IDENTIFICATION OF FEEDING STATIONS OF FOREST BIRDS IN NEW ZEALAND

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INTRODUCTION

The food and feeding behaviour of most New Zealand forest birds, both native and introduced, are not adequately known. Apart from its intrinsic interest, this information is needed to understand factors controlling bird numbers. In the case of rare birds, knowledge of their food is essential when control of the habitat is planned in order to maintain or increase their numbers. Analyses of crop contents are usually not possible; analyses of droppings are difficult, and because of breakdown within the alimentary canal, many foods taken leave no trace. During spring the food given to nestlings can sometimes be observed, although this may differ from that of the adult. For most of the year it is usually difficult to see what food is taken, especially in tall forest.

Another approach to the study of feeding habits in forest birds is to record the birds' feeding methods and the precise position within the community where feeding is taking place, i.e. *the feeding station*. Numerous records together give a picture of the frequency with which each station and feeding method is used. An example of this approach applied to pine forest in New Zealand has been published by Gibb (1961). Subsequent sampling at feeding stations can establish what particular foods are available, though not necessarily which are being eaten.

The method described here was developed particularly for studying Saddlebacks on Hen Island. However, the study by Merton and my own obseravtions show that the method can sometimes be useful for other birds in New Zealand forests. The main requirement is a systematic procedure for distinguishing feeding stations quickly and recording the position of each station within the forest. Feeding methods and errors that can be avoided are also discussed.

FEEDING LEVELS

Some species feed consistently more at one height than another. For example Hartley (1935), in his study of English titmice, found that each species had a characteristic height distribution of foraging activities with preferences for certain species of trees and parts of trees. The height distribution of some species varied seasonally.

The height at which a single bird is feeding can be estimated. If a bird is moving continuously or if a flock is encountered, it is easier to record the range of heights or vegetation storey in which feeding is taking place. The following scheme is suggested (Fig. 1):—

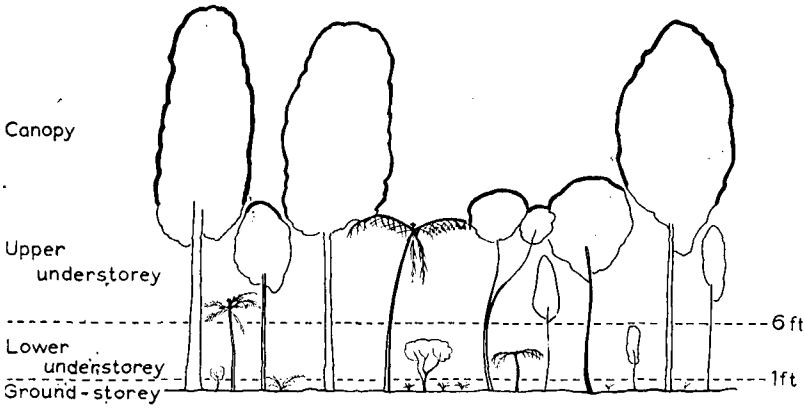

Fig. 1 — Division of forest storeys for recording positions of feeding stations. Note that in this diagram tree ferns are present in the canopy, upper and lower understorey.

1. *Canopy*. The uppermost storey of tree crowns, unshaded by other crowns.
2. *Upper understorey*. A storey of plant crowns (<6 ft.) shaded by the canopy.
3. *Lower understorey*. A storey of shrubs, tree ferns, etc., from 1 - 6 ft. in height, shaded by the canopy.
4. *Ground-storey*. The lowermost storey consisting of plants with growing points situated less than 1 ft. above the ground, together with the litter.

The 6 ft. level separating upper and lower understoreys in the above scheme is an arbitrary height chosen because it is the approximate upper limit of browsing reached by animals such as deer and goats.

It is important to make a clear distinction between *canopy*, which refers to the uppermost storey of vegetation, and *crown*, which refers to the upper part of any plant delineated by the periphery of its foliage. It should be noted also that a bird catching insects in the air at, for example, a height of 5 ft., is feeding in the lower understorey.

FEEDING STATIONS

Notes should be made of the type of forest with the height range of its canopy, e.g. rimu-rata/tawa forest (70-90ft.). Where necessary the kind of place can also be recorded, e.g. streambank, canopy gap caused by fallen tree. For some birds the time of day when feeding occurs may be important, because they change their feeding stations during the course of the day.

The main categories of feeding stations available to forest birds are listed in Table 1 and illustrated in Fig. 2. For study of some birds these categories may need to be subdivided or new ones added. With the exception of ground stations, the cateogries listed may be recorded within any of the vegetation storeys outlined above.

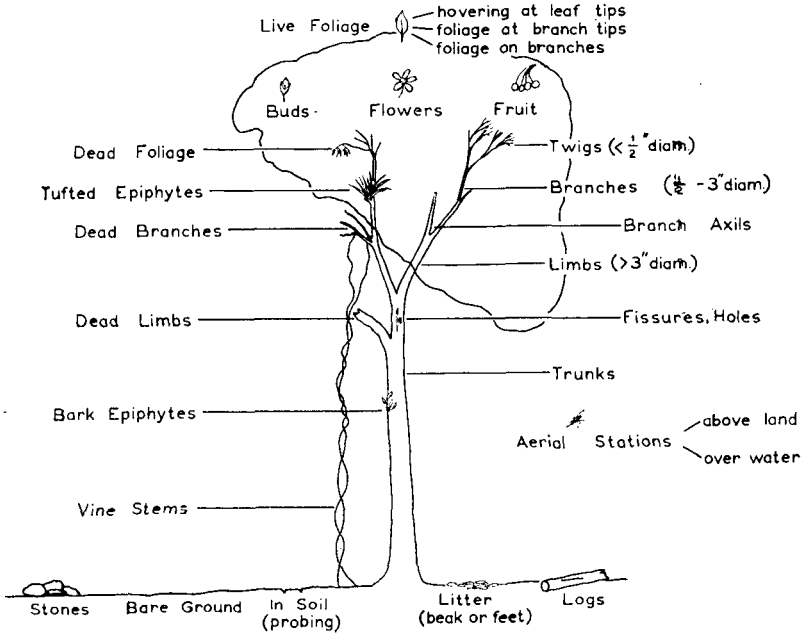

Fig. 2 — Feeding Stations

TABLE 1 — Feeding Stations for Birds in Forest

Aerial stations:	over land
	over water
Live foliage:	hovering at leaf tips
	foliage at branch tips
	foliage on branches
Dead foliage	
Buds	
Flowers	
Fruit	
Twigs (<½ in. diam.)	
Branches (½ - 3 in. diam.)	
Limbs (<3 in. diam.)	
Trunks	
Dead twigs and branches	
Dead limbs and trunks	
Branch axils	
Fissures and holes	
Tufted epiphytes	
Bark epiphytes	
Stems of vines and climbers	
Stones	
Bare ground: on surface	
In soil: probing	
Litter: beak or feet	
Logs	

Tufted epiphytes include astelias, collospermums and some of the larger ferns such as *Asplenium falcatum*. Typical bark epiphytes are filmy ferns (*Hymenophyllum* spp.). The size ranges of twigs, branches, etc., follow those used by Gibb (1954) in a paper on the feeding ecology of English tits that covers several aspects of feeding behaviour not dealt with here.

The growth form of the plant in which feeding is taking place is recorded, e.g. tree, shrub, sapling, tree fern, palm, climber. Whenever possible the plant species is identified; this information can tell much about food sources and other features of the bird's habitat.

In identifying the feeding station it is sometimes difficult to distinguish living from dead branches and limbs, especially when a bird is changing its station frequently. Nevertheless, stations should be identified as specifically as possible.

Ideally the observer would like to record the proportion of time a bird spends searching for food at each station but usually only isolated observations are possible. When a bird is watched for a period of time the feeding station can be recorded at regular intervals of $\frac{1}{2}$ or 1 minute. By staggering the recording times, the feeding of two or three birds can sometimes be followed simultaneously. With a flock, only a generalised statement of the feeding stations may be possible.

On occasions the food taken will be seen. The importance of trying to see exactly what food is taken rather than surmising cannot be too strongly emphasised. For example a White-eye visits a flower cluster and plunges its head into the centre of a flower. It may be drinking nectar or it may be searching for insects but even with binoculars it is difficult to be certain.

Some feeding stations are used as sources of water. For example, Mr. J. L. Kendrick (pers. comm.) saw a Bush Pigeon drinking from the leaf bases of epiphytic collospermums, even though a stream was flowing close by. Hollows in the forks of trees and rain drops on leaves are also used as sources of water by birds.

FEEDING METHODS

Careful notes should be taken of the exact method of feeding as different species are adapted to take different foods from the same feeding station. Gibb (1961) in his pine forest study, found Whiteheads, White-eyes and Grey Warblers all taking food from live pine needles. His analysis showed that Whiteheads fed mostly on stouter parts of the trees, whereas White-eyes fed generally farther out towards the tips of the foliage. Grey Warblers specialised in taking food from the tips of the foliage by hovering, and seldom fed on the stouter branches.

Pied Tits and Robins both take food from the ground, but whereas the Pied Tit watches the ground surface for any moving insects from a convenient perch, the Robin works on the ground amongst the litter. Other species probe into the litter with the bill.

SOURCES OF ERROR

Although I do not wish to convey the impression that observing feeding stations of birds has insuperable difficulties, there are sources of error that can be minimised. An observer on the ground is in a poor position to see what is going on in the canopy of a tall forest. His observations of the feeding activity of any particular bird are likely to be biassed towards stations at the lower levels where visibility is better.

This error can be reduced by choosing observation points on sloping ground that allow a view into the canopy, or by climbing trees. Such error can possibly not be eliminated but it must always be remembered in interpreting the feeding pattern of a species. A second source of error occurs when a bird feeding at a lower level is frightened by the approaching observer to a higher level where it may be recorded as feeding. Patience and intimate knowledge of the bird's habits will enable this error to be reduced to a minimum.

Little is known concerning the extent to which a bird may change its feeding stations during the course of a day. This possibility should be kept in mind when making comparisons of the feeding stations of different birds. Again, the seasonal variation in pattern of feeding behaviour should be known, before comparing feeding stations of different species at different times of the year.

DISCUSSION

The methods of observation discussed in this paper can be applied to both native and exotic forests. It is not possible to make any rules concerning the number of observations necessary. All records can be valuable. However, when two species are apparently using the same source of food, hundreds of observations may be needed to establish whether this is in fact the case. It is clear that teams of observers all recording their observations in a systematic manner can make more rapid progress than single individuals (see team studies published by Atkinson 1964 and Merton 1966). It is strongly recommended that each individual develop his own shorthand to increase the number of records he can make.

Example: 10/1/63 Ohakune mountain road, 3000'. Red beech-silver beech forest (80 - 120').

0900 Sun Kaka C 70/90 nf d. limb, hang, tear, bark, beak.

At 9 a.m. in sunny weather, a kaka seen in the canopy, 70 ft. up a 90 ft. high red beech *(Nothofagus fusca)* on a dead limb, hanging upside down and tearing at the bark with its beak.

Opportunities for both individuals and teams to make significant contributions to our understanding of forest birds in New Zealand are numerous. Two interesting questions concern the proportion of day that a particular species spends in feeding and the reasons for seasonal changes in feeding behaviour. A closely related question concerns competition for food between species. To what extent does the food taken by the introduced Blackbird and Chaffinch, both widely distributed through New Zealand forests, overlap with that of native birds? To what exent does the introduced bush rat *(Rattus rattus)* compete with Bush-pigeons for food? Do the foods of Pigeon and Kokako overlap and how are these birds affected by opossums eating young shoots or fruit?

As detailed knowledge of the feeding habits of forest birds increases it will be possible to plan surveys of the invertebrate and plant foods that are available in a forest. Study of the factors regulating the quantity of these foods will pose many problems. The regulation by man of this food supply, together with other factors of the habitat in order to maintain or increase the numbers of birds in a particular area of vegetation is an objective that even though distant, can be kept constantly in view.

SUMMARY

The points discussed are summarised below as a check-list of observations for recording the feeding habits of forest birds.

Check-list of observations for feeding habits

1. Date
2. Locality and altitude
3. Time of day and weather
4. Bird species
5. Type of forest and height range of canopy
6. Kind of place (where necessary)
7. Feeding level: height (when possible) and forest storey in which feeding occurs (see Fig. 1)
8. Feeding station: type of station (see Fig. 2)
   plant species and growth form
9. Method of feeding
10. Notes on possible sources of error

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SHORT NOTE

A BREEDING COLONY OF GREY-FACED PETRELS IN TARANAKI

On 27/6/65, a party of Tarankai members was led by Mr. Gordon Johns of Pukearuhe to two areas about 30 miles north of New Plymouth where he had found "black" petrels in burrows.

The larger of these areas contained 28 burrows, several of which were occupied. From one, in which there was a pair of birds, one bird was extracted, photographed, and identified as *Pterodroma macroptera*. The nesting area is situated on the sloping top of a sandstone cliff about 50 ft. above the sea. The vegetative cover is mainly Taupata and Flax, with bare sand in the nest area. Elsewhere there is much bracken, marram and lupin cover. As there are many miles of similar broken coastline north of New Plymouth, it is probable that there will be further nesting sites.

On a subsequent visit by R. and M. Bysouth on the night of 28th August, one bird landed from at sea at dusk, and a cold egg was taken from a burrow.

— M. G. MACDONALD
D. G. MEDWAY