

Microhabitat use and feeding behaviour of Adélie penguins *Pygoscelis adeliae* under Antarctic fast sea ice

Hina Watanabe¹, Junichi Takagi², Akinori Takahashi^{1,3}

¹*Department of Polar Science, The Graduate University for Advanced Studies, SOKENDAI, Tokyo, Japan*

²*Kyoto University, School of Platforms (KUSP), Kyoto, Japan*

³*National Institute of Polar Research, Tokyo, Japan*

In the Antarctic region, large-scale changes in sea-ice conditions are known to affect the feeding behaviour of ice-dependent predators, such as penguins, through changes in prey availability. On the other hand, few studies examined how fine-scale variability in sea-ice conditions (e.g., < 1 km) affects the feeding behaviour of ice-dependent predators. In this study, we examined the effect of sea-ice microhabitat on the feeding behaviour of Adélie penguins *Pygoscelis adeliae* using data on 3-D dive paths and feeding rates. Our study area, Lützow-Holm Bay in East Antarctica, is covered by thick fast sea ice throughout the summer. Therefore, penguins breeding in this area use small open waters (< 1 km) such as tide cracks or leads as foraging sites and feed on Antarctic krill *Euphausia superba* under fast sea ice. Twelve chick-rearing penguins were equipped with three data loggers: GPS loggers to record their movements on sea ice, multi-channel data loggers to reconstruct their 3-D dive paths, and head-mounted accelerometers to examine their feeding events. Based on GPS tracks and dive depth data, we identified 12 foraging sites (4 and 8 sites in lead and tide-crack habitats, respectively). Penguins used 2.1 ± 0.8 sites per foraging trip. At each site, penguins dived under the fast sea ice through the small open water and returned to the start point of the dive for breathing. Penguins had higher mean feeding rates (number of feeding events per 100 s) in the lead habitats than in the tide-crack habitats. In the lead habitat, penguins traveled shorter distances from the dive start point to the location of feeding events than in the tide-crack habitats. These results suggest that lead habitats may be profitable for Adélie penguins, allowing efficient feeding with shorter travel time during a dive. Our findings indicate that sea-ice microhabitats affect the feeding rates of penguins through differences in prey availability under fast sea ice. The selection of sea-ice microhabitats would be an important factor in determining the feeding success of ice-dependent marine predators.