

A survey of Fiordland crested penguins / tawaki (*Eudyptes pachyrhynchus*) from Cascade River to Martins Bay, South Westland, New Zealand, 2014

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Abstract A survey of Fiordland crested penguin/tawaki, *Eudyptes pachyrhynchus*, breeding colonies between Cascade River and Martins Bay, South Westland, was undertaken from August to September 2014 to obtain an accurate population estimate for the area. A total of 835 nests was found, making this one of the major breeding locations for the species. This total represents a minimum estimate as tawaki nests are spread through large areas of dense forest and are very difficult to locate, and so count accurately. A total of 150 nests was observed in previous surveys of the same location. This dramatic difference in results (835 vs. 150) is attributed to a difference in survey methods and the surveyor's familiarity with the breeding area, not a population increase. Given these results and the difficulty involved in locating tawaki, it is likely that the species' overall population size has been significantly underestimated.

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INTRODUCTION

The tawaki, or Fiordland crested penguin, *Eudyptes pachyrhynchus*, is endemic to New Zealand and breeds along the coastline of South Westland, Fiordland, Stewart Island/Rakiura and outlying islands (Mattern 2013). The majority of tawaki breeding populations are located in remote areas which are difficult to access. Exceptions include the Jackson Head, Murphy Beach and Munro Beach colonies which are situated within easy walking distance of a road. With a current population estimate of 5,000-6,000 individuals (Birdlife International 2016), the tawaki is classified as Vulnerable on the IUCN threat status (Birdlife International 2016) and Nationally Vulnerable by the New Zealand Department of Conservation (Robertson *et al.* 2017).

Due to the inaccessibility of most breeding colonies, the species is very difficult to survey;

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consequently, the accuracy of the population estimate is not known. Data from 1 breeding site which has undergone monitoring suggests a trend of population decline (St Clair *et al.* 1999). However, as the key demographic parameters for this species have only recently been documented and many aspects of its ecology remain unknown (Otley *et al.* 2017), an overall population trend is not currently known.

In the 1990s a series of surveys was carried out throughout the tawaki range (McLean & Russ 1991; Russ *et al.* 1992; McLean *et al.* 1993; Studholme *et al.* 1994; McLean *et al.* 1997); however, these were severely limited by the time ashore at most locations and observer experience. In the area covered by the present survey, only 150 nests were found in 1995 (McLean *et al.* 1997).

In this current survey I conducted an intensive search for tawaki nests along approximately 60 km of coastline between Cascade River and Martins Bay (a region covered by all previous surveys) in

August-September of 2014, when breeding was underway and eggs had been laid (Warham 1974). The objective of the survey was to derive the most accurate population estimate to date. This section of coastline was chosen to encompass most of the area between the breeding sites monitored by the Department of Conservation since 1993 (DOC 2012) at Jackson Head and Martins Bay, as well as locations previously surveyed by the Long family (Long *et al.* 2010; Long *et al.* 2011). I was very familiar with the area and the local tawaki population as I had lived in the area to the age of 19 and at the time of the survey I was a resident of Gorge River.

METHODS AND MATERIALS

This survey was carried out between 10 August and 9 September 2014 during 1-3 day trips based from Gorge River (Fig. 1).

A thorough count of some nesting groups could not be obtained practically or without undue disturbance. For these areas, the minimum number of nests recorded may be a significant underestimate.

In areas with bouldery beaches and gently sloping podocarp-broadleaf forests, habitat types tawaki appear to prefer (Long *et al.* 2010; Long *et al.* 2011), nests were located by walking through the forest in a zigzag pattern between the upper beach edge and the 40m contour. In habitats with different gradients and forest composition for which nesting preferences were not known, the remaining area up to the 60m contour was searched. To avoid double counting, all counts were carried out by a single person moving through the colony in 1 direction.

Sandy beaches were searched for footprints. Nesting groups are often established along small creeks or gullies and share a common entry point identifiable from the beach. When such features were encountered with obvious signs of penguin usage (e.g. guano trails, claw marks on rocks), these were followed to locate nests in the forest. Once a cluster of nests was found, a count was obtained by moving around the fringes to identify as many nests as possible by sight, while remaining hidden from the incubating birds whenever possible. In many larger groups, nests towards the centre could not be counted without disturbing those on the periphery, so were noted as likely to be there but not included in population estimates. For the colonies breeding between Cascade River and Barn Bay, the overall breeding population could not be counted accurately without causing disturbance and was conservatively estimated based on the distance of coastline occupied by tawaki and the number and amount of use of entry points compared to other areas which were surveyed intensively within the forest.

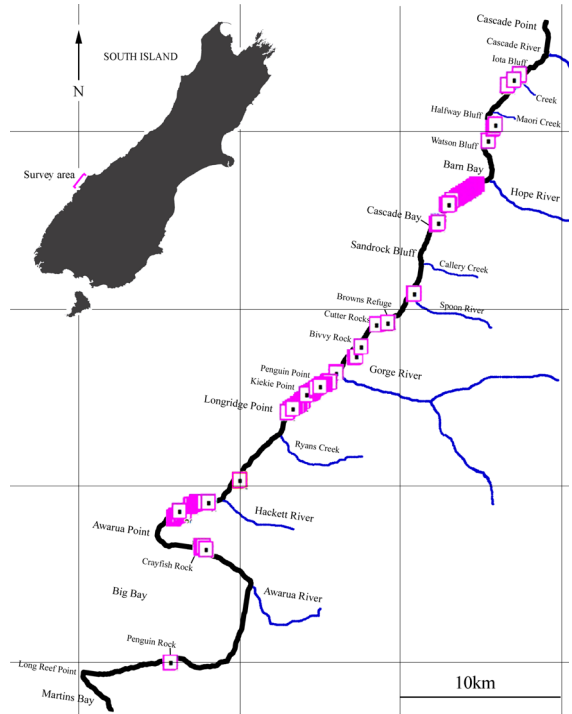


Fig. 1. Location of the 2014 survey area between Cascade River and Martins Bay, South Westland, showing waypoints for nests and nesting groups.

In places where the forest was either impenetrable or appeared unsuitable for tawaki, the upper edge of the beach was searched for guano trails and scratches on rocks, or footprints on sandy beaches to assess level of tawaki presence.

Throughout the majority of the survey, emphasis was placed on finding and counting all the larger nesting groups rather than spending excessive time searching for likely small groups (less than 3) on the outer limits of the breeding area, such as those at unusually high altitude. Trails continuing uphill from larger nesting areas were recorded as leading to likely additional nests.

Nesting groups were marked on a GPS and the number present recorded. Isolated nests or those further from the main group were assigned separate waypoints and larger groups were recorded with 2-3 waypoints to indicate the area within which nests were located. A 'nest' was recorded if a bird was found prone on a nesting bowl, with or without its mate. Notes were made of any eggs or chicks which were sighted, although such sightings happened infrequently.

In areas surveyed towards the end of the survey period, nest sites were seen which had clearly been

used earlier in the season but were abandoned, as indicated by broken or rolled out eggs. In order to record the number of breeding pairs accurately across all areas, abandoned nests were counted as 'already failed'.

The colony breeding between Gorge River and Longridge Point was surveyed in greater detail and all trails were followed in an attempt to find most of the isolated nests. This difference in survey intensity was due to ease of access from the base at Gorge River and a desire to establish the exact size of this population to compare to the earlier surveys of Long *et al.* (2010, 2011).

RESULTS

The numbers of nests counted and number of trails likely to lead to additional nests indicated a minimum population of 835 breeding pairs along approximately 60 km of coastline between Cascade River and Martins Bay (Table 1).

Cascade River to Barn Bay, 16 August 2014

The beach between Barn Bay and Watson Bluff was searched for sign but none was found.

Immediately north of Watson Bluff scattered sign indicated a few isolated pairs likely breed here. From 100m north of Watson Bluff to Halfway Bluff, a large dense colony nesting was found in the thin band of steep kiekie (*Freycinetia banksii*) and tutu (*Coriaria arborea*) on the seaward side of a cliff. This colony was so dense that surveying the penguins was impractical and searching the forest in this area would have unduly disturbed the incubating birds. There were >10 well used entry points along the 500 m of beach and many calls heard. One trail was followed and 12 nests identified. Based on the distance of coastline occupied by tawaki, the number of entry points, and the amount of use at these points compared to those in other colonies surveyed, this colony was conservatively estimated to contain approximately 100 nests.

The flat area of forest around Maori Creek (north of Halfway Bluff) appeared unsuitable for tawaki and no sign was found on the beach. However, minor entry points north to Iota Bluff indicated isolated pairs nesting in the thin band of kiekie. Two larger entry points were used by a total group of an estimated 25 pairs.

The creek south of Iota Bluff was used as an entry point. Many tawaki were heard calling from different directions higher up a steep slope of dense kiekie above this point. On the south side of the creek 5 nests were identified and trails led to many more in the steep kiekie face above. Based on these nests and trails to likely additional nests, as well as the number of calls originating from various directions, this group was estimated to contain 20-

30 nests.

Between Iota Bluff and Cascade River the terrain was flat and swampy and considered unsuitable for tawaki. No sign was found and it was concluded that none were present.

Barn Bay to Sandrock Bluff, 14-15 August 2014

Sandrock Bluff - Cascade Bay, 14 August

To the north of Sandrock Bluff, the forested slope and a large swampy area were searched, but revealed no tawaki sign.

A colony of tawaki was found on Fox Point, extending into Cascade Bay; 27 nests were present and 3 trails noted.

Cascade Bay - Barn Bay, 15 August

No sign was found on the beach at the northern end of Cascade Bay.

The forest from Cascade Bay to the Hope River was searched intensively revealing a total of 212 nests plus 14 trails leading to likely additional nests. A few nesting groups were large, sprawling and impossible to count accurately without disturbing peripheral birds. In these places, the number of nests sighted has been recorded as well as an estimate of how many were likely to be present. 28 nests were counted in 6 distinct groups where the total estimate was around 55-70 nests.

A minimum number for this area is 212 nests, but it is likely that at least 300 were present.

Sandrock Bluff to Gorge River, 9 August 2014

A group of 16 nests was located in the forest on the south side of Bivvy Rock, approximately 1 km north of Gorge River (Fig. 1). At Rocky Point and Cutter Rocks, minimal scratches were found on boulders indicating a few isolated nests. Five nests were found to the east of Cutter Rocks. No other sign was found on the sandy beach between Gorge River and Spoon River.

The bouldery beach between Spoon River and Sandrock Bluff was searched. Two minor entry points were found at the southern end indicating likely isolated nests.

Gorge River to Longridge Point, 12 August 2014, 4-5 September 2014

The tawaki breeding along this section of coastline is the most viable colony for ongoing monitoring to assess population trends due to relative ease of access from Gorge River. Therefore, this area was surveyed in greater detail in an attempt to find most isolated nests, as well as the main nesting groups.

Gorge River - Penguin Point, 12 August

The tawaki colony begins approximately 600 m

Table 1. Number of tawaki nests and trails leading to likely additional nests counted in 2014 at various survey sites between Cascade River and Martins Bay.

Location	Number of nests counted	Number of trails leading to likely additional nests
Cascade River - Barn Bay	145 (estimate)	0
Barn Bay - Sandrock Bluff	239	14
Sandrock Bluff - Gorge River	21	4
Gorge River - Longridge Point	356	10
Longridge Point - Hackett River	0	1
Hackett River - Awarua River	62	17
Penguin Rock	12	1
Total	835	47

south of Gorge River and from there south to a small bluff, 23 nests were found; 78 more nests were identified between the bluff and Penguin Point.

Penguin Point - Kieke Point, 4 September

Of the 186 nests were found between Penguin Point and Kieke Point 22 had already failed and 4 additional trails were found.

Kieke Point - Longridge Point, 5 September

A group of 5 pairs appeared to nest amongst flax adjacent to the beach on Kieke Point. 69 nests were located between Kieke Point and Longridge Point, 7 of which had already failed; 3 trails and 3 entry points further along the beach were recorded.

Longridge Point to Hackett River, 25 August 2014

This section of coastline was surveyed by walking along the sandy beach and searching rocky areas for scratch marks and guano. A single tawaki track was found leading to a possible nest.

Hackett River to Awarua River, 25-26 August 2014

Hackett River - Awarua Point, 25 August

This area was surveyed simultaneously in 3 sections by myself, Robert Long and Catherine Stewart.

In total, 58 nests, 6 of which had already failed, were found plus entry points and trails leading to a likely additional 17 nests. Adjacent to the beach is a thick band of impenetrable kiekie where a moderate number of tawaki may have nested, but could not be located without significant disturbance.

Awarua Point - Awarua River, 26 August

No tawaki sign was found on the beach in the swampy area from Awarua Point to Crayfish Rock. Minimal scratches were found on rocks slightly west of Crayfish Rock. To the east of Crayfish Rock 4 nests and 2 trails were identified. No tawaki sign

was found from there to Awarua River.

Penguin Rock, 27 August 2014

A group of at least 10 nests was identified under large boulders on the west side of Penguin Rock, as well as 2 isolated pairs and another trail nearby. This colony was very difficult to survey and could consist of around 25 pairs based on area occupied and density of sign.

DISCUSSION

The results of this survey show that the minimum number of tawaki present between Cascade River and Martins Bay in 2014 was 835 breeding pairs (Table 1). However, as it was impossible to cover every part of forest in the area during a single season, it is very likely that at least 1000 breeding pairs are present in this area.

Undercounting can be assumed, although it is difficult to judge the percentage of nests likely to have been missed in this survey. The search between Gorge River and Longridge Point was intensive and <50 nests would have been overlooked. However, the rest of the survey was focused on locating all of the larger nesting groups, along with smaller groups and single nests between the beach and 40m contour.

McLean *et al.* (1997) identified 150 breeding pairs between Cascade River and Martins Bay in August 1992-1994. However, the greater numbers found in this current survey are not necessarily indicative of an increased population. Although the McLean *et al.* (1997) survey was carried out by a greater number of people over a longer time, the majority of time was spent searching for sign on the coast and trails were often followed for only 20-50m into the forest (McLean *et al.* 1997). In addition, surveyor experience may have differed significantly between

the 2 surveys. As such, caution is necessary when comparing the results of the 2 surveys.

I have carried out surveys of the breeding area between Gorge River and Longridge Point on 3 occasions; in 2009 approximately 190 nests were found (Long *et al.* 2010), compared to 279 in 2011 (Long *et al.* 2011) and 356 in 2014. Tawaki nest throughout wide areas of coastal podocarp-broadleaf forest, are very difficult to find and easy to pass by unnoticed. Therefore, I believe that the apparent increase in numbers between these 3 surveys is due to increased experience in locating nests and other sign.

Due to site familiarity, surveyor experience and the comprehensive methodologies used in this current survey, it is considered likely that most colonies of tawaki between Cascade River and Martins Bay were located and a more accurate estimate of the breeding population present in the area has been achieved. As all the nests and nesting groups found are recorded on GPS, more accurate future comparisons can be made. The colony breeding between Gorge River and Longridge Point will be resurveyed biennially over a 10-year period to determine whether there is a general population trend occurring in South Westland in areas without human interference on land. McLean *et al.* (1997) identified the following as major breeding areas (identified as having >100 nests): Codfish Island, Solander Island, Breaksea and adjacent islands, Shelter Island, Yates Point, Cascade Point and the coast north, Jackson Head, the Open Bay Islands and the coast south of Paringa River. Numbers approaching 100 nests were also noted south of Hope River and Gorge River. According to the results of the current survey, approximately 240 nests are present south of Hope River and >350 nests south of Gorge River, with at least 835 nests in total between Cascade River and Martins Bay. This stretch of coastline should therefore also be classified as 1 of the major tawaki breeding areas. As an important breeding location for the species, this colony should be considered by the Department of Conservation as a site which needs to be managed to protect tawaki (e.g. the prohibition of dogs in the area) and to help increase the population of this vulnerable species.

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