

## Supplementary Notes on the Breeding Behaviour of Wedge-tailed Eagles *Aquila audax*

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### Summary

Aspects of territorial and courtship displays, breeding behaviour, nest defence and reaction to human disturbance are described for the Wedge-tailed Eagle *Aquila audax* in parts of southern Australia. Included are a description of a display by a pair that flagged the site of a future nest, and an account of nest abandonment after a focal dead tree in the nesting territory, near the nest-tree, was removed. The latter incident suggests that such focal perching trees, in addition to the nest-tree, might be a component of territory quality. However, the Eagle is notoriously sensitive to disturbance, especially early in the nesting cycle.

### Introduction

The breeding and territorial behaviour of the Wedge-tailed Eagle *Aquila audax* has been described reasonably comprehensively, although there are still gaps in knowledge of, for instance, the process of nest-site selection (cf. Brooker 1974; Hughes & Hughes 1984; Marchant & Higgins 1993; Olsen 2005; Debus *et al.* 2007). This paper addresses some of the gaps by collating behavioural observations on territorial and nesting Eagles incidental to the studies by SC and AF reported elsewhere (Foster 2001; Cherriman 2007, 2009, in prep.; Foster & Wallis in press a,b), or obtained casually by SD on individual Eagles previously studied (Debus *et al.* 2007). We also discuss factors affecting nest-sites and breeding success of some of the pairs studied by Debus *et al.* (2007).

### Study areas and methods

Seven active nests (of six pairs of Eagles, of which five pairs were monitored closely) were studied by AF in the Bacchus Marsh district of southern Victoria in 1999–2000. Five Eagle pairs were studied by SC in the outer Perth area of Western Australia in 2004–06. Observations were conducted across all months of the year, during the course of studies of nest-site characteristics, breeding chronology and diet; the study sites are described elsewhere (Foster 2001; Cherriman 2007, 2009, in prep.; Foster & Wallis in press a,b). Pairs and nest-sites of Eagles studied by Debus *et al.* (2007), in the New England region of New South Wales in 2005, were visited casually by SD in 2006–08, notably Armidale Pair 3 and Tamworth Pair 1 (see Debus *et al.* 2007 for description of study sites). Behavioural observations at nests were conducted remotely, with binoculars or telescope, and prey remains were collected from under nests when it was considered that the eagles would not be disturbed or eaglets were not at risk.

## Results

### *Bacchus Marsh district, Victoria*

At Bacchus Marsh, aerial displays generally began around April and continued throughout the breeding season. The most common aerial display observed was undulating dives, or 'pot-hooks', with loss of altitude as the series progressed, as described by Brooker (1974), Marchant & Higgins (1993) and Olsen (1995, 2005). On one occasion, an Eagle (presumed male) performed repeated pot-hooks on a diagonal path for ~40 minutes while his mate soared at great height nearby. Each time, the male performed the undulating display then soared back to his starting position, to repeat the same manoeuvre along the same line over the same area of land. This performance appeared to delineate a territorial border to neighbours, although no other Eagles were observed at the time, and was similar to behaviour along territorial boundaries as described by Brooker (1974).

Rolling and foot-touching courtship flights by resident pairs of Eagles were observed on several occasions. In most instances, the presumed male initiated the process by approaching the female from above, with feet extended. As he drew near, the female rolled and presented her claws and the pair touched feet briefly (<5 seconds) before breaking away. No talon-grappling between residents and interlopers, or 'cartwheeling' with locked claws, was observed.

At one nest, in a public reserve frequently disturbed by people, the parent Eagles always left the nest when approached by the observer. On several occasions, upon leaving, these Eagles circled on a course that overflew AF's observation position from behind. This behaviour was most noticeable on sunny days when the Eagles' shadows passed over the observer, suggesting that the Eagles were deliberately watching the observer from his 'blind spot' (i.e. from out of the sun, and out of his visual field).

After leaving the nest, fledgling Eagles spent several days perching and gliding between trees around the nest-site, then they left the immediate area and followed their parents around the territory. Further details were not obtained, but the fledglings' behaviour was apparently similar to that reported by Debus *et al.* (2007). Also in the Bacchus Marsh district of Victoria, an adult female Eagle was observed carrying a dead Rabbit *Oryctolagus cuniculus* to a dependent juvenile; the female dropped the prey to the juvenile in flight, and the juvenile followed it down and pounced on it as it hit the ground (D. Whelan pers. comm. to SD). This episode recalls that of a female Eagle dropping a dead Rabbit into the nest, for her near-fledged eaglet (which pounced on it), as she alighted (Debus *et al.* 2007). These activities seem like 'training' of juveniles to hunt, but may simply be the female avoiding bodily contact with a boisterous, hungry juvenile that might snatch prey in her grasp and possibly injure her.

### *Perth, WA*

Around Perth in three consecutive years, nests in one territory were lined with leaves but not used for breeding. In June 2002, a new nest was continuously lined with fresh leaves until late August. The adults were often seen perched on it and, on one occasion, they fed on a freshly killed Australian Wood Duck *Chenonetta jubata*. However, no eggs were laid. Then, in early September, another nest was constructed but not lined, and subsequent observations of the Eagles in 2002 were of the pair soaring high on thermals, often several kilometres from the nest

area. In late May 2003, both adult Eagles were observed alternately adding large branches to this second nest, and by late July the nest was freshly lined with leaves, but by early September no eggs had been laid. Throughout June 2004, there was no activity at any known nest in this territory. However, in early August an adult Eagle was seen with fresh eucalypt sprigs on an apparently old nest that had not been used for many years. Once again breeding did not take place, despite continuous lining of this nest throughout the laying season. Breeding was then recorded in 2005 at a third new nest, freshly built ~8 km west of the previous nests, and used to rear one offspring.

This pair's breeding attempts may have been disrupted by continuous human disturbance. On numerous observation visits to this territory, many illegal four-wheel-drive vehicles and trail-bikes were encountered, some of which were used for long periods on a track ~100 m from the initial new nest. Additional disturbance may have been caused by the observer finding and occasionally approaching the nests in this study. However, on most occasions the Eagles were observed with binoculars from >400 m away, and the fact that normal eagle behaviour (e.g. nest-building and feeding) was witnessed during visits when no recreational vehicles were encountered, suggests that the Eagles were not affected by a lone person in their territory.

A different pair of Eagles may have built and used the final nest, given its distance from the other nests, or the same pair may have nested in another part of their home-range far from their previous encounters with humans. However, the successful nest was ~200 m from a public quarry used frequently by abseiling groups, and only 800 m from a residential area: far less remote than the location of the other nests.

Around Perth, the adults usually soared high above the nest while the observer collected prey remains from below it and perch-trees. One exceptional female was highly protective of the nest-site on several occasions. She often remained at the nest when it was approached, and flew from the nest-tree and followed the observer closely, perching in trees above and calling continuously. On two occasions she disappeared from view, soared high for several minutes, then performed a series of dives from ~100 m in the air directly at the observer with wings folded in, alulae prominent and legs fully extended.

### *New England, NSW*

In summer 2006–07, Armidale Pair 3 had a new nest, built at the site where the display behaviour described by Debus *et al.* (2007) had taken place earlier (in autumn) in 2006. That is, before the nest was built, the female was perching on the future nest-branch while the male performed a 'pendulum' undulating display about her position. Although it was not clear which came first—selection of the site or the male's aerial display (which might have influenced the site choice)—the combined behaviour of the pair certainly flagged the position of the future nest.

Armidale nest 1 (on private land subject to routine grazing management) was not used after successful breeding in 2005, although the Eagles successfully bred in another nest in 2006 and 2008. It is suspected that the two inadvertent intrusions by an observer to within 60 m, that resulted in the female flushing off the egg(s) and chick in 2005 (Debus *et al.* 2007), caused a shift in nest-site in the following year. The 2005 nest has not been refurbished since, and has continued to deteriorate.



**Wedge-tailed Eagle swooping observer, Blue Mountains, NSW, September 2009**

Plate 26

Photo: Steve Tredinnick

Armidale nest 2 (in a locked reserve) was used again in 2006, after the female had been inadvertently flushed once from large downy chicks in 2005 and the nest-site was visited occasionally during the ensuing fledgling period (cf. Debus *et al.* 2007). This pair was unsuccessful in 2006, having already failed by the hatching stage when first checked. Since then, the nest-site was checked, or passed by walkers, occasionally until June 2009, but it has never been used or seen to be attended or lined, since 2006. This situation may be attributable to failure in 2006 (cf. Olsen 1995) and/or subsequent occasional human intrusion.

In 2007, the known nest of Tamworth Pair 1 (used in 2004 to 2006 inclusive: Debus *et al.* 2007) was unused, and in 2008 it was derelict. In 2008, the dead tree 40 m from the nest, used by the pair for perching and copulating and by the new fledglings, was found to be cut down and removed, presumably for firewood, some months earlier (from the well-weathered stump, possibly even before or during the 2007 season). Thus, loss of a key resource, and/or the disturbance of chainsawing, loading and transporting it within 50 m of the nest, apparently led to abandonment of the site, even though the sitting female had been tolerant of passing road traffic within 30 m.

In 2007, the known (live) nest-tree of Tamworth Pair 2 had fallen over, exemplifying the vulnerability of isolated paddock trees to storm damage.

Another Eagle nest in the region had been active, on private grazing land within <100 m of a quiet (unsealed) back road remote from farmhouses. However, after the nest became known to birdwatchers, a passing observer stopped and approached the active nest, whereupon one of the attending adult Eagles became agitated and 'screamed' at the observer. This nest was unused in subsequent seasons, apparently abandoned.

## Discussion

The observations herein generally confirm and enlarge a little on previous information. The territorial and courtship behaviour observed in Victoria was consistent with that previously recorded for the Wedge-tailed Eagle (cf. Brooker 1974; Marchant & Higgins 1993), and for large *Aquila* eagles in general (e.g. Brown 1976; Ferguson-Lees & Christie 2001). Elements of eagle display include conspicuous perching near the nest and aerial displays, but the combination of male 'pendulum' display about the perched female, at a future nest-site, has not been specifically mentioned as a behavioural component of nest-site selection for Wedge-tailed Eagles. It was not clear whether the female chose the site and advertised it by perching there, or whether the male showed her a suitable site by displaying over it. Either way, such behaviour by a pair may be a useful clue to the location of a new nest at the start of the building season.

Wedge-tailed Eagles may spend some time 'settling in', building nests but not yet breeding, if a newly formed pair has taken up residence in a vacant territory (as possibly with the pair near Perth). The observation that both adults build the nest is consistent with previous information (Marchant & Higgins 1993; Olsen 2005; Debus *et al.* 2007), *contra* Hughes & Hughes (1984) who observed only the female to carry branches to the nest. Wedge-tailed Eagles and other large aquiline eagles sometimes build and line nests but do not breed in that year, or line more than one nest in the territory before breeding (e.g. Brown 1976; Marchant & Higgins 1993; Olsen 1995, 2005).

Most pairs of Wedge-tailed Eagles near Perth were shy and unapproachable at the nest, as is usual for this species (Olsen 2005). Defensive behaviour by one female near Perth was unusual, and rarely recorded for the Wedge-tailed Eagle (cf. Cupper & Cupper 1981; Marchant & Higgins 1993; Olsen 2005). Aggressive defence of the nest-site may occur if an Eagle has become habituated to humans and is aware of intentional nest disturbance by them, but may also occur in regions remote from humans (Cupper & Cupper 1981).

Reaction by *Aquila* eagles to disturbance varies, and habituation may occur over time. Spanish Imperial Eagles *A. adalberti* sometimes react to disturbance <450 m from the nest, though are less often flushed by passing people than by other disturbances such as campers and hunters (González *et al.* 2006). Some pairs of Wedge-tailed Eagles habituate to routine human activities near their nests, even at distances of ~100 m (Debus *et al.* 2007; Fuentes *et al.* 2007). The apparently unsettled nesting behaviour of the Wedge-tailed Eagles near Perth may have resulted from a combination of territorial behaviour, fluctuations in prey numbers and human disturbance, and requires further study to quantify these factors and determine which most influence eagle behaviour and breeding success.

The history of nests in our studies suggests that some pairs may be sensitive to human intrusion and readily abandon nests even after minimal disturbance, as is well known for the Wedge-tailed Eagle (Mooney & Holdsworth 1991; Marchant & Higgins 1993; Olsen 2005; Collins & Croft 2007; Silva & Croft 2007; Bekessy *et al.* 2009). Even removal of a dead tree in a nesting territory, if used as a focal perch near a nest-tree, may render a nest-site less desirable and hence lead to desertion, although in the case herein the removal may also have taken place during the breeding cycle. A prominent dead tree near the nest-site is a common feature of some medium-sized and large raptors (SD pers. obs.), and should be considered a potentially important resource during assessments of potential impacts on threatened species.

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**Footnote:** The photograph fortuitously accompanying this paper is of an adult female Eagle that repeatedly swooped at humans on a mountain top, by diving at intimidating speed, screaming, with feet lowered and a whoosh of wings, as she passed overhead within centimetres. After several passes she departed with her mate, which had kept his distance. There was no eyrie obviously close by (per S. Tredinnick).