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Home Range and Dispersal of Juvenile Florida Burrowing Owls

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ABSTRACT.—We present the first use of necklace radio transmitters to document the home range and dispersal of juvenile Burrowing Owls (*Athene cunicularia floridana*) during the breeding and post-breeding period in rural Florida. Juvenile Burrowing Owls ($n = 4$) were detected close to main and satellite burrows during 65 day-time relocations. Home range estimates (95% kernel) for juvenile owls varied from 98 to 177 m^2. Juvenile Burrowing Owls were not detected near main and satellite burrows during three evening relocations. Dispersal of juvenile owls coincided with flooding of burrows during the rainy season. Juvenile owls upon fledging used an extensive patch of saw palmetto (*Serenoa repens*) before dispersing beyond the range of ground telemetry capabilities. Aerial telemetry assisted in locating one juvenile Burrowing Owl using scrub oak (*Quercus* spp.) habitat approximately 10.1 km southeast of its main and satellite burrows. *Received 16 February 2006. Accepted 7 October 2006.*

Early observations of Florida Burrowing Owls (*Athene cunicularia floridana*) describe their propensity to excavate burrows in short grass habitat (Hoxie 1889, Rhoads 1892, Scott 1892, Palmer 1896). Typically, a breeding pair of owls excavate one breeding burrow and one or more satellite burrows (Scott 1892, Neill 1954, Wesemann 1986, Mealey 1997). Burrows, which can be 1–3 m in length, contain an enlarged nest chamber at their terminus (Rhoads 1892, Scott 1892, Nicholson 1954, Sprunt 1954). Male and female Florida Burrowing Owls can breed at 1 year of age (Haug

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et al. 1993) with most females laying eggs in the spring (Nicholson 1954, Courser 1976, Millsap and Bear 1990). However, nesting can occur between October and July with 2–10 eggs/nest (Rhoads 1892, Scott 1892, Nicholson 1954, Owre 1978, Stevenson and Anderson 1994). Previous ecological research on Florida Burrowing Owls has occurred during the breeding period in urban areas including college campuses (Courser 1976), private residences (Mealey 1997), and vacant lots (Wesemann 1986; Millsap and Bear 1990, 1997, 2000).

The majority of ecological data on Florida Burrowing Owls in rural areas is observational and was collected in the late nineteenth and early twentieth centuries on dry prairie habitat in southcentral Florida (Ridgway 1874, Cahoon 1885, Hoxie 1889, Rhoads 1892, Scott 1892, Palmer 1896, Bent 1938, Nicholson 1954). There are no published studies from rural areas (agricultural lands, grazing land for cattle, and areas managed or maintained as natural habitat) in Florida that document productivity, survival, prey preference, dispersal, or habitat requirements (breeding and post-breeding) of Burrowing Owls.

Identifying habitat requirements for Florida Burrowing Owls in rural areas is particularly important because of the rate of habitat loss due to development. Florida's human population is the third fastest growing in the nation (U.S. Department of Census 2004) and a variety of habitats is being lost such as upland forests (Sprott and Mazzotti 2001), scrub oak (Myers 1990), and prairie habitats (Abrahamson and Hartnett 1990). There are no management strategies for Burrowing Owls in rural environments (Florida Fish and Wildlife Conservation Commission 2004a).

The objectives of our study were to estimate home range size and dispersal of juvenile Burrowing Owls in a rural environment. We also estimated size of home range of juvenile Burrowing Owls during the breeding season, measures of dispersal from breeding habitat, and the location and type of post-breeding habitat occupied by juvenile Burrowing Owls.

METHODS

The study was undertaken from 1 March to 5 August 2004 on Rutland Ranch, Bradenton, Florida (27° 30′ N, 82° 15′ W). Rutland Ranch encompasses 2,372 ha and is managed by the Southwest Florida Water Management District (Barnwell et al. 2003). The ranch contains a mixture of habitats including oak scrub, herbaceous marshes, riparian hardwoods containing laurel (*Quercus laurifolia*) and water oak (*Q. nigra*), pine flatwoods containing slash pine (*Pinus elliottii*) and saw palmetto (*Serenoa repens*), and non-native pastures. Burrowing Owls excavate burrows within a 81-ha rectangular portion of improved pasture that undergoes yearly prescribed burning. The major land uses surrounding Rutland Ranch include cattle ranching and agriculture.

We captured and fitted radio transmitters to seven juvenile Burrowing Owls (one male, one female, five gender unknown) between 6 June and 22 July. Juvenile owls were captured using noose carpet traps (Mealey 1997, Millsap and Bear 1997) placed on the burrow mound and in the entrance of burrows. The average (± SD) weight of captured juvenile owls (n = 7) was 122.9 ± 10.3 g. Juvenile Burrowing Owls were fitted with necklace-style radio transmitters (AVM Instrument Company Ltd., Colfax, CA, USA). Prior to capture, juvenile owls were observed flying between their respective main and satellite burrows, and undertaking short flights within the improved pasture.

The maximum range of the receiver and transmitters during field tests was 1.61 km and the expected battery life was 160 days. Five randomly selected transmitters were tested to examine the precision of directional bearings with a resulting mean and standard deviation of 1.64 ± 4.13 degrees (White and Garrott 1990). The average weight of the transmitters was 4.9 g which was 4% of the average body mass of the seven juvenile Burrowing Owls marked.

We attempted to locate radio-marked Burrowing Owls once each day between 1000 and 2000 hrs (EST) from 7 June to 10 October. Relocations were attempted between 2100 and 0500 hrs on 1–2 August to document activity and location of each owl during the evening and early morning. Radio tracking was conducted along all road and trails within Rutland Ranch when any radio-marked owl was not relocated during the day and evening telemetry sessions in the improved pasture. Once an

TABLE 1. Kernel home range estimates of juvenile Burrowing Owls within improved pasture, Bradenton, Florida, 2004.

Bird #	Relocations	95% Kernel home range (m^2)	75% Kernel home range (m^2)	50% Kernel home range (m^2)
1	8	177	123	79
2	13	186	110	70
3	22	105	64	45
4	22	98	60	38
Mean		141	89	58

TABLE 2. Dispersal distance of juvenile Burrowing Owls from improved pasture, Bradenton, Florida, 2004.

			Distance from main burrow	
Bird #	Dates	Relocations	Min (m)	Max (m)
1	6 Aug–5 Oct	3	407	10,083
2	6 Aug–24 Sep	15	466	679
3	17 Aug	1	366	366
4	6–17 Aug	7	236	337

owl was not located after several attempts, the road network surrounding Rutland Ranch was surveyed at intervals of 0.80 km. Aerial telemetry was used to locate missing owls if an owl was still not located.

Program Animal Movement V.2 Beta (Hooge and Eichenlaub 1997) was used to estimate home ranges for each juvenile owl during the breeding period using the fixed kernel method with least squares cross validation as the smoothing parameter. The home range for each juvenile owl was calculated using relocations taken during daylight hours. Three separate home range estimates for each owl were calculated based on probabilities (95, 75, and 50%) of the estimated distribution of use. The measure tool in ArcMap 8.3 was used to calculate dispersal distance by measuring the distance (m) from each owl's location outside of the improved pasture to its respective main burrow.

RESULTS

Three radio-collared juveniles were killed by unknown predators. The four remaining owls were relocated 41 of 56 days radio tracking was attempted within the improved pasture. Radio tracking was not attempted during 2 days due to lightning and for 13 days because two stream crossings were flooded. The mean home ranges of the four juvenile Burrowing Owls, based on probabilities of 95, 75, and 50% of the estimated distribution of use were 141, 89, and 58 m^2, respectively (Table 1).

Two Burrowing Owls during night tracking sessions were near their main burrows at 2100 hrs, but no Burrowing Owls were located in the pasture after 2200 hrs. One Burrowing Owl was located at 2300 hrs, 264 m from its main burrow within the extensive patch of saw palmetto surrounding the pasture. Telemetry signals outside of the improved pasture were faint and brief making it difficult to triangulate the position of any owl. No signals were located after midnight in the improved pasture or from the trails surrounding it.

Burrowing Owls began dispersing from the improved pasture on 6 August when all burrows, except for a main and satellite burrow in the highest elevated area of the pasture, were flooded due to seasonal rainstorms. No juvenile owls could be located within Rutland Ranch or from the road network surrounding the property by 30 September.

Aerial surveys were conducted on 5 October within a radius of approximately 15 km of the improved pasture to locate the missing owls. One juvenile owl was relocated 10.1 km southeast of Rutland Ranch in habitat composed of predominantly scrub oak (W. D. Gordon, pers. comm.). Dispersal distance for juvenile owls varied (Table 2).

DISCUSSION

The home range estimates of juvenile Burrowing Owls post hatch indicates that juvenile owls are extremely dependent on main and satellite burrows. Dispersal of juvenile Burrowing Owls from habitat used post hatching coincided with flooding of the pasture and burrows beginning on 6 August. Juvenile owls were not relocated in the improved pasture after dispersal even after the pasture had dried. All four juvenile Burrowing Owls used the extensive saw palmetto patch surrounding the pasture during the day before dispersing beyond the range of the receiver. One juvenile owl was relocated near several live oaks (*Quercus virginiana*) growing near the improved pasture.

The large areas of private agricultural and pasture land surrounding Rutland Ranch, coupled with limited access to these properties, made it difficult to locate Burrowing Owls from the surrounding road network. Aerial telemetry, initiated after the owls had dispersed from the pasture, assisted in locating only one of four juvenile Burrowing Owls, possibly because of battery failure of the three remaining transmitters.

Knowledge of breeding and post-hatching habitat requirements of Burrowing Owls in rural environments (especially grazing lands and natural areas) is particularly important because of continued habitat loss due to increased growth and development throughout Florida. We also note that Burrowing Owl populations in urban areas such as vacant lots, college campuses, and private residences are also not immune to the effect of development. Urban areas may provide only temporary Burrowing Owl habitat due to the inverse relationship between the size and persistence of owl populations, and the level of human development (Courser 1976, Wesemann 1986, Millsap and Bear 2000).

The Burrowing Owl has been listed as a Species of Special Concern since 1979 by the Florida Fish and Wildlife Conservation Commission (Millsap 1997). Without conservation and management, Burrowing Owls may become a state listed threatened species because of vulnerability to habitat modification, environmental alteration, human disturbance, or human exploitation (Florida Fish and Wildlife Conservation Commission 2004b). A greater understanding of Burrowing Owl ecology in rural environments is needed to successfully manage and conserve this species throughout Florida.

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American White Pelicans Force Copulations with Nestlings

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ABSTRACT.—We observed 56 forced copulation (FC) events in a breeding colony of American White Pelicans (*Pelecanus erythrorhynchos*) in Saskatchewan, Canada during the 2005 nesting season. All FCs were directed at nestlings >21 days of age that were not continuously attended by an adult. The onset of FCs occurred in close synchrony with an unexpected late-season increase in adult copulation attempts. We suggest that FC directed at nestlings is not simply an aberrant and nonadaptive behavior. Rather, copulations with nestlings result from adult male pelicans being inappropriately stimulated to copulate with nestlings when actually seeking copulations with adult females. *Received 22 December 2005. Accepted 24 July 2006.*

Forced copulation is a behavior used by males of some species as a strategy to fertilize females that would otherwise be unreceptive (McKinney et al. 1983). The proportion of fertilization events gained via forced copulations is likely low (e.g., 2–5%; Dunn et al. 1999), but this behavior is generally considered adaptive and has been reported for several avian orders (e.g., Anseriformes, McKinney et al. 1983; Charadriiformes, Ewins 1993; Passeriformes, Rising and Flood 1998; and Galliformes, Giudice and Ratti 2001). On rare occasions, forced copulation attempts by adults are directed toward conspecific young. We found a small number of reports of adults attempting to copulate with fledged conspecific juveniles (Armstrong 1988, Ewen and Armstrong 2002) and with unfledged chicks (Kinkel and Southern 1978, Besnard et al. 2002). Fledged juveniles may be mistaken for adult females in some species, but there is no obvious adaptive explanation for forced copulations with unfledged chicks. The motivation for forced copulation with unfledged chicks is therefore unclear.

We describe patterns associated with forced copulation attempts on chicks by adult American White Pelicans (*Pelecanus erythrorhynchos*; hereafter pelicans) in a breeding colony

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