

## Wintering hotspots of short-tailed shearwaters and their prey distribution in the Bering and Arctic Seas

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Short-tailed shearwaters (*Puffinus tenuirostris*) breed in the southern hemisphere, and make a trans-equatorial migration to the Bering and Arctic Seas during the non-breeding period. Recently, sea ice has decreased; this which might, through prey availability, affect the marine ecosystem including these highly mobile top-predators. Detecting high use areas of top-predators and understanding the links between them and key prey species are crucial to predicting ecosystem changes and designing effective management plans. We investigated at-sea distributions and movements of short-tailed shearwaters using two types of data sets: bird tracking (geolocators) (2009-2011) and ship-based at-sea surveys (autumn 2012 and summer 2013). Both ship-based surveys and tracking indicated that there was seasonal northward shift in their distribution. They were distributed mainly in the Bering Sea and around the Aleutian Islands in summer, on the other hand, they moved into the Arctic Sea through Bering Strait in autumn. We also conducted prey samplings using vertical tows with a NORPAC net during 2007, 2008, 2012 and 2013 to quantify the condition of their prey (mainly krill). Then, we tested overlap or difference between distributions of short-tailed shearwaters and krill. Krill were abundant in summer but there were no shearwaters in the Arctic Sea. In contrast, in autumn, both krill and shearwaters were distributed in the Arctic Sea and birds were concentrated in the area where krill were more abundant. The sizes of krill were small (1–5 mm total length) in summer, and large (5–25 mm) in the Arctic Sea during autumn. Previous study about diets of short-tailed shearwaters indicated that they preferred larger size of krill, even when smaller krill is present (Vlietstra et al. 2005). Therefore, the seasonal movement pattern of short-tailed shearwaters appears to be related to the size-availability of krill (i.e. preference for larger size). Future reduction of sea ice might affect krill availability and hence the distribution (i.e. northward shift) of shearwaters consequently inducing ecosystem changes in this region (e.g. energy flow).

### Reference

Vlietstra LS, Coyle KO, Kachel NB, Hunt GL (2005) Tidal front affects the size of prey used by a top marine predator, the short-tailed shearwater (*Puffinus tenuirostris*), *Fisheries Oceanography*, 14, 196–211