

Influence of Water Masses on the Distribution and Abundance of Seabirds in the Northeastern Chukchi Sea

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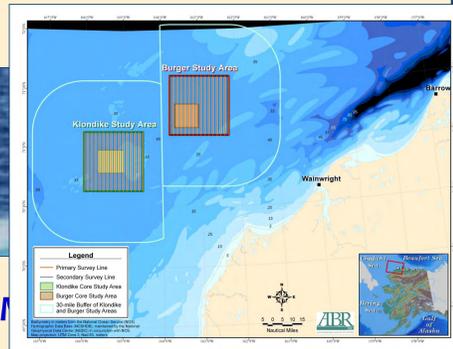
Introduction

The Chukchi Sea has one of the highest rates of primary productivity in the world ocean (Grebmeier et al. 2006). This extraordinary productivity supports rich benthic and planktonic communities that, in turn, support large communities of apex predators such as seabirds.

In addition to its rich marine resources, the Chukchi Sea is of great interest for exploration and offshore oil development.

In 2008 and 2009, we collected data on the distribution and abundance of seabirds in the northern Chukchi Sea in the vicinity of two proposed oil prospects. The two study areas lie ~110–180 km (~60–100 NM) northwest of the village of Wainwright and are known as Klondike and Burger, named after exploratory wells drilled in 1989.

This study builds on historical data collected in the Chukchi Sea and employs an ecosystem-based approach that uses oceanography to explore patterns in the distribution and abundance of seabirds.



Sampling

- Three cruises/year, ~28 days each
- Series of north-south parallel survey lines in each study area (16 primary lines, 15 secondary lines)
- 300-m sampling zone off one side of ship
- Two observers on each cruise
- ~12 h sampling/day



John Rose conducts surveys from the bridge of the R/V Westward Wind



M/V Bluefin (2008)



R/V Westward Wind (2009)

Analysis

- Line-transect sampling incorporates distance measurements in estimates
- Estimated density (birds/km²) from visual counts using species-specific detection functions
- Summarized data from CTD casts
- Retrospective comparison with existing data in the North Pacific Pelagic Seabird Database (NPPSD)

Acknowledgments

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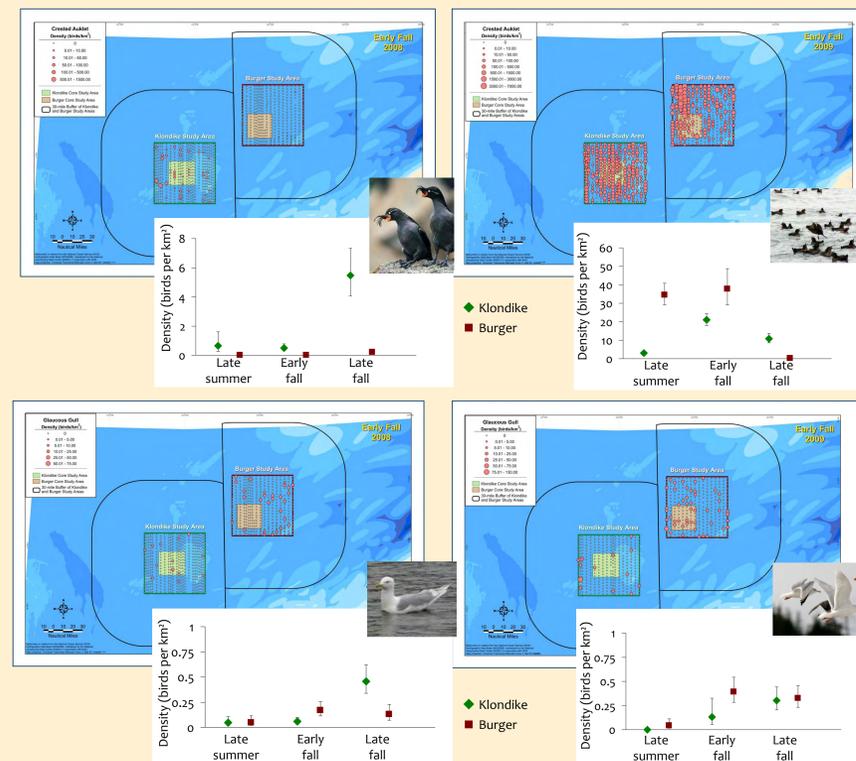
Objectives

- (1) Explore the spatial and interannual variation in abundance and distribution of seabirds.
- (2) Describe interannual changes in species-composition.
- (3) Examine relationships between oceanographic structure and the distribution and abundance of seabirds.

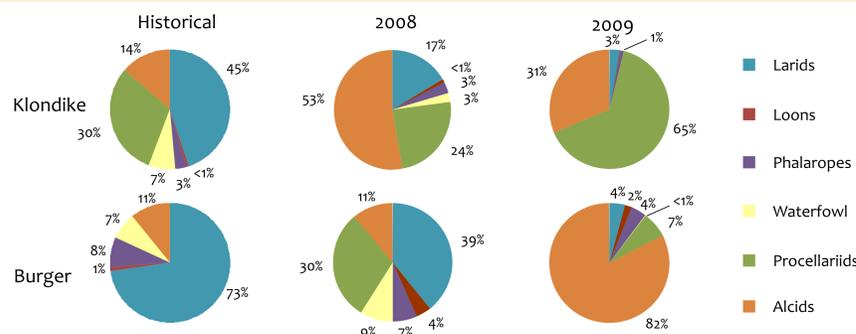
Results

The total density of seabirds was considerably higher in 2009 than it was in 2008 and was generally higher in Klondike than in Burger in both years.

- For example, total densities in early fall 2008 were 4 birds/km² in Klondike and 3 birds/km² in Burger.
- In contrast, total densities in early fall 2009 were 81 birds/km² in Klondike and 46 birds/km² in Burger.



- Alcids and procellariids were abundant in Klondike in both years and in Burger in 2009 only, whereas surface-feeding or near-surface-feeding larids were common in Burger in both years.
- Spatial patterns in species-composition suggest that alcids and procellariids are more common in the central Chukchi Sea now than they were historically.

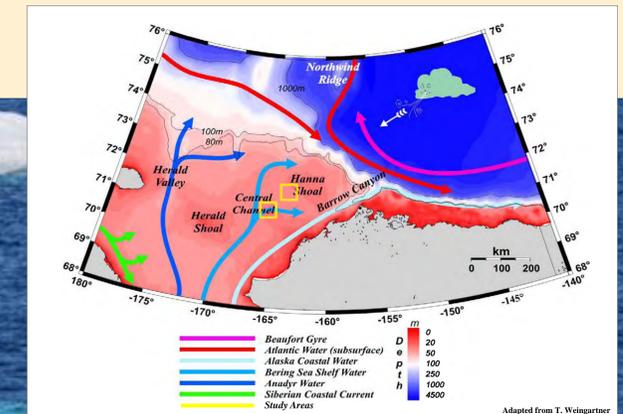


Oceanography

Northward flow through Bering Strait branches and follows three pathways associated with bathymetric features: Herald Valley, the Central Channel, and Barrow Canyon. This flow

- a) transports heat, carbon, and nutrients from the Bering Sea, strongly affecting production in the Chukchi Sea and Arctic Ocean; and
- b) creates water-masses with characteristics (physics, productivity, species-composition) that differ between the channels and the shoals.

The study areas lie on the northeastern shelf southwest of Hanna Shoal and between the Central Channel and Barrow Canyon.



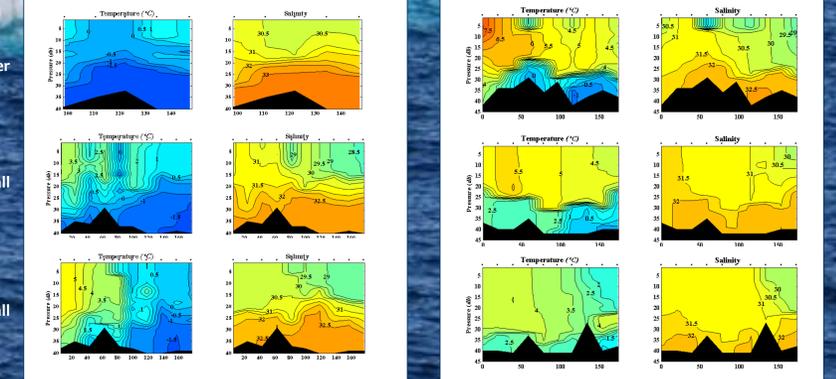
2008

2009

Late summer

Early fall

Late fall



Water masses differed between the two study areas in 2008, with warm, salty oceanic water in Klondike and cold, fresh melt water in Burger. Ice was present on both study areas until September. Water became warmer and more strongly stratified through time as Bering Sea water penetrated into the Chukchi Sea.

Temperatures and salinity were higher in 2009 than in 2008 and more homogenous throughout both study areas, indicating earlier and more extensive penetration of Bering Sea water. No ice was present on either study area during the survey period.

Conclusions

The distribution of seabirds, particularly the planktivorous species, may be influenced by the advective processes that transport oceanic species of zooplankton from the Bering Sea to the Chukchi Sea.

This transport apparently differed between years and resulted in a broader northeastward intrusion of Bering Sea Water and a higher abundance and wider distribution of planktivorous seabirds in both study areas in 2009 than in 2008.

References

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