Short Communications

Successful Foraging by the Wedge-tailed Eagle *Aquila audax* in Tropical Rainforest in North Queensland

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EMU Vol. 96, 277-280, 1996. Received 11-12-1995, accepted 10-3-1996

The Wedge-tailed Eagle *Aquila audax* preys upon a diverse range of species and employs an impressive repertoire of hunting behaviours in a variety of habitats (Marchant & Higgins 1993). The few published accounts of Wedge-tailed Eagles hunting in or at least pursuing prey into dense forests are difficult to interpret and none seem to be of rainforest hunting as described in this paper. Fawkner (1991) described a chase through 'quite dense forest' in the Marlborough area and Mooney's (1988) account of a Wedge-tailed Eagle chasing a currawong through the canopy alluded to a closed forest habitat. Gaffney & Mooney (1992) state that in Tasmania, Wedge-tailed Eagles prefer to hunt in forest. Wedge-tailed Eagles have also been reported flying over closed forest habitats in Bega and in south-eastern Queensland (Smith 1984; Czechura 1985) and are frequently seen soaring over rainforest in north Queensland. Wedge-tailed Eagles are known to nest in closed forest habitats. This behaviour is particularly common in Tasmania (Gaffney & Mooney 1992), and a nest-site in an emergent Turpentine tree *Syncarpia glomulifera* was pointed out to SB by forestry workers on the Mt. Windsor Tableland.

Below we describe some observations of successful foraging in tropical rainforest of north Queensland by Wedge-tailed Eagles and four hitherto unrecorded prey species.

Case studies

(1) Mt. Windsor Tableland (16°15′40″S, 145°02′30″E). This observation was recorded in an area of continuous notophyll vine-forest on the Tableland approximately 75 km north-west of Cairns (Tracey 1982).

An adult female Spotted-tailed Quoll *Dasyurus maculatus*, weighing 1000 g including a radio-transmitter, was observed by SB on 10 August 1993 at 1545 h. The animal was active in the upper canopy. On the following day (11 August 1993), when radio-tracking the animal, a Wedge-tailed Eagle was noted flying about 5 m above the continuous canopy (which typifies this forest type). When the quoll was located at about 1030 h that day, it had been partly consumed and was draped over a fork in a prostrate tree, approximately 1 m off the ground, about 100 m from the eagle sighting and over 200 m from the nearest forest edge (a natural granite platform). The tree had evidently fallen long ago and a 25-30 m canopy had formed over the gap so that the corpse did not appear to be visible from above. The tail and hind legs (except one femur) had been removed, as had the stomach and intestines and her two small joeys. The face had been stripped of skin and the eyes removed. Skin hung in strips from the shoulders. The hind limbs had been torn off and apparently consumed, rather than chewed, as evidenced by the pristine nature of the distal joint of the remaining femur. The heart and lungs were intact but the kidneys had been removed. There was no sign of eagle feathers nor of the corpse's entrails, which Fleay (1952) found captive Wedge-tailed Eagles to discard but which Olsen (1995) did not always find to be the case.

The corpse was left *in situ* at 1100 h and when SB returned again at 1245 h on the same day, a Wedge-tailed Eagle was flushed from a perch about 3 m above the ground in the under canopy, about 10 m from the corpse. Accompanied by much crashing of vegetation and laboured flapping, the bird clambered its way into the canopy before flying from view. In gaining the 25-30 m to the canopy, the eagle had traversed an horizontal distance of about 30 m.

The positioning of the corpse, the method in which it had been dismembered and the method of mutilation of its face and shoulders all indicated avian predation. Three species, Rufous Owls *Ninox rufa*, Grey Goshawks *Accipiter novaehollandiae* and Wedge-tailed Eagles were the only avian predators at the site capable

of tackling prey of this size and pugnacity. The nature of dismemberment, in which the hind legs were entirely removed, suggests strength beyond that of a Grey Goshawk, if not a Rufous Owl. The dense nature of the rainforest canopy suggests that the quoll was not killed *in situ* by some other predator and then sighted by the eagle as carrion. We suggest that the Wedge-tailed Eagle either found the quoll as carrion elsewhere and subsequently dropped it and came down after it, or that the eagle killed the quoll and subsequently dropped it and came down after it, or that the quoll was killed *in situ*. The lack of scraps associated with feeding suggest that the latter is unlikely. Irrespective of what actually killed the quoll the significance of this observation is that this eagle was active at ground level within dense rainforest.

(2) Longland's Gap State Forest (17°27′56″S, 145°29′18″E) on the Atherton Tablelands consists of notophyll vine-forest (Tracey 1982) and is bisected by bitumen and dirt roads and by powerline corridors. This state forest represents a large fragment of what was once a much more extensive closed forest block.

On 18 August 1994 at 1030 h, JW and Anne Goldizen were travelling on a road covered by continuous canopy through this forest when a Wedge-tailed Eagle took off from the side of the road. An apparently dead Herbert River Ringtail *Pseudocheirus herbertensis* was seen lying in the spot from which the eagle was disturbed. When examined, the possum was found to be alive though catatonic, with two small and superficial nicks on the right side of the chest and the inner left arm. She had two joeys and weighed 1125 g. The possum recovered within half an hour and, when released at the site of capture at 2030 h on the same day, it appeared to be sound in body and had no difficulty in climbing.

It is not known whether the eagle extracted the possum from a den in a manner similar to that described by Le Souef (1918) and Barnard & Barnard (1925) or whether the possum was caught travelling during the day as is rarely observed (JW unpubl. data).

(3) Massey Creek Rainforest Field Station (17°31′47″S, 145°33′45″E) is part of a continuous notophyll vine-forest block and occurs at an elevation of about 1000 metres above sea-level, nine kilometres west of Ravenshoe. The forest is 20-25 m tall with a closed canopy above the site of the following observation.

On 20 January 1995, JW, Keith McDonald and Helen Myles made the following observation. At 1300 h, several drops of blood were noted on fallen leaves along the foot trail they were walking. About 20 m further on, a Wedge-tailed Eagle was flushed from the ground. It hopped and flapped onto a branch about 5 m high and about 8 m to the side of the track. It remained there as the party stopped to watch and then walked past. The eagle appeared uninjured and no prey was found to explain the presence of the blood. We conclude that the eagle was on the ground within the rainforest from choice.

(4) Mt. Carbine Tableland (16°34′S, 145°17′E) consists of continuous notophyll vine-forest and lies immediately to the south of the Mt. Windsor Tableland, described in (1) above; the canopy height was 25-30 m.

In 1990, RR was driving on the Mt. Lewis Road when two Wedge-tailed Eagles were seen to take off from the ground below the canopy, about 4 m in from the forest edge. The eagles flew downhill, below the canopy and then emerged above the canopy about 20 m further downslope. A freshly killed Daintree River Ringtail *P. cinereus* was discovered upon inspection of the site from which the eagles had taken off. As with the Longland's Gap State Forest case above, it is unclear whether the eagles had extracted the possum from its den or whether it had been caught moving about during the day.

(5) Curtain Fig State Forest (17°17′S, 145°34′E) on the Atherton Tablelands consists of an approximately 350 ha fragment of simple notophyll vine-forest at an altitude of about 700 m and is surrounded on all sides by agricultural land. A single bitumen road bisects the forest

In May 1995, a Wedge-tailed Eagle was seen by a passing motorist, flapping around on the side of the road where it passes through the forest. The motorist, concerned that it had been hit by a car, went back to the site with John Bowen, a shire council worker, who related this anecdote. After 15 minutes of searching, the eagle was eventually located in tall grass by the roadside and upon closer inspection, a Green Ringtail *Pseudocheirops archeri* was found clinging to the inside of the bird's wing. Both were taken into care and survived the encounter. The eagle's golden plumage indicated that it was young (Ridpath & Brooker 1986) and, judging by its lack of pectoral fat, was in poor health.

Green Ringtails sleep by day, curled in a ball on an open branch, and this animal was probably sighted by the eagle from the canopy or from the road side. What events lead to the predicament in which both eagle and

possum found themselves can only be speculated upon; however, it is notable that the eagle was apparently in a state of shock, unwilling or unable to dislodge the possum and easily captured by a human observer.

Aboriginal lore

Brian Madsen of the Kuku Yalanji people of the Bloomfield to Mossman Rivers region of the Wet Tropics Area, related to SB that his elders told of Wedge-tailed Eagles hunting pademelons and sometimes small children beneath the forest canopy in the days when they were living a traditional existence. This was described as occurring in old growth closed-forest with a very open understorey and was facilitated by eagles making extended down slope glides just above ground level, with the wings outstretched. Successful and unsuccessful but nearly fatal attacks upon children by eagles have been reported in Africa, where human skeletal remains have been collected from nests of the Crowned Eagle *Stephanoaetus coronatus* (Berger & Clarke 1995; Steyn 1992 in Berger & Clarke 1995). Berger & Clarke (1995) also present evidence to suggest that an Australopithecine child whose fossilised remains were found in Southern Africa was killed by a large raptor, if not *S. coronatus*, probably similar to it. This species is not known to scavenge and these cases are most likely to represent predation. The Crowned Eagle is smaller than the Wedge-tailed Eagle in wingspan and weight (Brown & Amadon 1989) and given the prey size range recorded for the latter species, which includes adult kangaroos (e.g. Olsen 1995), it is entirely probable that human children could be fair game for *A. audax*.

Discussion

Although the exact circumstances of each of the observations made by the authors are not known, the fact that they suggest successful hunting by Wedge-tailed Eagles in tropical rainforest is significant. The number of sightings along roads may indicate that eagles are either more prone to hunt along these 'internal edges' and in gaps than below the canopy itself, or may merely reflect where people are most likely to see them. We would suggest that although the latter is certainly true, the former is also the case, and that observations of eagles below the canopy well within the forest are the result of their having dropped prey or espied carrion from above. Historical Aboriginal lore suggests that prior to the disturbance of old growth forest by logging and encroaching edge effects accompanying increased forest fragmentation, Wedge-tailed Eagles did forage beneath the canopy. The openness of the rainforest understorey in some places at the time of first European settlement is alluded to by folkloric tales which hold that horses could be ridden through it (pers. comm. with numerous 'oldtimers' still resident on the Atherton Tablelands). This type of hunting behaviour may be limited today by the scarcity of rainforest with such an open understory. Thus, it seems likely that hunting from the canopy and in gaps (such as roads) is the usual eagle behaviour in a closed-forest context. The observations presented here, combined with our other observations of Wedge-tailed Eagles soaring over the canopy or perched in roadside trees in rainforest, suggest that, in the Wet Tropics Area at least, they may be regular rainforest foragers. Dietary observations at the nests of eagles whose ranges would be expected to incorporate closed-forest habitats would provide very useful information on the extent of foraging within this habitat. The authors would like to take this opportunity to encourage anybody with locality details of nests that come under this category to contact SB.

Given the dietary data presented in Marchant & Higgins (1993) and Hollands (1984) the Wedge-tailed Eagle may be the only homeothermic predator capable of killing large arboreal vertebrates such as tree kangaroos, monitors and possibly pythons in the tree tops. Until nests of birds whose territories incorporate rainforest are found, the extent of rainforest hunting compared to open forest hunting remains unknown, as does the role of large raptors in shaping the structure of Australian rainforest animal communities over time.

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Bird Populations Density in Thinned, Unthinned and Old Lowland Regrowth Forest, East Gippsland, Victoria

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EMU Vol. 96, 280-284, 1996. Received 4-3-1994, accepted 28-3-1996

The response of forest avifauna to disturbance from timber harvesting has been well documented in south-eastern Australia (Pattemore & Kikkawa 1975; Loyn et al. 1980; Loyn 1980; Kavanagh et al. 1985; Recher 1991; Loyn 1993). One major effect of harvesting is the simplification of the forest structure by decreasing the complexity of the vegetation profile (Recher 1991). This shift towards a more homogenous, even-aged stand alters the foraging, nesting and breeding resources available to forest birds and in most cases reduces species diversity and density (Recher 1991). Where alternative silvicultural techniques to clear-felling are used, the changes to the vegetation structure and composition can be more variable (Brown et al. 1991).

The effect on bird populations of thinning regrowth forest — the removal of a proportion of the basal area of regrowth trees in a selected stand with the aim of increasing resources available to the remaining trees and increasing their growth rate — has been examined in Australia and the United States. In East Gippsland, Brown et al. (1991) found a reduction in bird species richness and abundance in sites recently thinned, while in the United States, Wood & Niles (1978) recorded a decrease in the richness and abundance of native pine forest bird species in response to thinning practices that eradicated the understorey and destroyed dead trees.

This survey examined the differences in the density of bird populations between old regrowth, unthinned regrowth and thinned regrowth forest; it was predicted that lower densities would be recorded in the the regrowth forest types. Other components of this study examined the responses of reptiles (Kutt 1993), arboreal mammals and nocturnal birds (Kutt 1994) and microchiropteran bats (Kutt 1995).

Five sites were surveyed in state forest 50 km east of Orbost, East Gippsland, Victoria. Within these sites, three types of forest stand were examined: 25-35 year-old regrowth coupes thinned between 1988–92 (hereafter thinned), 25-35 year-old regrowth coupes (hereafter unthinned) and old regrowth forest that was only selectively logged approximately 50 years ago (hereafter old). Bird censuses were conducted between 7 January 1993 and 14 March 1993, along 200 m fixed-line transects, placed through a representative area of the selected coupe. Transects were at least 100 m from the boundary of adjacent coupes to minimise edge effects. A total of 11 thinned, ten unthinned and five old forest transects were available for sampling. Each tran-