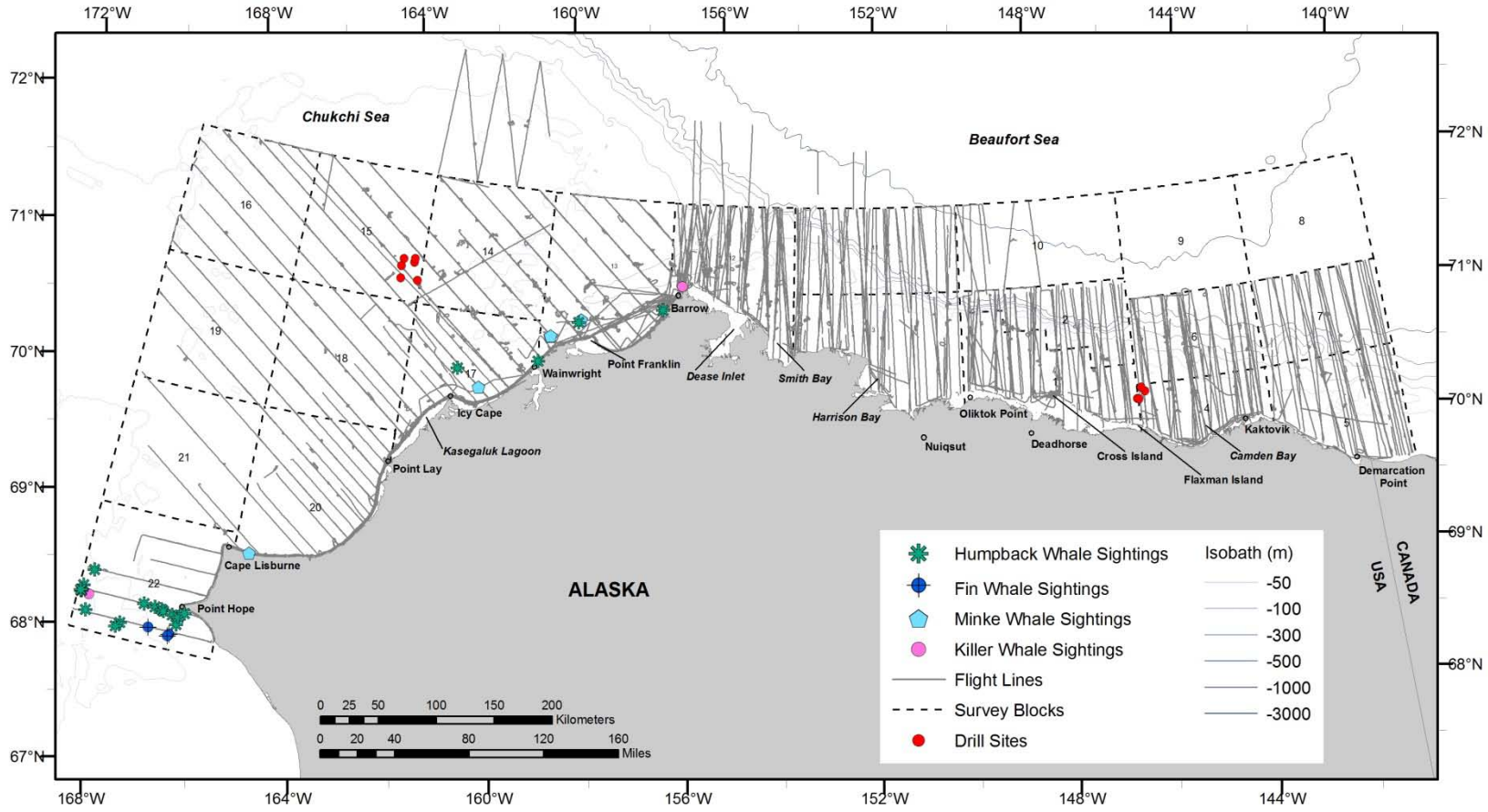


Figure 27. ASAMM humpback, fin, minke and killer whale sightings, with transect, search, and circling effort, 2012. Deadhead flight tracks are not shown.

Rone, NMML, pers. comm. to J. Clarke, 13 December 2013; K. Stafford, PMEL, pers. comm. to J. Clarke, 13 December 2013).

Minke Whales

There were six sightings of seven minke whales (*Balaenoptera acutorostrata*) in 2012 (Figure 27). Minke whale sightings were scattered both temporally and geographically. One minke whale was observed feeding very nearshore east of Cape Lisburne in July. Five minke whales were sighted within a two day period of one another in mid-August; two of these whales were sighted lunge-feeding east of Icy Cape, while the other three were seen nearshore between Wainwright and Point Franklin. One minke whale was observed on 11 September south of Point Hope in extremely close proximity to three humpback whales (symbol is obscured by humpback whale sighting symbols on Figure 27). All of the minke whales sighted were rather elusive, did not stay at the surface very long, and/or did not have conspicuous blows. The minke whales that were lunge-feeding completely disappeared from view in-between surface lunges. None of the minke whales appeared to respond to the survey aircraft.

This is the second consecutive year that ASAMM has documented minke whales in the northeastern Chukchi Sea (Clarke et al. 2012). Minke whales were also sighted in summer and fall 2012 in the northeastern Chukchi Sea during marine mammal aerial surveys and vessel-based oceanographic surveys conducted by the oil industry (Bisson et al. 2013; L. Aerts, LAMA Ecological, pers. comm. to J. Clarke, 12 April 2013). Prior to 2011, minke whales were not previously sighted in the northeastern Chukchi Sea study area during aerial surveys conducted in 1982-1991 (Moore and Clarke 1992), 2006-2010 (Thomas and Koski 2011), or 2008-2010 (Clarke et al. 2011d). They were also not sighted during the 2009 Joint Russian-American Long-term Census of the Arctic (RUSALCA; Bakhmutov et al. 2009) or the 2010 and 2011 Chukchi Acoustic, Oceanographic and Zooplankton (CHAOZ) cruises (B. Rone, NMML-AFSC, pers. comm. to J. Clarke, 14 November 2011). However, sightings of minke whales are becoming increasingly frequent in the eastern Chukchi Sea, especially south of Point Lay. Dave Roseneau, of the U.S. Fish and Wildlife Service (USFWS), reported seeing one to three minke whales per year near Cape Lisburne from 1995-2009 (pers. comm. to J. Denton, BOEM, 15 October 2010). Brueggeman (2010) reported two minke whales in the CSPA in summer 2009, near 71°N.

Belugas

Beluga Sighting Summary

During the 2012 ASAMM surveys, 506 sightings of 4,188 belugas (*Delphinapterus leucas*) were observed during all survey modes (transect, search and circling) in the study area (Table 3). Beluga sightings in the Chukchi Sea were nearshore in late June and July, with a few scattered sightings both nearshore and far offshore in October (Figure 28). In the western Beaufort Sea, belugas were seen along the continental slope in all months surveyed (July through October), with scattered sightings nearshore. Belugas were also seen near Barrow Canyon from July through October.

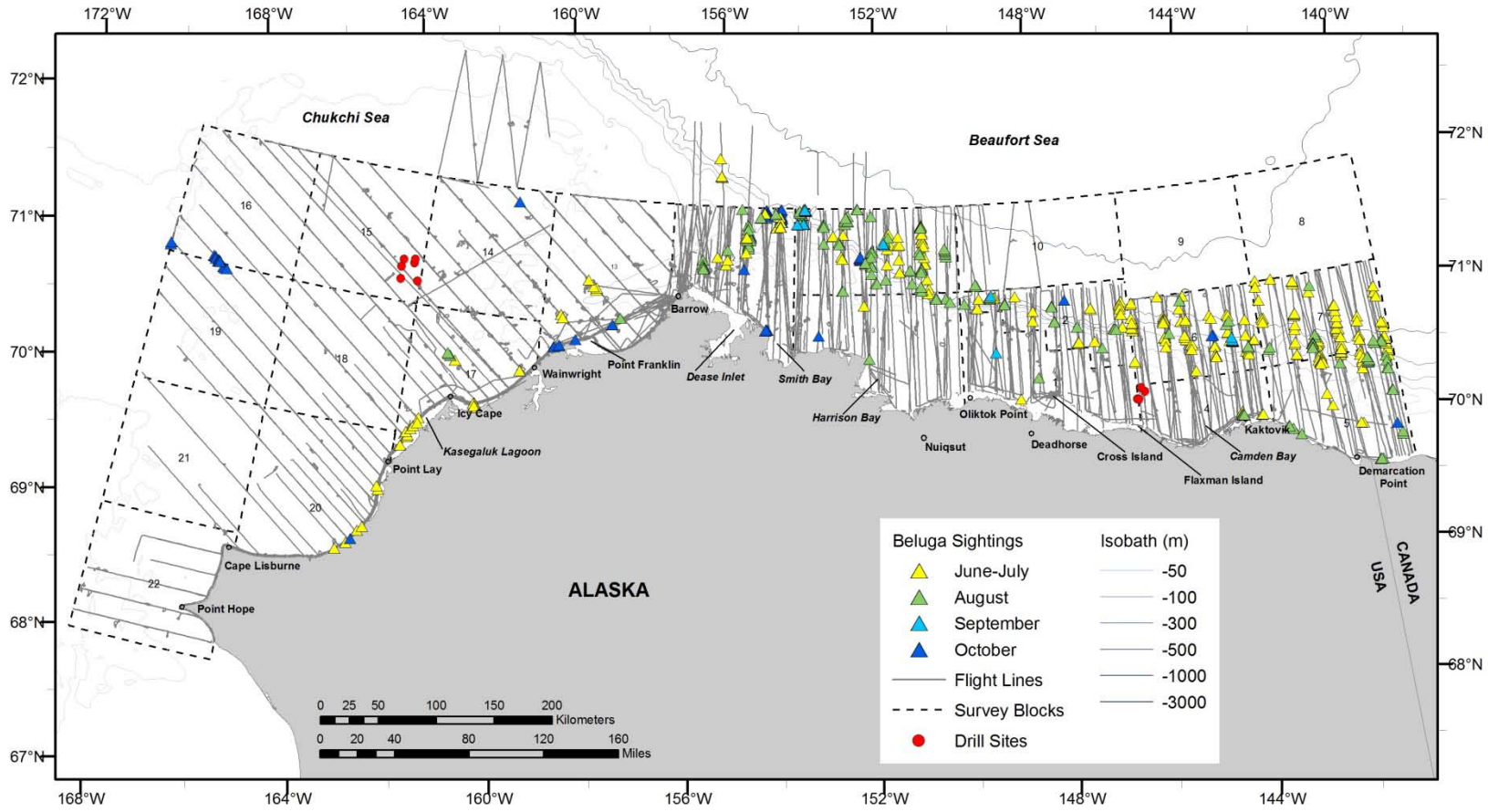


Figure 28. ASAMM beluga sightings plotted by month, with transect, search, and circling effort, 2012. Deadhead flight tracks are not shown.

Surveys conducted to document abundance and distribution of the Eastern Chukchi Sea (ECS) stock of belugas in late June-early July 2012 in the northeastern Chukchi Sea (beluga transects) added considerably to total effort and beluga sightings for that time period. Over 22,000 km were flown, including nearly 7,000 km on transect, and over 1,700 belugas were seen during 19 surveys (Table 3). Large groups (>100 whales) of belugas were observed on four days (30 June, 3 July, 6 July, and 15 July), mainly near entrances to Kasegaluk Lagoon (Figure 29). Few belugas were seen offshore in the northeastern Chukchi Sea or in the western Alaskan Beaufort Sea near Barrow Canyon, despite considerable survey effort.

Beluga distribution in 2012 was generally similar to that documented in previous years with light ice cover, particularly in the western Beaufort Sea (Figure 30). Beluga distribution in the northeastern Chukchi Sea documented by ASAMM in 2012 was similar to observations in 1989-1990 and 2008-2010, when few belugas were sighted particularly in the summer months (Moore et al. 2000; Clarke et al. 2011d). In 2011, belugas were distributed throughout the Chukchi Sea study area in all months (Clarke et al. 2012). Beluga sightings recorded during an industry-sponsored oceanographic cruise in the northeastern Chukchi Sea in summer and fall 2012 (L. Aerts, LAMA Ecological, pers. comm. to J. Clarke, 12 April 2013) and during industry-sponsored aerial surveys in the northeastern Chukchi Sea and central Alaskan Beaufort Sea in summer and fall 2012 (Bisson et al. 2013) were similar to those observed during 2012 ASAMM surveys.

Aerial survey effort conducted north of the current ASAMM study area from 1989-1991 (Moore and Clarke 1992) and results from beluga satellite tagging efforts (Suydam et al. 2001) indicated that belugas regularly traversed the northeastern Chukchi and western Beaufort seas much farther north than the current ASAMM study area. It is therefore likely that ASAMM effort does not document the full extent of beluga range in the northeastern Chukchi and western Beaufort seas. Distribution patterns south of 72°N have remained remarkably similar over the past 30 years, particularly in the western Beaufort Sea. The large groups of belugas seen near Kasegaluk Lagoon in late June and early July 2012 were reminiscent of large beluga groups seen during surveys conducted in the late 1970s through the early 1990s (Frost and Lowry 1990; Frost et al. 1993), although group sizes were smaller in 2012.

BELUGA SIGHTING RATES

In summer and fall 2012, belugas were seen from 69°N to 72.5°N between 140°W and 169°W. There were 456 beluga sightings on transect, ranging from one beluga per sighting (n = 230) to 750 belugas per sighting (n = 1). The highest number of sightings on transect per survey block was in block 11 (117 sightings), followed by blocks 7 (80 sightings) and 6 (69 sightings). The highest beluga sighting rate in 2012 in the northeastern Chukchi Sea occurred in June, then declined in July, dropped to almost zero in August and September, and increased slightly in October. Sighting rate in the western Beaufort Sea increased from July to August before declining in September and October (Figure 31). Sighting rates perhaps reflect the presence of the ECS stock in the northeastern Chukchi Sea in early summer (June-July) and in the western Beaufort Sea in late summer (August). Low sighting rates in the ASAMM study area in fall 2012 might be indicative of greater abundance north (north of 72°N) or east (east of 140°W) of

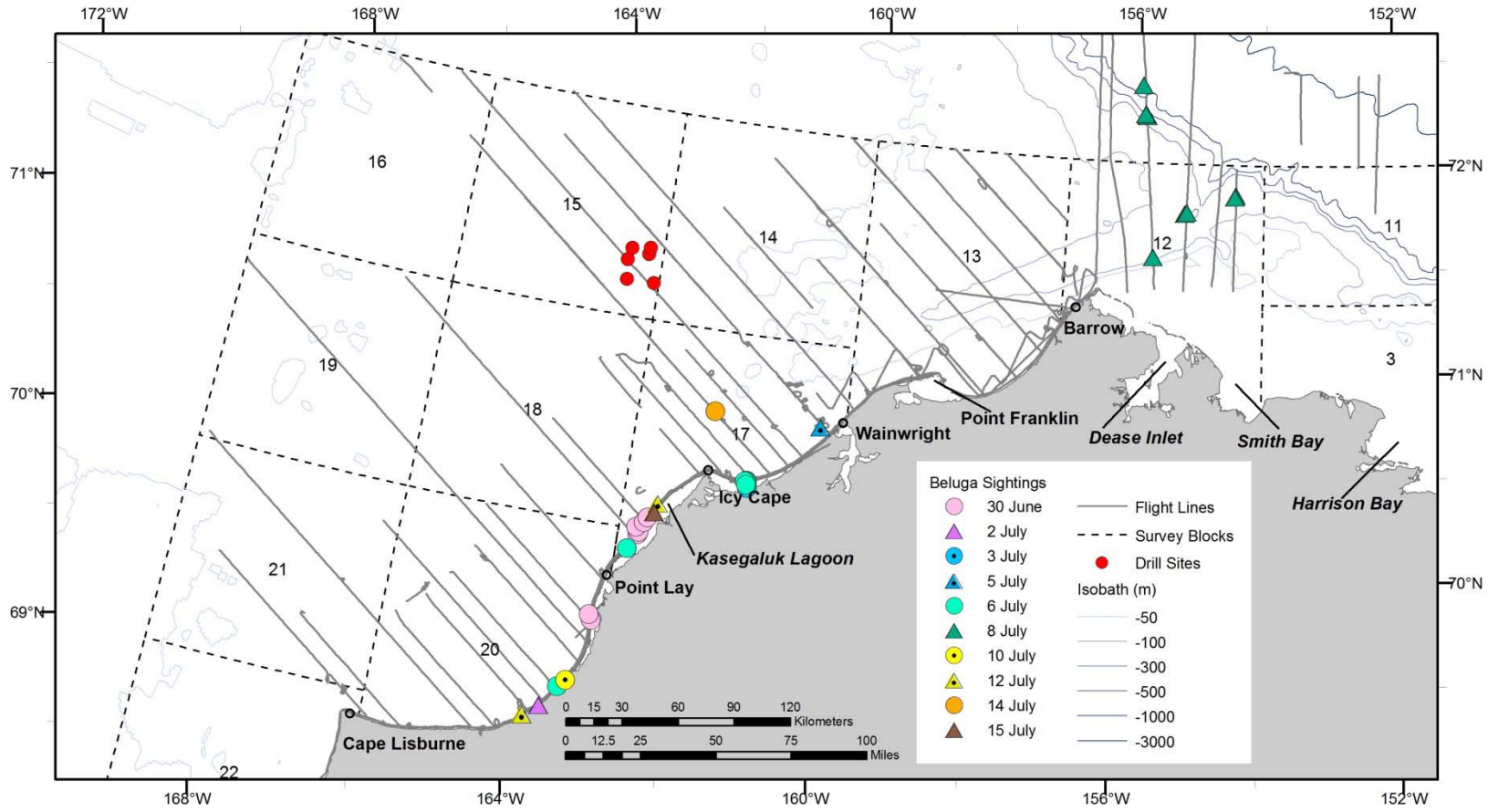


Figure 29. ASAMM beluga sightings, 30 June-15 July 2012, with transect, search and circling effort. Deadhead flight tracks are not shown.

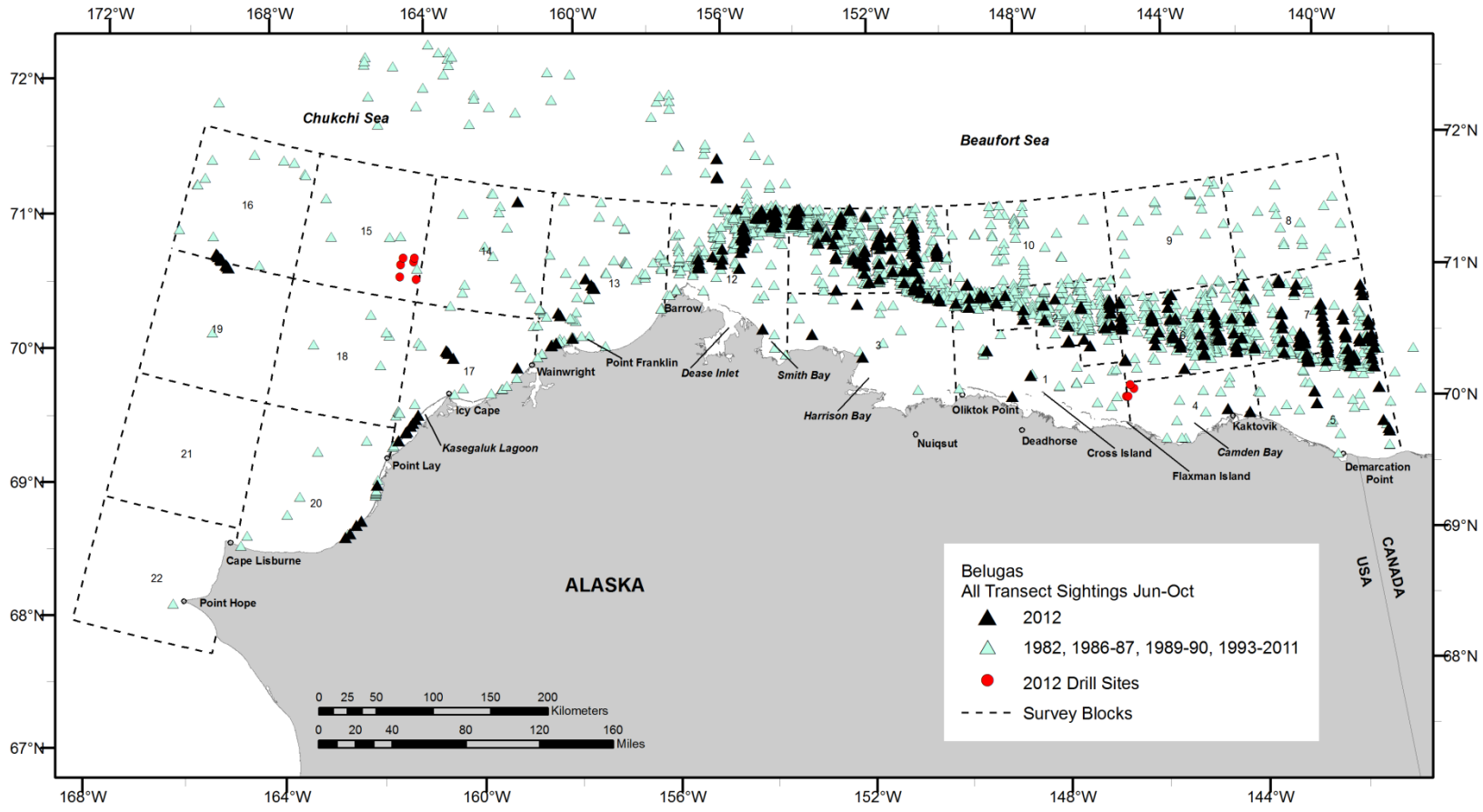


Figure 30. ASAMM beluga sightings on transect in years with light sea ice cover: 1982, 1986-87, 1989-90, 1993-2011, and 2012. Includes all sightings on transect, from primary and secondary observers.

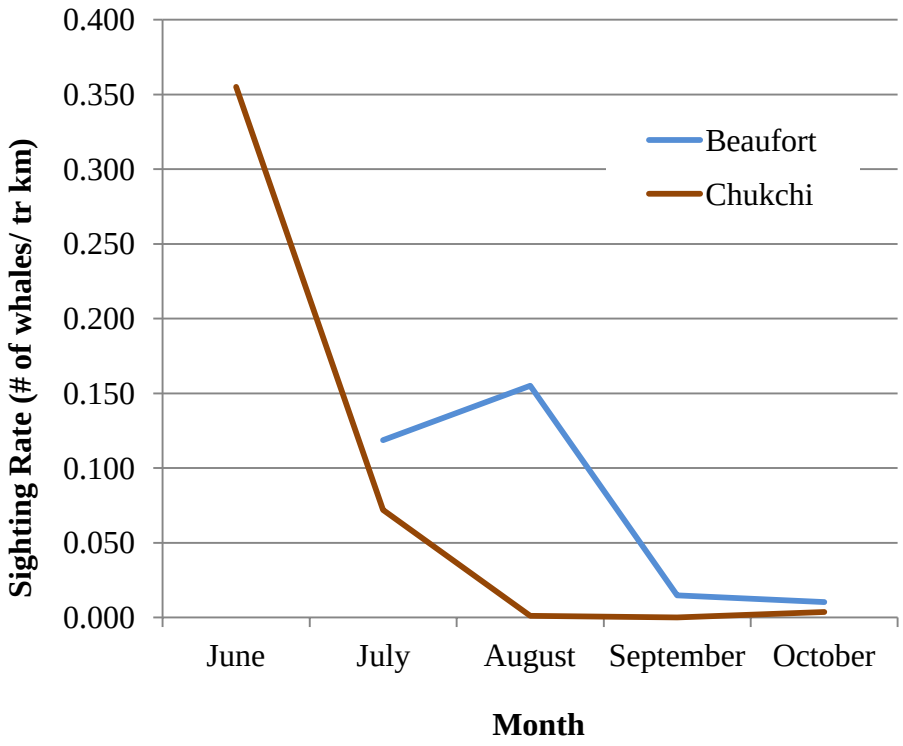


Figure 31. ASAMM monthly sighting rates (# whales per transect km) of belugas on transect in the western Beaufort and northeastern Chukchi Seas, 2012.

the ASAMM study area. Areas of highest fine-scale sighting rates (belugas on transect/transect km surveyed in 5 km x 5 km grid cells) were north of Smith Bay along the northern edge of the ASAMM study area (Figure 32). There were no areas of high fine-scale sighting rates in the northeastern Chukchi Sea.

In 2012, beluga sighting rate per depth zone was highest in the 201-2000 m depth zone near Barrow Canyon (154°W-157°W) and in the western Beaufort Sea (140°W-154°W) (Table 13). In the northeastern Chukchi Sea (157°W-169°W), beluga sighting rate per depth zone was highest in the ≤35 m depth zone. Sighting rates in 2012 followed similar trends to those documented previously in the same areas.

BELUGA HABITAT ASSOCIATIONS

Belugas were observed in sea ice cover ranging from no ice to 95% broken floe. Most belugas (66%) were observed in ≤10% sea ice cover. Belugas were observed in association with sea ice cover (1-95% sea ice cover) from late June through August. In September and October, sea ice was not present in the western Beaufort Sea study area, and very few belugas were seen in the northeastern Chukchi Sea where remnant sea ice remained.

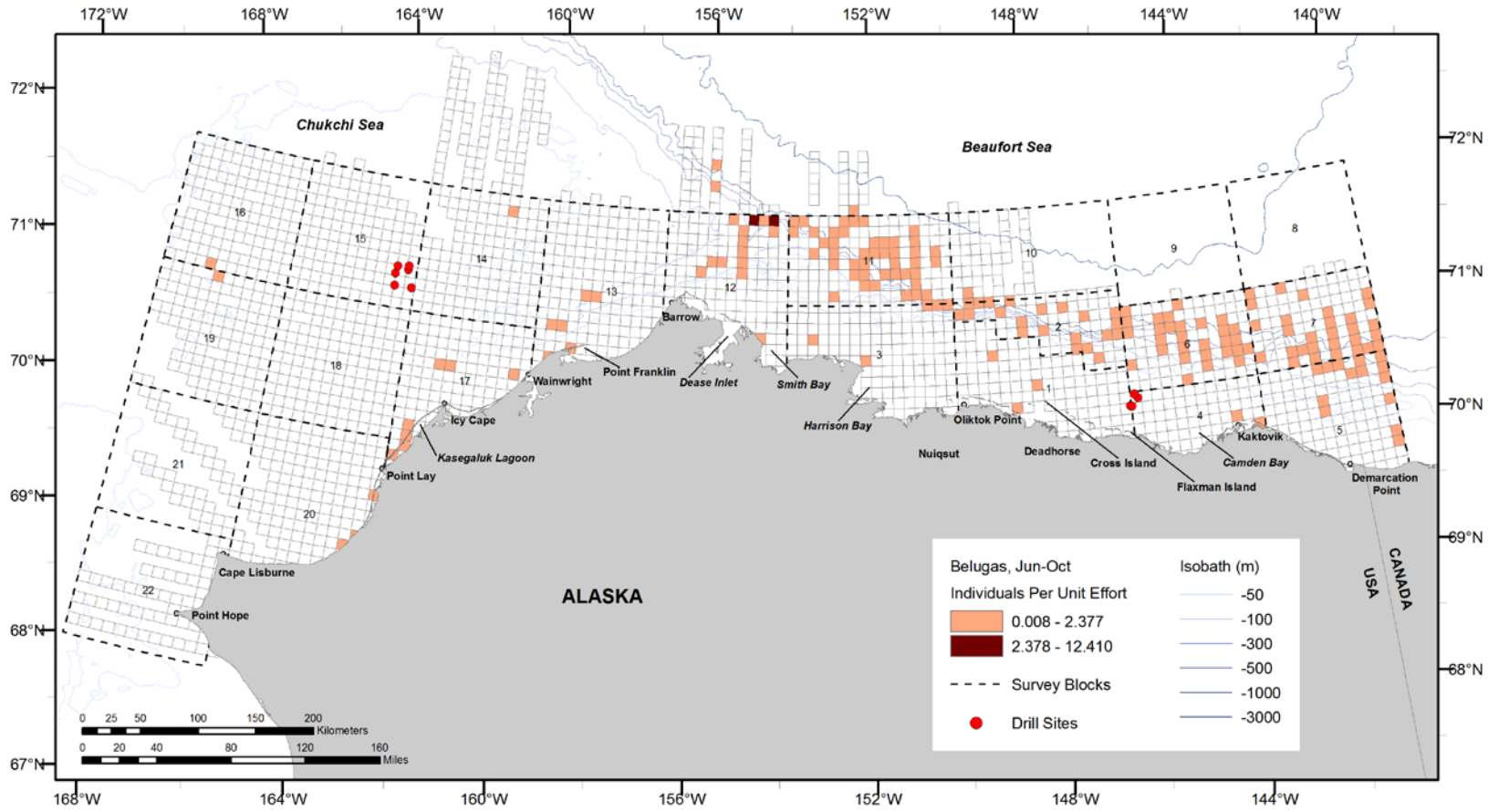


Figure 32. ASAMM beluga sighting rates (whales on transect/km of transect surveyed), 2012. Empty grid cells have sighting rates of zero; transect survey effort was not conducted in areas without grid cells. Transect sightings from primary observers only.

Table 13. ASAMM transect (Tr) effort (km), beluga transect sightings (primary observers only) and beluga sighting rate (WPUE = belugas per transect km surveyed) per depth zone per month, 2012. NA – surveys were not conducted. Does not include sightings north of 72°N.

	JUN Tr Km	Tr Sightings	Tr Whales	WPUE	JUL Tr Km	Tr Sightings	Tr Whales	WPUE	AUG Tr Km	Tr Sightings	Tr Whales	WPUE
157W-169W												
0-35 m	420	5	150	0.3568	3731	7	616	0.1651	1675	0	0	0.0000
36-50 m	0	NA	NA	NA	3512	1	6	0.0017	2448	3	6	0.0025
51-200 m N	0	NA	NA	NA	1387	6	11	0.0079	888	0	0	0.0000
51-200 m S	0	NA	NA	NA	0				0			
154W-157W												
0-20 m	0	NA	NA	NA	174	0	0	0.0000	298	0	0	0.0000
21-50 m	0	NA	NA	NA	200	0	0	0.0000	303	0	0	0.0000
51-200 m	0	NA	NA	NA	695	6	27	0.0389	717	8	137	0.1910
201-2,000 m	0	NA	NA	NA	139	4	6	0.0431	162	27	1157	7.1363
140W-154W												
0-20 m	0	NA	NA	NA	430	3	4	0.0093	1001	1	1	0.0010
21-50 m	0	NA	NA	NA	943	8	39	0.0414	2627	3	3	0.0011
51-200 m	0	NA	NA	NA	622	14	92	0.1479	1577	8	24	0.0152
201-2,000 m	0	NA	NA	NA	1025	146	329	0.3209	2442	100	250	0.1024
>2,000 m	0	NA	NA	NA	334	23	40	0.1198	1146	9	21	0.0183
TOTAL	**420**	**5**	**150**	**0.3568**	**13,192**	**218**	**1170**	**0.0887**	**15,285**	**159**	**1599**	**0.1046**

	SEP Tr Km	Tr Sightings	Tr Whales	WPUE	OCT Tr Km	Tr Sightings	Tr Whales	WPUE	TOTAL Tr Km	Tr Sightings	Tr Whales	WPUE
157W-169W												
0-35 m	2343	0	0	0.0000	2357	4	9	0.0038	10,527	16	775	0.0736
36-50 m	3982	0	0	0.0000	2947	11	15	0.0051	12,888	15	27	0.0021
51-200 m N	884	0	0	0.0000	1225	0	0	0.0000	4,384	6	11	0.0025
51-200 m S	121	0	0	0.0000	102	0	0	0.0000	223	0	0	0.0000
154W-157W												
0-20 m	271	0	0	0.0000	153	1	1	0.0065	897	1	1	0.0011
21-50 m	299	0	0	0.0000	186	1	1	0.0054	987	1	1	0.0010
51-200 m	514	0	0	0.0000	504	2	2	0.0040	2,430	16	166	0.0683
201-2,000 m	139	0	0	0.0000	94	14	28	0.2991	533	45	1,191	2.2325
140W-154W												
0-20 m	654	0	0	0.0000	636	1	1	0.0016	2,720	5	6	0.0022
21-50 m	1783	1	3	0.0017	1795	1	1	0.0006	7,147	13	46	0.0064
51-200 m	993	0	0	0.0000	816	0	0	0.0000	4,008	22	116	0.0289
201-2,000 m	1250	23	92	0.0736	966	11	22	0.0228	5,683	280	693	0.1219
>2,000 m	491	0	0	0.0000	294	0	0	0.0000	2,264	32	61	0.0269
TOTAL	**13,722**	**24**	**95**	**0.0069**	**12,073**	**46**	**80**	**0.0066**	**54,693**	**452**	**3,094**	**0.0566**

*Total transect effort (Tr km) differs from values in Table 2 because effort between barrier islands and the mainland was included in the sighting rate per depth zone analysis.

Behaviors of belugas observed during all survey modes (transect, search and circling) in 2012 are summarized in Table 14. The behavior most often recorded was swimming (60%). Milling and feeding were recorded for 1,233 belugas (29%), including most of the large groups of belugas seen near Kasegaluk Lagoon in early July.

Swim direction was evaluated for all "swimming" 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 (June-August) was significantly clustered around a mean heading of 67°T ($Z = 10.13$, $P = 0.00003$). In fall (September-October) in the northeastern Chukchi Sea, the mean vector swim direction was significantly clustered around a mean heading of 186°T ($Z = 5.94$, $P = 0.002$). Swim direction was clustered around a mean heading in the western Beaufort Sea (140°W-154°W) in summer of 280°T ($Z = 13.45$, $P = 0.000001$), but was not clustered around any heading in fall (mean vector = 59°T, $Z = 1.096$, $P = 0.34$).

There were 76 sightings of 208 beluga calves, including 31 cow-calf pairs, observed during all survey modes (transect, search and circling). Beluga calves were scattered throughout the Beaufort and Chukchi Seas (Figure 33), although few were seen in the offshore survey blocks of the Chukchi Sea. Calves were seen throughout summer and fall, with the largest numbers of calves seen near Kasegaluk Lagoon in July. Beluga calves are likely underrepresented in the dataset because of their small size and the infrequency of circling over beluga sightings.

Eight belugas (<1% of all belugas sighted) appeared to respond to the survey aircraft.

Killer Whales

There were two sightings of 18 killer whales (*Orcinus orca*) in 2012 (Figure 27). One group of 13 killer whales, including two calves, was seen on 20 August, approximately 10 km northwest of Barrow. Analysis of photos taken of this group revealed that one of the males has been sighted numerous times near False Pass, Unimak Island, in the Aleutian Island chain (J. Waite, NMML-AFSC, pers. comm. to C. Christman, 2 April 2013). One group of five killer whales, including one calf, was seen on 11 September, approximately 80 km northwest of Point Hope. None of the killer whales appeared to respond to the survey aircraft.

Killer whales were not previously observed in the northeastern Chukchi Sea by ASAMM observers, and their occurrence in the area has been sporadically documented. Killer whales were 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 2006-2010 (Thomas and Koski 2011) nor by marine mammal observers conducting the Chukchi Sea Environmental Studies Program from 2008-2010 (Aerts et al. 2011), but were seen were seen during those research efforts in 2012 (L. Aerts, LAMA Ecological, pers. comm. to J. Clarke, 12 April 2013). 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).

Table 14. Monthly summary of belugas (number of sightings/number of individuals) observed during all survey modes (transect, search and circling), by behavioral category, 2012. Excludes dead and repeat sightings.

Behavior	30 Jun	1-15 Jul	16-31 Jul	1-15 Aug	16-31 Aug	1-15 Sep	16-30 Sep	1-15 Oct	16-28 Oct	Total
Cow/Calf	0	0	2/4	0	0	0	0	0	0	2/4 (<1%)
Dive	0	0	1/1	3/3	0	0	0	1/2	0	5/6 (<1%)
Feed	0	1/250	0	0	0	0	0	1/4	0	2/254 (6%)
Mill	0	5/795	10/27	13/136	3/9	0	0	4/8	2/4	37/979 (23%)
Rest	0	1/300	21/30	8/13	8/17	1/1	4/30	1/1	7/9	51/401 (10%)
Swim	7/275	17/132	188/525	102/266	36/1206	11/32	8/32	24/45	14/23	407/2536 (60%)
Unknown	0	0	2/8	0	0	0	0	0	0	2/8 (<1%)
TOTAL	7/275	24/1477	224/595	126/418	47/1232	12/33	12/62	31/60	23/36	506/4188

Unidentified Cetaceans and Small Unidentified Marine Mammals

There were 72 sightings of 82 unidentified cetaceans in 2012 (Figure 34). 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. Thirty-nine of the unidentified cetaceans were in the northeastern Chukchi Sea, and 43 unidentified cetaceans were in the western Beaufort Sea. Eight of the unidentified cetaceans were probable gray whales, based on their proximity to other gray whales or the presence of well-defined mud plumes. One unidentified cetacean was a probable bowhead whale, and eight whales were noted as probable bowhead, gray or large whales. The majority of unidentified cetacean sightings were not seen clearly enough to identify to species with any probability. There were also six sightings of seven small unidentified marine mammals (Figure 34). One of these sightings was likely two belugas or walruses swimming underwater. The other five sightings were not seen closely enough to identify to species with any probability.

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

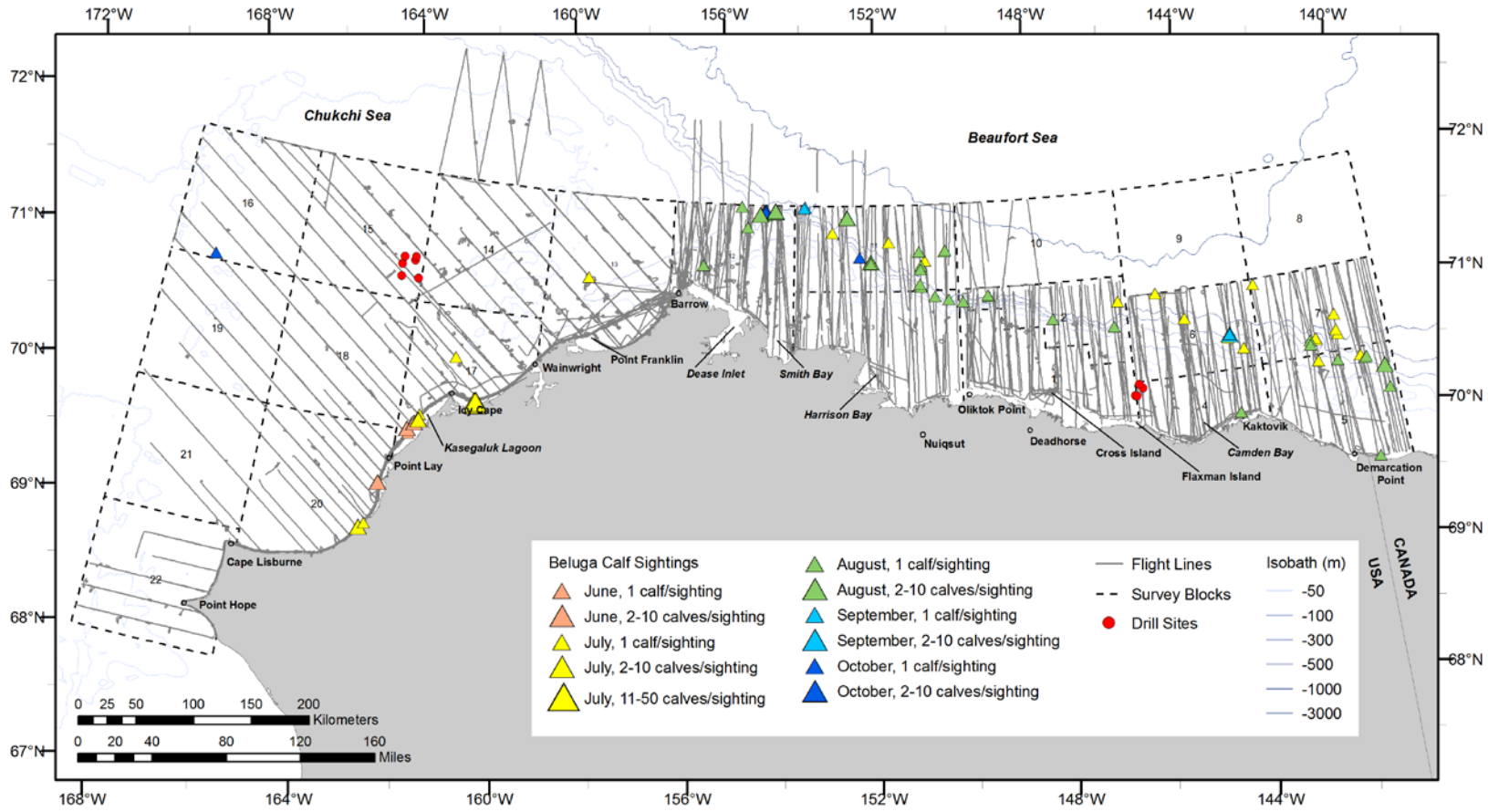


Figure 33. ASAMM beluga calves, with transect, search, and circling effort, 2012. Deadhead flight tracks are not shown.

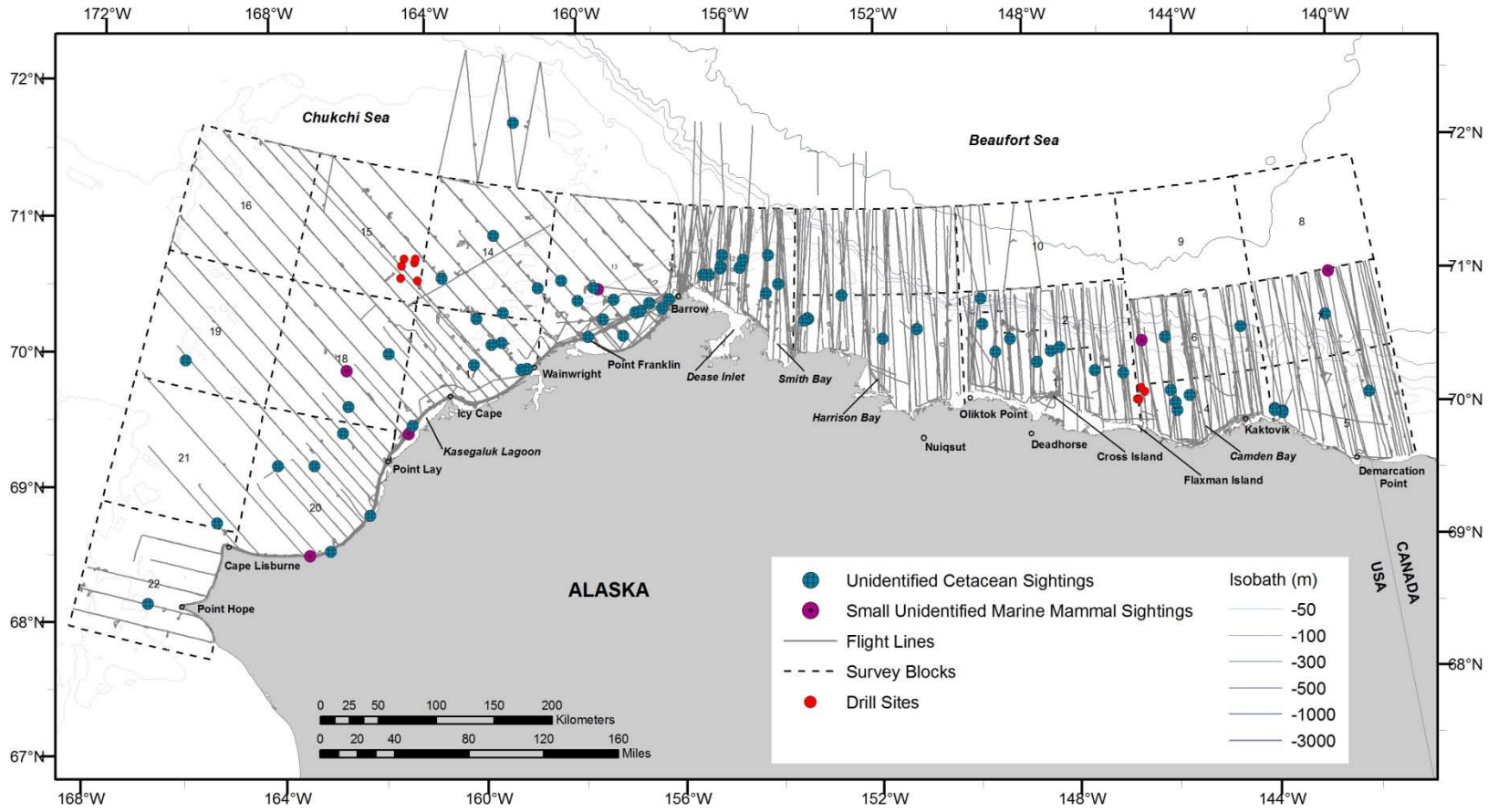


Figure 34. ASAMM unidentified cetacean and small unidentified marine mammal sightings, with transect, search, and circling effort, 2012. Deadhead flight tracks are not shown.

Pinnipeds

Walruses

Pacific walruses (*Odobenus rosmarus divergens*) were observed in all months throughout the northeastern Chukchi Sea (Figure 35). There were 470 sightings of 12,892 walruses observed from June to October (Table 3). Most of the walruses were sighted in July and August, with the majority of sightings in the northeastern Chukchi Sea. Walruses (28 sightings of 923 animals) were observed in the western Beaufort Sea from Point Barrow east to 153°W.

Most walruses (91%; 153 sightings of 11,677 walruses) were observed hauled out on sea ice, from 30 June to 14 September. Group sizes for walruses on ice ranged from single animals to an estimated 1,100 walruses in one group.

An ASAMM survey was conducted on 3 September north of the ASAMM study area to assess walrus use of sea ice habitats on a day when strong winds throughout the ASAMM study area precluded survey flights elsewhere (Appendix B, Flight 237). The area surveyed (72°N-73°N, 160°W-163°W) was selected based on sea ice information obtained from the National Weather Service. There were 12 sightings of 50 walruses observed during the survey, mainly near Hanna Shoal.

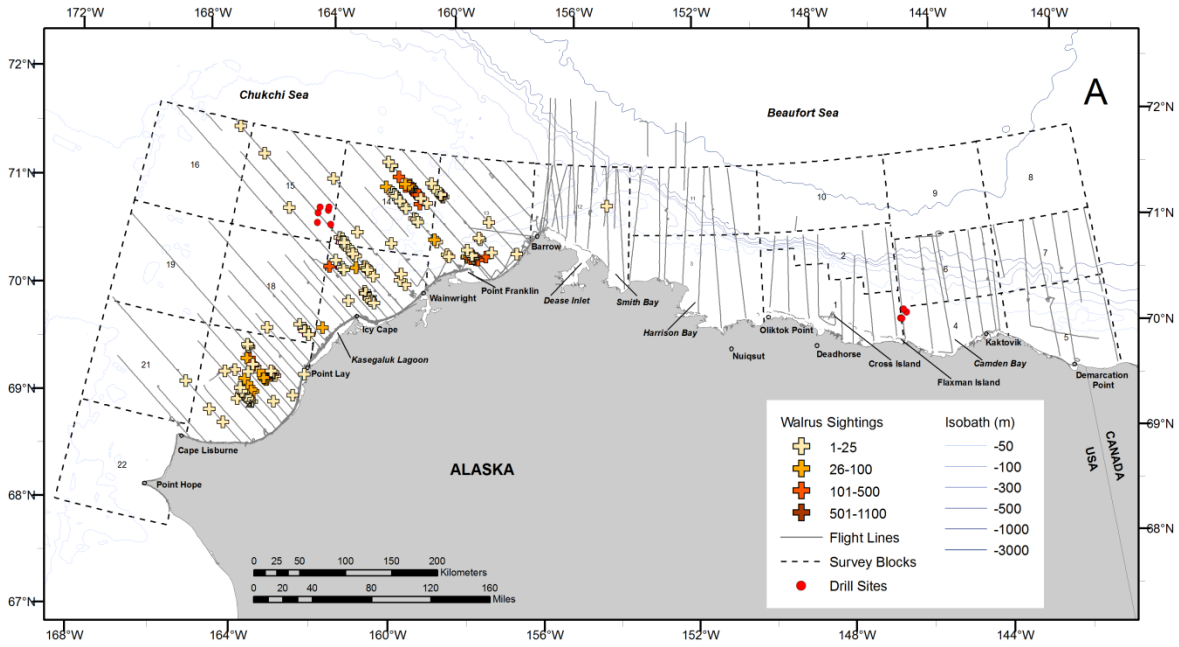
Walruses were not observed hauled out on land in 2012, likely due to the continued presence of sea ice in and near the study area in fall. The coastal transect, or portions thereof, was surveyed on 21 different days between 30 June and 26 October and, while walruses were seen close to shore in September and October, none were seen on shore. Walruses were observed in coastal haulouts in 2009, 2010 (Clarke et al. 2011d) and 2011 (Clarke et al. 2012). Coastal haulouts were not observed in 2008, when sea ice remained in the ASAMM study area throughout summer and fall (National Snow and Ice Data Center 2008).

There were 570 walruses (representing 4% of all walruses sighted) that appeared to respond to the survey aircraft.

Other Pinnipeds

Bearded seals (*Erignathus barbatus;* 24 sightings of 25 seals) were observed mainly in the western Beaufort Sea with scattered sightings in the northeastern Chukchi Sea (Figure 36). One bearded seal was observed hauled out on sea ice in mid-August; all other bearded seals were observed in open water. Two bearded seals (8%) appeared to respond to the survey aircraft.

Other pinnipeds were not identifiable to species and were recorded as unidentified pinnipeds (181 sightings of 251 seals) or small unidentified pinnipeds (1,039 sightings of 1,785 seals) (Figure 37). 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 aircraft (>305 m). "Unidentified pinnipeds" likely included sightings of ringed (*Pusa hispida*) and spotted (*Phoca largha*) seals, in addition to bearded seals and small walruses.



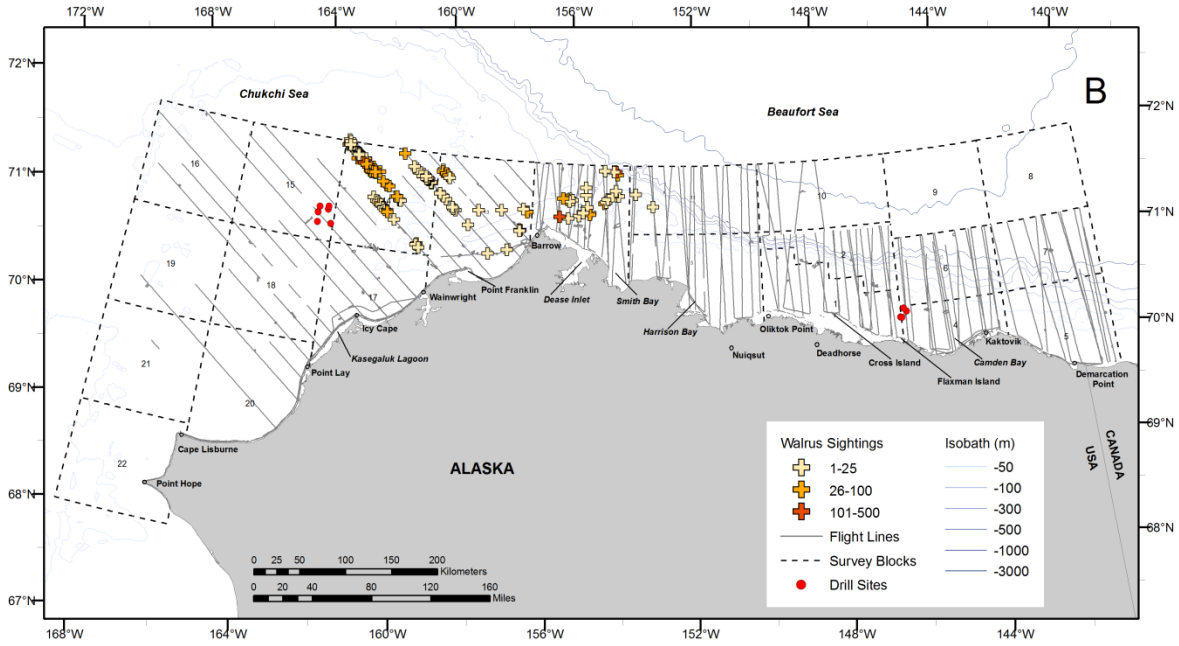
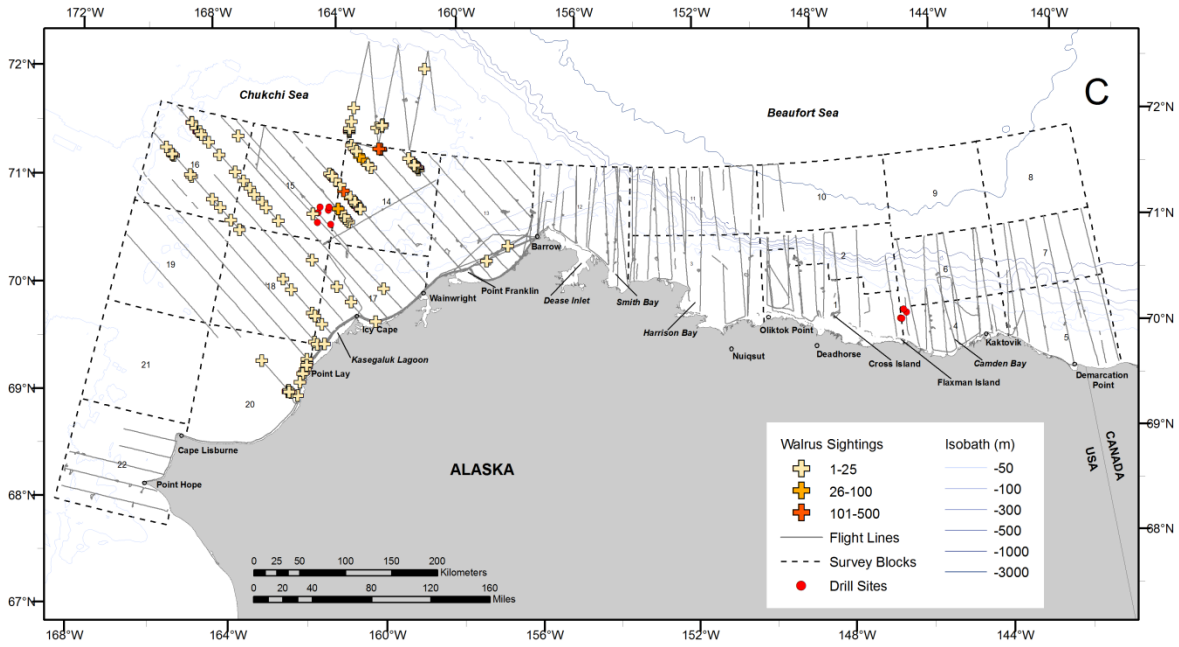


Figure 35. ASAMM walrus sightings plotted by month, with transect, search, and circling effort, 2012. Deadhead flight tracks are not shown. A: June-July; B: August.



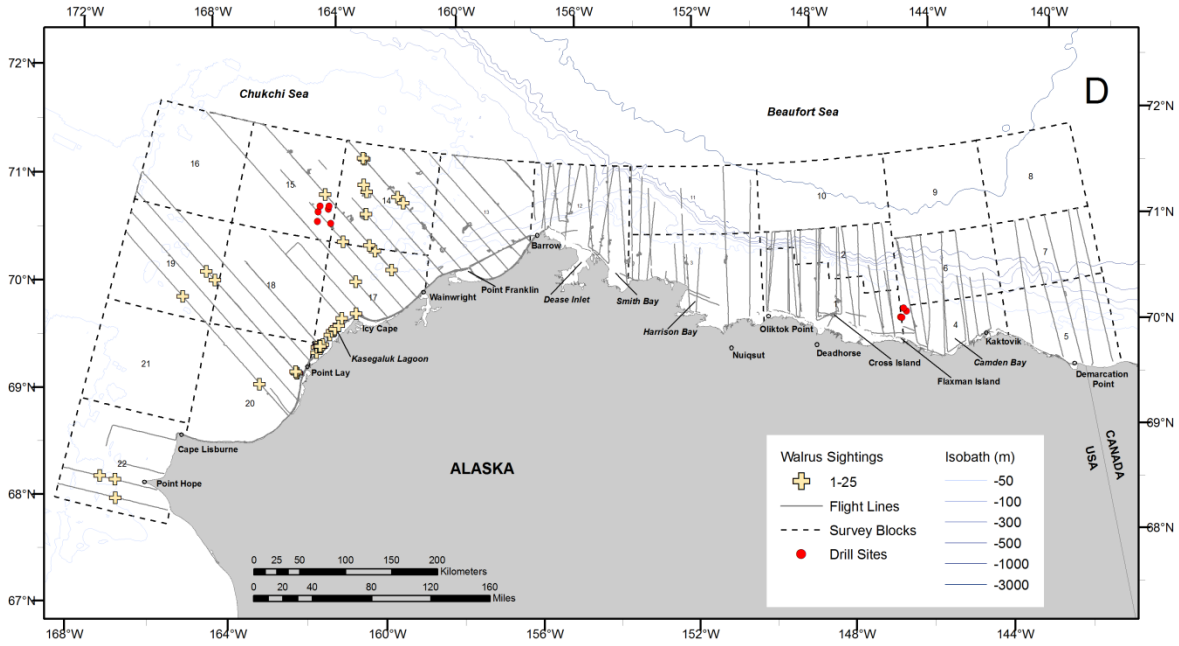


Figure 35 (cont.). ASAMM walrus sightings plotted by month, with transect, search, and circling effort, 2012. C: September; D: October.

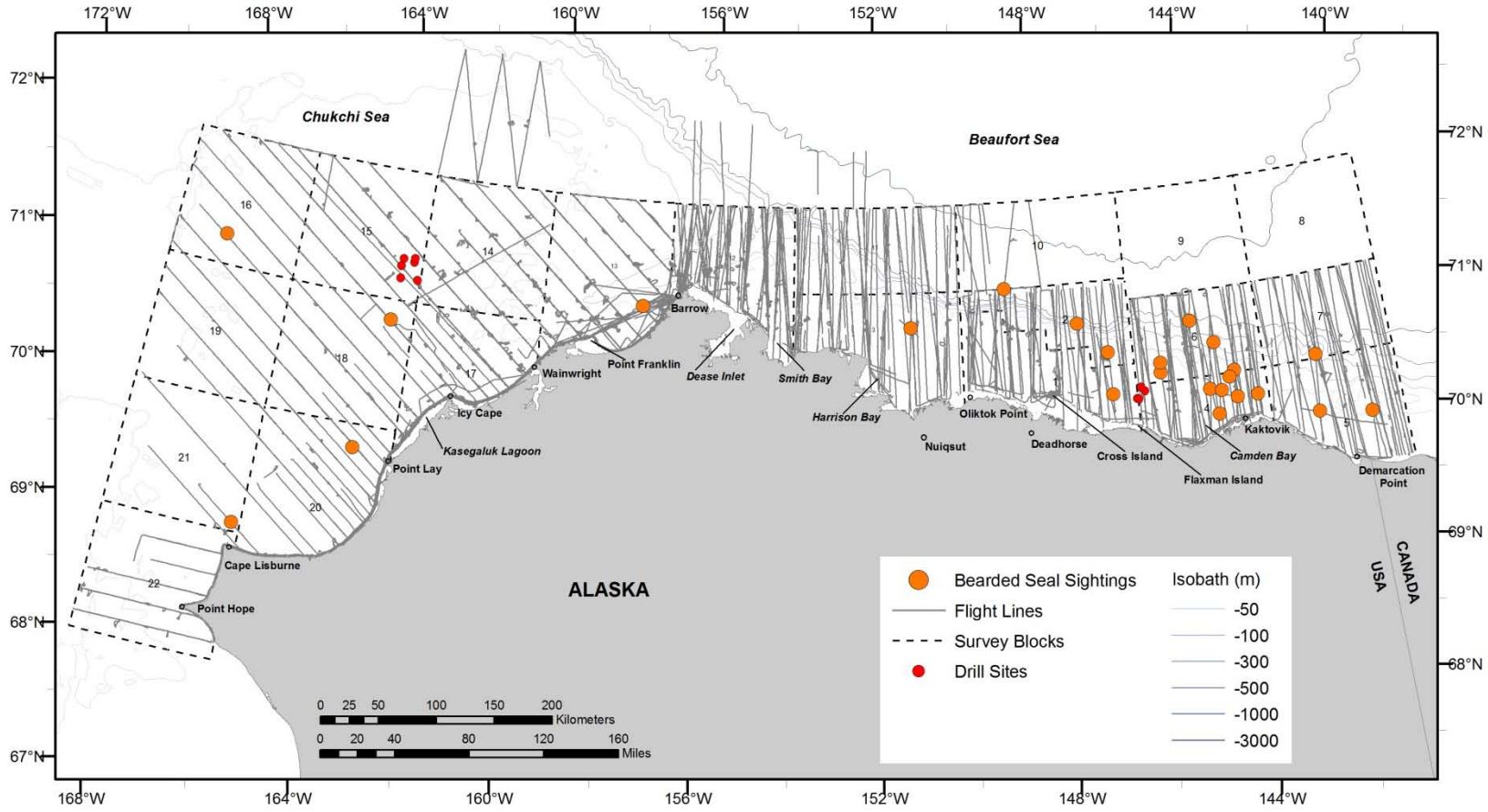


Figure 36. ASAMM bearded seal sightings, with transect, search, and circling effort, 2012. Deadhead flight tracks are not shown.

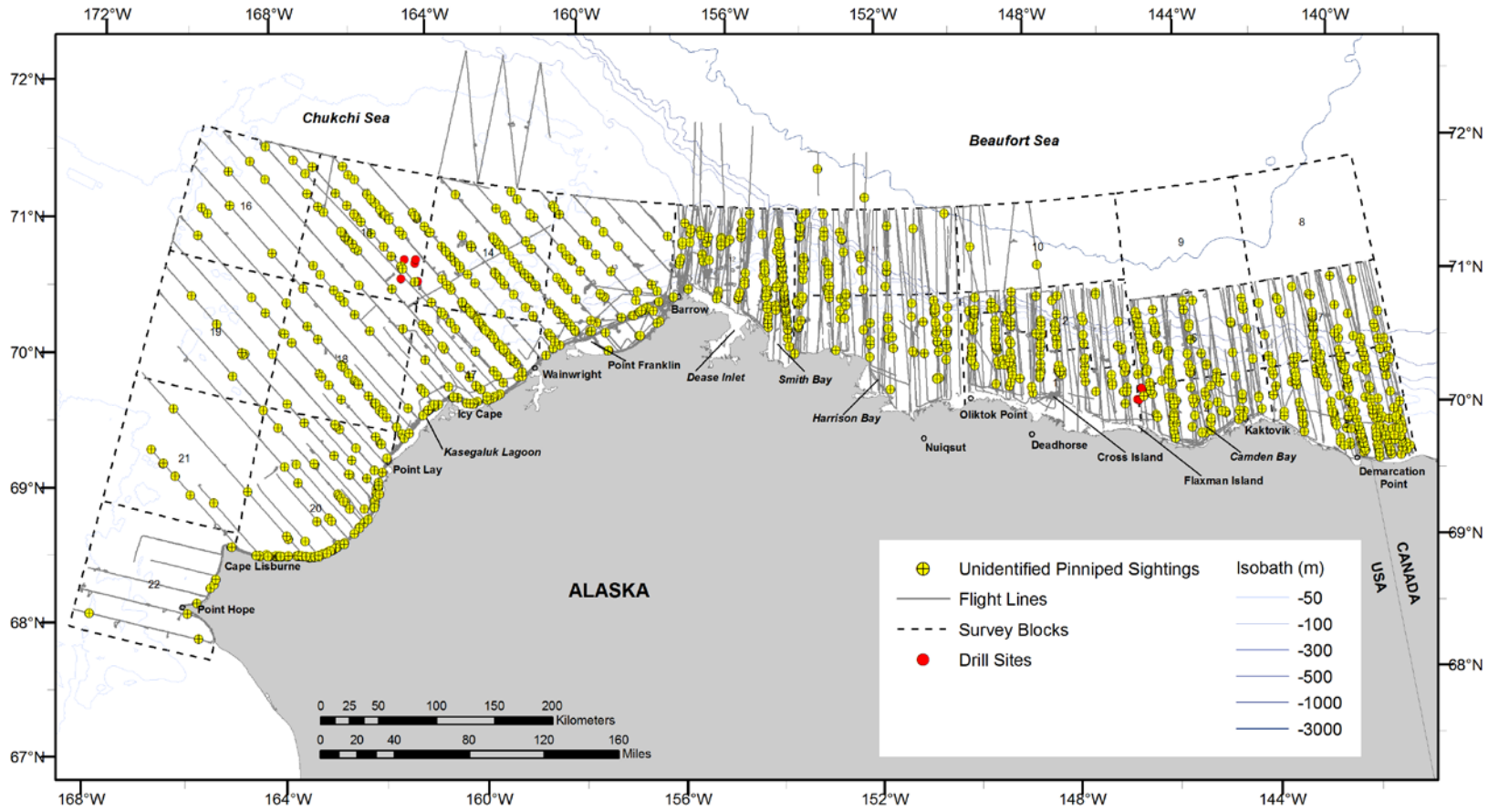


Figure 37. ASAMM unidentified pinniped sightings (including small unidentified pinniped sightings), with transect, search, and circling effort, 2012. Deadhead flight tracks are not shown.

"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; Boveng et al. 2009; Angliss and Allen 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). Pinnipeds were distributed throughout the extent of the study area, both on the continental shelf and in deeper areas of the continental slope.

Polar Bears

There were 65 sightings of 277 polar bears (Figure 38). In the northeastern Chukchi Sea, 32 sightings of 42 polar bears were observed. Sightings were scattered along the shore between Barrow and Point Franklin, between Icy Cape and Point Lay, and east of Cape Lisburne. There were three sightings of four polar bears offshore on sea ice between 103 km and 165 km from shore, and four sightings of four polar bears swimming offshore between 1 km and 111 km from shore. Most of the polar bears on shore in the Chukchi Sea region were sighted during surveys of the coastal transect.

In the western Beaufort Sea, there were 33 sightings of 235 polar bears, found along the shore between Demarcation Bay and Camden Bay, between Harrison Bay and Smith Bay, on barrier islands northeast of Deadhorse, and on Bernard Spit near Kaktovik (Figure 38). There is no coastal transect in the Beaufort Sea, and transits to and from survey blocks were often on deadhead or over land. Therefore, the opportunity to find polar bears along the coastline, where they would most likely be seen when the ice edge has receded offshore, is lower than in the Chukchi Sea. There were 13 sightings of 15 swimming polar bears: six of the swimming bears were within 1 km of shore and 9 of the swimming bears were offshore between 2 km and 82 km from shore. Two of the offshore swimming bears were near broken floe sea ice (10-40% ice cover) and the other seven offshore bears were swimming in open water.

Most of the polar bears (78%, n=215) observed in 2012 were seen at two locations, Cross Island and near Kaktovik; these locations attract polar bears because bowhead whale carcasses from fall subsistence hunts are hauled there by villagers from Nuiqsut (at Cross Island), and Kaktovik, and are a source of food for polar bears. Bears were seen on Cross Island on 10 days: 4 bears on 5 August, 6 bears on 15 August, 10 bears on 25 August, 4 bears on 5 September, 12 bears on 15 September, 25 bears on 23 September, 34 bears on 2 October, 34 bears on 5 October, 32 bears on 14 October, and 3 bears on 22 October. Some of these bears may have been repeat sightings. Fifty-one polar bears were seen near Kaktovik on 4 October, scattered over 5 km.

Polar bears on land were observed resting, walking, running, and feeding. Several polar bears were sighted on multiple days near two marine mammal carcasses onshore near Point Franklin. One polar bear was sighted approximately 25 km southwest of Barrow near a decomposed unidentified cetacean carcass. One polar bear was sighted lying on an ice floe near fresh bloody tracks with a live seal crawling away from the bear.

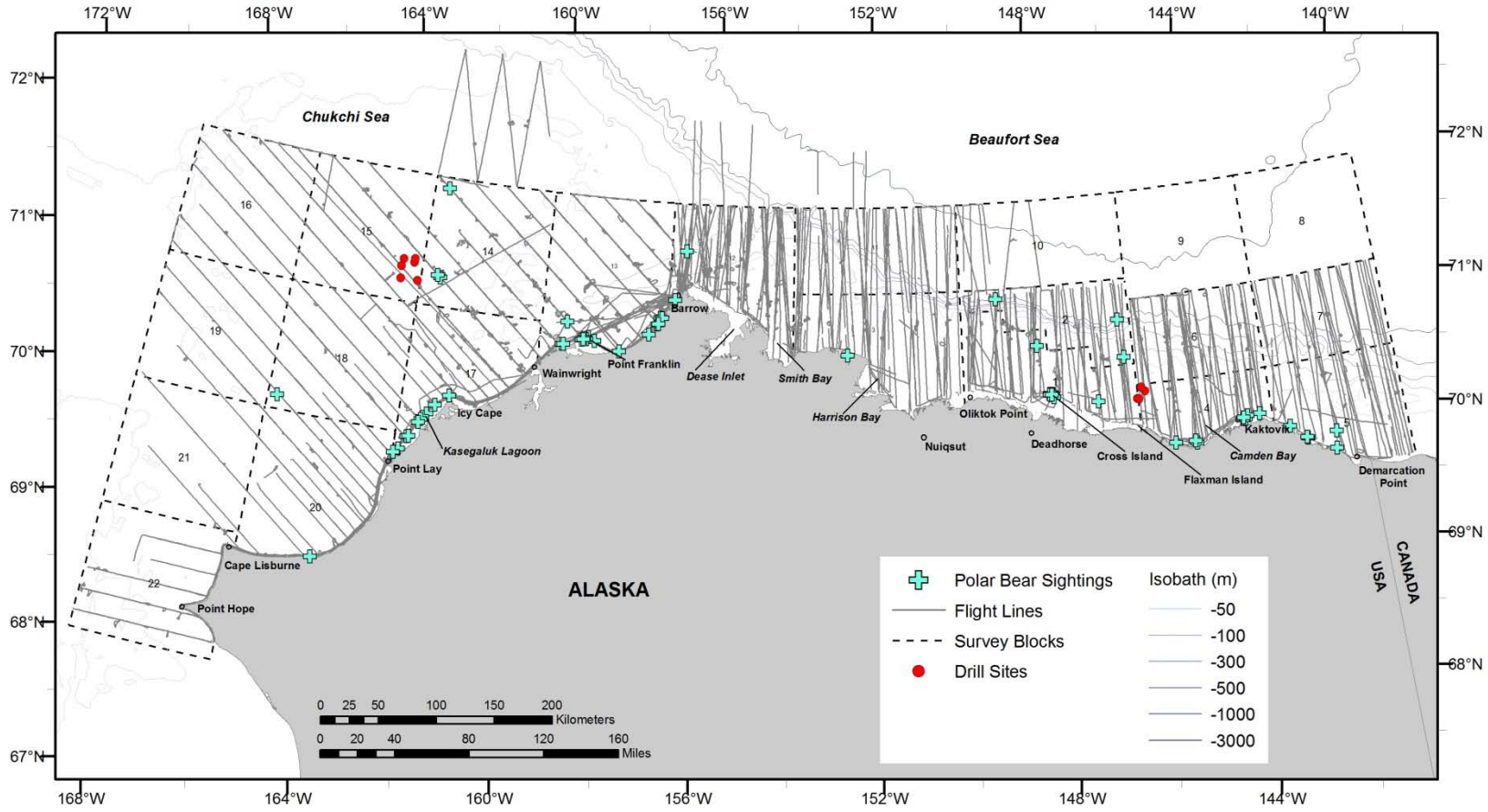


Figure 38. ASAMM polar bear sightings, with transect, search, and circling effort, 2012. Deadhead flight tracks are not shown.

There were 7 sightings of 21 polar bear cubs in 2012; 19 of the cubs were sighted on Cross Island, 2 cubs were on Bernard Spit near Kaktovik. There were also two sightings of eight polar bear yearlings; six of the yearlings were on Cross Island and two were on Bernard Spit near Kaktovik.

The majority (97%) of bears sighted did not respond to the survey aircraft. Nine bears (3%) did appear to react to the survey aircraft. Reactions included running towards the water and into the surf (three bears), standing and then running (three bears), standing up from a lying position (two bears), and looking at the aircraft while swimming (one bear).

In 2012, photographs were occasionally taken of polar bears on Cross Island and Bernard Spit, and analyzed post-flight to count the total number of bears, which was not done prior to 2012. In some of these instances, it was found that the final group size more than doubled the initial estimate once the photo analysis was completed (e.g., 16 bears were initially counted real-time during the flight, but 34 bears were counted in the photos during post-flight analysis).

The number of polar bears sighted in 2012 far surpassed the numbers sighted in 2008-2011 (Clarke et al. 2011a, 2011c, 2011d, 2012). There are likely several contributing factors to the increase in polar bear sightings in 2012, including the post-flight photo analysis, greater overall survey effort, and the presence of sea ice in some of the study area. Since broad-scale surveys of the entire ASAMM study area (western Beaufort Sea and northeastern Chukchi Sea) recommenced in 2008, the year in which the highest number of polar bears was sighted prior to 2012 was also that in which remnant sea ice remained in some of the study area (2008).

Dead Marine Mammals

There were 38 sightings of 38 dead marine mammals in 2012 (Table 15), although it is possible that some sightings were repeats of earlier observations. Half of the carcasses observed were cetaceans, including gray whales (8 sightings of 8 animals), belugas (2 sightings of 2 animals) and unidentified cetaceans (9 sightings of 9 animals). Five carcasses were walruses, 10 carcasses were unidentified pinnipeds and 4 carcasses were too decomposed to allow identification beyond "marine mammal". Twenty-four of the carcasses were observed in open water, 13 were on land and one was on ice. All but two dead marine mammals were in the northeastern Chukchi Sea. Level A stranding forms were completed by field teams and forwarded to personnel at the NSB Department of Wildlife Management (all sightings), NMFS (cetaceans and ice seals) and USFWS (walruses).

Accomplishments

Data from ASAMM 2012 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 NMML project website: http://www.afsc.noaa.gov/nmml/cetacean/bwasp/index.php.
- Ice data, including photos of representative sea ice cover, were sent to the National Weather Service Ice Desk, USCG, Pacific Marine Environmental Laboratory (PMEL), and the NOAA ship *Fairweather*.

Table 15. Summary of dead marine mammal sightings, all survey modes (transect, search and circling), 2012.

Flight No.	Date	Latitude (°N)	Longitude (°W)	Species	No. Individuals	Habitat
210	15-Jul-12	68.223	166.121	beluga	1	open water
213	21-Jul-12	69.830	163.849	beluga	1	open water
223	12-Aug-12	71.087	157.967	unidentified cetacean	1	open water
224	13-Aug-12	69.582	163.155	unidentified pinniped	1	on land
224	13-Aug-12	69.599	163.144	unidentified pinniped	1	on land
226	16-Aug-12	70.916	159.815	gray whale	1	open water
229	19-Aug-12	69.817	164.604	unidentified pinniped	1	open water
230	20-Aug-12	71.995	155.521	gray whale	1	open water
230	20-Aug-12	71.954	156.141	unidentified pinniped	1	on ice
231	21-Aug-12	71.391	157.532	unidentified cetacean	1	open water
231	21-Aug-12	71.366	157.462	gray whale	1	open water
232	23-Aug-12	71.983	167.480	unidentified pinniped	1	open water
232	23-Aug-12	70.998	161.917	unidentified cetacean	1	open water
233	25-Aug-12	70.238	163.747	walrus	1	open water
233	25-Aug-12	70.530	164.868	gray whale	1	open water
233	25-Aug-12	71.227	167.808	gray whale	1	open water
236	01-Sep-12	71.515	156.913	gray whale	1	open water
238	06-Sep-12	71.063	157.204	unidentified cetacean	1	on land
240	08-Sep-12	70.841	163.556	unidentified cetacean	1	open water
244	13-Sep-12	71.623	157.519	walrus	1	open water
246	15-Sep-12	70.483	164.688	unidentified pinniped	1	open water
250	24-Sep-12	71.119	157.155	gray whale	1	on land
250	24-Sep-12	70.969	157.460	walrus	1	on land
252	26-Sep-12	70.847	159.421	unidentified pinniped	1	on land
252	26-Sep-12	70.893	158.923	unidentified marine mammal	1	on land
252	26-Sep-12	70.899	158.927	walrus	1	on land
252	26-Sep-12	70.912	158.923	unidentified marine mammal	1	on land
252	26-Sep-12	71.133	157.648	unidentified cetacean	1	open water
255	30-Sep-12	71.089	160.419	unidentified cetacean	1	open water
256	01-Oct-12	71.338	158.902	unidentified cetacean	1	open water
256	01-Oct-12	71.560	158.085	unidentified pinniped	1	open water
257	02-Oct-12	71.058	157.254	walrus	1	on land
46	06-Oct-12	71.654	156.268	gray whale	1	open water
263	13-Oct-12	70.907	158.946	small unidentified marine mammal	1	on land
263	13-Oct-12	70.893	158.954	small unidentified marine mammal	1	on land
263	13-Oct-12	70.819	159.576	unidentified pinniped	1	on land
265	15-Oct-12	71.216	155.107	unidentified pinniped	1	open water
270	22-Oct-12	71.177	149.677	unidentified cetacean	1	open water

- Biweekly effort and sighting summary figures were sent to BOEM, NMML and NSB to provide an overview of data collected.
- Biweekly walrus sighting figures of distribution and group size were sent to researchers at BOEM, USFWS, USGS, ADFG, NSB, and the Alaska SeaLife Center.
- Biweekly polar bear sighting figures were sent to BOEM, USFWS, USGS, ADFG and NSB.
- Biweekly bowhead whale sighting figures and summaries were sent to U.S. Coast Guard Cutter *Bertholf*, to be disseminated further in the Coast Guard.
- All Level A stranding forms (32 total) were sent to the relevant agencies: NMFS and NSB received forms for cetaceans and ice seals, and USFWS and NSB received forms for walruses.

ASAMM incorporated walrus reconnaissance surveys into survey effort in mid-July to assist with USGS satellite tagging efforts.

Community outreach in 2012 included:

- Met with the North Slope Borough Search and Rescue to familiarize them with our project.
- Survey crew landed in the village of Point Lay during a survey flight in early July to talk to biologists and villagers during the beluga surveys.
- Sent the Deadhorse Whaling Communications Center emails with flight plans prior to and after every survey flight that occurred in the Beaufort Sea.
- Sent the industry-sponsored aerial survey teams emails with flight plans prior to every survey flight in both the Chukchi and Beaufort seas.
- Pre-season and in-season communication with Principal Investigators of unmanned aircraft projects operating in the study area to minimize risk to both projects.
- Posted Daily Reports to the NMML website within ~24-48 hrs after completion of each ASAMM flight. Beluga survey result summaries were distributed via email to an extensive list of stakeholders and interested parties (via John Citta, ADFG) during the 2-week beluga survey time period.
- Presented ASAMM to visitors who came to Barrow to birdwatch and to schoolchildren at Ipalook Elementary School.

Marine mammal photos taken by ASAMM personnel in 2012 were shared with interested parties in the federal government and media, including NOAA, BOEM, NSB, Alaska Public Radio, Anchorage Daily News, Juneau Empire, and the Arctic Sounder. Media efforts were coordinated through NOAA and BOEM Public Affair Offices, with media interest from Anchorage Daily News, Alaska Public Radio, Juneau Empire, Alaska Dispatch, North Slope Borough Department of Wildlife Management, and Arctic Sounder.

ASAMM provided subsets of the 1982-2011 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, NMFS Alaska Regional Office, NOAA Pacific Marine Environmental Laboratory, NMFS Protected Resources Division, USFWS, University of Alaska Fairbanks, World Wildlife Fund, University of Texas, NSB, and the U.S. Coast Guard.

Results from the 2012 ASAMM field season were presented by NMML personnel at several venues, including:

Brower, A., C. Christman, J. Clarke, and M. Ferguson. 2013. Gray whale calf occurrence in the Alaskan Arctic, summer and fall 2012. Poster presented at the Alaska Marine Science Symposium, Anchorage, AK, 21-24 January.

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 presented at the Alaska Marine Science Symposium, Anchorage, AK, 21-24 January.

Clarke, J. and M. Ferguson. 2012. Beluga distribution from aerial surveys conducted July-October 2012. Invited presentation to the Alaska Beluga Whale Committee 5th Workshop on Research about Beluga Whales, Anchorage, AK, 14-15 November.

Clarke, J., M. Ferguson, A. Brower, and C. Christman. 2013. It's not just about bowhead whales – collaborations between ASAMM and other research. Poster presented at the Alaska Marine Science Symposium, Anchorage, AK, 21-24 January.

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. Invited presentation to the 2012 United States-Canada Northern Oil and Gas Forum, Anchorage, AK, 13-15 November.

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 presented at the Alaska Marine Science Symposium, Anchorage, AK, 21-24 January.

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 presented at the Alaska Marine Science Symposium, Anchorage, AK, 21-24 January.

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 presented at the Alaska Marine Science Symposium, Anchorage, AK, 21-24 January.

ASAMM was featured in an Alaska Fisheries Science Center Quarterly Report, (www.afsc.noaa.gov/quarterly/jas2012/tocnmml.htm) and an article produced by the Northeast Fisheries Science Center (www.nefsc.noaa.gov/rcb/news/features/wf1218/index.html).

A complete listing of publications, posters and verbal presentations from the ASAMM project (and its precursors BWASP and COMIDA) from 2008-2013 is included in Appendix D. Also included are PDF copies of 2012 media reports related to ASAMM.

DISCUSSION

Conclusions

Sea ice conditions in 2012 were very light in the western Beaufort Sea in fall, similar to conditions observed from 2007-2011, with little to no ice after mid-August. In the northeastern Chukchi Sea, remnant sea ice remained in the northernmost part of the study area (or just north of the study area) until late September, which was reminiscent of 2008. 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 2012 but did not adversely affect survey effort as often as in past years.

Broad-scale aerial surveys were conducted regularly in the western Beaufort Sea in summer months (mid-July to August) for the first time since the 1980s. Bowhead whales were observed primarily on the outer shelf (>50 m water depth) in summer, which is similar to distributions reported 30 years ago (Ljungblad et al. 1986) when surveys were conducted in the western Alaskan Beaufort Sea intermittently in summer. Whales sighted in summer may have been early migrants from the Canadian Beaufort Sea, although satellite tag data suggests that some bowhead whales actively travel back and forth between the Canadian and Alaskan Beaufort Sea in summer (Quakenbush et al. 2012). Bowhead whale behaviors recorded in summer 2012 also suggested that bowhead whales in the western Beaufort Sea were not all actively migrating west. Most (54%) bowhead whales were swimming, but nearly 30% of bowhead whales were milling or feeding. Also of interest was the number of bowhead whale calves observed in the western Beaufort Sea in summer. Koski and Miller (2009) reported on bowhead whale size segregation in the central Beaufort Sea (139°W to 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, with bowhead whale cow-calf pairs passing by the village later than subadult whales (Braham et al. 1984). Bowhead whale cow-calf pairs may be regular visitors to the western Beaufort Sea in July and August, and not have been detected previously due to lack of survey effort during this time period. Conversely, bowhead whale calf occurrence in the western Beaufort Sea in summer 2012 may reflect annual variation, as suggested by Koski and Miller (2009).

Observed bowhead whale distribution in the western Beaufort Sea in fall 2012 was similar to that observed in previous light sea ice years for the eastern region (140°W-148°W) but was significantly farther from shore and in deeper water compared to previous years with light sea ice cover for the western region (148°W-156°W). Bowhead whales were not seen within 50 km of shore between 149°W and 152°W (Harrison Bay area), which is normally within the fall migration path. Possible reasons for the variation in bowhead distribution could include fewer feeding opportunities in that area or increased ship traffic or other anthropogenic activity in Harrison Bay. Sighting rate increased from August to September, then decreased slightly in October (Figure 39), which is expected as the bowhead whale fall migration from the Canadian Beaufort Sea begins to wane.

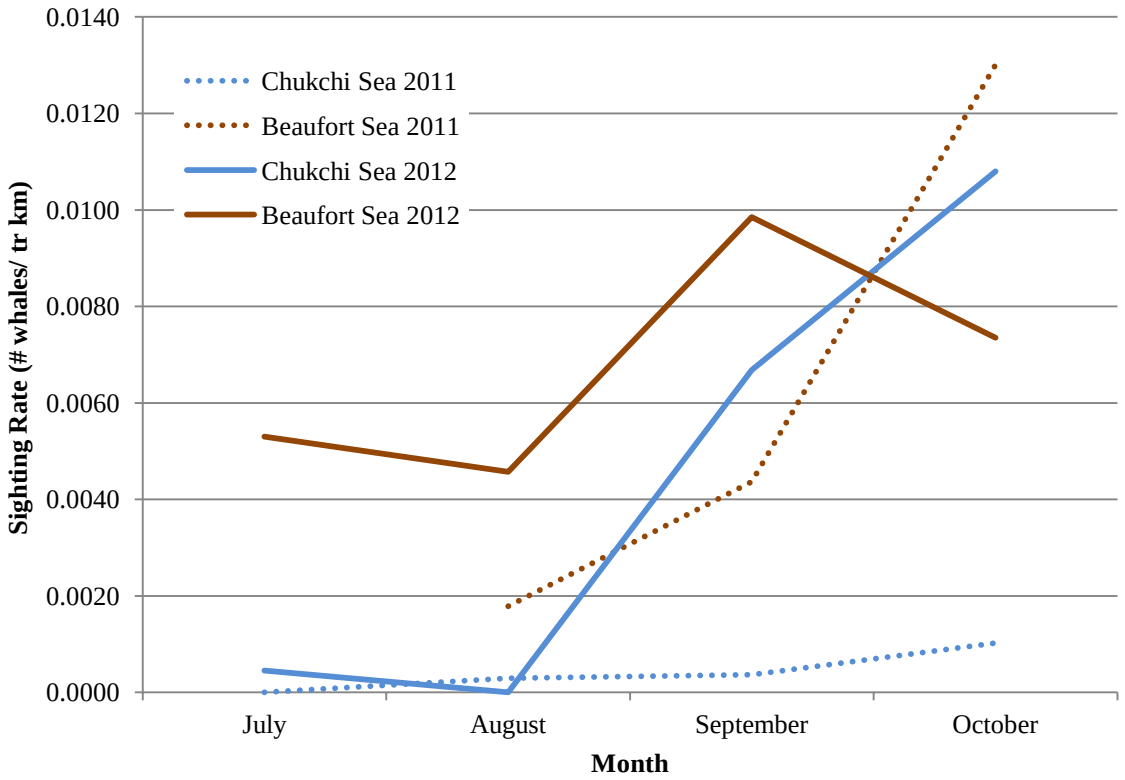


Figure 39. ASAMM monthly sighting rates (# whales per transect km) of bowhead whales in the northeastern Chukchi and western Beaufort Seas, 2011 and 2012.

Bowhead whale distribution in the northeastern Chukchi Sea in summer was similar to that observed in past years – relatively few scattered sightings, mainly nearshore. Results from fall 2012 were surprising, particularly the number of whales seen. Sighting rates for September and October 2012 in the northeastern Chukchi Sea were an order of magnitude higher compared with the same time periods in 2011 (Figure 39), when transect survey effort was most similar. The distribution of bowhead whales in 2012 overlays the distribution of bowhead whales observed in previous years with light sea ice cover, but sightings were far more numerous.

Gray whale distribution in 2012 was similar to that seen in recent past years (2008-2011) with a few exceptions. Gray whales were seen east of Point Barrow somewhat regularly, which has been documented during other aerial surveys (e.g., Goetz et al. 2011) but not previously on ASAMM. The number of gray whale calves recorded was almost four times higher than the highest annual count in any previous year, and sighting rates of calves were three times higher than any previous year (Brower et al. 2013). Although some of the calves seen 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 2012 also suggest that 2012 was a relatively good year for gray whale calves (http://swfsc.noaa.gov/textblock.aspx?Division=PRD&ParentMenuId=211&id=16464). Finally, aggregations of gray whales were not seen offshore west of Point Hope as they were in 1982-

1991 and 2008-2010; few gray whales were seen in that area in 2011. Conversely, cetaceans found in the offshore area west of Point Hope in 2012 included bowhead, humpback, fin, minke and killer whales.

Beluga distribution in the western Beaufort Sea was over the continental slope, regardless of season. Belugas were once again relatively scarce in the ASAMM study area in fall, similar to observations from 2007-2010 (Clarke et al. 2011a, 2011b, 2011c, 2011d). The lack of belugas in the study area in fall may be due to the timing of the migration relative to when ASAMM surveys are conducted. Data from two passive acoustic recorders located in the northeastern Chukchi Sea, offshore of Icy Cape, Alaska (the "inshore" recorder was ~64 km from shore, and the "offshore" recorder was ~193 km from shore), from September 2010 to June 2011, detected only sporadic beluga vocalizations during the fall prior to a strong peak in late November on the inshore recorder and a weak peak in late November on the offshore recorder (Garland et al. 2013). Alternatively, or in conjunction, the absence of beluga sightings may reflect a migration that occurs farther north than the ASAMM (or any other project with marine mammal observers) study area. Satellite tag data from both the eastern Chukchi Sea and Beaufort Sea beluga stocks indicate that belugas venture much farther north than 72°N (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 is bifurcated, with some belugas heading through Barrow Canyon and continuing southwesterly while others head west-northwest toward the Chukotka coast before heading south (Clarke et al. 1993).

Marine mammal data collected during the 2012 ASAMM field effort is vital in contributing to the overall understanding of marine mammal ecosystems in the northeastern 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 during ASAMM 2012 relating to unique situations and other species.

Several cetacean species (humpback, fin, minke and killer whales) not commonly observed in the Alaskan Arctic were seen more frequently in 2012, all in the northeastern Chukchi Sea. The majority of these sightings occurred in August and September, when survey effort in 2012 was equivalent to effort in those months in 2009-2011. Several of these species have been occasionally seen during other aerial or vessel surveys, heard via passive acoustic monitoring, or observed locally by villagers, but the frequency with which they were seen during broad-scale ASAMM surveys was unprecedented. These sightings reinforce the possibility of species expanding (or perhaps re-inhabiting) their range in the Arctic, and serve as reminders that every cetacean sighting needs to be positively verified to species.

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). The 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 (1982-2012) should be interpreted with caution because different ecological mechanisms could have been acting at different time periods within the duration of the study.

Huntington (2009) identified six areas of human influence that will pose threats to 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 concluded that 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 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 web site maintained by NMML (http://www.afsc.noaa.gov/nmml/cetacean/bwasp/index.php).

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 1982-2012), 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; Stafford et al. 2013).

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APPENDIX A: 2012 ICE CONCENTRATION MAPS

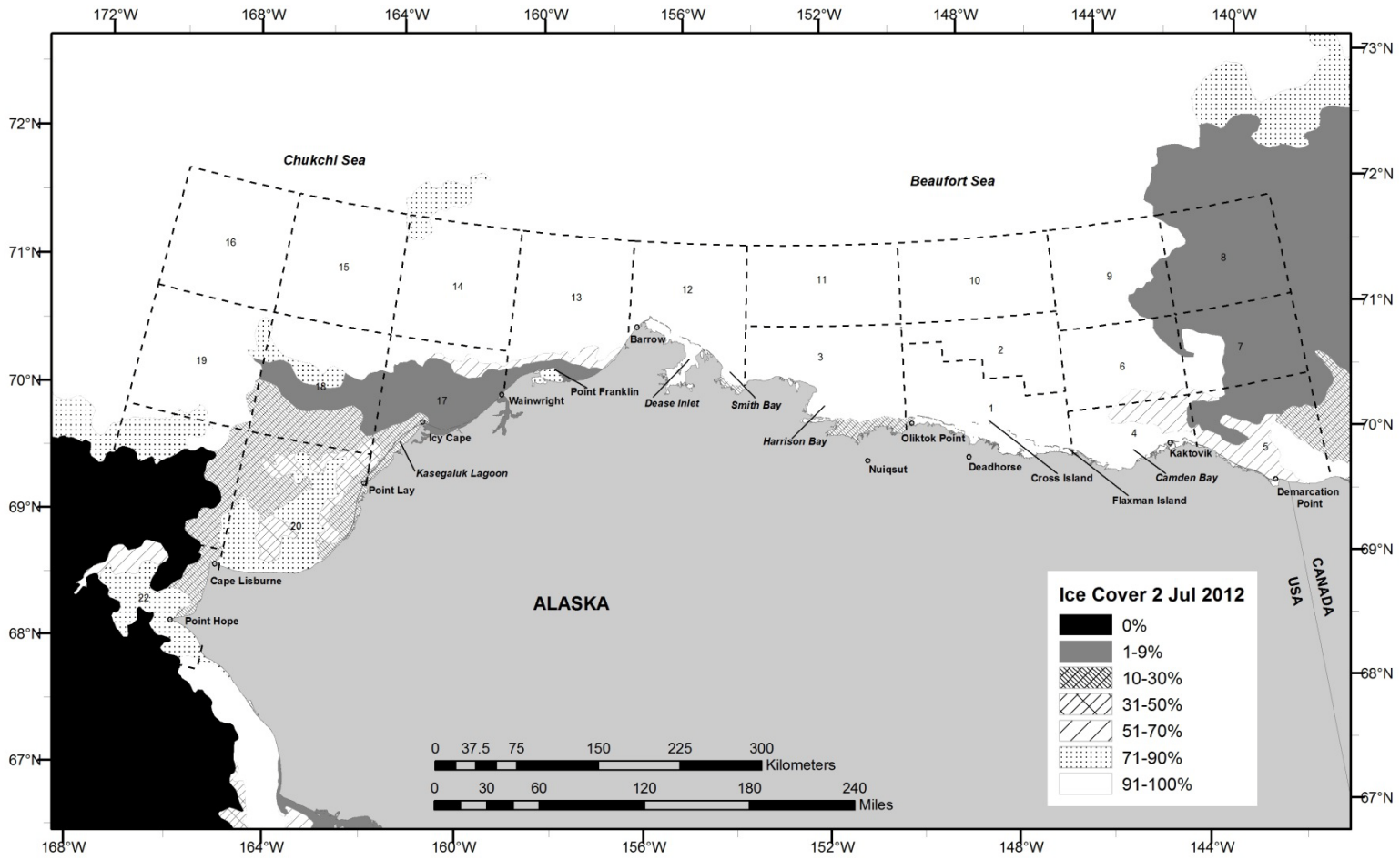

Figure A-1. Ice concentrations in the northeastern Chukchi and western Beaufort Seas, 2 July 2012. Sea ice information was obtained from the National Ice Center (http://www.natice.noaa.gov).

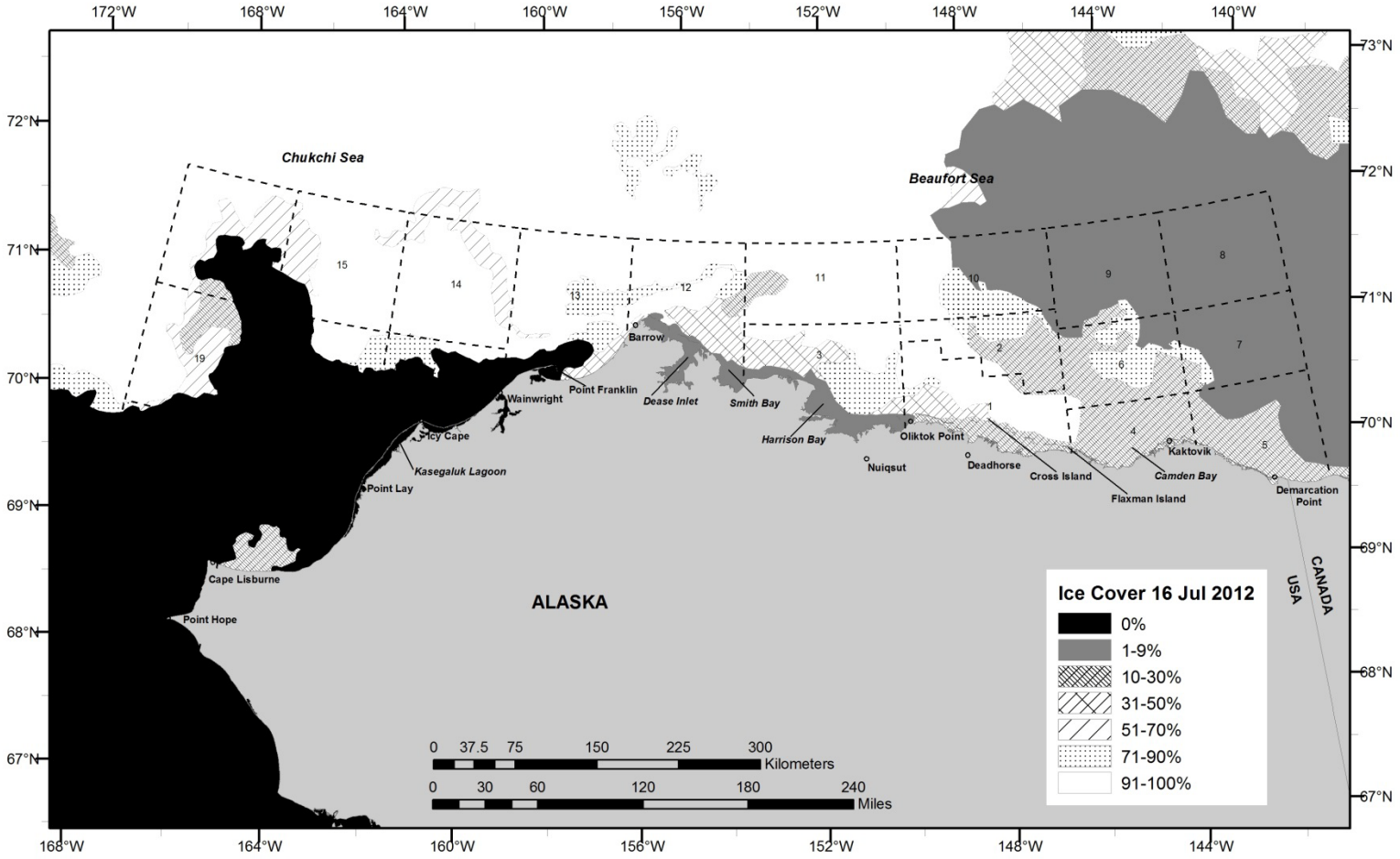

Figure A-2. Ice concentrations in the northeastern Chukchi and western Beaufort Seas, 16 July 2012. Sea ice information was obtained from the National Ice Center (http://www.natice.noaa.gov).

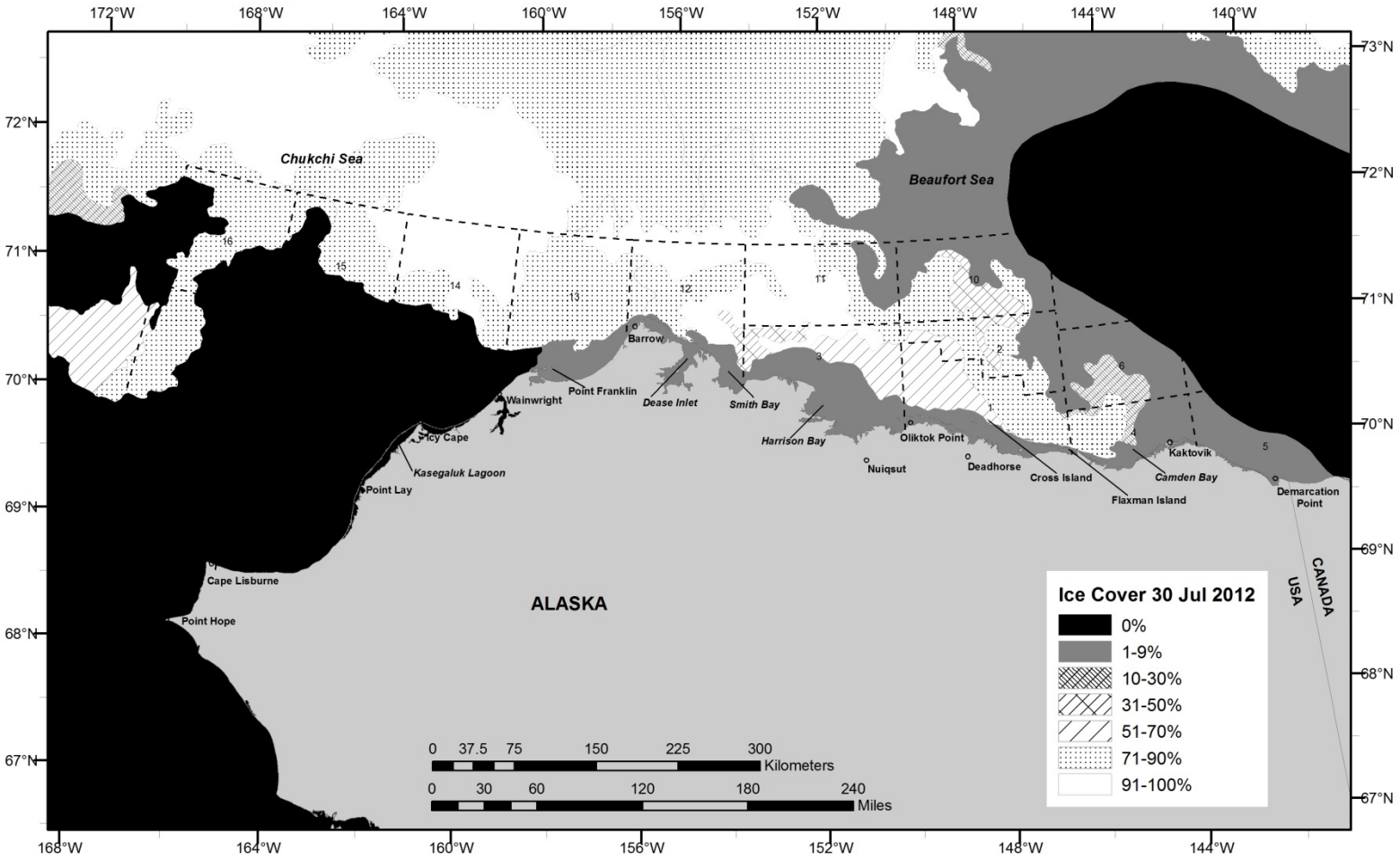

Figure A-3. Ice concentrations in the northeastern Chukchi and western Beaufort Seas, 30 July 2012. Sea ice information was obtained from the National Ice Center (http://www.natice.noaa.gov).

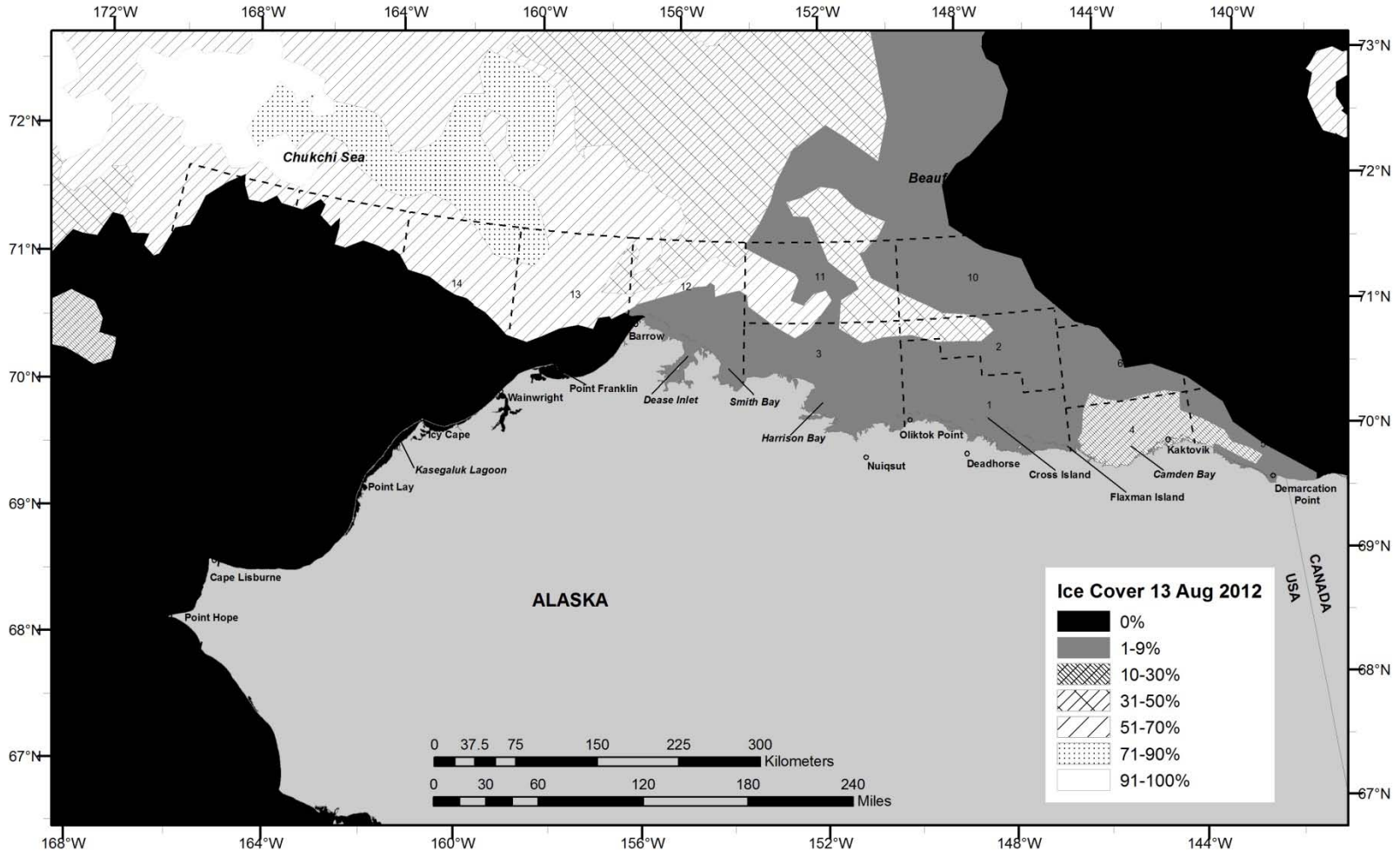

Figure A-4. Ice concentrations in the northeastern Chukchi and western Beaufort Seas, 13 August 2012. Sea ice information was obtained from the National Ice Center (http://www.natice.noaa.gov).

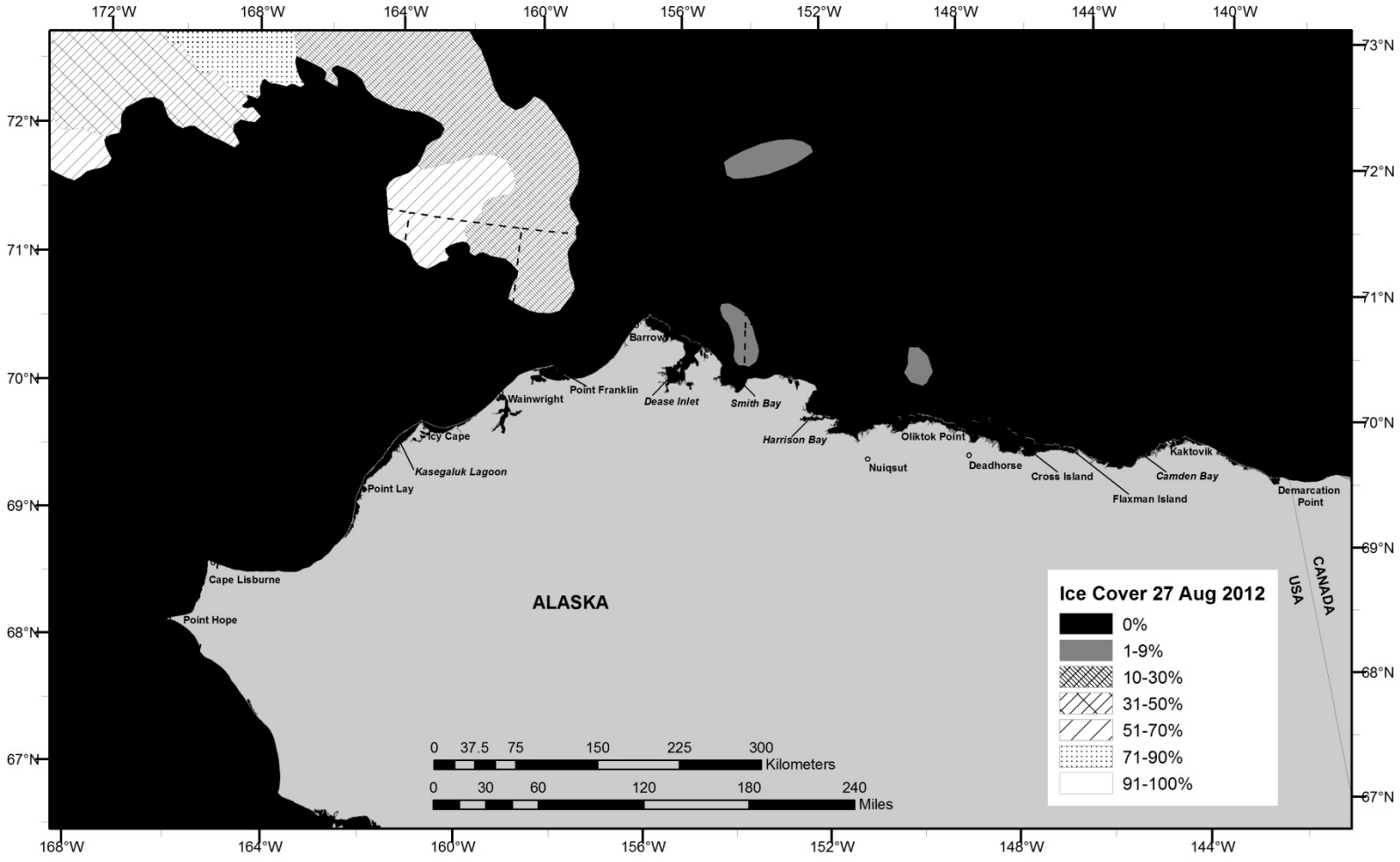

Figure A-5. Ice concentrations in the northeastern Chukchi and western Beaufort Seas, 27 August 2012. Sea ice information was obtained from the National Ice Center (http://www.natice.noaa.gov).

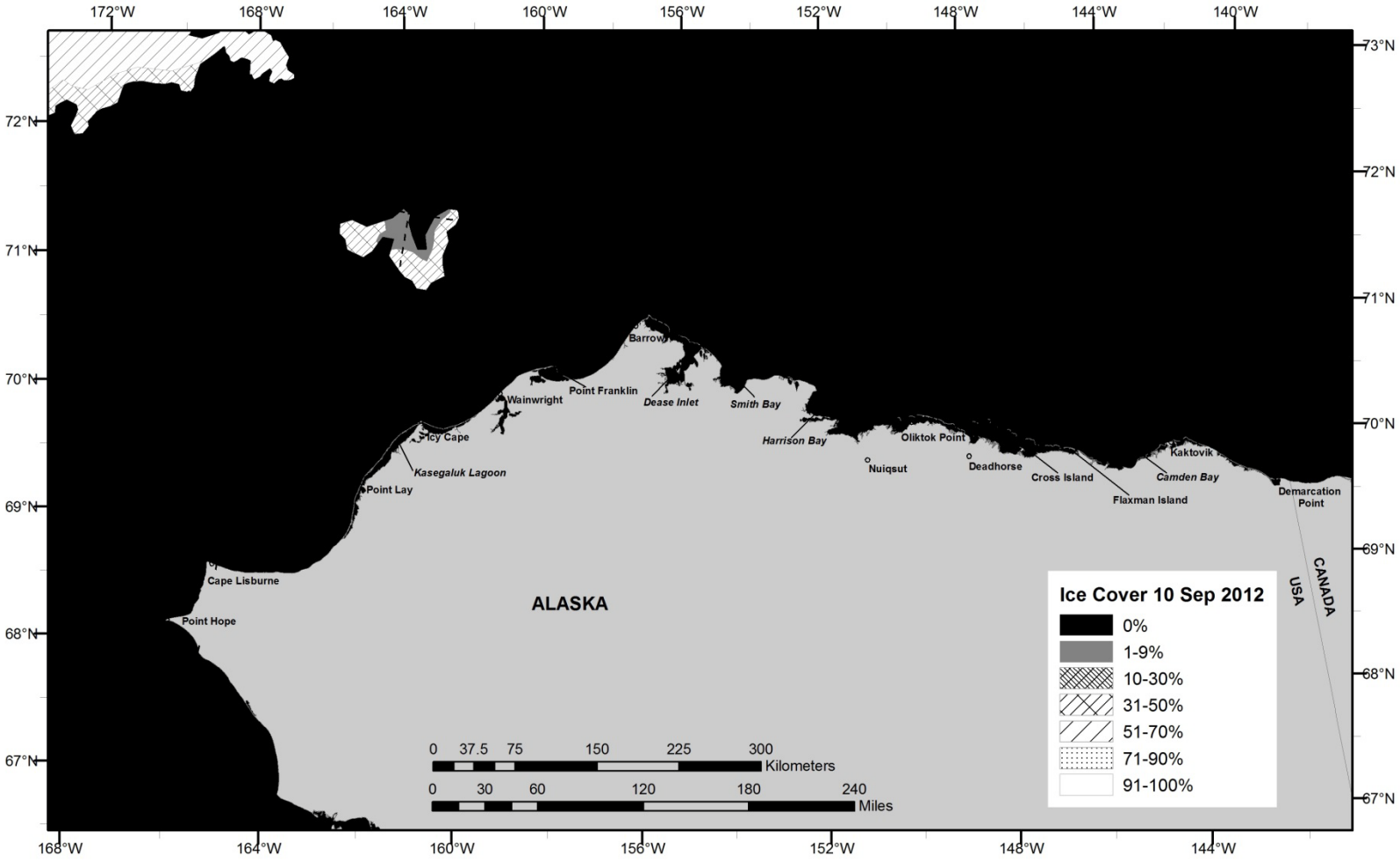

Figure A-6. Ice concentrations in the northeastern Chukchi and western Beaufort Seas, 10 September 2012. Sea ice information was obtained from the National Ice Center (http://www.natice.noaa.gov).

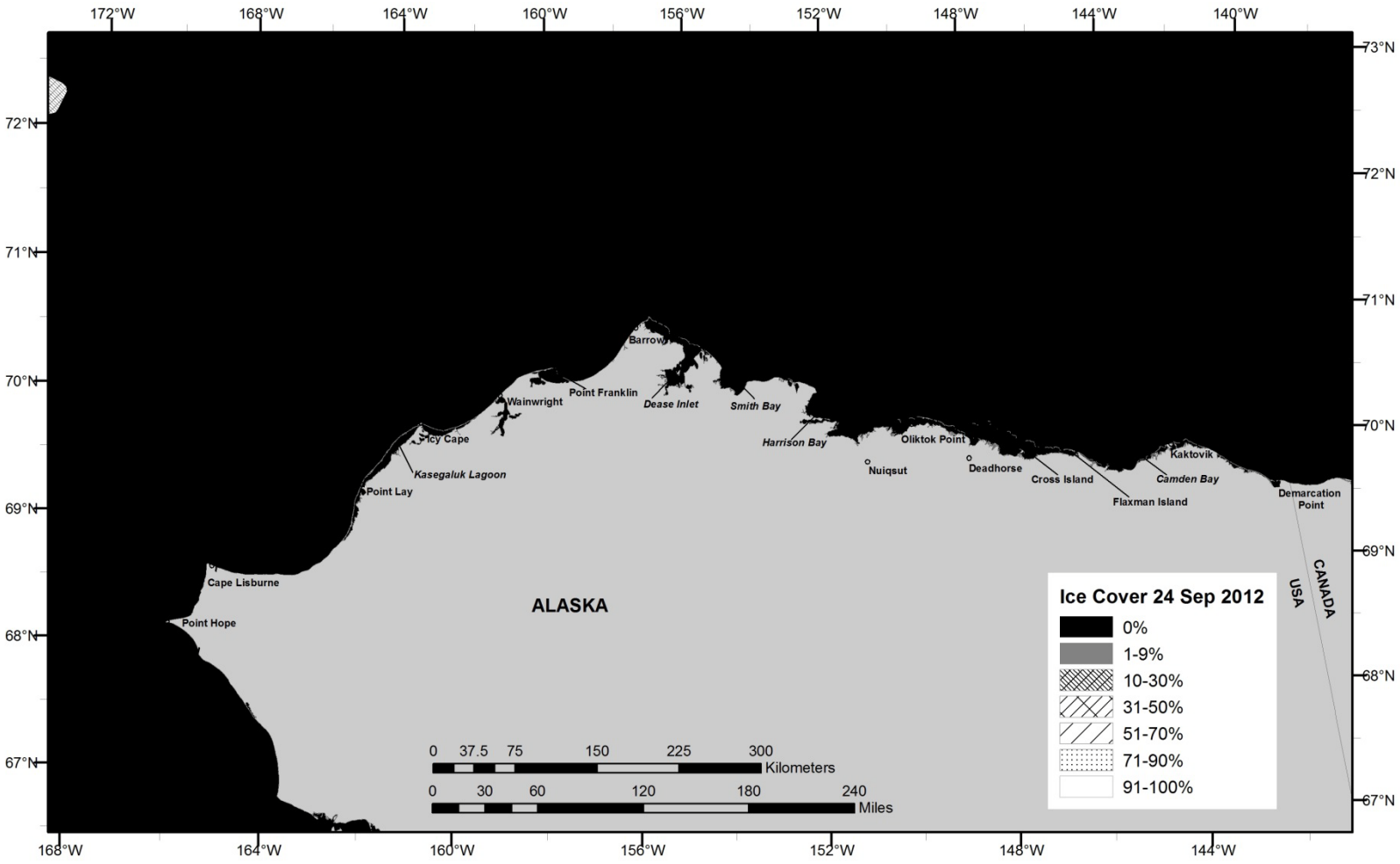

Figure A-7. Ice concentrations in the northeastern Chukchi and western Beaufort Seas, 24 September 2012. Sea ice information was obtained from the National Ice Center (http://www.natice.noaa.gov).

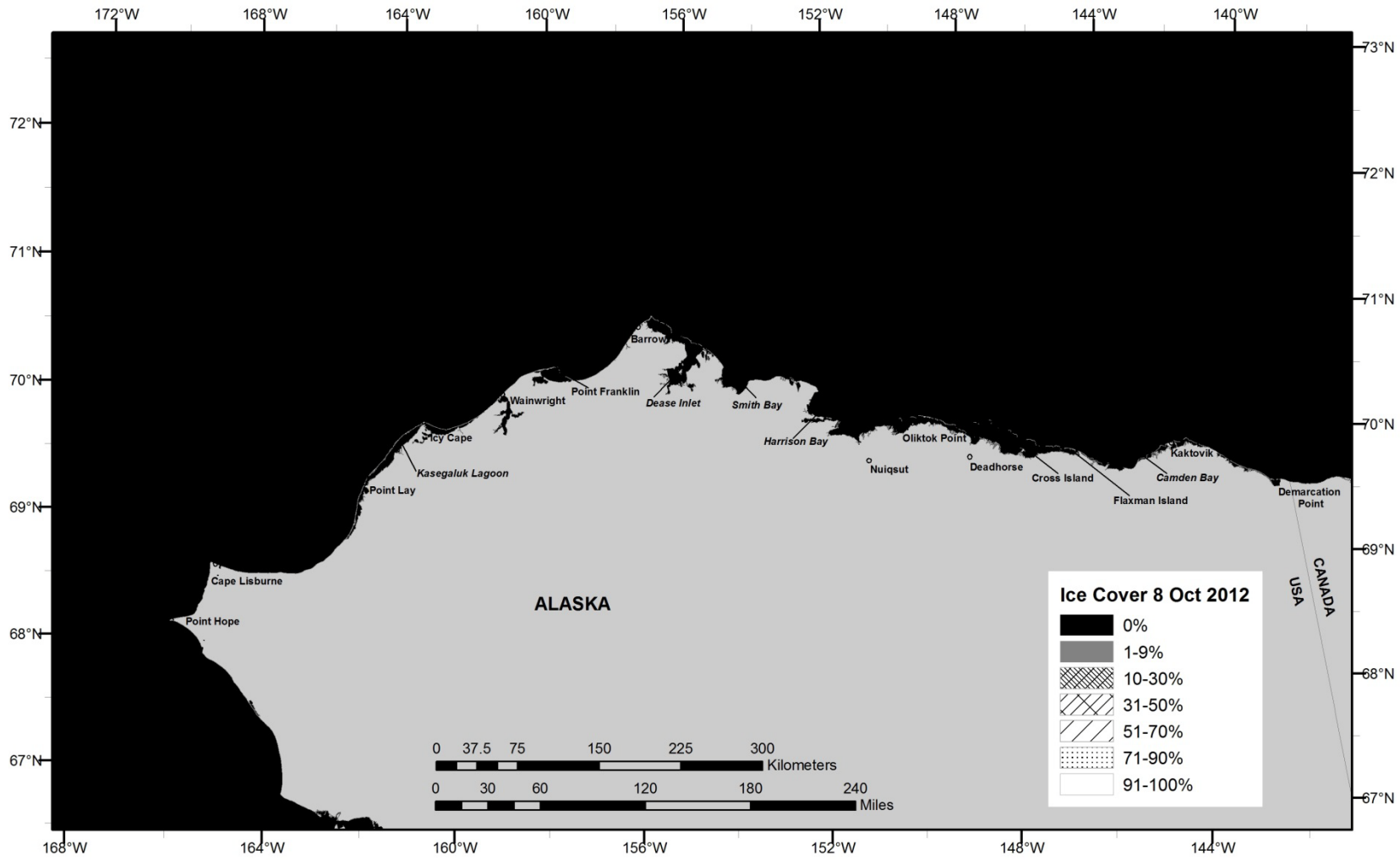

Figure A-8. Ice concentrations in the northeastern Chukchi and western Beaufort Seas, 8 October 2012. Sea ice information was obtained from the National Ice Center (http://www.natice.noaa.gov).

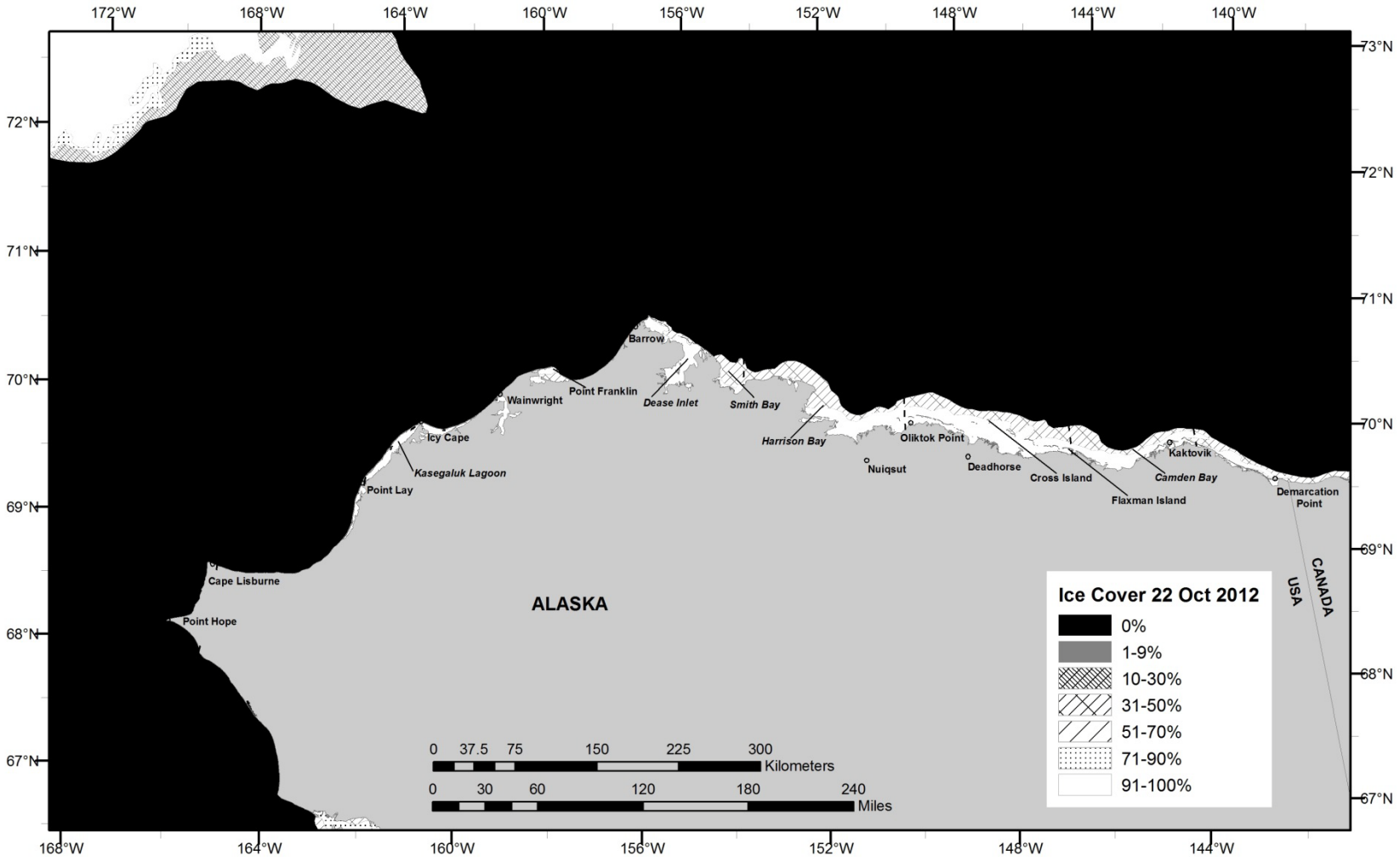

Figure A-9. Ice concentrations in the northeastern Chukchi and western Beaufort Seas, 22 October 2012. Sea ice information was obtained from the National Ice Center (http://www.natice.noaa.gov).

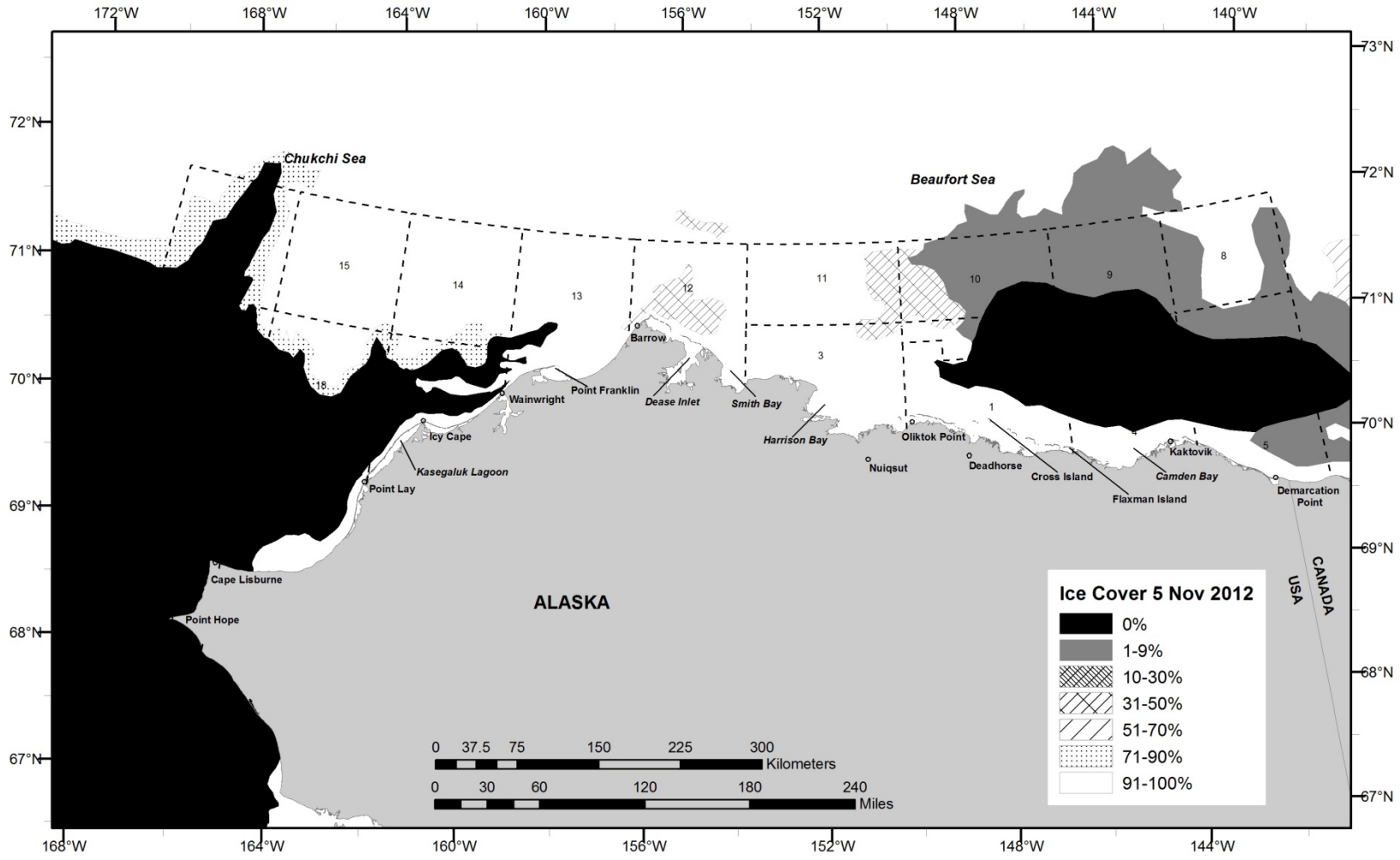

Figure A-10. Ice concentrations in the northeastern Chukchi and western Beaufort Seas, 5 November 2012. Sea ice information was obtained from the National Ice Center (http://www.natice.noaa.gov).

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APPENDIX B: 2012 DAILY FLIGHT SUMMARIES

30 June 2012, Flight 301

Flight was a survey of beluga transects 20 and 22 and a coastal transect from east of Cape Lisburne to just west of Point Franklin. Survey conditions were excellent, with partly cloudy to overcast skies, sea state Beaufort 1-2, and visibility 5-10 km. Ice cover was 1-60% broken floe sea ice in the area surveyed. One bowhead and several beluga groups were seen very close to shore. Beluga swim direction was mostly northerly, and most groups were swimming noticeably fast. Walruses, including several groups hauled out on ice, were also seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
301	6/30/12 12:04	69.536	163.175	beluga	swim	20	0	20
301	6/30/12 12:08	69.561	163.210	beluga	swim	100	3	20
301	6/30/12 12:24	69.977	162.732	beluga	swim	2	1	17
301	6/30/12 12:24	69.988	162.712	beluga	swim	1	0	17
301	6/30/12 12:25	70.015	162.708	bowhead whale	swim	1	0	17
301	6/30/12 12:26	70.011	162.756	beluga	swim	25	2	17
301	6/30/12 12:33	70.035	162.644	beluga	swim	2	0	17
301	6/30/12 12:33	70.059	162.606	beluga	swim	125	9	17

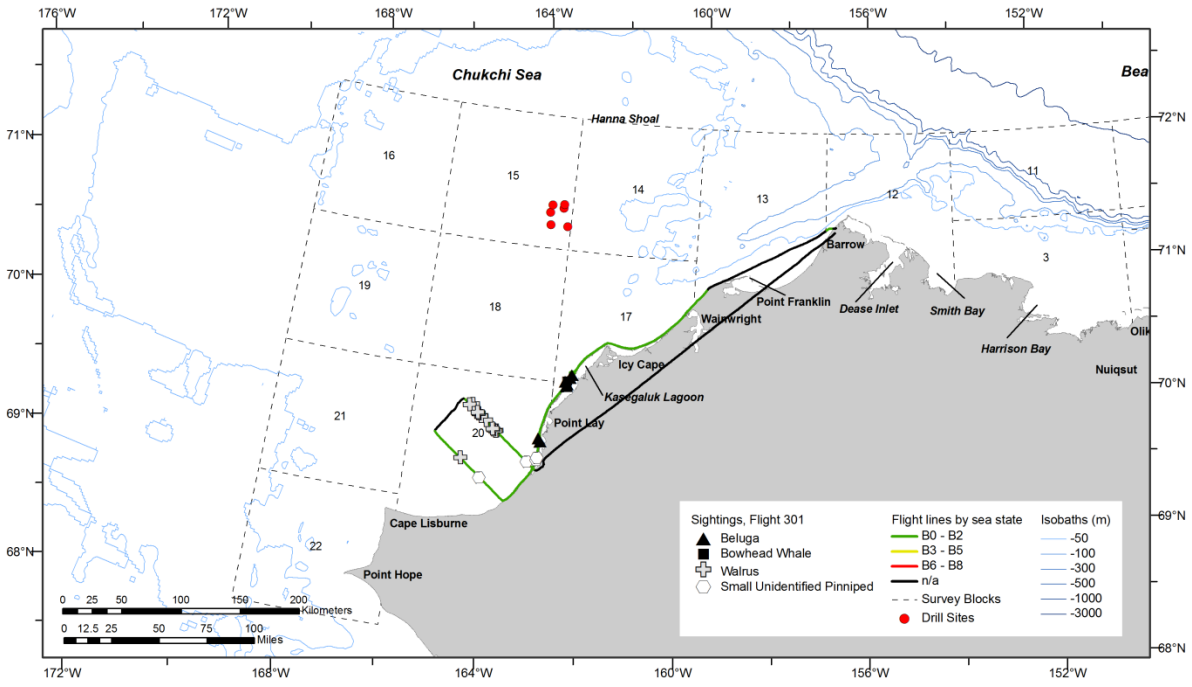

Figure B-1. ASAMM Flight 301 survey track, depicted by sea state, and all sightings.

1 July 2012, Flight 302

Flight was a survey of beluga transects 12 and 14. Survey conditions were fair, with partly cloudy skies and sea state Beaufort 1-3. Visibility on transect 12 was 5-10 km, but low lying fog reduced visibility to <2 km for most of transect 14. Ice cover was 1-90% broken floe sea ice in the area surveyed. Gray whales, including a cow-calf pair, an unidentified cetacean, and walruses were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
302	7/1/12 15:31	70.604	161.441	unid cetacean	swim	1	0	17
302	7/1/12 15:38	70.704	161.800	gray whale	feed	1	0	17
302	7/1/12 15:40	70.713	161.796	gray whale	feed	1	0	17
302	7/1/12 15:47	70.783	162.018	gray whale	feed	2	1	17

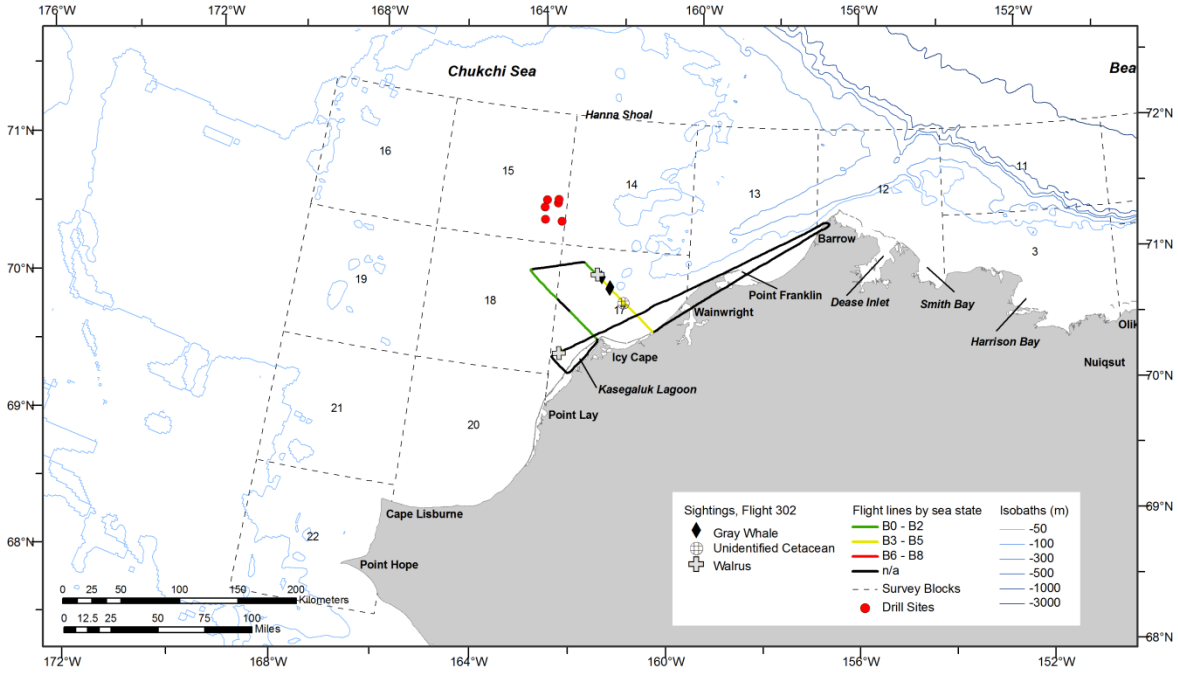

Figure B-2. ASAMM Flight 302 survey track, depicted by sea state, and all sightings.

2 July 2012, Flight 303

Flight was a survey of beluga transects 21, 23 and 25, and a coastal transect from east of Cape Lisburne to Point Lay. Survey conditions were excellent, with partly cloudy skies, sea state Beaufort 1-3, and visibility 3-10 km. Ice cover was 1-80% broken floe sea ice in the area surveyed. One bowhead whale, one gray whale, unidentified cetaceans, belugas, walruses, a bearded seal, and small unidentified pinnipeds were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
303	7/2/12 13:08	69.567	165.438	unid cetacean	swim	2	0	20
303	7/2/12 13:09	69.526	165.503	gray whale	swim	1	0	20
303	7/2/12 13:51	68.871	165.303	bowhead whale	swim	1	0	20
303	7/2/12 14:43	68.999	163.962	unid cetacean	.	1	0	20
303	7/2/12 14:50	69.091	163.677	beluga	swim	20	0	20

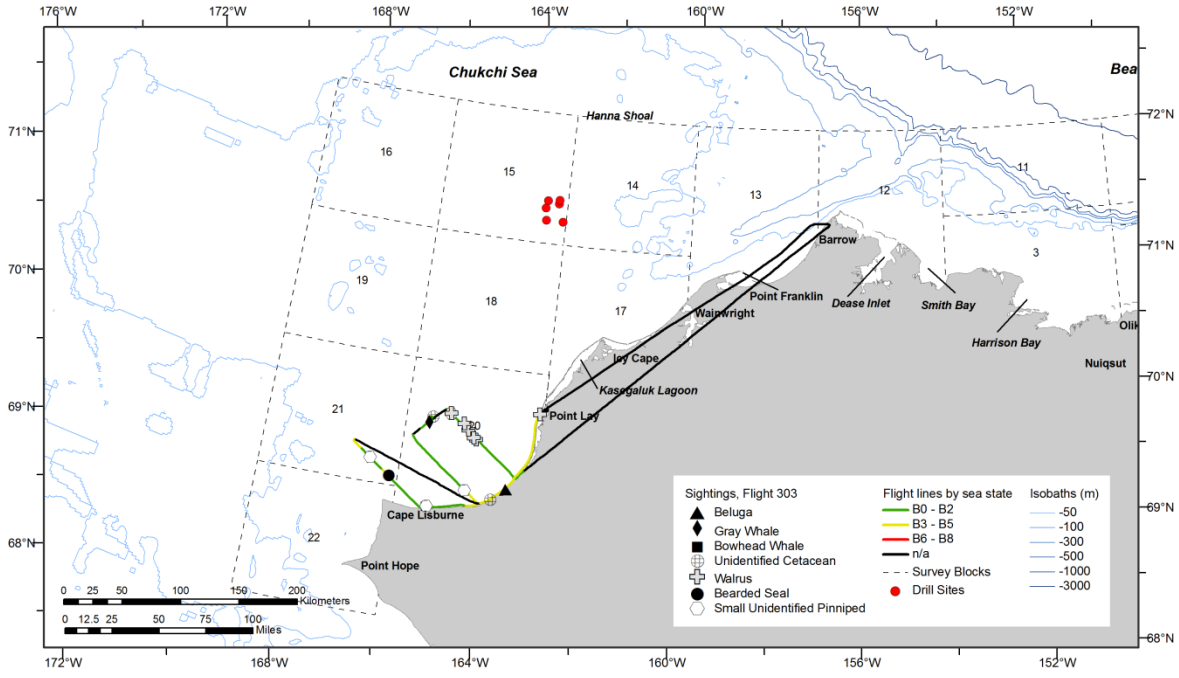

Figure B-3. ASAMM Flight 303 survey track, depicted by sea state, and all sightings.

3 July 2012, Flight 304

Flight was a survey of the coastal transect from Wainwright to east of Icy Cape. Survey conditions were poor, with widespread low lying fog impeding visibility, and sea state Beaufort 5-7. Ice cover was <1% broken floe sea ice in the area surveyed. Two groups of belugas were seen near Kasegaluk Lagoon east of Icy Cape. Belugas at the mouth of the lagoon were milling and appeared to be rubbing on the bottom in the shallows. Belugas outside the lagoon were also milling, and there appeared to be significant mixing between the two groups. Belugas were not seen inside the lagoon itself. Several beluga calves were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
304	7/3/12 16:20	70.309	161.336	beluga	mill	150	15	17
304	7/3/12 16:23	70.295	161.304	beluga	mill	250	50	17

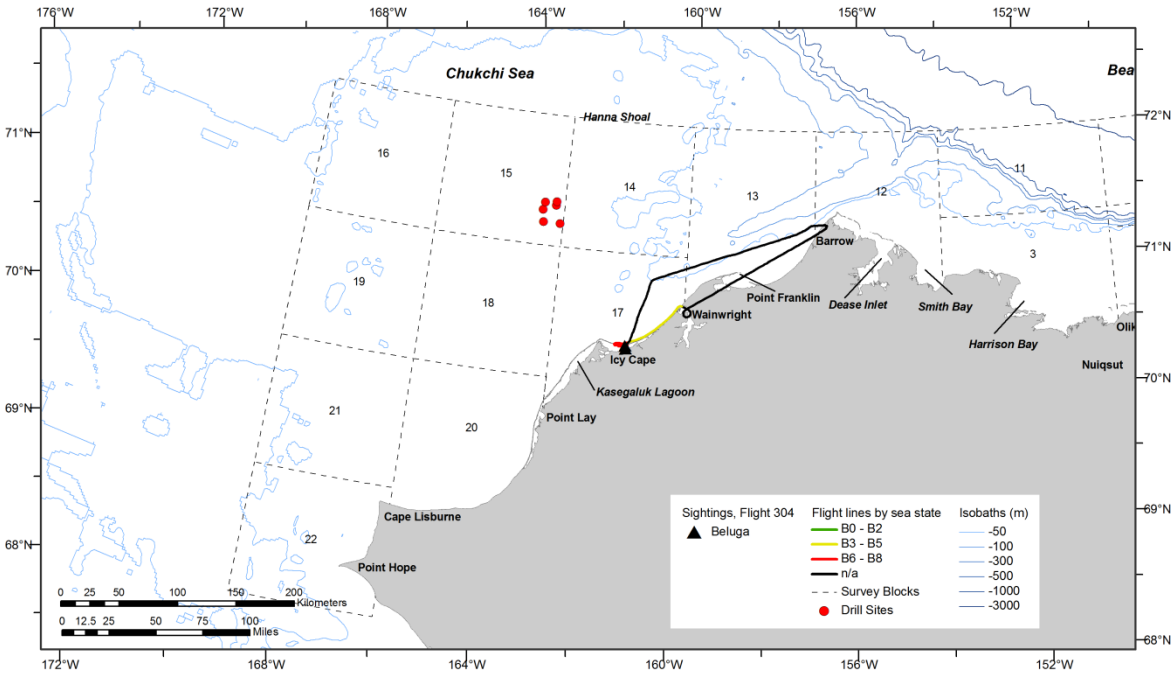

Figure B-4. ASAMM Flight 304 survey track, depicted by sea state, and all sightings.

4 July 2012, Flight 201

Flight was a survey of transect 2, and partial transects 4, 6, and 8. Survey conditions were fair with clear skies, visibility <1-10 km with patches of fog impeding visibility, and sea state Beaufort 0-4. Ice cover was 15-99% broken floe sea ice in the area surveyed. One unidentified cetacean, walruses, unidentified pinnipeds, and small unidentified pinnipeds were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
201	7/4/12 12:30	71.328	159.645	unid cetacean	swim	1	0	13

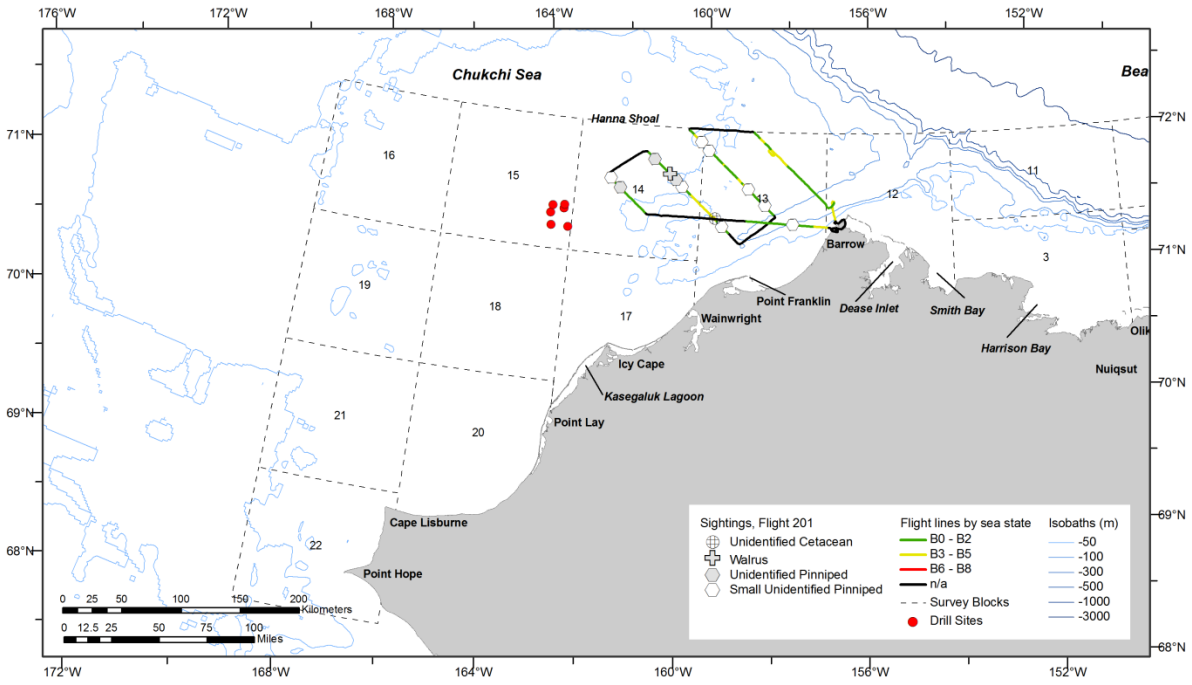

Figure B-5. ASAMM Flight 201 survey track, depicted by sea state, and all sightings.

5 July 2012, Flight 202

Flight was a survey of partial transects 10 and 12. Survey conditions were fair with clear skies, visibility <1-10 km with patches of fog, and sea state Beaufort 1-6. Fog prevented completion of offshore ends of transects. Ice cover was 0-98% broken floe sea ice in the area surveyed. One beluga, gray whales, unidentified cetaceans, walruses in open water and hauled out on ice, and small unidentified pinnipeds were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
202	7/5/12 10:19	70.603	160.370	beluga	swim	1	0	17
202	7/5/12 10:19	70.607	160.380	gray whale	feed	1	0	17
202	7/5/12 10:20	70.609	160.440	gray whale	feed	1	0	17
202	7/5/12 10:22	70.609	160.345	unid cetacean	swim	1	0	17
202	7/5/12 10:23	70.607	160.405	gray whale	feed	2	0	17
202	7/5/12 10:25	70.612	160.253	gray whale	feed	3	0	17
202	7/5/12 10:30	70.691	160.606	gray whale	feed	3	0	17
202	7/5/12 10:39	70.746	160.791	gray whale	feed	3	0	17
202	7/5/12 10:40	70.757	160.705	gray whale	feed	5	0	17
202	7/5/12 10:44	70.781	160.916	unid cetacean	.	1	0	17
202	7/5/12 10:59	70.957	161.542	unid cetacean	swim	1	0	17
202	7/5/12 12:50	70.651	162.048	gray whale	feed	1	0	17
202	7/5/12 12:54	70.572	161.765	gray whale	.	1	0	17

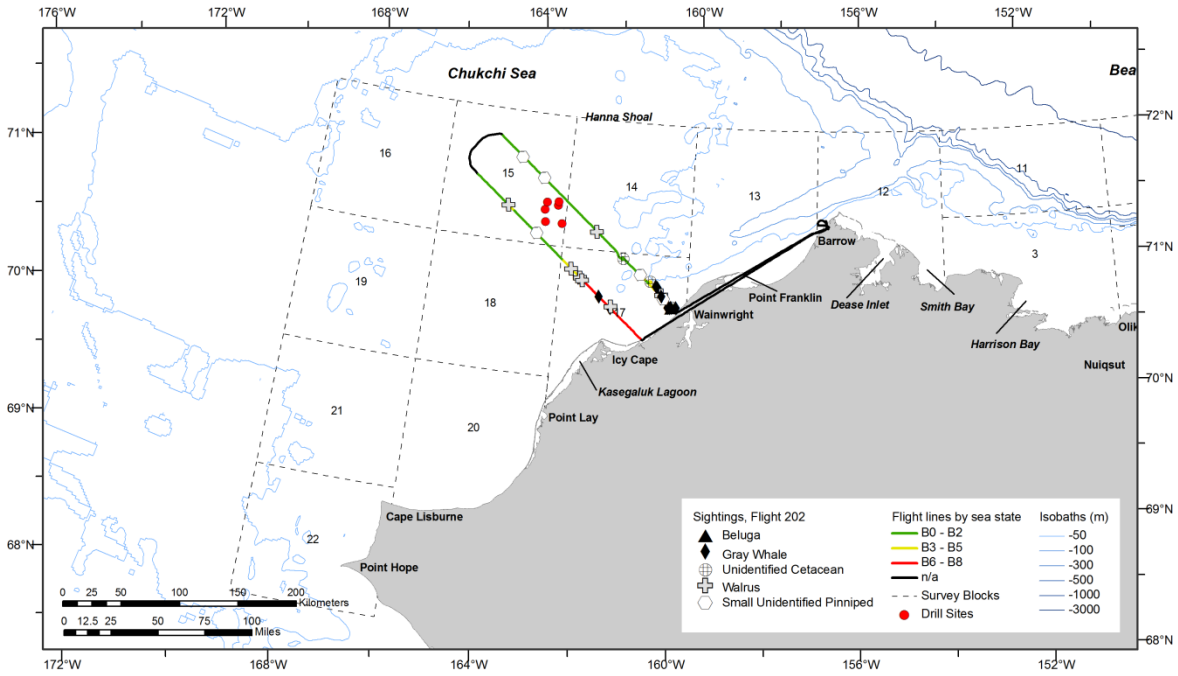

Figure B-6. ASAMM Flight 202 survey track, depicted by sea state, and all sightings.

6 July 2012, Flight 305

Flight was a survey of beluga transects 13, 16, 18 and 19, and the coastal transect from east of Cape Lisburne to south of Wainwright. Survey conditions were excellent in the southern part of the study area (south of Point Lay), but very poor north of Point Lay where high sea states (Beaufort 5-6) and widespread low lying fog curtailed surveying. Ice cover was 0-20% broken floe sea ice in the area surveyed. Sightings included one bowhead whale, four gray whales, including one calf, several beluga groups, one large (~500 animals) walrus group on ice and a single swimming walrus, and several small unidentified pinnipeds. All belugas were seen along the coastal transect, including a large group at 11-mile Pass north of Point Lay and two groups near northern Kasegaluk Lagoon east of Icy Cape. Belugas near both passes were milling and appeared to be rubbing on the bottom and feeding. Belugas were well within Kasegaluk Lagoon east of Icy Cape. Several beluga calves were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
305	7/6/12 10:44	70.697	162.615	gray whale	feed	2	1	17
305	7/6/12 11:59	69.200	163.486	beluga	swim	40	2	20
305	7/6/12 13:15	69.908	162.861	beluga	mill	225	0	17
305	7/6/12 13:27	70.174	162.411	gray whale	swim	1	0	17
305	7/6/12 13:33	70.318	161.958	bowhead whale	feed	1	0	17
305	7/6/12 13:42	70.304	161.378	gray whale	feed	1	0	17
305	7/6/12 13:42	70.303	161.339	beluga	mill	150	7	17
305	7/6/12 13:47	70.286	161.314	beluga	feed	250	25	17
305	7/6/12 14:00	70.307	161.315	beluga	mill	20	0	17
305	7/6/12 14:01	70.304	161.314	beluga	swim	2	0	17

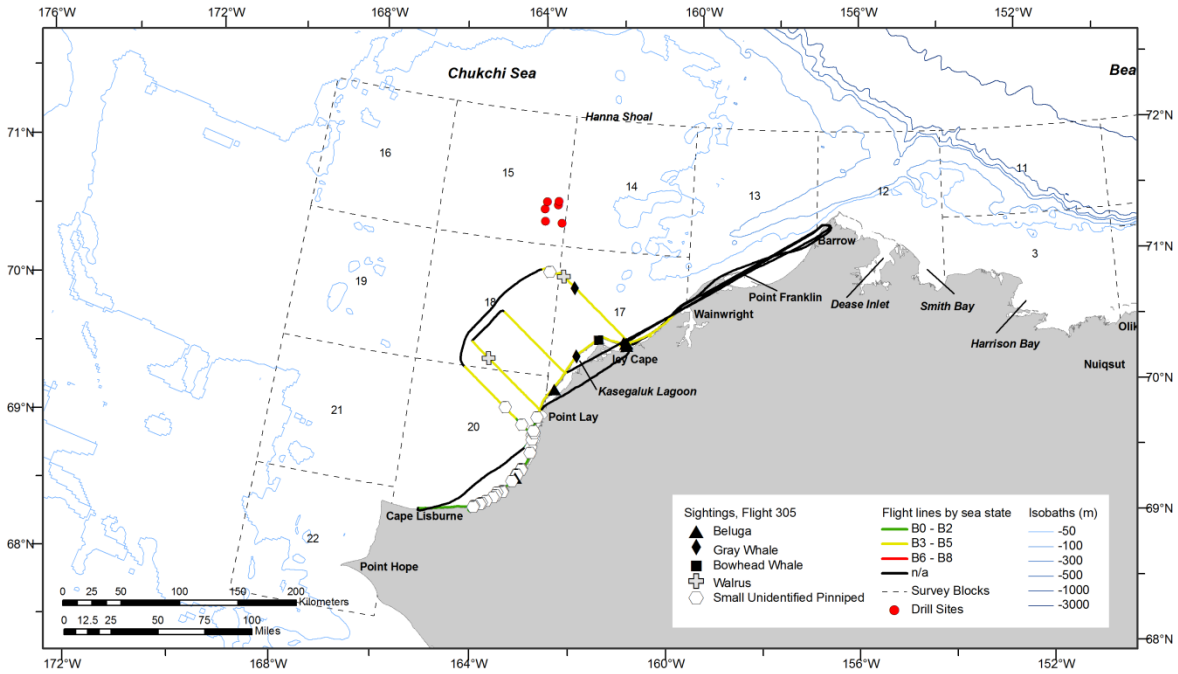

Figure B-7. ASAMM Flight 305 survey track, depicted by sea state, and all sightings.

6 July 2012, Flight 203

Flight was a survey of transects 1 and 19, and partial transects 3, 5, 7, and 13. Survey conditions were fair with clear to partly cloudy skies, <1-10 km visibility, and sea state Beaufort 0-6. Widespread fog prevented completion of offshore ends of the partial transects. Ice cover was 0-98% broken floe sea ice in the area surveyed. Gray whales, including four calves, walruses, and small unidentified pinnipeds were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
203	7/6/12 15:41	71.251	157.095	gray whale	feed	2	0	13
203	7/6/12 16:50	71.123	158.198	gray whale	feed	3	1	13
203	7/6/12 16:53	71.113	158.167	gray whale	feed	1	0	13
203	7/6/12 17:20	70.922	159.067	gray whale	feed	2	1	13
203	7/6/12 17:20	70.924	159.071	gray whale	feed	4	2	13
203	7/6/12 17:23	70.936	159.014	gray whale	swim	3	0	13

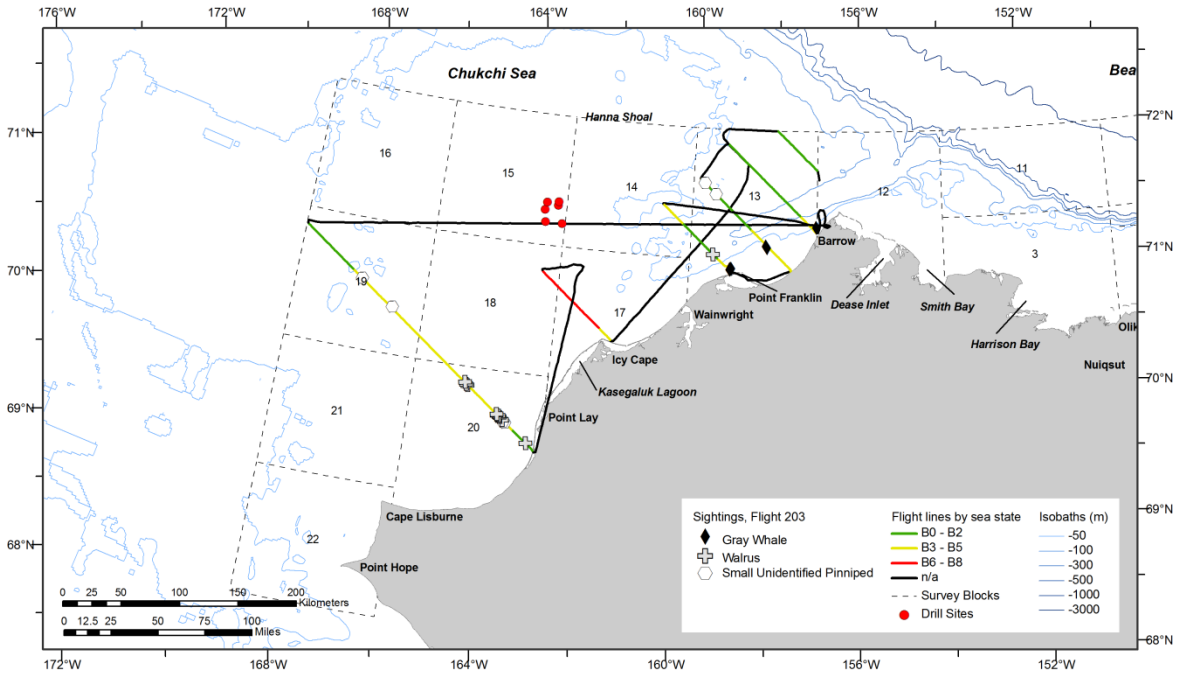

Figure B-8. ASAMM Flight 203 survey track, depicted by sea state, and all sightings.

8 July 2012, Flight 306

Flight was a survey of block 12 and areas north of block 12 to assess beluga distribution and abundance over the continental slope in the western Beaufort Sea. Survey conditions were excellent, with clear skies, 5-10 km visibility, and sea states of Beaufort 1-3. Ice cover was 65-90% broken floe sea ice in the area surveyed. Three bowhead whales, several beluga groups, and small unidentified pinnipeds were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
306	7/8/12 11:03	71.549	155.672	beluga	swim	1	0	12
306	7/8/12 11:25	72.222	155.863	beluga	swim	4	0	0
306	7/8/12 11:25	72.230	155.867	beluga	swim	2	0	0
306	7/8/12 11:25	72.234	155.868	beluga	swim	1	0	0
306	7/8/12 11:29	72.372	155.905	beluga	swim	1	0	0
306	7/8/12 12:11	71.769	155.189	beluga	swim	1	0	12
306	7/8/12 12:11	71.762	155.190	beluga	swim	3	0	12
306	7/8/12 12:16	71.567	155.191	bowhead whale	dive	1	0	12
306	7/8/12 12:17	71.550	155.172	bowhead whale	swim	1	0	12
306	7/8/12 12:17	71.552	155.166	bowhead whale	swim	1	0	12
306	7/8/12 13:07	71.857	154.435	beluga	swim	4	0	12
306	7/8/12 13:08	71.849	154.432	beluga	swim	15	0	12

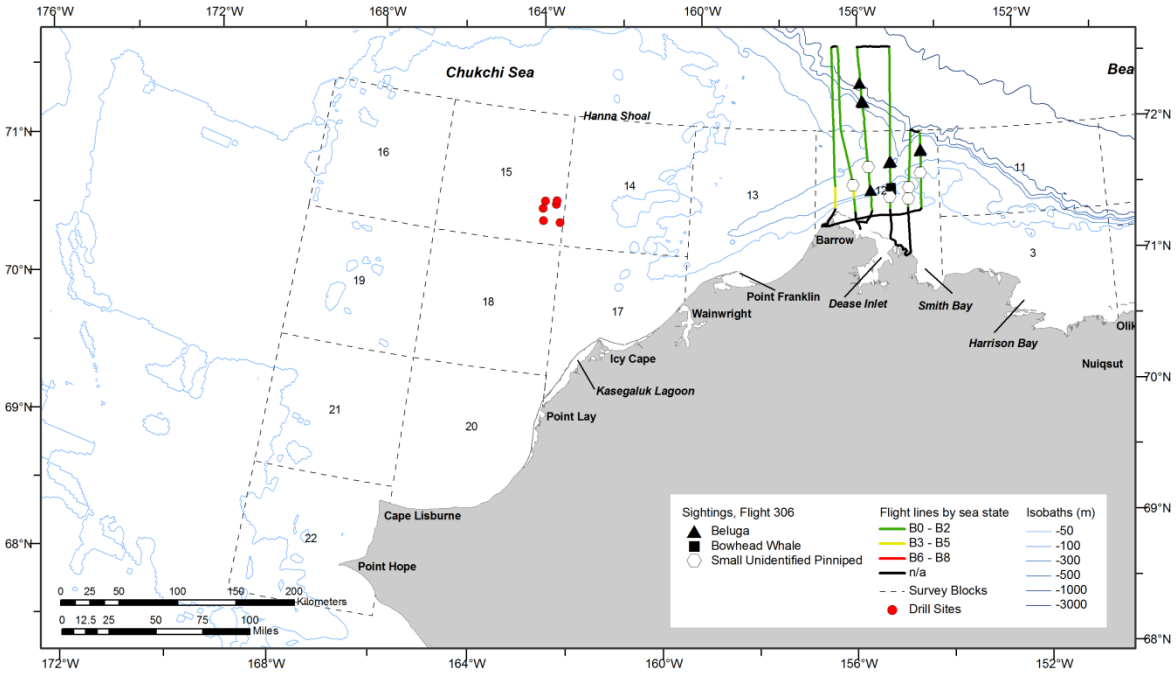

Figure B-9. ASAMM Flight 306 survey track, depicted by sea state, and all sightings.

8 July 2012, Flight 204

Flight was a survey of transects 9 and 11. Survey conditions were excellent with clear skies, 5-10 km visibility, and sea states of Beaufort 1-7 with higher sea states near shore in open water. Ice cover was 0-98% broken floe sea ice in the area surveyed. Gray whales, including one calf, walruses, and unidentified pinnipeds were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
204	7/8/12 12:56	70.585	161.021	gray whale	feed	3	1	17

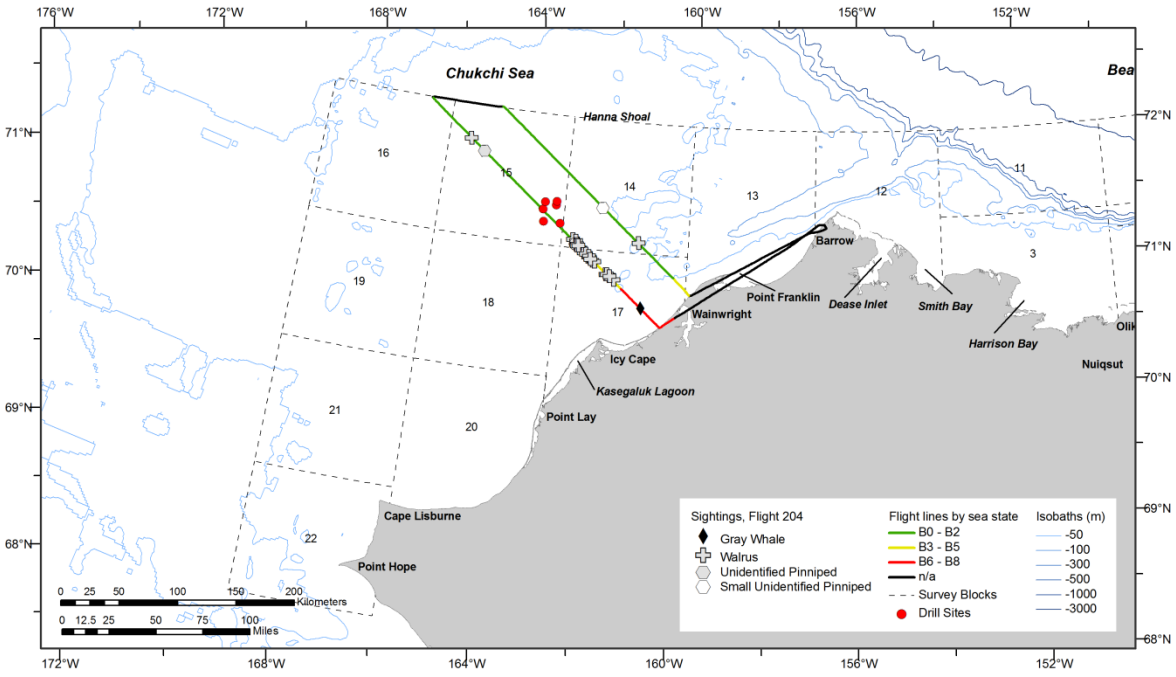

Figure B-10. ASAMM Flight 204 survey track, depicted by sea state, and all sightings.

10 July 2012, Flight 307

Flight was a survey of the coastal transect from Cape Lisburne to south of Icy Cape and a short segment between Barrow and Point Franklin. Survey conditions were excellent in the area surveyed with clear to partly cloudy skies; fog prevented surveying elsewhere. Visibility was <1-10 km, and sea states were Beaufort 1-3. Ice cover was 0-25% broken floe sea ice in the area surveyed. Sightings included several gray whales, including one calf, one beluga group, unidentified cetaceans, a small unidentified marine mammal, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
307	7/10/12 13:07	69.238	163.394	beluga	swim	27	1	20
307	7/10/12 13:28	69.881	162.912	gray whale	swim	1	0	17
307	7/10/12 13:36	69.995	162.692	small unid marine mammal	swim	1	0	17
307	7/10/12 14:36	71.153	157.098	gray whale	swim	4	1	13
307	7/10/12 14:37	71.183	157.164	unid cetacean	.	2	0	13
307	7/10/12 14:43	71.190	157.030	gray whale	feed	2	0	13
307	7/10/12 14:45	71.244	156.927	gray whale	swim	1	0	12
307	7/10/12 14:46	71.264	156.939	gray whale	feed	1	0	12
307	7/10/12 14:46	71.259	156.980	gray whale	feed	4	0	12

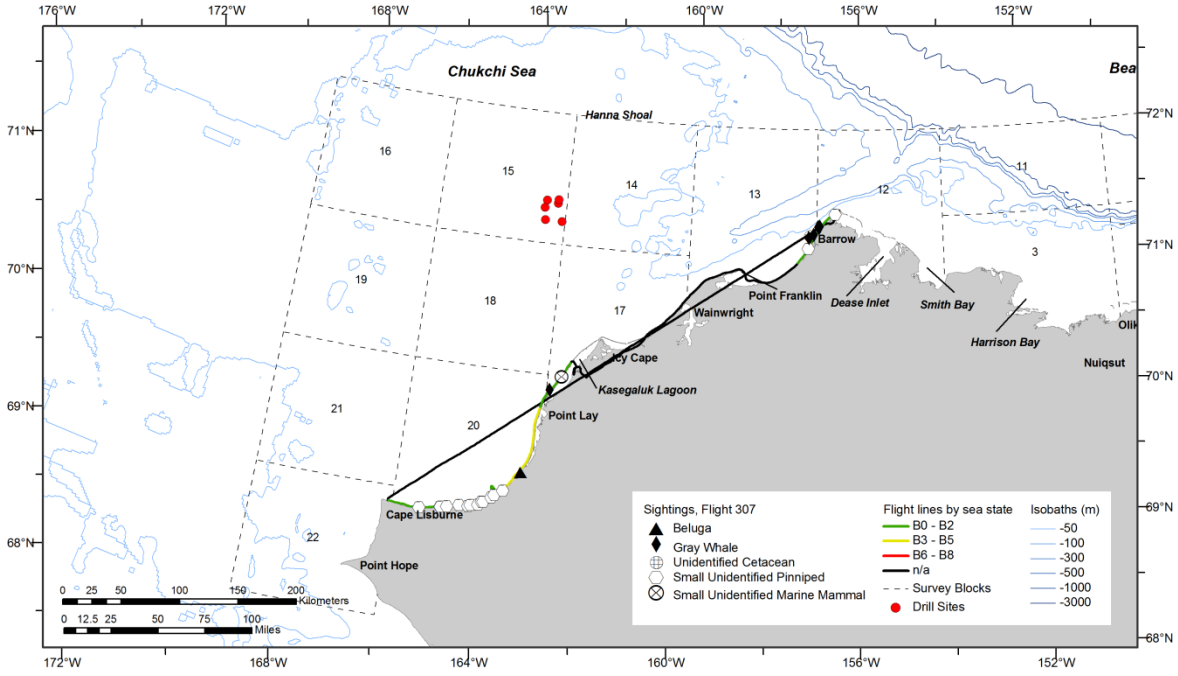

Figure B-11. ASAMM Flight 307 survey track, depicted by sea state, and all sightings

10 July 2012, Flight 205

Flight was a survey of transect 23 and partial transects 21 and 25. Survey conditions were good with clear to partly cloudy skies, <1-10 km visibility, and sea states of Beaufort 1-4. Extensive fog prevented completion of transect 21. Ice cover was 0-75% broken floe sea ice in the area surveyed. Bowhead whales were seen near and offshore of Cape Lisburne. Unidentified cetaceans, walruses, and unidentified pinnipeds were also seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
205	7/10/12 12:35	69.491	166.621	bowhead whale	swim	1	0	21
205	7/10/12 13:28	68.984	166.284	bowhead whale	swim	1	0	22
205	7/10/12 13:33	68.963	166.283	bowhead whale	rest	1	0	22
205	7/10/12 13:39	69.034	166.476	bowhead whale	swim	1	0	21
205	7/10/12 13:39	69.035	166.481	unid cetacean	swim	2	0	21

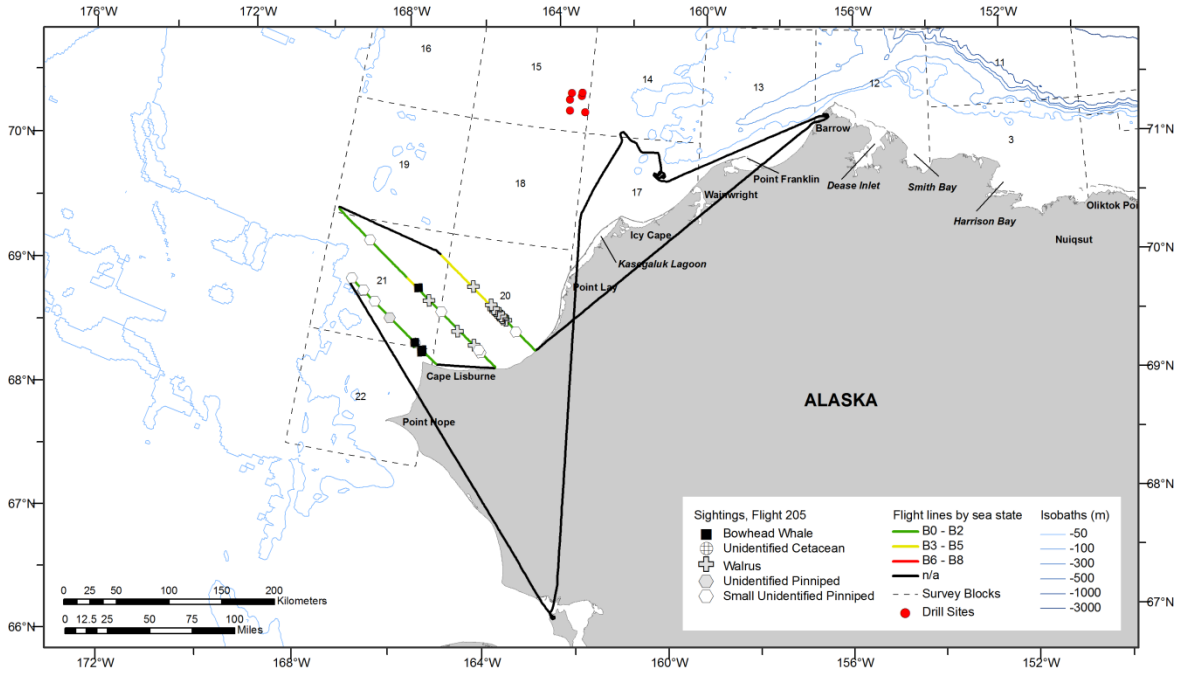

Figure B-12. ASAMM Flight 205 survey track, depicted by sea state, and all sightings.

11 July 2012, Flight 308

Flight was a survey of block 11 and areas north of block 11 to assess beluga distribution and abundance over the continental slope in the western Beaufort Sea. Survey conditions were excellent in the area surveyed with clear skies; fog prevented surveying elsewhere. Visibility was 3-10 km, and sea states were Beaufort 1-2. Ice cover was 60-85% broken floe sea ice in the area surveyed. Small unidentified pinnipeds were the only marine mammals seen.

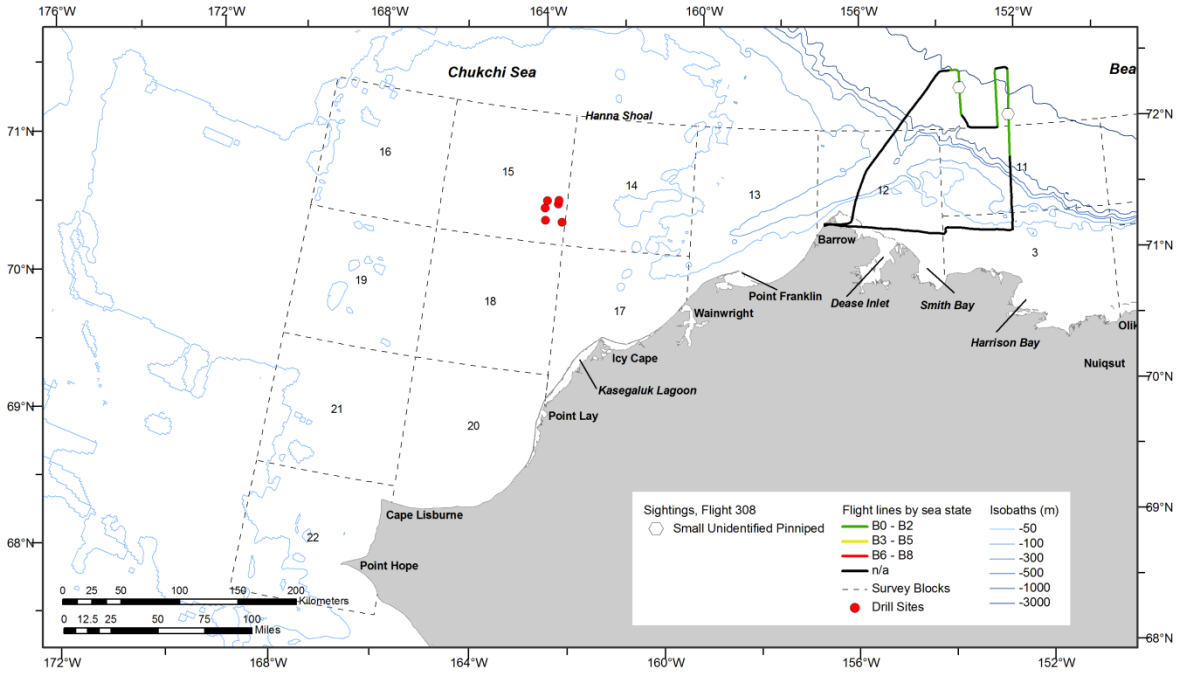

Figure B-13. ASAMM Flight 308 survey track, depicted by sea state, and all sightings.

11 July 2012, Flight 206

Flight was a partial survey of transect 16. Survey conditions were poor with clear to partly cloudy skies, <1-10 km visibility, and sea states of Beaufort 1-2. Extensive fog prevented completion of transect 16. Ice cover was 0-40% broken floe sea ice in the area surveyed. Walruses and unidentified pinnipeds were seen.

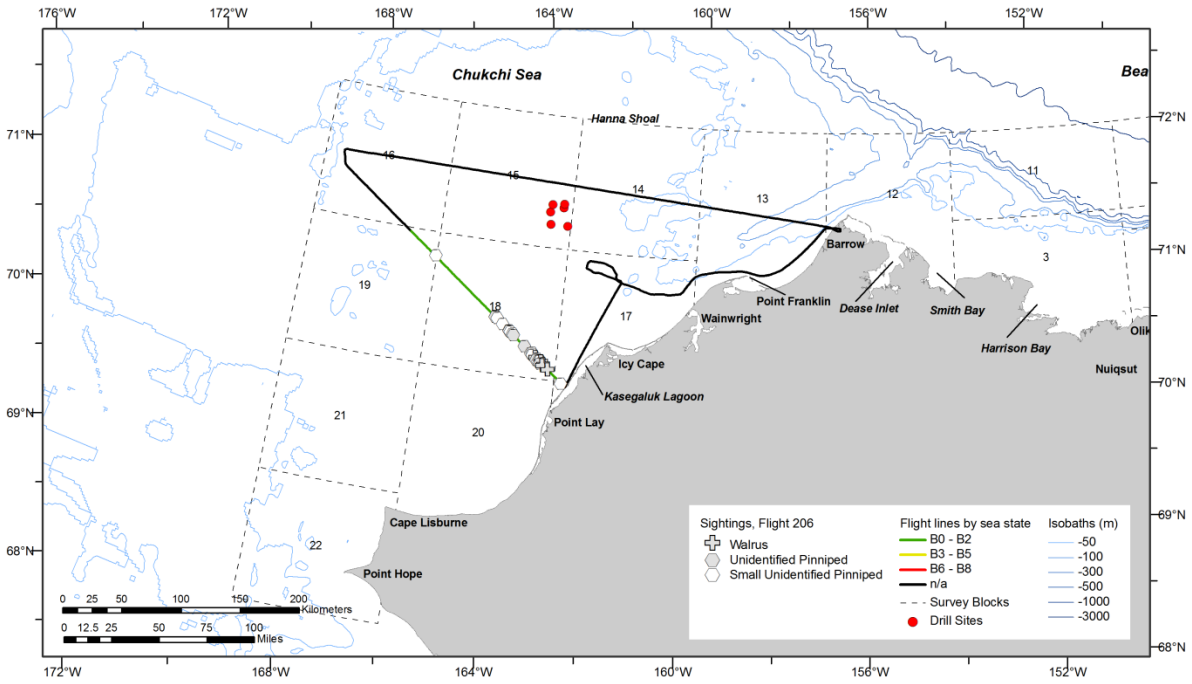

Figure B-14. ASAMM Flight 206 survey track, depicted by sea state, and all sightings.

12 July 2012, Flight 309

Flight was a survey of the coastal transect from Barrow to Cape Lisburne; fog prevented surveying elsewhere. Survey conditions were very good in the area surveyed with clear skies. Visibility was <1-10 km, and sea states were Beaufort 1-5. Ice cover was 0-40% broken floe sea ice in the area surveyed. Sightings included one bowhead whale, numerous gray whales including several calves, one minke whale, belugas, a small unidentified marine mammal, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
309	7/12/12 10:25	71.197	157.032	gray whale	feed	1	0	13
309	7/12/12 10:25	71.193	157.041	gray whale	feed	1	0	13
309	7/12/12 10:26	71.180	157.065	gray whale	feed	1	0	13
309	7/12/12 10:49	70.889	158.668	bowhead whale	swim	1	0	13
309	7/12/12 10:53	70.922	158.728	gray whale	swim	2	1	13
309	7/12/12 10:55	70.919	158.877	gray whale	swim	2	1	13
309	7/12/12 10:55	70.915	158.914	gray whale	swim	2	1	13
309	7/12/12 10:57	70.889	159.113	gray whale	swim	2	1	13
309	7/12/12 10:58	70.890	159.143	gray whale	swim	1	0	13
309	7/12/12 11:00	70.877	159.262	gray whale	swim	2	1	13
309	7/12/12 11:04	70.812	159.628	gray whale	swim	2	1	13
309	7/12/12 11:07	70.789	159.706	gray whale	swim	4	2	13
309	7/12/12 11:08	70.813	159.764	gray whale	swim	1	0	13
309	7/12/12 11:09	70.812	159.777	gray whale	swim	2	1	13
309	7/12/12 11:12	70.779	159.729	gray whale	swim	1	0	13
309	7/12/12 11:32	70.318	161.237	gray whale	breach	1	0	17
309	7/12/12 11:54	70.130	162.514	beluga	swim	3	1	17
309	7/12/12 11:55	70.118	162.530	gray whale	swim	1	0	17
309	7/12/12 12:07	69.771	163.087	gray whale	swim	2	1	20
309	7/12/12 12:08	69.767	163.152	gray whale	.	1	0	20
309	7/12/12 12:26	69.265	163.352	gray whale	swim	1	0	20
309	7/12/12 12:36	69.036	163.870	gray whale	swim	1	0	20
309	7/12/12 12:36	69.030	163.885	beluga	swim	1	0	20
309	7/12/12 12:48	68.931	164.370	small unid marine mammal	swim	1	0	20
309	7/12/12 13:05	68.864	165.663	minke whale	feed	1	0	20
309	7/12/12 13:21	68.876	165.885	gray whale	swim	1	0	20

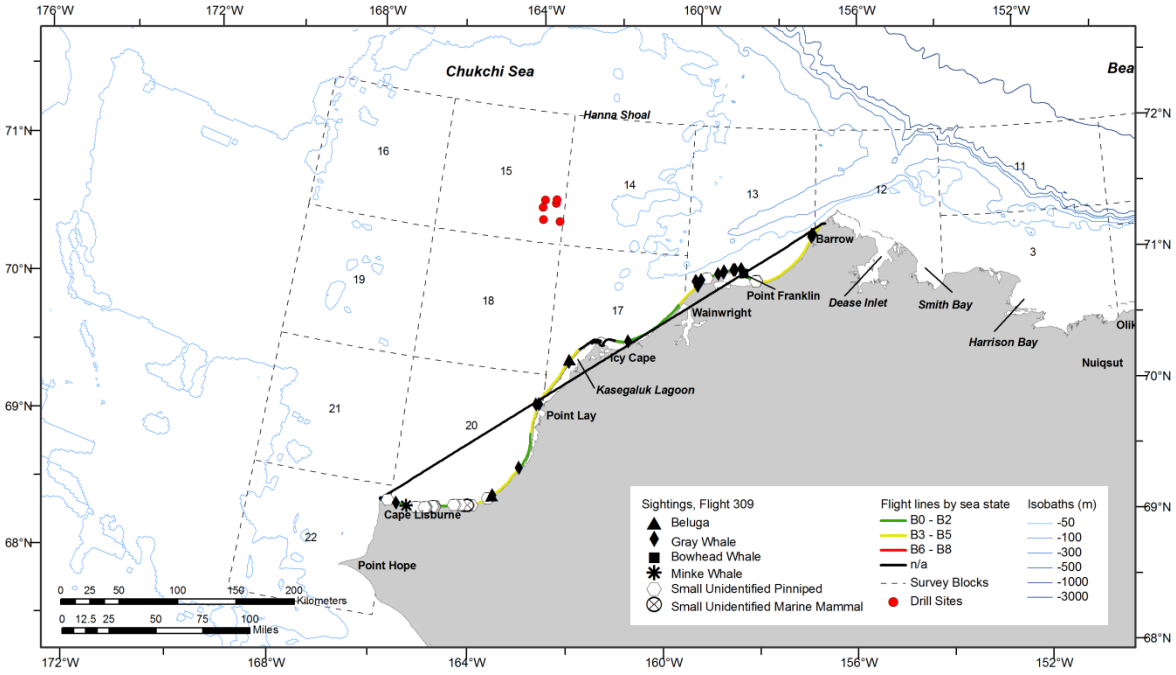

Figure B-15. ASAMM Flight 309 survey track, depicted by sea state, and all sightings.

12 July 2012, Flight 207

Flight was a saw tooth search effort nearshore from Wainwright to Barrow; offshore survey effort was "deadhead" to provide support for a walrus tagging effort. Survey conditions were good in the area surveyed with clear skies. Visibility was 5-10 km, and sea states were Beaufort 1-2. Ice cover was 25-65% broken floe sea ice in the area surveyed. Sightings included numerous gray whales including seven calves, one unidentified cetacean, and walruses.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
207	7/12/12 12:50	70.762	160.468	gray whale	feed	3	0	17
207	7/12/12 12:50	70.755	160.447	gray whale	feed	1	0	17
207	7/12/12 12:50	70.746	160.419	gray whale	feed	2	0	17
207	7/12/12 12:50	70.741	160.403	gray whale	feed	1	0	17
207	7/12/12 12:51	70.727	160.360	gray whale	feed	2	1	17
207	7/12/12 12:51	70.720	160.339	gray whale	feed	1	0	17
207	7/12/12 12:53	70.716	160.204	gray whale	rest	1	0	17
207	7/12/12 12:54	70.759	160.155	gray whale	cow w/ calf	2	1	17
207	7/12/12 12:54	70.767	160.144	gray whale	feed	1	0	17
207	7/12/12 12:54	70.782	160.124	gray whale	feed	1	0	17
207	7/12/12 12:59	70.833	159.812	gray whale	rest	1	0	13
207	7/12/12 13:00	70.809	159.745	gray whale	swim	2	1	13
207	7/12/12 13:03	70.874	159.585	gray whale	dive	1	0	13
207	7/12/12 13:03	70.890	159.567	gray whale	.	1	0	13
207	7/12/12 13:04	70.922	159.530	gray whale	rest	2	0	13
207	7/12/12 13:10	70.924	159.101	gray whale	swim	2	1	13
207	7/12/12 13:12	70.952	158.921	gray whale	feed	9	0	13
207	7/12/12 13:13	70.961	158.912	gray whale	.	1	0	13
207	7/12/12 13:13	70.966	158.908	gray whale	.	4	0	13
207	7/12/12 13:13	70.984	158.891	gray whale	.	2	0	13
207	7/12/12 13:14	71.010	158.866	gray whale	feed	1	0	13
207	7/12/12 13:15	71.039	158.789	gray whale	.	1	0	13
207	7/12/12 13:16	71.024	158.747	gray whale	feed	1	0	13
207	7/12/12 13:45	71.167	157.211	gray whale	swim	1	0	13
207	7/12/12 13:48	71.235	157.122	gray whale	feed	2	1	13
207	7/12/12 13:50	71.256	156.966	unid cetacean	feed	1	0	13
207	7/12/12 13:51	71.275	156.955	gray whale	feed	2	1	12
207	7/12/12 13:51	71.290	156.947	gray whale	feed	1	0	12
207	7/12/12 13:54	71.334	156.847	gray whale	feed	1	0	12
207	7/12/12 13:56	71.382	156.726	gray whale	swim	2	1	12

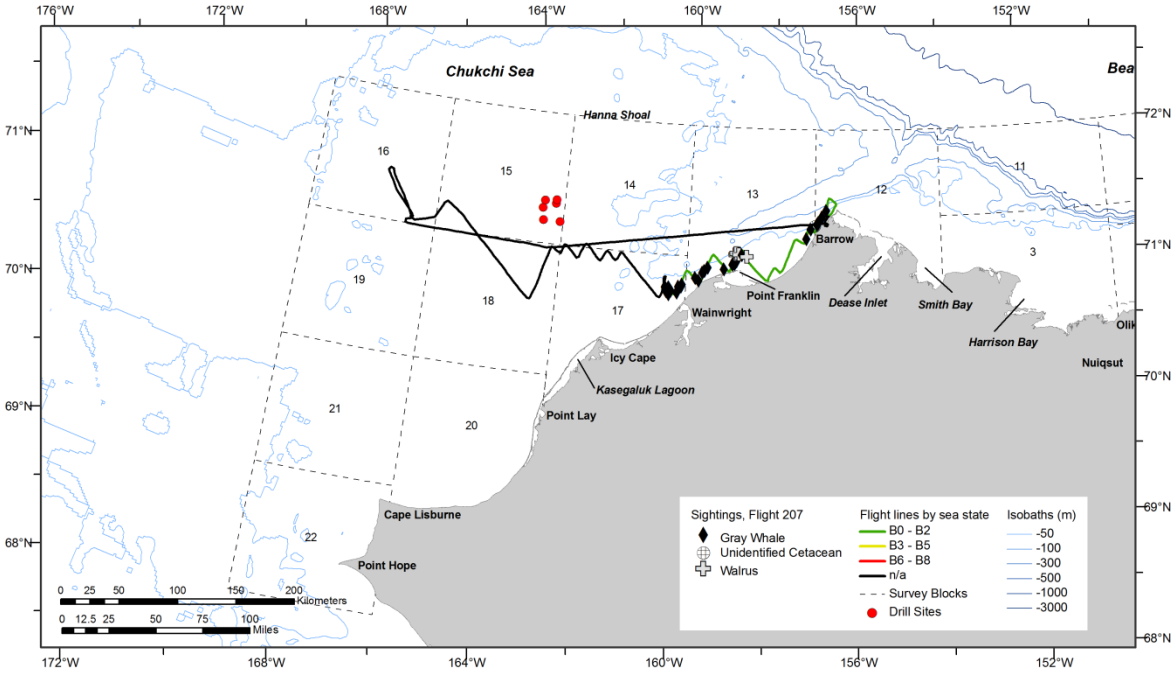

Figure B-16. ASAMM Flight 207 survey track, depicted by sea state, and all sightings.

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13 July 2012, Flight 208

Flight was a survey of transects 2 and 4 and partial survey of transect 6; offshore survey effort west of Wainwright was "deadhead" to provide support for a walrus tagging effort. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 3-10 km, and sea states were Beaufort 0-3. Ice cover was10-95% broken floe sea ice in the area surveyed. Sightings included one gray whale, walruses, and unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
208	7/13/12 14:07	71.055	158.737	gray whale	feed	1	0	13

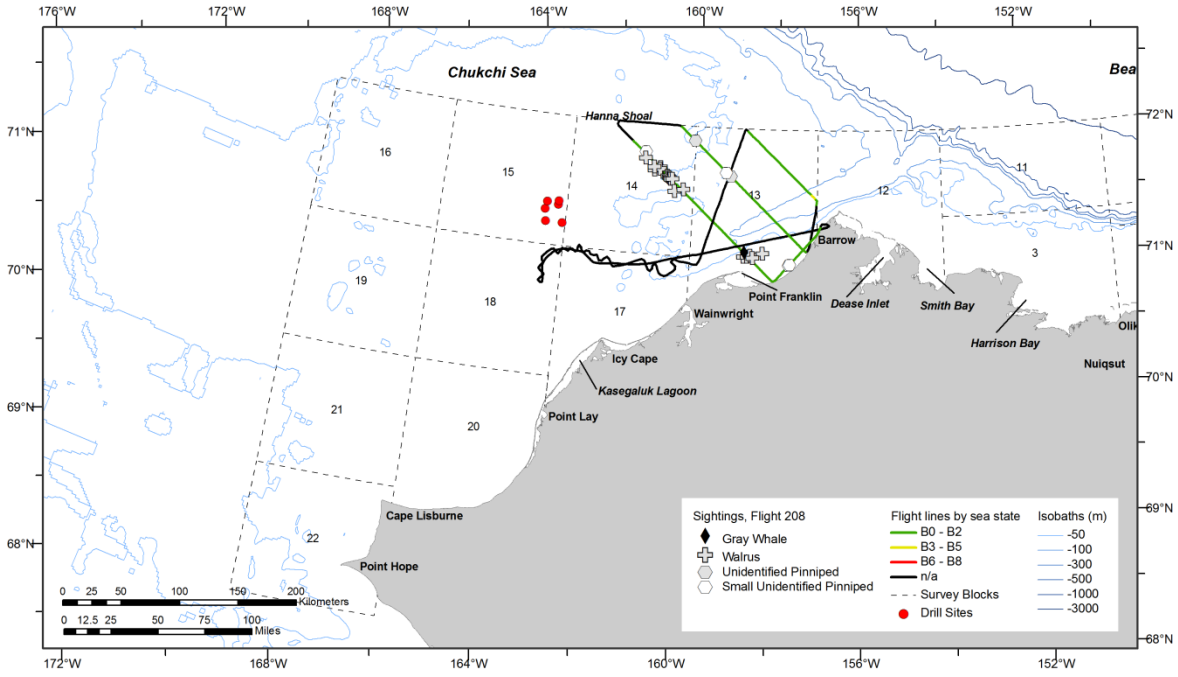

Figure B-17. ASAMM Flight 208 survey track, depicted by sea state, and all sightings.

14 July 2012, Flight 209

Flight was a partial survey of transects 8, 10, and 12. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 0-2. Widespread fog and low ceilings prevented complete coverage of transects. Ice cover was 0-95% broken floe sea ice in the area surveyed. Sightings included gray whales, including seven calves, belugas, walruses, and unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
209	7/14/12 12:16	70.612	161.900	beluga	swim	6	1	17
209	7/14/12 12:35	70.626	160.381	gray whale	feed	3	1	17
209	7/14/12 12:53	70.702	160.646	gray whale	feed	1	0	17
209	7/14/12 12:53	70.721	160.670	gray whale	feed	2	0	17
209	7/14/12 12:54	70.725	160.660	gray whale	feed	1	0	17
209	7/14/12 12:54	70.729	160.650	gray whale	feed	2	1	17
209	7/14/12 12:54	70.728	160.620	gray whale	feed	1	0	17
209	7/14/12 13:00	70.779	160.915	gray whale	feed	2	1	17
209	7/14/12 13:01	70.795	160.860	gray whale	feed	2	0	17
209	7/14/12 13:02	70.791	160.765	gray whale	feed	9	4	17
209	7/14/12 13:05	70.796	160.691	gray whale	feed	4	0	17

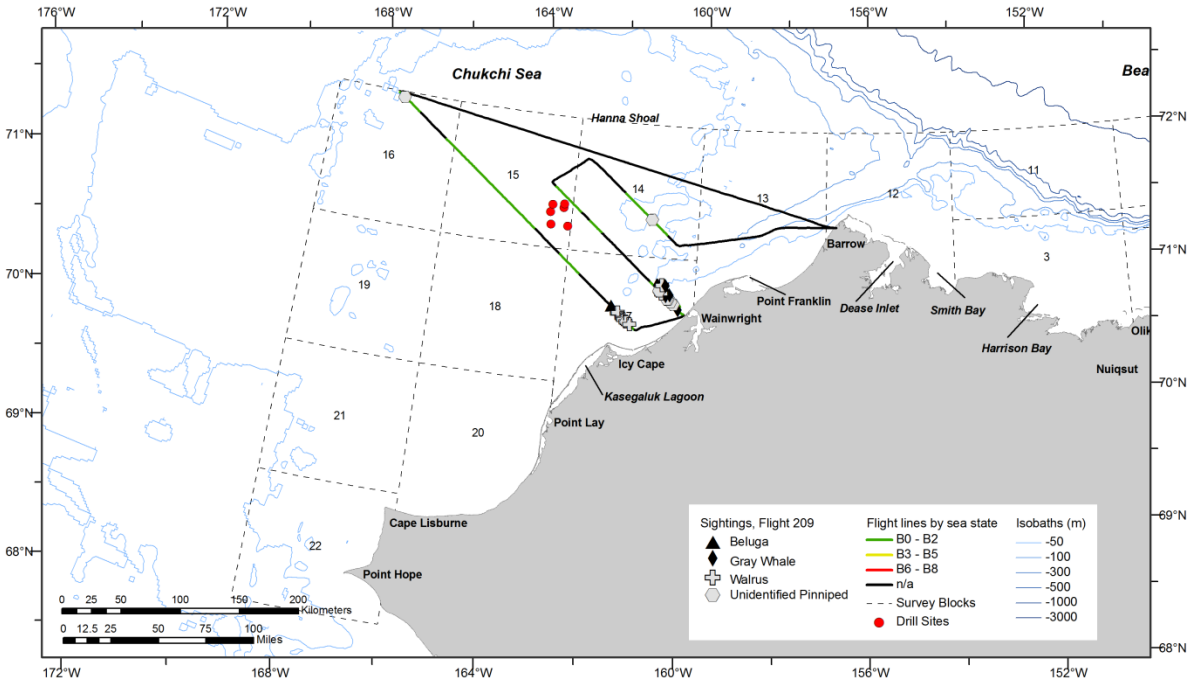

Figure B-18. ASAMM Flight 209 survey track, depicted by sea state, and all sightings.

Gray whale cow and calf sighted nearshore northwest of Wainwright, Alaska, on flight 209, 14 July 2012.

15 July 2012, Flight 210

Flight was a coastal transect from south of Point Hope to Point Franklin; offshore survey effort was "deadhead" to provide support for a walrus tagging effort. Survey conditions were good in the area surveyed with clear to partly cloudy skies. Visibility was 2-10 km and sea states were Beaufort 1-3. Ice cover was 0-5% broken floe sea ice in the area surveyed. Sightings included gray whales including nine calves, belugas, unidentified cetaceans, unidentified pinnipeds, and one brown bear. One beluga carcass was observed floating in the water south of Point Hope.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
210	7/15/12 12:23	68.223	166.121	beluga	dead	1	0	22
210	7/15/12 12:52	68.716	166.218	gray whale	rest	4	2	22
210	7/15/12 13:32	69.323	163.254	unid cetacean	unknown	1	0	20
210	7/15/12 14:02	70.094	162.550	beluga	rest	300	8	17
210	7/15/12 14:07	70.123	162.500	gray whale	feed	1	0	17
210	7/15/12 14:10	70.142	162.464	gray whale	rest	1	0	17
210	7/15/12 14:19	70.331	161.773	gray whale	rest	2	1	17
210	7/15/12 14:23	70.320	161.656	gray whale	feed	2	1	17
210	7/15/12 14:43	70.609	160.151	unid cetacean	swim	1	0	17
210	7/15/12 14:47	70.719	159.867	gray whale	rest	1	0	13
210	7/15/12 14:47	70.722	159.859	gray whale	feed	1	0	13
210	7/15/12 14:50	70.790	159.690	gray whale	swim	3	1	13
210	7/15/12 14:51	70.814	159.597	gray whale	rest	2	0	13
210	7/15/12 14:51	70.823	159.548	gray whale	rest	1	0	13
210	7/15/12 14:53	70.852	159.378	gray whale	rest	2	1	13
210	7/15/12 14:54	70.872	159.260	gray whale	swim	2	1	13
210	7/15/12 14:55	70.881	159.191	gray whale	rest	2	1	13
210	7/15/12 14:56	70.888	159.097	gray whale	swim	2	1	13

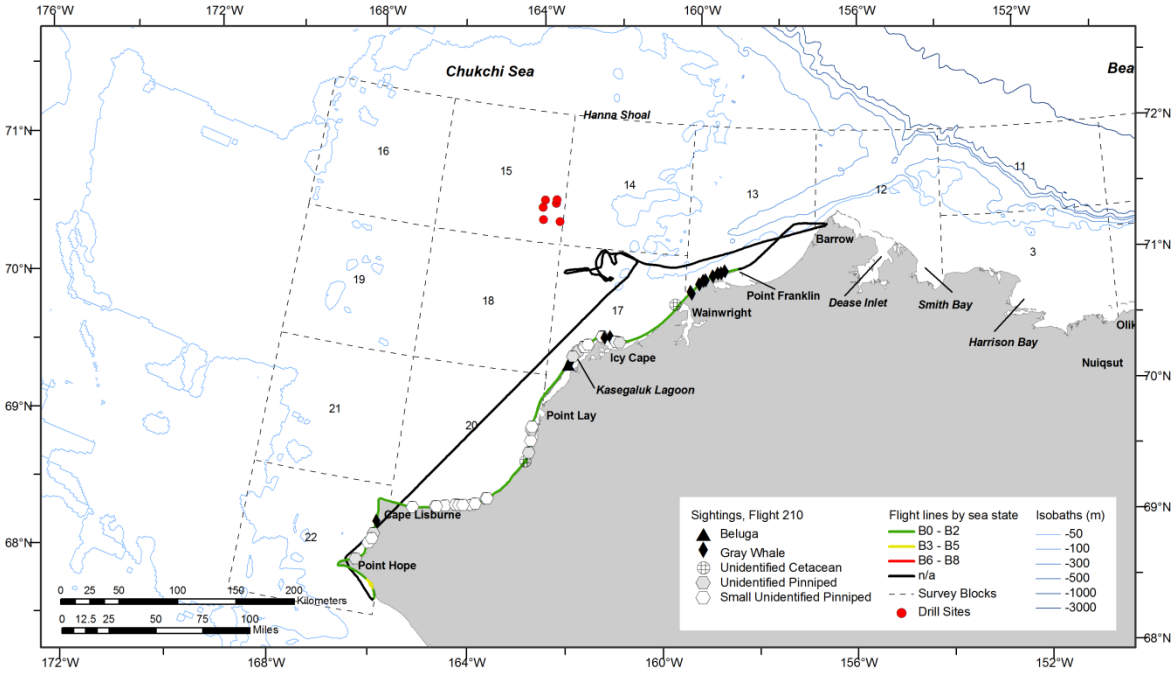

Figure B-19. ASAMM Flight 210 survey track, depicted by sea state, and all sightings.

Beluga aggregation observed near Kasegaluk Lagoon entrance north of Point Lay, Alaska, on flight 210, 15 July 2012 (left: wide angle view, right: zoomed view).

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19 July 2012, Flight 211

Flight was a partial survey of transects 11 and 13, and a survey of the western two transects in block 12. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 1-5. Dense, low cloud cover and fog prevented complete coverage of transects 11 and 13. Ice cover was 0-98% broken floe sea ice in the area surveyed. Sightings included one walrus, one unidentified pinniped, and small unidentified pinnipeds.

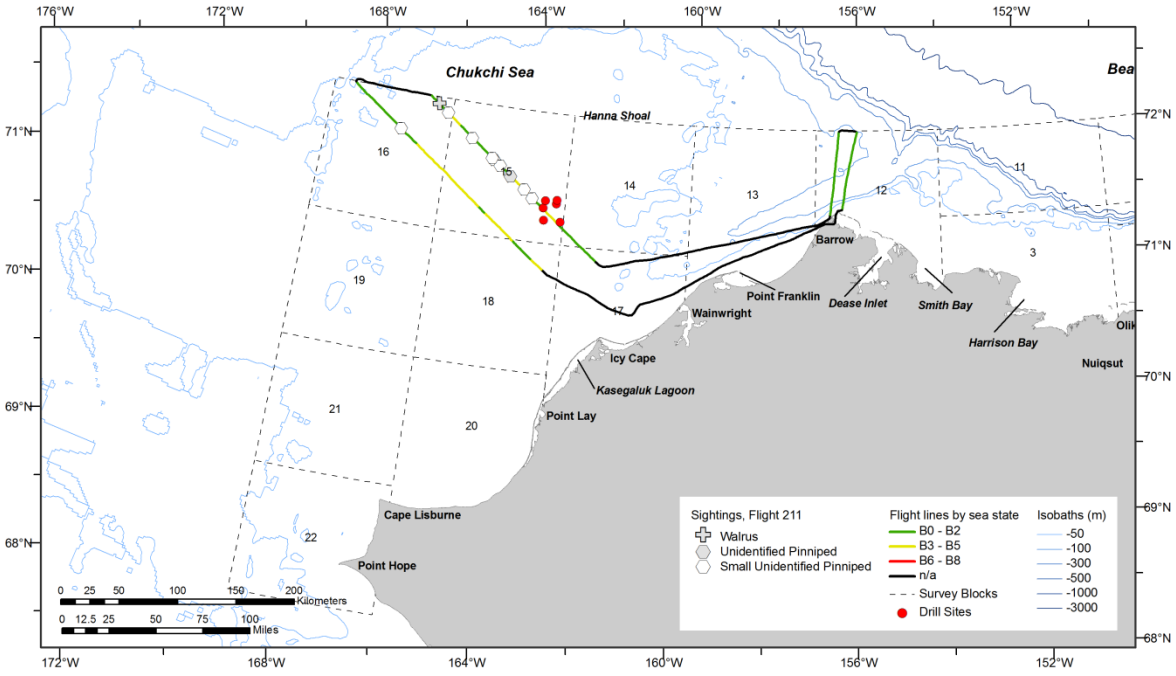

Figure B-20. ASAMM Flight 211 survey track, depicted by sea state, and all sightings.

19 July 2012, Flight 1

Flight was a transect survey of portions of blocks 4 and 6. Survey conditions were good in the area surveyed with partly cloudy to clear skies. Visibility was 5-10 km with glare, and sea states were Beaufort 2-4. Ice cover was 0-25% broken floe sea ice in the area surveyed. Sightings included bowhead whales, including one cow-calf pair, belugas, and one small unidentified pinniped.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
1	7/19/12 17:11	70.803	144.745	beluga	swim	7	0	6
1	7/19/12 17:12	70.822	144.748	beluga	swim	3	0	6
1	7/19/12 17:12	70.838	144.749	beluga	swim	3	0	6
1	7/19/12 17:16	70.952	144.765	beluga	swim	7	0	6
1	7/19/12 17:19	71.048	144.778	beluga	swim	1	0	6
1	7/19/12 17:34	70.965	144.086	beluga	swim	1	0	6
1	7/19/12 17:35	70.941	144.085	beluga	swim	1	0	6
1	7/19/12 17:41	70.731	144.077	beluga	swim	3	0	6
1	7/19/12 17:42	70.721	144.076	beluga	swim	7	0	6
1	7/19/12 17:44	70.657	144.072	beluga	rest	1	0	6
1	7/19/12 17:44	70.645	144.072	beluga	swim	1	0	6
1	7/19/12 17:44	70.639	144.071	beluga	swim	1	0	6
1	7/19/12 18:06	70.192	143.711	beluga	swim	15	0	4
1	7/19/12 18:24	70.747	143.699	beluga	swim	2	1	6
1	7/19/12 18:26	70.809	143.698	beluga	swim	1	0	6
1	7/19/12 18:26	70.816	143.697	beluga	swim	1	0	6
1	7/19/12 18:30	70.940	143.695	beluga	swim	1	0	6
1	7/19/12 18:30	70.951	143.695	beluga	swim	1	0	6
1	7/19/12 18:45	71.001	143.288	bowhead whale	swim	1	0	6
1	7/19/12 18:54	70.890	143.292	beluga	swim	2	0	6
1	7/19/12 18:58	70.772	143.298	beluga	swim	1	0	6
1	7/19/12 19:01	70.660	143.302	bowhead whale	swim	1	0	6
1	7/19/12 19:02	70.659	143.336	bowhead whale	swim	1	0	6
1	7/19/12 19:05	70.649	143.361	beluga	swim	2	1	6
1	7/19/12 19:08	70.639	143.302	beluga	swim	1	0	6
1	7/19/12 19:09	70.632	143.302	beluga	swim	15	0	6
1	7/19/12 19:09	70.622	143.303	beluga	swim	7	0	6
1	7/19/12 19:09	70.608	143.303	bowhead whale	breach	2	1	6

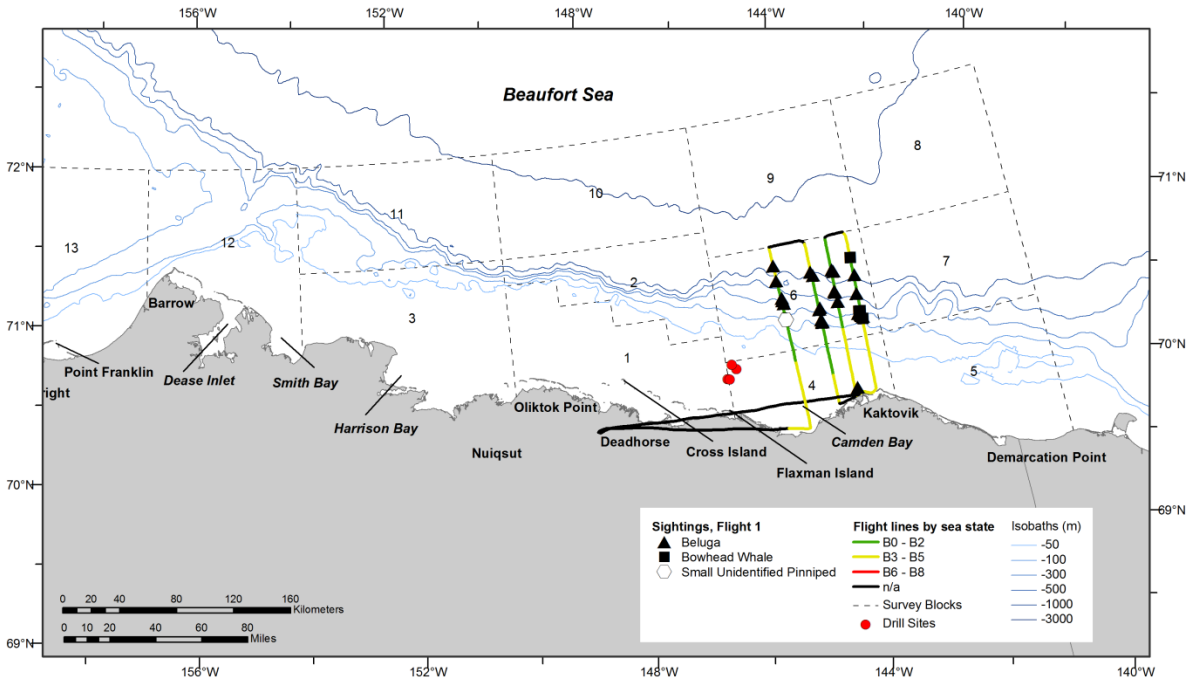

Figure B-21. ASAMM Flight 1 survey track, depicted by sea state, and all sightings.

Bowhead whale cow and calf sighted in Block 6 on flight 1, 19 July 2012. The initial sighting was of the cow breaching; subsequent circling confirmed the presence of the calf.

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20 July 2012, Flight 212

Flight was a survey of transect 1, a partial survey of transect 3, and a transect survey of a portion of Block 12. Survey conditions were poor in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km (mostly less than 1 km), and sea states were Beaufort 1-5. Widespread fog, low ceilings, and scattered snow showers prevented complete coverage of transect 3 and other portions of the survey area. Ice cover was 0-95% broken floe sea ice in the area surveyed. One beluga was seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
212	7/20/12 17:36	71.604	155.890	beluga	rest	1	0	12

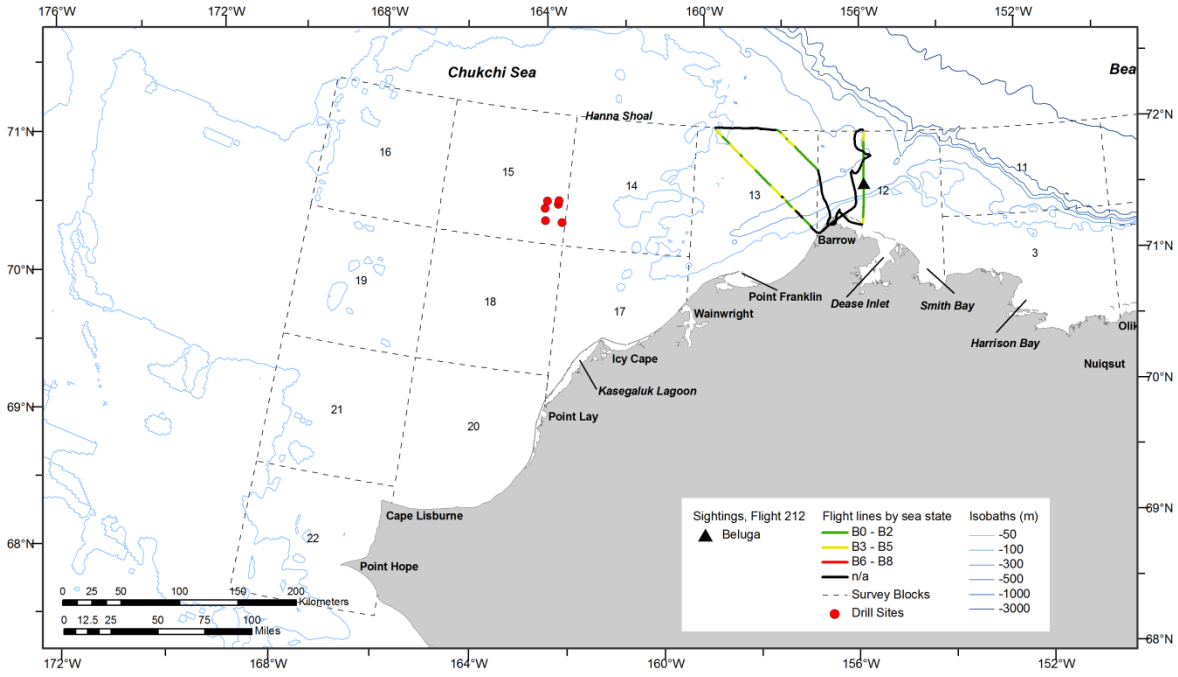

Figure B-22. ASAMM Flight 212 survey track, depicted by sea state, and all sightings.

20 July 2012, Flight 2

Flight was a transect survey of portions of blocks 1, 2, 4, and 6. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was <1-10 km with fog and precipitation, and sea states were Beaufort 2-4. Fog prevented complete coverage of transects in block 2. Ice cover was 0-80% broken floe sea ice in the area surveyed. Sightings included four bowhead whales, belugas, an unidentified cetacean, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
2	7/20/12 11:11	70.876	146.866	beluga	swim	7	0	2
2	7/20/12 11:14	70.967	146.867	bowhead whale	swim	1	0	2
2	7/20/12 11:22	71.122	146.867	beluga	swim	4	0	2
2	7/20/12 11:22	71.135	146.869	beluga	swim	1	0	2
2	7/20/12 11:36	71.159	146.165	beluga	swim	1	0	2
2	7/20/12 11:36	71.139	146.166	beluga	swim	3	1	2
2	7/20/12 11:37	71.126	146.167	beluga	rest	1	0	2
2	7/20/12 11:38	71.104	146.167	beluga	swim	1	0	2
2	7/20/12 11:39	71.064	146.168	beluga	swim	1	0	2
2	7/20/12 11:39	71.059	146.168	beluga	swim	1	0	2
2	7/20/12 11:42	70.962	146.171	beluga	swim	2	0	2
2	7/20/12 12:24	70.676	145.942	beluga	swim	1	0	6
2	7/20/12 12:25	70.685	145.942	beluga	swim	1	0	6
2	7/20/12 12:33	70.922	145.932	beluga	swim	2	0	6
2	7/20/12 12:33	70.940	145.932	beluga	swim	2	0	6
2	7/20/12 12:34	70.946	145.931	beluga	swim	2	0	6
2	7/20/12 12:35	70.974	145.932	beluga	swim	3	0	6
2	7/20/12 12:35	70.982	145.931	beluga	swim	2	0	6
2	7/20/12 12:35	70.987	145.931	beluga	swim	2	0	6
2	7/20/12 12:36	71.021	145.929	beluga	swim	1	0	6
2	7/20/12 12:38	71.069	145.925	bowhead whale	swim	2	0	6
2	7/20/12 12:44	71.127	145.926	beluga	swim	2	0	6
2	7/20/12 12:44	71.138	145.925	beluga	swim	1	0	6
2	7/20/12 12:55	71.006	145.187	beluga	swim	1	0	6
2	7/20/12 12:55	70.993	145.187	beluga	.	3	0	6
2	7/20/12 12:55	70.985	145.187	beluga	swim	1	0	6
2	7/20/12 12:56	70.977	145.187	beluga	swim	2	0	6
2	7/20/12 12:56	70.973	145.187	beluga	swim	2	0	6
2	7/20/12 12:56	70.968	145.188	beluga	swim	1	0	6
2	7/20/12 12:56	70.961	145.188	beluga	swim	1	0	6
2	7/20/12 12:56	70.956	145.188	beluga	.	5	0	6
2	7/20/12 13:00	70.847	145.190	unid cetacean	swim	1	0	6
2	7/20/12 13:00	70.840	145.190	beluga	swim	5	0	6
2	7/20/12 13:00	70.837	145.210	beluga	swim	2	0	6
2	7/20/12 13:01	70.844	145.212	beluga	swim	3	0	6
2	7/20/12 13:07	70.820	145.189	beluga	swim	1	0	6
2	7/20/12 13:07	70.803	145.191	bowhead whale	rest	1	0	6
2	7/20/12 13:11	70.769	145.190	beluga	swim	1	0	6

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
2	7/20/12 14:12	70.868	147.246	beluga	swim	8	0	2
2	7/20/12 14:12	70.874	147.243	beluga	swim	1	0	2
2	7/20/12 14:13	70.881	147.239	beluga	swim	11	0	2

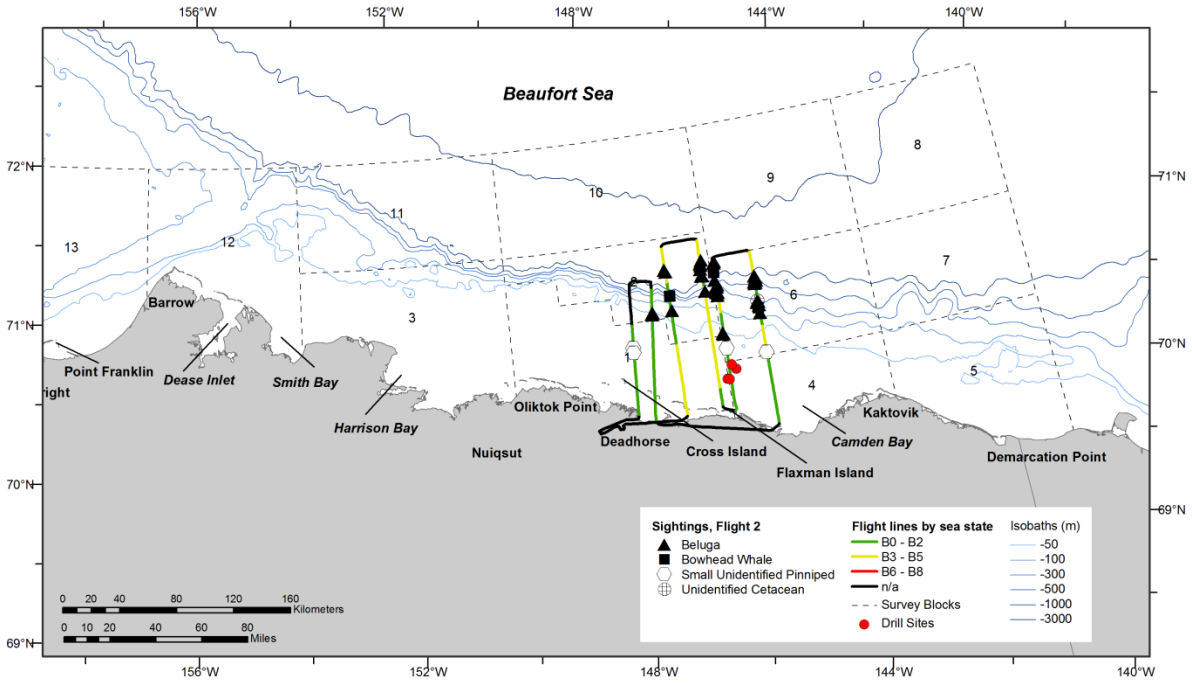

Figure B-23. ASAMM Flight 2 survey track, depicted by sea state, and all sightings.

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21 July 2012, Flight 213

Flight was a partial survey of transects 14, 16, 18, and 20, and the coastal transect beginning 75 km southwest of Point Lay and ending near Icy Cape. Survey conditions were good in the area surveyed with clear to overcast skies. Visibility was 0-10 km with lower visibility offshore and higher visibility nearshore, and sea states were Beaufort 1-3. Low ceilings, fog, and scattered snow showers prevented complete coverage of transects. Ice cover was 0-1% broken floe sea ice in the area surveyed. Sightings included one gray whale, unidentified cetaceans, walruses, one bearded seal, unidentified pinnipeds, small unidentified pinnipeds, and two small unidentified marine mammals observed underwater. One dead beluga was observed floating in the water approximately 30 km northwest of Point Lay.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
213	7/21/12 10:51	70.586	163.425	unid cetacean	feed	1	0	18
213	7/21/12 11:39	70.392	164.331	small unid marine mammal	rest	2	0	18
213	7/21/12 12:22	69.830	163.849	beluga	dead	1	0	20
213	7/21/12 13:27	69.618	164.660	unid cetacean	swim	1	0	20
213	7/21/12 14:15	69.947	162.816	gray whale	swim	1	0	17

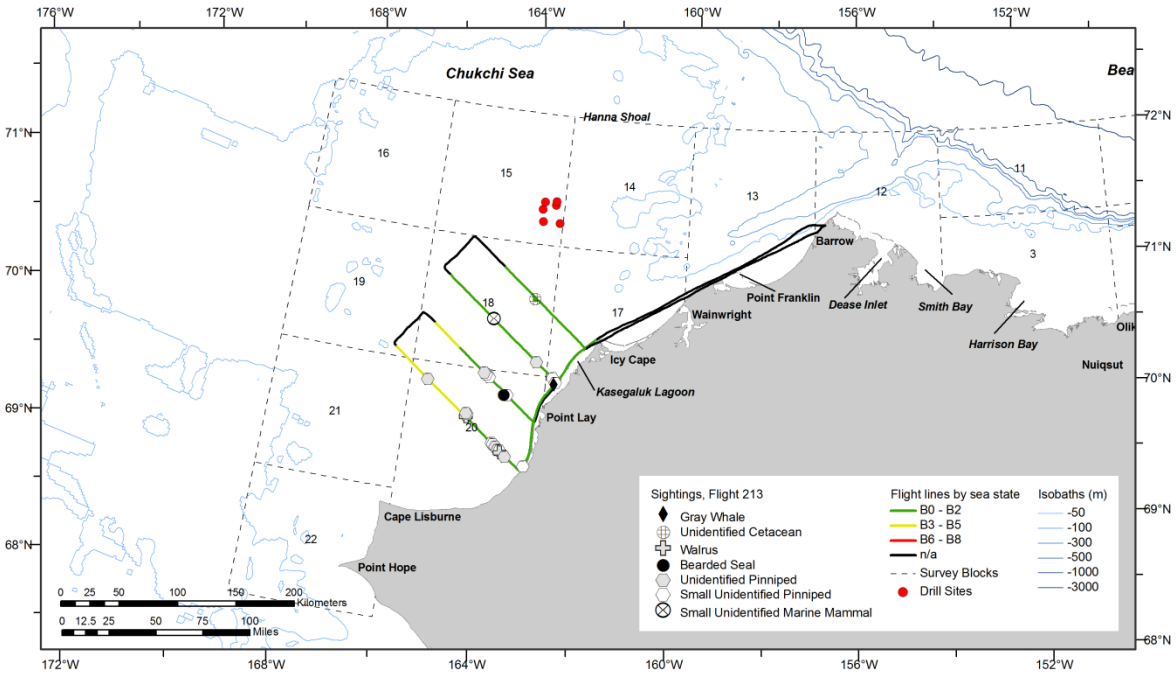

Figure B-24. ASAMM Flight 213 survey track, depicted by sea state, and all sightings.

21 July 2012, Flight 3

Flight was a transect survey of portions of blocks 5 and 7. Survey conditions were fair in the area surveyed with overcast skies. Visibility was 0-10 km with fog and precipitation, and sea states were Beaufort 2-3. Fog prevented complete coverage of transects in blocks 5 and 7. Ice cover was 0-10% broken floe sea ice in the area surveyed. Sightings included two bowhead whales, belugas, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
3	7/21/12 12:08	69.948	140.988	beluga	swim	9	0	5
3	7/21/12 12:09	69.953	141.039	beluga	swim	18	0	5
3	7/21/12 12:29	70.390	142.257	bowhead whale	swim	1	0	5
3	7/21/12 12:36	70.467	142.235	bowhead whale	swim	1	0	5
3	7/21/12 12:41	70.555	142.212	beluga	swim	2	0	7
3	7/21/12 12:41	70.558	142.210	beluga	swim	2	0	7
3	7/21/12 12:44	70.641	142.189	beluga	swim	2	0	7
3	7/21/12 12:45	70.652	142.186	beluga	swim	1	0	7
3	7/21/12 12:48	70.749	142.144	beluga	rest	1	0	7
3	7/21/12 12:49	70.783	142.133	beluga	swim	1	0	7
3	7/21/12 12:51	70.855	142.109	beluga	swim	3	0	7
3	7/21/12 12:51	70.856	142.109	beluga	swim	1	0	7
3	7/21/12 12:51	70.866	142.105	beluga	swim	1	0	7
3	7/21/12 12:51	70.867	142.104	beluga	swim	4	0	7
3	7/21/12 12:52	70.874	142.102	beluga	swim	2	0	7
3	7/21/12 12:59	71.099	142.029	beluga	swim	2	0	7
3	7/21/12 13:00	71.116	142.025	beluga	swim	5	0	7
3	7/21/12 13:00	71.123	142.023	beluga	swim	4	0	7
3	7/21/12 13:07	71.171	142.515	beluga	rest	1	0	7
3	7/21/12 13:11	71.170	142.887	beluga	swim	2	0	8
3	7/21/12 13:12	71.126	142.900	beluga	mill	2	1	7
3	7/21/12 13:16	71.020	142.888	beluga	swim	1	0	7
3	7/21/12 13:20	70.882	142.875	beluga	swim	2	0	7
3	7/21/12 13:20	70.875	142.873	beluga	swim	1	0	7
3	7/21/12 13:21	70.869	142.871	beluga	swim	2	0	7
3	7/21/12 13:21	70.847	142.868	beluga	swim	1	0	7

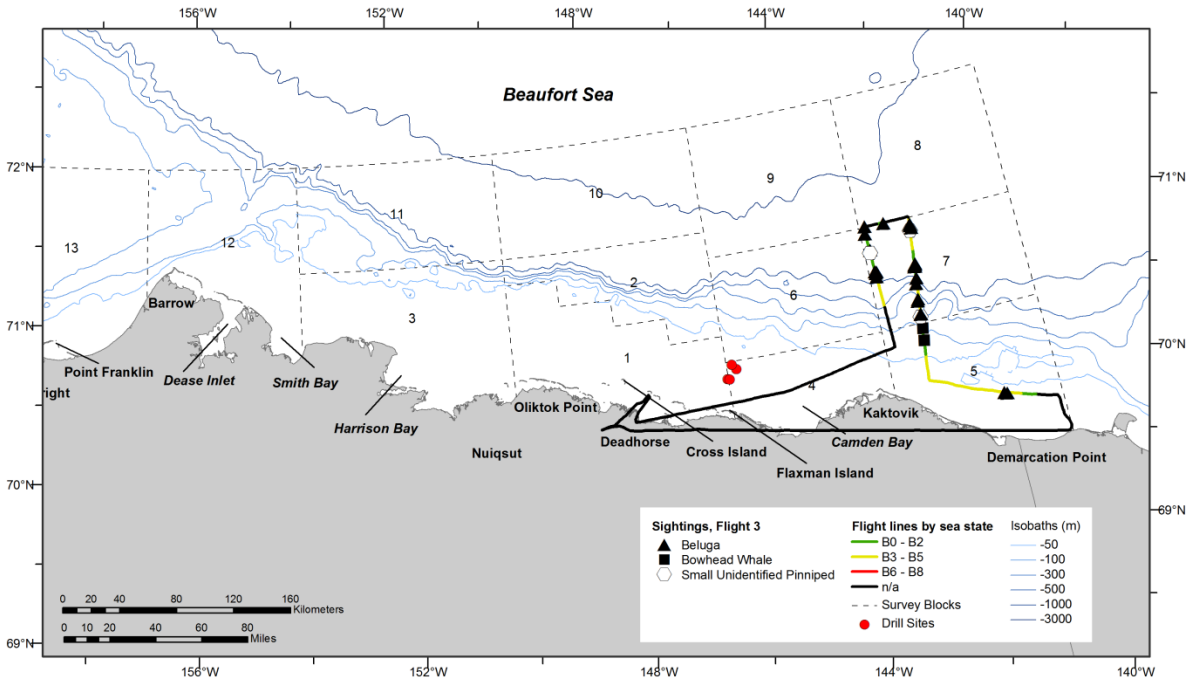

Figure B-25. ASAMM Flight 3 survey track, depicted by sea state, and all sightings.

22 July 2012, Flight 214

Flight was a survey of transects 5, 7, and 9. Survey conditions were good in the area surveyed with clear to partly cloudy skies. Visibility was 5-10 km, and sea states were Beaufort 0-3. Ice cover was 10-90% broken floe sea ice in the area surveyed. Sightings included one bowhead whale, gray whales, belugas, walruses, unidentified pinnipeds, small unidentified pinnipeds, one small unidentified marine mammal observed underwater, and one polar bear swimming between ice floes ~ 30 km northwest of Point Franklin.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
214	7/22/12 11:49	71.104	158.132	gray whale	feed	1	0	13
214	7/22/12 12:08	71.287	158.741	beluga	rest	4	0	13
214	7/22/12 12:08	71.290	158.748	small unid marine mammal	dive	1	0	13
214	7/22/12 12:08	71.292	158.758	beluga	swim	1	0	13
214	7/22/12 12:08	71.298	158.776	beluga	swim	2	0	13
214	7/22/12 12:09	71.313	158.826	beluga	swim	1	0	13
214	7/22/12 12:11	71.357	158.978	beluga	swim	6	1	13
214	7/22/12 13:37	71.241	160.150	bowhead whale	swim	1	0	14
214	7/22/12 13:48	71.068	159.554	beluga	dive	1	0	13
214	7/22/12 13:49	71.049	159.492	beluga	swim	2	0	13
214	7/22/12 14:10	70.768	160.090	gray whale	feed	2	0	17
214	7/22/12 14:12	70.776	160.112	gray whale	feed	2	0	17
214	7/22/12 14:20	70.900	160.547	gray whale	feed	1	0	17
214	7/22/12 14:21	70.930	160.650	gray whale	feed	2	0	17
214	7/22/12 14:23	70.934	160.604	gray whale	feed	2	0	17
214	7/22/12 14:26	70.952	160.564	gray whale	rest	2	0	17

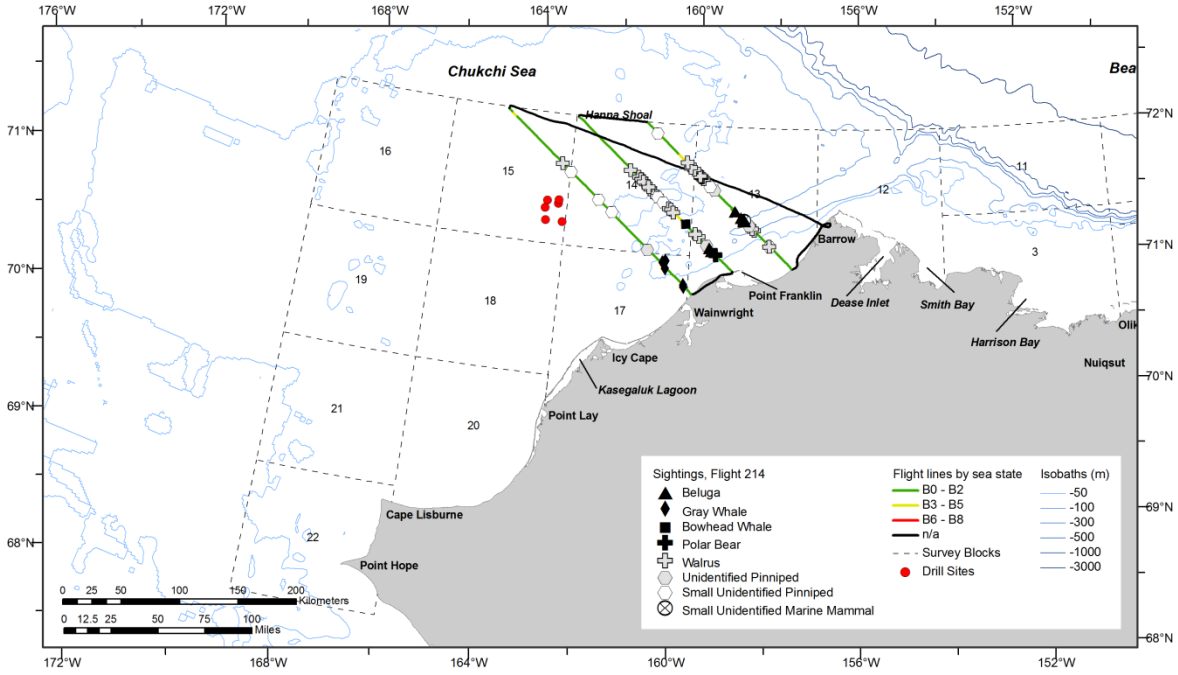

Figure B-26. ASAMM Flight 214 survey track, depicted by sea state, and all sightings.

Two feeding gray whales observed on flight 214, 22 July 2012.

22 July 2012, Flight 4

Flight was a transect survey of portions of blocks 5 and 7. Survey conditions were good in the area surveyed with clear skies. Visibility was 0-10 km with fog and low ceilings, and sea states were Beaufort 2-4. Fog prevented complete coverage of one transect in block 5. Ice cover was 0-50% broken floe sea ice in the area surveyed. Sightings included 10 bowhead whales including 4 calves, belugas, 1 small unidentified cetacean, 1 small unidentified marine mammal, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
4	7/22/12 11:46	70.112	140.094	bowhead whale	swim	1	0	5
4	7/22/12 11:56	70.424	140.100	bowhead whale	swim	1	0	5
4	7/22/12 11:58	70.419	140.121	beluga	swim	6	0	5
4	7/22/12 11:59	70.461	140.105	beluga	swim	1	0	5
4	7/22/12 11:59	70.467	140.106	beluga	mill	4	0	5
4	7/22/12 12:01	70.511	140.106	beluga	swim	6	0	7
4	7/22/12 12:01	70.517	140.107	beluga	swim	3	0	7
4	7/22/12 12:01	70.520	140.107	beluga	swim	1	0	7
4	7/22/12 12:02	70.546	140.107	beluga	mill	1	0	7
4	7/22/12 12:02	70.547	140.107	beluga	swim	1	0	7
4	7/22/12 12:03	70.568	140.108	beluga	swim	3	0	7
4	7/22/12 12:05	70.641	140.110	beluga	swim	2	0	7
4	7/22/12 12:06	70.670	140.112	beluga	swim	1	0	7
4	7/22/12 12:07	70.683	140.113	beluga	swim	5	0	7
4	7/22/12 12:12	70.860	140.116	small unid cetacean	rest	1	0	7
4	7/22/12 12:13	70.880	140.117	beluga	swim	8	0	7
4	7/22/12 12:14	70.915	140.119	beluga	swim	1	0	7
4	7/22/12 12:16	70.962	140.120	beluga	swim	1	0	7
4	7/22/12 12:40	70.760	140.681	beluga	swim	1	0	7
4	7/22/12 12:41	70.723	140.687	beluga	swim	1	0	7
4	7/22/12 12:44	70.617	140.705	beluga	swim	1	0	7
4	7/22/12 12:45	70.607	140.707	beluga	swim	1	0	7
4	7/22/12 12:45	70.581	140.710	beluga	swim	2	0	7
4	7/22/12 12:48	70.491	140.724	beluga	rest	1	0	5
4	7/22/12 12:50	70.464	140.768	beluga	swim	1	0	5
4	7/22/12 12:51	70.435	140.732	beluga	swim	8	1	5
4	7/22/12 12:52	70.407	140.736	beluga	rest	2	0	5
4	7/22/12 12:54	70.359	140.745	beluga	swim	3	0	5
4	7/22/12 13:42	70.493	141.190	beluga	swim	3	0	5
4	7/22/12 13:43	70.509	141.188	beluga	swim	1	0	7
4	7/22/12 13:43	70.514	141.188	beluga	swim	1	0	7
4	7/22/12 13:44	70.535	141.184	beluga	swim	1	0	7
4	7/22/12 13:44	70.538	141.183	beluga	swim	1	0	7
4	7/22/12 13:44	70.545	141.183	beluga	swim	1	0	7
4	7/22/12 13:44	70.554	141.183	beluga	swim	8	0	7
4	7/22/12 13:45	70.570	141.182	beluga	swim	2	0	7
4	7/22/12 13:47	70.630	141.174	beluga	cow w/ calf	2	1	7
4	7/22/12 13:50	70.665	141.166	beluga	swim	2	1	7

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
4	7/22/12 13:50	70.679	141.169	beluga	swim	1	0	7
4	7/22/12 13:50	70.679	141.169	beluga	swim	3	0	7
4	7/22/12 13:51	70.691	141.168	beluga	swim	1	0	7
4	7/22/12 13:51	70.699	141.167	beluga	swim	2	0	7
4	7/22/12 13:52	70.738	141.165	beluga	swim	1	0	7
4	7/22/12 13:52	70.742	141.164	beluga	mill	1	0	7
4	7/22/12 13:54	70.788	141.159	beluga	swim	2	1	7
4	7/22/12 13:55	70.834	141.153	beluga	rest	1	0	7
4	7/22/12 13:57	70.876	141.149	beluga	rest	1	0	7
4	7/22/12 13:57	70.881	141.148	beluga	rest	1	0	7
4	7/22/12 14:05	71.151	141.117	small unid marine mammal	.	1	0	7
4	7/22/12 14:16	71.015	141.697	beluga	swim	1	0	7
4	7/22/12 14:27	70.650	141.685	beluga	swim	1	0	7
4	7/22/12 14:28	70.648	141.685	beluga	swim	1	0	7
4	7/22/12 14:28	70.629	141.685	beluga	cow w/ calf	2	1	7
4	7/22/12 14:29	70.615	141.684	beluga	rest	2	1	7
4	7/22/12 14:29	70.608	141.683	beluga	swim	12	0	7
4	7/22/12 14:29	70.600	141.682	beluga	rest	1	0	7
4	7/22/12 14:32	70.513	141.680	beluga	swim	5	0	7
4	7/22/12 14:32	70.512	141.680	beluga	swim	6	0	7
4	7/22/12 14:32	70.494	141.680	beluga	swim	1	0	5
4	7/22/12 14:33	70.482	141.679	beluga	swim	5	0	5
4	7/22/12 14:33	70.482	141.679	beluga	swim	2	0	5
4	7/22/12 14:33	70.468	141.679	beluga	swim	1	0	5
4	7/22/12 14:33	70.468	141.679	beluga	swim	1	0	5
4	7/22/12 14:33	70.462	141.679	beluga	swim	1	0	5
4	7/22/12 14:34	70.457	141.678	beluga	swim	1	0	5
4	7/22/12 14:34	70.453	141.678	beluga	swim	2	1	5
4	7/22/12 14:36	70.372	141.676	bowhead whale	mill	8	4	5
4	7/22/12 14:57	70.219	141.670	beluga	swim	1	0	5
4	7/22/12 15:00	70.122	141.667	beluga	swim	1	0	5

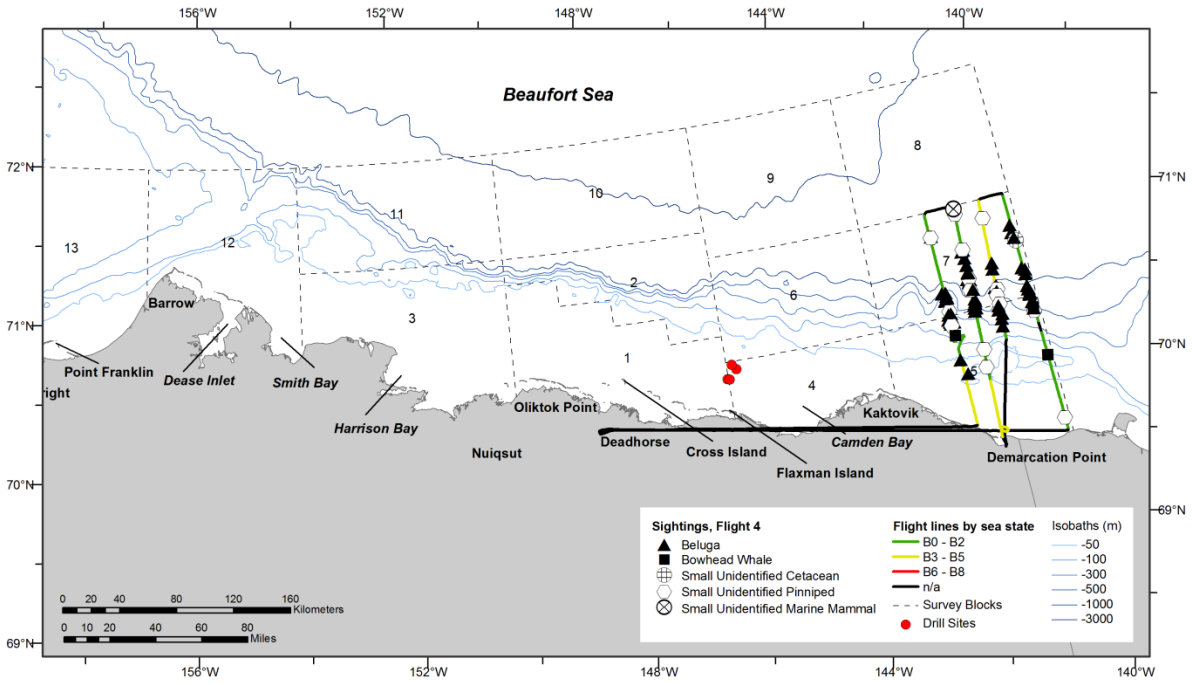

Figure B-27. ASAMM Flight 4 survey track, depicted by sea state, and all sightings.

23 July 2012, Flight 215

Flight was a transect survey of portions of blocks 3, 11, and 12. Survey conditions were good in the area surveyed with clear to partly cloudy skies. Visibility was <1-10 km, and sea states were Beaufort 0-1. Ice cover was 0-95% broken floe sea ice in the area surveyed. Sightings included 1 bowhead whale, belugas, 1 walrus, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
215	7/23/12 12:49	71.934	154.371	beluga	swim	1	0	12
215	7/23/12 12:50	71.891	154.359	beluga	swim	2	0	12
215	7/23/12 12:51	71.861	154.352	beluga	rest	1	0	12
215	7/23/12 12:51	71.854	154.352	beluga	rest	1	0	12
215	7/23/12 14:06	71.956	154.757	beluga	swim	1	0	12
215	7/23/12 14:20	71.646	155.190	beluga	mill	4	0	12
215	7/23/12 14:23	71.537	155.202	bowhead whale	rest	1	0	12
215	7/23/12 14:59	71.588	155.631	beluga	rest	3	0	12

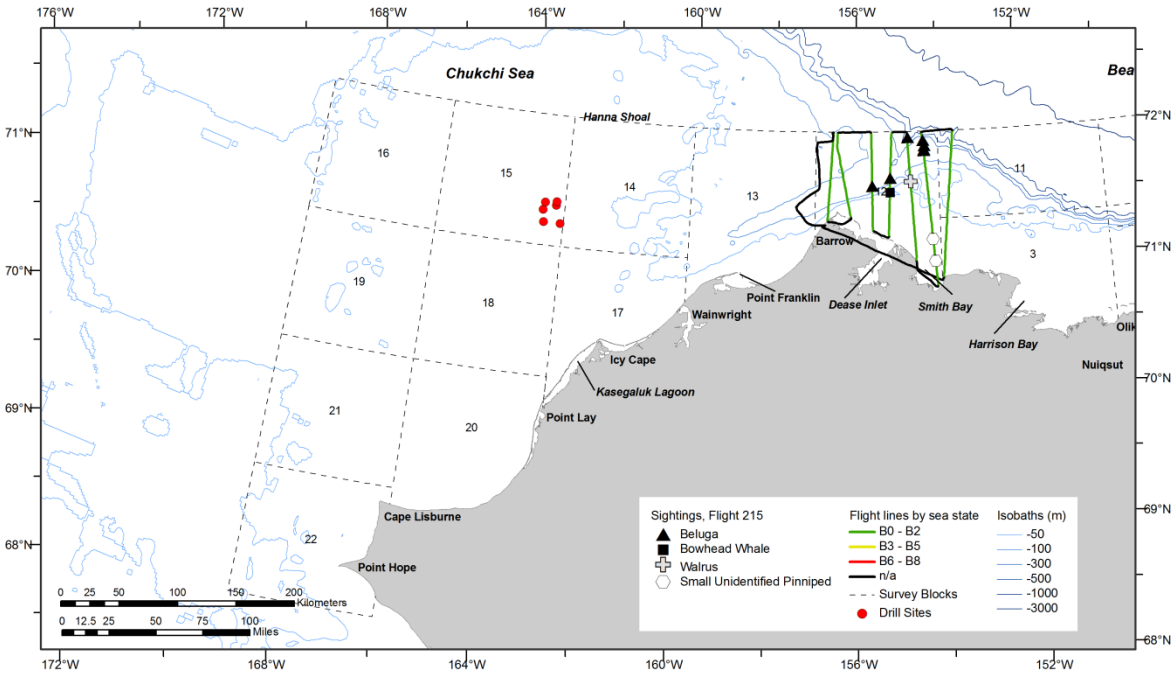

Figure B-28. ASAMM Flight 215 survey track, depicted by sea state, and all sightings.

23 July 2012, Flight 5

Flight was a transect survey of portions of blocks 3 and 11. Survey conditions were good in the area surveyed with clear to partly cloudy skies. Visibility was 5-10 km, and sea states were Beaufort 1-2. Ice cover was 0-95% broken floe sea ice in the area surveyed. Sightings included six bowhead whales, belugas, one unidentified cetacean, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
5	7/23/12 11:11	71.782	153.059	beluga	swim	4	0	11
5	7/23/12 11:11	71.790	153.058	beluga	mill	2	1	11
5	7/23/12 11:24	71.879	152.778	beluga	rest	2	0	11
5	7/23/12 11:27	71.799	152.797	beluga	mill	3	0	11
5	7/23/12 11:33	71.629	152.814	beluga	swim	1	0	11
5	7/23/12 11:33	71.611	152.818	beluga	swim	1	0	11
5	7/23/12 11:34	71.598	152.821	bowhead whale	swim	1	0	11
5	7/23/12 11:35	71.590	152.854	bowhead whale	dive	2	0	11
5	7/23/12 11:48	71.333	152.857	unid cetacean	unknown	1	0	3
5	7/23/12 12:24	71.250	152.300	beluga	swim	4	0	3
5	7/23/12 12:33	71.572	152.233	beluga	swim	1	0	11
5	7/23/12 12:33	71.577	152.232	beluga	mill	2	0	11
5	7/23/12 12:34	71.585	152.229	beluga	swim	1	0	11
5	7/23/12 12:35	71.619	152.221	bowhead whale	rest	2	0	11
5	7/23/12 12:58	71.803	151.690	beluga	swim	1	0	11
5	7/23/12 13:01	71.717	151.705	beluga	swim	6	1	11
5	7/23/12 13:03	71.684	151.713	beluga	swim	2	0	11
5	7/23/12 13:07	71.566	151.737	beluga	swim	1	0	11
5	7/23/12 14:25	71.503	151.413	beluga	swim	2	0	11
5	7/23/12 14:25	71.505	151.413	beluga	swim	1	0	11
5	7/23/12 14:28	71.585	151.426	bowhead whale	breach	1	0	11
5	7/23/12 14:30	71.601	151.427	beluga	mill	3	0	11
5	7/23/12 14:33	71.710	151.446	beluga	swim	3	0	11
5	7/23/12 14:33	71.716	151.447	beluga	swim	1	0	11
5	7/23/12 14:33	71.716	151.447	beluga	swim	1	0	11
5	7/23/12 14:35	71.776	151.454	beluga	mill	5	0	11
5	7/23/12 14:50	71.859	150.884	beluga	swim	1	0	11
5	7/23/12 14:50	71.857	150.884	beluga	swim	3	0	11
5	7/23/12 14:50	71.847	150.881	beluga	swim	2	0	11
5	7/23/12 14:50	71.845	150.881	beluga	swim	2	0	11
5	7/23/12 14:51	71.807	150.870	beluga	swim	1	0	11
5	7/23/12 14:52	71.793	150.867	beluga	swim	1	0	11
5	7/23/12 14:53	71.759	150.858	beluga	swim	1	0	11
5	7/23/12 14:53	71.753	150.856	beluga	swim	1	0	11
5	7/23/12 14:54	71.730	150.849	beluga	swim	1	0	11
5	7/23/12 14:54	71.726	150.848	beluga	swim	1	0	11
5	7/23/12 14:55	71.701	150.840	beluga	swim	1	0	11
5	7/23/12 14:58	71.614	150.816	beluga	swim	1	0	11
5	7/23/12 15:00	71.567	150.803	beluga	swim	11	1	11

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
5	7/23/12 15:00	71.563	150.802	beluga	swim	7	0	11
5	7/23/12 15:04	71.441	150.769	beluga	rest	1	0	11
5	7/23/12 15:07	71.367	150.748	beluga	swim	1	0	11
5	7/23/12 15:08	71.332	150.739	beluga	swim	1	0	3

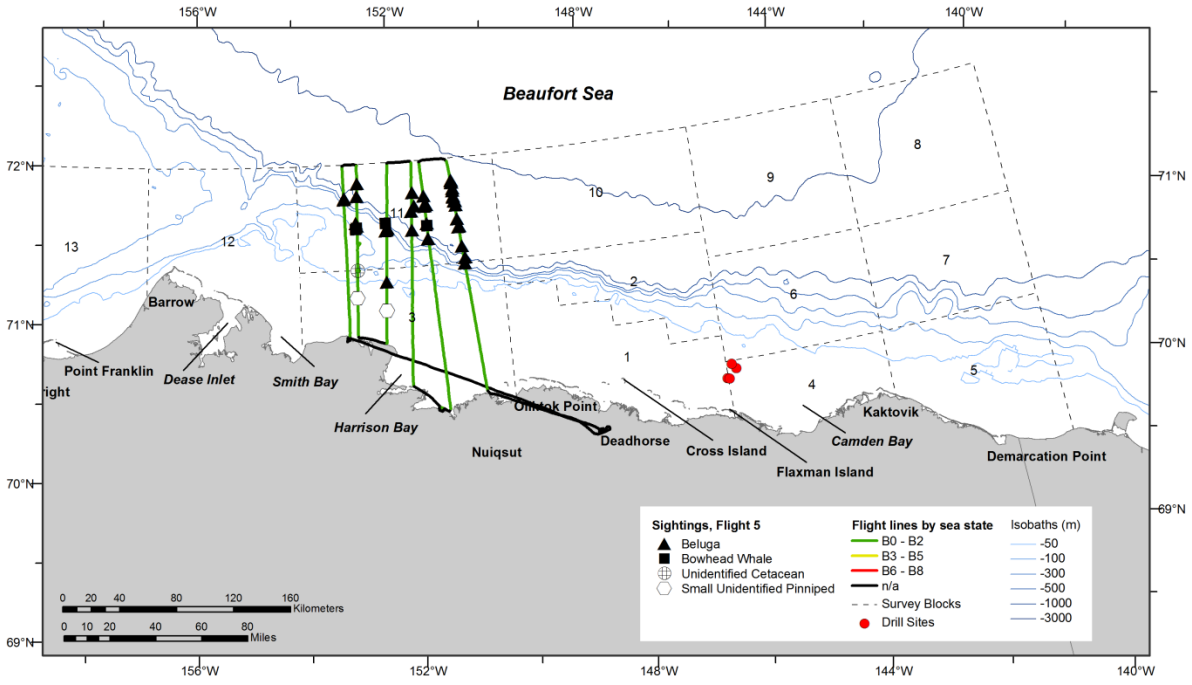

Figure B-29. ASAMM Flight 5 survey track, depicted by sea state, and all sightings.

24 July 2012, Flight 6

Flight was a transect survey of a portions of blocks 1 and 2. Survey conditions were good in the area surveyed with overcast skies. Visibility was 1-10 km, and sea states were Beaufort 1-2. Ice cover was 0-85% broken floe sea ice in the area surveyed. Sightings included belugas, one unidentified pinniped, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
6	7/24/12 10:53	71.198	149.582	beluga	swim	1	0	2
6	7/24/12 10:55	71.271	149.554	beluga	swim	1	0	2
6	7/24/12 11:00	71.277	149.161	beluga	swim	2	0	2
6	7/24/12 11:00	71.272	149.162	beluga	swim	1	0	2
6	7/24/12 11:30	70.477	148.684	beluga	swim	1	0	1
6	7/24/12 11:55	71.273	148.680	beluga	swim	3	0	2
6	7/24/12 12:03	71.149	148.269	beluga	swim	10	0	2
6	7/24/12 12:06	71.073	148.284	beluga	swim	1	0	2

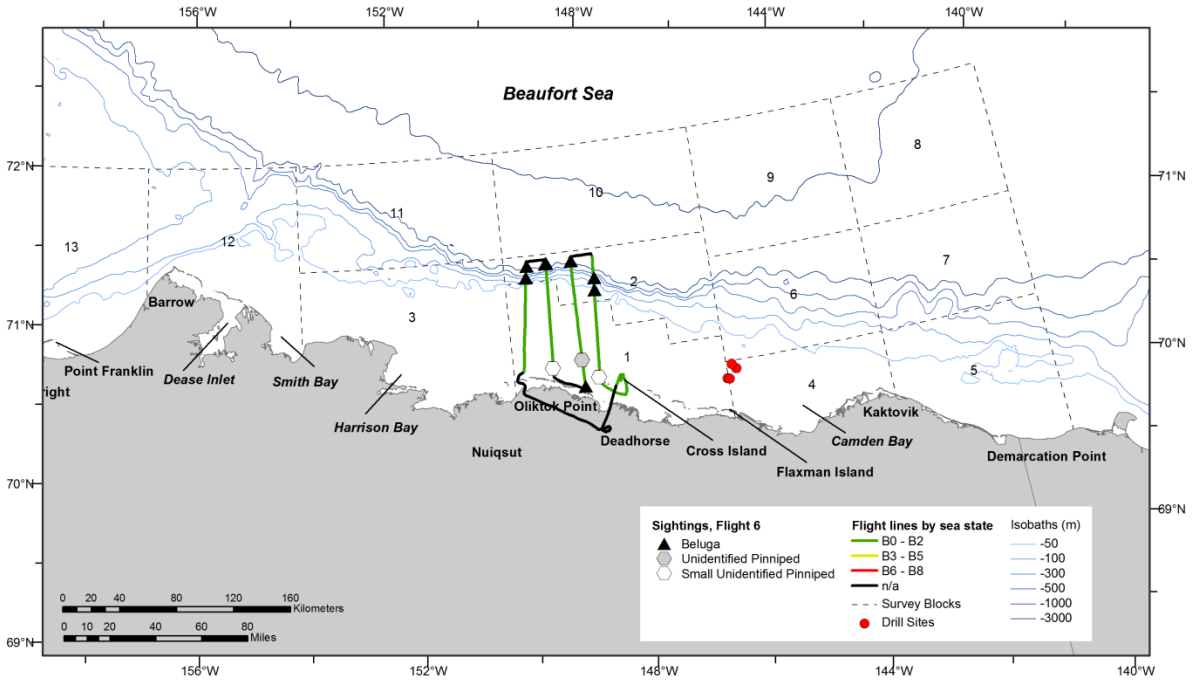

Figure B-30. ASAMM Flight 6 survey track, depicted by sea state, and all sightings.

25 July 2012, Flight 216

Flight was a partial survey of transects 11, 13, 15, and 17. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with lower visibility offshore, and sea states were Beaufort 1-5. Extensive cloud cover offshore, including low ceilings, fog, and precipitation, prevented complete coverage of transects. Ice cover was 0-60% broken floe sea ice in the area surveyed. Sightings included gray whales, including four calves, walruses, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
216	7/25/12 10:15	70.144	162.612	gray whale	swim	1	0	17
216	7/25/12 11:55	70.324	161.658	gray whale	swim	2	1	17
216	7/25/12 12:07	70.469	162.193	gray whale	swim	2	1	17
216	7/25/12 12:44	71.180	164.909	gray whale	swim	1	0	15
216	7/25/12 13:41	70.791	161.745	gray whale	rest	1	0	17
216	7/25/12 13:49	70.717	161.480	gray whale	rest	2	1	17
216	7/25/12 13:58	70.532	160.836	gray whale	feed	2	1	17

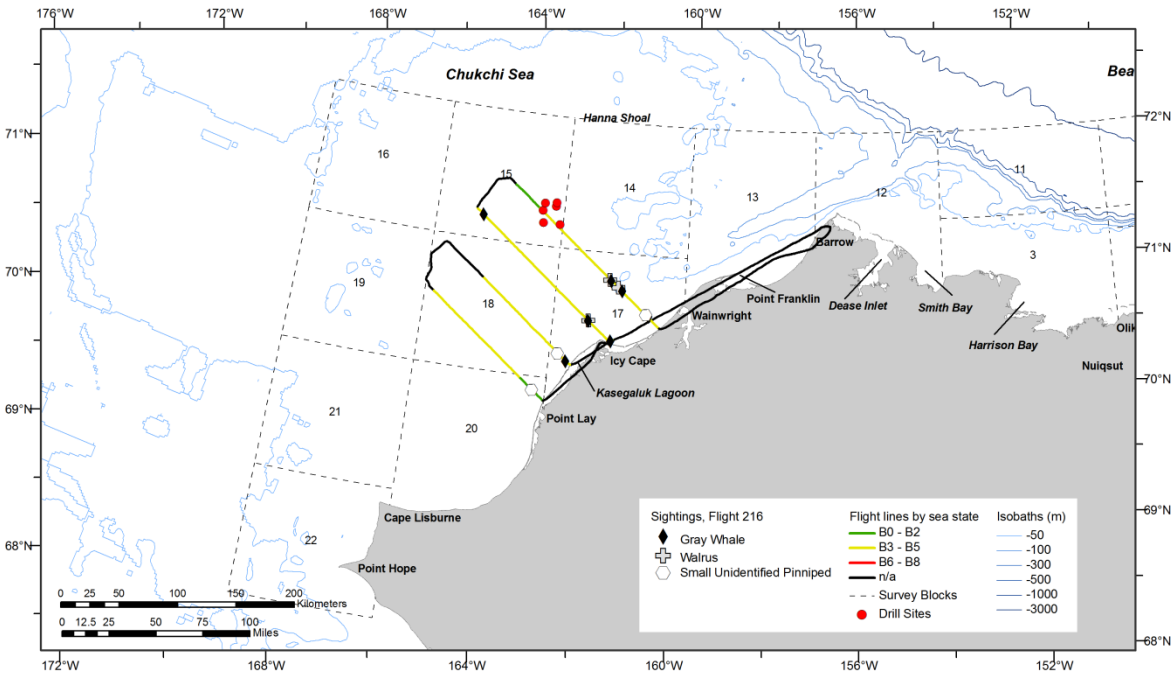

Figure B-31. ASAMM Flight 216 survey track, depicted by sea state, and all sightings.

26 July 2012, Flight 217

Flight was a survey of transect 2, a partial survey of transect 4, and the coastal transect from south of Point Barrow to Ledyard Bay. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was <1-10 km with lower visibility offshore and precipitation along the coast, and sea states were Beaufort 1-4. Extensive fog offshore prevented complete coverage of transect 4. Ice cover was 0-70% broken floe sea ice in the area surveyed. Sightings included gray whales including 12 calves, 1 humpback whale, 1 unidentified cetacean, walruses, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
217	7/26/12 10:51	70.885	159.167	gray whale	rest	2	1	13
217	7/26/12 10:58	70.846	159.461	gray whale	swim	1	0	13
217	7/26/12 11:00	70.843	159.494	gray whale	swim	2	1	13
217	7/26/12 11:03	70.825	159.588	gray whale	swim	2	0	13
217	7/26/12 11:03	70.822	159.601	gray whale	swim	1	0	13
217	7/26/12 11:04	70.821	159.606	gray whale	swim	1	0	13
217	7/26/12 11:04	70.820	159.614	gray whale	feed	8	2	13
217	7/26/12 11:04	70.818	159.619	gray whale	swim	2	0	13
217	7/26/12 11:04	70.815	159.638	gray whale	swim	1	0	13
217	7/26/12 11:05	70.796	159.702	gray whale	swim	3	0	13
217	7/26/12 11:05	70.792	159.711	gray whale	swim	2	0	13
217	7/26/12 11:07	70.791	159.709	gray whale	swim	2	1	13
217	7/26/12 11:12	70.786	159.675	gray whale	swim	2	1	13
217	7/26/12 11:15	70.771	159.742	gray whale	feed	1	0	13
217	7/26/12 11:15	70.762	159.769	gray whale	swim	2	1	13
217	7/26/12 11:15	70.750	159.778	gray whale	swim	1	0	13
217	7/26/12 11:16	70.761	159.753	gray whale	swim	2	1	13
217	7/26/12 11:20	70.718	159.878	gray whale	feed	4	0	13
217	7/26/12 11:21	70.717	159.886	gray whale	swim	1	0	13
217	7/26/12 11:23	70.688	159.964	humpback whale	feed	1	0	13
217	7/26/12 12:08	70.304	162.031	gray whale	swim	2	0	17
217	7/26/12 12:09	70.275	162.133	gray whale	rest	2	1	17
217	7/26/12 12:11	70.224	162.300	gray whale	swim	1	0	17
217	7/26/12 12:14	70.176	162.416	gray whale	feed	4	1	17
217	7/26/12 12:15	70.175	162.420	gray whale	swim	2	1	17
217	7/26/12 12:17	70.151	162.468	gray whale	swim	2	1	17
217	7/26/12 12:19	70.102	162.558	gray whale	swim	1	0	17
217	7/26/12 12:25	70.056	162.619	unid cetacean	swim	1	0	17

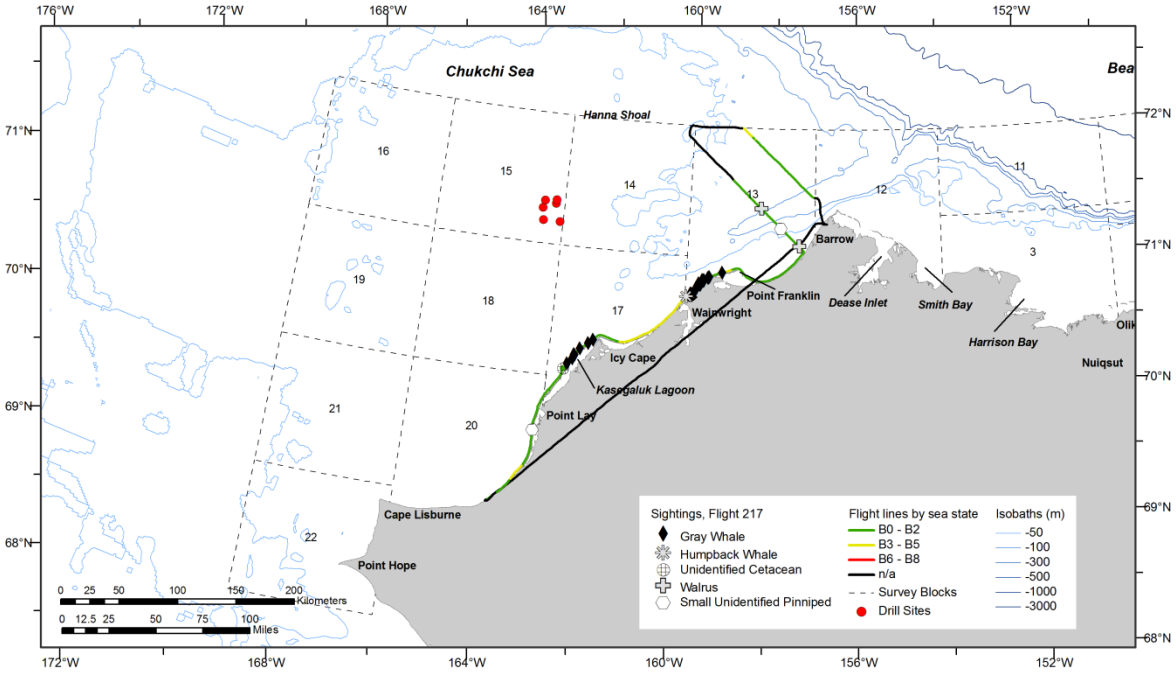

Figure B-32. ASAMM Flight 217 survey track, depicted by sea state, and all sightings.

26 July 2012, Flight 7

Flight was a transect survey of a portion of block 6. Survey conditions were fair in the area surveyed with overcast skies. Visibility was <1-10 km, and sea states were Beaufort 3-5. Widespread fog prevented complete coverage of transects. Ice cover was 0-7% broken floe sea ice in the area surveyed. Belugas were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
7	7/26/12 11:08	71.163	145.265	beluga	swim	2	1	6
7	7/26/12 11:16	71.142	144.658	beluga	rest	1	0	6
7	7/26/12 11:23	70.955	144.638	beluga	swim	1	0	6
7	7/26/12 11:23	70.944	144.637	beluga	rest	2	1	6
7	7/26/12 11:30	70.761	144.608	beluga	swim	1	0	6
7	7/26/12 11:30	70.756	144.608	beluga	swim	1	0	6
7	7/26/12 11:31	70.724	144.605	beluga	rest	1	0	6
7	7/26/12 11:38	70.555	144.585	beluga	swim	50	0	6

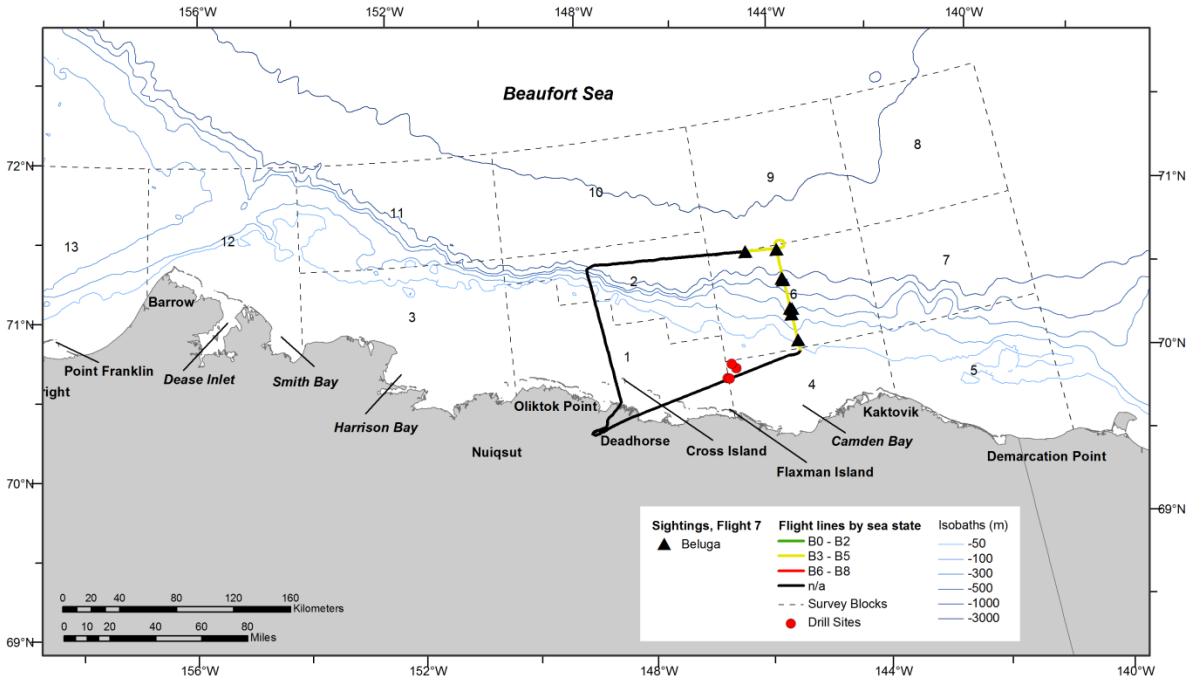

Figure B-33. ASAMM Flight 7 survey track, depicted by sea state, and all sightings.

28 July 2012, Flight 218

Flight was a survey of transect 6. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with fog, low ceilings, and precipitation, and sea states were Beaufort 1-5. Fog prevented coverage of other transects in the area. Ice cover was 0-80% broken floe sea ice in the area surveyed. Sightings included gray whales, walruses, and unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
218	7/28/12 11:53	70.946	158.382	gray whale	rest	1	0	13
218	7/28/12 11:59	71.072	158.789	gray whale	feed	1	0	13

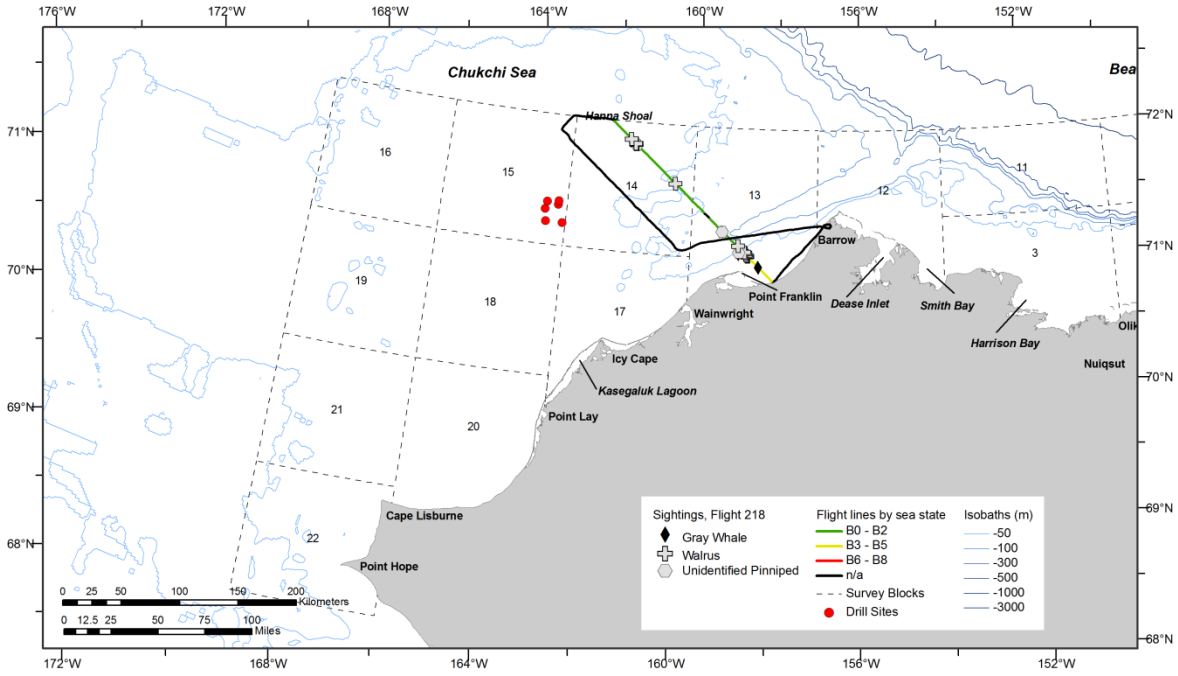

Figure B-34. ASAMM Flight 218 survey track, depicted by sea state, and all sightings.

29 July 2012, Flight 8

Flight was a partial transect survey of blocks 4 and 6, and a search survey of Cross Island. Survey conditions were fair in the area surveyed with clear to partly cloudy skies. Visibility was <1-10 km, and sea states were Beaufort 2-4. Widespread fog preventing coverage of other transects in the area. Ice cover was 0-50% broken floe sea ice in the area surveyed. Belugas were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
8	7/29/12 10:44	70.146	143.221	beluga	swim	1	0	4
8	7/29/12 10:44	70.146	143.221	beluga	swim	2	0	4
8	7/29/12 11:01	70.724	143.130	beluga	swim	2	0	6
8	7/29/12 11:01	70.727	143.130	beluga	swim	2	0	6
8	7/29/12 11:01	70.727	143.130	beluga	swim	1	0	6
8	7/29/12 11:02	70.730	143.129	beluga	swim	1	0	6

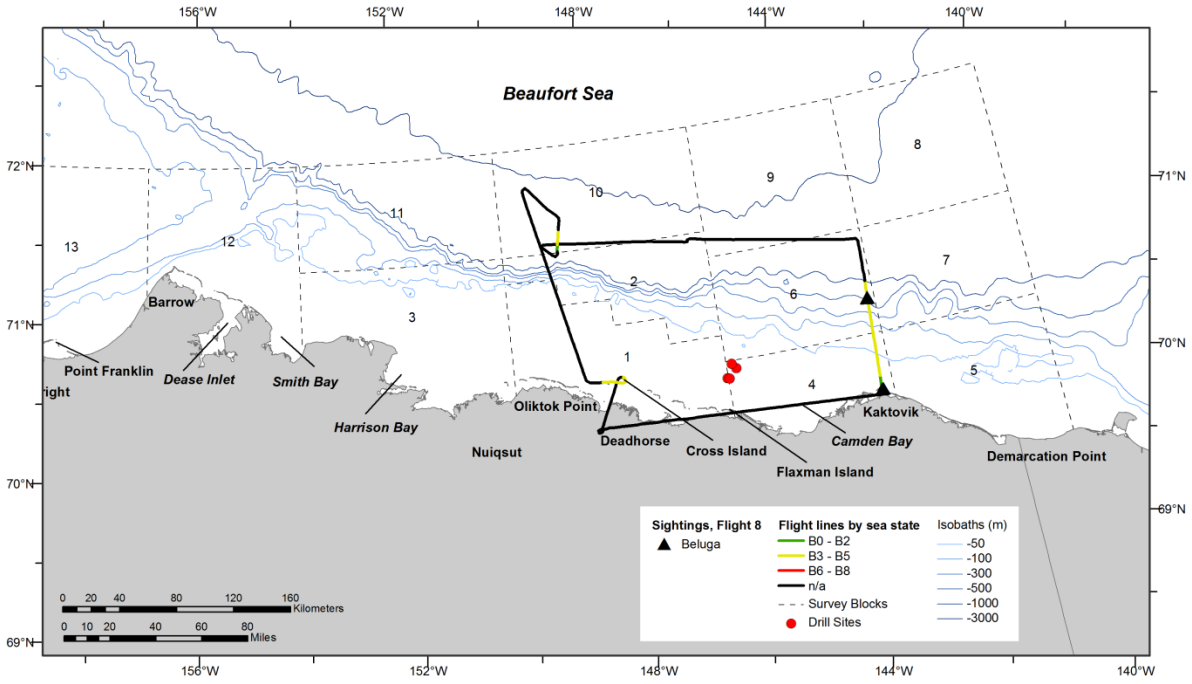

Figure B-35. ASAMM Flight 8 survey track, depicted by sea state, and all sightings.

30 July 2012, Flight 219

Flight was an attempt to survey in the Chukchi Sea. Survey conditions were poor in the area with extensive fog preventing survey effort. No marine mammals were seen.

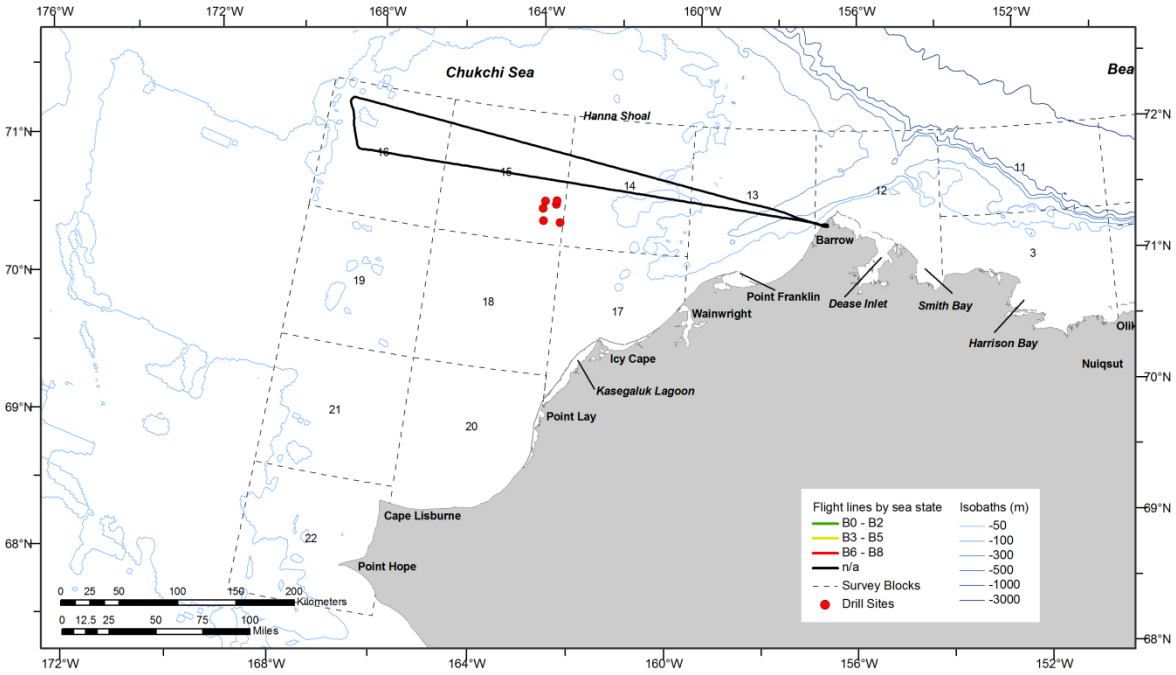

Figure B-36. ASAMM Flight 219 survey track, depicted by sea state.

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1 August 2012, Flight 9

Flight was a transect survey of portions of block 12. Survey conditions were fair in the area surveyed with overcast skies. Visibility was <1-10 km, and sea states were Beaufort 1-5. Extensive fog prevented coverage of other transects in block 12. Ice cover was 0-90% broken floe sea ice in the area surveyed. Belugas were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
9	8/1/12 17:43	71.666	155.654	beluga	swim	2	0	12
9	8/1/12 18:07	71.793	155.108	beluga	swim	1	0	12
9	8/1/12 18:07	71.786	155.105	beluga	swim	1	0	12
9	8/1/12 18:07	71.780	155.102	beluga	swim	1	0	12
9	8/1/12 18:07	71.777	155.100	beluga	swim	1	0	12
9	8/1/12 18:07	71.767	155.094	beluga	swim	1	0	12
9	8/1/12 18:07	71.767	155.094	beluga	swim	1	0	12
9	8/1/12 18:08	71.759	155.090	beluga	swim	2	0	12
9	8/1/12 18:08	71.758	155.090	beluga	swim	1	0	12
9	8/1/12 18:08	71.741	155.099	beluga	swim	1	0	12
9	8/1/12 18:08	71.741	155.099	beluga	swim	1	0	12
9	8/1/12 18:09	71.711	155.126	beluga	swim	1	0	12
9	8/1/12 18:09	71.704	155.134	beluga	swim	1	0	12
9	8/1/12 18:10	71.696	155.139	beluga	swim	1	0	12
9	8/1/12 18:10	71.683	155.144	beluga	swim	20	0	12
9	8/1/12 18:10	71.682	155.145	beluga	swim	3	0	12

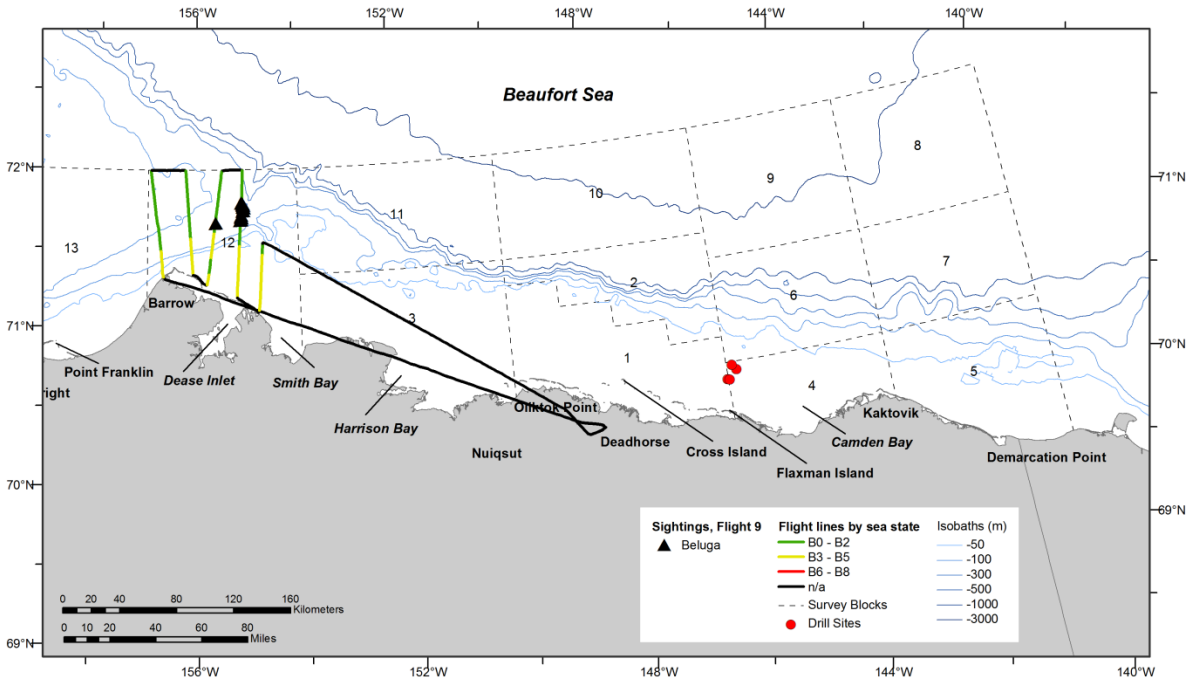

Figure B-37. ASAMM Flight 9 survey track, depicted by sea state, and all sightings.

4 August 2012, Flight 220

Flight was a search survey southwest of Barrow. Survey conditions were poor in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with fog, low ceilings, and glare, and sea states were Beaufort 2-4. Extensive fog and low ceilings prevented coverage of survey effort. Ice cover was 0-5% broken floe sea ice in the area surveyed. Sightings included gray whales, 1 humpback whale, and 1 unidentified pinniped.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
220	8/4/12 11:45	71.205	157.243	gray whale	swim	1	0	13
220	8/4/12 11:47	71.199	157.218	gray whale	feed	2	0	13
220	8/4/12 11:52	71.168	157.124	humpback whale	roll	1	0	13
220	8/4/12 11:53	71.166	157.122	gray whale	roll	1	0	13

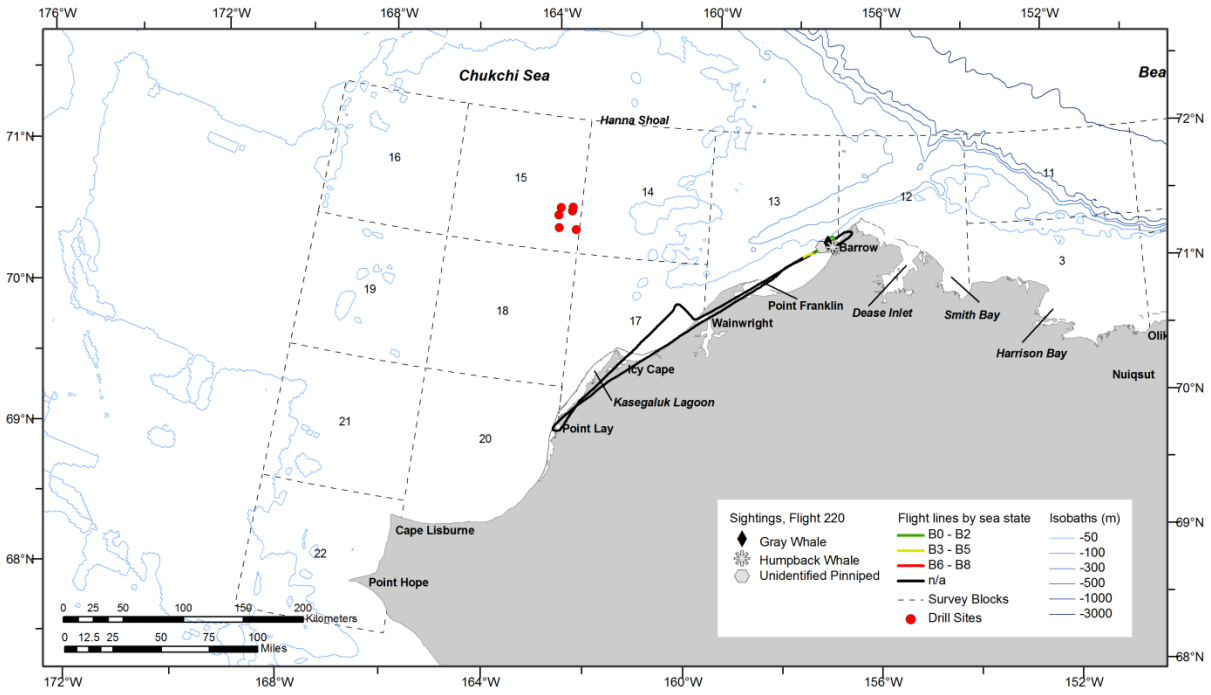

Figure B-38. ASAMM Flight 220 survey track, depicted by sea state, and all sightings.

Humpback (right) and gray whale (left) frolicking southwest of Barrow. Alaska, on flight 220, 4 August 2012.

4 August 2012, Flight 10

Flight was a transect survey of portions of blocks 5 and 7. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 2-5. Extensive fog prevented coverage of other transects in blocks 5 and 7. There was no sea ice in the area surveyed. Sightings included bowhead whales, including one calf, belugas, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
10	8/4/12 11:43	70.550	140.221	beluga	swim	1	0	7
10	8/4/12 11:43	70.542	140.220	beluga	swim	1	0	7
10	8/4/12 11:43	70.537	140.220	beluga	swim	1	0	7
10	8/4/12 11:47	70.418	140.210	beluga	swim	6	0	5
10	8/4/12 11:48	70.380	140.206	beluga	swim	1	0	5
10	8/4/12 11:50	70.323	140.201	beluga	swim	8	2	5
10	8/4/12 11:50	70.318	140.200	beluga	swim	4	0	5
10	8/4/12 11:56	70.152	140.187	beluga	mill	1	0	5
10	8/4/12 11:56	70.150	140.187	beluga	mill	3	1	5
10	8/4/12 11:57	70.111	140.183	bowhead whale	swim	2	1	5
10	8/4/12 12:12	69.819	140.162	beluga	swim	1	0	5
10	8/4/12 12:12	69.801	140.158	beluga	swim	1	0	5
10	8/4/12 12:34	69.905	140.567	bowhead whale	mill	1	0	5
10	8/4/12 12:50	70.393	140.612	beluga	swim	1	0	5
10	8/4/12 12:50	70.401	140.612	beluga	swim	1	0	5
10	8/4/12 12:50	70.405	140.612	beluga	swim	1	0	5
10	8/4/12 12:50	70.406	140.612	beluga	swim	6	1	5
10	8/4/12 12:51	70.416	140.614	beluga	swim	2	1	5
10	8/4/12 12:51	70.433	140.615	beluga	swim	1	0	5
10	8/4/12 12:51	70.434	140.616	beluga	swim	1	0	5

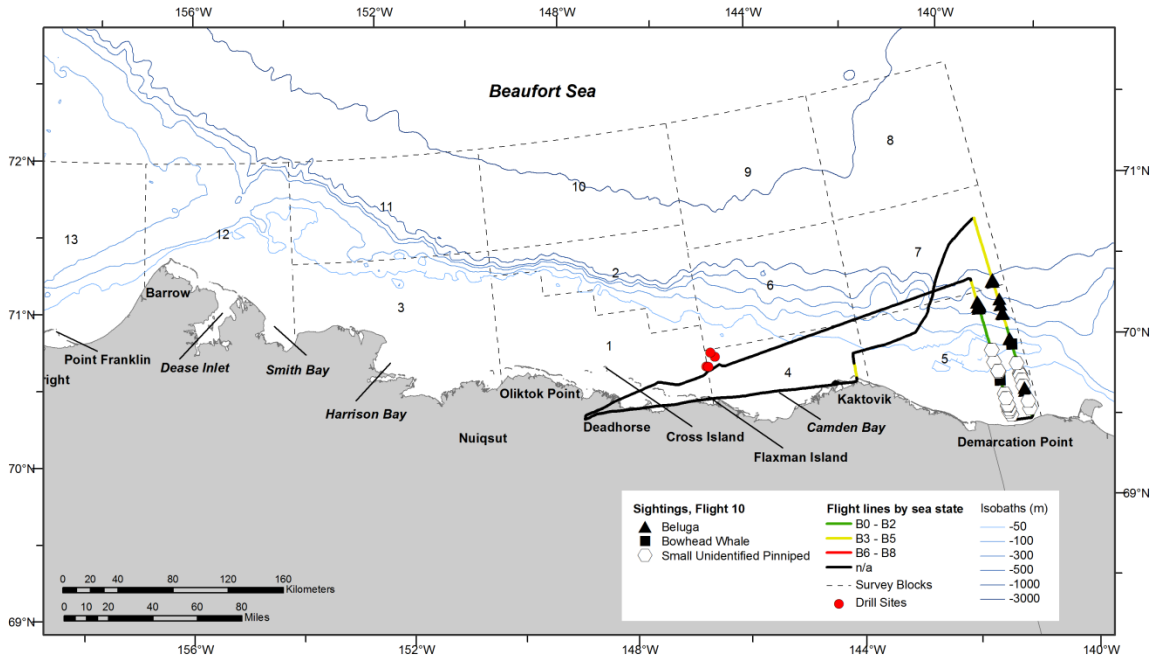

Figure B-39. ASAMM Flight 10 survey track, depicted by sea state, and all sightings.

5 August 2012, Flight 221

Flight was a transect survey of portions of blocks 3 and 11. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 5-10 km with glare, and sea states were Beaufort 2-6. Ice cover was 0-75% broken floe sea ice in the area surveyed. Sightings included belugas and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
221	8/5/12 11:35	71.299	150.554	beluga	swim	1	0	3
221	8/5/12 11:36	71.285	150.556	beluga	swim	2	1	3
221	8/5/12 13:17	71.425	151.995	beluga	swim	1	0	11
221	8/5/12 13:17	71.419	151.995	beluga	swim	12	0	11
221	8/5/12 14:14	71.582	152.270	beluga	swim	1	0	11

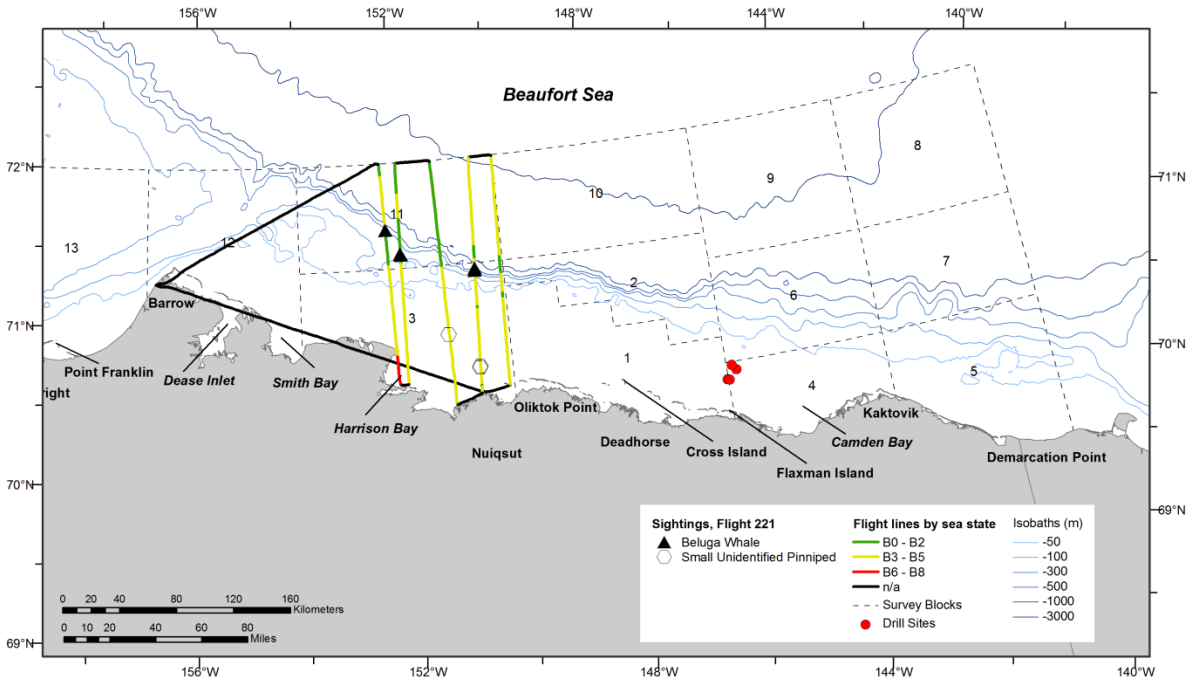

Figure B-40. ASAMM Flight 221 survey track, depicted by sea state, and all sightings.

5 August 2012, Flight 11

Flight was a transect survey of portions of blocks 1, 2, and 10. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 5-10 km, and sea states were Beaufort 0-4. Ice cover was 0-50% broken floe sea ice scattered throughout the area surveyed. Sightings included belugas, polar bears, one bearded seal and small unidentified pinnipeds. One polar bear was observed swimming among broken ice floe approximately 20 km from barrier islands and four polar bears, including one cub, were observed on Cross Island.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
11	8/5/12 10:43	71.372	149.583	beluga	swim	1	0	10
11	8/5/12 10:44	71.383	149.590	beluga	swim	2	0	10
11	8/5/12 12:51	70.956	146.337	beluga	swim	4	0	2
11	8/5/12 12:52	70.952	146.336	beluga	swim	1	0	2
11	8/5/12 12:52	70.947	146.336	beluga	swim	3	1	2
11	8/5/12 13:39	70.820	146.739	beluga	swim	11	0	2
11	8/5/12 14:09	70.999	147.226	beluga	swim	1	0	2

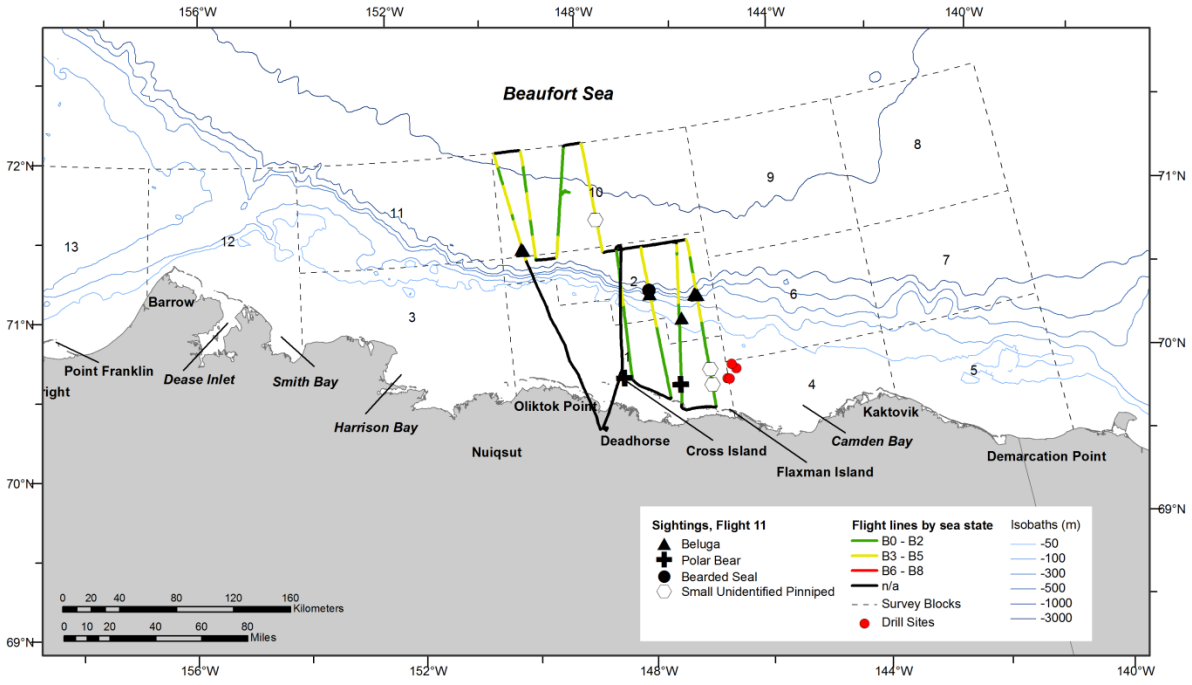

Figure B-41. ASAMM Flight 11 survey track, depicted by sea state, and all sightings.

6 August 2012, Flight 222

Flight was a survey of transects 1 and 3, and a partial survey of transects 5 and 7. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 2-10 km with glare, haze, low ceilings, and precipitation, and sea states were Beaufort 1-7. High sea states prevented completion of transects 5 and 7. Ice cover was 0-85% broken floe sea ice in the area surveyed. Sightings included one gray whale, walruses, unidentified pinnipeds, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
222	8/6/12 10:42	71.326	157.329	gray whale	swim	1	0	13

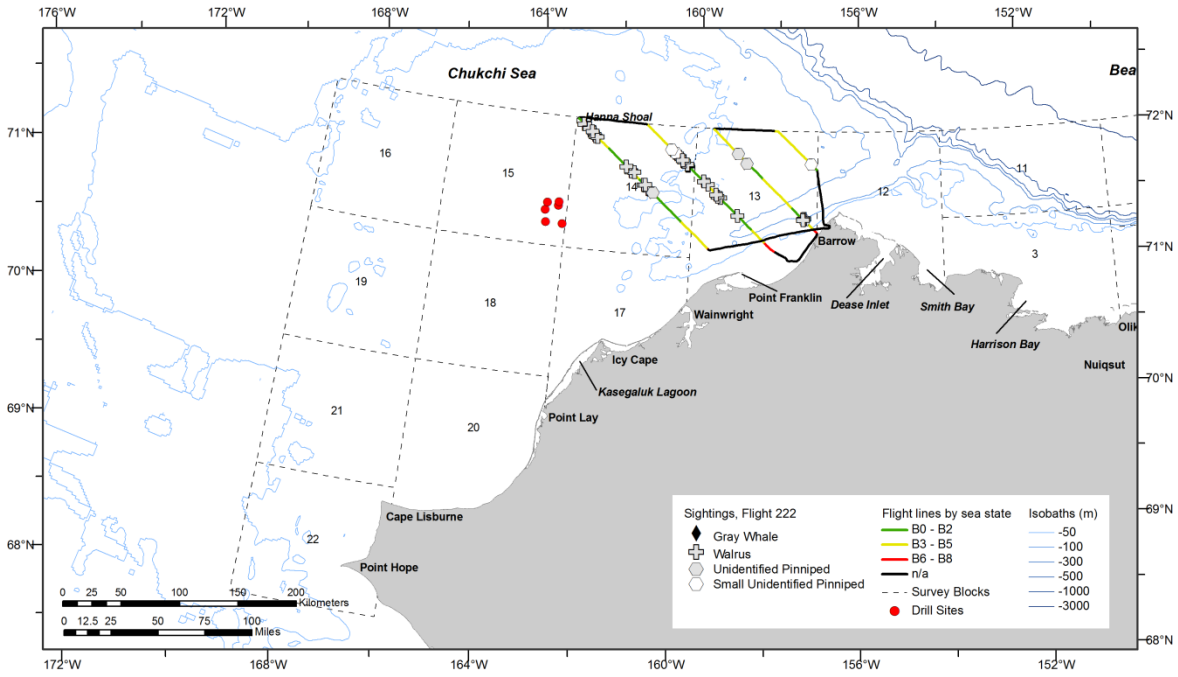

Figure B-42. ASAMM Flight 222 survey track, depicted by sea state, and all sightings.

7 August 2012, Flight 12

Flight was a transect survey of portions of blocks 4 and 6. Survey conditions were poor in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 2-6. High sea states and extensive fog and low ceilings prevented completion of transects of blocks 4 and 6. Ice cover was 0-30% broken floe sea ice in the area surveyed. Belugas were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
12	8/7/12 14:33	70.670	143.289	beluga	mill	1	0	6
12	8/7/12 14:33	70.680	143.285	beluga	mill	1	0	6
12	8/7/12 14:33	70.680	143.285	beluga	swim	1	0	6

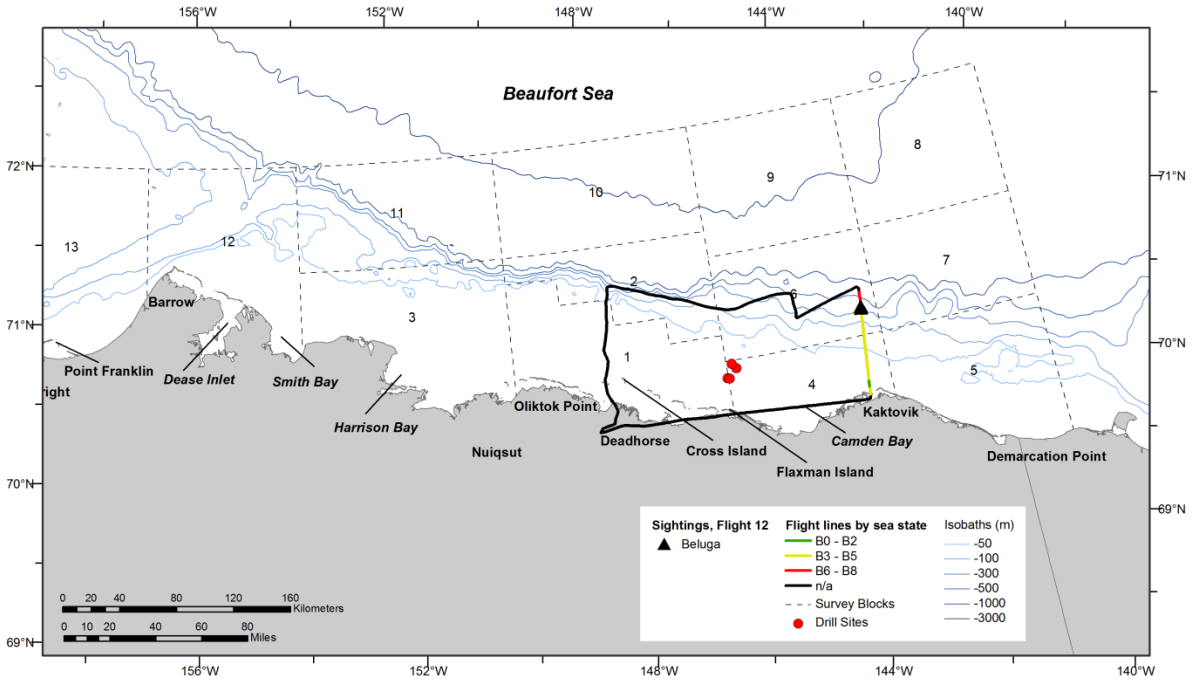

Figure B-43. ASAMM Flight 12 survey track, depicted by sea state, and all sightings.

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9 August 2012, Flight 13

Flight was a transect survey of blocks 4 and 6. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 5-10 km, and sea states were Beaufort 1-6. Ice cover was 0-40% broken floe sea ice in the area surveyed. Sightings included one bearded seal and small unidentified pinnipeds.

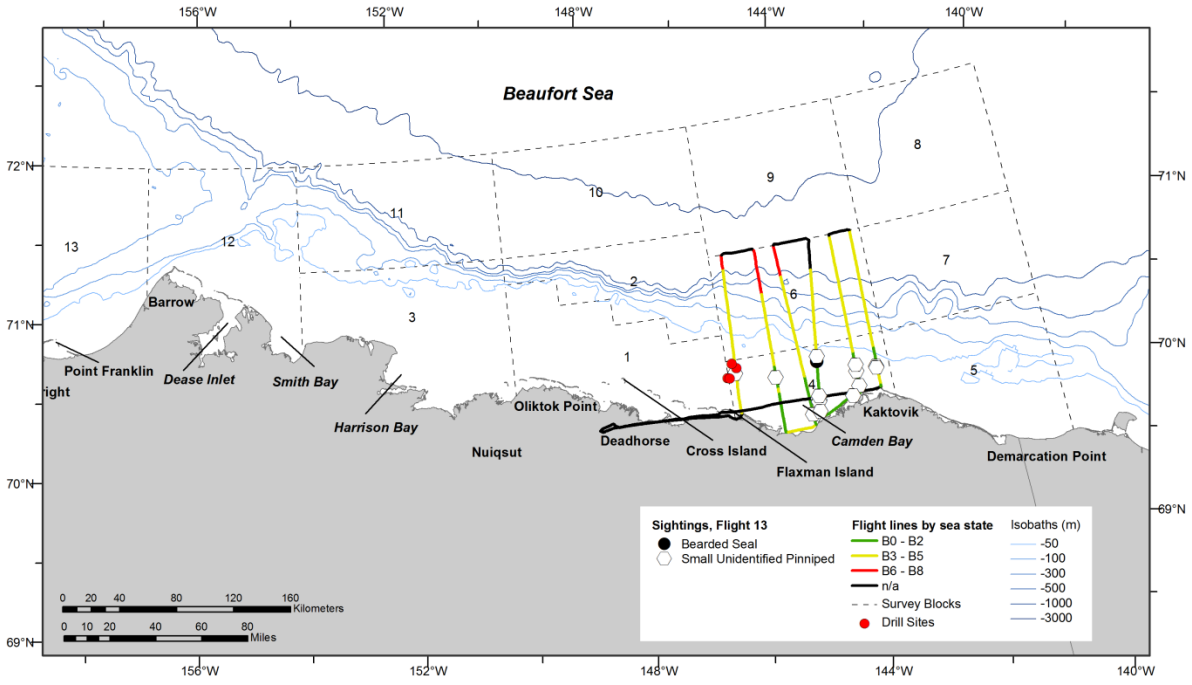


Figure B-44. ASAMM Flight 13 survey track, depicted by sea state, and all sightings.

11 August 2012, Flight 14

Flight was a transect survey of block 12. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 0-3. Ice cover was 0-90% broken floe sea ice in the area surveyed. Sightings included bowhead whales, gray whales, one unidentified cetacean, belugas, walruses and small unidentified pinnipeds. The bowhead whales were observed approximately 30 km east of Point Barrow. One group of six bowhead whales were observed in a circular formation, heads inward with one individual in the center. After the formation broke apart, two animals observed in close proximity to one another were seen creating subsurface bubbles. The bowhead whales in the sighting of seven individuals were spread apart and milling. All gray whale observations were associated with mud plumes and/or mud on heads. All walrus sightings were of animals hauled out on ice.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
14	8/11/12 16:25	71.406	156.659	gray whale	feed	3	0	12
14	8/11/12 17:00	71.577	156.241	beluga	swim	1	0	12
14	8/11/12 17:01	71.541	156.225	beluga	swim	1	0	12
14	8/11/12 17:02	71.527	156.219	beluga	swim	2	0	12
14	8/11/12 17:02	71.519	156.215	beluga	swim	5	0	12
14	8/11/12 17:02	71.515	156.213	beluga	swim	5	1	12
14	8/11/12 17:03	71.510	156.210	beluga	mill	100	0	12
14	8/11/12 17:03	71.499	156.204	gray whale	feed	1	0	12
14	8/11/12 17:03	71.495	156.202	gray whale	feed	2	0	12
14	8/11/12 17:03	71.489	156.200	gray whale	feed	3	0	12
14	8/11/12 17:08	71.486	156.147	gray whale	feed	1	0	12
14	8/11/12 17:31	71.400	155.562	bowhead whale	swim	1	0	12
14	8/11/12 17:31	71.404	155.563	bowhead whale	rest	6	0	12
14	8/11/12 17:33	71.395	155.604	bowhead whale	mill	7	0	12
14	8/11/12 18:20	71.858	155.148	beluga	swim	12	0	12
14	8/11/12 18:20	71.851	155.149	beluga	swim	2	0	12
14	8/11/12 18:21	71.825	155.152	beluga	swim	6	1	12
14	8/11/12 18:24	71.746	155.164	beluga	rest	1	0	12
14	8/11/12 19:08	71.636	154.692	unid cetacean	swim	1	0	12
14	8/11/12 19:17	71.922	154.734	beluga	mill	2	1	12
14	8/11/12 19:17	71.930	154.735	beluga	mill	8	0	12
14	8/11/12 19:17	71.939	154.738	beluga	swim	6	0	12
14	8/11/12 19:18	71.953	154.744	beluga	swim	2	1	12

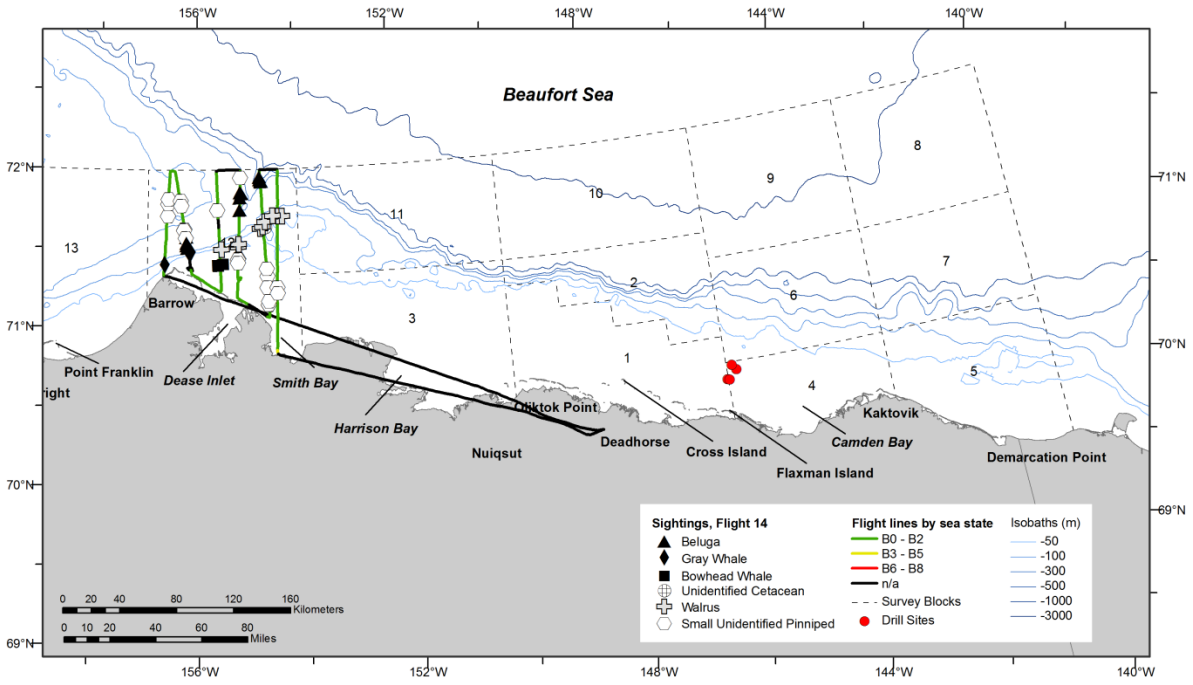


Figure B-45. ASAMM Flight 14 survey track, depicted by sea state, and all sightings.

Six bowhead whales at the surface: five whales observed in circular formation with heads inward, around one whale upside down in the center, on flight 14, 11 August 2012 (left). Bowhead whales with distinctive markings on flight 14, 11 August 2012 (right).

12 August 2012, Flight 223

Flight was a partial survey of transects 12, 14, 16, and 18. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with glare, low ceilings, fog, and precipitation, and sea states were Beaufort 1-2. Low ceilings and fog prevented completion of the transects. Ice cover was 0-5% broken floe sea ice in the area surveyed. Sightings included 21 gray whales, including 4 calves, 2 humpback whales, 3 minke whales, 3 unidentified cetaceans, 7 belugas, walruses, unidentified pinnipeds, and small unidentified pinnipeds. One dead unidentified cetacean (likely a gray whale) was also seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
223	8/12/12 11:07	71.087	157.967	unid cetacean	dead	1	0	13
223	8/12/12 11:13	71.084	158.070	gray whale	swim	1	0	13
223	8/12/12 11:13	71.082	158.132	beluga	swim	1	0	13
223	8/12/12 11:14	71.080	158.185	gray whale	feed	1	0	13
223	8/12/12 11:15	71.075	158.263	gray whale	feed	1	0	13
223	8/12/12 11:18	71.059	158.550	unid cetacean	swim	2	1	13
223	8/12/12 11:19	71.065	158.554	gray whale	swim	1	0	13
223	8/12/12 11:25	71.080	158.692	gray whale	swim	2	0	13
223	8/12/12 11:27	71.073	158.737	gray whale	feed	4	1	13
223	8/12/12 11:28	71.081	158.716	gray whale	swim	1	0	13
223	8/12/12 11:30	71.053	158.736	gray whale	feed	1	0	13
223	8/12/12 11:31	71.046	158.809	gray whale	feed	3	0	13
223	8/12/12 11:34	71.030	159.113	humpback whale	mill	2	0	13
223	8/12/12 11:35	71.020	159.078	gray whale	swim	4	2	13
223	8/12/12 11:39	71.041	159.059	minke whale	rest	1	0	13
223	8/12/12 11:45	71.029	159.061	gray whale	swim	2	1	13
223	8/12/12 13:39	69.912	164.160	unid cetacean	.	1	0	20
223	8/12/12 14:21	70.431	161.268	minke whale	feed	2	0	17
223	8/12/12 14:44	70.644	162.024	beluga	mill	3	0	17
223	8/12/12 14:44	70.654	162.065	beluga	swim	1	0	17
223	8/12/12 14:45	70.663	162.095	beluga	swim	2	0	17

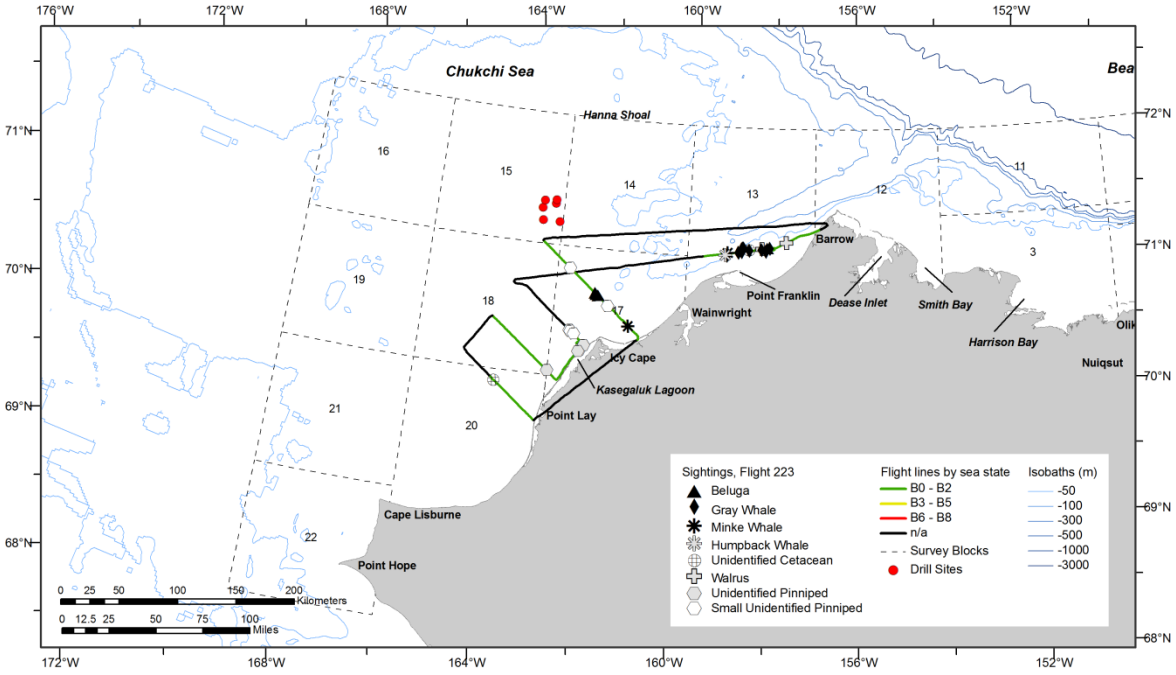
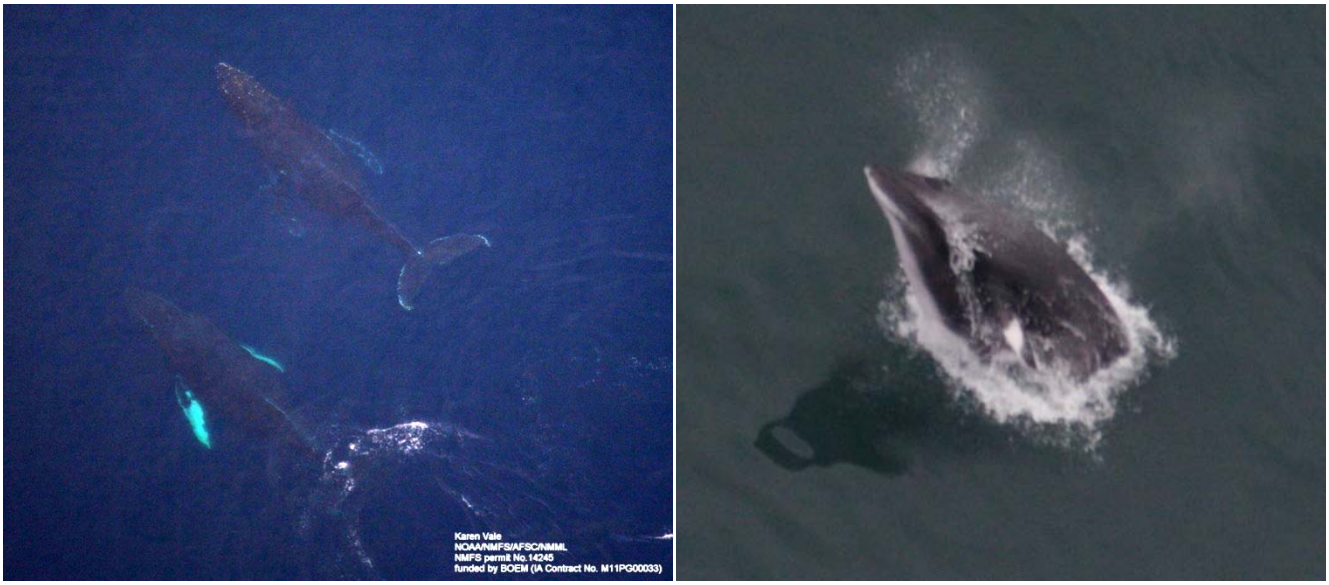


Figure B-46. ASAMM Flight 223 survey track, depicted by sea state, and all sightings.



Two humpback whales sighted approximately 80 km southwest of Barrow, Alaska, on flight 223, 12 August 2012(left). One of two minke whales sighted lunge feeding approximately 40 km southwest of Wainwright, Alaska, on flight 223, 12 August 2012(right) . Both minke whales made repeated lunges in the same area, disappeared quickly under the surface after lunging, and were distinguished from each other by differently shaped dorsal fins.

12 August 2012, Flight 15

Flight was a transect survey of blocks 3 and 11. Survey conditions were good in the area surveyed with clear to partly cloudy skies. Visibility was 0-10 km, and sea states were Beaufort 0-3. Ice cover was 0-60% broken floe sea ice in the area surveyed. Sightings included belugas, walruses and small unidentified pinnipeds. All walrus sightings were of animals hauled out on ice.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
15	8/12/12 12:51	71.931	153.809	beluga	swim	3	0	11
15	8/12/12 12:52	71.947	153.806	beluga	swim	1	0	11
15	8/12/12 12:52	71.952	153.806	beluga	swim	1	0	11
15	8/12/12 12:52	71.959	153.806	beluga	swim	4	0	11
15	8/12/12 12:53	71.994	153.802	beluga	swim	1	0	11
15	8/12/12 13:01	71.876	153.285	beluga	swim	2	0	11
15	8/12/12 13:01	71.876	153.285	beluga	swim	1	0	11
15	8/12/12 13:01	71.866	153.284	beluga	swim	2	0	11
15	8/12/12 13:01	71.862	153.284	beluga	swim	11	0	11
15	8/12/12 13:06	71.730	153.262	beluga	swim	1	0	11
15	8/12/12 13:49	71.363	152.816	beluga	rest	1	0	11
15	8/12/12 13:49	71.364	152.816	beluga	rest	2	0	11
15	8/12/12 14:01	71.724	152.876	beluga	swim	2	0	11
15	8/12/12 14:01	71.726	152.877	beluga	swim	1	0	11
15	8/12/12 14:04	71.740	152.911	beluga	swim	3	0	11
15	8/12/12 14:21	71.940	152.067	beluga	swim	1	0	11
15	8/12/12 14:29	71.677	152.097	beluga	swim	3	0	11
15	8/12/12 14:29	71.662	152.099	beluga	swim	3	0	11
15	8/12/12 14:29	71.662	152.099	beluga	swim	3	0	11
15	8/12/12 14:30	71.625	152.103	beluga	mill	1	0	11
15	8/12/12 14:32	71.561	152.110	beluga	mill	6	2	11
15	8/12/12 14:32	71.561	152.110	beluga	mill	4	1	11
15	8/12/12 14:33	71.552	152.111	beluga	mill	1	1	11
15	8/12/12 14:34	71.492	152.120	beluga	swim	2	0	11
15	8/12/12 14:55	70.837	152.183	beluga	swim	1	0	3
15	8/12/12 15:33	71.446	151.748	beluga	dive	1	0	11
15	8/12/12 15:42	71.740	151.757	beluga	swim	1	0	11
15	8/12/12 15:43	71.752	151.758	beluga	rest	3	0	11

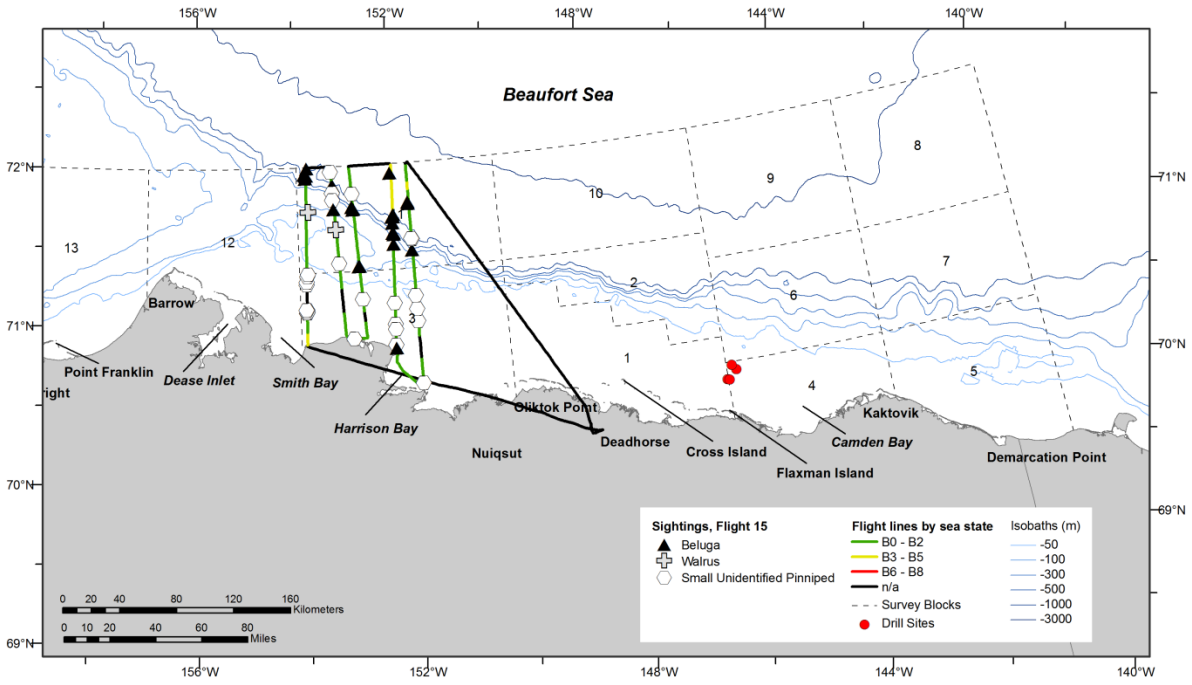


Figure B-47. ASAMM Flight 15 survey track, depicted by sea state, and all sightings.

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13 August 2012, Flight 224

Flight was the coastal transect from Point Barrow to Cape Lisburne. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with glare, low ceilings, and precipitation, and sea states were Beaufort 2-3. Fog and low ceilings prevented completion of the transect beyond Cape Lisburne. Ice cover was 0-2% broken floe sea ice in the area surveyed. Sightings included 6 gray whales including 1 calf, 1 unidentified cetacean, and small unidentified pinnipeds. Two pinniped carcasses were seen on the beach south of Point Lay.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
224	8/13/12 12:55	71.279	156.879	gray whale	feed	1	0	12
224	8/13/12 12:55	71.275	156.887	gray whale	mill	1	0	12
224	8/13/12 12:56	71.256	156.923	gray whale	feed	1	0	12
224	8/13/12 12:58	71.188	157.051	gray whale	swim	2	1	13
224	8/13/12 13:23	70.915	158.868	unid cetacean	swim	1	0	13
224	8/13/12 13:36	70.803	159.688	gray whale	dive	1	0	13

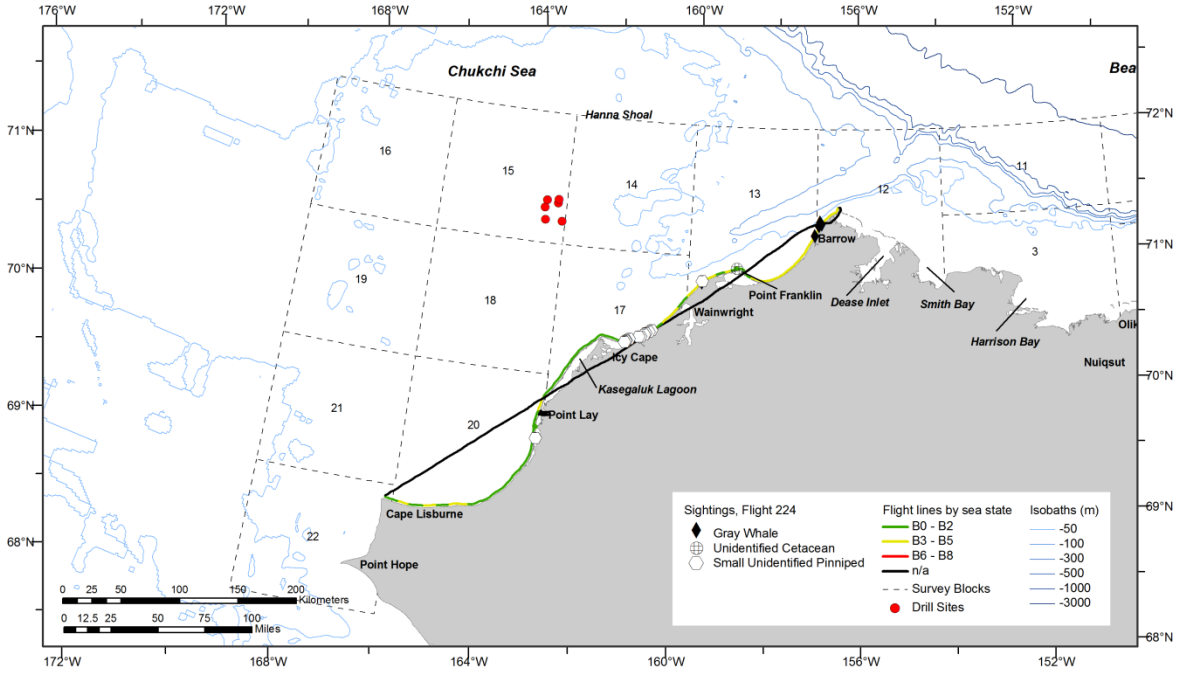


Figure B-48. ASAMM Flight 224 survey track, depicted by sea state, and all sightings.

13 August 2012, Flight 16

Flight was a transect survey of portions of blocks 1, 2, 3, 10, and 11. Survey conditions were good in the area surveyed with clear to partly cloudy skies. Visibility was 5-10 km, and sea states were Beaufort 0-3. Ice cover was 0-45% broken floe sea ice in the area surveyed. Sightings included 1 bowhead whale (juvenile), belugas, 1 bearded seal and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
16	8/13/12 14:31	71.413	151.146	beluga	rest	2	0	11
16	8/13/12 14:35	71.506	151.132	beluga	swim	2	0	11
16	8/13/12 14:35	71.516	151.131	beluga	swim	3	0	11
16	8/13/12 14:57	71.839	150.923	beluga	swim	1	0	11
16	8/13/12 15:03	71.660	150.916	beluga	dive	1	0	11
16	8/13/12 15:03	71.636	150.914	beluga	swim	1	1	11
16	8/13/12 15:07	71.528	150.910	beluga	swim	1	1	11
16	8/13/12 15:07	71.519	150.910	beluga	mill	5	0	11
16	8/13/12 15:08	71.499	150.908	beluga	swim	2	1	11
16	8/13/12 15:11	71.384	150.901	beluga	swim	2	1	11
16	8/13/12 15:12	71.362	150.900	beluga	swim	3	1	11
16	8/13/12 15:12	71.351	150.899	beluga	swim	1	0	11
16	8/13/12 16:08	71.229	150.307	bowhead whale	swim	1	0	3
16	8/13/12 16:12	71.263	150.288	beluga	swim	8	1	3
16	8/13/12 16:15	71.286	150.305	beluga	swim	3	0	3
16	8/13/12 16:26	71.611	150.301	beluga	swim	2	0	11
16	8/13/12 16:27	71.631	150.299	beluga	swim	1	1	11
16	8/13/12 16:27	71.641	150.300	beluga	swim	4	1	11
16	8/13/12 16:28	71.657	150.299	beluga	swim	2	0	11
16	8/13/12 16:28	71.660	150.299	beluga	swim	3	0	11
16	8/13/12 16:28	71.673	150.298	beluga	swim	1	0	11
16	8/13/12 17:10	71.236	149.897	beluga	swim	3	1	2

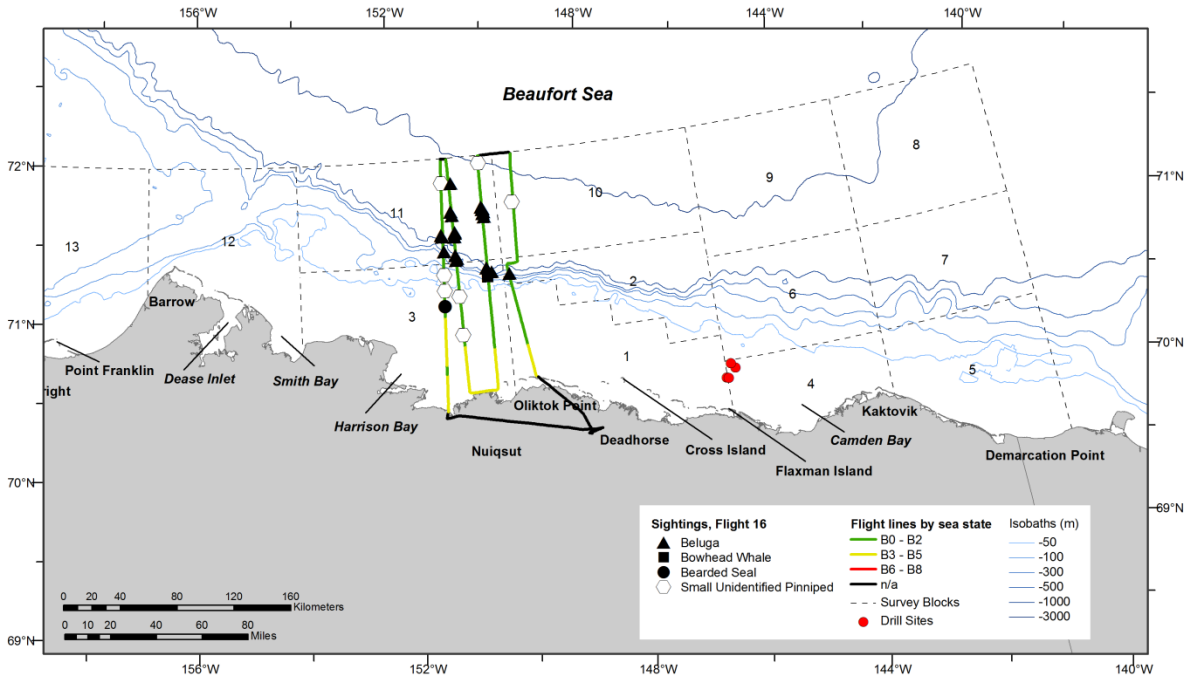


Figure B-49. ASAMM Flight 16 survey track, depicted by sea state, and all sightings.

14 August 2012, Flight 225

Flight was a partial survey of transects 8, 10, and 15. Survey conditions were fair in the area surveyed with overcast skies. Visibility was 0-10 km with glare, low ceilings, fog, and precipitation, and sea states were Beaufort 1-5. Fog and low ceilings prevented completion of transects. Ice cover was 0-50% broken floe sea ice in the area surveyed. Sightings included 19 gray whales, including 3 calves, 2 minke whales, walruses, unidentified pinnipeds, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
225	8/14/12 11:54	70.386	162.147	gray whale	swim	2	1	17
225	8/14/12 12:15	70.584	160.233	gray whale	swim	1	0	17
225	8/14/12 12:26	70.814	161.030	gray whale	rest	3	0	17
225	8/14/12 13:10	71.226	160.898	gray whale	feed	1	0	14
225	8/14/12 13:20	71.231	160.984	gray whale	feed	11	2	14
225	8/14/12 13:33	70.981	160.037	gray whale	feed	1	0	17
225	8/14/12 13:37	70.892	159.741	minke whale	swim	1	0	13
225	8/14/12 13:40	70.893	159.744	minke whale	dive	1	0	13

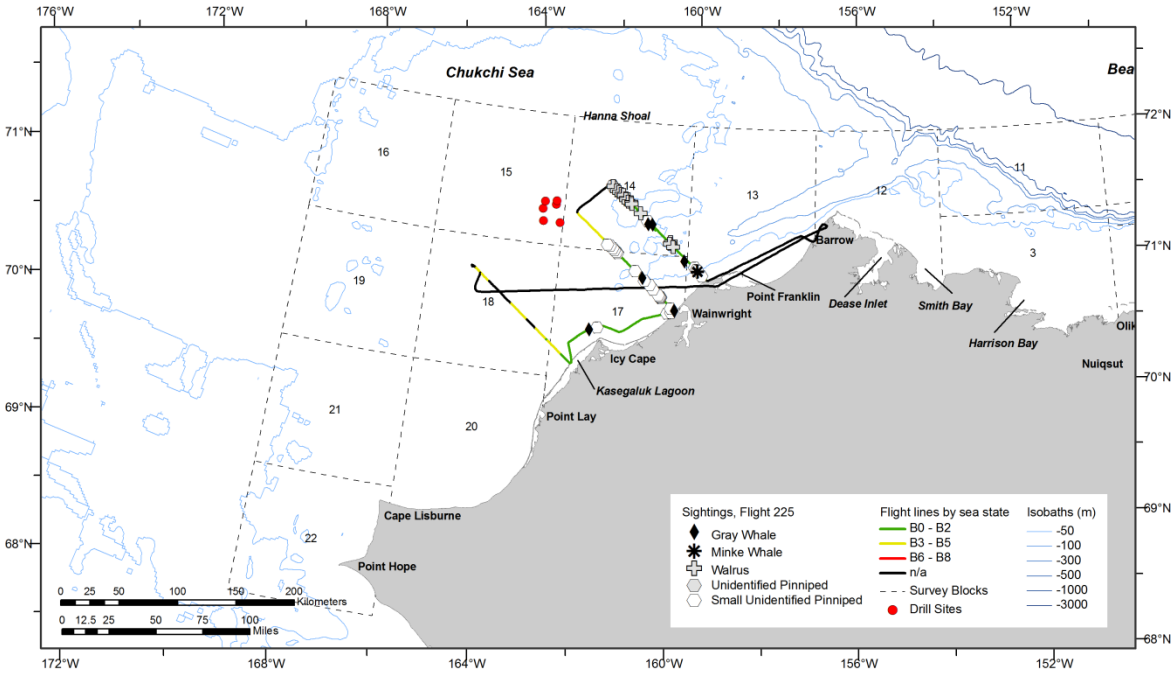


Figure B-50. ASAMM Flight 225 survey track, depicted by sea state, and all sightings.

15 August 2012, Flight 17

Flight was a transect survey of portions of blocks 1, 2, 5, and 7. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with fog, glare, and precipitation, and sea states were Beaufort 0-4. Ice cover was 0-35% broken floe sea ice in the area surveyed. Sightings included one unidentified cetacean, belugas, small unidentified pinnipeds, and polar bears. Six polar bears were seen on Cross Island, and 2 bears were sighted swimming in open water approximately 37 and 55 km from shore, respectively.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
17	8/15/12 11:21	70.652	146.900	unid cetacean	unknown	1	0	1
17	8/15/12 12:23	71.179	147.774	beluga	swim	1	0	2
17	8/15/12 12:23	71.173	147.774	beluga	swim	2	0	2
17	8/15/12 12:27	71.055	147.770	beluga	rest	1	0	2
17	8/15/12 12:27	71.053	147.770	beluga	rest	2	1	2
17	8/15/12 12:54	70.632	148.209	beluga	rest	1	0	1
17	8/15/12 13:22	71.226	148.900	beluga	dive	1	0	2
17	8/15/12 13:23	71.217	148.898	beluga	swim	3	0	2
17	8/15/12 14:11	71.265	149.274	beluga	swim	2	1	2
17	8/15/12 14:11	71.275	149.275	beluga	swim	2	1	2
17	8/15/12 14:11	71.276	149.275	beluga	swim	3	0	2

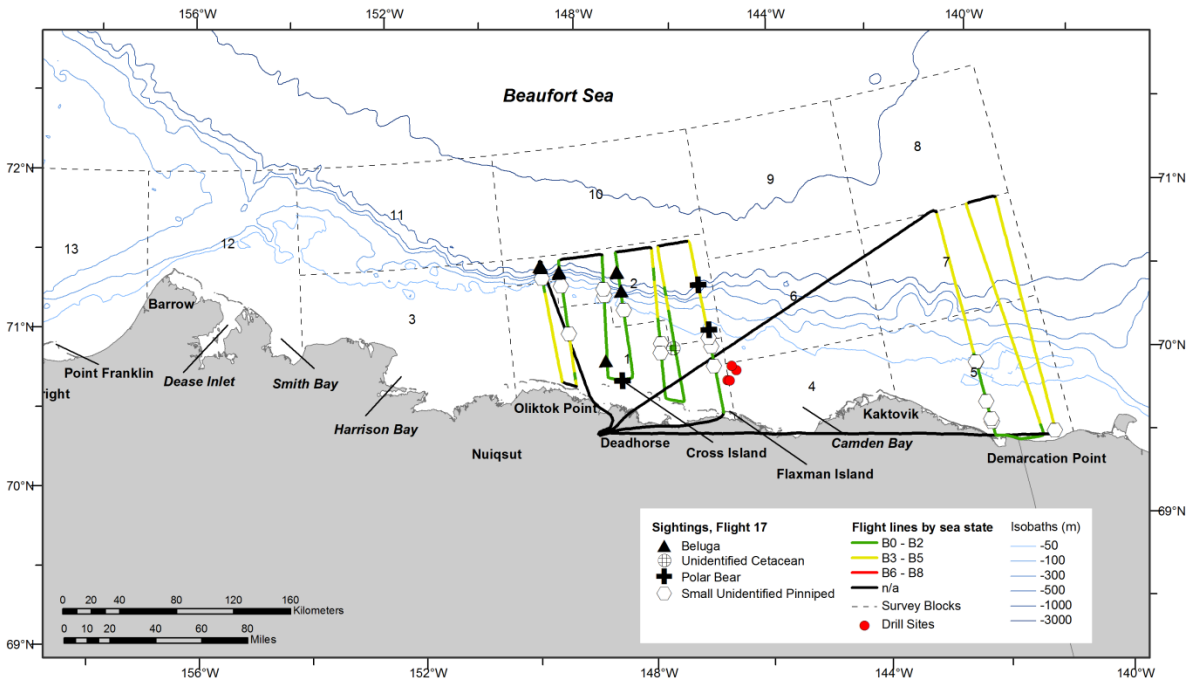


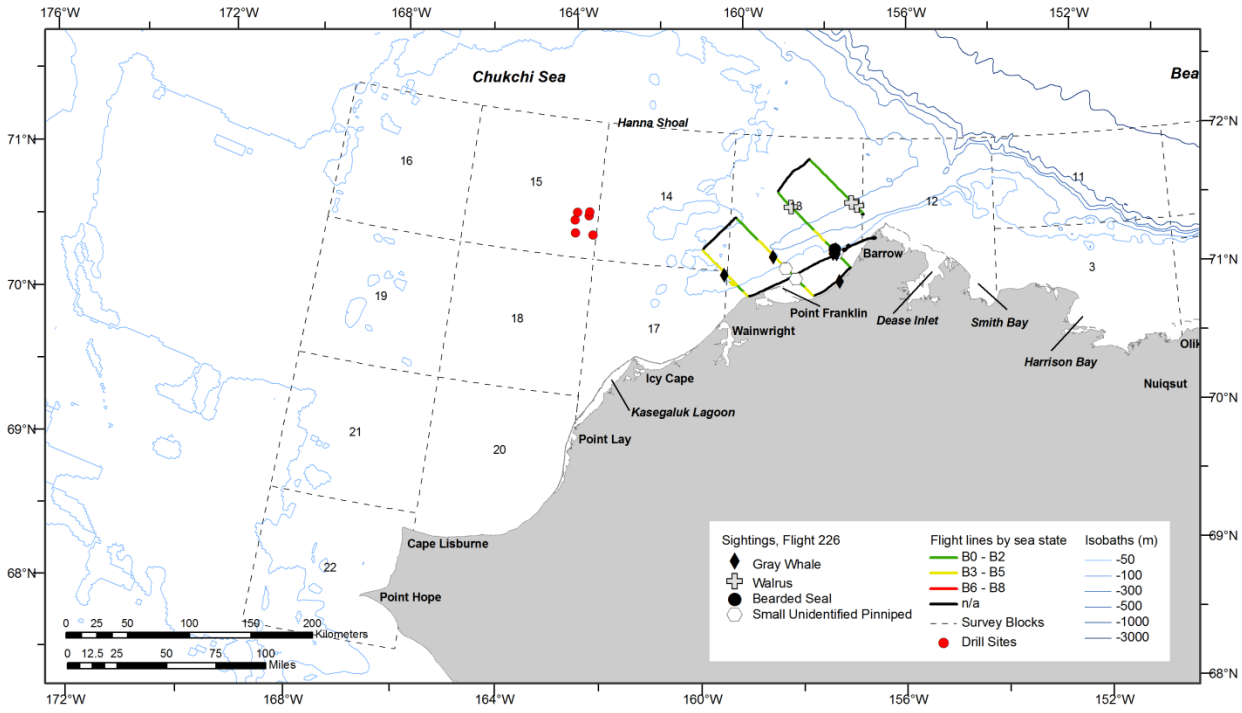
Figure B-51. ASAMM Flight 17 survey track, depicted by sea state, and all sightings.

16 August 2012, Flight 226

Flight was a partial survey of transects 2, 4, 6, and 8. Survey conditions were fair in the area surveyed with overcast skies. Visibility was <1-10 km, and sea states were Beaufort 1-4. Low ceilings prevented completion of transects. Ice cover was 0-55% broken floe sea ice in the area surveyed. Sightings included gray whales, walruses, small unidentified pinnipeds and one bearded seal. A gray whale exhibiting breaching and chin slapping behavior, and with a large wound/scar on its left dorsal side, was observed approximately 40 km southwest of Barrow. A gray whale carcass was seen roughly 30 km northeast of Wainwright.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
226	8/16/12 13:48	71.165	157.574	gray whale	feed	1	0	13
226	8/16/12 13:52	71.164	157.660	gray whale	feed	1	0	13
226	8/16/12 13:54	71.191	157.593	gray whale	feed	1	0	13
226	8/16/12 14:07	70.961	157.494	gray whale	breach	1	0	13
226	8/16/12 14:30	71.128	158.982	gray whale	swim	1	0	13
226	8/16/12 15:04	70.981	160.039	gray whale	feed	1	0	17
226	8/16/12 15:07	70.916	159.815	gray whale	dead	1	0	13



Flight B-52. ASAMM Flight 226 survey track, depicted by sea state, and all sightings.

Gray whale sighted approximately 40 km southwest of Barrow, Alaska, on flight 226, 16 August 2012. Photographs show breaching behavior and the ventral side of the rostrum (left), and a large wound/scar on the left dorsal side (right).

17 August 2012, Flight 227

Flight was an attempt to survey in the Chukchi Sea. Survey conditions were poor in the area with extensive fog, low ceilings, and precipitation preventing survey effort. In pockets where water was visible, sea states were high (Beaufort 5-6). No marine mammals were seen.

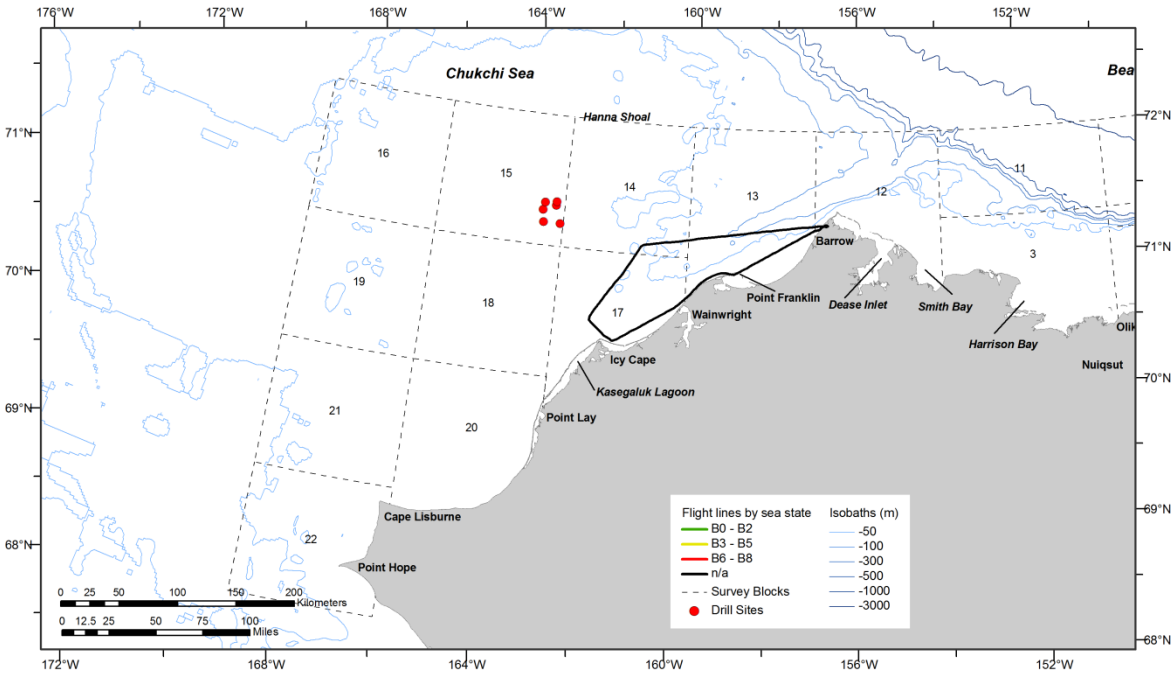


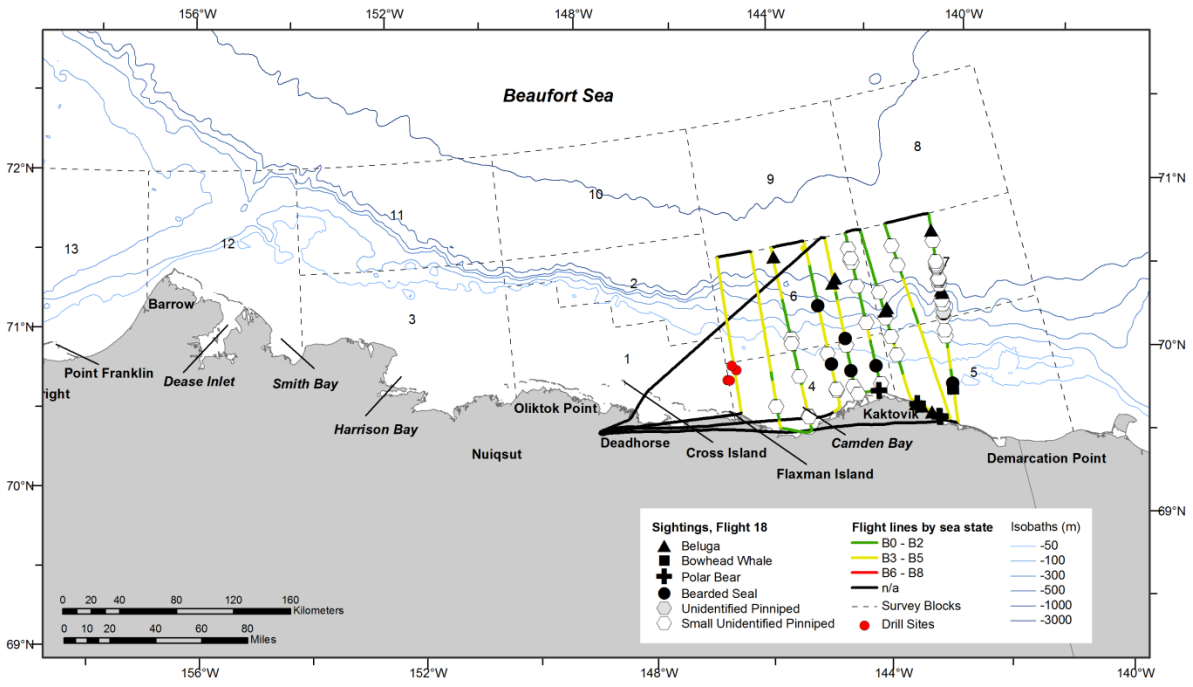
Figure B-53. ASAMM Flight 227 survey track, depicted by sea state.

17 August 2012, Flight 18

Flight was a transect survey of blocks 4 and 6, and portions of blocks 5 and 7. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 1-10 km, with fog, glare, and precipitation, and sea states were Beaufort 1-4. Ice cover was 0-20% broken floe sea ice in the area surveyed. Sightings included bowhead whales, belugas, polar bears, bearded seals, unidentified pinnipeds and small unidentified pinnipeds. Three polar bears were observed on barrier islands and one was observed swimming in open water less than 1 km from shore.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
18	8/17/12 11:27	70.058	141.929	bowhead whale	swim	2	0	5
18	8/17/12 11:27	70.062	141.928	bowhead whale	swim	1	0	5
18	8/17/12 11:53	70.664	141.753	beluga	rest	1	0	7
18	8/17/12 11:53	70.683	141.748	beluga	swim	1	0	7
18	8/17/12 12:05	71.062	141.633	beluga	rest	6	0	7
18	8/17/12 12:57	69.949	142.408	beluga	rest	1	0	5
18	8/17/12 12:59	70.005	142.555	beluga	swim	1	0	5
18	8/17/12 13:01	70.029	142.630	beluga	swim	7	0	5
18	8/17/12 13:01	70.032	142.641	beluga	swim	2	0	5
18	8/17/12 13:20	70.631	142.867	beluga	swim	14	0	7
18	8/17/12 13:20	70.647	142.870	beluga	swim	6	0	7
18	8/17/12 14:39	70.873	143.692	beluga	swim	1	0	6
18	8/17/12 14:39	70.899	143.691	beluga	rest	1	0	6
18	8/17/12 17:26	71.110	144.751	beluga	rest	2	0	6



Flight B-54. ASAMM Flight 18 survey track, depicted by sea state, and all sightings.

18 August 2012, Flight 228

Flight was a partial survey of transects 7, 9, and 15. Survey conditions were poor in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 1-5. Widespread cloud coverage, including low ceilings, precipitation, and fog, prevented complete coverage of transects. Ice cover was 0-65% broken floe sea ice in the area surveyed. Sightings included gray whales, walruses, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
228	8/18/12 17:17	71.526	162.840	gray whale	feed	1	0	14
228	8/18/12 17:21	71.530	162.814	gray whale	feed	1	0	14

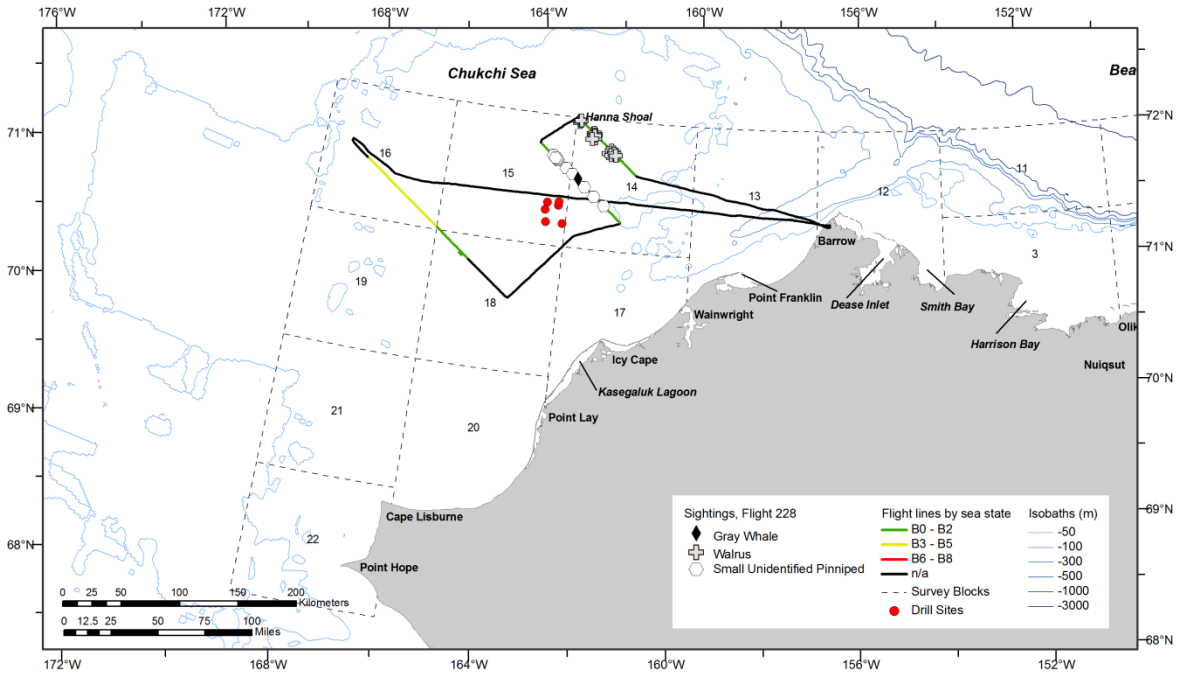


Figure B-55. ASAMM Flight 228 survey track, depicted by sea state, and all sightings.

18 August 2012, Flight 19

Flight was a transect survey of portions of blocks 3 and 11. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 5-10 km with glare, and sea states were Beaufort 1-3. Ice cover was 0-35% broken floe sea ice in the area surveyed. Sightings included belugas and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
19	8/18/12 15:06	71.882	153.875	beluga	swim	1	0	11
19	8/18/12 15:08	71.969	153.866	beluga	swim	1	0	11
19	8/18/12 15:08	71.983	153.866	beluga	swim	1	0	11
19	8/18/12 16:19	71.880	152.707	beluga	swim	1	0	11
19	8/18/12 16:19	71.900	152.701	beluga	swim	2	1	11
19	8/18/12 16:20	71.905	152.700	beluga	swim	2	0	11
19	8/18/12 16:20	71.907	152.700	beluga	swim	13	2	11
19	8/18/12 16:20	71.927	152.694	beluga	swim	1	0	11
19	8/18/12 16:21	71.941	152.690	beluga	swim	1	0	11
19	8/18/12 16:24	71.995	152.464	beluga	swim	1	0	0
19	8/18/12 16:24	71.987	152.462	beluga	swim	2	0	11
19	8/18/12 18:00	71.772	151.701	beluga	swim	3	0	11

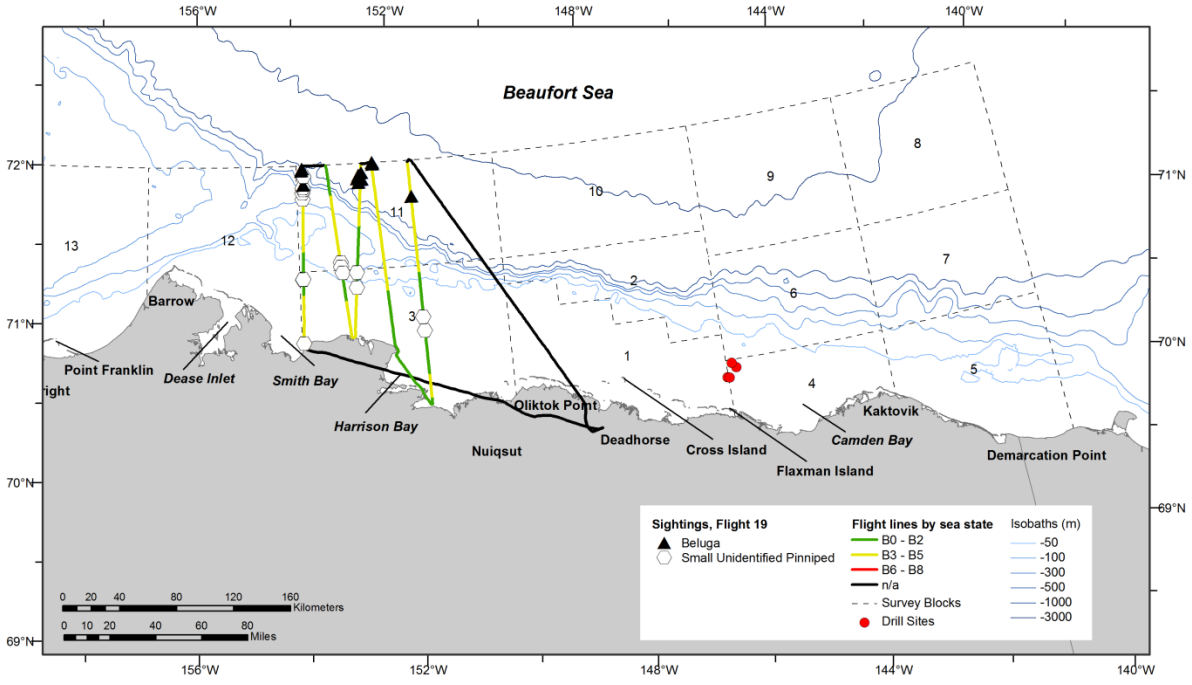


Figure B-56. ASAMM Flight 19 survey track, depicted by sea state, and all sightings.

19 August 2012, Flight 229

Flight was a partial survey of transects 17, 19, 21, and 23. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0 km to unlimited, and sea states were Beaufort 2-3. Widespread low ceilings, precipitation, and fog, prevented complete coverage of transects. No sea ice was present in the area surveyed. Sightings included unidentified cetaceans and small unidentified pinnipeds. A carcass (probable pinniped), in an advanced stage of decomposition, was observed floating in water about 60 km northwest of Point Lay.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
229	8/19/12 11:14	70.125	164.140	unid cetacean	swim	1	0	18
229	8/19/12 14:06	70.226	167.958	unid cetacean	unknown	1	0	19

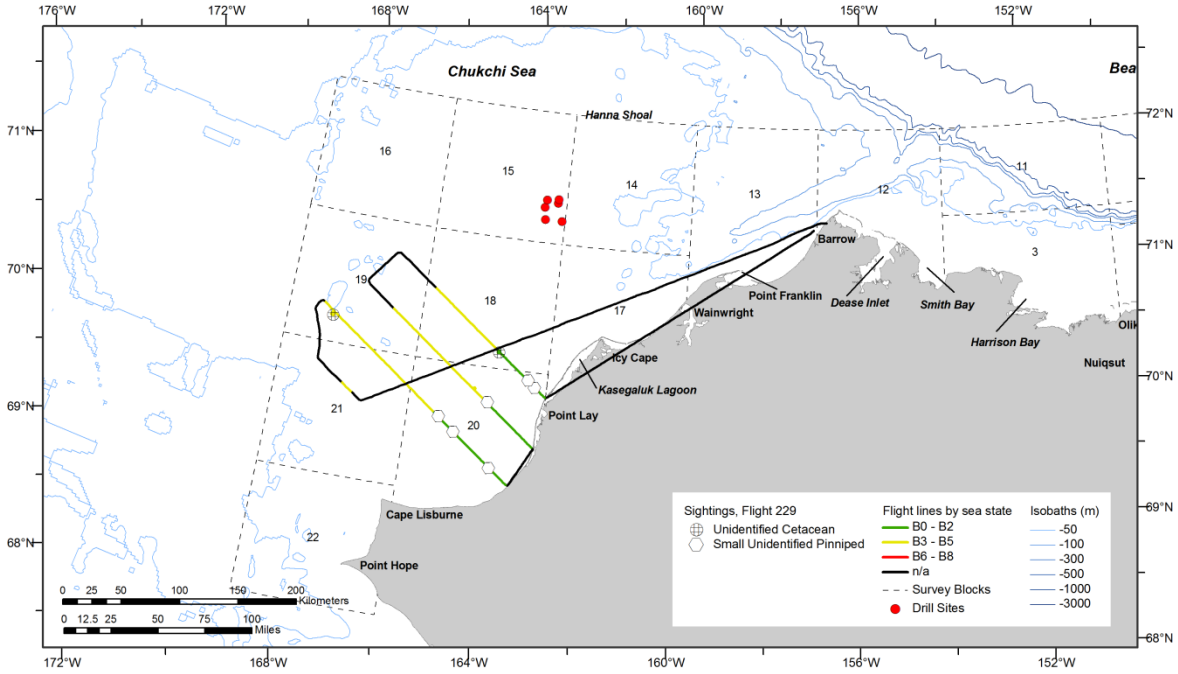


Figure B-57. ASAMM Flight 229 survey track, depicted by sea state, and all sightings .

19 August 2012, Flight 20

Flight was a partial survey of transects 11 and 13. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with fog, precipitation, and glare, and sea states were Beaufort 1-4. Fog prevented complete coverage of transects. No sea ice was present in the area surveyed. Sightings included gray whales, unidentified pinnipeds and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
20	8/19/12 13:28	70.701	161.429	gray whale	swim	1	0	17
20	8/19/12 13:42	70.933	162.266	gray whale	feed	3	0	17
20	8/19/12 13:42	70.938	162.281	gray whale	feed	2	0	17
20	8/19/12 13:43	70.955	162.241	gray whale	rest	1	0	17
20	8/19/12 13:43	70.946	162.197	gray whale	feed	3	0	17
20	8/19/12 13:45	70.943	162.281	gray whale	feed	2	0	17

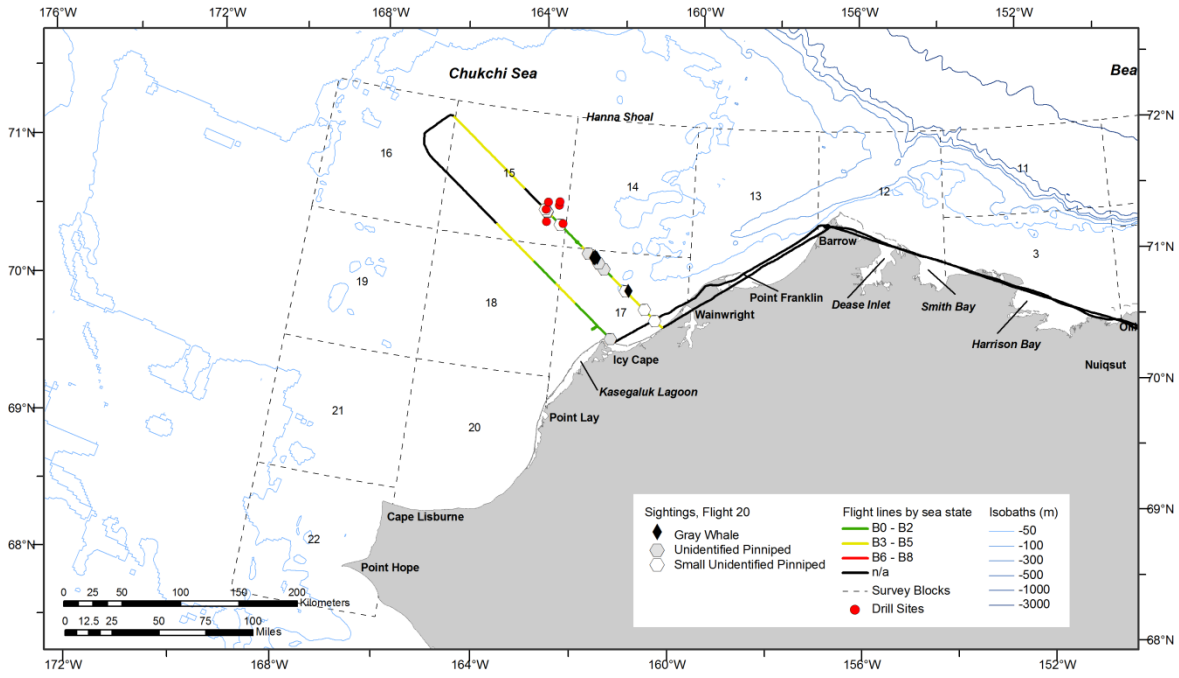


Figure B-58. ASAMM Flight 20 survey track, depicted by sea state, and all sightings.

20 August 2012, Flight 230

Flight was a transect survey of block 12. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 2 km to unlimited, and sea states were Beaufort 1-3. Ice cover was 0-15% broken floe sea ice in the area surveyed. Sightings included bowhead whales, gray whales including 2 calves, killer whales including 2 calves, belugas, unidentified cetaceans, walruses, unidentified pinnipeds and small unidentified pinnipeds. A moderately decomposed gray whale carcass was observed 80 km northeast of Barrow. The carcass was floating belly down and had large sections of its back missing around an exposed spine. Skeletal and soft tissues remnants of a pinniped carcass were observed at a kill site on sea ice approximately 35 km northeast of Barrow.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
230	8/20/12 12:56	71.419	154.267	unid cetacean	rest	1	0	12
230	8/20/12 13:29	71.949	154.474	beluga	swim	750	3	12
230	8/20/12 13:29	71.957	154.477	beluga	swim	60	3	12
230	8/20/12 13:37	71.925	154.840	beluga	swim	140	10	12
230	8/20/12 13:37	71.920	154.839	beluga	swim	150	1	12
230	8/20/12 14:23	71.284	155.344	gray whale	feed	1	0	12
230	8/20/12 14:24	71.285	155.289	gray whale	feed	1	0	12
230	8/20/12 14:24	71.279	155.301	gray whale	swim	2	0	12
230	8/20/12 14:25	71.280	155.344	gray whale	swim	2	1	12
230	8/20/12 14:29	71.341	155.343	bowhead whale	mill	1	0	12
230	8/20/12 14:29	71.345	155.342	bowhead whale	mill	5	0	12
230	8/20/12 14:29	71.350	155.342	gray whale	dive	2	0	12
230	8/20/12 14:29	71.357	155.342	bowhead whale	mill	1	0	12
230	8/20/12 14:29	71.358	155.342	bowhead whale	mill	6	0	12
230	8/20/12 14:30	71.367	155.342	bowhead whale	swim	4	0	12
230	8/20/12 14:30	71.373	155.342	bowhead whale	mill	1	0	12
230	8/20/12 14:38	71.342	155.316	gray whale	swim	1	0	12
230	8/20/12 14:52	71.379	155.353	bowhead whale	feed	3	0	12
230	8/20/12 14:57	71.388	155.347	bowhead whale	swim	2	0	12
230	8/20/12 15:01	71.531	155.341	unid cetacean	dive	1	0	12
230	8/20/12 15:08	71.594	155.340	unid cetacean	swim	1	0	12
230	8/20/12 15:32	71.745	155.339	gray whale	swim	1	0	12
230	8/20/12 15:39	71.985	155.332	beluga	rest	2	1	12
230	8/20/12 15:42	71.995	155.521	gray whale	dead	1	0	12
230	8/20/12 16:07	71.509	155.840	gray whale	swim	1	0	12
230	8/20/12 16:24	71.465	156.203	unid cetacean	unknown	1	0	12
230	8/20/12 16:25	71.478	156.167	gray whale	mill	3	0	12
230	8/20/12 16:29	71.460	156.140	gray whale	feed	1	0	12
230	8/20/12 16:35	71.494	156.200	gray whale	feed	1	0	12
230	8/20/12 16:35	71.495	156.199	gray whale	feed	8	1	12
230	8/20/12 16:38	71.504	156.021	gray whale	feed	10	0	12
230	8/20/12 16:49	71.538	156.194	gray whale	rest	1	0	12
230	8/20/12 17:39	71.358	156.845	killer whale	swim	13	2	12

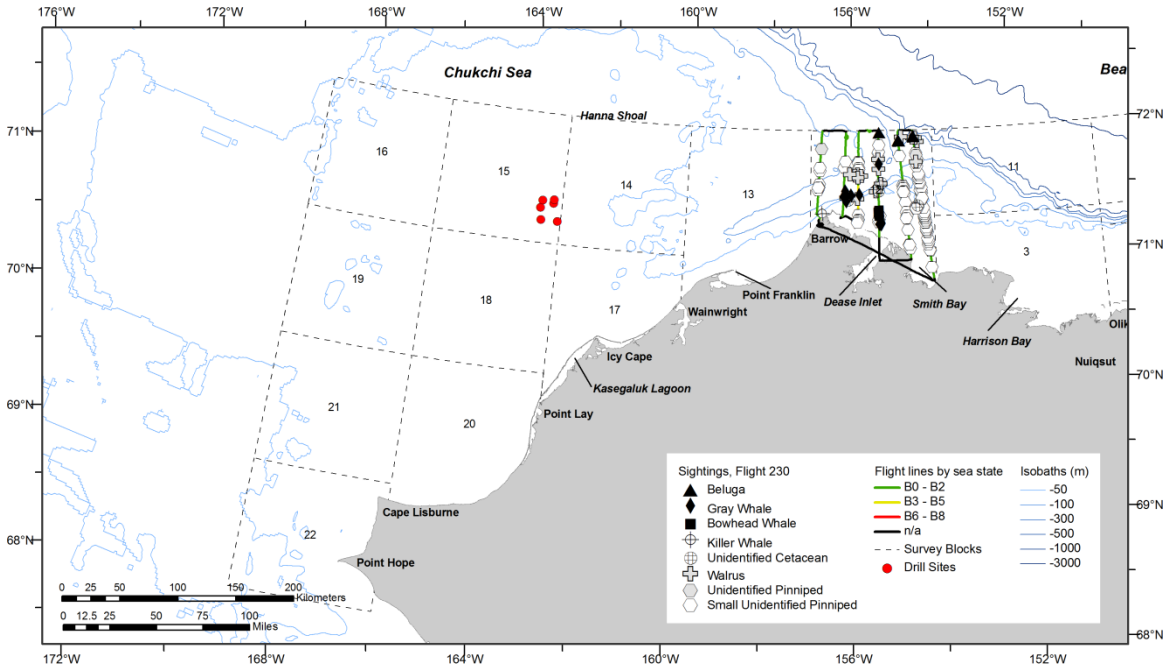


Figure B-59. ASAMM Flight 230 survey track, depicted by sea state, and all sightings.

Bowhead whales sighted 55 km east of Barrow, Alaska (top), and killer whales sighted 10 km northeast of Barrow, Alaska (bottom), on flight 230, 20 August 2012.

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21 August 2012, Flight 231

Flight was a partial survey of transects 1, 3, 5, and 7. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was <1-10 km, and sea states were Beaufort 2-6 with higher sea states in open water. High sea states nearshore and widespread fog offshore limited coverage of transects. Ice cover was 0-60% broken floe sea ice in the area surveyed. Sightings included 1 gray whale, walruses, and 1 small unidentified pinniped. Two carcasses were observed floating in open water in close proximity to one another, approximately 30 km northwest of Barrow. One carcass was an unidentified cetacean; the other carcass was a gray whale.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
231	8/21/12 14:45	71.391	157.532	unid cetacean	dead	1	0	13
231	8/21/12 14:51	71.366	157.462	gray whale	dead	1	0	13
231	8/21/12 16:08	71.998	162.408	gray whale	swim	1	0	14

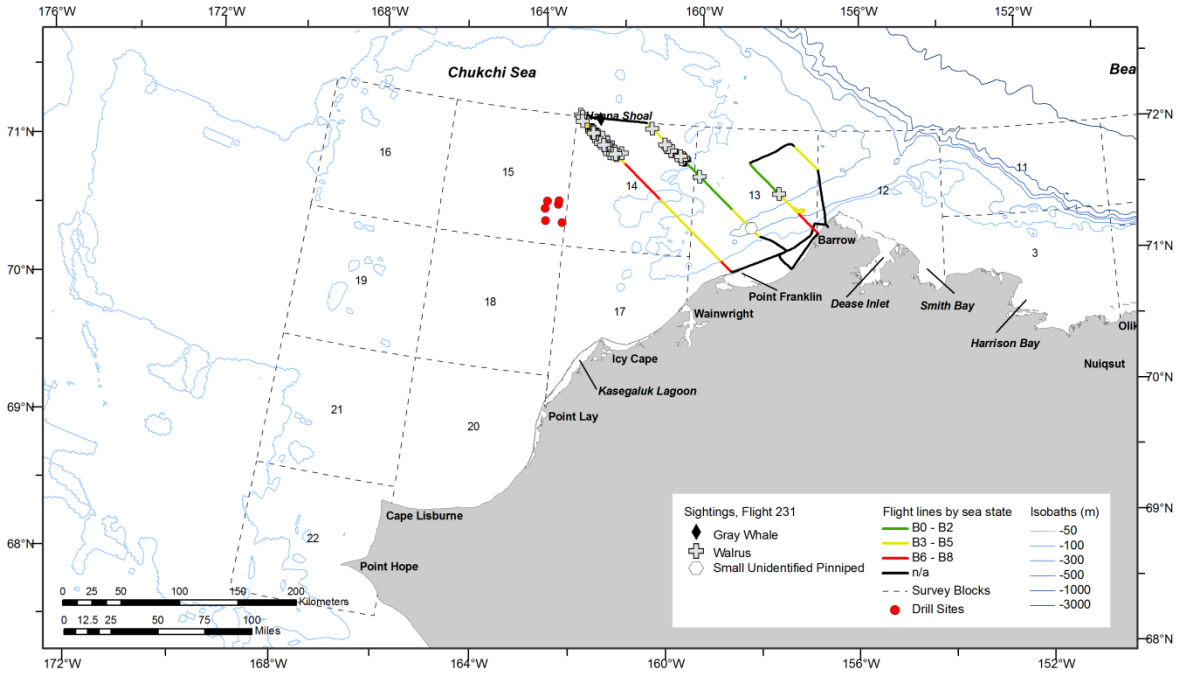

Figure B-60. ASAMM Flight 231 survey track, depicted by sea state, and all sightings.

23 August 2012, Flight 232

Flight was a survey of transects 10 and 12. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was <1 km to unlimited, and sea states were Beaufort 1-3. No sea ice was observed in the area surveyed. Sightings included gray whales, 1 humpback whale, 1 unidentified cetacean, and small unidentified pinnipeds. An unidentified pinniped carcass was observed floating in open water, approximately 300 km northwest of Wainwright. An unidentified cetacean carcass was observed floating in open water, approximately 75 km northwest of Wainwright.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
232	8/23/12 14:11	70.575	161.771	humpback whale	swim	1	0	17
232	8/23/12 14:24	70.561	161.832	gray whale	swim	2	0	17
232	8/23/12 16:58	71.022	161.777	gray whale	feed	1	0	14
232	8/23/12 17:00	71.005	161.792	gray whale	feed	5	0	14
232	8/23/12 17:02	70.997	161.910	gray whale	feed	6	0	17
232	8/23/12 17:02	70.998	161.917	unid cetacean	dead	1	0	17
232	8/23/12 17:12	70.992	161.671	gray whale	feed	1	0	14
232	8/23/12 17:13	71.003	161.592	gray whale	feed	2	0	14
232	8/23/12 17:14	71.006	161.612	gray whale	feed	2	0	14
232	8/23/12 17:14	71.011	161.618	gray whale	feed	1	0	14
232	8/23/12 17:16	71.012	161.626	gray whale	feed	1	0	14
232	8/23/12 17:18	71.010	161.662	gray whale	feed	1	0	14
232	8/23/12 17:18	71.006	161.652	gray whale	feed	1	0	14
232	8/23/12 17:24	70.979	161.616	gray whale	feed	3	0	14
232	8/23/12 17:27	71.007	161.563	gray whale	feed	7	0	14
232	8/23/12 17:27	71.016	161.545	gray whale	feed	2	0	14
232	8/23/12 17:28	71.014	161.560	gray whale	feed	1	0	14
232	8/23/12 17:38	70.836	161.112	gray whale	swim	1	0	17
232	8/23/12 17:46	70.809	161.017	unid cetacean	unknown	1	0	17

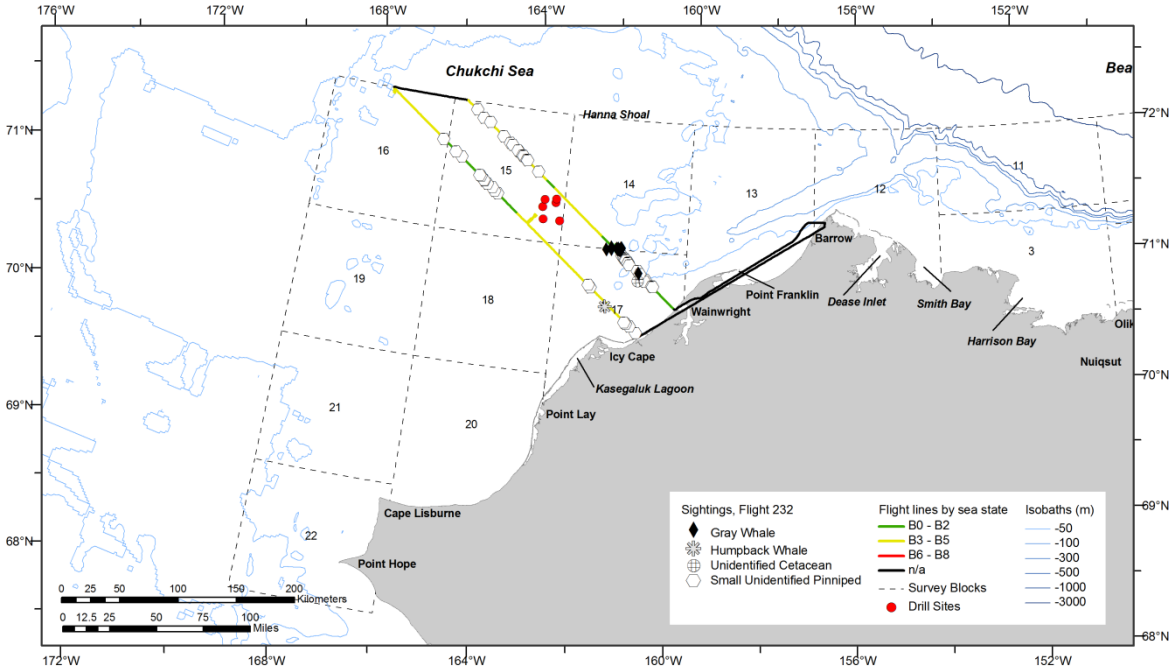

Figure B-61. ASAMM Flight 232 survey track, depicted by sea state, and all sightings.

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25 August 2012, Flight 233

Flight was a partial survey of transects 14 and 16, and the coastal transect from Icy Cape to Wainwright. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was <1-10 km, and sea states were Beaufort 2-5. No sea ice was observed in the area surveyed. Sightings included one bearded seal and small unidentified pinnipeds. Three carcasses were observed floating in open water. A walrus carcass was observed approximately 60 km northwest of Point Lay, 1 gray whale carcass was observed approximately 120 km northwest of Point Lay, and 1 gray whale carcass was observed approximately 240 km northwest of Point Lay.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
233	8/25/12 11:10	70.530	164.868	gray whale	dead	1	0	18
233	8/25/12 11:57	71.227	167.808	gray whale	dead	1	0	16

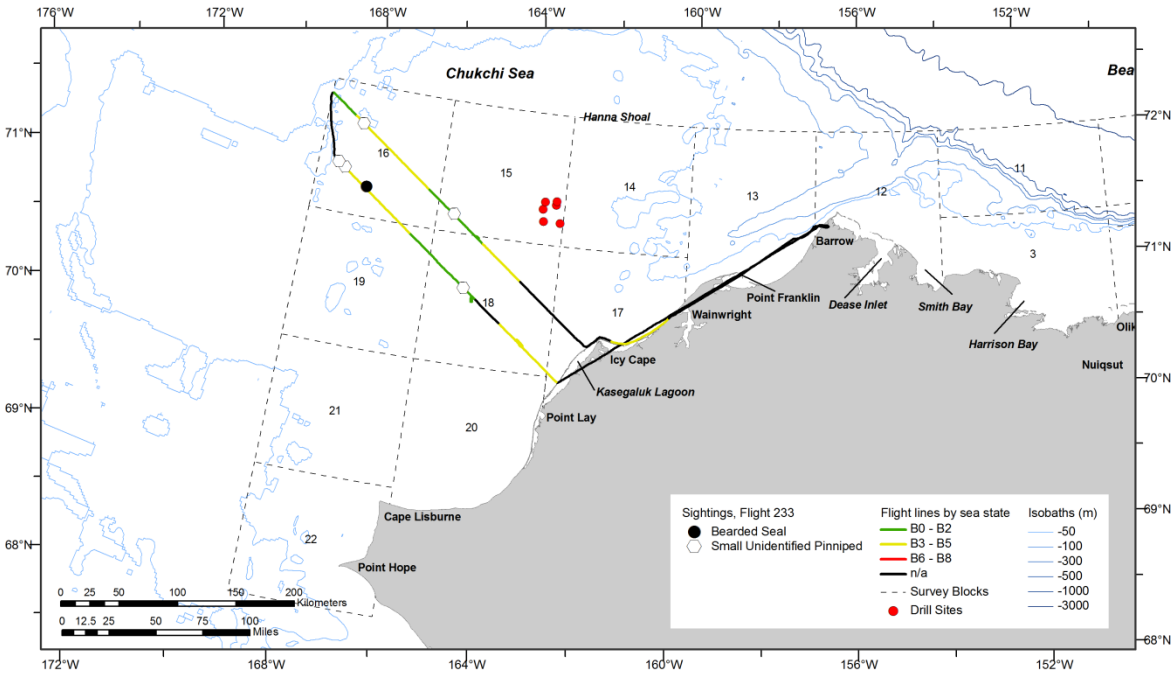

Figure B-62. ASAMM Flight 233 survey track, depicted by sea state, and all sightings.

25 August 2012, Flight 21

Flight was a transect survey of blocks 1 and 2. Survey conditions were good in the area surveyed with clear to partly cloudy skies. Visibility was 5-10 km, and sea states were Beaufort 1-5. Ice cover was 0-7% broken floe sea ice in the area surveyed. Sightings included bowhead whales, unidentified cetaceans, polar bears, unidentified pinnipeds and small unidentified pinnipeds. Ten polar bears were observed on Cross Island and one polar bear was seen approximately 44 kilometers north of the barrier islands, swimming north.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
21	8/25/12 10:54	70.609	146.254	unid cetacean	swim	1	0	1
21	8/25/12 11:51	70.747	146.705	bowhead whale	rest	2	0	2
21	8/25/12 11:51	70.742	146.705	bowhead whale	rest	2	0	2
21	8/25/12 12:09	70.746	146.723	bowhead whale	swim	2	1	2
21	8/25/12 12:51	70.951	147.258	bowhead whale	swim	1	0	2
21	8/25/12 12:54	71.000	147.266	bowhead whale	swim	1	0	2
21	8/25/12 13:54	70.977	148.241	bowhead whale	swim	1	0	1
21	8/25/12 13:57	71.017	148.246	bowhead whale	swim	2	0	2
21	8/25/12 14:04	70.997	148.259	bowhead whale	swim	2	0	1
21	8/25/12 14:27	71.018	148.662	bowhead whale	swim	2	0	2
21	8/25/12 14:27	71.011	148.663	bowhead whale	swim	2	0	2
21	8/25/12 14:29	71.014	148.681	bowhead whale	swim	2	1	2
21	8/25/12 14:34	71.048	148.820	bowhead whale	swim	2	1	2
21	8/25/12 14:34	71.043	148.807	bowhead whale	swim	3	0	2
21	8/25/12 14:37	71.026	148.628	bowhead whale	swim	2	1	2
21	8/25/12 14:38	71.010	148.654	bowhead whale	feed	1	0	2
21	8/25/12 14:38	71.006	148.656	bowhead whale	swim	6	0	2
21	8/25/12 14:40	70.999	148.625	bowhead whale	swim	2	1	1
21	8/25/12 15:14	70.858	149.225	unid cetacean	swim	1	0	1
21	8/25/12 15:23	71.084	149.164	bowhead whale	swim	1	0	1
21	8/25/12 15:23	71.086	149.163	bowhead whale	swim	1	0	1
21	8/25/12 15:23	71.095	149.160	bowhead whale	swim	1	0	1
21	8/25/12 15:25	71.176	149.118	bowhead whale	swim	1	0	2
21	8/25/12 15:33	71.263	149.532	unid cetacean	unknown	1	0	2
21	8/25/12 15:38	71.163	149.532	bowhead whale	swim	1	0	1
21	8/25/12 15:40	71.092	149.536	bowhead whale	swim	1	0	1
21	8/25/12 15:42	71.076	149.535	unid cetacean	swim	1	0	1
21	8/25/12 15:46	71.030	149.536	bowhead whale	swim	1	0	1

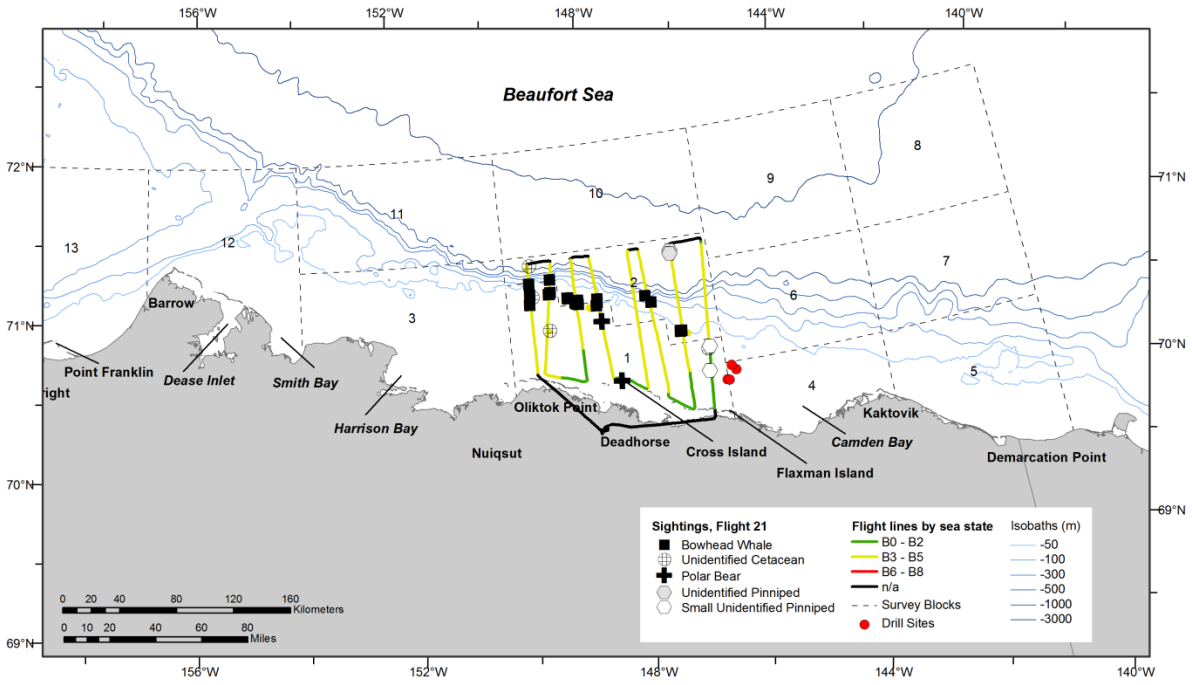

Figure B-63. ASAMM Flight 21 survey track, depicted by sea state, and all sightings.

26 August 2012, Flight 234

Flight was the coastal transect from south of Point Hope to Wainwright. Survey conditions were fair in the area surveyed with overcast skies. Visibility was <1-10 km, and sea states were Beaufort 3-6. No sea ice was observed in the area surveyed. No marine mammals were seen.

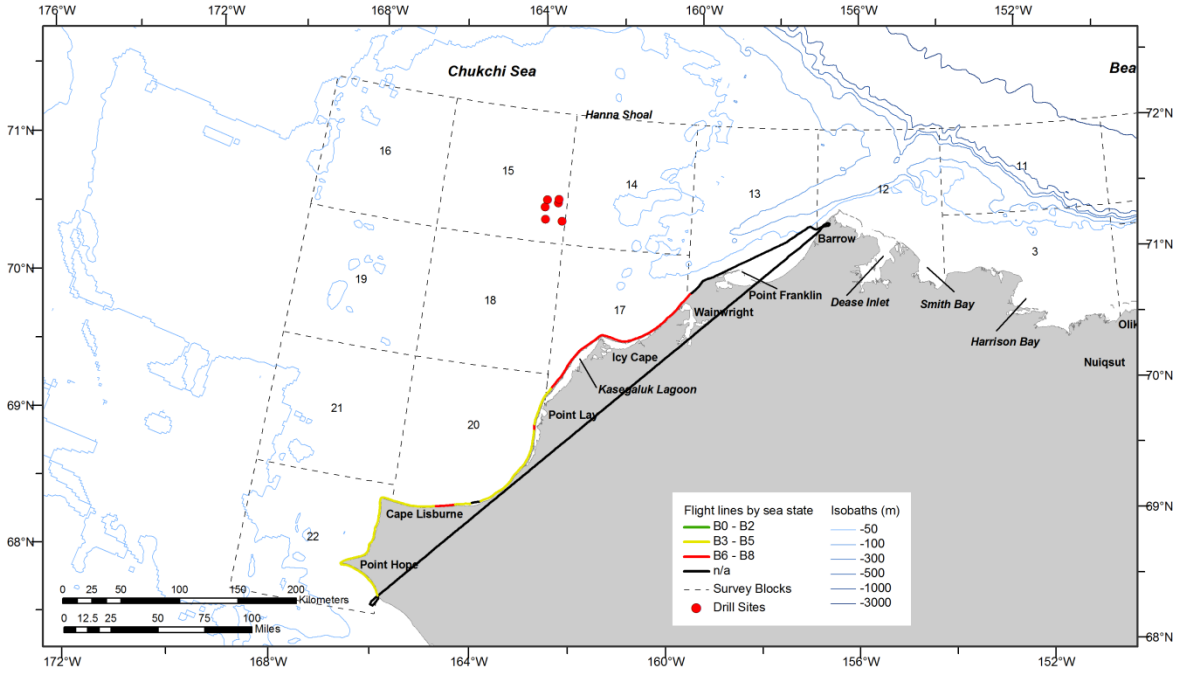

Figure B-64. ASAMM Flight 234 survey track, depicted by sea state.

26 August 2012, Flight 22

Flight was a transect survey of portions of blocks 5 and 7. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was <1-10 km with low ceilings, precipitation, and glare, and sea states were Beaufort 1-4. No sea ice was observed in the area surveyed. Sightings included 1 bowhead whale, 1 unidentified cetacean, belugas, unidentified pinnipeds and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
22	8/26/12 11:30	70.532	140.401	beluga	swim	3	0	7
22	8/26/12 11:31	70.552	140.402	beluga	rest	2	0	7
22	8/26/12 12:46	69.647	140.708	beluga	swim	3	1	5
22	8/26/12 12:46	69.650	140.744	beluga	swim	2	0	5
22	8/26/12 12:46	69.652	140.769	beluga	swim	8	0	5
22	8/26/12 12:46	69.652	140.769	beluga	swim	3	0	5
22	8/26/12 13:15	70.431	141.258	beluga	rest	2	1	5
22	8/26/12 13:28	70.813	141.343	bowhead whale	swim	1	0	7
22	8/26/12 13:33	70.826	141.349	unid cetacean	swim	1	0	7
22	8/26/12 14:11	70.624	141.810	beluga	swim	2	0	7
22	8/26/12 14:12	70.619	141.808	beluga	swim	1	0	7
22	8/26/12 14:12	70.616	141.807	beluga	mill	2	1	7
22	8/26/12 14:12	70.613	141.806	beluga	mill	5	0	7
22	8/26/12 14:12	70.594	141.799	beluga	mill	2	0	7
22	8/26/12 14:13	70.586	141.796	beluga	swim	2	1	7

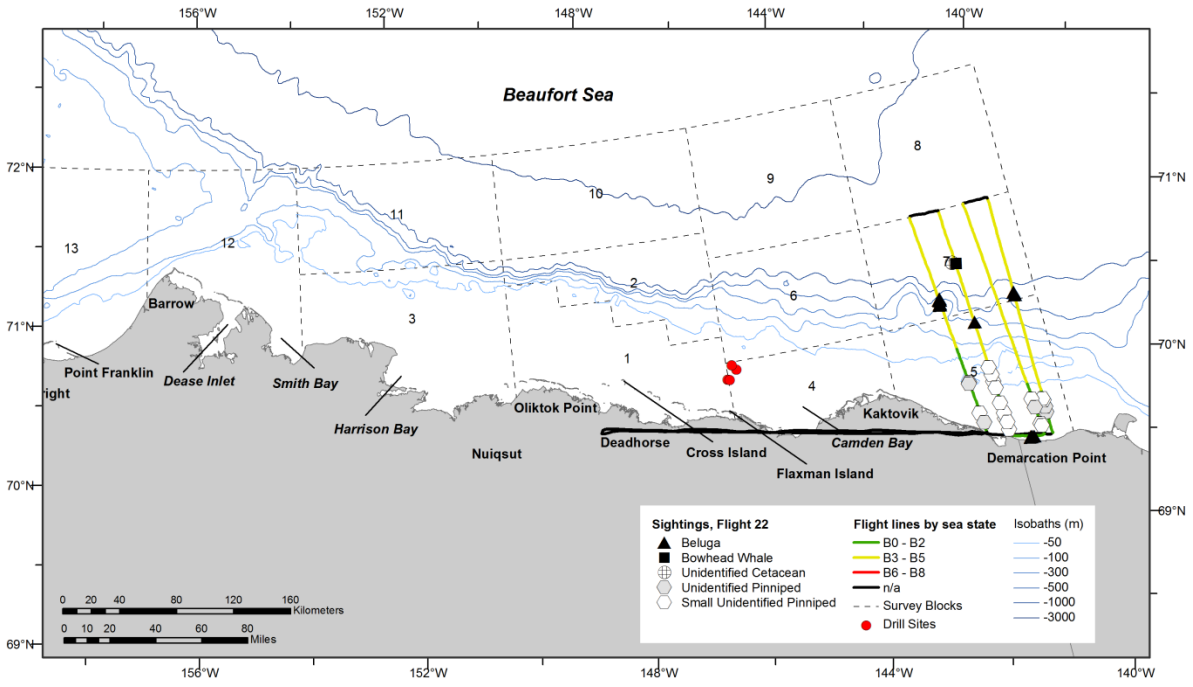

Figure B-65. ASAMM Flight 22 survey track, depicted by sea state, and all sightings.

29 August 2012, Flight 235

Flight was a partial survey of transects 4 and 6. Survey conditions were poor in the area surveyed with partly cloudy skies. Visibility was 0-10 km, and sea states were Beaufort 2-5. Widespread cloud cover, including low ceilings, fog, and precipitation prevented complete coverage of transects. Ice cover was 0-25% broken floe sea ice in the area surveyed. Walruses were seen.

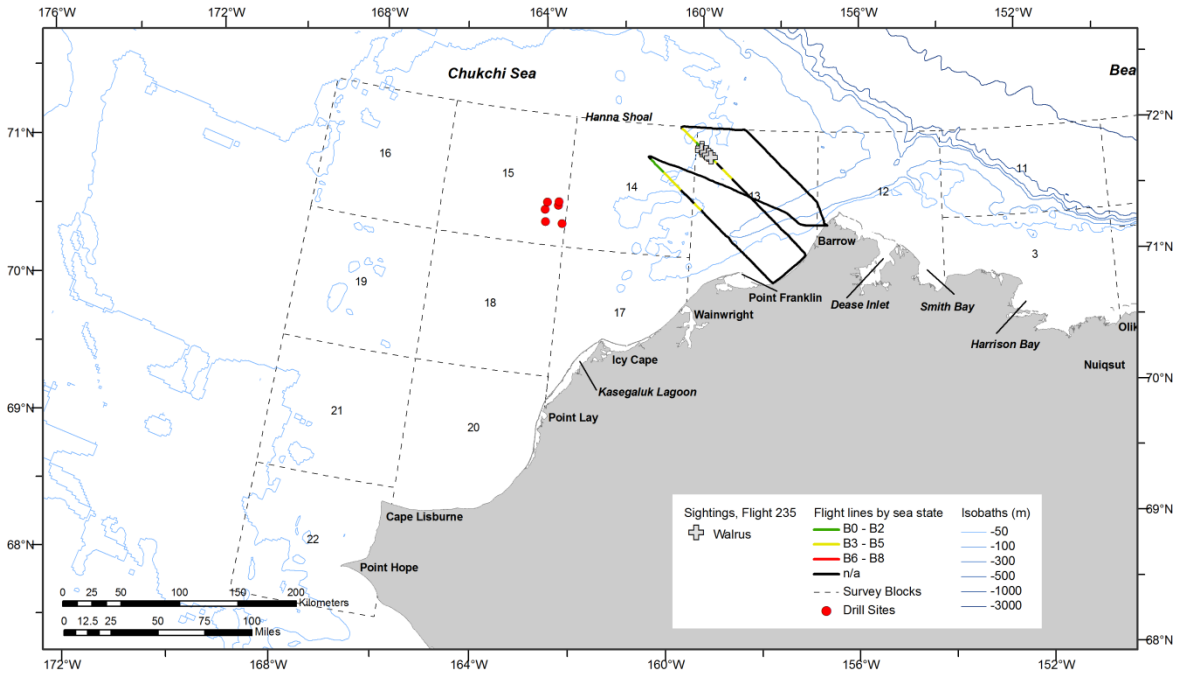

Figure B-66. ASAMM Flight 235 survey track, depicted by sea state, and all sightings.

29 August 2012, Flight 23

Flight was a transect survey of portions of blocks 4 and 6. Survey conditions were fair in the area surveyed with overcast skies. Visibility was 0-10 km, and sea states were Beaufort 1-6. Low ceilings, fog, and precipitation prevented complete coverage of transects. No sea ice was observed in the area surveyed. Sightings included unidentified cetaceans, belugas, unidentified pinnipeds and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
23	8/29/12 15:53	70.869	145.078	beluga	swim	1	0	6
23	8/29/12 16:08	70.432	145.185	unid cetacean	swim	1	0	4
23	8/29/12 16:47	70.378	144.747	unid cetacean	unknown	1	0	4
23	8/29/12 18:00	70.163	143.680	beluga	swim	4	0	4
23	8/29/12 18:00	70.164	143.655	beluga	swim	10	0	4
23	8/29/12 18:00	70.164	143.651	beluga	swim	4	1	4
23	8/29/12 18:01	70.165	143.627	beluga	swim	2	0	4

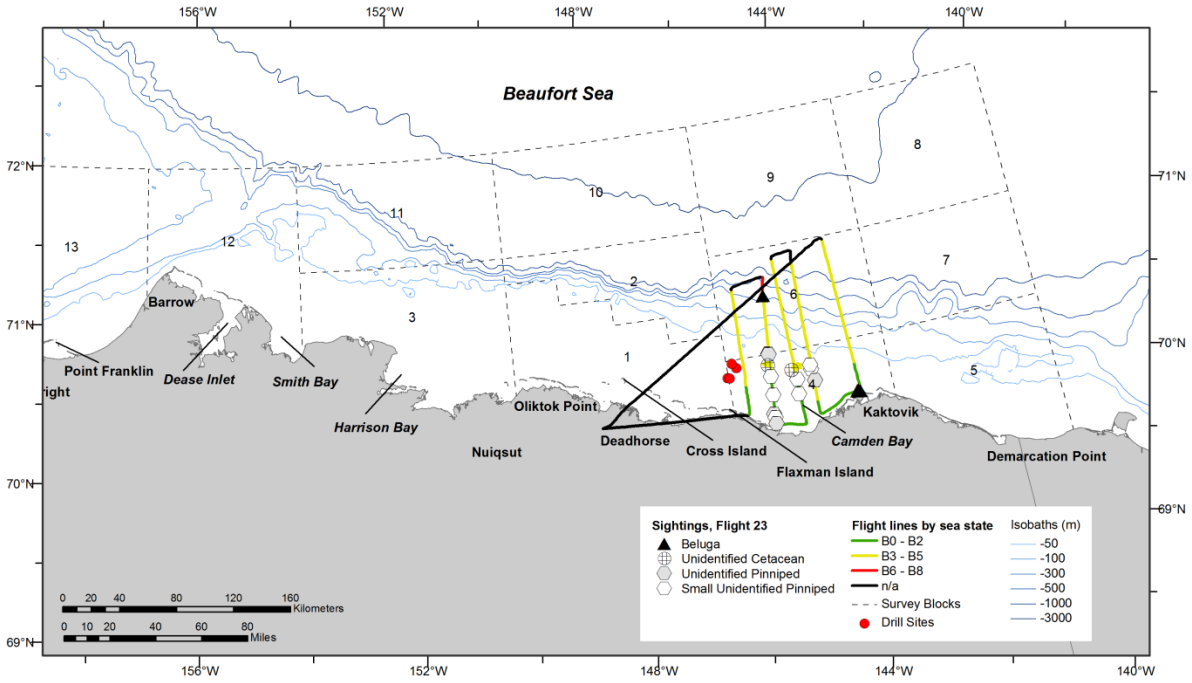

Figure B-67. ASAMM Flight 23 survey track, depicted by sea state, and all sightings.

1 September 2012, Flight 236

Flight was a partial survey of transect 7, and the coastal transect from Barrow to Point Franklin. Survey conditions were poor in the area surveyed with overcast skies. Visibility was 0-10 km, and sea states were Beaufort 3-7. Widespread cloud cover including low ceilings, precipitation, and high sea states prevented complete coverage of transects. No sea ice was observed in the area surveyed. Bowhead whales were seen. One gray whale carcass was observed floating in open water approximately 30 km north of Barrow.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
236	9/1/12 13:56	71.528	157.013	bowhead whale	swim	1	0	13
236	9/1/12 14:12	71.515	156.913	gray whale	dead	1	0	12
236	9/1/12 14:12	71.524	156.906	bowhead whale	mill	1	0	12

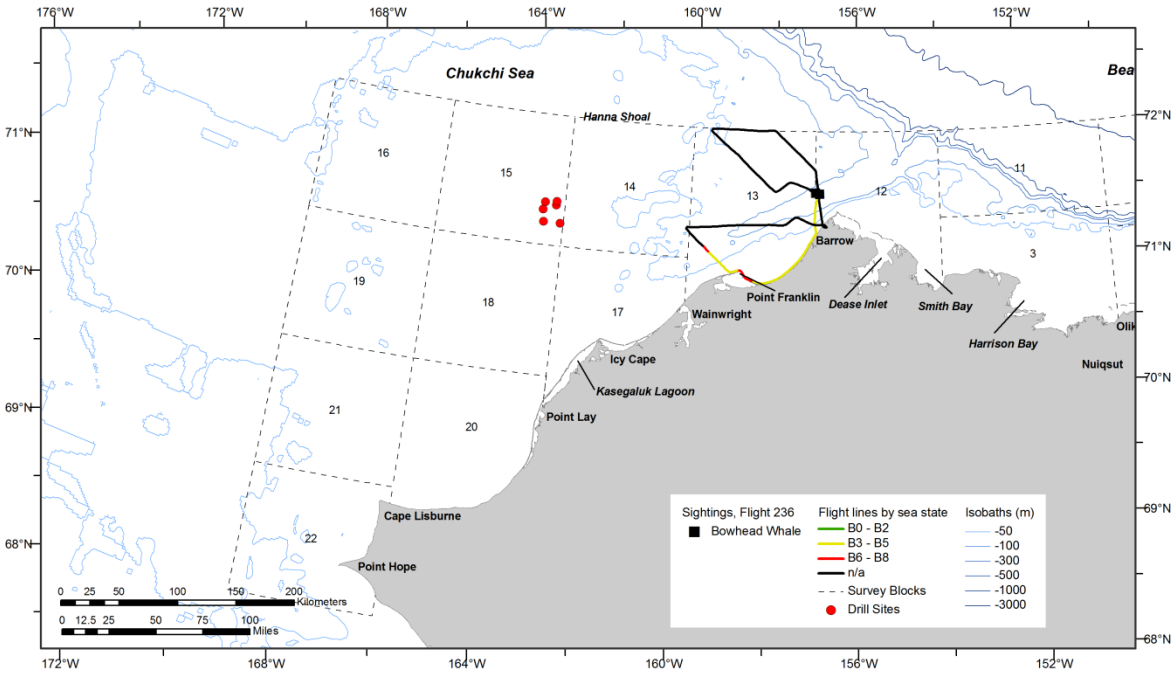

Figure B-68. ASAMM Flight 236 survey track, depicted by sea state, and all sightings.

2 September 2012, Flight 24

Flight was a transect survey of a portion of block 3. Survey conditions were poor in the area surveyed with partly cloudy skies. Visibility was 0-10 km with low ceilings, and sea states were Beaufort 3-6. Low ceilings and high sea states prevented complete coverage of transects. Ice cover was 0-2% broken floe sea ice in the area surveyed. No marine mammals were seen.

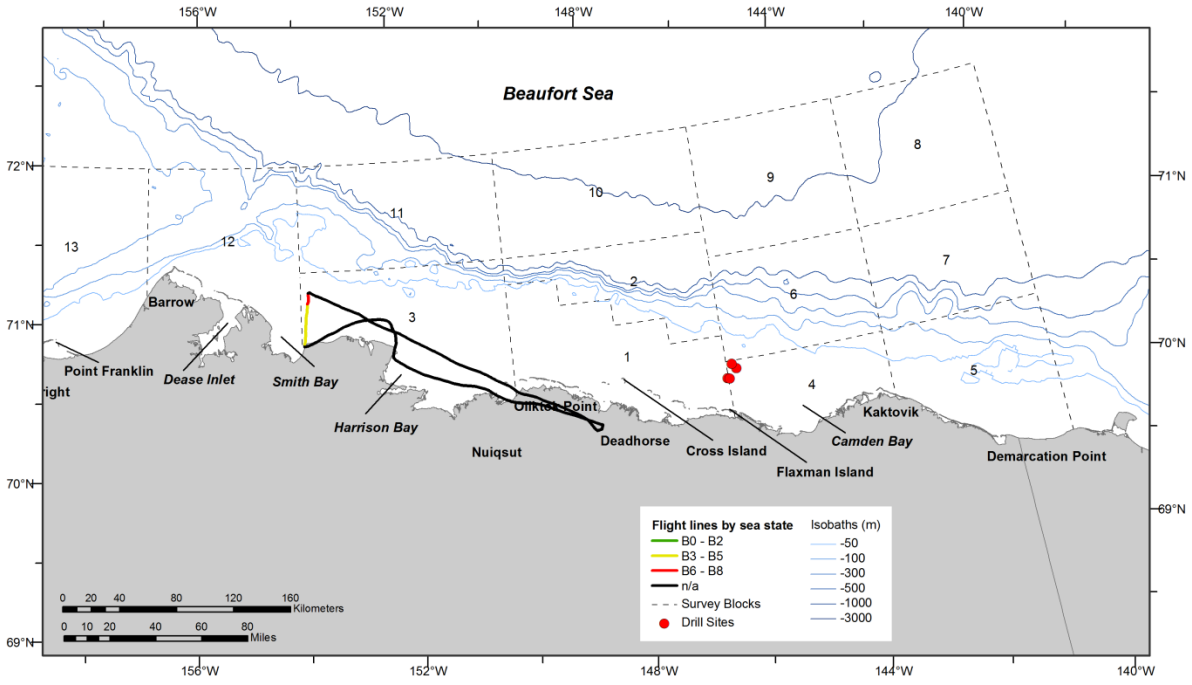

Figure B-69. ASAMM Flight 24 survey track, depicted by sea state.

3 September 2012, Flight 237

Flight was a transect survey of an area north of the primary study area to assess walrus habitat use. Survey conditions were poor in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 2-7. Low ceilings, snow showers, and high sea states prevented complete coverage of transects. Ice cover was 0-65% broken floe sea ice in the area surveyed. Most of the sea ice was concentrated in the southwestern corner of the area surveyed, from 72°N to 72.3°N, between 163°W and 162°W. The remaining ice observed consisted of diffuse and scattered broken ice floes, from 72°N to 73°N, between 163°W and 161°W. Sightings included bowhead whales, unidentified cetaceans and walruses.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
237	9/3/12 12:06	72.290	162.230	bowhead whale	swim	1	0	0
237	9/3/12 13:27	72.494	161.401	bowhead whale	tail slap	1	0	0
237	9/3/12 13:28	72.489	161.396	unid cetacean	swim	2	0	0
237	9/3/12 14:12	72.474	160.919	bowhead whale	swim	2	0	0
237	9/3/12 14:22	72.519	160.916	bowhead whale	swim	1	0	0

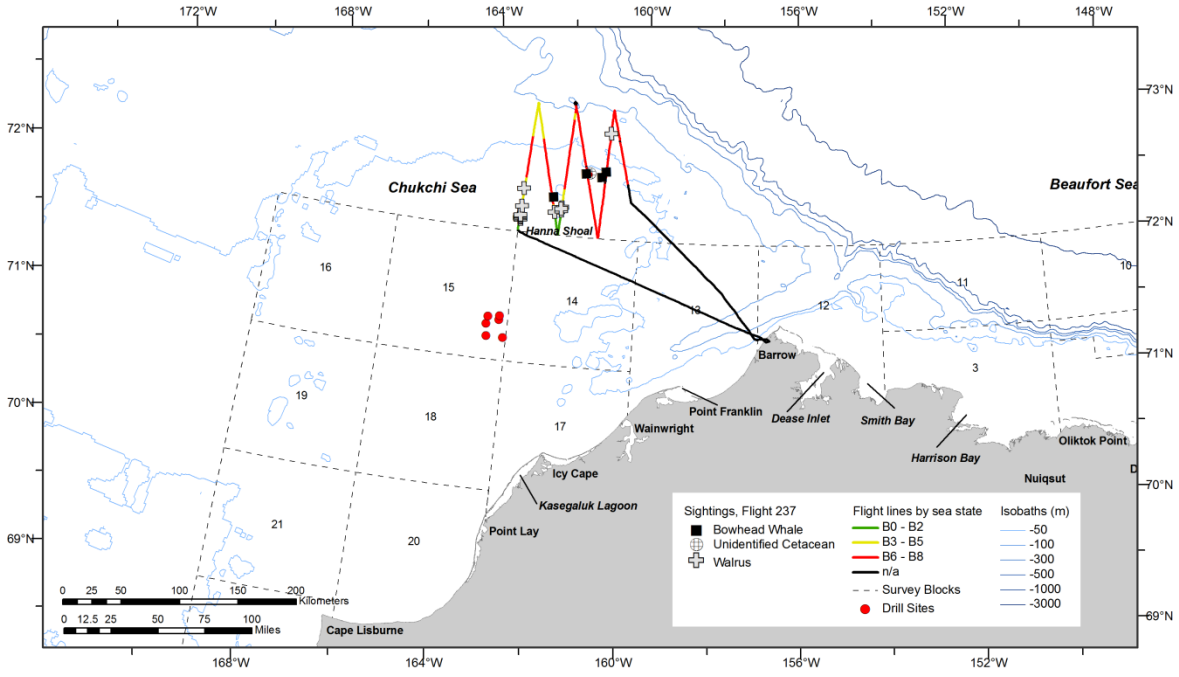

Figure B-70. ASAMM Flight 237 survey track, depicted by sea state, and all sightings.

5 September 2012, Flight 25

Flight was a transect survey of portions of blocks 1, 2, and 3. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with low ceiling, fog, glare, and precipitation, and sea states were Beaufort 2-3. Low ceilings prevented complete coverage of transects in block 3. Ice cover was 0-2% broken floe sea ice in the area surveyed. Sightings included bowhead whales, belugas, an unidentified cetacean, polar bears, one unidentified pinniped, and small unidentified pinnipeds. One polar bear was swimming approximately 78 km from barrier islands and four polar bears were seen on Cross Island.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
25	9/5/12 13:23	70.969	149.832	bowhead whale	swim	1	0	1
25	9/5/12 13:31	70.933	149.838	bowhead whale	swim	1	0	1
25	9/5/12 13:51	70.848	149.213	beluga	swim	3	0	1
25	9/5/12 14:23	70.722	148.886	bowhead whale	swim	2	0	1
25	9/5/12 14:25	70.727	148.927	bowhead whale	swim	1	0	1
25	9/5/12 15:22	70.834	147.775	unid cetacean	unknown	1	0	2

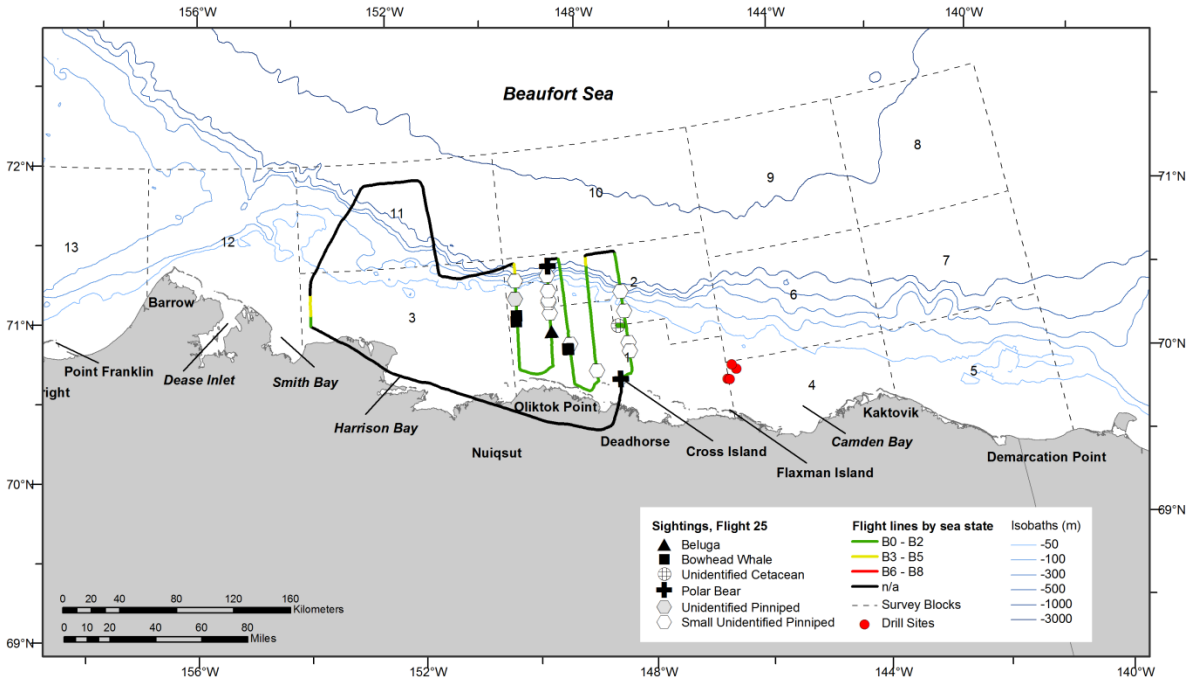

Figure B-71. ASAMM Flight 25 survey track, depicted by sea state, and all sightings.

6 September 2012, Flight 238

Flight was a partial survey of transect 4 and a portion of block 12. Survey conditions were poor in the area surveyed with overcast skies. Visibility was 0-1 km, and sea states were Beaufort 6-7. Low ceilings and snow showers prevented complete coverage of transects. No sea ice was observed in the area surveyed. Sightings included an unidentified cetacean carcass and one polar bear. The polar bear was near the well decomposed cetacean carcass, approximately 25 km southwest of Barrow.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
238	9/6/12 12:08	71.063	157.204	unid cetacean	dead	1	0	13

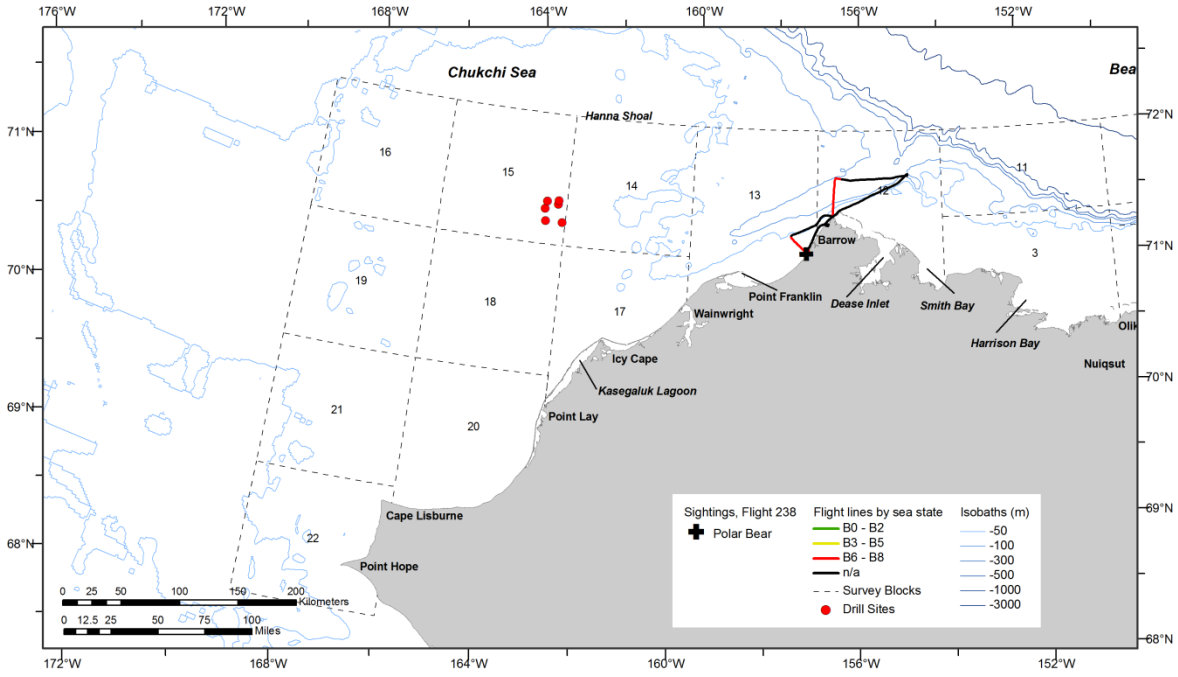

Figure B-72. ASAMM Flight 238 survey track, depicted by sea state, and all sightings.

6 September 2012, Flight 26

Flight was a transect survey of portions of blocks 4 and 6. Survey conditions were poor in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with low ceilings, glare, and precipitation, and sea states were Beaufort 2-7. Low ceilings and high sea states prevented complete coverage of transects. No sea ice was observed in the area surveyed. Sightings included bowhead whales and one unidentified cetacean.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
26	9/6/12 9:49	70.387	145.185	bowhead whale	breach	1	0	4
26	9/6/12 9:59	70.272	145.188	bowhead whale	breach	1	0	4
26	9/6/12 10:03	70.272	145.138	unid cetacean	breach	1	0	4
26	9/6/12 10:26	70.236	144.595	bowhead whale	swim	1	0	4

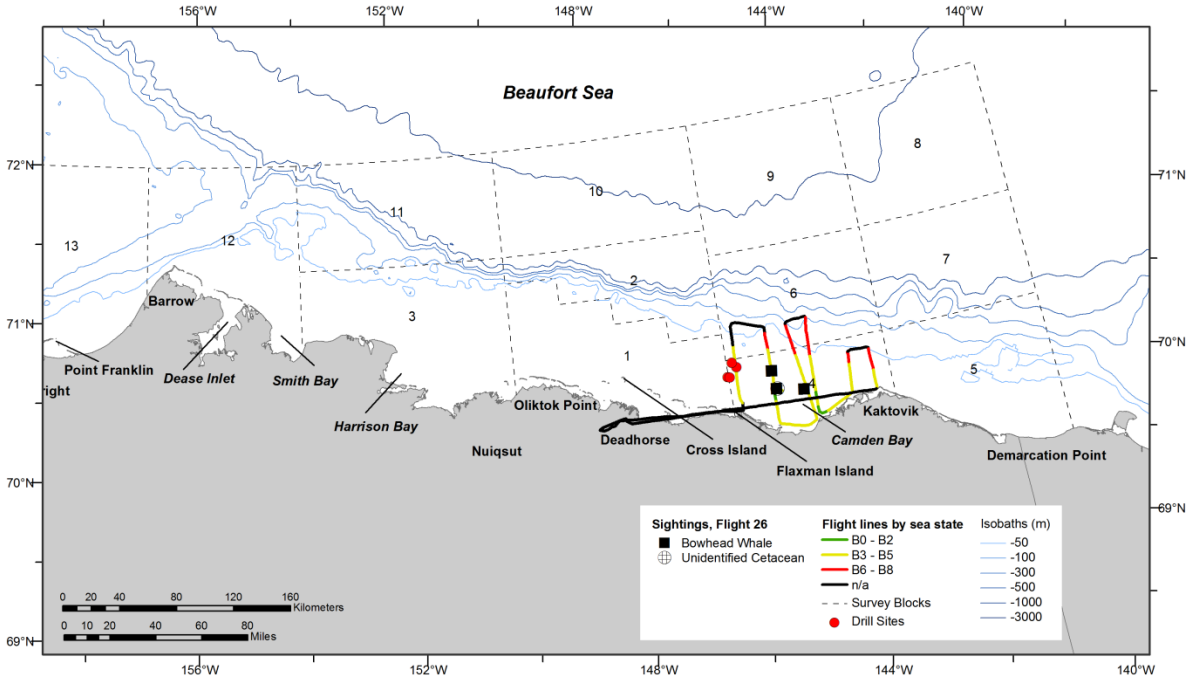

Figure B-73. ASAMM Flight 26 survey track, depicted by sea state, and all sightings.

7 September 2012, Flight 239

Flight was the coastal transect from Barrow to Point Hope. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 2-6. Other than a few periods of low ceilings and/or precipitation, visibility was fair to good along the coastal transect with limited visibility offshore. No sea ice was observed in the area surveyed. Sightings included polar bears and a small unidentified pinniped.

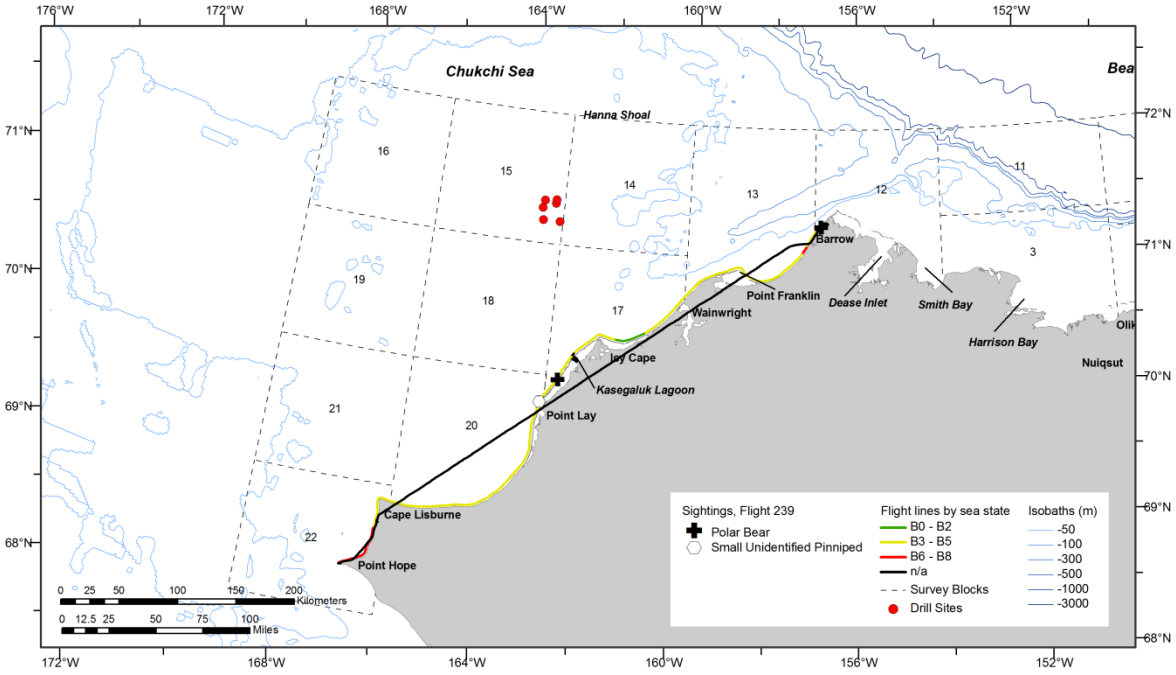

Figure B-74. ASAMM Flight 239 survey track, depicted by sea state, and all sightings.

8 September 2012, Flight 240

Flight was a survey of transects 11 and 13. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 2-4. Ice cover was 0-1% broken floe sea ice in the northwest portion of Block 15 on transect 11, otherwise the area surveyed was free of sea ice. Sightings included 1 bowhead whale, gray whales, 1 unidentified cetacean, walruses, unidentified pinnipeds and an unidentified cetacean carcass.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
240	9/8/12 11:48	71.205	157.498	bowhead whale	rest	1	0	13
240	9/8/12 11:51	71.161	157.690	gray whale	swim	1	0	13
240	9/8/12 11:52	71.147	157.747	gray whale	swim	1	0	13
240	9/8/12 11:53	71.117	157.872	gray whale	swim	1	0	13
240	9/8/12 11:55	71.082	158.021	gray whale	swim	1	0	13
240	9/8/12 11:58	71.027	158.242	unid cetacean	.	1	0	13
240	9/8/12 11:59	71.014	158.290	gray whale	feed	8	0	13
240	9/8/12 11:59	71.006	158.297	gray whale	swim	1	0	13
240	9/8/12 12:04	70.999	158.202	gray whale	swim	1	0	13
240	9/8/12 12:05	71.006	158.317	gray whale	feed	1	0	13
240	9/8/12 12:53	70.921	162.344	gray whale	feed	1	0	17
240	9/8/12 12:54	70.941	162.420	gray whale	feed	3	0	17
240	9/8/12 15:21	70.841	163.556	unid cetacean	dead	1	0	18

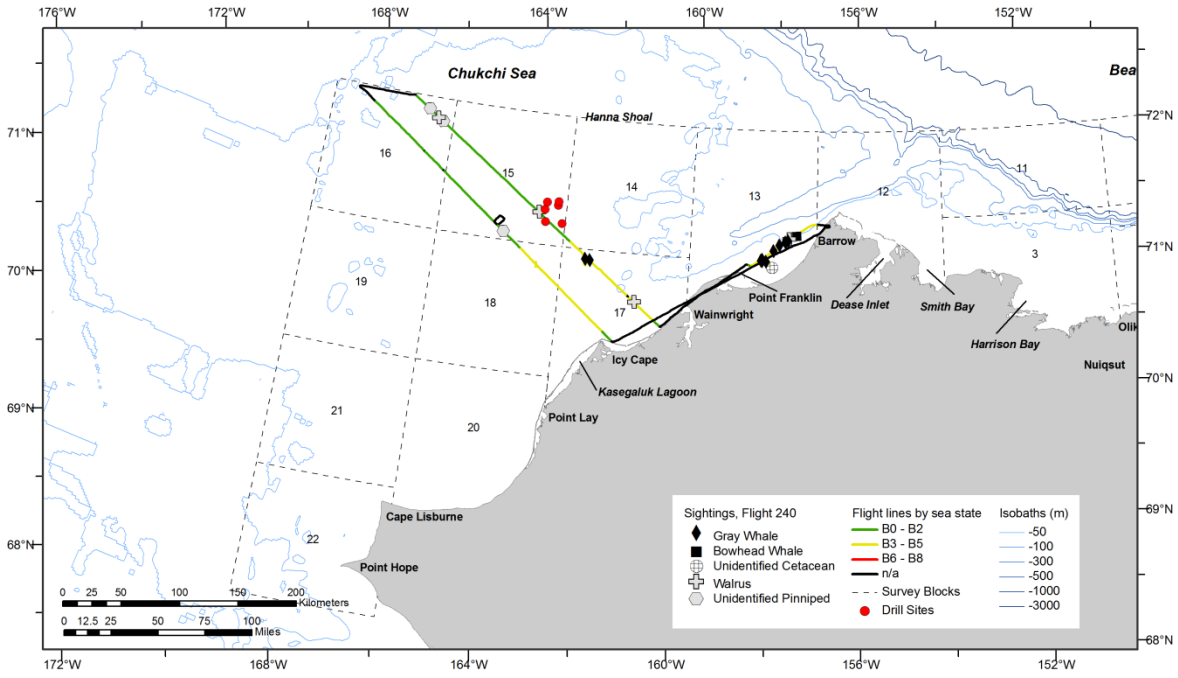

Figure B-75. ASAMM Flight 240 survey track, depicted by sea state, and all sightings.

8 September 2012, Flight 27

Flight was a transect survey of a portion of block 12. Survey conditions were poor in the area surveyed with overcast skies. Visibility was 0-10 km with low ceilings and precipitation, and sea states were Beaufort 4-7. Low ceilings, snow squalls, and high sea states prevented coverage of transects. No sea ice was observed in the area surveyed. No marine mammals were seen.

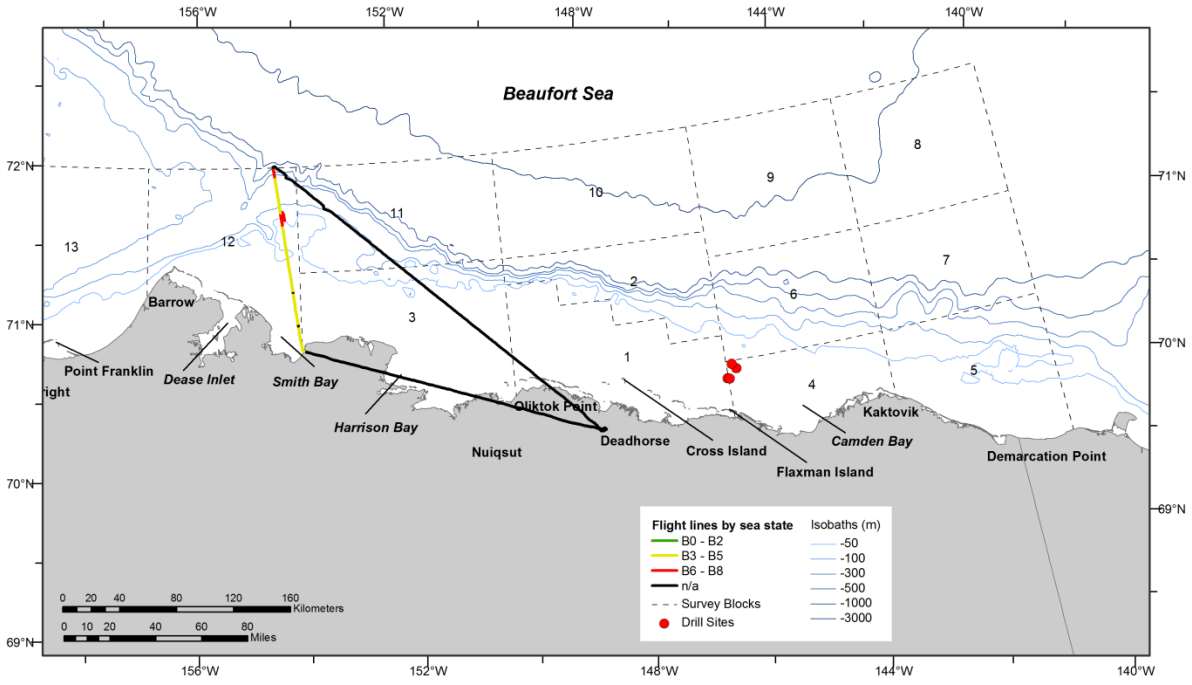

Figure B-76. ASAMM Flight 27 survey track, depicted by sea state.

9 September 2012, Flight 241

Flight was a survey of transects 15 and 17. Survey conditions were good in the area surveyed with overcast skies. Visibility was 0-10 km, and sea states were Beaufort 2-4. No sea ice was observed in the area surveyed. No marine mammals were seen.

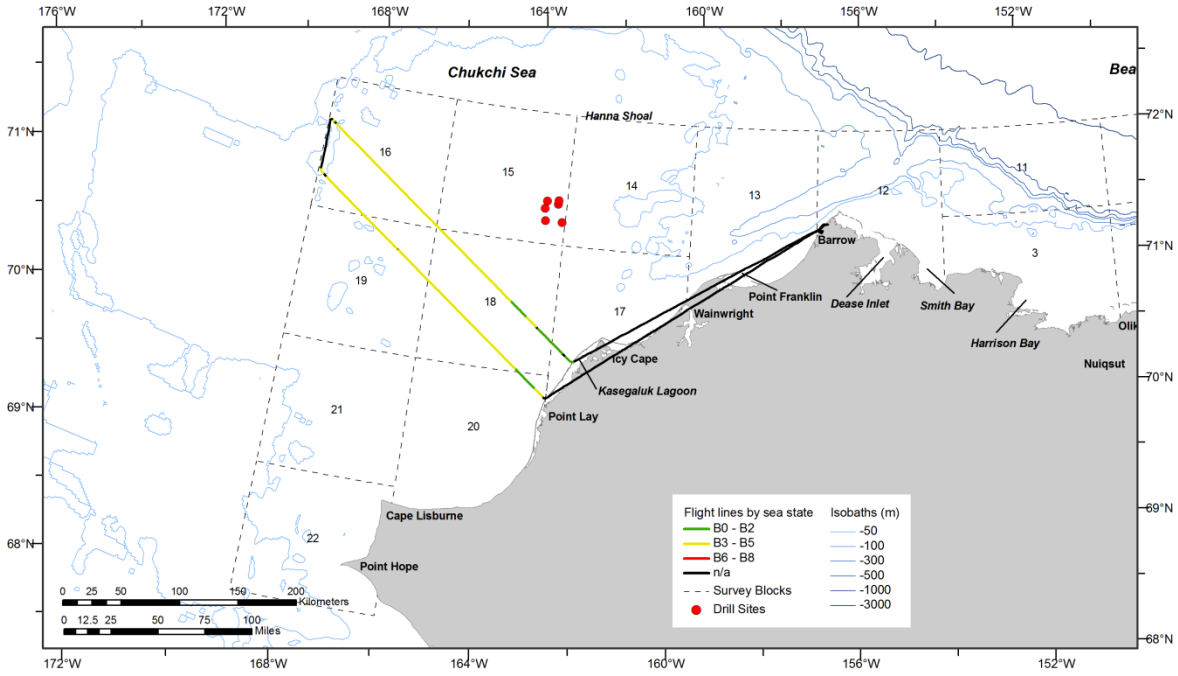

Figure B-77. ASAMM Flight 241 survey track, depicted by sea state.

10 September 2012, Flight 242

Flight was a survey of transects 5, 7, and 9. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 2-5. Ice cover was 0-90% broken floe sea ice in the area surveyed. Sightings included bowhead whales, gray whales, walruses and unidentified pinnipeds. Most of the walruses (>1500) were hauled out on sea ice in the northern parts of Blocks 14 and 15.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
242	9/10/12 12:30	71.088	158.085	bowhead whale	mill	2	0	13
242	9/10/12 12:34	71.124	158.199	gray whale	feed	2	0	13
242	9/10/12 12:34	71.125	158.202	gray whale	feed	2	0	13
242	9/10/12 12:35	71.158	158.308	bowhead whale	swim	1	0	13
242	9/10/12 12:36	71.180	158.378	bowhead whale	dive	1	0	13
242	9/10/12 12:46	71.400	159.115	bowhead whale	swim	1	0	13
242	9/10/12 13:17	71.973	161.737	gray whale	feed	1	0	14
242	9/10/12 14:35	70.863	160.418	bowhead whale	swim	1	0	17
242	9/10/12 14:35	70.868	160.435	bowhead whale	swim	2	0	17
242	9/10/12 14:35	70.869	160.440	bowhead whale	feed	1	0	17
242	9/10/12 14:36	70.880	160.476	bowhead whale	swim	1	0	17
242	9/10/12 14:36	70.885	160.493	bowhead whale	swim	1	0	17
242	9/10/12 14:36	70.888	160.499	bowhead whale	swim	1	0	17
242	9/10/12 14:37	70.912	160.579	bowhead whale	dive	1	0	17
242	9/10/12 14:40	70.976	160.807	bowhead whale	swim	1	0	17
242	9/10/12 14:41	70.988	160.851	bowhead whale	swim	1	0	17
242	9/10/12 14:41	70.993	160.866	bowhead whale	swim	1	0	17
242	9/10/12 14:41	70.998	160.887	bowhead whale	swim	1	0	14
242	9/10/12 14:42	71.025	160.982	gray whale	swim	1	0	14
242	9/10/12 14:43	71.029	160.996	gray whale	feed	2	0	14
242	9/10/12 14:43	71.048	161.063	bowhead whale	swim	1	0	14
242	9/10/12 14:45	71.075	161.159	bowhead whale	swim	1	0	14
242	9/10/12 14:45	71.078	161.168	bowhead whale	swim	1	0	14
242	9/10/12 14:50	71.189	161.574	bowhead whale	swim	1	0	14
242	9/10/12 14:55	71.290	161.941	bowhead whale	rest	1	0	14

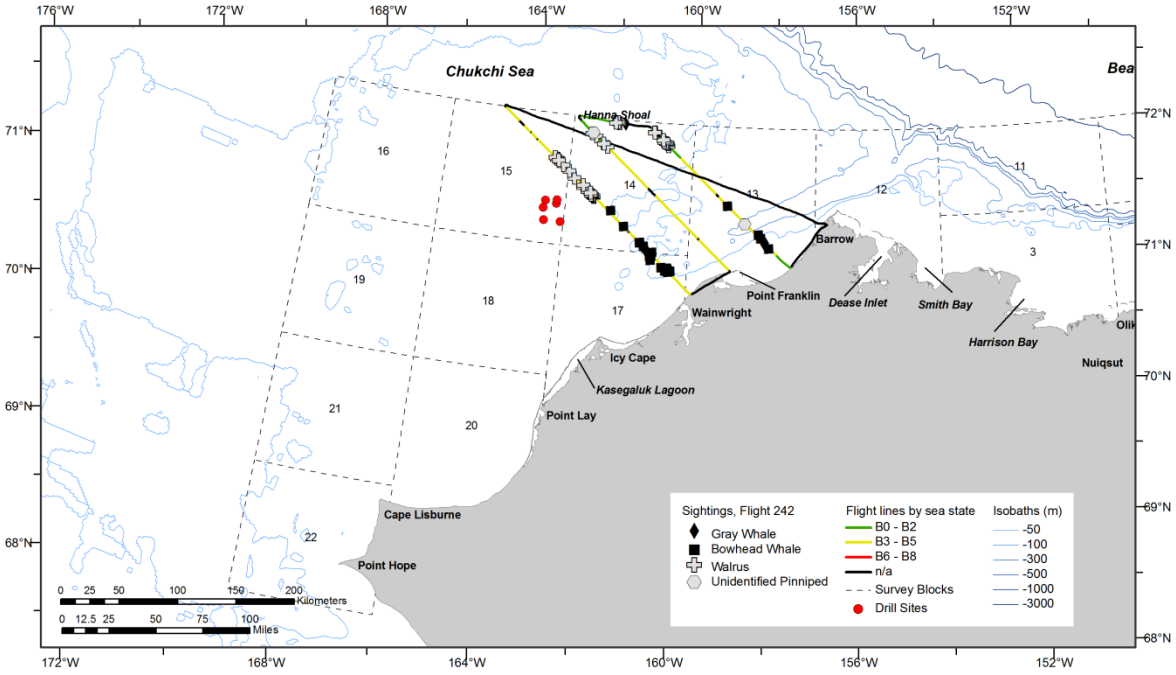

Figure B-78. ASAMM Flight 242 survey track, depicted by sea state, and all sightings.

10 September 2012, Flight 28

Flight was a transect survey of portions of blocks 3 and 11. Survey conditions were fair in the area surveyed with partly cloudy skies. Visibility was 0-10 km with low ceilings, glare, and precipitation, and sea states were Beaufort 2-4. Low ceilings prevented complete coverage of transects. No sea ice was observed in the area surveyed. Sightings included bowhead whales, belugas, one unidentified cetacean, small unidentified pinnipeds, and unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
28	9/10/12 13:47	71.101	153.815	bowhead whale	swim	2	0	3
28	9/10/12 13:47	71.107	153.814	bowhead whale	swim	1	0	3
28	9/10/12 13:47	71.105	153.784	bowhead whale	swim	1	0	3
28	9/10/12 13:53	71.166	153.816	bowhead whale	swim	1	0	3
28	9/10/12 13:54	71.207	153.808	bowhead whale	swim	1	0	3
28	9/10/12 13:54	71.217	153.806	bowhead whale	swim	1	0	3
28	9/10/12 13:55	71.219	153.807	bowhead whale	swim	1	0	3
28	9/10/12 13:55	71.222	153.807	bowhead whale	swim	1	0	3
28	9/10/12 13:55	71.232	153.808	bowhead whale	swim	1	0	3
28	9/10/12 14:15	71.879	153.754	beluga	swim	1	0	11
28	9/10/12 14:15	71.879	153.754	beluga	swim	1	0	11
28	9/10/12 14:15	71.883	153.755	beluga	swim	1	0	11
28	9/10/12 14:18	71.979	153.748	beluga	swim	2	0	11
28	9/10/12 14:18	71.982	153.747	beluga	swim	3	1	11
28	9/10/12 14:18	71.988	153.747	beluga	swim	2	0	11
28	9/10/12 14:18	71.989	153.746	beluga	swim	4	0	11
28	9/10/12 14:18	71.990	153.746	beluga	swim	1	0	11
28	9/10/12 14:18	71.994	153.746	beluga	swim	2	1	11
28	9/10/12 14:18	71.997	153.744	beluga	swim	12	0	11
28	9/10/12 14:54	71.114	153.108	bowhead whale	swim	2	0	3
28	9/10/12 14:57	71.124	153.155	bowhead whale	swim	1	0	3
28	9/10/12 16:13	71.170	152.287	bowhead whale	swim	2	0	3
28	9/10/12 16:48	70.991	151.824	unid cetacean	swim	1	0	3
28	9/10/12 16:59	71.165	151.805	bowhead whale	swim	1	0	3

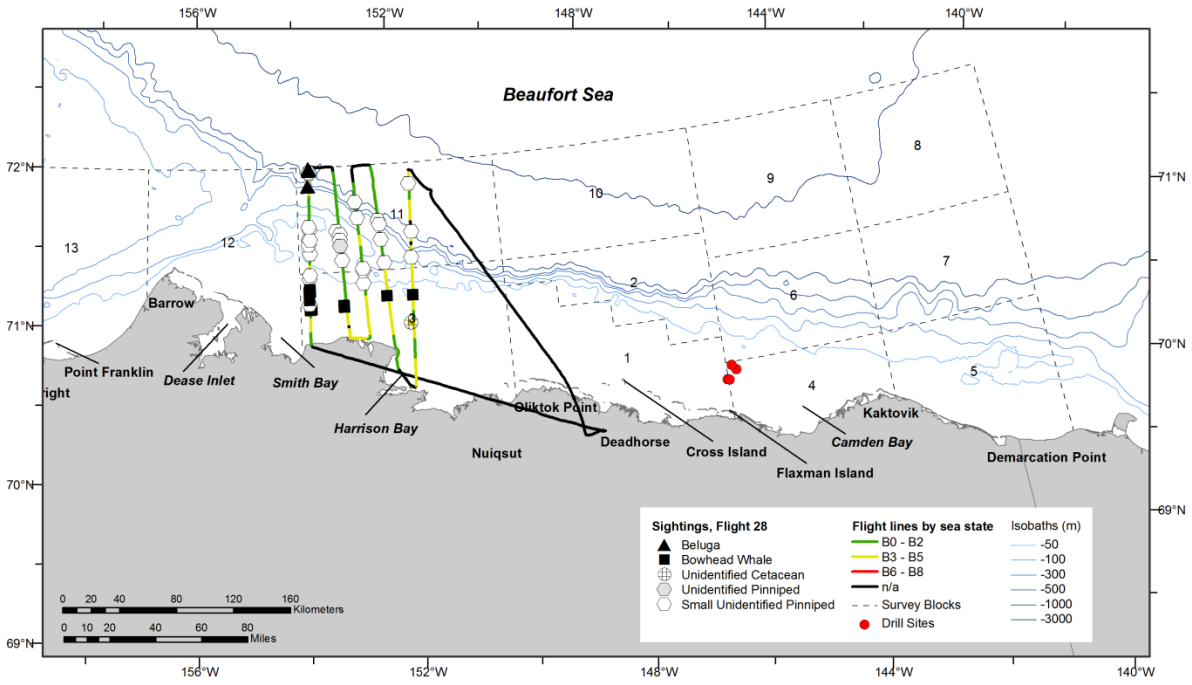

Figure B-79. ASAMM Flight 28 survey track, depicted by sea state, and all sightings.

11 September 2012, Flight 243

Flight was a survey of transects 30, 31, and 32, and a partial survey of transects 29 and 30. Survey conditions were good in the area surveyed with clear to partly cloudy skies. Visibility was 1 km to unlimited, and sea states were Beaufort 1-6. No sea ice was observed in the area surveyed. Sightings included bowhead whales, humpback whales (including several bubble net feeding), killer whales, including 1 calf, fin whales (lunge feeding, and including 2 calves), 1 minke whale, 1 unidentified cetacean, and one unidentified pinniped.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
243	9/11/12 12:32	68.476	168.555	bowhead whale	swim	1	0	22
243	9/11/12 12:37	68.475	168.761	bowhead whale	.	1	0	22
243	9/11/12 12:39	68.467	168.771	humpback whale	feed	4	0	22
243	9/11/12 12:52	68.333	168.924	humpback whale	swim	2	0	22
243	9/11/12 12:58	68.293	168.941	humpback whale	dive	1	0	22
243	9/11/12 13:00	68.286	168.934	humpback whale	.	1	0	22
243	9/11/12 13:01	68.293	168.926	humpback whale	feed	1	0	22
243	9/11/12 13:04	68.304	168.769	killer whale	swim	5	1	22
243	9/11/12 13:28	68.306	167.588	humpback whale	feed	1	0	22
243	9/11/12 13:29	68.307	167.524	unid cetacean	.	1	0	22
243	9/11/12 13:36	68.307	167.350	humpback whale	dive	1	0	22
243	9/11/12 13:38	68.308	167.206	humpback whale	swim	1	0	22
243	9/11/12 13:38	68.308	167.161	humpback whale	swim	1	0	22
243	9/11/12 13:43	68.306	166.956	humpback whale	swim	2	0	22
243	9/11/12 13:44	68.305	166.845	humpback whale	mill	2	0	22
243	9/11/12 13:48	68.262	166.829	minke whale	swim	1	0	22
243	9/11/12 13:50	68.265	166.833	humpback whale	.	2	0	22
243	9/11/12 13:51	68.305	166.744	humpback whale	swim	1	0	22
243	9/11/12 14:10	68.138	166.951	fin whale	feed	1	0	22
243	9/11/12 14:11	68.106	166.975	fin whale	feed	2	1	22
243	9/11/12 14:22	68.139	167.399	fin whale	swim	2	1	22
243	9/11/12 14:28	68.139	167.992	humpback whale	mill	1	0	22
243	9/11/12 14:29	68.088	168.067	humpback whale	mill	2	0	22
243	9/11/12 14:42	68.134	168.749	humpback whale	swim	1	0	22

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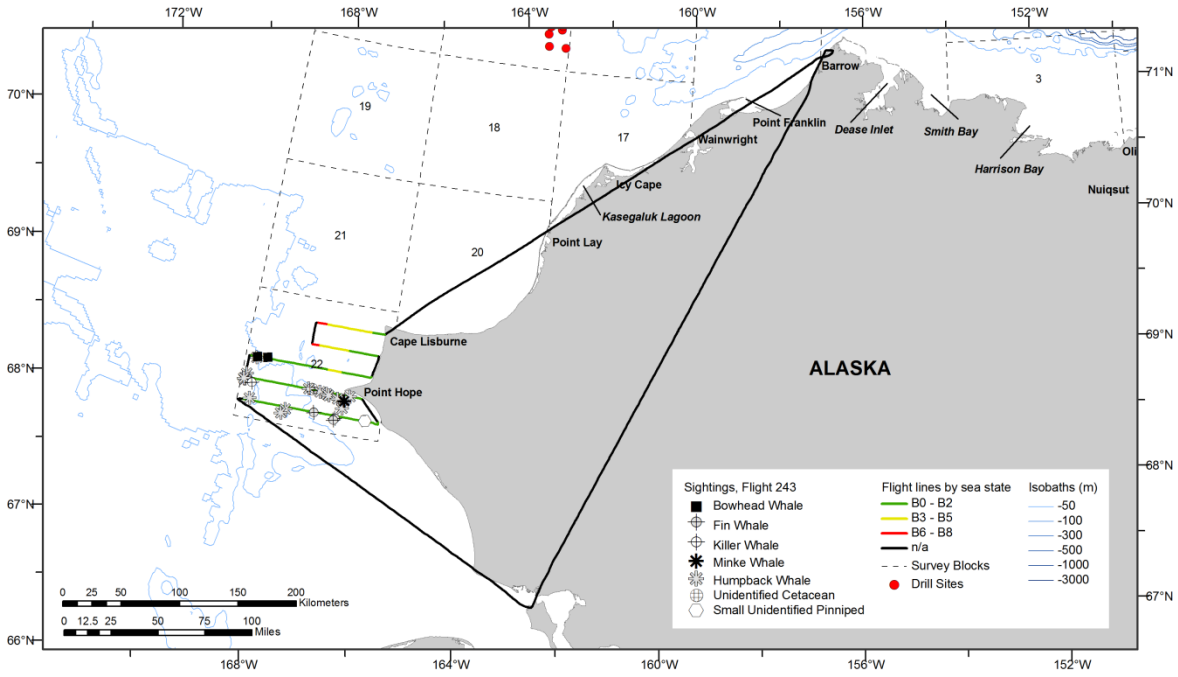
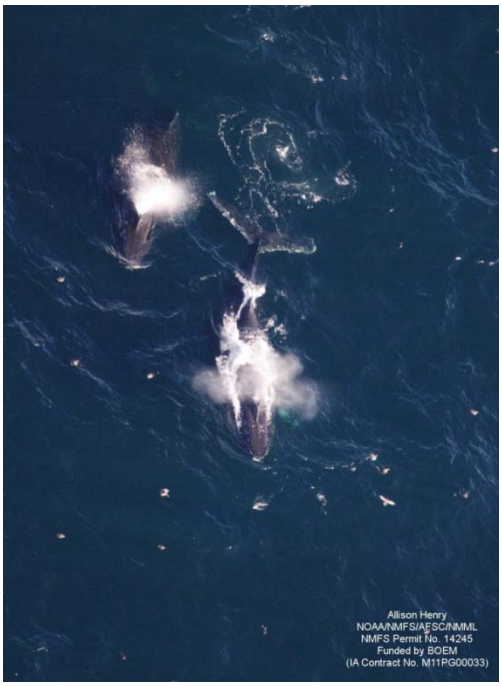


Figure B-80. ASAMM Flight 243 survey track, depicted by sea state, and all sightings.



Humpback whales (left) and a lunge feeding fin whale (above) observed on flight 243, 11 September 2012.

11 September 2012, Flight 29

Flight was a transect survey of portions of blocks 4, 5, 6, and 7. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with low ceilings, glare, and precipitation, and sea states were Beaufort 2-5. Low ceilings prevented complete coverage of transects. One transect was truncated to avoid whaling boats northwest of Kaktovik. No sea ice was observed in the area surveyed. Sightings included bowhead whales, including one calf, unidentified cetaceans, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
29	9/11/12 10:35	70.137	142.772	bowhead whale	swim	1	0	5
29	9/11/12 10:36	70.148	142.758	unid cetacean	swim	1	0	5
29	9/11/12 10:37	70.135	142.765	unid cetacean	swim	1	0	5
29	9/11/12 10:43	70.168	142.950	bowhead whale	swim	2	0	5
29	9/11/12 10:44	70.177	142.929	unid cetacean	swim	2	0	5
29	9/11/12 10:44	70.162	142.936	unid cetacean	swim	1	0	5
29	9/11/12 10:45	70.187	142.936	bowhead whale	swim	2	0	5
29	9/11/12 10:46	70.187	142.977	bowhead whale	swim	2	1	5
29	9/11/12 10:47	70.180	142.955	bowhead whale	swim	2	0	5
29	9/11/12 12:32	70.338	145.186	bowhead whale	swim	1	0	4
29	9/11/12 12:33	70.335	145.154	unid cetacean	swim	3	0	4

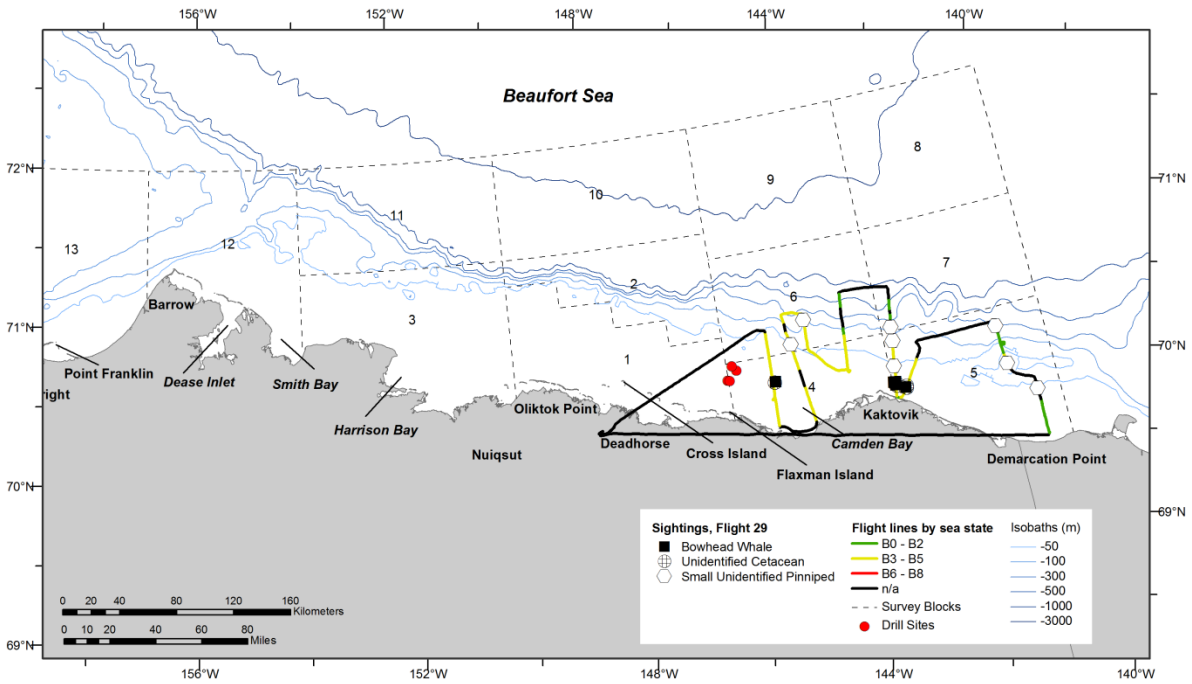


Figure B-81. ASAMM Flight 29 survey track, depicted by sea state, and all sightings.

12 September 2012, Flight 30

Flight was a transect survey of portions of blocks 1 and 2. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with low ceilings and snow showers, and sea states were Beaufort 2. Low ceilings prevented complete coverage of transects. One transect was truncated to avoid the potential whaling area north of Cross Island. No sea ice was observed in the area surveyed. Small unidentified pinnipeds were seen.

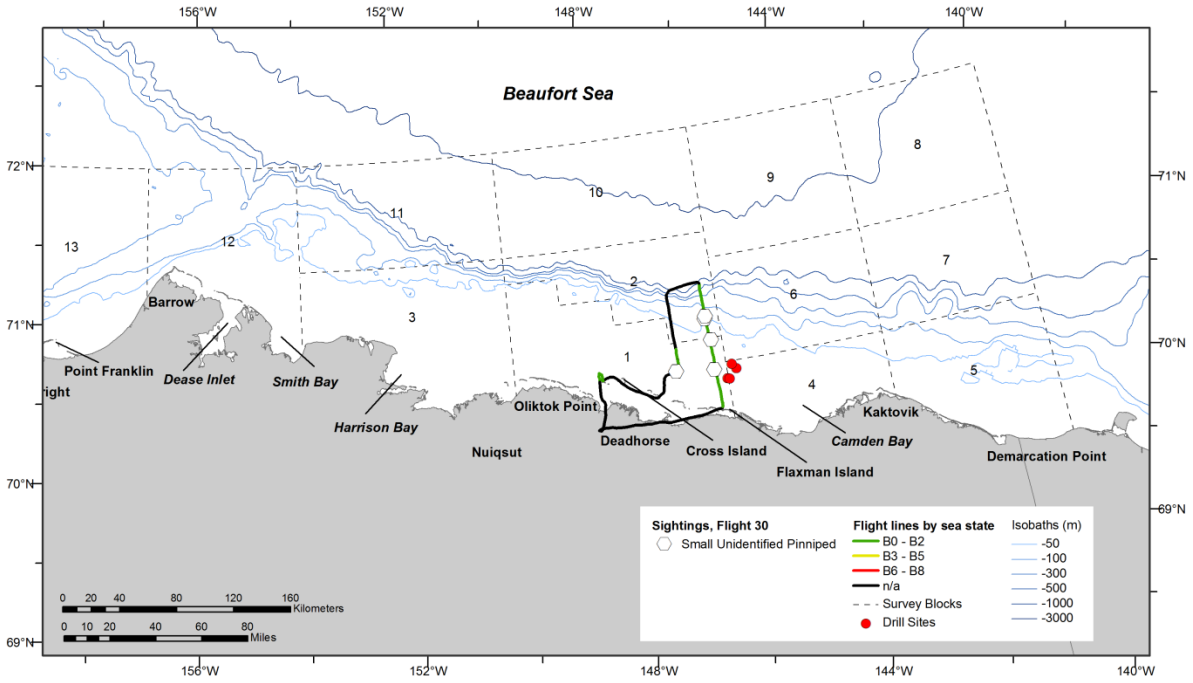


Figure B-82. ASAMM Flight 30 survey track, depicted by sea state, and all sightings.

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13 September 2012, Flight 244

Flight was a partial survey of transects 2 and 4. Survey conditions were poor in the area surveyed with overcast skies. Visibility was 0-3 km with precipitation, and sea states were Beaufort 5-7. Widespread low ceilings, low visibility, and high sea states prevented complete coverage of transects. No sea ice was observed in the area surveyed. One dead walrus was seen floating offshore.

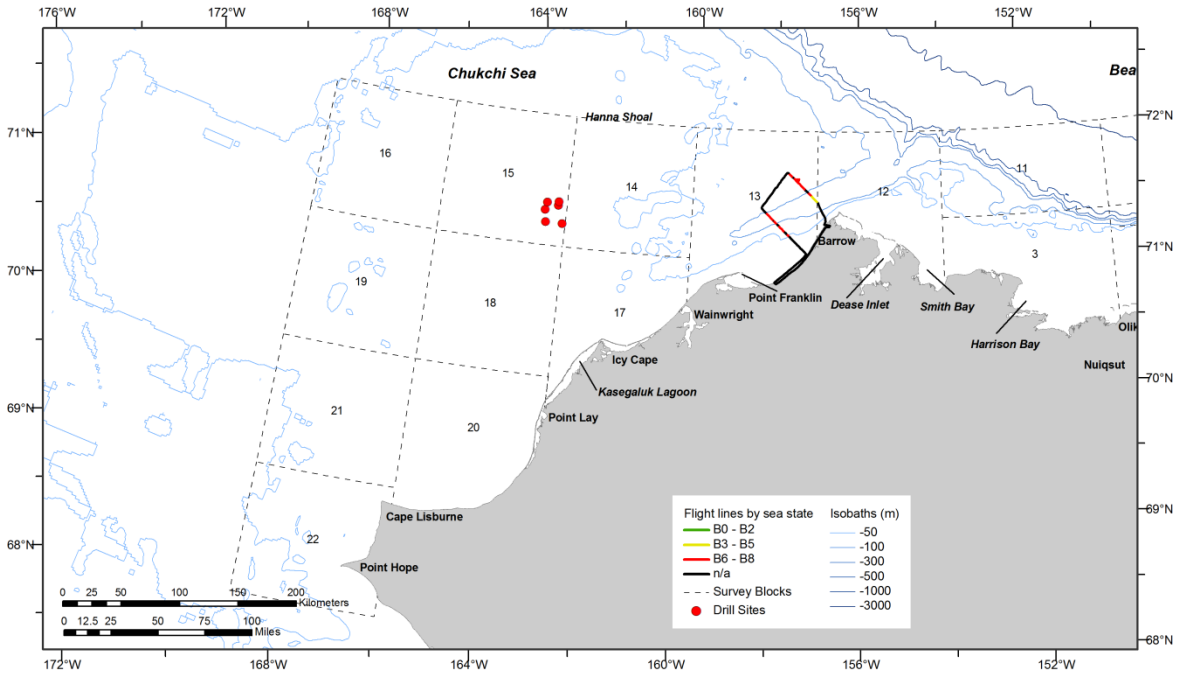

Figure B-83. ASAMM Flight 244 survey track, depicted by sea state.

14 September 2012, Flight 245

Flight was a partial survey of transects 10 and 12, and the coastal transect from southwest of Wainwright to Point Barrow. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 2-5. Low ceilings prevented complete coverage of transect 12. Ice cover was 0-35% broken floe sea ice in the area surveyed. Sightings included bowhead whales, gray whales, one unidentified cetacean, walruses (all hauled out on scattered ice floes), and polar bears. One polar bear was observed lying on an ice floe near fresh blood tracks with a live unidentified seal crawling nearby.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
245	9/14/12 11:06	71.274	157.019	gray whale	feed	1	0	13
245	9/14/12 11:06	71.276	157.030	gray whale	feed	1	0	13
245	9/14/12 11:15	71.155	157.831	unid cetacean	.	1	0	13
245	9/14/12 11:16	71.131	157.837	gray whale	feed	1	0	13
245	9/14/12 11:19	71.125	157.916	gray whale	feed	1	0	13
245	9/14/12 11:25	71.025	158.396	gray whale	feed	2	0	13
245	9/14/12 11:27	71.020	158.398	gray whale	feed	1	0	13
245	9/14/12 12:04	70.930	161.441	bowhead whale	swim	1	0	17
245	9/14/12 12:11	71.050	161.884	bowhead whale	swim	1	0	14

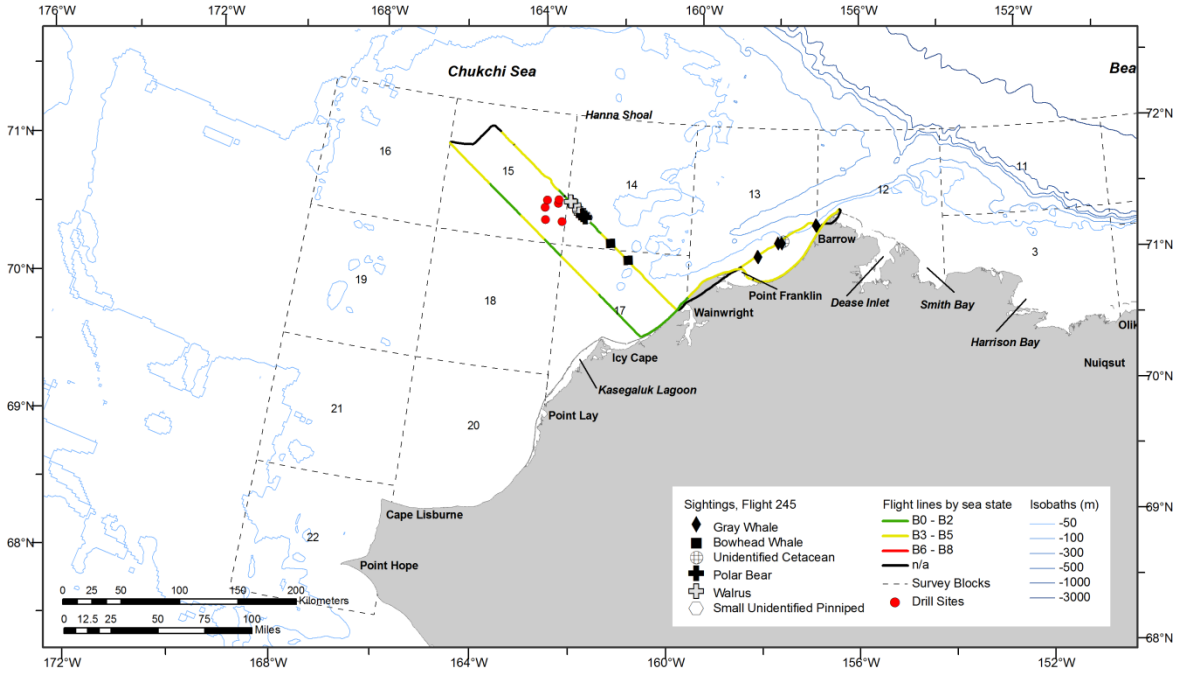

Figure B-84. ASAMM Flight 245 survey track, depicted by sea state, and all sightings.

Polar bear (lying down, center) and seal (crawling away, above right of bear) connected by bloody track on flight 245, 14 September 2012.

14 September 2012, Flight 31

Flight was a transect survey of portions of blocks 3, 10, and 11. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with low ceilings, snow showers, haze, and glare, and sea states were Beaufort 3-6. Low ceilings, snow showers, and high sea states prevented complete coverage of transects. No sea ice was observed in the area surveyed. No marine mammals were seen.

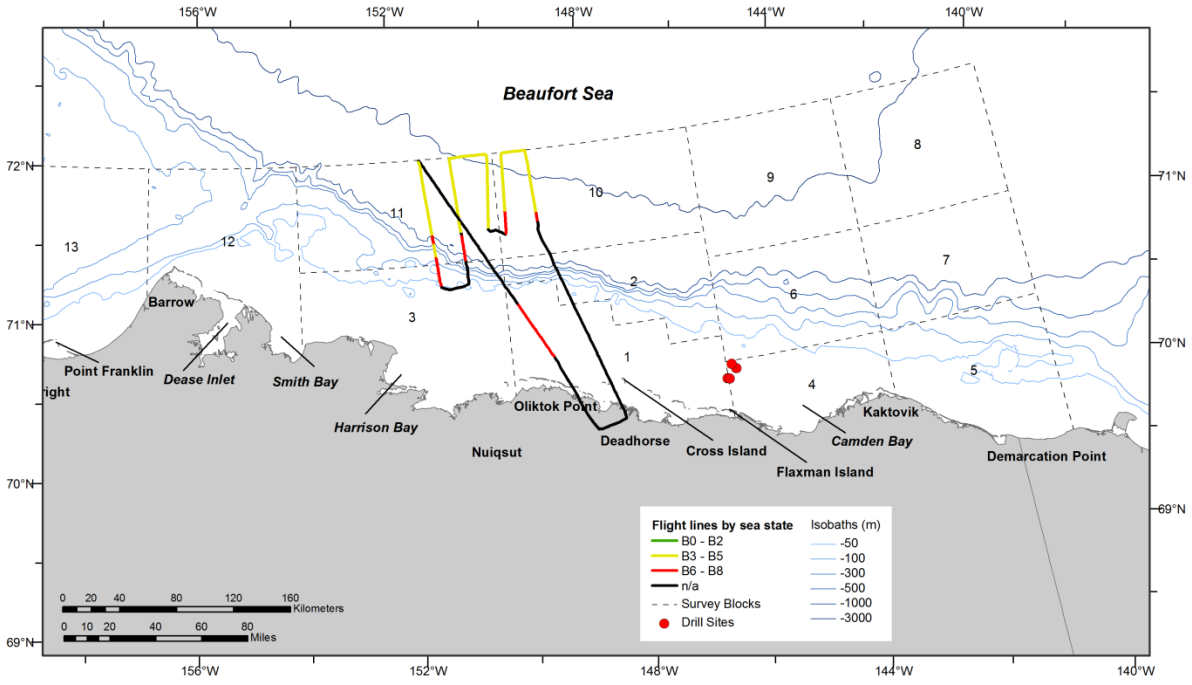

Figure B-85. ASAMM Flight 31 survey track, depicted by sea state.

15 September 2012, Flight 246

Flight was a partial survey of transects 14 and 16. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 1-5. Low ceilings and precipitation prevented complete coverage of transects. No sea ice was observed in the area surveyed. Sightings included unidentified pinnipeds, walruses, and one dead floating unidentified pinniped.

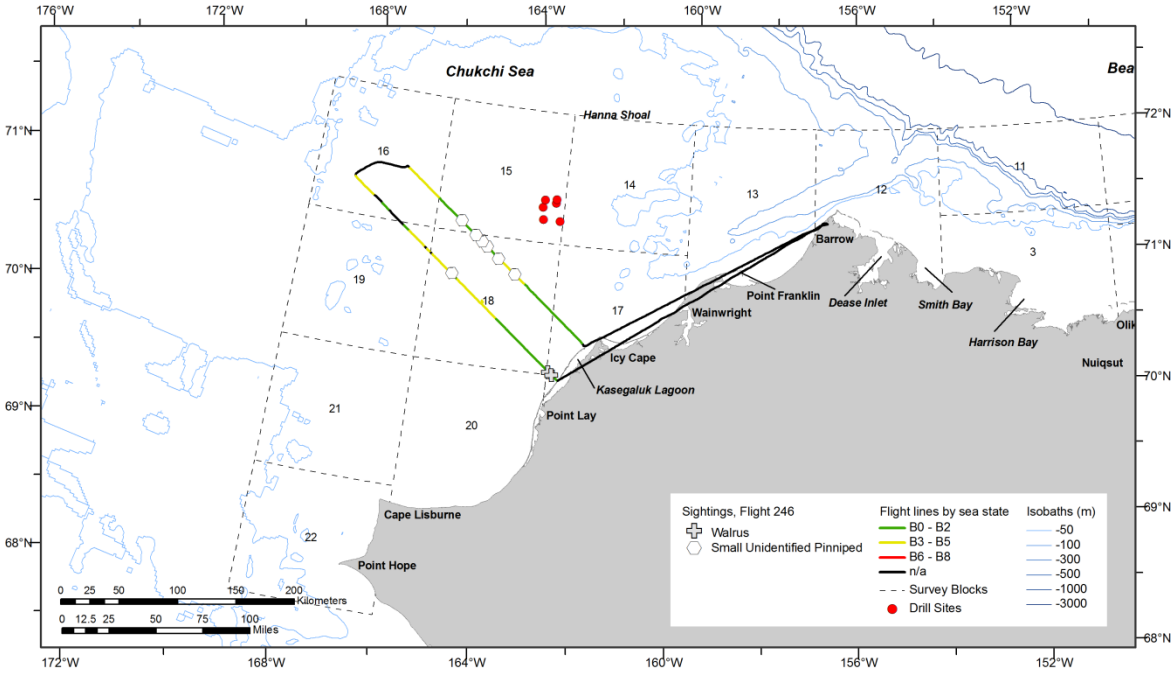

Figure B-86. ASAMM Flight 246 survey track, depicted by sea state, and all sightings.

15 September 2012, Flight 32

Flight was a transect survey of portions of blocks 1 and 2, and a search survey of Cross Island. Survey conditions were good in the area surveyed with clear to overcast skies. Visibility was 2 km to unlimited with glare, haze, and low ceilings, and sea states were Beaufort 2-5. No sea ice was observed in the area surveyed. Sightings included bowhead whales including one calf, one beluga, unidentified cetaceans, polar bears on Cross Island, and small unidentified pinnipeds. The bowhead whales were observed milling, diving, resting, and swimming in large groups. One bowhead whale in a large group was observed defecating.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
32	9/15/12 13:25	71.021	151.089	bowhead whale	swim	1	0	3
32	9/15/12 13:26	71.079	151.273	bowhead whale	swim	1	0	3
32	9/15/12 14:11	71.009	149.767	bowhead whale	swim	1	0	1
32	9/15/12 14:13	71.014	149.785	bowhead whale	swim	2	0	1
32	9/15/12 14:13	71.019	149.743	bowhead whale	swim	1	0	1
32	9/15/12 14:49	70.982	149.207	bowhead whale	swim	1	0	1
32	9/15/12 14:49	70.991	149.208	bowhead whale	dive	1	0	1
32	9/15/12 14:50	71.001	149.173	bowhead whale	swim	1	0	1
32	9/15/12 14:50	70.988	149.186	bowhead whale	swim	1	0	1
32	9/15/12 14:51	71.007	149.214	bowhead whale	swim	1	0	1
32	9/15/12 14:52	71.010	149.179	bowhead whale	swim	1	0	1
32	9/15/12 15:02	71.291	149.278	beluga	rest	1	0	2
32	9/15/12 15:14	71.086	148.888	bowhead whale	rest	1	0	2
32	9/15/12 15:14	71.080	148.889	bowhead whale	mill	2	1	2
32	9/15/12 15:14	71.072	148.906	bowhead whale	swim	1	0	2
32	9/15/12 15:14	71.069	148.916	bowhead whale	.	1	0	2
32	9/15/12 15:15	71.074	148.945	bowhead whale	swim	1	0	2
32	9/15/12 15:15	71.081	148.947	bowhead whale	.	2	0	2
32	9/15/12 15:15	71.083	148.940	bowhead whale	swim	1	0	2
32	9/15/12 15:16	71.079	148.966	bowhead whale	swim	2	0	2
32	9/15/12 15:18	71.072	148.994	bowhead whale	swim	3	0	2
32	9/15/12 15:18	71.062	148.983	bowhead whale	swim	1	0	2
32	9/15/12 15:19	71.064	149.026	bowhead whale	swim	3	0	1
32	9/15/12 15:20	71.063	149.025	bowhead whale	swim	3	0	1
32	9/15/12 15:20	71.074	149.035	bowhead whale	mill	2	0	1
32	9/15/12 15:23	71.065	148.884	bowhead whale	rest	1	0	2
32	9/15/12 15:23	71.057	148.865	bowhead whale	swim	1	0	2
32	9/15/12 15:24	71.055	148.891	bowhead whale	swim	1	0	2
32	9/15/12 15:24	71.046	148.895	bowhead whale	mill	5	0	2
32	9/15/12 15:24	71.041	148.896	bowhead whale	rest	1	0	2
32	9/15/12 15:26	71.034	148.886	bowhead whale	swim	1	0	2
32	9/15/12 15:26	71.034	148.886	bowhead whale	swim	1	0	2
32	9/15/12 15:27	71.027	148.858	bowhead whale	swim	1	0	2
32	9/15/12 15:27	71.036	148.866	bowhead whale	swim	3	0	2
32	9/15/12 15:27	71.035	148.876	bowhead whale	swim	1	0	2
32	9/15/12 15:28	71.030	148.816	bowhead whale	swim	2	0	2

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
32	9/15/12 15:29	71.039	148.839	bowhead whale	swim	2	0	2
32	9/15/12 15:29	71.036	148.796	bowhead whale	mill	1	0	2
32	9/15/12 15:30	71.023	148.757	bowhead whale	mill	2	0	2
32	9/15/12 15:31	71.019	148.767	bowhead whale	swim	1	0	2
32	9/15/12 15:35	70.949	148.880	unid cetacean	swim	1	0	1
32	9/15/12 16:07	70.723	148.188	bowhead whale	swim	1	0	1
32	9/15/12 16:08	70.727	148.187	bowhead whale	rest	2	0	1
32	9/15/12 16:13	70.757	148.180	bowhead whale	swim	2	0	1
32	9/15/12 16:14	70.764	148.261	bowhead whale	swim	2	0	1
32	9/15/12 16:15	70.756	148.267	unid cetacean	swim	1	0	1
32	9/15/12 17:57	70.683	147.871	bowhead whale	swim	1	0	1

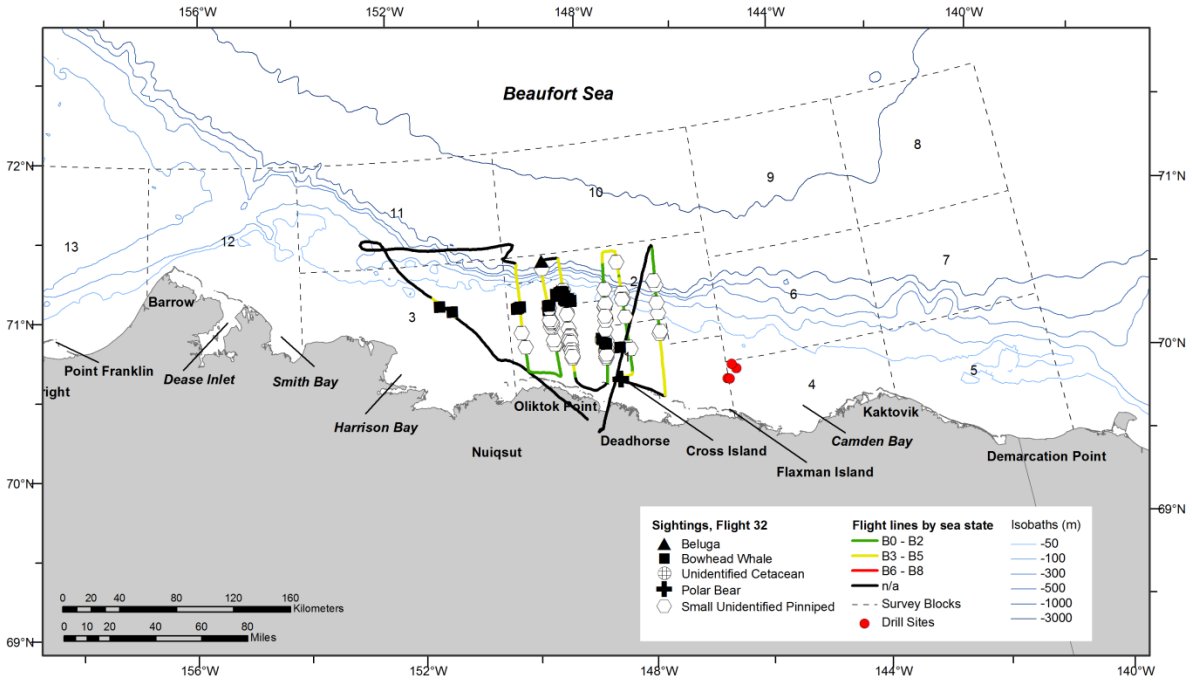

Figure B-87. ASAMM Flight 32 survey track, depicted by sea state, and all sightings.

16 September 2012, Flight 247

Flight was a partial survey of transects 18 and 20. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0 km to unlimited, and sea states were Beaufort 2-7, with higher sea states nearshore. Low ceilings and high sea states prevented completion of transects. No sea ice was observed in the area surveyed. No marine mammals were seen.

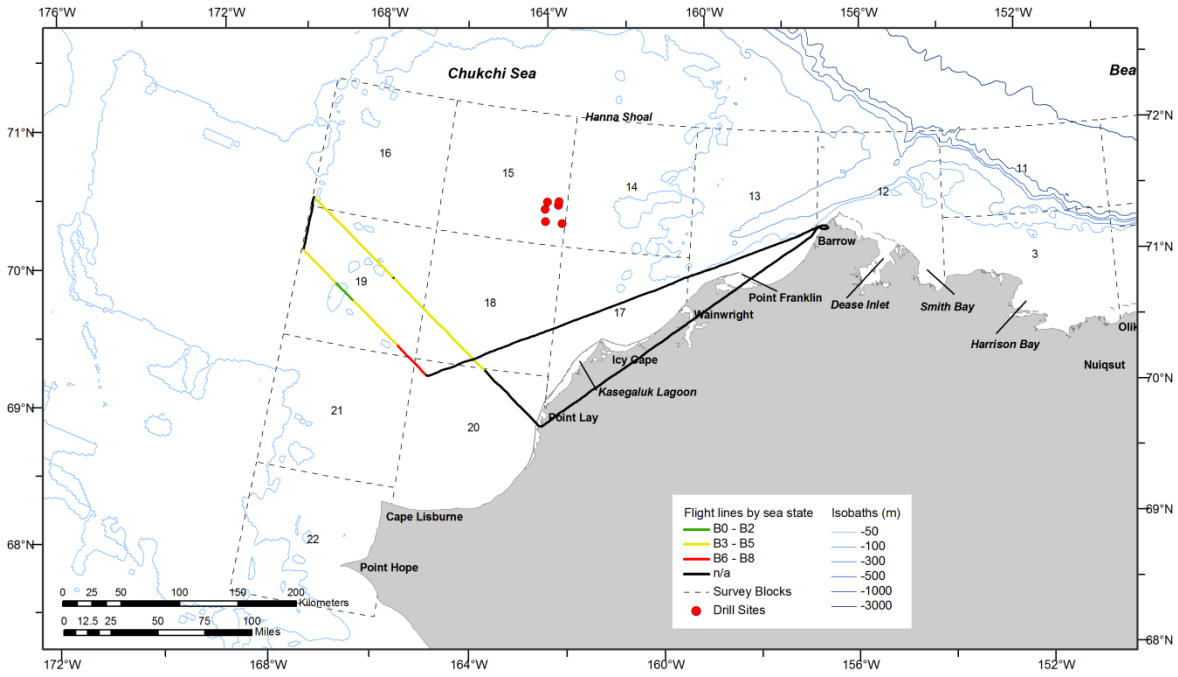

Figure B-88. ASAMM Flight 247 survey track, depicted by sea state.

17 September 2012, Flight 33

Flight was a transect survey of portions of block 3. Survey conditions were poor in the area surveyed with partly cloudy skies. Visibility was 0 km to unlimited, with low ceilings, and sea states were Beaufort 3-7. Low ceilings prevented completion of transects. No sea ice was observed in the area surveyed. No marine mammals were observed.

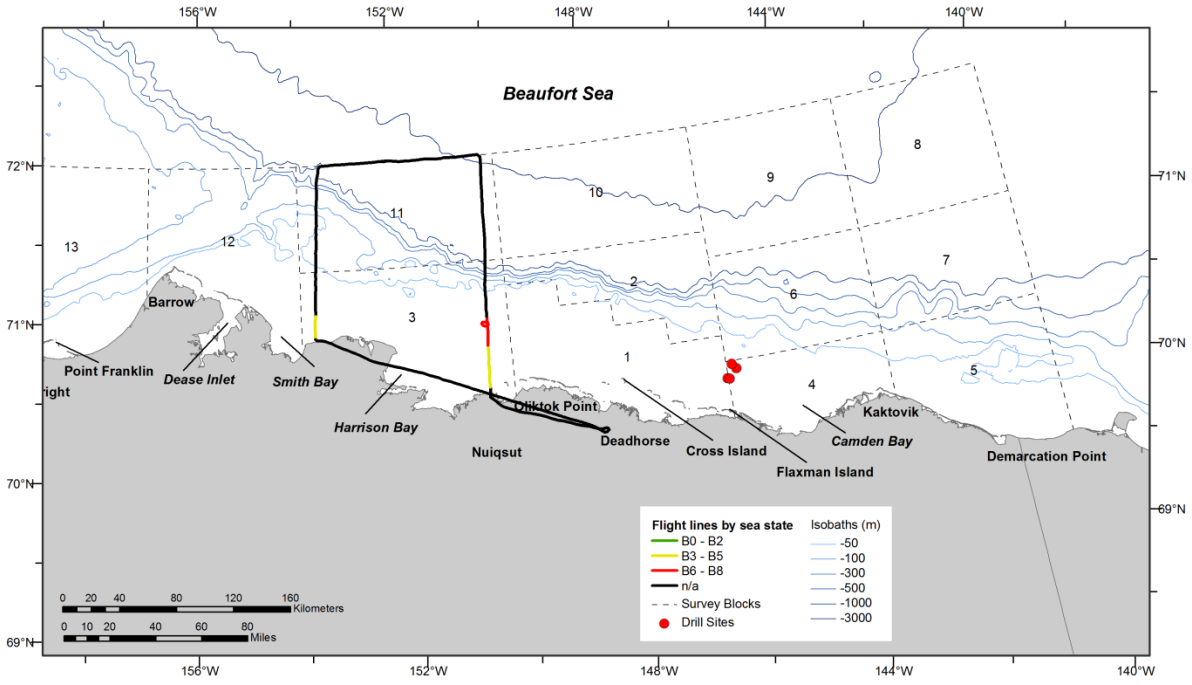

Figure B-89. ASAMM Flight 33 survey track, depicted by sea state.

18 September 2012, Flight 248

Flight was a survey of transects 1 and 7, and a partial survey of transects 3 and 5. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 2-6. Low ceilings and precipitation prevented completion of transects. Ice cover was 0-20% broken floe sea ice in the area surveyed. Sightings included bowhead whales, gray whales, one unidentified cetacean, walruses, and one polar bear.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
248	9/18/12 17:01	71.509	157.919	bowhead whale	swim	3	0	13
248	9/18/12 17:02	71.506	157.908	bowhead whale	swim	1	0	13
248	9/18/12 17:02	71.505	157.906	bowhead whale	swim	1	0	13
248	9/18/12 17:08	71.516	157.831	bowhead whale	swim	2	0	13
248	9/18/12 17:08	71.515	157.789	bowhead whale	swim	2	0	13
248	9/18/12 17:12	71.503	157.852	bowhead whale	swim	6	0	13
248	9/18/12 17:26	71.512	157.762	bowhead whale	swim	4	0	13
248	9/18/12 17:28	71.511	157.718	bowhead whale	swim	1	0	13
248	9/18/12 17:52	71.214	158.499	bowhead whale	swim	2	0	13
248	9/18/12 17:57	71.190	158.543	bowhead whale	swim	1	0	13
248	9/18/12 17:58	71.200	158.566	bowhead whale	swim	1	0	13
248	9/18/12 17:59	71.206	158.595	bowhead whale	swim	1	0	13
248	9/18/12 18:01	71.243	158.582	bowhead whale	swim	1	0	13
248	9/18/12 18:03	71.292	158.751	bowhead whale	swim	1	0	13
248	9/18/12 18:04	71.305	158.800	bowhead whale	swim	1	0	13
248	9/18/12 18:04	71.306	158.805	bowhead whale	swim	1	0	13
248	9/18/12 18:05	71.311	158.824	unid cetacean	dive	1	0	13
248	9/18/12 18:05	71.318	158.847	bowhead whale	swim	1	0	13
248	9/18/12 18:05	71.330	158.888	bowhead whale	swim	1	0	13
248	9/18/12 19:20	71.333	160.473	bowhead whale	swim	1	0	14
248	9/18/12 19:35	71.173	159.915	gray whale	swim	1	0	13
248	9/18/12 19:50	71.044	159.468	gray whale	swim	1	0	13

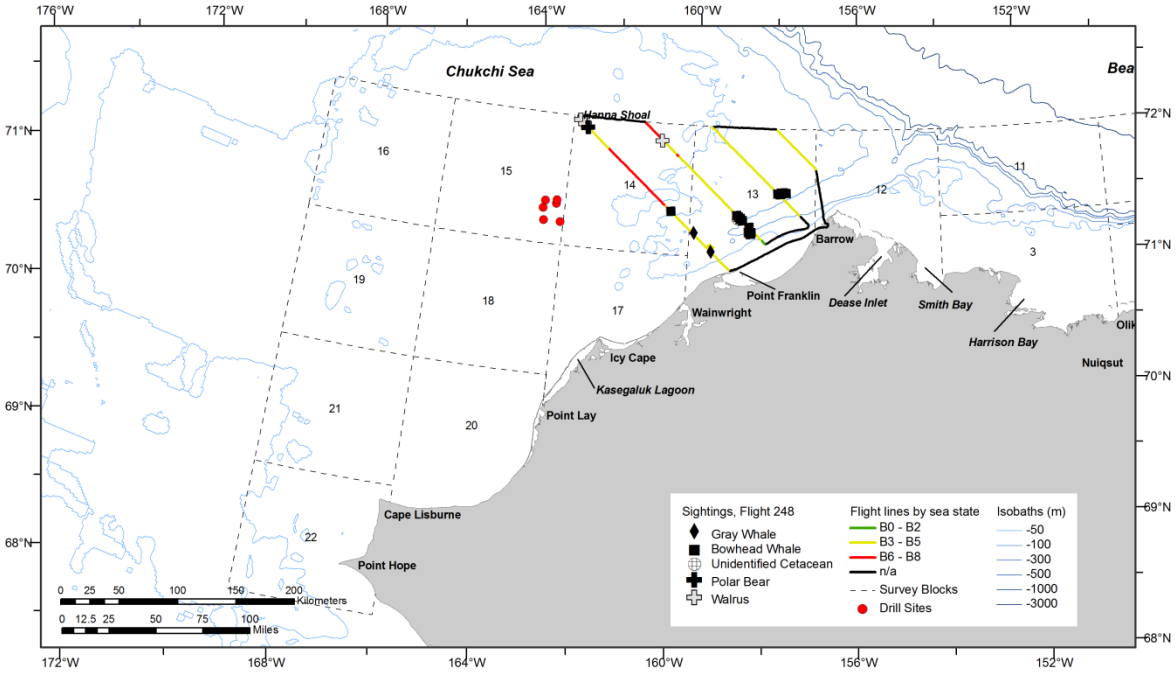

Figure B-90. ASAMM Flight 248 survey track, depicted by sea state, and all sightings.

18 September 2012, Flight 34

Flight was a transect survey of blocks 5 and 7. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 5 km to unlimited with glare and precipitation, and sea states were Beaufort 1-6. No sea ice was observed in the area surveyed. Sightings included bowhead whales including 1 calf, 1 unidentified cetacean, 1 bearded seal, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
34	9/18/12 11:08	70.177	140.745	unid cetacean	swim	2	0	5
34	9/18/12 11:54	70.102	141.324	bowhead whale	dive	1	0	5
34	9/18/12 11:55	70.099	141.335	bowhead whale	swim	2	0	5
34	9/18/12 11:56	70.093	141.353	bowhead whale	swim	1	0	5
34	9/18/12 12:01	70.177	141.321	bowhead whale	swim	2	1	5
34	9/18/12 16:04	70.098	141.947	bowhead whale	swim	1	0	5
34	9/18/12 16:05	70.102	141.916	bowhead whale	swim	1	0	5
34	9/18/12 17:27	70.300	142.706	bowhead whale	swim	1	0	5
34	9/18/12 17:29	70.253	142.720	bowhead whale	swim	1	0	5

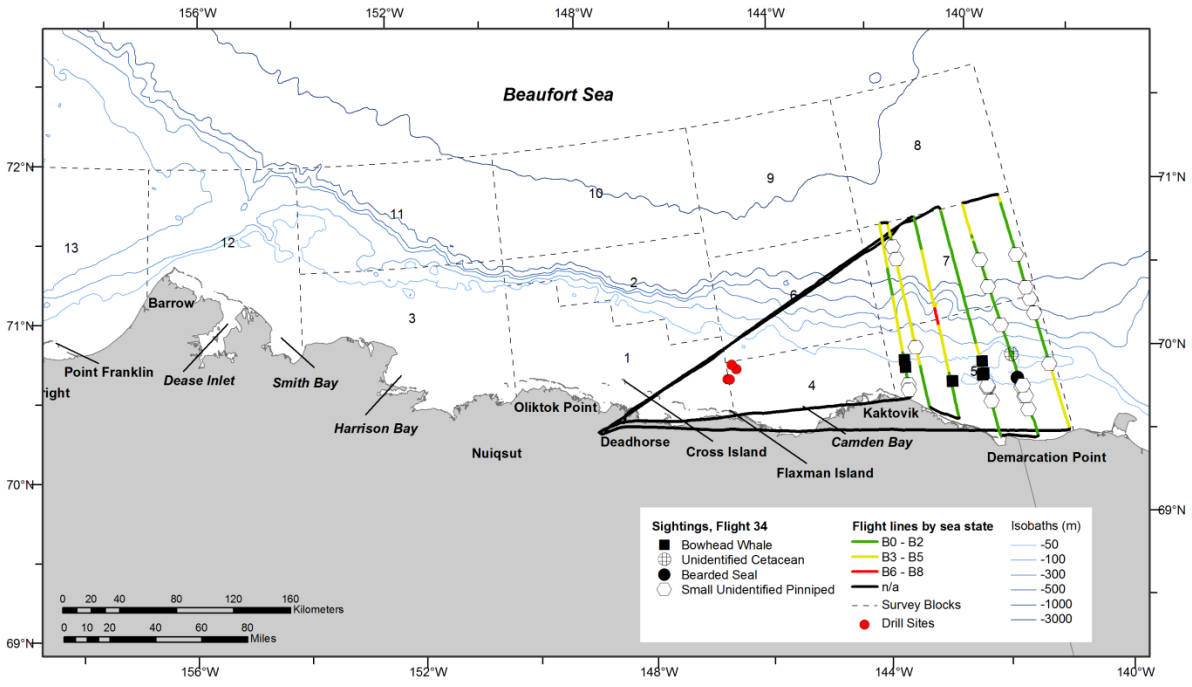

Figure B-91. ASAMM Flight 34 survey track, depicted by sea state, and all sightings.

19 September 2012, Flight 249

Flight was a survey of transects 9 and 11, and a search survey from Wainwright to Barrow. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 2-6. Ice cover was 0-1% broken floe sea ice in the area surveyed. Sightings included bowhead whales, gray whales, one unidentified cetacean, walruses and unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
249	9/19/12 12:25	71.398	164.039	bowhead whale	swim	1	0	15
249	9/19/12 12:25	71.399	164.045	bowhead whale	swim	1	0	15
249	9/19/12 12:25	71.400	164.047	bowhead whale	swim	1	0	15
249	9/19/12 12:35	71.393	164.002	bowhead whale	swim	2	0	15
249	9/19/12 14:16	71.028	160.986	gray whale	feed	1	0	14
249	9/19/12 14:16	71.019	160.958	unid cetacean	swim	1	0	14
249	9/19/12 15:03	71.094	158.033	gray whale	swim	1	0	13
249	9/19/12 15:07	71.149	157.679	bowhead whale	swim	1	0	13
249	9/19/12 15:09	71.178	157.485	gray whale	feed	1	0	13

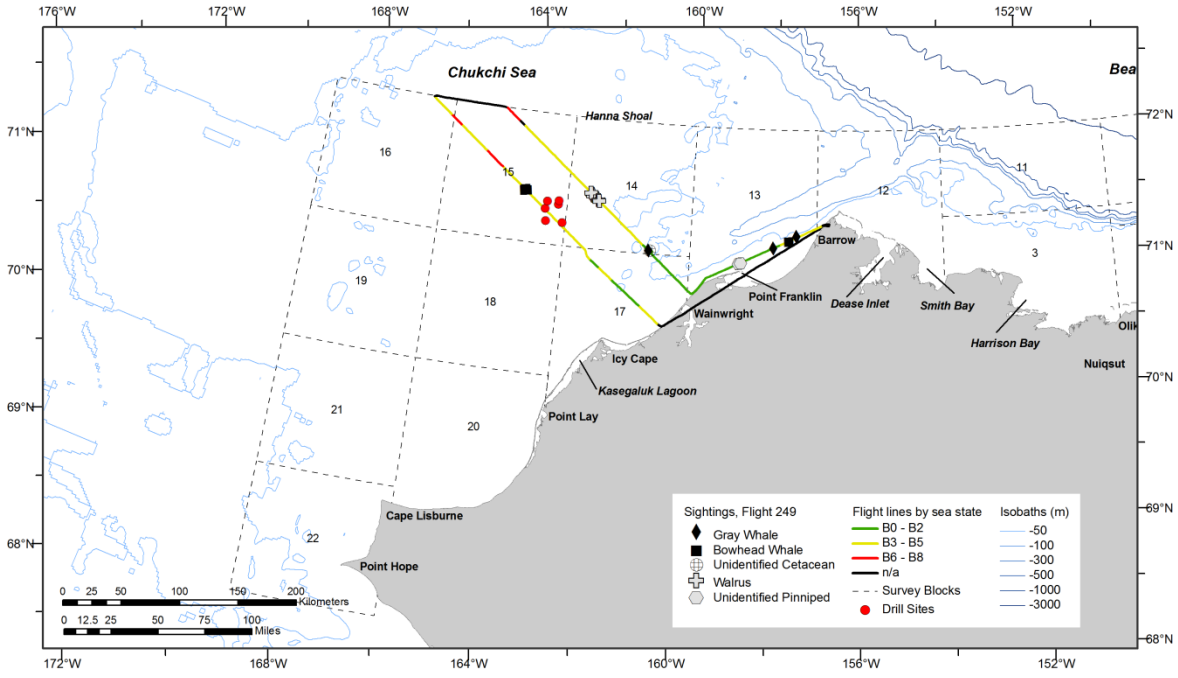

Figure B-92. ASAMM Flight 249 survey track, depicted by sea state, and all sightings.

19 September 2012, Flight 35

Flight was a transect survey of portions of blocks 3, 11 and 12. Survey conditions were fair in the area surveyed with partly cloudy skies. Visibility was 0 km to unlimited with haze, glare, low ceilings, and precipitation, and sea states were Beaufort 1-7. High sea states and low ceilings prevented completion of transects in block 12. No sea ice was observed in the area surveyed. Sightings included bowhead whales, including two calves, gray whales, unidentified pinnipeds, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
35	9/19/12 11:08	71.333	154.669	bowhead whale	swim	1	0	12
35	9/19/12 11:09	71.334	154.669	bowhead whale	rest	1	0	12
35	9/19/12 12:25	71.510	156.084	gray whale	swim	1	0	12
35	9/19/12 12:26	71.504	156.039	gray whale	swim	1	0	12
35	9/19/12 12:27	71.513	156.025	gray whale	feed	1	0	12
35	9/19/12 12:28	71.512	156.013	gray whale	swim	2	0	12
35	9/19/12 15:22	71.165	150.606	bowhead whale	swim	2	1	3
35	9/19/12 15:44	71.237	150.295	bowhead whale	swim	1	0	3
35	9/19/12 15:46	71.233	150.302	bowhead whale	swim	1	0	3
35	9/19/12 15:46	71.233	150.302	bowhead whale	swim	1	0	3
35	9/19/12 15:47	71.234	150.299	bowhead whale	swim	3	0	3
35	9/19/12 15:51	71.122	150.323	bowhead whale	swim	1	0	3
35	9/19/12 15:51	71.116	150.324	bowhead whale	swim	1	0	3
35	9/19/12 15:52	71.108	150.286	bowhead whale	swim	2	0	3
35	9/19/12 15:52	71.110	150.278	bowhead whale	swim	1	0	3
35	9/19/12 15:52	71.113	150.277	bowhead whale	swim	1	0	3
35	9/19/12 15:53	71.118	150.277	bowhead whale	swim	2	0	3
35	9/19/12 15:54	71.122	150.248	bowhead whale	swim	1	0	3
35	9/19/12 15:56	71.116	150.242	bowhead whale	swim	2	1	3
35	9/19/12 15:59	71.099	150.325	bowhead whale	swim	1	0	3
35	9/19/12 15:59	71.088	150.325	bowhead whale	swim	1	0	3
35	9/19/12 15:59	71.087	150.325	bowhead whale	swim	1	0	3
35	9/19/12 16:00	71.081	150.326	bowhead whale	swim	1	0	3

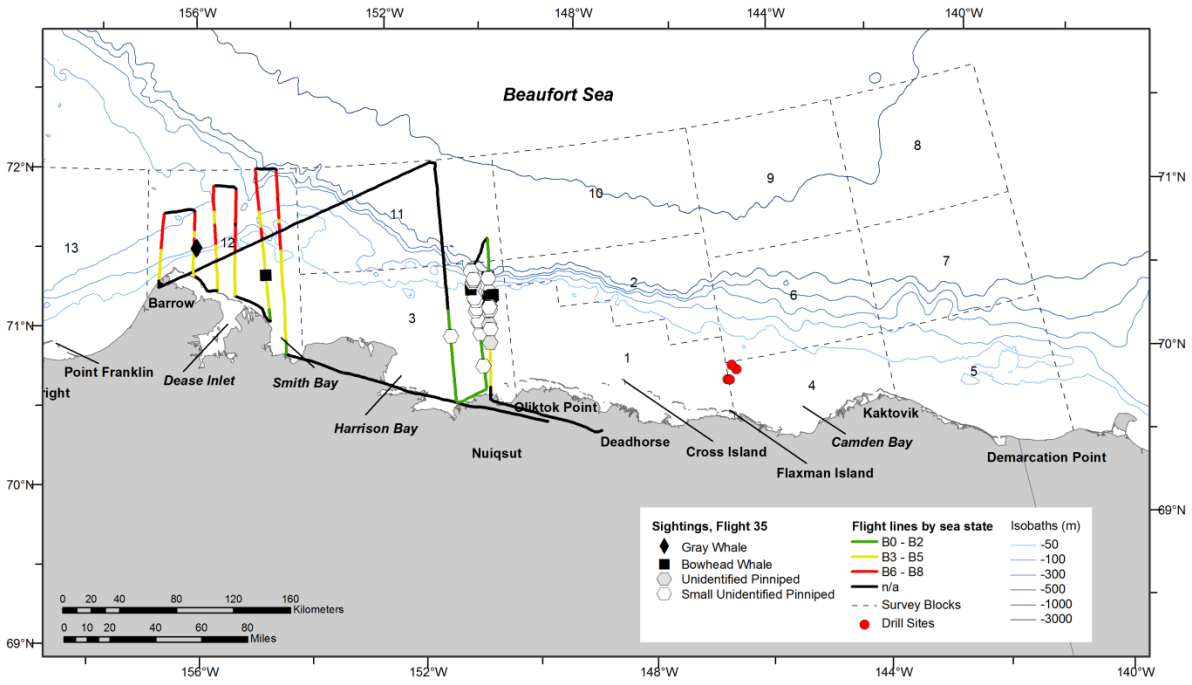

Figure B-93. ASAMM Flight 35 survey track, depicted by sea state, and all sightings.

21 September 2012, Flight 36

Flight was a transect survey of portions of blocks 4 and 6. Survey conditions were fair in the area surveyed with overcast skies. Visibility was 2-10 km with haze, low ceilings, and precipitation, and sea states were Beaufort 3-6. High sea states and precipitation prevented completion of transects in blocks 4 and 6. No sea ice was observed in the area surveyed. Sightings included 1 bowhead whale and 1 unidentified cetacean.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
36	9/21/12 10:21	70.191	143.438	bowhead whale	swim	1	0	4
36	9/21/12 10:46	70.845	143.451	unid cetacean	swim	1	0	6

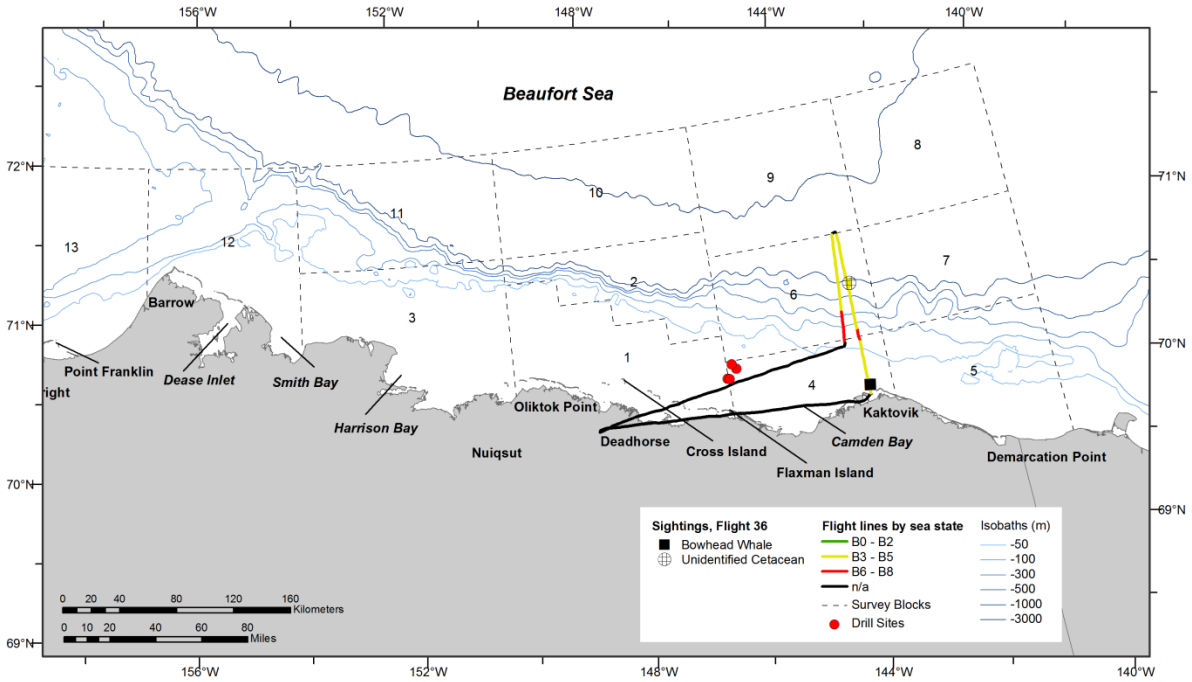

Figure B-94. ASAMM Flight 36 survey track, depicted by sea state, and all sightings.

23 September 2012, Flight 37

Flight was a transect survey of portions of blocks 4 and 6. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 2-10 km with haze and precipitation, and sea states were Beaufort 1-4. No sea ice was observed in the area surveyed. Sightings included bowhead whales including one calf, belugas, a small unidentified marine mammal, unidentified pinnipeds, small unidentified pinnipeds, and polar bears. Two polar bears were swimming very close to shore in Camden Bay, and 25 polar bears were counted on Cross Island.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
37	9/23/12 13:14	70.385	143.741	bowhead whale	swim	1	0	4
37	9/23/12 13:16	70.382	143.744	bowhead whale	swim	1	0	4
37	9/23/12 13:30	70.734	143.650	beluga	swim	1	0	6
37	9/23/12 13:30	70.739	143.647	beluga	swim	1	0	6
37	9/23/12 13:30	70.743	143.646	beluga	swim	1	0	6
37	9/23/12 13:30	70.745	143.645	beluga	swim	4	0	6
37	9/23/12 13:30	70.753	143.644	beluga	swim	2	1	6
37	9/23/12 13:31	70.771	143.642	beluga	rest	27	3	6
37	9/23/12 13:31	70.772	143.642	beluga	swim	20	1	6
37	9/23/12 14:24	70.172	144.245	bowhead whale	swim	1	0	4
37	9/23/12 14:45	70.411	144.759	bowhead whale	swim	1	0	4
37	9/23/12 15:43	70.439	145.267	bowhead whale	swim	2	1	4
37	9/23/12 16:22	70.843	145.772	small unid marine mammal	unknown	1	0	6

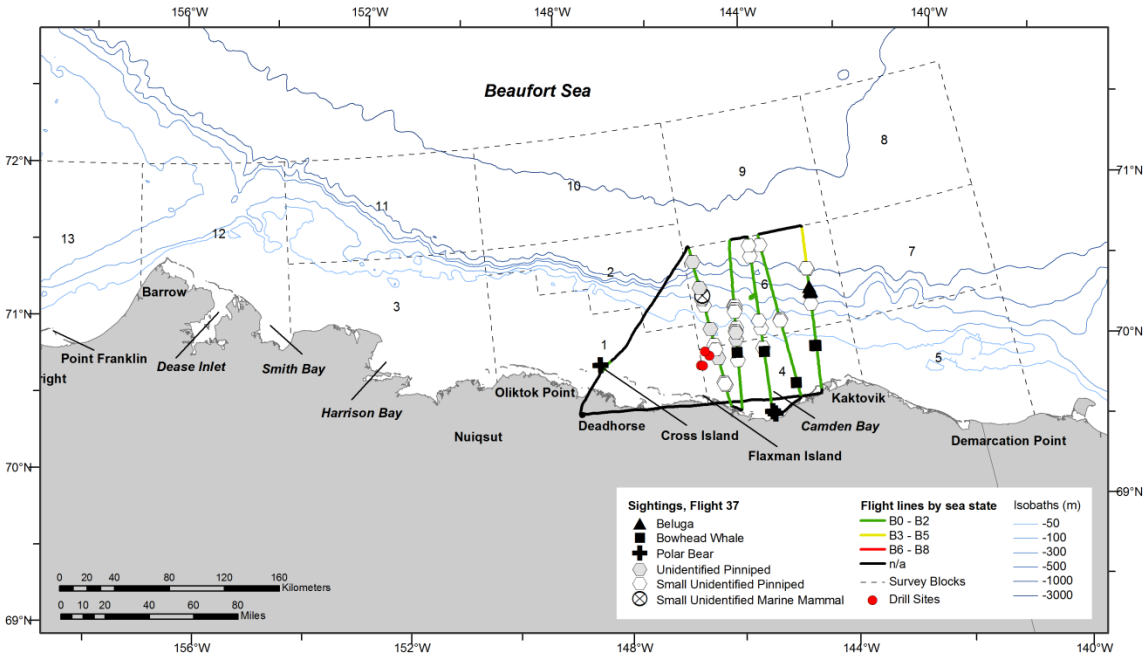

Figure B-95. ASAMM Flight 37 survey track, depicted by sea state, and all sightings.

24 September 2012, Flight 250

Flight was the coastal transect from Barrow to Point Lay. Survey conditions were poor in the area surveyed with partly cloudy to overcast skies. Visibility was <1-10 km with precipitation and low ceilings, and sea states were Beaufort 4-8. No sea ice was observed in the area surveyed. Polar bears were seen. One gray whale carcass and one walrus carcass were approximately 25 km southwest of Barrow. Four polar bears were near the carcasses, three polar bears were slightly farther down the beach from the carcasses and five polar bears were seen on barrier islands between Icy Cape and Point Lay.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
250	9/24/12 10:47	71.119	157.155	gray whale	dead	1	0	13

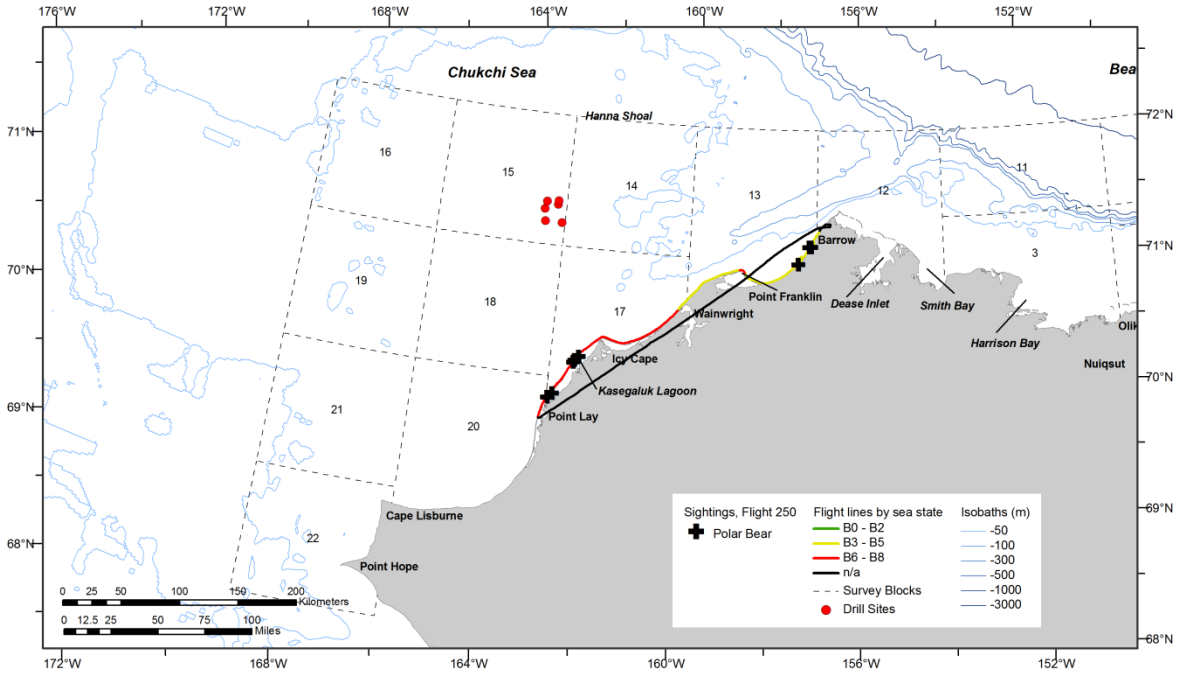

Figure B-96. ASAMM Flight 250 survey track, depicted by sea state, and all sightings.

24 September 2012, Flight 38

Flight was a transect survey of a portion of block 12. Survey conditions were poor in the area surveyed with partly cloudy skies. Visibility was 5-10 km, and sea states were Beaufort 5-6. High sea states prevented completion of the transect and further surveying in the area. No sea ice was observed in the area surveyed. No marine mammals were seen.

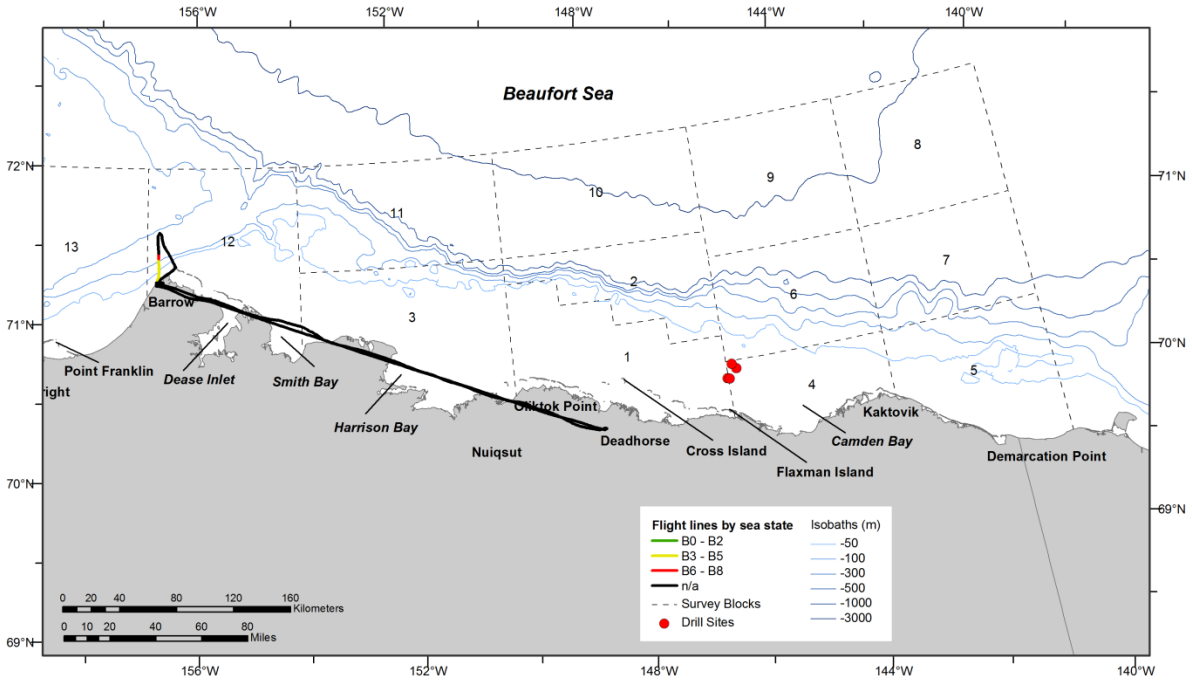

Figure B-97. ASAMM Flight 38 survey track, depicted by sea state.

25 September 2012, Flight 251

Flight was the coastal transect from Point Lay to Icy Cape, with search effort offshore between Icy Cape and Barrow to look for suitable weather conditions for transect effort. Survey conditions were poor in the area surveyed with partly cloudy to overcast skies. Visibility was 0-5 km, and sea states were Beaufort 4-7. High sea states, low ceilings, and scattered snow showers limited survey effort. No sea ice was observed in the area surveyed. Bowhead whales were seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
251	9/25/12 18:20	71.395	161.581	bowhead whale	swim	1	0	14
251	9/25/12 18:28	71.501	161.133	bowhead whale	swim	1	0	14

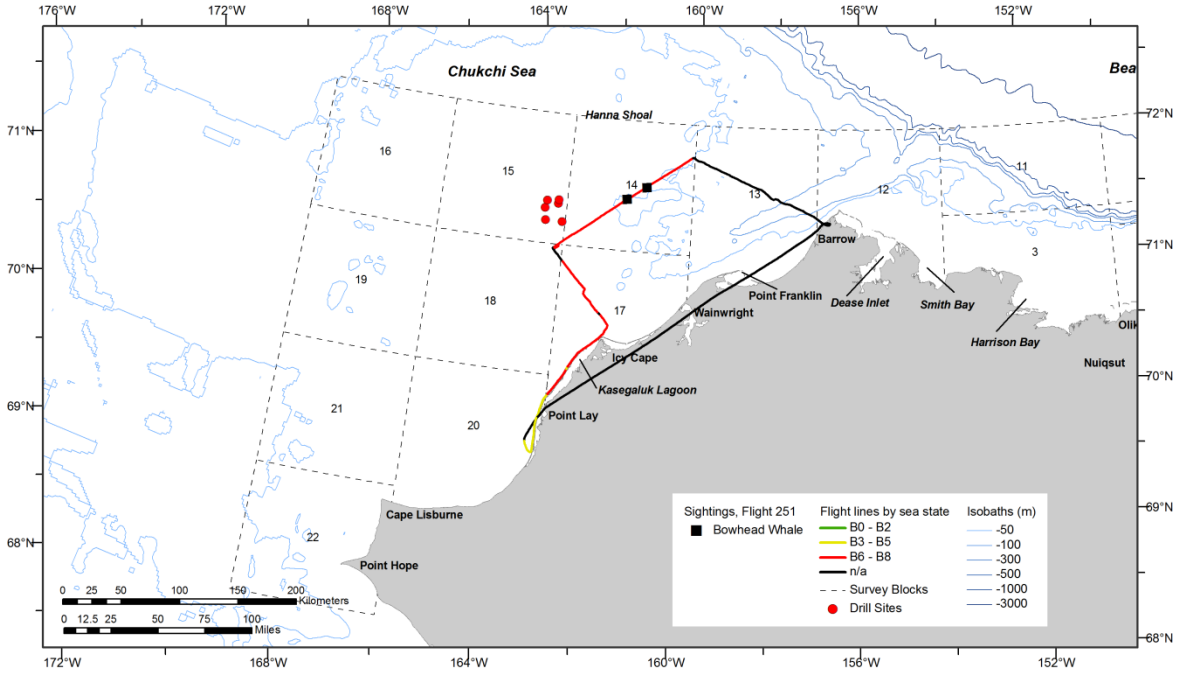

Figure B-98. ASAMM Flight 251 survey track, depicted by sea state, and all sightings.

25 September 2012, Flight 39

Flight was a transect survey of a portion of block 1. Survey conditions were poor in the area surveyed with partly cloudy skies. Visibility was <1-10 km, and sea states were Beaufort 6-7. High sea states and low ceilings prevented completion of transect and further surveying in the area. No sea ice was observed in the area surveyed. No marine mammals were seen.

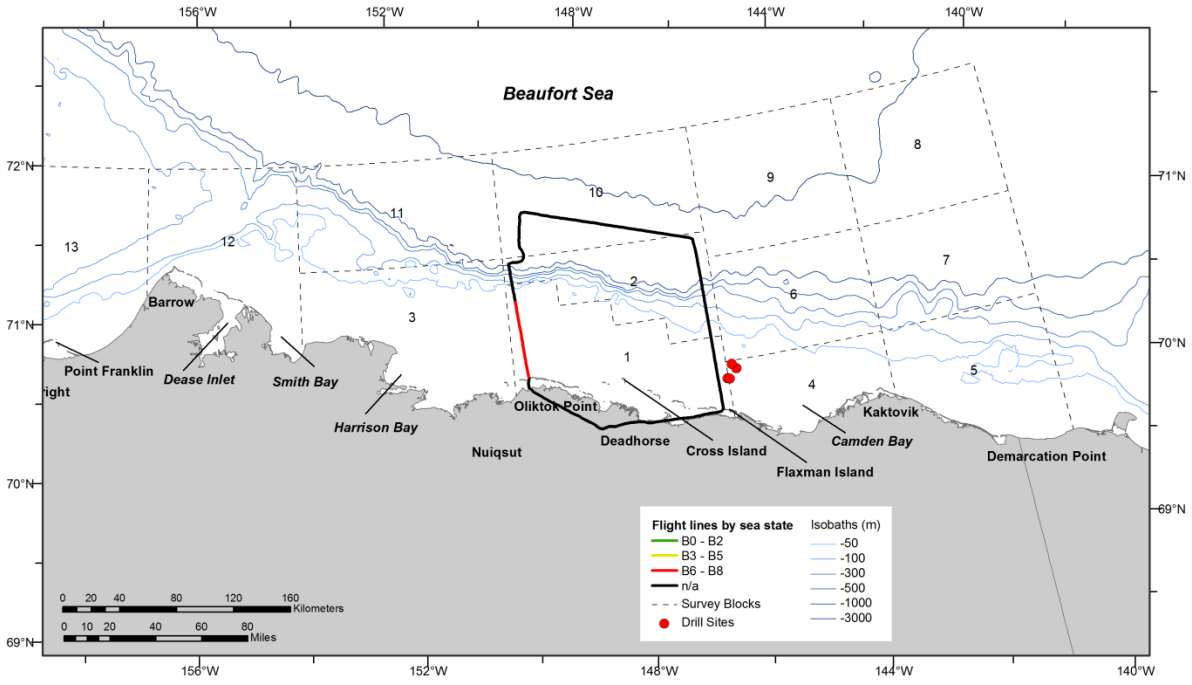

Figure B-99. ASAMM Flight 39 survey track, depicted by sea state.

26 September 2012, Flight 252

Flight was a partial survey of transects 17 and 19, the coastal transect from Point Lay to Point Franklin, and search effort along the shore near Point Lay between transects 16 and 19 and from Point Franklin to Barrow. Survey conditions were fair in the area surveyed with overcast skies. Visibility was 0-10 km, and sea states were Beaufort 2-5. Low ceilings, scattered snow showers, and high sea states offshore prevented further survey effort. No sea ice was observed in the area surveyed. Sightings included gray whales, polar bears and walruses. Walruses were in the water nearshore of Point Lay, but no land haulouts were observed. Five carcasses were observed including one unidentified pinniped (probable walrus) on land 32 km northeast of Wainwright, one walrus and two unidentified marine mammals on land 50 km northeast of Wainwright near Point Franklin, and one unidentified cetacean (possible bowhead whale) floating 36 km southwest of Barrow. Four of the polar bears sighted were either feeding on, or close to, the carcasses on land near Point Franklin, and two of the polar bears sighted were northeast of Point Lay near Icy Cape.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
252	9/26/12 13:30	70.893	158.923	unid marine mammal	dead	1	0	13
252	9/26/12 13:32	70.912	158.923	unid marine mammal	dead	1	0	13
252	9/26/12 13:45	71.034	158.193	gray whale	swim	1	0	13
252	9/26/12 13:48	71.078	157.949	gray whale	feed	3	0	13
252	9/26/12 13:51	71.105	157.966	gray whale	feed	3	0	13
252	9/26/12 13:55	71.111	157.979	gray whale	feed	1	0	13
252	9/26/12 13:56	71.092	158.008	gray whale	feed	1	0	13
252	9/26/12 14:01	71.133	157.648	unid cetacean	dead	1	0	13
252	9/26/12 14:03	71.161	157.682	gray whale	feed	2	0	13
252	9/26/12 14:10	71.202	157.254	gray whale	swim	1	0	13

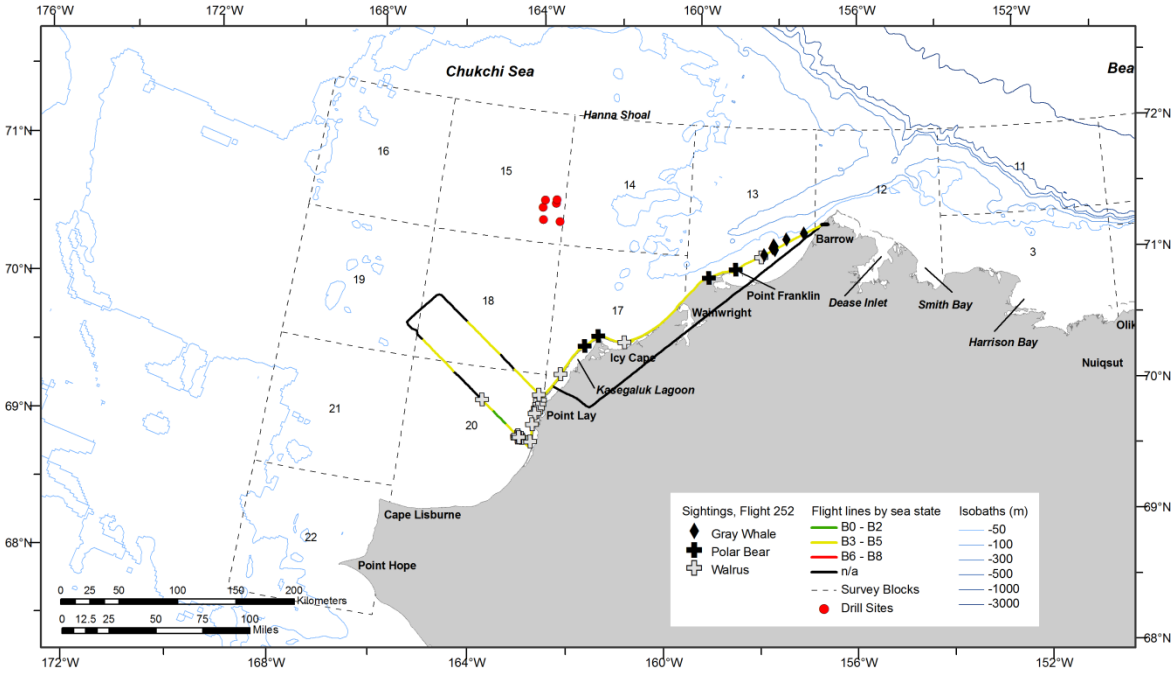

Figure B-100. ASAMM Flight 252 survey track, depicted by sea state, and all sightings.

28 September 2012, Flight 253

Flight was a survey of transects 2, 4, and 6. Survey conditions were poor in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km, with low ceilings and scattered snow showers, and sea states were Beaufort 3-7. No sea ice was observed in the area surveyed. Sightings included bowhead whales, one unidentified cetacean and unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
253	9/28/12 10:55	71.146	159.041	bowhead whale	rest	1	0	13
253	9/28/12 10:57	71.148	159.075	bowhead whale	rest	1	0	13
253	9/28/12 10:58	71.136	159.094	bowhead whale	rest	1	0	13
253	9/28/12 11:02	71.187	159.202	unid cetacean	.	1	0	13
253	9/28/12 12:57	71.294	157.108	bowhead whale	swim	1	0	13
253	9/28/12 12:57	71.299	157.108	bowhead whale	swim	1	0	13
253	9/28/12 13:00	71.295	157.134	bowhead whale	swim	1	0	13
253	9/28/12 13:02	71.306	157.088	bowhead whale	swim	1	0	13

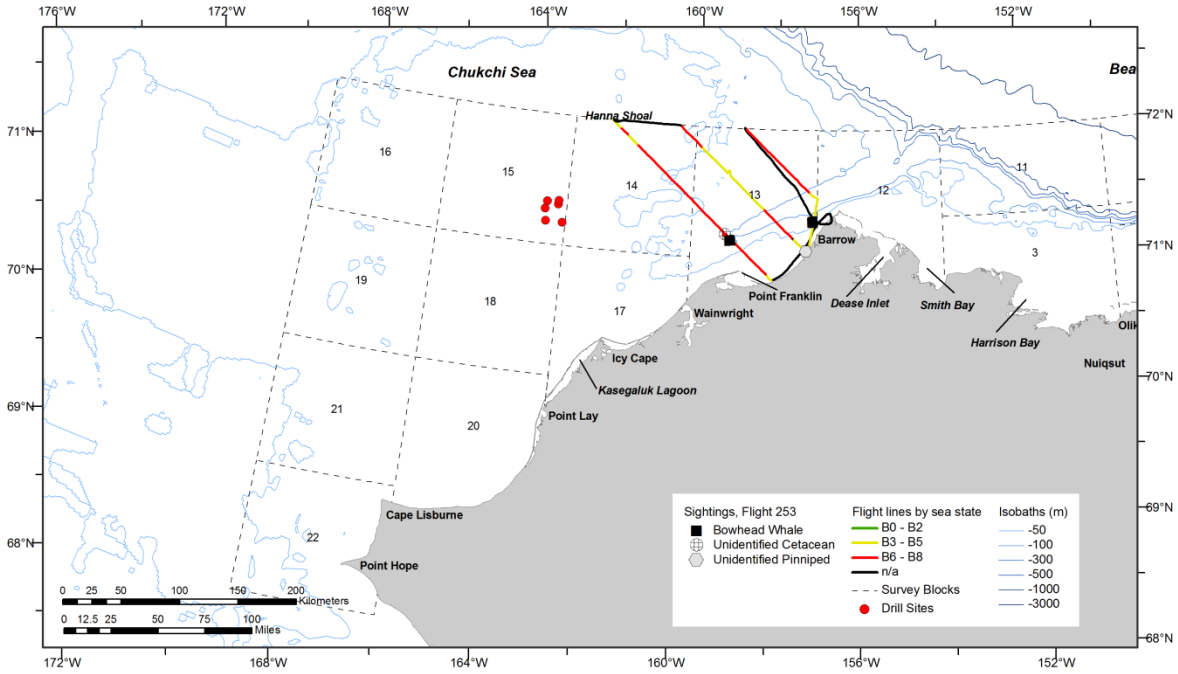

Figure B-101. ASAMM Flight 253 survey track, depicted by sea state, and all sightings.

28 September 2012, Flight 40

Flight was a transect survey of block 12. Survey conditions were fair in the area surveyed with partly cloudy skies. Visibility was 0-10 km, and sea states were Beaufort 2-6. No sea ice was observed in the area surveyed. Sightings included bowhead whales, 1 gray whale, and 1 unidentified cetacean.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
40	9/28/12 13:49	71.467	156.297	gray whale	feed	1	0	12
40	9/28/12 13:50	71.415	156.306	bowhead whale	swim	1	0	12
40	9/28/12 13:51	71.402	156.315	bowhead whale	swim	1	0	12
40	9/28/12 15:07	71.177	154.619	bowhead whale	swim	3	0	12
40	9/28/12 15:13	71.252	154.641	bowhead whale	swim	1	0	12
40	9/28/12 15:21	71.333	154.661	bowhead whale	swim	1	0	12
40	9/28/12 15:21	71.339	154.690	unid cetacean	swim	1	0	12
40	9/28/12 16:08	71.287	154.420	bowhead whale	rest	1	0	12
40	9/28/12 16:11	71.253	154.421	bowhead whale	swim	1	0	12
40	9/28/12 16:22	71.198	154.425	bowhead whale	swim	1	0	12
40	9/28/12 16:27	71.069	154.443	bowhead whale	swim	1	0	12

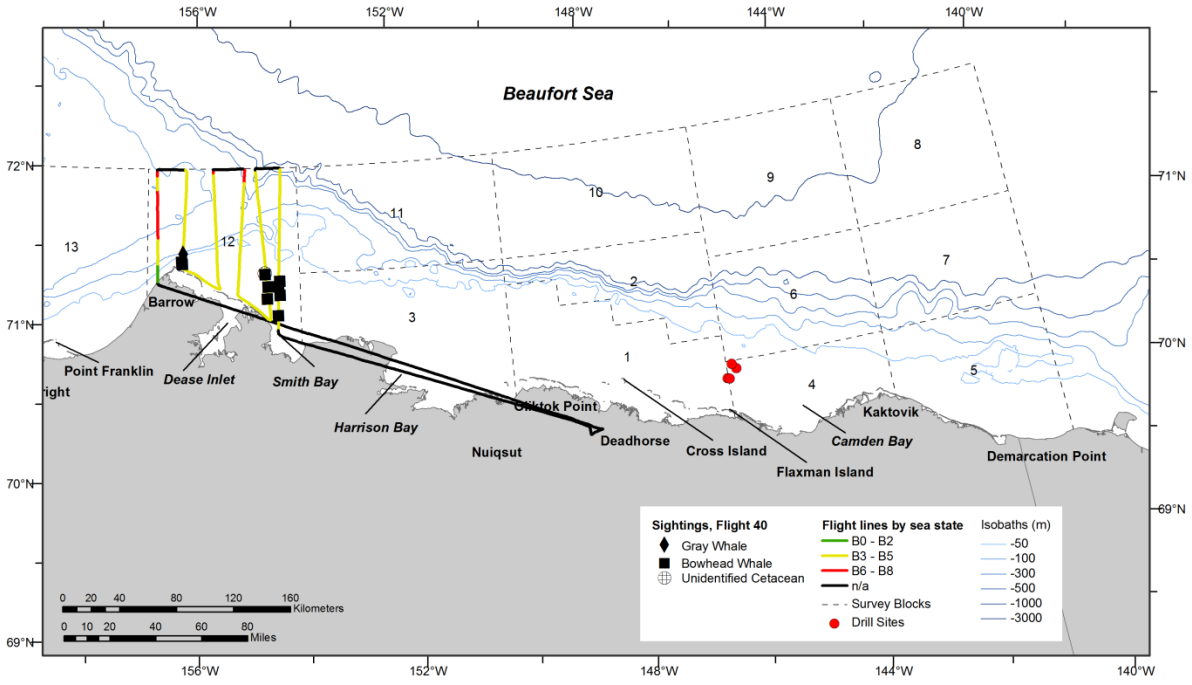

Figure B-102. ASAMM Flight 40 survey track, depicted by sea state, and all sightings.

29 September 2012, Flight 254

Flight was a survey of transects 13 and 15, the coastal transect from Point Lay to transect 15, and search effort from Point Franklin to Barrow. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 0 km to unlimited with low ceilings and scattered snow showers, and sea states were Beaufort 1-3. No sea ice was observed in the area surveyed. Sightings included one unidentified cetacean, walruses, bearded seals, unidentified pinnipeds and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
254	9/29/12 14:59	71.218	158.324	unid cetacean	swim	1	0	13

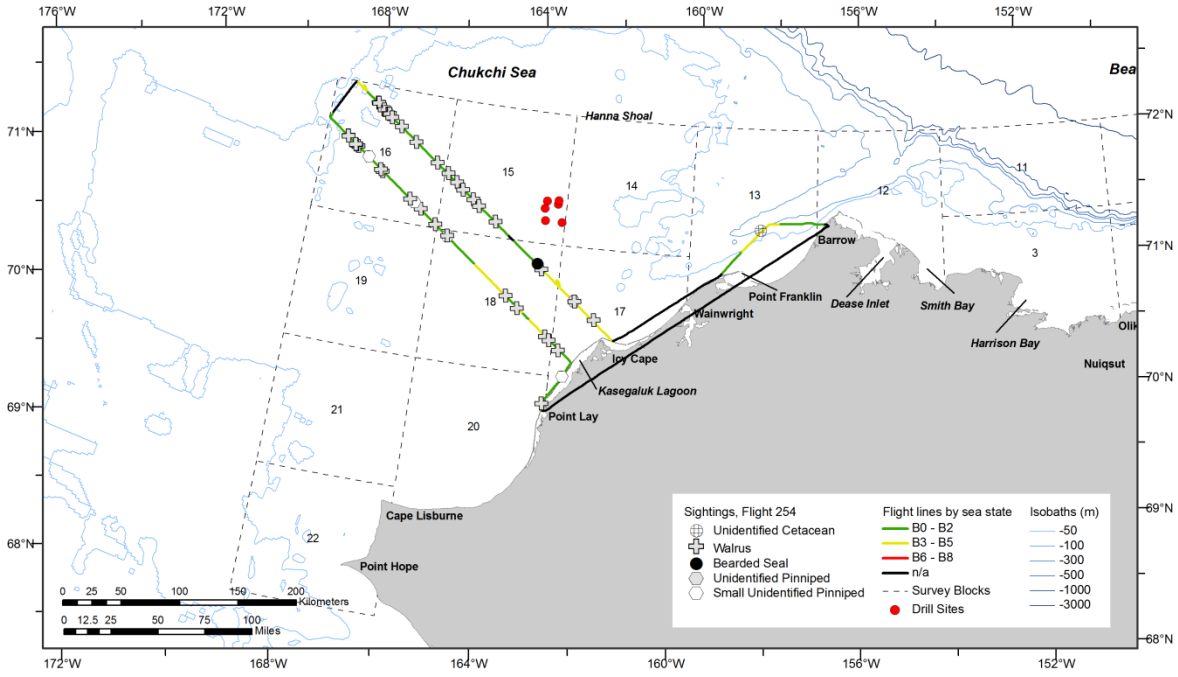

Figure B-103. ASAMM Flight 254 survey track, depicted by sea state, and all sightings.

29 September 2012, Flight 41

Flight was a transect survey of portions of blocks 3 and 11. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with low ceilings, haze, glare, and snow showers, and sea states were Beaufort 3-7. Low ceilings and high sea states prevented the completion of the transects. No sea ice was observed in the area surveyed. Sightings included one bowhead whale and belugas.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
41	9/29/12 11:38	71.875	153.919	beluga	swim	1	0	11
41	9/29/12 11:38	71.879	153.919	beluga	swim	2	0	11
41	9/29/12 12:12	71.129	153.399	bowhead whale	rest	1	0	3
41	9/29/12 13:53	71.714	151.795	beluga	rest	1	0	11
41	9/29/12 13:53	71.723	151.796	beluga	rest	1	0	11
41	9/29/12 13:53	71.729	151.795	beluga	rest	1	0	11

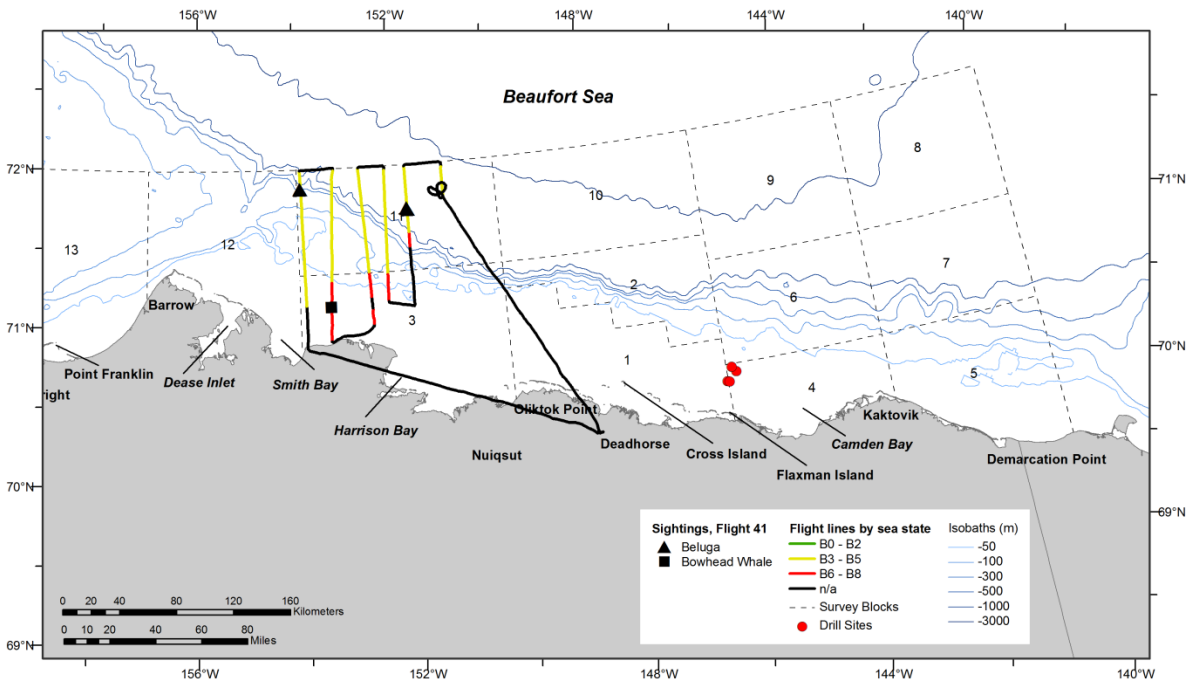

Figure B-104. ASAMM Flight 41 survey track, depicted by sea state, and all sightings.

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30 September 2012, Flight 255

Flight was a partial survey of transects 8, 10, and 12, and search effort from Point Lay to Icy Cape. Survey conditions were poor in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with low ceilings, scattered snow showers, and fog, and sea states were Beaufort 3-8. Fog and snow showers prevented completion of the transects. No sea ice was observed in the area surveyed. Sightings included bowhead whales and one gray whale. One unidentified cetacean carcass, in an advanced stage of decomposition, was floating in the water approximately 60 km north of Wainwright.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
255	9/30/12 12:22	71.612	165.620	bowhead whale	rest	2	0	15
255	9/30/12 12:53	71.764	164.657	bowhead whale	swim	1	0	15
255	9/30/12 12:55	71.744	164.580	bowhead whale	swim	1	0	15
255	9/30/12 13:11	71.516	163.656	bowhead whale	rest	1	0	15
255	9/30/12 13:16	71.462	163.440	bowhead whale	swim	1	0	15
255	9/30/12 13:18	71.422	163.290	bowhead whale	swim	1	0	15
255	9/30/12 13:54	71.223	160.884	gray whale	feed	1	0	14
255	9/30/12 14:09	71.089	160.419	unid cetacean	dead	1	0	14

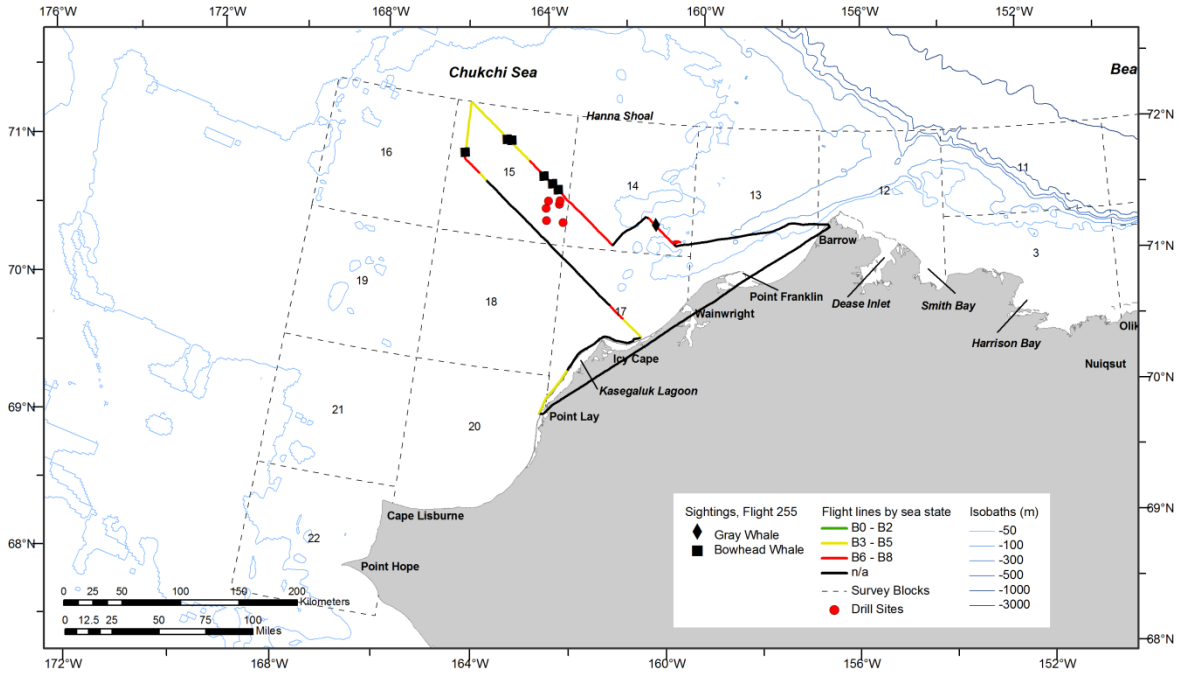

Figure B-105. ASAMM Flight 255 survey track, depicted by sea state, and all sightings

1 October 2012, Flight 256

Flight was a survey of transects 3, 5, and 7. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with low ceilings and scattered snow showers, and sea states were Beaufort 2-4. No sea ice was observed in the area surveyed. Sightings included bowhead whales including one calf, gray whales, unidentified cetaceans, polar bears and walruses. Two carcasses were observed, both floating in the water and in advanced stages of decomposition. One carcass was an unidentified cetacean, floating approximately 70 km west of Barrow. One carcass was an unidentified pinniped, floating approximately 60 km northwest of Barrow.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
256	10/1/12 13:25	71.073	159.571	bowhead whale	swim	3	0	13
256	10/1/12 13:28	71.074	159.545	bowhead whale	swim	1	0	13
256	10/1/12 13:29	71.089	159.629	bowhead whale	swim	1	0	13
256	10/1/12 13:39	71.127	159.748	bowhead whale	swim	1	0	13
256	10/1/12 13:42	71.167	159.891	bowhead whale	swim	1	0	13
256	10/1/12 13:44	71.152	159.987	bowhead whale	swim	1	0	13
256	10/1/12 13:45	71.166	159.986	bowhead whale	swim	1	0	13
256	10/1/12 13:51	71.202	160.010	bowhead whale	swim	1	0	14
256	10/1/12 13:55	71.205	160.014	bowhead whale	swim	2	0	14
256	10/1/12 13:58	71.213	160.044	bowhead whale	swim	1	0	14
256	10/1/12 13:59	71.229	160.105	bowhead whale	swim	1	0	14
256	10/1/12 14:00	71.245	160.156	bowhead whale	swim	1	0	14
256	10/1/12 14:00	71.252	160.176	unid cetacean	swim	1	0	14
256	10/1/12 14:01	71.265	160.225	bowhead whale	swim	2	0	14
256	10/1/12 14:03	71.251	160.222	bowhead whale	swim	1	0	14
256	10/1/12 14:05	71.255	160.291	bowhead whale	swim	1	0	14
256	10/1/12 14:07	71.274	160.285	bowhead whale	swim	1	0	14
256	10/1/12 14:07	71.271	160.246	bowhead whale	swim	1	0	14
256	10/1/12 14:08	71.283	160.279	bowhead whale	swim	1	0	14
256	10/1/12 14:10	71.261	160.197	bowhead whale	swim	2	0	14
256	10/1/12 14:12	71.276	160.262	bowhead whale	swim	1	0	14
256	10/1/12 14:13	71.296	160.239	bowhead whale	swim	1	0	14
256	10/1/12 14:14	71.285	160.301	bowhead whale	swim	2	0	14
256	10/1/12 14:14	71.292	160.323	bowhead whale	swim	2	0	14
256	10/1/12 14:19	71.304	160.340	bowhead whale	swim	2	0	14
256	10/1/12 14:22	71.303	160.366	bowhead whale	swim	2	0	14
256	10/1/12 14:23	71.324	160.437	bowhead whale	swim	1	0	14
256	10/1/12 14:24	71.330	160.456	bowhead whale	swim	1	0	14
256	10/1/12 14:24	71.340	160.482	bowhead whale	swim	1	0	14
256	10/1/12 14:26	71.369	160.596	bowhead whale	swim	1	0	14
256	10/1/12 14:30	71.467	160.952	bowhead whale	swim	1	0	14
256	10/1/12 14:40	71.601	161.440	bowhead whale	swim	2	0	14
256	10/1/12 14:40	71.602	161.445	unid cetacean	swim	1	0	14
256	10/1/12 15:31	71.797	160.515	bowhead whale	rest	2	1	14
256	10/1/12 16:16	71.338	158.902	unid cetacean	dead	1	0	13
256	10/1/12 16:22	71.336	158.908	bowhead whale	swim	2	0	13

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
256	10/1/12 16:25	71.252	159.043	bowhead whale	swim	1	0	13
256	10/1/12 16:34	71.316	158.998	bowhead whale	swim	1	0	13
256	10/1/12 16:45	71.119	158.187	gray whale	feed	2	0	13
256	10/1/12 16:46	71.115	158.200	gray whale	feed	1	0	13
256	10/1/12 16:49	71.100	158.192	gray whale	feed	1	0	13
256	10/1/12 16:51	71.093	158.201	gray whale	feed	3	0	13
256	10/1/12 16:51	71.105	158.240	gray whale	feed	3	0	13
256	10/1/12 16:58	71.103	158.211	gray whale	feed	1	0	13

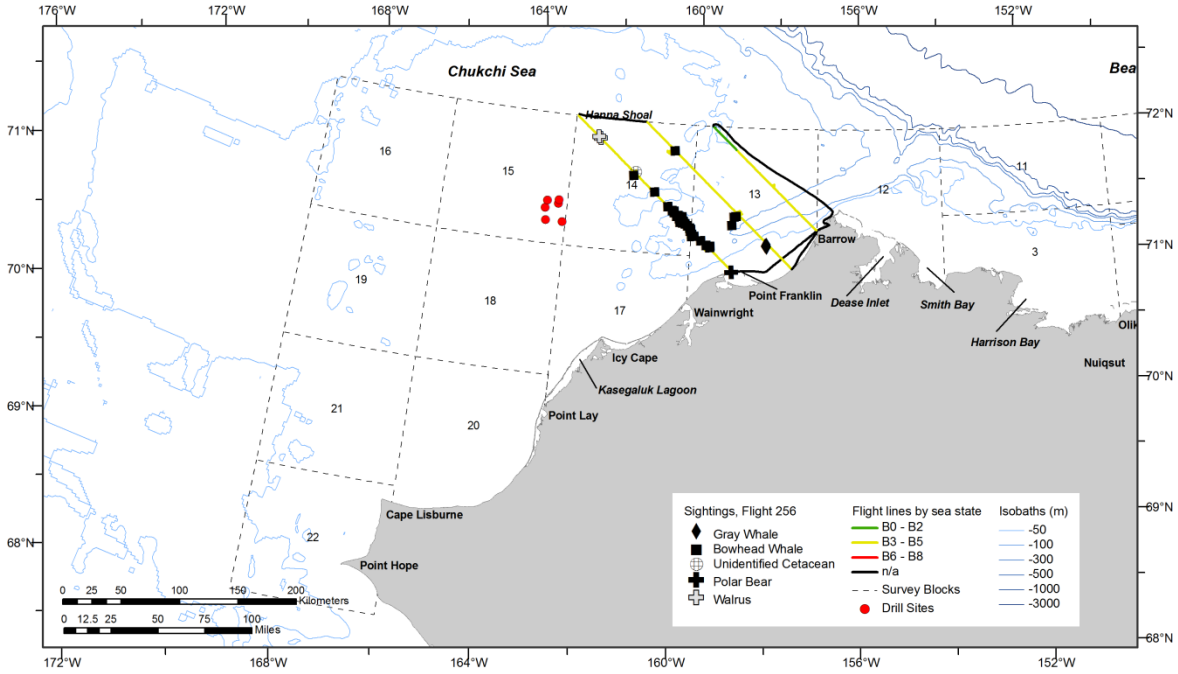

Figure B-106. ASAMM Flight 256 survey track, depicted by sea state, and all sightings.

Bowhead whale cow and calf (top) and bowhead whale calf surfacing near cow (bottom), approximately 140 km northwest of Barrow, Alaska, on flight 256, 1 October 2012.

2 October 2012, Flight 257

Flight was a partial survey of transects 16 and 18, and a coastal transect from Point Lay to Barrow. Survey conditions were fair in the area surveyed with overcast skies. Visibility was <1-10 km, and sea states were Beaufort 2-7. High sea states and low visibility prevented complete coverage of transects. No sea ice was observed in the area surveyed. Sightings included one bowhead whale, walruses, unidentified pinnipeds, and polar bears. One walrus carcass was on the beach approximately 30 km southwest of Barrow.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
257	10/2/12 14:04	70.911	157.674	bowhead whale	swim	1	0	13

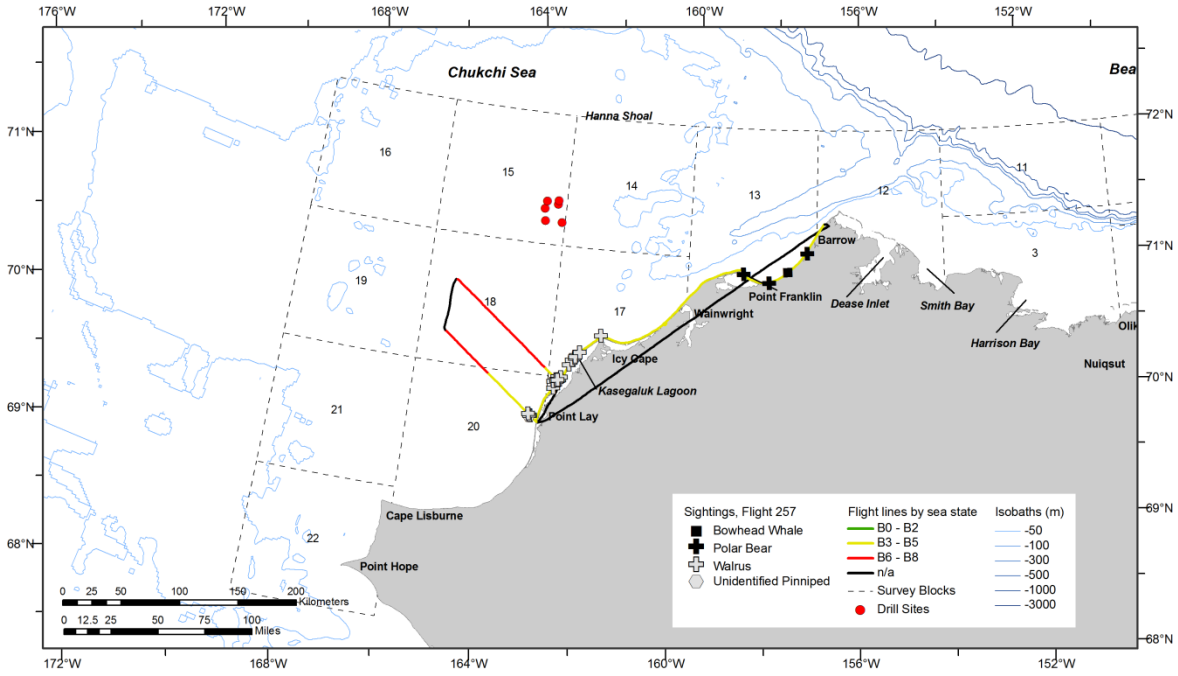

Figure B-107. ASAMM Flight 257 survey track, depicted by sea state, and all sightings.

2 October 2012, Flight 42

Flight was a transect survey of portions of blocks 1, 2, 3, and 11. Survey conditions were poor in the area surveyed with partly cloudy skies. Visibility was 5-10 km, and sea states were Beaufort 3-7. High sea states prevented complete coverage of transects. No sea ice was observed in the area surveyed. Sightings included 4 bowhead whales including 1 calf, 1 unidentified cetacean, and 34 polar bears on Cross Island.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
42	10/2/12 11:20	71.063	151.050	unid cetacean	swim	1	0	3
42	10/2/12 11:26	71.095	151.048	bowhead whale	swim	1	0	3
42	10/2/12 11:26	71.100	151.048	bowhead whale	swim	1	0	3
42	10/2/12 13:00	70.846	148.382	bowhead whale	swim	2	1	1

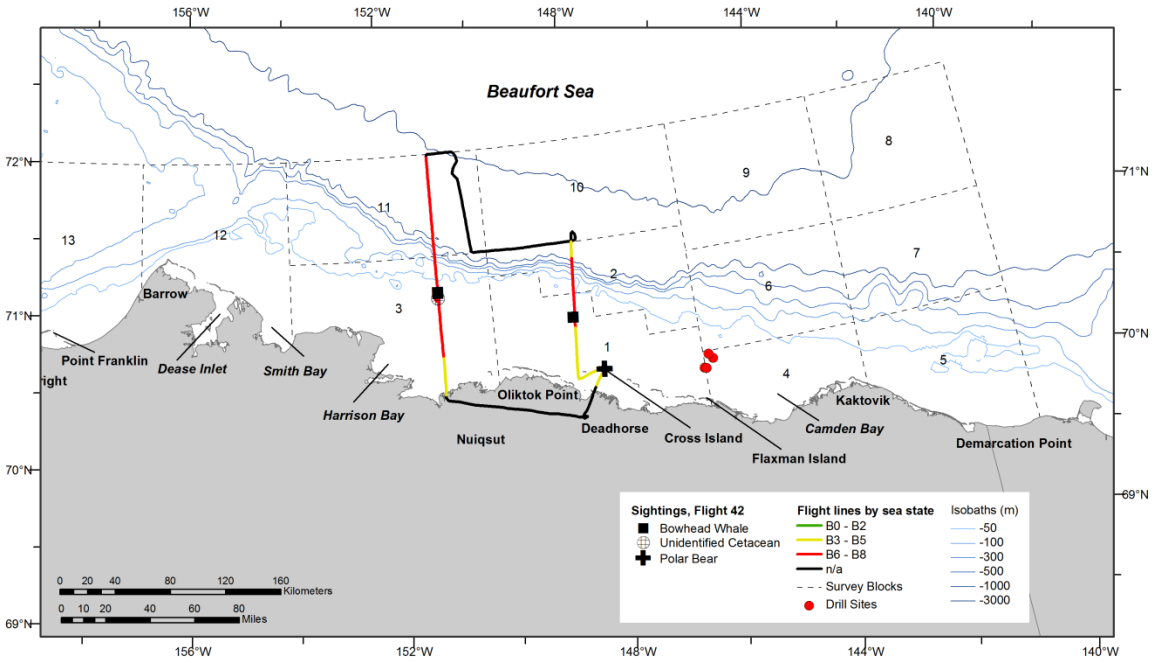

Figure B-108. ASAMM Flight 42 survey track, depicted by sea state, and all sightings.

Polar bears sighted on Cross Island, Alaska, during flight 42, 2 October 2012.

3 October 2012, Flight 43

Flight was a transect survey of portions of blocks 5 and 7. Survey conditions were good in the area surveyed with partly cloudy skies. Visibility was 5-10 km with glare and haze, and sea states were Beaufort 1-5. No sea ice was observed in the area surveyed. Sightings included 1 beluga, unidentified pinnipeds, small unidentified pinnipeds, and 4 polar bears.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
43	10/3/12 11:40	69.891	140.251	beluga	rest	1	0	5

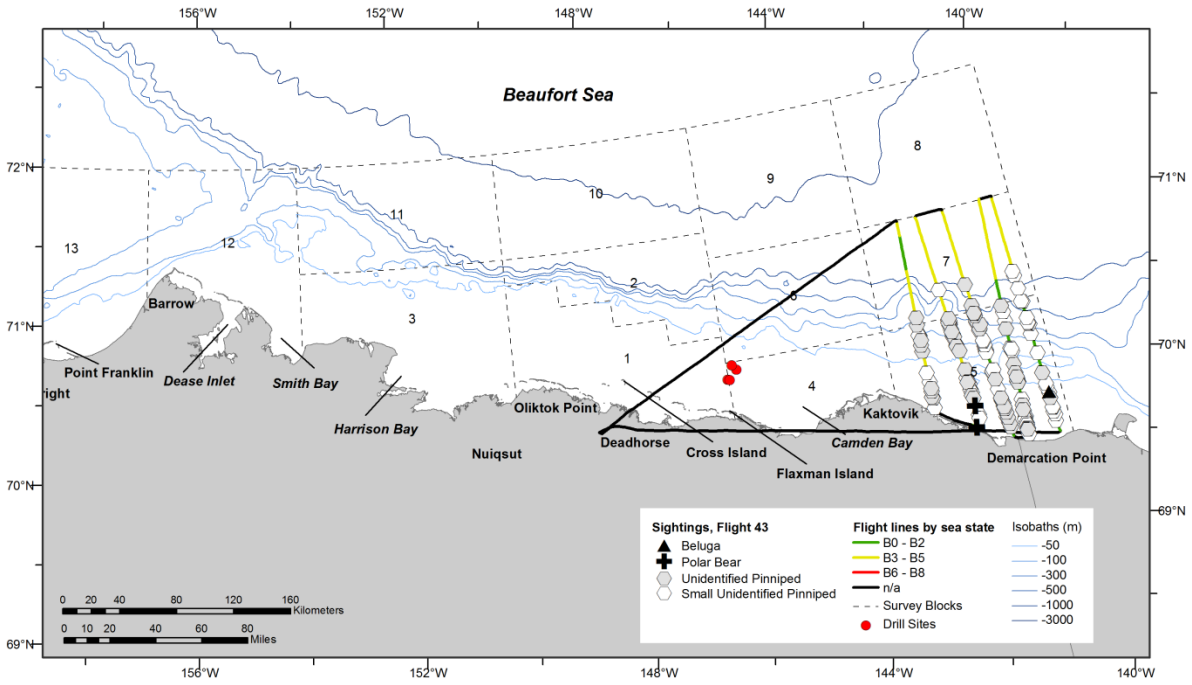

Figure B-109. ASAMM Flight 43 survey track, depicted by sea state, and all sightings.

4 October 2012, Flight 44

Flight was a transect survey of block 4 and portions of block 6. Survey conditions were fair in the area surveyed with partly cloudy skies. Visibility was 0-10 km with low ceilings and glare, and sea states were Beaufort 2-5. Low ceilings prevented complete transect coverage in block 6. No sea ice was observed in the area surveyed. Sightings included bearded seals, unidentified pinnipeds, small unidentified pinnipeds, and polar bears near Kaktovik. Most of the bears (41 bears, including 2 cubs) were on Bernard Spit just east of Kaktovik; 5 bears were on Barter Island, and 5 bears were swimming nearshore (<1 km) north of Barter Island.

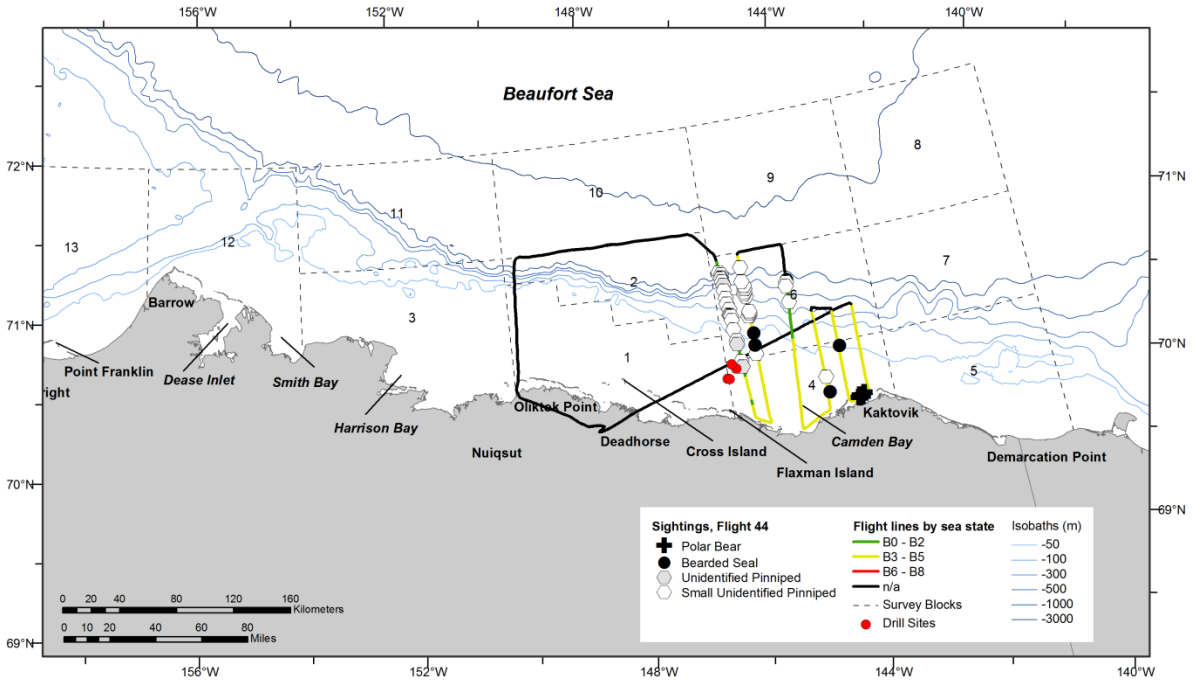

Figure B-110. ASAMM Flight 44 survey track, depicted by sea state, and all sightings.

5 October 2012, Flight 258

Flight was a partial survey of transects 6, 8, 9, and 11. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with fog, low ceilings, and rain, and sea states were Beaufort 2-4. Fog and low ceilings prevented completion of transects. No sea ice was observed in the area surveyed. Sightings included bowhead whales, gray whales, walruses, small unidentified pinnipeds, and one unidentified pinniped.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
258	10/5/12 12:47	71.136	163.021	bowhead whale	rest	1	0	15
258	10/5/12 13:20	71.316	163.714	bowhead whale	swim	1	0	15
258	10/5/12 14:23	71.352	162.174	bowhead whale	rest	1	0	14
258	10/5/12 14:27	71.313	162.027	bowhead whale	swim	1	0	14
258	10/5/12 14:39	71.307	162.005	bowhead whale	swim	1	0	14
258	10/5/12 14:55	71.022	160.969	gray whale	swim	2	0	14
258	10/5/12 14:56	71.022	161.000	gray whale	feed	1	0	14
258	10/5/12 14:57	71.028	160.993	gray whale	feed	2	0	14
258	10/5/12 15:00	71.017	161.018	gray whale	rest	1	0	14
258	10/5/12 17:00	71.110	160.487	bowhead whale	rest	1	0	14
258	10/5/12 17:13	71.386	161.470	bowhead whale	rest	1	0	14
258	10/5/12 17:20	71.518	161.957	bowhead whale	swim	1	0	14
258	10/5/12 17:21	71.529	162.002	bowhead whale	swim	2	0	14
258	10/5/12 17:21	71.526	162.043	bowhead whale	swim	1	0	14
258	10/5/12 17:22	71.514	161.990	bowhead whale	dive	1	0	14
258	10/5/12 17:26	71.492	162.008	bowhead whale	swim	1	0	14
258	10/5/12 17:26	71.482	162.014	bowhead whale	swim	1	0	14
258	10/5/12 17:29	71.502	161.997	bowhead whale	swim	1	0	14
258	10/5/12 17:32	71.522	162.224	bowhead whale	swim	1	0	14
258	10/5/12 17:33	71.496	162.245	bowhead whale	rest	1	0	14
258	10/5/12 17:33	71.487	162.246	bowhead whale	swim	2	0	14
258	10/5/12 17:36	71.507	162.245	bowhead whale	swim	1	0	14
258	10/5/12 17:43	71.574	162.172	bowhead whale	rest	1	0	14
258	10/5/12 17:43	71.575	162.177	bowhead whale	rest	2	0	14
258	10/5/12 18:15	71.291	159.527	bowhead whale	swim	1	0	13

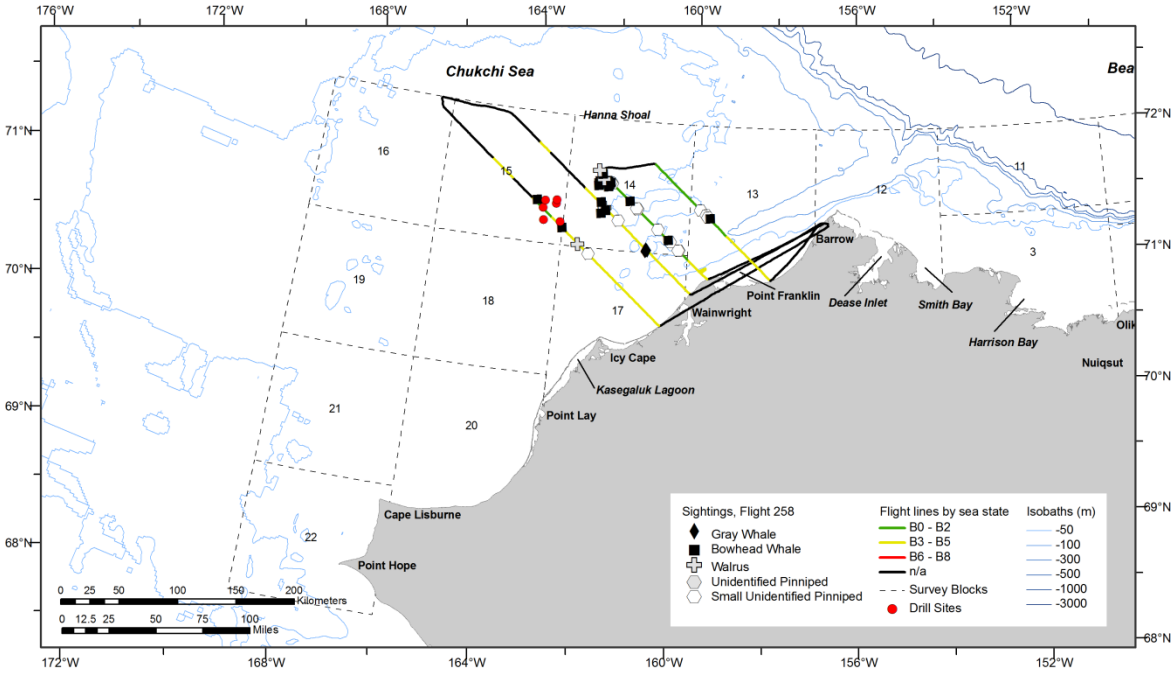

Figure B-111. ASAMM Flight 258 survey track, depicted by sea state, and all sightings.

5 October 2012, Flight 45

Flight was a transect survey of blocks 1 and 2. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 3-10 km with low ceilings, glare, haze, and precipitation, and sea states were Beaufort 2-6. No sea ice was observed in the area surveyed. Sightings included bowhead whales, bearded seals, unidentified pinnipeds, small unidentified pinnipeds, and polar bears on Cross Island.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
45	10/5/12 12:41	70.540	147.807	bowhead whale	swim	1	0	1
45	10/5/12 14:00	70.796	148.915	bowhead whale	swim	1	0	1
45	10/5/12 14:30	71.178	148.230	bowhead whale	swim	1	0	2
45	10/5/12 16:15	70.322	146.565	bowhead whale	mill	2	1	1

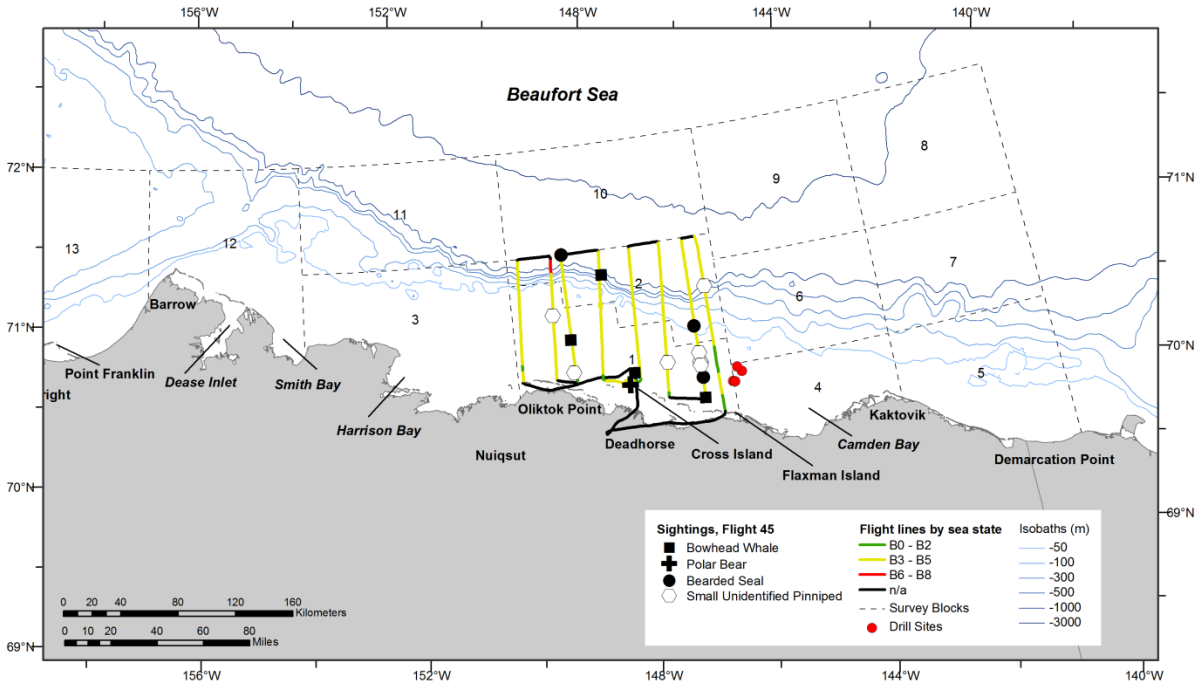

Figure B-112. ASAMM Flight 45 survey track, depicted by sea state, and all sightings.

Bowhead whale cow and calf observed on flight 45, 5 October 2012.

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6 October 2012, Flight 259

Flight was a partial survey of transects 7, 10, 12, and 14. Survey conditions were fair in the area surveyed with overcast skies. Visibility was 0-10 km with fog, low ceilings, and rain, and sea states were Beaufort 2-4. Fog and low ceilings prevented complete coverage of transects. No sea ice was observed in the area surveyed. Sightings included bowhead whales, one gray whale, walruses, and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
259	10/6/12 14:10	70.940	161.478	gray whale	swim	1	0	17
259	10/6/12 14:46	71.609	164.024	bowhead whale	swim	2	0	15
259	10/6/12 14:48	71.629	164.021	bowhead whale	swim	2	0	15
259	10/6/12 14:51	71.626	163.984	bowhead whale	swim	1	0	15
259	10/6/12 14:57	71.633	163.999	bowhead whale	swim	1	0	15
259	10/6/12 15:02	71.661	163.941	bowhead whale	swim	1	0	15
259	10/6/12 15:03	71.643	164.024	bowhead whale	swim	1	0	15
259	10/6/12 15:05	71.642	164.049	bowhead whale	swim	1	0	15
259	10/6/12 15:46	71.514	161.116	bowhead whale	swim	1	0	14
259	10/6/12 15:49	71.465	160.943	bowhead whale	dive	1	0	14
259	10/6/12 15:52	71.407	160.737	bowhead whale	swim	1	0	14
259	10/6/12 16:03	71.191	159.977	bowhead whale	swim	1	0	13
259	10/6/12 16:03	71.189	159.970	bowhead whale	swim	1	0	13
259	10/6/12 16:04	71.179	159.938	bowhead whale	swim	1	0	13
259	10/6/12 16:04	71.175	159.926	bowhead whale	swim	2	0	13

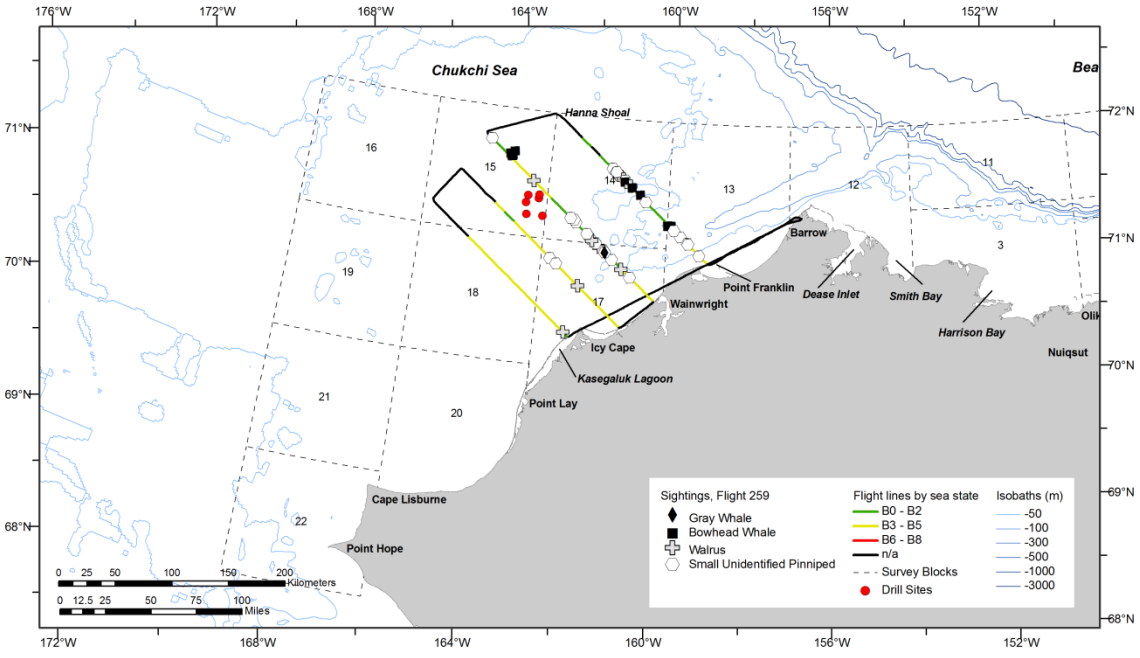

Figure B-113. ASAMM Flight 259 survey track, depicted by sea state, and all sightings.

6 October 2012, Flight 46

Flight was a transect survey of block 12. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 5 km to unlimited with glare and precipitation, and sea states were Beaufort 2-6. Two transects were cut short due to whaling vessels in the area. No sea ice was observed in the area surveyed. Sightings included bowhead whales, gray whales, belugas, and one unidentified cetacean. One gray whale carcass was seen ~30 km northeast of Point Barrow.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
46	10/6/12 11:17	71.062	154.093	bowhead whale	swim	1	0	12
46	10/6/12 11:17	71.063	154.093	bowhead whale	swim	1	0	12
46	10/6/12 11:18	71.074	154.111	bowhead whale	swim	3	0	12
46	10/6/12 11:19	71.063	154.094	bowhead whale	swim	1	0	12
46	10/6/12 11:20	71.082	154.089	bowhead whale	swim	3	0	12
46	10/6/12 11:20	71.086	154.090	bowhead whale	swim	2	0	12
46	10/6/12 11:20	71.086	154.090	bowhead whale	swim	1	0	12
46	10/6/12 11:20	71.088	154.090	bowhead whale	swim	2	0	12
46	10/6/12 11:20	71.095	154.101	bowhead whale	swim	2	0	12
46	10/6/12 11:21	71.086	154.110	bowhead whale	swim	1	0	12
46	10/6/12 11:21	71.085	154.108	bowhead whale	swim	1	0	12
46	10/6/12 11:22	71.070	154.054	bowhead whale	swim	2	1	12
46	10/6/12 11:26	71.069	153.964	bowhead whale	swim	2	0	3
46	10/6/12 11:27	71.079	154.015	bowhead whale	swim	1	0	12
46	10/6/12 11:28	71.095	153.964	bowhead whale	swim	1	0	3
46	10/6/12 11:29	71.102	153.947	bowhead whale	swim	1	0	3
46	10/6/12 11:32	71.056	154.006	bowhead whale	swim	2	0	12
46	10/6/12 11:35	71.111	154.102	bowhead whale	swim	1	0	12
46	10/6/12 11:35	71.111	154.102	bowhead whale	swim	1	0	12
46	10/6/12 11:57	71.891	154.321	beluga	swim	1	0	12
46	10/6/12 11:57	71.891	154.321	beluga	swim	1	0	12
46	10/6/12 11:58	71.914	154.327	beluga	swim	1	0	12
46	10/6/12 11:58	71.919	154.329	beluga	swim	1	0	12
46	10/6/12 11:58	71.924	154.330	beluga	swim	5	0	12
46	10/6/12 11:58	71.928	154.330	beluga	swim	1	0	12
46	10/6/12 11:59	71.940	154.333	beluga	swim	1	0	12
46	10/6/12 12:00	71.975	154.343	beluga	swim	1	0	12
46	10/6/12 12:00	71.986	154.347	beluga	swim	1	0	12
46	10/6/12 12:00	71.990	154.349	beluga	dive	2	0	12
46	10/6/12 12:05	71.981	154.706	beluga	swim	1	0	12
46	10/6/12 12:05	71.980	154.706	beluga	swim	1	0	12
46	10/6/12 12:06	71.956	154.704	beluga	swim	1	0	12
46	10/6/12 12:06	71.950	154.706	beluga	swim	7	3	12
46	10/6/12 12:06	71.946	154.707	beluga	swim	3	1	12
46	10/6/12 12:06	71.935	154.705	beluga	swim	2	0	12
46	10/6/12 12:10	71.835	154.691	bowhead whale	swim	1	0	12
46	10/6/12 12:11	71.837	154.725	bowhead whale	swim	1	0	12
46	10/6/12 12:34	71.272	154.610	bowhead whale	mill	2	0	12

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
46	10/6/12 12:39	71.239	154.616	bowhead whale	swim	1	0	12
46	10/6/12 12:45	71.164	154.610	bowhead whale	mill	1	0	12
46	10/6/12 12:47	71.157	154.584	bowhead whale	swim	1	0	12
46	10/6/12 12:52	71.050	154.596	beluga	mill	1	0	12
46	10/6/12 12:53	71.055	154.638	beluga	feed	4	0	12
46	10/6/12 12:53	71.057	154.642	beluga	mill	1	0	12
46	10/6/12 12:53	71.060	154.651	beluga	mill	1	0	12
46	10/6/12 13:01	71.280	155.201	bowhead whale	swim	1	0	12
46	10/6/12 13:42	71.529	155.829	gray whale	feed	1	0	12
46	10/6/12 13:42	71.525	155.831	gray whale	swim	1	0	12
46	10/6/12 13:43	71.535	155.816	unid cetacean	swim	1	0	12
46	10/6/12 13:44	71.541	155.802	gray whale	mill	1	0	12
46	10/6/12 13:46	71.519	155.818	unid cetacean	swim	1	0	12
46	10/6/12 13:47	71.520	155.857	gray whale	feed	1	0	12
46	10/6/12 13:47	71.520	155.875	gray whale	feed	1	0	12
46	10/6/12 13:47	71.517	155.892	gray whale	swim	1	0	12
46	10/6/12 13:48	71.487	155.957	gray whale	feed	1	0	12
46	10/6/12 13:48	71.487	155.957	gray whale	feed	1	0	12
46	10/6/12 13:49	71.476	155.948	gray whale	feed	2	0	12
46	10/6/12 13:54	71.466	156.162	unid cetacean	swim	1	0	12
46	10/6/12 14:00	71.654	156.268	gray whale	dead	1	0	12
46	10/6/12 14:05	71.730	156.304	bowhead whale	swim	1	0	12
46	10/6/12 14:17	71.981	156.530	bowhead whale	swim	1	0	12

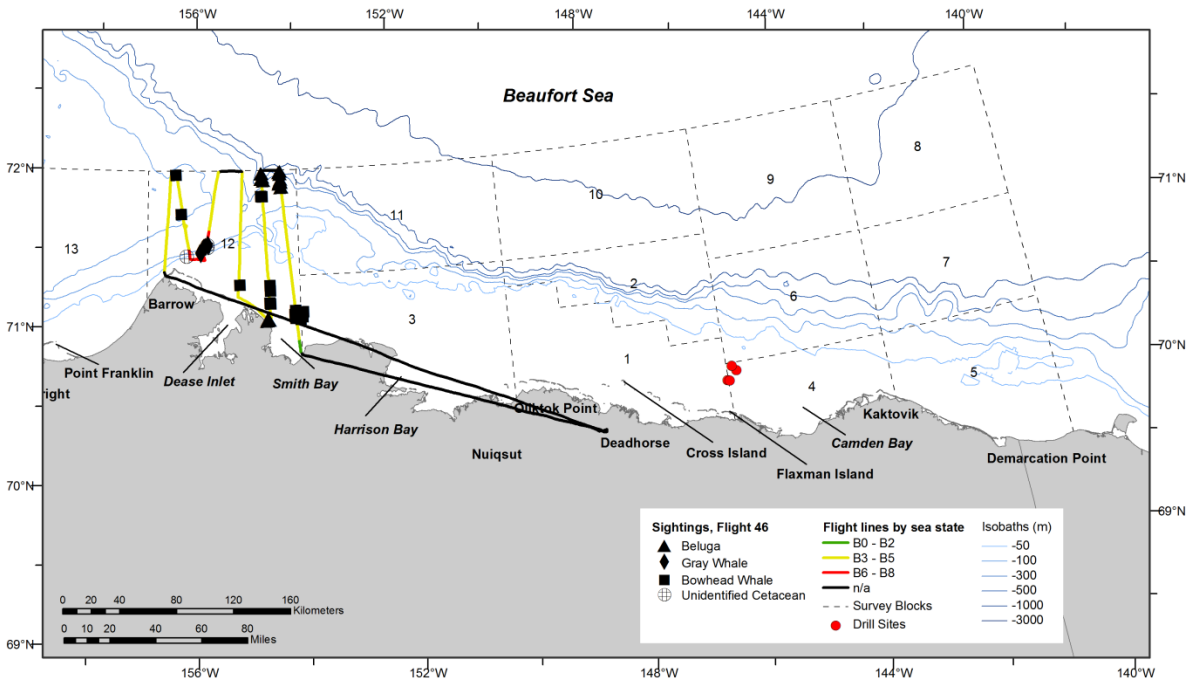

Figure B-114. ASAMM Flight 46 survey track, depicted by sea state, and all sightings.

Bowhead whales, one possibly skim feeding and one with mud on its rostrum, on flight 46, 6 October 2012.

Dead gray whale on flight 46, 6 October 2012.

7 October 2012, Flight 47

Flight was a transect survey of portions of blocks 3 and 11. Survey conditions were poor in the area surveyed with overcast skies. Visibility was 0-10 km with low ceiling, fog, glare and precipitation (snow), and sea states were Beaufort 3-7. Transects were truncated due to pervasive high sea state and low ceilings. No sea ice was observed in the area surveyed. Sightings included bowhead whales and belugas.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
47	10/7/12 11:31	71.106	152.330	bowhead whale	swim	1	0	3
47	10/7/12 11:33	71.108	152.299	bowhead whale	swim	1	0	3
47	10/7/12 11:50	71.599	152.379	beluga	mill	5	0	11
47	10/7/12 11:50	71.599	152.379	beluga	swim	3	0	11
47	10/7/12 11:50	71.600	152.379	beluga	swim	2	1	11
47	10/7/12 11:50	71.610	152.381	beluga	swim	3	0	11
47	10/7/12 11:50	71.614	152.382	beluga	swim	2	0	11
47	10/7/12 11:50	71.624	152.383	beluga	swim	1	0	11
47	10/7/12 11:50	71.624	152.383	beluga	swim	1	0	11
47	10/7/12 11:50	71.626	152.383	beluga	swim	1	0	11

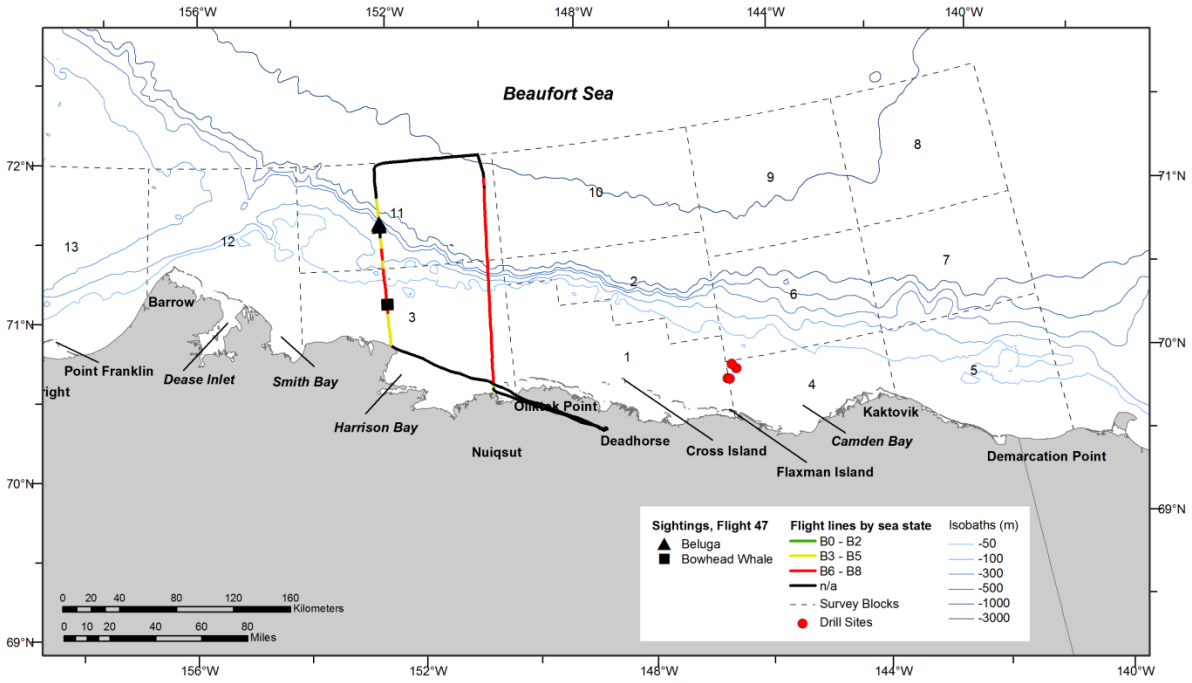

Figure B-115. ASAMM Flight 47 survey track, depicted by sea state, and all sightings.

8 October 2012, Flight 260

Flight was a partial survey of transects 4 and 6. Survey conditions were poor in the area surveyed with partly cloudy skies. Visibility was 0-10 km with scattered snow showers, and sea states were Beaufort 6-7. High sea states and snow showers prevented complete coverage of transects. No sea ice was observed in the area surveyed. No marine mammals were seen.

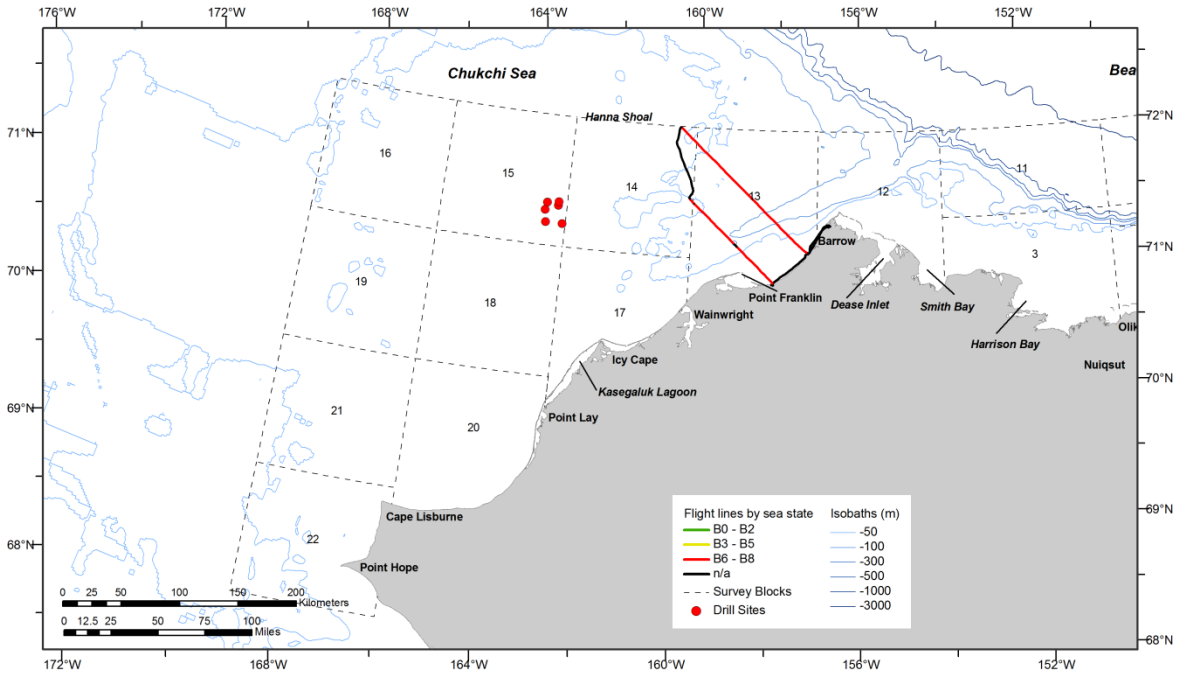

Figure B-116. ASAMM Flight 260 survey track, depicted by sea state.

10 October 2012, Flight 261

Flight was a survey of transects 18 and 20. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 3-10 km with glare and precipitation, and sea states were Beaufort 2-7. No sea ice was observed in the area surveyed. Sightings included walruses, one unidentified pinniped, and small unidentified pinnipeds.

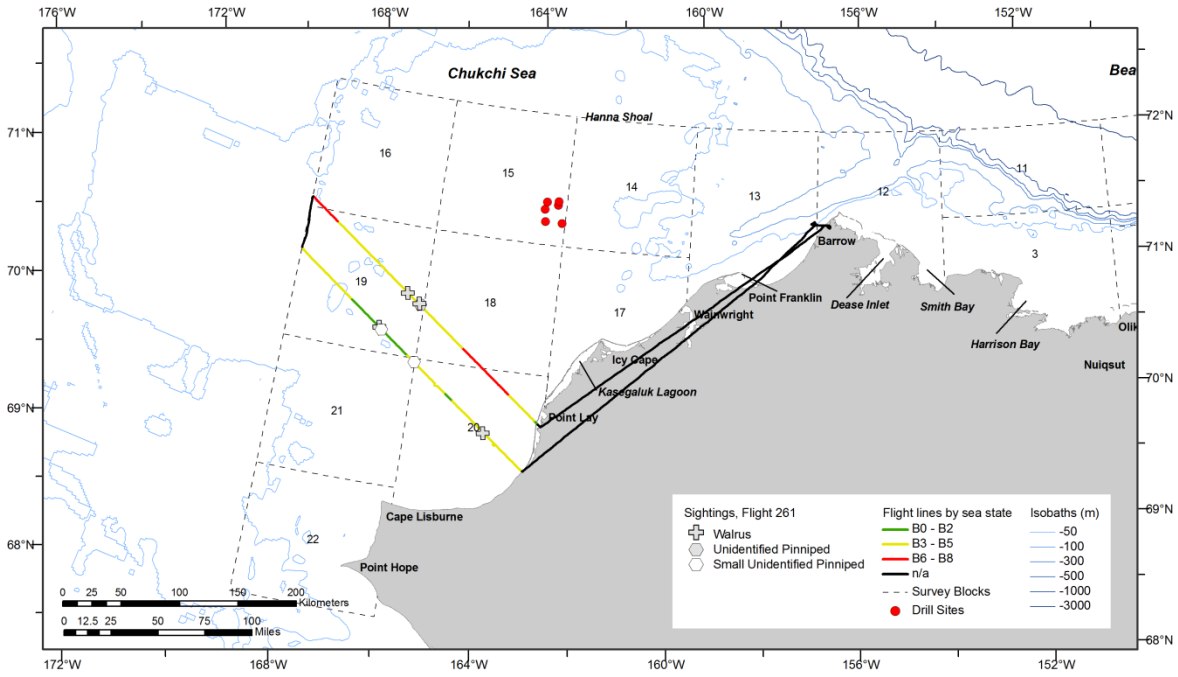

Figure B-117. ASAMM Flight 261 survey track, depicted by sea state, and all sightings.

10 October 2012, Flight 48

Flight was a transect survey of portions of blocks 3 and 11. Survey conditions were poor in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with low ceilings, glare, and precipitation (snow), and sea states were Beaufort 4-7. High sea states and low ceilings prevented completion of transects. No sea ice was observed in the area surveyed. One bowhead whale was seen.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
48	10/10/12 13:07	71.060	153.884	bowhead whale	swim	1	0	3

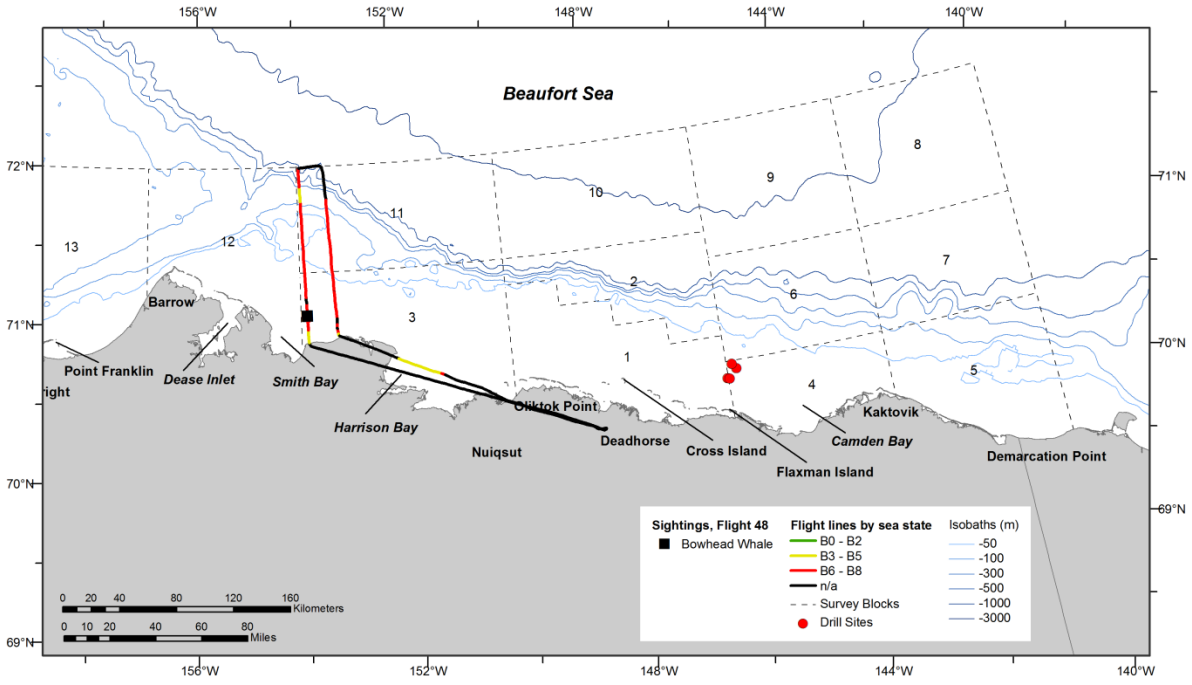

Figure B-118. ASAMM Flight 48 survey track, depicted by sea state, and all sightings.

11 October 2012, Flight 262

Flight was a survey of transects 32 and 33. Survey conditions were fair in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with snow showers, and sea states were Beaufort 3-6. Increasing snow showers and reduced visibility prevented further survey effort in the area. No sea ice was observed in the area surveyed. Sightings included gray whales, walruses and small unidentified pinnipeds.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
262	10/11/12 15:11	68.136	168.539	gray whale	swim	2	0	22

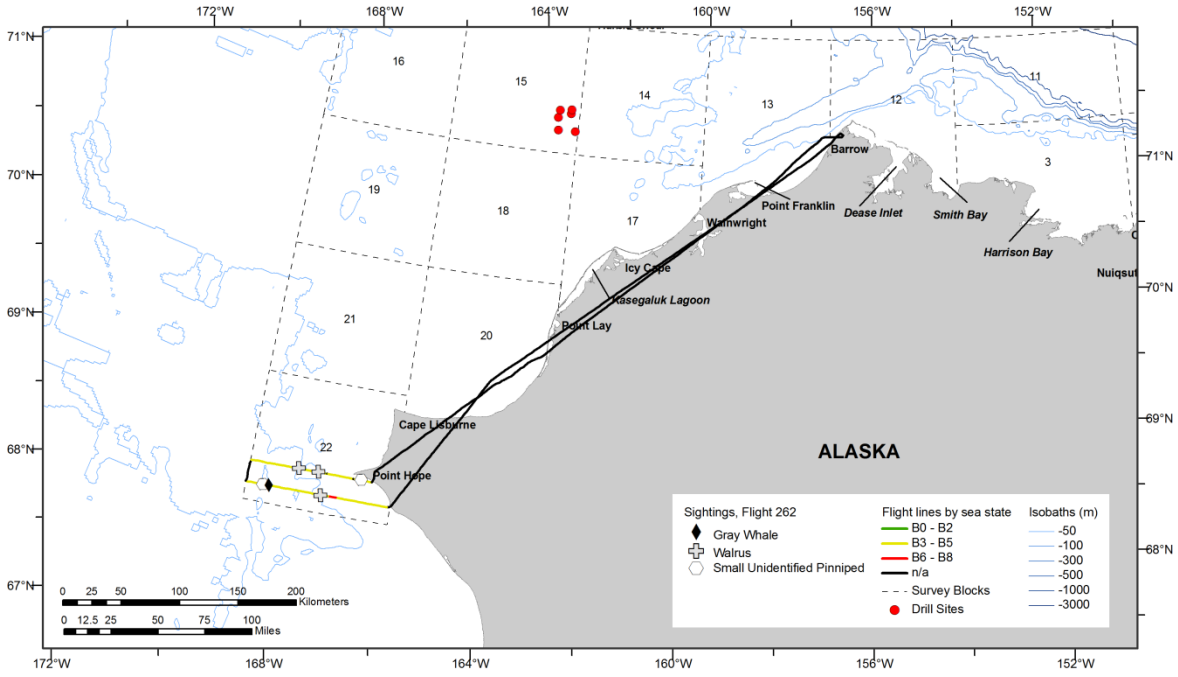

Figure B-119. ASAMM Flight 262 survey track, depicted by sea state, and all sightings.

11 October 2012, Flight 49

Flight was a partial survey of a portion of block 3. Survey conditions were poor in the area surveyed with overcast skies. Visibility was 0-5 km with fog and heavy snow, and sea states were Beaufort 6-7. Low visibility prevented further survey effort in the area. No sea ice was observed in the area surveyed. No marine mammals were seen.

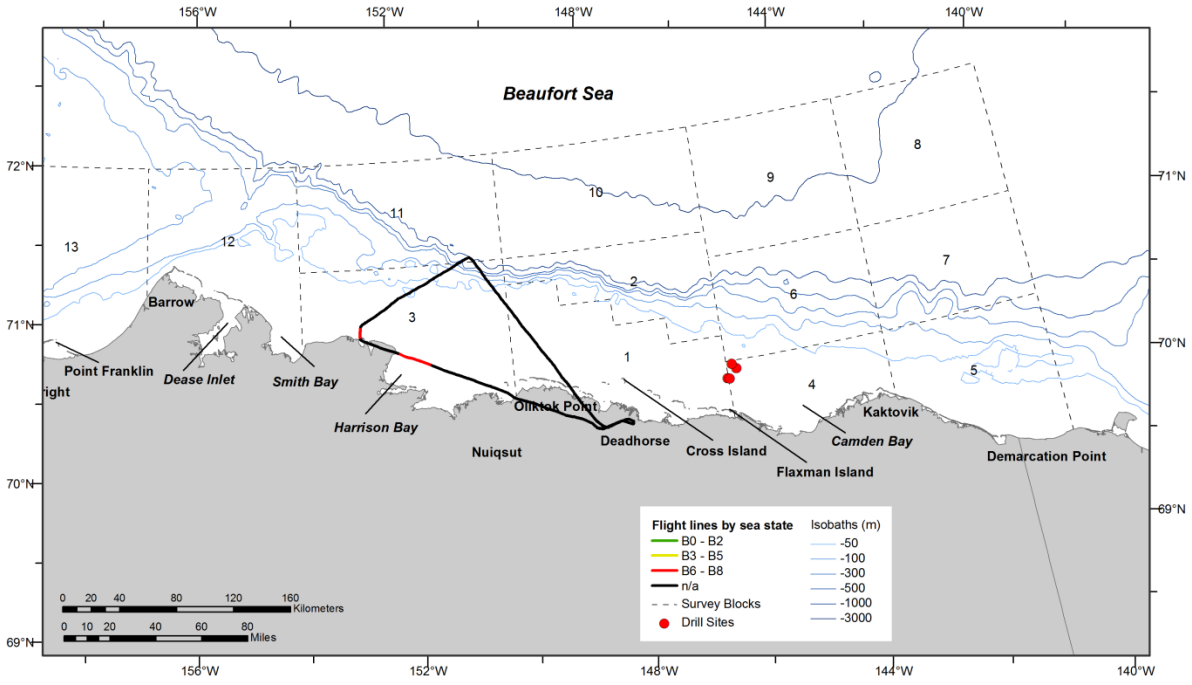

Figure B-120. ASAMM Flight 49 survey track, depicted by sea state.

13 October 2012, Flight 263

Flight was a coastal transect from Barrow to Point Lay. Survey conditions were poor in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with snow showers, and sea states were Beaufort 5-7. Snow showers and high sea states limited further survey effort in the area. No sea ice was observed in the area surveyed. Polar bears were seen. All polar bears were in the vicinity of Point Franklin; two bears were feeding on two marine mammal carcasses, and three bears were walking towards the carcasses. All carcasses were seen during previous flights.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
263	10/13/12 12:21	70.907	158.946	small unid marine mammal	dead	1	0	13
263	10/13/12 12:24	70.893	158.954	small unid marine mammal	dead	1	0	13

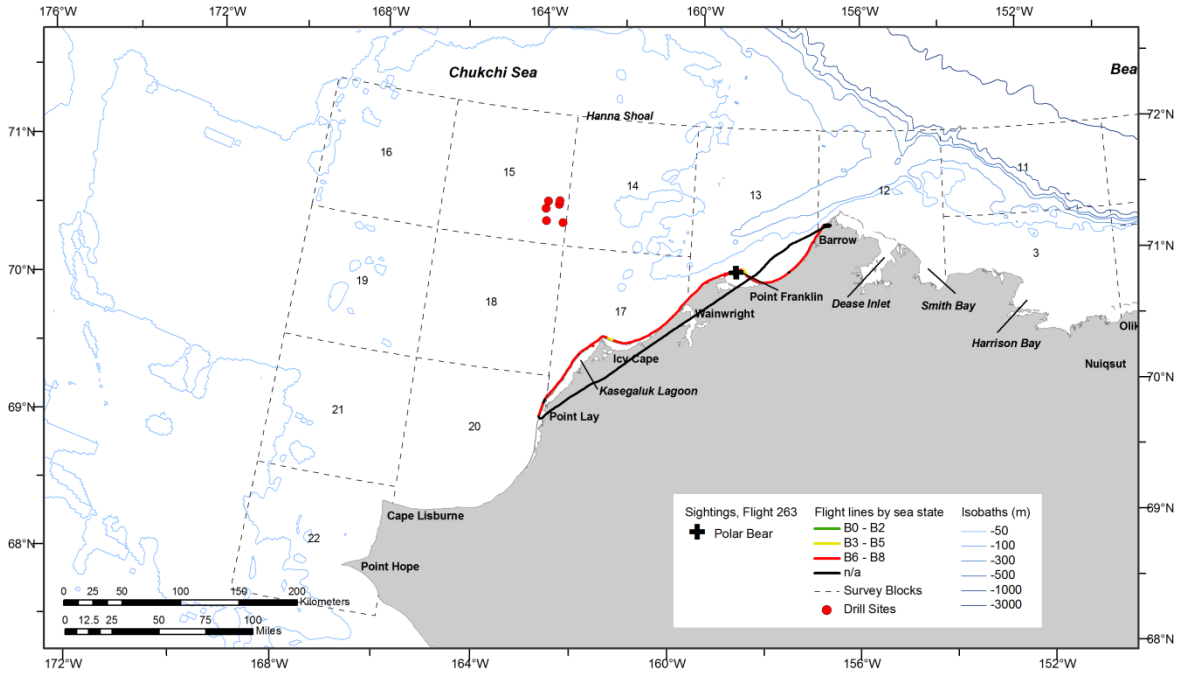

Figure B-121. ASAMM Flight 263 survey track, depicted by sea state, and all sightings.

14 October 2012, Flight 264

Flight was a survey of transects 1 and 3. Survey conditions were poor in the area surveyed with partly cloudy to overcast skies. Visibility was <1-10 km with precipitation, and sea states were Beaufort 5-7. Snow showers and high sea states prevented further survey effort in the area. No sea ice was observed in the area surveyed. No marine mammals were seen.

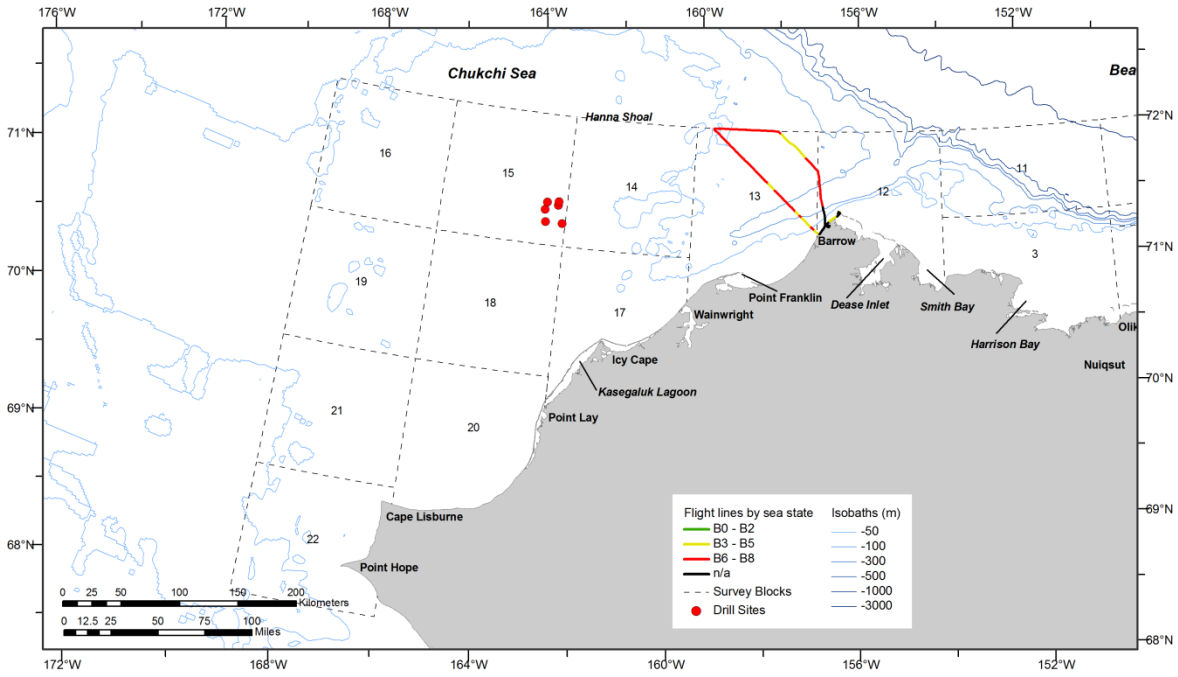

Figure B-122. ASAMM Flight 264 survey track, depicted by sea state.

14 October 2012, Flight 50

Flight was a transect survey of portions of blocks 1 and 2, and search survey effort in blocks 1 and 4. Survey conditions were poor in the area surveyed with partly cloudy skies. Visibility was 0-10 km with fog and low ceilings, and sea states were Beaufort 3-7. Ice cover was 0-20% grease/new ice in the area surveyed. Pervasive fog prevented further survey effort in the area. Eleven polar bears, including four cubs, were seen on Cross Island.

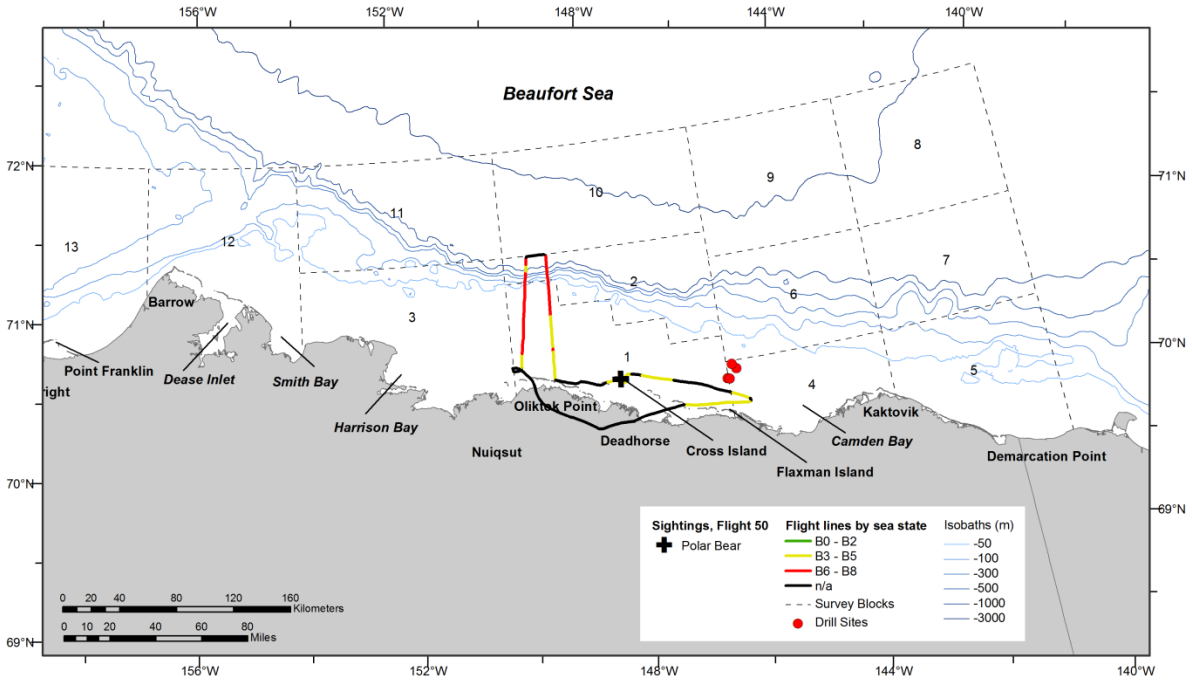

Figure B-123. ASAMM Flight 50 survey track, depicted by sea state, and all sightings.

15 October 2012, Flight 265

Flight was a survey of transects 1, 3, 5, and 7, a transect survey of portions of block 12, and a search survey from Barrow to Point Franklin. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with precipitation, and sea states were Beaufort 2-5. No sea ice was observed in the area surveyed. Sightings included bowhead whales, gray whales, belugas, unidentified cetaceans, unidentified pinnipeds, small unidentified pinnipeds, and polar bears. Two of the three polar bears were swimming, one within one kilometer of shore west of Point Franklin and one ~28 kilometers north of Point Barrow. One dead unidentified cetacean was recorded southeast of Point Barrow.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
265	10/15/12 11:04	71.154	157.682	unid cetacean	.	1	0	13
265	10/15/12 11:04	71.153	157.685	gray whale	swim	3	0	13
265	10/15/12 11:04	71.149	157.714	gray whale	swim	1	0	13
265	10/15/12 11:05	71.143	157.741	gray whale	swim	1	0	13
265	10/15/12 11:05	71.133	157.780	gray whale	feed	1	0	13
265	10/15/12 11:16	71.115	157.881	gray whale	feed	1	0	13
265	10/15/12 11:21	71.037	158.276	gray whale	feed	1	0	13
265	10/15/12 11:22	71.030	158.316	gray whale	swim	1	0	13
265	10/15/12 11:22	71.024	158.347	gray whale	swim	2	0	13
265	10/15/12 11:56	71.410	160.737	bowhead whale	dive	1	0	14
265	10/15/12 11:58	71.435	160.693	bowhead whale	swim	1	0	14
265	10/15/12 12:12	71.578	161.366	bowhead whale	swim	1	0	14
265	10/15/12 12:14	71.580	161.354	bowhead whale	swim	1	1	14
265	10/15/12 12:18	71.600	161.437	bowhead whale	swim	3	0	14
265	10/15/12 12:19	71.615	161.378	bowhead whale	swim	2	0	14
265	10/15/12 12:20	71.610	161.344	bowhead whale	swim	1	0	14
265	10/15/12 12:21	71.613	161.322	bowhead whale	swim	1	0	14
265	10/15/12 12:26	71.626	161.532	bowhead whale	swim	1	0	14
265	10/15/12 12:27	71.644	161.598	bowhead whale	swim	1	0	14
265	10/15/12 12:27	71.647	161.608	bowhead whale	swim	1	0	14
265	10/15/12 12:27	71.649	161.616	bowhead whale	swim	1	0	14
265	10/15/12 12:28	71.656	161.641	bowhead whale	swim	1	0	14
265	10/15/12 12:28	71.656	161.641	bowhead whale	swim	2	0	14
265	10/15/12 12:32	71.744	161.975	bowhead whale	rest	1	0	14
265	10/15/12 13:02	71.897	160.869	beluga	swim	3	0	14
265	10/15/12 16:50	71.519	155.920	gray whale	swim	1	0	12
265	10/15/12 16:51	71.522	155.924	gray whale	swim	1	0	12
265	10/15/12 16:52	71.524	155.900	gray whale	swim	3	0	12
265	10/15/12 16:53	71.521	155.887	gray whale	dive	1	0	12
265	10/15/12 16:56	71.622	155.911	unid cetacean	dive	1	0	12
265	10/15/12 16:58	71.603	155.811	bowhead whale	swim	3	0	12
265	10/15/12 17:25	71.663	155.271	bowhead whale	swim	1	0	12
265	10/15/12 17:25	71.662	155.270	bowhead whale	swim	1	0	12
265	10/15/12 17:30	71.521	155.217	beluga	swim	1	0	12
265	10/15/12 17:34	71.390	155.172	bowhead whale	swim	2	0	12

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
265	10/15/12 17:55	71.218	154.856	bowhead whale	swim	1	0	12
265	10/15/12 18:00	71.249	154.841	bowhead whale	swim	1	0	12
265	10/15/12 18:00	71.257	154.841	bowhead whale	.	2	0	12
265	10/15/12 18:02	71.275	154.832	bowhead whale	swim	3	0	12
265	10/15/12 18:02	71.276	154.831	bowhead whale	mill	17	0	12
265	10/15/12 18:03	71.276	154.839	bowhead whale	swim	1	0	12
265	10/15/12 18:11	71.302	154.804	bowhead whale	swim	3	0	12
265	10/15/12 18:12	71.299	154.799	bowhead whale	swim	2	0	12
265	10/15/12 18:14	71.323	154.812	bowhead whale	swim	1	0	12

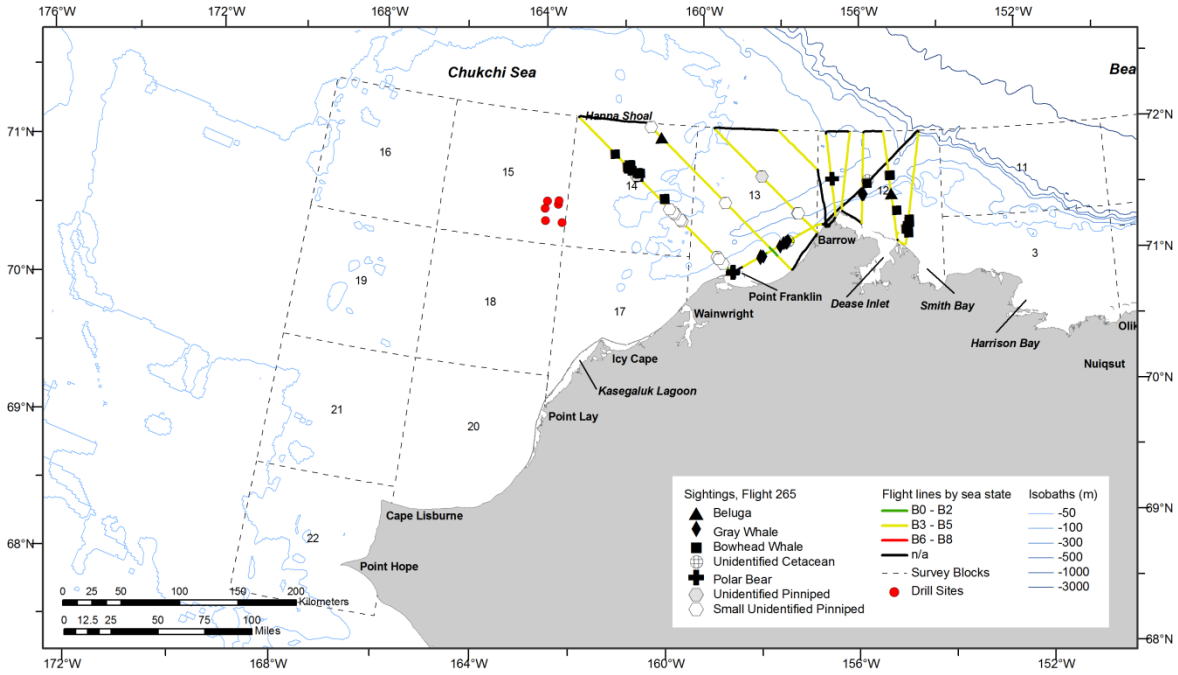

Figure B-124. ASAMM Flight 265 survey track, depicted by sea state, and all sightings.

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18 October 2012, Flight 266

Flight was a survey of transects 17 and 19, and the coastal transect from Point Lay to east of Icy Cape. Survey conditions were good in the area surveyed with partly cloudy to overcast skies. Visibility was 0-10 km with scattered snow showers, and sea states were Beaufort 2-4. Ice cover was 0-10% grease/new ice in the area surveyed. Sightings included bowhead whales, belugas, unidentified pinnipeds, small unidentified pinnipeds, and one polar bear. The polar bear was swimming ~110 km northwest of Point Lay.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
266	10/18/12 13:43	70.550	167.554	bowhead whale	swim	1	0	19
266	10/18/12 14:06	71.046	169.003	beluga	swim	2	0	16
266	10/18/12 14:07	71.063	169.000	beluga	swim	1	0	0
266	10/18/12 14:09	71.180	169.003	bowhead whale	swim	1	0	0
266	10/18/12 14:10	71.227	169.001	bowhead whale	swim	1	0	0
266	10/18/12 14:26	71.049	167.935	beluga	rest	2	1	16
266	10/18/12 14:27	71.041	167.897	beluga	rest	1	0	16
266	10/18/12 14:27	71.035	167.869	beluga	rest	1	0	16
266	10/18/12 14:28	71.022	167.814	beluga	swim	1	0	16
266	10/18/12 14:28	71.016	167.787	beluga	rest	2	0	16
266	10/18/12 14:29	71.013	167.775	beluga	rest	1	0	16
266	10/18/12 14:29	71.011	167.765	beluga	swim	1	0	16
266	10/18/12 14:30	70.985	167.647	beluga	swim	1	0	19
266	10/18/12 14:31	70.976	167.607	beluga	rest	1	0	19
266	10/18/12 14:31	70.968	167.572	beluga	mill	1	0	19

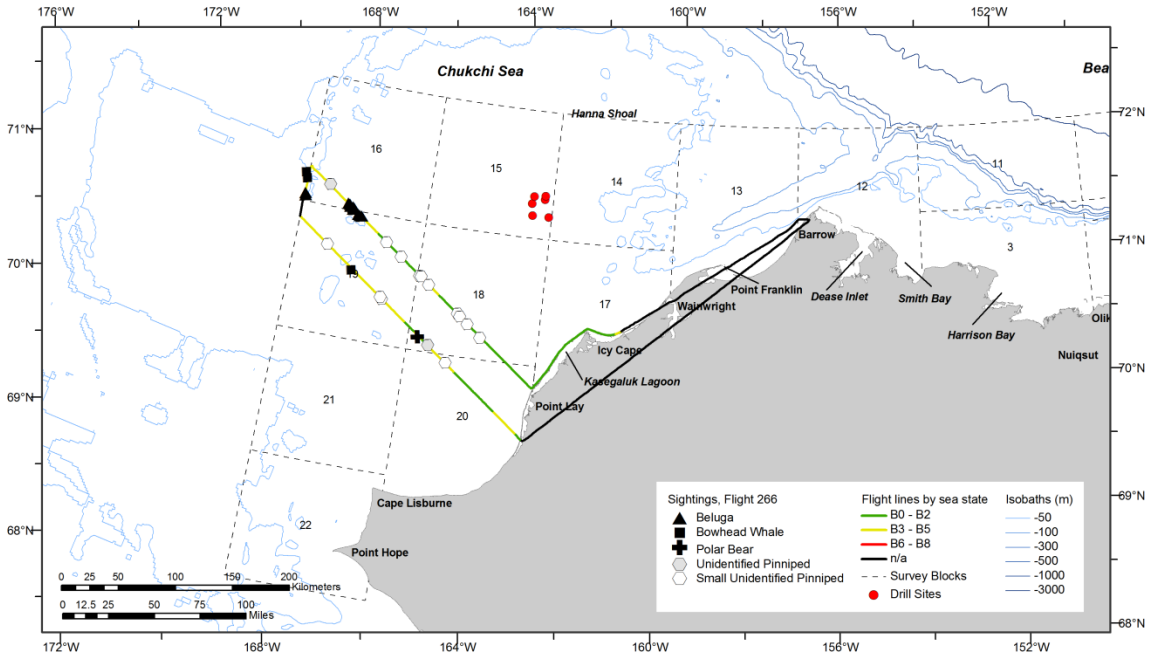

Figure B-125. ASAMM Flight 266 survey track, depicted by sea state, and all sightings.

19 October 2012, Flight 267

Flight was a survey of transects 10 and 12, the coastal transect from Wainwright to Point Franklin, and a search survey from Point Franklin to Barrow. Survey conditions were good in the area surveyed with clear to overcast skies. Visibility was 1-10 km with few scattered snow showers, and sea states were Beaufort 0-5. No sea ice was observed in the area surveyed. Sightings included bowhead whales, belugas, gray whales, unidentified cetaceans, unidentified pinnipeds, small unidentified pinnipeds, and one polar bear. The polar bear was sighted resting onshore north of Wainwright.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
267	10/19/12 13:54	72.001	165.697	bowhead whale	swim	1	0	15
267	10/19/12 14:08	71.856	165.042	bowhead whale	swim	1	0	15
267	10/19/12 14:13	71.780	164.719	bowhead whale	swim	1	0	15
267	10/19/12 14:24	71.789	164.732	bowhead whale	swim	1	0	15
267	10/19/12 14:55	71.289	162.779	bowhead whale	swim	2	0	14
267	10/19/12 14:56	71.300	162.710	bowhead whale	swim	1	0	14
267	10/19/12 14:56	71.304	162.726	bowhead whale	swim	1	0	14
267	10/19/12 14:57	71.298	162.749	bowhead whale	swim	1	0	14
267	10/19/12 15:02	71.221	162.512	unid cetacean	dive	1	0	14
267	10/19/12 15:15	71.273	162.504	bowhead whale	swim	1	0	14
267	10/19/12 15:15	71.280	162.508	bowhead whale	swim	1	0	14
267	10/19/12 15:15	71.278	162.476	bowhead whale	swim	1	0	14
267	10/19/12 15:16	71.286	162.509	bowhead whale	swim	1	0	14
267	10/19/12 15:18	71.272	162.577	bowhead whale	swim	2	0	14
267	10/19/12 15:18	71.267	162.581	bowhead whale	swim	2	0	14
267	10/19/12 16:14	70.882	159.145	beluga	swim	1	0	13
267	10/19/12 16:26	71.024	158.300	beluga	swim	1	0	13
267	10/19/12 16:31	71.074	158.061	gray whale	swim	1	0	13
267	10/19/12 16:32	71.078	158.046	gray whale	swim	2	0	13
267	10/19/12 16:35	71.106	157.913	gray whale	feed	1	0	13
267	10/19/12 16:39	71.140	157.751	gray whale	feed	1	0	13
267	10/19/12 16:42	71.192	157.500	gray whale	feed	3	0	13
267	10/19/12 16:43	71.212	157.506	gray whale	swim	1	0	13
267	10/19/12 16:45	71.213	157.516	gray whale	swim	2	0	13
267	10/19/12 16:48	71.221	157.481	unid cetacean	swim	2	0	13
267	10/19/12 16:48	71.218	157.415	gray whale	dive	1	0	13
267	10/19/12 16:49	71.221	157.379	gray whale	swim	1	0	13
267	10/19/12 16:49	71.228	157.341	gray whale	swim	1	0	13
267	10/19/12 16:49	71.233	157.313	gray whale	swim	1	0	13
267	10/19/12 16:49	71.234	157.308	gray whale	swim	3	0	13
267	10/19/12 16:52	71.255	157.194	gray whale	swim	1	0	13

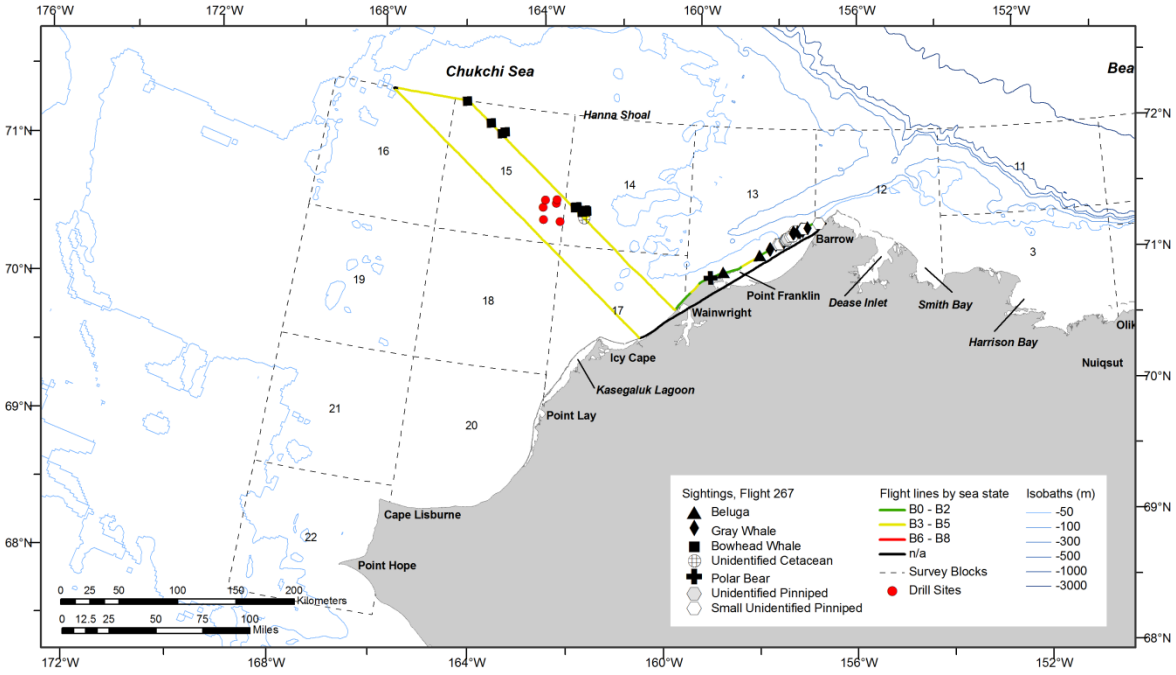

Figure B-126. ASAMM Flight 267 survey track, depicted by sea state, and all sightings.

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20 October 2012, Flight 268

Flight was a transect survey of portions of blocks 3 and 11. Survey conditions were fair in the area surveyed with clear to partly cloudy skies. Visibility was <1-10 km with extensive low ceilings, and sea states were Beaufort 1-4. Low ceilings prevented continued survey effort in the area. New/grease ice was present along the shore. Sightings included bowhead whales, 1 beluga, 1 gray whale, unidentified cetaceans, and 2 polar bears. The polar bears were sighted on land in a frozen inlet west of Smith Bay.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
268	10/20/12 11:12	70.951	154.229	gray whale	swim	1	0	12
268	10/20/12 11:25	71.133	153.670	unid cetacean	swim	1	0	3
268	10/20/12 11:35	71.148	153.655	unid cetacean	swim	1	0	3
268	10/20/12 11:39	71.152	153.665	bowhead whale	swim	1	0	3
268	10/20/12 11:42	71.162	153.666	bowhead whale	swim	3	0	3
268	10/20/12 11:42	71.155	153.674	unid cetacean	.	1	0	3
268	10/20/12 11:45	71.154	153.676	bowhead whale	swim	2	0	3
268	10/20/12 12:43	71.015	153.404	beluga	swim	1	0	3
268	10/20/12 13:12	71.056	152.241	bowhead whale	swim	1	0	3
268	10/20/12 13:14	71.064	152.268	bowhead whale	swim	1	0	3
268	10/20/12 13:16	71.052	152.248	bowhead whale	swim	2	0	3
268	10/20/12 13:18	71.044	152.215	bowhead whale	swim	1	0	3
268	10/20/12 13:25	70.914	152.217	bowhead whale	.	1	0	3

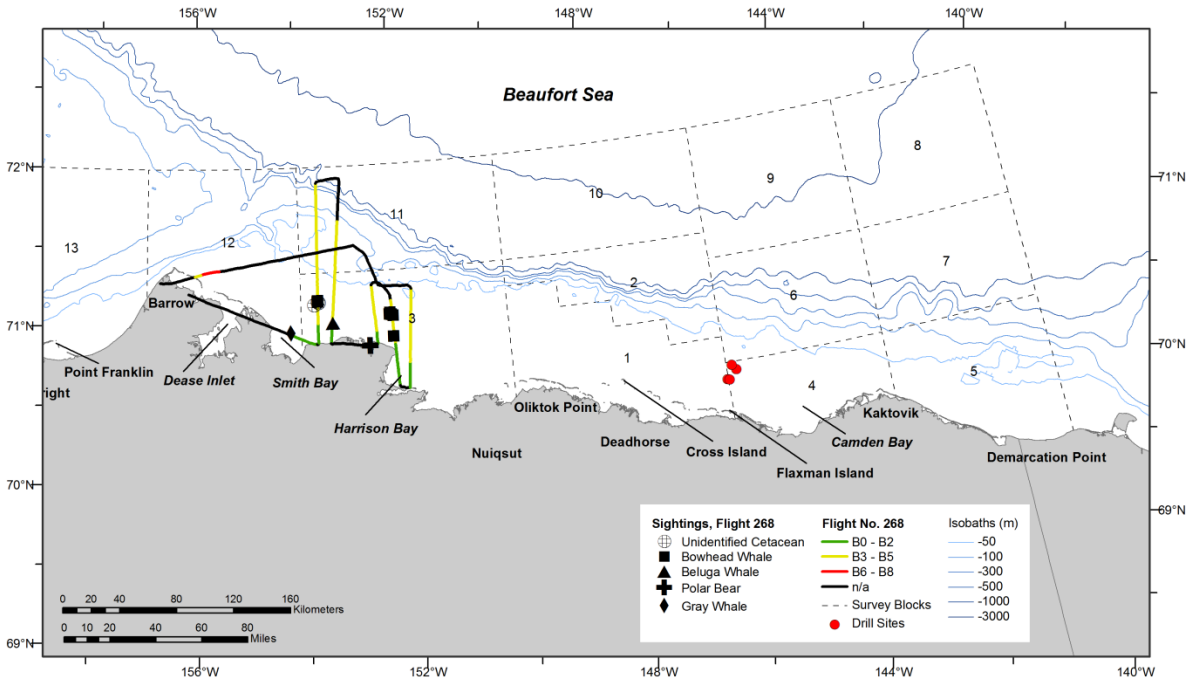

Figure B-127. ASAMM Flight 268 survey track, depicted by sea state, and all sightings.

21 October 2012, Flight 269

Flight was a transect survey of portions of blocks 4 and 6. Survey conditions were excellent in the area surveyed with clear to overcast skies. Visibility was unlimited, and sea states were Beaufort 0-5. Up to 90% new/grease ice was present along the shore. Sightings included bowhead whales, belugas, small unidentified pinnipeds, unidentified pinnipeds and one polar bear. The polar bear was sighted walking on land ~35 km ESE of Flaxman Island.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
269	10/21/12 13:06	70.243	145.642	bowhead whale	swim	1	0	4
269	10/21/12 13:08	70.292	145.645	bowhead whale	swim	2	1	4
269	10/21/12 13:13	70.293	145.594	bowhead whale	swim	1	0	4
269	10/21/12 13:34	70.872	145.803	bowhead whale	swim	1	0	6
269	10/21/12 14:56	70.677	144.663	bowhead whale	swim	2	1	6
269	10/21/12 14:59	70.715	144.653	bowhead whale	swim	1	0	6
269	10/21/12 15:29	70.811	144.104	beluga	rest	1	0	6
269	10/21/12 15:29	70.805	144.104	beluga	swim	1	0	6

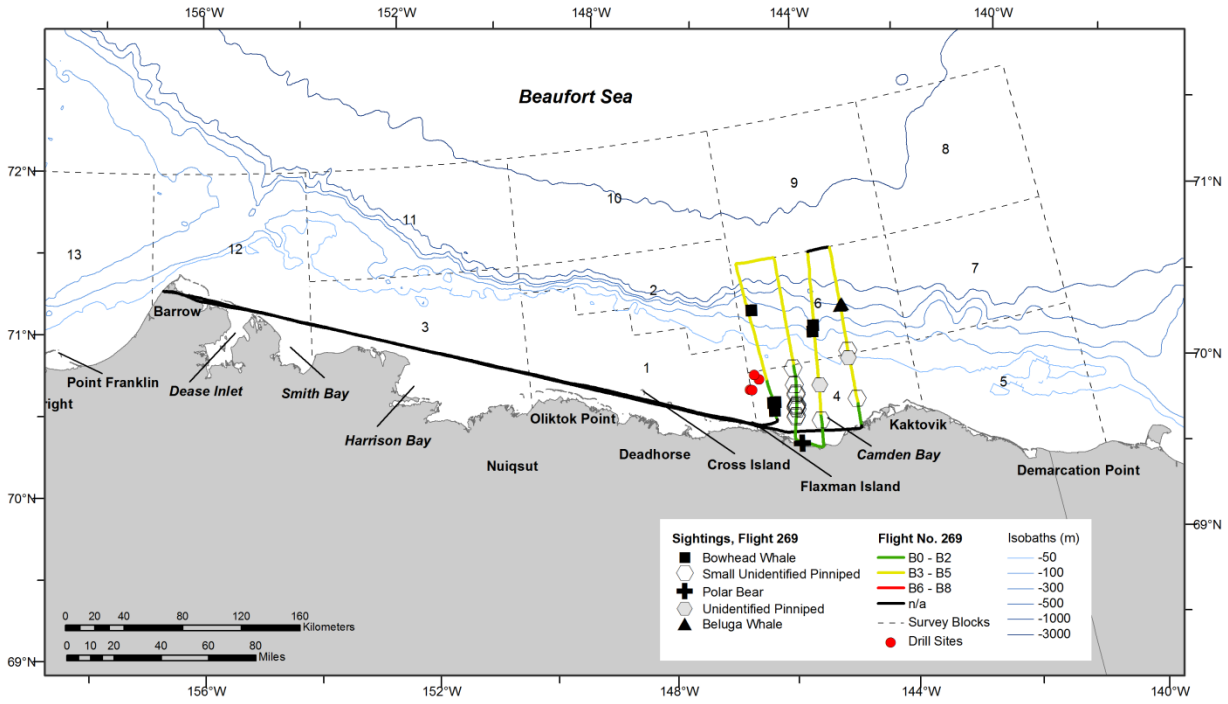

Figure B-128. ASAMM Flight 269 survey track, depicted by sea state, and all sightings.

Bowhead whale cow and calf sighted north of Camden Bay on flight 269, 21 October 2012.

22 October 2012, Flight 270

Flight was a transect survey of block 1 and portions of block 2. Survey conditions were excellent in the area surveyed with clear to partly cloudy skies. Visibility was <1 km to unlimited, and sea states were Beaufort 0-4. Up to 90% new/grease ice was present along the shore. Sightings included bowhead whales, belugas, small unidentified pinnipeds, unidentified pinnipeds, 1 dead unidentified cetacean, and 3 polar bears. The polar bears were sighted on Cross Island.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
270	10/22/12 13:01	71.177	149.677	unid cetacean	dead	1	0	2
270	10/22/12 14:07	71.050	148.824	bowhead whale	swim	1	0	2
270	10/22/12 14:30	71.005	148.244	bowhead whale	swim	1	0	2
270	10/22/12 14:56	70.567	147.854	bowhead whale	rest	1	0	1
270	10/22/12 14:57	70.591	147.848	bowhead whale	swim	1	0	1
270	10/22/12 14:57	70.592	147.848	bowhead whale	mill	26	0	1
270	10/22/12 14:58	70.610	147.844	bowhead whale	swim	1	0	1
270	10/22/12 15:10	70.596	147.779	bowhead whale	mill	3	0	1
270	10/22/12 15:10	70.595	147.785	bowhead whale	mill	3	0	1
270	10/22/12 15:11	70.605	147.705	bowhead whale	swim	1	0	1
270	10/22/12 15:12	70.606	147.739	bowhead whale	swim	1	0	1
270	10/22/12 15:16	70.650	147.832	bowhead whale	swim	1	0	1
270	10/22/12 15:24	70.858	147.776	unid cetacean	swim	1	0	2
270	10/22/12 15:47	71.214	147.471	beluga	swim	2	0	2
270	10/22/12 16:08	70.511	147.373	bowhead whale	swim	1	0	1

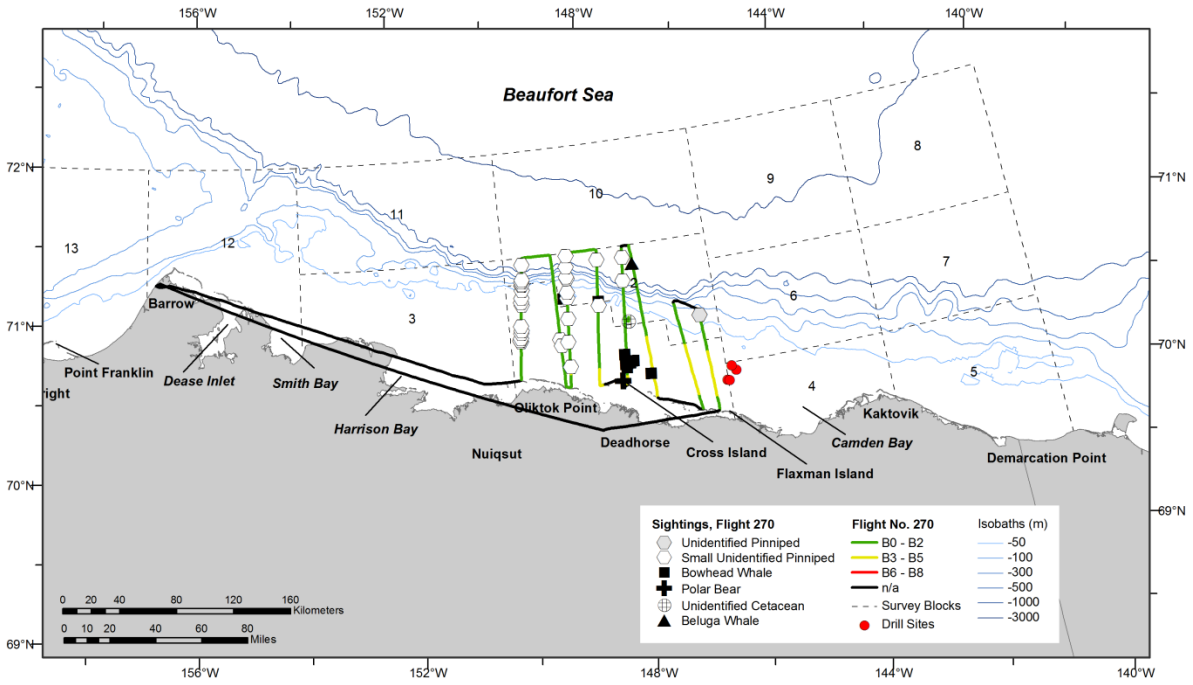

Figure B-129. ASAMM Flight 270 survey track, depicted by sea state, and all sightings.

24 October 2012, Flight 271

Flight was a partial survey of transects 13, 14, 16, and 18. Survey conditions were fair in the area surveyed with overcast skies. Visibility was 5-10 km, and sea states were Beaufort 2-7 with the majority of the transects surveyed in Beaufort 4-5. High sea states prevented completion of the transects. No sea ice was observed in the area surveyed. No marine mammals were sighted.

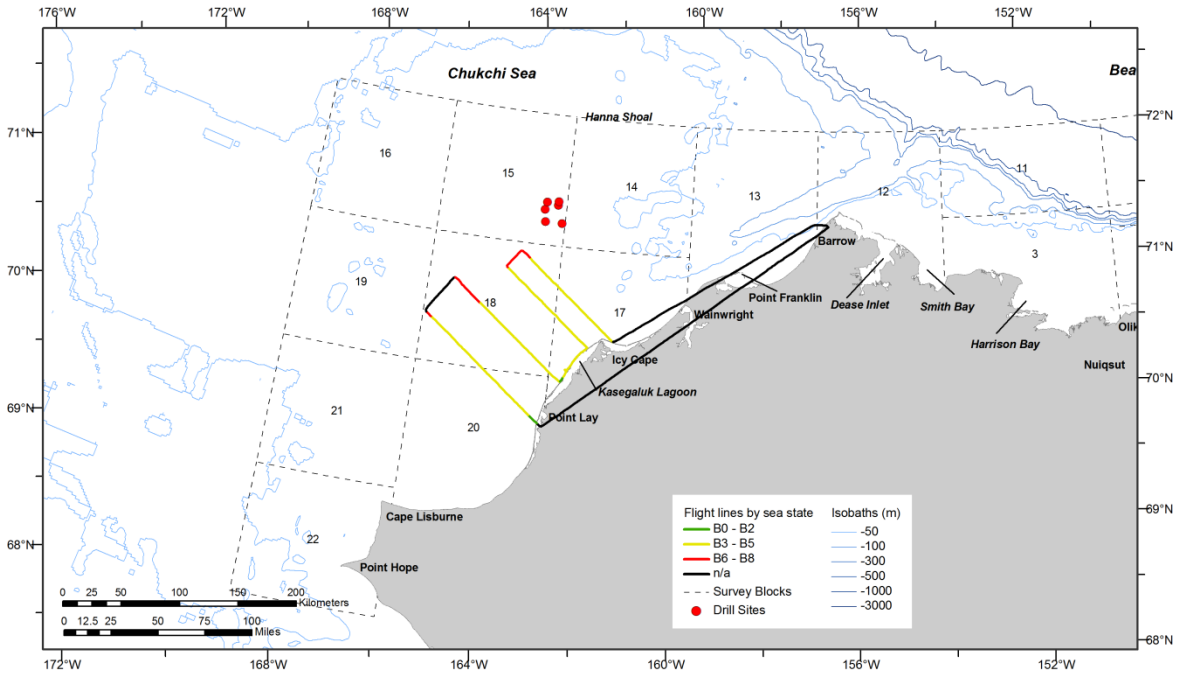

Figure B-130. ASAMM Flight 271 survey track, depicted by sea state.

26 October 2012, Flight 272

Flight was a partial survey of transects 8 and 20, and the coastal transect from south of Point Lay to Barrow. Survey conditions were fair in the area surveyed with clear to overcast skies. Visibility was 0-10 km, and sea states were Beaufort 2-5. Low ceilings prevented completion of the transects and further survey effort in the area. New/grease ice was present up to 40% only briefly along the coast. Sightings included belugas, polar bears, and small unidentified pinnipeds. The polar bears were located on the beach north of Point Lay.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
272	10/26/12 13:53	70.830	159.519	beluga	swim	3	0	13
272	10/26/12 13:53	70.830	159.522	beluga	mill	3	0	13
272	10/26/12 16:42	70.808	159.634	beluga	swim	5	0	13
272	10/26/12 16:42	70.810	159.627	beluga	swim	2	0	13

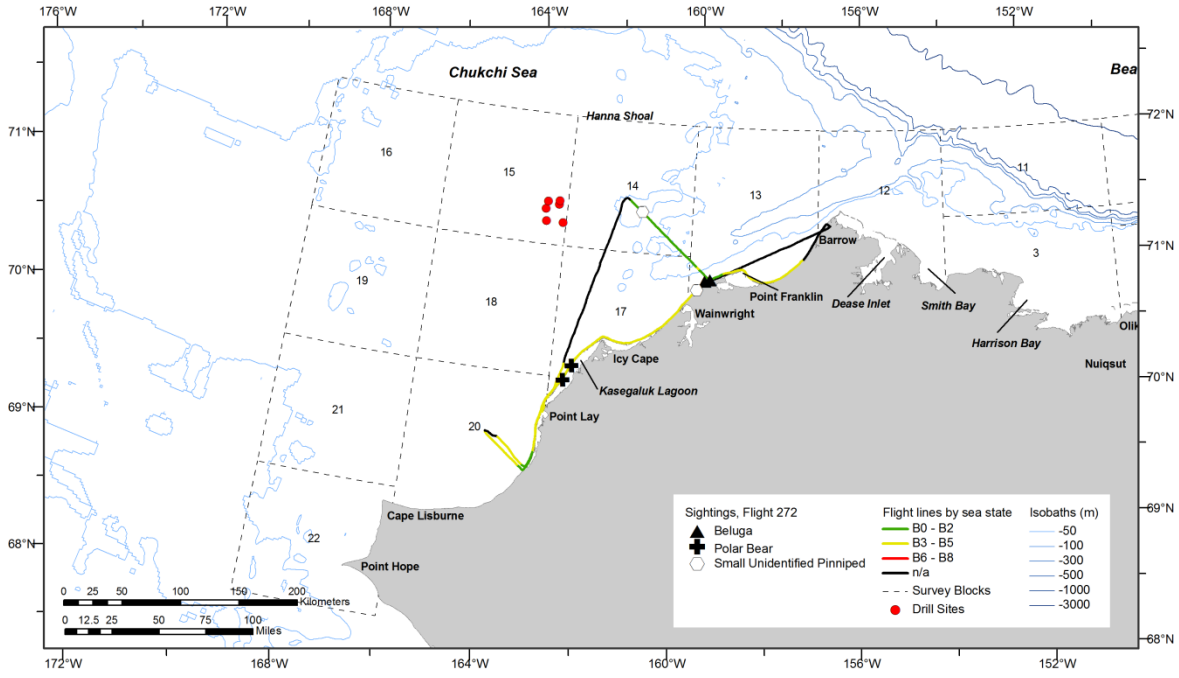

Figure B-131. ASAMM Flight 272 survey track, depicted by sea state, and all sightings.

28 October 2012, Flight 273

Flight was a partial survey of transects 29 and 31, and the coastal transect from Cape Lisburne to south of Point Lay. Survey conditions were fair in the area surveyed with overcast skies. Visibility was 0-10 km with patchy low ceilings and persistent snow squalls throughout the area surveyed, and sea states were Beaufort 2-4. Low visibility prevented completion of the transects and further survey effort in the area. No sea ice was observed in the area surveyed. Sightings included 1 beluga, 1 gray whale, 1 polar bear, 1 small unidentified pinniped, and 1 unidentified pinniped. The polar bear was swimming ~1.5 km offshore, approximately 70 km east of Cape Lisburne.

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

Flight No.	Date/Time	Latitude °N	Longitude °W	Species	Behavior	Group Size	Calf No.	Block
273	10/28/12 14:40	68.866	165.365	gray whale	swim	1	0	20
273	10/28/12 15:06	69.126	163.585	beluga	swim	1	0	20

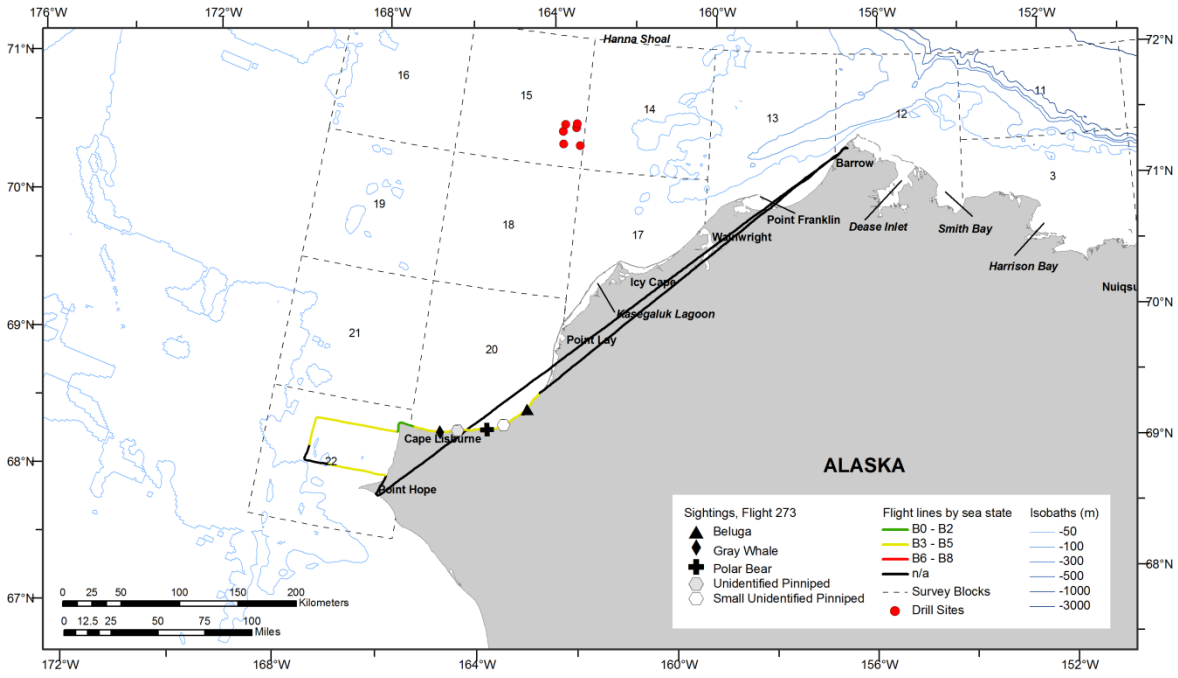

Figure B-132. ASAMM Flight 273 survey track, depicted by sea state, and all sightings.

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APPENDIX C: GLOSSARY OF ABBREVIATIONS and ACRONYMS

ABWC	Alaska Beluga Whale Committee
ADFG	Alaska Department of Fish and Game
AFSC	Alaska Fisheries Science Center
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
BSPA	Beaufort Sea Planning Area
BWASP	Bowhead Whale Aerial Survey Project
CI	confidence interval
CSPA	Chukchi Sea Planning Area
e.g.	for example
ENVISAT	Environmental Satellite
ESA	Endangered Species Act
FR	Federal Register
GPS	Global Positioning 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
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
Min	minimum
MODIS	Moderate Resolution Imaging Spectroradiometer
n	sample size
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
nm	nautical mile
NSB	North Slope Borough
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
P	probability
PMEL	Pacific Marine Environmental Laboratory
s	second
SAIC	Science Applications International Corporation
SD	standard deviation
SPUE	sightings per unit effort (sighting rate)
TrSi	transect sightings
USC	U.S. Code

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
WPUE	whales per unit effort (index of relative abundance or occurrence)

APPENDIX D: PUBLICATIONS, POSTERS, and PRESENTATIONS FROM ASAMM, 2008-2013, and MEDIA OUTREACH FROM ASAMM 2012

2008

Clarke, J.T., 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: Alaska Marine Science Symposium, Anchorage, AK, January 2009.

Clarke, J.T., 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.T. 2008. Monitoring the Distribution of Arctic Whales. Presentation: 11th MMS Information Transfer Meeting, Anchorage, AK, October 2008.

Clarke, J.T. 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.

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

2009

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

Clarke, J.T. 2009. Chukchi Offshore Monitoring in Drilling Area, 2008. Report: Prepared for NMML-NMFS and MMS-Alaska. 15 pp.

Clarke, J.T. 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.

Ferguson, M.C., R.P. Angliss, D.J. Rugh, J. Mocklin, and L. Vate Brattström. 2009. Comparison of UASs and manned aircraft for surveying bowhead whale distribution and density. Presentation: workshop *Using Unmanned Aircraft Systems to Study Marine Mammals and Other Wildlife Species*, Quebec City, Canada, October, 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.T. 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.T. and M.C. 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.T. and M.C. 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.T., 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.C. and R.P. Angliss. 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.T., C.L. 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.T., C.L. Christman, S.L. Grassia, A.A. Brower and M.C. 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.T., M.C. Ferguson, C.L. Christman, S.L. Grassia, A.A. Brower and L.J. 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.P., C.J. Ashjian, R.G. Campbell, J.T. Clarke, S.E. Moore and K.D. 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.

Brower, A.A., M.C. Ferguson and J.T. Clarke. *In prep*. Gray whale distribution in the northeastern Chukchi Sea, 2008-2010, with comparison to historical data.

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.L., J.J. Citta, L.T. Quakenbush, J.T. Clarke, B.K. Rone, R.A. Shea, M.C. Ferguson and M.P. Heide-Jorgensen. *In prep*. Summer presence of bowhead whales (*Balaena mysticetus*) in the Alaskan Beaufort Sea: Using aerial surveys and satellite telemetry as complementary tools.

Christman, C.L., M.C. Ferguson, J.T. Clarke and A.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.T. and M.C. Ferguson. *In prep*. Distribution and sighting rates of large whales in the northeastern Chukchi Sea before (1982-1991) and after (2008-2010) a 17-year gap.

Clarke, J.T., C.L. Christman, A.A. Brower and M.C. 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.C. and J.T. Clarke. *In prep*. Detecting spatial variability in the autumn migration of the Bering-Chukchi-Beaufort stock of bowhead whales across the Alaskan Beaufort Sea.

Ferguson, M.C. and J.T. 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.

Ferguson, M.C. 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., 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.

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., 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.

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.M., S.R. Okkonen, and J.T. 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.

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
UNITED STATES DEPARTMENT OF COMMERCE

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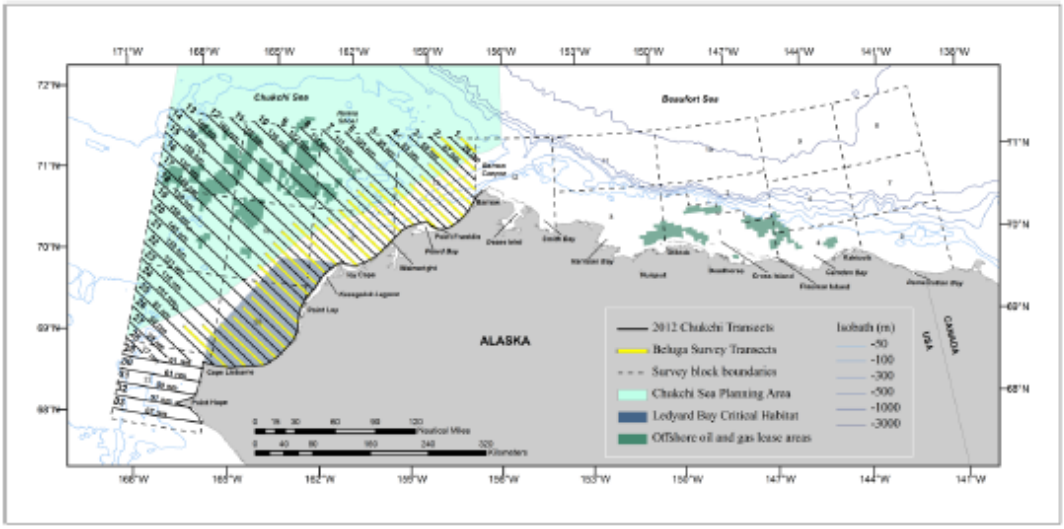
FOR IMMEDIATE RELEASE
August 2, 2012

NOAA's aerial surveys of arctic marine mammals: No one flies where these scientists fly
Unprecedented numbers of gray whale calves sighted by scientists so far this season



NOAA scientists participating in the annual Aerial Surveys of Arctic Marine Mammals (ASAMM) project say they have seen an unprecedented number of gray whale calves so far this year.

More than 50 calves have been sighted in just the first month of the survey. Even though some of the calves are undoubtedly repeat sightings, the total number is far higher than normal.

The ASAMM project kicked off about a month ago from Barrow, Alaska, with additional effort based out of Deadhorse beginning mid-July. It covers a massive study area in the Alaskan Chukchi and Beaufort seas.

The goal of the surveys is to document the distribution and relative abundance of bowhead, gray, right, and fin whales, belugas, and other marine mammals in areas of potential oil and natural gas exploration, development, and production activities in the Alaskan Arctic. The research is funded by the Bureau of Ocean Energy Management (BOEM).

NOAA scientists from the Alaska Fisheries Science Center's National Marine Mammal Laboratory will be conducting almost daily flights through October, weather permitting. Survey conditions are sometimes less than optimal in the Arctic but, despite the usual episodes of fog and low cloud ceilings, the survey teams have had much success so far and excellent data have been collected.

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Gray whale baby boom is noted in Alaska and California

57 cow-calf pairs are reported between July 1 and July 26.

By MIKE DUNHAM

(08/02/12 21:38:16)

A gray whale baby boom appears to be under way along Alaska's arctic coast. Scientists tracking marine mammals in the Chukchi Sea report an unprecedented number of sightings of gray whale calves in July.

The biggest number previously counted was 18, reported in 1982 and 2011. Those tallies were for the full season, which runs from late June/early July until October. But 57 cow-calf pairs were recorded between July 1 and July 26 this year, according to the federal Alaska Fisheries Science Center.

"There's the potential that some of those are repeat sightings," said Megan Ferguson, project coordinator for the Aerial Surveys of Arctic Marine Mammals Project in a phone interview from Barrow. "But the fact that we're seeing a five-fold increase makes me think that it is a real increase."

Wayne Perryman, a researcher with the federal Southwestern Fisheries Science Center in La Jolla, Calif, said California numbers for young gray whales are also high.

"This was a big calf count year," he wrote in an email, "(with an) estimate of about 1,000 calves, so there should be a lot of them everywhere."

The grays make seasonal trips from the Chukchi Sea to Mexico. Their well-documented travels make them a popular attraction for whale spotters who hit tour boats from Baja to Alaska when migrations take place.

Julie Speegle, a spokesman for the National Oceanic and Atmospheric Administration in Alaska, cited agency estimates that put the entire Eastern North Pacific gray whale population at between 18,000-21,000 animals. Adults are about 45 feet long and weigh 35 tons; babies are born weighing just 1,100 pounds and stretching 15 feet.

The Atlantic population was wiped out hundreds of years ago, Ferguson said. But the Pacific grays are no longer classified as endangered.

Data for previous sightings in the Chukchi Sea was collected between 1982 and 1991 and then ended. No calves were spotted in 1991 and only one was seen when surveys resumed in 2008. Ten were seen the following year and none in 2010. Ferguson noted that in the 1982-91 survey period, the whales were consistently seen in both coastal and offshore shoal areas. However, she said, "Since we started again, we still see them in the coastal areas but not in the shoal areas."

The calves and their mothers were all found within 30 to 40 nautical miles of the Alaska coast between Barrow and Point Lay, about 200 miles southwest. "That's where we typically find the cow-calf pairs," Ferguson said. "It's extremely rare that we see a gray whale east of Point Barrow."

Data in Alaska has not been collected for the past week because researchers have been stuck on the ground due to bad weather.

Reach Mike Dunham at mdunham@adn.com or 257-4332.

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Anchorage Daily News

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Large groups of orcas sighted in Arctic Ocean off Alaska

Presence of killer whales is unusual, not unprecedented

By DAN JOLING

(09/11/12 09:43:53)

Scientists counting marine mammals off Alaska's Arctic Ocean coast spotted two large groups of killer whales last month, but orca experts are not ready to say the species has increased its numbers in the Beaufort and Chukchi seas.

On Aug. 20 an aerial survey crew spotted 13 killer whales about 6 miles northeast of Barrow, America's northernmost community. The flight was part of a bowhead whale survey sponsored by the National Marine Fisheries Service, the Bureau of Ocean Energy Management and other federal agencies.

Five days later, crew members aboard the Westward Wind, a vessel in the Chukchi Sea Environmental Studies Program, which is conducting research on behalf of oil companies, spotted 25 to 30 orcas near Hanna Shoal, a shallow-water area northwest of Barrow.

The presence of killer whales in Arctic waters is unusual but not unprecedented. Research biologist Paul Wade of the National Marine Mammal Laboratory said he has no indication from published reports or anecdotal evidence that more orcas are spending time north of the Bering Strait. Russian scientists have reported them on their side of the Chukchi Sea, attacking gray whale calves. That could be why the surveys are seeing them in Alaska, he said.

"If there are more killer whales up in the Arctic, it's because they're following prey," he said.

Biologist Craig George of the North Slope Borough wildlife department, who has written research papers on killer whales in the Arctic, said Native Alaska seal hunters see orcas every summer but they're rarely spotted by aerial surveys. The main reason, he said, is that there are hundreds of hunters and few aerial surveys.

There are hints of more sightings but nothing scientifically defensible that he's aware of, he said.

Killer whales occasionally kill calves of bowhead whales, the same species targeted by Native whalers but competition is not a worry for whalers.

"We are more concerned about line entanglement in commercial fishing gear and ship strikes from commercial fishing," he said. "However, regarding other whales, we are somewhat concerned about competition from gray and humpback whales moving into bowhead whale feeding areas. The former are much more aggressive and efficient feeders in areas with high prey densities."

Lisanne Aerts, principal researcher for the Chukchi survey, said by email the killer whales were cruising close to the pack ice edge. Killer whales have been spotted before, she said, but never such a high number or that far north.

Brendan Cummings of the Center for Biological Diversity, which has sued to prevent Arctic offshore drilling, said killer whales in the Arctic are another sign of a reshuffled ecosystem.

"One concern is that ice-adapted species such as beluga and bowhead whales are shielded from killer whale predation by the ice, but in an increasingly ice-free Arctic these species will have a new predator to contend with," he said.

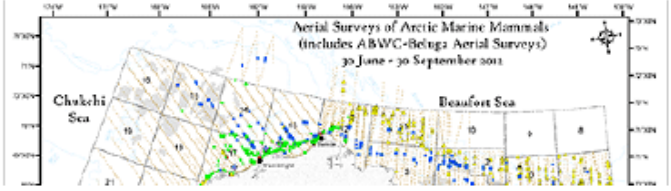
Cetacean Assessment and Ecology Program

Aerial Surveys of Arctic Marine Mammals Project: Preliminary Results from the 2012 Field Season

The Aerial Surveys of Arctic Marine Mammals (ASAMM) project is the successor to the Bowhead Whale Aerial Survey Project (BWASP) and the Chukchi Offshore Monitoring in Drilling Area (COMIDA) marine mammal aerial surveys. BWASP started in the late 1970s surveying the Beaufort and Chukchi Seas and has continued uninterrupted since; surveys in the Chukchi Sea were conducted as part of BWASP from 1979 to 1991 and as part of COMIDA from 2008 to 2010. The ASAMM project is conducted by the National Marine Mammal Laboratory (NMML), funded by the Bureau of Ocean Energy Management (BOEM), and permitted through the National Marine Fisheries Service (NFMS) and the U.S. Fish and Wildlife Service. Daily reports from the 2012 field season as well as previous years' reports are available on the NMML website.

The lengthened open-water season and reduced sea-ice coverage in summer and fall in the Arctic foretell increased human activities in this region, including shipping, fishing, recreation, and oil and gas exploration, development, and production. In order to minimize and mitigate the effects of anthropogenic activities on arctic marine mammals, information on marine mammal ecology is needed for all seasons in which activities could occur. ASAMM is the only project providing broad-scale visual information about the distribution, relative abundance, and behavior of marine mammals in the Alaskan Arctic during summer and fall including, but not limited to, regions of interest to the oil and gas industry.

The objectives of the ASAMM study are to 1) describe the annual migration of Western Arctic bowhead whales across the Alaskan Arctic, including 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 emphasis on endangered species, such as bowhead whales; 4) provide an objective, wide-area context for understanding

Researchers Describe 'Jaw-Dropping' Whale Survey Near Point Hope

By Annie Feidt, APRN - Anchorage | November 26, 2012 - 5:24 pm

Fin whale lunge feeding. Photo by Allison Henry NOAA/NMFS/AFSC/NMML

On September 11th of this year, low clouds covered the sky around Barrow. The whale observing team stationed there couldn't fly their preferred route over active oil leases nearby. But the weather was better in the Southern Chukchi Sea, near Point Hope, so they decided to go there instead. Research Biologist Janet Clarke, a contractor with the National Oceanic and Atmospheric Administration, was managing the team:

> "At the beginning of the day when our team was getting ready to do those surveys, in the back of my mind I'm thinking, 'wow, I sure hope they find some gray whales down there,' because that's what we've seen in that area before."

The team didn't find any gray whales. Clarke was shocked. But then they started listing what they had seen:

> "On that one flight we saw fin whales, 24 humpback whales, 5 killer whales and one minke whale. Reporter: So did your jaw kind of drop when you heard that? Clarke: yes, I would say that it did."

Killer whales have never been seen before in the previous three decades of the survey. Fin whales and humpback whales have been documented just once. Minke whales, only a handful of times.

> "Just the number and the diversity of species that were seen - it was just one after another after another."

The Aerial Surveys of Arctic Marine Mammals project runs from July through October, with teams based in Deadhorse and Barrow. September 11th was a standout day for the survey. But the teams documented subarctic species on a handful of other flights as well. Megan Ferguson is a marine ecologist with NOAA and is Project Coordinator for the survey. She says it's notable that several of the subarctic species were seen feeding in the Chukchi sea:

> "That means that they're using the resource. They're getting nutrition from the environment in that area."

And Ferguson says it was also surprising to see some calves. It's more evidence that the arctic waters are being used as habitat:

> "It means it is not just the adults, who are more bushy in coming up there. They're taking their kids up there. So it leads me to think there's a reason they're coming farther north."

All of the subarctic species were seen in the Chukchi Sea. Janet Clarke says it's difficult to speculate why so many different whale species are spending more time in that area. But she says the massive arctic ice retreat is likely playing a role. It is transforming the ocean. And she says it has scientists talking about a "new normal" for the arctic.

> "One thing that is just stunning is how different every year is. Things that we used to be able to predict and go, of course it's going to be that-it's not that any more. So it is really kind of this new normal that's going on in the arctic in general."

The annual whale survey is funded by the Bureau of Ocean Energy Management. And the survey encompasses the area the federal government has already leased to oil companies or is planning to offer for drilling in future years. Clarke says they did see Shell's drill rigs this summer and some whales nearby. She says the annual aerial survey isn't a good way to observe immediate impacts to whales from oil drilling. But the survey will be one tool to help assess the overall affects of drilling on marine mammals.

The Arctic Sounder

Chukchi Sea whale sightings wow researchers

December 14th 2:10 pm | **Hannah Heimbuch**

On the morning of Sept. 11, National Oceanic and Atmospheric Administration scientists took off from Barrow - eyes peeled for whales.

And the Chukchi Sea didn't disappoint.

In fact, during their 6.5-hour flight to Kotzebue and back, the survey team saw more marine mammals than they could have ever predicted.

It was the variety of whale species and unique sightings in a single day of observation that was cause for surprise, said NOAA research fisheries biologist Megan Ferguson.

The Sept. 11 crew was flying the western study area for this 32-year-old standard species survey. The eastern area reaches from Barrow to the U.S.-Canada border, while the other stretches west from Barrow to the U.S.-Russia border.

They can typically expect to spot gray whales off the coast of Point Hope, and up to 30 miles offshore.

"That's been kind of a gray whale hot spot ever since the early years of the survey," Ferguson said. "They ended up not seeing gray whales. What they saw was quite a diversity of what we call sub-Arctic species."

Those sub-Arctic species are animals that don't have a regular route through the Arctic - like gray, bowhead or beluga whales.

Over the course of the day, the crew saw 25 humpback whales, two bowhead whales, five fin whales, one minke whale, five killer whales and one unidentified cetacean.

It's not that these whales have never been seen in the northeast Chukchi, Ferguson said. She and other NOAA researchers are well aware that Arctic residents have spotted these species before, and that local knowledge tells us it's not unheard of. What makes it unique is that they were spotted, in impressive numbers, on a regulated survey.

That implies that these critters are making more than rare visits to the far north.

"Our surveys are standardized and systematic," Ferguson said. "So they're a good monitoring tool. They're a way to see if things are changing."

Change indeed

In the entire history of the survey there's only been one sighting of a fin whale, Ferguson said. That was spotted in July of 2008.

In July of 2009, a crew saw the only humpback whale in the three decades of surveying - making the 25 seen this fall even more jaw-dropping.

Minke whales have just appeared on the study's radar in the last two years - one in 2011 and one this year.

This year was the first year for killer whale sightings by a crew. The first one was in late August near Point Barrow. Killer whales have been seen by local residents before, and their communication has been picked up with acoustic equipment. However, it's still a noteworthy first for this survey - especially considering the kids.

Both the fin whale and killer whale pods had calves with them. What this told the observers, Ferguson said, was that the whales' trek to Arctic water was more than a fluke. If they were traveling that far north with young, that meant they were chasing a reliable food source - an indication of changing patterns.

"It's not just the adults going up and forging new territory, (it's) also the younger, potentially more vulnerable," Ferguson said.

Why the long journey

Behavior backed up that hypothesis, Ferguson said, as the fin and humpback whales were seen feeding.

"We suspect that it's a sign that the diversity of cetaceans in our study area is increasing," she said. "The fact that they were feeding leads us to believe that maybe there's a different prey base moving up."

Arctic water masses begin in the northern Bering Sea and follow the coastal current north, Ferguson said. It's possible that shifts in those waters and currents are bringing new prey sources north, which predators are following.

What it means for the future

"One potential implication of that is," Ferguson said, "when you're talking about looking ahead and doing spatial planning - like for shipping routes - it looks like the managers will have to consider a new collection of species that they wouldn't have had to consider in the past."

That's part of the reason these surveys are conducted - to provide industry and administrative management with the scientific data they need for

NOAA Fisheries Service
Northeast Fisheries Science Center
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NEWSROOM

October 22, 2012
by Shelley Dawicki

NOAA Northeast Aerial Marine Mammal Team Flies Alaskan Skies

Three members of the NEFSC'S marine mammal aerial survey team have been in Alaska assisting colleagues at the Alaska Fisheries Science Center with the annual Aerial Surveys of Arctic Marine Mammals (ASAMM) project.

Coordinated by the Alaska Fisheries Science Center's National Marine Mammal Laboratory and funded by the Bureau of Ocean Energy Management (BOEM), the project began in early July and is based out of Barrow, the nation's northernmost community, with additional effort based at Deadhorse, both located on Alaska's North Slope along the Arctic Sea shore.

Weather permitting, daily aerial survey flights commenced in July and are running through October. The survey is documenting distribution and relative abundance of bowhead, gray, right and fin whales, belugas, and other marine mammals in areas of potential oil and gas exploration, development, and production.

The study is similar to the Atlantic Marine Assessment Program for Protected Species (AMAPPS) in the North Atlantic. The NEFSC aerial survey team and other Center staff have been involved in that project as well, and have worked with many of their colleagues in Alaska before.

Click on photo to launch slide show

Humpback whales sighted approximately 90 kilometers (56 miles) west of Pt. Hope, Alaska on September 11, 2012. Point Hope, on the Chukchi Sea coast in northwest Alaska, is 330 miles southwest of Barrow. Photo by Allison Henry, NEFSC (NOAA/NMFS/AFSC/NMML, NMFS Permit No. 14245, Funded by BOEM, IA Contract No. M11PG00033)

Related Links:

- Get more information about the Arctic marine mammal study
- Learn more about the NEFSC's aerial survey team

Allison Henry spent most of the month of September flying out of Barrow, but recently returned to the NEFSC's Woods Hole Laboratory. Pete Duley also worked with the team in Barrow in September and October, while Jen Gatzke has been flying out of Deadhorse some 200 miles away.

"I saw several species I'd never seen before, and flying over the ice floes is indescribable," said Henry, who saw polar bears, bowheads and walrus for the first time. "I got some amazing looks at all of them. I also saw gray whales and orcas for the first time from the air. It was a truly amazing experience!"

For Jennifer Gatzke, observing bowheads and gray whales feeding was something she had never witnessed before. "We are seeing many beluga whales in the Beaufort Sea, along with groups of small ice seals and some bearded seals," Gatzke said. "Along with a few swimming polar bears, we have observed large numbers of polar bears feeding at the whale boneyard on Cross and Barter Islands - so exciting! One of the most interesting experiences for me has been the cooperation between the ASAMM project and the Inupiat whaling groups."

For Pete Duley, flying out over the ice seeing polar bears and walrus was a highlight. "Always strikes me as strange to see bears 60 miles offshore," he said. "They truly are marine mammals. Everything is just so big out there, and the wilderness landscape goes on forever. It was hard to leave, even as the days were getting shorter and the snow was flying. It was a fantastic trip and a great opportunity."

For all three NEFSC researchers, working on this project has been an experience they will not soon forget.

North Slope Borough Department of Wildlife Management

FALL 2012

THE TOWLINE

VOL 4 NO 2

New and Interesting this Summer

The Arctic is changing rapidly. In 2012, the summer ice retreat was the greatest ever measured. Warmer temperatures and altered rainfall are causing other changes to the tundra, permafrost, vegetation and wildlife. As the Arctic continues to change, we expect to see different animals in places we haven't seen them before.

This summer we saw some unusual animals. We saw about 10 of these 2-inch long, beautiful "sea slugs" called nudibranchs (upper right) near the beach in Barrow. This animal has been seen in the Arctic but this is the first time seen near the beach.

Every year, unusual birds find their way to the North Slope. Just outside our office we saw two Rusty Blackbirds. We thank observers who alerted us to other blackbirds seen in town. This species usually nests in southern Alaska, Canada and the northern lower 48 and spends the winter even farther south.

MALE RUSTY BLACKBIRD AT NARL
PHOTO: LESLIE PIERCE

Several wash-ups of lots of small fish, capelin, occurred during the summer. Capelin spawn on the beach and many can be washed ashore during storms. Spawning capelin isn't a new thing in the Arctic but we are wondering if it is becoming more regular.

CAPELIN WASHED UP NEAR PLOVER PT
PHOTO: NICOLE KANAYURAK

Different whale species seem to be making their way to northern Alaska. An aerial survey crew saw killer whales in August. Even though hunters have been seeing them for many years, killer whales have now been documented by aerial surveys planes. This was the first killer whale sighting since surveys began more than 30 years ago, although they have been seeing humpback and fin whales regularly in the past several years. These whales are common in the Bering Sea but are becoming more common in northern Alaska.

NUDIBRANCH NEAR CHUKCHI SHORE
PHOTO: LESLIE PIERCE

The NSB-DWM is recording unusual sightings of animals on the North Slope. This will help us keep track of changes occurring in the Arctic. Please send us your sightings, especially photographs, or provide them to your NSB Fish and Game Management Committee representative.

KILLER WHALES SPOTTED IN BEAUFORT SEA BY NOAA/NMFS SURVEY CREW

North Slope Borough, Department of Wildlife Management, Alaska Beluga Whale Committee webpage,www.north-slope.org/departments/wildlife/ABWC.php#EasternChukchiSea

Aerial Surveys of Eastern Chukchi Sea Stock

Principal Investigators: Janet Clarke and Megan Ferguson (NOAA-NMFS), Robert Suydam (NSB), Bob Small and John Citta (ADF&G), Lloyd Lowry and Kathy Frost (ABWC), Jeff Denton (BOEM)
Collaborators: ABWC, NMFS-NMML, NSB, ADF&G
Funding: ABWC, NMFS-NMML, and BOEM

Participants:

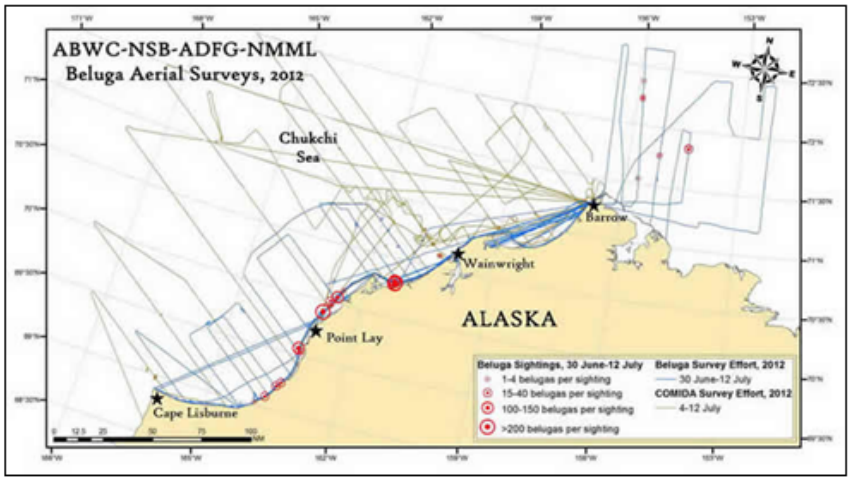
- NMFS Observers: Vicki Beaver, Elly Chmelnitsky, Cynthia Christman, Christy Sims, Dan Twyman (and several more)
- Clearwater Air pilots: Stan Churches, Andy Harcombe, Alex Shibakov, Baine Thorn, Jake Turner

Purpose: Through collaboration among the Alaska Beluga Whale Committee (ABWC), the North Slope Borough (NSB), the Alaska Department of Fish and Game (ADFG), and the National Marine Mammal Lab (NMFS), an aerial survey is being conducted to estimate the number of beluga whales in the Eastern Chukchi Stock.

The survey began on 30 June, and 9 flights totaling 35 flight hours and 8,300 kilometers were flown. The beluga surveys recorded 28 sightings of 1,445 belugas.

COMIDA aerial surveys, sponsored by BOEM, began 4 July, and seven flights totaling ~34 flight hours and ~8900 kilometers have been flown. The COMIDA program surveys all marine mammals and these surveys recorded 1 sighting of 1 beluga. COMIDA aerial surveys will continue through October 2012. Daily reports for COMIDA surveys are posted at http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_COMIDA.php.

The map below shows the survey tracks flown and the location of beluga sightings. More details on the flights and the sightings (including the ASAMM surveys of the Beaufort Sea) can be found below.



Methods: Used twin turbine, high wing aircraft at 1200 feet survey altitude. At least two dedicated observers and one data recorder were on board with the pilot(s). Collected data on all marine mammals seen on transects and circled in on beluga sightings to determine group size.

Gray Whale Calf Occurrence in the Alaskan Arctic, Summer and Fall 2012

Amelia Brower[1], Cynthia Christman[1], Janet Clarke[2], Megan Ferguson[1]

[1]National Marine Mammal Laboratory, Alaska Fisheries Science Center, NOAA, Seattle, WA, amelia.brower@noaa.gov

[2]Ocean Sciences Division, Science Applications International Corporation, Buckley, WA

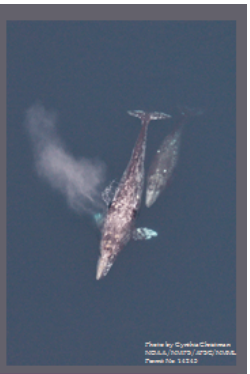


Photo by Cynthia Christman NMML, NOAA/ AFSC/NMML Permit No. 14245

Abstract

Marine mammal surveys were conducted in the northeastern Chukchi and western Beaufort seas (68-72ºN and 140-169ºW) from July to late October, 2012, as part of the Aerial Surveys of Arctic Marine Mammals project conducted by the National Marine Mammal Laboratory and funded by the Bureau of Ocean Energy Management. Additional surveys, sponsored by the Alaska Beluga Whale Committee (ABWC), were flown in early July up to 45 nm offshore in the northeastern Chukchi Sea to target beluga. Surveys were conducted in the larger study area from 1982 to 1991, and recommenced in 2008. Gray whale (*Eschrichtius robustus*) calves were sighted with far greater frequency in the Chukchi Sea in 2012; total numbers are far higher than gray whale calf sightings recorded in previous years, which were highest in the years 1982, 1985, 2009, and 2011. Gray whale calves in 2012 were particularly abundant in the month of July (n=87) few calves were seen in August, September or October, similar to previous years. Distribution of calves was also similar to previous years primarily nearshore along the Alaskan coast from Point Lay to just east of Barrow, with particularly high numbers near Point Franklin and in ice-free, shallow water (<50 m). This area is an important foraging ground for gray whales, feeding was the dominant behavior documented in this area throughout the survey years. It is possible that these shallow waters provide protection from predators, killer whales were sighted in multiple locations in the Chukchi Sea in 2012. In gray whale calf counts conducted along the California coast by the Southwest Fisheries Science Center during the annual northern migration, calf counts were also high in 2012 when compared to previous years' counts. It is possible that conditions were favorable for foraging in 2010 and 2011 and many females were able to accumulate sufficient energy reserves to conceive in 2011 and give birth in 2012. Another possibility is that other habitats where gray whale cow-calf pairs have been documented in the past, such as just west of Point Hope and along the Chukotka Peninsula, may not have been as favorable to cow-calf pairs in 2012.

Methods and Survey Effort

Transect flightlines of the study area lie perpendicular to the coastline, cutting across isobaths, prevailing currents, and expected gradients in marine mammal density. ASAMM flightlines in the Chukchi Sea (157ºW-169ºW) extended offshore to the study area borders, and the beluga survey flightlines extended 45 nm out from the coastline. A coastal transect between Point Barrow and Point Hope was regularly flown 1 km offshore and parallel to the coast. Flightlines for the Beaufort Sea portion of the study area (140ºW-157ºW) were flown along transect lines that were roughly north-south.

Survey effort was designated as "on-effort" (transect), "off-effort" (search and circling), or dashed. Circling effort was incorporated into the survey design in 2009. Gray whale calf sighting rates include only on-effort sightings, and include the Chukchi Sea portion of the study area and block 12 of the Beaufort Sea study area. Sighting rates (whales per unit effort, WPUE) were calculated for gray whale calves as the number of calves per transect kilometer (Tr-km) surveyed per month. On- and off-effort sightings are included in the analyses of gray whale calf distribution, habitat, and behavior.

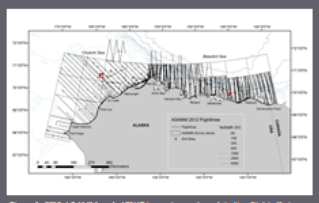


Figure 1. 2012 ASAMM and ABWC transect, search, and circling flight effort.

Surveys were conducted in twin turbine Aero Commander aircraft at a targeted altitude of 1200 ft (366 m) in the Chukchi Sea and 1500 ft (457 m) in the Beaufort Sea, and a speed of 110 kts (204 km/h). From 30 June to 28 October, 132 survey flights were initiated for a total of approximately 68,000 km flown on- and off-survey effort (Fig.1), 56,000 km were on transect. Of these, over 28,000 transect km were in the Chukchi Sea.

Survey effort in 2012 exceeded previous years' survey effort, in part because the Beaufort Sea surveys began in mid-July instead of August or September, and in part due to the additional survey effort of the beluga surveys, which increased survey coverage in the northeastern Chukchi Sea and the western Beaufort Sea in the first half of July. In 2012, more circling on cetacean sightings was initiated in an attempt to more accurately estimate group size and determine whether calves were present. About 12% of the total non-dashed survey time in 2012 was spent on circling compared with 5% in 2011.

Sighting Summary

- There were 310 sightings of 558 gray whales on- and off-effort in the study area, 67 of these individuals were calves (Fig.2). When transect-only sightings were considered, there were 132 sightings of 232 gray whales on-effort in the study area, 39 of these individuals were calves. Some of these sightings were likely of the same calf on multiple days.

- Gray whale sightings spanned all months surveyed, but calves were only sighted in July and August. The month with the highest total number of gray whales sighted was July, which was also true for gray whale calves: 87 calves were sighted in July; 10 calves were sighted in August.

- There were more sightings of gray whale calves in 2012 than in previous survey years (Table 1). Prior to 2012, the years with the greatest number of calf sightings were 1982 and 2011, with 18 calves each year.

- In 2012, 43% of calves were sighted once circling was initiated, compared to 22% in 2011.

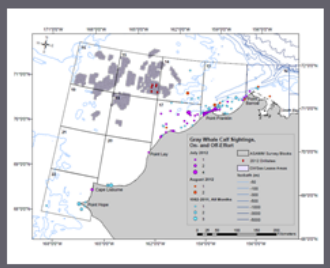


Figure 2. 2012 gray whale calf sightings on- and off-effort per month, and 1982-2011 calf sightings, all months shown.

Sighting Distribution and Habitat

- Gray whale calf sightings in 2012 ranged from east of Barrow to Point Lay, and one sighting south of Cape Lisburne. The majority of calf sightings were <15 km from shore and in waters <50 m depth, with scattered sightings out to 68 km from shore and in water up to 112 m in depth.

- In July, 22 calves were sighted in 1-80% broken floe sea ice; in August, 2 calves were sighted in 15% broken floe sea ice.

- Distribution of gray whale calves was similar to non-calves.

- The distribution of calves in 2012 was similar to gray whale calf distribution in previous years, with the exception that in previous years gray whale calves have been sighted nearshore by Point Hope and one calf was sighted offshore west of Point Hope.

Table 1. Gray whale calf sighting numbers per month for each survey year.

Year	June	July	August	September	October	Total
1982	0	15	0	0	0	15
1983	0	0	1	0	0	1
1984	0	0	0	0	0	0
1985	0	15	0	0	0	15
1986	0	0	0	1	0	1
1987	0	0	0	1	0	1
1988	0	0	0	0	0	0
1989	0	0	0	1	0	1
1990	0	0	0	0	0	0
1991	0	0	0	0	0	0
2008	0	0	1	0	0	1
2009	0	10	0	0	0	10
2010	0	0	0	0	0	0
2011	5	5	4	1	0	15
2012	0	87	10	0	0	97
Total	5	132	16	4	0	155

Transect Sighting Rates per Year

- When transect-only gray whale calf sighting rates were compared to past years' transect-only gray whale calf sighting rates, the results were significantly higher in 2012 (Table 2). This suggests that despite the additional survey effort and increased circling in 2012, the higher gray whale calf sighting rates signify there were more calves in the northeastern Chukchi Sea in 2012. During the gray whale annual northern migration from February to May, 2012, the Southwest Fisheries Science Center (SWFSC) also had relatively high gray whale calf counts when compared to previous years' counts, which have been conducted since 1994 (see the SWFSC's Gray Whale Studies – Calf Production website at http://swfsc.noaa.gov/textblock.aspx?Division=PRD&ParentMenuId=211&id=16464).

- When annual calf sighting rates are compared with annual total gray whale sighting rates, 2012 has a higher portion of calves (17%) compared with other years that had on-effort calf sightings (1985: 6%, 2009: 2%, 2011: 6%).

- In all years surveyed, July has consistently been the month with the highest gray whale calf sighting rates. Therefore, the continuation of broad-scale aerial surveys in the northeastern Chukchi Sea in July is imperative to assess the importance of this area to gray whale calves.

Table 2. Gray whale calf transect sightings (n = number of calves) and sighting rate (WPUE) of transect km (Tr-km) flown per month per year.

	June			July			August			September			October			Total		
Year	Tr-km	n	WPUE	Tr-km	n	WPUE	Tr-km	n	WPUE	Tr-km	n	WPUE	Tr-km	n	WPUE	Tr-km	n	WPUE
1982	0	0	0.0000	0	0	0.0000	0	0	0.0000	696	0	0.0000	4985	0	0.0000	5681	0	0.0000
1983	0	0	0.0000	0	0	0.0000	879	0	0.0000	2448	0	0.0000	6628	0	0.0000	9955	0	0.0000
1984	0	0	0.0000	2005	0	0.0000	1957	0	0.0000	2025	0	0.0000	3601	0	0.0000	9586	0	0.0000
1985	0	0	0.0000	5359	9	0.0026	0	0	0.0000	536	0	0.0000	3694	0	0.0000	9588	9	0.0009
1986	0	0	0.0000	0	0	0.0000	0	0	0.0000	6413	0	0.0000	6336	0	0.0000	12749	0	0.0000
1987	0	0	0.0000	0	0	0.0000	0	0	0.0000	10047	0	0.0000	4178	0	0.0000	14225	0	0.0000
1988	0	0	0.0000	0	0	0.0000	0	0	0.0000	0	0	0.0000	3991	0	0.0000	3991	0	0.0000
1989	0	0	0.0000	0	0	0.0000	0	0	0.0000	1475	0	0.0000	6143	0	0.0000	7618	0	0.0000
1990	0	0	0.0000	0	0	0.0000	0	0	0.0000	0	0	0.0000	1940	0	0.0000	1940	0	0.0000
1991	0	0	0.0000	0	0	0.0000	0	0	0.0000	2185	0	0.0000	8700	0	0.0000	10885	0	0.0000
2008	2787	0	0.0000	901	0	0.0000	5458	0	0.0000	545	0	0.0000	3684	0	0.0000	13375	0	0.0000
2009	1205	0	0.0000	5179	9	0.0026	3756	0	0.0000	6925	0	0.0000	5377	0	0.0000	22442	9	0.0001
2010	0	0	0.0000	7367	0	0.0000	4162	0	0.0000	4728	0	0.0000	3944	0	0.0000	20077	0	0.0000
2011	4121	1	0.0002	4979	5	0.0010	7139	4	0.0006	9748	1	0.0001	2983	0	0.0000	29215	11	0.0004
2012	423	0	0.0000	9996	87	0.0087	6541	3	0.0005	9514	0	0.0000	7605	0	0.0000	33518	90	0.0013

Acknowledgments

This study is funded by the Bureau of Ocean Energy Management and was supported by Jeffery Denton (BOEM COR) and Dr. Charles Monnett. At NMML, additional support was provided by Phil Clapham, Stefan Ball, and administrative and travel personnel. In addition to the authors, our outstanding team leaders in 2012 included Amy Kennedy, Brenda Rone, Rebecca Shea, and Christy Sims. Our dedicated field observers included: Corey Accardo, Lisa Barry, Vicki Beaver, Jessica Crance, Pete Duley, Heather Foley, Jennifer Gatzke, Stephanie Grassia, Allison Harvey, Luciana Santos, Jessica Thompson, Dan Twyman, Karen Vale, and Linda Vate Brattstrom. Clearwater Air, Inc and pilots Andy Harcombe, Stan Churches, Beine Thorn, Jim Kopczynski, Alex Shibakov, and Jake Turner kept us in the skies. Real-time flight following via satellite link was provided by Department of Interior personnel Jan Bennett and Lark Wuerth. Programming support was provided by Mike Hay (Kara GIS). Our sincerest thanks to all!

Aerial sightings of Pacific walruses (*Odobenus rosmarus divergens*) in the Alaskan Arctic, summer and fall 2012, with a comparison to sightings from 2009-2011

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Abstract

Marine mammal aerial surveys were conducted in the Alaskan Arctic from summer through fall 2012, as part of the ongoing Aerial Surveys of Arctic Marine Mammals (ASAMM) project, funded by the Bureau of Ocean Energy Management. Additional aerial surveys, funded by the Alaska Beluga Whale Committee, were conducted in July to assess the eastern Chukchi Sea stock of belugas. The primary study area encompassed the western Beaufort and northeastern Chukchi seas (68°N -72°N, 140°W-169°W), extending from the coast to a maximum of approximately 315 km offshore. A secondary survey area in the Chukchi Sea, located north of the primary study area (72°N -73°N, 160°W-163°W), was also flown. In 2012, Pacific walruses were primarily encountered in the northeastern Chukchi Sea, with few sightings in the western Beaufort Sea. From early to mid-summer, walruses were distributed nearshore between Point Barrow and Cape Lisburne, and offshore between 153°W-167°W. By late summer and early fall, walruses were mainly in the northern extent of the study area in Barrow Canyon, between Icy Cape and Point Barrow, and in the vicinity of Hanna Shoal (72°N, 162°W). Walruses were either in the water or hauled out on sea ice; none were observed hauled out on land along the northern Alaskan coastline. Pacific walruses were observed in the northeastern Chukchi Sea in the summer and fall of 2009-2011, and large walrus haulouts on land were encountered by either mid-August (2011) or early September (2009, 2010). Sea ice was absent in, and north of, the study area by late summer in 2009-2011, likely resulting in walrus movement closer to shore and, consequently, in the formation of large walrus aggregations on land. In 2012, despite sea ice receding to a record minimum extent, diffuse ice floes persisted in the northern part of the study area near Hanna Shoal. The persistence of sea ice remnants near Hanna Shoal throughout the summer and fall in 2012 likely provided enough at-sea haulout space, making land haulouts unnecessary.

Methods

- Primary Study Area:
  Northeastern Chukchi & Western Beaufort Seas
  (68°N -72°N, 140°W-169°W)
- Study Period:
  30 Jun – 28 Oct 2012
- Survey Design:
  Line-transect
- Survey Platform:
  Twin Turbine Aero Commander
- Target Altitude:
  1200-1500 ft (366-457 m)
- Target Speed:
  110 kts (57 m/s)
- Crew:
  Two pilots, three scientists (two primary observers & one data recorder)

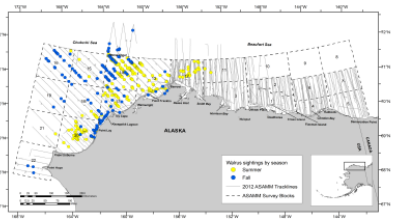

Figure 1 (left). Walrus sightings by season in 2012, overlaid on transect, search, and circling tracklines. Seasons are defined as Summer (Jun-Aug) and Fall (Sep-Nov).

2012 Results

- Total Effort:
  140,340 km flown over 549 hrs
- Transect Effort:
  56,007 km flown over 264 hrs
- Walruses were observed in all months of the study period (Jun-Oct), with the majority sighted in summer (Jul-Aug) (Figure 1).
- Most walruses were observed in the northeastern Chukchi Sea; few (28 sightings/923 individuals from transect, search, and circling effort) were in the western Beaufort Sea.
- Including sightings from transect, search, and circling effort, 475 walrus sightings of 12,897 individuals were observed (Table 1 shows daily totals).
- Walruses were observed in the water in all months (Jun-Oct) and hauled out on sea ice in summer and early fall (Jun-Sep). Behaviors included swimming, milling, diving, and resting.
- No walrus haulouts on the northwestern Alaskan coastline were observed in 2012.

Species	Project	Date	No. Animals Observed
Or	ASAMM	30-Jun-2012	573
Or	ASAMM	1-Jul-2012	90
Or	ASAMM	2-Jul-2012	222
Or	ASAMM	4-Jul-2012	8
Or	ASAMM	5-Jul-2012	633
Or	ASAMM	6-Jul-2012	527
Or	ASAMM	8-Jul-2012	48
Or	ASAMM	10-Jul-2012	61
Or	ASAMM	11-Jul-2012	35
Or	ASAMM	12-Jul-2012	178
Or	ASAMM	13-Jul-2012	4133
Or	ASAMM	14-Jul-2012	213
Or	ASAMM	19-Jul-2012	1
Or	ASAMM	21-Jul-2012	6
Or	ASAMM	22-Jul-2012	221
Or	ASAMM	23-Jul-2012	1
Or	ASAMM	25-Jul-2012	7
Or	ASAMM	26-Jul-2012	3
Or	ASAMM	28-Jul-2012	28
Or	ASAMM	6-Aug-2012	261
Or	ASAMM	11-Aug-2012	262
Or	ASAMM	13-Aug-2012	28
Or	ASAMM	14-Aug-2012	385
Or	ASAMM	16-Aug-2012	47
Or	ASAMM	18-Aug-2012	743
Or	ASAMM	20-Aug-2012	634
Or	ASAMM	21-Aug-2012	1798
Or	ASAMM	25-Aug-2012	1*
Or	ASAMM	29-Aug-2012	262
Or	ASAMM	3-Sep-2012	50
Or	ASAMM	8-Sep-2012	9
Or	ASAMM	10-Sep-2012	1657
Or	ASAMM	13-Sep-2012	1*
Or	ASAMM	14-Sep-2012	103
Or	ASAMM	15-Sep-2012	3
Or	ASAMM	18-Sep-2012	20
Or	ASAMM	19-Sep-2012	21
Or	ASAMM	24-Sep-2012	1*
Or	ASAMM	26-Sep-2012	41*
Or	ASAMM	29-Sep-2012	54
Or	ASAMM	1-Oct-2012	3
Or	ASAMM	2-Oct-2012	22*
Or	ASAMM	5-Oct-2012	4
Or	ASAMM	6-Oct-2012	16
Or	ASAMM	10-Oct-2012	5
Or	ASAMM	11-Oct-2012	4
Or	TOTAL		12897

*Includes one sighting of one walrus carcass.

Table 1 (above). Daily summary of walrus sightings from transect, search, and circling effort in 2012. Numbers combine all walruses sighted on the date specified and may include sightings made at multiple locations. Sightings that were known duplicates within the same day were excluded. Or=*Odobenus rosmarus*, ASAMM=Aerial Surveys of Arctic Marine Mammals

A comparison with 2009-2011

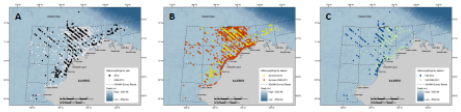

Figure 2 A-C (above). Walrus sighting distributions in 2009-2011 and 2012, depicted by year (A) and season (B-C). Seasons are defined as summer (Jun-Aug) and fall (Sep-Nov). All walrus sightings (excluding carcasses) regardless of survey mode are shown, including sightings made during transect, search, and circling effort. Walruses were similarly distributed in the northeastern Chukchi Sea in all years. In 2012, additional survey effort was conducted in the western Beaufort Sea offshore between Barrow and Smith Bay in summer and north of 72°N near Hanna Shoal in fall. Walrus sightings in those locations in 2012 are a result of the additional effort.

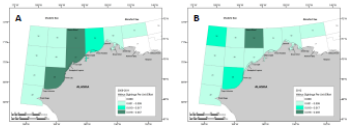

Figure 3 A-B (left). Walrus sightings corrected for survey effort. Sighting rates show number of walrus sightings per kilometer of effort flown in each survey block from 2009-2011 (A) and 2012 (B). Data were limited to walrus sightings made on transect (excluding repeats and carcasses) and kilometers of transect surveyed. In 2009-2011, blocks 14, 17, and 20 had the highest sighting rates (0.05, 0.04, and 0.02 respectively); in 2012, block 14 had the highest sighting rate (0.05).

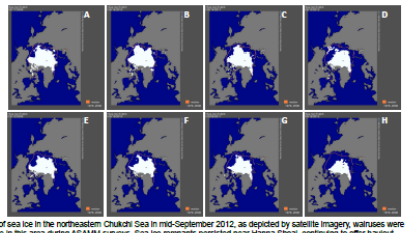

Figure 4 A-H (right). Sea ice extent reported by the National Snow and Ice Data Center in mid-August 2009-2012 (A-D) and mid-September 2009-2012 (E-H). Ice extent is derived from satellite imagery and areas with 15% or less ice coverage may be depicted as "ice-free". In mid-August 2012, a segment of sea ice is visible in the northeastern Chukchi Sea near the northwestern Alaskan coastline (D). In mid-September 2012 in the same area, no sea ice is visible (H).

Despite an apparent lack of sea ice in the northeastern Chukchi Sea in mid-September 2012, as depicted by satellite imagery, walruses were observed hauled out on ice in this area during ASAMM surveys. Sea ice remnants persisted near Hanna Shoal, continuing to offer haulout space over the continental shelf. It is likely that the ice provided enough at-sea haulout space, making land haulouts unnecessary, as no walrus aggregations on the northwestern Alaskan coastline were observed. This is in contrast to 2009-2011, when sea ice was not observed by the survey team in the ASAMM study area and coastal haulouts were observed by mid-August (2011) or early September (2009, 2010).

Acknowledgments

This project was funded by the Bureau of Ocean Energy Management (BOEM), with oversight provided by BOEM Contracting Officer Representative Jeffrey Denton. It has also been strongly supported by Dr. Charles Monnett. At NMML, we would like to thank Dr. Phillip Clapham and Kim Shelden for their contributions, as well as the administrative and travel personnel for assistance throughout the field season. The surveys would not have been possible without the help of Mike Hay (Xera GIS) for programming support; Clearwater Air, Inc., including pilots Andrew Harcombe, Stan Churches, Bahe Thom, Jacob Turner, Jim Kopczynski, and Alex Shibaikov for aircraft support; and Jan Bennett and Lark Wuerth (DOI) for providing real-time flight-following. Special thanks go to biologists Corey Accardo, Lisa Barry, Vicki Beaver, Elly Chmielnitsky, Jessica Crance, Peter Duley, Heather Foley, Jen Gabzke, Stephanie Grassia, Allison Henry, Amy Kennedy, Brenda Rone, Luciana Santos, Rebecca Shea, Christy Sims, Jessica Thompson, Dan Twyman, Karen Vale, and Linda Vate Brattström for collecting and managing data.

IT'S NOT JUST ABOUT BOWHEAD WHALES – COLLABORATIONS BETWEEN ASAMM AND OTHER RESEARCH

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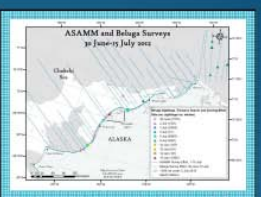
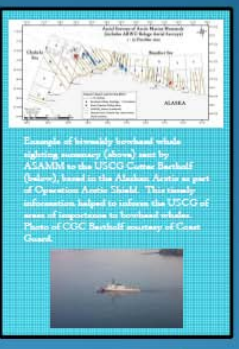
Partial list of Products (reports available at www.afsc.noaa.gov/nmml/cetacean/bwasp/publications.php)
Clarke, J. T., C. L. Christman, A. A. Brower, M. C. Ferguson and S. E. Grassia. 2011. Aerial Surveys of Bowhead Whales in the Alaskan Beaufort Sea, Fall 2010: Data Report. Report Prepared by the National Marine Mammal Laboratory (NMML) for the BOEMRE, OCS Study BOEMRE 2010-35.
Clarke, J. T., C. Christman, M. Ferguson and S. Grassia. 2011. Aerial surveys of marine mammals in the Beaufort Sea, Fall 2010: 2010 Data Report. Report Prepared by the National Marine Mammal Laboratory (NMML) for the BOEMRE, OCS Study BOEMRE 2010-42. 148 pp.
Clarke, J. T., C. L. Christman, S. E. Grassia, A. A. Brower, and M. C. Ferguson. 2011. Aerial surveys of marine mammals in the Beaufort Sea, Fall 2009. Report Prepared by the National Marine Mammal Laboratory (NMML) for the BOEMRE, OCS Study BOEMRE 2010-36.
Clarke, J. T., C. L. Christman, A. A. Brower and M. C. Ferguson. 2011. Distribution and relative abundance of marine mammals in the Alaskan Chukchi and Beaufort Seas, 2010. Annual Report, OCS Study BOEM 2011-009. National Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS, NOAA.

Walrus hauled out on sea ice floes in the northern Chukchi Sea, July 2011, observed during a reconnaissance flight supporting the USGS walrus satellite tagging crew based on the *Nersemen II*. Photo by Amelia Brower (NMML, USFWS permit MA121570).

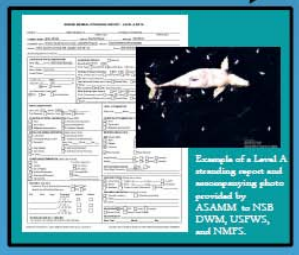


Aerial surveys that were conducted concurrently for ASAMM and the ABWC doubled the survey effort in the northeastern Chukchi Sea in early July 2011. Data collected were shared between both projects and minimized the effects on limited financial and logistical resources and field crews.

Example of biweekly map of polar bear sightings (above) provided over the course of the field season to several agencies, including USFWS, ADFG, and USGS. ASAMM also provided same-day aerial photographs of on-shore walrus haulouts (below) in separate monitoring haulout durations in 2009, 2010 and 2011. Photo by Rahsaan Shaw (NMML, USFWS permit 215570).



Example of biweekly bowhead whale sighting summary (above) sent by ASAMM to the USCG Cutter Berthoff (below), based in the Alaskan Arctic as part of Operation Arctic Shield. This timely information helped to inform the USCG of areas of importance to bowhead whales. Photo of CGC Berthoff courtesy of Coast Guard.



Example of a Level A stranding report and accompanying photo provided by ASAMM to NSB DWM, USFWS, and NMFS.

Meteorological buoy located on beach east of Pauline Bay, Alaska, during an ASAMM aerial survey conducted 18 September 2011. The buoy was later retrieved by its owners.

Increased offshore activity in the Arctic includes not just vessels but also unmanned autonomous vehicles (UAV). In 2011, ASAMM coordinated daily with Greenpeace representatives onboard the *Esperanza* (above) to ensure that their operation of an aerial UAV did not interfere with ASAMM operation of manned aircraft.

Example of sea ice information and photo, from 19 July 2011, sent to the NWS Sea Ice Desk, USCG, PMEL, and other interested parties. Photo by Cynthia Christman (NMML).

The Aerial Surveys of Arctic Marine Mammals (ASAMM) project, funded by the Bureau of Ocean Energy Management (BOEM), is the successor to the Bowhead Whale Aerial Survey Project (BWASP), which started in the late 1970s and has continued uninterrupted since. During this time period, the Arctic has undergone profound changes, and ASAMM has also evolved in its purpose and products. The primary focus of BWASP was to document the migration of bowhead whales (*Balaena mysticetus*) across the western Beaufort Sea, although data on all marine mammals were collected. ASAMM continues to document marine mammal distribution, behavior and relative density to meet its stated objectives, but also fosters collaborations with various researchers from local, state and federal agencies. The large ASAMM study area, spanning the entire Alaskan North Slope from 68°N to 72°N and 140°W to 169°W, allows ASAMM to collect visual data on several physical and biological factors that would otherwise not be available, and to share this information in a timely manner. Recent collaborations include, but are not limited to: 1) providing real-time walrus ice haulout information to U.S. Geological Survey (USGS) personnel to assist with satellite tagging efforts; 2) providing walrus and polar bear sighting data to USGS, U.S. Fish and Wildlife Service (USFWS) and Alaska Department of Fish and Game (ADFG), including information on large land haulout formations; 3) cooperation with the Alaska Beluga Whale Committee (ABWC) and North Slope Borough Department of Wildlife Management (NSB DWM) on aerial surveys focused on eastern Chukchi Sea belugas; 4) providing biweekly bowhead whale sighting data to the U.S. Coast Guard (USCG) in support of Arctic Shield 2011; 5) providing Level A stranding reports for marine mammal carcasses to NSB DWM, USFWS, and the National Marine Fisheries Service (NMFS); 6) locating wayward meteorological-oceanographic buoys for eventual retrieval by owners; 7) sending sea ice images to the USCG, NOAA research vessels, Pacific Marine Environmental Laboratory (PMEL), and the National Weather Service (NWS) Sea Ice Desk to ground-truth ice images available from satellites; and 8) fostering coordination between manned aerial survey efforts and aerial unmanned autonomous vehicles conducting research or reconnaissance. These collaborations, in addition to near real-time posting of daily flight reports and allowing public access to historical data, make the ASAMM project valuable in a broader scientific context.

ASAMM is funded by the Bureau of Ocean Energy Management, where we appreciate the support and guidance of Jeff Denton. ASAMM is managed and conducted by the National Marine Fisheries Service, National Marine Mammal Laboratory, where we appreciate the support of John Bengtson, Robyn Angliss and Phil Clapham.

Distribution and Relative Abundance of Belugas (*Delphinapterus leucas*) in the Alaskan Arctic, Summer and Fall 2012, with Comparisons to 2007-2011

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Megan Ferguson, NOAA-NMFS-AFSC-NMML
Cynthia Christman, NOAA-NMFS-AFSC-NMML
Amelia Brower, NOAA-NMFS-AFSC-NMML
Bob Small, Alaska Department of Fish and Game (ADFG)
Robert Suydam, North Slope Borough (NSB)

Aerial surveys for marine mammals were conducted in the northeastern Chukchi Sea and western Beaufort Sea from early July through late October 2012, under the auspices of the ongoing Aerial Surveys of Arctic Marine Mammals (ASAMM) project, funded by the Bureau of Ocean Energy Management (BOEM). Additionally, effort specifically designed to survey the Eastern Chukchi Sea beluga stock was flown from 30 June to 12 July, sponsored by the Alaska Beluga Whale Committee (ABWC). The combined study area encompassed approximately 230,000 km², extending from 140°W to 169°W and 68°N to 72°N. Twin Turbine Aero Commander aircraft with 5.5 hour flight endurance, outfitted with bubble windows for downward visibility, were used for all surveys. Line-transect surveys were flown every day, weather and logistics permitting. Survey effort in 2012 was greater than in any previous year, with >67,000 km flown (not including deadhead or unusable effort), including ~56,000 km on transect. Sea ice remained in parts of the study area in summer longer than in recent years (e.g., 2009-2011), but receded to zero percent in much of the study area (particularly the western Beaufort Sea) by early fall. In late June to mid-July, >8,600 km were flown on coastal and offshore transects in the northeastern Chukchi Sea. Despite this effort, very few belugas were seen offshore. Specifically, groups ranging in size from 1 to 300 belugas (representing 91% of beluga sightings) were observed within a few kilometers of shore while only two sightings (representing 9% of beluga sightings) were observed 7-50 km offshore. Large groups (150-300 whales) were observed feeding near entrances to Kasegaluk Lagoon on four days in late June and early July. Belugas remained largely absent in offshore areas of the northeastern Chukchi through August and September. In the western Beaufort Sea, belugas were seen from July through October, with the lowest numbers observed in early September. Distribution and areas of concentration (belugas per km per depth zone) in the western Beaufort Sea heavily favored the continental slope and Barrow Canyon. Beluga distribution in 2012 remained similar to that observed from 2007-2011, although some prominent differences do exist.

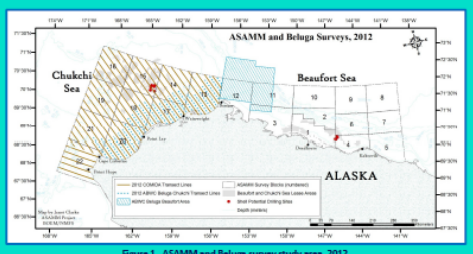

Figure 1. ASAMM and Beluga survey study area, 2012

Methods: Line transect aerial surveys
- *Twin turbine, high wing aircraft*
- *1200-1500' survey altitude*
- *fly every day, weather permitting*
- *two dedicated observers, one data recorder*
- *circle on most cetacean sightings to get positive species ID, determine group size and look for calves*

Significant Results: Summer 2012

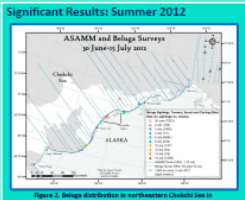

Figure 2. Beluga distribution in northeastern Chukchi Sea in late June-early July 2012.

Late June - Early July
- Intense survey coverage of northeastern Chukchi Sea (Figure 2).
- More sea ice coverage in area surveyed compared to recent years (2008-2011).
- Beluga distribution heavily coastal; largest groups were near and in Kasegaluk Lagoon passes; very few belugas were sighted offshore despite excellent survey coverage.

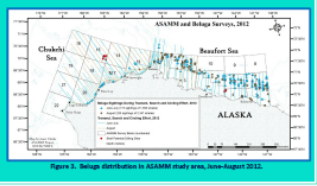

Figure 3. Beluga distribution in ASAMM study area, June-August 2012.

June - August
- Survey coverage of entire ASAMM study area starting in mid-July.
- Few belugas in Chukchi Sea after early July; beluga distribution in western Beaufort Sea on outer shelf and slope, and in Barrow Canyon (Figure 3).
- Swim direction in western Beaufort Sea significantly clustered around 280°T.

Significant Results: Fall 2012

Western Beaufort Sea
- Relatively few belugas compared to summer.
- Distribution was primarily on outer shelf and slope (Figure 4).
- Swim direction not clustered around any heading.

Northeastern Chukchi Sea
- No belugas seen in September; sightings in October scattered along coast and offshore.
- Swim direction significantly clustered around 186°T.

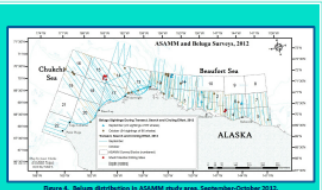

Figure 4. Beluga distribution in ASAMM study area, September-October 2012.

Acknowledgements
Aerial surveys can be fun, fruitful, boring, astonishing, treacherous, exhilarating, nauseating, confounding, amazing, dehydrating, and so much more. We would like to thank the following for joining and/or supporting ASAMM/ABWC during our 2012 aerial surveys. At BOEM, Jeff Denton and Chuck Monnett. At NOAA/NMFS/AFSC/NMML, Corey Accardo, Robyn Angliss, Stefan Ball, Lisa Barry, Vicki Beaver, Phil Clapham, Jess Crance, Heather Foley, Stephanie Grassia, Amy Kennedy, Brenda Rone, Jess Thompson, Luciana Santos, Becky Shea, Christy Sims, Dan Twyman, Karen Vale, and Linda Vate Bratstrom. At NMFS/NEFSC, Pete Duley, Jen Gatzke, and Allison Henry. At NSB, Elly Chmelnitsky. At Clearwater Air, Inc., Stan Churches, Andy Harcombe, Jim Kopczynski, Chad Russell, Alex Shibakov, Baine Thorn, and Jake Turner. At ADFG, John Citta and Lori Quakenbush. At ABWC, Kathy Frost. Without these people, the data do not exist. Background photo by Laura Morse, NMFS/AFSC/NMML. Our sincere thanks to all.

Sighting Rates: 2012

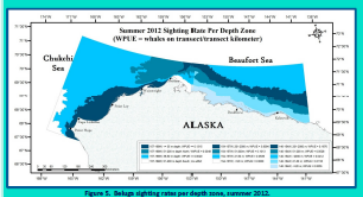

Figure 5. Beluga sighting rates per depth zone, summer 2012.

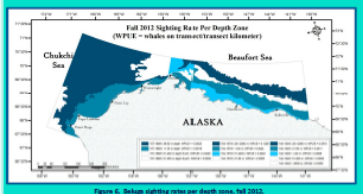

Figure 6. Beluga sighting rates per depth zone, fall 2012.

Summer Sighting Rates
- Almost 15x higher than fall sighting rates.
- Highest in depths >200 m in Beaufort Sea and in depths ≤35 m in northeastern Chukchi Sea (Figure 5).

Fall Sighting Rates
- Highest in deep depth zones in both Beaufort and Chukchi Seas (Figure 6), but low sample size led to fairly weak analysis .

Sighting Rate Trends
- Highest in July (Chukchi Sea) and August (Beaufort Sea), then dropped substantially in September and October (Figure 7).

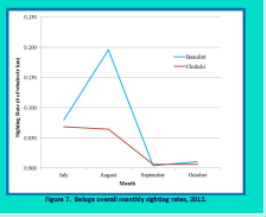

Figure 7. Beluga overall monthly sighting rates, 2012.

Final Thoughts on 2012

- Greater survey effort in 2012 than any previous year since ASAMM started in 1979; over 140,000 km (56,000 km on transect) during nearly 550 hours (257 hours on transect); first systematic effort in late July and early August in the Alaskan Beaufort Sea since the early 1980s.
- The majority of belugas were seen in summer in outer shelf and slope waters in the Alaskan Beaufort Sea and near Kasegaluk Lagoon in the northeastern Chukchi Sea.
- Belugas were largely absent from the ASAMM study area in fall; perhaps they were north (north of 72°N) or east (east of 140°W) of the study area?
- The overall observed beluga distribution in fall was similar to that observed since 2007 (Figure 8), when sea ice receded to historical minimums.
- However, beluga distribution, sighting rates and migratory timing can vary substantially inter-annually.

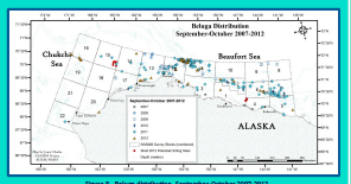

Figure 8. Beluga distribution, September-October 2007-2012.

Summer in the Western Beaufort Sea:

Results from Aerial Surveys of Arctic Marine Mammals, July and August, 2012

Megan Ferguson[1*], Janet Clarke[2], Rebecca Shea[1], Amelia Brower[1], and Cynthia Christman[1]

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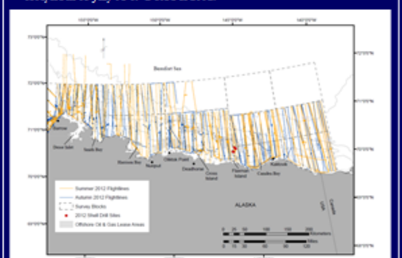
Abstract

The lengthened open water season and reduced sea ice coverage in the Arctic foretell increased human activities in this region, including shipping, fishing, recreation, and oil and gas exploration, development, and production. In order to minimize and mitigate the effects of anthropogenic activities on arctic marine mammals, information on marine mammal ecology is needed for all seasons in which activities could occur. Aerial surveys have proven effective for studying the distribution and behavior, and inferring the density, of arctic marine mammals within large study areas. Since 1987, broad-scale aerial survey coverage in the western Beaufort Sea has been mainly limited to the months of September and October. Between 8 July and 22 October, 2012, the Aerial Surveys of Arctic Marine Mammals (ASAMM) project, funded by BOEM and conducted by NOAA, conducted line-transect surveys for marine mammals over a vast (~107,600 km²) study area in the western Beaufort Sea (140°W to 157°W, from the coast to 72°N). In summer (July and August) 2012, ASAMM flew 26 surveys in this region, including over 14,000 km on transect, with total summer flight effort amounting to over 28,500 km. Bowhead whales were found on 13 days, distributed primarily along the outer continental shelf, in 61 sightings totaling 118 whales, including 11 calves. Belugas were found on 22 days, distributed primarily over the continental slope, in 395 sightings totaling 2253 individuals. Gray whales (29 sightings, 60 individuals, including 4 calves) were sighted on five days, near Barrow Canyon. Walruses (28 sightings, 923 individuals) were sighted on four days, near Barrow Canyon and over the continental slope in the western half of the region. Polar bears (11 sightings, 28 individuals, including 4 cubs or yearlings) were sighted on four days: 20 bears were found on Cross Island, 4 were located on barrier islands east of Kaktovik, and 4 were sighted swimming between 10 to 85 km offshore. One sighting of 13 killer whales (including 2 calves) was found near Barrow. These data help fill an important information gap into marine mammal ecology during the summer in the western Beaufort Sea.

Study Area and Survey Methods

- Survey Dates: One survey team was stationed at Barrow, AK, from 30 June to 28 October 2012. A second team was stationed at Deadhorse, AK, from 18 July to 19 October 2012.



ASAMM 2012 summer (July – August) and autumn (September – October) transect, search, and circling effort in the western Beaufort Sea.

- Survey Team: Two primary marine mammal observers, and one data recorder and two pilots who also served as secondary observers.
- Aircraft: Two twin turbine Aero Commander 690A aircraft, with bubble windows for primary observers.
- Survey Altitude and Speed: 305-457 m (1000-1500 ft); 204 km/hr (110 kts).
- Survey Protocol: Observers collected standard line-transect data on all marine mammals sighted and environmental data during transect, search, and circling survey modes. Data collected included: species identification; group size; number of calves or cubs present; angle of declination to sighting; side of plane; Beaufort sea state; visibility range (distance); impediments to visibility; percent sea ice cover; and sea ice type.

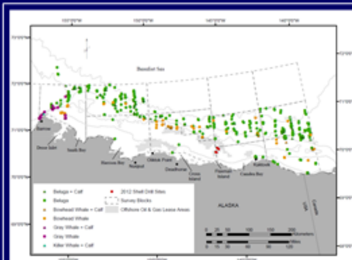
Summer 2012 Results

- The aircraft diverted from transect for most cetacean sightings to confirm species identification, estimate group size, and determine whether calves were present. Without circling, 90.9% of bowhead whale, 5.7% of beluga, 25% of gray whale, and 100% of killer whale calves would not have been sighted during the summer surveys (Table 1).

Table 1. ASAMM [illegible] summer (July and August) of 2012.

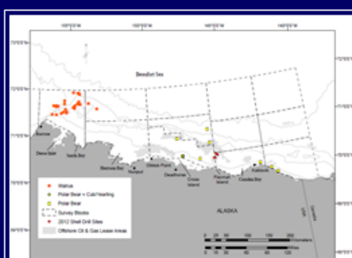
	Number Sightings	Number Individuals	Number Calves or Cubs	Number Calves or Cubs First Sighted on Circling	Number of Days Sighted	Sighting Date Range
Bowhead Whale	61	118	11	10	13	[illegible] Jul to 26 Aug 2012
Beluga	395	2253	40	[illegible]	22	[illegible] Jul to [illegible] Aug 2012
Gray Whale	29	60	4	1	5	[illegible] Jul to [illegible] Aug 2012
Killer Whale	1	13	2	2	1	[illegible] Aug 2012
Walrus	28	923	[illegible]	NA	4	[illegible] Jul to [illegible] Aug 2012
Polar Bear	11	28	4	[illegible]	4	[illegible] Aug 2012

More Summer 2012 Results



ASAMM 2012 summer sightings of cetaceans from transect, search, and circling effort.

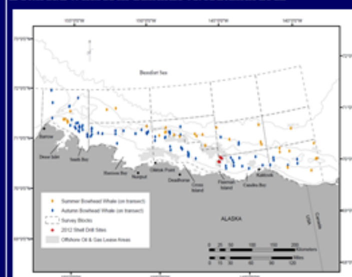
- Bowhead whales and belugas were sighted across the continental slope (~200-2000 m).
- Bowhead, gray, and killer whales and belugas were found near Barrow Canyon.
- 11 bowhead whale, 4 gray whale, 2 killer whale, and 4 beluga calves were sighted (see also Table 1).



ASAMM 2012 summer sightings of polar bears and walruses from transect, search, and circling effort.

- Walrus sightings were limited to the waters over Barrow Canyon.
- Polar bears were found on Cross Island (20 bears), the barrier islands east of Kaktovik (four bears), and swimming between 10 and 85 km offshore (four bears).
- Four polar bear cubs or yearlings were sighted.

Bowhead Whales in Summer vs. Autumn 2012



ASAMM 2012 summer and autumn bowhead whale sightings from transect effort.

- During the summer in the eastern portion (140°W to 154°W) of the Beaufort Sea study area, bowhead whales were encountered most frequently over the outer continental shelf (51-200 m) (Table 2).
- During the summer in the western portion (154°W to 157°W) of the Beaufort Sea study area, bowhead whales were encountered most frequently in shallow waters (0-20 m) (Table 2).
- During the autumn, bowhead whales were encountered most frequently over the inner continental shelf (21-50 m) across the Beaufort Sea study area (Table 2).

Table 2. Summary of summer (July – August) and autumn (September – October) bowhead whale sightings by depth zone in the Beaufort Sea during 2012.

Region	Summer: TOTAL Transect Km	Summer: Transect Sightings	Summer: Transect Whales	Summer: WPUE (whales/km)	Autumn: TOTAL Transect Km	Autumn: Transect Sightings	Autumn: Transect Whales	Autumn: WPUE (whales/km)
[illegible]								
0-20 m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21-50 m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
51-200 m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
201-2,000 m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]								
0-20 m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21-50 m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
51-200 m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
201-2,000 m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Beaufort Sea	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Acknowledgements

This study was funded by BOEM through an interagency agreement M11PG00033 with the Alaska Fisheries Science Center, NOAA, Department of Commerce. Jeffrey Denton at BOEM provided valuable oversight and logistical help. The Alaska Beluga Whale Committee provided the ASAMM team with additional financial support for surveys designed specifically to study the Eastern Chukchi Sea beluga stock from 30 June to 12 July 2012. At NMML, additional support was provided by Robyn Angliss, Phil Clapham, Stefan Bell, and administrative and travel personnel. In addition to the authors, our 2012 team leaders included Amy Kennedy, Brenda Rone, and Christy Sims. Thanks to our 2012 field observers Corey Accardo, Lisa Barry, Vicki Beaver, Jessica Crance, Pete Duley, Heather Foley, Jennifer Gatzke, Stephanie Grassia, Allison Henry, Jessica Thompson, Dan Tsuyuma, Karen Vale, and Linda Vate Brattström. Thanks to Clearwater Air, Inc., especially Andy Harcombe, Sean Churchill, Jim Nesterwick, Alex Schulz, and John Turner for keeping ASAMM in the air. Real-time flight following via satellite link was provided by Department of Interior personnel Jan Bennett and Luke Wuertz. Programming support was provided by Mike Hay (Xeno GIS).

Sightings of Humpback, Fin, Minke, and Killer Whales in the Alaskan Arctic from Aerial Surveys in 2012

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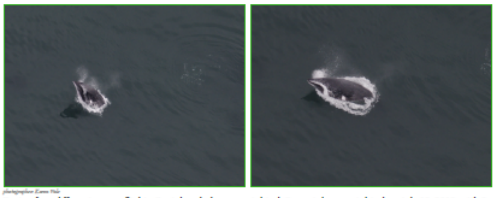
Janet Clarke • Ocean Sciences Division, Science Applications International Corporation, Buckley, WA

Marine mammal aerial surveys were conducted in the Alaskan Arctic from summer through fall 2012, as part of the ongoing Aerial Surveys of Arctic Marine Mammals (ASAMM) project, funded by the Bureau of Ocean Energy Management, with additional surveys targeting eastern Chukchi Sea belugas conducted in July in collaboration with the Alaska Beluga Whale Committee.

In addition to cetacean species typically seen by aerial marine mammal observers in this area, several species not commonly encountered were documented during the 2012 survey, including humpback (*Megaptera novaeangliae*), fin (*Balaenoptera physalus*), minke (*Balaenoptera acutorostrata*), and killer whales (*Orcinus orca*). None of these species were sighted during historical surveys flown from 1982 to 1991. Since broad-scale aerial surveys recommenced in the northeastern Chukchi Sea in 2008, the humpback, minke and fin whale sightings were limited to one fin whale in July 2008, one humpback whale in July 2009, and six minke whales in 2011. Although all of these species have been detected acoustically in the northeastern Chukchi Sea, particularly in the southern area, and some of these species have been sighted by Alaska Natives and other research platforms, the historical scarcity of sightings from systematic broad-scale aerial surveys is likely indicative of their relative rarity in this region in the past. The 2012 ASAMM sightings may represent a continuing trend towards greater cetacean species diversity and abundance in the northeastern Chukchi Sea.

The study area encompassed the western Beaufort and northeastern Chukchi seas (68°N-72°N and 140° -169°W), extending from the coast to approximately 315 km offshore.

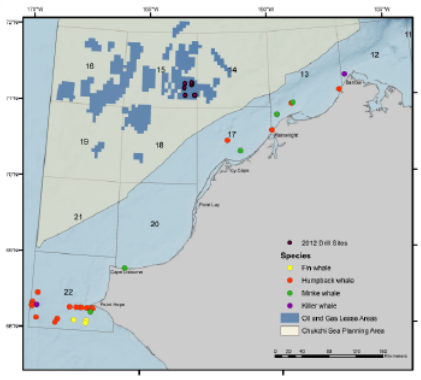
A group of 13 killer whales (including 2 calves) were seen during a survey north of Barrow on August 20th. A smaller group of 5 killer whales (including 1 calf) was seen on the September 11, 2012 survey near Point Hope.



During four different survey flights, 7 minke whales were sighted. One minke was sighted on July 12, 2012, with 3 whales sighted on August 12, 2 whales on August 1, and 1 whale sighted on the 11th of September. Three of the 7 whales were observed feeding; two of those were documented as lunge feeding.

Acknowledgements

This study is funded by the Bureau of Ocean Energy Management and was supported by Jeffery Denton (BOEM COR) through IA contract No. M11PG00033. All survey work and photos were taken under NMFS permit No. 14245. At NMML, support was provided by Phil Clapham, Stefan Ball, and administrative and travel personnel. In addition to the authors, the dedicated field observers included: Corey Accardo, Elly Chmelnitsky, Pete Dulay, Allison Henry, Luciana Santos, and Karen Vale. We are thankful for our flight staff at Clearwater Air, Inc., Andy Harcombe and pilots Stan Churches, Jim Kopczynski , Alex Shibakov, Baine Thorn, and Jake Turner. Real-time flight following via satellite link was provided by Department of Interior personnel Jan Bennett and Lark Wuerth. Programming support was provided by Mike Hay (Xara GIS). Thank you to all of those named and unnamed that made these surveys possible!



The sightings occurred primarily in two areas: nearshore between Icy Cape and Point Barrow, and west and south of Point Hope. Humpback, minke and killer whales were seen in both areas, whereas fin whales were seen only in the southern area. Most of the humpback whales were seen in the southern area, a region where gray whales have been reliably seen in past years. Other than the fin whales (all sighted during in a single survey day) some sightings may include resights of the same individuals.

Five fin whales (including 2 calves) were seen on September 11, 2012, in three different groups. Three individual whales were seen lunge feeding.

Twenty-nine humpback whales were seen on five different days, with 24 of those whales observed during one flight on September 11th in the southern area near Point Hope. There were four recorded feeding events, with three of the four occurring on the 11th of Sept flight. Although the majority of sightings were of single humpbacks, there were five groups of 2 whales and one group of 4 whales.

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