



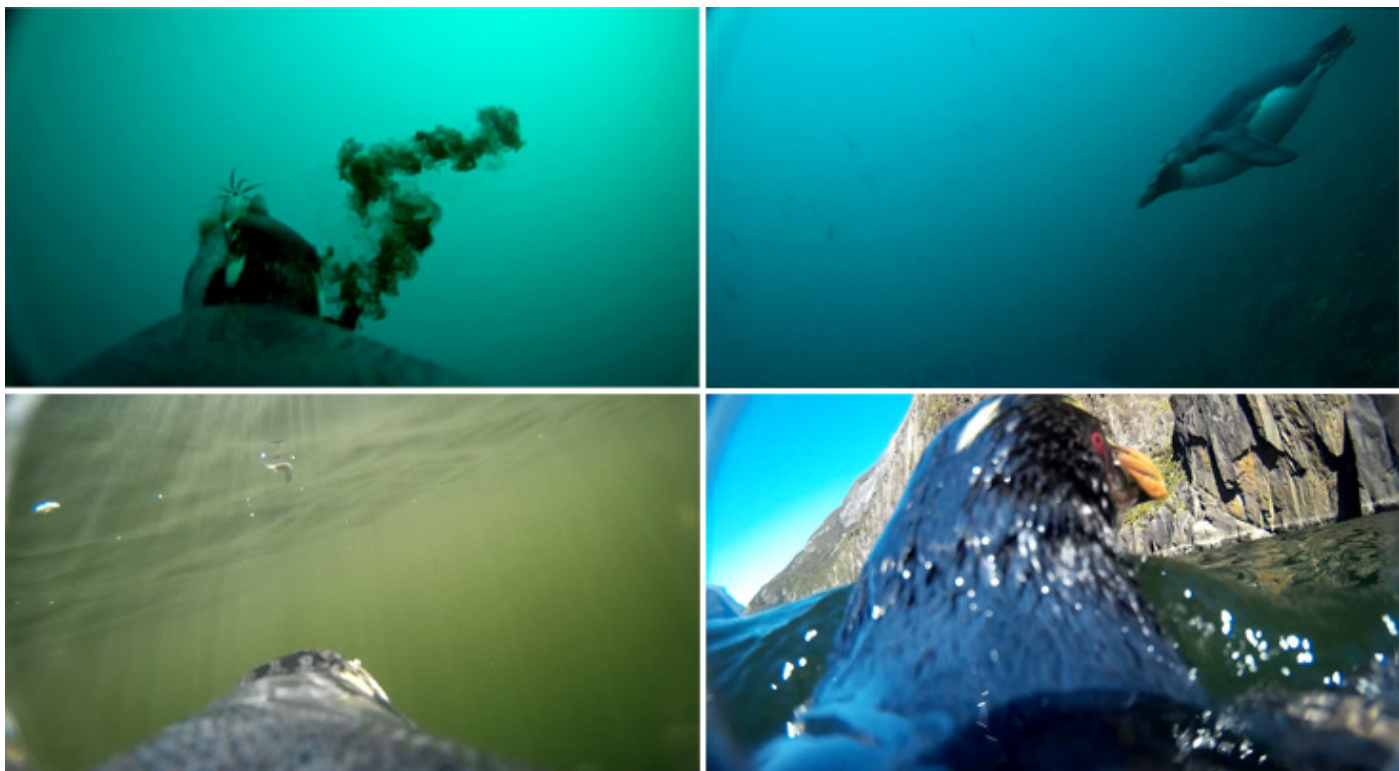
Habitat utilization of tawaki in New Zealand's fjord ecosystems

The tawaki/Fjordland penguin is the world's most elusive penguin species. Its breeding range is confined to the southern coastline of Westland, Fjordland, and islands in Foveaux Strait as well as Rakiura/Stewart Island. Despite this relatively restricted range, tawaki occupies highly diverse marine habitats ranging from continental shelf settings in Southwestland, fjord ecosystems inside and open deep waters outside the Fjordland boundaries, and shallow coastal habitat in Foveaux Strait.

Since 2014, the Tawaki Project has been studying the foraging ecology of tawaki and found the species' at-sea behaviour to be as versatile as the marine environments it occupies. Particularly, dive behaviour varied substantially in penguins from Milford Sound/Piopiotaahi when compared to conspecifics breeding along open coastlines. Dive profiles indicated that their strategy was to dive to a depth of about 20-30 m after which the penguins would gradually dive along a surface-ward trajectory before ascending steeply at the end of the dive. These dive patterns suggested that penguins were searching and approaching their prey from below, presumably aided the light backdrop of the surface.

To examine the prey pursuit behaviour as well as get first information about prey species targeted by tawaki within Milford Sound/Piopiotaahi we deployed novel animal-borne video cameras on chick rearing tawaki. Logistic constraints due to inclement weather conditions allowed only two camera deployments in September/October 2020. Whereas one camera malfunctioned, the second deployment yielded a total of 2.5 hours of video footage documenting a total of 56 prey capture events. Of these, 52 captures were of fish larvae; the penguin also captured two warty squid (*Moroteuthopsis ingens*) and two sprats (*Sprattus muelleri*) while the camera was operating. As suspected, the penguin's prey pursuit strategy was in all cases from below. Fish larvae were generally caught without a notable prey pursuit (i.e., "drive-by capture") whereas squid and sprat involved some chasing before successful capture.

After this successful pilot study, we plan to deploy cameras on chick-rearing tawaki in the coming years. We plan to compare feeding strategies of penguins known to forage predominantly inside fjords (e.g., penguins from Harrison Cove, Milford Sound/Piopiotaahi; Seymour Island, Doubtful Sound/Patea) and birds searching for prey in the open sea (Moraine, Milford Sound; Shelter Islands, Doubtful Sound).



Screenshots of from a total of 2.5 hrs of video footage recorded on a chick rearing tawaki on 1st October 2020. Top left to bottom right: successful capture of a juvenile warty squid; underwater encounter of another tawaki; (successful) pursuit of a sprat just below the surface, penguin cam "selfie" off Copper Point, central Milford Sound/Piopiotahi.