foraging ranges • diving patterns • behavioural plasticity

the **tawaki** project

www.tawaki-project.org

a 5 year project to study the marine ecology, breeding biology and population dynamics of the world's most enigmatic penguin - the Fiordland crested penguin / tawaki

field report - year 2

13 September -14 October 2015

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Contents

The Tawaki Project so far

The project's main aim is to examine the foraging strategies of tawaki in the varying different marine habitats the species inhabits. Across their breeding range, tawaki forage in the continental shelf regions off the West Coast, in the pelagic regions and fjord ecosystems of Fiordland, as well as shallow coastal marine habitats around Stewart Island. More specifically, **t**he project addresses questions about vulnerability to climate change, fishing activities and pollution (see also www.tawaki-project.org).

In the project's first season (August-November 2014), a pilot study was conducted to examine feasibility of the proposed methods and the penguins' tolerance to research interactions. Successful deployments of GPS loggers yielded the first insights into tawaki foraging ranges.

In the first weeks after chicks had hatched, penguins foraged close to their breeding sites seldom traveling further away than 10 km from Jackson Head. Only when chicks became more independent and formed crèches with young birds from neighbouring nests did the adult penguins travel up to 65 km from Jackson Head (for more information see last year's report).

The pilot study helped greatly to refine field protocols so that this season we were confident to deploy more sophisticated technology on breeding tawaki. Moreover, field experience gained during the pilot allowed the Tawaki Project to expand activities by working with a greater number of penguins and operating at two sites simultaneously.

Funding & Support

The transition from small scale pilot study to a two-sites-operation was made possible by the support from various individuals and organisations.

The **Global Penguin Society** provided funding for 25 dive accelerometers; an equal amount of miniaturized GPS Loggers were purchased through the **University of Otago**. Field work and associated logistics were supported by a grant from the **Department of Conservation**, stakeholder sponsorships and private donations. DOC furthermore allocated substantial staff time and provided logistic support in the Milford settlement.

The Tawaki Project received exceptional support from **Southern Discoveries** during the field work in Milford Sound / Piopiotahi that ranged from boat transport to and from Harrison Cove, to providing a base for the research team at the *Discovery Centre* and collection of penguin sighting data by their enthusiastic staff.

At Jackson Head, Geoff Robson provided helicopter time through his company **Greenstone Helicopters.**

The **Long family of Gorge River** took the time to guide us through the bush on a recce trip to this important tawaki breeding site.

The Tawaki Project works in close collaboration with the **West Coast Penguin Trust** which provides significant first-hand exchange of knowledge.

The project furthermore received support through donations on the project's website (http://www.tawaki-project.org/support-us/).

The research team making their way to the Jackson Head study colony in favourable weather conditions.

Male tawaki guarding a ca. two week old chick at Jackson Head.

Sites & Dates

In 2015, the Tawaki Project focused on the early chick rearing period of the breeding season (i.e. guard stage). Field work occurred at two study sites representing West Coast and Fiordland breeding habitat.

Jackson Head
14 September - 13 October 2015
Field work commenced at Jackson Head on 14 September although heavy rainfall in the first week delayed the start of logger deployments. Between 18 September and 1 October, the entire field crew (5 researchers) worked together to introduce those not involved with the pilot study to working with tawaki.

Harrison Cove, Milford Sound / Piopiotahi
13 September, 1 October - 14 October 2015
An initial 2-hour recce trip was conducted by two researchers on 13 September. Comprehensive field work was carried out in the first two weeks of October by a team of three.

Harrison Cove is not part of DOC's regular tawaki monitoring. Therefore, nest searches had to be conducted at the beginning of the season. A total of 16 active nests were found with four additional burrows showing signs of recent usage.

Gorge River
20 September 2015
A half day recce trip to Gorge River was undertaken to make contact with the local residents, the Long family, and to determine suitability of the site for deployment of long-term tracking devices in the coming seasons. Some of the breeding areas were visited under the guidance of Robin Long, Robert Long & Catherine Stewart.

Trail Cameras

As in the previous season, we deployed trail cameras at selected nest sites to determine nest attendance patterns. Cameras recorded a 3MP image of a nest every 5 minutes using true colour images during daylight hours and infra-red imagery at night. Average battery life was 2.5 weeks so that each camera had to be maintained - i.e. battery changed, SD cards replaced - only once over the course of field work.

Jackson Head
A set of five cameras were deployed in the DOC monitoring areas along the western shores of Jackson Head on 15 September 2015.

All cameras were recovered on 12 October 2015.

Harrison Cove
Four cameras were installed in the core breeding area at the eastern end of Harrison Cove on 13 September 2015.

Cameras were recovered on 13 October 2015.

Data outcome
At the time of this writing, no detailed analysis of the camera data has been conducted.

At Jackson Head data outcome is limited compared to last season (26,239 images recorded). This is primarily due to the fact that trail cameras available this season had to be distributed between the two study sites.

In Harrison Cove a total of 28,899 images were recorded representing nest observations between 13 September and 12 October 2015.

Harrison Cove in Milford Sound / Piopiotahi. The tawaki colony here comprised of 17 active nests in October 2015.

Unusually open tawaki nest in Harrison Cove which made it well suited for time-lapse monitoring using a trail cam.

GPS/TDR deployments

This season GPS/TDR logger packages were used to study the penguins' at sea movements and diving behaviour. The device packages consisted of a GPS unit to determine geographic positions at regular intervals, and a TDR which recorded dive depths, ambient temperature as well as 3D acceleration.

All devices were fitted to the birds using red cloth tape which made the penguins a lot easier to spot on the beach during recovery of the devices. Using bright tape colour is possible in tawaki which are not exposed to aerial predators like skuas.

Jackson Head

Between 16 September and 10 October, a total of **11 penguins were fitted with GPS/TDR loggers**. 10 of these birds were chick rearing females; one male penguin was fitted with logger but did not leave the nest during the deployment period. **Devices were recovered after ca. 4.5 days (range: 4-8 days)**. One bird could not be recaptured presumably because the device - the only feature by which to identify the bird - had fallen off.

Harrison Cove

Between 2 and 6 October 2015, **GPS/TDR loggers were attached to 11 adult tawaki**. The first five devices were fitted to females attending nests. However, due to unpredictable nest attendance patterns of females we deployed the remaining six devices on the beach. We intercepted penguins leaving the colony as they emerged from the forest; hence their nest association is unclear. **Devices were recovered after 4-8 days (mean: 5.5 days)**. Two birds avoided recapture. The state of tape on recovered devices suggests that the units likely fell off within two weeks of deployment.

Preliminary results

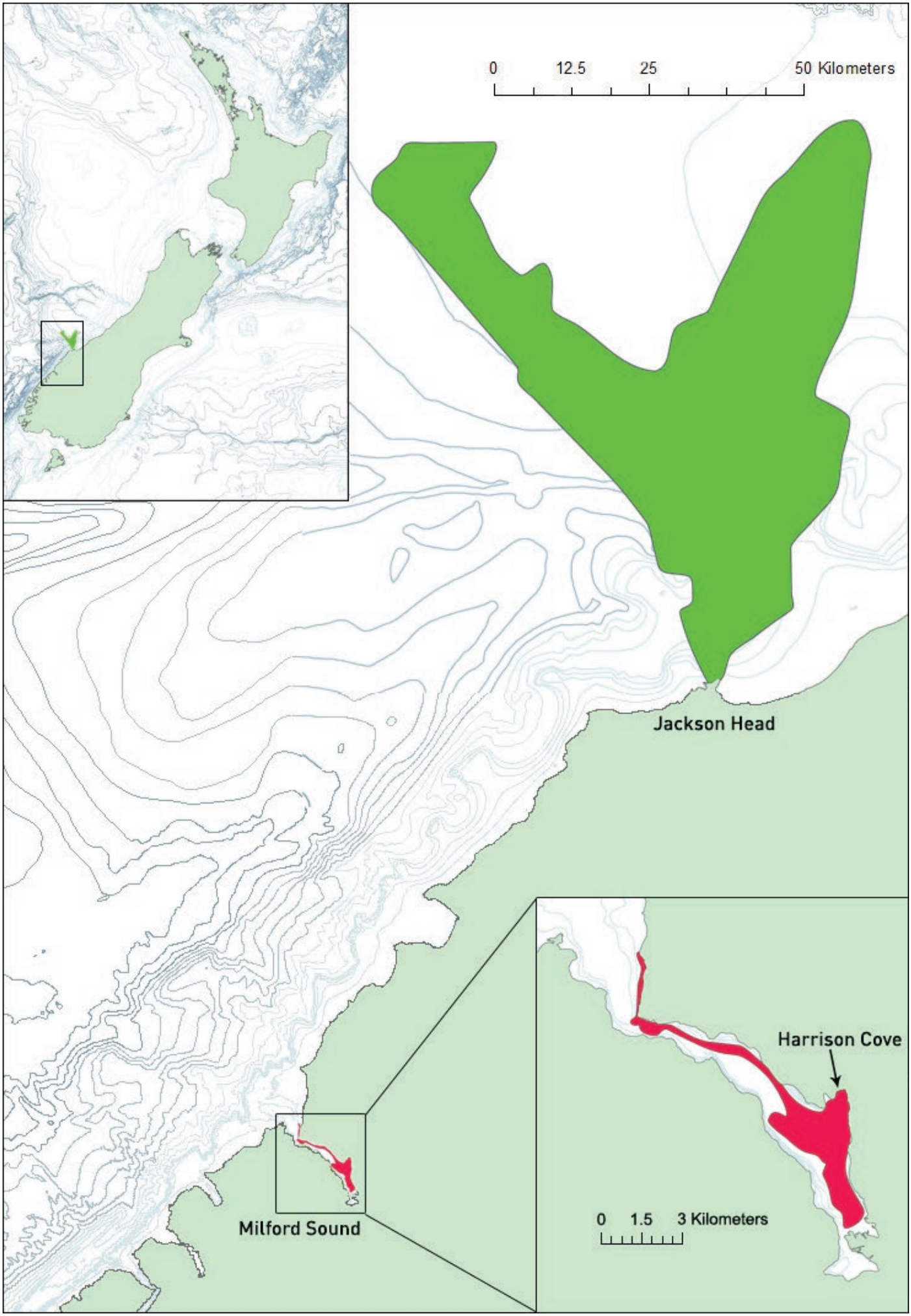
At **Jackson Head**, a total of 10 complete foraging trips were recorded. Trips were considerably longer than in the previous season. Some of the 2015 birds traveled as far as 100 km away from their breeding site, staying at sea for up to three days. These foraging ranges were greater by an order of a magnitude when compared to the 2014 pilot study. Dive depths reached ranged around 100 m which indicates high foraging effort, presumably due to sub-optimal feeding conditions.

This was also reflected in poor breeding success rate. Between mid-September and early October many nest had failed due to chick starvation. It appears that El Niño conditions (i.e. prevailing southerly winds) caused a shift of ocean productivity to offshore regions.

The situation at **Harrison Cove, Milford Sound /Piopiotahi** presented itself diametrically different. Four of the 16 active nests still had two 2-3 week old chicks in good condition, which was surprising given that in tawaki one of the two chicks usually dies a few days after hatching.

A total of 24 GPS tracks were recorded. Foraging ranges could not have been more different from what we observed at the West Coast with the majority of birds staying within a 2 km radius from their breeding colony; only two birds traveled to the outer reaches of the fjord some 10 km from Harrison Cove. Compared to Jackson Head, dive depths were shallow with maximum depths not exceeding 60 m.

GPS data was augmented with penguin sightings reported by staff of Southern Discoveries. The frequency of sightings inside the fiord were described as exceptional high when compared to previous years. So it appears as if feeding conditions inside the fjord were well above average for tawaki this season.



Tawaki home ranges at Jackson Head (green) and Milford Sound / Piopiotahi (red) in September and October 2015.
Thomas Mattern & Ursula Ellenberg

Blood sampling & PIT tagging

Jackson Head

Only two of the 11 birds handled were blood sampled (amount of blood taken: 0.5-1 ml) and marked with subcutaneous transponders (PIT tags, 23mm TIRIS).

Further blood sampling was suspended when it became evident that the penguins' were exposed to considerable environmental stress which we did not want to aggravate further by extending handling times.

Harrison Cove

In Milford Sound / Piopiotahi, all 11 birds fitted with loggers were injected with transponders during the deployment which provided a much more controlled environment.

Judging from the nest numbers determined during our stay (n=16), it is likely that about one third of the adult tawaki breeding population in Harrison Cove is now marked.

No penguins were blood sampled at Harrison Cove. We considered our two week study a local pilot, since we were unfamiliar with the territory and local penguins. To avoid problems we experienced during the pilot at Jackson Head we focused on successful logger deployments.

Assessment of research impact

As in the previous year, we monitored potential impact of our research activities and interactions with tawaki by comparing breeding success of handled birds with that of a control group.

At **Jackson Head**, the aforementioned very poor reproductive success across all penguins makes it difficult to draw definite conclusions. However, no nest failed as direct result of our actions; all birds fitted with loggers returned to their nest repeatedly during and after the deployment period. Of the 11 nests we interacted with 6 eventually failed. The state of two logger nests could not be ascertained as chick fates remained unclear. Three logger nests were still active when we finished field work.

There were no signs of negative effects due to our activities in tawaki breeding at **Harrison Cove**. All birds fitted with loggers were seen returning to their nest sites; this includes the two birds that could not be recaptured for device recovery. No nest failed during our time although chicks tended to wander off the nest so that their fate could not always be determined with absolute certainty.

Due to Harrison Cove penguins foraging extremely close inshore it was possible to observe foraging logger birds using binoculars. As the penguins tended to forage in small groups of 2-5 penguins we could time dive durations on a few occasions. Dive durations of logger birds were neither shorter nor longer than those in birds without device.

Colour of the tape had no apparent impact on the birds at sea or on land. However, it is safe to say that additional sightings would have been difficult to report if we had used black tape.

Table 1. *Details of tawaki tagged with subcutaneous transponders at Jackson Head & Harrison Cove*

Tag ID	Date	Location	Sex	Age	Status	Weight	Tagger
982000365941825	20.09.2015	Jackson Head	F	adult	1 chick	2650g	Ellenberg
982000365941855	26.09.2015	Jackson Head	F	adult	1 chick	2800g	Ellenberg
982000002117718	02.10.2015	Harrison Cove	F	adult	1 chick	2600g	Mattern
982000002119418	02.10.2015	Harrison Cove	F	adult	2 chicks	2800g	Ellenberg
982000365941897	03.10.2015	Harrison Cove	F	adult	1 chick	2600g	Ellenberg
982000365999908	03.10.2015	Harrison Cove	F	adult	2 chicks	3100g	Ellenberg
982000365941944	05.10.2015	Harrison Cove	F(?)	adult	1 chick	3300g	Ellenberg
982000402100915	05.10.2015	Harrison Cove	F	adult	-	-	Ellenberg
982000402100859	05.10.2015	Harrison Cove	F	adult	-	3250g	Ellenberg
982000002117213	05.10.2015	Harrison Cove	F	adult	-	3450g	Ellenberg
982000002117214	06.10.2015	Harrison Cove	F	adult	-	2850g	Ellenberg
982000002117200	06.10.2015	Harrison Cove	F	adult	-	2850g	Ellenberg
982000365941767	06.10.2015	Harrison Cove	F	adult	-	2900g	Ellenberg

Tawaki fitted with GPS/TDR logger foraging cooperatively with another penguin. The red tape had no apparent effects on the behaviour of either logger bird or its conspecifics. Coloured tape not only made it easier to observe returning birds for recapture, but also proved to be very helpful to gather information on penguin sightings to augment GPS data. Dive times of penguins with and without logger were comparable when timed during visual observations.

Outlook for breeding season 2016

In its third year, the Tawaki Project will expand its GPS/TDR tracking study to include a third, southern site and thereby cover the species' entire breeding range and key ocean habitats.

Additionally, we plan to deploy geolocators (GLS loggers) to investigate the adult penguins' pre-moult and winter dispersal.

Sites

GPS tracking work will be carried out at three sites:

- **Jackson Head/South Westland**
  In the light of the data collected during the 2015 El Niño, we decided to keep Jackson Head as our Westland site rather than shifting the operation to Gorge River.
- **Harrison Cove, Milford Sound / Piopiotahi**
  The site turned out to be near ideal for our project, not only in terms of number of penguins to work with but also with regard to support and engagement of stakeholders and the local community. Using multi-coloured tape will facilitate identification and engagement of stakeholders and visitors.
- **Whenua Hou/Southern Islands**
  We plan to work with the tawaki from the colony along Mephistopheles track. Dave Houston (DOC) successfully scouted for beach access and penguin paths in November 2015. In terms of access and logistics this is the best Southern Island site for the study.

Site for the long term **GLS tracking** study:

- **Gorge River**
  An ideal site in terms of access and penguin numbers. The support of the Long family will increase the chance of recovery of the devices some 8 months after deployment.

Dates

The **GPS/TDR tracking study** will take place at three sites around the same dates as in the previous seasons and shortly after conclusion of the 9th International Penguin Conference in Cape Town, South Africa:

- Between **14-21 September 2016**, all three field teams will work together at Jackson Head to coordinate field protocols.
- From **22 September - 16 October 2016**, the three teams will work simultaneously at the sites outlined above.

Deployment of **GLS loggers** is planned to be carried out immediately prior to fledgling:

- Tentative dates are **10-17 November 2016**.

Research team

The Tawaki Project will be continued by the core research team consisting of **Thomas Mattern** (University of Otago); **Ursula Ellenberg** (La Trobe University), **Dave Houston** (DOC), **Pablo Garcia-Borboroglu** (Global Penguin Society), and **Klemens Pütz** (Antarctic Research Trust). Every member of the core team has collected field work experience and handled tawaki in the past two seasons. Field assistants will involve post-graduate students from the University of Otago.

Funding & Donations

Funding for the 2016 has been partly secured through the NZ Ornithological Society. Further funding is sought through the Global Penguin Society and DOC.

Donations to the Tawaki Project can be made through the project website (http://www.tawaki-project.org/support-us/). Alternative funding option can be discussed with us directly (contact: t.mattern@eudyptes.net).

Acknowledgments

We could not realise the Tawaki Project without tremendous help from a great number of people and organisations.

At the Department of Conservation, **Helen Otley** (Hokitika) and **Bruce McKinlay** (Dunedin) both pulled their weight to keep the project going and secured essential funding. **Hannah Edmonds** (Te Anau) helped to make contact with stakeholders in Milford Sound / Piopiotahi, managed to book us into the awesome DOC house and found time to join us out in the field. **Jacinda Amey** had our backs on the West Coast.

The success of the field work was based on the dedication of our co-investigators and field helpers. **Klemens Pütz** and **Dave Houston (DOC)** both brought decades of penguin research experience into the field and went out of their ways to deploy and recovery data loggers in treacherous (nonetheless extremely beautiful) terrain and wet conditions. **Robin Long** not only showed us around her home, the tawaki colony at Gorge River, but also helped us with our logger work at Jackson Head. **Junishi Sugishita** endured those first nightmarishly wet few days at Jackson Head while searching tawaki nests. And finally very special thanks to the grey eminence, **Horst Mattern**, the most reliable and enduring field assistant one could ask for.

Enormous thanks are due to the fantastic people from **Southern Discoveries** in Milford Sound! Especially **Andrea Faris** went our of her way to make our field work possible. The interest in and enthusiasm for our work by the Southern Discoveries staff - **Oisean,Erika, Waitaha,** and **Dan**, to name just a few - was impressive and shows that nature tourism is more than just money making. We are looking forward to continue working with you guys!

Geoff Robson of Greenstone Helicopters, Jackson Bay, supported the project with helicopter time, internet access and promoted our work with the Jackson Bay area residents.

Although other penguin related commitments kept **Pablo Garcia-Borboroglu** from the field work this season, he was always present with advice and encouragement. It was once more a pleasure to spend a few days with our friends from the West Coast Penguin Trust, **Kerry-Jayne Wilson** and **Leon Dalziel**.

Liz and Jeff Dibben let us stay at their house in Neil's Beach which proved to be even cozier this year when rain and storms battered the coast.

Many thanks to the **private supporters** whose contributions through our website encourage us to continue our open science approach and help to keep to project going.

Finally, our greatest thanks go out to the **tawaki from Jackson Head and Harrison Cove**, who tolerated our interactions and diligently returned our devices (most of them, anyhow).

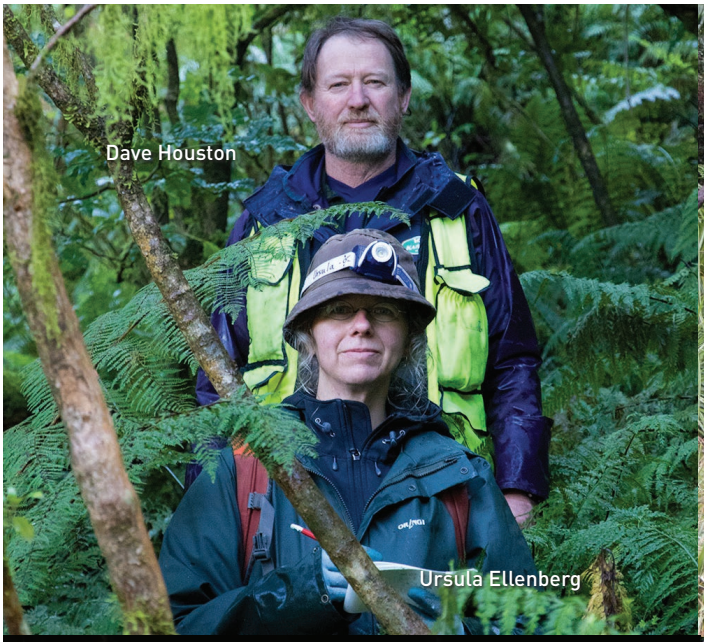
Further information

http://www.tawaki-project.org

http://facebook.com/TawakiProject

https://twitter.com/TawakiProject

https://youtube.com/c/TawakiProject



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