

Gray Whale Foraging Habits in the Alaskan Arctic, Summer and Fall 2009-2013

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Photo by Cynthia Christman
NOAA/NMML/AFSC/CHOWM1
NOAA Permit No. 5426

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NOAA Permit No. 746-1724

Abstract

The northeastern Chukchi Sea contains summer foraging habitat for the Eastern North Pacific (ENP) stock of gray whales (*Eschrichtius robustus*). The presence and distribution of gray whales on summer and fall (July through October) feeding grounds located from 68°-72°N and 155°-169°W have been documented by the Aerial Surveys of Arctic Marine Mammals (ASAMM) project and its predecessor projects, currently co-managed and funded by the Bureau of Ocean Energy Management and conducted by the National Marine Mammal Laboratory. Surveys were conducted periodically in the study area from 1982 to 1991, and 2008, but have been flown consistently during summer and fall 2009-2013. Gray whales are flexible and opportunistic foragers, feeding on abundant prey resources; they have been documented feeding on a variety of benthic invertebrates, in addition to pelagic organisms. When gray whales feed on benthic fauna, they suction prey and mud off the sea floor and strain the mud out through their baleen, resulting in a mud plume that is visible at the surface of the water and detectable by aerial observers. Feeding was the predominant behavior recorded for gray whales in 2009-2013 based on the presence of mud plumes at the surface. Feeding gray whales were sighted most frequently in July and were distributed primarily in three areas: 1) along the Alaskan coast from Point Barrow to Point Franklin, extending ~40 km from shore; 2) from Point Franklin to Icy Cape, along the coast and extending ~70 km from shore; and 3) west of Point Hope, extending ~90 km from shore. These distributions are similar to feeding gray whales documented in historical years (1982-1991) and 2008, with the exceptions that in historical years, gray whales extended only ~30 km offshore from Point Franklin to Icy Cape and were documented feeding near Hanna Shoal. The majority of feeding gray whales were in water with little to no sea ice and <200 m in depth. Results from these surveys indicate that the northeastern Chukchi Sea remains an important foraging ground for gray whales. It is recommended that these surveys be continued in order to document gray whale benthic foraging habitats in the future.

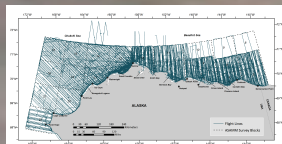


Figure 1. ASAMM on- and off-effort survey flightlines, 2009-2013.

Survey Effort

- Twin engine turbo aircraft
- 1200 ft (366 m) in the Chukchi Sea
- 1500 ft (457 m) in the Beaufort Sea
- Chukchi: June or July – October
- Beaufort: July, August, or September – October
- Survey effort: “on-effort” (transect and circling from transect), “off-effort” (search and circling from search), or deadhead
- From 2009-2013, ~263,000 km flown on- and off-effort (Figure 1, Tables 1 and 2).

Sighting Summary

- 1143 sightings of 1824 gray whales on- and off-effort in 2009-2013; 66% of the individuals were documented feeding, similar to 1982-1991 and 2008 (Tables 1 and 2).
- Feeding gray whales were documented in every month each year that surveys were conducted in 2009-2013 except for October 2013, probably due to the lack of survey effort resulting from the government shutdown, 1-19 October.
- From 2009-2013, 26% of on- and off-effort feeding gray whales were sighted near shorefast or broken floe sea ice; ice percent ranged 1-90%. Results were similar for feeding gray whales in 1982-1991 and 2008. It appears that gray whales are able to forage with some amount of sea ice present.

Distribution

In the study area, gray whales have been documented feeding in relatively shallow waters along the shelf (Figure 2). They are typically found feeding in waters <80 m deep in the Chukchi Sea and <140 m deep in survey block 12 of the Beaufort Sea. The distribution of feeding gray whales across the years 2009-2013 was similar, and similar to 1982-1991 and 2008, with a few exceptions as noted in the maps below.

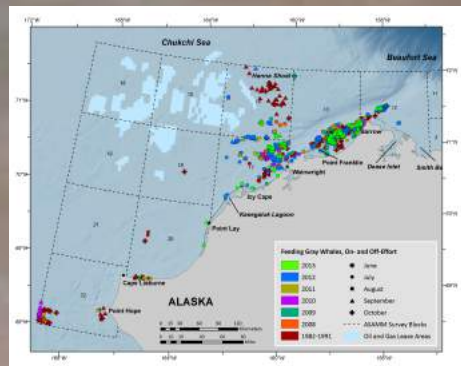


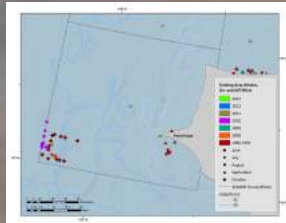
Figure 2. 1982-2013 feeding gray whales, on- and off-effort, all months shown.

Table 1. Kilometers flown on- and off-effort in 2009-2013 and proportions of gray whales feeding out of all gray whale sightings per year.

Year	km	Total Gray Whales	# Feeding Gray Whales	% Feeding Gray Whales
2009	50,021	390	268	69
2010	40,682	265	234	88
2011	53,549	330	204	62
2012	67,672	558	322	58
2013	50,519	281	150	68
Total	262,543	1824	1208	66

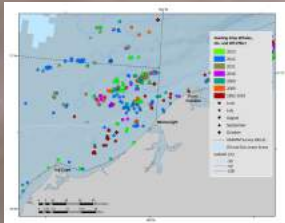
Table 2. Kilometers flown on- and off-effort in 2009-2013 and proportions of gray whales feeding out of all gray whale sightings per year.

Month	km	Total Gray Whales	# Feeding Gray Whales	% Feeding Gray Whales
June	8,280	97	57	59
July	54,292	892	528	60
August	61,149	532	391	73
September	91,832	253	175	69
October	46,891	110	57	52
Total	262,543	1824	1208	66



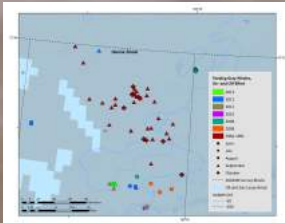
West of Point Hope

Feeding gray whales were sighted ~90 km from Point Hope in 2010 and 2011, as well as 2008 and 1982-1991. There is a known gray whale foraging hotspot in the south central Chukchi Sea (Hope Basin); these feeding gray whales are likely at the northern fringe of that hotspot.



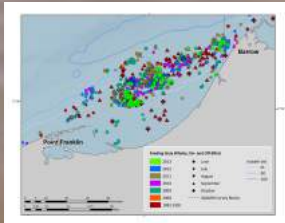
Icy Cape to Point Franklin

From Point Franklin to Icy Cape, feeding gray whales were sighted in June and July, 2009-2013, were documented within ~40 km from shore. In August the distribution moved offshore and extended out to ~70 km. In 1982-1991, gray whales extended only ~30 km offshore from Point Franklin to Icy Cape.



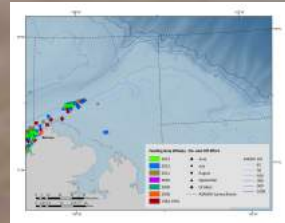
Hanna Shoal

In 2008-2013, few gray whales have been sighted feeding near Hanna Shoal; in 1982-1991 this was an active foraging ground for gray whales.



Point Franklin to Barrow

Along the Alaskan coast from Point Barrow to Point Franklin, feeding gray whale sightings in 2008-2013 extended ~40 km from shore, similar to feeding gray whales documented in 1982-1991. The area between Point Franklin and Barrow was searched regularly during transits to and from targeted transect lines, which may have resulted in greater sightings of gray whales than in other areas.



Block 12

In Block 12 of the Beaufort Sea, feeding gray whales have been documented up to 138 m deep but have not been documented in the deeper waters of Barrow Canyon (>200 m depth) by these surveys even though the area from Barrow to 72°N was searched regularly during transits to and from targeted transect lines. More whales were documented feeding in Block 12 in 2012-2013 than 2008-2011, but feeding gray whales were also sighted there in 1982-1991.

Sighting Rates

2009-2013 Sighting rates (whales per unit effort, WPUE): Number of on-effort feeding whales per on-effort kilometer (km) surveyed per month and depth zone.

- Per Year**
- Highest sighting rate: 2012 (0.0064 WPUE)
 - Lowest sighting rate: 2010 (0.0032 WPUE)

- Per Month**
- Highest sighting rates: July (0.0087 WPUE) and August (0.0074 WPUE)
 - Lowest sighting rates: June (0.0037 WPUE), September (0.0019 WPUE), and October (0.0017 WPUE)
 - After August, sighting numbers and sighting rates start to decline, suggesting gray whales begin their migration south in August and September.

Depth zones

Due to the bathymetry of the Chukchi and Beaufort seas, the depth zones are categorized differently. Chukchi Sea: <35m, 36-50 m, and 51-200 m (North) and 51-200 m South. Beaufort Sea: <20 m, 21-50 m, 51-200 m, and 201-2000 m.

Highest sighting rates of feeding gray whales by depth zone, 2009-2013, in descending order:

Chukchi Sea		Block 12	
depth zone (m)	WPUE	depth zone (m)	WPUE
<35	0.0062	51-200	0.0062
36-50	0.0051	21-50	0.0051
<35	0.0042	<20	0.0006

Highest sighting rates of feeding gray whales by depth zone, 2009-2013, by year and month:

Year or Month	Chukchi Sea		Block 12	
	depth zone (m)	WPUE	depth zone (m)	WPUE
2009	51-200 N	0.0107	n/a**	
2010	51-200 S	0.0086	21-50	0.0059
2011	51-200 N	0.0087	n/a**	
2012	36-50	0.0091	51-200	0.0124
2013	<35	0.0094	21-50	0.0070
June	51-200 N	0.0067	n/a**	
July	<35	0.0117	21-50	0.0222
August	51-200 N	0.0116	51-200	0.0159
September	51-200 N	0.0060	21-50	0.0037
October	36-50	0.0024	21-50	0.0046

*No feeding gray whales in block 12 in 2009 or 2011.

**No survey effort in block 12 in June.

Acknowledgements

This study is funded and co-managed by the Bureau of Ocean Energy Management and was supported by Chuck Monnett and Jeffrey Denton (current BOEM COR). At NMML, additional support was provided by Philip Clapham, Nancy Friday, Kim Sheldon, Stefan Ball, and administrative and travel personnel. In addition to the authors, numerous dedicated biologist have participated in these surveys. NOAA Aircraft Operations Center and Clearwater Air, Inc. and their pilots safely navigated us through the skies. Real-time flight following via satellite link was provided by Department of Interior personnel. Programming support was provided by Mike Hay (Xera GIS). Without all of these people, our surveys would not have been possible; our sincerest thanks to all!

