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

Introduction
The Chukchi Sea has one of the highest rates of primary productivity in the world (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 km (~60-~200 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.

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.

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

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.

References

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Inland Oceanography

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

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)

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

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

Adapted from T. Weingartner 361.