HABITAT ASSOCIATIONS OF THE SEABIRD COMMUNITY IN THE NORTHEASTERN CHUKCHI SEA

Adrian E. Gall,¹ Tawna C. Morgan,¹ and Robert H. Day¹

¹ABR, Inc.—Environmental Research & Services, PO Box 80410, Fairbanks, AK 99701
University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, 905 N. Koyukuk Dr, Fairbanks, AK 99775
E-mail: agall@abrinc.com

INTRODUCTION
Seabirds rely on oceanographic processes such as fronts to facilitate foraging. Identifying elements of the marine habitat that are associated with seabird distribution can reveal mechanistic links. Habitat can be defined by direct variables which affect the physiology of seabirds (e.g., prey availability) and indirect variables which characterize the physical habitat. An understanding of current ecosystem function and ongoing changes in the Chukchi Sea is needed to assess any potential impacts from future oil and gas exploration and development activities.

METHODS
• Surveyed birds and oceanography during September 2011 and September 2012
• Recorded all bird observations on a laptop that georeferenced and time-stamped records
• Measured vertical profiles with a Seabird, Inc. SBE-19+V2 CTD sampling at 4 Hz
• Sampled zooplankton with 505 µm nets towed obliquely at 5 kt
• Interpolated oceanographic covariates to a 3-km grid
• Split line transects into 3-km segments
• Modeled habitat of 8 species of seabirds using generalized additive models (GAMs)
• Species-specific models pooled both years
• Best model for each species selected from suite of 27 models using AIC

Modeling Results
Table 1. Statistical significance of environmental variables and deviance explained by models for the abundance of 8 taxa of seabirds in the northeastern Chukchi Sea, 2011–2012. P-values are approximate, based on degrees of freedom estimated by cross-validation; net text indicates a positive association; blue text indicates a negative association; and black text indicates no consistent association. Dashes indicate that the variable was not included in the model best supported by the data for that species.

<table>
<thead>
<tr>
<th>Species</th>
<th>Percent deviance explained</th>
<th>Multilayer depth (100 m) (°C)</th>
<th>Temperature (10°C) (°C)</th>
<th>Distance to front (km)</th>
<th>Biomass subarctic zooplankton (tonnes)</th>
<th>Biomass arctic zooplankton (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crested Auklet</td>
<td>10.00</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>0.94</td>
</tr>
<tr>
<td>Least Auklet</td>
<td>30.00</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>0.85</td>
</tr>
<tr>
<td>Short-tailed Shearwater</td>
<td>15.00</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>0.98</td>
</tr>
<tr>
<td>Phalaropes</td>
<td>20.00</td>
<td>0.34</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>0.35</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Northern Fulmar</td>
<td>7.00</td>
<td>0.1</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>0.83</td>
</tr>
<tr>
<td>Glaucous Gull</td>
<td>9.00</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>0.98</td>
</tr>
<tr>
<td>Black-legged Kittiwake</td>
<td>12.00</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>0.82</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Murres</td>
<td>36.00</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>0.98</td>
</tr>
</tbody>
</table>

• Strong divers are more abundant in warm (>4 °C), weakly stratified water. Surface-feeding birds are more abundant in cold (<4 °C), strongly stratified water.
• Planktivores are more abundant near to fronts and omnivores are more abundant far from fronts.
• Least Auklets are positively associated with abundance of zooplankton; relationships less clear for other species.

CONCLUSIONS
• Models provide insight into factors that seabirds use to select their habitat and how those relationships vary by prey preferences and foraging strategy.
• Associations with temperature (and vertical structure) differ depending on foraging strategy.
• Associations with fronts differ depending on prey preference.
• Prey abundance can be a factor, although less reliable than physical habitat characteristics indicating processes that aggregate prey.

ACKNOWLEDGMENTS
We thank the ABR seabird survey crew, captains and crew of the M/V Westward Wind, stellar coordination from Opgenorth Fairweather, LLC, and the village of Wainwright for supporting our field work. We appreciate assistance from Seth Daniloff, Liz Dobbins, Rau Hopcroft, and Jennifer Questel at UAF for providing the oceanographic data. This work was funded jointly by ConocoPhillips, Shell E&P, and Statoil.