Corella, 2007, 31(3/4): 65–72

DIET, OCCUPANCY AND BREEDING PERFORMANCE OF WEDGE-TAILED EAGLES *Aquila audax* NEAR CANBERRA, AUSTRALIA 2002–2003: FOUR DECADES AFTER LEOPOLD AND WOLFE

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Received: 15 December 2006

We compared the diet and breeding performance of Wedge-tailed Eagles *Aquila audax* near Canberra in 2002–2003 with that found in the same area in 1964 by Leopold and Wolfe (1970). We located a total of 44 active territories, and checked 26 of the 32 territories originally found by Leopold and Wolfe. Twenty-two (85%) of the 26 were still occupied after nearly four decades. Contrary to what was found in the 1964 survey, nine active nests were located inside the city limits, with an average distance to paved roads of 720 ± 132 metres (range 130–1 270 m) and to suburbs of 1 117 ± 251 metres (range 260–2 000 m). Four nests were less than 500 metres from houses, but only one territory was completely surrounded by urban areas.

Fledgling rates were greater in 2002–03 than in 1964 (1.1 versus 0.8 young per territory) mainly because more pairs fledged two young in the 2002–2003 survey, and there was a decrease in the number of pairs that fledged no young.

In 2002–2003, 492 prey items were recorded from 33 territories. Fifty-seven different species were found: 19 mammals, 20 birds, seven reptiles and one crustacean. Mammals and birds were the dominant groups by number, 54.7 and 41.9 percent respectively, and mammals dominated by biomass (95.3%). The breeding diet in 2002–2003 was dominated by macropods, representing 19.9 percent (n = 98) of the total items and 45.6 percent of biomass. The most important species among these macropods was the Eastern Grey Kangaroo (13.6 and 31.2% by number and biomass respectively). Other important items were the European Rabbit (16.9 and 9.5% by number and biomass) and adult sheep (3.3 and 19.7%). Among birds, the parrots and cockatoos, Order Psittaciformes, represented 12.8 percent of the total items, but their contribution to the biomass was negligible (1.1%). The Galah (5.1%, n = 25) and Australian Magpie (6.1%, n = 30) were the most important bird prey species.

The proportional contribution of the different prey categories was significantly different between the two time periods. Three groups decreased significantly: European Rabbit (43.8% in 1964 v 16.9% in 2002–2003), Hare (15.8 v 7.9%) and lamb (8.9 v 1.8%); and three others showed significant increases: macropods (1.9 v 19.4%;), parrots (3.5 v 10.9%) and Other Birds (4.6 v 17%).

As long as the current high levels of diverse prey are available for the eagles near Canberra, it is likely that the population will remain stable, and young fledged per territory will remain high.

INTRODUCTION

The Wedge-tailed Eagle *Aquila audax* is one of Australia's best-studied raptors (Marchant and Higgins 1993). Near Canberra in 1964, 66.7 percent of 15 territories (defined as a pair with nest and eggs) fledged a mean of 0.8 young per territory and 1.2 young per successful nest (= brood size: Leopold and Wolfe 1970). Diet consisted largely of European Rabbits *Oryctolagus cuniculus*, about 46 percent of the total number of items. Brown Hares *Lepus capensis* were the next most important species, followed by birds, sheep and lambs *Ovis aries*, small mammals, and lizards. Mammals accounted for 78 percent of *A. audax* diet near Mildura, Victoria and all but three percent of this was rabbit (Baker-Gabb 1984). In Western Australia 52–95 percent of the items in the diet were mammals (Brooker and Ridpath 1980), similar to that found for central Australia (79% – Aumann 2001), and on the Northern Tablelands of NSW (76% – Debus and Rose 1999).

To determine if breeding parameters and diet of Wedge-tailed Eagles had changed since 1964, we studied breeding eagles in the same area in the 2002 and 2003 breeding seasons, including many of the territories surveyed by Leopold and Wolfe (1970). In this paper we report the occupancy, reproductive success and breeding diet of the eagles, and compare our findings with those reported by Leopold and Wolfe. We also evaluated the 2002 and 2003 occupancy of the territories reported in the 1964 survey and document the establishment of new territories.

METHOD

Study Area

The study area incorporated the Australian Capital Territory (ACT) and bordering areas of New South Wales (NSW)(Figure 1). The northern part of the ACT is mostly covered by the city of Canberra, while the outskirts of the city and surrounding areas of NSW are mainly farmland. Most of the undeveloped hills and ridges in and around urban Canberra are protected nature reserves that, together, cover an area of 5 720 hectares. The major vegetation associations in these reserves are dry sclerophyll forest, open savannah and woodland. Two protected corridors run along the Upper Molonglo and Murrumbidgee

rivers, up to four kilometres wide and along the full length of the Australian Capital Territory (66 and 18 km respectively). The vegetation here is dominated by River She-oaks *Casuarina cunninghamiana*, Scribbly Gum *Eucalyptus rossii*, Brittle Gum *E. mannifera*, Red Stringybark *E. macrorhyncha* and Blakely's Red Gum *E. blakelyi* woodland, and Red Box *E. polyanthemos* and Yellow Box *E. melliodora* in more open areas (NCDC 1988). The understorey has abundant tussock grasses (Poa spp.), with the shrub *Cassinia longifolia* dominating more open areas. The Namadgi National Park (106 000 ha) covers much of the rest of the southern end of the study area. The habitat in the Park is mainly wet sclerophyll forest, dry forest with open grassy valleys in the lower elevations, and alpine woodland in the higher areas. (A more complete description of the habitat and climatic parameters can be found in Taylor and COG 1992.) During the period of study, the region was under severe drought.

Survey and Reproductive Parameters

During July–December 2002 and June–November 2003, we searched suitable habitat in the study area to locate as many eagle territories as possible, and visited most territories located in the previous survey (Leopold and Wolfe 1970) to assess occupancy. We used a global positioning system to fix the location of nests found and to measure the distance to roads, suburbs and urban limits when it was impossible to take these measurements in the field (mean accuracy 5.7 ± 1.1 m). A Bushnell Yardage pro-1000 laser rangefinder with an accuracy of ± 1 metre was used to take the same measurements directly in each location when suitable.

The located occupied territories were monitored monthly during the breeding season (July–February) to assess the pair's reproductive status. Following Steenhof (1987), we defined an occupied nesting territory as an area containing one or more nest within the home range of a pair of eagles. A pair was considered active or breeding only if eggs were laid. When egg-laying could not be confirmed, an adult observed in incubating posture on at least two occasions constituted evidence of breeding activity. Successful pairs were those in which at least one young reached fledging age.

Diet

Prey Collection and Analysis

We estimated diet by analysing pellets and prey remains collected during the breeding season from inside and under nests and roosts. Some observations of prey deliveries or kills were also included, after we confirmed that these items did not show in the following prey collection. Pellets and remains were stored separately, and each pellet was placed in an individual zip-lock bag.

Quantitative and Statistical Techniques

We identified and counted body parts to estimate the minimum number of prey items (MNI) in a pooled sample of pellets, prey remains and observations in order to minimise biases in the food estimations (Collopy 1983; Seguin *et al.* 1998; Simmons *et al.* 1991). We did not assume that one pellet represented one individual prey item. Feathers were identified

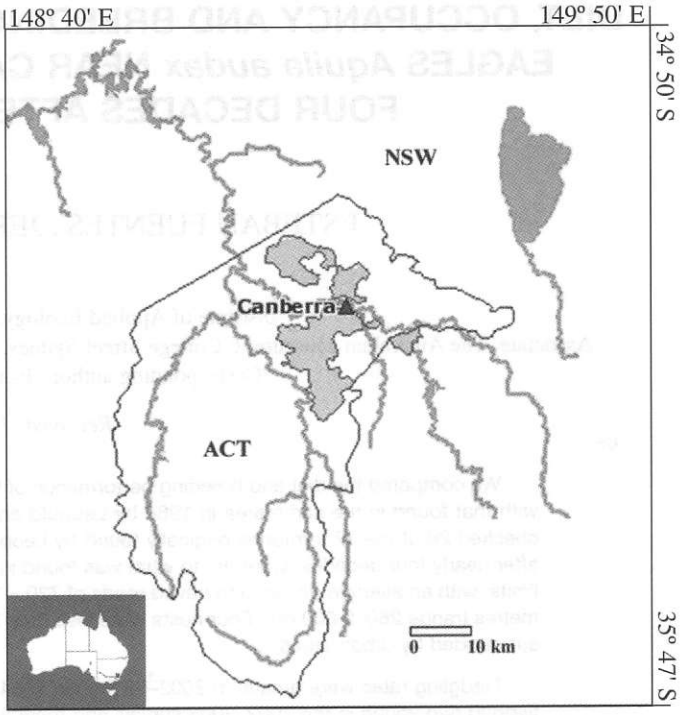

Figure 1. *The study area (34° 50' – 35° 47' S, 148° 40' – 149° 50' E).*

through comparison with collections and museum specimens when necessary. Bones, hair, and scales were identified by microscopy (following Brunner and Coman 1974 for mammalian hair) and by comparison with museum reference material.

Because Leopold and Wolfe (1970) did not present an estimation of pellets and remains combined, another estimation based on the MNI identified in fresh prey remains only (no pellets or observations) was used to compare the food habits of the eagles in 2002–2003 with those in 1964. For the purpose of this comparison, the prey species were grouped into eleven categories based on those reported in the Leopold and Wolfe study: rabbit, hare, macropods, sheep, lamb, other mammals, ravens, magpie, parrots, other birds and reptiles. Leopold and Wolfe also reported the frequency of occurrence of different prey types in pellets. This method, however, is one of the most biased estimators of food habits in birds of prey (Marti 1987) because of the production of multiple pellets from one item, and because nestlings and adults often share large prey items. Therefore, this approach was not considered for statistical analysis, but the trends observed are discussed.

Because Leopold and Wolfe (1970) presented their prey data in the categories noted above, we used the mean biomass contribution of the levels in each of their categories as the weight for that particular prey group:

$$\sum^{n} (No.\ Items\ L_n * Weight\ L_n) / \sum^{n} No.\ Items\ L_n$$

where *Ln* is each level included in the category for which mass is being estimated (for example, in the category Ravens, the three levels included were adult Australian Raven, juvenile Australian Raven and Little Raven). This formula was applied to six of the eleven categories described above; the other five

TABLE 1

Reproductive success and productivity of Wedge-tailed Eagles on the Southern Tablelands in 1964* and 2002-2003.

	1964	2002-03
Total territories **	15	44
% breeding (eggs laid)	86.7	93.9
% successful	66.7	83.7
No. of fledged young	12	56
Young fledged per territory	0.8 ± 0.2	1.1 ± 0.1
Young fledged per active nest	0.9 ± 0.2	1.2 ± 0.1
Young fledged per successful territory	1.2 ± 0.1	1.4 ± 0.1

* Taken from Leopold and Wolfe (1970, p. 14).

** Territories for which reproductive outcome was known.

were individual species for which mass was determined from the literature (see Appendix 1). In both calculations, we applied prey wastage factors based on those used by Brooker and Ridpath (1980): 50 percent wasted biomass for large prey (sheep and adult macropods), 25 percent for other mammalian prey and 20 percent for birds and reptiles.

Statistical Analysis

Preliminary explorations using chi-squared analysis on contingency tables (Zar 1999, p. 486) and a Wilcoxon rank-sum test showed no significant differences for either diet or productivity between 2002 and 2003 ($p > 0.05$). Consequently, the data for the two years were pooled for the rest of the analysis.

Chi-squared analysis on contingency tables was used to identify differences in the proportion of prey items consumed in 1964 and 2002–2003. For each prey class, the equality of proportions between these two samples was tested by multiple comparisons in subdivided contingency tables following the Haber method (Zar 1999, p. 502). All *post hoc* contrasts were subjected to a Bonferroni correction. Biomass figures were subjected only to visual examination. Means ± S.E. are shown where appropriate. The criterion for statistical significance was $P < 0.05$. All analyses and calculations were carried out using SAS 8.0 (SAS Institute Inc. Cary, NC) and Excel 2000 (Microsoft Corporation).

RESULTS

Nesting and Territory Occupancy

We located a total of 44 Wedge-tailed Eagle territories in 2002 and 2003. As part of the study, we checked 26 of the 32 territories found by Leopold and Wolfe in 1964. Twenty-two (85%) were still occupied after almost 40 years. We located another 15 territories within the original study area of Leopold and Wolfe (1970) that they either missed or were new since their study. The other seven territories were outside their study area, in the southern part of the ACT. Contrary to their 1964 survey, nine active nests were located inside the city limits, with an average distance to paved roads of 720 ± 132 metres (range 130–1 270 m) and to suburbs of 1 117 ± 251 metres (range 260–2 000 m). Four of those were less than 500 metres from houses. Only one territory was surrounded by urban areas.

Success and Productivity

The reproductive success and productivity of the Wedge-tailed Eagles in both time periods is shown in Table 1. Compared with 1964, there were more young fledged per territory in 2002–03 ($Z = -1.68$, $P = 0.09$, Table 1). This trend was mainly a result of more pairs fledging two young in the 2002-03 survey, as well as a decrease in the number of pairs that fledged no young ($\chi^2 = 15.21$, d.f. = 2, $P < 0.0001$; Table 2).

TABLE 2

Percentage of Wedge-tailed Eagle territories fledging 0, 1 and 2 young in 1964 and 2002-2003.

No. young fledged	1964	2002-03
0	33.3	16.3
1	53.3	53.1
2	13.3	30.6

Breeding Diet

In 2002–2003, 492 prey items from 33 territories were recorded from castings, prey remains and observations (Appendix 1). Fifty-seven different species were found: 19 mammals, 20 birds, seven reptiles and one crustacean. Mammals and birds were the most dominant groups by number with 54.7 and 41.9 percent of items respectively, but the former dominated when biomass was taken into account (95.3% of total dietary biomass). Macropods represented 19.9 percent (n = 98) of the total items and 45.6 percent of the dietary mass (Figure 2). The most important species among these macropods was the Eastern Grey Kangaroo *Macropus giganteus* (13.6 and 31.2% by number and biomass respectively). Other important items were the European Rabbit *Oryctolagus cuniculus* (16.9 and 9.5%) and adult Sheep *Ovis aries* (3.3 and 19.7%). Among birds, the parrots and cockatoos, Order Psittaciformes, represented 12.8 percent of the total items, but their contribution to dietary biomass was negligible (1.1%). The Galah (5.1%, n = 25) and Australian Magpie (6.1%, n = 30) were the most important bird prey species (Appendix 1).

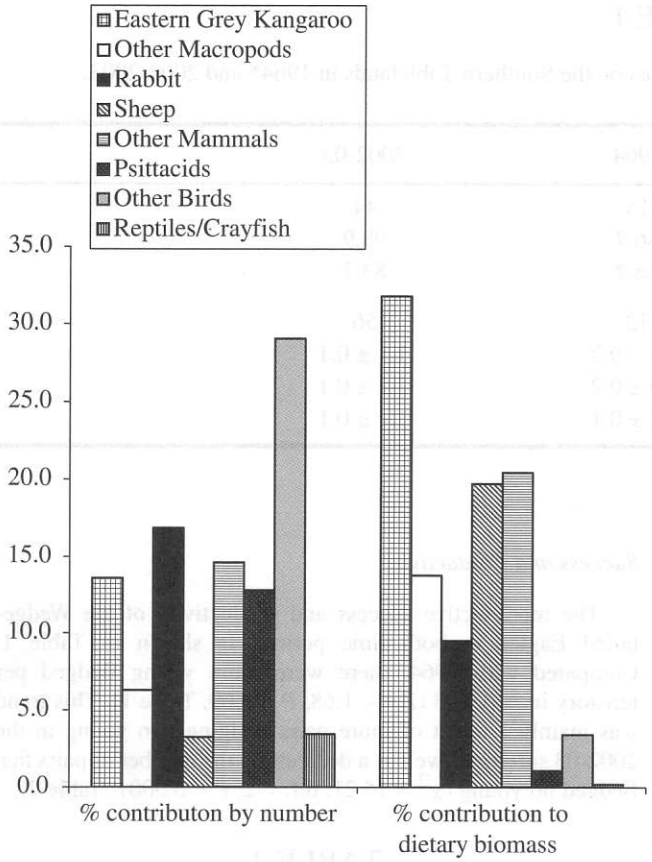

Figure 2: *Percentage contribution by number and biomass of the main prey items to the breeding diet of the Wedge-tailed Eagle on the Southern Tablelands, 2002-2003. Based on pellets, prey remains and observations combined.*

Diet in 1964 compared with 2002–2003

The proportional contribution of the different prey categories was significantly different between the two time periods (χ^2 = 136.80, d.f. = 10, $P < 0.0001$; Figure 3). Multiple comparisons in the divided contingency tables showed which categories were responsible for this difference. Three groups decreased significantly: Rabbit (43.8% in 1964 v 17.0% in 2002-2003; ¯2 = 50.99, d.f. = 1, P < 0.0001), Hare (15.8 v 7.9%; χ^2 = 8.27, d.f. = 1, P = 0.004) and lamb (8.9 v 1.8%; χ^2 = 14.71, d.f. = 1, P = 0.0001); and three others showed significant increases: macropods (1.9 v 19.4%; χ^2 = 41.62, d.f. = 1, $P <$ 0.0001), parrots (3.5 v 10.9%; χ^2 = 10.76, d.f. = 1, P = 0.001) and Other Birds (4.6 v 17%; χ^2 = 20.65, d.f. = 1, $P < 0.0001$).

The changes observed in the percentage composition of pellets agreed with those observed in the remains. Leopold and Wolfe (1970) found that 65.4 percent of the pellet composition consisted of lagomorphs (Rabbits and Hares), but this percentage decreased to 34.6 percent in the 2002–2003 sample. Sheep and lamb also decreased from 12.2 percent to 5.1 percent, whereas kangaroos/wallabies and birds increased (2.9 to 24.8% and 10.2 to 28.1% respectively).

Biomass figures showed similar trends, with a marked decrease in the biomass contribution of rabbit, hare and lamb and an increase in the macropods (Figure 4). On the other hand, birds made a similar (small) contribution to the dietary mass in the two time periods.

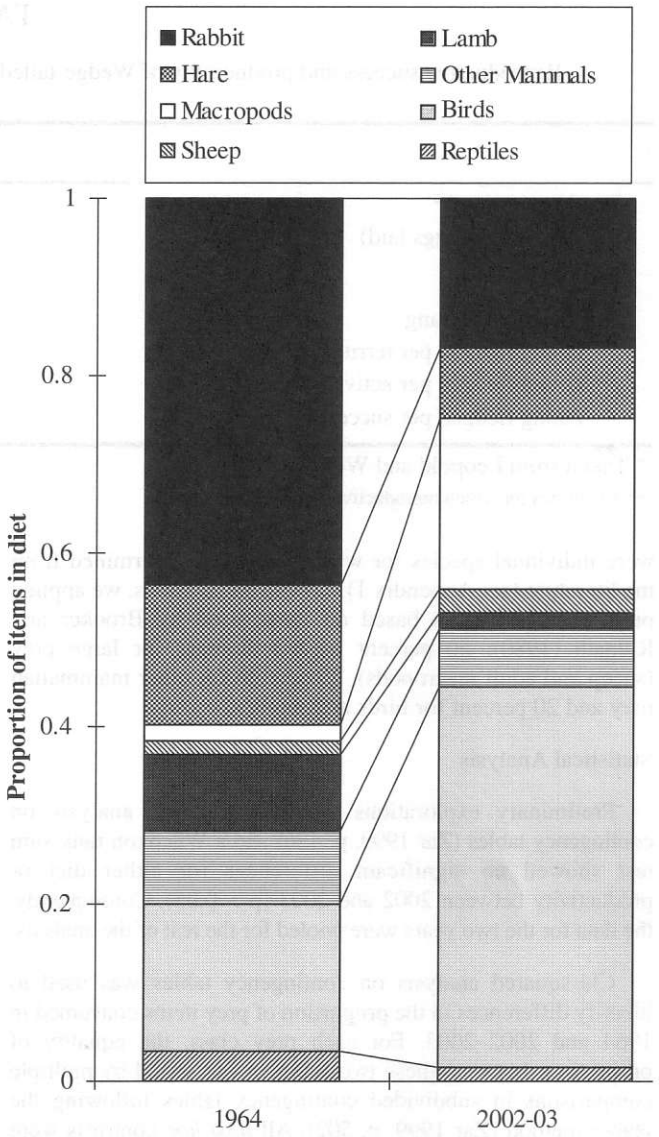

Figure 3: *Proportional contribution of different prey groups to the diet of the Wedge-tailed Eagle, based on fresh prey remains collected during the breeding season on the Southern Tablelands in 1964 and the 2002-2003.*

There was a shift from a diet dominated by exotic animals to a more equal distribution of exotic and native species. In 1964, exotics provided 72.1 percent of the prey items and 83 percent of the biomass, whereas native animals contributed 27.9 percent and 4.9 percent (12.1% of the items had an unknown origin). The contribution of these groups changed in 2002–2003, when only 36.7 percent of the prey items and 42.5 percent of the biomass had an exotic origin and native animals contributed 62.4 and 44.6 percent respectively (12.9% unknown).

DISCUSSION

Nesting and Occupancy

In 2002–2003 Wedge-tailed Eagles occupied many of the same territories used by eagles during the 1964 survey (Leopold and Wolfe 1970), though, since the 1960s, some left, and were replaced by Little Eagles *Hieraaetus morphnoides*, only to reappear in the late 1980s and early 1990s and displace the

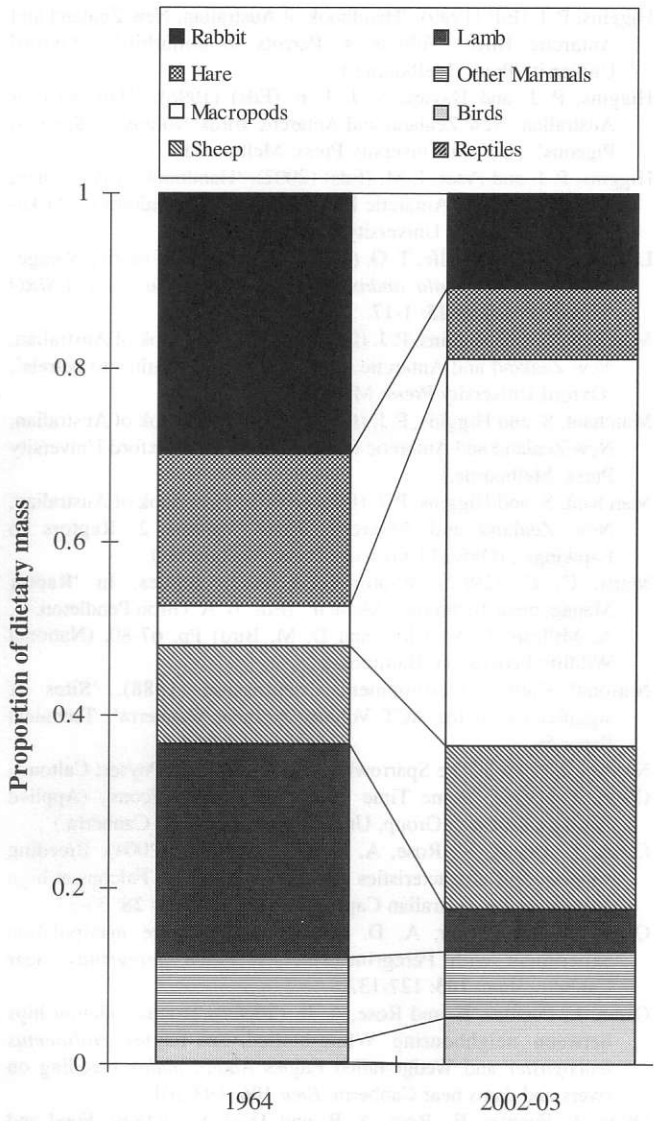

Figure 4: *Proportional contribution of different prey groups to the dietary biomass of the Wedge-tailed Eagle, based on fresh prey remains collected during the breeding season on the Southern Tablelands in 1964 and the 2002-2003.*

Little Eagles (Olsen 1994; Olsen *et al.* 2006b). These Wedge-tailed Eagles nested closer to suburbs than might be expected for a large *Aquila* species. Colonization of urban areas by raptors is often linked to two main factors: a more tolerant attitude from humans, and good food supply (Newton 1986). However, the urban nests were well-concealed and the areas were seldom visited by humans. They were still prone to disturbance and nest failure, and the one surrounded by suburbs was disturbed often and has since been abandoned (J. Olsen unpubl. data).

Productivity

The high productivity in the 2002–2003 survey compared with that found in other studies (see Marchant and Higgins 1993) may have related to permanent water near most nests (see Olsen *et al.* 2006a) and a permanent supply of macropods. The broad prey base and alternative prey such as birds, reptiles and domestic mammals probably contributed to the high breeding success, and expanded number of territories.

Diet

Overall, the diet of these pairs of Wedge-tailed Eagles near Canberra in 2002–03 was similar to that previously reported (Leopold and Wolfe 1970; Brooker and Ridpath 1980; Marchant and Higgins 1993; Harder 2000; Aumann 2001; Dennis 2006), with mammals dominating, mostly lagomorphs (rabbits and hares) and macropods as well as ground-feeding birds. Though Wedge-tailed Eagles have a generalist diet, the pairs along dams and rivers in this study took very few aquatic species compared with neighbouring White-bellied Sea-Eagles *Haliaeetus leucogaster* (see also Olsen *et al.* 2006a).

However, the diet changed significantly from that found by Leopold and Wolfe (1970) in 1964 (Figures 3 and 4). Changes in the diet of the Wedge-tailed Eagle in 2002–2003 compared to 1964 could be a response to changes in prey populations as suggested by Sharp *et al.* (2002).

There is some evidence of a decline in the abundance of rabbits near Canberra since the 1970s (Fletcher and Environment ACT, unpublished data), and for a dramatic increase in the number of Eastern Grey Kangaroos inside the city (Reardon 2003) and in non-urban reserves such as Namadgi National Park and the Googong Foreshores (Fletcher 2003; Fletcher and Environment ACT, unpublished data). The same applies to several ground-feeding birds that are important as eagle prey: Galahs, Sulphur-crested Cockatoos, Ravens and Magpies have all shown increases during the past 21 years (Veerman 2003).

These shifts in prey abundance fit with the proportional change in most commonly used prey in this study compared with prey used in the same area in 1964 (Leopold and Wolfe 1970). The 1964 diet was dominated by rabbits (43.8%), a pattern observed in most diet studies reported (Marchant and Higgins 1993), and it is widely believed that the Wedge-tailed Eagle breeding success is linked to rabbit abundance. The apparent stability and the high density and productivity of Wedge-tailed Eagles in this study contrasts with other reports of declining breeding performance related to declining rabbit populations after the introduction of the Rabbit Calicivirus Disease Virus (Sharp *et al.* 2002). However, most studies showing declines in eagle breeding performance linked to declines in Rabbits have taken place in arid areas of southern Australia, and the role of alternative native prey species may have been underestimated. Near Canberra, a mosaic of different habitats, among other things, makes the region less prone to extreme fluctuations in prey populations. Wedge-tailed Eagles in the 2002–2003 study had a broad prey base that could minimize the decrease in reproductive success that might otherwise have resulted from a decrease in the abundance of a particular prey species (Newton 1979; Brooker and Ridpath 1980). It is likely, then, that as long as alternative prey such as macropods are available, Wedge-tailed Eagles can maintain breeding even with a decrease in a particular prey such as Rabbits. They may, in fact, prefer macropods where they are abundant (see Olsen *et al.* 2006a). Wedge-tailed Eagles were the only breeding raptor of twelve species studied near Canberra that regularly took them (Fuentes, Olsen and Rose unpubl. data).

Raptors can also take rare or unusual prey, and the Southern-brown *Isoodon obesulus* and Long-nosed *Parameles nasuta* bandicoots that were found in prey remains in this study are not known to occur in the ACT (Don Fletcher pers. comm.). This finding underscores how raptors can locate and prey on species that are sometimes missed in fauna surveys (see Olsen *et al.* 2004, 2006b).

CONCLUSIONS

Wedge-tailed Eagles near Canberra shifted from a rabbit-dominated diet in 1964 to a diverse diet based on kangaroo, rabbit and birds in 2002 and 2003. In order to adjust to a decline in rabbits, eagles shifted mostly to another prey species, the Eastern Grey Kangaroo. As long as the current high levels of alternative prey are available for the eagles near Canberra, it is likely that the population will remain stable with high reproductive success.

ACKNOWLEDGEMENTS

We thank the property owners for access to their lands and Mark Osgood and Greg Hayes for assistance in the field, the ACT and NSW Parks and Conservation services for their support of the overall project. Special thanks to Don Fletcher, David Shorthouse, Murray Evans, Bernard Morris, Brett Macnamara, Darren Rosso, Christie Gould, Paul Higginbotham and Michael McGonicky for assistance, and to Terry Dennis, Jeff Jolly, Nick Mooney, Mark Clayton and Les Boyd for advice. David Mallinson and Frank Barnes found Wedge-tailed Eagle nests for the study, and Tony Bell, Mark Rodden, Marty Gardner, Trish D'Abrera, Kate Boyd and Monica Muranyi forwarded their observations at Googong Foreshores. We are grateful to Walter Boles, John Disney and staff of The Australian Museum who aided with the identification of problematic specimens. Special thanks to Ross Bennett, Enzo Guarino, Arthur Georges, Gabriela Peniche and the Kippax Veterinary Hospital for their assistance with prey weights. EF was supported by an International Graduate Scholarship from the National Council of Science and Technology (CONACYT) in Mexico. Thanks also to Stephen Debus and Tom Aumann for improving a first draft of the paper.

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APPENDIX 1

The number, percentage contribution by number and individual weights of different prey items recorded in the diet of wedge-tailed eagles in Southeast Australia in 2002-2003 based on pellets, prey remains and observations.

Based on: Higgins 1999, Higgins and Davies 1996, Higgins and Peter 2002, Marchant and Higgins 1990, Vol a & b, Marchant and Higgins 1993, Olsen *et al.* 2004, Olsen and Tucker 2003, Sharp *et al.* 2002, Strahan 1988. The weight of the categories marked with an asterisk was estimated using the biomass contribution of the species identified on each category (see methods). Items marked with an [n] have not been previously recorded in the diet of this species (Marchant and Higgins 1993, Sharp *et al.* 2002). Items marked with a [c] indicate possible captives or escapees. Introduced species are indicated with a [i].

Prey Items		n	%	Weight (kg)
MAMMALS				
Echidna	*Tachyglossus aculeatus*	3	0.6	4.5
Southern-Brown Bandicoot	*Isoodon obesulus*	2	0.4	0.78
Long-nosed Bandicoot	*Perameles nasuta*	1	0.2	0.93
Ringtail Possum	*Pseudocheirus peregrinus*	2	0.4	0.9
Mountain Possum [n]	*Trichosurus caninus*	1	0.2	3.5
Common Brushtail Possum	*Trichosurus vulpecula*	11	2.2	2.88
Tamar Wallaby [n c]	*Macropus eugenii*	4	0.8	6.5
Red-necked Wallaby	*Macropus rufogriseus*	4	0.8	16.85
Eastern Grey Kangaroo	*Macropus giganteus*	40	8.1	22.75
Juv. EGK		27	5.5	3
Wallaroo	*Macropus robustus*	5	1	21.25
Swamp Wallaby	*Wallabia bicolor*	10	2	15
Juv. Swamp Wallaby		1	0.2	2.5
Adult macropods*	*Macropus sp.*	3	0.6	21.1
Juv. macropods*		4	0.8	2.98
House Mouse [i]	*Mus musculus*	1	0.2	0.02
Black Rat [i]	*Rattus rattus*	3	0.6	0.28
European rabbit [i]	*Oryctolagus cuniculus*	82	16.7	2.5
Juv. Rabbit		1	0.2	1
Brown Hare [i]	*Lepus capensis*	29	5.9	4
Red Fox [i]	*Vulpes vulpes*	7	1.4	9
fox cub		4	0.8	3
Cat [i]	*Felis catus*	1	0.2	4.2
Sheep [i]	*Ovis aries*	16	3.3	40
lamb		6	1.2	15
Horse [i]	*Equus caballus*	1	0.2	200
BIRDS				
Domestic Fowl [i c]	*Gallus gallus*	2	0.4	2
Pacific Black Duck	*Anas superciliosa*	1	0.2	1.04
Australian Wood Duck	*Chenonetta jubata*	21	4.3	0.81
Purple Swamphen	*Porphyrio porphyrio*	1	0.2	0.99
Straw-necked Ibis	*Threskiornis spinicollis*	1	0.2	1.3
Unidentified Ibis		1	0.2	1.15
Peregrine Falcon [n]	*Falco peregrinus*	1	0.2	0.8
Australian Hobby [n]	*Falco longipennis*	1	0.2	0.25
Brown Falcon	*Falco berigora*	1	0.2	0.55
Rock Dove [i]	*Columba livia*	9	1.8	0.31
Crested Pigeon	*Ocyphaps lophotes*	1	0.2	0.21
Yellow-tailed Black -Cockatoo	*Calyptorhynchus funereus*	3	0.6	0.77
Galah	*Cacatua roseicapilla*	25	5.1	0.34
Sulphur-crested Cockatoo	*Cacatua galerita*	10	2	0.8
Musk Lorikeet	*Glossopsitta concinna*	1	0.2	0.15
Crimson Rosella	*Platycercus elegans*	12	2.4	0.14
Juv. Crimson Rosella		1	0.2	0.13

(Continued)

APPENDIX 1 (continued)

Prey Items		n	%	Weight (kg)
BIRDS (continued)				
Eastern Rosella	*Platycercus eximius*	8	1.6	0.11
Unidentified rosella*	*Platycercus* sp.	1	0.2	0.12
Red-rumped Parrot	*Psephotus haematonotus*	1	0.2	0.06
Unidentified parrots*	Order Psittaciformes	1	0.2	0.36
Laughing Kookaburra	*Dacelo novaeguineae*	3	0.6	0.34
Tawny Frogmouth	*Podargus strigoides*	2	0.4	0.33
Thornbill sp.	*Acanthiza* sp.	1	0.2	0.06
Red Wattlebird	*Anthochaera carunculata*	2	0.4	0.11
Noisy Miner	*Manorina melanocephala*	1	0.2	0.11
Magpie-lark	*Grallina cyanoleuca*	3	0.6	0.09
Australian Magpie	*Gymnorhina tibicen*	25	5.1	0.33
Juv. Magpie		5	1	0.3
Pied Currawong	*Strepera graculina*	1	0.2	0.27
Grey Currawong	*Strepera versicolor*	1	0.2	0.3
Currawong sp.	*Strepera* sp.	1	0.2	0.29
Australian Raven	*Corvus coronoides*	14	2.8	0.65
Juv Aust. Raven		4	0.8	0.5
Little Raven	*Corvus mellori*	2	0.4	0.54
Unidentified ravens*	*Corvus* sp.	7	1.4	0.59
White-winged Chough	*Corcorax melanorhamphos*	3	0.6	0.33
Juv. Chough		1	0.2	0.3
Common Starling [i]	*Sturnus vulgaris*	10	2	0.08
Unidentified birds*		17	3.5	0.48
REPTILES				
Red-bellied Black Snake [n]	*Pseudechis porphyriacus*	1	0.2	0.3
Cunningham 's Skink	*Egernia cunninghami*	3	0.6	0.03

APPENDIX 2

The number, percentage contribution by number and weights of different prey groups recorded in the diet of Wedge-tailed Eagles in southeastern Australia in 1964 and 2002-2003 based on prey remains. Items marked with an asterisk indicate groups whose weight is based on the average biomass contribution for all the levels on that group (see methods).

Prey groups	1964		2002-2003		Weight (kg)
	n	%	n	%	
Rabbit *Oryctolagus cuniculus*	114	43.8	56	17	2.47
Hare *Lepus capensis*	41	15.8	26	7.9	4
Macropods (kangaroos and wallabies) *	5	1.9	64	19.4	13.3
Sheep,*Ovis aries*	4	1.5	9	2.7	40
lamb	23	8.8	6	1.8	15
Other mammals *	21	8.1	22	6.7	4.4
Ravens *Corvus* sp. *	14	5.4	25	6.7	0.61
Magpie *Gymnorhina tibicen*	8	3.1	25	6.7	0.33
Parrots Order Psittaciformes *	9	3.5	36	10.9	0.36
Other birds *	12	4.6	56	18.8	0.48
Reptiles *	9	3.5	5	1.5	0.23

[a]Taken from Leopold and Wolfe (1970, p.8).