

The role of temperature as a proxy for prey availability

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Abstract:

Concern of climate change effects on marine trophic interactions is growing as thermally mediated changes in prey species composition and phenology can severely impact food webs. The impracticality of monitoring trophic level responses across a food web on appropriate spatial scales has led to considerable effort in developing ecological indicators reflecting the state of an ecosystem or its key components. In the North Sea, breeding performance of Black-legged Kittiwakes, *Rissa tridactyla*, has been suggested as an indicator of climate driven trophic changes. The main prey of kittiwakes is the planktivorous lesser sandeel, *Ammodytes marinus*, and kittiwake breeding success (KBS) appears related to sandeel availability. Correlative based studies have tried to consider the importance of various sandeel early life history conditions, such as *Calanus* prey or temperature, on KBS. However, simple correlations may fail to reflect the processes affecting the members of different trophic levels. We explore the relationship between temperature (or correlated physical forcing), *Calanus* prey, sandeel and KBS at a finer spatial and temporal resolution than previously considered. KBS at a colony was compared with weekly resolved temperature, chlorophyll and zooplankton data within the birds breeding foraging range. Indices of age 0 and 1 sandeel abundance tested the reported relation between predator and prey. To consider propagation of temperature effects through the food web, the relationship between different trophic levels with temperature was examined. We observed a seasonal relationship between temperature and zooplankton but temperature was not significant for sandeel recruitment or KBS.

Keywords: temperature, food web, kittiwakes, *Rissa tridactyla*, sandeel, *Ammodytes marinus*, *Calanus finmarchicus*, *Calanus helgolandicus*

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