Snares Island snipe (tutukiwi) translocation to Putauhinu Island, April 2005

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Cover photo: Tane Davis, Pete McClelland, Rongo Spencer, Jane Davis, Riki Davis, and Jonnise Pennicott releasing Snares Island snipe on Putauhinu Island, 16 April 2005. The two birds shown are the two that, based on tail-feather wear, are believed to have performed 'hakawai' aerial displaying. Photo: R. Cole.

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Executive summary

Thirty Snares Island snipe (*Coenocorypha aucklandica huegeli*) were transferred from North East Island (Snares Islands) to Putauhinu Island on 16 April 2005. Snipe were captured with handnets during 11–13 April, and were held in two 4.8 × 3.0 m tent aviaries (15 birds per aviary) until transfer. One aggressive bird was removed from an aviary on 15 April, and subsequently held in a 1.2 × 0.5 × 0.4 m cage. All 30 birds thrived on a diet of cultured mealworms, *Tenebrio molitor*, and transfer weights were (on average) similar to capture weights. Actual weight changes ranged from 11.8% lighter to 13.9% heavier than capture weights (mean 0.1% lighter). Twelve birds were lighter than their capture weight when transferred, and 16 were heavier.

No pathogenic diseases were identified from the transferred snipe. Blood samples for genetic analysis were collected from all 30 snipe transferred. Additional notes on Snares Island snipe breeding ecology and behaviour are presented. These include the first evidence of 'hakawai' aerial displaying by Snares Island snipe.

1. Introduction

1.1 ECOLOGY OF SNARES ISLAND SNIPE

Snares Island snipe (*Coenocorypha aucklandica huegeli*) are the best known of the *Coenocorypha* snipes, following six breeding seasons of intensive research during 1982–87 (Miskelly 1989a & b, 1990a, b & c, 1999a & b). These studies focused on breeding ecology and behaviour, and detailed comparisons were made with Chatham Island snipe, *Coenocorypha pusilla*, which were studied concurrently. Additional information on Snares Island snipe collected at this time was included in Higgins & Davies (1996), and Miskelly *et al*. (2001).

Most Snares Island snipe bred in monogamous pairs, with shared incubation of the 2-egg clutch. The brood was split at hatching, with the male caring for the first chick to leave the nest, and the female the remaining chick. Chicks were fed solely by their parents for their first 2 weeks, and accompanied their parents for about 8 weeks. If either adult lost a chick (or if only one egg hatched), then the emancipated adult attempted to breed with a previously non-territorial snipe. If both parents were caring for chicks, the territory was sometimes subsequently used for breeding by previously non-territorial snipe. Although raising of two broods by a pair in one season was not recorded, this sequential use of breeding territories by different pairs (or pairings) produced a drawn-out breeding season, with evidence of egg-laying recorded from 4 November to early April. We therefore anticipated that we would encounter many independent young snipe in April, a few parent-chick pairs, but no courting pairs (as pairs are not known to consort between the end of incubation, and the start of the following breeding season; pairs were observed in September 1985 but not in July/August 1992, CM pers. obs.).

The total population size for Snares Island snipe is estimated at just over 400 pairs (Miskelly *et al*. 2001). The areas identified for catching snipe in 2005 held an estimated 100 adult snipe in the 1980s (Miskelly 1999b and unpublished data), and it was expected that the 30–40 snipe that we intended to transfer would be rapidly replaced by non-territorial birds within and near the catch areas.

1.2 PREVIOUS SNIPE TRANSLOCATIONS AND CAPTIVITY TRIALS

The first attempt to transfer snipe was made in August 1964, when the New Zealand Wildlife Service attempted to rescue Stewart Island snipe (*C. a. iredalei*) following the invasion of Taukihepa (Big South Cape Island) by ship rats (*Rattus rattus*). The two birds caught proved difficult

to care for due to their need for a continuous supply of live food. They were caught on 30 August and placed in a 3 m × 2 m × 2 m aviary; unfortunately both birds died on 1 September (Merton 2000). There have been no subsequent acceptable records of the Stewart Island snipe, which is now considered extinct.

In November 1970, the Wildlife Service transferred 23 Chatham Island snipe from Rangatira Island to Mangere Island (Bell 1974), where they have thrived, and from there have colonised Little Mangere Island (Higgins & Davies 1996). Eight birds of unknown age and sex were caught on the night of 4 November and transferred the following morning. A further 15 birds were caught on the night of 10 November and were released on Mangere Island the following morning (Merton 2000). All were caught at night using headlamps and hand-nets. Apart from one bird killed when it was hit with the edge of a hand-net, there were no losses during transfer. Birds were placed directly into wooden carry crates with some food (litter invertebrates) then transferred early next morning. They were in the boxes for 12 hours at most.

Carry boxes were of the early saddleback type—light-weight, wooden, measuring about 50 × 40 × 30 cm, divided into two compartments, lined internally with acoustic tiles, sheathed on the outside with foam rubber, and covered on top with soft scrim; 10 mm diameter air holes were drilled along the lower part of each side. Access was via two muslin sleeves in the top. Two birds were placed in each compartment. The boat trip to Mangere Island took 1–2 hours and there was an additional 45-minute walk from the landing to the release site. Birds were bright and active on release. Breeding was confirmed just over a year later when two fully grown unbanded birds were found in March 1972 (Merton 2000).

In November/December 1979 Don Merton held two groups of Chatham Island snipe in a 3 m × 2 m × 1 m high pen on Rangatira Island, in order to obtain basic information on maintaining snipe in captivity. Two adults of unknown sex were placed in the pen on 29 November. They were offered "Startina" crumbles (chick starter crumbles) dampened with water, crumbled hard boiled egg, "Farex" baby cereal dampened with water, finely sliced raw meat, grated cheese, fresh leaf-litter (containing invertebrates) and water. The birds began feeding immediately after being placed in the pen, but on the limited live food only. Very small amounts of Startina and Farex were consumed but this was largely incidental. The birds steadily lost weight and would have died had they not been released 5 days later (Merton 2000).

A further two adults of unknown sex were placed in the pen on 2 December and fed *ad libitum* on live mosquito larvae, water boatmen, small maggots, small weta, amphipods, termites and small white grubs from rotting wood—all collected locally. The birds had constant access to fresh leaf litter and clumps of water-weed rich in invertebrates. The mosquito larvae and water boatmen were caught using a small hand-net made from fly mesh, and were presented in shallow dishes of 5–10 mm deep water. Maggots were cultivated from dead sheep and fish, and were cleansed in a tray of bran. Copious quantities of leaf litter

(rich in invertebrates) scraped from the forest floor were placed in the pen each day. Maggots, water boatmen, termites and mosquito larvae were the favourite foods, and comprised the bulk of the diet. Mealworms were unavailable at that time. Captive snipe fed constantly by day and night, consuming an unexpectedly large volume of food. Feeding activity peaked in the early morning and late evening. There was no problem in keeping up to four birds together in the same pen—no obvious stress, and no indication of aggression. The second two were released in good health on 10 December. Both weighed 76 g on capture (2 December), and they were 73 g (-3.9%) and 68 g (-10.5%) after 8 days in captivity (Merton 2000).

The Wildlife Service and the Department of Conservation (DOC) twice attempted to hold Chatham Island snipe in captivity at Mt Bruce (National Wildlife Centre files, and Merton 2000). In October and December 1983, 21 eggs were taken from Rangatira. Although most eggs hatched, the chicks survived for a maximum of only 14 days. In March 1988, five adult and three juvenile snipe from Rangatira were taken to Mt Bruce: six of these birds died within 23 days of arrival. The two remaining birds were force-fed for 4 months as artificial food was rejected. One died in October 1988 and the other survived until January 1989 (10 months). The main cause of mortality in both trials was thought to be the fungal pathogen *Aspergillus*, but it is likely that the underlying cause was malnutrition due to the difficulty of maintaining an adequate supply of live food for the birds. Overcrowding may also have contributed initially.

The eight snipe transferred in 1988 were caught about 21 March and held in a 3 m × 3 m × 2 m pen. Much of their food was provided by means of leaf litter, which was renewed daily; they were also fed mealworms and wax-moth larvae. Early on 27 March they were weighed and placed in crates; most had lost 18–20 g (= 20–25% of their body weight) during their 6 days in captivity. They were then in transit for about 32 hours before reaching Mt Bruce (Merton 2000). These experiences with holding and transporting snipe suggested that they are hardy birds, and that if the problem of supplying suitable food could be overcome, they would transfer well (Don Merton, pers.comm).

In order to develop management techniques that could be applied to the newly discovered Campbell Island snipe (*Coenocorypha* undescribed sp.; see below), DOC undertook a trial holding up to ten Chatham Island snipe in an aviary on Rangatira Island over a 13 day period in April/May 2001 (Miskelly & Barlow 2001). This captivity trial was intended to check whether issues of bird health and nutrition raised by the 1979, 1983 and 1988 trials could be resolved using modern food supplies and husbandry techniques. The birds thrived on a diet based on cultured mealworm (*Tenebrio molitor*) larvae, and nine of the ten birds gained weight during the trial. The methodology developed and documented by Miskelly & Barlow (2001) was directly applicable to the snipe translocation that we describe here, and their report proved invaluable to us.

1.3 BACKGROUND TO THE 2005 TRANSLOCATION

Following the astounding discovery of a previously unknown (and critically endangered) population of snipe on Jacquemart Island, off Campbell Island in 1997 (Barker *et al.* accepted ms), a Snipe Recovery Group was formed in 1998, and a recovery plan subsequently prepared (Roberts & Miskelly 2003). Among the recommendations of the snipe recovery plan were to: "Trial capture, holding, transfer and establishment of Snares Island snipe/tutukiwi to one or more islands near the South or Stewart Islands". This would create a back-up population for the "Range Restricted" Snares Island snipe, and would return snipe to the Stewart Island region. The first site selected for release of translocated Snares Island snipe was Putauhinu Island, a 141-ha Muttonbird (Titi) Island lying just 1.5 km west of Taukihepa, the last place which held the extinct Stewart Island snipe. Cats died out on Putauhinu in the 1960s, and the island owners joined with DOC to eradicate kiore/Pacific rats (*Rattus exulans*) in 1996. This successful rat eradication has allowed previously introduced South Island saddlebacks (*Philesturnus carunculatus carunculatus*) to thrive, and has also allowed subsequent introductions of Codfish Island fernbirds (*Bowdleria punctatus steadi*) in 1997, and Stewart Island robins (*Petroica australis rakiura*) in 1999. The timing of the 2005 Snares Island snipe transfer was chosen to be at the end of the snipe breeding season, but also to be when the muttonbirders were on Putauhinu, so that they could participate in the release.

In March 2005 the Snipe Recovery Group recommended that up to 40 Snares Island snipe be transferred, with a minimum number of 20 set if catching conditions proved difficult. Up to 30 snipe were to be held in the two aviaries, with the extra 10 to be caught and held in individual transfer boxes for up to 48 hours before release on Putauhinu Island.

1.4 BACKGROUND TO DISEASE SAMPLING AND GENETIC SAMPLING

The Snares Islands are one of the least modified terrestrial ecosystems in New Zealand, and therefore would be expected to have natural levels of wildlife disease presence. However, due to the huge populations of seabirds that breed there, and that forage over much of the Pacific Ocean and Southern Ocean over the course of a year, it is possible that some disease organisms present on the Snares Islands will not be found on the Titi Islands. This possibility is reduced due to the large number of breeding seabird species that are shared between the Snares Islands and the Titi Islands, but exceptions include Buller's mollymawk (*Thalassarche bulleri*) and Snares crested penguin (*Eudyptes robustus*). It was not feasible to undertake disease screening and receive results before the snipe transfer, but we decided that it would be prudent to check whether we had inadvertently transferred any organisms of concern.

Snipe may be a good indicator species for pathogen presence on the Snares Islands, as their foraging on the forest floor brings them into contact with large numbers of several migratory seabird species.

The blood samples collected from the transferred snipe are intended to be used as part of a comprehensive study of genetic and taxonomic diversity of *Coenocorypha* snipe, as well as providing an assessment of the genetic diversity of the Putauhinu founder population.

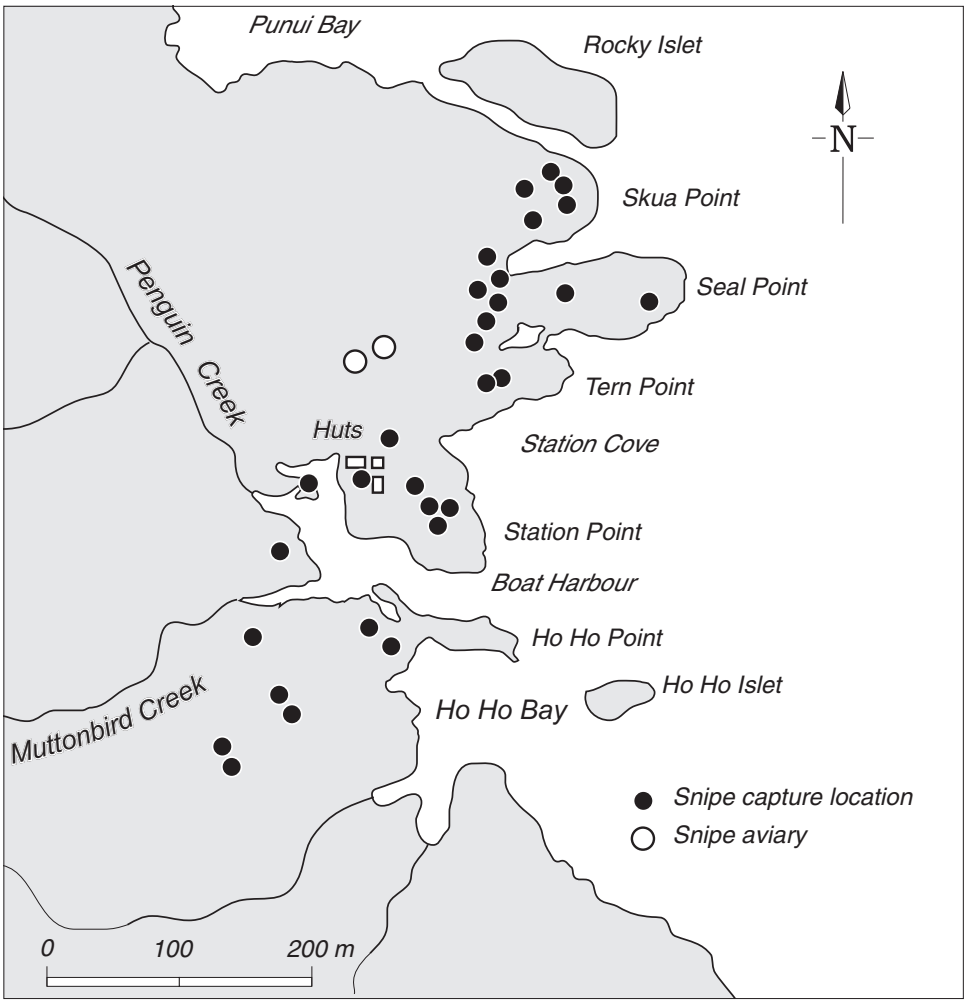

Figure 1. Locations where transferred snipe were caught.

2. Methods

All the information reported here was collected by the authors, assisted by Ros Cole, Phred Dobbins, Andrea Goodman and Malcolm Mackenzie, on North East Island, Snares Islands, 10–17 April 2005, and by CM, RC and Pete McClelland on Putauhinu Island on 16 April 2005.

2.1 TRANSLOCATION OF SNARES ISLAND SNIPE TO PUTAUHINU ISLAND

2.1.1 The aviaries

On 10 April two aviary sites were selected in close proximity to each other, on a ridge overlooking Station Point adjacent to the existing Station Point/Punui Bay track (locations shown in Fig. 1). Selection criteria included the need for level terrain without too many prostrate or overhanging branches, an absence of active sooty shearwater burrows, reasonably sheltered, not too much mud, close to the huts, and away from areas that receive much use by New Zealand sealions (*Phocarctos hookeri*). The sites selected met most criteria, but were accessible to sealions, and so *Olearia* branches were placed strategically around the aviaries, to discourage sealions from coming into contact with them. To further increase the security of the aviaries from sealions, 300 mm long PVC pipes were sunk into the ground as tent pole extensions to increase the rigidity of the aviaries, and, where possible, guy ropes were tied to *Olearia* trunks and branches above ground level. The two canvas tent aviaries (Fig. 2) were modified from former Scout tents, and measured 4.8 × 3.0 metres, with a minimum height of 2 metres. Mesh windows that could be exposed by rolling up and securing flaps were situated on most wall and some roof panels. A zipped double door was located in one corner of each aviary, which decreased the aviary area by about 1 m^2. The aviaries had previously been used for passerine translocations around Fiordland and Stewart Island. They were soaked in Virkon, and steam-cleaned before transport to the Snares Islands. The aviaries were erected

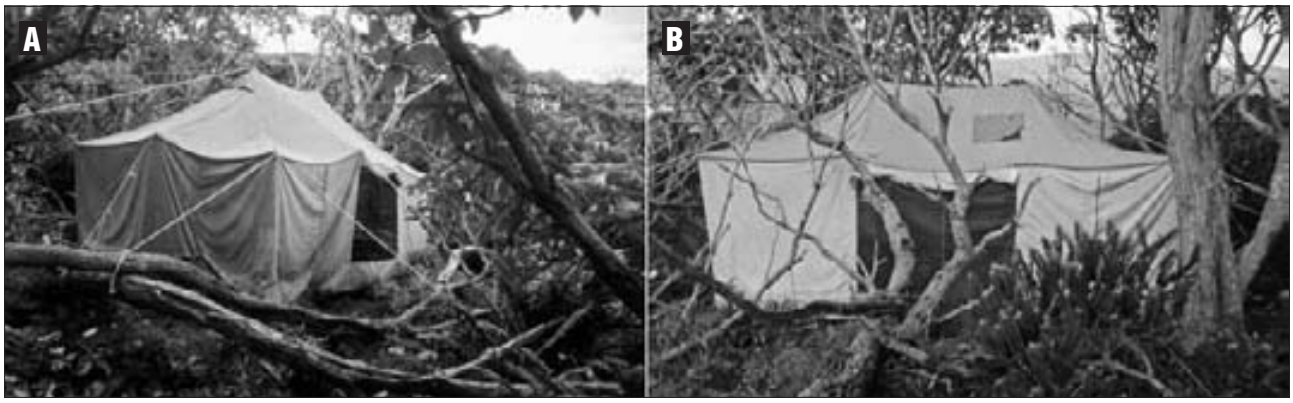

Figure 2. The two tent aviaries used to hold Snares Island snipe: A = aviary 1; B = aviary 2. Photos: C. Miskelly.

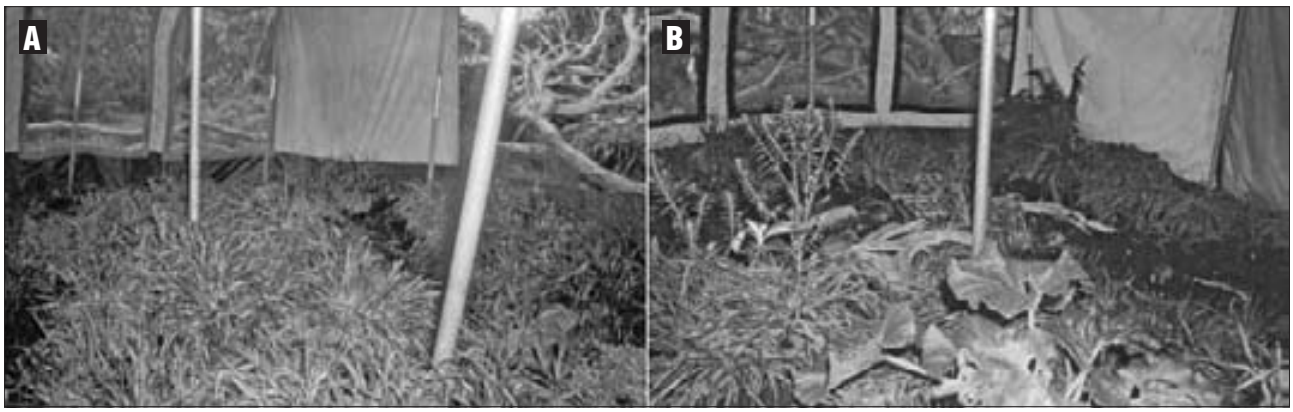

Figure 3. Interiors of the two tent aviaries used to hold Snares Island snipe: A = aviary 1; B = aviary 2. Photos: C. Miskelly.

on the morning of 11 April, and were then furnished with additional cover in the form of *Poa tennantiana* tussocks collected from within 10 metres of the aviaries. The tussocks were used to fill in disused shearwater burrows, and to cover mud patches, as well as ensuring sufficient cover for up to 15 snipe in each aviary (Fig. 3). The aviaries had a 0.5-metre wide horizontal skirt in their interiors, which we pegged and then covered with compacted soil and tussocks, to prevent snipe getting under the skirt. A bare earth/mud pathway was left about 1 metre in from the aviary walls, so that we could move around the aviaries without risking standing on snipe concealed in vegetation. These bare areas were used for placement of food trays and water bowls, allowing easy viewing of band combinations of snipe using these. Three shallow trays were dug into each aviary for presentation of food, as were two 750-ml pet bowls for freshwater. A deckchair was positioned in one corner of each aviary, for use during behavioural observations of the captive snipe.

The aviaries were taken down after the birds left North East Island on the afternoon of 16 April 2005.

2.1.2 Food items and presentation

Some natural food was discovered in the aviary during excavations, including large scarabaeid larvae (*Prodontria longitarsus*), large carabid larvae (*Mecodema alternans hudsoni*), and many large earthworms. All are known snipe food items (Miskelly 1989b) but the large earthworms are rarely taken, and snipe were not observed to eat them in the aviaries.

The main food provided for snipe in the aviaries were cultured mealworm larvae (*Tenebrio molitor*), from a supply of 40,000 taken to the islands. These were supplemented with locally harvested mats of *Callitriche antarctica* and *Crassula moschata*, which contained large numbers of amphipods (a preferred snipe food item). On one occasion maggots were collected from a sealion carcass and placed on a feed tray to discover if snipe would feed on them, and hence give us a quick and easy supplement to the mealworms if supplies began to dwindle. Effort was made to prevent mealworms escaping into the soil. Mealworms were presented among loose soil on small trays set within larger trays, which contained most ''escapees' (Fig. 4). We soon realised that most

mealworms were staying on the soil surface if they left the trays, and rapidly became moribund and died in the cool temperatures experienced (as low as 4 degrees Celsius overnight). When we became concerned that a few dominant snipe might be restricting access to food trays, we relaxed the rule about this "double tray" food presentation, and ended up with three large and three small trays of mealworms presented within each aviary. Feed trays were replenished four times a day at roughly 3-hour intervals from 0900 hrs, and water was changed daily. For our mealworm farming we placed a hot water bottle wrapped in a towel under the tub containing the mealworms, and the whole lot was then wrapped in a blanket to maintain warmth.

2.1.3 Catching and handling snipe

Snipe were caught during the day or (mostly) at night using handnets. Capture effort was focused along the coastal vegetation fringe between Station Point and Skua Point, and also on Ho Ho Point. These areas held high snipe densities in the 1980s (CM pers. obs.), were readily accessible from the huts, and were relatively robust to move over due to the frequent passage of sealions. Areas of the Snares Islands not frequented by sealions can easily be damaged by foot traffic, due to the high density of shallow petrel burrows. Tracks were marked out with reflectorised flagging to aid quick and safe movement to/from the huts and aviaries when snipe were being carried at night. Snipe were placed in cloth bags and taken to the research hut for measuring, plumage assessment and blood sampling. In order to age and sex birds before placement in the aviaries, standard measurements were taken (weight, bill length, head & bill length, tarsus length, mid toe and claw length, wing length

Figure 4. Male Snares Island snipe at a feed tray inside aviary 1. Photo: R. Cole.

and tail length) and descriptions taken of leg colour, bill colour, tail feather wear (Miskelly 1987), primary covert markings, and the amount of contrast between dark and light markings on the dorsal plumage (Table 1; Appendix 1). Although no single character can be considered diagnostic, in combination these characters can allow most Snares Island snipe to be assigned to age and sex classes. At the request of Graeme Taylor (Banding Officer, DOC) measurements were also taken of snipe tarsus diameters. The cloth holding bags were used for only a single bird before they were washed in Vircon® and dried before re-use.

TABLE 1. CHARACTER STATES USED TO ASSIGN SNARES ISLAND SNIPE TO AGE AND SEX CLASSES.

CHARACTER	ADULT MALE	ADULT FEMALE	JUVENILE MALE	JUVENILE FEMALE
Weight (g)	101 (89–118)	116 (98–128)		
Bill length (mm)	55 (51–58)	57 (51–61)	55 (51–58)	57 (51–61)
Leg colour	Yellow	Olive	Olive-grey	Olive-grey
Colour of bill base	Brown	Brown	Greyish	Greyish
Primary coverts	No markings	Usually mottled on inner web	Usually mottled on inner web	Usually very mottled on inner web
Dorsal markings	Strong contrast	Intermediate contrast	Dull, little contrast	Dull, little contrast

Any downy young caught were weighed and measured as above (except wing and tail length if plumage was insufficiently developed), and their hatch dates calculated using the growth equations from Miskelly (1999a). Adults known to be caring for dependent young were captured and marked with white Twink® on their nape before release, so that they were not inadvertently captured subsequently and placed in the aviaries. Most birds were captured during the nights of 11 and 12 April; the following mornings we checked all capture sites to determine whether any dependent snipe chicks had been inadvertently "orphaned". Any such chicks found were placed in an aviary with their suspected parent, to confirm a parent-chick bond before both were released back at their capture site.

All birds placed in the aviaries were permanently banded with a unique numbered metal band, and were also fitted with a unique combination of 1–2 'D'' size wrap-around colour bands to facilitate observations in the aviaries. All colour bands were removed before snipe were placed in transfer boxes on 16 April. Males were left with a metal band on their left tarsus, and females with a metal band on their right tarsus.

2.1.4 Monitoring condition of birds in the aviaries

Snipe were handled as little as possible once placed in the aviaries. Health and condition of the birds were assessed by observation of their behaviour. Attempts to monitor bodyweights remotely using a Mettler Toledo® electronic balance and hand-held Psion® data logger were unsuccessful due to equipment failure.

Three birds had to be captured in the aviaries before transfer day. The third bird released into aviary 1 on the night of 11 April was inadvertently

released before bands had been fitted. It was captured about 12 hours later for banding. A male caught on the morning of 12 April was, within 2 hours, found to have left a small (estimated 2-day-old) chick calling plaintively from his capture site. The chick and its presumed parent (one of two snipe caught at the location) were placed in the then vacant aviary 2, until their parental bond was confirmed, then returned to their capture site on Gull Point (upper Boat Harbour, opposite Research Hut). His colour bands were removed, and he is currently the only banded snipe known to be present on the Snares Islands (D-184613, metal band on left tarsus). On 15 April an aggressive female snipe from aviary 1 was removed and placed in "solitary confinement" (a 1.2 × 0.5 × 0.4 m cage furnished with soil, tussocks, a food tray and water bowl) to stop her harassing other snipe in the aviary.

2.1.5 Behavioural observations of snipe in the aviaries

Most behavioural observations of the captive snipe were made by single observers sitting on the chairs placed within each aviary. We developed a protocol of undertaking a "roll call" in each aviary at about 0900 each day, and again mid afternoon. The main focus of these sessions was to ensure every bird in each aviary was alive and active, but as food trays were replenished at the same time, we also recorded which birds were using the food trays, until we were confident that all 30 birds were.

When time and other demands allowed, we also undertook time-budget sampling within each aviary, by recording behaviour of all visible (identifiable) birds in 15 minute blocks (total 240 mins of observations) in addition to 9 roll calls in aviary 1, and 6 roll calls in aviary 2, which did not receive any birds until the night of 12 April.

A code system was developed to allow rapid scoring of behaviour of up to 15 birds at a time. Analysis of time-budget samples focused on how behaviour differed from captive Chatham Island snipe after they learned to use the feed trays (Miskelly & Barlow 2001).

2.1.6 Preparation of transfer boxes

We had sufficient boxes to transfer 40 snipe, namely 5 × 4-compartment boxes, 5 × 2-compartment boxes, and 10 single compartment boxes. All boxes were scrubbed and cleaned with Vircon® and then steam-cleaned before being taken to the Snares Islands. Each box had foam matting placed on their bases to reduce noise and vibration. Dark weed cloth was attached to cover sources of light into the boxes. On transfer day, non-slip mats were placed on the floor of each compartment, and water mist was sprayed throughout the compartment. Thirty mealworms were placed within a small container attached to the floor of each compartment; the container was necessary to prevent mealworms crawling through the open weave of the non-slip matting and becoming inaccessible to the snipe.

2.1.7 Transfer to Putauhinu Island

Transfer of the snipe was originally scheduled to occur by boat on the morning of 17 April. However, on the morning of 16 April we received

weather forecasts indicating rough seas for the next four days, and also news that there was a helicopter working around the southern Titi Islands. As we were concerned whether the supply of mealworms would last another 4 days, and were unwilling to risk a rough sea crossing for the snipe, we arranged for the transfer to occur by helicopter. This was confirmed at midday on 16 April, with pick-up scheduled for 1600 hrs that day. This meant that we had to forego plans to catch an additional ten snipe and place them directly into transfer boxes within the last 24 hours before departure. It took about 2 hours to capture all 29 birds from the aviaries (plus one from the cage), weigh them, remove their colour bands, collect cloacal swabs from 21 of them, and place them in transfer boxes; indeed we still had three birds to process when the helicopter arrived at 1545 hrs. Once processed and placed in their transfer boxes, birds were moved to wait in a quiet, sheltered location (the research hut).

The Squirrel helicopter arrived amidst rain and 30 knot northerly winds, and touched down on Seal Point initially, which is the designated helicopter landing site on North East Island. As there were few penguins in Station Cove in April, it was deemed to be much more efficient and safer for people and the snipe to have the helicopter closer to the hut. The helicopter then moved to the head of Station Cove, close to the huts. Power was maintained throughout in the strong northerly winds. All the bird boxes were loaded into the rear of the cockpit. Care was taken to ensure all curtains were down over the compartment entrances but that some ventilation was possible. The transfer boxes were then wedged into secure positions with foam matting; Ros Cole and Colin Miskelly accompanied the birds on the 40 minute flight to Putauhinu Island.

2.1.8 Release on Putauhinu Island

We touched down at the Davis helipad at about 1650 hrs on 16 April, and were met by Pete McClelland (DOC) and about 25 muttonbirders, including Rongo Spencer and Jane Davis, who had been instrumental in arranging the snipe translocation. After a brief mihi and karakia by Tane Davis, the birds were released one at a time into a fern-filled gully about 20 metres from the helipad. All muttonbirders who chose to had the opportunity to release a snipe. Pete, Ros & Colin left Putauhinu at 1745 hrs, and flew directly to Invercargill airport, arriving at 1830 hrs.

2.2 DISEASE SAMPLING

Blood smears were taken from 31 snipe at the same time that genetic samples were taken, before the birds were placed in the aviaries. We sampled one extra bird, as an additional male was held for 2 hours before being released with his young chick (see 2.1.4). Cloacal swabs were collected from 21 of the snipe immediately before they were placed in transfer boxes on 16 April. Faecal samples were collected from 28 transfer boxes/compartments back in Invercargill on the evening of 16 April, but these were not matched to individual birds, as we had not labelled the

boxes. All samples were sent to Brett Gattrell, Institute of Veterinary, Animal and Biomedical Sciences, Massey University, on 18 April.

Blood smears were used to assess presence of blood parasites, and white cell counts. Cloacal swabs were used to assess presence of *Salmonella*, *Yersinia* and *Campylobacter*. Faecal samples were used to assess presence of *Heterakis*, *Capillaria*, strongyles, ascarids, *Giardia*, coccidia or their eggs.

Detailed sampling methodology is given in Jakob-Hoff (1999).

2.3 GENETIC SAMPLING

All genetic samples were collected from the brachial (wing) vein with a sterile 26 gauge needle. Blood samples were collected from 31 snipe, and stored in 1 ml of 95% ethanol. The samples have been sent to Dr Allan Baker's laboratory in Toronto, Canada, for analysis, and are not discussed further here.

2.4 HAKAWAI SURVEY

Two attempts were made to listen for nocturnal aerial displaying (=hakawai) by snipe on the Snares Islands. The nights of 13 & 15 April were calm, cold and clear, with no moon and a faint aurora. CM spent two hours (2200–2400 hrs) at a single site each night, without artificial light, listening for snipe calls. A tussock saddle above Sinkhole Gut was surveyed on 13 April, and a small clearing among *Brachyglottis* and *Olearia* forest behind Ho Ho Point was surveyed on 15 April.

2.5 PACK UP AND DEPARTURE FROM THE SNARES ISLANDS

The aviaries were taken down after the birds left North East Island on the afternoon of 16 April 2005. The dead vegetation used to corral the aviaries, and the transplanted tussocks were spread out in the general area from which they originated. Track damage had been limited by the Punui Bay track giving direct access to the aviary sites. Flagging tape put out to mark tracks around the catching area was pulled in. The impact from the operation was felt to be minimal, and would be evident in the short term only.

On April 17 we packed up base and were ready for a late morning pick up by MV *Aurora Australis*. All huts were left in clean condition, with the main hut and the research hut being cleaned down with bleach. All windows had their shutters put on.

On the way home we called in at the "Narrows" at Port Pegasus to drop Phred Dobbins off. Matt, Malcolm and Andrea reached Halfmoon Bay after

dark on 17 April, and travelled through to Bluff and Invercargill on the morning of the 18 April.

At the Eye Street DOC quarantine store the transfer boxes and the two aviaries were soaked in Vircon® and steam cleaned before storage. Feed trays and pet bowls were soaked in Vircon® and washed in water before storage. Catch bags were washed in Trigene® before storage.

3. Results

3.1 AGES AND SEXES OF SNIPE CAUGHT

Most snipe encountered in the catch area (Fig. 1) were single adults (approximately 35 birds) or adults caring for chicks (eight parent-chick pairs). Only a single independent juvenile was identified (and was included in the transfer). A second juvenile (from Ho Ho Point) was considered to be independent at capture, but in the aviary it made chick calls, and associated with an adult caught nearby. It is possible that this juvenile was independent, but that the stress of capture caused it to revert to dependent behaviour. Three parents caring for chicks were captured and marked with Twink®; one of these was the bird held in an aviary for 2 hours, and released with a metal band on its left leg (see 2.1.4). One female was carrying an egg when caught on 12 April (see below), but all the other 26 birds captured were considered to be either nonbreeding or post-breeding adults. The 30 birds transferred comprised 28 adults and 2 juveniles.

Based on measurements, leg colour and markings (Table 1; Appendix 1) we determined that 16 of the birds transferred were female (15 adults, 1 juvenile) and 14 were male (13 adults, 1 juvenile). The sexes were, by chance, equally divided between the two aviaries, with 8 females in each initially (one aggressive female was removed from aviary 1 on 15 April). Both juveniles were held in aviary 2.

Tarsus diameters for adult snipe averaged 4.3 × 2.9 mm for males (range 3.8–4.7 × 2.6–3.3 mm) and 4.5 × 3.0 mm for females (range 4.3–4.7 × 2.6–3.7 mm). Two juveniles had tarsus diameters of 4.4 × 3.5 mm (male) and 4.3 × 3.1 mm (female).

No previously banded snipe were encountered despite searches of the area where the last known banded snipe was seen in March 2004 (Miskelly & Sagar in press).

3.2 BREEDING CONDITION, MOULT AND FEATHER WEAR

Most dependent chicks encountered were fully feathered, although four of the five fully feathered chicks had a patch of down on the nape (indicative of chicks 45–53 days old; Miskelly 1999a), and therefore could have been within a week or two of independence (age 57+ days; Miskelly 1990a). The three remaining chicks were estimated to be 2, 3 and 18 days old on capture (Table 2). Parents of the 18- and 2-day-old chicks were inadvertently captured and placed in aviary 1 on the night of 11 April and the morning of 12 April respectively. This was soon rectified for the 2-day-old chick (see 2.1.4), but the situation was recognised too late for the 18-day-old chick. It had been alone for 12 hours, and was weak when placed in aviary 1. None of the three adults caught near where the chick was found paid any attention to it, and it died within half an hour of placement in the aviary.

TABLE 2. MEASUREMENTS OF SNARES ISLAND SNIPE CHICKS, APRIL 2005.

DATE	WEIGHT (g)	CULMEN (mm)	TARSUS (mm)	MID T&C (mm)	WING (mm)	EST. AGE (days)	DOWN
11 April	21	21.0	20.0	27.1	–	3	Total
12 April	16	18.5	20.2	28.1	–	2	Total
12 April	46	34.4	23.9	32.2	62	18	Balaclava & rump, traces elsewhere. Primaries 18 mm from sheath.

A very heavy (143 g) female caught on the night of 12 April was determined, by palpation, to be carrying a fully formed egg. Consideration was given to releasing the female at her capture site, but we decided that it was very unlikely that she would complete incubation and chick rearing successfully, as (1) this was the latest ever recorded breeding event by Snares Island snipe, (2) it is likely that her mate had already been captured for transfer, and therefore she would have been left to incubate by herself, and (3) the stress of capture may have caused her to abandon the egg as soon as it was laid. She was placed in aviary 1, and by the next afternoon (13 April) had a normal profile, and so was likely to have laid. The egg was found in the aviary when it was being dismantled on 16 April; it measured 44.2 × 31.0 mm and weighed 23.5 g. Although concealed among tussock, there was no formed nest, and the female's behaviour in the aviary indicated that she was not incubating. The egg weight was subtracted from this female's capture weight when calculating weight change in the aviary. Both the egg and chick were delivered to Te Papa on 21 April 2005.

Twenty-two of the 28 adult snipe transferred were in pre-basic (post-breeding) moult (see Appendix 1). This appeared to start with the innermost primaries (seven birds were in primary moult), and end with moult of the rump and tail feathers (rectrices). Four of the adult snipe handled had not started their pre-basic moult: one was a male caring

for a 3-day-old chick on 11 April, one was the female carrying an egg, and the remaining two were females with bare brood patches but not accompanied by chicks (in retrospect, these females were probably either incubating or had recently lost their chicks). Three of the adult snipe transferred were considered to have completed their pre-basic moult (all were males).

Surprisingly, the male caring for a 2-day-old chick (male 13) was recorded as having nearly completed his pre-basic moult (some rump feathers in sheath). It is very unusual for birds of any species to breed during their moult, and it is possible that this male bred twice during the 2004/05 breeding season. A female caught nearby and at the same time (female 14) had not started her moult, and had a bare brood patch. She was almost certainly the mate of male 13, but did not bond with the chick when it was placed in the aviary. It is normal for each parent to bond with a single chick on the day of hatching (Miskelly 1999a), and 60% of chick mortality occurs on the day of hatching (Miskelly 1990a & 1999b). The most likely explanation for this female's moult condition (or lack of it) was that she was incubating until 10 April, and had lost her chick since then, while male 13 was caring for the first chick to hatch from the same clutch.

Even more surprising was the discovery that two of the 14 "post-breeding" males handled had the broken tail feathers considered characteristic of 'hakawai' aerial displaying (Miskelly 1987). One had completed his pre-basic moult, and the other was in primary and tail moult. This is the first recorded evidence of hakawai aerial displaying by Snares Island snipe (Miskelly 1990c and in press). Both birds were included among the 13 adult males transferred to Putauhinu Island.

3.3 SNIPE IN CAPTIVITY

With the exception of one aggressive female (see below) all 30 snipe adjusted well to captivity, and were released in good condition 3–5 days later. Twenty-three snipe were seen to use the feed trays within 24 hours of the birds being placed in the aviaries, and all 30 birds had been seen to use them within 48 hours. The quickest that a snipe learnt to use the feed trays was an adult female seen feeding within 5 minutes of placement in aviary 2. The two slowest birds were an adult male in aviary 1 (max. 41 hours) and an adult male in aviary 2 (max. 42 hours). Intriguingly, males were also slow learners in Chatham Island snipe (Miskelly & Barlow 2001). However, we were not observing the birds in the aviaries continuously, and it is very likely that some birds commenced using feed trays sooner than we detected. Natural food within the harvested mats of *Callitriche* and *Crassula*, and the maggots (when present), were fed upon by the snipe.

From the Chatham Island snipe trial, it was apparent that birds that had not learnt to use feed trays were very active, moving around the aviary seeking food; by contrast, snipe that had learnt to use feed trays had

brief bouts of feeding followed by long periods of roosting (Miskelly & Barlow 2001). Our observations of Snares Island snipe in the aviaries matched the latter pattern, with most birds roosting for much of the observation sessions. Once they had learnt to use feed trays, captive Snares Island snipe spent about 76% of their time roosting or preening, and about 16% feeding from feed trays (Table 3).

TABLE 3. SUMMARY OF BEHAVIOURAL OBSERVATIONS OF CAPTIVE SNARES ISLAND SNIPE. 'Total obs.' = total number of behaviour observations for that group of individuals. 'Roost' included sleeping and inactive, and birds concealed from the observer; 'Preen' included bathing and stretching; 'Probe' = probe soil; 'Feed' = feed from trays. All measurements (apart from 'Total obs') are percentage of the total for that group of individuals.

	TOTAL OBS.	INACTIVE		ACTIVE		
		ROOST	PREEN	WALK	PROBE	FEED
Adult males	155	66.5	8.4	3.9	3.9	17.4
Adult females	162	72.8	4.9	3.1	3.1	15.4
Adult total	317	69.7	6.6	3.5	3.5	16.4

No ritualised pacing was seen to be performed by captive Snares Island snipe, but 19 different birds were recorded fluttering up the mesh windows in attempts to escape from the aviaries (11 birds only within the first 24 hours of being placed in the aviaries). This fluttering behaviour all but ceased when the birds had been in the aviaries more than 48 hours (there were three later instances recorded, usually when a human observer was moving within the aviaries).

Captive snipe made much use of the freshwater provided, with 18 different birds seen to drink, and three to bathe (including one of the two juveniles). CM never observed bathing by wild Snares Island snipe or Chatham Island snipe during 540 days of fieldwork between 1982 and 1992, but three captive Chatham Island snipe (including two of three juveniles) were seen to bathe (Miskelly & Barlow 2001).

Snares Island snipe were mainly silent in the aviaries. Exceptions were the two juveniles (both in aviary 2) that continued to give 'Chick Calls' (Higgins & Davies 1996) throughout, and four adults noted giving contact calls ('Soft Call' of Higgins & Davies 1996). A male and a female did so in aviary 1 the day after they were put in, and another female called almost continuously during an observation session the following afternoon. The male presumed parent of a juvenile in aviary 2 was often harassed by the juvenile; he fed it at least once (it mainly fed itself), and gave contact calls to the chick once on 15 April (2 days after they were placed in the aviary).

A snipe in aviary 1 was heard giving a "*chep*" alarm call at night on 11 April just before another bird was placed in the aviary (this would have been in response to the approaching headlamp). Three different snipe (an adult male and two adult females) were seen to give the *chep* call as CM moved around the aviaries replacing food trays. CM had never observed this call given by wild Snares Island snipe, as it was usually given at night, or from dense vegetation. The call was given by birds in an alert, standing posture, with the bill held in the usual angled-down

position; the bill opened slightly during the call.

The only other call heard from captive snipe was the Distress call ("*nyerr*") given by both aggressors and victims during agonistic encounters (see below). Snipe sometimes give this call when they are being handled.

There was little overt aggression among the captive snipe, even when 15 birds were confined to 14 m^2 for 3–4 days. Most birds did not like other snipe approaching closer than 10 cm, and this led to some brief skirmishes at feed trays and favoured roost sites.

A total of 23 aggressive interactions between snipe were observed during 910 minutes of observations at the two aviaries (mean rate = one every 40 mins). However, 15 of these interactions were due to one aggressive female in aviary 1, with 11 attacks by her seen during 90 minutes on the morning of 15 April. This female was twice seen to pluck feathers from other snipe during skirmishes. This aggressive female was one of two females noted with male-like plumage, and so may have had elevated testosterone levels. No further aggressive interaction were observed in aviary 1 following her removal on the afternoon of 15 April, and only two brief chases were noted in aviary 2.

Three birds had to be captured in the aviaries before transfer day. The third bird released into aviary 1 on the night of 11 April was captured about 12 hours later for banding, and found to have lost 10 grams (88 g, down from 98 g). A male caught on the morning of 12 April was, within 2 hours, found to have left a small (estimated 2-day-old) chick calling plaintively from his capture site. This male had lost 2 grams in 2 hours (88 g, down from 90 g). On 15 April the aggressive female snipe from aviary 1 was placed in "solitary confinement" (a 1.2 × 0.5 × 0.4 m cage). She had weighed 126 g on capture on 11 April, was 124 g when transferred to the cage, and was 119 g the following day when placed into a transfer box.

3.4 WEIGHT CHANGES IN CAPTIVITY

There was no significant change in bodyweights of snipe during the 3–5 days that they were in the aviaries (Table 4). However, individual snipe varied between losing 11.8% and gaining 13.9% of their capture weight (mean 0.1% lighter). All 30 birds exceeded the minimum threshold weights set for transfer (these were 85% of capture weight for most birds), and so all 30 were transferred to Putauhinu Island. Twelve birds were lighter than their capture weight when transferred, and 16 were heavier.

TABLE 4. CAPTURE AND TRANSFER WEIGHTS FOR 30 SNARES ISLAND SNIPE HELD IN CAPTIVITY.

BAND NUMBER	AGE	SEX	TIME IN AVIARY (days)	CAPTURE WEIGHT (g)	TRANSFER WEIGHT (g)	PERCENTAGE CHANGE
D-184602	Adult	Male	5	109	112	2.8
D-184603	Adult	Male	5	98	98	0.0
D-184604	Adult	Male	5	91	103	13.2
D-184606	Adult	Male	5	111	101	-9.0
D-184608	Adult	Male	5	101	95	-5.9
D-184610	Adult	Male	5	92	93	1.1
D-184611	Adult	Male	5	96	103	7.3
D-184617	Adult	Male	4	102	90	-11.8
D-184622	Adult	Male	4	112	105	-6.3
D-184623	Adult	Male	4	107	103	-3.7
D-184627	Adult	Male	3	102	96	-5.9
D-184628	Adult	Male	3	104	97	-6.7
D-184630	Adult	Male	3	93	99	6.5
D-184629	Juvenile	Male	3	100	111	11.0
D-184601	Adult	Female	5	108	123	13.9
D-184605	Adult	Female	5	126	119	-5.6
D-184607	Adult	Female	5	116	118	1.7
D-184609	Adult	Female	5	119	108	-9.2
D-184612	Adult	Female	4	116	117	0.9
D-184614	Adult	Female	4	113	114	0.9
D-184615	Adult	Female	4	119.5	115	-3.8
D-184616	Adult	Female	4	107	114	6.5
D-184619	Adult	Female	4	104	104	0.0
D-184620	Adult	Female	4	119	106	-10.9
D-184621	Adult	Female	4	106	109	2.8
D-184624	Adult	Female	3	106	113	6.6
D-184625	Adult	Female	3	108	109	0.9
D-184626	Adult	Female	3	111	117	5.4
D-184631	Adult	Female	3	119	114	-4.2
D-184618	Juvenile	Female	4	116	112	5.2

3.5 FOOD CONSUMPTION WHILST IN TRANSIT

Each snipe had a container with 30 mealworms in their transfer box/compartment. The number of mealworms consumed before the birds were released ranged between 0 (n=12) and 29 (n=1). Only seven birds ate ten or more mealworms. As the first birds captured from the aviaries had nearly 2 hours of quiet waiting in the Research Hut before the helicopter flight, we suspect that most food consumption in transfer boxes occurred then.

3.6 DISEASE SAMPLING

Few disease organisms or parasites were detected in the snipe. The blood smears showed no evidence of haemoparasites, and white cell counts were within what is considered as a normal range for other species (Brett Gartrell pers. comm.). No evidence of *Salmonella*, *Yersinia*, or *Campylobacter* was found, although all cloacal swabs had *Escherichia coli* present. Faecal sample parasitology revealed only one positive result: a single bird had four cestode (tapeworm) eggs (each 70 × 60 μm) in 0.1 g of faeces (and so total burden was 40 eggs/g of faeces). Tapeworms are likely to be incidental parasites of snipe and not important for the health of the translocated birds (Brett Gartrell pers. comm.).

Two feather lice were noticed on one of the snipe handled, but they were not captured.

3.7 HAKAWAI SURVEY

The only snipe calls heard during the four hours of listening came from the ground: three bouts of 'chup' male territorial calls on 13 April, and a single 'chep' alarm call on 15 April (Miskelly in press).

4. Discussion

4.1 SNARES ISLAND SNIPE BREEDING SEASON

The 2004/05 breeding season was apparently a very poor and prolonged one for Snares Island snipe. There was an almost total absence of independent juveniles in the areas we searched, with only a single confirmed independent juvenile included among the transferred birds. The other juvenile transferred was considered old enough to care for itself, but it associated with its presumed parent in the aviary. The rarity of independent juveniles in April 2005 was in dramatic contrast to the number observed in February each year from 1983 to 1987 (CM pers. obs.).

We were also surprised at the number of young chicks encountered (three less than 3 weeks old) and the female captured carrying an egg on 12 April. Horning & Horning (1974) reported a small downy Snares Island snipe chick seen on 4 May 1972; this was likely to have come from an egg laid in early April (Miskelly 1999a). As no small chicks had been seen for several months (Don Horning pers. comm. to CM), this breeding record was considered exceptionally late.

The absence of courting pairs of adult snipe, and the few territorial calls heard indicated that breeding had probably all but ceased by mid April 2005. This conclusion is supported by the number of adults captured

that were in (or had completed) pre-basic moult. However, the adults captured were in good condition, with bodyweights comparable with those recorded in 1982–87 (CM pers. obs.).

The unexpectedly late breeding season meant that we inadvertently disrupted at least two breeding attempts, with one "orphaned" chick known to have perished, and an egg laid in an aviary. We suggest that April is still the best time to consider future transfers of Snares Island snipe, as the 2004/05 snipe breeding season was apparently unusually prolonged (see Miskelly 1999a). Day-length is shortening rapidly in April, as well as weather deteriorating. March–May is also the period that muttonbirders are present on their islands, allowing them to be present at any releases on to Titi Islands.

4.2 COMPARISON WITH CHATHAM ISLAND SNIPE IN CAPTIVITY

Captive Snares Island snipe responded to captivity in a similar way to Chatham Island snipe (Miskelly & Barlow 2001). Perhaps the most noticeable difference was that Snares Island snipe spent less time inactive (76% of observations cf. 83% for Chatham Island snipe) and more time using the feed trays (16% cf. 9%). This increased foraging effort may be due to the larger body size of Snares Island snipe (they average 37% heavier than Chatham Island snipe; Higgins & Davies 1996). Both species were fed on the same diet of mealworms, and apparently capture and consume prey at a similar rate (CM pers. obs.), and so the larger species would require more time to meet its energy requirements. The presumed higher energy needs of Snares Island snipe may also explain why they did not (on average) gain weight in captivity, while Chatham Island snipe increased by an average of 11% over a similar time in captivity.

The Snares Island snipe were held at higher densities than Chatham Island snipe—about 0.9 m^2 per bird compared to 1.6 m^2 for Chatham Island snipe (Miskelly & Barlow 2001). Apart from one overly aggressive female, we encountered no apparent problems with holding snipe at these higher densities.

4.3 SNIPE TRANSLOCATION TO PUTAUHINU ISLAND

The 30 snipe were all considered to be in good condition at release on 16 April, and all moved into dense cover on release. The one factor that may jeopardise establishment of snipe on Putauhinu is the presence of moreporks (*Ninox novaeseelandiae*). Stewart Island snipe clearly co-existed with morepork, but moreporks are very rare vagrants to the Snares Islands (Miskelly *et al.* 2001), and the transferred snipe are unlikely to have appropriate anti-predator behaviour. There may well be rapid selection pressure for snipe to stay among dense vegetation during the hours of darkness on Putauhinu (the opposite of their diurnal/nocturnal behaviour patterns on the Snares Islands).

This first translocation of snipe back to one of the Titi Islands is truly a landmark event for several reasons. This is the first time that a threatened New Zealand bird has been translocated specifically to replace an extinct relative, and allows snipe/tutukiwi to reclaim their niche within the titi islands' ecosystem. Assuming that a population establishes in the presence of morepork, this "predator-savvy" population would be a possible source population for other southern islands, all of which have morepork present.

Even more notable is that we believe that this translocation has restored the potential for hakawai to once again be heard on the Titi Islands. The hakawai was a legendary bird of the Titi Islands, and is now believed to have been a nocturnal aerial display performed by the extinct Stewart Island snipe (Miskelly 1987). Up until April 2005, it was believed that Snares Island snipe did not perform the hakawai display (Miskelly 1987 & 1990c), indeed the Putauhinu muttonbirders enquired as to whether a different form of snipe that did perform the hakawai could be released on their island. The finding of two male snipe with the characteristic tail feather wear caused by hakawai displaying was the find of our trip, and we felt hugely privileged to be able to contribute to the restoration of both tutukiwi and hakawai to Putauhinu Island.

5. Acknowledgements

This snipe translocation could not have occurred if Putauhinu Island wasn't ready to receive them. We are indebted to the Putauhinu muttonbirders, especially the Davis, Lee and Spencer whanau, for the commitment that they have made to restoring their island and keeping it free of rats, and also for the welcome we received on the transfer day. Funding and approval for the snipe translocation was organised by Pete McClelland, Andy Roberts and Jeremy Carroll of Southern Islands Area, Southland Conservancy, DOC; we are grateful for all the effort they put into making this project happen. Transport to and from the Snares Islands was provided by Colin Hopkins (Aurora Charters) and Doc Sutherland (South West Helicopters Ltd), who looked after us well in difficult weather conditions. Helicopter costs were part-funded by BP as part of their sponsorship programme for biodiversity work. We are indebted to our fellow team members Ros Cole, Phred Dobbins, Andrea Goodman and Malcolm Mackenzie for their hard work and good company; the good health of the 30 snipe transferred was a tribute to the effort they put into their care.

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Appendix 1

MEASUREMENTS OF ADULT AND JUVENILE SNARES ISLAND SNIPE HANDLED ON NORTH EAST ISLAND 11–13 APRIL 2005

ID = reference number used for disease sampling and genetic sampling, and was based on the last two digits of the birds' band numbers (full band number was D-1846xx).

All measurements are in millimetres, except weight (grams).

MTC = mid toe and claw.

'Hakawai' refers to distinctive tail feather wear thought to be caused by aerial displaying (Miskelly 1987a and in presss).

'1° coverts' refers to whether there was any mottling on the inner web of the greater primary coverts (a character that aids sexing).

Under 'Comments', stage of primary moult is presented using a standard scoring system where:

O = an old feather

1 = feather missing or in sheath

2 = feather less than one-third grown

3 = feather one-third to two-thirds grown

4 = feather more than two-thirds grown

N = new feather.

Superscript numbers give the number of feathers in each category, numbered from the innermost primary outwards to the tenth primary.

A. MALES

ID	DATE	AGE	WEIGHT	BILL	TARSUS	MTC	WING	TAIL	LEG COLOUR	1° COVERTS	COMMENTS
02	11/4/05	Adult	109	55.4	24.4	32.7	107	40.6	Yellow-olive	Clean	N^{10} Central rectrices in pin
03	11/4/05	Adult	98	53.3	23.5	32.0	105	40.3	Yellow-olive	Clean	$N^{3}4^{1}3^{1}2^{1}O^{4}$ Some wing covert moult
04	11/4/05	Adult	91	53.7	23.9	-	104	35.1	Yellow-olive	Slight mottled	N^{10} Central rectrices in pin
06	11/4/05	Adult	111	55.7	24.5	33.6	107	40.4	Yellowish	Clean	N^{10} Rump & inner wing coverts moulting
08	11/4/05	Adult	101	54.4	24.6	33.8	108	40.0	Yellow	Clean	N^{10} Rump moulting
10	11/4/05	Adult	92	52.6	24.2	33.1	106	42.3	Yellow	Clean	New feathers N^{10}
11	11/4/05	Adult	96	52.5	24.5	33.9	108	33.9	Yellow-olive	Slight mottled	N^{10} Tail, inner wing coverts & scapulars moulting
13	12/4/05	Adult	90	53.2	23.7	33.2	107	37.7	Yellowish	Clean	Not transferred. N^{10} Almost finished moult
17	12/4/05	Adult	102	52.4	23.7	33.2	106	40.8	Yellow	Clean	Hakawai. $2^{1}1^{1}O^{8}$ Back & tail moulting
22	12/4/05	Adult	112	54.2	24.5	33.8	106	37.3	Yellow	Clean	$N^{1}1^{1}O^{8}$ Moult on back, rump & belly
23	12/4/05	Adult	107	52.1	24.7	34.5	107	38.2	Yellow-olive	Clean	N^{10} Rump, belly & inner wing coverts moulting
27	13/4/05	Adult	102	54.2	24.7	34.0	107	41.7	Yellowish	Clean	Hakawai N^{10} Feathers all new
28	13/4/05	Adult	104	52.1	23.9	33.4	107	36.3	Yellowish	Clean	$4^{1}O^{9}$ No other moult apparent
30	13/4/05	Adult	93	52.4	23.9	33.4	107	40.1	Yellow-olive	Clean	N^{10} Feathers all new
–	11/4/05	Adult	101	53.2	24.9	34.3	108	36.1	Yellowish	Clean	Not transferred. No moult, O^{10}
Adult male mean			**100.6**	**53.4**	**24.2**	**33.5**	**107**	**38.7**			
29	13/4/05	Juv.	100	53.5	24.3	31.8	110	37.3	Olive	Very mottled	

B. FEMALES

ID	DATE	AGE	WEIGHT	BILL	TARSUS	MTC	WING	TAIL	LEG COLOUR	1° COVERTS	COMMENTS
01	11/4/05	Adult	108	57.9	25.6	33.1	108	36.6	Olive	Mottled	N^{10} Central rectrices in pin
05	11/4/05	Adult	126	57.2	26.1	34.8	111	42.6	Yellow-olive	Slight mottled	N^{10} Rump feathers in pin
07	11/4/05	Adult	116	59.0	25.7	33.9	105	37.2	Olive	Mottled	N^{10} Tail, rump, belly & inner wing coverts moulting
09	11/4/05	Adult	119	56.0	24.8	34.8	104	41.3	Greenish-yellow	Slight mottled	N^{10} Rump moulting
12	12/4/05	Adult	116	57.8	25.9	35.6	108	[30.1]	Yellow-olive	Mottled	$N^{3}4^{2}1^{2}O^{3}$ Tail moulting
14	12/4/05	Adult	113	57.4	25.4	35.5	109	41.4	Yellow-olive	Slight mottled	N^{10} Totally new (or old) plumage. Brood patch bare
15	12/4/05	Adult	119.5	55.7	25.3	35.3	108	40.4	Olive	Mottled	None, O^{10} Egg felt by palpation
16	12/4/05	Adult	107	56.9	24.9	31.8	105	[32.3]	Olive	Mottled	N^{10} Tail, belly & inner wing coverts moulting
19	12/4/05	Adult	104	54.5	24.7	33.0	109	39.7	Olive	Mottled	N^{10} Tail, rump, belly, inner wing coverts & back moulting
20	12/4/05	Adult	119	55.8	24.4	34.4	109	40.3	Olive	Slight mottled	$3^{1}2^{1}O^{8}$ Some tail & covert moult
21	12/4/05	Adult	106	55.2	24.3	34.8	106	40.6	Olive	Very mottled	$N^{2}4^{1}2^{1}1^{1}O^{5}$ Some rump moult
24	13/4/05	Adult	106	58.3	24.7	34.2	107	37.9	Yellow-olive	Mottled	N^{10} Rump & belly moulting. All inner tail feathers in sheath
25	13/4/05	Adult	108	56.8	24.7	33.5	107	32.3	Olive	Mottled	N^{10} Some rump feathers moulting, otherwise new
26	13/4/05	Adult	111	53.6	24.8	32.7	105	35.7	Olive	Mottled	N^{10} Belly, under tail coverts & scapulars all growing
31	13/4/05	Adult	119	55.6	24.4	35.2	108	35.0	Yellowish	Mottled	No moult apparent Bare brood patch
Adult female mean			**113.2**	**56.5**	**25.0**	**34.2**	**107**	**38.5**			
18	12/4/05	Juv.	116	54.7	25.6	33.7	114	40.7	Olive	Very mottled	No down. Estimated age 60 days

Appendix 2

HUT REPORT AND JOBS

Fuel shed:	Good condition Evidence that fairy prions had been nesting in there Replaced rope that holds the door to the shed
Toilet:	Generally in good condition though one wire hold-down was broken Replaced broken wire hold-down with a temporary but solid rope system—will need replacing
Research hut:	Good condition—piles still there Missing a window shutter for the western window—replaced
Castaway shed:	Good as gold—lovely wee hut Spade, saw, hammer, nails, screws, pliers, wire all present Mesh put on wooden platform by outside water tank
Main hut:	Good condition Water from roof supply tasted salty—recommend full roof and tank clean Enlarged gas pipe hole (can now take and set up the legal DOC gas cookers) Needs a kettle
Other:	Mosquito larvae and adults were collected for and sent to Amy Steele at the Wellington branch of the University of Otago.

Appendix 3

HISTORICAL FIND

On 12 April 2005 Malcolm Mackenzie and Ros Cole found the glass shade for a lantern near the trypot site at the head of the northern branch of Station Cove. It was in good condition though full of dirt. The glass was clear and had the words 'New York' imprinted upon it. It has been left on the western side of the northernmost trypot. (Rachel Egerton, Southland Conservancy, has been informed).