



foraging ranges • diving patterns • behavioural plasticity

# the tawaki project

[www.tawaki-project.org](http://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 3

*16 September - 13 November 2016*

Thomas Mattern & Ursula Ellenberg  
University of Otago



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## The Tawaki Project so far

After a successfully pilot study at Jackson Head between August and November 2014, the Tawaki Project expanded its foraging research on Fiordland penguins / tawaki in the following season (September-October 2015) to include Harrison Cove in Milford Sound / Piopiotahi as a second study site. This second year of research coincided with a very strong El Niño which affected penguins from both sites differently (see also [last year's report](#)).

In comparison to 2014, the penguins breeding at Jackson Head in 2015 increased their foraging ranges during chick-guard almost by an order of a magnitude (mean foraging radius, 2014 vs 2015: 12 km vs 100 km) which resulted in much longer trip durations and chick feeding intervals. As a result, starvation proved to be a significant problem for the penguins' offspring. Many nests failed before the penguins reached the post-guard phase.

In contrast, tawaki from Harrison Cove in Milford Sound / Piopiotahi showed extremely short foraging ranges (mean: 3 km); with one exception, none of the birds tracked with GPS dive loggers left the fiord. At the same time, breeding success was substantially higher when compared to what we observed simultaneously Jackson Head. Of the 17 nests monitored in Harrison Cove, three pairs managed to raise both chicks until the post-guard phase which is highly unusual for an obligate brood reducer like tawaki. Overall it appears as if El Niño conditions created beneficial foraging conditions for the penguins in the fjord.

In 2016, the Tawaki Project was able to expand its research activities to cover the species' full breeding extent operating at four sites: Jackson Head, Gorge River, Milford Sound / Piopiotahi and Codfish Island / Whenua Hou.

## Funding & Support

A study carried out at four different study sites, three of which were worked at simultaneously, not only requires the collaboration and coordination of several highly-experienced field scientists. It would also be impossible without substantial financial and logistic support. For its third year, the Tawaki Project was very fortunate to get help from a great many individuals and organizations.

The **Ornithological Society of New Zealand**, **Forest & Bird Southland**, and the **J S Watson Trust** all contributed significantly to funding that made it possible to conduct field work at three different sites simultaneously. The **Antarctic Research Trust** and *Klemens Pütz* provided us with 20 satellite tags and covered the costs associated with data retrieval. The **Global Penguin Society** provided a travel grant to our South African team member.

Once again, special thanks are due to **Southern Discoveries** in Milford Sound / Piopiotahi, particularly *Andrea Faris* and *Damien Skinner* who went out of their ways to make our research possible. *Geoff Robson* provided helicopter time through his company **Greenstone Helicopters**, while the **Long family of Gorge River** helped us with the deployment of satellite tags and kept an eye out for returning birds.

Our collaboration with the **West Coast Penguin Trust** has continued, and special thanks are due to *Kerry-Jayne Wilson* for many inspiring conversations and *Inger Perkins* for pulling organizational strings in the background.

Finally, we are extremely grateful for contributions we received from several private [donors through our website](#) and to all the people that helped fund the project by [purchasing Tawaki Project t-shirts and sweaters](#).





*Katta Ludynia searching tawaki nests in Harrison Cove in September 2016.*



*Tawaki fast asleep in the forest of Codfish Island/Whenua Hou*





## Sites & Dates

Between September and November 2016, the Tawaki Project conducted field work at four different study sites.

### **Jackson Head**

*16 September - 13 October 2016*

Since DOC did not carry out any nest searches this season, nest searches were conducted during the first two days which found a surprisingly low number of only 19 active nests compared to 2015. Some areas previously known to host breeding pairs showed no ('Apartment Block') or very little ('Hilltop') breeding activity.

### **Harrison Cove, Milford Sound / Piopiotahi**

*21-24 September, 28 September - 11 October 2016*

Field work in the fjord commenced with two days of nest searches (18 nests) & first logger deployments in Harrison Cove in mid-September. Main field work was carried out for two weeks starting at the end of September. Also during this period, nest searches were carried out at three other locations: Sinbad Gully (10+ nests), Moraine (37+ nests), and Anita Bay (6 nests).

### **Codfish Island / Whenua Hou**

*21 September - 5 October 2016*

During the two week stay on Whenua Hou, more than 60 nests were located of which 33 were mapped for potential logger deployment.

### **Gorge River**

*11 September - 13 November 2016*

In addition to the GPS tracking conducted at the three main study sites listed above, the project worked with 20 penguins from Gorge River to examine their pre-moult migration. Field work was carried out over the course of three days towards the end of the breeding season.

## Trail Cameras

Trail cameras were deployed at the three main study sites. All cameras were set up to record a still image of selected nests at a 5-minute interval to examine nest attendance patterns. The devices were set up to operate 24 hours a day.

### **Jackson Head**

10 cameras were deployed between 18 September and 4 October at nests. Deployments occurred principally in the small breeding area called 'Popi's Plaza' to the west of the DOC survey plots. The remaining cameras were positioned in the kiekie groves that are part of the DOC survey plot. All cameras were recovered on 13 October 2015.

### **Harrison Cove**

7 cameras were installed in the core breeding area at the eastern end of Harrison Cove between 22 and 30 September. All cameras were recovered on 10 October 2015.

### **Codfish Island / Whenua Hou**

8 cameras were installed in the breeding area above and below Mephistopheles track of Harrison Cove on 27 and 28 September. All cameras were recovered on 4 October 2015.

### **Data outcome**

At all three sites a total of 72,551 photos were recorded representing more than 6,000 hours of nest observations. The individual camera times range between 6 and 25 days (n=25 cameras).

Data analysis is planned to be conducted as part of the Penguin Watch crowd sourcing analysis project in 2017.







View from a tawaki nest on Whenua Hou with the Rugged Ranges/Stewart Island in the background.



51F11C



09-27-2016 17:55:04

Trail camera image of an active tawaki nest with two chicks guarded by a male on Codfish Island/Whenua Hou.





## GPS/TDR deployments

As last year, a device combination of GPS logger and time-depth recorder/accelerometer was used to study at-sea movement and diving behaviour. Red adhesive tape was used to fit devices to the penguins' lower backs. In Milford Sound / Piopiotahi, tape of various colours were used to allow identification of individual birds that were spotted by tour boats.

### Jackson Head

Between 20 September and 13 October **8 penguins were fitted with GPS/TDR loggers**. All birds were chick rearing females that were handled for deployment at the nest. **Devices were recovered after an average 5 days (range: 4-8 days)**. All devices were recovered successfully, principally on the shore as birds returned.

### Harrison Cove

Between 24 September and 9 October, **GPS/TDR loggers were attached to 9 adult tawaki**. Two devices were fitted to females attending nests; all remaining deployments occurred on the beach as penguins were about to leave on foraging trips. **Devices were recovered on the beach after 2-9 days (mean: 5.6 days)**. One bird could not be recaptured. The device has likely fallen off not long after the last observation (see below).

### Whenua Hou

Logger deployments occurred between 23 September and 4 October. **14 adult penguins were fitted with devices** at their nest sites. Loggers stayed on the birds for a mean **4.7 days (range: 3-7 days)** before they were recovered along the penguin trail leading up into the bush from the shore or at their nest. All devices were recovered and yielded data.

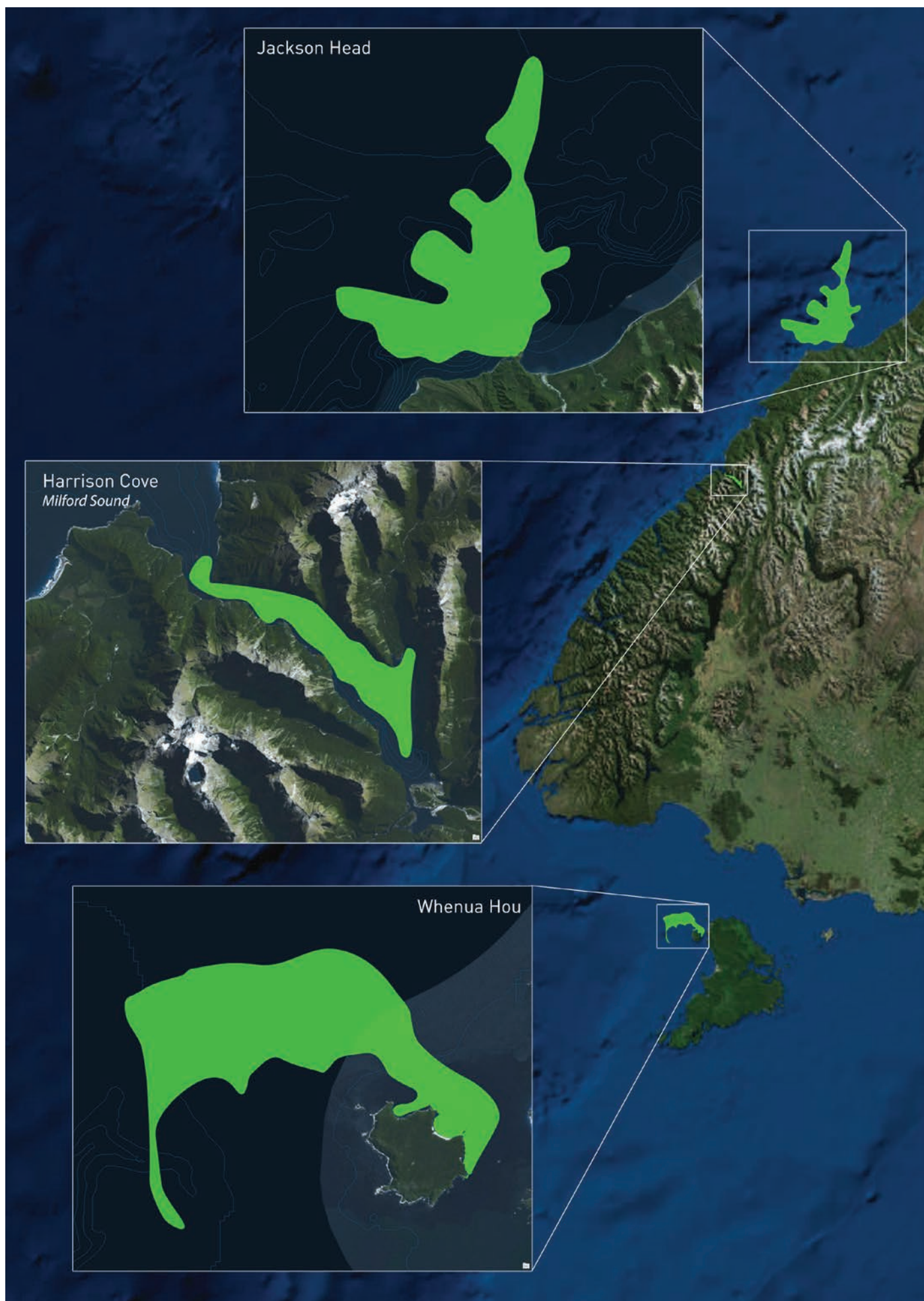
## Preliminary results

At **Jackson Head**, **19 foraging trips** were recorded performed by **6 different birds**. The remaining deployments did not yield tracking data due to GPS logger malfunctions. Trip lengths and travel distances were shorter than what we observed during the El Niño in 2015. However, foraging ranges were still greater than what we saw in 2014. The **majority of birds stayed within a 40 km radius** from Jackson Head. 12 of the trips were overnight trips. The penguins foraged north and north-west of Jackson Head, although two birds also undertook trips towards the west.

At **Harrison Cove**, **20 foraging trips** performed by **6 birds** were recorded. Two devices malfunctioned and a third device could not be recovered. Last year the majority of birds foraged within Harrison cove, whereas this year foraging hot spots were at Williamson Point just outside Harrison Cove, and past seal rock in central Milford Sound / Piopiotahi. With the exception of one bird that foraged past Dale Point on two consecutive trips, all penguins remained in the inner reaches of the fjord. No overnight trips were recorded. The bird that could not be recaptured was spotted inside the fjord by tour boats a few times. It was last observed just outside the fjord, three weeks after being fitted with a device; the device was likely lost shortly thereafter.

**11 penguins** from **Whenua Hou** returned with foraging data representing **44 trips**, 43 of which were one-day trips. One bird performed a single overnight trip. Foraging ranges varied with some birds foraging close inshore either towards Roderiques Bay or North West Bay staying **within 5 km of their breeding colony**. Roughly one third of the trips saw penguins foraging 10-15 km north-west and west of the island.





*Tawaki home ranges at Jackson Head, Milford Sound / Piopiotahi, and Whenua Hou in September and October 2016*





## Satellite tag deployments

Through collaboration with the [Antarctic Research Trust](#), it was possible for the first time to conduct a long-term tracking study of tawaki during the pre-moult migration. As it was unclear whether the birds would return to their breeding colonies to moult, it was important to use satellite tracking technology that would result in data even if the device could not be recovered.

Between **11 and 13 November 2016** we deployed **20 Kiwisat satellite transmitters** (model 202) were deployed on adult tawaki from **Gorge River, South Westland**. The site was ideal since the Long family has taken permanent residence at this remote location which provided the opportunity to potentially recover devices when penguins return to moult.

With the exception of one device which failed to transmit any locations, the **devices reported almost 4,000 penguin positions**. Data for individual deployments range from 6 to 121 days. As the deployments occurred before the breeding season was concluded, some of the early data gathered represents shorter foraging trips performed to obtain food for chicks. Two tags only transmitted positions during this time. **17 penguins left for their pre-moult migration between 12 November and 22 December**. The satellite tags operated on average **44 days per bird** which covered full migration trips for five birds and the majority of the trips undertaken by four birds. For eight birds, the tags stopped transmitting before the return journey was initiated. This was most likely due to the birds managing to preen the relatively small devices out of their feathers.

We are currently preparing a manuscript summarizing the results of this study for publication in *Marine Ecology Progress Series*.

## Blood sampling & PIT tagging

### Jackson Head

At Jackson Head, three penguins deployed with GPS dive loggers were marked with subcutaneous transponders and blood sampled.

### Harrison Cove

In Milford Sound / Piopiotahi, 9 birds were captured opportunistically as they returned from the sea to take blood samples. 3 birds were injected with transponders during logger deployment or blood sampling procedure.

### Whenua Hou

All 14 birds handled for logger deployment were injected with transponders and blood sampled.

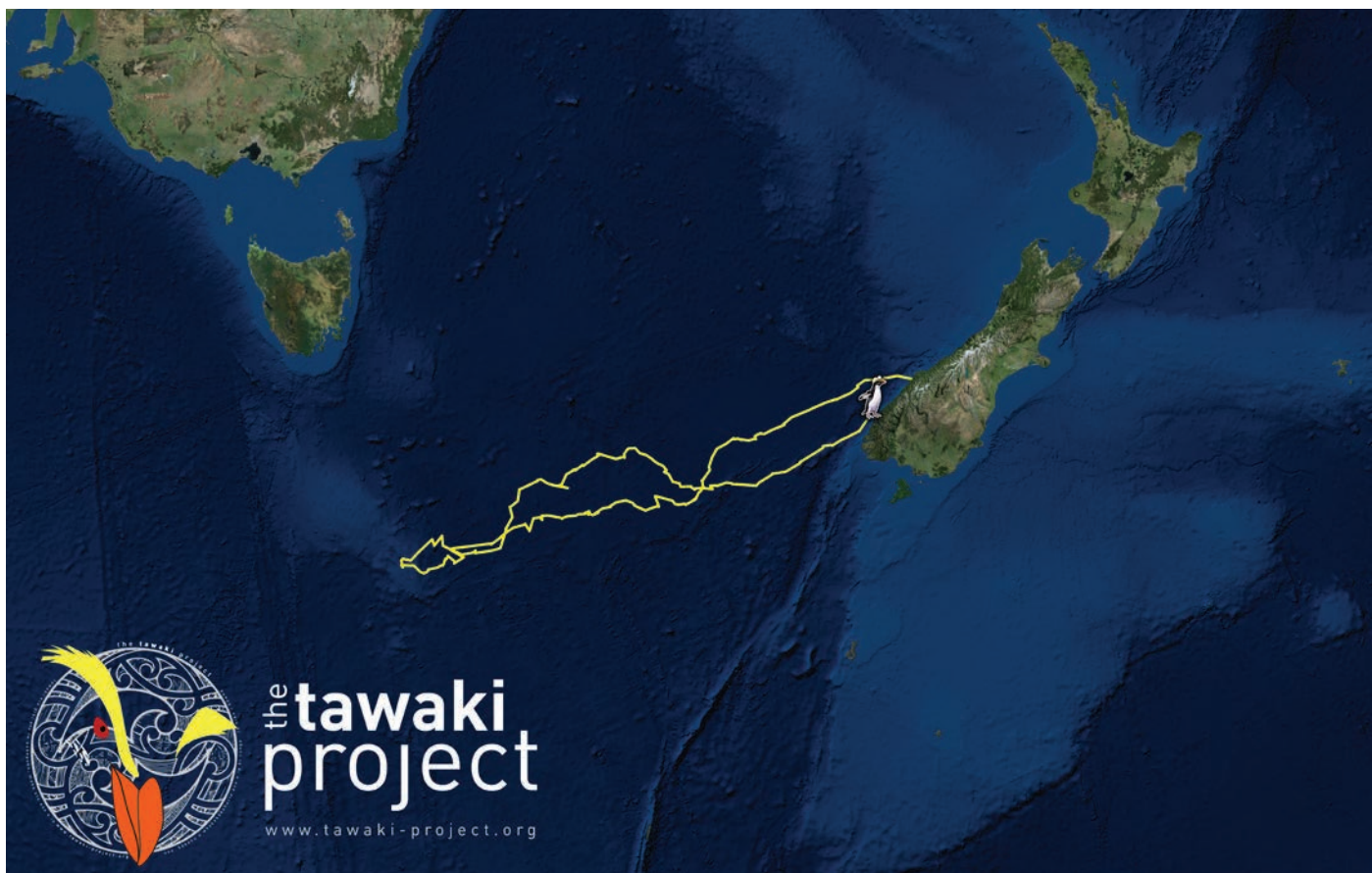
## Assessment of research impact

Penguins that were blood sampled resumed their breeding activities so that no effect beyond the stress exerted during the sampling procedure was apparent.

We monitored nest attendance patterns of penguin fitted with GPS dive loggers with those of control groups at all three sites. There was no measurable effect. Foraging trip lengths were comparable between experimental and control birds. Ship-based observations of birds fitted with loggers in Milford Sound / Piopiotahi also showed that their diving duration and frequency was similar to penguins without external device.

We have only limited information about the potential effect of satellite tags on birds during their pre-moult migration. But given that the lightest bird (2.5 kg) fitted with a sat tag returned to Gorge River after 66 days at sea, we can assume low physical and physiological effects on the penguins' foraging capabilities.





Pre-moult migration undertaken by a tawaki from Gorge River between November 2016 and February 2017

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

Tag ID	Date	Location	Sex	Age	Status	Weight	Tagger
982000365999809	28.09.2016	Harrison Cove	F	adult	-	2750g	Mattern
982000365999943	09.10.2016	Harrison Cove	F	adult	-	-	Mattern
982000365941969	09.10.2016	Harrison Cove	F	adult	-	-	Mattern
982000365941727	19.09.2016	Jackson Head	F	adult	1 chick	2650g	Ellenberg
982000365941655	13.10.2016	Jackson Head	F	adult	1 chick	2650g	Ellenberg
982000365941826	13.10.2016	Jackson Head	M	adult	-	3950g	Ellenberg
982000402100682	22.09.2016	Whenua Hou	F	adult	2 chicks	2900g	Ellenberg
982000365941763	22.09.2016	Whenua Hou	F	adult	2 chicks	2950g	Ellenberg
982000365999876	22.09.2016	Whenua Hou	F	adult	2 chicks	2750g	Ellenberg
982000365999858	23.09.2016	Whenua Hou	F	adult	2 chicks	3000g	Ellenberg
982000365999830	23.09.2016	Whenua Hou	F	adult	2 chicks	3050g	Ellenberg
982000365999821	23.09.2016	Whenua Hou	F	adult	2 chicks	3000g	Ellenberg
982000402100860	24.09.2016	Whenua Hou	F	adult	2 chicks	2950g	Ellenberg
982000402100821	27.09.2016	Whenua Hou	F	adult	2 chicks	3000g	Ellenberg
982000365941647	28.09.2016	Whenua Hou	F	adult	2 chicks	2700g	Ellenberg
982000365941729	29.09.2016	Whenua Hou	F	adult	2 chicks	2950g	Ellenberg
982000365941752	29.09.2016	Whenua Hou	F	adult	2 chicks	3000g	Ellenberg
982000365999691	29.09.2016	Whenua Hou	F	adult	1 chick	2650g	Ellenberg
982000365942075	29.09.2016	Whenua Hou	F	adult	2 chicks	2600g	Ellenberg
982000365941703	30.09.2016	Whenua Hou	F	adult	-	2750g	Ellenberg





## Stoat invasion at Jackson Head

Field work at Jackson Head commenced in mid-September at a stage of breeding where most chicks usually would have hatched already. We noticed very low numbers of active nests in areas that had been teeming with breeding penguins in the past two years. At first we suspected this to be the result of the strong El Niño in the previous summer; it appeared as if many of the penguins at Jackson Head had skipped breeding this season. This idea was seemingly supported by the fact that adult penguins were loitering in the breeding areas, often in pairs that were not engaged in any breeding activity.

In the evening of 25 September 2016 we headed out to the tawaki breeding areas to deploy GPS dive loggers. Below the westernmost breeding area we call 'Popi's Plaza' we noticed movement on the rocks of the shore, which we at first assumed to be a possum. When it was ca. 2 m from us, it became clear that we were looking at a stoat that was carrying a penguin chick in its jaws. The stoat dropped the chick and ran off. The chick was dead with obvious bite marks in the neck region.

We left the dead chick on the rock so that the stoat would return to recover its catch rather than going back into the breeding area to depredate another penguin nest. 30 minutes later the chick carcass was gone.

This observation triggered us to review some of the video footage recorded by trail cameras deployed by the West Coast Penguin trust in some of the apparently inactive breeding areas. The footage showed that the breeding areas had indeed been active in August but were visited frequently by stoats. Therefore, it seemed that a stoat invasion was the true reason for the low numbers of tawaki nests this season.

In the morning of 26 September we performed nest checks at 'Popi's Plaza' to assess which and how many of the tawaki nests had been affected by stoat predation since our last visit a week earlier. One nest was missing its chick with a male tawaki guarding a now empty nest bowl. Most likely the dead chick we had found the night before originated from this nest.

When we heard tawaki calls from further up the hill we investigated and found another sub-colony that we had not discovered before. Here, the full impact of stoat predation became very apparent.

Several pairs were guarding empty nest bowls, one of which had the remains of a ca. 2 week old chick lying outside the nest bowl. Other empty nests were attended by male penguins that clearly had an attachment to their nest sites but no nest contents to guard (see <https://vimeo.com/188116224>). Only one of the six nests visible still had a small chick.

That day we picked up stoat traps from the DOC workshop in Te Anau and deployed them in the late afternoon. Three traps were set in 'Popi's Plaza', one additional trap was set in the kiekie breeding area further along the shore where the last cluster of active tawaki nests remained.

Over the course of the next nights three stoats were caught with the traps which effectively removed the predation risk in 'Popi's Plaza'. No further chicks were killed in the following weeks. The last nest check on 13 November showed that the remaining four chicks were approaching fledging.

**Of 18 nests we monitored from mid-September, only six chicks survived until November. Four of these were from the trapped area.**





*Robin Long carrying fenn traps to the 'Popi's Plaza' tawaki breeding area; a total of four traps were deployed.*



*Carcass of a freshly killed tawaki chick its parents attending the now empty nest bowl in the background.*





## Outlook for breeding season 2017

*In its fourth year, the Tawaki Project will continue its GPS/TDR tracking study at the three study sites to investigate how annual variability reflects in the penguins' foraging behaviour.*

*Based on the successful outcome of this seasons migration study we plan to undertake a comprehensive study of the penguins' pre-moult and winter migration using a combination of GLS loggers (16 per site) and satellite tags (4 per site).*

*Furthermore, we would like to conduct a feasibility study of novel camera loggers on tawaki from Harrison Cove.*

### Sites

GPS tracking work will be carried out at three sites:

- **Jackson Head, South Westland**

It is important to examine whether the penguins from Jackson Head will be able to compensate for the two preceding poor breeding seasons. Hence, we will maintain Jackson Head as our main West coast site.

- **Harrison Cove, Milford Sound / Piopiotahi**

Since Harrison Cove penguins spend very little time with traveling while in the water, they are well suited for deployment of camera loggers to get visual information about their prey composition and prey pursuit strategies.

- **Whenua Hou, Foveaux Strait**

The second season on Whenua Hou will allow us to examine to which extent foraging patterns at this site tend towards consistency (like Harrison Cove) or variability (as observed at Jackson Head).

### Dates

The GPS/TDR tracking study will take place at three sites around the same dates as in the previous seasons:

- Field work for the chick-guard and early post-guard GPS tracking study (up to 20 birds per site) will occur between 11 September and 20 October 2017
- A feasibility study for camera loggers on up to 6 penguins from Harrison Cove will be conducted in the last week of September and the first week of October
- Deployments of GLS loggers and satellite tags (20 birds per site) are tentatively scheduled for 10-17 November 2017.

### Research team

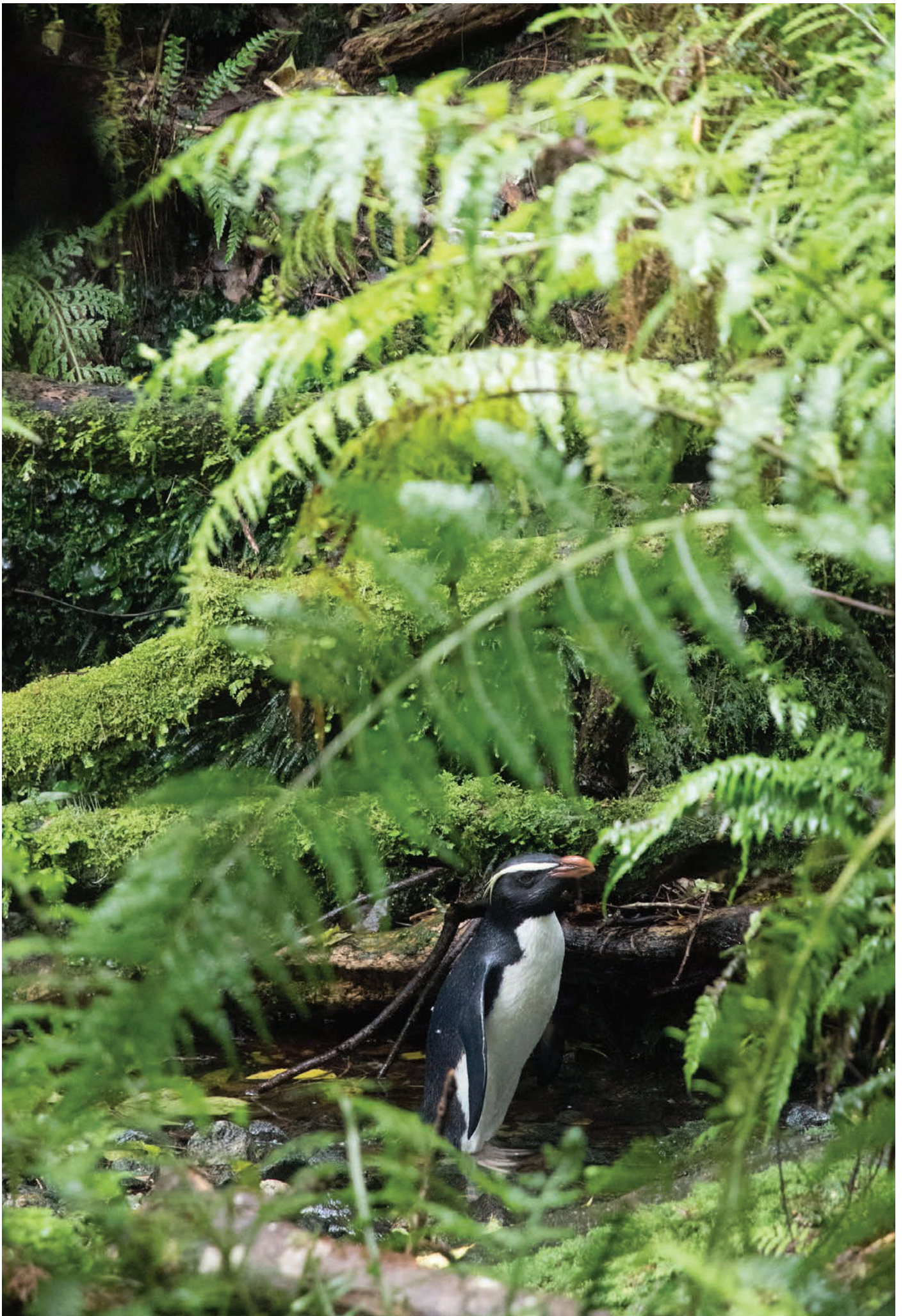
The Tawaki Project will be continued by the core research team consisting of **Thomas Mattern** (University of Otago), **Ursula Ellenberg** (La Trobe University), **Dave Houston** (DOC), **Robin Long** (West Coast Penguin Trust), **Pablo Garcia-Borboroglu** (Global Penguin Society), and **Klemens Pütz** (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

The Bird NZ Research trust, the Global Penguin Society and private donors all generously continue to support the project in 2017.

If you find any joy and stimulation in the work we're doing, please consider a modest donation through our website (<http://www.tawaki-project.org/support-us/>). Alternative funding option can be discussed with us directly (contact: [t.mattern@eudyptes.net](mailto: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) helped to keep the project on track in its third year. **Hannah Edmonds** (Te Anau) again organized us a place to stay in the Milford settlement and helped us out in the field. **Jacinda Amey** and **Paul Elwell-Sutton** were quick to help us out with stoat traps when our study at Jackson Head was threatened by nasty mustelids.

The success of the field work was based on the dedication of our co-investigators and field helpers. Teaming up with Ursula, **Dave Houston (DOC)** formed one half of our Whenua Hou team. In Milford Sound / Piopiotahi, **Robin Long** (West Coast Penguin Trust) and Thomas took care of the Fiordland portion of the project. They received phenomenal support from **Andrea Faris** and the whole crew at Southern Discoveries. **Tess Cole** joined the team to help out and amaze us with her huge collection of weird socks. **Horst Mattern** (Düsseldorf) and **Katta Ludynia** (Cape Town) took over the penguin work at Jackson Head and not only managed to get all loggers back but also catch stoats on the side.

While **Klemens Pütz** (Antractic Research Trust) had to pull out of field work this season, he helped us getting with 20 satellite tags and took care of the costs associated with the data acquisition. **Pablo 'Popi' Garcia-Borboroglu** (Global Penguin Society) helped out with finding funding to get Katta over from Cape Town.

Special thanks are due to **Robert 'Beansprout' Long** and **Catherine Stewart** at Gorge River, being fantastic hosts at a magical place, and

for helping us deploying satellite tags and for looking out for returning tagged birds.

**Kerry Jayne-Wilson** (West Coast Penguin Trust) also helped out at Gorge River and once again was an incredible source of information and discussions about tawaki. We are well and truly looking forward to continue our collaboration in the coming years.

**Geoff Robson** of Greenstone Helicopters, Jackson Bay, supported the project with helicopter time and continued to promote our work with the Jackson Bay area residents.

We are particularly thankful to **Ingrid Hutzler** from the Ornithological Society New Zealand and **Chris Rance** from Forest & Bird Southland for providing us with great news about support from their organizations.

Many thanks to the **private supporters** who donated through our website or purchased Tawaki Project t-shirts (<https://shop.spreadshirt.com.au/tawakiproject/>).

Finally, our greatest thanks go out to the **tawaki from Jackson Head, Harrison Cove, Whenua Hou, and Gorge River** who once again tolerated our presence and activities and provided us with data that allows us a glimpse of their fascinating secret lives at sea.

## Further information



<http://www.tawaki-project.org>



<https://facebook.com/TawakiProject>



<https://twitter.com/TawakiProject>



<https://youtube.com/c/TawakiProject>





Ursula Ellenberg

Dave Houston



Thomas Mattern

Robin Long



Horst Mattern

Katta Ludyina



Tess Cole

Andrea Faris



Thomas Mattern & Ursula Ellenberg