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Natal Dispersal of the Crested Caracara (*Caracara cheriway*) in Florida

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The process of dispersal has important implications for the distribution, regulation, and genetic structure of avian populations (Greenwood 1980, Greenwood and Harvey 1982, Paradis et al. 1998). Natal dispersal, movement of an individual from its site of birth to the site of first reproduction or potential reproduction, and breeding dispersal, movement of adult individuals between breeding sites (Howard 1960, Greenwood 1980), are major agents of gene flow that affect overall population relatedness and distribution. Understanding how dispersal influences population dynamics is necessary when assessing population responses to landscape change and when developing conservation plans for populations or species.

Because of the difficulty in obtaining dispersal data for large, wide-ranging species, information about dispersal in many birds is limited. This is generally true for raptors, which typically have large geographic distributions and range across wide areas. In addition, many raptors do not breed for several years post-fledging; hence, keeping track of individuals through this time period until they begin breeding is difficult for most populations.

Here, we report the first information on dispersal for the Crested Caracara (*Caracara cheriway*), a medium-sized raptor that inhabits open grasslands and pastures (Morrison 1996). In North America, extant populations of the Crested Caracara occur only in Florida, Texas, and Arizona. Despite this species' wide geographic range (Morrison 1996), many aspects of its biology remain poorly understood, perhaps because of its reputation as a pest throughout much of its Central and South American range, where it is more abundant.

Recent widespread loss of grassland and pasture habitats in Florida due to agricultural and urban expansion is perceived as a major threat to the persistence of this population of caracaras. These habitat changes and concomitant population decline (Millsap 1989, Layne 1996) led to listing of this population as federally threatened (U.S. Fish and Wildlife Service 1987). To better understand the caracara's biology and population responses to landscape change, a study of this non-migratory and isolated population was initiated in 1994 (Morrison 1998, 1999, Morrison and Humphrey 2001). Study objectives included obtaining information about demographic parameters and habitat use. This paper presents information collected on dispersal of known individuals from their natal site to a breeding site within the study population.

Methods

The study area incorporated all or parts of eight counties in the south-central peninsula and represents ca. 80% of the caracara's current breeding range in Florida (Morrison 1999). Our sample included breeding areas that were located throughout this range, but because most of Florida's caracaras currently live on privately-owned lands (Morrison and Humphrey 2001), efforts to obtain a systematic, random sample of breeding areas or to survey the entire study area were constrained by our ability to secure access from landowners.

Crested Caracaras nest primarily from December–April in Florida (Morrison 1999). We began marking nestling caracaras during the 1993–94 breeding season and continued through the subsequent three breeding seasons, 1994–95, 1995–96, and 1996–97. Nestlings were marked at 6–8 wk of age while still in the nest, or just after fledging, when they could be caught easily on the ground Each nestling was marked with a standard numbered U S Fish and Wildlife Service aluminum band and an aluminum color band with a unique alpha-numeric code (ACRAFT, Inc., Edmonton, Alberta, Canada). The gender of marked individuals was determined by DNA analysis of blood samples taken at the time of banding (Morrison and Maltbie 1998).

To obtain demographic information for this population, we monitored nesting activity annually. We monitored 48 breeding areas during the 1994–95 breeding season and 55 breeding areas during each subsequent year through the 1999–2000 breeding season. During the 2000–01 and 2001–02 breeding seasons, we monitored activity in 15 breeding areas, a subset of the original sample; these breeding areas were located along the Kissimmee River in the core of the caracara's current range. Each year, along with collecting information on nesting success and productivity, we identified adults nesting in each breeding area by reading their leg bands with binoculars or a spotting scope. Thus, data on dispersal and recruitment were collected opportunistically, incidental to routine annual nest monitoring efforts.

We calculated dispersal distance as the straight-line distance between the nest where the individual hatched and

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Table 1. Summary of marked juvenile Crested Caracaras, observed later as breeding adults, and their dispersal distances.

Year	No. Nestlings Marked		Known Adults Found as Breeders	Age When First Found Breeding	Distance from Natal Area to Breeding Area (km)
	M	F	Sex		
1994	14	16	—		
1995	23	28	F	3	19.24
			F[a]	4	19.20
1996	28	36	M[a]	3	5.84
			M	3	6.81
			M	3	3.86
			M	6	9.08
			F	3	16.97
			F	3	20.70
1997	9	6	F	4	40.72
Total	74	86	9		

[a] Breeding pair.

the location where it was found as a breeding adult. We define natal dispersal as movement between birthplace and first breeding site (Greenwood 1980, Greenwood and Harvey 1982).

Results and Discussion

During 1994–97, we banded 160 nestling caracaras: 74 males and 86 females in 55 different breeding areas. Since the 1998–99 breeding season, while conducting regular monitoring of nesting activity in our sample of breeding areas, we have encountered four males and five females banded as nestlings that were occupying nest sites as breeders (Table 1).

Distances between natal areas and breeding sites differed significantly ($t = -3.76$, $P = 0.02$) between male ($\bar{x} = 6.40$ km $\pm$ 1.08 SE, range = 3.86–9.08 km, $N = 4$) and female caracaras ($\bar{x} = 23.37$ km $\pm$ 4.38 SE, range = 16.97–40.72 km, $N = 5$). The breeding areas in which we found known males were located only two to three breeding areas away from their respective natal areas, based on a mean home-range diameter in Florida of ca. 5 km (J. Morrison unpubl. data). Despite the small sample size, these results corroborate the general pattern of female biased dispersal observed in birds (Greenwood 1980, Johnson and Gaines 1990, Paradis et al. 1998) including many raptors (Newton and Marquiss 1983, Mearns and Newton 1984, Rosenfield and Bielefeldt 1992, Millsap and Bear 1997, Wiklund 1996, Ellsworth and Belthoff 1997, Lehman et al. 2000).

Our results also supported that the age at first breeding for the Crested Caracaras was 3 yr of age, as was previously suspected (Voous 1955, Layne 1996). Caracaras attain full adult plumage during their fourth year (Layne 1996, J. Morrison pers. observ.), and throughout our study, we rarely observed a breeding caracara in Basic 1 plumage (age 2–3 yr) and never in the juvenile plumage (age 1 yr; Wheeler and Clark 1996). While we cannot entirely rule out caracaras breeding at age 1 or 2, the rarity of breeders in Basic 1 plumage (4.7%, $N = 108$) observed in our sample of breeding areas combined with our observations of known 3-yr-old caracaras breeding support age at first breeding as 3 yr for Florida's caracaras.

Distances we report here likely constitute natal dispersal for the 3-yr-old individuals. Because we do not know age at first breeding for the two 4-yr-old females and the 6-yr-old male, we are unable to assess whether distances reported for these individuals constitute natal or breeding dispersal. In any case, the new information reported here reveals distances that female and male caracaras in Florida travel between their natal site and a breeding site.

Explanations proposed for gender-biased, natal dispersal in birds include reproductive enhancement through mate and/or resource access and inbreeding avoidance (Greenwood 1980, Newton and Marquiss 1983, Pusey 1987, Korpimäki 1988, Johnson and Gaines 1990, Daniels and Walters 2000). Inbreeding avoidance could be an important selective factor for gender-biased dispersal in this non-migratory, isolated population of caracaras. However, interpretation of the observed patterns of dispersal distances reported here is complicated because our annual monitoring efforts were focused on sites of known previous nesting, and we did not search for recruits throughout the study area, so we could have missed other pairs that may have included individuals banded as nestlings.

The low encounter rate of banded individuals during annual monitoring efforts could be due to several factors. Mortality rates could be high during the period before first breeding, but low encounter rates could also reflect the high survival and site fidelity of adults in this population (J. Morrison unpubl. data), which, combined with limited suitable nesting habitat, may restrict opportunities for recruitment. Additionally, although unlikely, there is a possibility that some juveniles dispersed outside the study area to breed in other areas within Florida or even in other parts of North or Central America. However, no reports of banded caracaras, either recoveries or resightings, from distant populations have been received thus far. Furthermore, data obtained during 1995–2000 using telemetry for 131 juvenile caracaras radio-marked as nestlings within this population suggest that juveniles remain within the species' current Florida range, at least during the first 3 yr post-fledging (J. Morrison unpubl. data). Unfortunately, no transmitters lasted long enough to provide information on recruitment of radio-marked individuals.

Conclusions about dispersal behavior derived from data collected over a finite study area can be biased due to a non-uniform probability of resighting as a function of the distance dispersed (Moore and Dolbeer 1989, Koenig et al. 1996). Because we did not search for banded individuals outside the study area, we could have missed finding other recruits. We believe, however, that our sample of breeding areas scattered throughout the study area is representative of the population and, therefore, that the observed difference in mean dispersal distances between males and females, even given the small sample

size, provides evidence for female-biased dispersal in this population of Crested Caracaras.

Continued data collection on dispersal is needed for Crested Caracaras in Florida and throughout their geographic range to understand population structure and how these raptors use habitats and respond to landscape change. Our limited observations of dispersal movements in the Florida population may not be representative of the species overall due to broad differences in land use and habitat characteristics in other parts of the caracara's geographic range. We suggest, however, that the finding of female-biased dispersal in the species probably applies throughout the range, although distances involved probably vary among populations. Although the Crested Caracara has not received much conservation attention elsewhere, recent concern for the species' status has developed in Mexico (Rivera-Rodríguez and Rodríguez-Estrella 1998) and in parts of Argentina (Goldstein 2000) because of the loss of suitable nesting habitat in those regions as a result of rapid urban growth. To better understand this species' ecology and response to landscape change throughout its geographic range, additional studies of population dynamics and movement patterns for a number of populations are essential.

RESUMEN.—Como parte de un estudio poblacional a largo plazo del Caracara de Florida (*Caracara cheriway*), durante 1998–2002, encontramos cuatro machos en reproducción y cinco hembras en el mismo estadon, los cuales habían sido anillados en el nido. Nuestras observaciones sostienen que la edad de la primera reproducción en esta población ocurre a los tres años. Las distancias de dispersión de la natalidad fueron considerablemente más grandes para las hembras que para los machos; una hembra fue encontrada reproduciéndose en un lugar a 40 Km del área de nacimiento. Estas observaciones sugieren que la dispersión de las hembras en los caracaras de Florida es similar a la de otras rapaces. Los estudios de movimientos individuales y de la dinámica de poblaciones, son esenciales para entender la respuesta de los caracaras a la amplia perdida de hábitat y a los cambios de uso de la tierra en Florida y para el desarrollo de planes de conservación eficientes para esta población aislada y residente.

[Traducción de César Márquez]

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RECENT RECORDS OF CROWNED EAGLES (*HARPYHALIAETUS CORONATUS*) FROM ARGENTINA, 1981–2000

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KEY WORDS: *Crowned Eagle*; Harpyhaliaetus coronatus; *new records*; *conservation*; *status*; *Argentina.*

The Crowned Eagle (*Harpyhaliaetus coronatus*) is a vulnerable species whose distribution is limited to south-central South America (Collar et al. 1992, García-Fernández et al. 1997). The species has been protected in Argentina since 1954 and is listed as a threatened species in Brazil and Paraguay. The ecology of this large eagle is poorly known. It feeds on a variety of vertebrates including snakes (e.g., *Waglerophis merremi*), birds, skunks (*Conepatus* spp.), armadillos (Dasypodidae), and weasels (Collar et al 1992). The nest of the Crowned Eagle consists of a large platform placed in trees where one egg is laid (De la Peña 1992, Bellocq et al. 1998). Naturally low population numbers and habitat fragmentation have been recognized as primary contributors to the eagle's current status (Collar et al. 1992). Previous studies on habitat use by this eagle identified the potential negative effects of continuing afforestation (Bellocq et al. 1998). Over 60% of the Crowned Eagle records are from Argentina, where it occurs primarily in shrublands, savannas, and semi-open woodlands (Collar et al. 1992, Bellocq et al. 1998, Gonnet and Blendinger 1998). Crowned Eagles were also reported recently in subtropical rainforests (Chébez et al. 1998, Gonnet and Blendinger 1998). Here, we report new records of Crowned Eagles and integrate them with the previous information on this species from Argentina for 1981–2000.

METHODS

Road surveys for raptors were conducted in the northwest portion of Santa Fe province, north-central Argen-

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