

Notes on the breeding ecology of the extinct Stewart Island snipe (*Coenocorypha aucklandica iredalei*)

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Abstract The little information that we have on the breeding ecology of the extinct Stewart Is snipe (*Coenocorypha aucklandica iredalei*) is based on books published by Herbert Guthrie-Smith and Major Robert Wilson following visits to Big South Cape I in 1923 and 1931 respectively. Wilson was a member of a party including Edgar Stead, who collected 4 clutches of eggs now in Canterbury Museum. We summarise the published information on breeding ecology of the Stewart Is snipe, and provide new information based on previously unpublished photographs of nests, and notes made by members of the 1923 and 1931 visits to Big South Cape I, including Edgar Stead's unpublished diary. Stewart Is snipe appear to have had a different chick-rearing strategy from all other *Coenocorypha* snipe, with pairs jointly caring for a single chick. Guthrie-Smith's 1923 record of courtship-feeding was the 1st reported instance for the entire family Scolopacidae.

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INTRODUCTION

The Stewart Is snipe (*Coenocorypha aucklandica iredalei*) became extinct about 1964 following the invasion of its last stronghold, Big South Cape I (Taukihepa), by ship rats (*Rattus rattus*) (Bell 1978; Miskelly 1987). The little we know of the breeding ecology of the Stewart Is snipe is based on visits to Big South Cape I by Herbert Guthrie-Smith in 1923, and Edgar Stead and Major Robert Wilson in 1931. Guthrie-Smith summarised his observations of at least 2 nests in a chapter entitled "*Gallinago aucklandica*" in his classic 1936 book *Sorrows and joys of a New Zealand naturalist*, where he also published 2 photographs of snipe nests. Wilson (1959) mentions "several" nests found, and published 2 poor quality reproductions of photographs, apparently of the same nest. Six skins of adult and juvenile Stewart Is snipe and 4 clutches of their eggs collected by Stead reside in the Canterbury Museum.

CMM had long been aware of apparent differences between Guthrie-Smith's descriptions of parental care by Stewart Is snipe and what was known for other *Coenocorypha* snipe (Miskelly 1990, 1999a; Miskelly *et al.* 2006). His interest was further kindled following the chance discovery of unpublished photographs of Stewart Is snipe nests taken by Guthrie-Smith and Stead, found among Sir Robert Falla's papers in the Alexander Turnbull Library, Wellington, New Zealand (MS-papers-2366-312).

Here we summarise the published observations of Guthrie-Smith and Wilson, present detailed descriptions of 4 nests that they photographed, describe specimens collected by Edgar Stead, and add information from the diaries of members of the 1923 and 1931 expeditions. We also present 5 previously-unpublished photographs of 4 different nests of Stewart Is snipe, 4 taken by Herbert Guthrie-Smith in Nov 1923, and one taken by Edgar Stead in Dec 1931.

METHODS

Six unpublished photographs of Stewart Is snipe nests found among Sir Robert Falla's papers (Alexander Turnbull Library, MS-papers-2366-312) were prepared as high-resolution digital scans by the Alexander Turnbull Library. A further 2 images by Stead of the same nest referred to above from the David MacMillan collection (Canterbury Museum ARC2001) were prepared as high-resolution digital scans by Canterbury Museum. These photographs and those published by Guthrie-Smith (1936) and Wilson (1959) were analysed by PJdeL to generate descriptions of vegetation in the vicinity of the nests; the descriptions were then compared with the written descriptions of Guthrie-Smith and Wilson (Guthrie-Smith 1936; Wilson 1959). Eight eggs held in Canterbury Museum were measured to 0.1 mm by CMM, and a copy of the relevant page of Edgar Stead's egg diary was provided by Paul Scofield, Curator of Vertebrates, Canterbury Museum. The personnel who participated in both the 1923 and 1931 expeditions were identified by analysis of the writings of Guthrie-Smith (1936), Wilson (1959), and Woodhouse (1959). Diaries of expedition members were sought in national collections, and in provincial libraries near where participants lived. Descendants or relatives of Barbara Absolom (née Guthrie-Smith), Edgar Stead, Robert Wilson, Sir John Hanham, and Airini Woodhouse were also contacted to determine whether unpublished diaries or field notes, or personal egg collections remained in the possession of family members.

RESULTS

1923 expedition

William Herbert Guthrie-Smith (1861-1940) and party were on Big South Cape I during 6-18 Nov 1923. With him were his daughter Barbara (who later married J. Archer Absolom), Barbara's cousin Erica Clarke, Barbara's former nanny Elizabeth (Bessie) Spencer, John Leask from Stewart Island, and John's son Stanford Leask. Herbert Guthrie-Smith's and Barbara Absolom's diaries are not known to exist (Gertrude Absolom, William Rolleston, and Gail Pope pers. comm.). Relevant portions of Barbara's diary (where Bessie Spencer is referred to as "Penton") were quoted by Woodhouse (1959), and Bessie Spencer's diary survives in the Hawke's Bay Museum Library (M59/36(f) Spencer, Miss A.E.J. "Diary of a trip to Long Island" 1923).

It is unclear how many snipe nests Guthrie-Smith and party found. Guthrie-Smith (1936) described 2 nests (1 found just after hatching, the other with birds incubating), and these same 2 nests (and no others) were mentioned in Barbara Guthrie-Smith's diary (Woodhouse 1959) and Bessie Spencer's diary. Both were found on 11 Nov, by Barbara Guthrie-Smith and Bessie Spencer

respectively. Guthrie-Smith (1936) also implied that only a single active nest was found when he wrote "These were delightful hours indeed watching in perfect quietude the pair of incubating Snipe, sharing the responsibility of their nest". However, Guthrie-Smith's published and unpublished photographs appear to show 4 different nests, and this was the conclusion that Sir Robert Falla reached based on his pencilled annotations on the backs of the photographs found among his papers. Bessie Spencer's diary sheds some light on this apparent discrepancy, when she wrote (11 Nov 1923) "I found nest with two eggs...We got camera and Mr. G.-S. and I photoed bird on nest – did not clear much away", and (12 Nov 1923) "Mr Leask, Mr. G.-S. and I had lunch and then went out again, cleared nest and took four more photos." As vegetation was cleared from a nest found with incubating birds, it is possible that several of the photographs of apparently different nests were in fact of this one nest, which was photographed on at least 4 days (11, 12, 14, 16 Nov; Bessie Spencer's diary). Armed with this additional information, our analysis of background vegetation indicates that Guthrie-Smith and party photographed 3 different nests.

The 1st nest found (11 Nov) had 2 newly hatched eggs nearby; these were replaced in the nest bowl before being photographed, and Guthrie-Smith (1936) stated that they "appear as seen in the accompanying photograph". This is an error, as the nest with eggs shown in Guthrie-Smith's book (photograph opposite p. 176) is the same nest where Guthrie-Smith photographed an incubating bird (Fig. 1). Other *Coenocorypha* snipe never return to a nest after the chicks leave the nest (which they do on the day of hatching; CMM pers. obs.), and another of Guthrie-Smith's previously unpublished photographs shows 2 hatched eggs in a nest bowl fitting Guthrie-Smith's (1936) description of the 1st nest being composed almost entirely of *Dracophyllum* needles (Fig. 2); this is likely to have been the 1st nest found in 1923. Fig. 3, showing 2 eggs, is the same nest at which Guthrie-Smith (1936; photograph opposite p. 177) showed an incubating snipe. A further unpublished photograph in the R.A. Falla collection (Alexander Turnbull Library), not reproduced here, shows a snipe turning eggs in this same nest (MS-papers-2366-312-02). We suggest that these photographs (Fig. 1, 3, and both of Guthrie-Smith's published photographs) are all of the same nest, but appear different due to the gradual removal of surrounding vegetation. We publish for the first time a photograph of an apparent 3rd nest found by Guthrie-Smith, showing an incubating snipe (Fig. 4). Note that our images are cropped from the originals to show greater detail of the birds, eggs, and nests. The original photographs (R.A. Falla collection, MS-papers-2366-312, Alexander

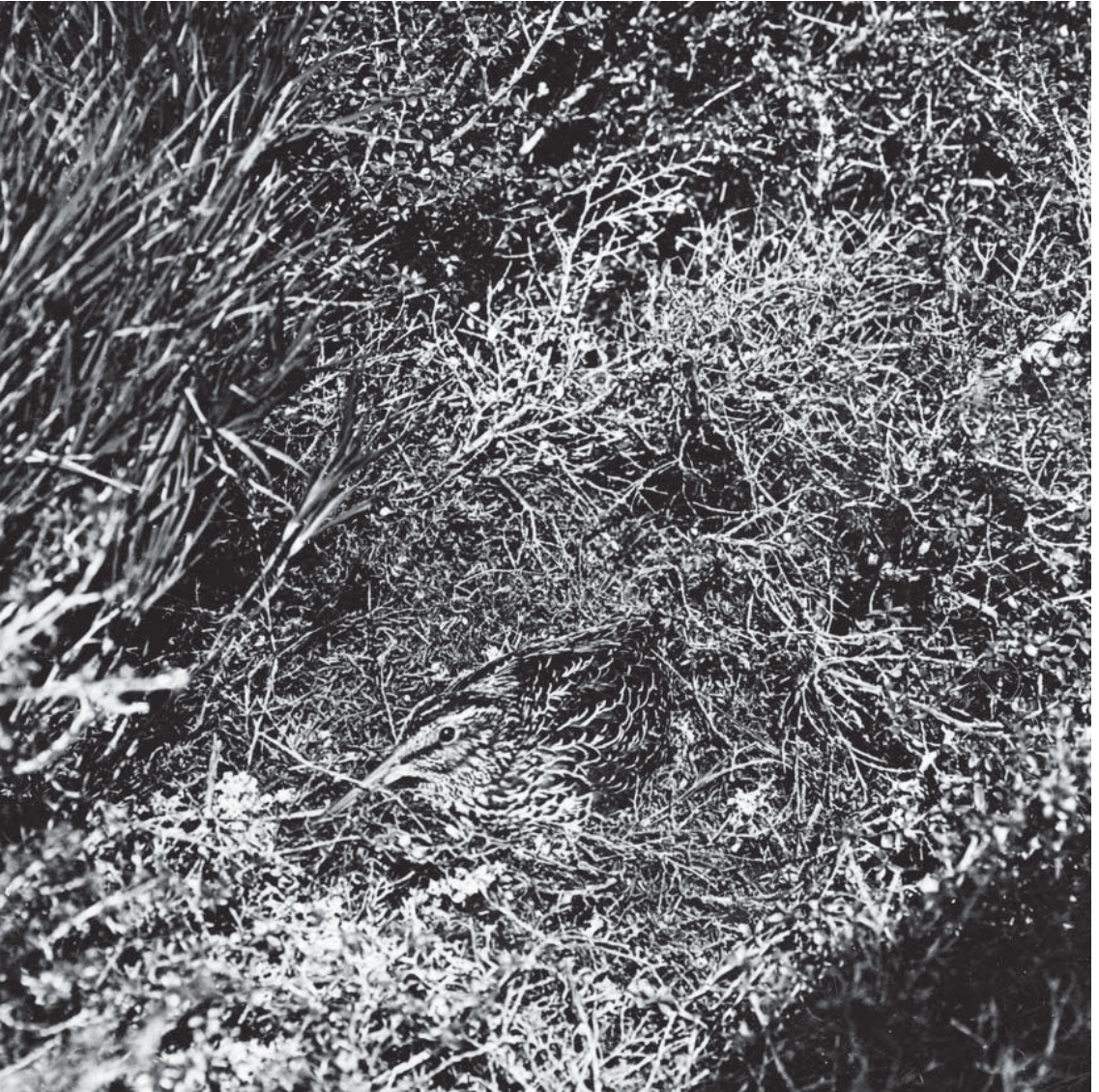


Fig. 1 Incubating Stewart Is snipe (*Coenocorypha aucklandica iredalei*), Big South Cape I, Nov 1923 (Guthrie-Smith photo, R.A. Falla collection, MS-papers-2366-312-05, Alexander Turnbull Library, Wellington, New Zealand; cropped from the original photograph).

Turnbull Library) show more of the surrounding vegetation, allowing our comparison of nest sites. The 3rd nest (Fig. 4) is distinctive in having a flax bush (*Phormium cookianum* subsp. *cookianum*) in the upper right of the original.

1931 expedition

Edgar Fraser Stead (1881-1949) and Major Robert Adams Wilson (1876-1964) were on Solomon I (adjacent to Big South Cape I) from 10 Nov to 14 Dec 1931, accompanied by Sir John Hanham (10 Nov to 3 Dec) and Eb Hay (3-14 Dec). They travelled

across to Big South Cape I on several occasions to observe snipe, finding nests on at least 2, 3, and 7 Dec (Stead's egg diary, Canterbury Museum). Wilson (1959) implied that they found at least 5 nests, when he wrote "Hanham found a nest with two eggs in, and I discovered another, and as Edgar wanted some more photographs, we developed a method of finding nests...by this method Edgar found several other nests".

The single Stead photograph of an incubating snipe among Sir Robert Falla's papers (MS-papers-2366-312-06, Alexander Turnbull Library, our



Fig. 2 Recently hatched Stewart Is snipe (*Coenocorypha aucklandica iredalei*) eggs in nest, Big South Cape I, 11 Nov 1923 (Guthrie-Smith photo, R.A. Falla collection, MS-papers-2366-312-01, Alexander Turnbull Library, Wellington, New Zealand; cropped from the original photograph).

Fig. 5) and 2 by Stead in Canterbury Museum (David MacMillan Collection ARC2001.59.8 & ARC2001.59.9) appear to be of the same nest photographed by Wilson (1959; plates 15 & 16).

The 4 clutches of Stewart Island snipe eggs in Canterbury Museum are recorded in Stead's egg diary as being collected by R.A. Wilson on 2 Dec 1931, and "E.F.S." on 3 Dec and 7 Dec (2 nests). It appears that the eggs from the 1st nest found (by Sir John Hanham) were not collected, or — more likely — that they ended up in Hanham's personal

collection. Wilson (1959) noted that Hanham was required to return to Wellington by late Nov to assist with 2 garden parties being hosted by his employer, the Governor-General, Lord Bledisloe. Bad weather delayed Hanham's departure until 3 Dec, and "Thanks to the delay Sir John was able to get both mutton bird and mottled petrel eggs for his collection. He would not have been able to do this if the *Brittannia* had arrived in time". Government House had to run the garden parties without his assistance.



Fig. 3 Stewart Is snipe (*Coenocorypha aucklandica iredalei*) nest with 2 eggs, Big South Cape I, Nov 1923 (Guthrie-Smith photo, R.A. Falla collection, MS-papers-2366-312-03, Alexander Turnbull Library, Wellington, New Zealand; cropped from the original photograph). This is probably the same nest as shown in Fig. 1, but with more vegetation cleared away.

Lieutenant Sir John Ludlow Hanham (1898–1955), 10th Baronet, (Grenadier Guards), was aide-de-camp to his uncle, Lord Bledisloe, during Lord Bledisloe's 1930–35 term as Governor General of New Zealand (Burstal 1955). He arrived in New Zealand in Mar 1930 and returned to England in 1932, where he lived at the stately family home of Deans Court, Wimborne Minster, Dorset (*Who's who* 1934; Gavin McLean pers. comm.). Following Sir John's death in 1955 the house and its contents passed to his brother, Sir Henry Phelps Hanham,

and thence to their nephew Sir Michael Hanham, 12th Baronet, who still lives at Deans Court (*Who's who* 1956; *Who's who* 1975; Viscount Bledisloe pers. comm.). Sir John Hanham presented his New Zealand egg collection to the British Museum of Natural History, Tring, in Aug 1932, and it was registered in Dec 1932. It contained eggs of sooty shearwater ("muttonbird" *Puffinus griseus*), common diving petrel (*Pelecanoides urinatrix*), fairy prion (*Pachyptila turtur*), Stewart Is robin (*Petroica australis rakiura*), and bellbird (*Anthornis melanura*) collected



Fig. 4 Incubating Stewart Is snipe (*Coenocorypha aucklandica iredalei*), Big South Cape I, Nov 1923 (Guthrie-Smith photo, R.A. Falla collection, MS-papers-2366-312-04, Alexander Turnbull Library, Wellington, New Zealand; cropped from the original photograph).

on "Muttonbird Is. S. of Stewart Island Nov – Dec 1931" (BMNH 1932.12.2.4-14; Douglas Russell and Polly Tucker, pers. comm.), but unfortunately the collection contained no snipe eggs. As the collection appears incomplete (i.e. no egg of mottled petrel *Pterodroma inexpectata*), it is possible that Hanham retained some specimens, or provided them to another museum or private collector. Attempts to locate further egg specimens through his surviving relatives, Sir Michael Hanham and the third Viscount Bledisloe, were unsuccessful.

The published information on Stead and Wilson's visit is frustratingly scant compared to the detailed information that was apparently recorded at the time. Wilson (1959) presented a glowing testimonial to his friend's abilities as a hunter and naturalist, including his skills as a taxidermist: "[Stead] had a permit from the Internal Affairs Department to collect specimens for his own collection and the Canterbury Museum, and when he obtained a specimen he spent great care on skinning and preserving it. When it was arranged



Fig. 5 Incubating Stewart Island snipe (*Coenocorypha aucklandica iredalei*), Big South Cape I, 4 Dec 1923 (Stead photo, R.A. Falla collection, MS-papers-2366-312-06, Alexander Turnbull Library, Wellington, New Zealand; cropped from the original photograph).

to his satisfaction he tied a label on it, giving date and locality and sex...At his death he willed [his collection] to the Canterbury Museum, which now has a very fine collection of specimens, many of which are now unobtainable elsewhere."

Stead's egg diary has long been in the Canterbury Museum; the egg diary entry for the four clutches of Stewart Is snipe eggs states "See Diary of these dates" alongside the 3 clutches collected by Stead on 3 and 7 Dec 1931, and so Stead must have written details about finding the nests. The 6 snipe skins

collected by Stead do not have his original labels, are undated and do not even have precise locality data, although it is clear from Wilson (1959) that Big South Cape I in Nov-Dec 1931 was the only location and dates that they encountered Stewart Is snipe. Stead's bird collection and associated information were gifted to Canterbury Museum following his death (Roland Stead, pers. comm.), and until recently it was assumed that none of his field notes survived. However, in May 2006 we discovered that Edgar Stead's diaries do exist, but were stored

inaccessible to researchers for over 50 years.

David MacMillan (1897–1983) was a Canterbury historian who was related to the Stead family through his wife (née Hope Dobson, a cousin of Edgar Stead's wife Irene Mary Phillips). MacMillan collected a large amount of information on Edgar Stead (and his father George Gatenby Stead, 1841–1908), with the intention of publishing a memoir or book on the life of this remarkable New Zealander. The book was never published, and the collated material (8 boxes, 42 folders, 427 items, including Stead's diaries) remained in the MacMillan home until the collection was gifted to Canterbury Museum in May 2001 before the house's being sold (Bryony MacMillan pers. comm.). MacMillan reduced Stead's diaries to a pile of pages extracted from the volumes in chronological sequence, as Stead used his diaries as notebooks as well as intermittently keeping a diary (Eva Sullivan pers. comm.). Canterbury Museum ARC2001.12: Item 206 comprises 3 folders of diary pages covering the periods 1916–17 (Folder 17), 1918–1921 (Folder 18) and 1929–1947 (Folder 19). Folder 19 includes 39 pages on the Nov–Dec 1931 expedition to Solomon I and adjacent Big South Cape I, of which 8 pages refer to snipe. The David MacMillan collection also includes 6 letters to Edgar Stead from Herbert Guthrie-Smith written between 1925 and c.1933 (ARC2001.12: Folder 10, Items 18–23), unfortunately none of these mention snipe.

The full text of Stewart Is snipe entries in Stead's 1931 diary are given in Appendix 1. Snipe were encountered on 7 days, with 5 nests found: 2 Dec (2), 3 Dec (1) and 7 Dec (2); and a large dependent chick was seen on 4 Dec. Photographs were taken of a nest on 4 Dec (Fig. 5; and Plates 15 & 16 in Wilson 1959). Only 1 clutch of eggs was noted by Stead as having been collected from the 2 nests found on 2 Dec, with 1 clutch recorded as "just hatching"; we presume that these eggs were left in the nest, and therefore it is unlikely that Hanham ever had snipe eggs in his collection.

Habitat use, and nest descriptions

During an hour ashore in 1913, Guthrie-Smith (1936) found snipe in wooded areas of Big South Cape I. The introduction (or increase) in weka (*Gallirallus australis*) over the ensuing decade led to snipe being confined to the unforested tops of the island (Guthrie-Smith 1936). In 1923, Guthrie-Smith found snipe in the "central desert" — a few ha in the centre of the island "recovering from fire", and cloaked in low manuka (*Leptospermum scoparium*), *Dracophyllum longifolium* var. *longifolium*, and coral-like lichens (probably *Cladia retipora* and *C. aggregata*). He also considered it likely that snipe inhabited the surrounding "impenetrable thickets" of manuka, *Dracophyllum*, and *Cyathodes acerosa* [= *Leptecophylla juniperina*]. Wilson (1959)

described snipe as inhabiting "a large area of tussock land above the bush line" in 1931. This is at odds with the vegetation surrounding the 1 nest photographed (Wilson 1959 plates 15 & 16; Fig. 5), which is in a dense bed of *Cladia retipora* lichen under low manuka and *Dracophyllum*, with no visible tussock. Stead's diary (Appendix 1) also makes it clear that snipe were mainly (perhaps only) encountered in the *Dracophyllum*/manuka heathlands (which he called "scrub") and associated *Cladia* lichen fields. So Wilson (1959) appears to have used "tussock land" to describe non-forested areas.

Both parties used a similar method to find snipe nests. Herbert Guthrie-Smith (1936), Barbara Guthrie-Smith (Woodhouse 1959), and Edgar Stead (Appendix 1) all referred to "beating" for snipe, but more detail is given in Bessie Spencer's unpublished diary (11 Nov 1923): "Then Mr. G-S. took us in a row tapping the bushes. No luck at first and we scattered and I wandered off alone. Tapped a bush and a Snipe flew off — a little leap and a shriek and shammed wounded. I found a nest with two eggs". Wilson (1959) described the method used by Stead, Hanham, Hay, and himself in 1931 as: "In the tussock where they were found one had to almost step on them before they flew off the nest, so we formed a line and with long flag sticks covered the area systematically, brushing the tops of the tussock with the sticks. This would flush the bird, and by this method Edgar found several other nests." According to Stead's diary (Appendix 1), 2 of these "several" other nests were actually found by Wilson, with only 1 found by Stead. Again Wilson's use of the term "tussock" is incorrect, as all 4 nests described by Stead (Appendix 1) were under windswept or sparse manuka, with 3 of these also set among "coral-like moss" (= *Cladia* lichen).

The 1st nest found in 1923 "was of the most simple construction, hardly more than an indentation on the thickly scattered brown dracophyllum needles blown there and wind-stored in the open cushion of stunted manuka" (Guthrie-Smith 1936; Fig. 2). Analysis of the full unpublished photograph (MS-papers-2366-312-01) showed the nest to be situated in *Dracophyllum*/manuka heathland, with lichen field dominated by *Cladia retipora* in the background. The nest is made of *Dracophyllum* leaves with some *C. retipora* and manuka twigs.

The 2nd nest found in 1923 "placed also in the shelter of a low manuka cushion showed more care in construction; on granite grit and sand thickly littered with *Dracophyllum* needles, it was piled a couple of inches high with moss, softest lichen and minutest lengths of frayed lissom manuka twiglets" (Guthrie-Smith 1936; probably the nest shown in Fig. 1, 3). Analysis of Guthrie-Smith's photographs (MS-papers-2366-312-02, 03 & 05) revealed this nest to have been built among *Dracophyllum*/manuka

heathland with a nearby shrub of a *Coprosma* species (possibly *C. pseudocuneata*). The widest-framed shot (MS-papers-2366-312-05) shows a *Cladia* lichen field in the background. The nest appears to be constructed of manuka twigs, *Dracophyllum* leaves and *Cladia retipora*.

The 3rd nest photographed by Guthrie-Smith (MS-papers-2366-312-04; Fig. 4) was situated in *Dracophyllum*/manuka heathland with some *Coprosma pseudocuneata* and flax (*Phormium cookianum*). The nest is mainly concealed, but appears to be constructed of manuka twigs, *Dracophyllum* leaves, and *Cladia retipora*.

The only nest photographed by Wilson (1959) and Stead (Alexander Turnbull Library MS-papers-2366-312-06; Fig. 5; also Canterbury Museum ARC2001.59.8 & ARC2001.59.9) in 1931 was located on the ecotone of a *Dracophyllum*/manuka heathland and *Cladia retipora*-dominated lichen field. *Dracophyllum longifolium* var. *longifolium* and manuka dominate 75% of the images, with the rest dominated by *Cladia retipora*. The full images also show *Campylopus* sp. (moss), *Polytrichadelphus magellanicus* (moss), and a small plant of *Astelia cockaynei*. Stead (Appendix 1) described the site as a "sparse bit of manuka about nine inches high", with the eggs plainly visible from all directions. The nest itself was constructed of "a few bits" of *Cladia* lichen, *Dracophyllum* leaves and manuka twigs (Appendix 1; plate 16 in Wilson 1959).

The 1st 2 nests found in 1931 were collectively described by Stead (Appendix 1) as "a shallow structure of bits of fern and *Dracophyllum* in windswept Manuka about six inches high". The 3rd nest found was photographed as well as described (see paragraph above). The 4th nest "was in a small open piece of manuka, half of it dead, on the edge of an old burn, and was a shallow scratching in the peat, lined with "coral moss" [*Cladia* lichen] and a few *dracophyllum* leaves" (Stead diary, Appendix 1). The 5th and final nest was in "a sparse bit of manuka growing around a bare dead branch of same"; the nest itself was made of *Cladia* lichen and flakes of manuka bark (Stead diary, Appendix 1).

All 4 nests photographed in 1923 and 1931 and the 4 others described by Stead (Appendix 1) were situated among *Dracophyllum*/manuka heathland near to or on *Cladia retipora* lichen fields. This habitat is likely to have been fire-induced, developed over impoverished soils, or a combination of both fire and impoverished soils. *Cladia* occurs mainly on acidic, poorly drained to well-drained skeletal or peaty soils. The *Dracophyllum* and manuka plants photographed were quite old (at least 20 or more years old based on the branching pattern of the manuka and the lack of juvenile leaves on the *Dracophyllum*), but were severely stunted.

Fineran (1973) referred to the *Dracophyllum*/manuka heathland on Big South Cape I using the

local term "pakihi", which he divided into "open scrub" (the vegetation described as the "central desert" by Guthrie-Smith 1936), and "closed scrub" (Guthrie-Smith's "impenetrable thickets"). Based on Fineran's vegetation map, open scrub occupied about 225 ha in 1965, and closed scrub about 200 ha.

Clutch size and descriptions of eggs

All 8 nests of Stewart Island snipe discovered (1923, 3; 1931, 5) are believed to have contained 2 eggs. This was explicitly stated for 7 nests (1923, 2; 1931, 5; Guthrie-Smith 1936; Stead diary, Appendix 1). Guthrie Smith (1936) implied that all nests found in 1923 had 2 eggs when he wrote "Of the five pair of mature birds we knew...not one possessed more than a single chick...[we thought we had scared the first female into deserting the weaker nestling], but when pair after pair...were found with only a single chick we came to think it must be the custom of the impatient little mother immediately to leave the nest with her one youngster able to follow", and "There were no grounds for the belief that one chick was taken by the female, another by the male..."

Guthrie-Smith (1936) described 2 clutches found in 1923 as: (1) "on their ground colour of brown were spots and blotches of black, chiefly at their thick end" and (2) "greeny brown in hue with dark spottings and blotches evenly distributed over the whole surface". Bessie Spencer (unpublished diary) described the 2nd clutch of eggs found as being much darker than the 1st. Oliver (1955) described the eggs collected by Stead as "light or very pale brown with dark and pale brown spots and small blotches all over but with concentration near the larger end".

Measurements are available for 8 eggs (4 clutches) collected in 1931 (Table 1). The 3 sets of egg measurements given by Oliver (1955) are similar to measurements of 3 of the eggs collected by Stead, and were presumably selected as an indicative sample. Assuming that the eggs are the same shape as those of Snares Is snipe, their estimated fresh weights ranged from 16.8 to 22.4 g (equation in Miskelly 1989). Guthrie-Smith (1936) commented on the large size of the eggs in relation to the size of the snipe, but this is difficult to determine with any precision as no bodyweights are available for adult female Stewart Is snipe. Stewart Is snipe and Snares Is snipe had very similar body shapes and proportions (Worthy *et al.* 2002). The single set of measurements from a known female Stewart Is snipe skin (Higgins & Davies 1996) other than bill length average 4.1% smaller than female Snares Is snipe, and 1.9% smaller than male Snares Is snipe. By matching these measurements with those of small individual male Snares Is snipe, we estimate this bird to have weighed about 95 g, therefore the eggs were about 20% of female bodyweight; this is within the range of 19.3–21.6% for 5 other taxa of *Coenocorypha* snipe (Miskelly *et al.* 2006).

Table 1 Details of Stewart Is snipe (*Coenocorypha aucklandica iredalei*) eggs collected on Big South Cape I in Dec 1931. Eggs with the same reference number were from the same clutch. All 8 eggs are held in the Canterbury Museum (ex Stead collection). These are the only eggs of Stewart Is snipe known to exist. Stead's label numbers are based on the page number of his egg diary used for the taxon *Coenocorypha aucklandica iredalei* (i.e. "190"), "A" etc. matches his field labels for each clutch, and "2" is the clutch size.

Stead label	Reference	Date found	Collected by	Length (mm)	Breadth (mm)	Est. fresh mass (g)
190 A.2.	AV4674	2 Dec 1931	R.A. Wilson	39.7	29.9	18.7
	AV4674			37.8	29.2	17.0
190 B.2.	AV4675	3 Dec 1931	E.F. Stead	42.2	31.1	21.5
	AV4675			41.3	32.1	22.4
190 C.2.	AV4676	7 Dec 1931	E.F. Stead	38.7	28.7	16.8
	AV4676			40.1	28.9	17.6
190 D.2.	AV4677	7 Dec 1931	E.F. Stead	39.7	30.6	19.6
	AV4677			39.8	30.0	18.8
Mean $\pm$ SD				39.9 $\pm$ 1.4	30.1 $\pm$ 1.2	19.1 $\pm$ 2.0

Timing of breeding

Assuming an egg interval of 3 days for the 2 eggs, and incubation length of 22 days as observed for Snares Is snipe (*C. aucklandica huegeli*), and similar growth rates for chicks (Miskelly 1990, 1999a), the minimum range of lay dates for Stewart Is snipe was mid Sep to late Nov or early Dec (Table 2). With the exception of 2 fully-feathered "juvenile" birds (both in Canterbury Museum) which appear to have been collected in Dec 1931, it appears that most pairs bred earlier in 1923, as several family groups were encountered (Guthrie-Smith 1936), however no descriptions of the ages or sizes of the chicks were given other than a brood that apparently hatched on 10 Nov. Wilson (1959) and Stead (diary, Appendix 1) did not mention any downy chicks seen in Dec 1931, and Stead collected adults (4), juveniles (2), and eggs (4 clutches) but no downy chicks (all specimens now in Canterbury Museum).

Parental care

Guthrie-Smith (1936) made frequent reference to snipe as "hens" or "cocks", and stated "The sexes vary but little, the male rather larger and of rather a richer plumage". The description of males having richer plumage is appropriate for at least 2 other taxa of *Coenocorypha* snipe (Snares Is snipe; Chatham Is snipe *C. pusilla*), but plumage differences are not apparent in Auckland Is snipe (*C. aucklandica aucklandica*), Antipodes Is snipe (*C. aucklandica meinertzhagenae*), or Campbell Is snipe (*Coenocorypha* undescribed sp.) (CMM unpubl.). In all 5 other *Coenocorypha* taxa studied so far, females were significantly larger than males (CMM unpubl.), making it unclear as to whether Guthrie-Smith was sexing Stewart Is snipe correctly. However, Guthrie-Smith's sole observation of courtship-feeding "They fed also on small chrysalis-like objects on the surface and once I noted the female take from the male an inch-long pale worm of another kind." suggests

that his sex determination was correct, as all 51 food passes recorded in Snares Is snipe and Chatham Is snipe were from male to female (Miskelly 1990).

Both sexes of Stewart Is snipe incubated (Guthrie-Smith 1936). On one occasion Guthrie-Smith deliberately "– rushed – the incubating hen, before she had completed her feigned death agonies a few feet distant, the cock passing her by an inch or two clambered over my boot and took the vacated space on the warm eggs".

In the single nest where this was determined, the chicks left the nest within hours of hatching, although 1 was moribund and did not survive (Guthrie-Smith 1936). Guthrie-Smith believed that only a single chick survived from each brood, and that only the female cared for the chick, yet that family groups or trios were encountered. As these statements appear contradictory, they are quoted here in the sequence he gave them:

"Of the five pair of mature birds we knew and were always sure to find each in its own domain, not one possessed more than a single chick. Concerning the first discovered brood at one time we had thought it possible that inadvertently the hen might have been scared and thus been led to desert the weaker nestling, but when pair after pair both in the valley and on the tops were found with only a single chick we came to think it must be the custom of the impatient mother to immediately leave the nest with her one youngster able to follow."

"There were no grounds for the belief that one chick was taken by the female, another by the male; in every instance the hen seemed to be the mothering one and one only. In the case, furthermore, of the first nest, the little ones must have been coaxed – actually tempted – to leave at all, for even

Table 2 Estimated hatch and lay dates (1st egg of clutch) for 8 breeding events recorded for Stewart Is snipe (*Coenocorypha aucklandica iredalei*).

Date found	Stage of development	Estimated date	
		Hatching	Laying
10 Nov 1923	Newly hatched chicks	10 Nov	15 Oct
11 Nov 1923	Incubating 11-16 Nov		23 Oct - 8 Nov
2 Dec 1931	Hatching eggs	2 Dec	7 Nov
2 Dec 1931	Eggs ½ incubated, blown		22 Nov
3 Dec 1931	Incubating 3-4 Dec, eggs blown		22-30 Nov
4 Dec 1931	Flying, down-free chick	Before 11 Oct	Before 16 Sep
7 Dec 1931	Eggs ¼ incubated, blown		29 Nov
7 Dec 1931	Incubating 7 Dec, eggs blown		23 Nov - 4 Dec

the larger was very, very young, an hour or two old perhaps; nor did it that first day follow with the bright alertness and quick sprightliness of a normal youngster; on the contrary it did seem so bored, rolling heavily after its parent, making no brief rushes and excursions of its own, neither did the little creature wear its tiny wings tucked tightly against its sides, an unfailing indication of vigour in nestlings."

"As happily, too, the days passed following the appearances and disappearances, the exits and returns of the parents of the single chicks amongst the prone strips and cushions of green manuka, the grey flat dead sticks, the lichen stiff, like coral, and dwarf grass tree no taller than real grass... Usually the male...moves a foot or two ahead. If lost to sight, however, for the briefest period communication is kept up betwixt the pair by a low hoarse double croak. This is uttered from time to time as the pair or trio irregularly progress..."

No observations of chicks being fed were made; Guthrie-Smith attributed this to the parent being anxious when away from cover. When he captured (temporarily) the stronger chick of the recently-hatched brood, the "dolorous wailing [of the weaker chick] induced its restless mother to delay; as if to inspire and inspirit the poor little beastie, her probings in the peat were doubly frequent near it, she even once or twice touched it with her long bill, but would not brood or mother it, not at all from fear of us, for as I have explained, the birds could hardly have been less perturbed, but rather because the inherited memory of some danger of past time forbade in the open an absolutely easy mind. For the same reason I suppose we never saw the stronger chick fed; promises there were in plenty, encouragements and inducements to follow, but no fulfilment visible to us".

Other members of the 1923 expedition do not shed much light on whether single parents ("mothers") were caring for single chicks, or whether pairs were jointly caring for single chicks. Both Barbara Guthrie-Smith (Woodhouse 1959) and Bessie Spencer (unpublished diary) referred to the brood of 2 recently-hatched chicks (one of which was dead or dying) as having 1 adult in attendance (which Spencer referred to as the "mother bird"). There are no other references to adult snipe caring for young.

The only information on chick care recorded in 1931 was on 4 Dec (Stead diary; Appendix 1), when they "flushed two, an old one and a young one, the latter able to fly".

DISCUSSION

Most of the details of Stewart Island snipe breeding ecology described or discovered by Guthrie-Smith, Stead, and Wilson are consistent with what is known for Snares Is snipe, Chatham Is snipe, Auckland Is snipe, Antipodes Is snipe, and Campbell Is snipe (Miskelly 1990, 1999a; Miskelly *et al.* 2006). Laying occurred at least during Sep-Nov, the 2 large eggs were incubated by both parents, and chicks left the nest within hours of hatching.

Guthrie-Smith's (1936) observation of a female Stewart Island snipe taking a worm from a male in Nov 1923 was the 1st observation of courtship-feeding by any member of the family Scolopacidae (which contains about 90 species; Hayman *et al.* 1986). Courtship-feeding has been observed more recently in Snares Is snipe (41 food passes) and Chatham Is snipe (10 food passes); all food passes being from male to female (Miskelly 1990). These 3 *Coenocorypha* snipe remain the only scolopacids for which courtship-feeding has been reported. In the most-thoroughly-studied *Coenocorypha* taxon (Snares Is snipe), courtship-feeding occurred almost exclusively during the 3 weeks before egg-laying, and was considered to have evolved to decrease

energy demands on the female during formation of the large eggs (Miskelly 1990).

The nests on Big South Cape I were more exposed than those on the Snares Is, presumably reflecting the low density of burrowing petrels (which pose a threat to exposed nests when they land clumsily near their burrows at night; Miskelly 1999a) in the heathlands and lichen fields on Big South Cape I. Vast numbers of sooty shearwaters and mottled petrels breed on Big South Cape I, but they occupy mostly the forested coastal margins and steeper slopes, rather than the open plateaux and basins where snipe were found (Stead diary, MacMillan Collection, Canterbury Museum ARC2001.12 Box 4 Folder 19, Item 206).

The major discrepancy between what Guthrie-Smith (1936) recorded and what is now known for other *Coenocorypha* snipe is the system of parental care after hatching. In all other *Coenocorypha* snipe the typical parental care system is for single adults to be found caring for single chicks (Miskelly 1990, 1999a; Miskelly *et al.* 2006). During 565 days of observing 5 taxa of *Coenocorypha* snipe during breeding, CMM has never seen 2 adult snipe caring for the same chick, or more than 1 chick with the same adult. The 4 records of *Coenocorypha* snipe caring for more than 1 chick at a time are poorly documented (but see Miskelly 1990; Miskelly *et al.* 2006).

In both Snares Is snipe ($n = 10$) and Chatham Is snipe ($n = 5$) the male cared for the 1st chick to leave the nest (and the female the 2nd) at all nests where both eggs hatched (Miskelly 1990). An adult that lost its chick (or never had one because an egg failed to hatch) did not assist its mate to rear the other chick (Miskelly 1990), and many emancipated adults rapidly obtained a 2nd mate and bred again while their 1st mate reared the surviving chick from the 1st nest (Miskelly 1999b). Even when both members of a pair were caring for chicks from the same brood, the family group did not stay together, and each parent-chick pair was completely independent of the other (CMM pers. obs.). While Guthrie-Smith's (1936) observations of "pair after pair" being found with only a single chick appears at odds with what is known for other *Coenocorypha* snipe, he may have been referring to sightings of single parents with single chicks (rather than the 2 chicks he may have expected to see) and loosely referred to these as "pairs" having single chicks. This interpretation is consistent with his comment that "in every instance the hen seemed to be the mothering one and one only". However the one explicit mention of males uttering calls "as the pair or trio irregularly progress" suggests that some pairs at least did remain together while caring for a single chick. Unless Guthrie-Smith's 1923 field notes can be located, and they contain information

that contradicts his 1936 book, we must assume that Stewart Is snipe, unlike all other *Coenocorypha* snipe, had a system of dual parental care for single chicks.

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Appendix 1 Edgar Fraser Stead's diary entries referring to Stewart Is snipe on Big South Cape I, Nov-Dec 1931

E.F. Stead 1929-1947 diary pages, David MacMillan Collection, Canterbury Museum ARC2001.12, Box 4, Folder 19, Item 206

[Comments in square brackets, C. Miskelly]

[Edgar Stead, Robert Wilson, Sir John Hanham, and Eb Hay stayed on Solomon I, and encountered snipe only on adjacent Big South Cape I, which they reached by boat.]

11 Nov 1931 Launched the boat this morning... and went off to Murderers' Cove [east coast Big South Cape I]...We made for the high land, and after we got above the bush came into the open with stunted *Dracophyllum* and manuka...Hanham saw a snipe up there but we could not see it again...

2 Dec 1931 ...In the afternoon we went across to BSC [Big South Cape Island] and pulled the boat up at the N. end huts. Bob [Wilson] & H [Hanham] went up on top...They found two Snipes' nests each with two eggs^A – one set just hatching, the other ½ incubated. The nest was a shallow structure of bits of fern and *Dracophyllum* in windswept Manuka about six inches high...

3 Dec 1931 ...got gear and went to B.S.C. We went right up on top and began to systematically beat the scrub tops for Snipe. I flushed a hen which ran away, and later Bob put one off its nest. It flew up and settled some four yds [yards] away, and there fluttered its wings and squeaked. The nest was a few bits of moss and dracophyllum leaves, very shallow, and placed on the ground in a sparse bit of manuka about nine inches high. The two fresh eggs were plainly visible from almost any direction through the scrub. We will go back and try to photograph her tomorrow...

4 Dec 1931 It was a beautiful fine calm morning so we all went in the boat to B.S.C. taking the camera

with us up to the Snipe's nest. I took pictures of the bird on and off the nest, and of the nest itself. We then went along the island for about two miles, beating all likely scrub in the hope of finding more nests, but without avail. At the S. end we flushed two, an old and a young one, the latter able to fly. They were much darker in plumage than the ones we saw at this [northern] end. The nest I pictured was chiefly made of the white coral-like moss [*Cladia* lichen]. The bird ran in a furtive manner in and out of the patches of scrub, running fast when in the open, and, sometimes, when in cover. Its manner reminded one of the old motor joke about the quick and the Dead – the Skuas [brown skua *Catharacta skua lonnbergi*] get those that are not quick. Its actions were very like those of a mouse, and it, as a rule, carried its bill more or less down. On the nest it allowed me to pick bits of manuka out of the way, with my fingers almost touching it, giving a low whistling note the while. I tried to move it with a stick, but it sat tight; yet it jumped off the nest and flew a few yards when I touched it with my hand. It seems that, when disturbed they always jump off the nest and fly. It pretended to be wounded, shaking its drooping wings and giving vent to a harsh, grating cry. It took nearly an hour to come back to the nest enabling me to get a picture of it, and then it did not come back again in the next half hour that I waited...

7 Dec 1931 ...Came back & went to Timaru [north coast of Big South Cape I], and up onto the top. Just as we were turning off up the second hill, Bob [Wilson] flushed a snipe from a nest with two^D eggs ¼ incubated. We must have passed this bird repeatedly during the last week and yet never flushed her. The nest was in a small open piece of manuka, half of it dead, on the edge of an old

burn, and was a shallow scratching in the peat, lined with "coral moss" [*Cladia* lichen] and a few dracophyllum leaves. We went on and later flushed a pair of birds (they did not fly, but ran) on a fairly steep hillside, below the highest top at this end of the island [Mount Onion]...We then had lunch and went along the top through very good snipe country, but saw none...Bob went away down the main gully [Boatharbour Gully], while Eb [Hay] and I worked a flat in a basin. I flushed a bird from a sparse bit of manuka growing around a bare dead branch of same. It did not fly but ran, shamming, among some small scrub. The eggs^c were dark and rather small, the nest, of coral moss and flakes of manuka bark...

9 Dec 1931 ...As the light had then gone we went to B.S.C. and up on top to photo the Oeg [*Oestrelata gularis* ≡ mottled petrel *Pterodroma inexpectata*] nest, which we did. Saw a snipe on the track as we went up...

10 Dec 1931 ...Bob [Wilson] & Eb [Hay] repaired the hole in the boat, and we got on board for Murderer's Cove [east coast Big South Cape I.]... Photoed Skuas' midden at upper hut, left camera there and went on up to the plateau. Saw many wrens [Stead's bush wren *Xenicus longipes variabilis*] on the way, and a snipe in the scrub...

12 Dec 1931 ...We then went to B.S.C....Then went right to the top of the bush getting several [mottled petrel eggs] there at the edge of the scrub and finding two burrows with pairing birds in them. Then beat a large basin of scrub for snipe but saw none...

[Stead used superscript capital letters to denote eggs he collected. He labelled three of the snipe nests ^a, ^c & ^b; ^b was not labelled, but was clearly the nest found on 3 Dec and photographed on 4 Dec. The eggs from this nest were collected (Table 1), with the collection date recorded as 3 Dec 1931. These letters match the labels that Stead applied to the eggs (Table 1).]