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Title: Ecological Detection in the Arctic: Three Vignettes

Abstract:

By combining models and data, we are able to learn more about ecological systems than either alone can provide. I will illustrate this idea with three examples, concerning the past, present, and future. First, I will the decline in the population of Steller sea lions in Western Alaska. A wide range of hypotheses have been suggested to explain the decline. These include not enough or the wrong kind of food, competition or incidental mortality from the fishing industry, predation by orcas and environmental change. There are sufficient data to investigate 10 of these hypotheses simultaneously. I will illustrate how this can be done by confronting models for the decline with the data, showing which of the hypotheses have support from the data, and examining the resulting policy options. Second, I will combine models and data to assess the current status of sea otters in Southeast Alaska. Otters, which are ecosystem engineers affecting coastal food webs and fisheries, were nearly driven to extinction; after protection the focal population grew from 400 translocated animals in the late 1960s to nearly 10,000 in 2003. I will combine models for population dynamics of otters and surveys with data to assess the current abundance (absolute numbers) and density (fraction of carrying capacity occupied) across about 20 habitats in SE Alaska. Third, I will show how we can combine models and data to understand what might be – in this case the consequences of climate change for polar bears in the Arctic. Polar bears are the apex predator, with an obligate ice stage of their life history. I will illustrate an individual level model that can be used to study trade-offs faced by polar bears (to hunt in fast ice or active ice; to continue a reproductive attempt or not) and use the model to investigate consequences of climate change. Although starving polar bears make the news, it is likely to be gradual declines in reproduction that is the mechanism for declining population size. I will conclude with general comments about modeling nature, which is indeed complicated and variable.