

Breeding ecology of three subantarctic snipes (genus *Coenocorypha*)

COLIN M. MISKELLY

Wellington Conservancy, Department of Conservation, PO Box 5086, Wellington, New Zealand
cmiskelly@doc.govt.nz

KATH J. WALKER

549 Rocks Road, Nelson, New Zealand
kwalker@doc.govt.nz

GRAEME P. ELLIOTT

549 Rocks Road, Nelson, New Zealand
gelliott@doc.govt.nz

Abstract Information on the breeding ecology of Auckland Is snipe (*Coenocorypha aucklandica aucklandica*), Antipodes Is snipe (*C. aucklandica meinertzhagenae*), and Campbell Is snipe (*Coenocorypha* undescribed sp.) is summarised. Auckland Is snipe laid between Sep and Jan (peak late Nov), whereas Antipodes Is snipe laid from Aug to early Nov, with a 2nd pulse of breeding from late Jan to Mar. The 5 breeding events recorded for Campbell Is snipe were from clutches estimated to have been commenced between 11 Nov and 8 Jan. All 3 taxa laid 2 large eggs (each 19-22% of female body weight) in nests that were well concealed amid dense vegetation. Chicks left the nest soon after hatching, with each chick cared for by a single adult. Exceptions to this were adult Auckland Is snipe seen with 2 or 3 young chicks on 3 occasions. Chicks remained with adults until down-free and capable of flight. The only notable differences from the more thoroughly-studied Snares Is snipe (*C. aucklandica huegeli*) and Chatham Is snipe (*C. pusilla*) were the earlier breeding by Antipodes Is snipe, and its bimodal breeding season. Snipe were encountered more frequently on the Auckland Is (0.6 person-h⁻¹ of walking on Adams I) than on Antipodes I (0.2 person-h⁻¹) and this was also reflected in the frequency with which breeding events were recorded. We suggest that the impact of house mice (*Mus musculus*) on the invertebrate food supply available for snipe is the most plausible explanation for the much lower abundance of snipe on Antipodes I.

Miskelly, C.M.; Walker, K.J.; Elliott, G.P. 2006. Breeding ecology of three subantarctic snipes (genus *Coenocorypha*). *Notornis* 53(4): 361-374.

Keywords New Zealand snipe; *Coenocorypha aucklandica*; Auckland Island; Antipodes Island; Campbell Island; breeding ecology; Robert Alexander Falla

INTRODUCTION

New Zealand snipe (*Coenocorypha* spp) are arguably the most characteristic birds of the New Zealand biogeographic region. They formerly occurred on all major vegetated island groups bar the Kermadec Islands and Macquarie Island, and were all-but confined to the region (but see Worthy 2003). Paradoxically, snipe are among the least known New Zealand birds; they are unknown to the general public, and few details of their life histories

are available to ornithologists and conservation managers.

The first *Coenocorypha* snipe to receive any attention by New Zealand naturalists was the now extinct Stewart Is snipe (*C. aucklandica iredalei*). Visits to Big South Cape I (off the southwest coast of Stewart I) by Herbert Guthrie-Smith in 1923, and Edgar Stead and Major Robert Wilson in 1931 produced information on nests and some details of chick care (Guthrie-Smith 1936; Wilson 1959; Higgins & Davies 1996; Miskelly & de Lange 2006). Now, the most intensively studied *Coenocorypha* taxa are the Snares Is snipe (*C. a. huegeli*) and Chatham Is

snipe (*C. pusilla*), with 56 and 51 nests, respectively, described by 1990, along with other details of their breeding ecology (Miskelly 1989, 1990, 1999a, b; Higgins & Davies 1996).

The 3 southernmost *Coenocorypha* snipe remain the most poorly known of the extant taxa. At the time that texts were prepared for the *Handbook of Australian, New Zealand and Antarctic birds* (Higgins & Davies 1996), only 1 nest had been described for the Auckland Is snipe (*C.a. aucklandica*) and 3 for the Antipodes Is snipe (*C.a. meinertzhagenae*); the Campbell Is snipe (*Coenocorypha* undescribed sp.) had yet to be discovered (Barker *et al.* 2005). Since then, long and frequent visits to Adams I (Auckland Is) and Antipodes I to study Gibson's and Antipodean wandering albatrosses (*Diomedea gibsoni* and *D. antipodensis*) (Walker & Elliott 1999, 2005, 2006; Elliott & Walker 2005) and the use of bird-locator dogs to survey for flightless teal (*Anas aucklandica*, *A. nesiotis*) and snipe on Ewing, Rose, and Enderby Is (Auckland Is) and on Campbell I have led to the collection of many more data. Here we describe details of 71 breeding events by Auckland Is snipe, 32 by Antipodes Is snipe, and 5 by Campbell Is snipe, based on 39 nests found and 71 chicks measured or described between 1962 and 2006, and compare these data with what is known for the Snares Is snipe and Chatham Is snipe.

METHODS

Most of the records reported here were incidental sightings made during fieldwork on other birds or mammals. Exceptions were surveys for snipe on Antipodes I (2025 ha) in 1990, Rose I (75 ha) and Enderby I (710 ha) in Dec 2000, and on Enderby I and Campbell I (11,268 ha) in Jan 2006 (Miskelly & Fraser 2006), and collection of blood and feather samples from snipe made during the course of research on albatross on Adams I (10,119 ha) and Antipodes I in Jan-Feb 2001, and on Adams I in Jan-Feb 2006.

The authors and co-workers were present at the study sites (Fig. 1) during the following dates: 2 Nov-7 Dec 1989 Adams I (GE, KW, Rhys Buckingham), 12-16 Oct 1990 Antipodes I (CM), 5-25 Feb 1991 Adams I (GE, KW), 7 Dec 1991 - 17 Jan 1992 Ewing I (57 ha), Rose I, Ocean I (12 ha) and Enderby I (Dave Barker, Murray Williams), 16-27 Jan 1993 Disappointment I (566 ha) (GE, KW), 28 Jan-21 Feb 1993 Adams I (GE, KW), 22 Jan-17 Feb 1994 Adams I (Peter Dilks), 13 Feb-24 Mar 1994 Antipodes I (Jacinda Amey, Gus McAllister), 29 Dec 1994 - 26 Feb 1995 Adams I (GE, KW), 9 Feb-27 Mar 1995 Antipodes I (Jacinda Amey, Gus McAllister), 30 Oct-26 Nov 1995 Antipodes I (Reg Cotter, Andy Grant, Terry Greene, Mike Imber, Pete McClelland, Graeme Taylor, Alan Tennyson), 4-17 Dec 1995 Adams I (Mike Aviss, Pete Gaze), 20 Jan-9 Mar 1996 Antipodes I (GE, KW, Richard Cuthbert, Les Moran), 22-28 Nov 1996 Rose I (Dave

Barker, Murray Williams), 16 Dec 1996 - 18 Feb 1997 Adams I (Jacinda Amey, Gus McAllister), 3 Jan-27 Feb 1997 Antipodes Island (GE, KW), 1-14 Nov 1997 Adams I (Gus McAllister, Janice Molloy), 9 Nov 1997 Jacquemart I (19 ha), Campbell I (Dave Barker, Jeremy Carroll, James Fraser), 11 Jan-1 Mar 1998 Adams I (Jacinda Amey, Gus McAllister), 15 Jan-2 Mar 1998 Antipodes I (GE, KW), 3 Jan-6 Feb 1999 Adams I (GE, KW), 20 Jan-26 Feb 1999 Antipodes I (Sheryl Hamilton, Al Wiltshire), 30 Nov-9 Dec 1999 Adams I (GE, KW), 7 Jan-17 Feb 2000 Adams I (Rhys Buckingham, Josh Kemp), 3 Jan-14 Feb 2000 Antipodes I (Sheryl Hamilton, Al Wiltshire), 17-24 Feb 2000 Adams I (Sheryl Hamilton, Al Wiltshire), 7-16 Dec 2000 Rose I and Enderby I (Dave Barker, Jeremy Carroll, Murray Willans), 19 Dec 2000 - 14 Feb 2001 Antipodes I (GE, KW), 29 Dec 2000 - 7 Feb 2001 Adams I (Sheryl Hamilton, Al Wiltshire), 24 Apr-10 Jun 2001 Antipodes I (Elizabeth Bell, Mike Imber), 15-25 Jun 2001 Adams I (GE, KW), 13 Dec 2001 - 3 Feb 2002 Adams I (GE, KW), 4 Jan-12 Feb 2002 Antipodes I (Josh Kemp, Chris Rickard), 14 Dec 2002 - 7 Feb 2003 Adams I (GE, KW), 28 Jan-4 Mar 2003 Adams I (Colin O'Donnell, Jane Sedgely), 4 Jan-13 Mar 2003 Antipodes I (Kerri-Anne Edge, Erica Sommer), 13 Dec 2003 - 5 Mar 2004 Adams I (Josh Kemp), 30 Dec 2003 - 27 Feb 2004 Antipodes I (GE, KW), 15 Dec 2004 - 15 Jan 2005 Adams I (GE, KW), 15 Jan-30 Mar 2005 Adams I (Phil Tisch, Chrissey Wickes), 22 Jan-14 Apr 2005 Antipodes I (Sarah Fraser, Chris Rickard), 20 Feb-16 Mar 2005 Campbell I (Dave Barker, Hannah Edmonds), 4 Jan-16 Feb 2006 Adams I (GE, KW), 6 Jan 2006 Enderby I (CM, James Fraser), 7-15 Jan 2006 Campbell I (CM, James Fraser), and 15 Feb-10 Mar 2006 Campbell I (Dave Barker, James Fraser).

Dogs trained to locate teal (*Anas* spp.) were used to find snipe and their nests on Ewing I (Dec 1991 - Jan 1992), Rose I (Dec 1991, Nov 1996, Dec 2000), Ocean I (Dec 1991), Jacquemart I (Nov 1997), Enderby I (Dec 1991-Jan 1992, Dec 2000, Jan 2006), and Campbell I (Mar 2005, Jan-Mar 2006). Except for Dec 2000 and Jan 2006, the dogs and their handlers focused on Auckland Is teal (*A. aucklandica*) and Campbell Is teal (*A. nesiotis*); records of snipe were incidental. Apart from Antipodes I in Oct 1990, the remaining 1989-2006 records of nests and chicks reported here were the results of chance encounters by field workers studying Auckland Is rail (*Dryolimnas muelleri*) and Gibson's wandering albatross (Adams and Disappointment Is), and Antipodean wandering albatross, grey petrel (*Procellaria cinerea*), and gadfly petrels (*Pterodroma* spp.) (Antipodes I). Notes and photographs of a snipe nest and chicks seen by the New Zealand sea lion (*Phocarctos hookeri*) research team on Enderby I between 1999 and 2006 were provided by Murray Blake, Louise Chilvers, Nadine Gibbs, and Bruce

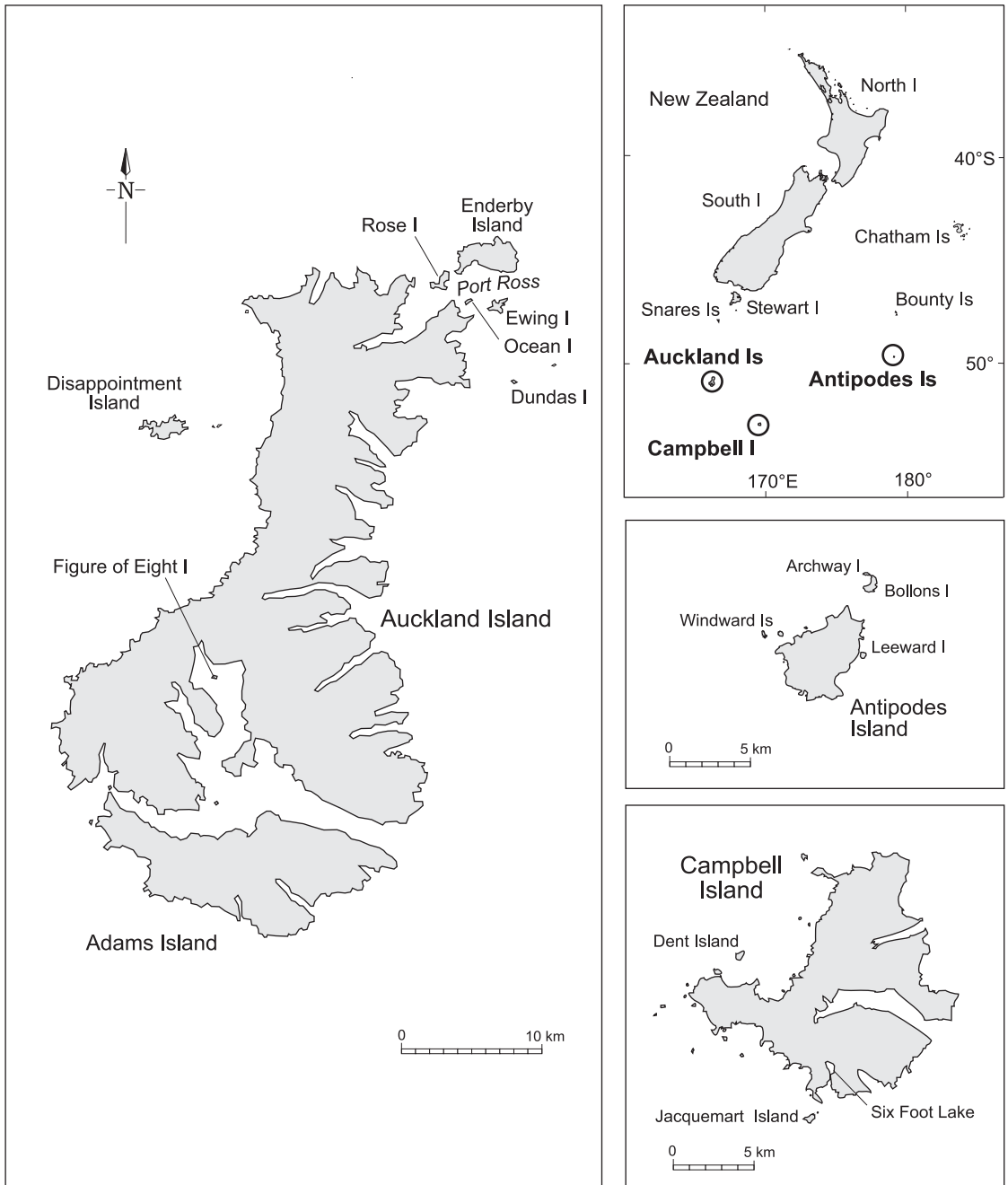


Fig. 1 Auckland Is, Antipodes Is, and Campbell Is, showing locations mentioned in the text.

Robertson (pers. comm.), but these records have not been included in analyses of search effort.

During 19 Dec 2002 - 27 Feb 2003, 17 Dec 2003 - 28 Feb 2004, 15 Jan-30 Mar 2005, and 4 Jan-16 Feb 2006 we recorded snipe encounter rates (birds

seen person⁻¹h⁻¹) during albatross research in tussock grassland on Adams I. Similar records of snipe encounter rates were made on the plateau of Antipodes I during albatross research 18 Jan-12 Feb 2002, and again during 9 Jan-12 Mar 2003.

Table 1 Encounter rates for snipe on Adams I (Auckland Is snipe, *Coenocorypha a. aucklandica*) and Antipodes I (Antipodes Is snipe, *C. aucklandica meinertzhageni*)

Site	Year	Search effort (person-h)	No. of snipe seen	Snipe person-h ⁻¹
Adams I	2002/03	77.3	61	0.79
	2003/04	147.9	103	0.70
	2004/05	48.5	28	0.58
	2005/06	177	83	0.47
Antipodes I	2002	203	39	0.19
	2003	84.7	12	0.14

Few nests were checked more than once, and we were unable to obtain any information on intervals between eggs or on incubation periods. Eggs in 14 nests were measured to the nearest 0.1 mm, and photographs or descriptions, or both, were taken of 31 nests. None of the 22 chicks measured was handled more than once. Ages for a further 48 chicks (or broods) were estimated based on descriptions of size and plumage development. We calculated hatching and laying dates by assuming that growth rates and plumage development were similar to those known for Snares Is snipe (Miskelly 1999a), and that inter-egg interval and incubation period were the same as for Snares Is snipe (3 d, and 22 d, respectively; Miskelly 1990). Fresh egg masses were calculated using the equation: $M = 0.000526 \times L \times B^2$ derived for Snares Is snipe (Miskelly 1989), where M is initial egg mass (g), L is egg length (mm) and B is maximum egg breadth (mm). For most nests where there was no information on hatch date, laying date for the 1st egg was estimated by subtracting 12 d from the date the nest was found. For 4 nests where eggs were measured and weighed when found, laying dates were estimated by calculating fresh egg mass from the equation above and assuming a constant rate of 0.18 g d⁻¹ water loss during incubation (Miskelly 1989).

Data collected from a snipe chick handled on Ewing I in Dec 1962 (R.A. Falla notes; Alexander Turnbull Library MS Papers 2366 Folder 305) and for a snipe nest found on Ewing I in Jan 1966 (Appendix 1; Ron Ordish in lit.), 1 found on Disappointment I in Jan 1973 (Ron Nilsson in lit.), and 3 nests found on Antipodes I in Nov 1978 (Brian Bell & Rowley Taylor, in lit.) are also presented.

Egg measurements are given as mean \pm standard deviation (sample size, minimum - maximum).

RESULTS

Snipe distribution and encounter rates

We found snipe on 6 islands in the Auckland Is archipelago, and observed nests or chicks on 5 of these. Snipe footprints and probe holes were found on 2 other islands in 1985 (see below). Snipe are absent from the main Auckland I (50,990 ha),

presumably as a result of predation by feral cats (*Felis catus*) and feral pigs (*Sus scrofa*), both of which have been present since the early 1800s (Challies 1975; Fitzgerald 1990). Until recently, the strongholds for Auckland Is snipe were Adams I, Disappointment I, and Ewing I. However, snipe have increased greatly in abundance and distribution on islands in Port Ross, in addition to Ewing I, following the eradication of pest mammal species.

Enderby Island is the type locality for Auckland Is snipe (and hence the genus *Coenocorypha*), following collection of specimens there in Nov 1840 (McCormick 1884). At least 7 species of introduced mammals — feral dogs (*Canis familiaris*), feral pigs, rabbits (*Oryctolagus cuniculus*), mice (*Mus musculus*), feral cattle (*Bos taurus*), feral sheep (*Ovis aries*), feral goats (*Capra hircus*) — were present on Enderby I between 1842 and 1900 (Taylor 1971). However, only mice, rabbits, and cattle were reported after 1900. There was 1 report of snipe on Enderby I in 1891 (R.A. Wilson in Taylor 1971), then no further sightings until Soper (1976) reported them as present following his visits in Dec 1972 to Feb 1973. Snipe were reported occasionally from Enderby I over the following 20 years (e.g., 1, 18 Feb 1985, Rowley Taylor in lit.; 2 seen during 3 days of dog searching 30 Dec 1991 - 1 Jan 1992, Dave Barker & Murray Williams pers. comm.), but it is unclear whether there was a resident population. Feral cattle were eradicated from Enderby I during 1991-93, and rabbits and house mice in Feb 1993 (Torr 2002). Snipe have been reported regularly from the island ever since. We found snipe to be abundant on Enderby I during brief surveys with dogs on 19 Dec 2000 and 6 Jan 2006. Encounter rates in short tussock and *Oreobolus* moorland were similar to encounter rates in the tall *Poa litorosa* on Rose I, e.g., 1 encounter for every 7.5 min of searching in Jan 2006. Snipe chicks were seen near the hut in each season from 1998/99 to 2004/05 (Louise Chilvers & Nadine Gibbs, pers. comm.), and a nest was found on 12 Feb 2006 (Murray Blake, pers. comm.).

Rabbits were present on Rose I from 1850 until their eradication in 1993 (Torr 2002). The vegetation on Rose I was also modified by fire, and (between

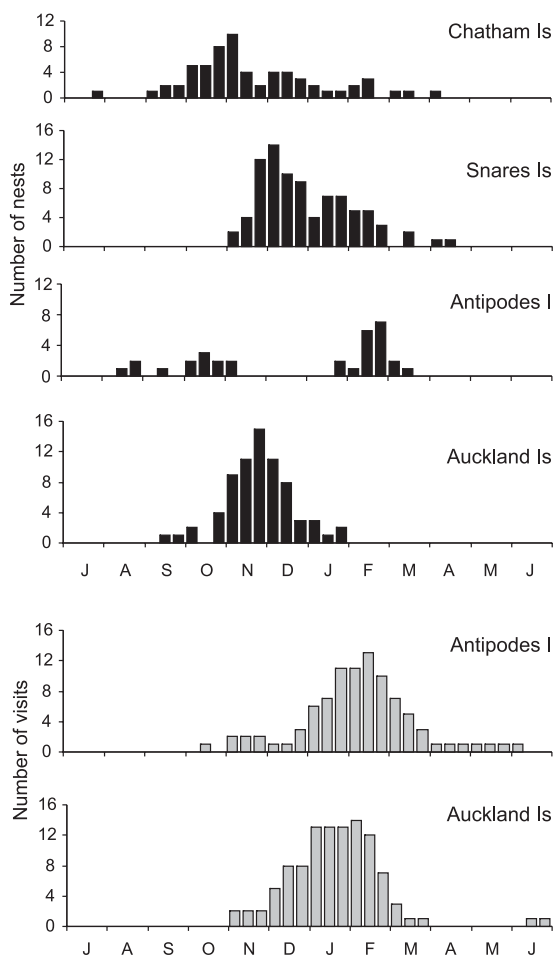


Fig. 2 Laying dates of Chatham Is snipe (*Coenocorypha pusilla*), Snares Is snipe (*C. aucklandica huegeli*), Antipodes Is snipe (*C. aucklandica meinertzhageni*), and Auckland Is snipe (*C. a. aucklandica*), with search effort shown for the 2 latter taxa. Data shown are the number of clutches estimated to have been commenced 10-d-period¹, with search effort shown as the number of years that observers were present for 1 or more days per 10-d-period. Labels on x-axis are months, starting at Jul.

1890 and 1920) grazing by sheep and cattle (Taylor 1971). Snipe were reported first on Rose I during 19–20 Feb 1985 (1 seen, 2 heard; Rowley Taylor in lit.), and several were seen and heard during 27–29 Nov 1989 (Moore & McClelland 1990). Six days of searching with a dog in Dec 1991 produced a total of only 4 snipe (1 on a nest), but snipe were extremely abundant there in Nov 1996, less than 4 years after rabbits were eradicated (Dave Barker & Murray Williams pers. comm). During 12 days of searching with 2 dogs in Dec 2000, 17 snipe were caught and 4 nests were found in two 10 ha survey blocks, and

many other snipe were seen (Dave Barker & Jeremy Carroll pers. comm).

An Auckland Is snipe was caught on nearby Ocean I on 15 Feb 1988 (Graeme Taylor in lit.), and Dave Barker and dog “Bob” also found snipe on Ocean I during 16–18 Dec 1991. No nests or chicks were seen during these 2 brief visits.

In addition to these 6 islands with resident snipe populations, tracks of snipe and their probe marks were plentiful in soft mud on Figure-of-Eight I (5.3 ha) in Carnley Harbour on 16 Feb 1985, and on Dundas I (3.9 ha) on 20 Feb 1985 (Rowley Taylor in lit.). A dog survey on Friday I (1.5 ha) and French I (1.8 ha) in Port Ross on 29 Dec 1991 failed to find any snipe (Dave Barker & Murray Williams, pers. comm.).

Within the Antipodes archipelago, our work was focussed on the main island. Snipe have been recorded previously on Bollons I (50 ha), Archway I (6.3 ha), and Inner Windward I (9.2 ha) (Bell 1979; Imber 1979; Taylor 2006), and they are likely to be present on the sheer-sided (and as-yet-unsurveyed) Leeward I (12.5 ha) and Outer Windward I (7.5 ha).

Our timed surveys on Adams I, Auckland Is, produced a mean encounter rate of 0.79 snipe per person-hour in 2002/03, 0.70 in 2003/04, 0.58 in 2004/05, and 0.47 in 2005/06 (Table 1). By comparison, the encounter rate for snipe on Antipodes I was only 29% of that on Adams I: 0.19 birds person-h⁻¹ in 2002, and 0.14 in 2003 (Table 1). Similarly, the number of breeding events recorded on Antipodes I was only 0.35 per 10 days of observer presence, as against 0.67 breeding events per 10 days of observer presence on the Auckland Is, despite observers apparently being present at the appropriate time to record breeding behaviour (Fig. 2). Note that a successful breeding event is detectable for at least 90 d after the 1st egg of a clutch is laid (Miskelly 1999a).

Snipe recolonising Campbell I were found to be breeding at both the outlet and the head of Six Foot Lake in Jan 2006 (Miskelly & Fraser 2006). Five chicks from 3 broods were handled (estimated ages 8–36 d), and 1 nest was found.

Nests

Active snipe nests were found between 8 Nov and 12 Feb on the Auckland Is, between 1 Nov and 24 Mar on Antipodes I, and 1 was found on Campbell I on 12 Jan (Table 2). Few detailed descriptions were made of nests, but all were on the ground, typically among dense vegetation. The following summaries are based on descriptions of 19 Auckland Is snipe nests (Ewing Island, 2; Disappointment I, 1; Rose I, 2; Adams I, 13; Enderby I, 1), 8 Antipodes Is snipe nests, and the single Campbell Is snipe nest. As the vegetation differed among the 7 islands, nest sites are described separately, by island.

Ewing I The predominant vegetation on Ewing I was a closed canopy of *Olearia lyalli* shrub-forest, with a

Table 2 Nest contents and estimated lay dates for Auckland Is snipe (*Coenocorypha a. aucklandica*; Ewing, Disappointment, Rose, Adams, Enderby Is), Antipodes Is snipe (*C. aucklandica meinertzhageni*), and Campbell Is snipe (*Coenocorypha* sp.).

Date found	Location	Contents	Estimated lay date
18 Jan 1966	Ewing I	2 eggs	05 Jan
06 Jan 1973	Disappointment I	1 egg	03 Jan
19 Dec 1991	Ewing I	1 egg	14 Dec
24 Dec 1991	Rose I	2 eggs	10 Dec
30 Dec 1994	Adams I	2 eggs	11 Dec
06 Dec 1995	Adams I	2 eggs	24 Nov
12 Dec 1995	Adams I	2 eggs	30 Nov
12 Dec 1995	Adams I	2 pipping eggs	18 Nov
14 Dec 1995	Adams I	2 eggs	02 Dec
08 Nov 1997	Adams I	2 eggs	27 Oct
01 Dec 1999	Adams I	2 eggs	19 Nov
06 Dec 1999	Adams I	2 eggs	24 Nov
10 Dec 2000	Rose I	2 eggs	26 Nov
14 Dec 2000	Rose I	2 eggs	30 Nov
15 Dec 2000	Rose I	2 eggs	01 Dec
16 Dec 2000	Rose I	2 eggs	12 Dec
06 Jan 2001	Adams I	2 eggs	25 Dec
10 Jan 2001	Adams I	2 eggs	17 Dec
11 Jan 2001	Adams I	2 eggs	22 Dec
15 Dec 2001	Adams I	2 eggs	03 Dec
28 Jan 2002	Adams I	2 eggs	16 Jan
19 Dec 2002	Adams I	2 eggs	07 Dec
03 Feb 2006	Adams I	1 chick + eggshell	09 Jan
08 Feb 2006	Adams I	2 eggs	27 Jan
12 Feb 2006	Enderby I	2 eggs	31 Jan
16 Nov 1978	Antipodes I	2 deserted eggs	-
23 Nov 1978	Antipodes I	2 eggs	09 Nov
24 Nov 1978	Antipodes I	1 egg + 1 chick	30 Oct
01 Nov 1995	Antipodes I	2 eggs	28 Oct
21 Feb 1998	Antipodes I	2 eggs	09 Feb
11 Feb 2001	Antipodes I	2 eggs	28 Jan
25 Feb 2005	Antipodes I	2 eggs	13 Feb
04 Mar 2005	Antipodes I	2 eggs	20 Feb
07 Mar 2005	Antipodes I	2 eggs	23 Feb
12 Mar 2005	Antipodes I	2 eggs	28 Feb
c.16 Mar 2005	Antipodes I	2 eggs	4 Mar
c.20 Mar 2005	Antipodes I	2 eggs	8 Mar
c.24 Mar 2005	Antipodes I	2 eggs	12 Mar
12 Jan 2006	Campbell I	2 eggs	8 Jan

central core of southern rata (*Metrosideros umbellata*) forest, and a narrow coastal fringe of *Poa foliosa* and *P. litorosa* tussock grassland (Williams 1995). The 1st Auckland Is snipe nest found (18 Jan 1966) was a deep saucer of *P. foliosa* leaves (external diameter c.19 cm) concealed among *P. foliosa* and *Leptinella*

plumosa at the edge of the *Olearia* shrub-forest (Appendix 1; Ron Ordish in lit., and photograph provided by Rowley Taylor). The remains of this nest are preserved in Te Papa Tongarewa Museum of New Zealand (MNZ 11944). A 2nd nest, found on 19 Dec 1991, was a shallow depression among

Olearia leaves in the middle of a sparse clump of *Asplenium obtusatum* fern under *Olearia* forest (Dave Barker & Murray Williams pers. comm.).

Disappointment I Disappointment I is covered mostly by dense *P. litorosa* tussock grassland. The snipe nest found on 6 Jan 1973 was under *P. litorosa* (Ron Nilsson in lit.).

Rose I Most of Rose I is covered with dense *P. litorosa* tussock grassland, but there is a small patch of rata forest (Taylor 1971). Five snipe nests found in Dec 1991 and 2000 were under *P. litorosa* (3 nests), under the sedge *Carex appressa*, and beneath *Histiopteris* fern under forest (Dave Barker & Jeremy Carroll pers. comm.).

Adams I Snipe occur all over Adams I, but because of the focus of our field activities, nests were found only among the Gibson's wandering albatross colonies in *Chionochloa antarctica* tussock grasslands at altitudes of 300-600 m. Twelve nests were cups of *C. antarctica* leaves amongst *C. antarctica* tussock (Fig. 3), but 3 were also sheltered by small shrubs of *Dracophyllum longifolium*, and 1 was under a small *Coprosma* shrub. The 13th nest was situated under a *Dracophyllum* shrub and consisted entirely of *Dracophyllum* needles.

Enderby I The only nest found (12 Feb 2006) was among a carpet of bidibidi (*Acaena minor*) and nettle (*Urtica australis*) under southern rata (*Metrosideros umbellata*) forest, about 10 m from the forest edge, near South East Point (Murray Blake, pers. comm.).

Antipodes I All 13 Antipodes Is snipe nests found were on the 80-200 m altitude plateau of Antipodes I itself, which has a predominant cover of low *P. litorosa* tussock interspersed with the shield fern *Polystichum vestitum* (Warham & Bell 1979). Seven of the 8 nests described were cups of *P. litorosa* leaves well concealed under either *P. litorosa* (3), or both *P. litorosa* and *P. vestitum* (4). One nest was also partially sheltered by water fern *Histiopteris incisa*, and another was noted as having fragments of *P. vestitum* in the bowl, in addition to *P. litorosa* leaves. The 8th nest was a shallow cup of *P. vestitum* stipes and fragments among a dense 30 cm-high *P. vestitum* clump, near the base of a small *P. litorosa* tussock (Fig. 3).

Campbell I The single snipe nest found on Campbell I was a 25 mm-deep bowl of *P. litorosa* leaves, with an internal bowl diameter of 110 mm (Fig. 3), and it was well concealed under a large *P. vestitum* growing intertwined with *P. litorosa*.

Eggs

Most nests found contained 2 eggs, or 1 egg and a chick (Table 2). The exceptions were 2 nests each found containing a single egg, on Disappointment I in Jan 1973 and on Ewing I in Dec 1991. Birds were sitting on these nests when they were found.

As there are no records of other *Coenocorypha* snipe incubating single eggs (Miskelly 1990, 1999a), we have assumed that these birds had just laid the 1st egg, or were in the process of laying their 2nd egg. The egg from the Disappointment I nest was collected (MNZ 17351; Te Papa Tongarewa Museum of New Zealand) and was recorded as being very fresh. The Ewing I nest was not checked subsequently (Dave Barker & Murray Williams, pers. comm.). Larger clutches are presumed to occur occasionally, as we know of 2 instances in which adult Auckland Is snipe were seen with 3 newly-hatched chicks (see below).

The eggs were olive-brown or mid to pale brown, and were heavily marked with spots and blotches of darker brown, especially around the widest part of the egg (Fig. 3). Auckland Is snipe eggs measured 43.5 ± 1.5 mm (15, 41.4 - 45.9 mm) by 31.3 ± 0.8 mm (15, 30.5 - 32.6 mm), and had an estimated fresh egg mass of 22.4 ± 1.6 g (15, 20.8 - 25.1 g) (Table 3). Each egg was c. 19% of adult female body weight (Table 4). The single egg measurement of 51×35 mm given for Auckland Is snipe by Oliver (1955) is far larger than any egg we have found; it was probably misidentified, but we have been unable to locate the egg. Antipodes Is snipe eggs measured 41.8 ± 1.5 mm (11, 39.8 - 44.1 mm) by 32.3 ± 0.9 mm (10, 30.8 - 33.4 mm), and had an estimated fresh egg mass of 22.9 ± 1.7 g (10, 20.6 - 25.4 g) (Table 3). Each egg was about 20% of adult female body weight (Table 4). Campbell Is snipe eggs measured 43.2 ± 1.6 mm (2, 42.1 - 44.3 mm) by 30.7 ± 0.2 mm (2, 30.5 - 30.8 mm), and had fresh egg masses of 22.1 ± 0.8 g (2, 21.5 - 22.7 g) (Table 3). Each egg was about 22% of mean adult female body weight (Table 4), and 20-21% of the bodyweight of the female found at the nest (107 g).

Both sexes incubated at the nest found on Ewing I in Jan 1966 (Appendix 1), but the incubation pattern was not determined for other nests.

Fate of nests

Outcomes were determined for only 16 of the 39 nests (Ewing I, 1; Rose I, 3; Adams I, 5; Antipodes I, 6; Campbell I, 1), and so we were unable to estimate overall nesting success. The few records that we have indicate a high level of nest failure.

The 1st nest found (on Ewing I in 1966) was observed until both eggs had hatched (Appendix 1). Both eggs in a nest found on Adams I on 6 Jan 2001 were still being incubated on 17 Jan, and had hatched by 23 Jan; another nest found on Adams I, on 3 Feb 2006, contained a single dry chick and the remains of 2 hatched eggs. Both eggs hatched in all 3 nests revisited on Antipodes I in Feb-Mar 2005 (Chris Rickard & Sarah Fraser, pers. comm.). One of 2 eggs in a nest found on Adams I on 10 Jan 2001 had hatched by 14 Jan; the 2nd, abandoned, egg was still present on 17 Jan. Two nests were found in the

Table 3 Dimensions of eggs of Auckland Is snipe (*Coenocorypha a. aucklandica*; Ewing, Disappointment, Rose, Adams Is), Antipodes Is snipe (*C. aucklandica meinertzhageni*), and Campbell Is snipe (*Coenocorypha* sp.). Eggs with the same reference number were from the same clutch. The eggs from nest A02 and C01 are held in Te Papa/Museum of New Zealand (OR 17351, OR 27632, respectively). BMNH 1941.2.1.49 held in The Natural History Museum (formerly, the British Museum (Natural History)) was measured by Douglas Russell in 2005 (in lit.).

Reference	Location	Length (mm)	Breadth (mm)	Est. fresh mass (g)
A01	Ewing I	43 ¹	30 ¹	20.4 ¹
A02	Disappointment I	42.5	30.7	21.1
A04	Rose I	42.9	30.7	21.3
A04	Rose I	42.0	30.7	20.8
A05	Adams I	43.3	32.3	23.8
A05	Adams I	42.3	31.6	22.2
A12	Rose I	41.4	30.9	20.8
A12	Rose I	41.8	30.9	21.0
A15	Rose I	43.0	30.5	21.0
A15	Rose I	43.1	30.7	21.4
A16	Adams I	44.9	32.6	25.1
A16	Adams I	42.9	32.2	23.4
A17	Adams I	45.1	32.1	24.4
A17	Adams I	45.8	32.3	25.1
A18	Adams I	45.5	30.8	22.7
A18	Adams I	45.9	30.6	22.6
M01	Antipodes I	40.2	33.2	23.3
M01	Antipodes I	40.6	33.4	23.8
M02	Antipodes I	39.8	31.4	20.6
M02	Antipodes I	41.2	30.8	20.6
M04	Antipodes I	40.7	31.9	21.8
M04	Antipodes I	41.7	31.9	22.3
M05	Antipodes I	43.0	33.0	24.6
M05	Antipodes I	44.1	33.1	25.4
M06	Antipodes I	41.3	31.5	21.6
M06	Antipodes I	44.1	-	-
BMNH	Antipodes I	42.7	33.0	24.4
C01	Campbell I	44.3	30.8	22.7 ²
C01	Campbell I	42.1	30.5	21.5 ²

¹One egg measured to only the nearest mm (Appendix 1), therefore measurements and estimated fresh mass excluded from summaries.

²The 2 Campbell Is snipe eggs were freshly laid, with estimated fresh mass exceeding actual mass; we present actual mass here.

process of hatching; 2 pipping eggs on Adams I on 12 Dec 1995, and a small chick and a pipping egg on Antipodes I on 24 Nov 1978 (latter record, Rowley Taylor in lit.).

The 1st nest found on Antipodes I (16 Nov 1978) was already cold and deserted (Brian Bell, in lit.); 6 further nests failed after they were found. A nest with 2 eggs found on Antipodes I on 1 Nov 1995 was monitored occasionally until both eggs were found deserted on 19 Nov (Reg Cotter, pers. comm.); both full-term embryos are now in Auckland Museum (AIM LB7455 & LB7456). Based

on egg measurements and weights taken on 2 Nov, incubation at this nest probably started on 31 Oct, and therefore the eggs were expected to hatch on 21 Nov. A nest on Adams I had 2 eggs on 11 and 14 Jan 2001, but contained a dead chick and an abandoned egg on 17 Jan following a day of strong winds and heavy rain. Failure of the 4 remaining nests (on Rose I, 1, Dec 1991; Rose I, 2, Dec 2000; Campbell I, 1, Jan 2006) was probably observer-induced. A nest found on Rose I on 14 Dec 2000 had a broken egg and an abandoned egg on 16 Dec. The most likely cause was disturbance by 1 of the 2 dogs being used



Fig. 3 a, Auckland Is snipe (*Coenocorypha a. aucklandica*) nest, Adams I, 6 Jan 2001 (Photo: S. Hamilton); b, Antipodes Is snipe (*C. aucklandica meinertzhageni*) nest, Antipodes I, Nov 1995 (Photo: R. Cotter); c, Campbell Is snipe (*Coenocorypha* sp.) nest, Campbell I, 12 Jan 2006 (Photo: C. Miskelly); d, Newly-hatched Auckland Is snipe chick, Adams I, 20 Jan 2001 (Photo: S. Hamilton); e, Newly-hatched Antipodes Is snipe chick, Antipodes I, Mar 2005 (Photo: S. Fraser); f, Campbell Is snipe chick (estimated age 8 d), Campbell I, 14 Jan 2006 (Photo: C. Miskelly).

Table 4 Fresh egg mass in relation to female body mass for Chatham Is snipe (*Coenocorypha pusilla*), Snares Is snipe (*C. aucklandica huegeli*), Antipodes Is snipe (*C. aucklandica meinertzhageni*), Auckland Is snipe (*Coenocorypha a. aucklandica*), and Campbell Is snipe (*Coenocorypha* sp.). Mean egg mass for Chatham Is snipe and Snares Is snipe from Miskelly (1990).

	Egg mass (g)		Female body mass (g)		Proportion of female body mass
	<i>n</i>	Mean	<i>n</i>	Mean	%
Chatham Is snipe	28	16.1	43	80.3	20.0
Snares Is snipe	81	23.7	88	115.5	20.5
Antipodes Is snipe	10	22.9	4	117.3	19.5
Auckland Is snipe	15	22.4	15	116.1	19.3
Campbell Is snipe	2	22.1	6	102.3	21.6

to find snipe and their nests. Two other nests found on 24 Dec 1991 and 17 Dec 2000 were preyed on subsequently by southern skuas (*Catharacta skua lonnbergi*). The skuas may have found the nests by observing their discovery, or by investigating markers used to relocate the sites (Dave Barker & Jeremy Carroll, pers. comm.). The only nest found on Campbell I (12 Jan 2006) was discovered at the point of clutch completion (based on both egg mass, and the absence of an embryo in 1 egg that was blown subsequently). It is likely that inadvertent capture of an adult at this nest (the bird was captured before the nest was found) early in incubation led to this pair deserting. One egg was damaged and outside the bowl, and the other egg was cold when the nest was checked next 36 h later.

Parental care of chicks

Most dependent chicks encountered were single chicks accompanied by a single adult (Auckland Is, *n* = 44; Antipodes I, *n* = 20; Campbell I, *n* = 6). The only exceptions were a brood of 2 young chicks accompanied by a single adult encountered on Ewing I in Dec 1991 (Dave Barker, pers. comm.), and 2 broods of 3 young chicks accompanied by a single adult encountered on Adams I in Jan 1997 and Jan 1998 (Jacinda Amey, pers. comm.). Chicks left the nest on the day of hatching (Fig. 3), and remained with an adult until free of down (estimated age when down no longer present 55 d; Miskelly 1999a). Chicks were observed between 4 Nov and 17 Feb on the Auckland Is, between 15 Oct and 7 May on Antipodes I, and between 9 Jan and 10 Mar on Campbell I (Table 5).

Observations of feeding of chicks by adults were made on Antipodes I (Elizabeth Bell, Chris Rickard, pers. comm.) and on Adams Island (GE, KW). In all instances, the adult removed a prey item from the soil and stood motionless with the prey held just above the point it was extracted from; the chick then moved forward and took the food from the tip of the parent's bill. The adult never carried prey to the chick, nor even orientated its bill towards the chick. The sudden cessation of the adult's constant motion while foraging appeared to be the cue to the chick

that the parent had captured food and was ready for transfer.

Breeding seasons

Breeding seasons differed greatly between the Auckland Is and Antipodes I (Fig. 2). Antipodes Is snipe commenced laying in mid Aug and continued to early Nov. They then appeared to cease laying for 10 weeks, and start to lay again in late Jan through to mid Mar. In 2005 a precise date was recorded for only the 1st chick seen (19 Mar), but 6 other chicks considered to have hatched on or about the same date were seen at scattered locations between then and the departure date of 14 Apr (Sarah Fraser & Chris Rickard, pers. comm.). The 6 additional chicks are distributed between the "11-20 Feb" and "21-28 Feb" lay date bins in Fig. 2, but have been left out of Table 5. Also, in addition to our 19 records for laying in Jan-Mar, we note that a female with an unshelled egg in her oviduct was collected on 25 Feb 1969 (Warham & Bell 1979). If mid-Mar nests were successful, Antipodes Is snipe could be caring for chicks until mid Jun, and their breeding season would therefore span 10 months.

The resurgence in snipe breeding activity on Antipodes I in late Jan-Mar appeared to be matched by a change in their vocal behaviour and diurnal activity patterns. In 3 years (2002, 2004, 2005), we noted that snipe were completely silent and rarely seen in Jan, but they started to call frequently from early Feb, with birds then being seen every day.

Auckland Is snipe had a more synchronous breeding season, with laying from mid-Sep to the end of Jan, peaking in late Nov (Fig. 2). The limited data from Campbell I indicate laying from 11 Nov to 8 Jan (Table 2, 5).

DISCUSSION

Effects of introduced mammals on *Coenocorypha* snipe

All 3 of the subantarctic snipes reported on here have been affected by introduced mammals to varying degrees. Apart from an ambiguous report by the islands' discoverer Abraham Bristow (*in*

Table 5 Details of dependent Auckland Is snipe (*Coenocorypha a. aucklandica*), Antipodes Is snipe (*C. aucklandica meinertzhageni*), and Campbell Is snipe (*Coenocorypha* sp.) chicks measured or described, with estimates of their age (d). Auckland Is snipe chicks were encountered on Ewing, Adams, Disappointment, Enderby, and Rose Is.

Date found	Location	Est. age (d)	Date found	Location	Est. age (d)
28 Dec 1962 ¹	Ewing I	1	19 Dec 2002	Adams I	13
04 Nov 1989	Adams I	21	19 Dec 2002	Adams I	18
08 Nov 1989 ²	Ewing I	5	28 Dec 2002	Adams I	25
11 Nov 1989	Adams I	25	30 Dec 2002	Adams I	25
04 Dec 1989	Adams I	9	26 Dec 2003	Adams I	3
17 Feb 1991	Adams I	59	06 Jan 2006	Enderby I	32
10 Dec 1991	Ewing I	5	20 Jan 2006	Adams I	55
c.19 Dec 1991 ³	Ewing I	1	24 Jan 2006	Adams I	48
22 Jan 1993	Disappointment I	26	24 Jan 2006	Adams I	55
30 Jan 1993	Adams I	33	05 Feb 2006	Adams I	50
30 Jan 1993	Adams I	53	05 Feb 2006	Adams I	50
31 Jan 1994	Adams I	30	10 Feb 2006	Adams I	60
02 Jan 1995	Adams I	17	10 Feb 2006	Adams I	54
02 Jan 1995	Adams I	5	15 Oct 1990	Antipodes I	24
02 Jan 1995	Adams I	40	15 Oct 1990	Antipodes I	37
03 Jan 1995	Adams I	5	04 Nov 1995	Antipodes I	45
13 Jan 1995	Adams I	55	05 Nov 1995	Antipodes I	10
14 Dec 1995	Adams I	18	16 Nov 1995	Antipodes I	27
c.06 Jan 1997 ⁴	Adams I	1	16 Nov 1995	Antipodes I	5
c.13 Jan 1998 ⁴	Adams I	1	17 Nov 1995	Antipodes I	5
22 Dec 1998	Enderby I	1	21 Nov 1995	Antipodes I	14
09 Dec 2000	Rose I	42	21 Nov 1995	Antipodes I	22
20 Jan 2001	Adams I	5	02 Mar 1996	Antipodes I	12
25 Jan 2001	Adams I	5	23 Dec 2000	Antipodes I	20
29 Jan 2001	Adams I	34	07 May 2001	Antipodes I	60
17 Dec 2001	Adams I	1	19 Mar 2005	Antipodes I	2
07 Jan 2002	Adams I	30	10 Mar 2005	Campbell I	50
14 Jan 2002	Adams I	30	09 Jan 2006	Campbell I	20
12 Dec 2002	Enderby I	2	11 Jan 2006	Campbell I	35 ⁵
16 Dec 2002	Adams I	18	12 Jan 2006	Campbell I	36 ⁵
16 Dec 2002	Adams I	3	14 Jan 2006	Campbell I	8 ⁵
19 Dec 2002	Adams I	1	14 Jan 2006	Campbell I	8 ⁵
19 Dec 2002	Adams I	7			

¹Chick found by Linsley Gressitt (R.A. Falla; Auckland Islands Expedition 1962-63, bird notes and species list; Alexander Turnbull Library MS Papers 2366 Folder 305).

²Moore & McClelland (1990).

³A brood of 2 young chicks was encountered once; we have treated this as a single breeding event.

⁴Broods of 3 young chicks were encountered twice; we have treated these as single breeding events in our analyses.

⁵Four of the chicks from Campbell I are believed to represent 2 broods of 2 chicks each; we have treated these as 2 single breeding events.

Encyclopaedia Britannica 1842 vol. 4: 217) Auckland Is snipe have never been reported from the main Auckland I, where feral pigs and cats had been introduced before the 1st naturalists visited in 1840 (McCormick 1884; Miskelly 2000), and mice are also present. Snipe disappeared from Enderby and Rose Is following the burning of the original vegetation and introduction of a suite of mammals including cattle, rabbits, and mice on Enderby I, and cattle, sheep, and rabbits on Rose I (Taylor 1971). Snipe returned rapidly to both islands following the removal of all introduced mammals from both islands in the early 1990s, and are now abundant there in areas with dense vegetation.

Campbell Is snipe were almost certainly eradicated from the main island by introduced Norway rats *Rattus norvegicus* (Miskelly 2000; Barker *et al.* 2005). Feral cats (introduced long after the rats) died out in the 1980s (Pete McClelland, pers. comm.). Following eradication of the rats in 2001, snipe began to recolonise the main island almost immediately from their only known refuge on Jacquemart I 1 km offshore of the southern coast (Barker *et al.* 2005; Miskelly & Fraser 2006).

Antipodes Is snipe have persisted in the presence of mice on Antipodes I, although we found that snipe were at much lower densities on Antipodes I than on mouse-free Adams I. There has been no opportunity to compare relative densities of snipe on Antipodes I (in the presence of mice) with their densities on the outlying islands of the Antipodes group, all of which are mouse-free.

Nesting and care of young

The breeding systems of Auckland Is snipe, Antipodes Is snipe, and Campbell Is snipe were essentially identical to those reported for Snares Is snipe and Chatham Is snipe, although some parameters (including egg interval, incubation length, incubation constancy, and parental sharing of incubation duties) are known for the Snares Is snipe only (Miskelly 1989, 1990, 1999a). Females in all 5 populations typically laid 2 large eggs in a ground-level nest well-concealed in dense vegetation. Incubation was shared at the 1 Auckland Is snipe nest where this was determined, and in the better-known Snares Is snipe and Chatham Is snipe. Broods were split at hatching, with each adult caring for a single chick until they were fully feathered. In Snares Is snipe and Chatham Is snipe the male took the 1st chick to leave the nest and the female the 2nd (Miskelly 1990, 1999a), but parental input has yet to be determined for the 3 southernmost *Coenocorypha* populations. Chicks were fed by their attendant adult, in the same way as that reported for Snares Is snipe and Chatham Is snipe (Higgins & Davies 1996). We are not aware of any reported observations of courtship feeding for the 3 southernmost snipes. Snares Is snipe, Chatham Is snipe, and Stewart Is snipe are the only members of

the family Scolopacidae for which courtship feeding has been reported so far (Miskelly 1990; Miskelly & de Lange 2006). Other *Coenocorypha* snipe are likely also to courtship-feed, but such behaviour is difficult to observe on islands lacking forest cover, where it is unusual to observe snipe from a sufficiently close range without affecting their behaviour.

Breeding seasons of *Coenocorypha* snipe

Coenocorypha snipes have extraordinarily long breeding seasons. The earliest known breeding was a Chatham Is snipe chick estimated to be 32 d old that was seen on Mangere I on 23 Sep 2006 (estimated laying date 28 Jul; Lynn Adams, pers. comm.). The latest known breeding event was an egg laid on the Snares Is on 13 Apr (Miskelly 2005). A chick hatching from this egg would not have become independent until mid Jul, therefore *Coenocorypha* eggs or dependent young can be found in any month of the year.

The most surprising finding from our compilation of breeding records was the marked difference in breeding chronology between snipe populations. If the timing of snipe breeding is determined by food availability, we would expect breeding to be later and more synchronous at higher latitudes. Instead we found no correlation with latitude, and a bizarre bimodal breeding season on Antipodes I. The differences between the populations are emphasized by the observation that 73% of the breeding attempts recorded for Auckland Is snipe were initiated during the 10 weeks when no breeding attempts were initiated for Antipodes Is snipe.

Auckland Is snipe appeared to have a more synchronous breeding season than Chatham Is snipe and Snares Is snipe (Fig. 2), but this may be an artefact of search effort. Snipe breeding events can be detected up to 90 d after egg-laying (Miskelly 1999a), but adults with chicks are more conspicuous than nests, which means that laying events 1-3 months before an observation date are more likely to be recorded than those in the previous 3 weeks. Few observers have stayed on the Auckland Is after Feb (Fig. 2), and so it is not surprising that snipe breeding appears to stop abruptly at the end of Jan.

In contrast, the bimodal breeding season exhibited by Antipodes Is snipe is not an artefact of observer effort. Observers have been present often in Jan and Feb (Fig. 2), at the ideal time to detect the results of laying events that occurred between mid Nov and mid Jan. The resurgence in breeding activity in Feb was also matched by increased vocal behaviour and increased encounter rates of birds in the daytime, possibly as they increased the time spent foraging so as to attain breeding condition. We have not been able to identify an underlying cause of the bimodal breeding season on the Antipodes Is, but speculate that it results from an interaction between invertebrate productivity and mouse abundance. Whether mice are driving the timing of

snipe breeding on Antipodes Is could be determined by seeing if snipe breed in Dec and Jan on the mouse-free outlying islands in the archipelago. Determining how the timing of snipe breeding could be affected by mice would require a detailed study of the terrestrial food web on Antipodes I.

ACKNOWLEDGEMENTS

We are indebted to our fellow field workers who assisted with collection of the data presented, especially Lynn Adams, Jacinda Amey, Mike Aviss, Dave Barker, Elizabeth Bell, Murray Blake, Rhys Buckingham, Jeremy Carroll, Louise Chilvers, Reg Cotter, Peter Dilks, Hannah Edmonds, James Fraser, Sarah Fraser, Pete Gaze, Nadine Gibbs, Terry Greene, Sheryl Hamilton, Mike Imber, Stewart Janes, Josh Kemp, Gus McAllister, Pete McClelland, Janice Molloy, Chris Rickard, Bruce Robertson, Graeme Taylor, Alan Tennyson, Murray Williams, Murray Williams, and Al Wiltshire. Measurements of the egg held in the Natural History Museum (formerly, British Museum (Natural History)) were provided by Douglas Russell. We also thank Brian Bell, Ron Nilsson, the late Ron Ordish, and Rowley Taylor for providing information and photographs of snipe nests found in 1966, 1973, and 1978. Permission to reproduce extracts from Robert Falla's 1966 diary (R.A. Falla Collection) was granted by Graham Falla and the Alexander Turnbull Library, Wellington. We thank Brett Fotheringham for information on Abraham Bristow's 1806 record of snipe on the Auckland Is. Permission to visit the Auckland Is, Antipodes I, and Campbell I, and to carry out our research was provided by Southland Conservancy, Department of Conservation. Staff from their Southern Islands Area provided invaluable logistical assistance. The Jan 2006 Campbell Island snipe survey was sponsored by BDG Synthesis.

LITERATURE CITED

- Barker, D.; Carroll, J.W.A.; Edmonds, H.K.; Fraser, J.R.; Miskelly, C.M. 2005. Discovery of a previously unknown *Coenocorypha* snipe in the Campbell Island group, New Zealand subantarctic. *Notornis* 52: 143-149.
- Bell, B.D. 1979. The southern islands of New Zealand. *Wildlife, a review* 10: 5-10.
- Challies, C.N. 1975. Feral pigs (*Sus scrofa*) on Auckland Island: status, and effects on vegetation and nesting sea birds. *New Zealand journal of zoology* 2: 479-490.
- Elliott, G.P.; Walker, K.J. 2005. Detecting population trends of Gibson's and Antipodean wandering albatrosses. *Notornis* 52: 215-222.
- Fitzgerald, B.M. 1990. House cat. pp. 330-348 In: King, C.M. (ed.) *The handbook of New Zealand mammals*. Auckland, Oxford University Press.
- Guthrie-Smith, H. 1936. *Sorrows and joys of a New Zealand naturalist*. Reed, Dunedin.
- Higgins, P.J.; Davies, S.J.J.F. 1996. *Handbook of Australian, New Zealand and Antarctic birds*. Vol. 3. *Snipe to pigeons*. Melbourne, Oxford University Press.
- Imber, M.J. 1979. Petrels of the Antipodes Islands. *Wildlife, a review* 10: 11-15.
- McCormick, R. 1884. *Voyages of discovery in the Arctic and Antarctic seas and round the world*. 2 vol. London, Sampson Low, Marston, Searle and Rivington.
- Miskelly, C.M. 1989. Flexible incubation system and prolonged incubation in New Zealand snipe. *Wilson bulletin* 101: 127-132.
- Miskelly, C.M. 1990. Breeding systems of New Zealand snipe *Coenocorypha aucklandica* and Chatham Island snipe *C. pusilla*; are they food limited? *Ibis* 132: 366-379.
- Miskelly, C.M. 1999a. Breeding ecology of Snares Island snipe (*Coenocorypha aucklandica huegeli*) and Chatham Island snipe (*C. pusilla*). *Notornis* 46: 207-221.
- Miskelly, C.M. 1999b. Social constraints on access to mates in a high density population of New Zealand snipe (*Coenocorypha aucklandica*). *Notornis* 46: 223-239.
- Miskelly, C.M. 2000. Historical records of snipe from Campbell Island, New Zealand. *Notornis* 47: 131-140.
- Miskelly, C.M. 2005. Evidence for 'hakawai' aerial displaying by Snares Island snipe (*Coenocorypha aucklandica huegeli*). *Notornis* 52: 163-165.
- Miskelly, C.M.; de Lange, P.J. 2006. Notes on the breeding ecology of the extinct Stewart Island snipe (*Coenocorypha aucklandica iredalei*). *Notornis* 53: 339-352.
- Miskelly, C.M.; Fraser, J.R. 2006. Campbell Island snipe (*Coenocorypha* undescribed sp.) recolonise subantarctic Campbell Island following rat eradication. *Notornis* 53: 353-359.
- Moore, P.J.; McClelland, P.J. 1990. Notes on birds of the Auckland Islands, November-December 1989. *Science & Research Internal Report no. 93*, Wellington, Department of Conservation.
- Oliver, W.R.B. 1955. *New Zealand birds*. 2nd ed. Wellington, A.H. & A.W. Reed.
- Soper, M.F. 1976. *New Zealand birds*. 2nd ed. Christchurch, Whitcoulls.
- Taylor, R.H. 1971. Influence of man on vegetation and wildlife of Enderby and Rose Islands, Auckland Islands. *New Zealand journal of botany* 9: 225-268.
- Taylor, R.H. 1990. Feral cattle. pp. 373-379 In: King, C.M. (ed.) *The handbook of New Zealand mammals*. Auckland, Oxford University Press.
- Taylor, R. 2006. *Straight through from London: the Antipodes and Bounty Islands, New Zealand*. Christchurch, Heritage Expeditions.
- Torr, N. 2002. Eradication of rabbits and mice from subantarctic Enderby and Rose Islands. pp. 319-328 In: Veitch, C.R.; Clout M.N. (ed.) *Turning the tide: the eradication of invasive species*. IUCN SSC Invasive Species Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.
- Walker, K.; Elliott, G. 1999. Population changes and biology of the wandering albatross *Diomedea exulans gibsoni* at the Auckland Islands. *Emu* 99: 239-247.
- Walker, K.J.; Elliott, G.P. 2005. Population changes and biology of the Antipodean wandering albatross (*Diomedea antipodensis*). *Notornis* 52: 206-214.
- Walker, K.J.; Elliott, G.P. 2006. At-sea distribution of Gibson's and Antipodean wandering albatrosses, and relationships with longline fisheries. *Notornis* 53: 265-290.
- Warham, J.; Bell, B.D. 1979. The birds of Antipodes Island, New Zealand. *Notornis* 26: 121-167.
- Williams, M. 1995. Social structure, dispersion and breeding of the Auckland Island teal. *Notornis* 42: 219-262.
- Wilson, R.A. 1959. *Bird islands of New Zealand*. Christchurch, Whitcombe & Tombs.
- Worthy, T.H. 2003. A new extinct species of snipe *Coenocorypha* from Vitilevu, Fiji. *Bulletin of the British Ornithologists' Club* 123: 90-103.

Appendix 1 Robert Alexander Falla's notes on an Auckland Is snipe (*Coenocorypha aucklandica aucklandica*) nest found on Ewing I, Auckland Is, in Jan 1966

R.A. Falla 1966 diary, Alexander Turnbull Library MS-papers-2366-312

[Comments in square brackets, C. Miskelly]

Tuesday 18th Jan '66 For Ewing I R.G.O. [Ron Ordish - entomologist] and R.A.F. [Robert Falla] set off after breakfast and reached Ewing at 10 a.m... Still no sign of Brian [Fineran] so we returned to the South point where Ron had found a snipe nest in the morning. After doing some photography here we returned to the boat and left for home about 4 pm.

Nature Notes 18/1/66 Ewing I Coenocorypha Ron's nest is at the extreme South base of the triangular point s.w. in *Poa foliosa* just where it joins the *Olearia*. It is bounded and shielded by tall *Poa* on the seaward side and the approach from the muddy bush floor is through less than 1 foot of *Cotula* [*Leptinella*]. The deep saucer depression is lined with *Poa* leaves well bound in and circular (diameter about 7.5 inches [19 cm] over all). The two egg [*sic*] were approximately the same size (1 measured was 43 x 30 mm.), obovate, brownish buff with purple brown blotches and sienna spots thickest in a band above the greatest diameter. They lay parallel in the nest. The discovery was due to the bird coming off and approaching Ron while he was examining leaf litter. Later she (?he) refused to be flushed unless touched, never running more than a foot and uttering a faint tremulous alarm call (vaguely like a skua). She was aware of the removal of one egg and did not settle properly until both eggs were in position. Noted later were distraction display by wing dragging (both together) but for only a second or two at a time.

On a subsequent visit (22nd Jan) she sat even

closer and was more aggressive. The exit from the nest when touched by hand (a stick had no effect) was by direct flight in a parabola of some 5 feet altitude which landed the bird ten or twelve feet away. Its next flight was directional, at the intruder as the nest was molested, when it flew up and struck me on the back of the hand with beak and wing. After returning to the nest the routine was regular, first to shuffle into position, then to rise feet astride and rearrange the eggs and then to settle down in position which should be shown in the photographs. No other snipe seen about in vicinity.

Saturday 22nd January 1966 Another visit to Ewing I. by B.F. [Brian Fineran], R.O. and R.F. leaving after lunch and remaining on the island till 5:30 pm...; R.F. spent the whole time taking additional photographs of the snipe nest, and of the skua.

Wed 26th Jan 1966 Erebus party (-Brian) returned at 2 pm and shortly afterwards Colin [Clark], Rowley [Taylor] and I left for Ewing to photograph snipe and band skuas.

Nature Notes 26th January 1966 Coenocorypha The snipe, still on 2 eggs, was not the same bird as seen on 2 previous visits. It was darker and had a slightly smaller bill [probable male]. Likewise it was more timid, making very little display of aggression and deserting the nest when disturbed. The other partner was later seen some distance away.

Nature Notes 2/2/66 Coenocorypha Ron reports only egg shell in the nest.

Nature Notes 4/2/66 Ron collected the abandoned snipe nest and egg shell at Ewing I. in an early morning dash from the camp area.