TĀKOKETAI MOVEMENTS AND DIVING BEHAVIOUR – ARTICLE

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Seabirds exhibit diverse foraging strategies to exploit a great variety of marine resources, including a range of diving abilities which enable access to various depths in the water column. Seabirds are capable of flying great distances to access highly productive areas, even when they are tied to a central location during the breeding period. Unfortunately, this exposes them to a range of at-sea risks, including incidental capture in longline fisheries. Bycatch mitigation measures include bird-scaring lines, hook shielding devices, and the setting of hooks at night when many seabirds are less active. In order for these measures to be effective, they must be informed by an understanding of seabird foraging ecology.

The Tākoketai (Black Petrel), an endemic seabird with a remaining population size of approximately 5,600 breeding pairs, faces ongoing threats of incidental capture in longline fisheries. With generous assistance from the Birds New Zealand Research Fund, we deployed time-depth recorders (TDRs) and global position system (GPS) loggers on Tākoketai during the 2023-24 breeding period. We collated these results with TDR and geolocation sensor (GLS) loggers retrieved from closely related Karetai kauae mā (White-chinned Petrels) and Tāiko (Westland Petrels). Using a comparative approach our aim is to investigate the foraging behaviour of these three *Procellaria* petrels to further our understanding of seabird ecology and inform measures to reduce bycatch.

We found that Tākoketai dived significantly deeper than both Karetai kauae mā and Tāiko, with a mean dive depth of 5.9 m, and a maximum dive depth of 38.5 m. This is a record dive for *Procellaria* petrels. Using the GPS and GLS data to calculate the time of day, we found that Tākoketai dived much more frequently during the day than during the night, and that dives during the night were significantly shallower. Specifically, dives tended to be deepest at noon, and shallowest at around midnight. In contrast, Tāiko showed no preference for daytime diving, but their dives were still shallower at night. This trend is likely due to the physiological constraint of reduced vision in the dark. In fact, we found higher lunar luminance increased the night-time dive depth in Tāiko.

The exceptional deep-diving ability of Tākoketai not only increases their own risk of bycatch, but also enables them to retrieve hooks to the surface which then become available to less adept divers such as albatrosses. Thus, by protecting Tākoketai, we may be able to reduce bycatch of other seabirds which share foraging areas. Previously, the recommendation was to protect hooks until 10 m, however, we found a quarter of Tākoketai dives exceeded this depth. This is problematic as at depths beyond 10 m the efficacy of tori lines and hook-shielding devices is limited. However, since Tākoketai dive more often during the day and to shallower depths at night, setting hooks at night could significantly reduce their bycatch.

Tracking five Tākoketai from incubation to early chick-rearing showed an impressive average total distance of 17,100 km travelled in an average of 4.5 trips over the deployment (59-75 days) (Figure 1). A single bird tracked from chick-rearing to fledging covered a remarkable 28,700 km in 16 trips during a 67-day deployment. This much greater distance and number of trips is likely due to the high energetic demands of chick-provisioning which requires frequent returns to the burrow.

The next phase of our study aims to determine whether diving behaviour changes when birds are foraging near fishing vessels. If we observe differences, it could significantly impact how we use diving behaviour to develop mitigation measures, as bycatch risk is specific to dives associated with vessels.

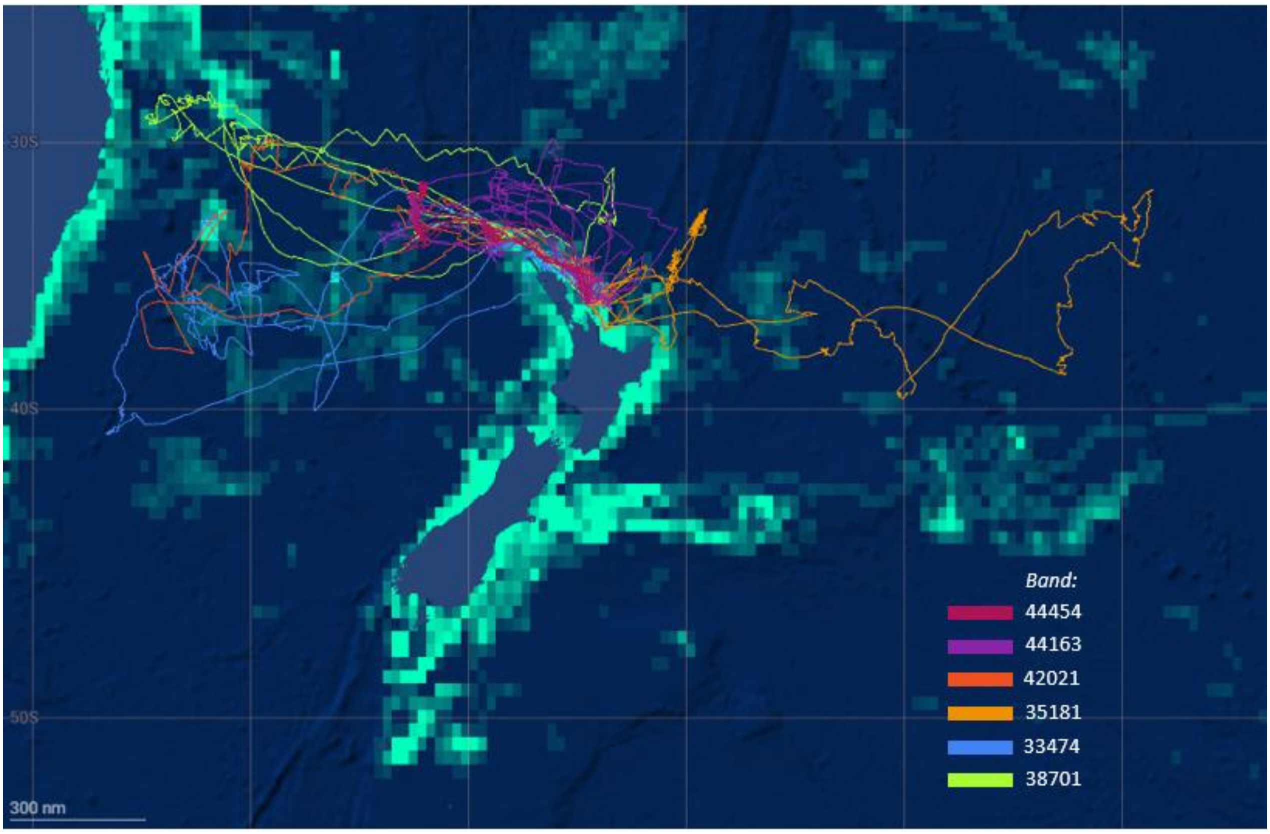

Figure 1: Tākoketai tracks overlaying AIS fishing vessel tracks between December 2023 and May 2024, from Global Fishing Watch (2024).