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The impact of storm-induced tree loss on the population of Wilkins's Finch *Nesospiza wilkinsi*

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Research Article

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Summary

Wilkins's Finch *Nesospiza wilkinsi* is endemic to Nightingale Island (2.5 km^2), Tristan da Cunha. It feeds on the woody fruits of the Island Tree *Phylica arborea* and in 2017 had a population of 120 breeding pairs. In 2021 it was uplisted from "Endangered" to "Critically Endangered" following damage to *P. arborea* woodland during severe storms in 2019. During a brief visit to Nightingale in February 2024, we confirmed that the finch population in the area of storm-damaged woodland has decreased by up to 75%, but the density in other areas was similar to that prior to 2019. Extrapolating from the 2017 survey, we estimated the current population to be 60–90 breeding pairs. Surveys of *P. arborea* structure in the storm-affected area indicated that some large trees had survived, despite being flattened, that recruitment of new trees is occurring, and that fruit loads on surviving trees are similar to those in 2017. Satellite imagery from 2005 showed similar woodland loss during another severe storm in 2001 to that experienced in 2019, indicating that the finch has survived similar events in the past. Coupled with the successful release of a biological control agent to limit the impact of the introduced brown soft scale *Coccus hesperidum* on *Phylica* fruit production, the future prospect for Wilkins's Finch is less bleak than previously thought. However, the risk that global warming is increasing the frequency of severe storms remains a concern. Planting more woodland patches in sheltered areas would help to offset future storm damage.

Introduction

Wilkins's Finch *Nesospiza wilkinsi* is confined to Nightingale Island (37.42°S, 12.48°W), a 2.5 km^2 island in the Tristan da Cunha archipelago in the central South Atlantic Ocean (Ryan 2007, 2008). The island has been little affected by human activities; there are no introduced mammals and only a few introduced plants (Ryan 2007). Wilkins's Finch has evolved to exploit the woody fruits of the Island Tree *Phylica arborea* (Ryan et al. 2007). Due to the limited area of *Phylica* woodland on Nightingale (only some 12 ha), it is one of the naturally rarest birds. The population was previously estimated at only 30–50 breeding pairs (Elliott 1957; Richardson 1984; Ryan 2007), but a comprehensive survey in 2016–2017, which individually colour-ringed most territory-holding adults, indicated a population of 120 pairs (Dilley et al. 2021a).

Since its recognition as a distinct species (Ryan et al. 2007), Wilkins's Finch has been listed as "Endangered" due to its extremely small range and small population size (BirdLife International 2021; Ryan 2008). However, it was uplisted to "Critically Endangered" in 2021 following extensive storm damage to the largest area of *Phylica* woodland on the island in 2019 (BirdLife International 2021). Preliminary observations by Tristan Conservation personnel in September 2020 and January 2021 suggested that as few as 20 pairs survived (BirdLife International 2021). The species is threatened also by the arrival of the non-native brown soft scale *Coccus hesperidum* on Nightingale from other islands in the Tristan archipelago (Dilley et al. 2020). This scale insect and its associated sooty mould, *Seiridium phylicae*, greatly reduces fruit production by *Phylica* trees and can kill larger trees (Dilley et al. 2020; Ryan et al. 2014). To limit the impact of the scale insect, *Microterys nietneri*, a wasp parasite of brown soft scale, has been successfully introduced to Nightingale (Kinchin-Smith et al. 2024). We surveyed Wilkins's Finch numbers in selected woodland areas in February 2024 to provide a more comprehensive assessment of the bird's current population status.

Methods

Nightingale Island is the smallest (2.5 km^2) and oldest (rocks dating back 18 million years) of the three Tristan islands (Ryan 2007). As a result of its relatively low elevation, rising to only some 300 m above sea-level, it has the simplest vegetation structure of the three islands; most of

Nightingale is cloaked in a dense stand of 2–3 m high *Spartina arundinacea* tussock grass, with scattered patches of *Phylica* trees (Ryan 2007). The western plateau, at around 200-m elevation, has four bog-filled depressions or "ponds", covered with sedges (mainly *Scirpus sulcatus*) and bogferns *Blechnum palmiforme.* In 2017, the total area of *Phylica* woodland was around 12 ha (Dilley et al. 2021a) (Figure 1). Historically some woodland was cut for firewood (Milton et al. 1993), especially in low-lying areas in the east of the island near the landing area and huts. Harvesting of *P. arborea* is not formally prohibited, but islanders visiting Nightingale have switched to gas for cooking so there is no call for wood fires, and there is no evidence of any wood being cut for many years. A programme to re-establish trees in areas where they formerly occurred started in 2016, when 220 seedlings (<10 cm high) and 80 small saplings (20–30 cm high) were translocated from woodland around the ponds to an area cleared of tussock grass near the west road junction (37.4183°S, 12.4771°W). Saplings start to bear fruit once their basal diameter exceeds 20 mm (Milton et al. 1993), which occurred within five years on Nightingale (BJD personal observation).

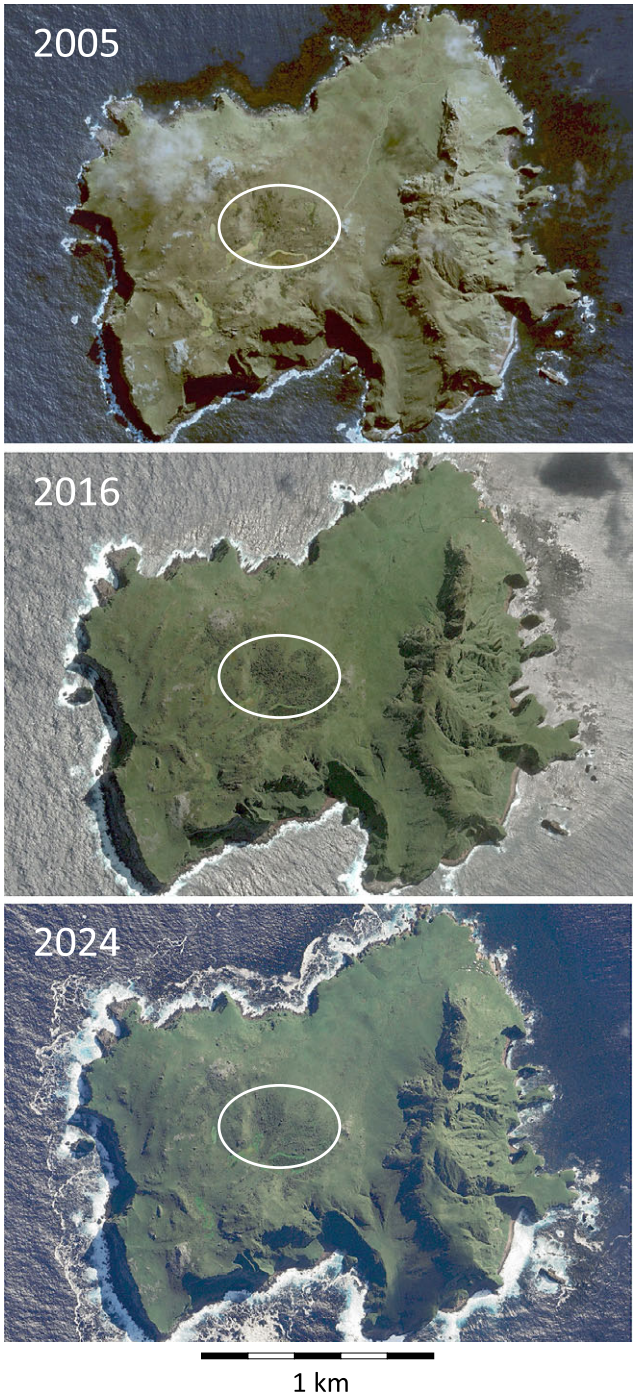

Figure 1. Google Earth images of Nightingale Island showing the increase in woodland cover in First Wood (circled) from 26 September 2005 to 4 March 2016, and the subsequent loss of trees (image 25 March 2024).

The largest patch of woodland is First Wood (3 ha), north of Pond 1 (Figure 1). During the 2016–2017 survey of Wilkins's Finch numbers, First Wood was mostly closed-canopy woodland, with trees up to 8 m tall (Dilley et al. 2021a). However, when the island was visited in late 2019, most large trees in First Wood had been blown over. Edinburgh of the Seven Seas, the settlement on Tristan da Cunha, 40 km NNW of Nightingale, was hit by a severe storm on the night of 18 July 2019, which caused extensive damage to buildings and other infrastructure (www.tristandc.com/storm-2019-07). A second, slightly less severe storm caused further damage on Tristan on the night of 2 November 2019. It is assumed that the trees in First Wood were flattened during one of these storms.

PGR and CLM visited Nightingale from 24 February to 1 March 2024, at the end of the Wilkins's Finch breeding season (Dilley et al. 2021b). Adult males are responsive to playback of male song at this time, facilitating the detection of territorial birds. We mapped the distribution of territorial males in accessible areas of *Phylica* woodland. Observations were largely restricted to three days of relatively good weather, limiting our ability to visit the more inaccessible *Phylica* patches. Systematic checking of territories was confined to First Wood and the immediate borders of Ponds 1–3. We focused most search effort in First Wood, which was the area most impacted by the 2019 storms. We also visited several other woodlands on the western plateau and checked those readily accessible along the "road", but limited time prevented comprehensive surveys in these areas.

The GPS locations of all birds seen were recorded, and their legs were checked for rings using Zeiss 10 × 32 binoculars and a Canon R7 camera fitted with a Canon 100–500 mm lens. Although colour-ringing of Wilkins's Finches ceased after the summer of 2017/18 (Dilley et al. 2021a), our ability to discriminate different males responding to playback was greatly enhanced by more than half of all territory-holding males being ringed. Birds that still retained all three colour-rings (two on the left leg and one over the metal ring on their right leg) could be identified individually, and their location compared with that of their territories six years previously (Dilley et al. 2021a). Based on the observations in areas that were fairly well searched, we extrapolated the numbers of occupied territories in other woodland areas based on the degree of visible storm damage. Given the inherent uncertainty in this extrapolation, we provide plausible upper and lower estimates for each area to derive a range within which the current population is likely to lie.

In addition to observations of Wilkins's Finches, we also recorded the structure of the storm-damaged *Phylica* woodland at two transects in First Wood, centred on 37.4233°S, 12.4855°W and 37.4242°S, 12.4834°W. The first of these, north of Pond 2, repeated one of four *Phylica* monitoring transects sampled in 2012 and 2017 (Dilley et al. 2020; Ryan et al. 2014), and was towards the western edge of the area of marked storm damage. The second, north of Pond 1, was a new transect in the centre of First Wood where storm damage was most severe. At each site we measured the basal circumference and height (length of trunk

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and canopy height) of all trees within 2.5 m either side of a 50 m-long transect. Both live and dead trees were measured. Fruit loads were scored from 0 to 5 (see Dilley et al. 2020; Ryan et al. 2014 for further details). We also photographed the affected area from the high point south of Pond 1 on 28 February 2024, to match images taken on 20 October 2007 (PGR) and 11 November 2016 (from Dilley et al. 2021a) and used historical satellite imagery in Google Earth to assess changes in woodland cover.

Chi-squared tests with Yates' correction for continuity were used to compare mortality rates and the proportions of collapsed trees between the two vegetation transects. Normal approximations of two-tailed Mann–Whitney U tests were used to compare fruit scores between transects and between years.

Results

At least 35 different male, 12 female, and three fledgling Wilkins's Finches were encountered during our brief visit. The fledglings were still begging for food from their parents; two were around Pond 1 and one was at Pond 3. The much larger number of adult males than females recorded reflects their greater detectability thanks to their far-carrying songs and their response to song playback. Of the males, nine were only heard but 26 were seen well enough to check for the presence of rings; 15 were colour-ringed, and one had a metal ring only. The first six digits of the metal ring on the latter bird (LJ 3741) were legible in photographs, identifying it as one of six males ringed in October 2016. All six were colour-ringed, so this bird had lost (or removed) all its colour-rings. Of the other colour-ringed birds, two males and one female had lost one colour-ring, and the colour-ring on the right leg of one male had slipped over the metal ring but the colour combination was still unambiguous.

Females seldom responded to playback, and even those that were seen typically remained in dense vegetation, making it hard to check for the presence of rings. Of the 12 seen, at least three were ringed. We could not check rings on both legs of one male and one female, leaving 13 full colour combinations: 12 males and one female. None had moved more than 150 m from their territory in 2017/18. Of the eight males around the ponds, six occupied the same territory as 2017 and two had moved one territory. By comparison, both males at small woodland patches along the road had moved ~120 m to occupy adjacent territories; one that formerly was in the *Phylica* patch along the west road heavily impacted by brown soft scale (Dilley et al. 2020) had moved to the patch of woodland planted near the road junction as part of an initiative to restore woodland in areas subject to historical wood collection. The two individually identified males in First Wood were within 100 m of the areas they occupied in 2017, but it was not possible to assess movement in terms of territories due to the loss of most territories (see below). The sole individually identified female had moved two territories north on the west side of Pond 3 and was mated to the male that held that territory in 2017; neither of their former partners were observed.

In the areas where systematic checking of territories occurred, there was a stark difference between First Wood and the immediate borders of Ponds 1–3. First Wood, which suffered most tree damage during 2019, had lost as many as three-quarters of Wilkins's Finch territories, whereas there was no change around the three ponds (Table 1). Playback in different territories identified in First Wood during 2017 often attracted the same male, indicating that the few remaining males in this area occupied much larger territories than was the case in 2017. By comparison, the sizes of territories around the Ponds appeared to be little changed from 2017.

Table 1. Numbers of Wilkins's Finch *Nesospiza wilkinsi* territories in areas searched in February 2024 compared with the 2017/18 breeding season

Area	2017/18	2024
First Wood	36	9
Pond 1	8	7
Pond 2	2	2
Pond 3	8	8
Total	54	26

Storm impact on Phylica woodland

Toppled tall trees were common throughout First Wood, but scarce or absent in the rest of the woodland areas visited. Although many toppled trees were dead, some retained live branches, and a few had coppiced new branches from the base of their trunks. At the two *Phylica* transects in First Wood there was no difference in the proportion of dead trees with basal circumferences >20 cm (30% overall) or >30 cm (35%, χ^2 = 0.018 and 0.029, respectively, both P >0.9). However, a much greater proportion of the surviving trees in the transect north of Pond 1 had been blown over (71% of trees >20 cm and 88% >30 cm) than at the transect north of Pond 2 (9% and 11%; χ^2 = 15.67 and 17.85, respectively, both P <0.001). The average canopy height of live toppled trees in both transects was 2.4 ± 0.8 m (n = 15), less than half their height prior to being blown over (6.5 ± 1.2 m). Maximum tree height was only 5.6 m and 5.0 m in the two transects, compared with at least 8 m for toppled trees north of Pond 1. Average fruit loads of trees with basal circumferences >20 cm were similar in both transects: Pond 1 = 3.2 ± 1.1 (n = 22), Pond 2 = 3.2 ± 1.0 (n = 20, Z = 0.32, P = 0.37). Fruit scores in the Pond 2 transect in 2024 were not significantly different from those recorded in 2017 (3.0 ± 0.8, n = 42, Z = 0.99, P = 0.19). Saplings (basal circumference <10 cm) were more common in the badly damaged area sampled north of Pond 1 (n = 12, 32% of all live trees) than north of Pond 2 (n = 1, 3%).

Google Earth only has three images of Nightingale with sufficient resolution to see *Phylica* cover; one from December 2016, a few years prior to the 2019 storms, shows much greater woodland cover in First Wood than one from September 2005 (Figure 1), four years after a severe storm in 2001 (Dilley et al. 2021a). This change is consistent with an increase in woodland cover from 2007 to 2016 visible in images taken from the high hill south of Pond 1 (Figure 2). A comparable image from February 2024 shows a marked reduction in woodland cover relative to both 2007 and 2016 (Figure 2) and is consistent with the sparse woodland cover visible in satellite imagery from 25 March 2025 (Figure 1).

Discussion

Our observations confirm that extensive damage to *Phylica* woodland in First Wood during storms in 2019 caused the loss of many Wilkins's Finch territories. Within the main area of First Wood we could only find nine territorial males; we might have missed a few males along the northern edge of First Wood, where not all remaining *Phylica* patches were visited, but most of the 36 territories recorded in First Wood during 2017/18 were lost. It was striking how much more wide-ranging individual males were within the worst affected area of the woodland than the territory boundaries indicated by Dilley et al. (2021a). By comparison, territories around

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Figure 2. Changes in woodland cover in First Wood, above Ponds 1 and 2, from October 2007 to November 2016 and February 2024. Tristan is visible in the background.

the edges of the Ponds were similar to those in 2017/18. Visual inspection of tree condition in other areas (High Ridge and the hill south of Pond 1) suggests that the Ponds were typical of most of the rest of the island, with only limited tree damage extending to the area north of Pond 4. Accordingly, we infer little decrease in Wilkins's Finch numbers across most of the island; we estimate that the total population is likely to be between 60 and 90 breeding pairs in 2024 (Table 2).

The *Phylica* transects indicate that even within First Wood, storm damage was more severe in the eastern part of the wood, north of Pond 1, than it was north of Pond 2. Almost all tall trees in the eastern sector were flattened by the 2019 storms, and it was in this area that male finches appeared to have the largest territories. This area also has many more saplings coming up than the less severely affected area north of Pond 2. Disturbance is thought to be crucial for *Phylica* recruitment (Milton et al. 1993). It appears that *Phylica* woodlands in storm-damaged areas on Nightingale regenerate fairly quickly through a combination of resprouting from the base of felled trees and germination of seedlings. In addition, parts of some large trees survive after being blown over, providing an important source of fruit in the years before the new plants start to flower. It is encouraging that fruit loads on trees in storm-affected areas were similar to those prior to the storm. These observations also indicate encouragingly little evidence of impact from brown soft scale, suggesting that the release of a biocontrol wasp is limiting the damaging impact of this invasive species.

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Table 2. Numbers of Wilkins's Finch *Nesospiza wilkinsi* territories in the 2017/18 breeding season and lower and upper population estimates based on remaining woodland cover in February 2024

Area	2017/18	2024	
		Lower	Upper
First Wood	36	9	10
Pond 1	8	7	8
High hill south of Pond 1	12	6	11
Pond 2	2	2	2
Pond 3 and surrounds	16	10	16
Pond 4 and surrounds	18	8	15
North-eastern lowlands	8	4	8
High Ridge	20	14	20
Total	120	60	90

Further evidence that *Phylica* regrowth is fairly rapid after storm damage is supported by historical satellite imagery and photographs (Figures 1 and 2). The most severe storm event on Nightingale prior to 2019 was in 2001 (Dilley et al. 2021a), probably associated with a devastating storm that wreaked havoc on Tristan on 24 May 2001 (https://sthelena.se/tristan/disaster/index/). Reduced woodland cover relative to 2016 is visible in satellite imagery from 2005, with the most marked impact again being on First Wood (Figure 1). Photographs from the hill south of Pond 1 show some recovery of this woodland by 2007, but still a marked increase in *Phylica* canopy cover from 2007 to 2016 (Figure 2). By comparison, there is little canopy cover visible in imagery from 2024, more than four years after the 2019 storms (Figures 1 and 2).

It thus appears that storms periodically reduce woodland cover on Nightingale, with knock-on impacts on numbers of Wilkins's Finches. The population estimate of 120 pairs in 2017 coincided with a time of high woodland cover; previous estimates were a more modest 30–50 pairs (Elliott 1957; Richardson 1984; Ryan 2007). Although the higher count in 2017 resulted in part from having most pairs individually marked and was influenced by territories being appreciably smaller than previously thought (Dilley et al. 2021a), it is likely that finch numbers fluctuate in tandem with woodland area and condition. In 2017, finch territories were smallest in First Wood, where densities approached 10 pairs/ha (Dilley et al. 2021a). Subsequent storm damage to First Wood greatly reduced the woodland cover, resulting in increased territory sizes and reduced the number of pairs that could be supported.

These observations from Nightingale, coupled with observations on Inaccessible Island (18 km NW), indicate that exposed areas of tall, closed-canopy *Phylica* woodland are particularly prone to storm damage. Trees growing in large, dense stands such as found in First Wood prior to 2019 are taller and more slender than trees in small copses, which are partly protected by the surrounding tussock grass. Once a few trees in a dense stand are blown over, the wind can rip through swathes of trees (PGR and BJD personal observations). Such events presumably subject Wilkins's Finches to periodic crashes in carrying capacity, but our observations indicate that the 2019 storm had less impact on Wilkins's Finch than initially feared. The finch has survived similar events in the past and coupled with the successful release of a biological control agent to limit the impact of brown soft scale on *Phylica* fruit production, the future prospect for Wilkins's Finch is not as bleak as previously thought. However, it is probably too soon to recommend reverting its status to Endangered given uncertainty as to the long-term benefits of the scale insect biocontrol programme, and the likelihood that global warming will increase the frequency of severe storms. High-resolution satellite imagery offers an effective tool to monitor future changes in woodland extent on Nightingale, which serves as a proxy for numbers of Wilkins's Finches. Restoring woodland patches close to the huts on Nightingale, where historic wood collection was concentrated, would help to offset future storm damage. Planting 5–10 small copses of *Phylica* trees in sheltered areas at lower elevations would provide a buffer against future damage to the more exposed First Wood area.

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