

## Are king penguin populations threatened by Southern Ocean warming?

Recently, Le Bohec *et al.* (1) inferred that king penguins (*Aptenodytes patagonicus*) are at heavy extinction risk under current global warming predictions. Although their demographic modeling was elegant, they based further inferences on results showing that warm El Niño–Southern Oscillation events negatively affect both breeding success and adult survival. Although the results are interesting, we here warn against conclusions that are probably too strong. First, king penguin populations, including the one studied by Le Bohec *et al.*, have increased exponentially since the 1960s (2, 3) despite coincident warming of the northern Southern Ocean (4); today, its world population totals  $\approx 1.5$  million breeding pairs. Second, evidence exists for density dependence in this species' population growth rate (3), which may affect its response to climate change. Third, described relationships are derived from short time series (breeding success, 6 years; adult survival, 8 years) relative to the species' 30-year life expectancy, analogous to the closely related emperor penguin (*Aptenodytes forsteri*). Such time series are too short to evaluate temporal variation without sampling error, and extinction risk has not been evaluated with mechanistic population models. Finally, the temporary warming of El Niño may not be a surro-

gate for long-term climate effects, because the Southern Annular Mode has been locked in its positive state, duplicating La Niña conditions, since the mid-1970s, contributing greatly to climate effects observed thus far (5). Although Le Bohec *et al.* clearly demonstrate that ocean environment affects seabirds, a now well documented topic, longer time series and comprehensive population models are needed for more robust conclusions.

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Author contributions: C.B., H.W., C.-A.B., J.F., P.T., and D.A. wrote the paper.

The authors declare no conflict of interest.

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