

Occurrence of Humpback, Fin, and Minke Whales in the Eastern Chukchi Sea, 2008-2015: Population Recovery, Response to Climate Change, or Greater Effort?

Janet Clarke – Leidos, janet.clarke@leidos.com **Megan Ferguson** – Marine Mammal Laboratory, AFSC, NMFS, NOAA
Amelia Brower, Amy Willoughby, and Christy Sims – Joint Institute for the Study of the Atmosphere and the Ocean

Fin whale, July 2013; photo by Vicki Beaver, NMFS Permit No. 14245

Abstract

Sightings of humpback (*Megaptera novaeangliae*), fin (*Balaenoptera physalus*) and minke (*Balaenoptera acutorostrata*) whales were made during the Aerial Surveys of Arctic Marine Mammals (ASAMM) project, funded by BOEM and co-managed by BOEM and NOAA. Surveys were conducted in the eastern Chukchi Sea (67°-72°N, 157°-169°W) from July through October, 2008-2015, in a study area that encompassed offshore oil and gas leases in the Chukchi Sea Planning Area and shipping lanes in the southern Chukchi Sea. Approximately 186,000 km on effort was flown to document relative abundance, spatial and temporal distribution, and behavior of marine mammals. Fin whales (41 sightings of 67 whales) had the most limited distribution, from 67°N to 69.5°N, and were seen primarily in August and September. Humpback whales (55 sightings of 97 whales) were distributed from 66.9°N to 71.2°N, and were seen primarily in September. Minke whales (24 sightings of 27 whales) had the most extensive distribution, from 67.1°N to 71.9°N, and were seen from July through September. Fin, humpback, and minke whales were often seen in close association with other cetacean species, including gray whales. Behaviors observed included diving, feeding, milling, resting, rolling, swimming, and tail slapping. Fin whale calves (2) were seen in 2012; humpback whale calves were seen in 2014 (1) and 2015 (1). Fin, humpback and minke whales are known to have occurred historically in the Pacific Arctic, particularly near the Chukotka Peninsula, and recent visual and acoustic detections suggest that use of this area may be increasing. During aerial surveys conducted from 1979-1991 in this same area, there was 1 sighting of 3 fin whales; however, survey effort was sporadic among years, and most survey effort occurred in October. Increased occurrence may be due to each population’s abundance and range recovering from commercial whaling that occurred as recently as the 1970s, but may also reflect an increase in marine mammal research in the area or responses to ongoing climate change. (Abstract has been updated to reflect sightings from October 2015.)

References

Clarke, J., K. Stafford, S.E. Moore, B. Rone, L. Aerts, and J. Crance. 2013. Subarctic cetaceans in the southern Chukchi Sea: Evidence of recovery or response to a changing ecosystem. *Oceanography* 26(4):136–149.

Eisner, L., N. Hillgruber, E. Martinson, and J. Maselko. 2013. Pelagic fish and zooplankton species assemblages in relation to water mass characteristics in the northern Bering and southeast Chukchi seas. *Polar Biology* 36:87-113.

Ivashchenko, Y.V., P.J. Clapham, and R.L. Brownell, Jr. 2013. Soviet catches of whales in the North Pacific: revised totals. *J. Cetacean Res. Manage.* 13(1): 59-71.

Moore, S.E., J.M. Waite, N.A. Friday, and T. Honkalehto. 2002. Cetacean distribution and relative abundance on the central-eastern and southeastern Bering Sea shelf with reference to oceanographic domains. *Progress in Oceanography* 55: 249-261.

Acknowledgements: This study was funded and co-managed by the Bureau of Ocean Energy Management (IA Nos. M11PG00033 and M08PG20023), where we appreciated the support of Jeff Denton, Carol Fairfield, Chuck Monnett, and Dee Williams. At AFSC, additional support was provided by Robyn Angliss, Phil Clapham, Stefan Ball, Nancy Friday, Kim Shelden, Janice Waite, and administrative and travel personnel. Aerial surveys were safely and expertly flown by NOAA Aircraft Operations Center, Commander Northwest, and Clearwater Air. Our sincere appreciation to the dedicated and professional marine mammal observers who suited-up and contorted their bodies into bubble windows for several hours at a time. Real-time monitoring via satellite tracking of survey flights was provided by USDOL. We are also grateful for the analytical and programming expertise of Mike Hay (Xera GIS). AFSC Graphics assisted with the poster design.

Methods

- Eastern Chukchi Sea study area, 67°-72°N, 157°-169°W (Figure 1)
- Line transect aerial surveys
- Twin turboprop, high wing aircraft
- 1200 ft (366 m) survey altitude
- Fly every day, weather permitting, 2 July through 30 October
- Two primary marine mammal observers, one data recorder
- Survey modes include on-effort (transect and circling from transect) and off-effort (search and circling from search)
- Circle on most cetacean sightings to get positive species ID, determine group size, and look for calves

Results

Figure 1. Eastern Chukchi Sea study area with fin, humpback, and minke whale sightings, July-October 2008-2015, and one fin whale sighting, July 1981. All sightings are plotted, regardless of survey mode; on-effort sightings by primary observers are designated with a star. Each sighting may be of one or more whales. The northeastern Chukchi Sea subarea is outlined in magenta; the southcentral Chukchi Sea subarea is outlined in umber.

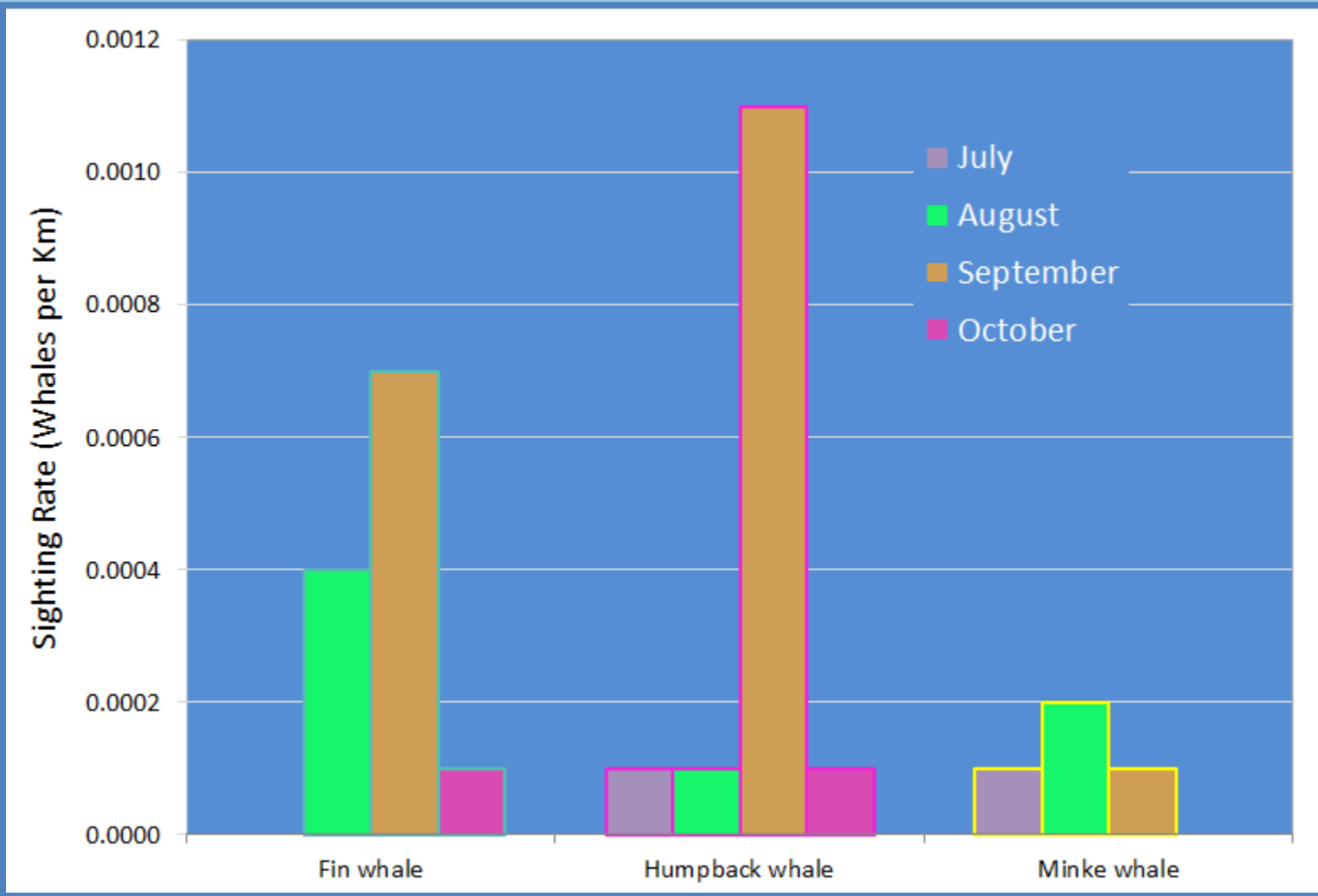
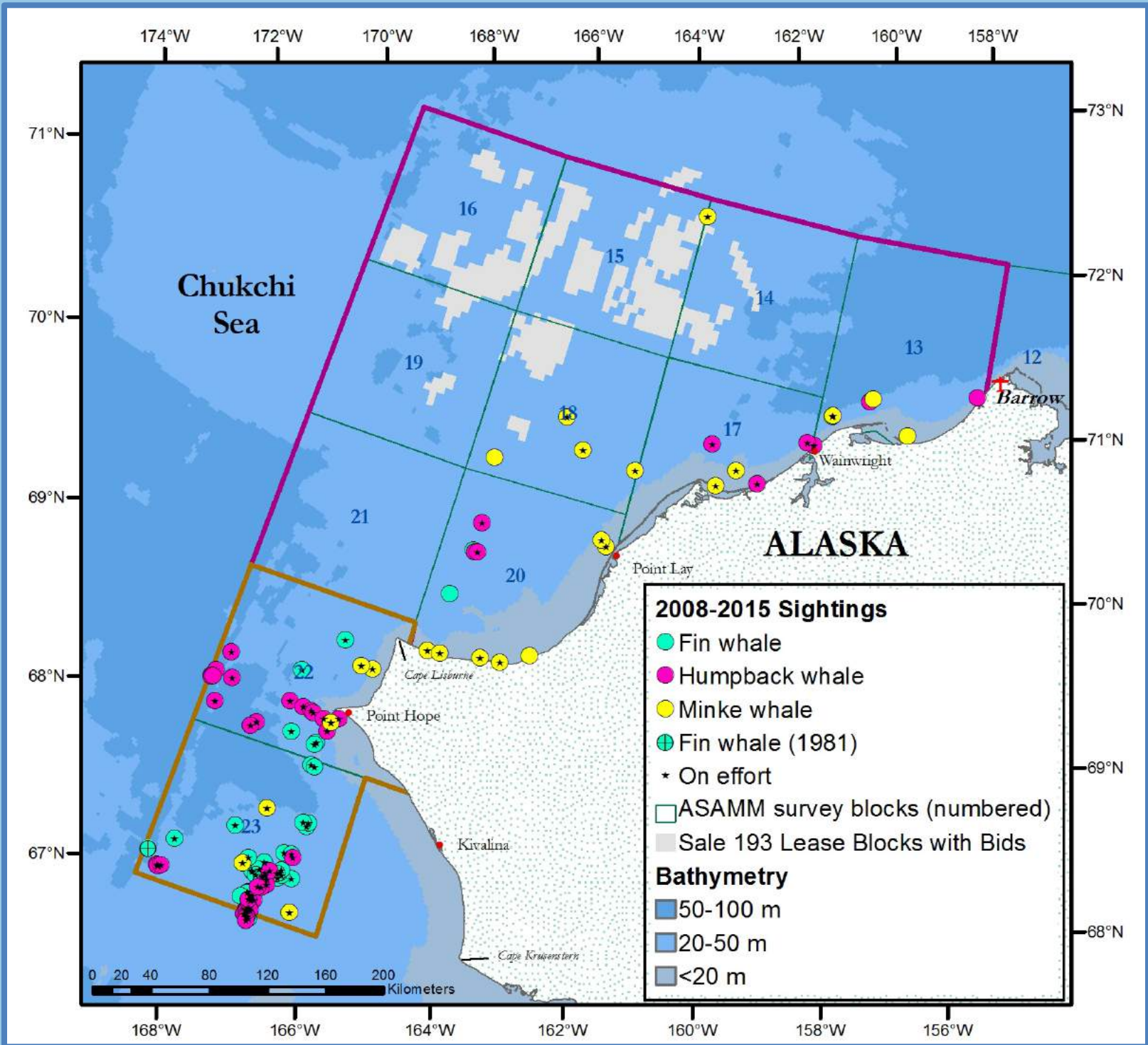


Figure 2. Fin, humpback, and minke whale sighting rates per month, eastern Chukchi Sea, 2008-2015. Sighting rate, using sightings by primary observers collected only during on-effort surveys, provides an estimate of relative abundance.

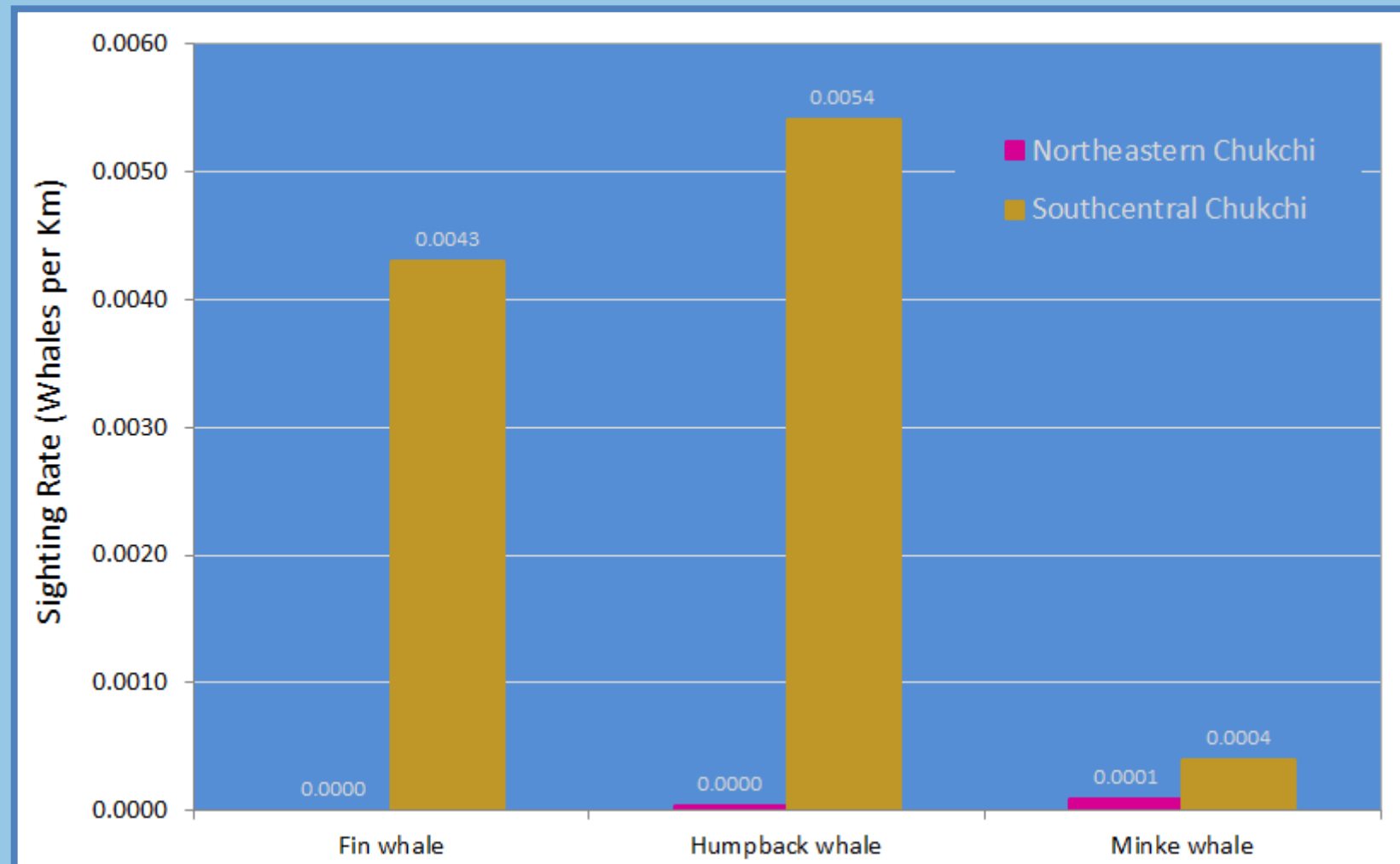


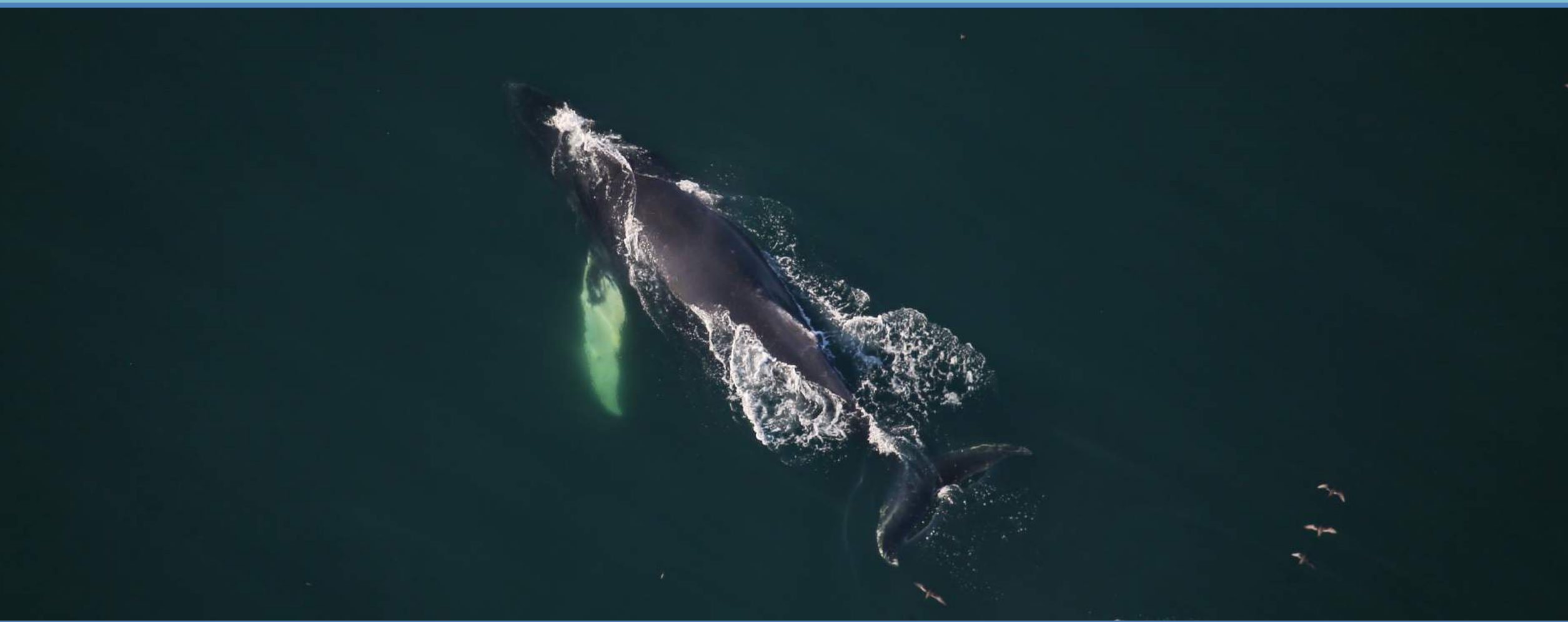
Figure 3. Fin, humpback, and minke whale sighting rates for the northeastern Chukchi Sea and southcentral Chukchi Sea subareas, July-October combined, 2008-2015. Sighting rate, using sightings by primary observers collected only during on-effort surveys, provides an estimate of relative abundance.

Summary, 2008-2015

Table 1. Summary of key results based on all sightings, regardless of survey mode (except as noted). Maximum values **bolded and italicized**.

	Fin whale	Humpback whale	Minke whale
Eastern Chukchi Sea			
Months of occurrence	<i>July to October</i> ¹	<i>July to October</i> ¹	July to September ¹
Relative abundance ⁴	0.0003 ²	<i>0.0005</i> ²	0.0001 ²
Distribution	67°N to 69.5°N ¹	66.9°N to 71.2°N ¹	<i>67.1°N to 71.9°N</i> ¹
Depth range	28 to 52 m	7 to 61 m	3 to 60 m
Distance from shore range	24 to 140 km	1 to 145 km	<1 to 170 km
Northeastern Chukchi Subarea			
Months of occurrence	July to August ¹	July to August ¹	<i>July to September</i> ¹
Relative abundance ⁴	0 ³	<0.0001 ³	<i>0.0001</i> ³
Depth range	28 to 33 m	7 to 55 m	3 to 60 m
Distance from shore range	42 to 75 km	1 to 89 km	<1 to 170 km
Southcentral Chukchi Sea Subarea			
Months of occurrence	<i>July to October</i> ¹	August to October ¹	August to September ¹
Relative abundance ⁴	0.0043 ³	<i>0.0054</i> ³	0.0004 ³
Depth range	33 to 52 m	15 to 61 m	24 to 38 m
Distance from shore range	24 to 140 km	4 to 145 km	8 to 114 km

¹ Figure 1; ² Figure 2; ³ Figure 3; ⁴ based on sightings by primary observers during on-effort surveys



Humpback whale, September 2014; photo by Leah Crowe, NMFS Permit No. 14245

Comparison with ASAMM 1979-1991

- Sightings limited to 1 sighting of 3 fin whales (July 1981) (Figure 1)
- Survey effort was orders of magnitude less except in October (Figure 4)

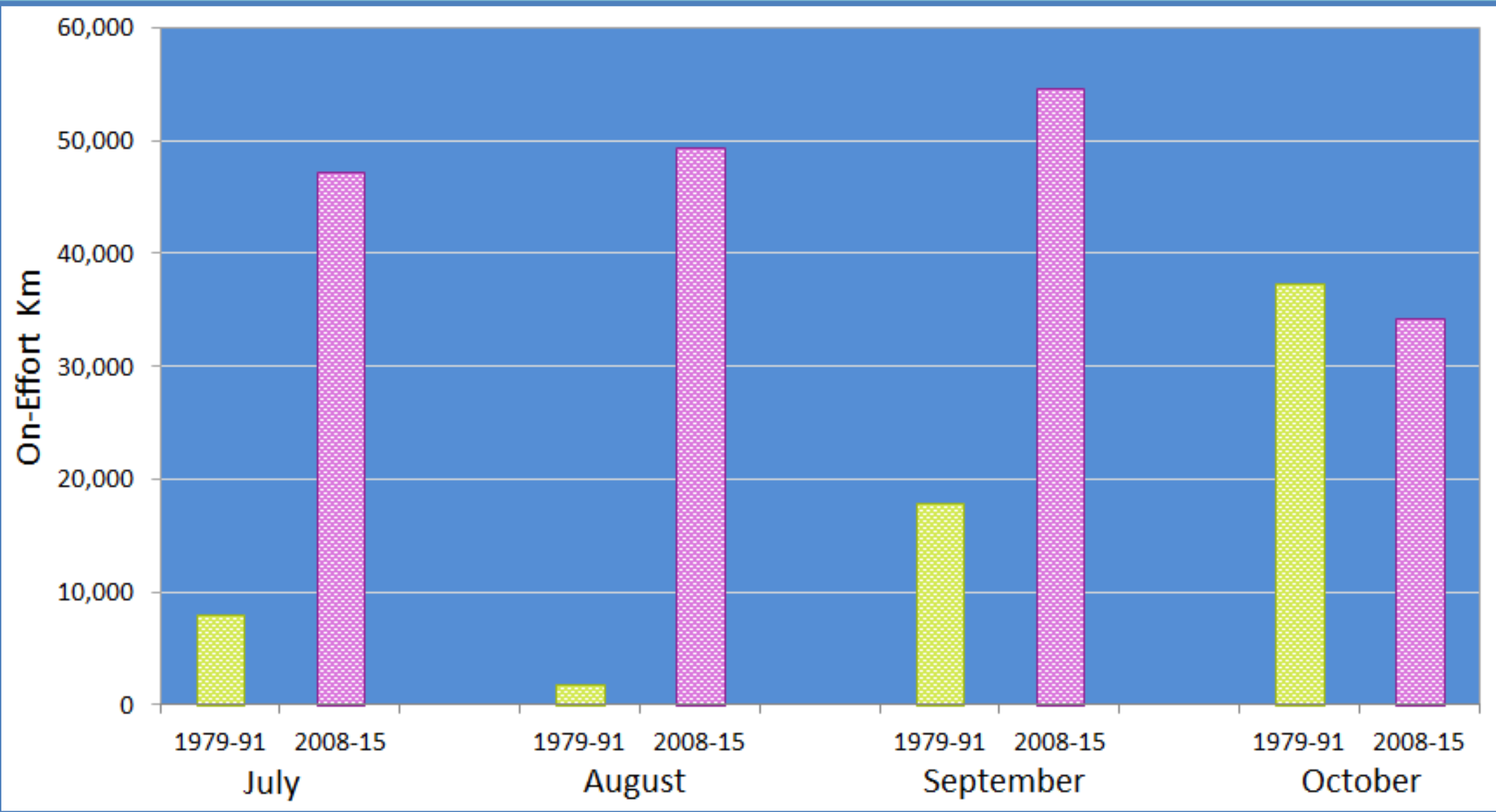


Figure 4. Summary of ASAMM effort in the eastern Chukchi Sea, 1979-1991 and 2008-2015. Effort from 1992 to 2007 was negligible.

Discussion

- Fin, humpback, and minke whales occur in the northern Bering Sea (Moore et al., 2002) and there is ample evidence of historical occurrence in the western Chukchi Sea, but there are relatively few records for the eastern Chukchi Sea (summarized in Clarke et al., 2014).
- Increasingly common occurrence of these large whales in the eastern Chukchi Sea in recent years (2008-present) has been documented by this study and corroborated by concurrent visual and acoustic studies (e.g., CSESP, ARCWEST, CHAOZ, Shell).
- Populations may be recovering from illegal commercial whaling that occurred in the North Pacific as recently as the 1970s (Ivashchenko et al., 2013).
- Distribution of these large whales may also be related to water masses that collectively produce sharp temperature and salinity gradients (Eisner et al., 2013), which can aggregate zooplankton, fishes that feed on zooplankton, and large whales that feed on fishes. Variations in water mass incursion, combined with earlier and greater loss of summer sea ice and other effects of climate change, may be enhancing the ability of large whales to expand further into the Chukchi Sea.
- Finally, the potential effect of increased survey effort cannot be ignored. Most fin, humpback, and minke whales were seen (and sighting rates were highest) in August and September 2008-2015. Survey effort during August and September 1979-1991 was not extensive, particularly in August (Figure 4). Survey effort in October 1979-1991 actually exceeded that for October 2008-2015. However, October 2008-2015 had the lowest sighting rates, indicating that fin, humpback, and minke whales may be migrating south from the Chukchi Sea by that time. It is possible that large whales were present in the eastern Chukchi Sea, particularly the southcentral subarea, in 1979 to 1991 but not detected due to infrequent survey effort during the months they would most likely have occurred.