

Foraging movements and prey of short-tailed shearwaters in the Southern Ocean

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In the Southern Ocean food web, Antarctic krill is believed to be the key prey species in the sea-ice related shelf and shelf-slope regions; feeding mainly on ice algae and being a major food of predators (predatory fish, marine mammals and seabirds). However, myctophids can be an alternative food source when Antarctic krill is less abundant, especially in the basin region. These spatial and temporal variations in the abundance of krill and myctophids may indicate the change of overall food web. Thus it is important to know when and where this shift occurs and to explore the underlying mechanisms. During the summer, seabirds feed in offshore habitats and come back to the nests often to exchange incubation duties and to feed their chicks. At this time of year, they are relatively easy to capture and the composition of their prey has been well studied. A review study of seabird diet indicates that myctophids appear to be important food in penguins and shearwaters/petrels, in locations where birds are foraging in oceanic basin/slope habitat and among those feeding often in the night. Many recent studies of the fatty acid signature of stomach oil of Procellariiformes (shearwaters, petrels, prions, storm-petrels) also showed that myctophids are important prey when these birds are exploiting oceanic habitats distant from the colonies. Stomach oil, which consists of undigested lipids of prey species (triacylglycerols and wax esters) is often found in the adult Procellariiformes returning from long (~ca. two weeks) foraging trips. Fatty acid profiles of undigested lipids reflect that of the prey consumed about ~ a week earlier. Therefore, seabirds can be a tool to explore spatial and temporal variation of key prey species and their interactions with predators in the Southern Ocean. Short-tailed shearwaters (STSH) breeding in Tasmania employ a dual foraging strategy; the birds feed in the Tasman Sea during short trips (<2days) and feed in the Indian Ocean sector of Southern Ocean during long trips (>10 days). In the Indian Ocean sector, krill abundance is relatively low compared to the Scotia-Weddell Sea, and it is expected that krill-dependent food web may be dominant over the shelf slope while krill-independent food web may exist in oceanic zone. To understand how STSH move in these two habitats, we tracked the movements of adult birds using GPS loggers and identified their prey species using fatty acid signatures of stomach oils that were collected when they returned to the colony after long trips. We collected 14 long trip tracks and two oil samples from STSH breeding on Wedge Island in Tasmania in Jan- Feb 2019. We identified the areas where birds were feeding or resting on the water from slow movement speed (<7m/s). Two core-use areas (50% kernel density) of feeding/resting were recognized. One (named "Core-2") was in 160°E 67°S in the shelf-slope around Burny Islands and the other ("Core-3") was in 120°E 57°S in the basin of Polar Frontal Zone. 93% of birds used Core-2 during the long trips. We analyzed the fatty acid composition of stomach oil in two birds spending 7 days in Core-2 area c 10days before coming back to the colony. The fatty-acids profile of these stomach oil samples indicated that the two birds fed on myctophids. Core-3 might also be important to some extent but no diet samples were available in 2019. In Core-2 area, birds often made short-distance movements and fed or rested on the water both in day and night, while in Core-3 area, birds fed or rested on the water in the night time more often than they did during the day. Thus at least some individuals fed on myctophids even over the shelf-slope both in day and night in the basin around Burny Islands. This study indicates the importance of myctophids for seabirds in the Southern Ocean ecosystem.

Keywords: krill, myctophids, food web, tracking, fatty acids, Indian Ocean sector