

YEAR 6
2019/20

the tawaki project

www.tawaki-project.org

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The Tawaki Project so far

In the breeding season 2019, the Tawaki Project completed its sixth field season and entered a new phase of research. The first five years of the project examined how the species' foraging ecology and population dynamics varied across the entire tawaki breeding distribution, i.e. West Coast, Fiordland and the Foveaux Strait region.

The project's research revealed that the penguins show highly adaptable at-sea behaviour allowing them to forage successfully in open pelagic (West coast), constricted fjord ecosystems (Milford Sound/Piopiotahi), as well as shallow coastal marine habitat (Whenua Hou/Codfish Island). We also found that the tawaki population in Milford Sound is significantly larger than previously thought.

One reason for strong population numbers could be that within fjords, penguins are isolated from large scale environmental perturbations. For example, the 2015 El Niño event caused near complete breeding failure at Jackson Head, West Coast, while the penguins in Harrison Cove, Milford Sound/Piopiotahi experienced a successful breeding season.

Satellite tracking of tawaki during the non-breeding period showed that birds from different breeding regions all travel southwards to forage along the Subantarctic Front. Hence, outside the breeding season odds are even for penguins from all regions. Any regional differences in population developments, therefore, are likely tied to breeding and reproductive success.

The next phase of the Tawaki Project will investigate how the penguins fit into the marine ecosystem of New Zealand's fjords, and whether Fiordland provides a safe haven for tawaki in an era of substantial global changes.

Funding & Support

As in previous years, field work was principally funded through the [Tawaki Project's Patreon campaign](#) with our top patrons being [Oliver Aughton](#), [Andrea Faris](#), [Joanna Lankester](#), [Gary Wayne](#), [Janis Russel](#), [Ali Sortomme](#), [Ali Thorne](#), [Kean Maizels](#) and [Penny Gwynn](#).

With the [New Zealand Penguin Initiative](#), the Tawaki Project has gained important support that will allow us to continue our work over the coming years.

We are grateful to [Birds New Zealand](#) for granting us funding for state-of-the-art animal-borne cameras.

[Wellington Zoo](#) (especially [Clare Stringer](#)) helped us to purchase a new transponder reader and provided fantastic help in the field lending us the wonderful [Deleece McLaren](#).

The [Antarctic Research Trust](#) covered the substantial costs for another satellite tracking study. This included the purchasing of 18 satellite transmitters and the associated data access fees.

In Milford Sound/Piopiotahi, [Southern Discoveries](#) remains the most vital supporter of the project (special thanks to [Andrea Faris](#) & [Wolfgang Hainzl](#)). In Doubtful Sound/Patea, [Richard "Abbo"](#) and [Mandy Abernathy](#) of [Fiordland Expeditions](#) went out of their way to get us safely to, on and off the Shelter Islands.

We count ourselves lucky to be working with the fantastic [Monique van Rensburg](#) of the [Department of Conservation](#) in Te Anau and the equally fantastic [Sharon Trainor](#) and [Rory Hannan](#) of DOC Southland helped us to get to Whenua Hou on a short notice to get satellite tags off several penguins that returned with the precious cargo.



A male tawaki incubating freshly laid eggs, Codfish Island/Whenua Hou, 10 August 2019



The Fiordland Expeditions vessel Tutoko as seen from East Shelter Island.



Sites & Dates

Satellite tag recovery 2019

Harrison Cove, Milford Sound / Piopiotahi

18 July 2019

A one-day visit to Harrison Cove was made in the afternoon to recover satellite tags from any birds that had returned from winter journeys.

Codfish Island / Whenua Hou

7-12 August 2019

A team of two travelled to Codfish Island/ Whenua Hou to search the Mephistopheles area for satellite tagged birds.

Jackson Head

16 August 2019

The tawaki colony was visited for a single day to recover the device from the only bird fitted at this site with satellite tag in February.

Doubtful Sound / Patea recce trip

East & West Shelter Islands

6-7 September 2019

In preparation for the 2020 breeding season, this recce trip was undertaken to assess site feasibility for GPS logger deployments. East and West Shelter Islands were visited and tawaki nests searched for around 2.5 hours.

Seymour Island

6 September 2019

Seymour Island was visited in the late afternoon and searched for approximately 1.5 hours.

Bauza, Fergusson & Rolla Islands

7 September 2019

Around lunchtime, a section of the northern bay of Bauza Island was searched for ca. 1.5 hours. In the afternoon, the northern end of Fergusson Island was searched for 1.5 hours. In the late afternoon, tawaki nests were mapped on Rolla Island for approximately 2 hours.

Elizabeth Island & Davidson Cove

8 September 2019

Davidson Cove was searched for signs of tawaki for ca. 2.5 hours. Elizabeth Island was visited and a stretch of probably 200 m of the southeastern coast was searched for approximately 1 hour.

GPS tracking 2019

Harrison Cove, Milford Sound / Piopiotahi

26 September - 15 October 2019

Field work commenced two weeks later than planned due to a delay with issuing permits. Nest searches commenced on 27/09. First device deployments occurred on 30/09; the last penguin was fitted with a device on 8/10. All devices were recovered by 15/10.

Moraine, Milford Sound / Piopiotahi

03-18 October 2019

First nest checks and device deployments at the Moraine colony were conducted on 3/10; last devices were fitted to birds on 13/10. All devices were recovered by 17/10.

Satellite tracking 2020

East Shelter Island, Doubtful Sound / Patea

17-18 February 2020

East Shelter Island was visited for two days to deploy satellite tags on six tawaki. Total time on the island amounted to approximately 5 hours.

Otago Coast

1 February - 9 March 2020

Satellite transmitters were deployed at three rehabilitation centres, Oamaru Blue Penguin Colony (1 & 14/02), Katiki Point (14 & 21/02), and Penguin Place (1, 12, 20 & 21/02). Furthermore, tawaki were fitted with satellite transmitters at Doctor's Point (14/02), Blackhead (15/02), and Kakanui River (9/03).



Searching satellite tagged tawaki on Codfish Island / Whenua Hou, 11 August 2019



The team heading towards the Moraine field site, Milford Sound / Piopiotahi, 15 October 2019



Deployment of satellite transmitter on a tawaki at Doctor's Point, 14 February 2020



Satellite tracking 2019 [completed]

In February 2019, a total of 16 tawaki were fitted with satellite transmitters to monitor the winter dispersal of penguins from the species three main breeding regions, i.e. West Coast, Fiordland, Foveaux Strait (see [2018 report](#)).

While eleven birds stopped transmitting between April and July, five birds could be tracked for the entire duration of their winter journeys. Three of these birds returned to Whenua Hou, and one each to Harrison Cove and Jackson Head.

An effort was made to recover these devices in July and August, and to search for any other tracked birds that lost their transmitters at sea.

Harrison Cove

A two hour search resulted in the recovery of the bird that could be tracked until its return.

Another three of the satellite tracked birds were registered as returned throughout the 2019 breeding season (September-November) by the transponder gate. Only one of the tracked birds (982 000402100815, 'Waimarie') has not been resighted so far.

Therefore, the **recovery rate of tracked birds in Harrison Cove is 80% (4 out of 5 birds)**



Male tawaki (982 000210214761, 'Wolfgang') still carrying its satellite transmitter, 18 July 2019

Codfish Island / Whenua Hou

During the five days of searches, all eight satellite tagged birds were found, four were still carrying the devices which were recovered; one of these had stopped transmitting nearly six weeks earlier.

The Whenua Hou recovery rate is 100%.

Jackson Head

The only bird, a female, fitted with transmitter had returned around 4 August and was encountered incubating two eggs 12 days later. The transmitter was removed and the bird resumed incubation right away. We found the nest occupied by a large chick during a second visit in late September.

The Jackson Head recovery rate is 100%.



Female tawaki (982000210215961, 'Hedwig') incubating her eggs while still carrying a satellite transmitter, Cave Area, Jackson Head, 16 August 2019.

Impact of device attachment

The plumage of most penguin that carried satellite transmitters showed visible albeit minor damage. In the worst case, an entire line of feathers was missing where the transmitter had been attached. However, most birds preened adjacent feathers effectively covering patches of missing feathers. On Whenua Hou, all birds were paired up, and two were already incubating eggs. **So it is safe to assume that the study had no substantial negative effects on the penguins.**



Recovery of satellite transmitters on Codfish Island/Whenua Hou, August 2019. Top panel: a pair of tawaki in their burrow with the male (982 000405533982, 'Toby') carrying a satellite transmitter. Middle panels: transmitter still attached and level of feather damage after device recovery. Bottom panel: tawaki (looking to the right) that lost satellite transmitter prior to return (982000405532496, 'Flint') showing some damage to the plumage (lower back).



GPS/TDR deployments

As in the previous years, the foraging behaviour of tawaki rearing chicks was studied using GPS dive loggers. To compare the at-sea movements of penguin breeding deep within and at the entrance of the fjord, deployments occurred at two sites within Milford Sound/Piopiotaho:

- **Harrison Cove**, located ca. 9 km from the open sea, the site we have worked at for the past five seasons, and
- **Moraine**, a large tawaki colony on the southern side of the fjord with direct access to the open ocean.

Harrison Cove

Between 30 September and 08 October 2019, a total of **6 females and 3 male tawaki** were fitted with **GPS dive loggers**. The devices remained on birds for an average **6.0±2.6 days**. The **females weighed 2,610±244 g**, while the three **males** were substantially heavier at an average **3,500±805 g**.

One additional female was fitted with an **animal-borne camera and a TDR** (i.e. no GPS). The bird left on an overnight trip and was **recaptured two days** after deployment.

Moraine

Deployments at Moraine were carried out on 3, 12 and 13 October. Overall, **7 females were fitted with GPS dive loggers**. Devices remained on the birds for an average **7.1±2.6 days**. These slightly longer deployment times compared to Harrison Cove were due to more difficult access to the site. **Average weight of Moraine penguins was 2,650±200 g**.



Preliminary results

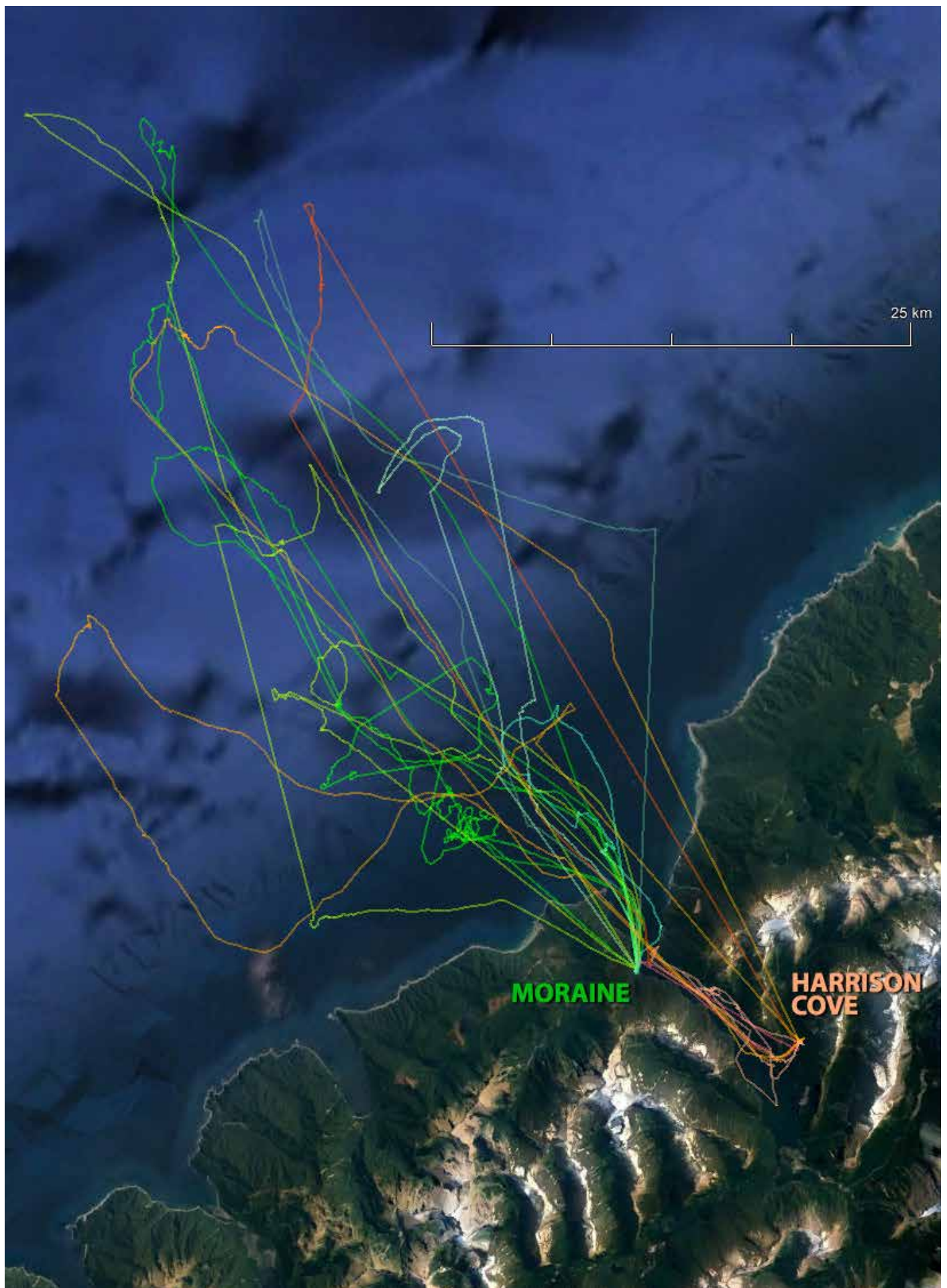
Data outcome was significantly compromised by a batch of faulty GPS dive loggers. Although all devices had been tested prior to deployment, three units that were fitted to penguins only stored highly fragmented data that could not be reconstructed for meaningful analysis.

At **Harrison Cove**, of the nine deployments of GPS dive loggers **only four resulted in usable data sets**. Two of the birds performed overnight trips on which **they left the fjord travelling 25-40 km offshore staying at sea for a mean 43.7±2.2 hrs (n=2)**. This represents unusual behaviour compared to exclusive within-fjord-foraging behaviour observed in Harrison Cove birds in the previous years. The other two birds foraged within Milford Sound/Piopiotahi (mean trip length: 11.0±5.0 hrs).

Of the seven penguins fitted with devices at Moraine, six returned with valid data. **All penguins foraged outside the fjord, travelling between 15 and 55 km away from their colony, exclusively foraging in waters >2000 m depth. Longer trips lasted around 53.6±13.2 hrs (n=6 trips), while trips with shorter ranges were completed in 15.3±2.3 hrs (n=3 trips),**

A new dive depth record was registered with a Harrison Cove bird reaching 108.7 m; the dive occurred ca. 6 km outside of from Sutherland Sound, the next fjord south of Milford Sound/Piopiotahi.

The **deployment of a camera logger yielded only dive data** as the bird entered the water at 2 am, triggering a premature video recording and draining of the battery before first light. As it became clear that birds performed mainly overnight trips, no further camera deployments were attempted as these are only viable on one-day trips.



Tawaki foraging tracks at Milford Sound / Piopiotahi in September and October 2019. Tracks with a green hue represent data of six penguins from the Moraine colony close to the entrance of the fjord; reddish coloured tracks derive from GPS data recorded in four penguins from Harrison Cove.



Satellite tracking 2020

Two penguins of the 2019 satellite tracking study completed their moult in rehabilitation on the East coast. They also started their winter journeys from there. Unlike tracked tawaki that moulted at their breeding sites, these two penguins stopped transmitting only 2-3 weeks into their trip.

Were tawaki that moult in rehabilitation at a disadvantage? If so, was this related to the location of the moult (i.e. East coast) or a result of getting fed throughout the moult?

The **Antarctic Research Trust** once again supplied us with satellite tags to examine the winter migration of three groups of penguins:

- **REHAB:** birds that were cared for (i.e. fed and medicated if required)
- **EAST:** penguins that moulted unassisted along the Otago coast
- **WEST:** penguins that underwent their moult at their breeding colony (control group).

REHAB: Penguin Place & Katiki Point

Four birds (3 females, 1 male) of this group completed their moult under care (i.e. getting fed) at Penguin Place, Otago Peninsula. Two male penguins received similar treatment at Penguin Rescue, Katiki Point.

EAST: Oamaru, Kakanui River, Doctors Point & Blackhead

Two female tawaki moulted unassisted on the grounds of the Oamaru Blue Penguin colony. Two further females were located by members of the public at Doctor's Point and Blackhead. One male tawaki moulted on the premises of Penguin Rescue but did not receive any assistance. Finally, one male penguin moulted in a small cave in the bank of Kakanui River.

WEST: East Shelter Island

Four female and two male tawaki were fitted with satellite tags on East Shelter Island in mid-February. Two of these likely from a breeding pair as they were moulting together allowing us to examine if paired birds travel in tandem.

Detailed accounts of every deployment can be found on the project website at

<https://www.tawaki-project.org/category/winter-tracking-2020/>

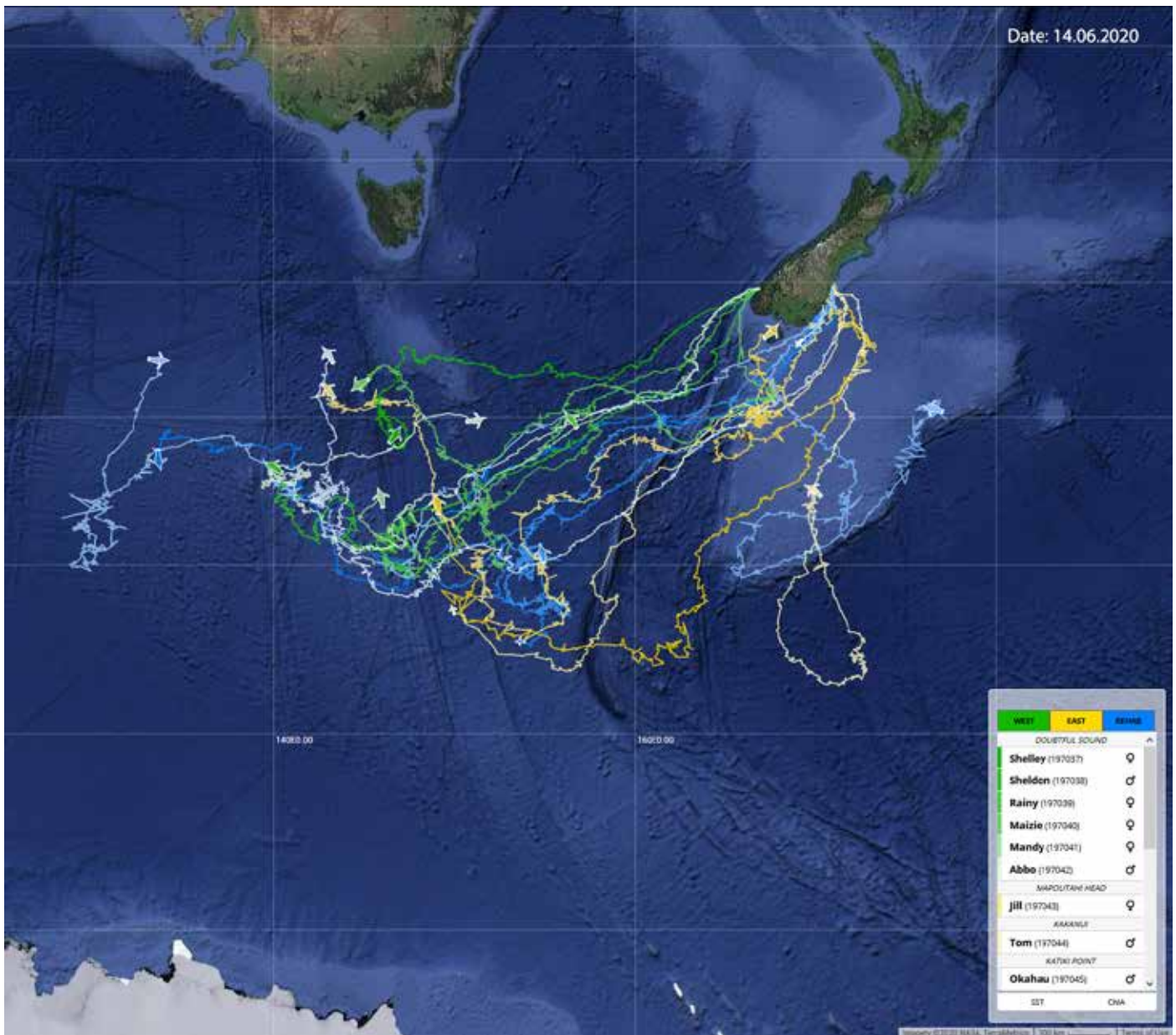


A female tawaki equipped with a satellite transmitter, East Shelter Island, Doubtful Sound/Patea, Fiordland, 28 February 2020.

Preliminary Results

Consistent with previous satellite tracking, tawaki from Fiordland all travelled along a south-western trajectory until reaching the Sub-antarctic Front (SAF). Penguins that moulted unassisted on the East coast generally departed in a south-eastern direction; most of these birds eventually moved westward along the SAF. Rehabilitated penguins swam directly against the Southland current in a south-western direction reaching travel destination similar to the penguins from Fiordland.

There seem to be considerable differences in movement patterns between East coast and Fiordland birds. However, more further analysis is required to draw meaningful conclusions.



Satellite tracks of tawaki fitted with transmitters as of 14 May 2020. Screenshot of the interactive map published online. Track colours indicate penguin origins: Rehabilitated birds (blue), East coast (yellow), and the East Shelter Island, Fiordland (control group - green).



Female tawaki that moulted at Oamaru on the East coast (982 000210214869, 'Velma') after her release on 14 February 2020. At the time of writing (14/05/20), the penguin is only a few kilometres south of Codfish Island/ Whenua Hou and may be the first tawaki to complete the 2020 winter dispersal.



Future focus on sub-antarctic species

The work of the Tawaki Project over the past six years has shown that **tawaki are doing substantially better than previously thought**. Their population numbers appears to be significantly higher than in the 1990s (see <https://doi.org/10.36617/SoP.tawaki.2019-04>). One reason for **tawaki's apparent success seems to be their behaviour versatility that allows them to thrive despite changing oceanic conditions**, potentially them more resilient to climate change.

At the same time, climate change is believed to be the main cause of observed and suspected population declines in **Eastern Rockhopper penguins** and **Erect-crested penguins** on New Zealand's sub-antarctic islands. The latter species is one of five penguin species world-wide ranked 'endangered' by the IUCN red list.

Why are tawaki apparently doing better than the sub-antarctic crested penguin species?

To address this question, the Tawaki Project has been working towards adding both sub-antarctic species to the project's activities. **To this end, we have been discussing a research proposal on the sub-antarctic Antipodes and Bounty Islands with the Department of Conservation since 2018; a comprehensive permit application has been submitted in March 2020 (86101-FAU).**

Recce to Bounty & Antipodes Islands

In October 2019, we had the chance to join an expedition to the Bounty and Antipodes Islands carried out by DOC's CSP programme and NIWA. The main focus for the Tawaki Project was to get first hand experience with the working conditions, albatross work carried out on the Bounty Islands also allowed the trial of novel penguin survey methods.

On the *RV Evohe*, the expedition arrived at the Bounty Islands on 24 October 2019. **Over the course of five days various projects were completed including a comprehensive ground and camera drone-based survey of Erect-crested penguins.** While work on the island is challenging due to the exposed nature of the archipelago, the survey results made it clear that some aspects of the local penguin population need to be addressed in future research (see below). However, visits will be limited to a few days.

The plan to continue to the Antipodes Islands on 29 October 2019 had to be dropped due to unfavourable sea conditions. The expedition returned to Dunedin on 31 October 2019.

Erect-crested penguin survey

The Erect-crested penguin population on the Bounty Islands is suspected to have undergone a significant decline since 1978. Our visit offered the chance to repeat a penguin survey that had previously been conducted in 1997, 2004, 2011 and 2014. Nest numbers were determined using ground counts, penguin presence on the islands was documented using camera-drone imagery. **This is one of the key research activities we propose to conduct as part of the Tawaki Project in the future.** Both ground counts and drone surveys were highly successful and proved to be the most robust and repeatable approach to population assessments on the islands.

The survey found that penguin numbers have remained stable at least since 1997. Moreover, the density analysis using drone-imagery showed that extrapolation used in the 1978 survey likely over-estimated penguin numbers, thus, casting doubt on the apparent steep population decline.



Typical breeding habitat for Erect-crested penguins on the Bounty Islands - a mixed colony with Salvin's albatross on bare rock with hardly any soft material available for nest building.



Density distribution of Erect-crested penguins on Proclamation Island, Bounty Islands as derived from counts facilitated by extremely high-definition aerial photography recorded via camera drone. The penguins concentrate in areas that are sheltered particularly from southerly winds which results in a highly heterogeneous distribution. Previous assessments of the penguin population were based on gross extrapolation of nest densities over what was considered suitable breeding habitat so that substantial overestimation of penguin numbers is a likely result. The graphic is part of a scientific paper that is currently in review.



Outlook 2020

In the coming years, the Tawaki Project will expand its activities in Fiordland. Besides tracking tawaki in Milford Sound/Piopiotahi, research activities this year will also include sites in Doubtful Sound/Patea.

Until GPS tracking of chick rearing tawaki from fjord and fjord entrance colonies will commence in early September 2020, smaller side-activities are planned over the winter.

Beyond the research work related directly to tawaki, we hope that research permits for work on the Antipodes and Bounty Islands will be issued in time for a November/December 2020 expedition.

Winter activities

Throughout the winter a few visits to Milford Sound/Piopiotahi are planned to download data and maintain the transponder gate at Harrison Cove.

The return of tawaki currently fitted with satellite transmitters is anticipated to occur in June and July. Every effort will be made to recover the birds and remove devices prior to the breeding season. While we are already planning a trip to East Shelter Island for July, the destinations of the East coast penguins is still unclear.

Tracking of chick rearing tawaki

We plan to operate in two fjords this season. One team will be based in Milford Sound/Piopiotahi, a second team will operate in Doubtful Sound:

- **Milford Sound/Piopiotahi**

Continuing the research patterns already established in 2019, the project will operate at **Harrison Cove** and **Moraine** to examine behavioural differences between inner fjord and fjord entrance penguins.

- **Doubtful Sound/Patea**

The recce trip to the fjord in August 2019 showed that tawaki numbers in Doubtful Sound are biased towards the entrance and central region of the Sound. We therefore, plan to work at three sites, **East Shelter Island** (fjord entrance), **Seymour Island** (central region), and **Rolla Island** (deeper inner fjord).

Monitoring of the penguins' **at-sea behaviour using GPS dive loggers** will continue as in previous years. Additionally, we will deploy up to **six birds per site with animal-borne camera loggers** to examine diet composition.

GPS tracking of tawaki during pre-moult

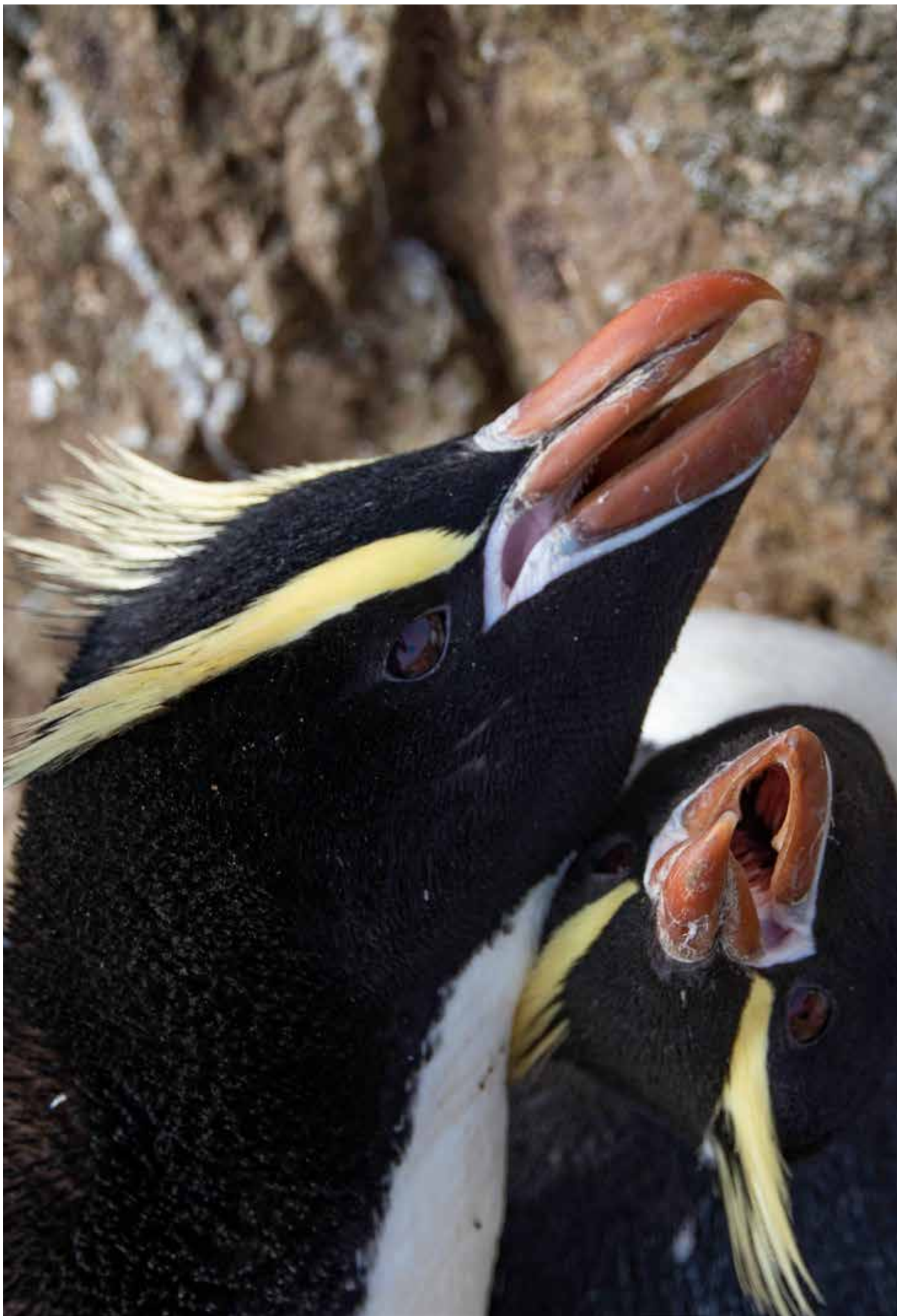
We plan to conduct trial deployments of GPS dive loggers on a small number of tawaki (4-6 birds) from Harrison Cove in late November/early December 2020 to assess feasibility of this method for monitoring of the pre-moult dispersal.

Initiation of research activities on Antipodes Is

Provided that permits are issued, we plan to **conduct a first expedition to the Antipodes Islands for 5-6 weeks in late November/early December 2020**. Planned activities are **drone surveys of all Erect-crested and Eastern Rockhopper penguin colonies** as well as **terrestrial nest counts at some sites** for ground-truthing purposes.

During the early chick rearing period, we furthermore plan to deploy **GPS dive loggers on both species as well as trial animal-borne cameras on Erect-crested penguins**.

Finally, before departure from the island, we plan to fit **20 satellite transmitters on breeding Erect-crested penguins** to remotely monitor the last weeks of breeding and the **pre-moult dispersal of the penguins**.





Acknowledgments

The success of the field work was based on the dedication of our co-investigators and field helpers. **Ursula Ellenberg** and **Robin Long** got the Tawaki Project off the ground even though permits were issued late in the season. **Thomas Mattern** and **Richard Seed** scouted out Doubtful Sound and took care of all the satellite tag deployments. They were helped by the enthusiastic **Myrene Otis** who will actually return to do her Masters thesis on tawaki next season. **Kolja Dorschel** was a keen field helper (with an insatiable appetite) for the entire field season.

We have stated it many times before, but we say it again. The Tawaki Project would not have gotten this far, without the outstanding support of **Andrea Faris** and her team at the Southern Discoveries Underwater Observatory in Milford Sound/Piopiotahi. **Dan Crook** picked us up reliably with the SD tender 'Tawaki' or provided us with sea kayaks to get to our field sites. **Stella Cybulski** actively helped us in the field.

The 2020 satellite tracking study relied on the help of many providing us access to moulting tawaki. **Megan Abbott** from Penguin Place on the Otago Peninsula kept us constantly informed about numbers of tawaki in their care and helped us fit satellite trackers to five of the penguins they cared for. Similarly, **Rosalie Goldsworthy** of Penguin Rescue/Katiki Point fame kept us in the loop about any tawaki that swam her way. **Philippa Agnew** at the Oamaru Blue Penguin Colony once again went out of her way to support our study. DOC ranger **Tom Woodhouse** from Oamaru told us about a tawaki he spotted while kayaking on Kakanui River. Several members of the public reported tawaki sightings to **Jim Fyfe (DOC Dunedin)** and **Mel Young** who relayed the information to us. **Tereza Chudobova** spotted a female while

hiking around Blackhead. **Jill Taylor** stumbled across another female hiding in the rocks at **Doctor's Point**.

Ingrid Hutzler and the **scientific committee from Birds New Zealand** paved the way for cutting edge research using animal-borne cameras... even if it has to wait until the coming season.

Once again, our [supporters on Patreon](#) covered the bulk of this year's field work expenses and provided us with valuable feedback. Special thanks to **Janis Russel** and **Ali Sortomme** for helping us with proof-reading and editing several manuscripts we worked on.

We are extremely grateful to the **T-Gear Charitable Trust** for putting their weight behind the New Zealand Penguin Initiative which in turn provides the Tawaki Project with planning security.

Finally, a thousand thanks for their continued cooperation to the the tawaki from Milford Sound/Piopiotahi, Doubtful Sound/Patea, and the various places on the Otago Coast. We keep learning so much - you guys rock!



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