

# Densities of Seals in the Pack Ice of the Bering Sea

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## What We Know...

Current density and abundance estimates for bearded (*Erignathus barbatus*), ribbon (*Histiophoca fasciata*), ringed (*Phoca hispida*), and spotted seal (*Phoca largha*) populations in the Bering Sea are imprecise and outdated.

For example, spotted seal population estimates for the Bering Sea vary over ranges of 6,985 – 54,765 (Rugh *et al.*, 1997) to 200,000 – 250,000 (Burns 1973), and densities of 0.0 – 6.75 seals per Nmi<sup>2</sup> (Burns and Harbo, 1977).

These species utilize sea ice habitat for critical life history events such as giving birth, nursing, breeding, and molting, and are vulnerable to loss or thinning of sea ice caused by a rapidly warming climate.

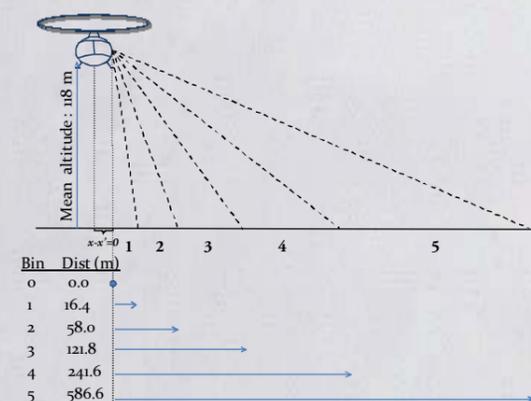
## Species Info



	Bearded	Spotted	Ribbon	Ringed
Length at birth:	130 cm	77-92 cm	90 cm	60-65 cm
Adult length:	2.1-2.4 m	1.6-1.7 m	1.5-1.75 m	1.1-1.5 m

## Aerial Survey Summary

Time period:	13 April – 10 June, 2007
Aircraft:	helicopter (Bell 206L Long Ranger III)
Target altitude and speed:	400 ft. / 95 knots
Observer positions:	right and left rear seats
Distance estimation method:	binned distances at 10° increments
Flights completed:	44
Total distance:	4,415 Nmi
Total area (alt. adjusted):	2,903 Nmi <sup>2</sup> (bin 6 truncated)
Total seals recorded:	1193
Data analysis:	Distance 5.0



Observer's eye position is standardized by lining up the red bars on the Plexiglas strip with the blue bars on the window, ensuring consistent bin identification between observers.



## Aerial Survey Tracks



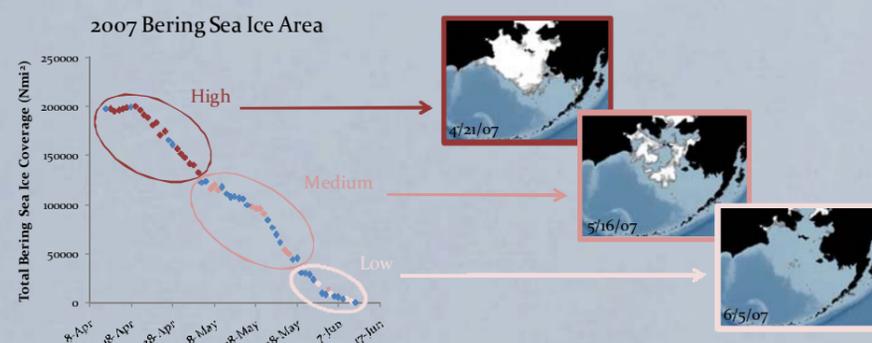
## Changing Ice

Figure below shows decline of Bering Sea ice coverage throughout the survey period. Survey data were divided into three categories of ice coverage for analysis:

- high (4/12/07 – 5/4/07)
- medium (5/5/07 – 5/28/07)
- low (5/29/07 – 6/11/07)

The color coordinated points indicate survey days.

• Midpoint snapshots of each period provide a visual example of ice coverage for the Bering Sea.



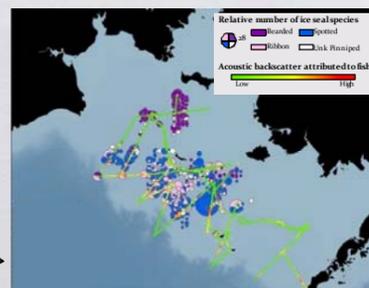
## Discussion

• Density estimates for bearded, spotted and ringed seals fall within the lower ranges observed by previous studies (Rugh *et al.*, 1997 and Bengston *et al.*, 2005) for the Bering and Chukchi Seas. Our survey focused on off-shore pack ice, while previous surveys focused more on near shore habitat. Also, our survey did not target specific species or habitat, but rather surveyed all available ice within the area accessible by helicopter from the ship's track.

• Potential changes in density and group size over the course of the survey could be due to loss of available habitat, which dropped from over 200,000 Nmi<sup>2</sup> to approximately 1,300 Nmi<sup>2</sup> during the survey. Also, changes in life history phases may have influenced density and group size. All species of seals were molting during the survey period, but were also in various stages of pupping, weaning, and breeding, which may affect their distribution and group size.

## Future Work

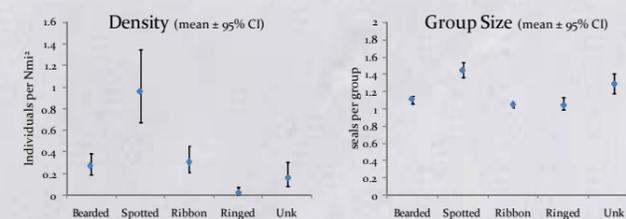
- Correct densities for fluctuations in survey altitude.
- Determine the factors driving changes in density, and group size such as: total ice coverage, ice type and condition from helicopter images, distance from shore, etc.
- Calculate Bering Sea abundance estimates for each species incorporating haul-out correction factors where available.
- Collaborate with fisheries researchers to study correlations between pinniped and prey distributions. (See example)



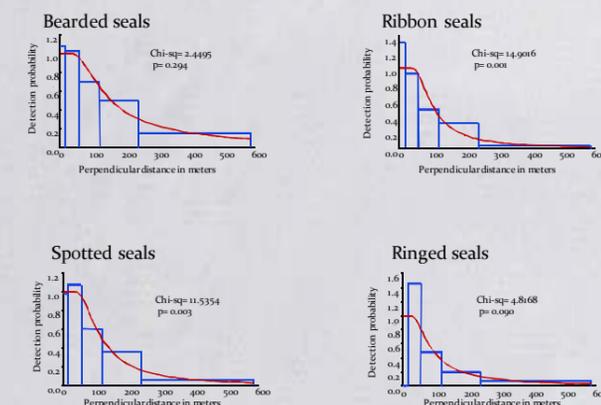
## Survey Results

Species	Total Count	Survey Density* animals/Nmi <sup>2</sup> (% CV)	Group Size (% CV)
Bearded	271	0.28 (17.92)	1.11 (2.17)
Spotted	533	0.95 (17.70)	1.45 (3.22)
Ribbon	207	0.31 (19.64)	1.05 (1.43)
Ringed	23	0.03 (45.66)	1.04 (4.17)
Unidentified	159	0.17 (32.80)	1.30 (4.49)

\* Densities are for the overall survey which spanned from April 12 – June 11. Due to extreme changes in habitat, changes in life history phases, and our inability to account for seals in the water, it is inappropriate to extrapolate these densities to estimate species abundance for the Bering Sea.

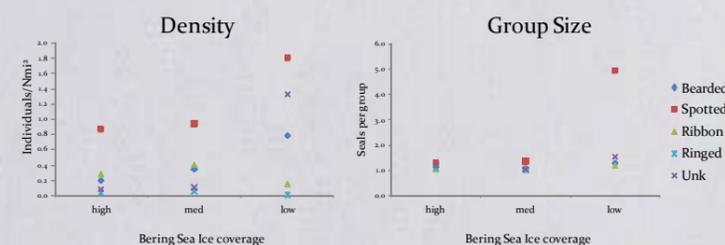


## Detection Probabilities



The detection probability graph for ringed seals indicates avoidance of the aircraft. No ringed seals were seen in bin 1, closest to the transect line, suggesting that they were diving into the water before being counted or moving away from the helicopter. Therefore, densities of ringed seals have likely been underestimated in this study.

## Density and Group Size as Ice Melts



Densities of bearded and spotted seals appeared to increase as total ice coverage decreased. Unidentified seals followed a similar pattern suggesting that many of these seals may have been young bearded and spotted seals which can be difficult to discern. Group size for spotted seals also appeared to increase as ice became less available.

## Special Thanks To:

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## Literature Cited

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