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FURTHER OBSERVATIONS ON THE BREEDING BIOLOGY OF THE POWERFUL OWL *Ninox strenua* IN SOUTH-EASTERN AUSTRALIA

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This paper describes significant new information on the breeding biology of the Powerful Owl *Ninox strenua* from Victoria and New South Wales. The observations were made in areas of eucalypt forest within the urban fringes of major cities (Melbourne and Sydney) and in more secluded forest near Eden in south-eastern NSW.

A banded first year female Powerful Owl dispersed from her birthplace to mate with a recently widowed, neighbouring male at a nest site 900 metres from her birthplace. She layed eggs at twelve months of age, and successfully reared two young in the nest used by her predecessor during the previous year. This is the only documented case of a banded nestling Powerful Owl being found outside its natal area. Evidence is presented to suggest that males may be responsible for selecting nest sites. Two instances are reported of males raising chicks following the death of their mates. Recently widowed males at three sites were observed to pair opportunistically with new females, including one case where murder was suspected. On several occasions, non-breeding floaters were observed in the territories of established breeding pairs.

INTRODUCTION

The breeding biology of the Powerful Owl *Ninox strenua* has been intensively studied (Fleay 1979; Hyem 1979; Hollands 1991; Traill 1993; Pavey *et al.* 1994; McNabb 1996; Kavanagh 1997, 2004; Cooke 2000) but several aspects are still poorly known. For example, Fleay (1979) reported that captive Powerful Owls do not reach reproductive maturity until nearly two years of age, possibly later in the wild. Further, Debus and Chafer 1994 suggested that breeding might be even later due to a need for males to acquire hunting experience. Little is known about the dispersal and recruitment of young, and there have been no previous recoveries of adult Powerful Owls that were banded as nestlings (Australian Bird Banding Scheme data). This paper documents the first and only finding of an adult Powerful Owl that was banded as a nestling. It also presents new data on opportunistic pairing, nest selection and the possible murder of one Powerful Owl by another.

The occurrence of non-breeding 'floaters' in the territories of breeding pairs has not been documented for Powerful Owls, but is generally recognised as a potentially significant albeit unknown component of the population structure for many birds (e.g. Olsen 1995). The presence of floaters could serve to facilitate the re-establishment of breeding pairs after the loss of one member.

Earlier research by Fleay (1979) suggested that Powerful Owls might remain unmated for many years after one of a pair disappears (i.e. probably dies). Also, Hyem (1979) reported a widowed male called each autumn for 6 – 7 years apparently without finding another mate. Conversely, Pavey *et al.* (1994) reported a recently widowed female apparently pairing with a new male within 80 days and subsequently breeding in the next season. More recently, Cooke (2000) reported two incidents of males finding a new mate and breeding again within the following breeding season. Further evidence is presented here that supports the growing realisation that establishment of a new pair bond may be opportunistic rather than selective. The male has been reported to play a major role in nest hollow selection and preparation (Hollands 1991), suggesting that he also selects the nest tree location. New evidence is presented here that supports this finding.

Infanticide ('Cain and Abel') by older, larger nestlings over younger, smaller siblings is well known for many diurnal raptors (e.g. Edwards and Collopy 1983; Olsen 1995) and has also been reported for the Powerful Owl (Webster *et al.* 1999). However, murder of one member of a breeding pair by another adult, which is known among Australian owls for the Southern Boobook *Ninox novaeseelandiae* (Olsen *et al.* 2002), has not been reported for the Powerful Owl.

BACKGROUND

Two of us (McNabb and Craig) have been conducting a long-term study of the Powerful Owl in southern Victoria since 1984, while the other (Kavanagh) has been independently studying the biology and ecology of these owls in New South Wales, particularly near Sydney and Eden. An element of the Victorian study has been the banding of nestlings at various sites around the Greater Melbourne area. Since 1997, powder-coated coloured stainless steel bands (Australian Bird and Bat Banding Schemes) have been trialed to assist in identifying individual birds by observation. Altogether, 59 nestlings have been banded, including 14 with powder-coated bands. The observations in southern Victoria were made at Yellingbo State Fauna Reserve (37°50'S, 145°29'E) and Lysterfield Lake Park (37°58'S, 145°22'E). The observations in New South Wales were made in the northern suburbs of Sydney at Cumberland State Forest (33°45'S, 151°02'E) and Devlins Creek, Lane Cove River National Park (33°45'S, 151°05'E) and at Bruces Creek, Bruces Creek State Forest (37°21'S, 149°45'E) and Ludwigs Creek, Nadgee State Forest (37°19'S, 149°48'E) near Eden.

At Lysterfield Lake Park, Quinn (1993) reported two pairs of Powerful Owls roosting approximately 250 metres apart in the same gully. Since then, we (supported by other observers) have located and monitored the roosts and nests of both pairs every year. The two pairs nested each year 800–900 metres apart in neighbouring gullies (Fig. 1). Nestlings were banded at the nests of one or both pairs in nine breeding seasons since 1994.

The individual owls at Lysterfield Lake Park (see Fig. 1) are identified herein as:

Wm = male nesting in the western gully

Wf = female nesting in the western gully

Em = male nesting in the eastern gully

Ef = female nesting in the eastern gully

Wjf = juvenile female reared at nest D in the western gully.

OBSERVATIONS

Lysterfield Lake Park, Vic.

Two pairs of Powerful Owls were each observed nesting in hollow trees, 900 metres apart, in neighbouring gullies during winter 2000 (nests D & E, Fig. 1). Both of these nests were monitored with the intention of banding the chicks. However, by 10 August the eastern nest (E, Fig. 1) was abandoned for unknown reasons and these owls were not seen again in 2000. Two chicks at the western nest (D, Fig. 1) were colour-banded on 19 August 2000 at an estimated age of seven weeks.

Both nest sites (D & E, Fig. 1) were used again during 2001. At the eastern nest (E), the adult female, assumed at the time to be Ef, was photographed delivering prey to the nestlings on 23 August 2001. Subsequent examination of the photograph revealed that the adult female was wearing a dark blue band on her right leg. This identified her as Wjf, a bird that was banded at the western nest (D) one year earlier (19 August 2000), five days prior to fledging. Fledging occurs at eight weeks of age (McNabb 1996) hence this bird is estimated to have hatched on or around 29 June 2000. Her two chicks were banded at nest E on 20 September 2001 and fledged on 25 September 2001. Fledging is reported to occur at a median 97 (range 93 – 103) days after laying (McNabb 1996) hence the subject female owl (Wjf) began laying her first clutch on or about 22 June 2001. Therefore, she was approximately 11 months and three weeks old and obviously reproductively mature when her first clutch was layed. The other female (Ef) was then assumed to have died during the previous nesting season or, alternatively, may have been driven off (or murdered?) by the younger owl, Wjf, at the commencement of breeding season 2001.

In 2002, Em & Wjf (identified again by the blue leg band) nested in a different tree 300 metres from their previous nest. This was a site used previously by Em & Ef from 1994–1997 (Site A, Fig. 1). Two chicks fledged from this nest in the first week of October 2002.

Yellingbo State Fauna Reserve, Vic.

On 11 September 1996, the adult female was found dead beneath a regular roost beside her nest tree while two young were still in the nest. Post mortem examination by veterinarians at Healesville Sanctuary revealed severe haemorrhage and bruising around the atlanto-occipital joint, indicating a severe blow was delivered to the back of the owl's head whilst she was roosting. Both young fledged, however, one of them was also found dead (decapitated) near the nest a few weeks after fledging. The male parent at this site successfully raised the surviving owlet, found a new mate prior to the next breeding season, and raised two chicks the following year in the same hollow as used in the previous year by the male and his previous mate.

Cumberland State Forest, Sydney, NSW.

Powerful Owls were first recorded breeding in Cumberland State Forest, West Pennant Hills, in 2000 (Kavanagh 2004), although individual birds have been seen roosting there on occasions over the previous 20 years (Kavanagh pers. obs.). While one young fledged in 2000, it died nearly three months later (in November) and the 2001-nesting attempt failed. Thus, there was no previous history of young produced in the known nest tree. On 8 April 2002, the adult female was found injured (by a car) approximately 500 metres west of the nest site. The bird (1436 g) was taken into care and later released, wearing a leg band, near the nest site on 26 May 2002 in the presence of the adult male who was calling nearby. The injured bird had suffered a damaged wing, from which it never fully recovered, and it was thereafter recognisable by its drooping wing and metal leg band. Over the following 10 months, the injured bird was seen roosting at one of its regular roost sites on many occasions, including at least three times when it was seen roosting with the male (26 September, 3 October, 7 November). The bird was apparently capable of hunting (although it could have received prey from the male) because it was seen at its roost holding a captured Common Ringtail Possum *Pseudocheirus peregrinus* on at least one occasion (12 February 2003). Nesting did not occur in 2002, or if it did it was unsuccessful.

On 24 March 2003, the banded female was found dead approximately two kilometres south-east of the nest site. According to the finder, the bird had been 'ripped apart' but the body was unavailable for later inspection. Three days earlier (21 March), two Powerful Owls were seen roosting together at the regular roost, but it was not known if one of them was the injured bird. Then, on 12 and 16 May 2003, two adult Powerful Owls were seen roosting together in the usual roost tree, indicating that the male had found a new mate. At dusk on 2 June 2003, the new female was observed flying out of the previously used nest hollow, indicating that she had begun nesting in the old nest tree.

Devlins Creek, Sydney, NSW.

The Powerful Owls at Devlins Creek near North Epping are probably the best-known pair in Sydney and have bred successfully almost every year since at least 1990 (Kavanagh 2004). On several occasions, including 19 November 1991 and 4 December 1991, five birds, including three adults and two juveniles, were seen roosting together in adjacent trees, indicating tolerance of a non-breeding floater (possibly female) by a breeding pair. Occasionally, at Devlins Creek and elsewhere, solitary birds (presumably floaters) have been seen roosting in other parts of the territory when the adults have been roosting near the nest tree.

Bruces Creek, Eden, NSW.

On 13 August 1996, a female Powerful Owl with adult plumage (possibly a subadult) was trapped, banded and radio-tagged near Bruces Creek, approximately 40 km south of Eden. This bird was radio-tracked for over eight months (until 23 April 1997) during which time it utilised a home-range of approximately 800 hectares (Kavanagh 1997). It was regarded as

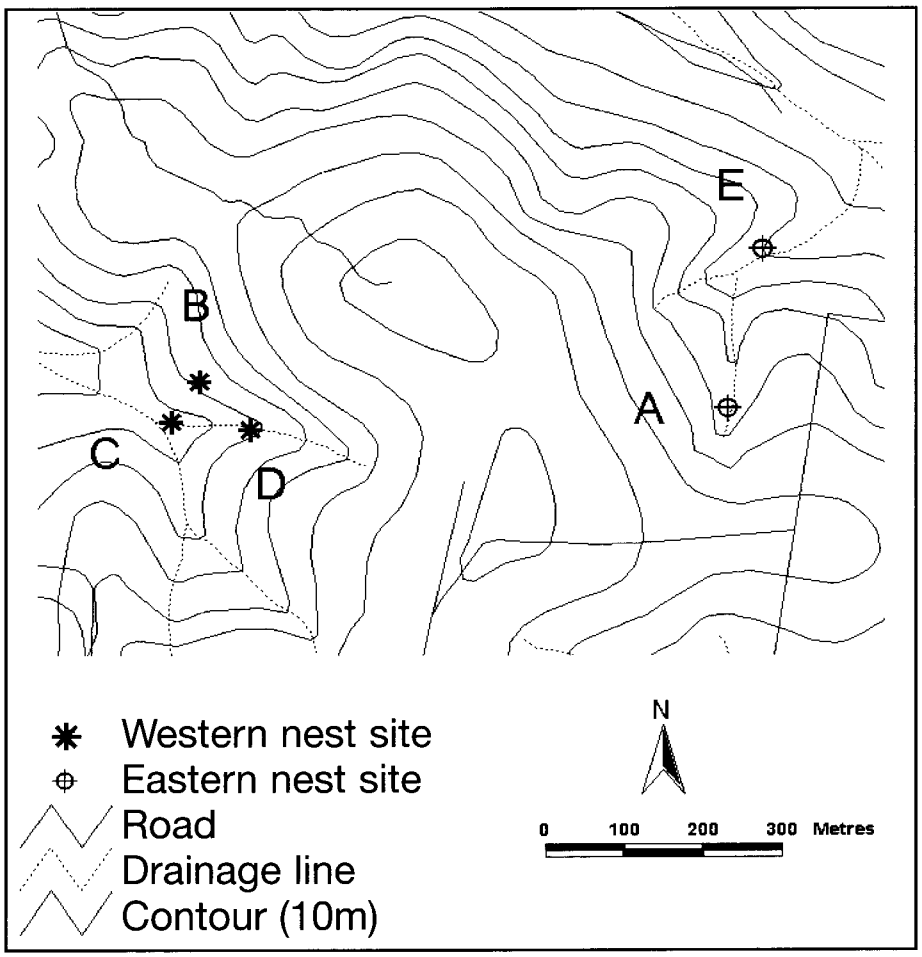

Figure 1. *Powerful Owl nests at Lysterfield Lake Park (37°58'S, 149°45'E), Victoria 1994 –2001. Years each site was used (eastern gully, western gully; nd = no data, probably did not breed): 1994 and 1995 - A, B; 1996 and 1997 - A, D ; 1998 - nd, nd; 1999 - nd, C; 2000 and 2001 - E, D; 2002 - A, nd.*

a subadult floater because this owl called rarely and there was another territorially-calling pair occupying much of the same home-range. The three owls were never seen roosting together although they shared similar roosting locations. On at least one occasion, a fourth (male) owl was heard calling and apparently associating with the tagged bird, only to be chased off by the calls of the dominant pair in the territory as they approached. This 'intruder' retreated, calling as it left, over a distance of more than one kilometre while the tagged bird did not move.

Ludwigs Creek, Eden, NSW

On 26 August 1996, an adult female Powerful Owl was trapped, banded and radio-tagged at Ludwigs Creek, approximately 40 kilometres south of Eden. At the time of capture, this owl was nesting with at least one recently hatched owlet in the nest hollow. One owlet fledged from the nest on about 1 October 1996. All was proceeding well until 21 November 1996 when the radio-tagged adult was found dead on the ground below a roost tree. A veterinary post-mortem showed that this owl had been in excellent health, and death was attributed to a massive haemorrhage caused by a sudden blow to the back of the head. Given that very windy conditions prevailed at the time, it was assumed that this owl was killed by a falling branch or dead stick that hit the bird on the back of the head. A subsequent visit to this site about three weeks later in December 1996 re-located the male and the owlet, indicating that the male had continued to raise this owlet on his own.

DISCUSSION

Reproductive maturity

This report describes the only banding return to date, of a Powerful Owl that was banded as a nestling and successfully dispersed from the natal territory (Australian Bird and Bat Banding Scheme data). These observations show that female Powerful Owls are capable of breeding when less than one year old (*contra* Fleay 1979; Debus and Chafer 1994) and suggest that earlier reports of failure to breed by first year captive birds (Fleay 1979) may not reflect the breeding patterns of birds in the wild.

Widowed males finding new mates

Although the fate of the female (Ef) at Lysterfield Lake Park is not known, it is assumed that she died, and this must have occurred sometime between August 2000 and August 2001. In southern Australia, young Powerful Owls are dependent on their parents for food until at least the end of January, thereafter most appear to disperse from their natal territory in late summer or early autumn and adults begin to court during March-May (Hollands 1991; McNabb 1996; Kavanagh pers. obs.). Therefore, it is reasonable to assume that the young female (Wjf) arrived in the widowed male's territory some time between January and May, and these owls paired up sometime between one and ten months after the male (Em) was widowed. At Cumberland State Forest in 2002, the male called for long periods on many nights without attracting a new mate during the

seven weeks that his mate was recovering from injury, despite the fact that this was in the main season for courting (April – May). When she was released, the male appeared to accept her back immediately. In contrast, in the following year, this male found a new mate within seven weeks of the death of his partner.

It is difficult to detect the presence of non-breeding floaters in owl territories, but the observations reported here suggest that there may be a ready source of replacements in some territories in the event of misadventure by breeding birds. Furthermore, the high fledging success for many pairs of Powerful Owls (Kavanagh 2004), and the likely low adult mortality of this long-lived species, suggest that it may not be difficult to find new mates when required.

These observations support the view that widowed male Powerful Owls may not necessarily be selective in accepting a new mate (*contra* Fleay 1979). Our observations suggest that the time taken to select and accept a new mate probably depends largely on the availability of potential mates. In the Lysterfield case, the newly independent owlet would have easily heard the neighbouring male's calling before she began to disperse and had less than a kilometre to travel in response. Thus, the recently widowed male (Em) at Lysterfield apparently also paired up with the first available female (Wjf). The three cases described here are of widowed males and we have only one record of a female becoming widowed. This was a female at Olinda, Victoria (37∞51'S, 145∞23'E), widowed in 1979 but still without a mate in the following breeding season (McNabb 1996). It would be interesting to know if females accept new mates as readily as males apparently do. The report by Pavey *et al.* (1994) suggests this may be the case.

The fatal injury to the Yellingbo female was suspected to have been inflicted by a diurnal bird such as a Raven *Corvus* sp. or Magpie *Gymnorhena* sp. Both species are known to vigorously attack and in one case kill a Powerful Owl (McNabb pers. obs.). Little Ravens *C. mellori* were nesting close to the owls at the time. While fatal injury caused by a diurnal bird cannot be ruled out in the case of the Ludwig's Creek female, the prevailing windy conditions suggested that the death of this owl was more likely due to a falling branch or dead stick. The circumstances of the death of the injured female at Cumberland State Forest are also uncertain, but the rapid replacement by another adult female suggests the possibility that the old female was murdered by the new female or by the male. Such an instance has been documented for the Southern Boobook (Olsen *et al.* 2002) but not previously for the Powerful Owl. With the approach of the new breeding season, it is possible that the male knew his injured female was unlikely to breed successfully.

Nest site selection

There are several alternative large, hollow-bearing trees near each of the nest trees used by Em & Wjf. Because Em and his previous mate (Ef) had nested in each of the hollows used by Em & Wjf, and this was not her natal territory, the young female Wjf was unlikely to have been familiar with either of the nest sites used by her predecessor. Thus, it seems likely that in these two cases, the male selected the nest site. Further support for the key role of the male in selecting the nest site comes from the Cumberland State Forest owls. In 2003, the new female was observed using the favourite roost tree of her predecessor and she was also observed using the same nest hollow. It seems unlikely that, within such a short time, she would have located and used these unfamiliar trees unless the male showed her. We cannot discount the possibility that territorial familiarity is the key point and that widowed females might also show new males the locations of previously used nest trees in the territory. However, given the two instances reported here of widowed males successfully raising young chicks, it is clear that the male plays an important role in the breeding biology of this species.

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