

Is the loss of sea ice good or bad for Antarctic penguins?

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Understanding how changing climates affect organisms' fitness is an important challenge in ecology. In polar regions, sea ice extent in summer varies considerably among years, making the habitats of a variety of marine animals variable. As a sentinel of polar climates, Adélie penguins have been intensively studied, but mechanistic links between sea ice extent and their fitness remain unclear. Here, we recorded the foraging behavior of Adélie penguins by using modern electronic tags (accelerometers, GPS, and video cameras) over the four summer seasons, including one unusual season with no sea ice. In the ice-free season, penguins swam (rather than walked) during foraging trips and travelled longer distances in shorter durations. Because entrance to (or exit from) water was not limited by cracks, diving locations were distributed more evenly and dive durations were shorter for a given dive depth compared to ice-present seasons. Water was greener due to direct sunshine, which presumably lead to higher prey (krill) availability as assessed by the number of kill capture events in a dive. These changes were associated with higher breeding success, higher chick growth rates, and larger adult body mass in the ice-free season. Overall, our results demonstrate mechanistic links between sea ice extent and fitness in an Antarctic marine predator.