ASPECTS OF THE BIOLOGY OF THE FERRET, *MUSTELA PUTORIUS* FORMA FURO L.* AT PUKEPUKE LAGOON

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INTRODUCTION

Studies of waterfowl productivity at the Pukepuke Lagoon Wildlife Management Reserve have shown high mortality amongst young ducklings. This has been found in other studies in which it has often been attributed to predation. (Evans and Wolfe 1967, Balser *et al.* 1968, Urban 1970, Schranck 1972).

Since the Pukepuke waterfowl study began in 1968 the three mustelids introduced to New Zealand—ferret, *Mustela putorius,* stoat, *M. erminea,* and weasel, *M. nivalis*—have all been recorded there. A study of the ecology of these species was started in 1970 with the aim of obtaining basic data on populations, home range and food habits so that the effect mustelids have as predators on waterfowl could be assessed.

Live-trapping commenced in November 1970 but insufficient numbers of stoats or weasels have been caught and little data have been gathered on their ecology. Ferrets are readily trapped and data obtained from 178 captures of 32 marked animals is presented here.

THE STUDY AREA

The study area (Fig. 1) consists of 11km² of pasture-land and dunes surrounding Pukepuke Lagoon. The most intensive trapping was carried out within the boundary of the 121 ha reserve where swamp vegetation predominates. Areas of pasture, cut-over pine forest, and dunes outside the reserve were also included in the trapping area.

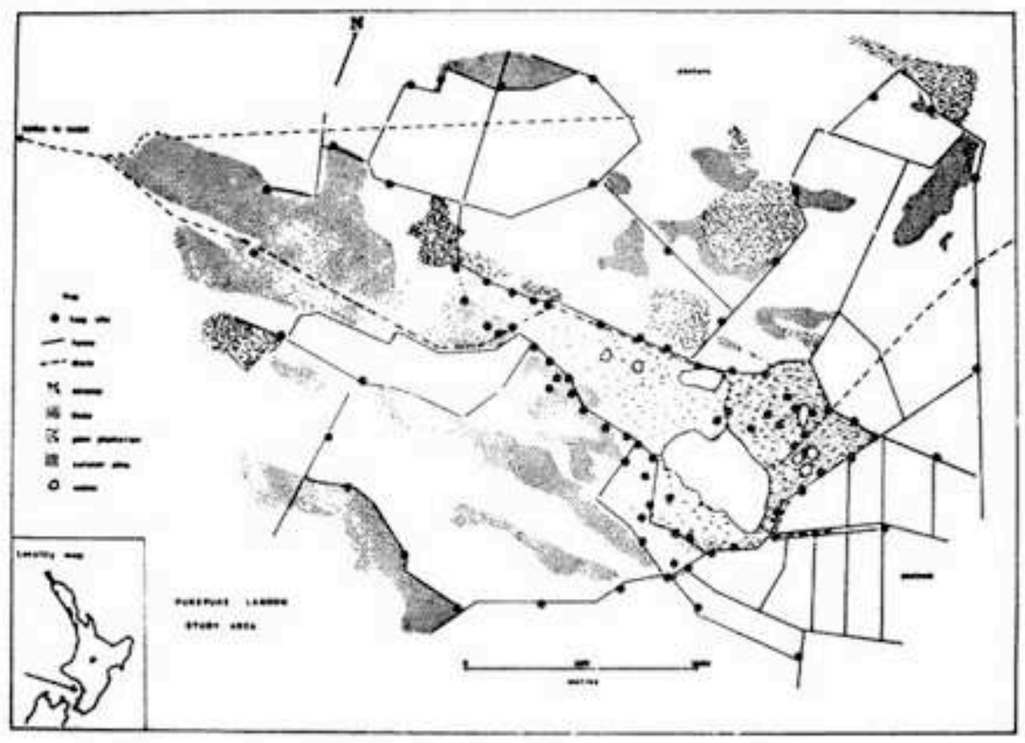

FIGURE 1. *Pukepuke Lagoon study area.*

METHODS

Live-trap boxes were placed at approximately 200m intervals on the "inner" trap line within the Reserve boundary and at approximately 400m intervals on the "outer" trap line in farmland surrounding the Reserve (Fig. 1). Between November 1970 and July 1972 an average of 50 traps on the "inner" trap line were set on four to five successive nights every month. During the first 13 months traps were not baited, but from February 1972 rabbit gut and dead white mice were used as bait. Boxes on the "outer" trap line were operated only in April, May, June, and July 1972.

Trapped animals were ear-tagged, and a record was kept of coat, body and breeding condition, weight and ectoparasites, and the age of each animal was estimated.

Faeces were collected for later analysis as part of a food habit study.

*Although the origin and taxonomic position of the New Zealand ferret are not clear, an examination of some New Zealand material by Dr U. Rempe (pers. comm.) lead him to conclude that the specimens were ferrets and not polecats. He considers the ferret to be a domesticated form of the polecat *Mustela putorius* (Rempe 1970:350).

RESULTS

1. *Trap Results*

Thirty-two ferrets (18 males, 14 females) were caught and tagged during the 20-month trapping period. Recapture rates were high; in 4,525 trap nights the animals were caught a total of 178 times. During the same period, seven stoats and four weasels were caught and tagged but none was recaptured.

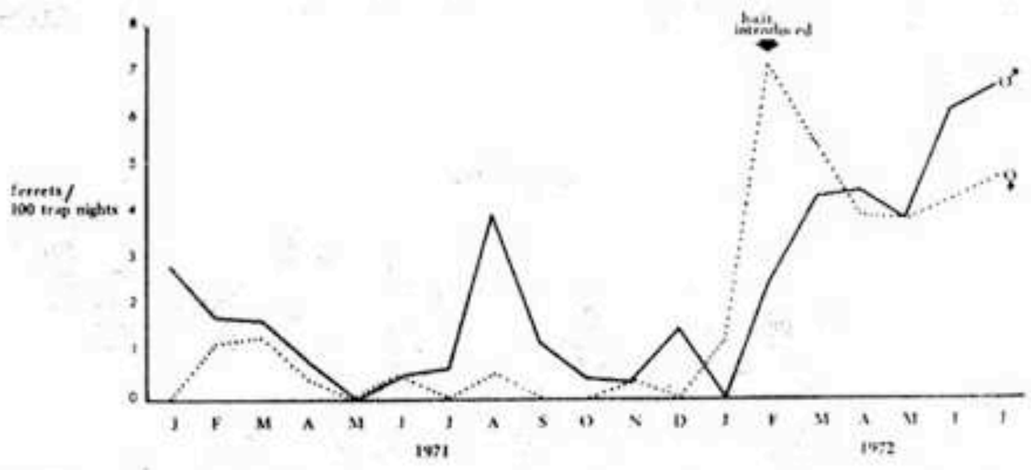

FIGURE 2 *Capture rate of males (continuous line) and females (dotted line).*

Analysis of all data shows that 76 (43%) of all captures were of adult males, 33 (18%) of adult females, and 69 (39%) of juveniles. Throughout the period prior to baiting, adult females were trapped only occasionally, and the peak in the female catch in February 1972 (Fig. 2) was a result of an increase of juveniles in the population as well as a response of adults to the introduction of bait in the traps.

Using the recapture data (Fig. 3) animals are grouped into several categories (following Weckwerth and Hawley 1962) depending on whether they were caught repeatedly over several trapping periods (residents), less frequently over several periods (temporary residents) or during one period of trapping (transients).

Five of the 14 adult males tagged have been residents (901, 902, 910, 2356, 2364). However, the actual number of apparent resident males in the Reserve at any one time varied from between one and three. Six other males were transients and three were temporary residents.

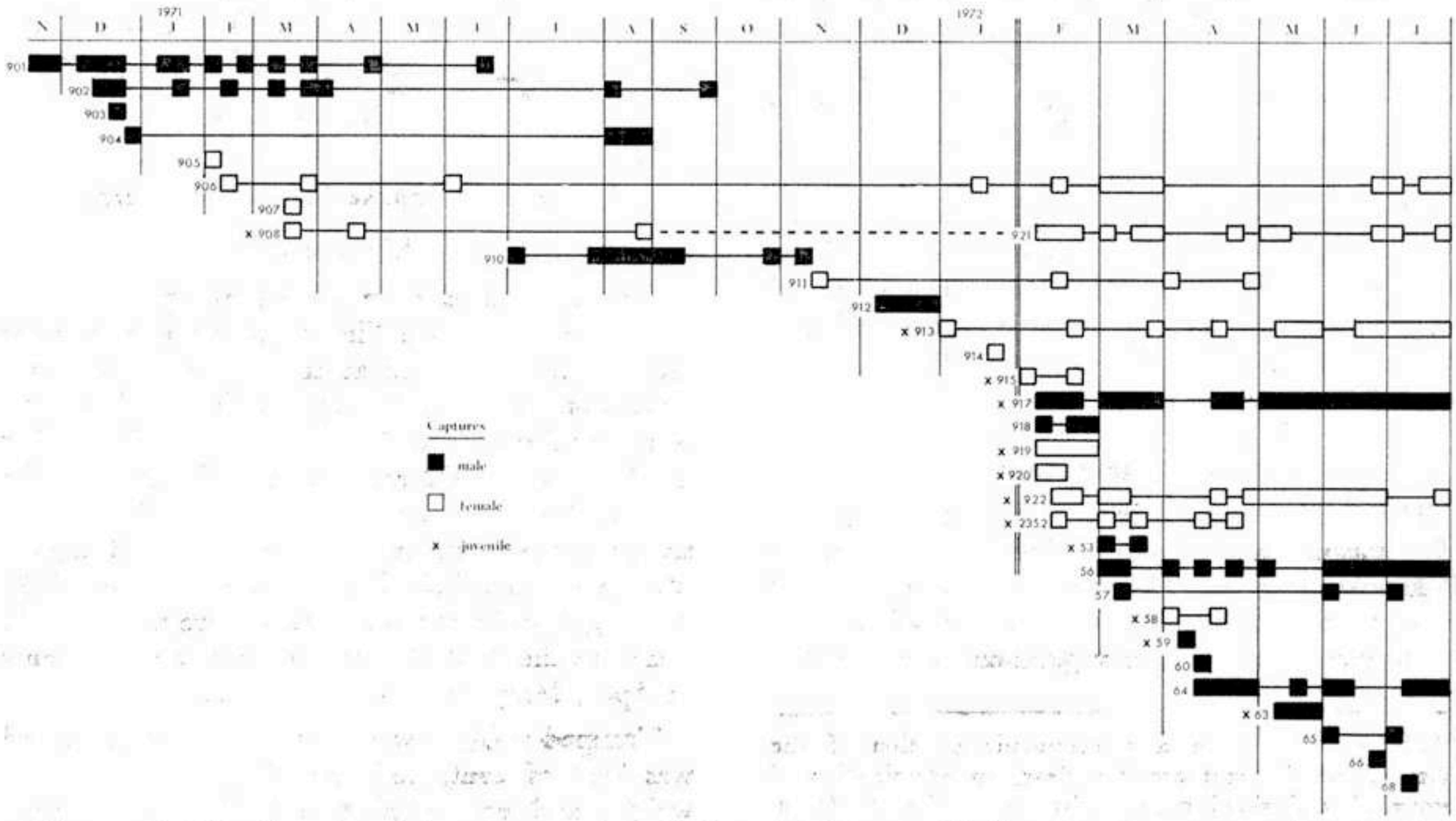

FIGURE 3 *Life histories of ferrets tagged at Pukepuke Lagoon. Each square represents a capture. The double lines between January and February 1972 separate the pre-baiting and baiting periods of trapping.*

Two of the six adult females (906 and 921) have occasionally been trapped over a 17-month period; though during the latter part of 1971 there was a five to six month gap in which neither was caught. Another adult female (911) was resident for six months and three others were transients.

After the 1971-72 breeding season three of the seven juvenile females tagged remained as residents (913, 922, 2352); the other four apparently dispersed. Three juvenile males were tagged but only one (917) has remained in the area.

2. *Weights and Physical Condition*

The mean body weight of adult male ferrets (1126g) is twice that of adult females (505g).

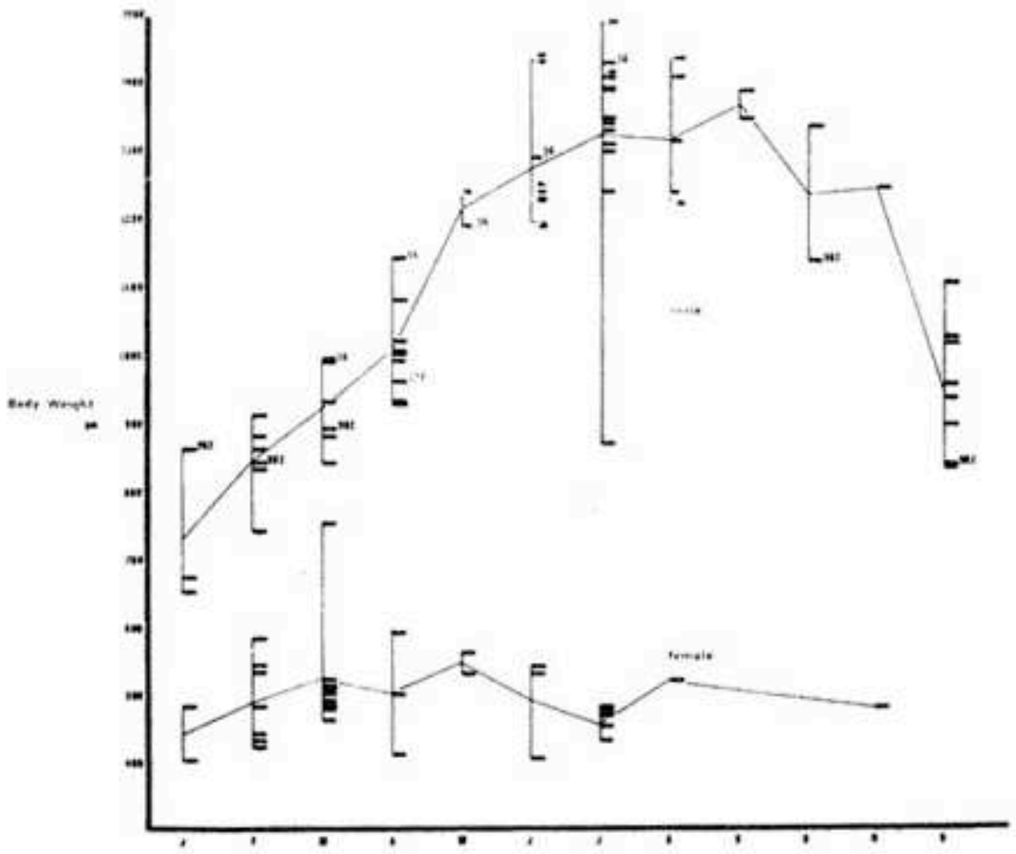

FIGURE 4 *Seasonal changes in the body weight of adult males (upper line) and females (lower line). Variation in individual weights are indicated for males 902 and 2356.*

Male weights fluctuate seasonally (Fig. 4); the mean winter weight is 1318g (n=27), while the mean summer weight is 886g (n=17). Harvey and MacFarlane (1958) showed that seasonal weight change in ferrets is a phenomenon controlled by day-length and is associated with breeding activities. During the breeding season androgen levels are high, and there is an associated increase in aggressiveness (MacLennan and Bailey 1969). Evidence of fighting has been recorded for several mustelid species (e.g. marten: Hawley and Newby 1957, mink: MacLennan and Bailey 1969, skunk: Verts 1967); and at Pukepuke between August and December there were neck wounds and scars on several male ferrets.

Although seasonal weight changes have also been recorded in captive female ferrets (Harvey and MacFarlane 1958) the weights of adult females at Pukepuke do not deviate greatly from the annual mean (505g) in any particular month.

Following the 1971-72 breeding season four adult and eight juvenile females were caught and weighed a total of 69 times (adults=26 times, juveniles=43 times) over a period of seven months (January-July 1972), when weights of adult females were consistently below those of juvenile females (Fig. 5). The mean adult weight was 500g (range 420-600g) and the mean juvenile weight was 565g (range 375-690g).

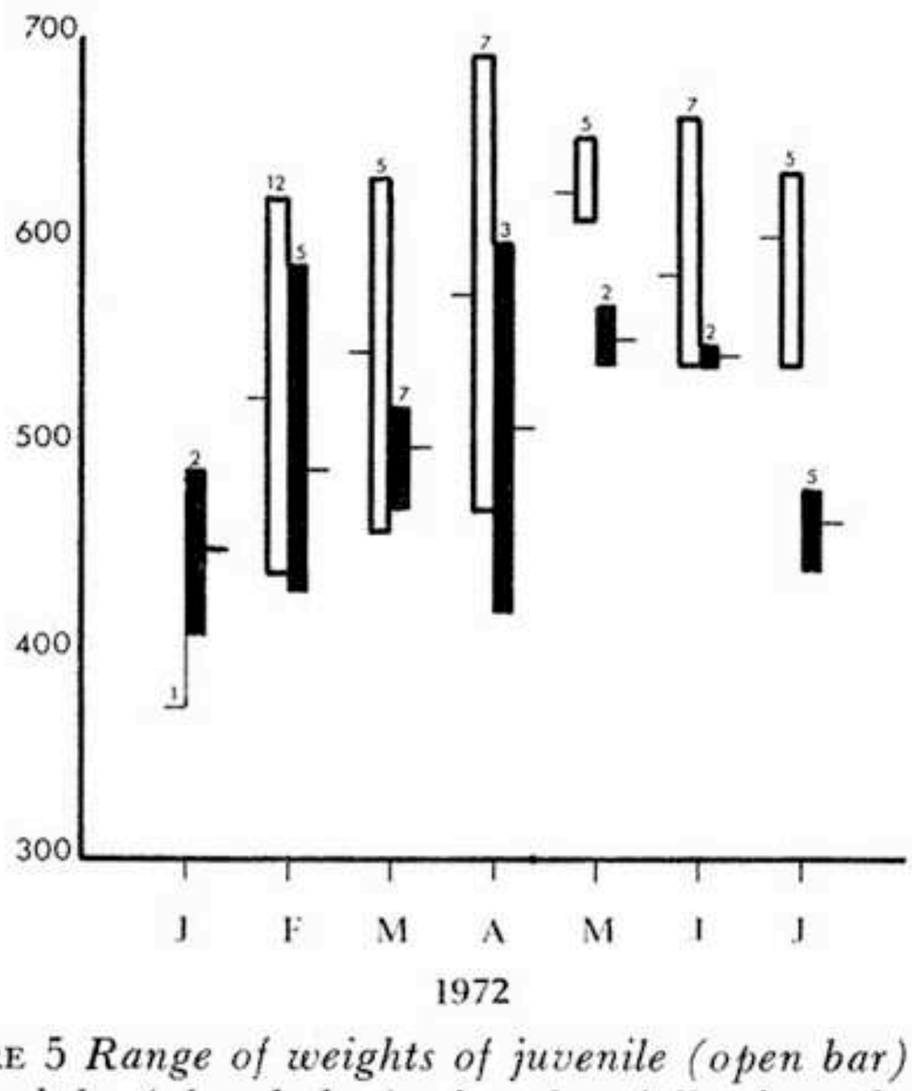

FIGURE 5 *Range of weights of juvenile (open bar) and adult (closed bar) females following the 1971/72 breeding season. The number of animals in each sample is shown on top of the bar and the mean is shown by a horizontal line.*

In their studies on mink and marten Gerell (1971) and Hawley and Newby (1957) found that adult females reach a low in their weights after they have suckled and reared their young.

Low post-parturition weights were thus expected in adult female ferrets. However, because the weight of adult females did not markedly increase following the breeding season, it appears that they are in poor condition for an extended period. Possibly this failure to gain weight is not entirely a result of breeding; by now it could be associated with a greatly increased population density.

3. *Breeding*

Ferrets are seasonally anoestrus, being sexually active from September to March. A peak in the physical condition of the males is reached in August; the decline in body weight after this date is correlated with the increasing demands imposed by breeding activities (e.g. territorial defence—including fighting and scent laying). First matings probably occur in September, corresponding with the onset of oestrus in females (when the enlarged vulva is obvious).

In captive polecats there is a 41 to 42 day gestation period (Herter 1953) and, after birth, the young are suckled for six to eight weeks (Southern 1965). The family unit is maintained until the young are about three months old, at which time they become independent and disperse (Eibl-Eibesfeldt 1956). The appearance of juveniles in the traps at Pukepuke in January and February implies that the dissolution of family groups has begun.

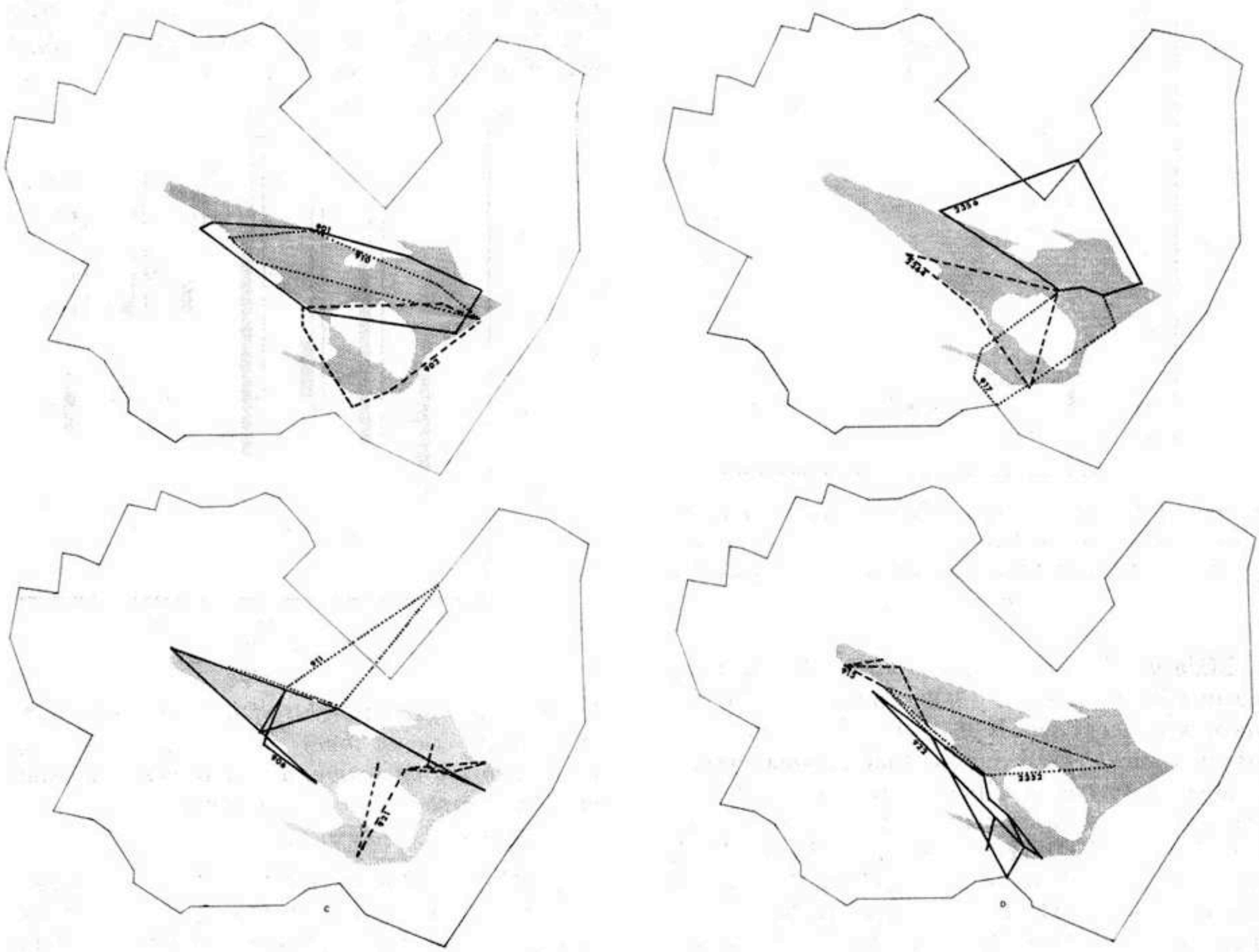

FIGURE 6 *Trap-revealed ranges of resident male ferrets (above) and females (below).*

Three females were caught between September and January and, although none was pregnant or lactating, all showed obvious signs (enlarged nipples, sparse belly fur) of having recently bred.

Subsequent observations of these females between March and June 1972 indicate that only one litter was raised by each during the 1971-72 breeding season.

4. *Spatial Distribution and Movement*

The population size fluctuates widely as new animals move into the area and others disappear. Females appear to be resident for longer than males and there are more transient males than females.

Six resident females have home ranges in the study area (Fig. 6 c, d). The boundaries of these ranges are undetermined because of the limited amount of data, but generally females remained in one part of the study area for an extended period.

The range of one adult (906) increased in early winter 1972. The reason for this is not clear; however it could be significant that a juvenile (913) was at that time occupying the western part of the range of 906.

Juvenile females caught after February 1972 covered large parts of the swamp during a night, probably because of dispersal behaviour. Minimum nightly movements of four juveniles (913, 919, 920, 922) averaged 326m (n=18, range 0-966m).

Minimum nightly movements of adult females were over short distances — averaging 329 metres (n=8). The greatest distance between capture points of an adult female was 935m (911).

Adult males, on the other hand, ranged over significantly greater distances than females (χ^2_1 4.96, $p<0.05$). Eighteen (53%) of 34 recaptured males had moved more than 500m between capture points compared with only 4 (21%) of the 19 females recaught.

Although the average distance between successive trapping points of resident males was just over 500m they are capable of travelling the length of he Reserve (approximately 1,600m) during a night.

Male 901 ranged across the northern part of the swamp (Fig. 6a) during the first 8 months of trapping and in one trapping session travelled at least, 1,308m in less than 12 hours. While this male was resident another male (902) ranged over the south east part of the Reserve. Male 901 was later displaced, but the newcomer (910) remained for only five months (Fig. 6a). Between December 1971 and March 1972 there were apparently no resident adult males on the Reserve; but since then three males (two adults and one juvenile) have occupied, more or less exclusively, parts of the study area (Fig. 6b).

DISCUSSION

Females are more sedentary than males. They have smaller home ranges and once established in an area they occupy it for a considerable time, although the boundary of the range is less well defined than that of resident males.

The general physical condition of most female mustelids is often proportionately much poorer than that of males (Hawley and Newby 1957). Breeding activities are thought to result in weight loss in both male and female ferrets (Harvey and MacFarlane 1958), but continued poor physical condition in female mustelids has been attributed to population pressure associated with territorial behaviour (Lockie 1966).

A territorial system, in which one or more females have territories within that of a single male has been demonstrated in several mustelid studies (pine marten: Hawley and Newby 1957, stoat and weasel: Lockie 1966, otter: Erlinge 1968, and striped skunk: Bailey 1971). During periods of food shortage high numbers or both, such a territorial system may result in differences in mortality between the sexes. "Males become more aggressive and tend to treat females as males with consequent poor breeding and high mortality of females" (Lockie 1966).

Resident male ferrets at Pukepuke were territorial, in that fixed areas were defended (Brown and Orians 1970). Male ranges were mutually exclusive and fighting occurred in the breeding season. Further, as Stubbe (1970) noted, deposi-

tion of faeces often accompanies scent marking of the territory. Scats were regularly found on trap-box lids during the study, indicating that scent marking had taken place.

Female ferrets do not appear to exhibit behaviour typical of a territorial species, although this is difficult to determine. Trapping has shown that females have home ranges that vary greatly in size. The boundaries also change from time to time and ranges of different females sometimes overlap.

These results are preliminary. Population data will be accumulated over several breeding seasons and, with a food habits analysis, will be related to waterfowl productivity and the possible effects of ferret predation will then be discussed.

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