A BRIEF RADIO-TELEMETRY STUDY ON MOREPORKS

By CHRISTOPH IMBODEN

Ecology Division, D.S.I.R., Lower Hutt

ABSTRACT

Two pairs of Moreporks *(Ninox novaeseelandiae)* in dense rata-podocarp and open beech forest were radio-tracked between August and October 1973. The home range of both pairs (minimum size 3.5 and 5.3 ha, respectively) included each forest type, and both pairs used several roost trees. During seven years of regular mist-netting 20 different owls passed through the two territories. Some of them, possibly juveniles, were caught only once and others up to 15 times. In each territory one bird was present for more than five years.

INTRODUCTION

For several years Ecology Division of DSIR has been studying the relationship between mammalian predators (stoats and cats) and prey species (mice, rats, rabbits, and birds) in the Orongorongo Valley near Wellington. (For a description of the area see Ward 1972.) Until now the Morepork *(Ninox novaeseelandiae)*, the main bird of prey in New Zealand rata-podocarp and beech forests, has not been included, and there is generally little known of the biology of this native owl in New Zealand.

To find out more about the role and the importance of Moreporks in this type of forest research began in July 1973, using the technique of radio-telemetry that had previously been used on opossums *(Trichosurus vulpecula)* in the same area (Ward 1972). The aims of the study were (1) to locate Morepork roosting sites and there to collect food pellets, (2) to locate nests to study the development of the young and identify the food brought to them, and (3) to determine the birds' home ranges and activity patterns. A useful background to the study was some information on the owl's distribution in the valley and the longevity and the home range of a few individuals obtained during seven years of mist-netting by A. H. Whitaker.

The study was discontinued after three months before achieving objectives (1) and (2) because of increasing difficulty in recapturing the birds for renewing the rather short lived transmitter battery. Some of the technical experience gained and the results obtained may be of interest and helpful for future similar projects and are therefore reported on briefly.

NOTORNIS 22: 221-230 (1975)

METHODS

Transmitter

The transmitters (built by G. D. Ward, Ecology Division, DSIR) produced a continuous signal of 27 MHz. To a certain extent, the birds' movements modulated the signal, permitting the listener to distinguish some activities through the receiver (e.g. flying caused a characteristic note oscillation). The current drain of the transmitter was 0.4 mA, giving the mercury cell (Eveready E 625) a theoretical life of 35 days.

The transmitter circuit was potted in dental acrylic in a rectangular box 15x15x7 mm (Fig. 1). The loop aerial (circumference 17 cm) protruded from one end and consisted of an insulated single (later multi-stranded) copper wire slid into a plastic transfusion tube. At the opposite end were two leads on to which the cell was soldered when the transmitter was put on a bird. The cell was sealed with liquid tape. The total weight of the transmitter was 9-9.5 g (ca. 6% of the bird's body weight), half of which was battery weight.

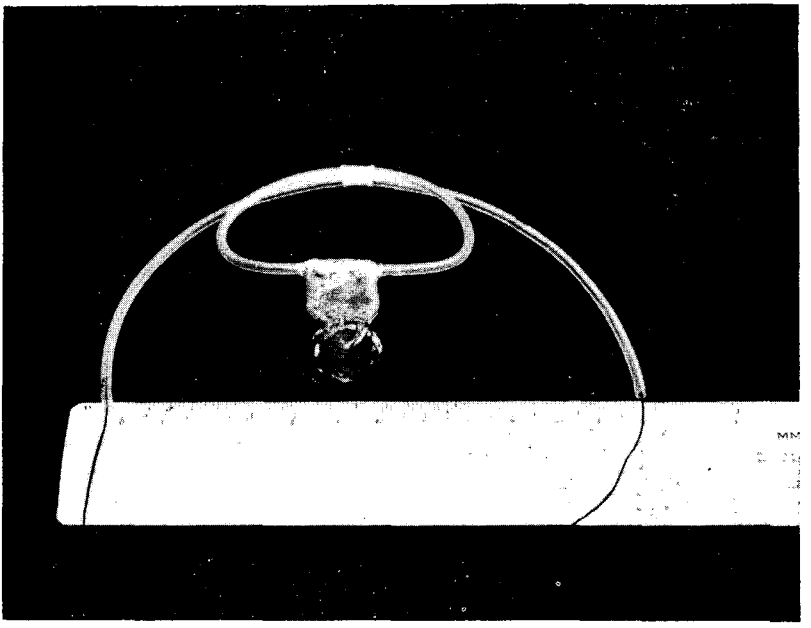

FIGURE 1 — Morepork radio transmitter with mercury cell and two harnesses.

The transmitter was placed on the upper part of the back of the bird with the loop aerial around its breast. A second plastic harness containing a waxed thread was joined to the loop aerial on its

outermost point and the two ends taken underneath the wings to the back end of the transmitter where the thread was tied to a small hook. The transmitter was completely hidden in the feathers (Fig. 2).

FIGURE 2 — Morepork carrying a radio transmitter.

Before a transmitter was attached to a wild bird, trials were made with two Moreporks in Wellington Zoo. For six weeks they carried transmitters and were fed live mice to see if their hunting ability was restricted. The birds were not adversely affected.

Whether the four Moreporks that were radio-tracked were in any way hindered by the transmitters is difficult to decide. The birds often pulled strongly at the loop around the breast, distorting the aerial and attenuating the signal, and one bird lost its transmitter after 8 days by chewing through the insulating tape holding the plastic harnesses together. The insulating tape was then replaced

by a metal ring. One bird broke a single strand copper wire loop aerial inside its plastic tube by chewing on it, which caused the transmitter to stop working. None of the three birds recaptured after 2-3 weeks showed any decrease in weight or any obvious wear of feathers. However, in December 1973 a transmitter was found in a pile of Morepork feathers. The bird (probably eaten by a cat or stoat) had been carrying a transmitter for two months and may have been in a weakened condition.

Trapping

All the birds were caught in mist nets, using different sites and attractants.

(1) Seven standard mist net rigs (Whitaker 1972) were put up at dusk. The pocket size of the mist nets was enlarged as Moreporks can escape from a small pocket of a small-mesh mist net. To reduce the chance of a bird escaping the nets were checked every 30-45 minutes. Tape recordings were tried but the birds did not respond.

(2) When a roosting bird was found, a mist net was set up before dusk in front of it and a live white mouse tethered behind the net as bait. In all instances the bird flew at the mouse in less than 10 minutes. This technique looked promising, but few roosting sites were suitable for its use and the birds avoided the net after being caught once or twice.

(3) In spring when puriri moths *(Aenatus virescens)* are abundant, Moreporks often hunt for moths attracted by the lights of the field station. Several times in September and October mist nets were set up near the lights and live mice used as additional bait. During the first trial two were caught in an hour, but subsequently the birds appeared less frequently in the yard and avoided the nets which were rather conspicuous in the bright light.

None of these catching techniques proved satisfactory and their efficiency soon decreased as the birds learned the procedure.

Tracking

The birds were mainly followed with a hand-held directional loop aerial, although some information on the bird's movements, and sometimes its approximate location, was obtained through a big stationary aerial in the field station yard.

The range of the signal varied considerably according to the bird's position. Maximum distances with the portable aerial were approx. 120 m, the mean range being only 50-60 m. Reception and range were better in beech forest where the undergrowth was thinner and the foliage generally less dense than elsewhere. During the day, if no signal could be heard through the main aerial the bird's roosting place was tracked by walking along a few transect lines.

No satisfactory way of systematically tracking the birds at night could be established. They were too mobile to be followed continuously on foot as parts of the terrain were too rough for rapid traversing. On the other hand, hourly location points (as was done with opossums) were not very meaningful for a bird which sometimes crossed its home range several times in an hour. The birds appeared disturbed when followed too closely and may have changed to other parts of their home range more often than they would normally have done.

RESULTS

Status of the Morepork in the Orongorongo Valley

Of the predators in the Orongorongo Valley the Morepork is the most abundant species. In winter and spring 1973, besides the two pairs living on the central study area, up to nine different Moreporks could be heard along 4 km of drive-way below the field station. Additional birds were calling from the other side of the valley where they seemed to be as abundant.

Mist-netting data

The general mist-netting programme begun in late 1967 indicated that during these years never more than two pairs lived in the central study area (ca. 16 ha) sharing the area in a way similar to that shown in Fig. 3. Up to September 1974 20 different owls had been caught, 11 of which were subsequently recaptured up to 15 times. Two birds, H6 and H9 (both banded as adults), were continuously present for more than five years. H6 was banded in November 1968 in territory A and was, with one exception in April 1970, always retrapped in that territory. During this period it had at least three different partners: H51 (until July 1969), H8 (first caught in May 1969, last caught in May 1971) and H17 (first caught in January 1972, last in October 1973). After H8 disappeared and before the appearance of H17 another bird was trapped twice (November 1971, January 1972) in territory A. The resident H6 died between October and December 1973 and was immediately replaced by the new bird H19 (first caught in December 1973 and controlled 7 months later). Another new bird (H20) was found in territory A in April and June 1974, presumably replacing H17.

The second of these long term resident birds (H9) was banded in October 1969 and has been living in territory B ever since. Its predecessor was probably H2 (caught three times between December 1967 and August 1969). The history of successive mates to the resident of territory B is not as clear as for territory A. Between December 1967 and October 1970, 5 different Moreporks were caught once in territory B and not recaptured at all. They may have been partners or off-spring. From November 1971 on, however, the partner of H9 was retrapped several times (H16).

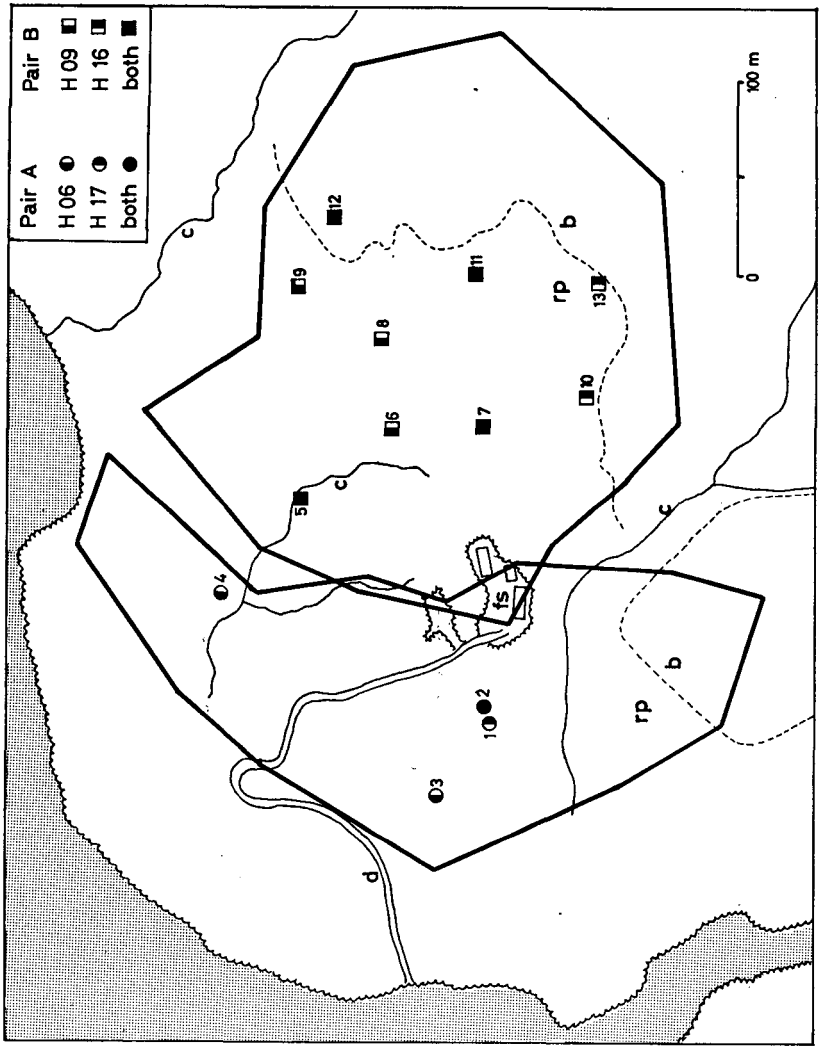

FIGURE 3 — Roosting places and home range boundaries of the two Morepork pairs as found during six weeks of radiotracking. The minimum size of the area of pair A was 3.5 and of pair B 5.4 ha. The dashed line shows the approximate boundary between rata-podocarp and beech forest. Hatched area: shingle bed of Orongorongo river. b: beech forest (uphill); c: creek; d: driveway; fs: field station; rp: rata-podocarp forest.

Home range of radio-tracked birds

During the tracking period from the end of August to the beginning of October 1973 territory A was occupied by H6 and H17 and territory B by H16 and H9. At least once, for various numbers of days, all these birds carried a transmitter.

Fig. 3 shows for each pair the boundaries of their home range as observed during these six weeks. Earlier sight or recapture data are not included. The data of pair A are based on 11½ bird-tracking-nights (ca 3.5 ha), those of pair B on 15 nights (ca 5.3 ha) which may be the reason for the larger revealed range of pair B. To determine the real size of the territories a much longer period of radio-tracking would be required. The southern boundaries are least accurate, and the birds are believed to go higher up into the beech forest.

Around the field station the territories overlap. The lights of the station attract moths and therefore the birds from either side. One evening all four were seen around the station, but pair A was perching east and pair B west of the houses. Except for counter calling no direct interactions between the two pairs were ever observed.

The home ranges of both pairs included an area of beech forest, which may be of considerable importance to the birds if hunting is easier when there is less undergrowth. I estimate that the birds spent about 35-40% of their time in beech forest although it represented a far smaller fraction of their home ranges (Fig. 3). Tawny owls, *Strix aluco,* in England are much more efficient hunters in open than in dense forest and therefore require smaller territories than in forest with dense undergrowth (Southern & Lowe 1968).

Day roosts

For pair A four, and for pair B nine, different roosts were found (Fig. 3). The birds of pair A were never seen roosting together, although they both used the same tree (no. 2) on different days. Pair B, however, roosted close together on three days in the same trees (nos. 5, 11, 12). Four days in a row was the longest period that a bird used the same tree (H17 in tree no. 1). The birds returned frequently to some roosting places (e.g. tree no. 2 for pair A and no. 4 for pair B), but used others only once or twice. By contrast Cunningham (1948) reported a Morepork that roosted in a cabbage tree (*Cordyline* sp.) for almost three months in autumn with only occasional changes to another site.

The roosts were in the following tree species:

Pukatea	*Laurelia novae-zelandiae* (tree nos. 2, 5, 6, 7)
Rata	*Metrosideros robusta* (nos. 8, 11, 13)
Rewarewa	*Knightia excelsa* (no. 1)
Mahoe	*Melicytus ramiflorus* (nos. 3, 9, 10)
Pigeonwood	*Hedycarya arborea* (no. 4)
Tree Fern	*Cyathea sp.* (no. 12)

The trees varied in size from ca. 10 cm diameter to over 300 cm, the biggest being nos. 6 and 11. The trunks of most were thickly covered with epiphytes such as *Astelia solandri* and *Collospermum hastatum,* so that the bird was often invisible from the ground. Three sites, however, were surprisingly open (e.g. site in tree fern) with the bird clearly visible from all sides but not from above. Overhead cover seems to be the most important feature of a roosting place. The height of the perches varied from 3.5 to 8 m; in one tree it was probably as high as 15 m. If the birds were not disturbed they did not change their roosting place during the day. One bird between checks in the morning and afternoon, however, changed to the other side of the same tree.

Food

Several authors have shown that the food of the Morepork consists mostly of insects, with a few small birds, mice and young rats (Cunningham 1948, Moon 1957, Hogg & Skegg 1961, Lindsay & Ordish 1964). Thus, it is not surprising that in a habitat like the Orongorongo Valley the systematic collecting of pellets proved very difficult: remains of insects produce loose and inconspicuous pellets that easily break on falling to the ground, and many would get caught in the dense epiphytes present at most roosts in the study area. Although the ground was always searched carefully below the roost only a few fragments of pellets were found. These contained only insect material (which was not further analysed). Separately, one big hind leg of a tree weta *(Hemideina thoracica),* one bird bone (humerus ?, species ?) and one colour bird band of a small passerine were collected. Earlier, on the same study area, Daniel (1972) had found a few Morepork pellets that contained insect material exclusively (green chafers, huhu beetles, cicadas). On one occasion he watched a Morepork hunting a juvenile rat just released from a live-trap.

Wetas (Order: Orthoptera) which can reach 5-7 g may be the most important and most constant food item for this forest dwelling owl (as it has been shown for the diet of the ship rat *(Rattus rattus)* by Daniel 1973) and their role might be that of voles for European owls (e.g. Southern & Lowe 1968, Southern 1969, 1970). This finds some confirmation in an analysis of 25 Morepork stomach contents by Lindsay & Ordish (1964) in which wetas were by far the most abundant single prey item. Other prey species which reach a seasonal abundance may temporarily become the prevailing food (e.g. puriri moth in spring, cicadas in summer, and mice during a population peak).

Activity

Moreporks left the roost in the evening between 1730 and 1800 hours, the time being closer to 1800 hours in October with increased daylength. When both birds roosted together they usually left the roost together or within half a minute.

The birds became restless about 30 minutes before departure, spread their wings, sometimes made subdued grunting calls and pulled

at their transmitter collars. Normally they first flew only a few metres to another perch, where they stayed a few minutes before flying another short distance. Several times a bird could be followed for half an hour, always moving only 10-20 m at a time. During these short inconspicuous movements there was still much daylight. Before dusk, hunting for small birds that are then still active may be easier, and the short movements may protect the owl from being detected by its prey species. Mr A. H. Whitaker (pers. comm.) occasionally saw Moreporks attacking birds in the mist nets at this time of the day. When dusk was well advanced the birds started flying longer distances and the birds of both pairs then very often flew to the beech forest areas. At night they could change rapidly from one area to another.

During three nights both birds of pair B carried a working transmitter. The birds spent not more than 50% of the time together. One night, at 2015 hours (1 September), a mating episode lasting over 10 minutes was heard. At first the birds appeared to be on neighbouring trees. While calling softly they moved toward each other and then began a duet of cooing and grunting calls. This obviously ended in copulation judging by the fluttering of the wings.

The time at which the birds returned to their roosts in the morning was more difficult to determine for they were then more easily disturbed by somebody following. On 31 August H17 reached its roost at 0632 hours. (At 0610 hours one could walk without a torch through the bush and the first Blackbirds were calling at 0625 hours.) On three other dates birds reached their roosts at about the same time (0615-0630 hours), but on 12 October H6 was already in its roost at 0540 hours.

In the first week of October, shortly before the breeding season, Moreporks were heard calling several times in late afternoon outside the study area. On 8 October, a warm cloudless day, the first Morepork call was heard at 1500 hours and was soon followed by others from both sides of the valley; the high calling activity continued for the whole afternoon and throughout the night.

CONCLUSIONS

Radio-telemetry appears to be an adequate technique for obtaining, directly or indirectly, information on the biology of an owl and probably also of many other nocturnal birds (e.g. Kiwi). The available equipment is reliable and adaptable to even small species. The main limitation to overcome with birds the size of Moreporks is the need to recapture them to replace the power cell. These intervals, of course, could be lengthened by using smaller but more expensive transmitter components, thus allowing more weight for the battery, or by a more sensitive receiver, requiring less power output.

The obvious application for this technique is to find out the birds' home range, habitat use and activity pattern and how these

change throughout the year. Another application may be less obvious but more important as it reveals information that could not as easily be obtained in any other way: to locate roosts and nest sites to study the birds' diet (pellet analysis or direct observation) and breeding biology.

ACKNOWLEDGEMENTS

I am very specially grateful to G. D. Ward for his constant help and advice throughout the study. Furthermore, I would like to thank A. H. Whitaker for providing unpublished results of his mist netting programme for this article, the Wellington Zoo for letting me test the equipment on their birds and Drs M. R. Rudge, B. M. Fitzgerald and J. E. C. Flux for giving valuable comments on this manuscript.

LITERATURE CITED

CUNNINGHAM, J. M. 1948. Food of a morepork. N.Z. Bird Notes 3: 22-24.
DANIEL, M. J. 1972. Bionomics of the ship rat (**Rattus r. rattus**) in a New Zealand indigenous forest. N.Z. Jl. Sci. 15: 313-341.
DANIEL, M. J. 1973. Seasonal diet of the ship rat (**Rattus r. rattus**) in lowland forest in New Zealand. Proc. N.Z. Ecol. Soc. 20: 21-30.
HOGG, M. J.; SKEGG, P. D. G. 1961. Moreporks in a nesting box. Notornis 9: 133-134.
LINDSAY, C. J.; ORDISH, R. G. 1964. The food of the morepork. Notornis 11: 154-158.
MOON, G. J. H. 1957. Focus on New Zealand birds. 132pp. Cameo Press, Warkworth.
SOUTHERN, H. N. 1969. Prey taken by Tawny owls during the breeding season. Ibis 111: 293-299.
SOUTHERN, H. N. 1970. The natural control of a population of Tawny owls (**Strix aluco**). J. Zool., Lond. 162: 197-285.
SOUTHERN, H. N.; LOWE, V. P. W. 1968. The pattern of distribution of prey and predation in Tawny Owl territories. J. Anim. Ecol. 37: 75-97.
WARD, G. D. 1972. Techniques for tracking opossums (**Trichosurus vulpecula**) by radio telemetry in New Zealand lowland forest. N.Z. Jl. Sci. 15: 628-636.
WHITAKER, A. H. 1972. An improved mist net rig for use in forests. Bird-Banding 43: 1-8.

Dr Christoph Imboden,
Schweizerische Bund fur Naturschutz,
Secretariat, CH-4052 Basle,
Wartenberg Strasse 22, Switzerland

MORE ABOUT OYSTERCATCHERS

Another contribution to the biology of the New Zealand Oystercatchers has appeared recently:

> BAKER, A. J. 1975. Morphological variation, hybridization and systematics of New Zealand oystercatchers (Charadriiformes: Haematopodidae). *Journal of Zoology, London* 175: 357-390, text-figs 1-5. Abstract: "Variation in eight morphological variables was analysed for the three New Zealand species of oystercatchers, *Haematopus ostralegus finschi,* Martens, *H. unicolor,* and *H. chathamensis,* Hartert. Within species, significant size variation was detected among age classes and between the sexes separately in ensuing taxonomic comparisons. Analysis of morphological variation in hybridizing forms of *H. unicolor* suggests that gene exchange between the parental black and pied phases is extensive. Univariate and multivariate statistical analyses isolated three phenetic entities, consistent with three species as proposed in recent classification."