

TERRITORIES OF SOUTH ISLAND FERNBIRDS (*Bowdleria punctata punctata*)

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ABSTRACT

South Island Fernbirds near Invercargill, Southland, were studied for two years: Adult birds had year-round preference for areas with low dense ground vegetation and emergent shrubs. The preferred habitat occurred in a linear strip along an estuary margin. Territories were contiguous and distributed in linear fashion along the strip. Territory areas varied from 530 m² approximately to 2870 m² approximately. Territories were strongly defended during the prebreeding and breeding seasons, and defended to some degree at other times. Juveniles were often found outside the preferred adult habitat. There were indications that total Fernbird population needs may include an area adjacent to but exclusive of adult territory areas. Fire had a prolonged adverse effect on breeding habitat.

INTRODUCTION

Very little quantitative information is available on the habitat preferences and territories of South Island Fernbirds (*Bowdleria punctata punctata*). In an intensive 1-day study, Best (1979) found that Fernbirds at Kongahu Swamp in western Nelson had "a marked preference for areas with a low, dense ground vegetation and emergent shrubbery, and are infrequently seen in cut-over kahikatea forest bordering on swampland, or in level pakihi vegetation lacking shrubs."

I studied South Island Fernbirds at Bushy Point on the shore of the New River Estuary, Invercargill, between June 1978 and September 1981. The data in this paper, obtained between June 1978 and July 1980, not only confirmed Best's findings but also showed that the habitat preference continued throughout the year.

Observations of individually banded birds gave information on territories and bird movements. During the breeding season, observations of unbanded birds in relation to known nests yielded further information.

Breeding extended from September to February. In this paper I call the 1978/79 breeding season "1978" and the 1979/80 season "1979" and have rounded compass directions to the nearest full compass point.

I was motivated in this study by realising how little is known about the Fernbird and how such information is needed in the planned management of wetlands. Because the study area was a small remnant of wetland close to a city, information about it may be relevant to environmental management plans for land containing pockets of similar habitat. Despite the continuation of wetland drainage there are still many areas supporting populations of Fernbirds, as demonstrated by Bull, Gaze & Robertson (1978).

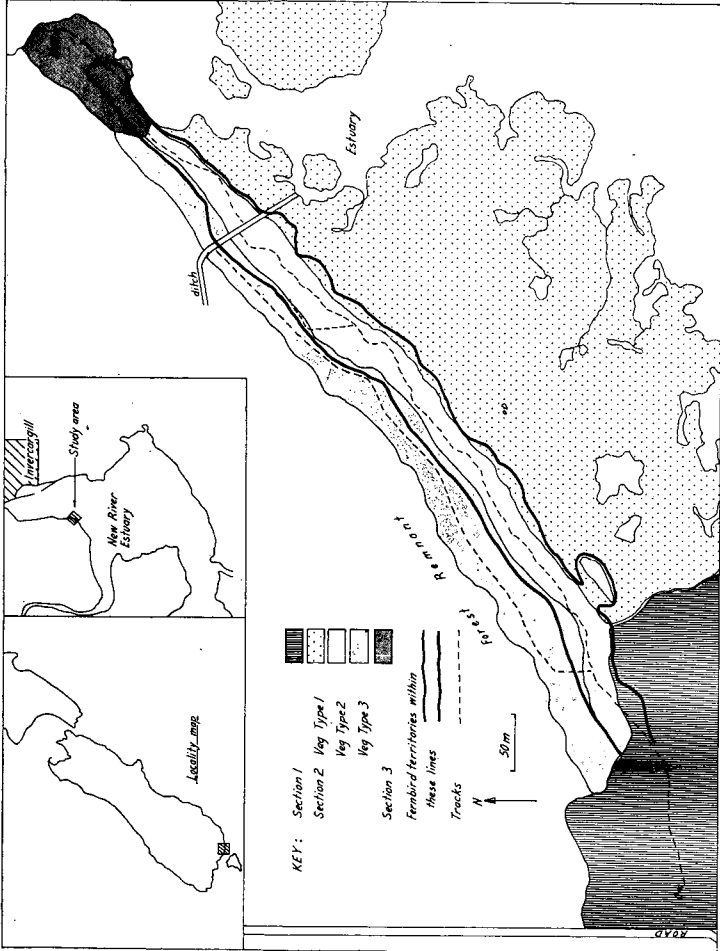


FIGURE 1 — S.I. Fernbird study area, Bushy Point, near Invercargill.

THE STUDY AREA

The study area was a strip of swamp bordering the New River Estuary near Invercargill (46°27'S, 168°19'E). It is approximately 1000 m long and varies in width from 25 m to 300 m. It was bounded on one long side by the estuary, on the other long side by dense manuka and remnants of mixed podocarp forest, and on the western end by a partly formed road. An excavated ditch crossed it (Fig. 1). Part of the swamp was regenerating from a fire in 1968, but during the study years it was dry underfoot only once, for 3 weeks in the summer of 1978.

The Fernbirds occupied this strip of swamp in a chain of breeding territories that pairs needed to defend only at the adjoining west and east boundaries because, with four exceptions, there were no territories to north or south.

The study area consisted of the following three sections, which are shown in Figure 1.

Section 1. The western end, regenerating from fire in 1968: Flax (*Phormium tenax*), cabbage trees (*Cordyline* sp.), dead and emerging manuka (*Leptospermum* sp.), *Coprosma* spp., occasional stunted silver tussocks (*Poa caespitosa*) and jointed rush (*Leptocarpus similis*) on its northern half merged into a level reedbed of jointed rush 0.5-1.0 m high to the south. The regenerating jointed rush was evenly distributed but sparse. High spring tides invaded much of the rush area.

Section 2. The major part of the study area: The vegetation was classified into three types, which formed a seral succession from reedbeds in the tidal zone through scrub to a climax vegetation of manuka-dominant bush. I have followed Best's (1979) method of describing vegetation types to simplify comparison between the Kongahu Swamp and Bushy Point habitats. Types 1 and 2 were similar in profile to Best's types 1 and 2 in Kongahu Swamp.

Type 1. Level reedbeds: Jointed rush moderately dense (the ground visible between rush stalks when viewed from above) 0.5-1.3 m high, with occasional stunted *Coprosma* spp. and marsh ribbonwood (*Plagianthus divaricatus*) seldom taller than the rush. The rushes extended to the open tidal mud, and the area varied in width from 5 m to about 230 m at the widest point. The ground was waterlogged estuarine mud. High spring tides invaded the rushes to varying depths, the depth decreasing as the ground steepened gradually and the plant cover merged into type 2.

Type 2. Reedbeds with stunted shrubs: Jointed rush very dense (the ground not visible when viewed from above), 1.2-1.4 m high with frequent intrusions of stunted *Coprosma* spp., marsh ribbonwood, *Muehlenbeckia complexa* and manuka growing to 1.8 m high, forming hummocks above the rush. Occasional flax, toetoe (*Cortaderia* sp.), lancewood (*Pseudopanax crassi-*

folius), weeping matipo (*Myrsine divaricata*), *Pittosporum* sp., *Carex* spp. and clumps of introduced grasses, the last two occurring where rushes had been flattened by ground-roosting and nesting Harriers (*Circus approximans*). This area was 20-40 m wide and merged into type 3.

Type 3. Manuka-dominant bush: A band 20-50 m wide along the northern boundary, consisting of a dense stand of manuka 1.8-3.0 m high, *Coprosma* spp., marsh ribbonwood, *Muehlenbeckia*, flax, *Pittosporum* sp., broadleaf (*Griselinia* sp.), lancewood and some jointed rush. Manuka dominant.

Section 3. The eastern end: A coastal strip of 30-60 m wide with ground cover of native grasses, occasional intrusions of marsh ribbonwood, *Coprosma* spp. and jointed rush, bordered on the north by 2.4-m high manuka and dense growths of *Muehlenbeckia complexa* with some introduced blackberry (*Rubus fruticosus*), elderberry (*Sambucus nigra*) and grasses.

METHODS

Access: Sections 1 and 3 and type 1 of section 2 were easy to walk through. In *section 2 type 2*, a track about 75 cm wide was cut through the middle of the 750 m of this section, and extended through sections 1 and 3 to a total length of 1000 m (Fig. 1). The track avoided dense shrubs but whenever possible was straight for lengths of 10 m to accommodate a mist-net. The track was in effect a line transect, and labelled marker pegs were placed at 50-m intervals. A 60-m tributary track was cut at an angle to the main track.

Track-making damages the habitat. By chance the track was cut through the birds' prime habitat, and so I could keep habitat damage very low when collecting data by staying on the track for most observations. Movement off the track to find or check nests and to mark territory boundaries also damages the habitat. To reduce this damage, I set and abided by a rule that, when nest-searching, I stepped off the track only after I had two clear indications of the possible nest site. Nests were visited during the breeding season only when necessary to check egg numbers and hatching and to band chicks. The range of visits to nests was 1-7.

In *section 2 type 3*, the manuka-dominant vegetation, a track was cut roughly parallel to and 50 m north of the main track (Fig. 1). Blazes were made and labelled on trees at 50 m intervals, in line with the pegs on the main track. The main advantage of this track was to show me where I was (and hence where observed birds were) in the manuka in relation to the main track pegs, my chief navigational aid.

Numbers and times of visits: Between June 1978 and July 1980 I made 115 visits, averaging $2\frac{1}{2}$ hours each, to the study area. In the prebreeding and breeding seasons between August and February I worked on Fernbird territory boundaries, breeding, and behaviour and I banded chicks. Outside the breeding season I circumnavigated and

traversed the study area, recording the whereabouts and behaviour of birds, and I trapped and banded adults. Between March and July 1980, when my main concern was the birds' distribution outside the breeding season, I made 14 2-hour walks around and across the study area. Although visits were made at all times of the day, most were made in the two hours after dawn, when the birds were most active and the weather was most likely to be calm.

Banding: Individual colour combinations were necessary for identification. Adults and juveniles were caught by mist-net or hand-net. Nestlings were banded in the nest when aged 7 days or more. To reduce disturbance of birds and habitat during breeding, after 1978 I stopped catching adults from August to February. Altogether 76 birds were banded, comprising 45 fledged birds of unknown age and 31 banded as nestlings of known age.

Observation: From the tracks I could see the track floor and walls, the upper surface of the swamp's vegetation, and the interior of some of the more open shrubs. To extend my view I used a 2-metre-high portable observation tripod with steps, made after the style of an orchard ladder but with a flat top that I could use as desk or seat. With 7 x 35 binoculars I could see in detail any birds moving above the vegetation within a radius of 200 m. In calm weather (all too rare in the study area) I could detect birds travelling by subway in the rushes by the twitching of the rushes.

Legbands were hard to see because most of the adult birds' activities took place under cover. Nest-building and feeding young were the activities in which legbands were most visible, the birds tending to fly in to a shrub near the nest site with neck extended and head up. The legs were thrust forward as the bird came in to alight and the bands could sometimes be read in the moments before the bird dived into the shrub.

Territory boundary identification: Nest sites were marked with a strip of coloured fabric (red in 1978, yellow in 1979) tied to the rush or shrub above the nest. Territory boundaries were identified by observing the behaviour of individual birds and listening to their calls. Boundary dispute sites were marked with patterned cotton ties on the vegetation. Individual birds were watched to find out how far they travelled. I could do this most easily from the ladder when birds were flying above the vegetation from and to the vicinity of their nests. A bird's movements were plotted in my field notebook on a sketch plan showing shrubs and other identifiable features. The limits (i.e. the farthest from the nest in any direction) of such movements were marked with cotton ties (see Fig. 3). I practised and became skilled at throwing flax koraris (dead flower stalks 1.5-2.0 m long) at targets, dart-fashion. I could then reduce habitat damage by attaching marker ties to koraris and harpooning them into the vegetation to mark territory boundaries.

In calm weather when movement of rushes indicated a bird's position and route much information could be obtained in a short time.

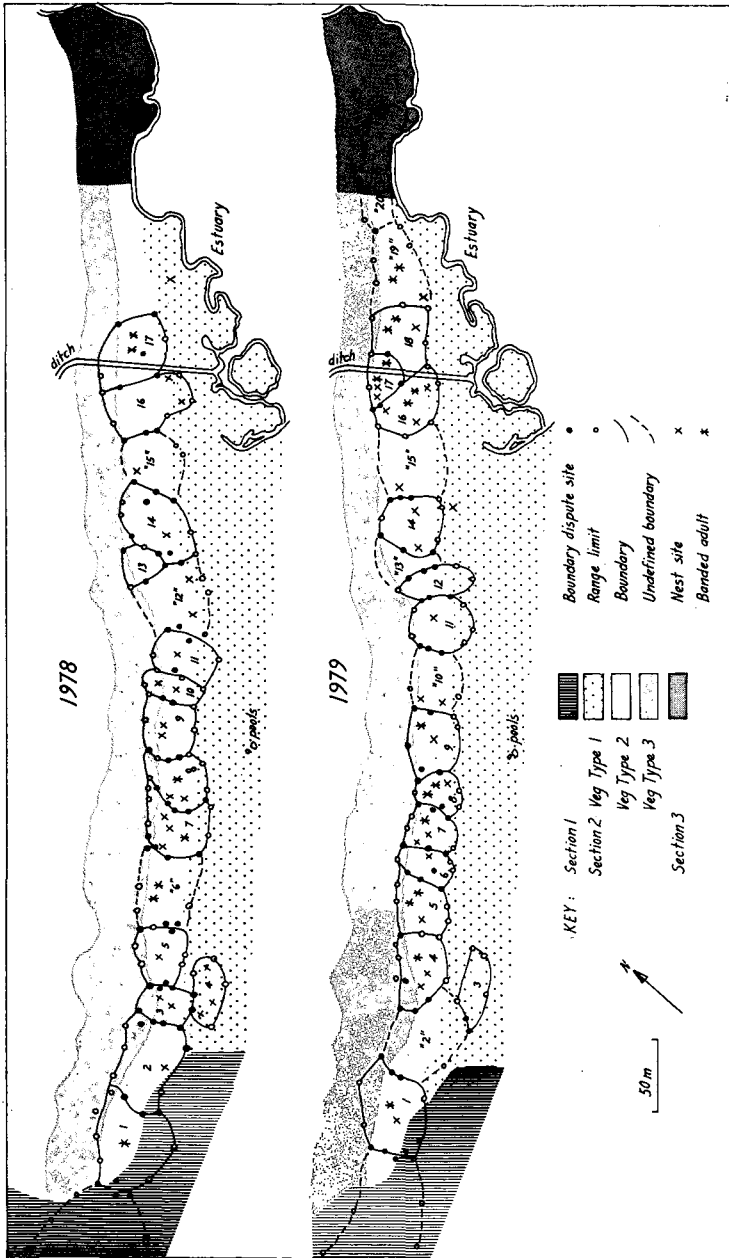


FIGURE 2 — Fernbird territories. Bushy Point, near Invercargill, 1978 and 1979

TABLE 1 — Fernbird territory areas 1978 and 1979

Territory No. (Fig. 3)	1978		Territory No. (Fig. 3)	1979	
	Area to nearest 10 m ² (m ²)			Area to nearest 10 m ² (m ²)	
1	2660		1	2870	
2	2410		3	920	
3	1060		4	1750	
4	890		5	870	
5	1310		6	1370	
7	1350		7	980	
8	1380		8	860	
9	1420		9	1770	
10	680		11	1480	
11	1360		12	800	
13	530		14	1590	
14	2060		16	1690	
16	1940		17	710	
17	1820		18	1600	
Mean	1490		Mean	1375	
Largest territory for both seasons 2870 m ² Smallest territory for both seasons 530 m ² Mean territory for both seasons 1430 m ²					

However, this information was useful only if the identity of the bird was known. Mere presence of a bird was not proof that it was on its territory, especially after November when independent juveniles were moving about from one occupied territory to another.

On an enlarged aerial photograph in which the main track was clearly visible, I plotted the positions of the 50-m marker pegs and calculated the scale. From this photograph I made two maps (one for each year) on cardboard. After each breeding season I measured, in relation to the nearest 50-m peg, the positions of cotton ties for boundary-dispute sites and limits of range of known individuals. Results were plotted on the map as in Figure 3, and built up into complete maps (Fig. 2). By cutting round the territory boundaries marked on the cardboard map, I made templates of the territories. By weighing each template to one decimal point on milligram scales and comparing its weight with that of a 2500 m² template to the same scale, I calculated the territory area.

TERRITORIES

Figure 2 shows territories for both years. Table 1 shows territory areas.

Territorial disputes

These were witnessed on the floor and walls of the track and within some of the less dense shrubs. They took three forms:

1. *Threatening postures*: The birds faced each other, the aggressor's head forward, nape feathers raised, spotted breast plumage prominent, wings slightly spread and rapidly quivering, legs straight. The bird rapidly advanced and retreated or flitted from side to side, using short stiff leg movements. As the aggressor advanced the other retreated, until they reached a point where the aggressor turned away and both moved off in different directions.
2. *Pursuit*: The territorial bird followed closely behind the other and stopped when they reached a certain point. The intruder then moved away and the territorial bird preened or foraged.
3. *Physical combat*: Two birds lunged towards each other with nape feathers and breast prominent and pecked at each other's spotted breasts for a second or two, leaping up as they did so. The vanquished bird turned and slunk away and the victor turned and foraged or preened.

Sites where these disputes terminated were marked as "boundary dispute sites" (Fig. 2 and 3).

Disputes seldom took place above the vegetation. Only once did I witness an aerial fight between two birds, which hurtled out of the rush facing each other and apparently with feet locked together, each plunging and pecking at the other's throat and breast. They rolled over and fell into the rushes but at once jumped out, separate, and locked into a second and then a third attack. The episode ended when one bird flew, chased by the other, on three flights of 3-4 m between shrub hummocks, both birds then dropping into a shrub and one emerging about 2 minutes later, foraging as it moved. Observed fragments of other disputes were explosions of two birds out of vegetation, one chasing the other.

More disputes were seen during the prebreeding months (August/September) than during or after breeding, but some disputes, particularly pursuit, were seen in all months.

All disputes were accompanied by high-intensity clapping interspersed with occasional *tchip* calls of high or moderate intensity.

Clapping

During clapping the bird's head was lifted, the neck was extended and the bill was opened and closed rapidly. The throat

feathers vibrated. Both sexes clapped. Clapping has been variously described by different observers. Best (1973) described "a series of rapid clicks, subsequently named 'chittering'." Jenkins (1978) said that "When the birds are highly motivated in defence of territory they also make a clicking sound between their calls." Clapping was not limited to boundary disputes. I heard and/or saw it at different degrees of intensity and in the following situations:

1. Of low intensity and brief
 - (a) When a human intruder approached the nest (some birds sometimes)
 - (b) At incubation changeover, sometimes; but the human observer may have been the trigger
2. Of moderate intensity
 - (a) A human intruder 'surprising' a bird in its territory sometimes evoked a brief clapper before the bird slipped into the vegetation. This happened most often in windy conditions, the noise of wind in vegetation possibly obscuring the sounds of human approach.
 - (b) From fledged independent juveniles, at any time, in response to humans, other Fernbirds, and sometimes other species, e.g. Redpolls (*Acanthis flammea*), Silvereyes (*Zosterops lateralis*).
 - (c) From territorial birds when a roving juvenile passed through the territory. Brief moderate clapping was often the only reaction of the territorial bird as long as the juvenile continued to move along, sometimes foraging as it went. If, however, the juvenile stayed loafing, or itself clapped, the territorial bird moved it along with a further burst of moderate clapping and sometimes a flight chase.
 - (d) Between neighbours, during the non-breeding season. After mid-May the frequency and intensity of clapping increased.
3. Of high intensity

Heard only during the prebreeding and breeding seasons as part of all observed territorial disputes. High-intensity clapping sites I regarded and marked as boundary dispute sites.

Territorial advertising

Territorial birds sometimes gave richly musical calls. The single organ note was sometimes repeated in a slow sequence of 8-10 calls. One exceptionally long sequence lasted about 7 minutes. These calls, which were heard most often in the breeding season, sometimes seemed to trigger similar calls from birds on other territories.

After November, fledged juveniles 'practised' organ notes. Their calls did not have the tonal purity of the adults' and frequently 'choked' and 'crackled.' Whenever a juvenile 'organ-practised' on a territory, it was rapidly evicted by one of the territorial adults.

Organ calls seemed to be a form of territorial advertising.

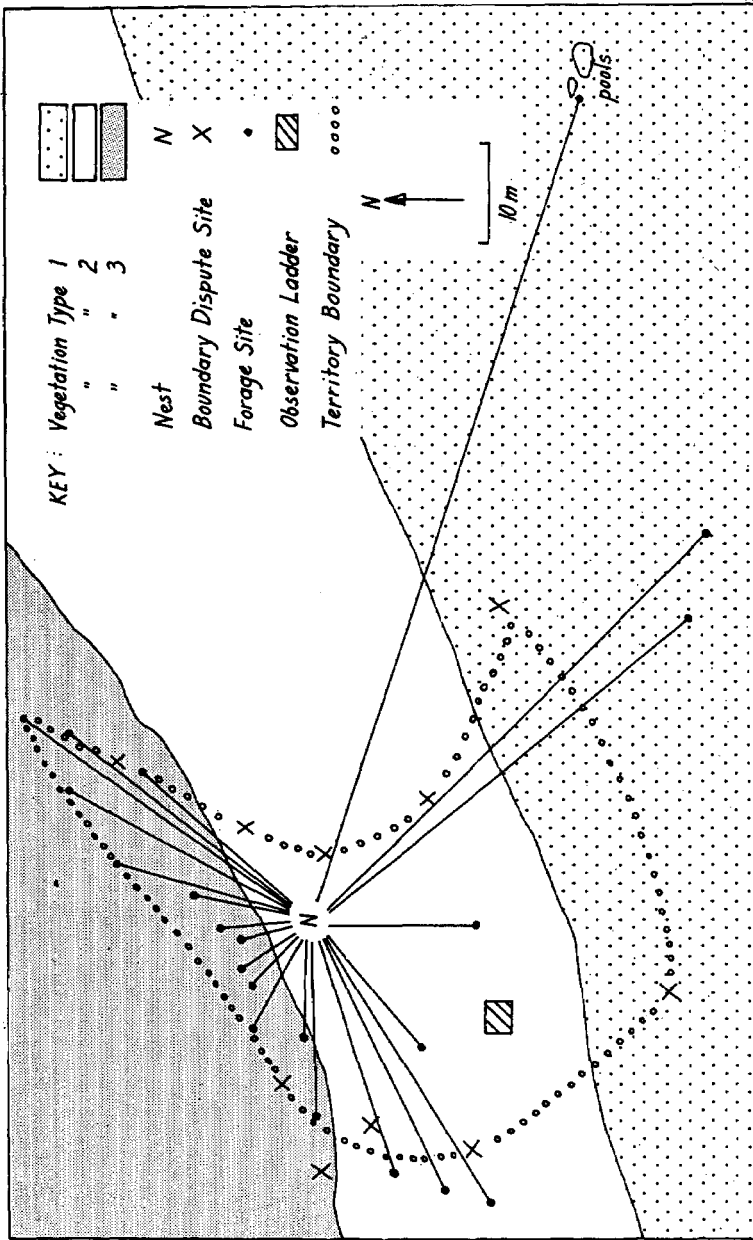


FIGURE 3 — Territory 1978/7

Movements of adults to or from the nest

Figure 3 shows the recorded distances travelled by the pair (one banded and one unbanded) on one territory (1978/7) between 0850 h and 1010 h on 20/1/79. They were feeding three 10-day-old chicks. Of the 21 visits, 13 were to the tall type-3 vegetation 7-30 m from the nest. The unvisited area east and south-east of the nest was part of the territory of the neighbouring pair to the east, and the boundary with the western neighbour followed the line shown. Although this boundary was strongly defended by the neighbour, the pair crossed it three times. On each occasion the trespassing adult returned with a large food item. Three flights were made into the type-1 rush, one of these being to the edge of a tidal pool 85 m from the nest. This was the farthest distance travelled and incidentally the longest single Fernbird flight I have recorded. My presence on the ladder at the point drawn on Figure 3 may have affected the adults' movements. Figure 3 demonstrates the absence of boundary dispute sites to north and south and my somewhat arbitrary use of adult movements to help determine boundaries.

Sightings of identified banded adults

Sightings of identified banded adults contributed information on 8 territories in 1978 and 11 territories in 1979. In addition to sightings during breeding activities, some banded birds were seen several times, mostly from the track, as they foraged, preened or moved about.

Table 2 shows west/east movements of territory-holding banded adults and the corresponding territory boundary limits on the 0-1000 m track.

Disparities between banding and/or retrap site and territory boundary limits may sometimes relate to the bird-catching method. Most adult birds were caught by chasing them into a mist-net set along the track. Some birds were pursued for over 100 m. Banded and retrapped birds are therefore listed separately in Table 2 from birds seen again.

Table 2 gives the positions of birds seen again. These birds had not been grossly disturbed at the time of sighting. In Table 2, 56 of 69 sightings were *within territory boundaries*. Of the 13 sightings outside the boundaries 11 were 20 m or less outside, 1 was 40 m outside and 1 was 65 m outside. Some of the 11 seen 20 m or less "outside" were in fact inside their boundaries, which seldom followed a straight north/south line. Similarly, some shown as apparently "inside" their boundaries were in fact marginally outside. Table 2 is therefore an approximation, but a fair representation, of the true position.

TABLE 2 — Locations and west/east territory boundaries of banded adult Fernbirds

Bird No.	Territory No.	Locations (m)			Territory Boundaries			
		Where banded	Where retrapped	Where seen again	West	East		
1978	10	—	50	30 40 50 100	]	0	150	
	11	—	50	50 130 165		150	230	
	2	1	+185	240 270	150 170 195 225	275	305	
	3	3	+230		280 290 305	]	345	395
	13	6'	380	360	325 370		395	425
	15	6'	350	355	340 400 460	425	475	
	23	7	405		410 415	]	730	775
	4	8	+640	450 450	440 470		730	775
	22	17	775	+750	750]		
	5	17	+755		730 750 760			
1979	10	—		0 20 50 80 100 150 190	]	0	180	
	11	—		25 60 80 100		180	230	
	2	1		+220	220	270	340	
	3	4			255 290 300 315	]	340	375
	13	5			350 355		390	410
	15	5			355 380	]	410	460
	7	7	+410		370 395 400		460	500
	9	8	520	+600	435	]	690	725
	45	8	+420		410 435		725	755
	4	9		+470	450 470 485]		
	26	16	+710	+650	715 740		755	795
	21	16	720	+650	650 700 715 740]		
	22	17		+740	730 740			
	5	17		+740	730 740 (Nov. 1979)]		
5	18			760 (Jan. 1980) +770 (May 1980)	755		795	
49	18	730	720	760]			

+ Indicates March/July trapping or sighting

Summary TABLE 2

	Times birds banded or retrapped	Times birds seen again
	(n)	(n)
August/February—Within territory boundaries	11	55
August/February—Outside territory boundaries	5	13
March/July—Within territory boundaries	10	1
March/July—Outside territory boundaries	5	—
	31	69

Note: The "Locations" in Table 2 are the points where banded birds were caught or seen on the 0-1000 m track or parallel to it, measured from west to east to the nearest 5 m by pacing from the nearest 50-m peg. When the bird was north or south of the track the distance north or south was estimated. This distance was seldom more than 20 m. The information was recorded and later transferred from notebook to map. North/south distances are not given in Table 2.

"Where retrapped" shows location of all retraps of the birds listed.

"Where seen again": Whenever a bird was seen many times at or near its nest, these sightings are recorded only once for each nest. All other sightings of the birds listed are shown.
Braces indicate mated pairs.

Territory boundary definition

Territory boundaries were mapped from boundary dispute sites and the adults' known range limits. Figure 3 and Table 2 show that a small amount of overlap sometimes occurred.

Definition of east and west boundaries was more precise than that of north and south boundaries because boundary disputes occurred between neighbours only on east/west boundaries, except for territories 1978/3, 4 and 13 and 1979/3. That is, most territories had no neighbouring territories to the north and south.

Detailed observations such as those shown in Figure 3 were recorded for only 6 territories in 1978 and 8 in 1979.

North/south boundaries of 'territories' 1978/6, 12, 15 and 1979/2, 10, 13, 15, 19 and 20 were not defined. Nevertheless, these 'territories' contained breeding pairs which defended their east/west boundaries. On Figure 2 these 'territories' are numbered but not defined. They are not of course included in territory area calculations.

In 1978 two nests were found at the western end in the regenerating area (section 1) and in 1979 one nest. These were successive nests of a banded pair which roamed over at least 12 000 m² of the total regenerating area of c.30 000 m². After mid-November in each year, fledged juveniles were seen in this area on most visits. This was the part of the study area most frequented by fledged juveniles (44 records of juveniles in c. 30 000 m² of section 1 compared with 26 records in c. 25 000 m² of section 2 type 2). The resident pair were not effective in their sporadic efforts to evict the fledged juveniles. Effective territorial defence behaviour was seen only along a short boundary with the neighbour to the east, and so section 1 was not a precise territory.

Reasons for the wide disparity in the size of territories are not known. The more aggressive birds appeared to hold the larger territories, but small territory size did not preclude successful breeding.

The same number of breeding pairs was found between the road and the ditch in 1978 and 1979, although there were some boundary and therefore area changes, some of these involving the same birds in both years.

DISTRIBUTION

Fernbirds used and bred in all three sections of the study area.

Section 1 was inhabited by one breeding pair, both banded birds, which in 1979 pushed their boundary east into section 2. Section 1 was the area favoured by fledged independent juveniles.

Section 2 held 17 known breeding pairs in 1978 and 19 in 1979. They lived in circumscribed territories. Most defended their territory strongly before and during breeding (August to February) and less intensively from March to July. The preferred habitat, as indicated by breeding density, was the 750 m linear strip of dense tangled growth of vegetation type 2. Most territories extended a few metres south into type 1 and a few metres north into type 3. Exceptions were

1. Territory 1978/4 (1979/3), which encompassed a dense 'island' of type 2 growth on slightly elevated ground, surrounded by type 1 reedbeds.
2. Territory 1978/13, which was strongly defended but in which no nest was found. In 1979 this territory was enlarged at the expense of the western neighbours.
3. Territory 1979/17, which straddled the ditch. The banded pair had in 1978 occupied a fairly large territory (1978/17). In 1979, on a reduced area and with an aggressive eastern neighbour, they raised one chick to fledging age from their first nest. A second nest was built and three eggs laid, but the habitat surrounding this nest was despoiled by a photographer, the nest was deserted, and I later found the partly decomposed body of one of the adults near the nest. The mate joined forces with the vociferous neighbour east of the ditch, also a banded bird, and they hatched a brood of four chicks.

As shown by the example in Figure 3, the narrow fringe of type 3 vegetation which the birds penetrated appeared to be a favoured foraging area. However, the existence of territory 1978/4 (1979/3) and successful breeding in it in 1978 showed that access to type 3 vegetation and presumably to the food it yields was not essential.

Of 45 nests found in section 2, only 2 were in type 1 vegetation, 10 m and 8 m respectively from the nearest shrubs of type 2. Breeding birds occasionally foraged in the rushes of type 1, as demonstrated in Figure 3, but the southern boundaries, based for the most part on adult bird movements, in general followed a line where vegetation type 2 gave way to type 1.

Birds were rarely found beyond the fringe of the tall growth of vegetation type 3.

Section 3 held one breeding pair in each year. In 1979, in addition to section 3, the pair used part of section 2 to the west.

Outside the breeding season

Table 3 shows numbers of birds seen or heard in different parts of the study area from March to June. On 14 visits between 9/3/80 and 28/6/80 I circumnavigated and traversed the study area, following the same route each time. I walked at a steady pace, stopping only to check for leg-bands, and it is unlikely that on any one visit I counted the same bird more than once. "Total birds counted" in Table 3 does not of course indicate the number of birds in the area. It will include some of the same birds recounted on different days and exclude birds present but not seen or heard. Table 3 shows a clear preference for reedbeds with protruding shrubs (type 2 habitat).

TABLE 3 — Fernbird distribution March to June 1980. Figures are numbers of birds counted on each visit

Date	Section 1	Section 2			Section 3	Total
		Veg. Type 1	Veg. Type 2	Veg. Type 3		
9.3.80	3		8	2	2	15
19.3.80	4		6			10
12.4.80	2	1	5			8
20.4.80			4			4
26.4.80	1		3			4
27.4.80	2	1	11			14
16.5.80	2		8			10
27.5.80	2	1	7	1		11
31.5.80	3		7			10
2.6.80	2		13		2	17
11.6.80	1		6		2	9
14.6.80	2		14			16
18.6.80			3		1	4
28.6.80			6		2	8
Total birds counted 14 days	24	3	101	3	9	140
Minimum on any one day	0	0	3	0	0	
Maximum on any one day	4	1	14	2	2	
Mean (all days)	1.71	0.21	7.21	0.21	0.64	

JUVENILES

After mid-November independent juveniles roamed about the study area. There were more sightings of juveniles in section 1 (44 records) than in section 2 (32 records) or section 3 (4 records). Some of these were repeat sightings of the same bird on different days.

Juveniles roaming through territories were sometimes challenged by residents and chased off, but they were sometimes tolerated (once to within 1 metre of a nest), as long as the juvenile was on the move.

The accommodation of juveniles in section 1 reduced their pressure on the optimum breeding habitat of section 2 and its resident adults.

Juveniles were sometimes found in the expanse of rush of type 1, where they were unmolested by adults. For example, No. 56, banded 11/11/79 in nest at 305 m, was seen four times between 8/12/79 and 6/2/80: at 350 m and 510 m in type 2, and twice in type 1, c. 150 m south of the 400-m peg and c. 170 m south of the 500-m peg. The use by juveniles of the outer rush beyond the territory boundaries requires further study. Table 3 shows little use of this area between March and June.

PREFERRED HABITAT

Best (1979) suggested that territorial behaviour partly explains the birds' preference for habitat of uneven profile. He described "males," both in Buller district and on The Snares, which maintained territory defence by "calling regularly for prolonged periods (sometimes more than thirty minutes) from elevated sites," and the effect of such territorial advertising on neighbouring males. Thus he suggested that "the strong preference for areas of hummocked profile over those of even height may be related in part to the presence or absence of suitable 'calling posts'." He also stated that a territorial male could more easily detect an intruder from a high vantage point.

Bushy Point birds showed similar preference for hummocked vegetation. Behaviour differed, however, in that birds seldom used the elevated shrubs as calling posts. They occasionally perched on a hummock for a few seconds, rarely as long as a minute, looking about with head raised and neck extended. The frequent strong winds at Bushy Point, by masking the movements of vegetation as intruders move through the territory, may make hummocked vantage points ineffective.

At Bushy Point nests were usually built in rush close to or within 3-4 m of a protruding shrub. When feeding young, the adults often flew from shrub to shrub, diving head down into the last shrub and travelling the final metre or two to the nest through the rushes. The few birds which built nests more than 4 metres from a shrub usually followed the same procedure of dropping into the nearest shrub and moving through rushes to the nest.

The functions of protruding vegetation as 'stepping stones' or 'signposts' to the nest may contribute to the birds' preference for areas of hummocked profile over those of even height. These functions, and their possible survival value for the species, require further study.

Effect of fire damage

After 12 years the vegetation of fire-damaged section 1 had not fully recovered. Its *Leptocarpus* was shorter and less dense than elsewhere in the study area, its other plant species were different, and the margin between burned section 1 and unburned section 2 was still evident. Section 1 was less than optimum breeding habitat. It supported only one breeding pair in its c. 30 000 m², compared with section 2 type 2 (c. 25 000 m²), which held at least 17 breeding pairs.

Fire is a disaster to Fernbirds for two reasons:

1. The birds' weak power of flight reduces their chances of escape; and
2. Habitat is lost, plant regeneration may take many years, and the regenerating area is unlikely to provide suitable breeding habitat.

MANAGEMENT OF WETLANDS

Any wetland management plan which includes protection of Fernbird habitat must allow for

1. Reduction of fire hazards; and
2. The needs of a total population. In the present study, the Fernbird territories occupied about 30 000 m² of a total wetland area of about 220 000 m² and contained at least 19 breeding pairs. This was a self-sustaining population in the area. The study suggests that a 'no-man's-land' adjacent to or close to territory areas is valuable, and may be essential, for total population needs.

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SHORT NOTE

SONG THRUSH FAR AT SEA

On 31 March 1983 at 1 p.m., a Song Thrush (*Turdus philomelos*) was observed from the frigate HMNZS *Otago* near the Pukaki Rise. The bird was also seen and identified by four other members of the scientific party en route to the subantarctic. As the bird was blown eastward across the stern of the vessel it made an effort to return and land. This may have been successful as a thrush was again seen 30 minutes later. The bird was not subsequently seen and presumably perished at sea.

Our position was 173°E, 49°31'S, approximately 400 km south-east of the South Island of New Zealand and 400 km north-west of the Auckland Islands. Although a strong north-westerly was blowing at sea, conditions in Southland were not particularly adverse. The Meteorological Office reports light to moderate northerlies at Invercargill on the morning of the 31st, reaching 20 knots at Dog Island in the eastern approaches to Foveaux Strait.

The subantarctic islands in this region were rapidly colonised by many of the passerines introduced to New Zealand in the late 19th century. The Song Thrush has been recorded from all groups of outlying islands in the New Zealand region, with the exception of Macquarie and the Bounty Islands (Williams 1953, Warham & Bell 1979). This observation shows that dispersal of passerines from New Zealand still occurs and that the process is not dependent on extreme weather conditions.

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