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Visual and passive acoustic marine mammal monitoring in northern U.S. and international Chukchi Sea open waters in summer-fall 2013



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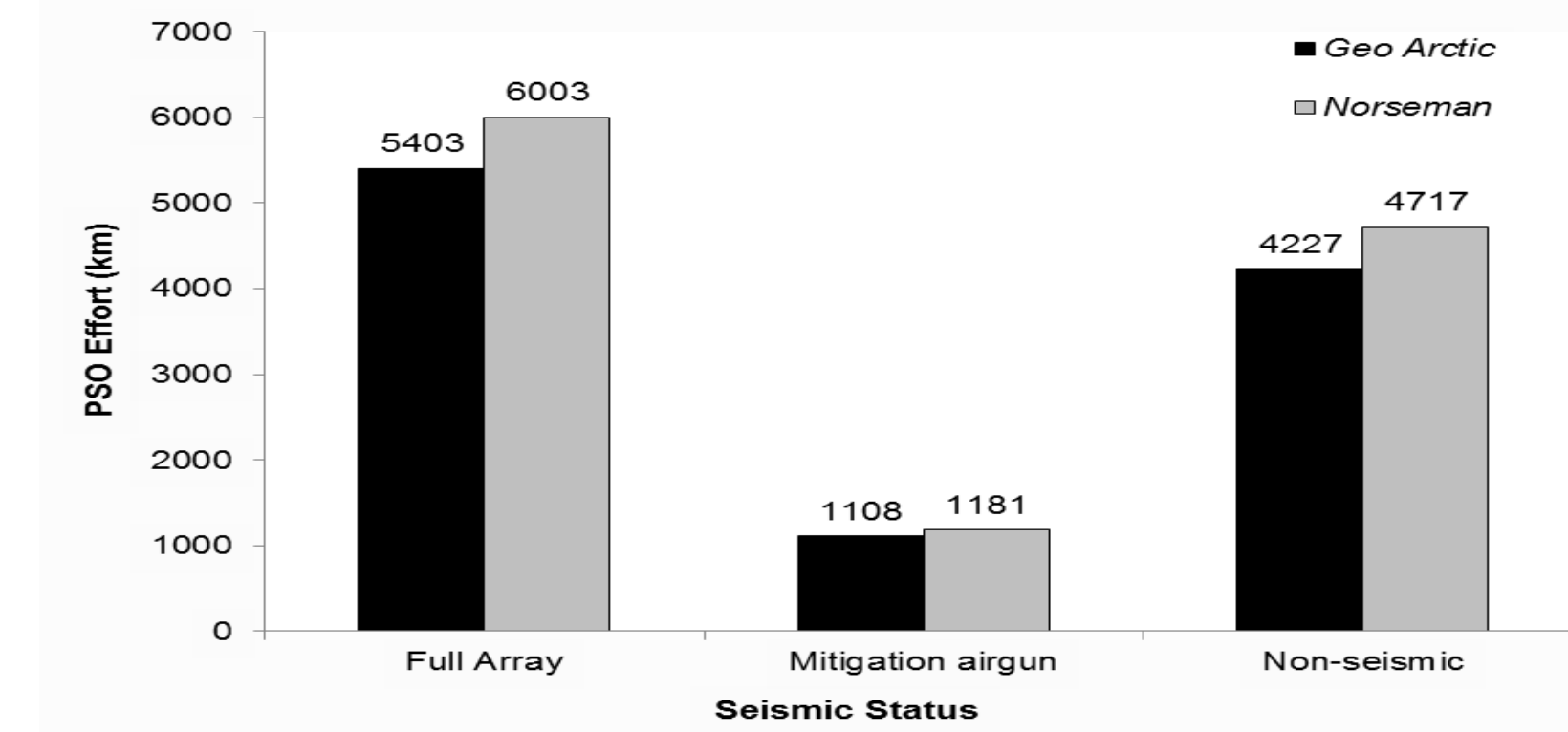
Two Pacific walrus photographed by M. Bles



Norseman - Dedicated Marine Mammal Monitoring Vessel

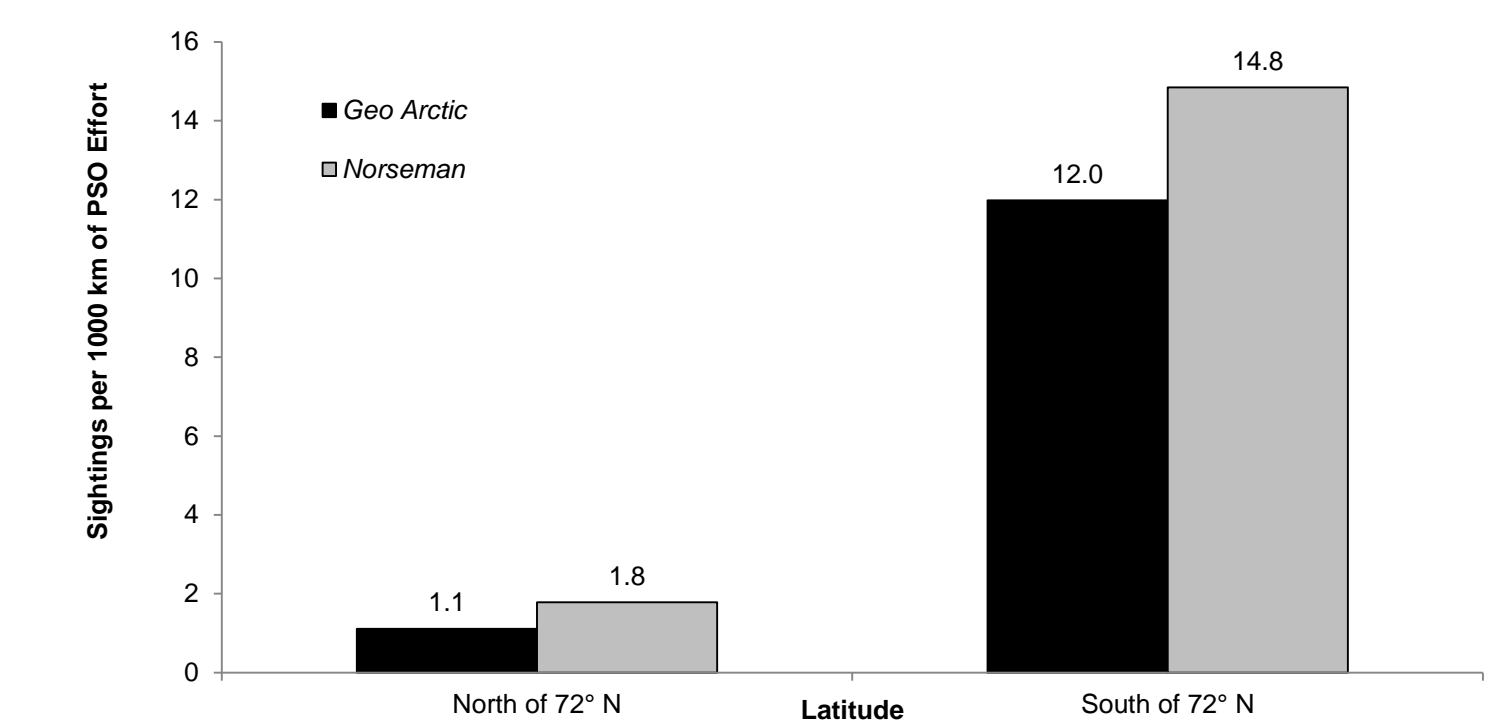
Geo Arctic - Seismic Source Vessel

Effort by Seismic Status & Vessel



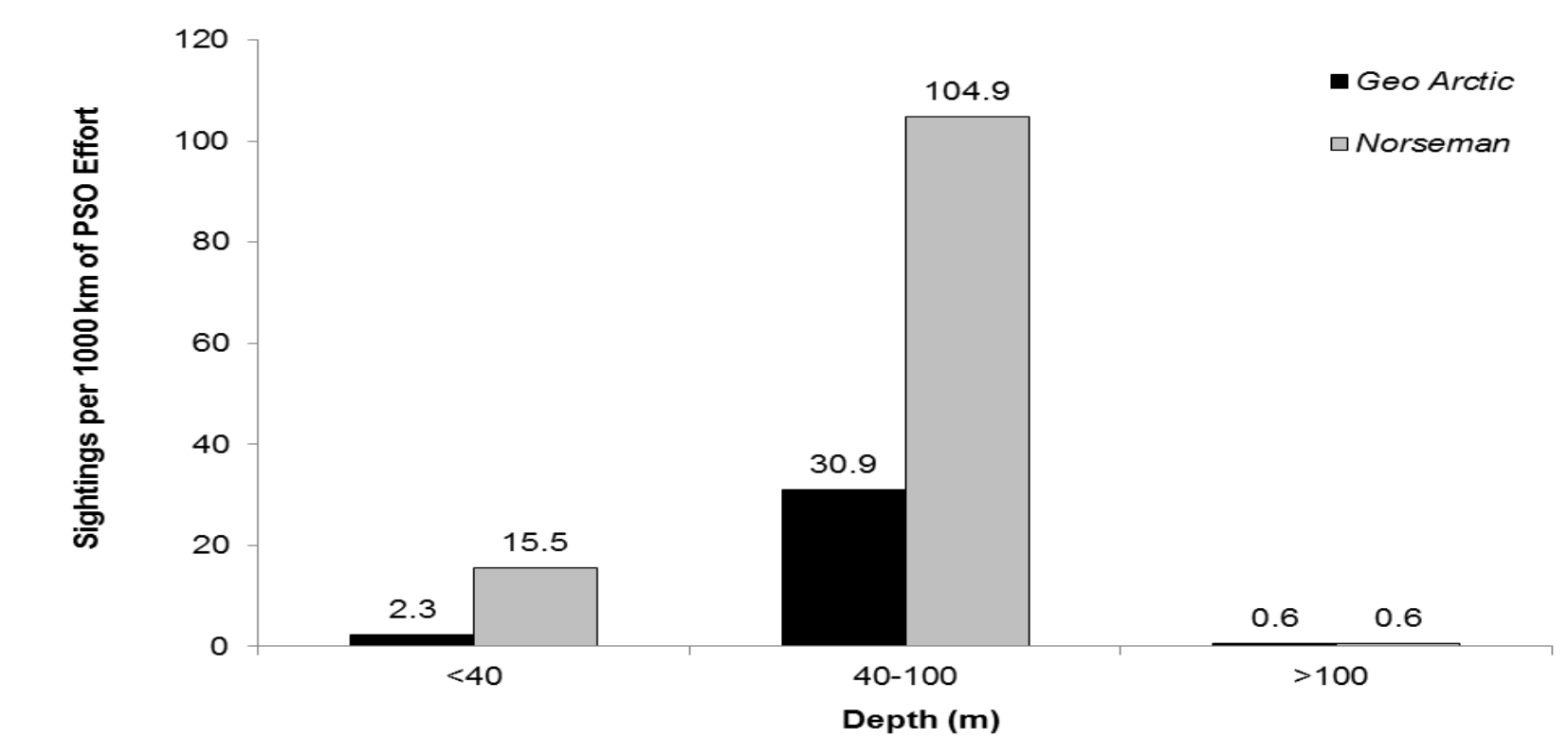
Cetacean Sighting Rate by North & South of 72° N Latitude *

Based on 10,265 km of "useable" effort



Pinniped Sighting Rate by Water Depth *

Based on 10,265 km of "useable" effort



* Limited to effort during "useable" conditions (*daylight, Bf<5, Vic>1km, severe glare, vessel speed <2kt, periods of 3 - 60 min, for pinnipeds and walrus and 3 - 120 min, for cetaceans after the airguns were turned off ("post-seismic" period). NOTE: "useable" data for these sighting rate calculations was less restrictive than effort used for line transect density calculations, as the latter was restricted by theoretical assumptions for this approach.

SUMMARY

- 480 sightings of ~713 individual marine mammals
- 78 sightings (16%) seen > 72° N
- Most (44%) sightings in water < 100 m depth per 1000 km of effort
- Confirmed species seen:
 - > PINNIPEDS: Pacific walrus; spotted, ringed, and bearded seals
 - > CETACEANS: Bowhead, gray, minke, and humpback whales
- No beluga whales seen but heard 12 occasions by PAM
- 29,404 km (3,137 hr) visual effort and 1,195 hr of PAM effort
- Analyses still underway for the 90-day report to NMFS

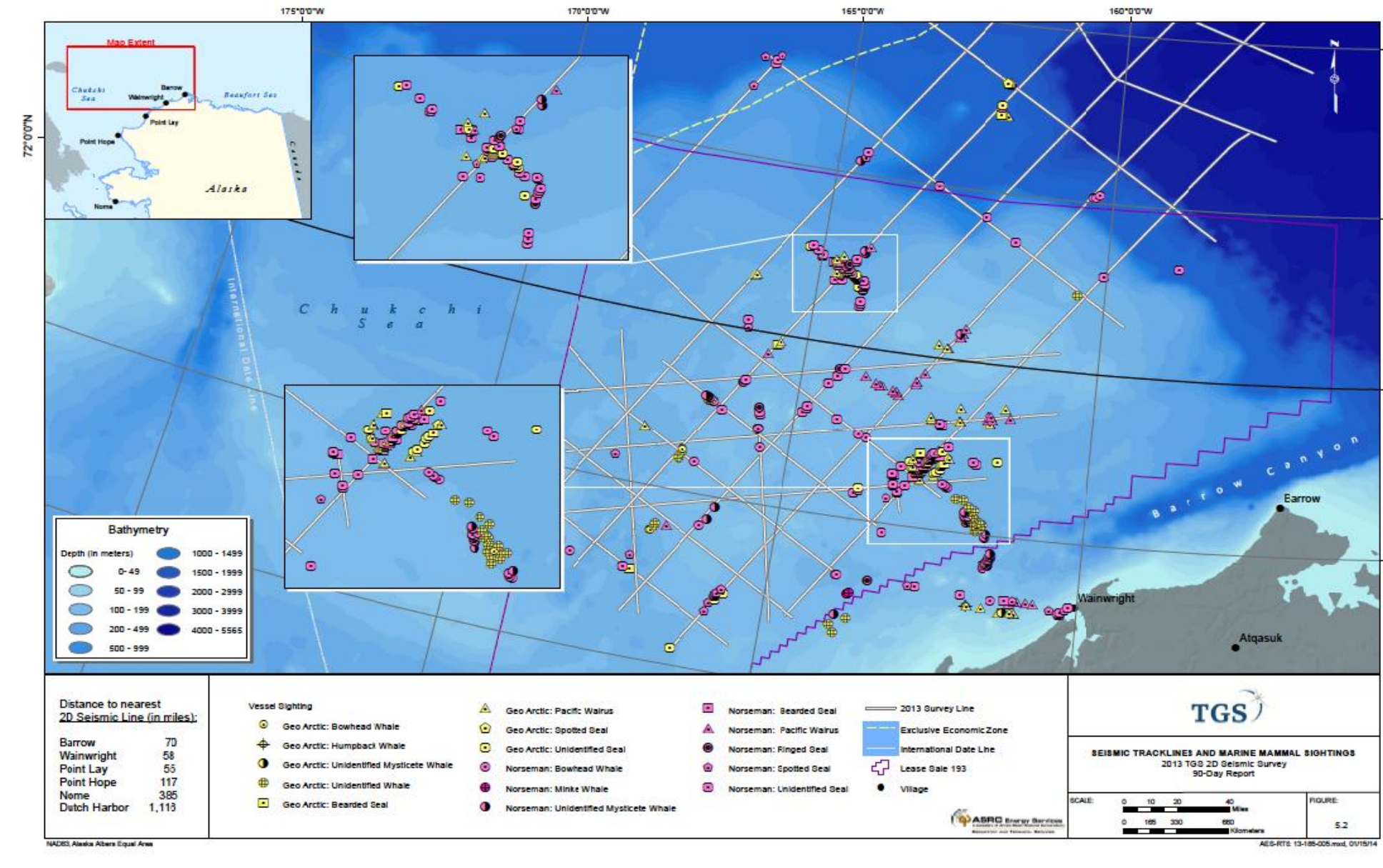
Future Work

TGS proposes seismic exploration activities during the 2014 open-water period to occur for approximately 92 days somewhere between 1 August - 31 October. The same procedures used in 2013 will be used but will acquire data along survey lines that were not acquired in 2013 due to ice conditions, and along new proposed lines.

Acknowledgments

2013 data were collected by ASRC PSOs under 2013 IHA (78 FR 51147). Data collection and funding for marine mammal monitoring efforts during 2013 was provided by TGS-NOPEC Geophysical Company. A big thanks to Elizabeth Benson for her continuous support and commitment to the monitoring efforts. Many thanks to field personnel Ernestine Ahgeak, Harriet Carrig, Sierra Deutsch, Kelsey Hall, Renee Hobson, Harold "Ray" Hooper, Paul Naglekirik, J.D. Paes, Kenneth Patrick, Kimberly Sturdevant, Mark Tanski, Robyn Ticket, Randy Tullous, Rex Tuzroyluk, and Tyler Tyson.

RESULTS



Seismic tracklines and marine mammal sightings 25 Aug - 30 Oct during the 2013 open-water season

Sightings by Species

Species	Geo Arctic			Norseman			Total
	n	(%)	CL	n	(%)	CL	
Cetaceans							
Bowhead Whale	5	(4)		44	(86)		49 (90)
Gray Whale	5	(12)		0			5 (12)
Harbor Porpoise	0			1	(2)		1 (2)
Humpback Whale	1	(2)		0			1 (2)
Minke Whale	1	(1)		2	(2)		3 (3)
Unidentified Mysticete Whale	3	(12)		17	(29)		20 (41)
Unidentified Whale	36	(60)		1	(1)		37 (61)
Total Cetaceans	51	(91)		65	(120)		116 (211)
Bearded Seal	8	(8)		15	(15)		23 (23)
Ribbon Seal	0			1	(1)		1 (1)
Ringed Seal	0			9	(9)		9 (9)
Spotted Seal	6	(6)		45	(49)		51 (55)
Unidentified Pinniped	9	(9)		15	(17)		24 (26)
Unidentified Seal	41	(43)		134	(138)		175 (181)
Total	64	(66)		220	(230)		284 (296)

* All sightings from periods of on-watch effort

Marine Mammal Densities

Conventional line-transect (LT) analyses (Distance Sampling) were used to estimate marine mammal densities during seismic and non-seismic periods based on sightings made only from the Norseman that met the following conditions (to meet basic LT assumptions):**

- Within the seismic survey area
- Beaufort sea states 0-4
- 2 observers on watch
- Visibility at least 1.0 km
- Vessel speed 4 - 12 knots

Sightings from the Norseman**	SEISMIC ON (2807 km)					SEISMIC OFF (1233 km)				
	n	Density (#/100 km ²)	Lower 95% CL	Upper 95% CL	% CV	n	Density (#/100 km ²)	Lower 95% CL	Upper 95% CL	% CV
Bowhead whale	8	3.0	1.1	8.1	53	2	1.1	0.2	5.8	32
Unid. mysticete	4	1.0	0.3	4.1	67	1	0.7	1.1	3.9	103
Walrus	26	9.7	4.0	23.5	46	3	2.4	0.6	9.0	67
Bearded seal	1	0.2	0.0	0.8	100	5	1.8	0.7	4.7	51
Ringed seal	2	0.3	0.1	1.7	101	3	1.0	0.4	3.1	57
Spotted seal	11	1.7	0.7	4.0	44	12	4.8	1.7	13.4	54
Unid. pinniped	5	1.4	0.4	4.8	66	1	0.4	0.1	1.9	100
Unid. seal	46	7.4	3.0	18.4	48	25	8.7	4.2	18.3	38

Introduction

TGS-NOPEC Geophysical Company (TGS) conducted a 2D marine seismic survey along pre-determined lines in U.S. Federal and international waters of the Chukchi Sea during the 2013 open water season from 25 August to 30 October.

Two vessels were involved:

- the Geo Arctic towed a 3,280 in³ seismic array and a 8,100-m long hydrophone solid streamer, and
- the Norseman was dedicated to monitoring for marine mammals ~7.5 km ahead of the Geo Arctic.

Scientific Monitoring Objectives

- To understand how marine mammals use these waters and how the seismic activities may impact them as required under the U.S. ESA and MMPA.
- Contribute to sparsely available information on marine mammals in northern Arctic waters previously largely inaccessible due to ice coverage.
- Conduct line-transect density analysis of sightings



Bowhead whale photographed by M. Bles

Methods

- Scientific and Iñupiat Protected Species Observers (PSOs) observed during daylight for marine mammals from both vessels during full seismic, reduced seismic (single 60 in³ airgun on during turns/transits between lines) and no seismic periods
- Passive acoustic monitoring (PAM) occurred 24 hr/day only from the monitoring vessel using a towed hydrophone array
- Mysticetus Observation Platform software was used to collect data and display real-time sighting locations relative to the respective vessel and/or seismic source location and the NMFS 180- and 190-dB re 1 µPa (rms) exclusion zones on a laptop PC monitor