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Campbell Island snipe (*Coenocorypha* undescribed sp.) recolonise subantarctic Campbell Island following rat eradication

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Abstract The Campbell Is snipe (*Coenocorypha* undescribed sp.) was unknown to science until its discovery on 19 ha Jacquemart I in 1997. Following the successful eradication of Norway rats (*Rattus norvegicus*) from 11,268 ha Campbell I in 2001, there was increasing evidence that snipe had begun to recolonise the main island: footprints were found at Monument Harbour in 2003, and a fully-feathered dependent chick was captured nearby in Mar 2005. A survey of Campbell Is snipe recolonising Campbell I was undertaken by the authors and a trained bird-locater dog during 7-15 Jan 2006. We confirmed the presence of snipe and their successful breeding at 2 sites: the outlet to Six Foot Lake (head of Monument Harbour), and near the mouth of Kirk Stream at the head of Six Foot Lake. We estimated at least 22 adult snipe to be present. Twelve adult snipe were caught, along with 5 dependent chicks with estimated ages ranging from 8 to 37 d. One snipe nest was found. Subsequent sightings in Feb 2006 revealed at least 2 snipe to be present on the north-western shores of Perseverance Harbour, c. 3 km north of where we recorded them. We document the successful re-establishment of snipe on Campbell I within 5 years of rat eradication, and recommend that their natural recolonisation be left to continue unaided.

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INTRODUCTION

A previously unknown population of *Coenocorypha* snipe was discovered on 19 ha Jacquemart I off the south coast of Campbell I in 1997 (Miskelly 2000). Following the 2001 eradication of Norway rats (*Rattus norvegicus*) on 11,268 ha Campbell I (McClelland & Tyree 2002) at least 2 snipe colonised Campbell I at Monument Harbour near Jacquemart I. Footprints suspected to be those of snipe were found in May 2003, and a fully-feathered dependent snipe chick was caught (and its attendant adult seen) in Mar 2005 (Barker *et al*. 2005). Between 2000 and 2005, blood samples were collected from 71 *Coenocorypha* snipe from 5 other populations away from Campbell I, to provide a baseline for assessing the genetic distinctiveness of the newly found birds (CM & Allan Baker, unpubl. data). However, neither blood nor feather samples were collected from the 2 Campbell Is snipe handled in 1997 and 2005. The objectives of our survey were to capture snipe to obtain measurements, photographs, and genetic samples, to assess the spatial extent and size of the colonising population; and, if possible, to determine the population structure of the colonising population in order to guide conservation management. Here we report on the spatial distribution and numbers of snipe encountered, and their population structure.

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METHODS

The survey team comprised the authors plus "Percy", James's 3-year-old English setter. Percy is a Department-of-Conservation-certified species-dog mainly used to locate brown teal (*Anas chlorotis*), Campbell Is teal (*A. nesiotis*), and North I brown kiwi (*Apteryx mantelli*). He had never encountered snipe before, so we arranged a training session on Enderby I, Auckland Is, en route to Campbell I. During 4 h on Enderby I on 6 Jan 2006 we captured 5 Auckland Is snipe (*Coenocorypha aucklandica*

aucklandica), 2 of which were located by Percy (Fig. 1), who also located 3 other birds that evaded capture.

The survey team was on Campbell I from 7 to 19 Jan 2006, and camped near the head of Six Foot Lake 7-15 Jan. We searched for snipe around Six Foot Lake and the nearby Eboulé Peninsula on 8 days (Table 1).

A Campbell Is teal monitoring team was on Campbell I 15 Feb-10 Mar 2006. The team included JF and Percy, and Dave Barker and his bird-locating dog "Gus", who had worked with snipe on Rose & Enderby Is, Auckland Is, in Dec 2000, and who had encountered Campbell Is snipe on Jacquemart I in Nov 1997, and at the outlet to Six Foot Lake in Mar 2005 (Barker *et al*. 2005). The teal team was briefed to record observations of snipe away from the Six Foot Lake catchment, and to attempt to capture any birds seen.

Searching

Our primary search method was to use Percy (always muzzled, and usually wearing a high-visibility dog cover) to investigate thoroughly all habitat within a defined search area (usually < 1 ha at a time). If we thought any areas were worth searching (e.g., habitat that looked similar to sites where we had found snipe, or sites where snipe had called) James used spoken or whistled commands to ensure that Percy searched the site. We used playback of calls to locate the general area where some snipe were, but used this technique sparingly as we did not want to bias sampling effort too strongly in favour of males, which are most likely to reply to taped calls (Miskelly 1999a). One night (12 Jan) was spent searching with headlamps (in conjunction with using Percy) at the eastern side of the outlet to Six Foot Lake, from midnight to 0540 h.

When searching as a team, we tried to keep within 10 m of Percy (or keep him within 10 m of us) as in the tall dense vegetation it was easy to lose contact with him. When Percy "pointed" he was both motionless and silent, and gave no clues to his whereabouts. He would hold a point for at least 20 min unless insistently called off.

Percy generally followed ground scent, then pointed to a bird concealed in dense vegetation (Fig. 2). Of the 32 confirmed snipe sightings, only 2 were found independently of Percy. About a third of the birds were flushed by Percy; the birds typically flew 5-15 m. When a bird flushed, we moved to the landing site as quickly as possible to try to net the bird directly, or called Percy (who remained at the site of flush) in to relocate the bird if it had moved out of sight. All adults were caught using hand nets, as were 2 of the 5 chicks captured.

Handling snipe

Global Positioning System (GPS) locations were obtained for all capture sites using a Garmin® eTrex receiver. Standard measurements were taken of all snipe handled; these gave an initial assessment of the sex ratio for adults, and allowed approximate ages of chicks to be estimated (assuming birds grew at the same rate as Snares Island snipe *C. a. huegeli*; Miskelly 1999b). A blood sample (*c*.0.2 ml) was collected from the brachial vein of the right wing of all adult snipe and large chicks handled, and preserved in 95% ethanol. Blood samples were not collected from the 2 youngest chicks handled (estimated age 8 d). Adults were checked for moult, the condition of their brood patch, and for tail feather wear indicative of "hakawai" aerial displaying (Miskelly 1987, 2005). The state of plumage development and extent of down on chicks were described.

All birds were banded with a numbered metal band on the left tarsus, and most were marked with correcting fluid on their head or dorsal plumage or both (all combinations used were unique) so that we could recognise them if sighted subsequently.

RESULTS

Encounter rates

We searched for snipe on 8 of the 9 days that we were in the Six Foot Lake catchment (Table 1). We searched actively for *c*. 29:10 h, not including an estimated 6:20 h spent handling snipe, or the time spent in transit between our camp and search areas. We saw snipe on 32 occasions, although 2 of these were seen outside timed searches. No snipe were found on Eboulé Peninsula (2 h search). The encounter rate in areas that are now known to have had snipe was 30 sightings in 27:10 h of searching, or 1 bird seen for every 54 min of searching. This was a much lower rate than the 1 bird seen for every 7.5 min of searching in tussock at the eastern end of Sandy Bay, Enderby I, on 6 Jan 2006.

We handled Campbell Is snipe on 20 occasions (Fig. 3), although 3 of these were recaptures, and 5 were chicks (4 of which were accompanied by parents that were caught at the same time; for the 5th parent-chick pair the parent was caught 60 min before the chick, but both were seen together subsequently). Overall catch rates for adults during timed searches was 13 captures (11 birds) during 27:10 hrs, or 1 bird caught for every 125 min of searching, 8 times less frequently from on Enderby I on 6 Jan 2006 (1 adult caught for every 15 min searching).

Distribution of snipe on Campbell I

We found snipe to be present in 2 main areas: around the outlet to Six Foot Lake, and either side of Kirk Stream at the head of Six Foot Lake (Fig. 4). However, we sampled thoroughly only a tiny portion (< 40 ha) of Campbell I. The only substantial areas that we searched without finding snipe were Eboulé Peninsula, and the western side of Six Foot Lake. We

Fig. 1 Colin Miskelly (left), James Fraser, and Percy with an Auckland Is snipe (*Coenocorypha aucklandica aucklandica*) on Enderby I, Auckland Is, 6 Jan 2006. Photo: Andy Maloney.

Table 1 Effort and results for survey of Campbell Is snipe (*Coenocorypha* sp.). The list covers intensive searches undertaken in Jan 2006, and not routes taken between camp and search areas when the bird-locater dog was at heel and sampling only a narrow transect. Search times do not include time spent handling birds (typically about 30 min bird-1). In addition to the 3 areas listed as intensively surveyed (Six Foot Lake outlet; Eboulé Peninsula; Kirk Stream), we took different routes most of the 11 times that we moved along the western side of Six Foot Lake, and so consider this area to have been surveyed intensively too. Resightings and recaptures are given in parentheses.

			Adults		Chicks	
Date	Search time	Location	Sightings	Captures	Sightings	Captures
7 Jan	1:40	Western lake outlet	1	1	-	-
9 Jan	3:00	Western lake outlet	1(1)	1(1)	1	1
	0:30	Eastern lake outlet	-	-	-	-
10 Jan	3:20	Western lake outlet	1	-	-	-
11 Jan	4:40	Western lake outlet	4	2	-	-
	1:50	Eastern lake outlet	2	1	1	1
12 Jan	5:40	Eastern lake outlet	6(3)	3	5(4)	1
13 Jan	2:00	Eboulé Peninsula	-	-	-	-
	0.30	Eastern lake outlet	-	-	1(1)	1(1)
14 Jan	5:00	Kirk Stream	4	4	2	2
15 Jan	1:00	Kirk Stream	1(1)	1(1)	-	-
Total	29:10		20(5)	13(2)	10(5)	6(1)
Outside timed searches			2(1)	1	-	-
Total			22(6)	14(2)	10(5)	6(1)

were surprised not to find snipe on the peninsula, where there is about 10 ha of habitat we judged to be suitable for snipe (extensive *Poa foliosa* cover in damp basins) within 1 km of Jacquemart I. In hindsight, the absence of snipe on the western side of Six Foot Lake was also surprising, given that snipe were present at the head of the lake in addition to the outlet of the lake, where they were detected in March 2005.

Fig. 2 Colin Miskelly (top), James Fraser, and Percy about to capture a snipe on Campbell I. Photo: Michelle Gutsell, Department of Conservation.

In addition to the 4 main areas searched, Percy was "at heel" for an estimated 8 km south of Garden Cove (Fig. 4). We believe that he would have pointed to any snipe within 5 m of the track or route taken in this area which equated to a further 8 ha of survey.

The teal monitoring team (including 2 dog/handler teams familiar with snipe) surveyed large areas of the shoreline of Perseverance Harbour, and Northwest Bay beyond the areas that we surveyed. Three snipe (probably 2 individuals) were seen at Tucker Cove and Duris Point on the north-western shore of Perseverance Harbour, 3 km north of Six Foot Lake (Dave Barker pers. comm. and JF pers. obs.; Fig. 4).

Capture of snipe

We handled 12 different adult Campbell Is snipe (6 ♂♂ 6 ♀♀; sexes determined from blood samples sent to Royal Ontario Museum, Allan Baker & Oliver Haddrath, pers. comm.). All 12 birds had bare (10) or refeathering (2) brood patches. Eight of the 12 adult snipe had "hakawai" tail feathers (5 ♂♂, 3 ♀♀).

Five snipe chicks were captured, which probably came from 3 broods. The chicks were estimated to be 20, 35, 36 , and 8 (2 birds) days old when captured (Miskelly, Walker *et al*. 2006). The 1 nest found on 12 Jan 2006 contained 2 eggs (Miskelly, Walker *et al*. 2006).

Fig. 3 Adult Campbell Is snipe (*Coenocorypha* sp.). Photo: James Fraser.

In addition to the birds caught, at least 6 snipe were calling north of Kirk Stream on the night of 14 Jan in an area where only 2 birds had been caught (in addition to a pair with young chicks caught south of Kirk Stream). Based on sightings and calls, we estimated a minimum of 14 adult snipe (8 caught) near the outlet to Six Foot Lake. The density of adult snipe in the 2 areas where we found them was a minimum of 1.3 birds ha^{-1}. This estimate is based on a minimum of 14 adult snipe in 10 ha at the lake outlet, and a minimum of 8 adult snipe in 7 ha near the mouth of Kirk Stream.

No snipe were caught by the teal monitoring team.

Habitat use

Campbell Is snipe were mainly found in areas with tall *Poa litorosa* tussock. Around the outlet to Six Foot Lake the tussock was growing in association with the fern *Polystichum vestitum* and the sedge *Carex trifida* on ridges between boggy hollows covered with the mat-forming herbs *Callitriche antarctica* and *Crassula moschata*, with isolated small shrubs of *Dracophyllum scoparium*. At the head of Six Foot Lake snipe were found in well-drained areas of *Poa litorosa* with scattered *Dracophyllum*, on the edges of dense swards of *Carex appressa* sedge, and in pure stands of *Dracophyllum*. Based on habitat use by other *Coenocorypha* snipe (CM pers. obs.), we suggest that almost all of Campbell I is covered by vegetation associations that snipe will inhabit eventually.

Vocalisations

Campbell Is snipe were heard giving 5-6 separate displays (out of 8 audible displays known for the genus *Coenocorypha*; Higgins & Davies 1996). So far as could be determined, all the calls and displays were identical to those known for other *Coenocorypha* snipe (CM, pers. obs.). Campbell Is snipe were not very vocal, and most calls heard during daylight were in response to our playing a tape recording of Snares Is snipe calls. Most frequently heard was a "*trerk trerk trerk*" call that is given from the ground by territorial males in other populations. Adults that were flushed while accompanying dependent chicks gave a "*nyerr*" (a "distress" call) call, both when flushed and (sometimes) while being handled. Dependent young separated from their parent gave

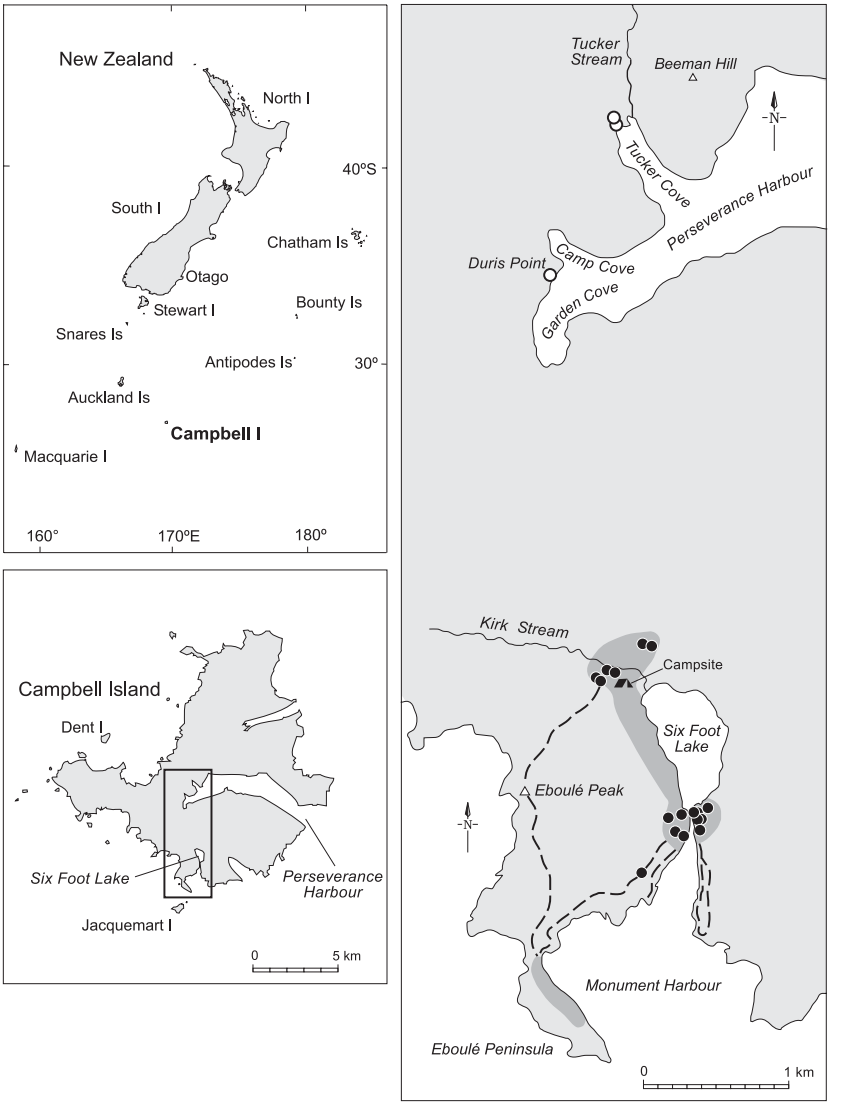

Fig. 4 Areas surveyed (shaded) for Campbell Is snipe in Jan 2006. Broken lines show routes taken with the dog at heel. Filled circles show the 17 snipe capture sites. Open circles are the 2 locations where snipe were seen in Feb 2006. Snipe are also known to be present on Jacquemart I.

a piercing "*peeyoo*", especially while being handled (this call resulted in 3 adults being captured when they approached us within 1-2 m while their chicks were being handled). The "*chep*" alarm call was heard only at night, both at the lake outlet (11-12 Jan) and from our camp (14 Jan). Distant "*queeyoo queeyoo*" calls were heard at night on 11-12 Jan, and (from our camp) on 13 Jan. This call can be given either on the ground (as a high-intensity territorial call by males) or in the air by other *Coenocorypha* snipe (Miskelly 1990a). This is the vocal component of the hakawai display (Miskelly 1987), but it is sometimes given without the accompanying non-vocal "roar" (Miskelly 1990a). The calls heard on 12 and 13 Jan were too distant (and masked by wind) to determine whether they came from the ground or the air, or indeed whether or not they were part of the full hakawai display, whose non-vocal "roar" we did not detect. The true hakawai display was heard from at least 3 birds displaying simultaneously at night from our camp on 14 Jan (Miskelly, Bell *et al*. 2006), and at least 3 further snipe called ("*trerk trerk trerk*", and "*chep*") from the ground.

DISCUSSION

Recolonisation of Campbell I by snipe

The major finding of our survey was that snipe were recolonising Campbell I at a sufficiently rapid rate that they can be left to do so without management

intervention. We estimated at least 22 adult snipe to be present at 2 main sites (the outlet to Six Foot Lake, and near the mouth of Kirk Stream at the head of Six Foot Lake) in addition to the 5 chicks handled. The teal monitoring team subsequently located at least 2 snipe on the shores of Perseverance Harbour about 3 km north of where we encountered them. As snipe are cryptic in both markings and behaviour, and prefer densely vegetated habitat, it is very likely that we have underestimated their numbers and distribution on Campbell I. We found a balanced sex ratio among the 12 adults handled, and evidence of a minimum of 4 pairs attempting to breed during the 2005/06 breeding season, all of which indicate that sufficient birds of both sexes are now present on Campbell I for a viable population to become established. Given the remarkably rapid rate that snipe have recolonised Campbell I from Jacquemart I since the 2001 rat eradication, it is expected that further birds will continue to colonise from Jacquemart I, bolstering the growing population on the main island. There are > 11,000 ha of habitat potentially suitable for snipe on Campbell I itself, so it has the potential to hold many thousands of birds at population densities known for other snipe populations (Miskelly 1999a) .

Breeding ecology and behaviour of Campbell Is snipe

Most aspects of breeding ecology and behaviour observed for Campbell Is snipe were consistent with what has been recorded for other *Coenocorypha* snipe populations (Miskelly 1990a, 1990b, 1999b; Higgins & Davies 1996; Miskelly & de Lange 2006; Miskelly, Walker *et al*. 2006). The only nest found contained 2 eggs; and both sexes were involved in chick care, with each adult caring for a single chick until they were fully feathered. These are all features typical of other *Coenocorypha* snipe. The range of vocalisations and non-vocal displays we recorded were all within the known repertoire of *Coenocorypha* snipe (Higgins & Davies 1996). The only unusual feature of their displays was the high proportion of females exhibiting worn "hakawai" tail feathers (50%; Miskelly, Bell *et al*. 2006) when few female snipe in other populations have been found with this condition (Miskelly 1987, 1990a, 2005).

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