

ID: W2605663622

TITLE: An Arctic predator-prey system in flux: climate change impacts on coastal space use by polar bears and ringed seals

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ABSTRACT:

Summary Climate change is impacting different species at different rates, leading to alterations in biological interactions with ramifications for wider ecosystem functioning. Understanding these alterations can help improve predictive capacity and inform management efforts designed to mitigate against negative impacts. We investigated how the movement and space use patterns of polar bears (*Ursus maritimus*) in coastal areas in Svalbard, Norway, have been altered by a sudden decline in sea ice that occurred in 2006. We also investigated whether the spatial overlap between polar bears and their traditionally most important prey, ringed seals (*Pusa hispida*), has been affected by the sea-ice decline, as polar bears are dependent on a sea-ice platform for hunting seals. We attached biotelemetry devices to ringed seals ( $n = 60$ , both sexes) and polar bears ( $n = 67$ , all females) before (2002–2004) and after (2010–2013) a sudden decline in sea ice in Svalbard. We used linear mixed-effects models to evaluate the association of these species to environmental features and an approach based on Time Spent in Area to investigate changes in spatial overlap between the two species. Following the sea-ice reduction, polar bears spent the same amount of time close to tidal glacier fronts in the spring but less time in these areas during the summer and autumn. However, ringed seals did not alter their association with glacier fronts during summer, leading to a major decrease in spatial overlap values between these species in Svalbard's coastal areas. Polar bears now move greater distances daily and spend more time close to ground-nesting bird colonies, where bear predation can have substantial local effects. Our results indicate that sea-ice declines have impacted the degree of spatial overlap and hence the strength of the predator-prey relationship between polar bears and ringed seals, with consequences for the wider Arctic marine and terrestrial ecosystems. Shifts in ecological interactions are likely to become more widespread in many ecosystems as both predators and prey respond to changing environmental conditions induced by global warming, highlighting the importance of multi-species studies.

SOURCE: Journal of animal ecology

PDF URL: <https://besjournals.onlinelibrary.wiley.com/doi/pdfdirect/10.1111/1365-2656.12685>

CITED BY COUNT: 78

PUBLICATION YEAR: 2017

TYPE: article

CONCEPTS: ['Ursus maritimus', 'Sea ice', 'Arctic', 'Climate change', 'Glacier', 'Marine ecosystem', 'Environmental science', 'Predation', 'Oceanography', 'Ecosystem', 'Apex predator', 'Polar', 'Ecology', 'Geography', 'Physical geography', 'Fishery', 'Geology', 'Biology', 'Physics', 'Astronomy']