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BREEDING BIOLOGY, NESTING HABITAT, AND DIET OF THE ROCK EAGLE-OWL (*BUBO BENGALENSIS*)

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Abstract.—The Rock Eagle-Owl (*Bubo bengalensis*) was recently recognized as a species, with a distribution restricted to the Indian subcontinent. We studied breeding biology, habitat use, diet, and nesting density of 44 pairs of Rock Eagle-Owls in western Maharashtra state (India) for two successive breeding seasons (2004–05 and 2005–06). We present here for the first time (a) egg shell thickness (0.305 ± 0.001 mm; range: 0.303–0.306 mm); (b) egg-laying interval (1.7 ± 0.5 d; range: 0.5–4 d); (c) incubation period (33–34 d); (d) hatching pattern (asynchronous); (e) breeding success (1.5 ± 0.9 fledglings per occupied nest; range: 0–4 fledglings); and (f) post-fledging dependency period (6 mo, from April to September). Most productive nesting territories have several alternative nest sites and open landscapes such as agricultural lands and scrublands, which offer high-value foods including rodents, birds, and chiropterans. Early onset of breeding was positively correlated with the presence of high-value foods in the diet.

Key Words: *Rock Eagle-Owl*; Bubo bengalensis; *breeding*; *diet*; *habitat*; *nests*; *reproductive success.*

BIOLOGÍA REPRODUCTIVA, HÁBITAT DE ANIDACIÓN Y DIETA DE *BUBO BENGALENSIS*

Resumen.—El buho *Bubo bengalensis* fue reconocido recientemente como una especie con una distribución restringida al subcontinente de India. Estudiamos la biología reproductiva, uso del hábitat, dieta y la densidad de anidación de 44 pares de *B. bengalensis* en el estado occidental de Maharashtra (India) durante dos temporadas reproductivas consecutivas (2004–05 y 2005–06). En este estudio presentamos por primera vez (a) el espesor de la cáscara del huevo (0.305 ± 0.001 mm, rango: 0.303 a 0.306 mm), (b) el intervalo de la puesta de huevos (1.7 ± 0.5 días, rango: 0.5–4 d), (c) el período de incubación (33 a 34 d), (d) el patrón de eclosión (asincrónica), (e) el éxito reproductivo (1.5 ± 0.9 volantones por nido ocupado; rango: 0–4 crías) y (f) el periodo de dependencia después del emplumamiento (6 meses, de abril a septiembre). La mayoría de los territorios de anidación productivos tienen varios sitios de anidación alternativos y contienen paisajes abiertos como tierras agrícolas y matorrales que ofrecen alimentos de alto valor como roedores, aves y quirópteros. El inicio temprano de la cría se correlacionó positivamente con la presencia de alimentos de alto valor en la dieta.

[Traducción del equipo editorial]

The Rock Eagle-Owl (*Bubo bengalensis* Franklin 1831), was until recently considered a subspecies of the Eurasian Eagle-Owl (*Bubo bubo*), but is now recognized as a species in its own right (Wink and Heidrich 1999, Penhallurick 2003). The Rock Eagle-Owl is found in the outer hills of the western Himalayas (at an altitude of about 1500 m, rarely rising up to 2400 m), and extending to western and central Nepal, and includes the entire Indian peninsula (Ali and Ripley 1969, Pande et al. 2003). This nocturnal predator and endemic resident is not pres-

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ently included in any of the threatened categories of the IUCN Red Data Book (2010). The Rock Eagle-Owl has received scant attention in the past (Jerdon 1862, Dharmakumarsinhji 1954, Ali and Ripley 1969), and its population status is unknown (Duncan 2003). Published reports on this bird are limited to descriptions of calls and diet (Ramanujam 2000, 2001, 2004, 2006). There is, therefore, no detailed information available on breeding biology, nesting density, and habitat use of this owl.

We here report new information on a breeding population of Rock Eagle-Owls nesting in western India. We studied: (1) density of nesting sites; (2) habitat use; (3) breeding biology; and (4) diet. We also investigated potential correlations among nesting habitat, onset of nesting, diet, and breeding success.

METHODS

During the 2003–04 breeding season, we identified occupied nesting sites, and during the two subsequent breeding seasons (2004–05, 2005–06), we studied habitat use, breeding biology, and diet.

Study Area. The study area covered regions of the Deccan plateau in Pune district (about 200 km^2), the coastal region in Raigad district (about 24 km^2), and Ratnagiri district (about 30 km^2) districts in western Maharashtra state, India. The average annual precipitation in the study area, which is derived from the southwestern monsoon, ranges from 250 mm to 1250 mm in the Deccan plateau and from 1500 mm to 3500 mm in the coastal region. The temperature ranges between 6°C (wintertime minimum temperature) and 40°C (summertime maximum temperature). The study area comprises agricultural cropland, scrubland, and hilly areas, interspersed with water bodies and human settlements.

Nest Location. During the 2003–04 breeding season (October–March in our study area), we identified occupied nests. These nests were found using a combination of four techniques: (a) searching for owls, pellets, prey remains, excreta, and feathers in potential rocky areas; (b) passive auditory surveys in early morning and late evening, when eagle-owls are most vocal (Delgado and Penteriani 2007); (c) playbacks of recorded owl calls; and (d) questioning local people. Sites were visited at least three times (Bergerhausen and Willelms 1988). GPS locations of all nest sites were recorded and density was calculated by the nearest neighbor distance (NND) method (Newton et al. 1977).

Habitat Around Nests. We plotted a circle with radius of 1000 m centered on each nest (hereafter ''nesting plot''). For each nesting plot, we estimated the percentage of six different habitat types: (1) agricultural lands, (2) scrublands, (3) grasslands, (4) water bodies, (5) hilly areas, and (6) human settlements, using the 'look down' visual survey technique conducted from high vantage points (Bibby et al. 1998).

Breeding Biology. We monitored nest sites to measure: (1) dates of egg-laying, (2) number of hatchlings, (3) number of fledglings, and (4) nest fidelity. During the breeding seasons 2004–05 and 2005–06, we made at least five visits per year to each nest site by walking to some nests and climbing to others. During incubation, we checked all nests every 2–3 d, with the assumption that the egg-laying interval was 2–4 d. We weighed eggs twice, once after laying and once just prior to hatching, with Pesola spring scales (nearest 0.1 g). In order to minimize disturbance, we measured only 19 eggs from 6 randomly selected nests when owls were not present at the nest or were not incubating during daylight hours only. For egg mass, we measured eggs of 3 pairs that changed nest sites between years and of 3 pairs that used the same nest sites in both years. Eggshell thickness was measured after hatching with a vernier caliper (nearest 0.01 mm). For all nests that fledged young we also measured the juvenile postfledging dependence period by repeated visits to each nest area to relocate the owl families until young were no longer seen with their parents (Pande et al. 2007). Our visits to the nest never engendered a breeding failure.

We considered a nest site occupied if we were able to verify that a pair was present during the breeding season, even if subsequently there was no evidence of breeding. A breeding pair was defined as one that laid at least one egg. We determined breeding success (or productivity) as the number of fledglings per occupied nest, and nesting success was defined as the percentage of occupied nests that fledged at least one young (Steenhof 1987). We considered the date of laying of the first egg as the date for the onset of the breeding season; almost all nests were found during the egg-laying period, but for nests found at a later stage, we estimated the egg-laying date by back-calculating based on the age of the owlets. The incubation period was calculated from the date of the laying of the last egg until the date the last egg hatched.

Diet. At each nest visit, we collected owl pellets and prey remains from nest sites; these were analyzed separately for each nesting site and for breeding season. To avoid duplication, items found in pellets were used only when not found as remains in the same visit (Penteriani 1997). Prey in pellets were identified using published literature (Tikader and Bastawade 1983, Tikader and Sharma 1992) or by comparison with specimens in the collection of the Zoological Survey of India, Pune. The fresh masses of species were estimated by weighing specimens in the field using Pesola scales (nearest 0.1 g) or by using published data (Khajuria 1968, Spillet 1969, Ranade 1989, Pande et al. 2004, 2007). A total of 2748 food items was collected. The various food items were broadly categorized as birds, mammals (rodents, insectivores, chiropterans, carnivores, and lagomorphs), insects, and other prey species (amphibians, reptiles, and arachnids). Species richness for each category was defined as number of identified species in that category.

Statistical Methods. All values are reported as mean ± SD. We used a *G*-test to compute regularity of nest spacing for both consecutive breeding seasons: this index ranges from 0 to 1, with values >0.65 indicating a uniform distribution of nests (Brown and Rothery 1978).

Time of breeding onset and breeding success (including possible differences between the two reproductive seasons), as well as owl diet, were analyzed using Student's *t*-tests. For comparisons between the two breeding seasons, nest site was considered a categorical variable: 1 = the same nest site for the two seasons; 2 = different nests (but in the same nesting territory) for the two seasons. When data were not normally distributed, they were transformed: habitat variables were normalized using either square root or cube root, and percentage of prey biomass using square root.

The Canonical Correlation Analysis (CCorA) tested for possible associations among (1) breeding onset, (2) clutch size, (3) hatching success, (4) number of fledglings, (5) average time between laying of two eggs and (6) number of nest sites and the following independent variables: (a) types of habitat

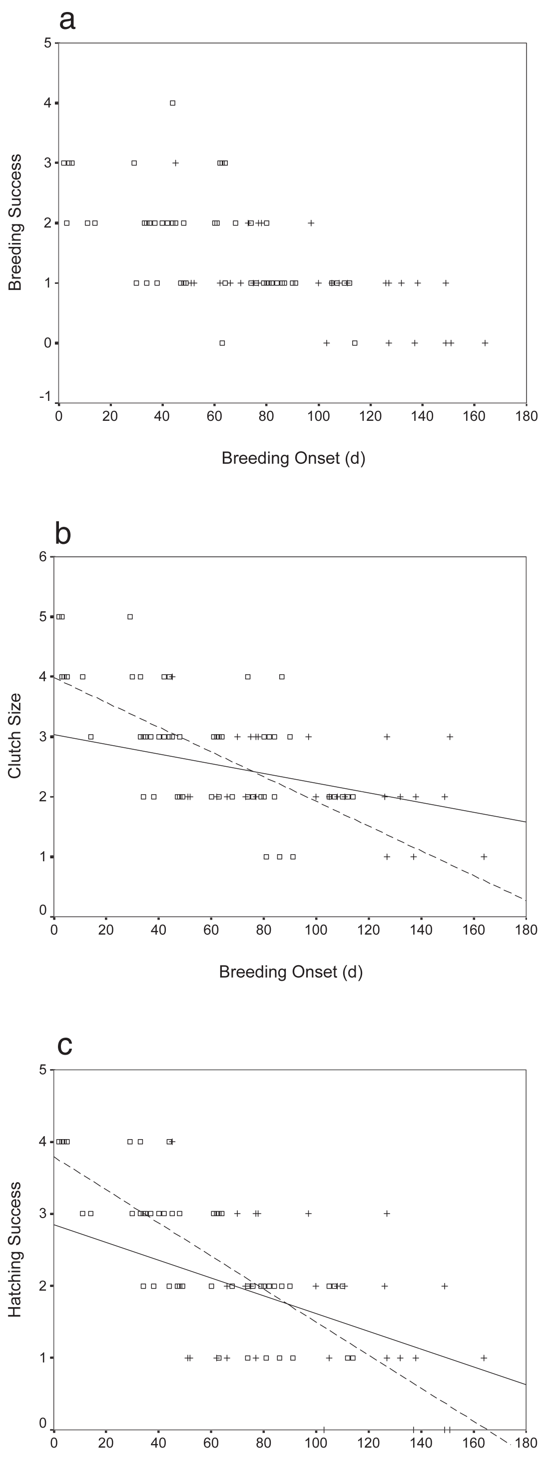

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Figure 1. Relationships between time of breeding onset and (a) breeding success, (b) clutch size and (c) hatching success for nest-site locations (□ = changed nest site between seasons, + = same nest site between seasons, d = days, day 0 = day first egg is laid).

Table 1. Diet of the Rock Eagle-Owl (*Bubo bengalensis*). Relative frequency of occurrence of each diet category (n), with relative contribution of each species to that diet category (%), average mass (g), total biomass, and % biomass of prey in the diet of the Rock Eagle-Owl.

SPECIES	FREQUENCY n (%)	MEAN MASS (g)	BIOMASS TOTAL g (%)
BIRDS			
Ashy-crowned Sparrow-Lark (*Eremopterix griseus*)	14 (0.5)	17	238 (0.17)
Rufous-tailed Lark (*Ammomanes phoenicura*)	17 (0.6)	26	442 (0.14)
Unidentified lark	12 (0.4)	26	312 (0.1)
Rock Pigeon (*Columba livia*)	18 (0.7)	170	3060 (0.93)
Common Myna (*Acridotheres tristis*)	175 (6.4)	115	20 125 (6.2)
Jungle Myna (*Acridotheres fuscus*)	51 (1.9)	93	4743 (1.5)
Unidentified egret	2 (0.1)	350	700 (0.21)
Asian Koel (*Eudynamys scolopaceus*)	7 (0.3)	163	1141 (0.35)
Large Grey Babbler (*Turdoides malcolmi*)	18 (0.7)	73	1314 (0.4)
Painted Francolin (*Francolinus pictus*)	4 (0.2)	270	1080 (0.33)
Unidentified quail	5 (0.2)	67	335 (0.1)
Eurasian Collared-Dove (*Streptopelia decaocto*)	17 (0.6)	133	2261 (0.69)
Common Kingfisher (*Alcedo atthis*)	1 (0.04)	25	25 (0.007)
Little Green Bee-eater (*Merops orientalis*)	13 (0.5)	20	260 (0.08)
House Sparrow (*Passer domesticus*)	7 (0.3)	22	154 (0.05)
Unidentified sunbird	1 (0.04)	8	8 (0.002)
House Crow (*Corvus splendens*)	5 (0.2)	272	1360 (0.4)
TOTAL BIRDS	**367**	-	**37558 (11.5%)**
MAMMALS			
Rodentia			
Lesser bandicoot rat (*Bandicota bengalensis*)	397 (14.5)	273	108381 (33.1)
Greater bandicoot rat (*Bandicota indica*)	207 (7.5)	350	72450 (22.1)
Indian bush rat (*Gollunda ellioti*)	153 (5.6)	75	11475 (3.5)
Soft-furred field rat (*Milardia meltada*)	154 (5.6)	100	15400 (0.05)
House mouse (*Mus musculus*)	8 (0.3)	15	120 (0.04)
Elliot's spiny mouse (*Mus saxicola*)	35 (1.3)	22	70 (0.02)
House rat (*Rattus rattus*)	208 (7.5)	160	33280 (10.2)
Indian gerbil (*Tatera indica*)	196 (7.1)	162	31752 (9.7)
Long-tailed tree mouse (*Vandeleuria oleracea*)	18 (0.7)	15	270 (0.008)
Insectivora			
Common house shrew (*Suncus murinus*)	92 (3.3)	43.5	4002 (1.2)
Anderson's shrew (*Suncus stoliczkanus*)	35 (1.3)	18	630 (0.2)
Chiroptera			
Indian fulvus fruit bat (*Rousettus leschenaulti*)	88 (3.2)	72	6336 (1.9)
Lesser dog-faced bat (*Cynopterus sphinx*)	46 (1.7)	67	3082 (0.9)
Carnivora			
Felidae (juvenile) unidentified species	1 (0.04)	275	275
Lagomorpha			
Lepus nigricollis (juvenile)	1 (0.04)	250	250
TOTAL MAMMALS	**1629**		**287773 (87.9%)**
INSECTS			
Rhinoceros beetle (*Oryctes rhinoceros*)	328 (11.9)	1	328 (0.1)
Mango stem—borer (*Batocera rufomaculata*)	21 (0.8)	1	21 (0.006)
Mantodea: grasshoppers and mantids	249 (9.1)	1	249 (0.08)
Stag beetle (*Lucanus cervus*)	114 (4.2)	1	114 (004)
TOTAL INSECTS	**712**		**712 (0.2%)**

Table 1. Continued.

SPECIES	FREQUENCY n (%)	MEAN MASS (g)	BIOMASS TOTAL g (%)
OTHER PREY SPECIES			
Amphibia: unidentified frogs, toads	6 (0.2)	70	420 (0.13)
Reptilia: Agamidae - Lizards - Callotes sp.	8 (0.3)	24–35	240
Gekkonidae - Geckos	2 (0.1)	8–18	26
Scincidae – Skinks	2 (0.1)	8–18	26
Colubridae – (*Coelognathus helena*)	2 (0.1)	225	550
Arachnida:			
Mesobuthus tamulus	10 (0.4)	1–3 g	20
Heterometrus xanthopus	3 (0.1)	2.5–3.5	9
Heterometrus granulomanus	2 (0.1)	2.5–3.5	6
Galeodus orientalis	2 (0.1)	1	2
Galeodus indica	2 (0.1)	1–2	3
Galeodus sp. (unidentified)	1 (0.04)	1–2	2
TOTAL OTHER PREY SPECIES	**40**		**1304 (0.4%)**
GRAND TOTAL OF FOOD ITEMS	**2748**		**327,347**

(% of agricultural lands, scrublands, grasslands, water bodies, hilly areas and human settlements), (b) species richness, and (c) frequency of prey types (%) and (d) biomass of prey types (%; birds, mammals, insects and other prey species). CCorA was performed in the freeware Biplot 1.1 (Smith and Lipkovich 2002).

Finally, two principle components analyses (PCA) were used to explore the potential effects of habitat types and prey type biomass on productivity outcomes (i.e., time of onset of breeding, number of nest sites, clutch size, hatching success, and breeding success). From the original habitat and diet variables, PCA allowed deriving new variables (i.e., principle components) which were uncorrelated. We considered eigenvalues >0.4 suitable for interpretation. All the principal components together with breeding onset were included in a forward stepwise multiple linear regression analyses (MLRA) to predict productivity outcomes. SPSS 10 software was used for statistical analysis. Data are given as means ± SD.

RESULTS

Nests and Nesting Density. We found 44 occupied nesting sites of Rock Eagle-Owls during 2003–04; nest measurements and diet assessments were made for all 44 nests in the two subsequent years, 2004–05 and 2005–06. Nests were located on ledges, crevices, cliff faces, steep hill-slope or vertical shores of water bodies, generally concealed under an overhanging rock or at the base of cactus and brushes. No nest material was added to the nest scrape. Between seasons, the same nest site was used in 32% (n = 22) of the breeding attempts.

We estimated nesting density only for the 34 pairs that bred on the Deccan plateau (Pune district). Mean distance between neighboring nesting territories was 3.3 ± 1.5 km (range 0.9–6.5 km, n = 34), corresponding to a density of 17 breeding pairs/100 km^2. Nests were quite uniformly distributed in the study area (G-test = 0.68).

Habitat Around Nests. In the 1000 m around the nests, agricultural lands were predominant (30.9 ± 17.4%, range: 10–75%), followed by grasslands (21.9 ± 18.5%, range: 0–60%), scrublands (15.0 ± 8%, range: 5–40%), human settlements (14.0 ± 7.4%, range: 0–40%), hilly areas (9.6 ± 5.5%, range: 0–25%), and water bodies (7.6 ± 6%, range: 0–20%).

Breeding Biology. Eggs were laid from early October to mid-March. A total of 232 eggs were laid in 88 breeding attempts with an average clutch size of 2.7 ± 0.9 eggs (range: 1–5 eggs). Eggs were laid asynchronously with an average interval of 1.7 ± 0.5 d (range: 0.5–4 d). We did not observe any replacement clutches despite thorough searches. Mean egg size (n = 19) was 53 ± 1.8 mm (range: 49–55 mm) × 43.5 ± 1.4 mm (range: 41–46 mm); mean egg mass was 51.1 ± 5.9 g (range: 39–59 g). The incubation period lasted 33–34 d. Egg mass loss from laying until hatching was 4.2%. Eggshell thickness was 0.305 ± 0.001 mm (range: 0.303–0.306 mm).

During the study period, 130 (56%) young fledged successfully (1.5 ± 0.9 fledglings per occupied nest, range: 0–4 fledglings). Overall nesting

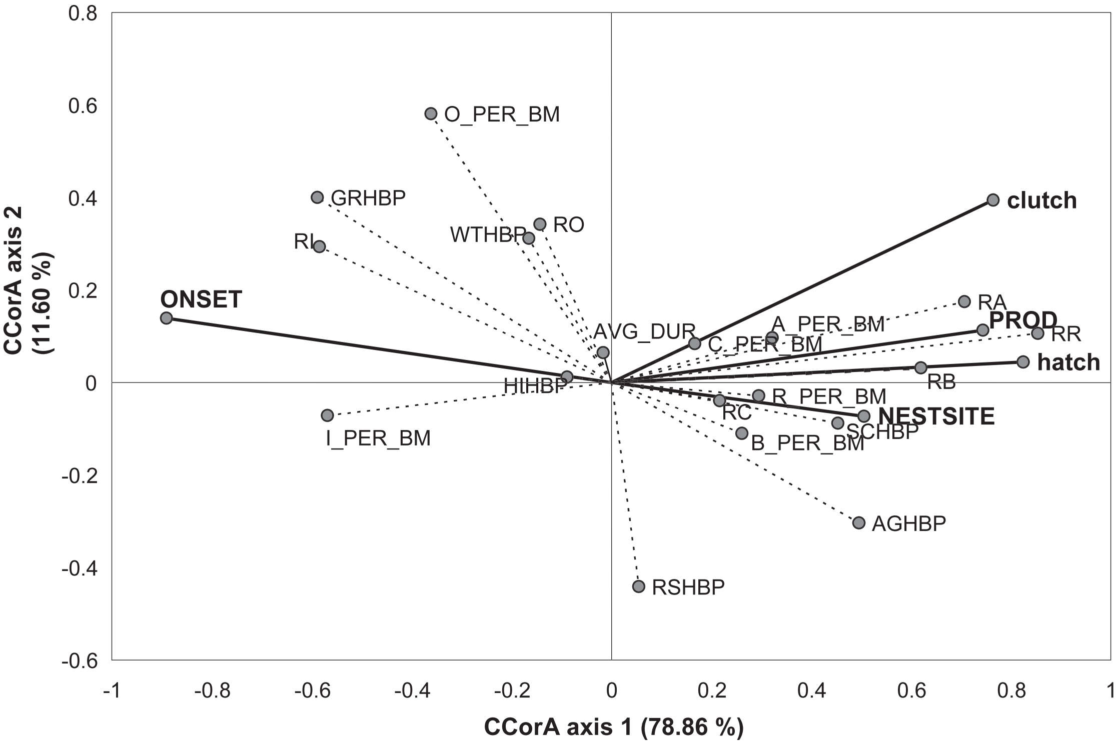

Figure 2. Canonical Correlation Analysis (CCorA) biplot for breeding variables (solid line) and variables of both habitat preference and diet (dashed line). Numbers in parentheses along the axes are % variations explained by each canonical factor. Abbreviations: richness of rodents (RR), insects (RI), carnivores (RC) and other prey species (RO). Percent biomass of rodents (R_PER_BM), birds (RA, A_PER_BM), bats (RB, B_PER_BM), insects (I_PER_BM), carnivores (C_per_BM), and other prey species (O_PER_BM). Percent agricultural lands habitat (AGHBP), grasslands habitat (GRHBP), scrublands habitat (SCHBP), water bodies habitat (WTHBP), hilly areas habitat (HIHBP) and % human settlement habitat (RSHBP). Clutch size (clutch), hatching success (hatch), number of nest sites (NEST SITE), early breeding onset (ONSET), productivity (PROD), and average duration between laying of two eggs (AVG_DUR). Numbers in parentheses are percent variations explained by each canonical factor.

success was 90.9%. Fledglings took their first flight when 52 ± 2 d old (n = 34). Postfledging dependence period lasted 6 mo (from April to September), and natal dispersal started when the young were approximately <200 d old.

Diet. We identified 47 prey species in the diet of Rock Eagle-Owl (n = 1889 pellets; 44.4 ± 34.5 pellets/nest). The most common prey types and their relative contribution to the total diet were mammals (1629 items; 59.2% of total prey items), insects (712; 25.9%), birds (367; 13.4%), and other prey species (40; 1.5%; Table 1). Rodent dietary richness was the highest (4.3 ± 1.9), followed by that of insects (2.9 ± 1.2), birds (1.8 ± 1.5), chiropterans (0.6 ± 0.6), carnivores (0.2 ± 0.1), and other prey species (0.1 ± 0.3). In terms of percent biomass, rodents were the predominant prey (84.8 ± 22.7%), followed by birds (7.0 ± 13.8%), insects (6.9 ± 19.6%), chiropterans (0.84 ± 1.8%), other prey species (0.4 ± 1.5%) and carnivores (0.2 ± 0.15%; Table 1). The most common rodent species in the diet were the lesser bandicoot rat (*Bandicota bengalensis*; 33.1%) and the greater bandicoot rat (*B. indica*; 22.1%). Among birds, the most frequent species were the Common Myna (*Acridotheres tristis*; 6.2%) and the Jungle Myna (*A. fuscus*; 1.5%).

Factors Associated with Reproductive Success. Richness of mammals and birds in the diet were positively associated with breeding success (r = 0.7 and r = 0.4 respectively, P < 0.01 for both); conversely, richness of insects in the diet was inversely associated (r = −0.5, P < 0.01). Mammal biomass (%) in the diet was positively associated with breeding success (r = 0.3, P < 0.01), whereas biomass of insects (%) and other prey species (%) were inversely associated ($r = -0.5$, $r = -0.2$ respectively, $P < 0.01$ for both).

Early onset of breeding was associated with greater breeding success (Fig. 1a), greater clutch size (Fig. 1b), and greater hatching success (Fig. 1c). However, these associations were statistically stronger in the group comprising pairs that changed nest sites between seasons ($P < 0.01$ for all).

Canonical correlation analysis (CCorA) extracted five canonical axes, of which only first two were statistically significant (for the first axis: Wilk's Lambda $= 0.045$, $F_{70,323} = 4.252$, $P < 0.001$; for the second axis: Wilk's Lambda $= 0.339$, $F_{52,265} = 1.647$, $P = 0.006$). Canonical correlations for the first two axes were 0.932 and 0.687 respectively (Fig. 2). Clutch size, breeding success, hatching success, and nest sites were positively correlated with the richness and percent biomass of mammals and birds, and with the percent of scrublands and agricultural lands, and were negatively correlated with insect richness and percent insect biomass (Fig. 2). Early breeding onsets were positively correlated with clutch size, breeding success, hatching success, and number of nest sites.

The PCA for habitat use showed high positive loadings for percent of agricultural lands (0.95) and high negative loading for grasslands (−0.89). The other two components with high positive loadings were scrublands (0.99; component 2) and human settlements (0.96; component 3): together these three components accounted for the 76.6% of the variation in habitat around Rock Eagle-Owls' nest sites. The PCA for the diet showed high positive loadings for the percent biomass of insects (0.97) and high negative loadings for percent biomass of mammals (−0.87); the other two components with high loadings were percent biomass of both birds (0.99) and other prey species (0.89; together explaining almost 99% of the variation in the diet).

The MLRA with principal components of habitat, diet, and breeding onset as independent variables indicated that early onset of breeding was the best predictor of breeding success (standardized $\beta = -0.66$, $P < 0.001$, $r^2 = 46.0$).

DISCUSSION

Habitats surrounding the Rock Eagle-Owl nesting sites were prevalently agricultural lands, scrublands, and grasslands, which may represent important foraging patches for this species (as has been reported for the Eurasian Eagle-Owl by Olsson 1979, Leditznig 1992, 1996, and Penteriani 1996). In fact, a positive relationship between open patches and breeding success was previously reported for the Eurasian Eagle-Owl (Blondel and Badan 1976, Penteriani et al. 2001, 2004).

Higher breeding success and early breeding onset were positively associated with a greater proportion of agricultural lands, and negatively associated with a greater proportion of grasslands in plots surrounding the nesting sites. The negative correlation with open grasslands habitat may be due to the predominant native perennial grasses (*Aristida, Heteropogon* spp., *Xanthium stumerium*), which have luxuriant sharp bristles and extensive prickly awn at the time of owl breeding, which may make it difficult for the owls to forage there. Open habitats such as agricultural lands and scrublands are richer in larger prey like rodent and birds, the main prey of owls in our study area. In fact, breeding onsets were positively correlated with percent biomass of high-value prey (rodents, birds, and chiropterans) and negatively correlated with percent biomass of insects.

Although Eurasian Eagle-Owl, Spotted Eagle-Owl (*Bubo africanus*), and Pharaoh Eagle-Owl (*B. ascalaphus*) are dietary generalists, with diets dominated by large prey such as rabbits (e.g., Delibes and Hiraldo 1979, Lesne and Thevenot 1981, Demeter 1982, and Lourenço 2006), we mainly recorded smaller-sized prey such as *Bandicota bengalensis* and *B. indica* as primary foods for Rock Eagle-Owls in our study area. These rodents can be considered important prey for this species because they were correlated with highest breeding success. In fact, rodents made up 85% of the dietary biomass for owls in the population we studied and, together with higher species richness, they were associated with higher breeding success (whereas high percentages of insects in the diet were associated with poor breeding success). Such results were similar to those reported for Burrowing Owls (*Athene cunicularia*; Yosef and Deyrup 1994).

Our PCA analysis suggested that a nesting area rich in agricultural lands and poor in grasslands, or rich in scrublands, was also rich in high-quality prey and contributed to an earlier breeding onset, resulting in higher breeding success. Dalbeck and Heg (2006) have also shown that early breeding Eurasian Eagle-Owls were reproductively more successful in Germany. Penteriani et al. (2002) found that Eurasian Eagle-Owl pairs that nested away from open habitat had later egg-laying dates than those nesting closer to open landscapes.

The Rock Eagle-Owl is essentially a terrestrial nesting species, with open nests that are vulnerable to some extent to predation by ground predators such as the common palm civet (*Paradoxurus hermaphrodites*) and small Indian mongoose (*Herpestes javanicus*). We found that 68% of nest sites were changed in the subsequent year. Importantly, change in nest site was significantly associated with early breeding onset and greater breeding success. This has ecological implications, as the higher incidence of change of nest sites in successive years may cause lower nest detection and, thus reduced risks from ground predators and ectoparasites. We suggest that the availability of alternative nest sites is an important criterion of what makes a high-quality nesting site for a breeding Rock Eagle-Owl pair. However, the relationship between frequent nest-checking and change of the nest site remains unknown.

The identification of high- and low-quality nest sites is important because protection of high-quality sites, improvement of low-quality sites, and the use of habitat quality in predicting population trends have conservation and management implications (Ferrer and Donázar 1996, Sutherland 1996, Rodenhouse et al. 1999, Penteriani et al. 2004, Ortego 2007).

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