



RESEARCH & CONSERVATION
NZPENGUIN
i n i t i a t i v e

Quarter Three (Q3) Report 2020

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Abstract

Satellite tracking of the winter dispersal of tawaki has been concluded with the cessation of transmissions in mid-August; some birds travelled up to 13,000 km over the course of six months. GPS tracking of breeding tawaki commenced in Milford and Doubtful Sounds in September 2020. Field work conditions at both sites were difficult due to logistical constraints and unsettled weather preventing access to study sites. Nevertheless, GPS and dive data sets could be recorded from penguins from Doubtful Sound; work in Milford Sound is still ongoing. Six new tawaki colonies were mapped in Doubtful and Thompson Sounds. The transponder gate in Harrison Cove suffered a malfunctioning component that needs replacement, so the unit has remained inoperable since July. Development of the New Zealand Penguin Database progressed substantially. We now have devised a data entry application for Android Smartphones that links recorded data to the NZPDB. The app runs on devices that NZPI will supply to community groups. The new system is currently being used by the Tawaki Project and the West Coast Penguin Trust before being rolled out to more community groups. Work with Little penguin community groups is progressing at pace. We have initiated a kororā survey project with the Halfmoon Bay school on Stewart Island/Rakiura using trail camera maintained by the pupils.

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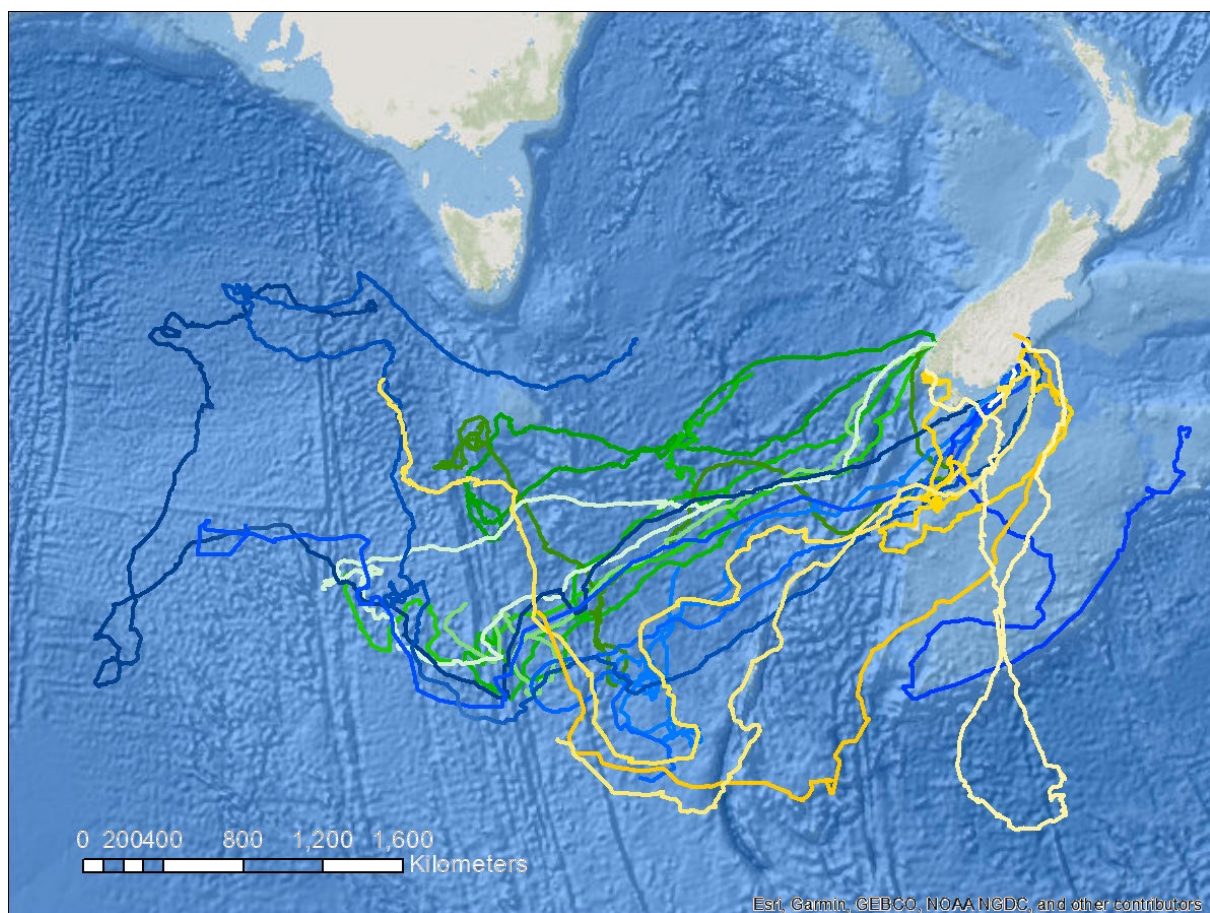
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Satellite tracking study of tawaki winter dispersal 2020 concluded

Milestone FP5 – Marine Ecology

On 23 August 2020, at 21:10 hrs, we received the last and final position fix from Okahau, a one-year old tawaki fitted with a satellite tracker when it was released from the rehabilitation centre at Katiki Point, North Otago 181 days earlier. It was the last of the 18 tawaki fitted with satellite transmitters in February and March this year. Overall, the transmitter submitted 1,163 position fixes allowing it to follow the penguin's travel through the winter over a total distance of 12,948 km. The bird was on its journey back towards New Zealand and had to cover another 1,400 km to reach the Fiordland coast.

When the transmissions stopped, Okahau's device battery had been operating about two weeks longer than what we anticipated based on the programming we chose. However, all other devices ceased transmissions considerably earlier and only three birds could be tracked for the entirety of their winter trips.



Satellite tracks of 18 tawaki recorded during the winter dispersal period of 2020.

Tom, an adult male tawaki that had moulted in a small cave in the riverbank of the Kakanui River about 20 km south of Oamaru, North Otago, made landfall on Chalky Island 102 days after travelling 7,407 km since its departure on 11 March 2020.

Velma, an adult female tawaki that moulted unassisted on the premises of the Oamaru Blue Penguin colony, travelled 5,669 km over 97 days to arrive at Solander Island in the Foveaux Strait on 23 May 2020.

Finally, Shelley, a female penguin that was fitted with a satellite tracker in its breeding colony on East Shelter Island, Doubtful Sound/Patea on 18 February 2020, returned to the island 159 days later having travelled 8,376 km.

The devices of all other penguins stopped transmitting 49-153 days after they commenced their winter journeys so that no complete trip records could be acquired. The likely explanation for this is that the birds managed to preen off the devices. This is supported by our findings during a pre-season trip to East Shelter Island in August 2020.

When searching for nests on the island, we encountered two of the six penguins fitted with satellite tags that went silent in early May and early July, respectively. Hence, cessation of transmission was a result of device loss. The remaining four penguins could not be located during our 2-hour stay on the island. However, we could not perform a thorough search as the penguins had started to lay eggs at the time of our visit so that checking for transponders was too disruptive in most cases.



Sheldon, a male tawaki from East Shelter Island recovered on the island in August 2020, three months after his satellite transmitter stopped signalling some 1,000 km west of New Zealand; the device was no longer attached when the bird was found.

Preliminary analysis of the data indicates that birds that started their winter journeys with greater body mass travelled significantly further than lighter birds. The body mass of individuals itself was directly linked to the group they belonged to, with birds that were fed throughout the moult being significantly heavier (mean: 3.5 kg) than their Fiordland and East Coast counterparts (means: 2.5 and 2.4 kg, respectively).

As such it appears as if feeding tawaki throughout the moult substantially affects their behaviour. Whether travelling further away from New Zealand is to the detriment of the birds is difficult to say. It should also be noted that several of the rehabilitated birds tracked for the study were young birds (yearlings) that had not yet reached the breeding age. Young penguins generally do not show up on the mainland until the end of October, suggesting that they generally stay longer at sea than breeders.

Nevertheless, a cautionary approach for rehabilitation centres should be to restrict feeding so that the release weights of tawaki do not exceed 2.4-2.6 kg in females and 2.8-3.0 kg in males.

Full analysis and publication of the results will be conducted at the conclusion of this year's field work season (March 2021 onwards).

As in the previous year, we were extremely fortunate to have the support of Richard and Mandy Abernethy of Fiordland Expeditions who provided us with transport and accommodation on their vessel Tutoko.



The Fiordland Expedition Tutoko at the Shelter Islands, August 2020.

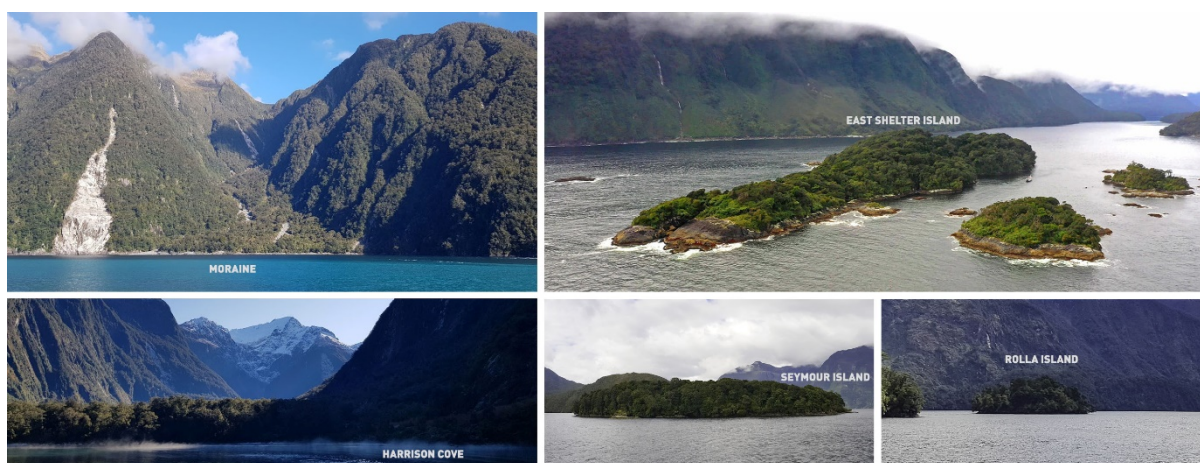
Foraging ecology of tawaki from inner and outer fjord colonies

Milestone FP5 – Marine Ecology

On 6 September 2020, the long-term study of the foraging ecology of breeding tawaki through their Fiordland range commenced in Milford Sound/Piopiotahi. Deployments of GPS dive recorders as well as animal-borne video loggers are being used to track the penguins' foraging ranges, diving behaviour, as well as prey composition and capturing strategies.

The main aim of this study is to compare at-sea behaviour of tawaki breeding at the entrance to fjords with conspecifics that occupy nests in colonies deep within the fjords. While the former group has both access to foraging in the open ocean as well as inside the fjords, birds from the latter group generally have to travel longer distances to reach the open ocean and, therefore, are generally confined to fjord foraging. The option to leave the fjord is likely unavailable to penguins that breed in fjords substantially deeper than Milford Sound/Piopiotahi.

To investigate this further, the study this year also includes Doubtful Sound/Patea which is 40+ km deep with penguins breeding as far inland as Rolla Island. Beginning in the first half of September, two teams were operating simultaneously in the two fjords. The Milford team tracking birds from Harrison Cove and Moraine, continuing the work that commenced in that fjord in 2019 (see 2019Q4 report). The Doubtful team intending to work at three sites, East Shelter Island at the entrance to the fjord, Seymour Island located at the confluence of Doubtful, Thompson and Bradshaw Sound some 15 km from the open ocean and Rolla Island located ca. 3 km from Deep Cove, about 30 km from the open ocean.



The five study sites in Milford Sound/Piopiotahi (first column) and Doubtful Sound/Patea (second column).

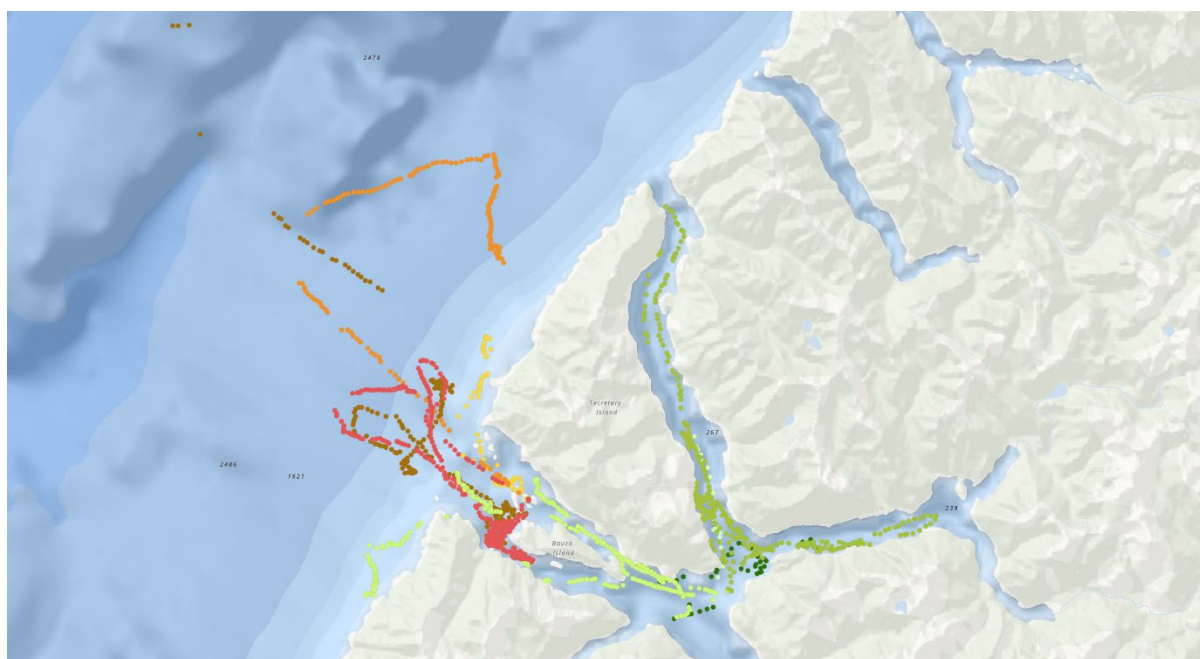
Doubtful Sound

Field work in Doubtful Sound began on 16 September 2020, about 10 days after the Milford team. With 2020 being the first season in Doubtful Sound, there were several uncertainties about the logistics involved with the project, especially with regards to landing on the islands with the variable weather conditions at this time of the year. Because of this, the Doubtful Sound portion of the project is considered a pilot study that is used to develop field protocols and establish best approaches to working on the different islands.

The Doubtful Sound team was based on the Tutuko for two weeks again with support from Fiordland Expeditions. While unsettled weather along with other logistical constraints restricted our movement and complicated field work, we were extremely fortunate to have Richard Abernathy as our skipper whose enormous experience with Fiordland marine conditions ensured our teams safety.

Until 30 September 2020, a total of 10 GPS dive logger deployments were conducted; six units were fitted to penguins from East Shelter Island and four devices deployed on tawaki from Seymour Island. Recovering devices on Shelter Island proved to be difficult as rough sea conditions prevented landing on the island for several days. As a result, two of the devices could not be recovered.

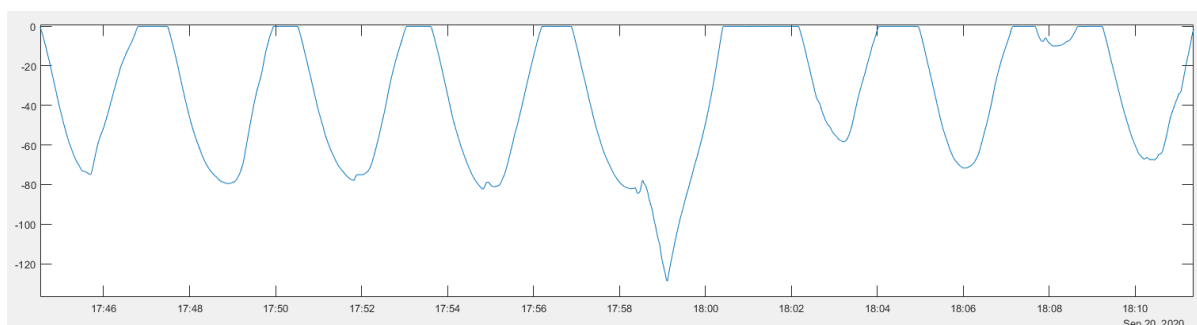
Recovery attempts on East Shelter Island disrupted the intended work schedule so it was decided not to deploy devices on Rolla Island; in the coming season we will allocate more than this year's 14 days for field work in Doubtful Sound.



GPS data recorded during eight deployments of AxyTrek data loggers on tawaki from East Shelter Island (red hue) and Seymour Island (green hue).

The data sets obtained from four birds each on East Shelter and Seymour Islands, showed that penguins from the inner fjord (Seymour Is) exhibit greater foraging ranges than anticipated. Penguins from the fjord entrance (East Shelter Is) generally foraged within 20 km from the coast, although two of the birds spent considerable amount of time foraging in the outer fjord just west of Bauza Island.

One penguin from Seymour Island travelled along the entire length of Thompson Sound and back in a single day. During this trip, the logger recorded the greatest dive depth (128.5 m) measured in tawaki to this date. The dive profile suggest that this extraordinary dive may have been a result of predator avoidance by the penguin. Preceding and following dives did not exceed 85m, a depth at which the penguin had also initiated its bottom phase before quickly gaining depth.



Profiles of dive events prior and after the record dive to 128.5 m by a female tawaki from Seymour Island

Two days after the data was recorded, the Tutuko visited the location of the dive and lowered an action camera to 70 m depth to investigate light level. The camera recorded largely black with a hint of light in the top frame. Therefore, it can be assumed that at depths >100 m darkness prevails.

Milford Sound

The work in Milford Sound/Piopiotahi is still ongoing at the time of writing this. Communication with the Milford team is limited, and GPS and dive data has yet to be delivered from the site. Overall, a total of 21 female tawaki were fitted with GPS dive loggers. So far not all devices have been recovered and at least in one case it is suspected that the penguin carrying a device may have been killed by a leopard seal that has taken up residence in Harrison Cove in the past two weeks. A summary of the GPS logger data will be presented in the 2020 Q4 report.

Early in the season, a camera logger was successfully deployed on a female tawaki for a day. The device recorded high definition video for a continuous 2 hours 5 minutes, as well as a series of shorter clips that covered the second half of the foraging trip. The video data provides a unique insight into the prey pursuit behaviour of tawaki as well as the diverse range of prey taken by the

penguins within the fjord. Fish larvae, clupeid fish (likely sprat) and squid seem to be the chief prey items taken.



Female tawaki capturing a squid recorded by Full HD video logger. Note that the timestamping the bottom left corner is incorrect.

Working conditions in Milford Sound otherwise proved to be unexpectedly difficult. On one hand this is due to extremely limited boat operations in the absence of international visitors due to Covid-19 travel restrictions. Nevertheless, tour operator Southern Discoveries supported our team by providing transfer to the study sites whenever possible. Just as in Doubtful Sound, inclement weather and rough sea conditions repeatedly hampered access to the field sites.

Moreover, Southern Discoveries has revised its standard operation procedures so that no further transport to Moraine will be possible in the future. This means unless we can organise our own transport (boat or sea kayaks) we will not be able to continue working at that site. Considering that the team managed to microchip a large portion of the breeding population as well as most of the chicks this would be extremely disappointing. We will investigate options for the 2021 season.

Survey of new tawaki breeding colonies in Doubtful Sound/Patea

Milestone FP1 - Design & conduct Fiordland-wide census

During a four-day visit to Doubtful Sound in August as well as while conducting the tracking study in the fjord in September, we had the chance to visit and map sites within Doubtful, Thompson and Bradshaw Sounds where tawaki breeding sites were suspected. Penguin sightings on land reported to us by Sam Goodall, a sea kayaker who contacted us via Instagram, local fishermen, and our skipper Richard Abernethy provided us with hints which sites to survey.

We visited three sites in Doubtful Sound. Utah Island, a cove along the northern coast of Bauza Island, and a site approximately 3 km west of Crooked Arm on the southern coastlines of the fjord (Sam's Spot). The sites featured only low numbers of tawaki nests with only a single nest found on Utah, 1-2 nests in the Bauza Island Cove and a small colony of 5-10 nests at Sam's Spot.



Sam's Spot tawaki colony, perfectly concealed by the Fiordland rainforest, was only located after receiving a hint from a sea kayaker that observed penguins climbing up some rocks.

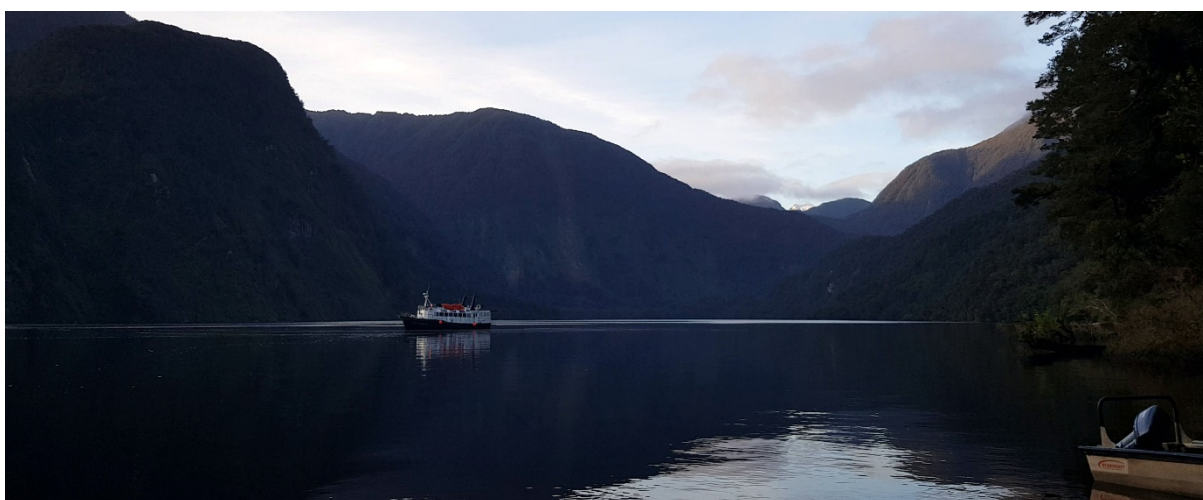
In Thompson Sound, an additional three sites were visited. In Lyall Bay, we found a small colony of an estimated 5-10 tawaki breeding pairs, most of which breed under an old and inaccessible rockfall overgrown by primary forest. In a small cove in the northern reaches of the fjord (named by our team "Sniffer Dog Cove" honouring our skipper's ability to point out tawaki colonies), we surveyed another steep rock fall area and found evidence of at least seven tawaki nests, only one of which contained a male guarding a chick. All other nests had obviously failed with the lack of eggs or dead chick suggesting that the site had been raided by stoats. Finally, we managed to briefly visit a sea cave that was populated by a considerable number of penguins. 13 chicks formed two crèches not far from the cave entrance but calls from chicks further in the cave suggest further crèches deeper in

the cave. We did not venture further than the entrance to avoid undue disturbance of the colony. We estimate that there are 20-25 breeding pairs in the cave. We called this colony “The Hive” owing to the small entrance to the cave in which the penguins breed and the considerable traffic of tawaki going in and coming out of the cave at the time of our visit.



The Hive tawaki colony in Thompson Sound. Inset shows crèche of five chicks.

We searched one site in Precipice Cove which branches off Kaikiekie/Bradshaw Sound but found no evidence for tawaki. What all sites have in common is that they have an unassuming appearance when seen from the water which will makes it difficult to locate breeding sites without sightings of penguins exiting the water. We, therefore, will work towards a reporting protocol for skippers frequently travelling through the fjords.



The Tutuko in Precipice Cove as seen from the bay searched for tawaki.

Update on automatic monitoring of tawaki in Harrison Cove

Milestone FP2 - Automated monitoring solutions - Establish first transponder gate (TG) in Harrison Cove, Milford Sound

In keeping with the complications experienced during the tawaki tracking work in Fiordland this season, the transponder gate solution at Harrison Cove stopped working just prior to the penguins returning from their winter journeys to start breeding. While power supply and light barrier worked as intended, the data logging unit would not boot up and record any data. After several unsuccessful attempts to fix the issue on site, the logging unit was pulled out by the Milford team. The Doubtful Sound team drove to Milford Sound to pick up the unit when the Skipper of the Tutuko had an appointment in Te Anau.

While in town, we contacted the developer of the transponder gate (Kean Electronics) who sent troubleshooting instructions. Back on the Tutuko, the logging unit was partly disassembled and some of the elements tested. It turned out that the main PCB that supplies the various elements of the logging unit with power was malfunctioning. Satellite communication with Kean Electronics made it clear that the PCB needs to be replaced.

So far, the replacement part has not been received. Thus, the transponder gate in Harrison Cove remains inoperable.



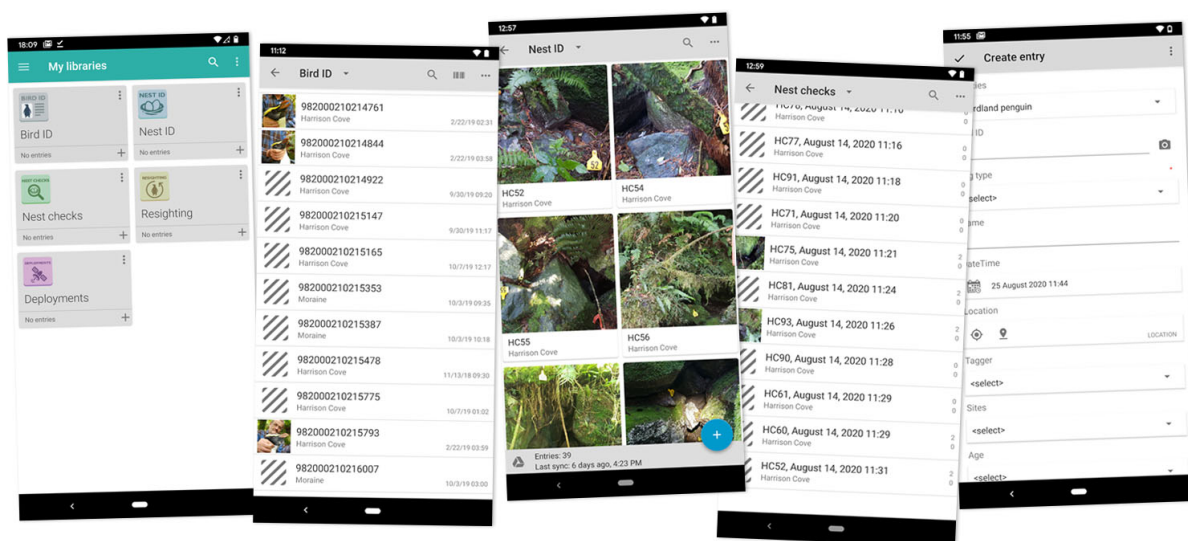
Thomas trying to repair the Harrison Cove transponder gate logging unit on board of Tutuko while steaming up Doubtful Sound.

Development of the New Zealand Penguin Database (NZPDB)

Milestone LP2 - Develop universal monitoring and survey protocols as well as a centralized Little penguin monitoring database accessible to all regional groups.

In the weeks preceding field work, development of the NZ penguin database progressed significantly. The work focussed on the development of a universal data recording app to be tested first by the teams working with tawaki in Fiordland and subsequently by the West Coast Penguin Trust.

The app is designed to operate on Android smart devices. Rather than developing a bespoke application, we are using the Memento database app, a mobile database application that features limited relational database functions and has a highly customizable user-interface and a wide range of data acquisition functionalities such as recording GPS position, scanning bar codes and taking high resolution pictures.

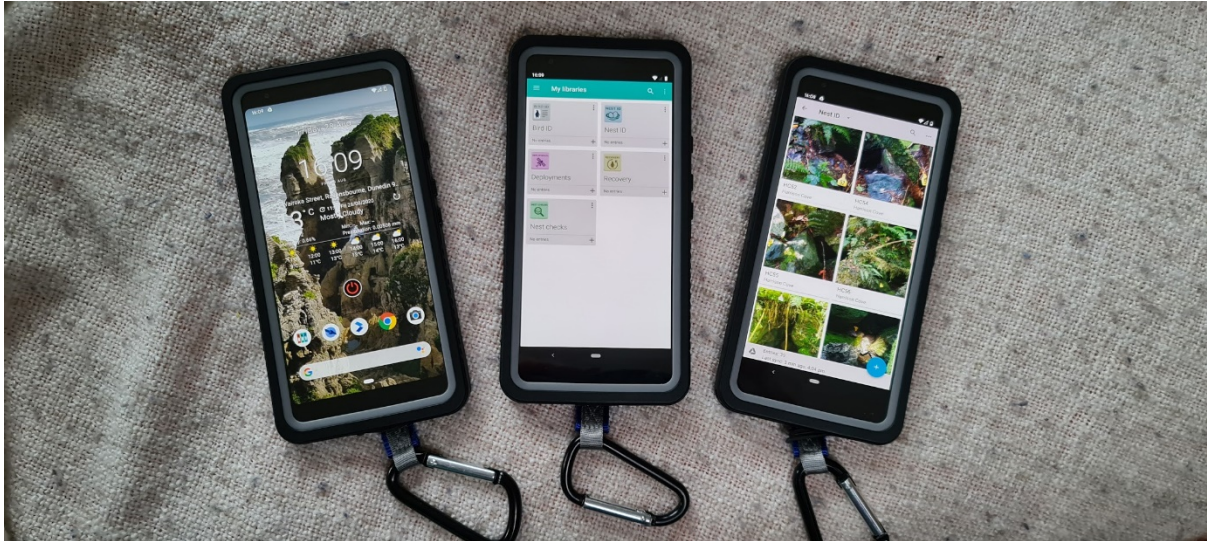


Screenshots of the NZPDB data entry app developed for Android devices in 'Memento' populated with data from tawaki field work in Doubtful Sound.

The key advantage of using Memento as a framework for the data recording app is the cloud functionality which uses Google services to synchronize entered data from the phone with the NZPDB. During the synchronization process, all data and images are uploaded to the phone's associated Google account. The NZPDB queries the Google account every hour for any changes in the data and then adds any new information to the database.

To facilitate this process, every community group will be provided with a smart device customized for their sites and (if available) pre-populated with existing data (e.g. Bird IDs, Nest numbers). This

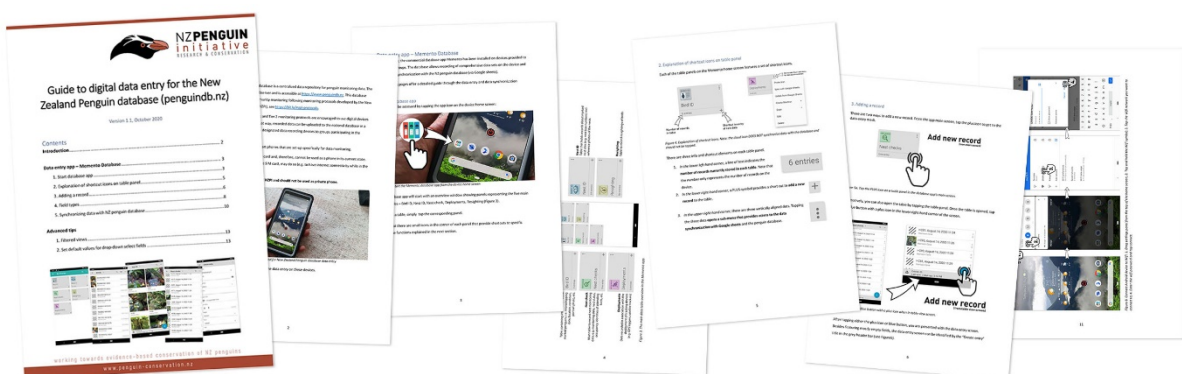
removes any reliance on the use of personal smartphones and ensures that NZPI can streamline the data pathway from the app to the NZPDB via a designated Google account. To this end, we purchased the first three devices (Google Pixel 3a XL) with matching water- and shockproof cases (Armor-X).



The first three smart devices in shockproof cases set-up with the NZPDB data entry app.

The three devices at this stage are designated for the West Coast Penguin Trust (Greymouth), the Supporters of Tiritiri Matangi (Hauraki Gulf) and Ngā Motu Marine Reserve Society (New Plymouth). Further devices will be purchased for more community groups following the conclusion of field trials with the Tawaki Project and the West Coast Penguin Trust.

An instruction manual of how to use the app has been compiled and will be available for users.



Page views of the instruction manual for the NZPDB data entry app.

The next step is to develop a graphical front-end that provides summaries of the recorded data in quasi-real time (provided the respective device users synchronized the data with the cloud in a timely fashion).

Update on national little penguin/kororā monitoring programme

Milestone LP3 – Work towards adoption of national monitoring plan and adjust monitoring protocols

Last quarter we published our little penguin/ kororā monitoring protocols with feedback from community groups and our scientific advisory group, these protocols are available for download at <https://www.penguin-conservation.nz/publications/#protocols>. The next stage with the national monitoring programme is to visit community groups and offer training with this standardised methodology. Major focus will be on thorough training of key people from each community group to certify them to mark kororā using PIT tags, or ‘microchips’ in accordance with the New Zealand National Bird Banding Scheme. Other training will revolve around best practice for bird handling and nest checks as well as how to get the most out of the Memento database app.

The first stop is the West Coast Penguin Trust in early October which will coincide with the kororā tracking project that began last year. Beyond that we are waiting for permit applications and permit variation requests to be approved before commencing further work with Places for Penguins (Wellington), Penguin Place (Otago Peninsula), Ngā Motu Marine Reserve Society (New Plymouth). Further north we are on stand-by until ferry services resume in the Hauraki Gulf, allowing us to proceed with the Supporters of Tiritiri Matangi and Motuora Restoration Society.

Using trail cameras to monitor kororā with Halfmoon Bay School, Rakiura/ Stewart Island

In July we travelled down to Rakiura/ Stewart Island to assist Halfmoon Bay School and the Stewart Island Rakiura Community and Environment Trust (SIRCET) with establishing a tier 3 kororā monitoring project- Using trail cameras to gauge population size and gain insights into penguin behaviour around Ackers Point. NZPI’s role was simply to help set the project up, from there it would be left in the capable hands of Halfmoon Bay Schools’s year 6, 7 & 8s. This project also served as a pilot study as we look to roll out similar projects at different sites around the country where schools and conservation groups are wanting to engage pupils with a field and classroom project that furthers our knowledge of local kororā populations.

Initially we identified suitable sites to deploy the motion-triggered trail cameras. Together with the year 7 & 8 pupils we searched the Ackers Point area for suitable penguin landing sites, as well as footprints, penguin poo and scratch marks worn into rocks as indicators of routes used by penguins to travel between nests and the shore. After a couple of hours we had identified some suitable looking sites and set up four cameras to record a 20 second clip each time they're triggered by a passing animal.



Clockwise from left: 1) One of four motion-triggered trail cameras in place, with a sign made by the pupils; 2) Shona, from SIRCET, pointing out a kororā footprint; 3) the pupils getting hands-on, preparing to change the batteries and SD cards in one of the cameras.

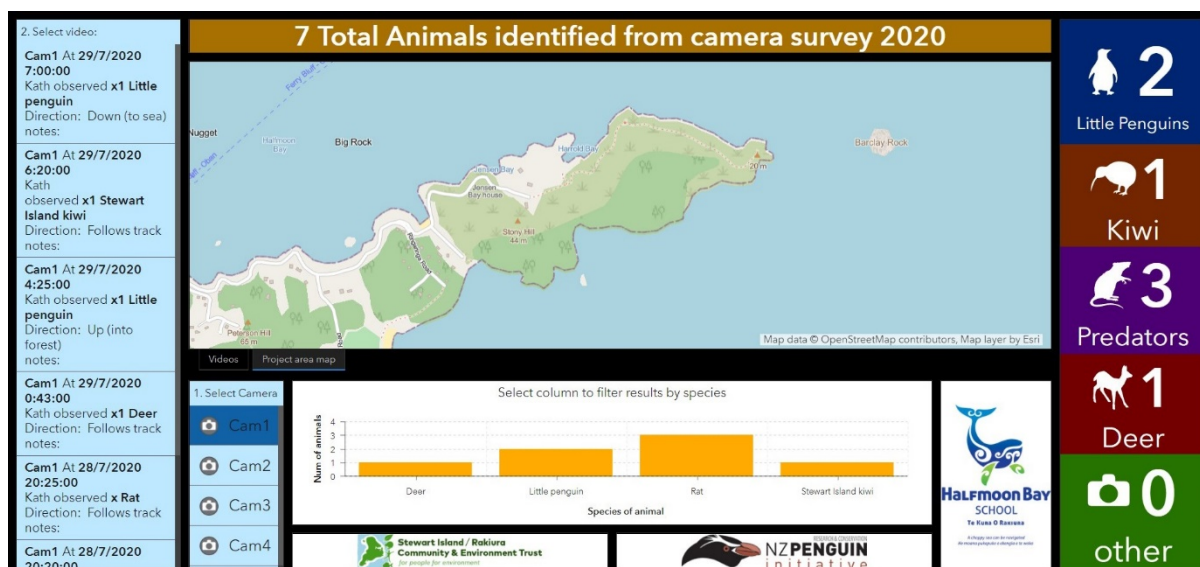
The following day we returned with the year 6 pupils to demonstrate how to change the camera batteries and switch out the SD cards, along with a game of trail cam hide & seek- using coordinates to locate one of the cameras. Back in the classroom we checked out the footage from the SD cards and began recording observations. Our site selection was vindicated as we had penguins after a single night's deployment.



With the year 6, 7 & 8s we watched through all the clips and added our observations to the shared data template we had set up; by using Google Sheets each pupil can access the data and add observations as they comb through the footage over the next few months. As of the end of September there have been a total of 158 kororā observations across the four cameras. The data is being displayed in a neat web app developed by SIRCET's GIS expert, Willy Gamble.

Date	Time	Species	Number of individuals	same animal?	Direction	Observer	Notes
01/08/2020	08:20:00	Sheep	1	<input type="checkbox"/>	Follows track	Molly	
31/07/2020	08:28:00	Sheep	1	<input type="checkbox"/>	Up (into fores	Molly	
05/08/2020	08:06:00	Sheep	1	<input type="checkbox"/>	Up (into fores	Molly	
05/08/2020	20:39:00	Rat	1	<input type="checkbox"/>	Up (into fores	Molly	
05/08/2020	21:05:00	Little penguin	1	<input type="checkbox"/>	Up (into fores	Molly	
06/08/2020	05:48:00	Little penguin	1	<input type="checkbox"/>	Down (to sea	Molly	

Example of the template used to record observations from the trail cameras



Screenshot from an early version of the web app used to display the data from the trail camera observations

Huge thanks to Kath (HMB School principal) and Shona (SIRCET trustee) for being the local driving force behind this project, and to the pupils for diligently maintaining the cameras and recording their observations for the last 10 weeks and onwards through the kororā breeding season.

We put a short video together summarising the project:

https://www.youtube.com/watch?v=bnQJFxoJdZU&t=2s&ab_channel=NewZealandPenguinInitiative

Facilitating Little penguin/ kororā tracking projects

Milestones LP5 – Facilitate, support and conduct projects investigating foraging behaviour nation-wide to establish a base understanding of Little penguins' utilization of the marine habitat

In October we will resume the kororā tracking work with the West Coast Penguin Trust that began last November. Last year poor foraging conditions and infrequent nest attendance from adults in the post-chick-guard stage led to a high rate of device loss so this year we will begin with a pilot project, tracking 5 breeding adults that are in the chick-guard stage. We will be using AxyTrek Marine GPS loggers with integrated accelerometer and pressure sensor (TDR) for recording dive data (55 x 25 x 12mm; 20g).

Deployment and retrieval of loggers will be recorded using the Memento database app and NZ Penguin Database described above. A graphic front end will be developed for the WCPT and stakeholders to view the results of the tracking and dive analysis.

This project also serves as an opportunity to develop best practice guidelines as we look to conduct and facilitate kororā tracking projects with community groups covering all regions of New Zealand.

New penguin weigh bags

General business- Community engagement

With our expansion of penguin research and monitoring activities came a need for more penguin weigh bags to safely catch, weigh and handle penguins. Initial quotes from commercial canvas makers came back at over \$50 per bag; with an order of 40 bags we had to look for a more affordable option. We were directed towards “Stitch Kitchen”, a Dunedin based non-profit organisation that focuses on sustainable fabric use and community initiatives (www.stitchkitchen.nz). Fiona Jenkin from Stitch Kitchen welcomed the task at short notice and did an amazing job of creating instructions and coordinating the volunteers to create the 40 bags using suit wool. With the bags almost complete we sought the help of Adam’s Flags (www.adamsflags.co.nz) who generously donated their time and materials to insert the eyelets.



Clockwise from top left: 1) Richard and the team at Stitch Kitchen finishing the bags; 2) The Stitch Kitchen team working on the bags 3) A female tawaki emerging from one of the new weigh bags; 4) One of the smaller bags used for kororā.

10 larger bags are being used with the Tawaki Project and possibly with other crested penguins in the Sub Antarctic in the future. 30 of the bags are a smaller size and will be used by community groups as part of the national kororā monitoring programme.

Publications

General business – Media engagement

Penguinkind

In early September 'Penguinkind' written by Carolyn Managh was released by Allied Press and is currently on sale at outlets of *PaperPlus* and *Whitcoulls* as well as online (<https://penguinkind.org.nz/>). An international release is planned for the future. The book is principally a life-style book that provides tips and inspiration for a more sustainable lifestyle. It also features nine illustrated penguin stories written by Thomas Mattern. Part of the proceeds of the book go towards NZPI and the Global Penguin Society.

NZPI advisory board member Popi Garcia-Borboroglu provided a foreword to the book.



Penguinkind, released in early September 2020.

Notornis

The scientific paper summarizing the results of the Erect-crested penguin survey on the Bounty Islands in October 2019 (see 2019 Q4 report) has completed the peer-review stage and is now accepted for publication. At this stage it is planned to be published in the first *Notornis* issue of 2021.

New Zealand Geographic

The September-October 2020 issue of New Zealand Geographic's feature story is titled "Where The Seabirds Go" and describes the significance of seabird tracking research conducted in recent years. One section covers the long winter journeys of tawaki and the work conducted by the Tawaki Project and NZPI. The article is written by Bill Morris who was part of the October 2019 expedition to the Bounty Islands (see 2019 Q4 report). Photography by Richie Robinson.



The September-October 2020 edition of New Zealand Geographic.