The satellite tracking of tawaki over the winter months concluded in August 2019 with recovery of most of the penguins and some of the satellite transmitters. The Tawaki Project received its permits for the next 10 years and has started this year’s field work in Milford Sound. We conducted a recce trip to Doubtful Sound where we plan to expand the Tawaki Project work to in the coming years. An intensive monitoring period at Jackson Head found no evidence for stoats despite the severe mast year. NZPI in collaboration with DOC will conduct the first survey of Erect-crested penguins on the Bounty Islands in nearly two decades and assess working conditions for future research on the Antipodes Islands. Liaison with community groups engaging in Little penguin conservation continued and first field work training will commence in November on the West Coast. The 10th International Penguin Conference helped substantially with the outreach to community groups in NZ and to establish collaborations with international colleagues in the future.

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Satellite tracking of tawaki winter dispersal concluded

Milestone FP6 – Examine species’ fjord ecology and suitability of fjords as buffer zones in the face of continuing ocean warming

Tawaki have now concluded their winter journeys and are currently engaging in breeding. Of the 16 penguins fitted with satellite receivers in February 2019, six could be tracked all the way back to the mainland, two birds stopped transmitting about a week short of returning to their colonies. The remaining eight birds all stopped transmitting while still out at sea.

In an effort to recover any returned devices (and relieve the penguins of their transmitter) we visited the three main study sites between 18 July and 16 August.

The first bird to return to its breeding colony, a male penguin from Harrison Cove, Milford Sound/Piopiotahi was encountered alone at its nest site on 18 July. At that stage only a few birds, mostly males, had returned to their colony with most birds still on their way back to the fjord. The penguin was in fantastic condition, weighing 4.2 kg.

On 7th August 2019, we flew into Codfish Island/Whenua Hou to recover satellite transmitters from at least three birds we knew had returned to the island in the weeks prior. On the first day we found four of the eight birds fitted with satellite tags, two still sporting their transmitters. Over the course of the next four days, we managed to recover two more devices and find all eight birds, two of which had already started to breed and were guarding or incubating eggs.
Male tawaki on Codfish Island/Whenua Hou, satellite tracked for 141 days, accompanying his female partner standing over their first egg.

That we managed to recover all penguins fitted with transmitters on Whenua Hou is a fantastic success. Usually the fate of satellite tracked penguins cannot be determined so there is the suspicion that the animals perished while – and potentially because of – carrying a device. With this trip to Whenua Hou we can now provide evidence that the attachment of satellite transmitters does not impede the penguins to a degree that their survival chances are reduced.

Finally, we conducted an overnight trip to Jackson Head on August 15th, where the only bird that we encountered in February and fitted with a transmitter had returned to just 10 days earlier. To our surprise the bird, a female penguin, was already incubating two eggs. This is particularly interesting from a brood reduction perspective. Crested penguins lay two, different-sized eggs but generally only raise the chick from the larger one. The quick egg turn-over time in our female highlights that in tawaki – and presumably in most other crested penguin species – egg formation commences while the birds are still out at sea. Egg yolk formation on average takes 16 days with an additional 6 days required to produce the eggshell. This means that the bird returned to its colony with almost fully formed eggs before it had a chance to be fertilized by its partner. This finding supports the hypothesis that the egg size differences in crested penguins may be correlated to the foraging success of individuals. All recovered tawaki were in excellent body condition, which suggests that despite travelling >10,000 km during their winter journeys, tawaki benefit from abundant food.

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resources. This could explain why, of all crested penguins, tawaki show the smallest egg-size difference and occasionally manage to raise both chicks to fledging.

Female tawaki incubating two eggs a mere 11 days after she made landfall at Jackson Head, West Coast.

Another outcome of this study is that with the less intrusive attachment method (i.e. not using glue on feathers, see 2019Q2 report) we can now confirm that the impact of long-term attachment of devices to the penguins’ plumage can be greatly mitigated by using cable ties to secure the units. While deterioration of the feathers located underneath the devices cannot be prevented as the bird is unable to preen and reapply oil to these feathers for the duration of the deployment, the resulting feather damage is much reduced compared to glue-based attachments.

Female tawaki (same as above) six weeks after recovery of a satellite transmitter; the feather loss where the device was located is moderate compared to traditional long-term attachment methods that use two-component epoxy glue directly on the feathers.
Tawaki Project: permits approved & field work underway

Milestones FP1-8 – Tawaki survey in Fiordland, establish mark-recapture programme & demography database, coordinate & conduct research, examine fjord ecology

The permits for the initial phase of the Tawaki Project expired in March 2019. The first phase focussed on the examination of the penguins’ utilization of their diverse marine habitat across the species’ breeding range. One important finding was that Fiordland appears to be of special significance for tawaki as fjord ecosystems may buffer the impacts of environmental perturbations such as El Niño. Whether this is indeed the case, which specific factors are beneficial for the penguins, and which fjord regions provide tawaki with ideal breeding and foraging conditions will be the focus of the next phase of the project. The details of the research we proposed to conduct over the next 10 years were outlined in the previous quarterly report (2019Q2).

Permit applications were submitted to the Department of Conservation in late June. Comprehensive iwi consultation was necessary for the satellite tracking component of the proposal (comparison of post-moult movements of tawaki moulting on the West and East coasts, and in rehab). As a result, the issuing of the permits was delayed well into the field season so that we could only start work in Milford Sound at the beginning of October. This means field work is cut short by two weeks. However, at the time of this writing, first GPS dive logger deployments were underway on penguins from the Harrison Cove and Moraine colonies in Milford Sound/Piopiotahi.

The Tawaki Project field team (Ursula Ellenberg & Robin Long) at the Moraine colony camp site, Milford Sound/Piopiotahi, 6 October 2019.
Doubtful Sound/Patea reconnaissance trip

Milestones FP1, FP4, FP5-8 – Tawaki survey in Fiordland, continuation of DOC monitoring programme, examine fjord ecology

Phase two of the Tawaki Project will examine the foraging and breeding ecology of tawaki across different fjords. Milford Sound/Piopiotahi (9km) is one of the shortest fjords. Penguins from Harrison Cove should be able to forage out at sea if necessary – although this behaviour has rarely been observed in the past four years. Doubtful Sound/Patea in comparison is much longer (40 km) and in its topography considerably different from Milford Sound. We therefore propose to expand our research to include Doubtful Sound from next year onwards.

To assess working conditions and get a better understanding of the distribution of tawaki in Doubtful Sound, we conducted a three-day reconnaissance trip in mid-September. With the generous help of Fiordland Expeditions, Thomas and Richard managed to visit various islands and coves within the fjord to examine site access, penguin numbers and nest accessibility.

First locations to be visited were the Shelter Islands which were part of DOC’s monitoring programme that’s been on hiatus since 2015. Both East Shelter and West Shelter islands were visited and searched for about two hours. Most penguin nests contained eggs or young chicks, i.e. hatching was well underway.

Typical tawaki nest on East Shelter Island, 6 September 2019.
A total of 23 nests were located on East Shelter, although it is almost certain that this does not represent the actual total number of nests. Following the assumption that brief one-off searches of tawaki nests generally miss out on one third of the actual nests number\(^2\), there may be 32 nests. This corresponds well to previous counts conducted during the DOC monitoring programme on the island, where nest numbers found between 1994 and 2009 ranged between 17 and 26 nests\(^3\) (mean: 17 nests\(^4\)).

On West Shelter Island, only 12 nests were found which is significantly lower than what was recorded during DOC surveys in the mid-1990s (52 nests in 1995\(^2\)) but is comparable to more recent surveys (14 nests in 2006\(^2\)).

Access to both islands is extremely difficult. Both islands are located right at the fjord entrance and can be exposed to substantial swells. Landing involves jumping from a dinghy onto the slippery rocks which can be challenging even during calm conditions. This renders both islands only marginally suitable for the proposed research. Other sites visited proved to be much more promising.

A better site to work with tawaki that have direct access to the open ocean is Bauza Island, a large island to the west of the Shelter Islands. We managed to search about 200m of coastline – which represents less than 1% of the entire island’s circumference – in the large bay of the northern end of the island. During our 1-hour search, we recorded 12 nests. Doubtlessly there are considerably more tawaki nests on the island; especially along the northern end where numerous coves and bays appear to provide access to ideal tawaki breeding habitat.

The tawaki survey conducted in August 1990 concluded that there are no tawaki on Bauza Island⁵.

Bauza Island represents a much better site for the proposed research as it is less exposed to the swell and the numerous bays and coves will allow access to the island under most conditions. There are several freshwater streams on the island which will make it possible to camp out during device deployment and recovery periods.

The island also warrants a full survey in the future, particularly along the north-western coast. The north-eastern side of the island that faces Secretary Island appears to be less suitable for penguins to get ashore; we did not visit the southern side of the island.

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We also visited Seymour Island, which is located at the intersection of Doubtful Sound/Patea and Thompson Sound, some 14 kilometres from the open ocean.

Access to the island is easy, the island itself is easy to navigate. We searched most of the southern coast over a 1.5-hour period and recorded 14 tawaki nests. However, many of the nest sites were in deep caves under tree roots where we suspected more nests that were not visible from the cave entrance. We assume that there are at least 25-30 nests on Seymour Island. The only other previous count in 1990 found 12 nests.

Direct access to most of the nests is difficult, but since all nest caves are located not more than 20 m from the water’s edge, access is easy to monitor, and penguins can be intercepted easily when they leave or return to the island. Hence, Seymour Island is much better suited for the proposed work. Moreover, the island is located at what can be described the interface between two tawaki foraging habitats, pure fjord habitat (locations south and east of Seymour Is) and ocean accessible habitat (locations to the West).

Deep inside the fjord, tawaki numbers thinned out considerably. In the late afternoon of 7 September 2019, we surveyed Rolla Island which is located about 3 km from Deep Cove, some 40 km from the fjord entrance. While the 1990 survey found 8 nests, we only located four nests, despite spending almost two hours on the tiny island.
Other searches were conducted on Elizabeth Island, Ferguson Island as well as in Davidson Cove (located south of Rolla Island) and an unnamed cove to the north of Ferguson Island. No penguins were found; some signs of moulting were evident on Elizabeth.

This means that while we have found suitable sites for our proposed research in the outer and mid-fjord regions, we remain on the lookout for other deep fjord locations. From discussions with skippers and observations of other researchers, it appears as if penguin numbers in Malaspina Reach are much lower than in Bradshaw Sound which extends eastward from the intersection of Thompson and Doubtful Sound. We therefore will start our work next year focussing on Seymour and Bauza Island with a low number of deployments on Rolla Island. Further reconnaissance will be conducted to identify suitable work sites at the end of Bradshaw Sound.

Open tawaki nest on Seymour Island in Doubtful Sound/Patea, 6 September 2019.
Tawaki monitoring for stoat impacts at Jackson Head

FP4 - Continuation of DOC monitoring programme

While not necessarily a direct effort to continue DOC’s monitoring programme at Jackson Head, the opportunity arose to survey tawaki breeding success following a mast year with predicted high stoat abundance. A 1080-drop in the Moeraki area provided a near ideal experimental set-up to determine how different predator management approaches benefit tawaki. At Jackson Head, a self-setting trap line has been established after the devastating impact of stoats on the breeding population of tawaki in 2016. To assess the potential impact of stoats on tawaki we monitored the Jackson Head breeding sites daily throughout the early chick rearing phase.

Penguin numbers at Jackson Head dropped sharply after the 2015 El Niño and the following 2016 breeding season where a stoat incursion led to almost complete breeding failure at Jackson Head. The nest numbers we found during initial searches in August 2019 were encouraging, with nest numbers at some of our study areas approaching those we found before the 2015 El Niño. Overall, we mapped 38 nests of which we followed their breeding progress daily from 18 to 26 September 2019.

Male tawaki guarding two chicks in the Apartment Building area of Jackson Head, 17 September 2019.
The nine days of daily nest checks coincided with the crucial period of late guard, early post-guard period, where chicks are becoming more mobile and start to venture out of their nests. This makes them particularly vulnerable to stoat predation.

Throughout the survey period three chicks died, all of which were the smaller, first-hatched chicks that usually do not survive the first week after hatching. Throughout the monitoring period there was no indication of predator presence apart from an eggshell that may have been scavenged by a possum after rolling out of a nest.

There was no evidence for stoat presence. Moreover, passerine birds were present in tawaki breeding areas for the first time since the Tawaki Project started work at Jackson Head in 2014. We noticed silver eyes, bellbirds, tui, fantails, grey warblers and kereru while monitoring penguins. In previous years, the forest of the western side of Jackson Head was practically devoid of birds other than penguins. Apparently, the trap line that has been maintained along the Jackson Head ridgeline by the local community manages to keep introduced predators in check.

**Erect-crested & Rockhopper survey & reconnaissance trip**

**AP1 - Liaise with DOC to facilitate foraging & demographic research on Antipodes Islands**

From 22 October to 7 November 2019 a joint DOC/NIWA research expedition will be conducted to the sub-Antarctic Bounty and Antipodes Islands. The trip will complete various surveys of seal, albatross and giant petrel counts. Another component is the deployment of GLS loggers on Erect-crested penguins as part of a study conducted by NIWA and the University of Tasmania. After proposing a long-term study on crested penguins on the Antipodes Islands, the Department of Conservation suggested that NZPI would take part to conduct reconnaissance for the planned research (see also the 2019Q1 report). At the same time, we could assist with the penguin work as well as other surveys.

Since the initial suggestion several months ago, the scope of our involvement has been extended. It is now planned that NZPI conduct ground counts of Erect-crested penguins on Proclamation Island in the Bounty Island Group as well as at the Erect-crested & Rockhopper penguin colony near the hut on the Antipodes Islands. Moreover, if logistics and weather permits, we will also attempt to do aerial surveys of the same penguin colonies using camera drones.
This expedition will represent the first concerted survey of penguins on the Bounties since the late 1990s. Beyond the survey work, this trip will allow us to assess feasibility of the proposed research and to get acquainted with the working conditions on the island.

Working towards a national little penguin/kororā monitoring program

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

Since our last quarterly report in July we have learned of an additional 14 groups involved in kororā conservation, bringing the total up to 45. These groups cover a range of conservation and research activities around the country, including monitoring, tracking, rehabilitation, advocacy, education, trapping, and habitat restoration.

Locations of groups involved with kororā conservation.
Of these 45 groups, 16 are currently undertaking regular monitoring with a further 7 looking to engage in a more structured monitoring approach. Over the last 3 months we contacted these groups to learn more about their work, discuss our programme and determine the survey methods and level of monitoring being undertaken around the country. One thing is for sure, there are a lot of enterprising people with sound knowledge of their local kororā colonies who are devoting their time and efforts to protecting and enhancing the kororā population. The proposal of standardisation and coordination of monitoring regimes was well received as it serves to bolster local efforts while offering regional and national perspective on the health of the kororā population.

This season we’re working with the West Coast Penguin Trust to roll out the monitoring protocols and train members of the group in the use of tracking devices and transponder insertion (permit pending). Through this process we will develop and refine monitoring plan documentation with feedback from the community group. Richard (research & conservation coordinator) will be leading the charge on the West Coast; Thomas (scientific director) will be joining the efforts after returning from the reconnaissance trip to the sub-Antarctic islands in November.

Following this season’s work with the West Coast Penguin Trust we will put our draft monitoring protocols and database out to community groups for their feedback and insight on how well the protocols apply to their group structure and kororā colonies.

International outreach – 10th International Penguin Conference

LP6 - Liaise with Australian researchers to ensure continuous flow of information and facilitate collaborative efforts

The 10th International Penguin Conference in Dunedin, in August allowed for a great opportunity to discuss NZPI’s coordinated monitoring strategy with local groups as well as experts from across the ditch. Two of the major themes of the conference were the importance of long-term data and an emphasis on understanding the marine ecology of penguins. Dr Peter Dann presented on Phillip Island Nature Parks’ long-term demographic data while Associate Professor Andre Chiaradia highlighted how an understanding of little penguins’ marine ecology can be used to inform conservation in the face of environmental change. Being able to tap into this knowledge is a huge asset to the programme.

We also discussed the project with Dr Perviz Marker, a researcher with the University of Tasmania who is running a similar programme to coordinate community groups undertaking little penguin monitoring in Tasmania. Perviz shared the same beliefs, that conservation should be community lead
and that our role as coordinators is simply to facilitate and support these groups. We will compare notes and collaborate as the projects move forward.

General knowledge exchange

Through the Tawaki Project and Yellow-eyed penguin research, NZPI was represented with three oral presentations and two posters at the 10th International Penguin Conference in Dunedin, August 2019. Ursula Ellenberg presented a comprehensive summary of the first five years of research of the Tawaki Project to the 300+ delegates of the conference; PhD student Jeff White talked about the stable isotope work he conducted as part of the Tawaki Project. NZPI Scientific Director Thomas Mattern gave an oral presentation about the potential of using high-definition camera loggers in future penguin research.

The conference offered ample opportunities for exchange with international colleagues as well as establish new collaborations for our future work. Both the Tawaki Project as well as our efforts to facilitate Little penguin research (see above) were met with great interest. Several colleagues expressed their interests to work with us in the coming years.