Notornis, 2000, Vol. 47: 13-35
0029-4470

Activity of birds in the Western Hutt Hills, New Zealand

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Abstract This paper describes the activity of garden, bush and riverine birds in the Western Hutt hills, 1981-92. The area is 15 km north of Wellington, 7 km north of the Hutt River estuary, and 15 km south of Pauatahanui Inlet, Porirua Harbour, on the southwest coast of the North Island. Observation is based on 35 years' residence and >12 500 10-min counts conducted between 1981 and 1992. Species first seen each day are distinguished from those first heard. Whenever possible the birds' food was recorded. The western hills have fewer native passerines than similar habitat on the eastern hills. Several species increased or decreased during the study. Some apparent decline was attributed to the author's hearing loss. Wind reduced bird detection. Nectar of New Zealand flax (*Phormium* spp.) was eaten by silvereyes (*Zosterops lateralis*), tui (*Prosthemadera novaeseelandiae*) and starlings (*Sturnus vulgaris*) at different times. In the study area there were about 0.9 cats (*Felis catus*) per household, a potential predator on birds.

Gibb, J.A. 2000. Bird activity in the Western Hutt Hills, Wellington, New Zealand. *Notornis 47(1)*: 13-35.

Keywords bird activity; detection; counts; garden; forest; river; food; voice; house cats

INTRODUCTION

I began this study because I was curious how birds used the habitat between Lower Hutt city and bush along the Western Hutt hills. To describe the birds I also needed to know why they attracted my attention (cf. Calquhoun 1940, Buckland 1987) and how the habitat changed.

I recorded the activity of all bird species seen or heard around my house. The numbers of some species increased or decreased, but 12 years is not long enough to distinguish temporary from long-term changes. I recorded some of the birds' foods that might account for their using the area. Unfortunately, counting birds was not fashionable when the forest in what is now the estuary of the Hutt River was explored in the 19th century, nor is it on record precisely when the Western Hutt hills were first settled. However, a symposium of the New Zealand Ecological Society in 1958 was devoted to the ecology of the Hutt Valley and Dr Peter Bull described the birds, mentioned also by Dell (1959). I have used Bull's (1959) paper as a basis for measuring change.

STUDY AREA

The study area (Fig. 1) around my house in Pearson's Lane, a cul-de-sac off Wairere Road in the Western Hutt hills (41°12'S, 174°55'E), is 150 m. a.s.l., 15 km north of Wellington, 7 km north of the Hutt River estuary, and 15 km south of Pauatahanui at the head of Porirua Harbour on the southwest coast of the North Island. It includes a steep valley now carrying modified bush, some houses and gardens, and the air space above. In 1960 I obtained a recent aerial photograph showing 25 houses between Wairere and Pomare Roads (Fig. 1). A recount in 1997 revealed 45 houses in the same area.

The eastern slopes of the hills are covered in bush between houses and gardens. The bush includes native and exotic trees and shrubs (names follow texts used by Gibb (1994)). Included are tawa (*Beilschmiedia tawa*), rewarewa (*Knightia excelsa*), titoki (*Alectryon excelsum*), and hinau (*Elaeocarpus dentatus*), with pohutukawa (*Metrosideros excelsa*), sycamore (*Acer pseudoplatanus*), *Eucalyptus* and *Pinus* spp. beyond. Mahoe (*Melicytus ramiflorus*), kawakawa (*Macropiper excelsum*), fivefinger (*Pseudopanax arboreum*), karamu (*Coprosma robusta*), pigeonwood (*Hedycarya arborea*) and tree ferns (mainly *Sphaeropteris medullaris*) are common, with a few cabbage trees (*Cordyline australis*) and karaka (*Corynocarpus laevigatus*). The vines *Ripogonum scandens* and *Metrosideros fulgens* are common. Gorse (*Ulex europaeus*), broom (*Cytisus scoparius*), blackberry (*Rubus fruticosus* agg.) and tree lucerne (*Chamaecytisus*

Received 20 February 1999; accepted 13 May 1999

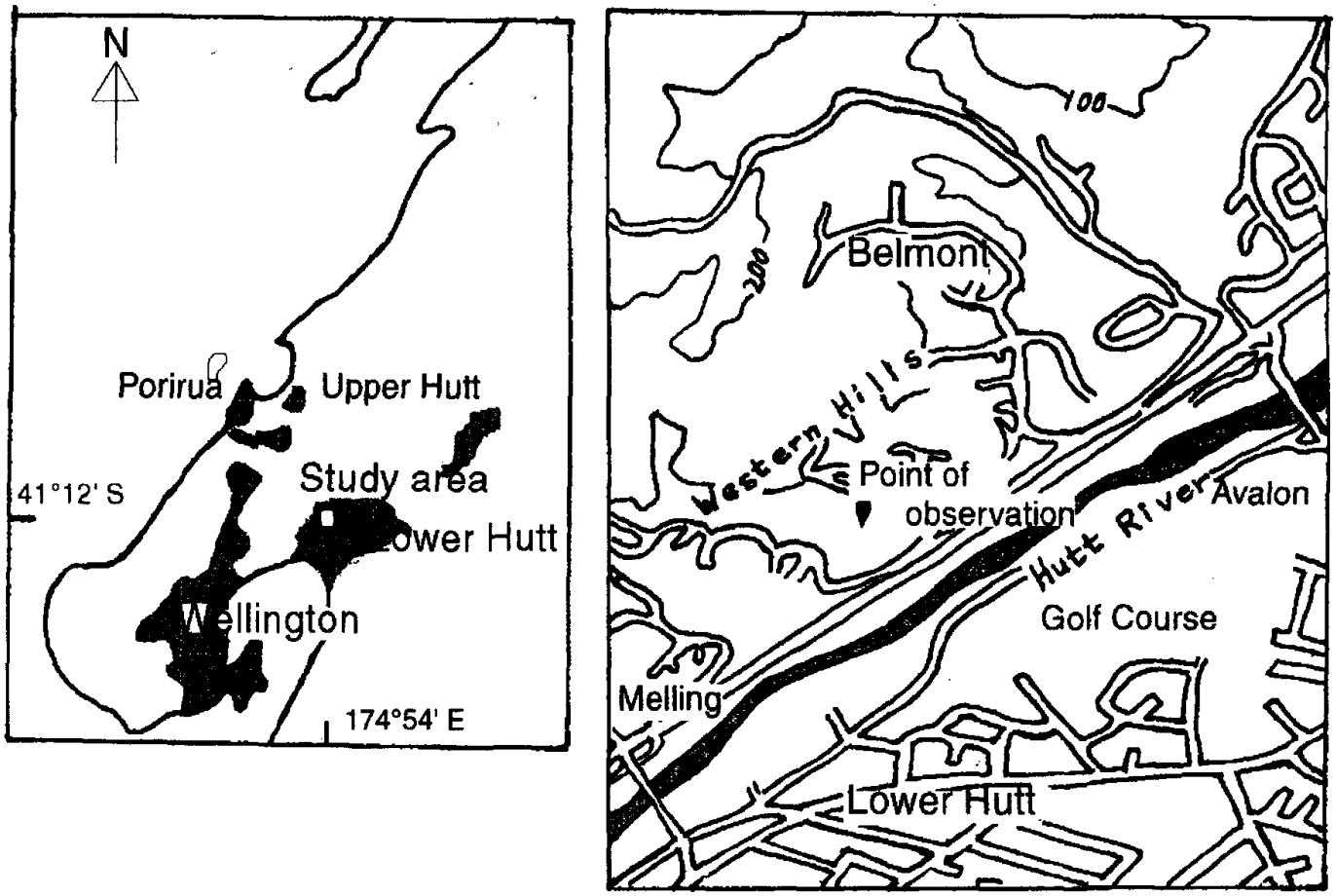

Fig. 1 Location of study area. (Left) SW tip of North Island. Scale: Base of map = 46 km. (Right) Enlarged portion of Western Hutt Hills showing location of observation point. Base of map = 2.25km.

palmensis) grow on waste ground. Kowhai (*Sophora* spp.), rhododendrons (*Rhododendron* spp.) and camellias (*Camellia* spp.) grow in the gardens. The Hutt River is lined with poplars (*Populus* spp.) and willows (*Salix* spp.) beside grassy paddocks that replace the former shingle works.

Brush-tail possums (*Trichosurus vulpecula*) were common until the late 1980s, but are now scarce. Black rats (*Rattus rattus*), house mice (*Mus musculus*), dogs (*Canis familiaris*) and house cats (*Felis catus*) are common. I have seen only two stoats (*Mustela erminea*) and one weasel (*M. nivalis*) in more than 35 years.

The climate is moist temperate (Tomlinson 1976). Annual rainfall (c.1300 mm) is well distributed. The study area is partially sheltered by hills from prevailing northwest winds, but is exposed to the south.

METHODS

Much information about birds comes from >12 500 10-min counts completed from January 1981 to December 1992 from the raised deck of my house (Table 1). I completed 3-5 counts per day when at home. Counts p.a. ranged from 781 in 1985 to 1296 in 1992; per month (years pooled) from 904 in Sep. to 1130 in Mar. I could not see the Hutt River from the deck, so riverine species were recorded from elsewhere nearby.

Wind speed (Beaufort scale) and direction were recorded after the morning bird counts (Table 1). Turbulence made it difficult to judge wind direction, so WNW-ENE winds were combined as 'northerly' and ESE-WSW winds as 'southerly'.

A questionnaire about cats was distributed to all 45 houses in the study area in 1996 and answers are summarised here.

Tables and figures give the number of birds detected per count and the percentages of those days when they were detected that each species was first seen or heard that day. Each point on the graphs thus refers to the mean ($\bar{x}$) ± standard error ($SE\bar{x}$) of c.1000 counts.

Spring includes September-November (Sep-Nov), summer December-February (Dec-Feb), autumn March-May (Mar-May), winter June-August (Jun-Aug).

Table 1 Number per annum and time of start (NZST) of counts each month (years pooled). Days, days of observation; Begun, mean time counts began ± SD (min.); Mas, time (time after sunrise, min).

Year	Days	Total counts	Month	Days	Total counts	Begun	Mas
1981	306	874	Jan	260	996	0624±24	79
1982	253	982	Feb	217	925	0633±18	50
1983	259	1003	Mar	266	1130	0703±24	43
1984	248	965	Apr	270	1146	0727±21	37
1985	200	781	May	274	1110	0748±24	26
1986	267	1154	Jun	284	1055	0818±24	34
1987	247	1058	Jul	269	965	0815±21	35
1988	268	1214	Aug	251	955	0800±24	47
1989	196	866	Sep	225	904	0727±27	75
1990	248	1153	Oct	257	1081	0657±27	87
1991	287	1202	Nov	272	1143	0630±24	100
1992	343	1296	Dec	277	1138	0617±24	95
Total				12548	12548		

Table 2 Annual variation in bird numbers detected. For morepork, proportion of nights when heard.

	Mean birds per count, 12-month periods autumn-summer											
	1981-1982	1982-1983	1983-1984	1984-1985	1985-1986	1986-1987	1987-1988	1988-1989	1989-1990	1990-1991	1991-1992	1992-1993
Dominican gull	2.45	2.07	1.73	1.29	1.69	1.35	1.63	1.57	1.86	1.23	1.33	1.35
New Zealand pigeon	0.49	0.32	0.45	0.39	0.25	0.28	0.47	0.37	0.44	0.37	0.24	0.34
Morepork	0.38	0.24	0.17	0.08	0.10	0.12	0.08	0.07	0.11	0.28	0.39	0.20
Blackbird	1.24	1.38	1.08	0.88	1.19	0.89	0.86	0.67	0.93	0.94	0.96	0.75
Song thrush	0.59	0.59	0.47	0.48	0.52	0.41	0.50	0.35	0.37	0.42	0.29	0.33
Grey warbler	0.19	0.09	0.08	0.11	0.06	0.04	0.04	0.03	0.01	0.03	0.01	0.02
Fantail	0.44	0.38	0.36	0.40	0.29	0.30	0.33	0.30	0.35	0.42	0.25	0.19
Silvereye	2.44	2.38	1.79	1.69	1.46	1.78	1.11	1.49	1.80	1.47	1.16	1.04
Tui	0.22	0.04	0.08	0.06	0.11	0.28	0.27	0.35	0.52	0.27	0.24	0.35
Chaffinch	0.75	0.81	0.48	0.66	0.46	0.31	0.39	0.29	0.21	0.20	0.15	0.14
Magpie	0.37	0.36	0.40	0.66	0.29	0.26	0.24	0.12	0.22	0.16	0.07	0.33

RESULTS

The birds

Black and little shags (*Phalacrocorax carbo*, *P. melanoleucos*) fly up river at least to Upper Hutt (Bull 1959); seen here especially in May (Fig. 2). They are least common in Wellington Harbour in winter (Robertson 1992). A few black shags breed in trees 400 m north of Melling Bridge. Shags were usually seen singly (max. 6 together, Apr). A few flew to or from Pauatahanui. Of 218 shags identified to species, 73% were black shags and 27% little shags.

White-faced heron (*Ardea novaehollandiae*) were still increasing (cf. Carroll 1970; Robertson 1992); most frequent prospecting nest-sites, Aug (Fig. 2). One flew towards Pauatahanui, Jan. Cattle egret (*Bubulcus ibis*): one for 2-3 days beside Hutt R., May 1983.

Black swan (*Cygnus atratus*) seen 11 days Sep-Jan; 3 as if from Pauatahanui, Sep. Bull (1959) reported a few. Canada Goose (*Branta canadensis*): 1 fed by Hutt R., May 1983; flock of 15 flew S., May 1987. Bull (1959) thought them rare. Paradise shelduck (*Tadorna variegata*): reported Whiteman's Valley and Mangaroa by Bull (1959). First here Mar 1983, then Mar & Apr 1989, others Jun 1990, May & Oct 1991, 2 Apr, 1 May 1992. Mallard (*Anas platyrhynchos*) common Hutt R. esp. late winter-spring (Fig. 2). A few flew as if to/from Pauatahanui. Grey teal (*Anas gracilis*): single birds as if from Pauatahanui, Mar & Apr 1980, Mar & Dec 1987, Oct 1989, Sep 1990, Oct 1992. Robertson (1992) saw one Hutt R. estuary, Sep 1975.

Australasian harrier (*Circus approximans*): usually low over bush: autumn (9), summer (12), most autumn (31)

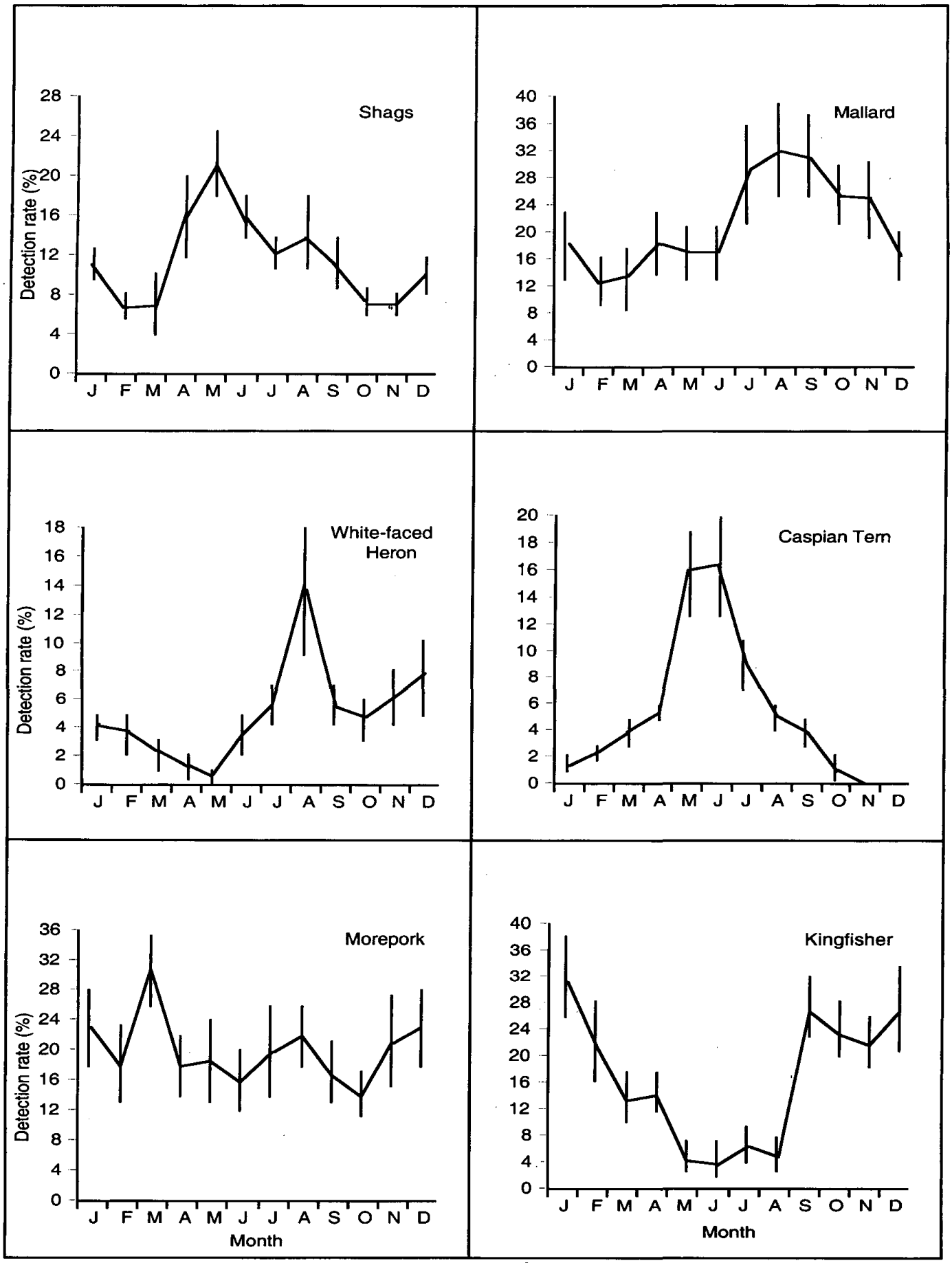

Fig. 2 Percentage of days/nights when shags, mallard, white-faced heron, Caspian tern, morepork and kingfisher were detected per month; $\bar{x} \pm SE\bar{x}$.

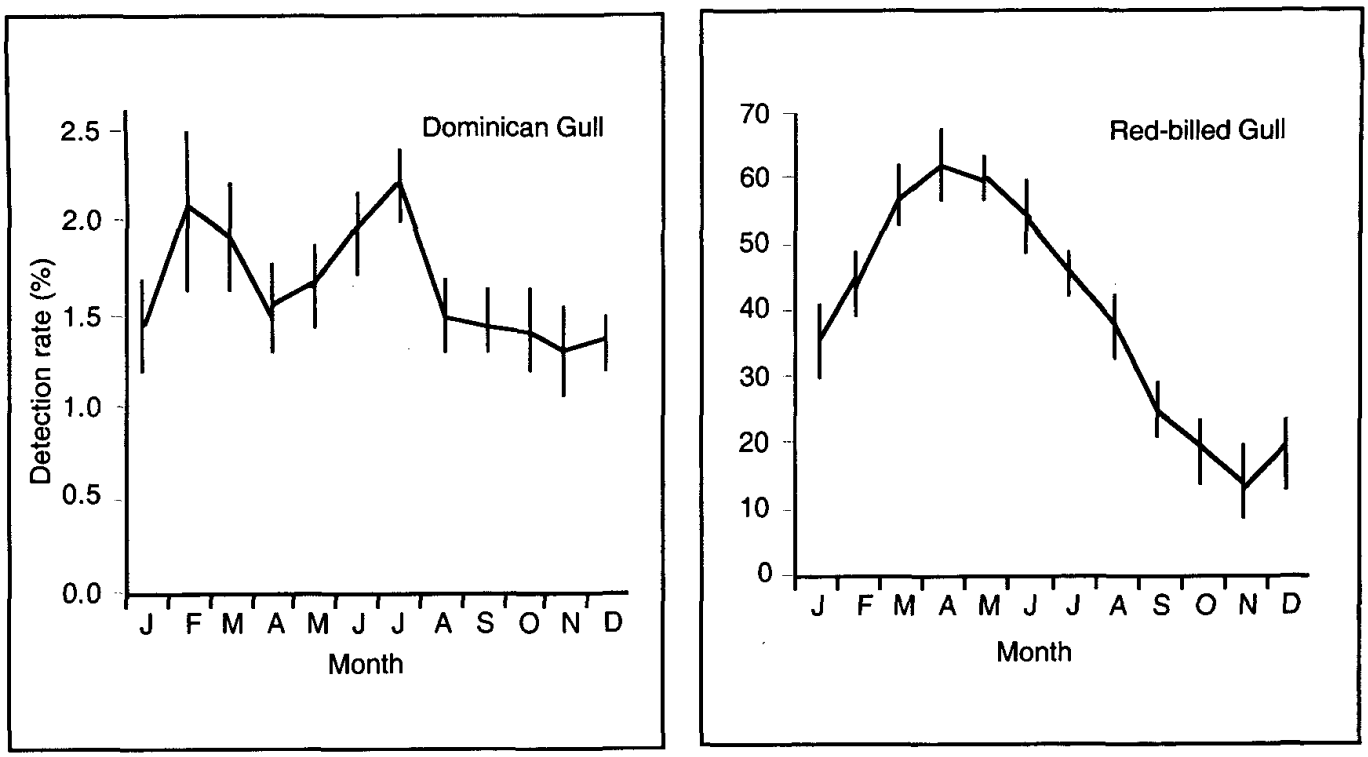

Fig. 3 Dominican gull: number detected per count. Red-billed gull: percentage of days when seen; $\bar{x} \pm SE\bar{x}$. The number of red-billed gulls detected per day decreased markedly in late 1980s when they probably changed roost. They could not be counted when numerous.

($P<0.01$), winter (20). Fewer since 1986 ($P<0.01$). New Zealand falcon (*Falco novaeseelandiae*): seen 1986 (7), max. 2 other years. Not seen recent years: spring (3), summer (2), autumn (7), winter (4); seasonal differences not significant. Bull (1959) reported them mainly in winter.

California quail (*Callipepla californica*) still live Western Hutt hills (cf. Bull 1959). Three separately Pearson's Lane 1980; others Aug, Oct-Dec 1984, 1988, 1989.

Pukeko (*Porphyrio porphyrio*) irregular by Hutt R. (cf. Bull 1959). Max. 2 young together.

Pied Oystercatcher (*Haematopus ostralegus*): 2 up-river calling in 1970s. Pied stilt (*Himantopus himantopus*): 3 on riverbed, autumn. Banded dotterel (*Charadrius bicinctus*): 1 on riverbed, autumn. Last two species probably regular though not seen by me. Spur-winged plover (*Vanellus miles*): first seen Jan 1987. Groups max. 15 Jan-Feb. First Belmont Hill, Feb 1987 (J.E.C. Flux pers. comm.).

Dominican gull (*Larus dominicanus*) (Table 2): many flew towards/from Porirua, others up Hutt V. Increase Jan-Feb and decrease Jul-Aug (Fig. 3) probably when they left/reached breeding colonies. Red-billed gull (*Larus novaehollandiae*): hundreds roosted up Hutt V. in winter until late 1980s; 150 flew towards Pauatahanui, 0745 h, Jun 1980. Black-billed gull (*Larus bulleri*): flock 6-8 over Hutt R. 5-10 May 1980. Bull (1959) reported single birds Petone. Caspian tern (*Sterna caspia*) often fly up-river to Upper Hutt (Bull 1959). Most seen in study area May-Jun (Fig. 2). Regular Wellington Harbour (Robertson 1992). In Oct 1981 & twice before flocks c.12 flew over towards Pauatahanui.

New Zealand pigeon (*Hemiphaga novaeseelandiae*): common in bush despite dwindling numbers reported elsewhere (Heather & Robertson 1996). Single birds flew from bush to city gardens in spring (6), most summer (16) ($P<0.01$), autumn (5), winter (4). Means per count fluctuated, 0.24-0.49 (Table 2): many Jan-Mar, Aug-Sep (Fig. 4). Foods (Table 3) (not in order of frequency) included buds, leaves, flowers in spring, fruit in summer (cf. Clout *et al.* 1986, 1991). Laburnum leaves eaten all summer, Stokes V. (B. M. Fitzgerald pers. comm.). Little local food in study area Mar-Jul or between spring legumes and summer fruit when few pigeons seen. The supply of legumes was assured in spring, but not that of fruit (e.g. tawa) in summer. Heavy crops of fruit deplete plants' reserves, so are irregular. Pigeons range widely, have large home ranges, and defend individual food sources. They advertise themselves with conspicuous display flights without wing-claps, the number of which broadly tracks the birds seen ($P<0.01$) (Fig. 4). The

Table 3 Observed foods of New Zealand pigeon (*Hemiphaga novaeseelandiae*).

Plant species	Records per month J	F	M	A	M	J	J	A	S	O	N	D	Total
Fruit													
Tawa *B. tawa*	29	25	26							9	6	18	113
Pigeonwood *H. arborea*	5											26	31
Hinau *E. dentatus*			1	5	5	2	3	5					21
Karaka *C. laevigatus*			2	7	3	1							13
Titoki *Alectryon excelsa*										1	1	2	4
Plum *Prunus* hybrid	3												3
Cabbage tree *Cordyline australis*				1		2							3
Karamu *Coprosma robusta*				1									1
Buds, leaves and flowers													
Tree Lucerne *C. palmensis*	2			2	4	15	33	28	15	1	1	2	103
Broom *Cytisus scoparius*										25	12	6	43
Kowhai *Sophora* spp.							3	5	20	13			41
Plum, *Prunus* hybrid								2		5	1		8
Mahoe *Melicytus ramiflorus*				1						1			2
Willow *Salix* sp.				1									1
Wisteria floribunda											1		1
Summary: Fruit	37	29	34	10	6	2	3	5	0	10	7	46	189
Foliage, etc.	2	0	0	3	2	18	38	50	34	27	14	8	199

seasonal peak of displays coincides with the laying season given by Heather & Robertson (1996; see also Goodwin 1967). Pairs often sit together from Aug (when displays become frequent, Fig. 4). They gather to feed (Clout *et al.* 1991) but seldom flock coherently. A flock of 15 visited pines in Jan 1987. About 75 rock (feral) pigeons (*Columba livia*) lived beneath Melling Bridge. A barbary dove (*Streptopelia roseogrisea*) was glimpsed in bush beside Wairere Road, Mar 1980.

The sulphur-crested cockatoo (*Cacatua galerita*) has visited the Western Hills; not reported by Bull (1959). One seen calling Jul 1988; another seen a few days later.

Shining cuckoo (*Chrysococcyx lucidus*) regular while grey warblers (*Gerygone igata*) common. First heard here week later than in Orongorongo V. (Brockie 1992); latest in Jan. Long-tailed cuckoo (*Eudynamys taitensis*): one heard in flight at night, 1960s.

Morepork (*Ninox novaeseelandiae*) heard 40% of nights 1982 and 1992, less often 1983-89 (Table 2). Most heard Mar (χ^2=10.2, 1 df. P<0.01) (cf. O'Donnell 1980); often at dawn.

Sacred kingfisher (*Halcyon sancta*) arrived late Aug (Table 2); seen Hutt R. Jun (11), Jul (10), Aug (6). Noisy on arrival but soon first seen/heard equally often. Common round Wellington Harbour Aug-Sep (Robertson 1992). Ate many cicadas, few skinks and one mantis confirmed, autumn. Mobbed by grey warbler, fantail

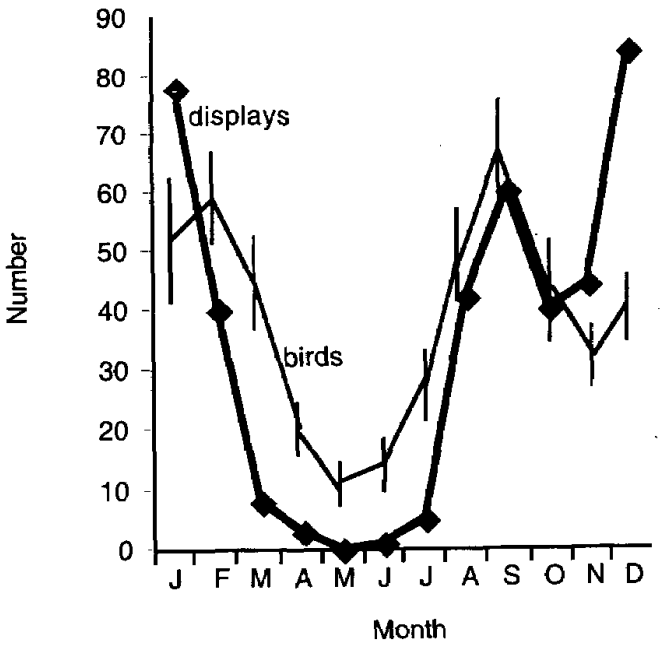

Fig. 4 New Zealand pigeon: number detected per count, $\bar{x} \pm SE\bar{x}$ and no. display flights seen month^{-1}, years pooled.

(*Rhipidura fuliginosa*), silvereye (*Zosterops lateralis*), goldfinch (*Carduelis carduelis*), house sparrow (*Passer domesticus*). Child (1984) saw silvereye caught, Stead (1932) a redpoll (*Carduelis flammea*) (Moon 1979). One driven from flowering eucalypts by tui (*Prosthemadera novaeseelandiae*), Mar.

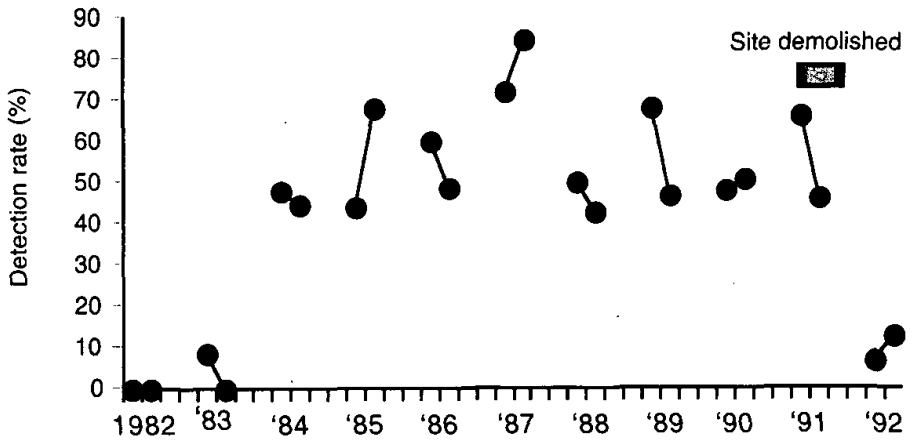

Fig. 5 Welcome swallow: proportion of days when seen: mean of spring-summer and autumn-winter for each 12-month period.The buildings where they nested had existed for many years before 1981; they were demolished Nov-Dec 1991.

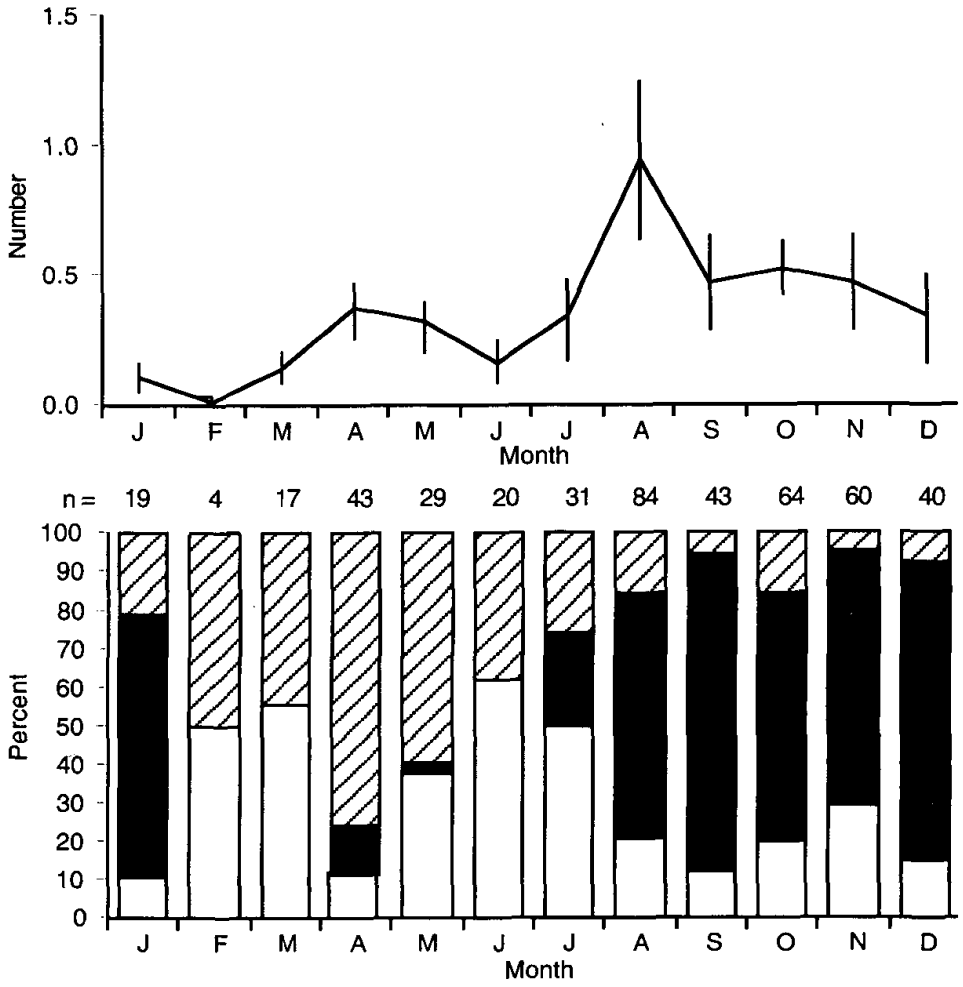

Fig. 6 Dunnock: (upper) no. per 10 counts (note reduced scale on *y* axis); (lower) sign (%). *n* = no. records of sign. Open, Seen; filled, song; hatched, call.

Table 4 Grapes, figs, crab-apples eaten by blackbird (*Turdus merula*).

	Records per half-month							
	March		April		May		June	Total
Fruit	1-15	16-31	1-15	16-30	1-15	16-31	1-15	
Grape, black *Vitis* hybrid	5	9	10	3	1	2	3	33
Fig *Ficus carica*		3	6	5	7	3	2	26
Crab-apple *Malus* hybrid	1	3	5	6	17	19	12	63

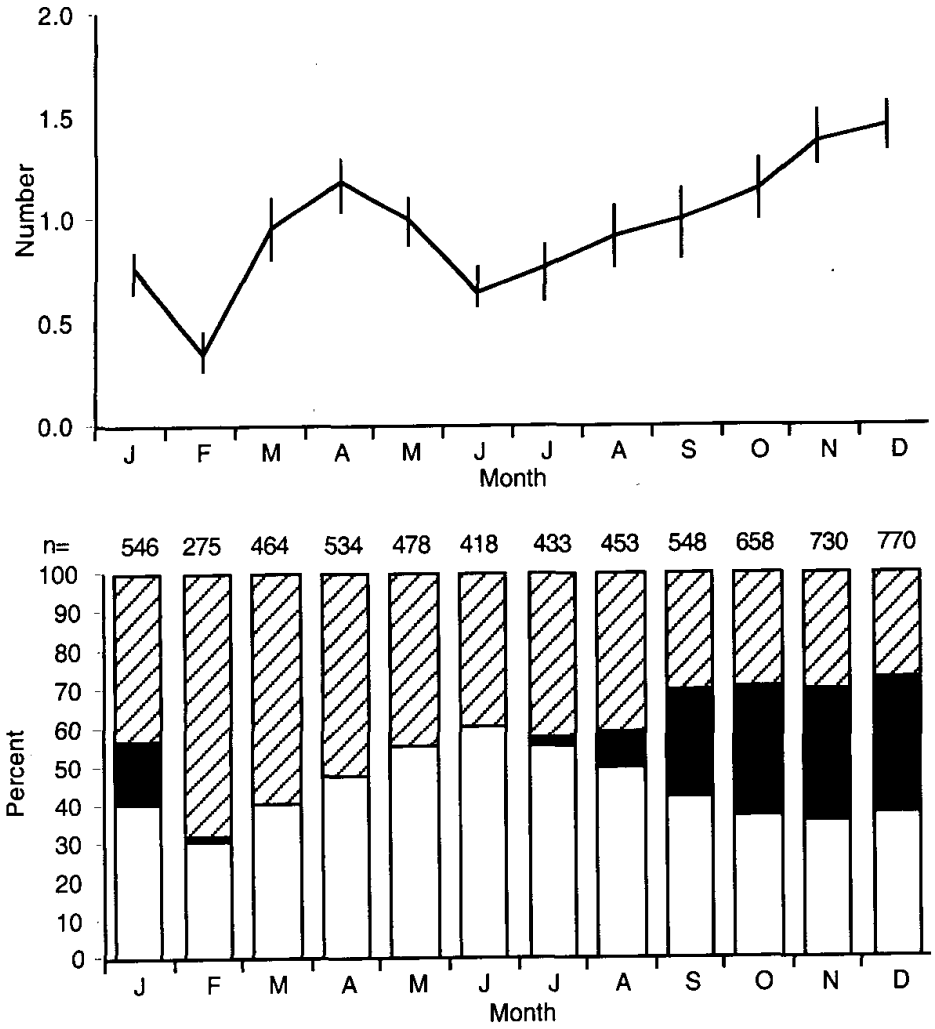

Fig. 7 Blackbird: (upper) no. detected per count, $\bar{x}$ ± SE$\bar{x}$; (lower) sign (%). *n* = no. records of sign. Open, seen; filled, song; hatched, call.

Welcome swallow (*Hirundo tahitica*) first bred in New Zealand 1958, but slow to colonize Hutt V. (Bull 1959). First seen here autumn 1978. About 100 over Hutt R. between Melling/Avalon Bridges, 2 Jul 1983. I recorded the percentage of days when they were seen in spring-summer, usually over river, 1980-late 1992 (Fig. 5): 7% in spring, 54% summer, 28% autumn, 24% winter; difference between spring/winter χ^2=90.3, 1 df, P<0.001. These observations suggest that swallows are limited by shortage of nest-sites. Some remained in autumn-winter after their site was demolished but few were left by the following spring. A female with mate collected mud from roadside puddle, Sep. and Oct. 1984, 1986.

Dunnock (*Prunella modularis*): easily overlooked. Called Apr-Mar, sang Aug-Jan (Fig. 6). First seen on only 7%* of days when detected, often on song-posts. In Dunedin, Tily (1947) heard song regularly from mid-May, peaking Aug, waning Oct.

Blackbird (*Turdus merula*): number detected fell 1981-1992 (Table 2). Fewest Feb (Fig. 7) when moulting in bush where they did not just skulk, but were attracted by fallen titoki fruit. More detected Mar-Jun when eating garden fruit (Table 4). Many first heard singing Jul-Dec; usually first seen May-Jul, first calling Feb-Apr. Main song-period (Jul) Aug-Jan. Males often first seen on song-posts. Sang hard from 0430 h late Sep. Latest copulation seen late Dec, once precariously on swaying wires. Only fruit seen eaten Nov-Feb were raspberries and plums, kawakawa in bush. Switched to figs, crab-apples and grapes in Mar; these lasted till Jun. Karamu berries eaten Mar-Apr, Pyracanthus berries Apr-Jun; once hard fallen Japonica fruit. Blackbirds chased tui from where both were feeding, Sep & Nov.

Song thrush (*Turdus philomelos*): unobtrusive when silent. Commonly detected (singing) May-Aug, fewest Feb-Apr (Fig. 8). Song from early May. Fewer sang early Jul than late Jun/late Jul. Extra song-posts first used late Jul suggest first-year birds began singing then. Rarely call (unlike Blackbird). None seen carrying worms until Nov nor smashing snails (once a slug) until Dec. Grey

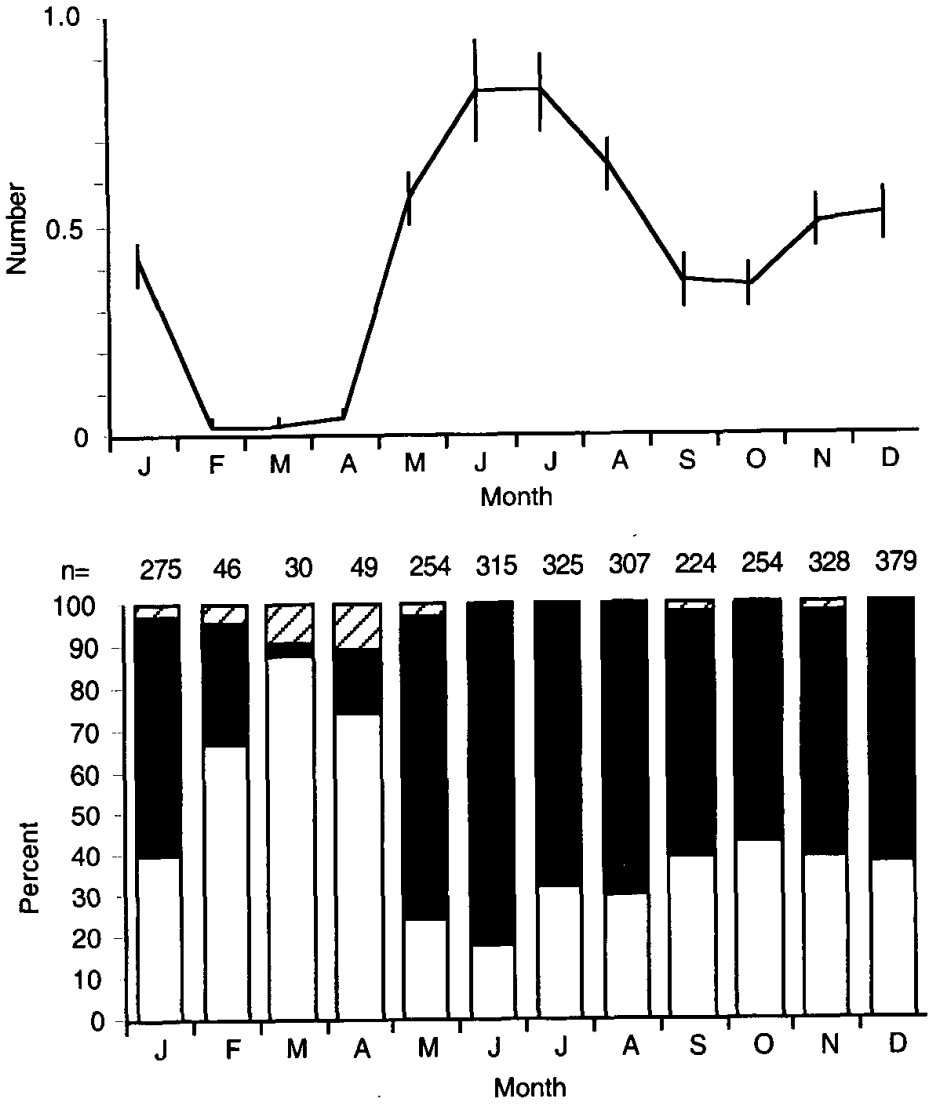

Fig. 8 Song thrush: (upper) number detected per 10 counts, $\bar{x} \pm SE\bar{x}$; (lower) sign (%). n = no. records of sign. Open, seen; filled, song; hatched, call.

warbler: often recorded early years, scarce latterly (Table 2); often in spring and autumn (Fig. 9). Rarely call but more often first heard singing than first seen. Latterly fewer first heard singing (χ^2=13.6, 1 df, P<0.001) (Fig. 10), probably because of my hearing loss. Stidolph (1974) also supposed warblers declined in Masterton. Aerial chases to c.15m. seen Mar, Apr, Jun, Aug, Dec.

Fantail: number detected seemed to fall latterly (Table 2). Few Jul-Dec (Fig. 11). Dell (1959) wrote, "They vanish during the breeding season and seem to seek out conditions approaching their original native preferences...". Or do they merely feed inconspicuously beneath the canopy in the windy weather prevailing in spring-summer? Fantails are unusual in that more are first seen than first heard. McLean (1989) thought that most food was obtained on the wing. Many were seen in autumn, when often calm and flying insects abundant (pers. obs.). Fantails sheltered near the house when windy, entering in Jan-May (when our cat killed 4). Tail-less birds seen Jan, May, Oct may have had a brush with a cat. Fantails accompanied other birds and people to catch disturbed insects (McLean 1989); here a pigeon in Jan, starling in Mar. Black fantails were seen May 1983, Dec 1991.

Silvereye: mean number per count fell from 2.4 in 1981-82 to 1.0 in 1991-93 (Table 2), possibly because of my hearing loss. As in Orongorongo V. (Gibb 1996) they peaked in Apr, fell Jul-Feb (Fig. 12). The weak song-period lasted Oct-Feb (Mar); more first heard calling Sep-Feb, May than singing. Dates autumn peaks given in Fig. 13. There is no evidence of banded birds migrating in New Zealand (Heather & Robertson 1996); however, >100,000 were banded in Australia before migration was confirmed (Rooke 1984). Zugunruhe (migration restlessness; Thomson 1964) was seen in autumn when flocks took off, circled and settled again, calling excitedly. Some flocks settled in trees after flying up the hill, as if tired. Flocks flying E-W. over Christchurch at night in

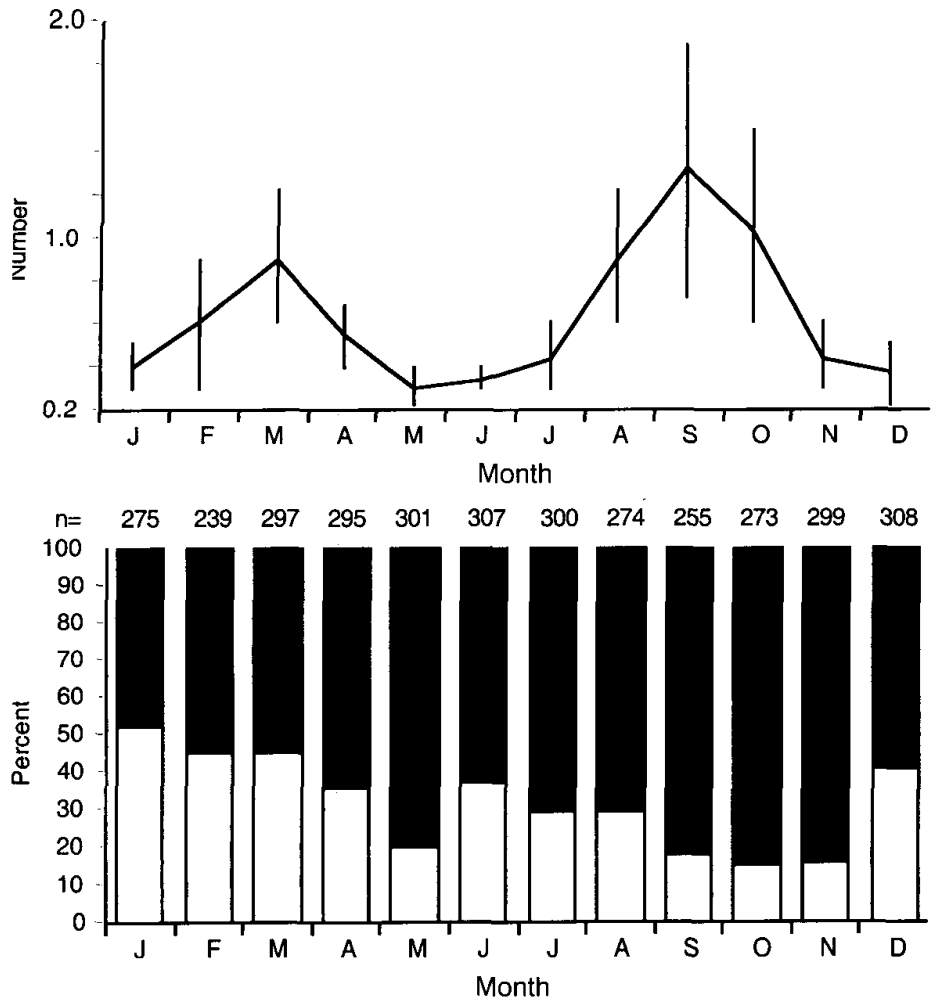

Fig. 9 Grey Warbler: (upper) number detected per 10 counts, $\bar{x} \pm SE\bar{x}$; (lower) sign (%). *n* = no. records of sign. Open, seen; filled, song.

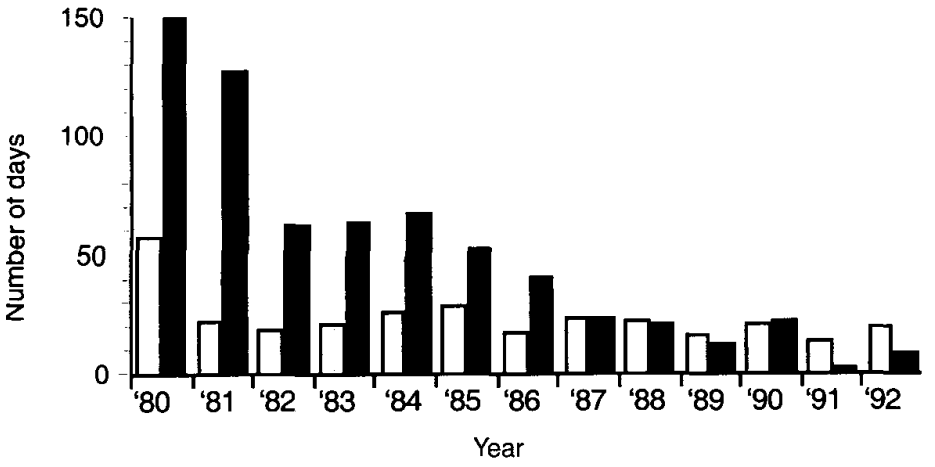

Fig. 10 Grey Warbler: number of days first seen cf. first heard. Open, days p.a. first seen; filled, days p.a. first singing.

Apr were described as migrating (Dawson 1961). Grant (1970) saw thousands flying up the West Coast in Jun (a weather movement?). Dennison *et al.* (1981) heard flocks over Farewell Spit by day in May, as if migrating (see also Stead 1932). Table 5 lists foods seen eaten in the study area.

Tui bred in bush and large city gardens. They probably increased in the study area (Table 2). Most were detected Jan, fewest Mar (Fig. 14) (cf. Gravatt 1970). They sometimes flew bush to city gardens when not breeding. Bull (pers. comm.) saw tui at puriri (*Vitex lucens*) flowers in Lower Hutt, autumn. Merton (1966) thought tui "dependent on nectar from puriri and kohekohe" (*Dysoxylum spectabile*) on Hen I., May. Table 6 lists records of tui taking nectar in study area. A few chased cicadas in late summer. I never saw them eat fruit. Tui

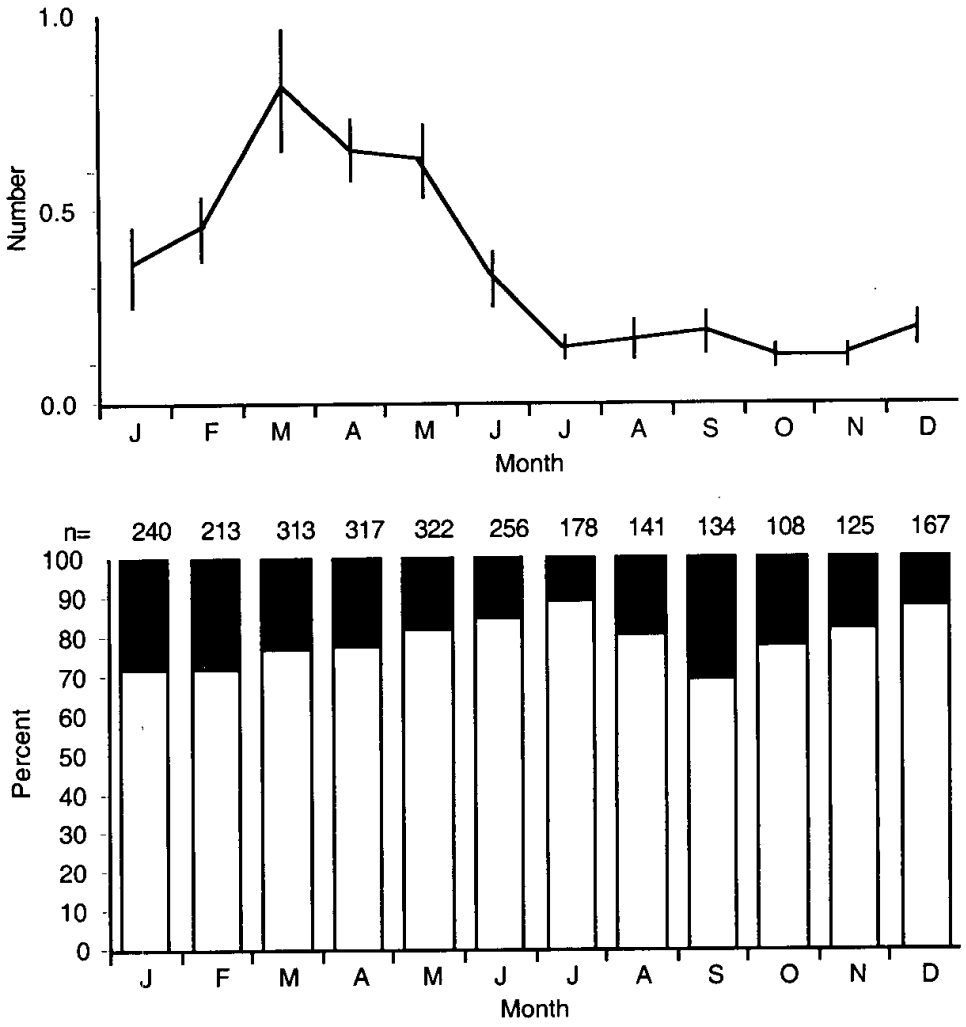

Fig. 11 Fantail: (upper) number detected per count, $\bar{x}$ ± SE$\bar{x}$; (lower) sign (%). n = no. records of sign. Open, seen; filled, heard.

were first seen/first heard equally often (Fig. 14). They became noisy in Aug, chased each other Aug-Sep, nested Oct. A pair bred in nearby pines 1994, 1996; young left one nest 2 Dec 1994. Tui sometimes 'sing' silently with little audible sound. Inaudibly low notes would carry furthest. They started singing 0340-45 h Nov-Dec, 0400-30 h Jan, 0500-15 h Sep-Oct, and performed aerial displays in breeding season, ascending 50 m. then dropping or flying slowly with rapid wing-beats.

Yellowhammer (*Emberiza citrinella*): a few flew from golf courses in valley to hill pastures. Chaffinch (*Fringilla coelebs*) seem to have decreased (Table 2), again perhaps because of my hearing loss. Fewest were detected Feb, then more till Aug (Fig. 15). Main song-period (Jul) Aug-Jan. A few Greenfinches (*Carduelis chloris*) ate weed seed late summer-autumn, esp. *Cerastium glomeratum*; also crumbs and grain in winter. Goldfinch (*Carduelis carduelis*) arrived in spring (Fig. 16), bred in pine trees. First seen more often than first heard (usually calling). Main song-period Oct-Feb (Mar). Males accompanied females collecting cobwebs from power poles Oct (1), Nov (4), Dec (3) (cf. Burrows 1955). Fledged young seen late Dec; 2nd broods usual. Food included seed of sow thistle (*Sonchus asper*) Oct-Dec (5 records), lavender (17+) May-Jul; pohutukawa (2) Jun; *Cerastium glomeratum*, dandelion (*Taraxacum officinale*), nettle (*Urtica incisa*) once each in Jul. Small parties redpolls (*Carduelis flammea*) arrived Mar-Aug, once Dec; ate seed of *Eucalyptus incisa* Mar, pampas (*Cortaderia selloana*) Apr-May, pohutukawa Jun, *Paulownia tomentosa* (as in Stokes Valley, B.M. Fitzgerald pers. comm.) Aug, toetoe (*Cortaderia fulvida*) Dec. House sparrow (*Passer domesticus*) always abundant. Numbers fluctuated with unpredictable actions of neighbours: one fed chickens excess grain to which sparrows flew >300 m; another stripped house of ivy in which sparrows had congregated. They fed in bush Nov-Feb and chased flying cicadas, dismembering some on the roof. They took *Cortaderia* flower tassels for nests Aug-Mar.

Starling (*Sturnus vulgaris*) always common (Fig. 17); more often first seen than first heard probably because I was between roost and feeding grounds. Often fed in bush

Table 5 Fruit eaten and sources of nectar of silvereye (*Zosterops lateralis*), by month.

Plant	Number of days recorded per month J	F	M	A	M	J	J	A	S	O	N	D	Total
Fruit													
Fig, *Ficus carica*		7	25	31	5								68
Crabapple, *Malus* hybrid			7	21	13								41
Fivefinger *Pseudopanax arboreus*	1					4	2						7
Cabbage tree *Cordyline australis*		5	2										7
Grape, black, *Vitis* hybr.		2		2									4
Blackberry *Rubus fruticosus* agg.		3											3
Pyracantha sp.			1		1	1							3
Karamu *C. robusta*	1												1
Black nightshade *Solanum nigrum*							1						1
Tomato (rotten) *Lycopersicon esculentum*						1						1	
Nectar													
Flax, *Phormium* spp.	19	2									45	60	126
Crimson bottlebrush *Callistemon* sp.	2									3	23	39	67
Japonica sp.							13	12	5	6	1		37
Kniphofia spp.	4					4	11	3	2	3			27
Rhododendron hybrids							1	12	4	2			19
Rewarewa *K. excels*									1	2	12		15
Rata vine *M. fulgens*				1	5	5	3	1					15
Banksia integrifolia			1	1		5		8					15
Tree lucerne *C. palmensis*					2	2	1	3	5	1			14
Kowhai, *Sophora* spp.									4	7			11
Camellia sp.							3	2	3	1			9
Grevillea sp.								1	4	4			9
Pohutukawa *M. excelsa*	5											2	7
Waratah, *Telopea* sp.										4			4
Plum *Prunus* hybrid						1	2						3
Lophomyrtus sp.	3												3
Fuchsia spp.	1						1				1		3
Tree rata *M. robusta*												2	2
Eucalyptus ficifolia		1											1
Erica cerinthiodes									1				1
Cherry *Prunus* sp.									1				1
Foxglove *Digitalis purpurea*												1	1
Wattle *Acacia* sp.							1						1
Rosemarinus officinalis										1			1
Aloe sp.												1	1
Summary: Fruit		5	15	35	54	20	5	3					137
Nectar	34	3	1	2	7	16	34	43	32	34	82	103	393

in summer (Table 7). They chased flying cicadas Jan.-Mar. and dismembered some on the roof, swallowing body+wings.

Australian Magpie (*Gymnorhina tibicen*) bred in valley; some moved to hills Jan-Apr (Fig. 18). I never saw them attack other birds though Flux (pers. comm.) saw them attack newly-arrived spur-winged plover.

Wind

Wind hampers the detection of birds (Dawson 1981). Cold days in spring were cloudless with strong southerly winds; in summer, they were cloudy with strong southerlies; in autumn-winter, calm and clear. Warm days were usually cloudy with strong northerlies. Northerlies were twice as frequent as southerlies and commonest in spring-early summer; strong in Jul and Sep-Feb. Southerlies were strong May and Sep-Dec. Ten percent of days were judged calm (Beaufort 0-1) at the time when wind was recorded.

Most Dominican gulls flew over against the wind without landing. Some presumably returned by another route, unseen, with the wind; but that route was not ascertained. More were seen in strong northerlies (χ^2=4.90, 1 df, P<0.05), and many more in strong southerlies (χ^2=535, 1 df, P<0.001), than when calm (Table 8).

I noted the proportion of days when swallows and the proportion of counts when other species were recorded

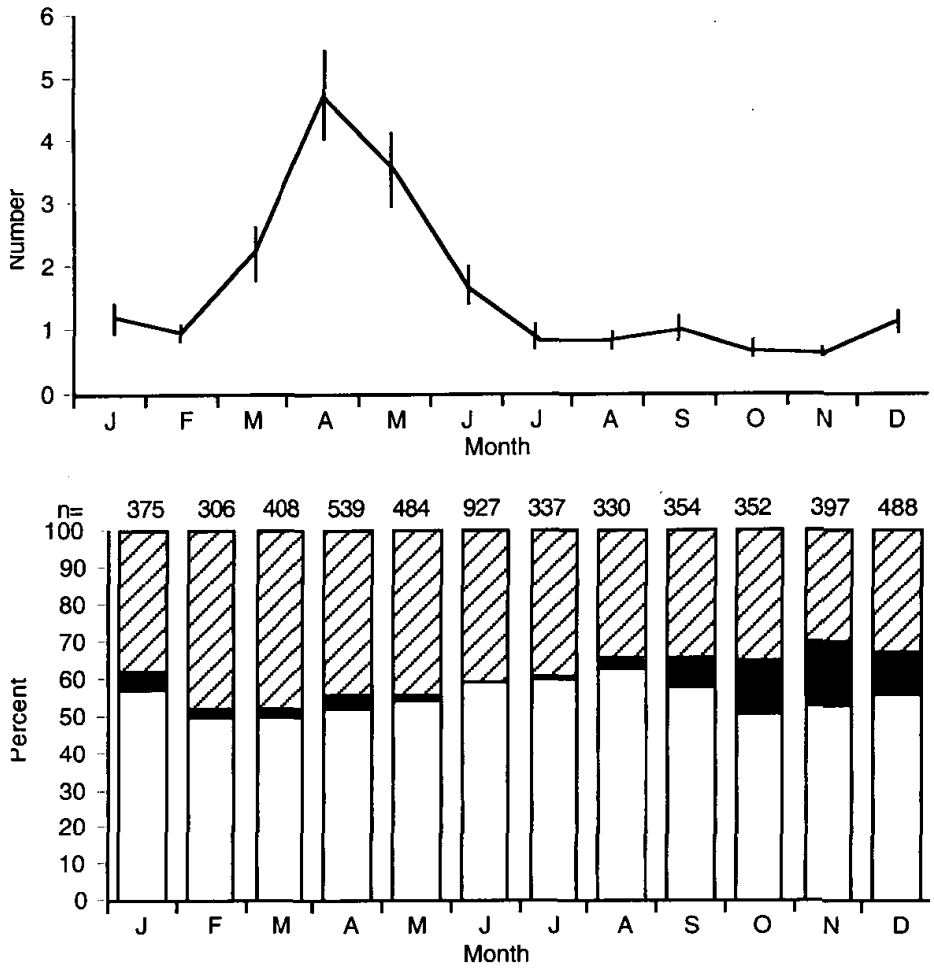

Fig. 12 Silvereye: (upper) number per count, $\bar{x}$ ± SE$\bar{x}$; (lower) sign (%). *n* = no. records of sign.Open, seen; filled, song; hatched, call.

in different winds. Swallows obtained all their food on the wing, e.g., over the river. They were seen more often in northerly winds than when calm (χ^2=3.86, 1 df, P<0.05); and about as often in strong as in light-moderate northerlies (Table 9). They were less frequent in southerlies than in equally strong northerlies (χ^2=14.05, 1 df, P<0.001).

Fantails fed aerially above or inconspicuously beneath the canopy, depending on the wind (cf. Dell 1959). When conspicuous in Mar-May (Table 10), about as many were seen in Force 2-3 northerlies as when calm; but many fewer were seen in Force 4-5 northerlies (χ^2=48.8, 1 df, P<0.001). Also, they were seen less often in strong than in light southerlies (χ^2=8.32, 1 df, P<0.01). More were seen in Force 4-5 than >5 winds; and fewer in Force 4-5 southerlies than in 4-5 northerlies (χ^2=39.9, 1 df, P<0.001).

Table 11 shows the effect of wind on detecting blackbird, silvereye, tui, and chaffinch. In Jun-Aug (when rarely singing) fewer blackbirds were detected as the wind strengthened (P<0.01); similarly with silvereye and tui. Unexpectedly, however, in Apr-Jul chaffinches were detected as often in strong as in light winds.

Fewer starlings were detected dispersing from the roost in the morning in strong southerlies than in northerlies (P<0.001) (Table 12). In Apr-Aug >5 per count were detected more often in Force 4-5 northerlies than in equally strong southerlies (χ^2=5.78, 1 df, P<0.05).

House cats

Thirty respondents kept 13 male and 14 female cats, mostly neutered or spayed. Of prey brought home, rodents were mentioned 16 times, birds 10, lizards (skink) 8, weta (large Orthoptera), adult stoat and young rabbit once each. The density of 0.8 cats per household exceeds that of feral cats in similar areas in New Zealand (Fitzgerald 1990).

DISCUSSION

Counts

Others have used bird counts lasting 2 to 20 min each (Scott & Ramsey 1981). Dawson & Bull (1975) counted for 5 min at a time and Gibb (1996) for 10 min in New Zealand, Scott & Ramsey (1981) for 8 min in Hawaii.

Table 6 Sources of nectar (flowers) used by tui (*Prosthemadera novaeseelandiae*), by month.

Plant species	Days recorded J	F	M	A	M	J	J	A	S	O	N	D	Total
Flax *Phormium* spp.	17	2									6	13	38
Kowhai *Sophora* spp.								2	10	5			17
Banksia integrifolia			1		1	8	4	1					15
Kniphofia sp.	9	1											10
Rewarewa *K. excelsa*										7	6		13
Crimson bottlebrush *Callistemon* sp.										3		1	4
Waratah *Telopea* hyb.										2	1		3
Camellia hybrid								2					2
Tree *Eucalyptus* sp.							2						2
Pohutukawa *M. excelsa*	2												2
Tree rata *M. robusta*												1	1
Protea sp.	1												1
Total	29	3	1	0	1	8	6	5	10	17	13	15	108

Table 7 Observed foods of starling (*Sturnus vulgaris*), by month.

Food	Number of records J	F	M	A	M	J	J	A	S	O	N	D	Total
Nectar of flax *Phormium* spp.	32	3									54	164	253
Fruit of fig, *Ficus carica*			6	31	19	1							57
Cicada* in flight	8	21	9										38
Fruit of crab-apple *Malus* hybrid			1	6	12	5							24
Fruit of cabbage tree *Cordyline australis*	1	7	7		1							16	
Nectar of pohutukawa *Metrosideros excelsa*											13	1	14
Fruit of karamu *Coprosma robusta*			1		2								3
Nectar of tree rata *Metrosideros robusta*											1	1	

* Mostly *Amphipsalta cingulata*.

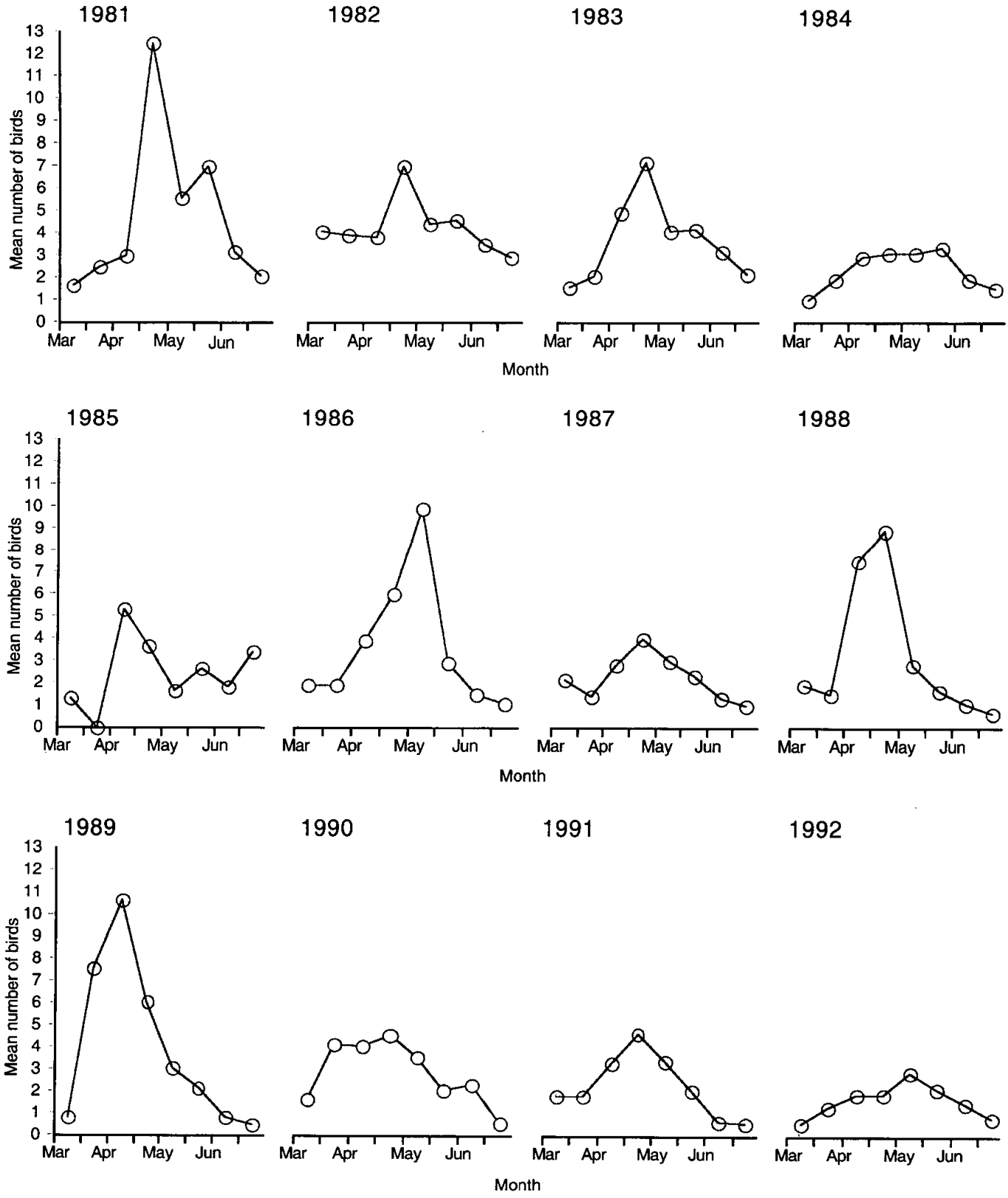

Fig. 13 Silvereye: date and size of autumn peaks. Points are the mean counts for half-month periods.

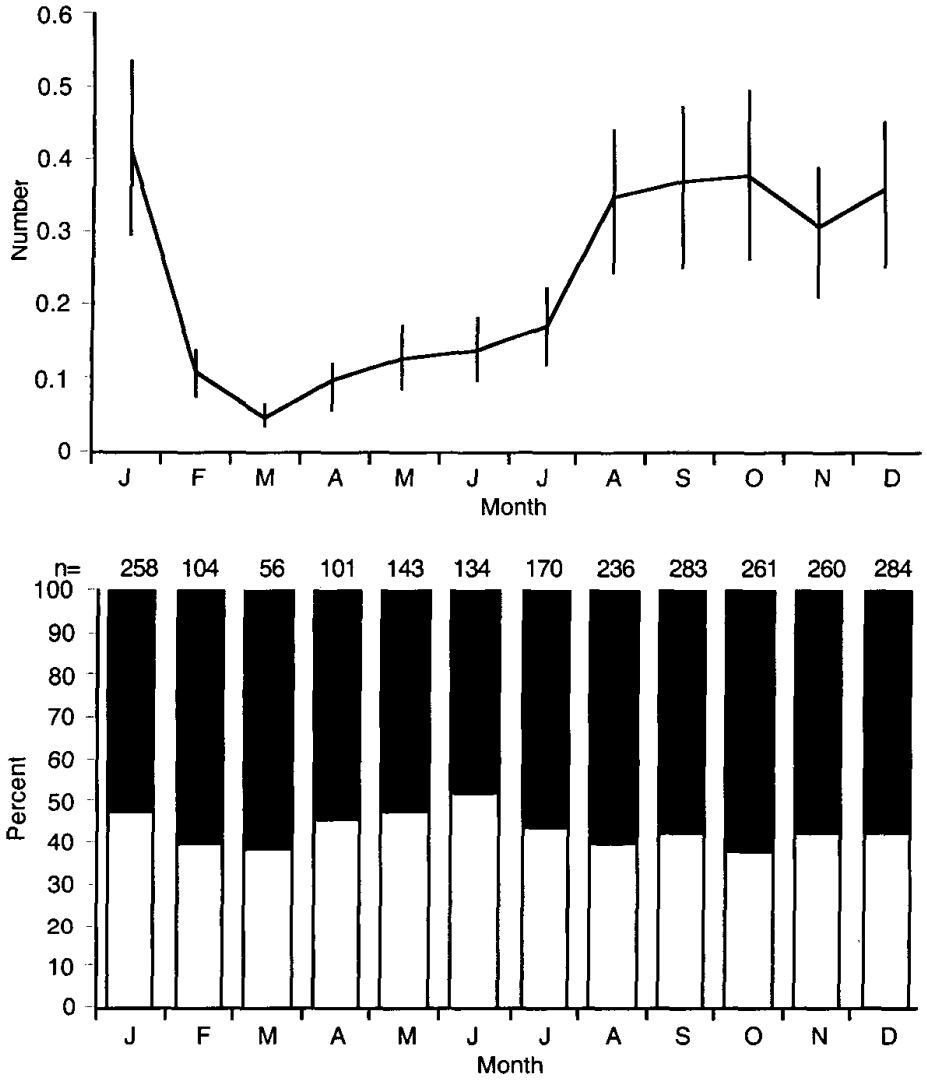

Fig. 14 Tui: (upper) number per count, $\bar{x} \pm SE\bar{x}$; (lower) sign (%). *n* = no. records of sign. Open, seen; filled, heard.

Table 8 Effect of wind speed (Beaufort scale) and direction (N, north; S, south) on number of Dominican gulls (*Larus dominicanus*) detected in alternate weeks August-January.

	Number of counts Wind direction, speed		
	Calm	N, >4	S, >3
Beaufort 0-3	1139	904	351
>3	40	51	320
Mean gulls per count ($\bar{x} \pm SE\bar{x}$)	0.65 ± 1.24	0.83 ± 1.59	5.25 ± 6.48

Table 9 Effect of wind on detection of welcome swallows (*Hirundo pacifica*), spring - summer 1984-92.

	No. of days @ Beaufort scale		Proportion of days
	Swallows detected	Not detected	Swallows detected
Beaufort 0-1 (calm)	129	130	0.50
Beaufort N. 2-4	248	185	0.57
Beaufort N. >4	52	44	0.54
Beaufort S. 2-4	75	100	0.43
Beaufort S. >4	9	20	0.31

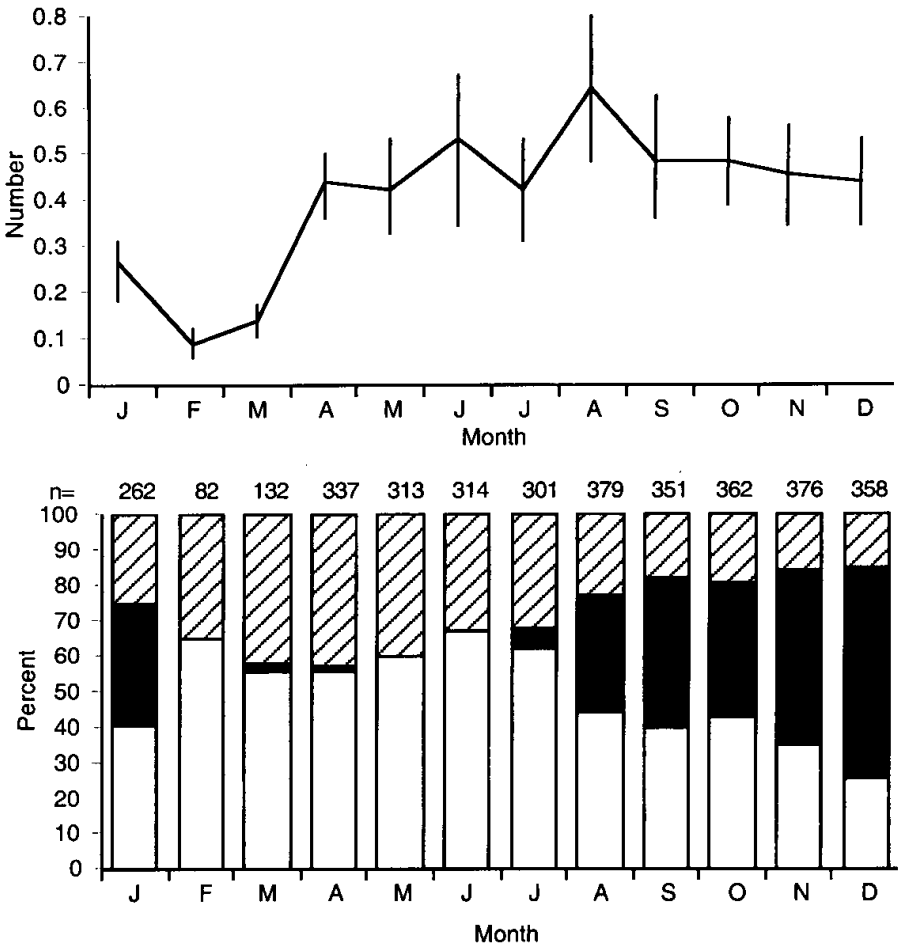

Fig. 15 Chaffinch: (upper) number detected per count, $\bar{x}$ ± SE$\bar{x}$; (lower) sign (%). *n* = no. records of sign. Open, seen; filled, song; hatched, call.

Table 10 Effect of wind on detection of fantails (*Rhipidura fuliginosa*), March-May all years.

Beaufort speed	Counts (*n*)	Counts with fantails (%)
0-1(calm)	1298	52.39
N. 2-3	822	50.73
S. 2-3	378	31.22
E/W. 2-3	40	42.15
N. 4-5	426	30.05
S. 4-5	196	19.90
E/W. 4-5	18	33.33
N. >5	73	19.18
S. >5	54	11.11
E./W. >5	3	0

Table 11 Effect of wind on detection of blackbird (*Turdus merula*), silvereye (*Zosterops lateralis*), tui (*Prosthemadera novaeseelandiae*), and chaffinch (*Fringilla coelebs*).

Species & period	Beaufort speed	Counts (*n*)	Counts with species (%)
Blackbird Jun-Aug	0 - 3	2173	54.03
	4 - 5	744	47.98
	>5	120	40.83
Silvereye Jul-Dec	0 - 3	2231	38.68
	4 - 5	808	31.42
	>5	107	25.23
Tui Aug-Jan	0 - 3	2281	31.70
	4 - 5	855	27.25
	>5	155	21.94
Chaffinch Apr-Jul	0 - 3	1790	32.18
	4 - 5	501	32.93
	>5	87	31.84

Note. Periods selected were those with little change in the frequency of detection.

Table 12 Effect of wind on number of Starlings detected per count, Apr - Aug , all years.

	Wind direction and Beaufort speed					
	Calm	N, 2-4	N, >4	S, .2-4	N, >4	E+W, .2-4
Counts (*n*)	821	684	141	294	60	59
Birds detected ($\bar{x}$ ± SE$\bar{x}$)	4.12 ± 2.36	4.16 ± 2.48	4.79 ± 3.48	3.62 ± 2.15	3.43 ± 2.30	3.78 ± 2.15
Counts of >5 birds (%)	22.53	22.22	36.88	16.38	16.67	18.64

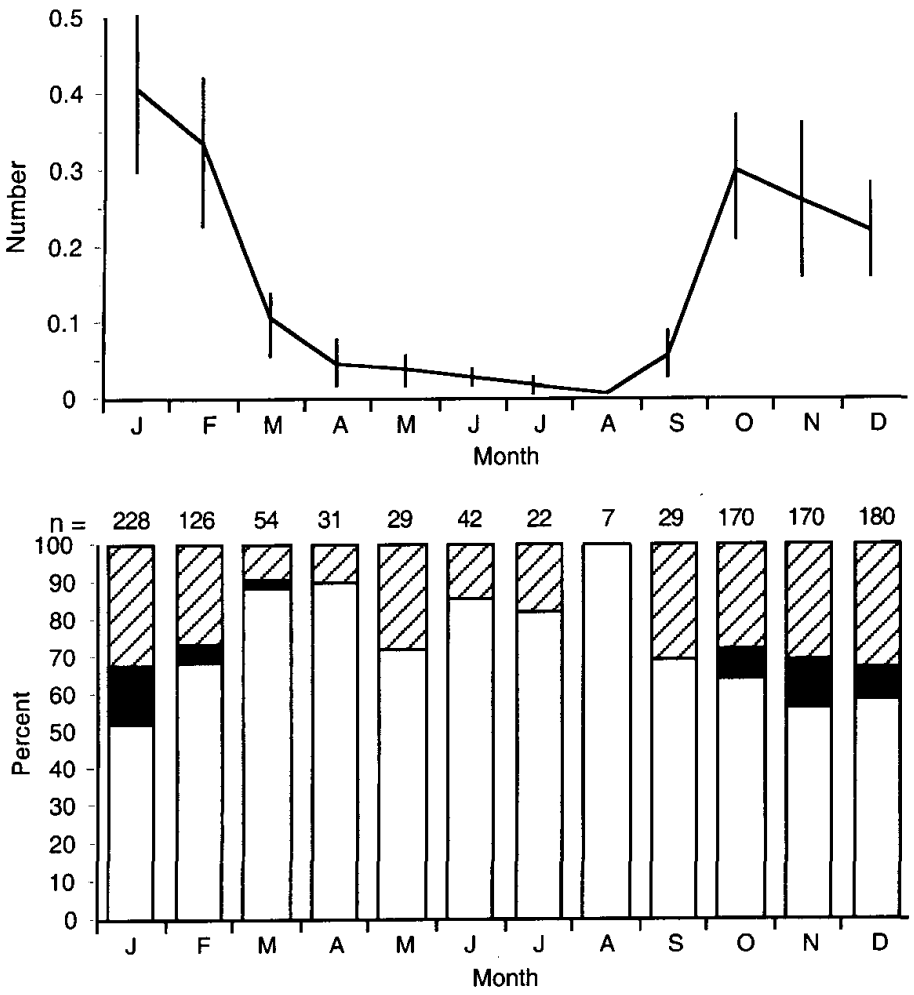

Fig. 16 Goldfinch: (upper) number detected per count, $\bar{x} \pm SE\bar{x}$; (lower) sign (%). n = no. records of sign. Open, seen; filled, song; hatched, call.

Some counts were made by an observer walking slowly through the forest (Gibb 1960; unpubl. data) or at points a fixed distance apart (Dawson & Bull 1975). Others by a stationary observer (Gibb 1996; this paper); the behaviour of a few close birds biases stationary counts.

The appropriate method in one habitat may be inappropriate in another and what is suitable with a sparse avifauna may be impractical with a rich one. Similarly, what is appropriate for spaced counts in forest may not be for fixed-point counts in the garden.

In 1981 the choice lay between Dawson & Bull's (1975) 5 min and Scott & Ramsey's (1981) 8 min. The latter headed a list of supposed advantages of long counts by claiming that they gave inconspicuous species a better chance of detection. This seemed important because I wished to spend as long as possible counting birds, not writing about them. Counts of 10 min involved less writing than 5-min counts, so I chose them. I accepted the possible (but in the event imaginary) difficulty of deciding whether successive observations referred to the same or different birds. The time saved was devoted to searching for inconspicuous species.

Adopting 10-min counts made it difficult to compare results with those using 5-min counts. This was considered unimportant because strict comparison requires that all relevant matters be duplicated. These should include the habitat, avifauna, and the observers themselves - as different observers concentrate on different species (pers. obs.). Proper duplication is rare and separate studies must usually be treated as unique even when counts are the same length.

Bird 'sign'

Bird 'sign' varied seasonally and between species (Calquhoun 1940; Gibb 1996). With few exceptions (Marples 1944; Cunningham 1955; Sibson 1966), the song-periods of New Zealand birds are poorly documented. When birds call is rarely recorded at all (cf. Marler & Evans 1996). Grey warblers rarely call. The song and calls of tui and bellbird are each difficult to differentiate. New Zealand pigeons do not sing though other pigeons do (Goodwin 1967; pers. obs.). Blackbirds and thrushes have different songs and song periods; their function must differ.

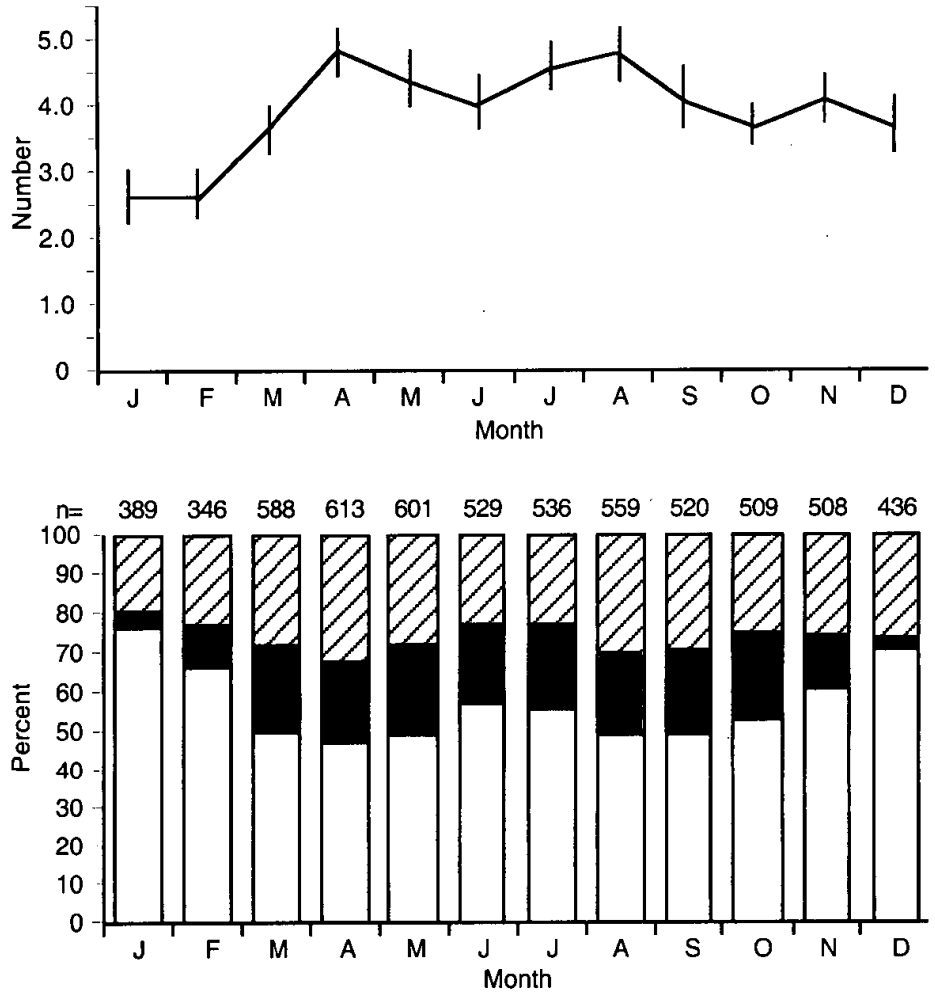

Fig. 17 Starling: (upper) number detected per count, $\bar{x}$ ± SE$\bar{x}$; (lower) sign (%). *n* = no. records of sign. Open, seen; filled, song; hatched, call.

There is no one season when all species are best detected. Many riverine species leave the area to breed. More New Zealand pigeons are to be seen in spring-summer than at other seasons. Thrushes, dunnocks, and chaffinches often sing in spring; dunnocks often call in April, sing in August. Blackbirds and tui are most often detected after breeding; warblers and thrushes in early spring, fantails and silvereyes in autumn. A few species may be first seen on song-posts. Dunnocks, blackbirds, thrushes, tui, chaffinches, and starlings are seldom seen when moulting; fantails, silvereyes and magpies when breeding. As each species has its own times of apparent scarcity/abundance unrelated to actual changes in numbers, counts alone may be misleading indices of abundance. Also, as wind reduces the number of birds detected, counting should definitely not be attempted in winds exceeding say Beaufort Force 3.

Food

The spread of houses with gardens may benefit silvereyes but not pigeons. Varieties of *Ph. cookianum* flower 10 days earlier and more regularly than *Ph. tenax* (cf. Brockie 1986), and they finish flowering earlier. They have shorter flowers (25-40 mm cf. 25-50 mm long; Moore & Edgar 1970) and are visited before *Ph. tenax* (χ^2=214, 1 df, P<0.001), chiefly by silvereyes. After mid-Dec *Ph. tenax* was preferred to *Ph. cookianum* and (given the choice) visited by longer-billed tui and starling. Tui concentrated on *Ph. tenax* more strictly than did other species (χ^2=8.81, 1 df, P<0.01). Snow & Snow (1988) described how some shrubs in northern Europe, where seed-eating birds migrate south in autumn, entice birds to eat their fruit and defecate (i.e. disperse) their seed. Clout *et al.* (1991) stressed the importance of seed dispersal by birds in New Zealand, where plants need not adapt to migrants. Instead, some plants provide edible fruit for a long time. Individual karamu, for instance, bear flower buds, flowers, unripe and ripe fruit together for months on end (pers. obs.).

Some plants also compete for bird pollination by flowering at different times. The vine *M. fulgens* and tree *M. robusta* both have large red flowers attractive to honeyeaters. The vine flowers for a long, variable period in autumn-winter and is visited by silvereyes, tui and

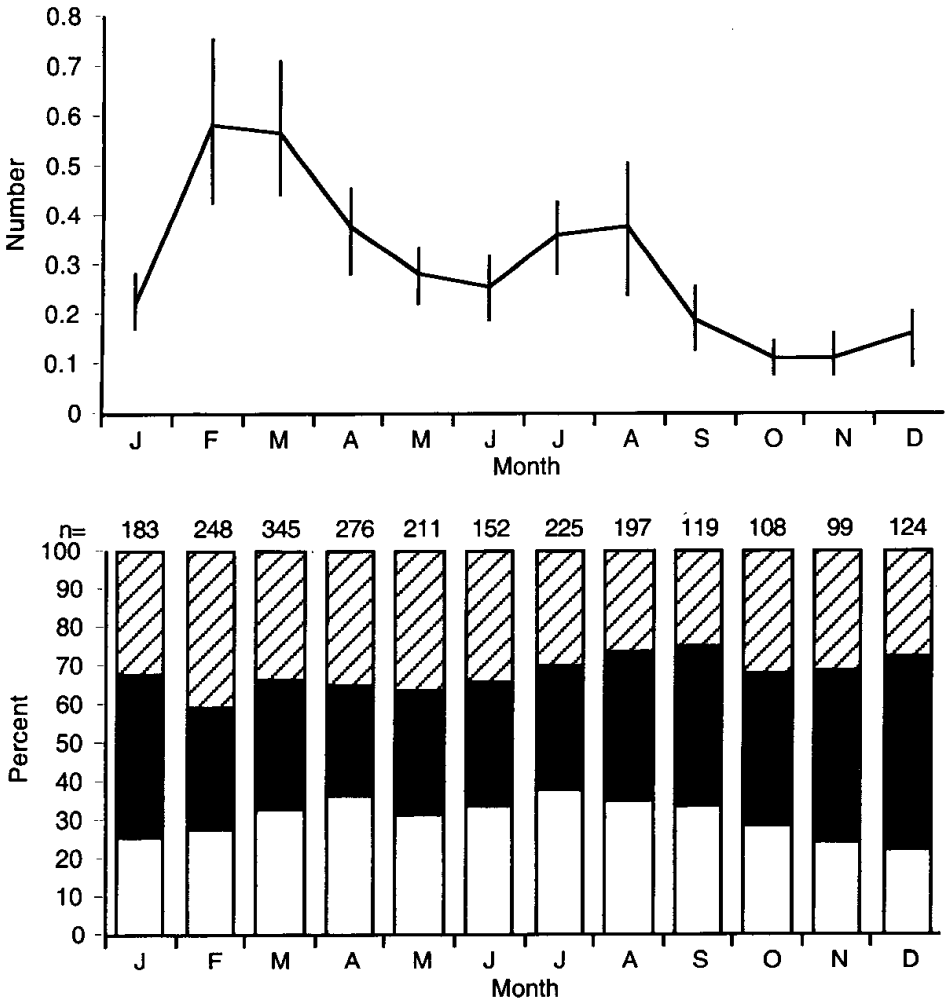

Fig. 18 Magpie: (upper) number detected per count, $\bar{x} \pm SE\bar{x}$; (lower) sign (%). n = no. records of sign. Open, seen; filled, song; hatched, call.

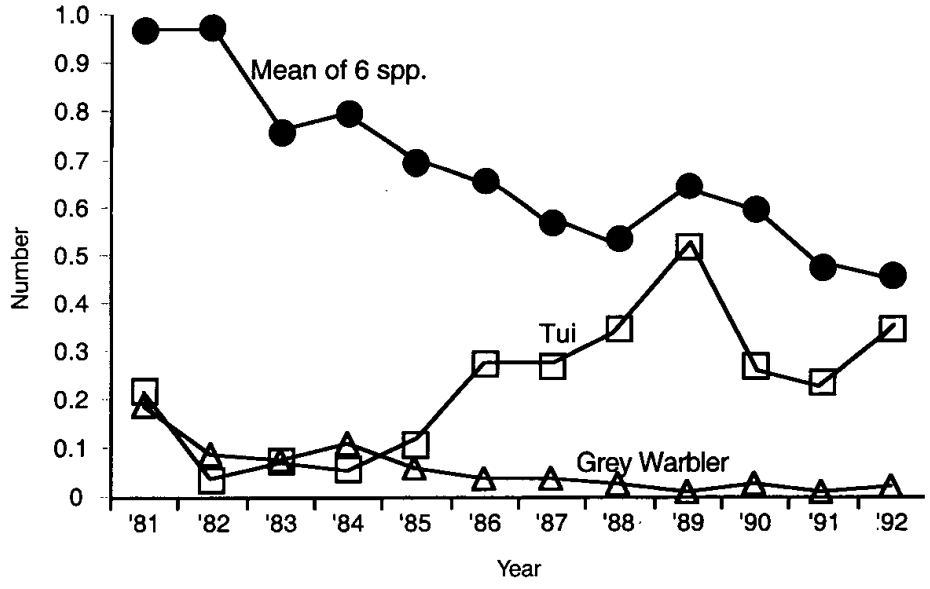

Fig. 19 Mean number of birds per count of six passerine species (fantail, silvereye, tui, chaffinch, starling & Australian magpie) and of tui and grey warbler, 1981-92.

Table 13 Status of birds in study area; *, introduced; !, recent (19th & 20th century) Australian immigrant.

Resident (breeding)	
Black shag (few)	Song thrush* (common)
White-faced heron! (scarce)	Grey warbler (formerly common)
Paradise duck (scarce)	Fantail (common)
Mallard* (common)	Silvereye! (common)
California quail* (few)	Tui (common)
Pukeko (few)	Yellowhammer* (scarce)
Spur-winged plover! (few)	Chaffinch* (common)
New Zealand pigeon (common)	Greenfinch* (few)
Rock pigeon* (common)	Goldfinch* (common)
Morepork (formerly common)	House sparrow* (abundant)
Skylark* (scarce)	Starling (abundant)
Welcome swallow! (formerly common)	Magpie* (common)
Dunnock* (common)	
Blackbird* (abundant)	
Visitor	
Little shag (common, winter)	Red-billed gull (common)
Black swan* (scarce, winter)	Black-billed gull (rare)
Canada goose* (rare, winter)	Caspian tern (common)
Grey teal (scarce, winter)	Shining cuckoo (few)
Australasian harrier (scarce)	Kingfisher (common, summer)
Falcon (rare)	Skylark* (scarce)
Pied stilt (scarce?)	Redpoll* (scarce)
Banded dotterel (scarce?)	
Vagrant	
Cattle egret	White cockatoo*
Oystercatcher	Long-tailed cuckoo
Barbary Dove*	

elsewhere by bellbirds; whereas the tree flowers only briefly after most birds have finished breeding but when honeyeaters are most abundant. Wherever two or more bird-pollinated *Metrosideros* spp. are sympatric, each minimizes competition and maximizes pollination by adjusting its time of flowering.

On the Western Hutt hills the vine *M. fulgens* is common and *M. robusta* largely replaced by *M. excelsa* brought from further north. The latter's large red flowers are here visited by silvereyes, tui, house sparrows, and starlings.

Distribution and abundance

In over 35 years I have seen 45 species of birds in the Hutt Valley (see Caughley 1965). I found few nests, so some species are listed as breeding only because present in the breeding season. The shining cuckoo is the only long-distance migrant and the kingfisher the only summer visitor here that winters elsewhere in New Zealand. The scarcity of native passerines results from New Zealand's isolation. Vagrant land-birds are scarce.

Although present in the Eastern Hutt hills and the Rimutaka Range beyond, tomtit (*Petroica macrocephala*), whitehead (*Mohoua albicilla*), rifleman (*Acanthisitta chloris*) and bellbird (*Anthornis melanura*) are absent from the Western Hills, apparently held up by a narrow belt of urban land. Non-passerines are less sedentary: Black shag, white-faced heron, black swan, Canada goose, mallard, grey teal, Dominican and red-billed gull, and rarely Caspian tern and oystercatcher cross the 15 km neck of land between the Hutt Valley and Pauatahanui (cf. Dell 1959).

Since 1959, white-faced heron, paradise shelduck, spur-winged plover, welcome swallow (temporarily) and probably tui have increased. Australasian harrier, silvereye, grey warbler, and probably chaffinch have decreased (Table 2, Fig. 19). Twelve years is too short a time to distinguish supposedly permanent from temporary changes.

The immediate surroundings here have changed little, but my hearing has deteriorated. Use of a hearing-aid to count birds since 1989 resulted in slightly more passerines detected, but surprisingly not warblers. Most species heard

more often with the hearing-aid had previously been first seen, not heard. The low-pitched call of the morepork is easy to hear unaided. The numbers of tui detected seemed to increase with the aid, but they had also done so in 1985-86 without it. Therefore, the gradual reduction in birds detected latterly was not just because I failed to hear them.

The song of warblers was hard to hear unaided. None the less they must have declined. Since moving next-door in 1993 local shrubbery has grown into good warbler habitat; yet none has been detected here for years, though they were previously common. There are certainly more houses (with cats) here than formerly; some species may have declined as a result.

For some birds native forest may be an important source of recruits in surrounding districts (so called 'sinks'). A decline of birds may be delayed until long after the forest has been cleared; yet there are already more native species in the Tararua Range than in the Rimutaka Range, more there than in the Eastern Hutt hills, more there than in the Western Hills, and more here than closer to Wellington City. More lowland forest may be needed to boost native birds in surrounding districts such as the study area.

ACKNOWLEDGEMENTS

I thank Drs Peter Bull, David Dawson, Mike Fitzgerald, John Flux, the editor and anonymous referees for many improvements and for allowing me to quote their personal observations. Mike Fitzgerald also helped overcome printing glitches. My wife Judy kindly drew the figures and helped in numerous other ways.

LITERATURE CITED

Brockie, R.E. 1986. Periodic heavy flowering of New Zealand flax (*Phormium*), Agavaceae. *New Zealand journal of botany 24*: 381-386.

Buckland, S.T. 1987. On the variable circular plot method of estimating animal density. *Biometrics 43*: 363-384.

Bull, P.C. 1953. Observations on a marked population of blackbirds at Lower Hutt. *Notornis 4*: 149-156.

Bull, P.C. 1959. Birds of the Hutt Valley. *Proceedings of the New Zealand Ecological Society 6*: 52-58.

Burrows, W.M. 1955. Goldfinch (*Carduelis carduelis*) collecting nesting material. *Notornis 6*: 178.

Calquhoun, M.K. 1940. Visual and auditory conspicuousness in a woodland bird community: a quantitative analysis. *Proceedings of the Zoological Society of London, series A 110*: 129-148.

Carroll, A.L.K. 1970. The white-faced heron in New Zealand. *Notornis 17*: 3-24.

Caughley, G. 1965. A method of comparing the numbers of species in areas covered by different periods of observation. *Emu 65*: 115-118.

Child, P. 1984. Kingfisher taking a silvereye. *Notornis 31*: 171.

Clout, M.N.; Gaze, P.D.; Hay, J.R.; Karl, B.J. 1986. Habitat use and spring movements of New Zealand pigeons at Lake Rotoroa, Nelson Lakes National Park. *Notornis 33*: 37-44.

Clout, M.N.; Karl, B.J.; Gaze, P.D. 1991. Seasonal movements of New Zealand pigeons from a lowland forest reserve. *Notornis 38*: 37-47.

Cunningham, J.M. 1955. Diagrammatic expression of the seasonal intensity of bird song. *Acta XI Congressus Internationalis Ornithologici*: 555-560.

Dawson, D.G. 1961. Silvereyes moving by night over Christchurch. *Notornis 9*: 200.

Dawson, D.G. 1981. Counting birds for a relative measure (index) of density. *Studies in avian biology 6*: 12-16.

Dawson, D.G.; Bull, P.C. 1975. Counting birds in New Zealand forests. *Notornis 22*: 101-109.

Dell, R.K. 1959. Some ecological aspects of the Hutt Valley as an animal habitat. *Proceedings of the New Zealand Ecological Society 6*: 49-52.

Dennison, M.D.; Heather, B.D.; Robertson, H.A. 1981. Migratory movement of silvereyes at Farewell Spit. *Notornis 28*: 119-120.

Fitzgerald, B.M. 1990. House cat. pp. 330-348 *In*: King, C.M. (*ed..*). *The handbook of New Zealand mammals*. Auckland, Oxford University Press.

Gibb, J.A. 1960. Populations of tits and goldcrests and their food supply in pine plantations. *Ibis 102*: 163-208.

Gibb, J.A. 1994. Plant succession on the braided bed of the Orongorongo River, Wellington, New Zealand, 1973-1990. *New Zealand journal of ecology 18*: 29-39.

Gibb, J.A. 1996. First seen or first heard? A useful distinction when counting forest birds. *Notornis 43*: 7-13.

Gibb, J.A.; Fitzgerald, B.M. 1998. Dynamics of sparse rabbits (*Oryctolagus cuniculus*), Orongorongo Valley, New Zealand. *New Zealand journal of zoology 25*: 231-243.

Goodwin, D. 1967. *Pigeons and doves of the world.* London, Trustees of the British Museum (Natural History).

Grant, P. 1970. Northerly movement of silvereyes in winter on the West Coast, South Island. *Notornis 17*: 322-323.

Gravatt, D.J. 1970. Honeyeater movements and the flowering cycle of vegetation on Little Barrier Island. *Notornis 17*: 96-101.

Heather, B.D.; Robertson, H.A. 1996. *The field guide to the birds of New Zealand.* Auckland, Viking.

McLean, I.G. 1989. Feeding behaviour of the fantail. *Notornis 36*: 96-106.

Marler, P.; Evans, C. 1996. Bird calls: just emotional displays or something more? *Ibis 138*: 26-33.

Marples, B.J. 1944. Notes on the songs of certain birds in Dunedin. *New Zealand bird notes 1*: 62-64.

Merton, D.V. 1966. Foods and feeding behaviour of some forest birds on Hen Island in May. *Notornis 13*: 179-184.

Moon, G.J.H. 1979. *The birds around us.* Auckland, Heinemann.

O'Donnell, C.F.J. 1980. Morepork calling frequency in Nelson. *Notornis 27*: 397-399.

Robertson, H.A. 1992. Trends in the numbers and distribution of coastal birds in Wellington Harbour. *Notornis 39*: 263-289.

Rooke, I.J. 1984. The silvereye (*Zosterops lateralis*: Aves: Zosteropidae): a review. *Journal of the Royal Society of Western Australia 66*: 163-169.

Scott, J.M.; Ramsey, F.L. 1981. Length of count period as a possible source of bias in estimating bird densities. *Studies in avian biology 6*: 409-413.

Sibson, R.B. 1966. p. 246 *In*: Falla, R.A.; Sibson, R.B.; Turbott, E.G. (*ed.*). *A field guide to the birds of New Zealand.* Auckland, Collins.

Sibson, R.B. 1989. Starlings quick to find a new source of food. *Notornis 36*: 182.

Snow, B.; Snow, D. 1988. *Birds and berries.* Calton, Staffordshire, T. & A.D. Poyser.

Stead, E.F. 1932. *The life histories of New Zealand birds.* London, Search Publishing.

Stidolph, R.H.D. 1974. Decrease of grey warbler. *Notornis 21*: 82.

Thomson, A.L. 1964. Migration. pp. 465-472 *In*: Landsborough Thomson, A. (*ed.*). *A new dictionary of birds.* London, Nelson.

Tily, I. 1947. Year's record of song of hedge sparrow. *Notornis 2*: 72.

Tomlinson, A.I. 1976. Climate. pp. 82-89 *In*: Wards, I. (*ed.*) *New Zealand atlas.* Wellington, New Zealand Government Printer.