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## DECLINE OF THE STEWART ISLAND POPULATION OF THE NEW ZEALAND DOTTEREL

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### ABSTRACT

Between 1988 and 1992, we conducted the first comprehensive survey of the number and breeding distribution of the New Zealand Dotterel (*Charadrius obscurus*) on Stewart Island. The population forms three post-breeding flocks, two of them on Stewart Island; band sightings have confirmed an earlier suggestion that the flock at Awarua Bay, Southland, is also composed of birds from the island. The population is widely spread over difficult terrain during the breeding season; autumn counts of the flocks provide the only practical means of assessing population size. Comparisons with earlier counts show that the population has declined to about one-fifth of its former size in the past 37 years. The population is critically endangered because the decline continues and only 60-65 dotterels remain. Average annual mortality of banded adults between 1990 and 1992 was 23%. The major reason for the decline is believed to be predation by feral cats. Band sightings suggest that, apart from Southland, most or all of the recent NZ Dotterel records from the South Island coast (including Farewell Spit) are of juveniles wandering from Stewart Island.

### INTRODUCTION

The New Zealand Dotterel (*Charadrius obscurus*) is an endemic plover with a population estimated at about 1400 birds in a census in 1989-90 (Dowding, in prep.). It was formerly widespread in New Zealand but there are now two separated breeding populations; at least 95% of the birds are found on the coast of the northern part of the North Island. Until the late 19th century, the species was widespread (and apparently locally numerous) in the South Island (e.g. Buller 1882, Potts 1885) with most records suggesting that it bred inland and formed post-breeding and winter flocks on the coast. In the past 100 years it has all but disappeared from the South Island and we know of no confirmed breeding records there this century. Almost all sightings now are on the coast, although two birds seen near Luggate in Central Otago in about 1953 (Williams 1963) were well inland and may have

been attempting to breed. There are regular reports of small numbers of NZ Dotterels in the northern part of the South Island, particularly on Farewell Spit, and there has been some speculation on the origin of these birds (e.g. Sibson 1982). A group of birds has survived and still breeds on Stewart Island.

The species was not recorded on Stewart Island by Black (1872), but his list contains only birds collected on the east coast between Port William and Port Adventure. Similarly, it does not appear among 13 species recorded by Reischek (1888) from the Lords River district. The first record of the species on the island appears to be that of Buller (1896), who obtained two specimens, collected on Table Hill, from a Mr Marklund. The birds were breeding at the site because Marklund recorded the presence of unfledged chicks. Cockayne (1909) published the first list of birds of the island (based largely on information provided by J.W. Murdoch) and recorded 53 species. The NZ Dotterel was described as "plentiful on beaches and also on the mountain-tops, where, as on the Table Hill Range, it nests in November." Guthrie-Smith (1914) recorded breeding by a few NZ Dotterels in the sand dunes at Mason Bay; his account suggests that he found about five pairs there in November 1911. Philpott (1918) noted that the species was "Seldom seen on the mainland. In Stewart Island it occurs in fair numbers". Oliver's (1926) review of the birds of Stewart Island lists the NZ Dotterel among 64 species but does not comment on abundance or distribution.

In the past 50 years, there have been a number of reports of NZ Dotterels at various localities on Stewart Island but few counts of flocks. In May 1955, a flock of more than 218 birds was recorded at The Neck, at the mouth of Paterson Inlet (McKenzie & Traill 1956). Blackburn (1972) recorded up to 40 birds in Cooks Arm, Port Pegasus, in southern Stewart Island in 1969. A flock of 51 birds was recorded at Awarua Bay, Southland, in January 1969 and Edgar (1969) suggested that "In the absence of proof that dotterel breed on Southland coast it must for the present be assumed that these birds came across Foveaux Strait". Numbers in Awarua Bay have been monitored fairly regularly since then (Barlow, this issue).

Apart from the counts in Southland, there has been virtually no work on the Stewart Island population of the NZ Dotterel. This is probably partly due to the remoteness of dotterel breeding sites on the island and the difficulties of access. Our study aimed to determine the breeding distribution of the species on Stewart Island and to provide the first accurate estimate of the size of the population. It was also hoped to determine, by comparison with earlier counts, whether the population was stable.

#### METHODS & STUDY AREA

Ten field trips, each of 2-4 weeks, were made to Stewart Island between December 1988 and April 1992. We searched different areas of the island during each breeding season. Initially, we were guided by historical records, unpublished NZ Wildlife Service and Department of Conservation (DoC) reports, personal communications (particularly from S. King, R. Buckingham and A. Davis) and sightings recorded in Powlesland (DoC unpublished S&R internal report no. 11, 1988). We also checked areas not

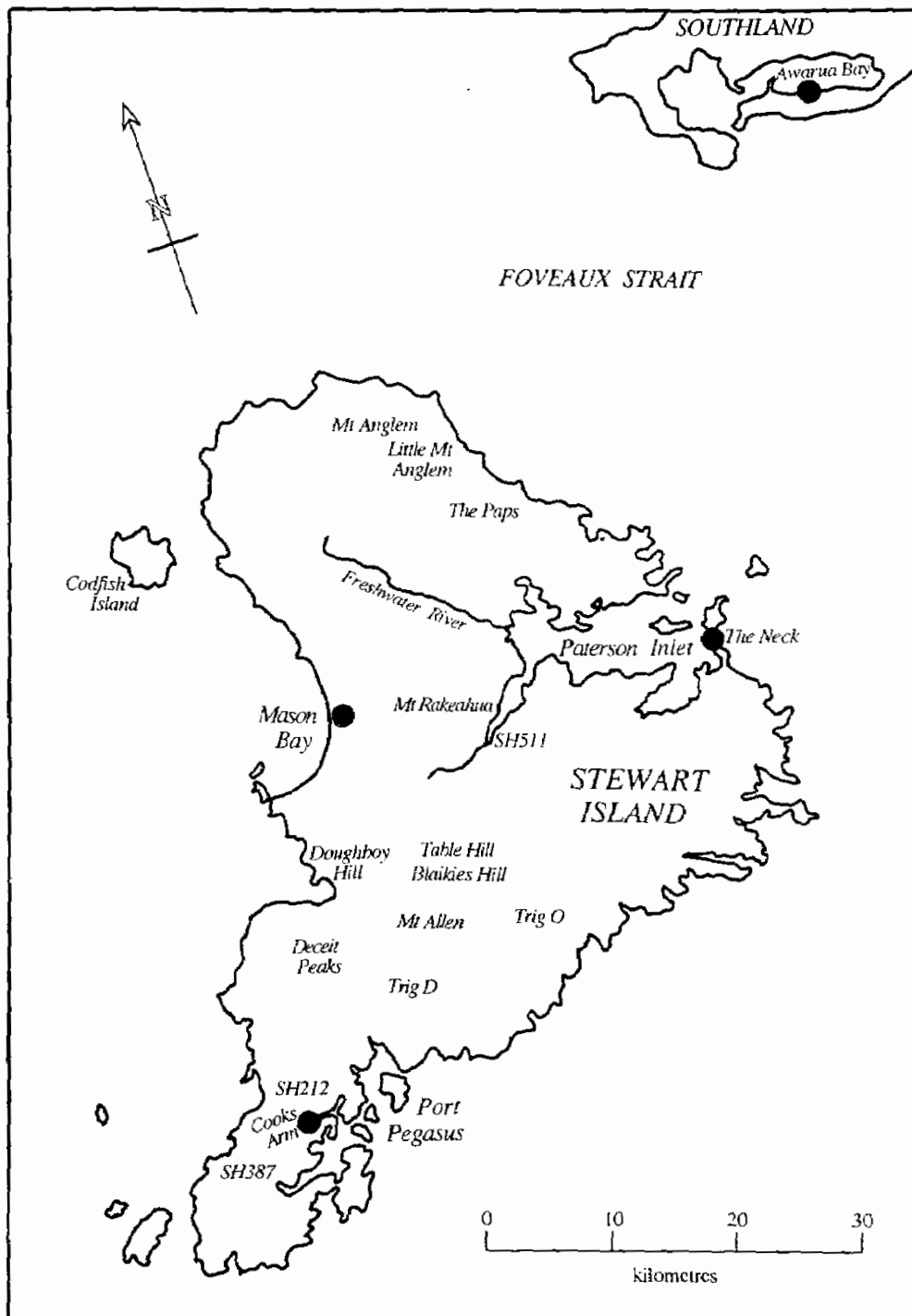


FIGURE 1 — Map of Stewart island showing localities mentioned in the text. Closed circles (●) indicate the roost sites of winter flocks.

previously known to have NZ Dotterels. We checked Mt Rakeahua and the Table Hill-Blaikies Hill area at the northern end of the Tin Range each season. After the 1988-89 season, we checked potential breeding sites only at or near high water because off-duty birds or both members of a pair without nest or chicks were frequently found to be absent at other times. From 1990, we counted flocks and checked birds for bands during late March and early April. Each flock was checked at high water for at least three

consecutive days to ensure that numbers were roughly constant. Birds were caught and banded at breeding and flock sites as described by Dowding & Chamberlin (1991). Adults and birds of the year caught in March and early April were distinguished by the state of their primary moult. Localities mentioned in the text and roost sites of winter flocks are shown in Figure 1.

## RESULTS

### Distribution of breeding sites

Table 1 shows all the localities at which NZ Dotterels are currently known to breed or have bred on Stewart Island in the past 10 years. Latest records (mostly 1991-92) of the numbers of pairs at each site are shown, with other recent records for comparison.

TABLE 1 — Known breeding localities of NZ Dotterels on Stewart Island

Location	Number of Pairs	
	Recent records	Latest records
Mt Anglem-SH 975 ridge	3 (b)	2 (a)
Little Mt Anglem		2 (a)
Mt Rakahua	3 (b)	0 (a)
SH 511, NE of Trig X		1 (a)
Doughboy Hill	2 (c)	1 (b)
Table Hill	6 (b)	8-9 (a)
Blaikies Hill	3 (b)	1 (a)
Trig O, S of Kirklands Hill	2 (d)	?
Deceit Peaks	2 (e)	?
Southern Tin Range (Mt Allen-Trig D)	4 (f)	1 (b)
SH 212, N of Cooks Arm	1 (e)	0 (b)
SH 387, S of Fraser Peaks	1 (e)	1 (b)

(a) 1991-92 (this study)

(b) 1988-91 (Dowding & Murphy, unpublished report to DoC Southland, 1991)

(c) 1987-88 (A. Davis, pers. comm.)

(d) 1989-90 (S.D. King, pers. comm.)

(e) 1984-85 (Powlesland, DoC unpublished S&R internal report no. 11, 1988)

(f) 1986-87 (B. Lloyd, pers. comm.)

The following are notes on breeding distribution.

*North-east Stewart Island:* Still present on Mt Anglem, but probably only two pairs on the whole ridge. Two pairs on Little Mt Anglem in December 1991 appear to be the first record for this locality. None found on The Paps in December 1991.

*Mason Bay*: NZ Dotterels were recorded breeding in the dunes by Guthrie-Smith (1914) and Dawson (1951); our extensive searches in the 1989-90 breeding season yielded no birds.

*SH511*: In January 1981, 11 NZ dotterels were found in the open area around SH 511 (D. Mules, DoC internal file, *per* S.D. King). A thorough search in December 1991 revealed one pair defending chicks. The decline at this site may be partly due to the presence of a breeding colony of Southern Black-backed Gulls (*Larus dominicanus*).

*Mt Rakeahua*: Has disappeared from this site during our study; three pairs (all with chicks) in December 1988, one pair in November 1990 and none in December 1991. The partial remains of an adult NZ Dotterel were found on the summit of Mt Rakeahua in November 1990 but it was not clear what had caused its death.

*Northern Tin Range*: Blaikies Hill and the ridge immediately to the south and east had three pairs in 1990-91 and one pair in 1991-92. Table Hill is the only locality where numbers have increased during our study and is now the only site with more than two pairs. In December 1991, a group of five juveniles was also present on the breeding grounds at Table Hill.

*Southern Tin Range*: There has been an obvious decline in this area. Four pairs were seen between Lees Knob and Trig D in December 1986 (Brian Lloyd, pers. comm.), two pairs in 1989-90 (Sandy King, pers. comm.) but only one pair in 1990-91. Not checked in 1991-92.

*Deceit Peaks*: Two pairs were reported in 1984-85 by Powlesland (DoC, unpublished S&R internal report no. 11, 1988). This area contains much suitable habitat and needs to be thoroughly surveyed specifically for NZ Dotterels.

*Southern Stewart Island*: The species appears to have almost disappeared from the area south of Cooks Arm; probably only one or two pairs remaining in 1992.

There were no surveys in 1991-92 at Trig O or from the Deceit Peaks. Assuming one pair at Trig O and two pairs in the Deceit Peaks, latest breeding ground records account for 20-21 pairs (of a likely maximum of 25 pairs in the whole population - see Population size below).

### **Flock sites and movement patterns**

The Stewart Island population forms three post-breeding flocks. A review of the literature (and many unpublished reports), examination of aerial photographs for likely sites, and extensive searches (by boat and on foot) in many parts of the island suggest that no other flocks now exist.

*Awarua Bay flock, Southland*: Band recoveries from our study have shown that NZ Dotterels routinely cross Foveaux Strait. Three adults known to breed on the island wintered with the Awarua Bay flock; five juvenile birds banded on the island have also been recorded there for varying periods.

*Paterson Inlet flock, Stewart Island*: Banding revealed that the largest flock, based around feeding grounds in Paterson Inlet, was highly mobile. The birds feed on the tidal flats at the mouth of the Freshwater River at

the western end of the Inlet. At high water during daylight, they fly to Mason Bay on the west coast and roost in the sand dunes there for 1.5-3 hours; as the tide falls they return to the Freshwater Flats. At high water at night they fly to the east coast and roost at The Neck. The flock therefore commutes from one side of the island to the other and back, a round trip of about 60 km, every 24 hours. Most other waders that also feed on the Freshwater Flats in Paterson Inlet, including Bar-tailed Godwit (*Limosa lapponica*), South Island Pied Oystercatcher (*Haematopus ostralegus finschi*) and Turnstone (*Arenaria interpres*), roost at The Neck night and day and are not seen at Mason Bay.

*Cooks Arm flock, Port Pegasus, Stewart Island:* The birds normally roost on a rock on the south side of Cooks Arm, at its western end. At very high tides, this rock is covered and the birds fly east to another (undiscovered) site, possibly on the open tops immediately south of the Arm. At times other than high water, the birds can usually be found feeding as a group on the tidal flats in the upper reaches of the Arm.

By April 1992, 31 adults and 17 fledged juveniles had been individually colour banded. In autumn 1991, at least 23 of the 79 birds (29% of the population) were banded and in autumn 1992, 25 of 62 birds (40% of the population) were banded. All surviving banded adults were faithful to one of the three flock sites during the three years 1990-92; we detected no movement between flocks by any adult, and no adult which disappeared from a flock was seen again. There was no obvious link between breeding and flocking sites. Birds from all three flocks are known to breed on Table Hill and we know of three pairs in which members of the pair flock at different sites. One member of a pair breeding on Little Mt Anglem flocks at Awarua Bay, while its mate flocks at Mason Bay; one member of a pair breeding on Table Hill flocks at Mason Bay, while its mate flocks at Cooks Arm; one member of another pair breeding on Table Hill flocks at Awarua Bay and its mate flocks at Mason Bay. Flocks stayed together over winter, at least until early August (see also Barlow, this issue).

### **Population size**

Checking all known breeding grounds on Stewart Island in a single season would be difficult and very time-consuming. Therefore, we derived population estimates by summing counts of the three post-breeding flocks and allowing for a few juveniles wandering in the South Island. There is no evidence that birds remain at breeding sites after the end of February. Totals for the period 1990-92 are shown in Table 2.

Band sightings and captures suggest that at least 15 of the 1991 total of 79 (19%) and 11 of the 1992 total of 62 (18%) were juveniles (birds of the year or known 1-year-olds); this in turn suggests a maximum of 25 pairs of breeding birds in the southern population in 1992.

### **Rate of decline**

Individual flock counts from this study (Table 2), previous counts from the literature and other sightings are combined in Figure 2. A flock estimated to contain 140 birds was seen on The Neck in May 1971 (H.A. Best, pers.

TABLE 2 — Flock counts and population estimates, 1990-1992

Flock	1990	1991	1992
Cooks Arm	13	7	3
Paterson Inlet	64	52	43
Awarua Bay	23	13	11
Wandering juveniles (estimated)	9	7	5
Totals	109	79	62

comm.) and a flock of about 30 was seen in Cooks Arm on 11 April 1978 (H.D. Wilson, pers. comm.). Data for the Awarua Bay flock are largely from Barlow (this issue).

Although there are few counts of the Paterson Inlet and Cooks Arm flocks, all three flocks show a consistent steep decline in numbers, a decline that has continued during our study. In particular, the Paterson Inlet flock (much the largest) has declined to about one-fifth of its former size in 37 years. During the period 1990-92, this flock averaged 64% of the total Stewart Island population. If this proportion was similar in 1955 (when the flock contained more than 218 birds), the total population in 1955 would have been about 350. Adding the 1969 Cooks Arm count and the 1971 Awarua Bay and Paterson Inlet counts suggests a minimum of 230 (probably 250-260 allowing for wandering juveniles) in the early 1970s.

### Annual adult survival

The annual mortality of adult birds was determined from the number of banded birds seen in the autumn flocks (Table 3). Although sample sizes were small, annual adult mortality was clearly very high, averaging 23.1%.

### Movement of juveniles

Our study provides the first direct evidence that at least some of the few NZ Dotterels recorded in the north of the South Island (notably on Farewell Spit and at Motueka) are juveniles wandering from Stewart Island.

One bird (WB-BM) was banded as a recently fledged juvenile near Trig D, at the southern end of the Tin Range, Stewart Island, in January 1991. It was still at Trig D two days after banding and was next seen in early February at Farewell Spit, a minimum journey of 835 km in 13 days or less. This bird was seen again at Westhaven Inlet (about 35 km WSW of Farewell Spit) in May 1991. It was found back on Stewart Island in December 1991. A second bird (YM-WB) was banded as a recently fledged juvenile at Blaikies Hill, Stewart Island, also in January 1991. It was seen at Motueka Sandspit, Nelson (a straight-line distance of about 770 km), in March and again in May 1991.

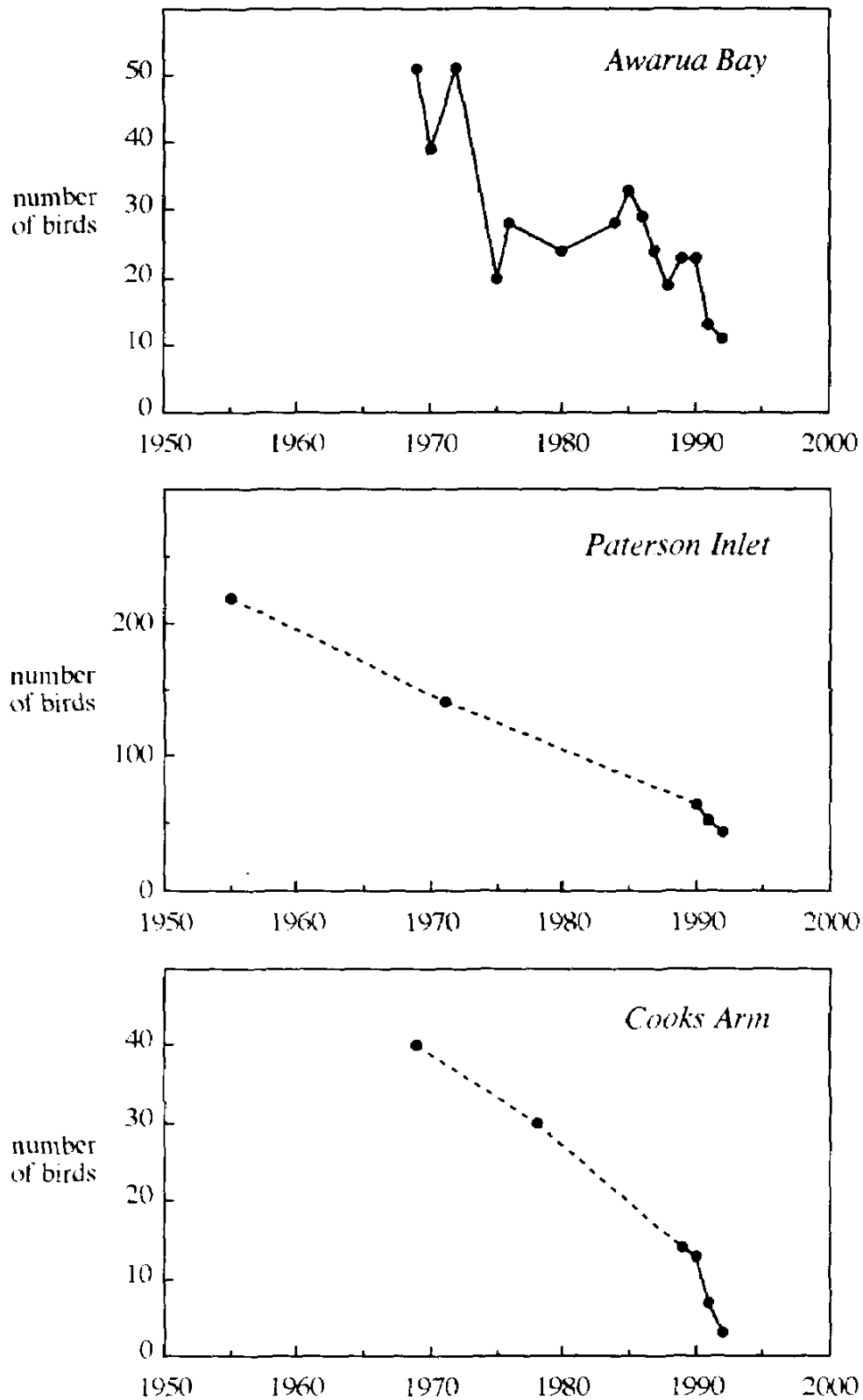


FIGURE 2 — Numbers of NZ Dotterels counted in autumn-winter flocks at Awarua Bay, Southland, and at Paterson Inlet (including Mason Bay) and Cooks Arm, Stewart Island. Data for Awarua Bay from 1971 to 1989 are from Barlow (this issue).



TABLE 3 — Annual mortality of banded adult NZ Dotterels on Stewart Island

Year (Y)	No. alive in autumn flocks		Mortality
	at Y	at Y+1	
1989	9	8	1
1990	17	13	4
1991	26	19	7
Totals	52	40	12

At least 265 chicks or juveniles have been colour-banded in the northern North Island over a period of 41 years, including 148 in the past 3.5 years. In spite of many expeditions to Farewell Spit and twice-yearly counts of waders there since 1983, none of these birds has been seen at Farewell Spit or elsewhere in the South Island. By contrast, we have banded only 21 chicks or recently fledged juveniles on Stewart Island in 3.5 years, and already two have been seen (twice each) in the northern South Island.

## DISCUSSION

### Flock sites and movements

Our banding study has shown that the Awarua Bay flock in Southland contains birds from Stewart Island. As there are no recent records of NZ Dotterels breeding in Southland (or anywhere else in the South Island), the entire flock probably comes from Stewart Island, as suggested by Edgar (1969). There have been regular reports of birds (usually <20) on the beach at Mason Bay, and one sighting of 30 in March 1976 (Sagar 1976), but no evidence that a large flock roosted in the dunes there regularly. Our discovery of a flock of 64 birds among the dunes in 1990 suggests that roosting behaviour may have changed in the past 35 years; the birds in this flock are known to feed in Paterson Inlet at low water and to roost at The Neck only at night. Assuming that McKenzie & Traill's (1956) record of a large flock on The Neck was made during the day, there appears to have been a change in the flock's day-time roost site since 1955. The day-time record of about 140 birds on The Neck in 1971 (H.A. Best, pers. comm.) indicates that the flock had not moved its roost by that date. On 30 January 1979, a flock of about 30 was seen on The Neck (H.D. Wilson, pers. comm.), suggesting that this could have been when the flock was moving roost sites.

In the northern population, Dowding & Chamberlin (1991) found that post-breeding flocks consisted of discrete groups of birds (breeding adults from the adjacent coastline and a few wandering juveniles), that there was very high fidelity of adults to their flock site from year to year, and that both members of pairs always visited the same flock. On Stewart Island,

banded adults were also faithful to a flock site but there was no obvious link between breeding site and flock, and members of some pairs visited different flocks. This may be a consequence of the high mortality among breeding adults; some widowed birds may move to a different breeding site when they find a new mate but remain faithful to their flock site.

### **Population size and decline**

Based on McKenzie & Traill's (1956) count (and in the absence of other information), most authors since have apparently assumed that the Stewart Island population of the NZ Dotterel was stable at 200-250 birds (e.g. Falla *et al.* 1966, Soper 1972, Reed 1981, McKenzie & Heather 1985). Falla *et al.* (1966) proposed that the flock on The Neck may represent the normal winter flocking of the southern population; sightings of NZ Dotterels at Port Pegasus in 1937 (Richdale 1953) and around Awarua Bay in the 1950s (Barlow, this issue) suggest, however, that the Cooks Arm and Awarua Bay flocks existed then. Our analysis indicates that the total population was probably much higher than 200 in 1955, but has declined very rapidly in the past 37 years to its present level of 60-65 birds, together with a contraction of the breeding range. The species no longer breeds in the dunes at Mason Bay, as it did 40 years ago (Dawson 1951), and all known breeding sites are now on the open tops of the island between 300 and 980 m a.s.l. Since 1988, birds have disappeared from Mt Rakeahua and declined in number at other breeding sites (Table 1). The number of pairs on Table Hill increased during our study and juveniles were there during the breeding season. Perhaps survivors from other areas (probably including widowed birds) and juveniles may be congregating on Table Hill, the only important breeding site remaining, in an attempt to acquire mates.

At the current rates of decline of the three flocks (Figure 2), the southern population will be extinct in 5-10 years. It will probably pass the point from which recovery might reasonably be expected sooner than this, however; the birds are thinly spread, in difficult terrain, and if the decline continues at the present rate, it will soon be too difficult and expensive to protect enough birds for the population to survive.

### **Causes of decline**

Many problems faced by NZ Dotterels breeding in the North Island do not exist on Stewart Island; there is little or no disturbance by people, domestic animals or vehicles and much apparently suitable habitat is available. The population currently contains a high proportion of juveniles, suggesting that lack of productivity is not the primary reason for the decline. Our results show that the annual mortality of adult birds is about three times that seen in the northern population (Dowding & Chamberlin, in prep.). Together, these findings suggest that predation is a major problem. Given that mustelids are not on Stewart Island, feral cats (*Felis catus*) seem the most likely predators of adult NZ Dotterels, although ship rats (*R. rattus*) could also be a threat. Birds, particularly species nesting or feeding on the ground, are a major item of the diet of cats on the island, being found in 44% of scats (Karl & Best 1982). It seems unlikely that many cats are permanently resident on the open tops of Stewart Island but the home ranges of cats can

be large (e.g. Fitzgerald & Karl 1986). Perhaps relatively few animals are doing much of the damage, visiting breeding sites on the tops periodically from forest or scrub areas lower down.

Why predation is having such an impact now is not clear. Cats (and rats) have probably been on Stewart Island for 150 years or more; if they had been killing dotterels at the present rate for long, the population should have disappeared many years ago. Therefore, the density, distribution, behaviour, or diet of cats on the island may have changed in the past 40 years. The situation appears similar to that seen for Kakapo (*Strigops habroptilus*), which suffered high mortality on Stewart Island in the early 1980s (Powlesland 1989). There was some evidence that a few cats were learning to target Kakapo and having a disproportionate effect (A. Roberts, pers. comm.) and the same could now be happening to NZ Dotterels. Other species may also have been particularly affected by cat predation in the past 40 years. Wekas (*Gallirallus australis scotti*) were described as abundant on Stewart Island by Oliver (1926) and were still plentiful south of Paterson Inlet in 1941 (Traill 1953); they are now almost extinct on the island, in spite of the release of about 900 birds from Codfish Island between 1979 and 1981 (Powlesland, DoC unpublished S&R internal report no. 11, 1988). Brown Teal (*Anas (aucklandica) chlorotis*) also declined rapidly on Stewart Island "after cats increased in 1950s" and none has been seen since 1972 (Marchant & Higgins 1990).

### **Juvenile wandering**

The minimum distance travelled by WB-BM, from Stewart Island to Farewell Spit and back via Westhaven (in 11 months), is about 1670 km, by far the longest recorded for any NZ Dotterel. Apart from sightings on Farewell Spit and elsewhere in Nelson, a few NZ Dotterels are occasionally recorded on the west and east coasts of the South Island (e.g. Onley 1987, Crossland & Reese 1991). In the light of our findings and in the absence of evidence to the contrary, it seems likely that most or all of these are juveniles (and possibly also bereaved adults) wandering from Stewart Island. There is no evidence so far of interchange between the present northern and southern populations.

### **Differences between northern and southern populations**

The question of the taxonomic status of the Stewart Island population has not yet been resolved. In 1969, Sir Robert Falla stated (in a letter to M.L. Barlow) that he believed the Stewart Island birds to be a separate subspecies and wrote "It is so different in behaviour and habits from the northern race" (M.L. Barlow, pers. comm.). The genetic work that would decide this question has not yet been undertaken, but we have noted considerable differences between northern and southern birds. Those on Stewart Island are significantly heavier and larger in some measurements (Dowding, in prep.) and have noticeably darker plumage than North Island birds. There are also behavioural differences, the most obvious being that dotterels on Stewart Island now nest only on the open subalpine tops and that flocks stay together throughout winter, unlike those in the North Island (Dowding & Chamberlin 1991).

## Conclusions

The Stewart Island population of the NZ Dotterel has declined dramatically and currently numbers only about 60 birds, probably less than a fifth of its size 40 years ago. The decline continues. Reversing the decline of the southern population should have the highest priority; unless the population is managed successfully it will probably die out within a decade, although it is likely to pass the point of no return well before this. There are obvious logistical problems in trying to protect these birds, as breeding grounds are now widely scattered, in difficult terrain and with few pairs at each location. If most (or all) of the NZ Dotterels seen in the South Island are from Stewart Island, the loss of that population would greatly reduce the species range. With the physical and behavioural differences we see in birds of the southern population, there would also be a loss of diversity, some of which may well be genetically based.

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