

## Penguins coping with climate change

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Climate change effects on wildlife populations are increasing, especially at the poles, where massive changes are happening now.

Understanding the limits of the natural history and demographic attributes of ice-obligate species like the Adélie penguin is of importance given these massive changes, which include a rapid increase in sea ice extent and persistence in the Ross Sea over the past 30 years, in stark contrast with the Antarctic Peninsula sector and the Arctic Ocean where ice is disappearing equally rapidly.

Using data from a 14-year time series (1997-2010) from 3 Adélie penguin colonies ranging in size from among the smallest in the world to the largest, we determined the effect of typical seasonal variation in the sea ice environment on three important natural history parameters: breeding productivity, chick mass, and nesting chronology.

During the middle part of the study (2001-2005), two giant icebergs grounded in the study

area and completely altered local habitat conditions, providing a “natural experiment” with which to evaluate the effects that rapid change could cause on the important factors regulating colony size and persistence.

We found that the icebergs had far more influence on the natural history parameters of the penguins the normal range of environmental variability, resulting in population level changes including delays in nesting chronology, depressed breeding productivity, and lower chick mass.

These effects were most negative at the smallest, southern-most colony. Additionally, throughout the study, chick mass was negatively correlated with colony size, supporting previous findings indicating density-dependent energetic constraints at the largest colony.

Understanding the negative effects of rapid change on Adélie penguins, as well as their response to long-term

environmental variation, are important to our overall understanding of climate change effects in this and other species facing both rapid and persistent environmental change.

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### Main Points

We studied life history responses to extreme environmental changes during a long-term study of Adélie penguins at 3 colonies ranging in size from very small to very large.

We found that rapid changes led to population level changes in metrics of reproductive performance.

Rapid environmental changes had more severe negative consequences at the smallest of the three penguin colonies we studied.

Dugger, K.M., G. Ballard, D.G. Ainley, P.O’B. Lyver, C. Schine. 2014. Adélie penguins coping with environmental change: results from a natural experiment at the edge of their breeding range. [Frontiers in Ecology and Evolution: doi:10.3389/fevo.2014.00068](https://doi.org/10.3389/fevo.2014.00068). (Open access).