THE DIET OF THE RUFOUS OWL *NINOX RUFA* NEAR COOINDA IN THE NORTHERN TERRITORY

The Rufous Owl is the only exclusively tropical owl in Australia. It is a large owl (weight: ♂♂ – 1150–1300 g; ♀♀ – 700–1020 g) and only a little smaller than its south-eastern Australian counterpart, the Powerful Owl *Ninox strenua* (weight: ♂♂ – 1130–1700 g; ♀♀ – 1050–1600 g). The only detailed dietary information recorded for the Rufous Owl comes from north-eastern Queensland where Young (in Schodde & Mason 1980) found mostly birds and insects with very few mammals being eaten. This is in contrast to the predominance of medium-sized mammals (Common Ringtail Possum *Pseudocheirus peregrinus*, Greater Glider *Petauroides volans*, Yellow-bellied Glider *Petaurus australis*, Sugar Glider *Petaurus breviceps* and Common Brushtail Possum *Trichosurus vulpecula*) eaten by Powerful Owls (Fleay 1968; Hyem 1979; Seebeck 1976; James 1980; Van Dyck & Gibbons 1980; Tilley 1982).

During a quantitative fauna survey of Kakadu National Park, Rufous Owls were recorded in a patch of tropical monsoon forest just north of Cooinda (12°53′30″S, 132°32′E). Here intensive studies (Braithwaite, unpublished data) on the vertebrates were conducted for 48-hour periods on eight occasions over a three year span beginning 14.8.80, 22.10.80, 14.3.81, 16.9.81, 28.2.82, 1.7.82, 7.9.82 and 13.2.83. On all visits to this site except that 28.2.82, at least one Rufous Owl was sighted. Pellets were collected on all dry season visits (May–November) except that of 7.9.82. None was collected on the wet season visits (December–April) as the Owls were not present and probably roosted outside our study area during the wet seasons. This suggests that they may utilize roosts on a rational basis as does the Powerful Owl (Tilley 1982).

In tropical Australia, pellets are broken down by organisms in the soil rather rapidly. A pellet may last in a wholesome state for only two to three weeks at most in the dry season, and much less during the wet season (J. Estbergs, pers. obs. and I.J. Mason, pers. comm.). Therefore the collections were accumulated over short periods (less than 1 month). Pellets were located under a different tree (*Diospyros ferrea* var *humilis* and *Nauclea orientalis*) on each occasion. These trees were the largest and most densely foliaged in the immediate vicinity and offered both good vantage points and cover.

The regurgitated pellets of owls consist of undigested remains of animals eaten and are known to reflect accurately the number and identity of prey consumed (Wallace 1948; Glue 1974; Raczynski & Ruprecht 1974) and hence have been used to determine the diet of owls (e.g. Morton & Martin 1979). In the present study, prey were identified from skeletal material (mandibles, maxillae and pelvic girdle bones), fur (after Brunner & Coman 1974) and feathers. The numbers of individual prey species per pellet collection were then estimated. These data and the live body weights of juvenile and adult prey species (Strahan 1983; Braithwaite, unpub. data) were used to estimate prey biomass.

It is likely that each pellet collection was produced by the same number of adult Rufous Owls. Sight records from twenty-five other locations in the Top End show no more than two adult Owls present, with or without fledglings, depending on time of year (Estbergs, unpubl. obs.). Schodde & Mason (1980) suggested that females begin breeding at approximately the same time each year. It is therefore likely that the pellet collections represent seasonal changes in diet, rather than variation between years. In this highly seasonal environment year to year variation in the abundance of different mammal species in the study area was relatively minor (Braithwaite, unpubl. obs.).

The most consistent dietary items were the medium-sized arboreal mammals which represented 42% of the total biomass. However, in August they were replaced by *Antechinus bellus*. Terrestrial mammals were most important early in the dry season and the *Pteropus* bats were more important late in the dry season. Very little bird (3.0% of estimated live biomass) or insect material (< 1%) was represented in the pellets examined (Fig. 1). The bird species identified were Northern Rosella *Platycercus venustus*; Dollarbird *Eurystomus orientalis*; Restless Flycatcher *Myiagra inquieta nana* and White-gaped Honeyeater *Meliphaga unicolor*.

Apart from small bats, most mammal species recorded in the area by trapping and spotlighting were found in the pellets collected. It is evident from the species composition, that almost all hunting occurred in the surrounding open forest and woodland. The number of species and individuals in the pellets generally reflected the abundance of mammals within those two habitats more so than that of the monsoon forest (Braithwaite, unpublished data). For example, the rodent *Melomys burtoni* which is usually absent from open forest and woodland but not uncommon in the monsoon forest and wetlands, was absent from the pellets. Prey sizes ranged from the small rodent *Pseudomys delicatulus* (5–15 g) to the Northern Brushtail Possum (1100–2000 g). The individuals of the larger species were frequently

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TABLE I

Dry season diet of Rufous Owls from near Cooinda, NT.

Species	Number of Individuals 1.7.82 early dry	14.8.80 mid dry	16.9.81 mid dry	22.10.80 late dry	Total
Bats					
Pteropus scapulatus	0	1	1	3	5
Pteropus alecto	0	0	0	1	1
Arboreal mammals					
Phascogale tapoatafa	1	0	0	0	1
Trichosurus arnhemensis	1	0	1	1	3
Petaurus breviceps	1	3	1	0	5
Mesembriomys gouldii	1	0	1	1	3
Conilurus penicillatus	0	0	0	1	1
Scansorial mammal					
Antechinus bellus	1	27	2	2	32
Terrestrial mammals					
Isoodon macrourus	0	3	1	0	4
Pseudomys nanus	6	1	1	1	9
Pseudomys delicatulus	2	2	2	0	6
Rattus tunneyi	8	2	2	0	12
Rattus colletti	10	1	1	0	12
Birds*	1	4	3	1	9
Insects+	0	2	0	1	3
Number of individuals	32	46	16	12	106
Number of mammal species	9	8	10	7	13
Number of pellets	30	29	12	18	89
Percentage of complete pellets	30	28	0	28	25

* See text for species + Unidentified

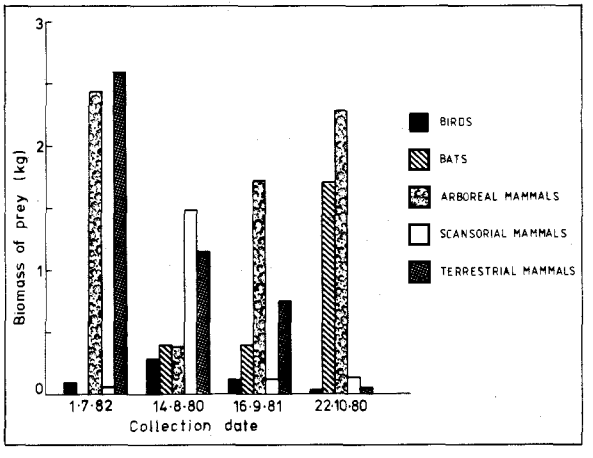

Figure 1. Estimated biomass of prey of major animal groups in the four collections of Rufous Owl pellets.

juveniles or sub-adults. The only relatively common mammal species which was absent from the pellets was the Northern Quoll *Dasyurus hallucatus* (300–900 g).

The size and composition of pellets differed between collections (Table II). The late dry season pellets (October) were smaller and lighter and contained less bone with fewer individuals and species. These differences suggest a seasonal shift from small animals to larger animal prey. The larger animals (>100 g) were not swallowed whole; the inedible wings and bones being removed before the prey was consumed. The numbers of pellets containing parts of more than one individual and often more than one species may reflect provision of food to mate and young. On 14.8.80, a juvenile Rufous Owl, still in downy plumage, was observed in the company of an adult. Based on the fledging and incubation times from Schodde & Mason (1980), the egg was estimated to have been laid in about mid-May. If the same area was consistently used each dry season, then the July and August collections represent the period when the adults were feeding their young and the September and October samples represent the diet of non-breeding adults.

The apparent seasonal changes in diet suggested by the remains found in the pellets relate well to knowledge of the life histories of the mammalian prey. The arboreal mammals breed throughout the dry season and pro-

TABLE II

Characteristics of intact pellets of Rufous Owl from different collections.

Characteristics	Date of Collection 1.7.82 early dry	14.8.80 mid dry	22.10.80 late dry	F Value
Pellet length (mm)	41.4 ± 4.8	43.6 ± 8.8	30.4 ± 3.9	7.2**
Pellet breadth (mm)	28.0 ± 3.0	30.3 ± 6.3	21.4 ± 2.5	6.5**
Pellet weight (g)	4.3 ± 1.2	3.5 ± 1.1	1.8 ± 0.3	9.6**
Percentage of bone	39.4 ± 9.2	31.9 ±13.1	10.0 ± 6.1	13.7***
Number of individuals per pellet	2.0 ± 0.7	1.9 ± 1.1	1.0 ± 0	2.8
Number of species per pellet	1.3 ± 0.5	1.3 ± 0.5	1.0 ± 0	1.0
Number of pellets	9	7	5	

** $p<0.01$ *** $p<0.001$

bably are the staple diet of Rufous Owls as they are for the Powerful Owl in southern Australia (e.g. Tilley 1982). With the ground-dwelling mammals, reproduction tends to be concentrated in the late wet and early dry season (Strahan 1983) producing greatest abundance of these species in the early half of the dry season. In the August sample, *Antechinus bellus* was the dominant prey. These marsupial mice mate at this time and have a life history like that of the more closely studied *Antechinus stuartii* (Calaby & Taylor 1981). The males become increasingly vulnerable immediately before they all die at the end of the mating season (Braithwaite 1973).

Regionally, flying foxes are observed in large numbers throughout the year. They feed in a wide range of habitats but generally roost in a variety of monsoon forest sites. Their seasonal appearance in the pellets probably reflects a seasonal availability of animals within the areas used by these Owls. Alternatively the Owls are switching to those prey at a time of decreased availability of the terrestrial mammals.

Both the Rufous Owls and their mammanlian prey (apart from flying foxes) are relatively uncommon species. It is puzzling that the Rufous Owls at this site did not concentrate on the more abundant birds as they do in north Queensland (where mammals are also more common). Instead they appear to be using almost the whole range of mammals from open forests and woodlands. During the wet season when the ground vegetation is much denser, the Rufous Owls may, however, take more birds.

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J.A. ESTBERGS and R.W. BRAITHWAITE, *CSIRO Division of Wildlife and Rangelands Research, PMB 44, Winnellie, NT 5789.*

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ADELIE PENGUINS BREEDING IN EASTERN ENDERBY LAND, ANTARCTICA

The present and historical distribution and abundance of penguins on sub-Antarctic islands and the Antarctic coastline have been reviewed recently (Horne 1983; Wilson 1983). Neither gave records of Adelie Penguins *Pygoscelis adeliae* breeding in eastern Enderby Land, Antarctica (50°-55°E), both overlooking the accounts of Mawson (1932) and Falla (1937).

In this note I give details of a visit to eastern Enderby Land, apparently the first ornithological visit since that of the British, Australian and New Zealand Antarctic Research Expedition (BANZARE) in 1930 (Mawson 1930, 1932; Falla 1937).

RESULTS AND DISCUSSION

On 17 April 1984 I visited a small part of the coast of eastern Enderby Land, by helicopter from the M V *SA Agulhas*, overflying the coast from Cape Batterbee (65°51′S, 53°48′E) to the Aargaard Islands (65°51′S, 53°35′E), a distance of *c* 12.5 km, and landing at Proclamation Island (65°51′S, 53°41′E) for approximately 1.5 hours. Proclamation Island is a small, steep island close to the continental ice shelf. Due to the lateness of the season no live Adelie Penguins were seen. However, at Proclamation Island, the presence of nest mounds, copious guano deposits and the frozen bodies of downy and feathered chicks (of which eight were collected) showed that Adelie Penguins had recently bred there. On defrosting, chicks were found to be rotten but not mummified, strongly suggesting that Adelie Penguins had bred there in the 1983/84 summer. The presence of moulted feathers and bile-stained excreta also suggested that moulting adults had only recently departed from the colony. The stomachs of the chicks collected were mostly empty, containing only a number of stones and a few fragments of crustacean exoskeletons.

The colony occupied a gently-sloping area in the south-western part of the island. Based on the spacing of nest mounds and a rough pacing-out of the colony, I estimated, very crudely, that the colony had supported about 5,000 pairs of Adelie Penguins. The only live birds present were several hundred Snow Petrels *Pagodroma nivea* and a few Antarctic Petrels *Thalassoica antarctica*, which flew around the higher parts of the island, but were not seen to land.

On flying over Proclamation Island, the grey guano-stained deserted colony was most obvious from the air. Several such grey areas were seen from the air at Cape Batterbee. It is therefore likely that Adelie Penguins had also bred at this locality earlier in the summer. An impression was gained from the air that the colonies at Cape Batterbee were smaller in area than at Proclamation Island. No signs of penguin colonies were seen on the tiny Aagaard Islands to the west of Proclamation Island.

Sir Douglas Mawson sailed past Cape Batterbee in the S Y *Discovery* on 13 January 1930 and landed at Proclamation Island on the same day, where he proclaimed Enderby Land for the British Crown (Mawson 1932, p 110). During his visit he reported that "...rookeries of Adelie penguins occupy the lower slopes of Proclamation Island and other low, rocky islets and rock outcrops on the coast at Cape Batterbee". Falla (1937, p 29) gave further details, stating that "The first two hundred feet (of Proclamation Island) took us through the most crowded part of an Adelie penguin rookery. A few birds were still incubating eggs, but the majority had chicks, ...". Falla (1937, p 61) collected at least four Adelie Penguins on 13 January in Enderby Land, presumably from this locality. Other species breeding at Proclamation Island on 13 January 1930 were Snow Petrels, Antarctic Petrels and Cape Petrels *Daption capense* (Falla 1937, p 29). Southern Fulmars *Fulmarus glacialoides*, Wilson's Storm Petrels *Oceanites oceanicus* and Southern Skuas *Stercorarius maccormicki* were also present and were most likely breeding (Falla 1937, pp 29-30).

Unfortunately, neither account (Mawson 1932; Falla 1937) gave quantitative estimates of the sizes of the

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