Environmental factors affecting foraging habitat and behaviour of Adélie penguins throughout the breeding season

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Seabird foraging activities are constrained by the heterogeneous distribution of prey, prey accessibility, prey depletion by congenerics, and the birds' varying energy requirements throughout their life history cycle. Investigations of intra-seasonal variation in foraging habitat will therefore provide clues to understand how predators respond to differences and changes in the marine environment. As a sea ice-obligate species, we selected Adélie penguins (*Pygoscelis adeliae*) breeding in the Prydz Bay region to examine this. Using GPS tracks throughout a breeding season, we calculated First Passage Time to extract Area Restricted Search (ARS) zones to indicate foraging intensity, and classified the ARS zones by *K*-means clustering. A total of 47, 64, 23 and 10 ARS zones were detected during early and late incubation, chick-guard and crèche stages (n = 4, 11, 6 and 3 birds), respectively. Higher and more stable sea ice concentration and distance from the nearest major colony had positive effects on foraging intensity. The ARS zones were classified into Nearshore, Offshore and Open water habitats. Birds used Offshore habitat and avoided Open water habitat during early incubation and crèche, when birds need to return to the nests less frequently. During late incubation and chick-guard, when birds frequently return to the colony, they used Nearshore and Open water habitats in proportion to availability. These results suggest higher availability and predictability of prey in relation to pack ice, prey depletion by intra-specific competition, as well as different provisioning requirements between the breeding stages, affect foraging habitat and behavior over the breeding season.