

Foraging strategy plasticity in Fiordland Penguins / Tawaki (*Eudyptes pachyrhynchus*): A stable isotopic approach

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The Fiordland Penguin/Tawaki (*Eudyptes pachyrhynchus*) is one of New Zealand's three mainland penguin species, and the only crested penguin in the group. Their breeding range stretches down the west coast of the South Island from Bruce Bay down to the southern tip of Stewart Island distributing them across diverse marine ecosystems. This habitat plasticity suggests that they may be better equipped to tailor their foraging strategy to local environmental conditions. As global climate change and human disturbance alters prey abundance and distribution, assessing their foraging strategy plasticity is vital for understanding their marine ecology and potential threats to important resources during critical periods in their annual cycle. This project, in collaboration with the Tawaki Project, aims to understand the trophic interactions of Fiordland Penguins across the breeding range during both the late incubation/early chick rearing period as well as the pre-molt forage in the Tasman Sea.

Many dietary studies require the extraction of stomach contents to determine prey composition, but we are using a minimally invasive technique not previously employed on this species: stable isotopic analysis. For this, blood and feathers were collected from penguins at three locations (Jackson Head, Milford Sound/Piopiota, and Codfish Island/Whenua Hou) during the chick guard stage. Each of these sites is associated with one of the three major marine ecosystems occupied during the breeding season (offshore pelagic zone, fjord, and shallow continental shelf respectively). From these samples, isotopes of carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) reveal foraging information from time periods that would otherwise be difficult to assess. Carbon reflects the foraging zone (latitude, pelagic vs. benthic, etc.) while nitrogen corresponds to the Tawaki's position within the food web (trophic position). By focusing on these two specific isotopes, a more complete picture of their foraging behavior and requirements can be created.

The field component during the first year of the project sampled both male and female penguins at all three sites. The season began in late September and ran through October 2017. Samples have since been processed at the University of Cincinnati's Stable Isotope and Biogeochemistry Laboratory. The data collected during the 2017 season are currently being analyzed, but preliminary results are promising and will soon help to increase our understanding of Fiordland Penguin foraging ecology. The 2018 field season has recently been completed and samples will be processed and analyzed in the upcoming months.

This project has been a truly collaborative effort. Field work has included members of the Tawaki Project, West Coast Penguin Trust, Taronga Zoo, and the University of Otago. Laboratory work has been similarly collaborative with the use of facilities at Middle Tennessee State University, the University of Cincinnati, as well as my home institution (Marshall University). Thanks to funding provided by Birds New Zealand and others, we can work together to better understand this enigmatic species and help conserve a truly incredible New Zealand endemic treasure.

