AN ANALYSIS OF PREY REMNANTS FROM OSPREY *PANDION HALIAETUS* AND WHITE-BELLIED SEA-EAGLE *HALIAETUS LEUCOGASTER* FEEDING ROOSTS

The Osprey *Pandion haliaetus* and White-bellied Sea-eagle *Haliaetus leucogaster* nest on islands along the Great Barrier Reef. Nests are used as feeding roosts irrespective of nesting activities. Prey is also examined and devoured while at roost on dead tree stumps or in live trees, on coral boulders on the reef flat or on the beach terrace.

Prey 'middens' (or 'butcheries'; Storr 1966) have been noted around feeding roosts on the Great Barrier Reef islands by MacGillivray (1928). However, there have been no subsequent attempts to quantify and compare the diets of Osprey and White-bellied Sea-eagle inhabiting reef environments. The aims of this study were to compare the contents of prey middens of each species and to interpret midden material in the context of other information on the feeding behaviours of each species.

In the Capricorn-Bunker group (14°40′S, 145°30′E), four White-bellied Sea-eagle nests and four roosts were examined for prey remains. No prey records were obtained from the Capricorn-Bunker group for Ospreys, as the Osprey is a rare visitor here (Domm 1977).

Around Lizard Island (23°S, 152°E), one White-bellied Sea-eagle nest was investigated for prey remnants. Carcasses were examined at seven Osprey nests. Ospreys are common in the vicinity of Lizard Island, while White-bellied Sea-eagles are seen less frequently. Prey remnants were found at two roosts in the Lizard Island group, which were used by both Osprey and White-bellied Sea-eagle. Since it is uncertain which prey items were caught by which of the two species, these have been omitted from the breakdown in Figure 1.

Prey were classified at least to family level. No attempt was made to identify fish from pieces of axial skeleton, although skulls could be identified. Usually, sufficient remains were left to allow classification by shape, scales and/or presence of distinguishing features (e.g. spines and barbs). Collections of prey remnants and observations on birds were made between February 1982 and March 1984.

A breakdown of identifiable prey into Classes and Families is given in Figure 1. Five families of fish, three families of seabird and sea-snakes (F. Hydrophobiidae) were found at White-bellied Sea-eagle roosts (Fig. 1). Longtoms (Belonidae) only (n = 7) were found at the northern Queensland nest. Similarly, in the Capricorn-Bunker group, Belonids were the most commonly encountered prey item. The data from the two study areas were pooled in Figure 1. Wedge-tailed Shearwaters *Puffinus pacificus* were the most common bird prey (Capricorn-Bunkers only).

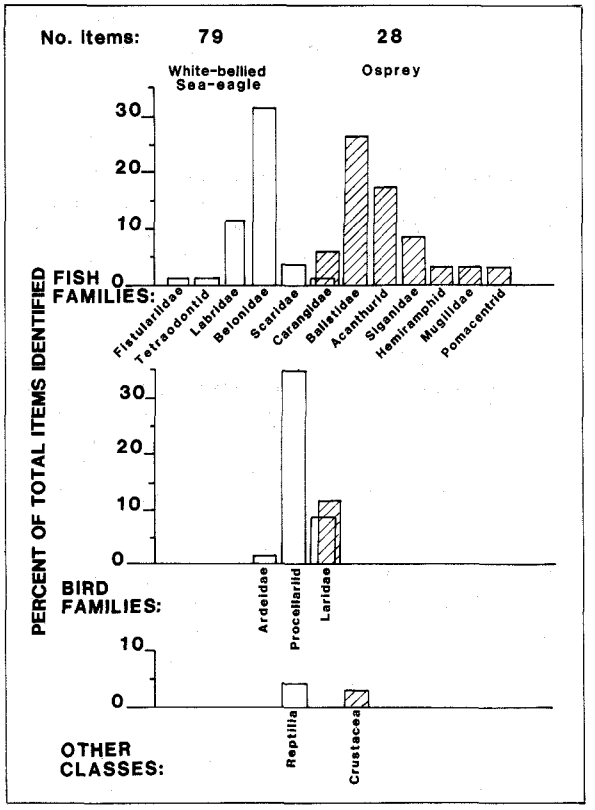

Figure 1. Osprey and white-bellied sea-eagle prey remnants by identifiable families and classes.

Eight families of fish, one family of seabird and a Crustacean were found at Osprey feeding roosts (Fig. 1). Triggerfish (Balistidae) and Surgeonfish (Acanthuridae) were well represented in collections. These fish are armed with sharp spines that could inflict serious wounds. Birds and Crustacea were present but not abundant at roosts. Birds taken include terns *Sterna spp.*

Nine prey items were identified from the vicinity of the two roosts used by both Osprey and White-bellied Sea-eagle. These items included three Brown Boobies *Sula leucogaster* (Sulidae) and two Bridled Terns *Sterna*

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anaethetus (Laridae). The other four carcasses were fish of the families Belonidae (Longtoms), Muraenidae (Moray Eels), Diodontidae (Pufferfishes) and Tetraodontidae (Toadfishes).

White-bellied Sea-eagles and Ospreys appear to differ markedly in their food. Fish made up a greater proportion of the diet of the Osprey (85%) than of the White-bellied Sea-eagle (59%). Furthermore there was only minor overlap in taxonomic composition of fish taken by the two species. It is possible that some of the fish remnants found at White-bellied Sea-eagle roosts represent carcasses discarded by spear-fishermen who frequent the Capricorn-Bunker group.

Belonids (Longtoms), the main prey at White-bellied Sea-eagle roosts, are pelagic (associated mainly with the deeper waters between islands). They are fast swimming fish that leap, skulk and skip near to the surface (Monroe 1967). Balistids (Triggerfish) and Acanthurids (Surgeonfish), the principal prey items found at Osprey roosts, are associated with shallow waters around reefs (Monroe 1967) and are slow swimmers.

The differences in fish remnants at Osprey compared to White-bellied Sea-eagle roosts could be linked to differences in geographical locality or to different feeding behaviours. There was considerable similarity in diets between White-bellied Sea-eagles in the Lizard Island region compared with the Capricorn-Bunkers and this tends to negate an explanation of differences in terms of locality. The fishing techniques of the two species are however markedly different. White-bellied Sea-eagles patrol islands, reef edges and deeper water between islands. When feeding, they hover low (Pizzey 1980) and hence are probably more adept at catching fish that swim fast close to the water surface. In contrast, Ospreys mainly search over the reef flat and in lagoons. They characteristically fly back and forth over the same stretch of water at a height of about 30 m (Pizzey 1980). Their high dive is possibly more suited to taking slower fish at depth. Cupper & Cupper (1981) have noted that their fishing ability appears to be enhanced at low tide.

White-bellied Sea-eagle and Osprey sometimes take fish that are toxic, including some Diodontidae and Tetraodontidae. Presumably the birds of prey can cope with toxic compounds or they avoid eating toxic parts of the fish; or even the whole fish. The specimen of *Arothron hispidus* (Tetraodontidae) found at the mixed roost, was untouched; not only is this fish toxic but it is enclosed in a hard leathery skin, which makes it difficult to obtain meat. The skins of Pufferfishes (Diodontidae) were all that remained at feeding roosts. The skin is a highly toxic part of this fish (G. Anderson, pers comm) and was probably left for good reason.

In addition to fish, both Ospreys and White-bellied Sea-eagles took birds. White-bellied Sea-eagles took many *Puffinus pacificus*, although not in the Lizard Island region, where Shearwaters are scarce. Wedge-tailed Shearwaters are also common prey for the White-bellied Sea-eagle off the coast of Western Australia (Storr 1966). No remains of Wedge-tailed Shearwaters were found at Osprey roosts. Again, this could be an artifact of their scarcity in the Lizard Island region, although Shearwaters may be too large for the Osprey to take. Both species took terns (Laridae). In the Crested Tern *S. bergii* breeding season of 1983–84 I frequently saw White-bellied Sea-eagles take both adults and runners of this species. K. Means (pers comm) found large numbers of dead Black Noddies *Anous minutus* around a White-bellied Sea-eagle roost at Heron Island, whereas I found none.

Mine are the first records of birds and crustacea in the diet of the Ospreys from the southern hemisphere. Elsewhere, Ospreys also take fish, small mammals, waterfowl and amphibians (Mason 1976).

The presence of fish and sea-snakes at White-bellied Sea-eagle roosts is consistent with other records (Calaby 1976). Sea-eagles also feed on penguins, coots, ducks, domestic turkeys, juvenile Black Swan and juvenile Cape Barren Geese; as well as rabbits, young wallabies, bandicoots and lambs as carrion; and freshwater turtles (Green 1959; Storr 1966; Guiler 1967; Eckert 1971; Calaby 1976; Frith 1976; Reilly 1978; Woodall 1982; Bilney & Emison 1983).

Prey remnants found at the feeding roosts of any particular bird (whether Osprey or White-bellied Sea-eagle) may not represent the true frequencies of all prey types taken by that bird. This is because: (1) some prey may be taken only seasonally and older items may be overlooked or rendered unrecognizable through decomposition; (2) some prey types may be totally consumed by predators or scavengers while others will not (e.g. toxic species); (3) tides and winds may more readily transport some prey remnants than others; (4) some species decay more rapidly or leave few recognizable remnants.

Despite these drawbacks, biases might be expected to be the same for both species, so that interspecific comparisons are still valid. Thus the use of observations at feeding roosts has shown clearly defined and minimally overlapping diets for Osprey and White-bellied Sea-eagle. This distinction correlates well with independent observations of differences in the feeding behaviour adopted by each of the predator species. The method of identifying prey remnants at roosts is likely to prove useful as a supplement to more direct observations of these predators feeding, in obtaining an overall and accurate picture of Osprey and White-bellied Sea-eagle diets.

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NOCTURNAL HYPOTHERMIA IN THE WHITE-THROATED NEEDLETAIL, *HIRUNDAPUS CAUDACUTUS*

Torpidity is a well-recognised physiological response to cold and stress in a variety of mammals and birds, which can reduce their body temperature and metabolism in certain circumstances. Members of three avian families have so far been shown to exhibit torpidity, the hummingbirds, Trochilidae, the nightjars, Caprimulgidae, and the swifts, Apodidae (see review by Dawson & Hudson 1970). Hummingbirds go into torpor whenever energy reserves fall below a minimum threshold, as part of their adaptation to the intense metabolic demands made by their tiny size and high surface area to volume ratio (Hainsworth *et al.* 1977). On the other hand, the Caprimulgid Poor-will *Phaelenoptilus nuttalli* can apparently go into torpor for a long period, having been found overwintering in rock crevices (Jaeger 1949). The question of torpor in swifts was first raised when White-throated Swifts *Aeronautes saxatalis* were observed to appear suddenly in the air around their cliff roosts on sunny days following cool periods with low insect abundance when they had not been observed for days at a time. Subsequent work in the laboratory has confirmed that White-throated Swifts can enter and recover from hypothermia (Bartholomew *et al.* 1957).

In the present report we provide observations on the White-throated Needletail *Hirundapus caudacutus*, which indicate that this migratory swift may also become torpid under certain conditions. Although our sample is restricted to one individual we feel that a record is warranted since the observation is of general interest and since it is unlikely to be repeated in the near future because of the very unusual circumstances involved.

The Needletail was found inside a hollow branch on a 20 m eucalyptus tree which had been felled by a bulldozer in the early afternoon of 25 November 1983 at 8 Mile Plain (153°E, 28°N). The bird suffered no injuries as a result of the felling, apart from a minor skin abrasion on the chin. An unseasonal, severe cold snap had occurred in the area over the previous two days, with some snow and temperatures near freezing being recorded when summery weather with a mean temperature around 25°C is normally to be expected.

When brought in the same evening the Needletail was vigorous and rapidly climbed as high as it could on any

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