BEST-BSIERP
Bering Sea PROJECT
UNDERSTANDING ECOSYSTEM PROCESSES IN THE BERING SEA 2007–2013

Aging Murres in a Warming Sea

OLD AGE AND EXPERIENCE BEAT YOUTH IN POOR CONDITIONS

Thick-billed murres (*Uria lomvia)* are a common seabird in the Bering Sea. Better understanding of their demography and life history is crucial to predicting their role as an indicator of a changing ecosystem and how they may respond to worsening conditions or future changes in the dominant climate patterns of the Bering Sea. Our project explored the relationship between biological age and environmental conditions in thick-billed murres with breeding grounds in the Bering Sea. Murres are long-lived animals, and in the wild may survive up to a venerable age of 30 years old, while adapting to dramatic manmade and climate-induced changes in their environments.

How We Did It

We measured telomere length (a DNA marker) as an indicator of biological age, and compared it among three murre colonies in the southeastern Bering Sea that have contrasting environmental conditions and population trajectories. Providing a more accurate picture of an organism's true aging process, biological age is a measure of aging that integrates chronological age

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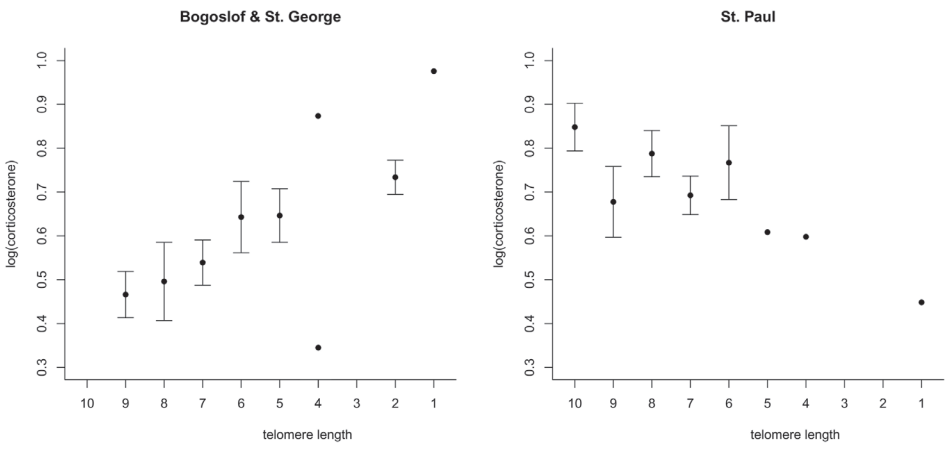
Fig. 1



Nutritional stress (measured by corticosterone levels) increases with age on high quality colonies (left: Bogoslof and St. George) and decreases on poor quality colonies (St. Paul). Note that since telomere quantity decreases with age, the x-axes run from large quantities to small so as to run from young to old, as a chronological age axis would.

The Big Picture

The Bering Sea system is characterized by ice covered winters and complex interactions of food webs and water masses during the summers. Seabirds are top predators, and they act as land-based indicators of various changing marine signals: fish stocks, timing of annual marine food web changes, and climate-related fluctuations in the environment. Some long-lived seabirds, with lifespans easily reaching 30 years, may have witnessed two or more radical regime shifts in the environment. Our work has demonstrated that longevity is an important factor in how seabird populations respond to their environment: age and environmental conditions interact to explain the stress levels that affect reproduction and survival of breeding murres.

A component of the BEST-BSIERP Bering Sea Project, funded by the National Science Foundation and the North Pacific Research Board with in-kind support from participants.

(time since birth) with the effects of stress, reproduction, and individual variability. As organisms age, their physiological deterioration may lessen their ability to meet environmental challenges. On the other hand, older birds may be more experienced and be better at responding to the environment: they know where to forage when conditions have changed.

Our results demonstrate that stress levels of breeding thick-billed murres depend on an interaction of colony conditions and biological age (Figure 1). When conditions are favorable, such as on Bogoslof Island, or relatively stable (e.g., St. George), biologically older birds have higher stress levels, likely due to the effects of aging. When conditions are poor, such as on St. Paul Island, biologically older birds have lower stress levels. We concluded that older birds are more experienced, but also might be less fit in obtaining food than younger individuals. When food is plentiful, prior experience in finding food is less important, but as conditions worsen, the experience of older individuals becomes beneficial. Under the worst conditions, all birds become food limited; here older birds outperform younger ones, as their experience in finding food and weathering tough years becomes more important than their failing physiology.

Why We Did It

Although population modeling estimates demographic parameters, the age structures of wild populations are often unknown. However, knowing the makeup of populations and how different age classes perform in the environment is crucial to our understanding of animals' responses to that environment. Especially in long-lived organisms, like seabirds, adults can vary in their quality and ability, based on biological age. If the environment becomes less predictable, is it better to have populations comprising younger or older birds responding to that situation? Is a colony of old birds in trouble, or will it be more likely to weather poor foraging conditions successfully? Knowing that younger birds are poor foragers or that older birds are more stressed could help explain why some colonies do well and others decline.

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The Bering Sea Project is a partnership between the North Pacific Research Board's Bering Sea Integrated Ecosystem Research Program and the National Science Foundation's Bering Ecosystem Study. **www.nprb.org/beringseaproject**

Murres breed in dense colonies on sea cliffs in the circumpolar north.

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