Diet of the Crowned Eagle (Harpyhaliaetus coronatus) During the Breeding Season in the Monte Desert, Mendoza, Argentina

Authors: Lobos, Roberto Pereyra, Santander, Francisco J., Orellana, Sergio Alvarado, Ramírez, Piero A., Muñoz, Leonardo, et al.

Source: Journal of Raptor Research, 45(2) : 180-183

Published By: Raptor Research Foundation

URL: https://doi.org/10.3356/JRR-10-36.1

Short Communications

J. Raptor Res. 45(2):180–183

Diet of the Crowned Eagle (*Harpyhaliaetus coronatus*) During the Breeding Season in the Monte Desert, Mendoza, Argentina

Roberto Pereyra Lobos
Proyecto de Conservación del Águila Coronada, Reserva Natural Bosques de Telteca, Mendoza, Argentina

Francisco J. Santander[1]
Laboratorio de Zoología, Departamento de Biología, Universidad Metropolitana de Ciencias de la Educación, Chile.
Laboratorio de Ecología de Vida Silvestre, Facultad de Ciencias Forestales y Conservación de la Naturaleza, Universidad de Chile

Sergio Alvarado Orellana
Area de Salud Ambiental, Escuela de Salud Pública, Facultad de Medicina, Universidad de Chile

Piero A. Ramírez
Escuela de Medicina Veterinaria, Facultad de Ciencias Silvoagropecuarias, Universidad Mayor, Chile

Leonardo Muñoz and Darío Fernández Bellón
Proyecto de Conservación del Águila Coronada, Reserva Natural Bosques de Telteca, Mendoza, Argentina

Key Words: *Crowned Eagle*; Harpyhaliaetus coronatus; *diet*; *Monte desert*; *Zaedyus pichiy*.

The Crowned Eagle (*Harpyhaliaetus coronatus*) is a large raptor with a geographic distribution restricted to southern South America, including Bolivia, Brazil, Paraguay, and Argentina (Collar et al. 1992, del Hoyo et al. 1994, Ferguson-Lees and Christie 2001). This species inhabits semi-open, semi-xeric areas, mainly in lowlands, but also at middle altitudes (Collar et al. 1992). Their hunting techniques include perching and waiting for prey, and also performing circular low-altitude flights approximately 100 m above the ground (S. Alvarado Orellana unpubl. data). The Crowned Solitary Eagle is classified as globally Endangered by BirdLife International (2004), and is currently legally protected in Argentina (Bellocq et al. 2002). The most important threats to its populations in Argentina are human persecution and habitat disturbance (Sarasola and Maceda 2006). The natural history and biology of this species is poorly known. Diet appears to be one of the best-studied aspects, but most of the information is based on brief anecdotal reports (Maceda 2007, Chébez et al. 2008) and no detailed data on the feeding ecology of the Crowned Eagle has been published. Here, we provide a detailed description of the diet of Crowned Eagles in the Mendoza desert, northwestern Argentina.

[1] Email address: fcojsantan@gmail.com

Study Area and Methods

Our study was in the Telteca Reserve, which comprised 38 500 ha, approximately 120 km northwest of Mendoza, Argentina. The study area was in the Monte ecoregion and was characterized by an arid climate, with an annual mean temperature of 18.5°C (mean maximum: 27°C, mean minimum: 9.3°C) and annual rainfall ranging from 155–164.6 mm (Estrella et al. 1979). The vegetation was composed mainly of shrubs of the genera *Larrea* and *Bulnesia*, halophyte plants and open woodland of algarrobo (*Prosopis flexuosa*; Morello 1958, Alvarez et al. 2006). *P. flexuosa* was particularly important because shadows produced by its canopy regulated the soil temperature, water regime, and the incidence of the solar radiation, creating microhabitats that have different conditions than exposed areas (Villagra et al. 2004). *P. flexuosa* was also the main nesting substrate of Crowned Eagles.

During four breeding seasons (September–February) from 2005 to 2009, we studied the diet of Crowned Solitary Eagle during the brood-rearing period using direct observations of prey deliveries and collections of prey remains and pellets. Prey deliveries were recorded during the nestling phase for 18 d (153 h) at one nest in 2006–07 and for 23 d (196 hr) in 2008–09. Observations were made using 8 × 40 and 10 × 40 binoculars and a 20 × 60 spotting scope. Prey remains and pellets were collected beneath six nests containing nestlings (including both nests used for direct observations) and adjacent trees used as perches or roosts. We visited each nest 3 d/mo, with a sample effort of 56 hr each month for prey remains and pellets. Overall, we spent 1351 hr

Table 1. Prey of the Crowned Eagle during the breeding season in the Telteca Reserve, Mendoza, Argentina, as derived from direct observations of prey deliveries and examination of prey remains at nests and adjacent trees.

		Direct Observations		Remains		Total	
Prey Item	Mass (g)[a]	Percent Frequency	*n*	Percent Frequency	*n*	Percent Frequency	Percent Biomass
All mammals		**14**	**7**	**89.0**	**243**	**77.4**	**77.5**
Xenarthra							
Dwarf armadillo (*Zaedyus pichiy*)	1700	4	2	65.9	180	56.4	51.5
Large hairy armadillo (*Chaetophractus villosus*)	4500	0	0	0.4	1	0.3	0.8
Screaming hairy armadillo (*Chaetophractus vellerosus*)	1100	0	0	1.5	4	1.2	0.7
Unidentified Xenarthra		0	0	15.8	43	13.3	17.4
Molina's hog-nosed skunk (*Conepatus chinga*)	2075	8	4	4.0	11	4.6	5.2
Unidentified mammal		2	1	1.5	4	1.6	2.0
All reptiles		**84**	**42**	**11**	**30**	**22.3**	**22.5**
Squamata							
Argentine red tegu (*Tupinambis rufescens*)	4500	0	0	2.9	8	2.5	6.0
Bothrops sp.	1250	42	21	0	0	6.5	4.4
Unidentified snake		42	21	0.7	2	5.0	3.3
Testudines							
Chaco tortoise (*Geochelone chilensis*)	1720	0	0	7	19	5.9	5.4
Unidentified reptile		0	0	0.4	1	2.5	3.3
All birds		**2**	**1**	**0**	**0**	**0.3**	**0**
Unidentified bird[b]	100	2	1	0	0	0.3	0
TOTALS			**50**		**273**		

[a] Weights were obtained from Vizcaíno and Milne (2002) for Xenarthra, Montalvo et al. (2008) for Carnivora, and Taber (1997) for *Geochelone*. Masses of remaining taxa were obtained from the authors' unpubl. data.

[b] Excluded from biomass estimation because it was not possible to identify birds at a higher taxonomic level.

searching for and collecting prey remains and pellets, and 349 hr making direct observations of prey deliveries.

Observers identified mammalian, reptilian, and avian prey delivered to the nest based on the morphology of potential prey species. Prey species in remains and pellets were identified following methods described by Seguin et al. (1998) and Marti et al. (2007). Remains of mammalian and reptilian prey were identified on the basis of skull and dentary fragments by using private reference collections. Testudines and Xenarthra were also identified by carapace features and reptiles were identified by shape and coloration patterns following Cei (1986).

We identified each prey item to the lowest possible taxonomic category. We determined the minimum number of possible individuals for each pellet and prey remains. Because the pellets contained only scales, we set the number of individuals to one per pellet. The relative importance of each prey item in the diet was evaluated by prey frequency and biomass (Marti 1987, Marti et al. 2007). The biomass of each species was estimated as the mean adult mass, combining both sexes.

Prey frequency was calculated by dividing the number of individuals in each identifiable prey category by the total number of prey in the sample (Marti et al. 2007). Biomass contribution of the prey consumed was estimated by multiplying the number of prey species by the mean weight of that prey (Marti et al. 2007). Biomass was calculated using the total number of prey found in remains and direct observations. Weights of prey were obtained from the literature and from unpublished data of the authors (Table 1). We assumed that weights of unidentified prey species were similar to the mean mass of the most closely related identified taxon. For avian prey, we could not estimate biomass because we were unable to identify the birds at the family or genus level. Thus, the avian prey was included only in the frequency analysis.

Geometric mean weight of vertebrate prey (Marti et al. 2007) was calculated as follows: GMWVP = antilog $(\sum n_i \log w_i / \sum n_i)$, where n_i was the number of individuals of the ith species and w_i was the mean weight (Figueroa and González-Acuña 2006, Marti et al. 2007). Only prey items identified to the generic level were included to estimate GMWVP.

RESULTS

We recorded 50 prey deliveries, including mammals, reptiles, and birds during our study (Table 1). Throughout the brood-rearing period, we collected 273 prey remains (Table 1). We collected seven pellets in the first breeding season only, and they consisted solely of remains of unidentified snakes; we did not include remains in pellets in our analysis, because of the small sample size. Overall, we identified a total of 330 prey items, including mammalian (armadillos and skunks), reptilian (snakes and tortoises), and avian prey. Total biomass of prey was estimated to be 600 727 g. The geometric mean weight of vertebrate prey was 1725.9 g.

Mammals were the most common prey both by number and biomass (>70% of total individual prey and total biomass, respectively; Table 1). Among these, armadillos (Xenarthra) were the most frequent prey with the dwarf armadillo (*Zaedyus pichiy*) accounting for almost 50% of the prey by both number and biomass. The importance of the remainder of mammalian prey (carnivores and unidentified mammals) was minor. Reptiles were the second most common prey item, accounting for almost 23% of total individual prey and total biomass. On a combined basis, snakes were the most common reptilian prey (Table 1). The contribution of birds to the diet was negligible.

DISCUSSION

Our results were similar to those reported previously by Maceda (2007), who reported that Crowned Eagles preyed mainly on mammals and reptiles. Maceda (2007) also indicated that the dwarf armadillo was the most important prey in term of number and biomass, and suggested that there was trophic selection for this prey species. A number of other prey types such as tinamous (*Nothoprocta cinerascens*), insects (Acrididae, Tettigonidae, Scarabeidae), and carrion (*Ovis aries, Cerdocyon thous, Blastoceros dichotomus, Bos taurus*) are probably consumed in an opportunistic manner, depending on their availability in the nesting area (Canevari et al. 1991, Collar et al. 1992, Bellocq et al. 2002, Maceda 2007).

The geometric mean weight of vertebrate prey in our study was almost 1725.8 g, which was almost two times higher than that reported by Maceda (2007). Possibly, this was due to a proportionally higher importance of heavier prey at our study site; the total biomass in our study was 1725.8 g. Differences between our study and that of Maceda et al. (2003) may also reflect the prey availability and selection in different seasons: Maceda et al. (2003) reported prey found in the stomachs of dead birds during the nonbreeding season, which might explain the abundance of insects and carrion he documented.

In our study, we found several differences between diet determined by direct observations and that determined using prey remains, including a dearth of avian prey among the prey remains and greater prey species diversity in the prey remains than in the direct observations. At the level of prey class, the number of mammalian prey were greatly underrepresented in direct observations, and the number of reptiles overrepresented. At the level of prey species, the dwarf armadillo was overrepresented among prey remains and *Bothrops* snakes were overrepresented in direct observations. Finally, both methods either underestimated or overestimated prey in various classes, compared with the combined results. Several studies on biases in dietary analyses suggest that small prey are underestimated in prey remains, compared to direct observations, and that bias may be minimized by combining data from both prey remains and pellets (e.g., Simmons et al. 1991, Mersmann et al. 1992, Oro and Tella 1995, Seguin et al. 1998).

The successful design and implementation of measures for the conservation of Crowned Eagle populations in Argentina requires a comprehensive understanding of the species' ecology. To this end, it is essential to conduct further research on the species' ecological requirements to assess whether dietary patterns recorded in this study are widespread and representative of the breeding population and to understand the effects of habitat disturbance on prey populations and the Crowned Eagle.

DIETA DEL ÁGUILA *HARPYHALIAETUS CORONATUS* DURANTE LA TEMPORADA REPRODUCTIVA EN EL DESIERTO DE MONTE, MENDOZA, ARGENTINA

RESUMEN.—Estudiamos la dieta del águila *Harpyhaliaetus coronatus* durante la época reproductiva entre los años 2005 y 2009, en la Reserva Bosques de Telteca, Mendoza, Argentina. Recolectamos 273 restos de presa, 7 egagrópilas y observamos 50 entregas de presa. Las presas de *H. coronatus* incluyeron: Xenarthra (n = 230), Carnívora (n = 15), Squamata (n = 52) y Testudines (n = 19). En términos de frecuencia los mamíferos aportaron un 77.4% (77.5% de la biomass) y los reptiles un 22.3% (22.5% de la biomass). Entre los mamíferos el armadillo (*Zaedyus pichiy*) fue la especie más en la dieta del águila (56.4% de la frecuencia, 51.2% de la biomasa) seguida por el zorrillo (*Conepatus chinga;* 4.6% de la frecuencia, 5.2% de la biomasa). Entre los reptiles los ofideos fueron los más comunes, seguidos por la tortuga (*Geochelone chilensis;* 5.9% de la frecuencia, 5.4% de la biomasa), y la iguana colorada (*Tupinambis rufescens*; 2.5% de la frecuencia, 6.0% de la biomasa). El peso geométrico promedio de las presas vertebradas (1725.9 g) fue superior a los pesos de presas documentados previamente para *H. coronatus* en Argentina. En general, la composición de la dieta de *H. coronatus* en nuestro sitio de estudio fue similar a la documentada para otras áreas de la Argentina.

[Traducción del equipo editorial]

ACKNOWLEDGMENTS

We thank Santiago Mayorga and Flavio Martínez for assistance in the field. Ricardo A. Figueroa R. and two anonymous reviewers made useful suggestions. This research would not be possible without the support of Optics for the Tropics, Eagle Optics, Pcrar zoo de Buenos Aires, and Fundación Bioandina.

LITERATURE CITED

ALVAREZ, J.A., P.E. VILLAGRA, M.A. CONY, E.M. CESCA, AND J.A. BONINSEGNA. 2006. Estructura y estado de conservacion de los bosques de *Prosopis flexuosa* D.C. (Fabaceae, subfamilia: Mimosoideae) en el noreste de Mendoza (Argentina). *Revista Chilena de Historia Natural* 79: 75–87.

BELLOCQ, M.I., P. RAMÍREZ-LLORENS, AND J. FILLOY. 2002. Recent records of Crowned Eagles (*Harpyhaliaetus coronatus*) from Argentina, 1981–2000. *Journal of Raptor Research* 36:206–212.

BIRDLIFE INTERNATIONAL. 2004. Threatened birds of the world 2004, CD-ROM. BirdLife International, Cambridge, U.K.

CANEVARI, M., P. CANEVARI, G.R. CARRIZO, G. HARRIS, J. RODRÍGUEZ MATA, AND R.J. STRANECK. 1991. Nueva guía de las aves Argentinas, Tomo 2. Fundación Acindar, Buenos Aires, Argentina.

CEI, J.M. 1986. Reptiles del centro, centro-oeste y sur de la Argentina. Herpetofauna de las zonas áridas y semiáridas. Monografía IV. Torino, Museo Regionale di Scienze Naturali di Torino, Turin, Italy.

CHÉBEZ, J.C., J.J. MACEDA, AND R. PEREYRA-LOBOS. 2008. Águila Coronada. Pages 177–186 *in* J.C. Chébez [ED.], Los que se van. Fauna Argentina Amenazada, Tomo 2. Albatros, Buenos Aires, Argentina.

COLLAR, N.J., L. GONZAGA, N. KRABBE, A. MADROÑO NIETO, L. NARANJO, T. PARKER, AND D. WEGE. 1992. Threatened birds of the Americas: the ICBP Red Data Book. International Council for Bird Preservation, Cambridge, U.K.

DEL HOYO, J., A. ELLIOTT, AND J. SARGATAL. 1994. Handbook of the birds of the world, Vol. 2. New World vultures to guinea fowl. Lynx Editions, Barcelona, Spain.

ESTRELLA, H.A., V.A. HERAS, AND V.A. GUZZETA. 1979. Registro de elementos climáticos en áreas críticas de la provincia de Mendoza. *Cuaderno Técnico* 2:49–72.

FERGUSON-LEES, J. AND D.A. CHRISTIE. 2001. Raptors of the world. Houghton Mifflin Company, New York, NY U.S.A.

FIGUEROA, R.A. AND D. GONZÁLEZ-ACUÑA 2006. Prey of the Harris's Hawk (*Parabuteo unicinctus*) in a suburban area of southern Chile. *Journal of Raptor Research* 40:164–168.

MACEDA, J.J. 2007. Biología y conservación del águila coronada (*Harpyhaliaetus coronatus*) en Argentina. *Hornero* 22:159–171.

———, J.H. SARASOLA, AND M.E. PESSINO. 2003. Presas consumidas por el águila coronada (*Harpyhaliaetus coronatus*) en el límite sur de su rango de distribución en Argentina. *Ornitología Neotropical* 14:419–422.

MARTI, C. 1987. Raptor food habits studies. Pages 67–79 *in* B.A. Giron Pendleton, B.A. Millsap, K.W. Cline, and D.M. Bird [EDS.], Raptor management techniques manual. Natl. Wildl. Fed., Sci. and Tech. Ser. 10, Washington, DC U.S.A.

———, M. BECHARD, AND F.M. JAKSIC. 2007. Food habits. Pages 129–151 *in* D.M. Bird and K.L. Bildstein [EDS.], Raptor research and management techniques. Hancock House Publishers, Blaine, WA U.S.A.

MERSMANN, T.J., D.A. BUEHLER, J.D. FRASER, AND J.K. SEEGAR. 1992. Assessing bias in studies of Bald Eagle food habits. *Journal of Wildlife Management* 56:73–78.

MONTALVO, C.I., M.E. PESSINO, AND F.C. BAGATTO. 2008. Taphonomy of the bones of rodents consumed by Andean hog-nosed skunks (*Conepatus chinga*, Carnivora, Mephitidae) in central Argentina. *Journal of Archaeological Science* 35:1481–1488.

MORELLO, J. 1958. La Provincia Fitogeografica del Monte. *Opera Lilloana (Argentina)* 2:5–115.

ORO, D. AND J.L. TELLA. 1995. A comparison of two methods for studying the diet of the Peregrine Falcon. *Journal of Raptor Research* 29:207–210.

SARASOLA, J.H. AND J.J. MACEDA. 2006. Past and current evidence of persecution of the endangered Crowned Eagle (*Harpyhaliaetus coronatus*) in Argentina. *Oryx* 40: 347–350.

SEGUIN, J.F., P. BAYLE, J.C. THIBAULT, J. TORRE, AND J.D. VIGNE. 1998. A comparison of methods to evaluate the diet of Golden Eagles in Corsica. *Journal of Raptor Research* 32:314–318.

SIMMONS, R.E., D.M. AVERY, AND G. AVERY. 1991. Biases in diets determined from pellets and remains: correction factors for a mammal and bird eating raptor. *Journal of Raptor Research* 25:63–67.

TABER, A.B. 1997. The food habits of sympatric jaguar and puma in the Paraguayan Chaco. *Biotropica* 29:204–213.

VILLAGRA, P.E., M.A. CONY, N.G. MANTOVÁN, B.E. ROSSI, M.M. GONZÁLEZ-LOYARTE, R. VILLALBA, AND L. MARONE. 2004. Ecología y manejo de los algarrobales de la Provincia Fitogeográfica del Monte. Pages 1–32 *in* M.F. Arturi, J.L. Frangi, and J.F. Goya [EDS.], Ecología y manejo de bosques nativos de Argentina. Editorial Universidad Nacional de la Plata, La Plata, Argentina.

VIZCAÍNO, S.F. AND N. MILNE. 2002. Structura and function in armadillo limns (Mammalia: Xenarthra: Dasypodidae). *Journal of Zoology* 257:117–127.

Received 5 April 2010; accepted 18 January 2011
Associate Editor: Carol L. McIntyre