WINTERING SILVEREYES AT BIRD TABLES IN THE DUNEDIN AREA

By JIRO KIKKAWA

For at least 15 years residents of Dunedin have been feeding birds, particularly House Sparrows *(Passer domesticus)*, Bellbirds *(Anthornis melanura)* and Silvereyes *(Zosterops lateralis)*. Silvereyes are especially numerous around the city during the winter months and extensive feeding by the public is thought to have considerable effect on the population of this species.

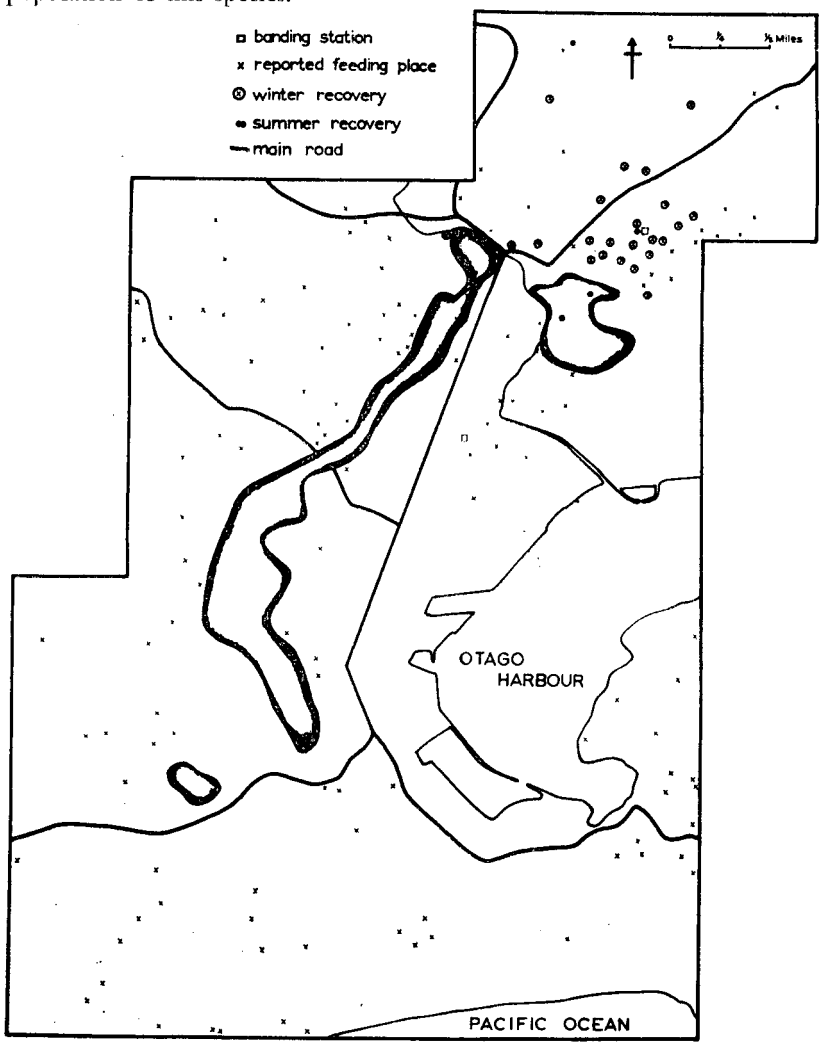
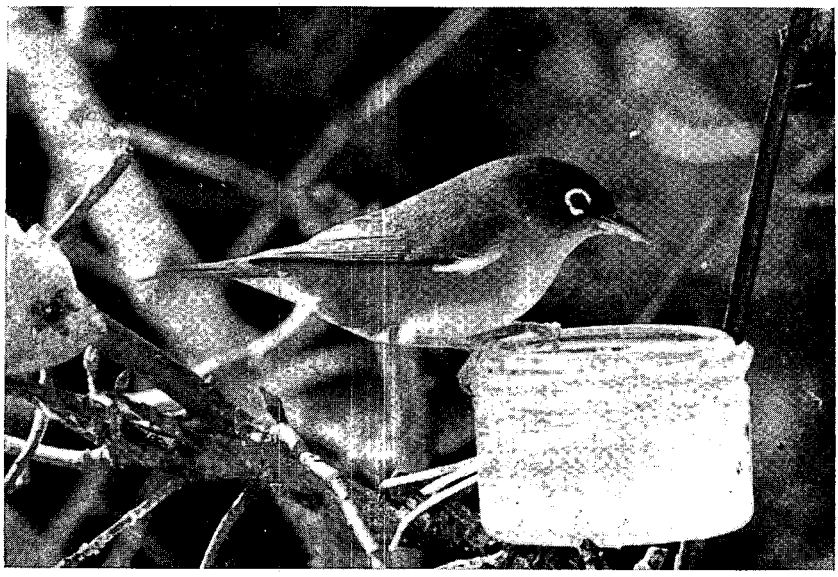
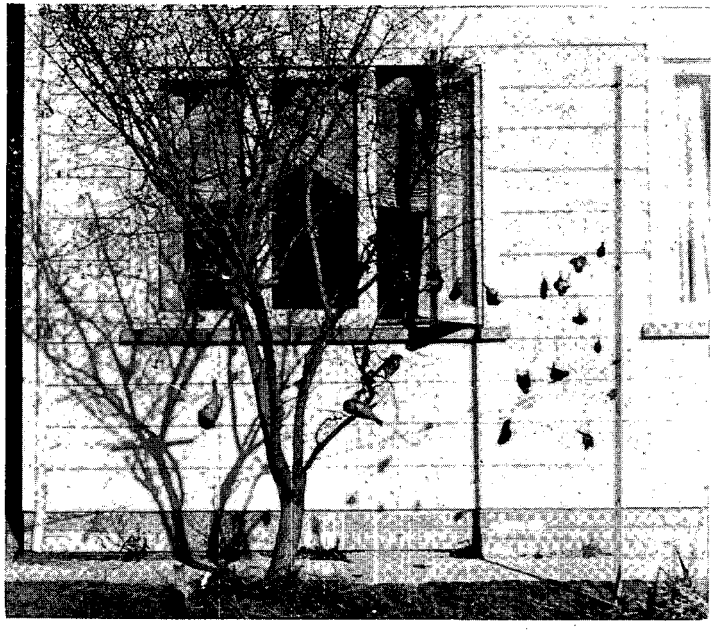


Figure 1 — A map of Dunedin showing the distribution of the reported feeding places in winter. Recoveries are shown for Silvereyes banded at one station only and include sight recoveries made by the author. The enclosed areas indicate the breeding ground of Silvereyes.



LII (a) — Silvereye **(Zosterops lateralis)** taking sugar-water at feeding-station in Dunedin.



(b) — Silvereyes caught for banding in the mist-net at their feeding-station.

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In order to obtain an estimate of the number of Silvereyes supported by the food put out by people a questionnaire was circulated in Dunedin (see Appendices). At the same time a study was made of movements and population change in winter by banding at two feeding stations. Between 1958 and 1960, a total of 881 Silvereyes were banded, mist-nets being used for trapping (Plate LII b) and combinations of colour bands (up to three per bird) for the identification of individuals by sight. Records of sight recoveries were kept at one feeding station and dead banded birds were collected with the co-operation of local people. The amount of food required by the bird was determined in an aviary study.

The present report incorporates the replies to the questionnaire and the banding study and provides a basis for the estimation of the size of the population utilising the artificial food supply. I am grateful to the Evening Star for printing the questionnaire and to Dunedin members of the Ornithological Society of New Zealand and of the general public who co-operated in this enquiry.

Size of the population at a feeding station. In the winter of 1960 mist-netting and detail observations made possible a fairly accurate estimation of the total number of Silvereyes visiting a feeding station at 54 Mechanic Street, N.E.V., Dunedin.

If the recapture of banded birds is random, the ratio of the number of new captures (C) to the number of recaptures (R) in one period should equal the ratio of the number of unbanded birds (U) to the number of sight recoveries (Σ G) in the same period. Thus,

$$U = \frac{C\Sigma G}{R} ,$$

and the estimate of the total number in this period can be expressed as

$$\hat{N} = \frac{\Sigma G(C+R)}{R} ,$$

since all recaptures are included in Σ G and all new captures are inculded in U. Applying the method of Bailey (1951) to this equation, a less biased estimate of the total number may be obtained:

$$\overset{v}{N} = \frac{\Sigma G(C+R+1)}{(R+1)} ,$$

with the standard error

$$\pm \overset{v}{N} \sqrt{\frac{C}{(C+R+1)(R+2)}} .$$

Table I shows, in half-monthly periods, the sight recoveries according to the time of first capture and provides a basis for estimating the number of Silvereyes during each half-month period. The effect of migration upon the estimate for any period could be eliminated by calculating the recapture rate from the number of sight recoveries made during that period, instead of using the recapture rate of the previously banded birds which would include the birds that had left the area.

Table 1 — The number of sight recoveries of banded Silvereyes according to the time of the first capture and half-monthly estimates of the number visiting a feeding station in Dunedin in 1960. Birds banded in 1959 were treated as unbanded until they were recaptured in 1960.

Time of first capture	Time of Recoveries									
	May I (0)	May II I	June (1) (2)	June II (3)	July I (4)	July II (5)	Aug. I (6)	Aug. II (7)	Sept. I (8)	Sept. II (9)
May I (0)		9	10	9	5	4	4	4	4	3
II (1)			8	8	8	3	4	3	1	0
June I (2)				14	9	7	6	4	5	5
II (3)					18	10	10	6	6	2
July I (4)						26	15	8	7	2
II (5)							31	15	9	6
Aug. I (6)								9	3	3
II (7)									9	4
Sept. I (8)										10
II (9)										
Total sight recoveries (ΣG)		9	18	31	40	50	70	49	44	35
Number of recaptures (R)		3	6	12	7	12	12	15	27	5
Number of first captures (C)	15	22	28	72	92	110	53	28	51	9
Number estimated ($\overset{V}{N}$)		58.5	90.0	202.8	500.0	473.1	355.4	134.8	124.1	87.5
Standard error		± 24.1	± 28.4	± 49.9	± 160.0	± 118.3	± 85.3	± 25.6	± 18.6	± 25.4

In fact, if we divide the banded birds present in any period into two groups, those previously banded ($\sum_{x=0}^{t-1} G_{x,t}$) and those banded in that period (C_t), as shown in Table 2 the recovery rate of the former was always greater than the recovery rate of the latter in the following period:

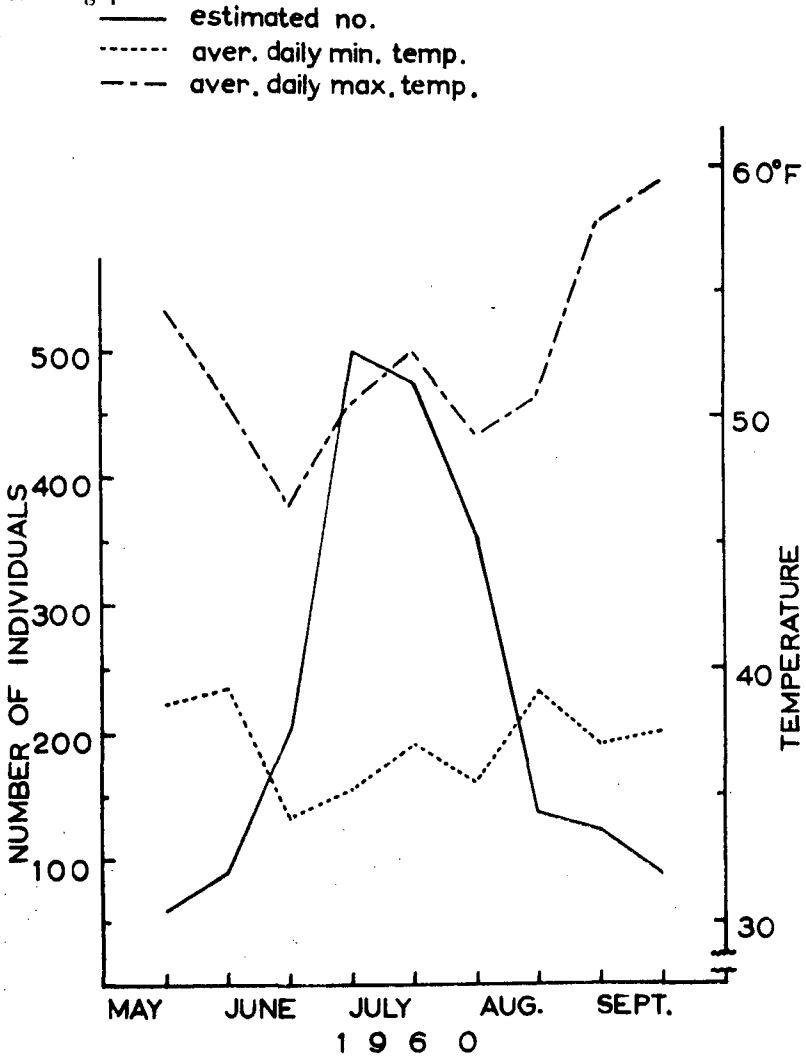

Figure 2 — Half-monthly changes of the Silvereye population and of maximum and minimum temperatures at a feeding-station in Dunedin in the winter of 1960. See Table 1 for the estimation of the numbers.

$$\frac{\sum_{x=0}^{t-1} G_{x,\,t-1}}{\sum_{x=0}^{t-1} G_{x,t}} > \frac{G_{t,\,t-1}}{C_t}$$

where $G_{x,t}$ indicating the number of birds sight-recovered in the period t which were banded in the period x ($x=O,1,2\ldots,$ t-1). In other words, in any period there were more transient elements among newly banded birds than among birds recovered during that period, and this would affect the population estimate if the recapture data only were used for the calculation. Also, in this way it was possible to estimate the number present during the last interval.

The recovery rate was greater in the early winter when the population size was small, indicating the early arrival of resident flocks. The population increase in mid-winter was brought about by the late arrivals and the increase in the number of transient birds which either had nomadic habits or expanded their range of activities. As shown in Figure 2 this increase in number was associated with low temperatures. On the other hand, in semi-natural habitat in Dunedin, higher population counts of Silvereyes were obtained in warm days in winter and flocking itself was not associated with the movement between natural habitat and feeding places (Kikkawa, 1961).

Table 2 — Percentages (A) of newly banded birds which were sight-recovered in the following period and percentages (B) of sight-recovered birds which were again recovered in the following period.

Period	0	1	2	3	4	5	6	7	8
A	60.0	36.3	50.0	25.0	29.2	28.2	17.0	32.1	19.6
B	–	100.0	94.4	76.0	60.0	76.0	57.1	69.2	49.0

Range of movements and total population size. Many of the birds banded at the feeding station in mid-winter disappeared soon after banding, but as indicated in the Map (Fig. 1) some of these birds regularly visited other feeding places and 18 were recovered dead, in winter, within 1,600 yards of the feeding station. These records, together with sight recoveries, indicated that the range of the 500 or so birds which visited the feeding station in mid-winter was approximately 450 acres. However, the range of individual birds was much less than this. Nomadic birds probably moved over 50-100 acres while resident birds were restricted to only a few acres. From the calculated range for 500 birds a minimum estimate of 7,500 Silvereyes was obtained for the area of 6,000 acres which was covered by 147 reported feeding places.

In summer, apart from a few resident birds which bred near the feeding station, very few banded birds were recovered. The only long distance movement was shown by a male which was taken in breeding

conditions at the Shag River (about 30 miles north of Dunedin). Other instances of long distance movement have been noted by Marples (1944), but as yet the pattern of seasonal movements is not clear. The breeding density of Silvereyes in the wooded part of Dunedin averaged 1.2 pairs per acre over the seasons 1958-61 (sample size, 20 acres). In the Dunedin City area the breeding habitat is limited to about 400 acres of the town belt, which suggests a total population of 960 birds or 480 pairs. If each pair rears 4 young on the average (2 successful nests with 2 fledglings per nest) there will be 2,880 birds at the end of the breeding season. Many birds probably die before mid-winter and yet this figure is smaller than the estimated minimum number (7,500) for the mid-winter population. This difference may be accounted for by partial migration. In autumn Silvereyes move in separate flocks and feed on berries and only late in May do they begin to show interest in food at the bird table. From the end of August, when Kowhai *(Sophora microphylla)* flowers, they gradually leave feeding tables while still flocking and at this time larger flocks are often seen in natural habitat.

Artificial food supply and food requirements. Of 147 replies received in the enquiry 137 were suitable for analysis of the amount of food provided for the birds. Estimates of the amount per week, for major food items, are given in Table 3 together with calorific values obtained from Hawk et al (1954). As bread is eaten also by House

Table 3 — Minimum amount of food put out by people each week in winter in Dunedin and the estimated amount consumed by Silvereyes.

Food item	*Total*	*Estimated amount consumed by Silvereyes*	*Food energy*
	lb.	g.	Cal.
Bread	169	25,400	68,580
Fruits	28.7	9,752	5.656
Sugar	78.9	26,853	103,384
Honey	29.8	9,978	29,336
Jam	16.2	5,443	15,132
Fat	2.2	907	8,019
Total	—	—	241,783

Sparrows, Blackbirds, etc., and as other food may be shared with Bellbirds and Tuis, the calculation of the quantity consumed by Silvereyes was made with the assumption that they obtained one-third of the available bread and three-quarters of fruit, sugar, honey, syrup and jam. Minimum estimates have been used throughout so that the value of 240,000 Calories contained in the artifical food eaten per week provides a minimum estimate for the energy content of the food available to Silvereyes. Moreover, other kinds of food such as porridge and meat

scraps were not included in the calculation and there were probably other feeding places which were not reported. The actual amount consumed per week at the feeding station in mid-winter, when the estimated number of Silvereyes reached 500, had the food energy of 1,632 Calories (sugar 272g, fruit 850g, bread 150g) and this value was near average when compared with the values for reported feeding places.

Ten birds kept in an aviary consumed the following quantities of food containing 995 Calories in a week in mid-winter: honey 65g, apples 450g, bananas 110g, bread 180g. If they require a similar amount of energy under natural conditions, the estimated minimum amount of available food put out by people can fully support 2,440 Silvereyes, which is about one-third of the estimated total winter population.

Although only approximate the above estimates show that, in the Dunedin area where in winter people provide food for birds, as much as one-third of the total food intake of Silvereyes derives from this artificial food supply, or two and a half thousand birds could fully depend on it. The winter mortality of Silvereyes seems to be high in Dunedin and it would be interesting to find out more about the effect of such artificial feeding on the population.

SUMMARY

Fairly accurate estimates were obtained for the number of Silvereyes visiting a feeding station in Dunedin and the amount of food energy required by these birds. From these estimates and the results of the enquiry sent to the public, it was found that in the part of Dunedin City (6,000 acres) where at least 147 people fed birds, more than 7,500 Silvereyes spent winter in 1960 and consumed at least 240,000 Calories of artificial food per week. This is as much as one-third of the total energy required by the estimated population. It is likely, therefore, that the natural population of Silvereyes is greatly influenced by artificial feeding.

REFERENCES

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APPENDIX I

The questionnaire circulated among the public in Dunedin in September, 1960.

(1) The address at which you have been feeding birds. (2) How long have you been feeding birds? Did you start more than five years ago? Or less? This year? If not this year, when? (3) What time of the year did you start feeding them this year — give month and early or late in the month. Or did you feed them all the year round? If not, when did you stop feeding them, month and time in the month? (4) Do you feed them on the ground, on a bird table, or both, or on a tree? (5) What kind of birds do you have at the feeding place?

Sparrow, Starling, White-eye (Wax-eye, Silvereye), Bellbird, Tui, Blackbird, Thrush, Finches. (6) Which species is the most common visitor? (7) How often do you feed them? Twice or more daily, once a day, three times a week, once a week or less? (8) What kind of food do you put out? Bread, fruit, honey water, sugar water, milk, fat, porridge, or anything else? (9) On an average, how much food do you feed a week? Bread, how many loaves approximately? fruit, number of pounds, or less? honey? sugar? and so on, even if it is only spoonfuls. (10) Have you seen any banded birds? If so, how many and what kind of bands were they? Did they have coloured bands, metal bands, or both? Which months did you see them this year? Were they seen last year, this year, or in both years.

APPENDIX II

Summary of the replies to the above questionnaire (other than those shown in Table 3). The number of replies was 147 (the number of feeding places from which the following statistics were obtained was 130).

Item	*Number of feeding places*	*Percentage*
Feeding all year	59	45.4
Feeding in winter only	71	54.6
Feeding on table or tree	86	66.2
Feeding on ground	72	55.4
Feeding on ground only	33	25.4
Feeding twice or more a day in winter	56	43.1
Feeding once a day in winter	47	36.2
Feeding less than once a day in winter	27	20.7
House Sparrow as regular visitor	125	96.2
Silvereye as regular visitor	127	97.7
Bellbird as regular visitor	53	40.8
Tui as regular visitor	11	8.5

For the bird feeders who feed Silvereyes in winter it is recommended that feeding on the ground should be avoided and food has to be fastened to a tree or a table at least 2 feet above the ground so that it does not scatter on the ground. Many Silvereyes are caught by cats in winter when they come to feed on the ground. It is also advisable to have more than one feeding place at each site in order to reduce the amount of fighting among the birds. Silvereyes provide a unique opportunity for the study of behaviour at the feeding place. They fight over food or perches while moving in flocks, and, when they rest, pairs perch close together and one bird often preens the other. The male always has a darker flank and in a pair the sexes can be distinguished by careful observation.