Chatham Island snipe translocation to Ellen Elizabeth Preece Conservation Covenant, Pitt Island, April 2008

Department of Conservation
Te Papa Atawhai

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Cover photo: Brent Mallinson, Dave Houston and Dianne Gregory-Hunt releasing a Chatham Island snipe on Pitt Island, 28 April 2008. Photo: Colin Miskelly,

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Executive summary

Twenty Chatham Island snipe (*Coenocorypha pusilla*) were transferred from Rangatira (South East Island) Nature Reserve to Ellen Elizabeth Preece Conservation Covenant, Pitt Island on 28 April 2008. Snipe were captured with handnets during 27–28 April, and were held individually in corflute pet carry boxes until release. All 20 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 7.6% lighter to 13.7% heavier than capture weights (mean 0.7% lighter). Eleven birds were lighter than their capture weight when released, and seven were heavier. Feather samples for genetic sexing were collected from all 20 snipe transferred, but it was not possible to extract DNA from these samples. Additional notes on Chatham Island snipe distribution, breeding ecology and behaviour are presented, including an observation of an adult caring for two fully grown chicks.

1. Introduction

1.1 DISTRIBUTION AND ECOLOGY OF CHATHAM ISLAND SNIPE

Chatham Island snipe (*Coenocorypha pusilla*) were studied by the author on Rangatira (South East Island) Nature Reserve during November 1983 to January 1984, in July 1986, and April–May 2001 (Miskelly 1987, 1989a, 1990a & b, 1999; Miskelly & Barlow 2001). These studies focused on breeding ecology and behaviour, and response to temporary captivity. Detailed comparisons were made with Snares Island snipe, *Coenocorypha huegeli*, which were studied concurrently. Additional information on Chatham Island snipe collected at this time was included in Higgins & Davies (1996) and Miskelly, Walker *et al.* (2006). Blood samples collected from snipe on Mangere Island in Oct 2000 and Rangatira in May 2001, plus feather samples collected from Rangatira in February 2007 were used to assess the genetic diversity of Chatham Island snipe, and to compare this diversity with samples collected from five other *Coenocorypha* snipe populations (Baker *et al*. submitted ms). The February 2007 feather samples were also used as part of a wider study of marine-sourced nutrient enrichment of snipe feathers in relation to their co-occurrence with dense seabird and marine mammal colonies (Hawke & Miskelly 2009).

Snipe originally occurred on the four main islands of the Chatham Islands (Millener 1999) but became confined to less than 0.3% of their range following introductions of rats and/or cats to Chatham, Pitt and Mangere Islands. For about 80 years (1890–1970), snipe were confined to 249 ha Rangatira Island, where they came perilously close to extinction. Fleming

(1939) found them to be abundant in 1937. However, neither Bell (1955) nor Dawson (1955) recorded them during brief visits in 1953 and 1954 respectively, and it is likely that over 110 years of grazing by farm stock had removed most of the dense ground cover that snipe prefer. The last stock were removed from Rangatira in 1961 (Nilsson *et al.* 1994); snipe are now abundant there (Miskelly & Barlow 2001), and were re-introduced to 131 ha Mangere Island in 1970 (Bell 1974). From Mangere, snipe have colonised 19 ha Little Mangere Island and 2 ha Rabbit Island. Snipe were first reported on Little Mangere Island by Dave Crouchley and Rick Thorpe on 5 Dec 1982 (Mangere Island hut log-book, Archives New Zealand AANS 3353 W5559/4g) and were subsequently seen there on 14 Dec 1984 (Mangere Island hut log-book, Archives New Zealand AANS 3353 W5559/4b B) and also in January 1998 (Mike Bell pers. comm.). Two snipe were seen on Rabbit Island by John Dowding & Nathan McNally in February 2006 (Miskelly, Bester *et al*. 2006).

Snipe were not recorded on the Star Keys (c.10 ha) during an overnight visit in September 1968 (Brian Bell pers. comm.), but two were seen on 24 Jan 1974 by Warwick Brown & Doug Flack (New Zealand Archives AAAC W3207 Box No: 68, file WIL 30/3/5). Most subsequent observers have confirmed the ongoing presence of snipe on Star Keys. Chatham Island snipe are therefore known to be present on five islands totalling about 410 ha.

Snipe are also seen occasionally on Pitt Island (Higgins & Davies 1996; Aikman & Miskelly 2004; Table 1), including once within the predator-fenced portion of Ellen Elizabeth Preece Conservation Covenant (14 Jul 2005; Mike Joy pers. comm.).

TABLE 1. KNOWN SIGHTINGS OF SNIPE ON PITT ISLAND 1986–2007. EEPCC = ELLEN ELIZABETH PREECE CONSERVATION COVENANT.

DATE	LOCATION	SEEN BY
1986	The Bluff	multiple sightings by James Moffett and farm workers
5 May 1986	Motutapu Point	Rob Chappell
c.5 July 1986	Glory Bay	Jo Wylde
10 July 1986	Glory Bay	Rob Chappell
13 July 1986	Motutapu Point	Rob Chappell
1987–2007	North Head	occasional sightings by Kenneth Lanauze (Kenny Dix pers. comm.)
2004–07	North Head	several sightings by Ruka Lanauze (Celine Gregory-Hunt pers. comm.)
14 July 2005	EEPCC	Mike Joy

Chatham 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 2.5 weeks, and accompanied their parents for 5–7 weeks. Evidence of egg-laying was recorded from late July to early April (Miskelly 1990a, 1999; Miskelly, Walker *et al.* 2006). We therefore anticipated that we would encounter

many independent young snipe in April, a few parent-chick pairs, but no courting pairs.

The population size for Chatham Island snipe on Rangatira was estimated at 1300 birds (Miskelly & Barlow 2001). The areas identified for catching snipe in 2008 were coastal margins near the main landing and west landing, and the main tracks below Rangatira trig junction. The effect of removing 20 birds (aiming for 10 adults and 10 juveniles) from the Rangatira population was expected to be negligible.

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. 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) and Rabbit Island (Miskelly, Bester *et al*. 2006). 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 ¾ hour 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 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 & 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.

The techniques developed with Chatham Island snipe in 2001 were applied to Snares Island snipe in April 2005, when 30 birds were held in captivity for 3–5 days, and transferred to Putauhinu Island (Charteris & Miskelly 2005). All 30 birds were released in good condition, with release weights similar to capture weights (release weight mean 0.1% lighter).

1.3 BACKGROUND TO THE 2008 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*. 2005), 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 a series of linked actions:

- Objective 4: Create snipe habitat through maintenance of the predator-proof fence at Ellen Elizabeth Preece Conservation Covenant on Pitt Island. ***Action 1*** *Manager of the snipe programme on the Chathams will ensure that requirements for snipe habitat are incorporated into the Ellen Elizabeth Preece Conservation Covenant project.*
- Objective 5: Develop and test transfer techniques for Chatham Island and Snares Island snipe. ***Action 1*** *Trial transfer of Chatham Island snipe adults and eggs from Rangatira to the National Wildlife Centre within 2 years of this plan being approved.* ***Action 2*** *Trial capture, holding, transfer and establishment…of Chatham Island snipe to Ellen Elizabeth Preece Conservation Covenant, Pitt Island.*
- Objective 6: Develop captive-rearing and breeding capability for snipe. ***Action 1*** *Trial captive-rearing of Chatham Island snipe eggs from Rangatira at NWC.* ***Action 2*** *Trial captive maintenance and breeding of wild-caught and captive-reared Chatham Island snipe at NWC.*
- Objective 7: Develop transfer and establishment techniques for captive-reared snipe. ***Action 1*** *Trial transfer and establishment of captive-reared Chatham Island snipe from NWC to Pitt Island or Chatham Island.*

These actions were intended to develop techniques that could be applied to the Campbell Island snipe, to facilitate its restoration to Campbell Island following the 2001 rat eradication campaign. However, the Campbell Island snipe did it themselves, with birds recolonising and breeding within 4 years of rat eradication (Barker *et al*. 2005; Miskelly & Fraser 2006a). A survey of Campbell Island snipe on Campbell Island in January 2006 recommended "That natural recolonisation of Campbell Island by snipe be left to continue unaided" (Miskelly & Fraser 2006b). This removed any need to develop captive-rearing expertise for *Coenocorypha* snipe, and cleared the way for a direct wild-to-wild translocation of snipe from Rangatira to Ellen Elizabeth Preece Conservation Covenant.

Fieldwork to assess the suitability of Ellen Elizabeth Preece Conservation Covenant for Chatham Island snipe was undertaken in February 2007, and concluded that "EEPCC should provide excellent habitat for Chatham Island snipe" (Miskelly & Emberson 2008).

In 2007 the Chatham Islands Threatened Birds Recovery Group and the Snipe Recovery Group recommended that 20 Chatham Island snipe be translocated from Rangatira to Ellen Elizabeth Preece Conservation Covenant, and this was approved by the Wellington Conservator in April 2008.

1.4 DISEASE SAMPLING

Comprehensive disease samples were collected from ten Chatham Island snipe after 3–9 days in temporary captivity on Rangatira in April–May 2001, and also from an additional ten wild birds (Miskelly & Barlow 2001). Few disease organisms or parasites were detected in the snipe. No evidence of *Salmonella*, *Yersinia*, *Campylobacter*, *Pasteurella*, *Chlamydia,* avian influenza or paramyxoviruses was found. One bird had 400 ascarid eggs per gramme faecal matter, but no birds showed evidence of carrying *Heterakis*, *Capillaria*, strongyles, *Giardia* or coccidia. All 20 faecal smears had small or moderate numbers of gram-positive cocci, 12 had gram-positive rods (11 small numbers, 1 moderate), and 7 had small numbers of gram-negative rods. There was no evidence for these faecal bacteria being more prevalent among the 10 captive birds.

The snipe-specific louse *Quadraceps coenocoryphae* Timmermann, 1955 was removed from three captive birds. One wild snipe had an immature tick (*Ixodes* sp.) and another had an adult flea (a female *Parapsyllus mangarensis* Smit, 1979).

No further disease sampling was required or undertaken during the 2008 translocation.

2. Methods

All the information reported here was collected by the author, assisted by Dave Houston, Kate McAlpine, Dianne Gregory-Hunt, Bernie & Brent Mallinson, and Chatham Island Conservation Board members Celine Gregory-Hunt and Peter Johnson, on Rangatira (South East Island), 27–28 April 2008, and by CM, DH and Kenny Dix on Pitt Island, 28 April to 1 May 2008.

2.1 TRANSLOCATION OF CHATHAM ISLAND SNIPE TO PITT ISLAND

2.1.1 Timing of the translocation

The timing of the translocation was planned to occur at the end of the snipe breeding season, and to match two previous snipe captivity and translocation trials: Chatham Island snipe 29 April – 11 May 2001 (Miskelly & Barlow 2001), and Snares Island snipe 11–16 April 2005 (Charteris & Miskelly 2005). We initially intended to be on Rangatira 26–28 April 2008, but our departure was delayed by bad weather. We reached the island about 1215 hrs on 27 April travelling on *F.V. Acheron* (skipper Glenn King) from Owenga via Flower Pot. Our initial plan was to stay for two nights, but this was changed to less than 24 hours when we looked at the forecast poor weather. After a wait of several hours on the morning of 28 April, we were picked up at 1215 hrs by Robert (Ruka) Lanauze on *F.V. Mary Ellen II*.

2.1.2 Holding and translocation boxes

The snipe were held individually in green corflute boxes 420 × 240 mm × 300 m high; these served both as temporary aviaries while the birds remained on Rangatira (up to 16 hours) and during translocation to Pitt Island (2–3 hours). Each box was furnished with a clump of grass (including root mass and soil), and had 2–3 cm of fine soil covering the base. Water was provided in 150 g yoghurt pottles held in place by a corflute flange. The water containers were removed during translocation to prevent spillage.

Food was presented in plastic 'take-away' dishes 175 × 120 mm × 35 mm deep held in place by a corflute flange. Both flanges were incorporated in the box design, and were formed by making a U-shaped cut, hinged at the top. The flange was bent outwards to insert inside the container; when returned to vertical, the flange held the container in place. The outer wall of the container was then covered with duct tape to ensure that snipe beaks could not protrude through the gap around the flange. Similarly, the existing ventilation holes on the boxes were covered with fine mesh taped to the inside of the boxes, again to ensure that beaks could not protrude and be damaged in transit. It took the whole team several hours to prepare the 20 boxes (including a few spares that were not used).

2.1.3 Food items and presentation

The sole food provided for snipe in the boxes were cultured mealworm larvae (*Tenebrio molitor*), from a supply of 10,000 taken to the island. Fifty mealworms at a time were placed in loose dry, friable soil in the food trays. Food trays for the first 12 birds caught were replaced at 0145 hrs on 28 April (after 3–5 hours of potential foraging), and all 20 food trays were replaced at 0815 hrs on 28 April (after 5.5 to 6.5 hrs of potential foraging). The numbers of mealworms remaining in the trays were counted as a guide to whether birds were feeding. However, mealworms that climbed out of the trays could not be counted until after the snipe were released and the interior of the boxes could be searched.

Due to our ever-changing departure plans, it was not possible to replenish the food trays after 0815 hrs, meaning the birds had only 50 mealworms available each from 0815 hrs until their release at 1430 to 1530 hrs.

To maintain the 'mealworm farm' in good condition, we placed heated tins wrapped in a towel under the tub containing the mealworms, and the whole lot was then wrapped in a blanket to maintain warmth. The mealworms were fed on banana skins.

2.1.4 Catching and handling snipe

The 20 snipe were caught at night (between 1950 hrs on 27 April and 0230 hrs on 28 April) using headlamps and hand-nets. Capture effort was focused along the coastal vegetation above the main landing and west landing, and along the main tracks below the junction to Rangatira trig. These areas held high snipe densities in the 1980s and in 2001 (CM pers. obs.), were readily accessible from the huts, and the track surfaces were relatively robust due to frequent use by people.

Snipe were placed in cloth bags and taken to the hut for measuring and plumage assessment. In order to age and sex birds before placement in the holding boxes, standard measurements were taken (weight, bill length, tarsus length, mid toe and claw length, wing length and tail length) and descriptions taken of leg colour, bill colour, tail feather wear (Miskelly 1987, 2005; Miskelly, Bell *et al*. 2006), and primary covert markings (Table 2; Appendix 1). Although no single character can be considered diagnostic, in combination these characters can allow most Chatham Island snipe to be assigned to age and sex classes. Any juveniles caught were weighed and measured as above, and their hatch dates calculated using the growth equations from Miskelly (1999).

The cloth holding bags were used for only a single bird before they were washed in Virkon®.

All birds caught were permanently banded with a unique numbered metal band on one tarsus, and were also fitted with a unique combination of two wrap-around colour bands on the opposite tarsus to facilitate observations after release.

TABLE 2. CHARACTER STATES USED TO ASSIGN CHATHAM ISLAND SNIPE TO AGE AND SEX CLASSES. 'HAKAWAI' REFERS TO UNUSUAL TAIL FEATHER WEAR ATTRIBUTED TO MECHANICAL DAMAGE DURING NOCTURNAL AERIAL DISPLAYING (MISKELLY 1987, 2005; MISKELLY, BELL *ET AL.* 2006).

CHARACTER	ADULT MALE	JUVENILE MALE	ADULT FEMALE	JUVENILE FEMALE
Weight (g)	69–85	60–81	68–94	60–81
Bill length (mm)	40–48	40–46	43–49	40–46
Leg colour	Yellowish	Olive-yellow or olive-grey	Olive or olive-yellow	Olive
Colour of bill base	Brown	Greyish	Brown	Greyish
Tail wear	Often 'Hakawai'	Not worn	Rarely 'Hakawai'	Not worn
Primary coverts	No markings	Usually unmarked	Usually slightly mottled on inner web	Usually slightly mottled on inner web
Dorsal markings	Strong contrast	Dull, little contrast	Intermediate contrast	Dull, little contrast

2.1.5 Monitoring condition of birds in the translocation boxes

Snipe were not handled once placed in the holding and translocation boxes. The only measure that we had of their welfare was evidence of consumption of mealworms when food trays were replaced. We attempted to re-weigh all 20 birds on release on Pitt Island, to determine weight changes since capture, but the final bird flew from the box before it could be weighed.

2.1.6 Transfer to Pitt Island

Sea conditions were rough on 28 April, which made for a wet and noisy trip around the south end of Pitt Island. Conditions were more sheltered on the west side of Pitt Island, but some of the translocation boxes (on the deck, immediately behind the wheelhouse) were splashed with spray. The boat was hauled out at Flower Pot, and the translocation boxes were taken to Ellen Elizabeth Preece Conservation Covenant (30 min drive) on the back of the DOC ute.

2.1.7 Release in Ellen Elizabeth Preece Conservation Covenant

The boxes were carried by hand from the hut to the release site in the middle of the covenant, close to the second black robin aviary. The birds were released between 1430 and 1530 hrs on 28 April, which was 15–19 hours after capture. Each member of the translocation team was given the opportunity to release at least one bird, after each had been removed from its box and weighed. Most birds walked off into the undergrowth, but five birds flew to above the canopy after release. Birds released by hand under dense ground cover were less likely to fly when let go, and this is the recommended technique for future translocations.

2.2 FEATHER SAMPLING

Two or three breast feathers were plucked from each bird during processing on Rangatira, with the intention that these be used for DNA sexing and isotopic analysis. The feather shafts were sent to Dr Allan Baker's laboratory in Toronto, Canada, for analysis. Unfortunately they were unable to extract DNA from the feathers, whereas the same technique had worked well for snipe previously (e.g. ten feather samples from Rangatira in February 2007).

The feather vanes were sent to Dr David Hawke, Christchurch Polytechnic Institute of Technology, with the intention that the birds' isotopic signature could be compared with samples from the same birds after they had completed at least one moult cycle within Ellen Elizabeth Preece Conservation Covenant.

2.3 POST-RELEASE OBSERVATIONS

I was based in the hut within Ellen Elizabeth Preece Conservation Covenant until 2 May 2008 while attending the annual Chatham Islands threatened bird recovery group meetings at Pitt Island School. Although weather conditions were generally atrocious, this allowed several opportunities to walk the tracks within EEPCC, and also around the perimeter fence. Kenny Dix (Pitt Island ranger) also patrolled the outside of the fence, searching for and repairing storm damage, and made some incidental snipe sightings reported here.

3. Results

3.1 AGES AND SEXES OF SNIPE SEEN AND CAUGHT

Most snipe encountered in the catch area were single adults (approximately 25 birds), or independent juveniles (c.12). Six adults were accompanying large, well-feathered chicks (five parent-chick pairs, and one adult with two chicks). The threesome was seen from the main track in Woolshed Bush, near Skua Gully, in the late afternoon on 27 April. Both chicks were fully grown and the same size.

Based on measurements, leg colour and markings (Table 2; Appendix 1) we determined that five of the birds transferred were adult males, seven were adult females, and eight were juveniles of indeterminate sex. There are no reliable morphological characters for separating the sexes of juvenile Chatham Island snipe. None of the birds were able to be sexed using DNA techniques, and so we do not know the sex ratio among the eight young birds translocated, which were estimated to be 30–72 days old (Appendix 1).

3.2 BREEDING CONDITION, MOULT AND FEATHER WEAR

All the chicks encountered were fully feathered, although four had a patch of down on the nape and/or frons (forehead), indicative of chicks 30–53 days old (Miskelly 1999), and therefore should have been close to independence (age c.41 days; Miskelly 1990a). The youngest chick encountered would have come from an egg laid about 3–6 March, which is considerably earlier than the latest recorded breeding events for Chatham Island snipe (estimated lay date 2–5 April; Miskelly & Barlow 2001; Miskelly, Walker *et al*. 2006).

Seven of the 12 adult snipe transferred were in pre-basic (post-breeding) moult (see Appendix 1). This appeared to start with the innermost primaries (five birds were in primary moult). Five of the adult snipe handled had not started their pre-basic moult, but all but one had re-feathering brood patches, indicating that they had ceased breeding for the season. One bird had completed primary moult, but was still moulting body feathers.

Eight of the 12 adult snipe had broken tail feathers indicative of hakawai aerial displaying (Miskelly 1987, 2005; Miskelly, Bell *et al*. 2006). This was more prevalent among males (80%) than females (58%). No hakawai displays were heard during our one night on Rangatira (27 April; last quarter of the moon). Hakawai displays are most prevalent around and soon after the full moon (Appendix 2), probably because there are fewer petrels flying on bright, moonlit nights, and the snipe can see them to avoid mid-air collisions.

3.3 WEIGHT CHANGES IN CAPTIVITY

There was no significant change in bodyweights of snipe during the 13–19 hours that they were in captivity (Table 3; $t = 0.61$, $P = 0.55$). However, individual snipe varied between losing 7.6% and gaining 13.7% of their capture weight (mean 0.7% lighter). There was no evidence that the length of time snipe were held captive affected their bodyweight (Fig. 1). Eleven birds were lighter than their capture weight when transferred, and seven were heavier.

TABLE 3. CAPTURE AND RELEASE WEIGHTS FOR 20 CHATHAM ISLAND SNIPE.

BAND NUMBER	AGE	SEX	TIME IN CAPTIVITY (HOURS:MINUTES)	CAPTURE WEIGHT (g)	RELEASE WEIGHT (g)	PERCENTAGE CHANGE
D-182968	Adult	Male	18:40	77	76	-1.3
D-182973	Adult	Male	17:15	75	74	-1.3
D-182974	Adult	Male	17:00	82	78	-4.9
D-182975	Adult	Male	16:40	78	74	-5.1
D-182980	Adult	Male	15:15	66	65	-1.5

BAND NUMBER	AGE	SEX	TIME IN CAPTIVITY (HOURS:MINUTES)	CAPTURE WEIGHT (g)	RELEASE WEIGHT (g)	PERCENTAGE CHANGE
D-182969	Adult	Female	18:25	82.5	83	0.6
D-182976	Adult	Female	16:20	75	76	1.3
D-182977	Adult	Female	16:05	86	82	-4.7
D-182982	Adult	Female	14:40	92	85	-7.6
D-182985	Adult	Female	13:50	72.5	75	3.4
D-182986	Adult	Female	13:30	84	80	-4.7
D-182987	Adult	Female	13:15	82	–	–
D-182970	Juvenile	–	18:05	74.5	76	2.0
D-182971	Juvenile	–	17:50	63	62.5	-0.8
D-182972	Juvenile	–	17:30	69.5	71	2.2
D-182978	Juvenile	–	15:50	74	73	-1.4
D-182979	Juvenile	–	15:30	71	73	2.8
D-182981	Juvenile	–	14:55	56	55	-1.8
D-182983	Juvenile	–	14:25	66	66	0
D-182984	Juvenile	–	14:05	73	83	13.7

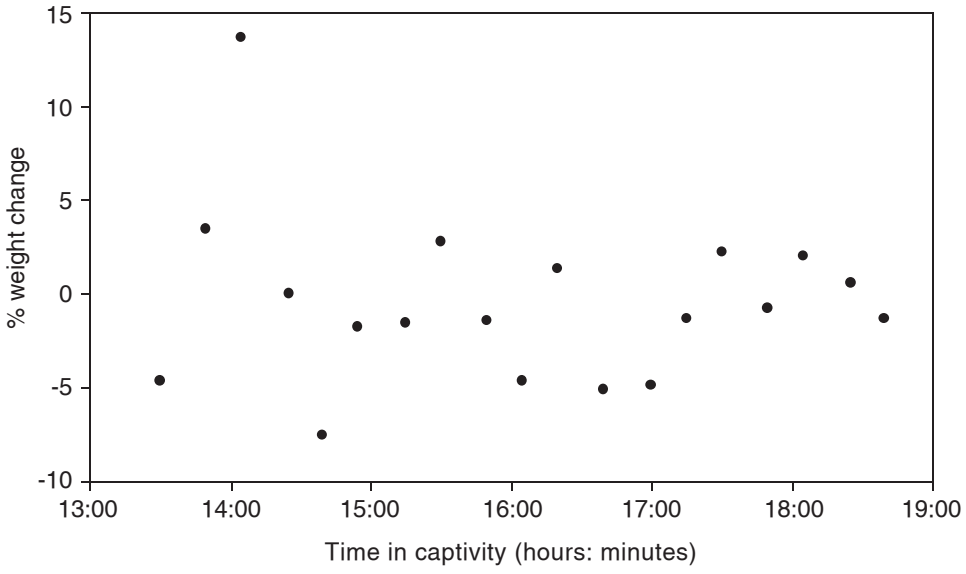

Figure 1. Relationship between the length of time Chatham Island snipe were in captivity and changes in their bodyweight between capture and release.

3.4 FOOD CONSUMPTION WHILST IN CAPTIVITY

Each snipe had its food tray replenished with 50 mealworms 2–3 times, with the first 12 birds captured receiving new food trays about 0145 hrs on 28 April, and all 20 birds receiving new food trays at 0815 hrs. Therefore each bird had access to 100–150 mealworms during the 13–19 hours that they were in captivity.

The total number of mealworms consumed by each bird varied from 55 to 147 (Table 4), and neither the total number of mealworms consumed, nor the number consumed per hour were strongly correlated with measured changes in bodyweight (Figs 2 & 3).

TABLE 4. MEALWORM CONSUMPTION BY CAPTIVE CHATHAM ISLAND SNIPE.

Each bird was provided with 50 mealworms on 2–3 occasions. The first 12 birds received mealworms between 2030 and 2400 hrs on 27 April. The number under 'Tray' shows the number of mealworms remaining in the food tray at the time above. The number under 'Box' shows the number of mealworms hiding under the food tray or under the flaps of the box after the snipe was released. These mealworms were unlikely to have been accessible to a foraging snipe, while any remaining in the food trays would have been.

				MEALWORMS REMAINING / TIME				
				0145	0815	1430–1530		
BAND NO.	COMBN	AGE	SEX	TRAY	TRAY	TRAY	BOX	% WEIGHT CHANGE
182968	M-RW	Adult	Male	36	1	3	3	-1.3
182969	RY-M	Adult	Female	1	0	2	0	0.6
182970	M-RG	Juvenile	Unknown	37	33	0	1	2
182971	M-RB	Juvenile	Unknown	0	6	0	0	-0.8
182972	M-WR	Juvenile	Unknown	21	39	0	0	2.2
182973	M-WY	Adult	Male	34	47	8	3	-1.3
182974	M-WG	Adult	Male	2	4	1	0	-4.9
182975	M-WB	Adult	Male	1	41	9	1	-5.1
182976	M-YR	Adult	Female	3	1	0	1	1.3
182977	YW-M	Adult	Female	20	13	11	1	-4.7
182978	M-YG	Juvenile	Unknown	22	3	14	9	-1.4
182979	M-YB	Juvenile	Unknown	14	3	0	0	2.8
182980	M-GR	Adult	Male	–	0	0	0	-1.5
182981	M-GW	Juvenile	Unknown	–	3	1	0	-1.8
182982	GY-M	Adult	Female	–	3	4	9	-7.6
182983	M-GB	Juvenile	Unknown	–	0	2	1	0
182984	M-BR	Juvenile	Unknown	–	4	0	0	13.7
182985	BW-M	Adult	Female	–	3	0	1	3.4
182986	BY-M	Adult	Female	–	30	13	2	-4.7
182987	BG-M	Adult	Female	–	0	2	1	–

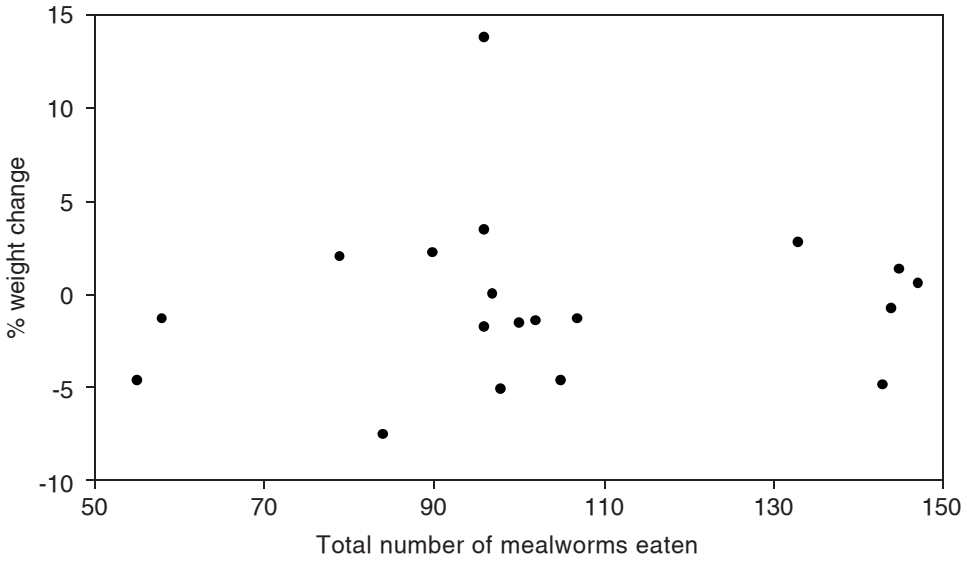

Figure 2. Relationship between the total number of mealworms eaten by captive Chatham Island snipe and changes in their bodyweight between capture and release.

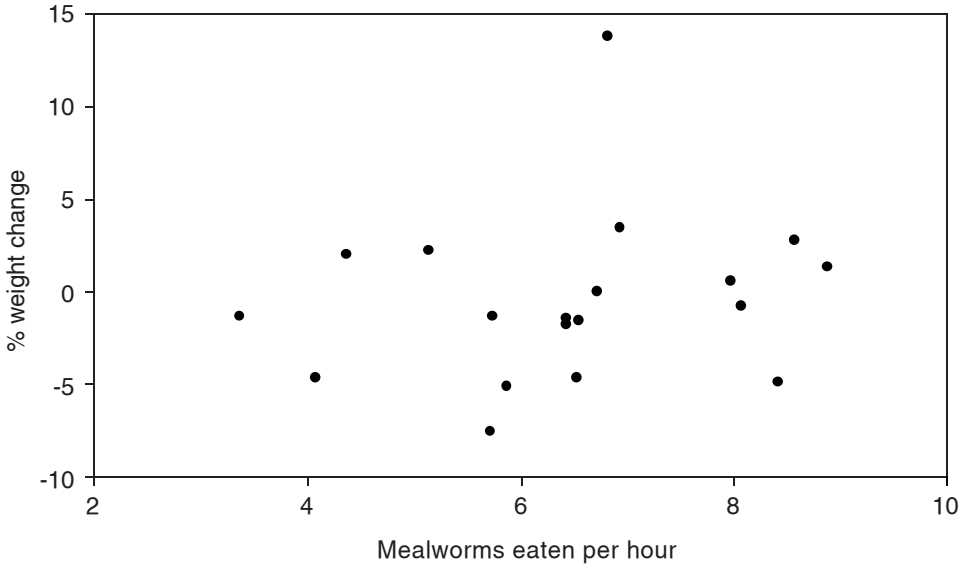

Figure 3. Relationship between the number of mealworms eaten per hour by captive Chatham Island snipe and changes in their bodyweight between capture and release.

3.5 POST-RELEASE OBSERVATIONS

Fifteen birds walked off into the dense undergrowth on release on 28 April, and the other five flew up above the canopy. It was not possible to see whether these birds landed within the covenant, or whether they flew beyond the predator-proof fence. No attempt was made to search for snipe within the covenant during the first 48 hours, to give them time to settle (the risk being that nervous birds could fly beyond the predator-fence if disturbed, compared to typical snipe behaviour of walking or running away from disturbance).

The first post-release sighting was a bird with a white band seen outside the fence, trying to get back in on 29 April 2008. The bird was seen by Kenny Dix while inspecting the fence for storm damage. It was on the seaward side of the fence, near and to the north of the Chatham petrel colony, at a point where the fence has an interior angle. The bird flew off towards the north, still outside the fence.

On the morning of 30 April several observers (including Kenny Dix and Colin Miskelly) returned to the site and found a different bird outside the fence at the same point. M-GB was a juvenile that had walked off into the undergrowth in the company of an adult on release. CM netted the bird, which weighed 67.5 g (compared to capture and release weights of 66 g). It was released inside the fence near the Chatham petrel colony, where another snipe was heard calling by Dan Palmer.

A second snipe was noticed dead in the grass outside the fence near where M-GB was caught, about 5 metres from the fence. This adult male (M-RW) had flown on release, and may have been the bird seen by KD the day before it was found dead. It weighed 73.5× compared to a capture weight of 77 g and a release weight of 76 g. On necropsy, the bird was found to have severe bruising on the left shoulder where the humerus attaches, and the clavicle was broken (Noel Hyde email 23 Mar 2009). The injuries were consistent with the bird flying into a fence standard, which is plausible given where the bird was found.

After finding the two birds (one live, one dead) outside the fence, CM walked the entire perimeter of the fence on the morning of 30 April without seeing another snipe.

CM walked the main loop track within the covenant on the morning of 1 May without seeing or hearing snipe. That evening Dan Palmer heard a snipe call near the Chatham petrel colony. During a one hour slow walk around the loop track after dark (CM and Dave Houston), one snipe was seen (and flew) near the Chatham petrel colony. It had a yellow band on the left leg, which made it one of four possible adult females, but it was probably RY-M. One other probable snipe was heard moving through undergrowth near the hut.

Kenny Dix reported one snipe seen behind the hut within Ellen Elizabeth Preece Conservation Covenant about a month after the translocation, but was not able to see colour bands. Peter de Lange and Peter Heenan saw a snipe near the release site about 8 p.m. on 27 Nov 2008, but again failed to see any bands (Peter de Lange pers. comm.). Bird watchers who stayed at EEPCC during November 2008 walked the main tracks during the day, and at dusk, listening and looking for snipe; none was seen or heard (Annette Harvey and Peter Langlands pers. comm.).

4. Discussion

4.1 CHATHAM ISLAND SNIPE BREEDING SEASON

The 2007/08 breeding season had apparently ceased in early March (in terms of egg-laying), as the youngest chick we encountered was about 30 days old. Chatham Island snipe have a very long breeding season, potentially spanning late July to early April (Miskelly & Barlow 2001; Miskelly, Walker *et al*. 2006), but apparently ceased breeding earlier in 2008 than they did in 2000 and 2001 (Miskelly & Barlow 2001).

The absence of courting pairs of adult snipe, and the few territorial calls heard also indicated that breeding had ceased by late April 2008. This conclusion is supported by the number of adults captured that were in pre-basic moult.

The breeding season had apparently been successful, as we caught eight fully grown juveniles among the 20 birds translocated (which were effectively the first 20 birds that we were able to catch), and several other fully grown chicks accompanied by adults were seen.

4.2 CHATHAM ISLAND SNIPE PARENTAL CARE SYSTEM

The sighting of two fully grown chicks accompanied by a single adult on 27 April 2008 was extremely unusual. I have studied *Coenocorypha* snipe of five taxa during 582 days of field work over 14 breeding seasons, and had never previously seen any parental care arrangement other than a single adult accompanying a single chick. Unfortunately it was not possible to determine the sex of the attendant adult.

The typical parental care system for *Coenocorypha* snipe is for females to lay two large eggs in a ground-level nest well-concealed in dense vegetation. Incubation is shared; the brood is split at hatching, with each adult caring for a single chick until they are fully feathered. In Snares Island and Chatham Island snipe, the male took the first chick to leave the nest, and the female the second (Miskelly 1989b, 1990a, 1999; Miskelly, Walker *et al*. 2006).

The only known exceptions to the "two eggs, each adult cares for one chick independent of the other adult and chick" pattern are:

- A three-egg nest of Chatham Island snipe on Rangatira Island on 27 Dec 1971 (Les McPherson *in* Miskelly 1990a)
- A four-egg nest of Chatham Island snipe on Mangere Island on 15 Oct 1976 (Rod Morris *in* Miskelly 1990a)
- A pair of Chatham Island snipe with three recently hatched chicks on Rangatira Island in December 1979 (Hugh Robertson *in* Miskelly 1990a)
- A three-egg nest of Snares Island snipe found on North East Island on 11 Jan 1985 (CM pers. obs.) that was subsequently destroyed by a sooty shearwater (*Puffinus griseus*) scratching out a nest burrow (Miskelly 1990a)
- Two young Auckland Island snipe (*Coenocorypha aucklandica aucklandica*) chicks accompanied by a single adult on Ewing Island in December 1991 (Dave Barker *in* Miskelly, Walker *et al*. 2006)
- Two broods of three young Auckland Island snipe chicks accompanied by a single adult on Adams Island in January 1997 and 1998 (Jacinda Amey *in* Miskelly, Walker *et al*. 2006)
- Two fully-grown Chatham Island snipe chicks accompanied by a single adult on Rangatira Island on 27 Apr 2008 (reported here).

Other than the two 3-egg and one 4-egg nests, and three 3-chick broods reported above, the remaining 150+ completed clutches of *Coenocorypha* snipe found have contained two eggs as follows:

- 49 nests of Chatham Island snipe up until 1985 (Miskelly 1990a), with several dozen 2-egg nests reported in Rangatira and Mangere Island hut logs since, but records not collated
- 55 nests of Snares Island snipe (Miskelly 1990a)
- 23 nests of Auckland Island snipe (Miskelly, Walker *et al*. 2006)
- 13 nests of Antipodes Island snipe (*C. aucklandica meinertzhagenae*) (Miskelly, Walker *et al*. 2006)

- 1 nest of Campbell Island snipe (Miskelly, Walker *et al*. 2006)
- 8 nests of Stewart Island snipe (Miskelly & de Lange 2006).

4.3 HAKAWAI AERIAL DISPLAYING

We did not hear any snipe aerial displays during our one night ashore, but 8 of the 12 adult snipe handled had tail feather wear consistent with them having performed hakawai aerial displays.

Hakawai aerial displaying is mainly performed on bright moon-lit nights on or soon after the full moon. The best data for Chatham Island snipe was collected on Rangatira Island by Tansy Bliss and Richard Kinsey during February–March 2007 (in lit. to Colin Miskelly). CM was present on Rangatira on the nights of 21 & 22 Feb 2007 (dark moon phase) and did not hear hakawai. TB & RK first heard hakawai on 24 Feb 2007 (4 displays, waxing moon). The displays peaked during 4–8 March (immediately after the full moon on 3 March), with ten or more displays heard per night (Appendix 2).

4.4 COMPARISON WITH PREVIOUS CAPTIVITY TRIALS

This was the first trial where snipe were held in translocation boxes and fed on mealworms. During recent trials, snipe have been held in aviaries with access to unlimited quantities of mealworms before release or translocation (Miskelly & Barlow 2001; Charteris & Miskelly 2005). Chatham Island snipe held in an aviary for 3–12 days were released at a mean weight 10.6% above capture weight ($t=2.99$, $P=0.015$). Snares Island snipe held for 3–5 days were translocated at a mean weight 0.1% below capture weight ($t=0.09$, $P=0.93$, not significant). We found no significant change in weights (mean release weight 0.7% below capture weight).

It is likely that the Chatham Island snipe would have been released at higher weights if more mealworms had been provided before translocation. Fifteen of the 20 birds were found to have fewer than 5 mealworms remaining in their food trays on release, and none had more than 14 mealworms remaining (of the 50 supplied about 6 hours earlier). It was not expected that the translocation would take so long. With hindsight, either more mealworms should have been provided at the morning feed, or provision should have been made for the food trays to be replenished shortly before the birds were uplifted from Rangatira Island.

4.5 SNIPE TRANSLOCATION TO ELLEN ELIZABETH PREECE CONSERVATION COVENANT

The 20 snipe were all considered to be in good condition at release on 28 April 2008, although five flew on release, and may have left the fenced covenant. One of the birds that walked into dense undergrowth

on release was found outside the fence 2 days later, indicating that some birds dispersed over the fence some time after release.

The paucity of sightings of snipe after release may have been to a combination of low numbers translocated, dispersal beyond the fence, and the low number of adult males translocated. Adult male snipe call more often than females or juveniles. One of the five adult males translocated was found dead outside the fence 2 days later, and so a maximum of four adult males could have remained within the covenant.

Snipe can be difficult to detect when at low densities, and it is possible that snipe are still present within the predator-fenced portion of Ellen Elizabeth Preece Conservation Covenant at the time of writing (11 months later). A survey for snipe using a bird-locater dog should be considered before there are any further attempts at translocating snipe to EEPCC.

5. Recommendations

1. A survey for snipe within Ellen Elizabeth Preece Conservation Covenant, using a bird-locater dog, should be undertaken as soon as practicable.
2. The results of the dog survey should be used to guide any further translocation effort, particularly in relation to the number of birds found, and the age and sex of any birds found.
3. If fewer than ten snipe are detected in EEPCC, a second translocation should be attempted.
4. If fewer than five banded snipe are detected in EEPCC, use of transmitters to monitor snipe movements after release should be considered.
5. Chatham Island snipe can be maintained in good condition on cultured mealworms when inside translocation boxes, provided adequate numbers of mealworms are supplied. It should be possible to extend the holding period to 40 hours (from the maximum 19 hours trialled in 2008) without undue risk to the birds.
6. If genetic samples are required from snipe (e.g. for DNA sexing), plucking of breast feathers is not guaranteed to provide sufficient DNA for analysis; blood samples are guaranteed to work, otherwise larger feathers (e.g. from the wing) should be used.

6. Acknowledgements

This snipe translocation could not have occurred if Ellen Elizabeth Preece Conservation Covenant wasn't ready to receive them. Thanks are due to the owners of the covenant (John & Bridget Preece and Greg & Karen Preece), the Pitt Island community and Chatham Islands Area, Department of Conservation for the commitment that they have made to restoring the covenant and keeping it free of cats, weka and pigs. Boat transport to and from Rangatira Island was provided by Glen King (*F.V. Acheron*) and Robert (Ruka) Lanauze (*F.V. Mary Ellen II*); particular thanks to Ruka for picking us up in difficult conditions that undoubtedly would have meant a stay of many days duration if we hadn't left when we did. Thanks also to DOC's Pitt Island ranger Kenny Dix for his organising and assistance once we got to Pitt Island.

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Appendix 1

MEASUREMENTS OF CHATHAM ISLAND SNIPE HANDLED ON RANGATIRA 27–28 APRIL 2008

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 1987, 2005; Miskelly, Bell *et al.* 2006). 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, and N = new feather. Superscript numbers give the number of feathers in each category, numbered from the innermost primary outwards to the tenth primary.

A. ADULT MALES

BAND NO.	COMBN	WEIGHT	BILL	TARSUS	MTC	WING	TAIL	LEG COLOUR	HAKAWAI	COMMENTS
182968	M-RW	77	45.1	23.7	30.6	103	31.9	Yellowish	Yes	Brood patch re-feathering
182973	M-WY	75	44.2	22.3	30.0	99	32.2	Yellowish	Yes	$N^4 4^1 3^1 1^1 O^2$ Brood patch feathered
182974	M-WG	82	42.4	23.3	29.6	102	29.8	Yellow	Yes	$N^2 4^1 3^1 2^1 1^1 O^4$ Plus body moult
182975	M-WB	78	42.6	22.2	28.7	101	33.4	Yellow-olive	No	No moult, brood patch feathered
182980	M-GR	66	41.7	22.5	29.3	101	31.2	Yellow	Yes	$2^1 O^9$ Brood patch bare

B. ADULT FEMALES

BAND NO.	COMBN	WEIGHT	BILL	TARSUS	MTC	WING	TAIL	LEG COLOUR	HAKAWAI	COMMENTS
182969	RY-M	82.5	48.7	24.1	31.5	103	25.1	Olive	Yes	Brood patch re-feathering
182976	M-YR	75	45.0	23.6	31.9	102	34.0	Yellow-olive	Yes	Brood patch re-feathering
182977	YW-M	86	46.6	24.4	31.8	104	32.1	Olive	No	No moult, brood patch feathered
182982	GY-M	92	49.2	24.3	32.3	102	30.4	Yellowish	Yes	$4^1 3^2 2^1 O^6$ Brood patch feathered
182985	BW-M	72.5	45.1	24.1	30.8	101	29.1	Olive-yellow	No	N^{10}, some body moult
182986	BY-M	84	44.0	27.1	30.8	99	27.1	Olive	No	Some body moult
182987	BG-M	82	48.0	22.7	31.1	102	31.3	Yellow-olive	Yes	$4^1 1^1 O^8$ Brood patch re-feathering

C. JUVENILES

BAND NO.	COMBN	WEIGHT	BILL	TARSUS	MTC	WING	TAIL	LEG COLOUR	COMMENTS
182970	M-RG	74.5	43.4	24.0	30.8	99	32.5	Olive	Trace of down on nape. Est. age 51 days
182971	M-RB	63	37.4	23.2	29.7	97	29.1	Olive	Down on nape & frons. Est. age 38 days
182972	M-WR	69.5	43.8	24.2	30.2	102	32.4	Yellow-olive	No down. Est. age 54 days
182978	M-YG	74	41.1	21.7	28.8	98	29.8	Olive	No down. Est. age 46 days
182979	M-YB	71	44.7	24.2	31.0	101	32.0	Olive	No down. Est. age 72 days
182981	M-GW	56	34.1	22.5	29.1	95	27.4	Olive	Down on nape & frons. Est. age 30 days
182983	M-GB	66	41.8	24.4	31.0	97	28.2	Olive	Down on nape & frons. Est. age 43 days
182984	M-BR	73	41.5	23.1	31.1	101	32.5	Olive	No down. Est. age 49 days

Appendix 2

HAKAWAI AERIAL DISPLAYING BY CHATHAM ISLAND SNIPE IN RELATION TO MOON PHASE, FEBRUARY–MARCH 2007

Observations were made only between 21 February and 11 March (vertical dashed lines). Data collected by Colin Miskelly (21 & 22 February) and Tansy Bliss and Richard Kinsey (remaining data).