Jean-Luc E. Cartron
W. Scott Richardson
Glenn A. Proudfoot

Chapter 1:

The Cactus Ferruginous Pygmy-Owl: Taxonomy, Distribution, and Natural History

The cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*) is a small, cryptic owl that is often difficult to observe. Its natural history and conservation needs are poorly understood. Despite ongoing research in Texas and Arizona, the available information remains limited. In addition, factors influencing demographics (e.g., habitat configuration, causes of mortality and reproductive failure, and prey availability) may vary geographically, increasing the need for information from all parts of the range. Without a significant commitment to additional research, management and recovery strategies will be difficult to develop. This chapter first describes the taxonomy and distribution of the ferruginous pygmy-owl (*G. brasilianum*). It then discusses the known ecology of *cactorum*.

1. Taxonomy and distribution

The taxonomy of the genus *Glaucidium* (order Strigiformes, family Strigidae) is a topic of debate among authorities, at both the species and subspecies levels. Both Johnsgard (1988) and Sibley and Monroe (1990) list 12 species of owlets and pygmy-owls occurring worldwide, including the ferruginous pygmy-owl. However, recent molecular and vocalization studies distinguish a number of additional mainland New World species of pygmy-owls (Vielliard 1989, Robbins and Howell 1995, Howell and Robbins 1995, D. Holt pers. comm.). The austral pygmy-owl, sometimes considered a separate species, *G. nanum* (e.g., Meyer de Schauensee 1970), has recently been treated as a morph of *G. brasilianum* (Marín et al. 1989, Stoltz et al. 1996). Conversely, the pygmy-owl of southwest Ecuador and northwest Peru, once treated as *G. brasilianum* (Meyer de Schauensee and Phelps 1978), has been proposed as a distinct species, *G. peruanum,* by König (1991) and Stoltz et al. (1996).

The ferruginous pygmy-owl, also called the ferruginous owl, is considered abundant or extremely abundant throughout most of its range, which is centered on the Neotropics (Fig. 1-1) (Phillips et al. 1964, Johnsgard 1988, Terres 1991). In Mexico, this species was the one most often collected between 1840 and 1991 (Enriquez-Rocha et al. 1993). To the south, the ferruginous pygmy-owl's distribution extends to central Argentina, even to Tierra del Fuego if *nanum* is treated as conspecific (Johnsgard 1988, König and Wink 1995). At the northern edge of its geographic range, the ferruginous pygmy-owl reaches central Arizona and extreme southeast Texas (Fig. 1-2). Since 1937, the form found from central Arizona south to Michoacan in western Mexico (see Johnsgard 1988) has been recognized as the subspecies *cactorum* (van Rossem 1937, Friedmann et al. 1950, Blake 1953, Sprunt 1955, Phillips et al. 1964, Monson and Phillips

Figure 1-1. Geographic range of the ferruginous pygmy-owl (adapted from Johnsgard 1988). The distribution includes *nanum* (Marín et al. 1989, Stoltz et al. 1996) but not *peruanum* (Meyer de Schauensee and Phelps 1978). The distribution of the recently described subspecies *stranecki* (König and Wink 1995) is not included.

1981, Millsap and Johnson 1988, Binford 1989). Whether the ferruginous pygmy-owl which ranges from southeastern Texas to Tamaulipas and Nuevo Leon in northeastern Mexico (see Johnsgard 1988) is also *cactorum* has not been resolved. Peters (1940) refers to the ferruginous pygmy-owl of Texas as *ridgwayi* and to the ferruginous pygmy-owl of Arizona as *cactorum*. Since Friedmann et al. (1950), however, both forms have been treated as *cactorum*. Molecular analyses are currently in progress to decide whether the two owls should be taxonomically divided (Proudfoot et al. unpubl. data). Pending the results of these analyses, we follow the currently accepted taxonomy (Johnsgard 1988, U.S. Fish and Wildlife 1997, American Ornithologists' Union 1998) and consider the ferruginous pygmy-owl of Texas and northeastern Mexico as *cactorum*.

In southern Mexico and throughout Central America *cactorum* is replaced by *G. b. ridgwayi*. In South America, several subspecies have been described. One is the widely distributed *G. b. brasilianum* (Fisher 1893, van Rossem 1937, Friedmann et al. 1950, Schaldach 1963, Phillips et al. 1964, Meyer de Schauensee 1966, Karalus and Eckert 1974, Oberholser 1974, Johnsgard 1988, Sick 1993). Another subspecies recently described from central Argentina is *G. b. stranecki* (König and Wink 1995). The austral pygmy-owl of Tierra del Fuego may represent the southernmost subspecies of the ferruginous pygmy-owl.

Two populations of *cactorum* are generally recognized (e.g., Burton 1973, Johnsgard 1988, but see comments above) (Fig. 1-2). In the west, the cactus ferruginous pygmy-owl ranges north to central and southern Arizona. The historical boundaries of its distribution in Arizona are New River in the north, the confluence of the Gila and San Francisco rivers to the east, and the desert of southern Yuma County to the west (Fisher 1893, Phillips et al. 1964, Monson and Phillips 1981, Hunter 1988). This western population extends south along the Pacific slope of the Mexican Plateau, where it is common in lowlands and foothills (Peterson and Chalif 1973). The eastern population occurs from extreme southeastern Texas south to Tamaulipas and Nuevo Leon in northeastern Mexico. In Texas, it occurs in the live oak (*Quercus virginiana*)-honey mesquite (*Prosopis glandulosa*) forest of the historical Wild Horse Desert in Brooks and Kenedy counties (Mays 1996). Historically, it was also often reported along the Rio Grande in Star and Hidalgo counties (Oberholser 1974, Texas Ornithol. Soc. 1984, Proudfoot in press).

The eastern and western populations are separated over most of their ranges by a series of biogeographic barriers: the United States' Chihuahuan desert basins and associated mountain ranges and Mexico's Sierra Madre Occidental and Oriental and Mexican Plateau. These barriers may prevent contact between the two populations. There is no record of the cactus ferruginous pygmy-owl in any U.S. location between Arizona and south Texas (Bailey 1928; Phillips et al. 1964, Oberholser 1974, Williams 1997). In Mexico, it is rarely encountered on the Mexican Plateau above 1200 m on the west side and 300 m on the east side (Friedman et al. 1950). At the southern tip of the Mexican Plateau, however, the two ranges may merge (Johnsgard 1988, but see Burton 1973 for a different opinion).

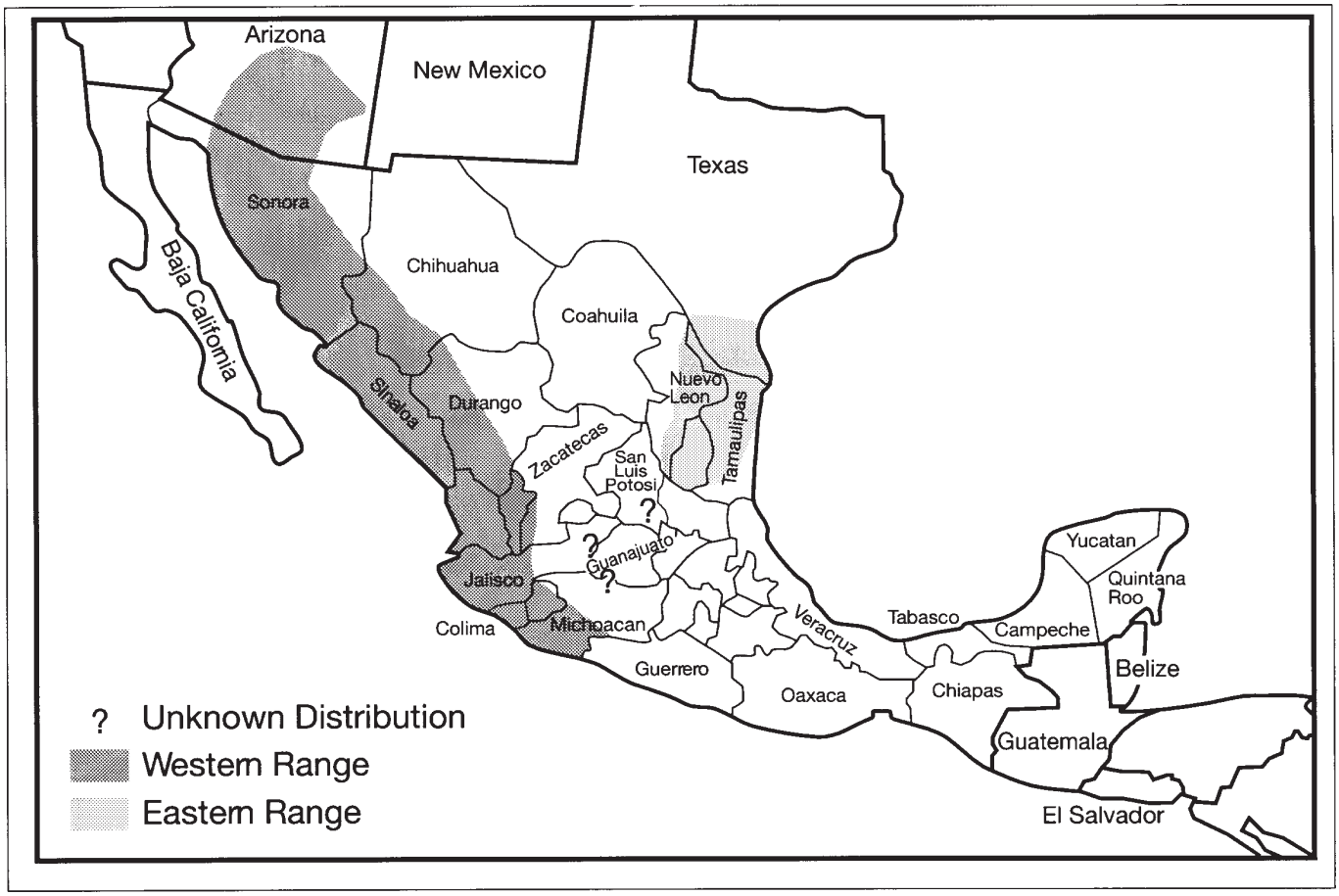

Figure 1-2. Geographic range of the cactus ferruginous pygmy-owl (adapted from U.S. Fish and Wildlife 1994). Whether the eastern and western parts of the range are completely disjunct is unknown. The eastern population is currently treated as the subspecies *cactorum*, but its taxonomic status remains uncertain.

2. Description

The cactus ferruginous pygmy-owl is a small gray-brown or rufous-brown owl, approximately 16.5 to 18 cm long. In comparison with *G. b. brasilianum* and *G. b. ridgwayi*, this subspecies exhibits shorter wings, a longer tail, and generally lighter coloration (van Rossem 1937, Phillips et al. 1964, Proudfoot 1996). The head is relatively small and without ear tufts. The eyes are lemon yellow and the crown is finely streaked with flecks of buff. On the nape, a pair of conspicuous black patches outlined in white is suggestive of eyes. The back is not spotted as in the northern pygmy-owl (*G. gnoma*), but plain, rusty brown (Robbins et al. 1966). The white breast shows well-defined streaks of brown. The tail is long compared to other small owls and is rufous in color with seven or eight darker brown cross bars. Although no true seasonal changes in plumage coloration are documented, Breninger (1898) reported that the rufous coloring of the tail and upper body becomes less noticeable through the spring months. According to Ridgway (1914), the Arizona and Texas populations of cactus ferruginous pygmy-owls exhibit slightly distinct color forms, the latter occurring with a more rufous plumage. A gray-brown phase with white tail bands has been described in other parts of the species' distribution (Edwards 1972).

As is typical in owls, the female is larger, weighing around 75 g while the male averages 64 g (Proudfoot unpubl. data) (Fig. 1-3). Additionally, subtle differences in plumage exist between the sexes, at least in the United States (Abbate et al. 1996, Proudfoot 1996). Compared to males, females display a more pronounced cinnamon-rufous color tone on their coverts, remiges, occipitals, and scapulars (Proudfoot 1996). Overall, juveniles are similar to adults but are distinguished for the first few weeks by their shorter tails and by well-contrasted white, tear-drop-like feather ends that form a broken line running from shoulder to rump when the birds are perched. Other characteristics of fledglings include lighter, less distinct eye patches on the nape, the lack of buff on their crowns, and more white on their underparts

Figure 1-3. Sexual dimorphism in the cactus ferruginous pygmy-owl. Note the difference in color tone and the larger size of the female, right. Photograph by Glenn Proudfoot.

(Abbate et al. 1996). Fledglings in Arizona also exhibit a more chocolate brown color, lacking any real rufous coloration except on their tails.

The vocal repertoire of the cactus ferruginous pygmy-owl comprises several calls, some of which appear to be specific to age or sex of the owl. The advertising call of the adult male is heard primarily at dawn and dusk but also during daylight and even moon rise, especially during the courtship period. It is ventriloquial (Sprunt 1955) and consists of a prolonged and monotonous series of clear, mellow, whistling notes uttered at approximately 1400 Hz (Stillwell and Stillwell 1954). During the breeding season, females utter a rapid chitter, possibly a contact call with the male and juveniles and also for food begging (Abbate et al. 1996, Proudfoot and Johnson in press). When the female receives food from the male, the same chitter may be used to signal her position to the fledglings (Abbate et al. 1996). Two additional female calls have been recorded; the "chirp," sometimes repeated with short pauses in between, may be used to signal distress or for warning (Abbate et al. 1996). The other call is similar to the territorial vocalization of the male, only at a higher pitch and slower beat (Phillips et al. 1964, Abbate et al. 1996). The specific function of this latter call is not well understood. The fledglings' primary vocalization is a chitter similar to the female's but at a higher pitch. When they are flushed from a perch, fledglings also produce a high-pitched chirp-like call (Proudfoot and Johnson in press, Richardson unpubl. data).

Like other species in the genus *Glaucidium*, the ferruginous pygmy-owl is reported to hunt both day and night (Oberholser 1974, Sick 1993). Yet, except during nestling development, *cactorum* is primarily diurnal (Proudfoot and Johnson in press). Although the ferruginous pygmy-owl is generally quite cryptic, it is sometimes seen during the day perched on exposed branches (Sutton 1951, Oberholser 1974). The tail, often cocked at an angle with the body, is jerked from side to side when the owl is agitated (Sprunt 1955, Oberholser 1974). Unlike many owl species, the ferruginous pygmy-owl flies with audible wingbeats due to reduced numbers, lengths, and surface area coverage of the barbs and barbules (D. Holt, pers. comm.). The ferruginous pygmy-owl's flight is generally short and consists of quick sallies from one lookout point to another. It has been compared to that of a shrike (e.g., Sprunt 1955).

3. Habitat

Across its range, the ferruginous pygmy-owl occurs in many distinct environments, such as scrublands, forests, cerrados (i.e., a neotropical type of open woodlands), and towns (Meyer de Schauensee 1966, Davis

1972, Meyer de Schauensee and Phelps 1978, Hilty and Brown 1986). Partly because of this species' plasticity and partly due to the lack of detailed habitat studies, the habitat requirements of *cactorum* remain poorly understood. The following section profiles habitat occupied by the cactus ferruginous pygmy-owl and discusses some potentially important habitat characteristics (Fig. 1-4). This topic is addressed in more detail in Chapter 4.

In the eastern part of the range, plant communities supporting the cactus ferruginous pygmy-owl are coastal-plain oak associations, mesquite bosques, and Tamaulipan thornscrub in south Texas (Tewes 1993, Wauer et al. 1993, Mays 1996), lowland thickets, thornscrub associations, riparian woodlands and second-growth forests in northeastern Mexico (van Rossem 1945, Enriquez-Rocha et al. 1993, Tewes 1993).

In western Mexico, the owl may occur in Sonoran desertscrub, Sinaloan thornscrub, Sinaloan deciduous forest, riverbottom woodlands, cactus forests, and thornforests (Enriquez-Rocha et al. 1993, U.S. Fish and Wildlife 1997). In Arizona, the owl is historically associated with cottonwood (*Populus fremontii*) and mesquite (*Prosopis velutina*) riparian woodlands (Bendire 1888, Breninger 1898, Phillips et al. 1964), and Sonoran desertscrub (Johnson and Haight 1985). Recently, cactus ferruginous pygmy-owls have been chiefly reported from Sonoran desertscrub (see Chapter 3).

The physical settings and vegetation compositions of southern Texas and Arizona have very little in common. However, the frequent association between *G. brasilianum* and thickets and edges, and its regular use of densely foliated exotic landscape trees in Arizona (Chapter 4) suggests that vegetation structure is more important to this owl than vegetation composition. Similarities between currently occupied habitat in Arizona and Texas include the presence of thorny bushes: ironwood (*Olneya tesota*) in Arizona and lime prickly ash (*Zanthoxylum fagara*) in south Texas. Results from research in Texas (Proudfoot 1996) indicate the importance of moderate (50 to 75%) to dense (76 to 100%) understory cover and trees large enough to hold cavities. Understory cover may be critical for both foraging and fledgling survival (Fig. 1-4, see also Chapter 4).

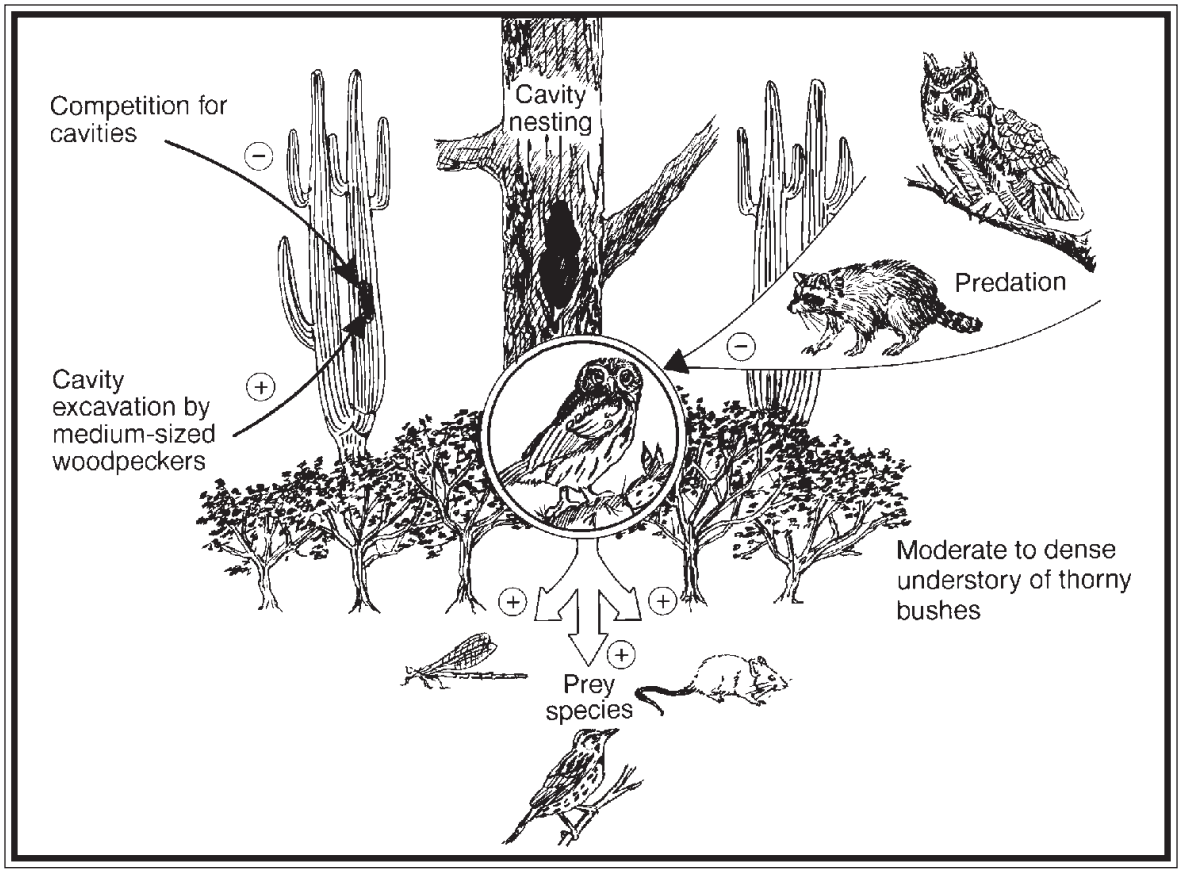

Figure 1-4. Known and hypothesized ecological relations of the cactus ferruginous pygmy-owl (⊕: ecological relations benefitting individual cactus ferruginous pygmy-owls; ⊖: ecological relations with a negative impact on individual cactus ferruginous pygmy-owls). The degree of competition for nesting cavities with other species is unclear.

4. Breeding cycle

Until recently, the breeding biology of the cactus ferruginous pygmy-owl was largely undocumented. Since 1994, however, critical information has been obtained, especially in Texas, where nests have been monitored using radio telemetry and miniature video cameras with infrared-light-emanating diodes (Proudfoot 1996, Chapter 5). In Arizona, nest sites have been located and monitored since 1996 (Abbate et al. 1996, Richardson unpubl. data). These studies have provided region-specific information on the breeding chronology of the owl, habitat use by the fledglings, and adult-fledgling interactions.

Typically, the nest site is a natural cavity or an abandoned woodpecker hole in a tree or in a large columnar cactus. Nest cavities in trees have been recorded primarily in live-oak and cottonwood but also in Montezuma baldcypress (*Taxodium mucronatum*), willow (*Salix* sp.), and honey mesquite (Bendire 1892, Gilman 1909, Rea 1983: 169, Proudfoot 1996, Russell and Monson 1998). In Arizona, all nest cavities detected between 1995 and 1998 have been in saguaro cacti (*Carnegiea gigantea*) (Abbate et al. 1996, Richardson unpubl. data). Nest height varies from 2 to 12 m above ground (Breninger 1892, Gilman 1909, Oberholser 1974, Proudfoot in press). No lining material is added inside the cavity (Breninger 1898, Proudfoot 1996).

Cactus ferruginous pygmy-owl eggs are white and almost spherical and weigh approximately 8 g. They are laid at regular intervals of 32-39 hours (Proudfoot and Johnson in press). Clutch size ranges between three and seven eggs (Bent 1938, Heintzelman 1979, Proudfoot and Johnson in press). In Texas, the most commonly recorded clutch size is five (Proudfoot 1996); in Arizona, it is four (Hunter 1988); in Sonora, it is three or four (Russell and Monson 1998). In Texas, incubation is conducted solely by the female and lasts about 28 days (Proudfoot in press). However, recent observations (Richardson unpubl. data) indicate the male may play a limited role in incubation in Arizona. If the first clutch fails, a replacement clutch may be produced within 21 days (Proudfoot unpubl. data). Hatching is asynchronous, occurring every 20 to 26 hours. During the first week after hatching, the female remains with the nestlings, leaving the nest only to obtain food, cast a pellet, and/or defecate (Proudfoot and Beasom 1997). As the nestlings develop, the female spends more time outside the cavity and both adults bring food to the nest (Proudfoot unpubl. data). Intense competition for food occurs among the nestlings, occasionally resulting in siblicide (Proudfoot in press). Fledging time ranges between 21 and 30 days (Scherzinger 1977, Terres 1991, Proudfoot 1996). After fledging, both adults hunt but the female delivers most of the prey items to the juveniles. Initially, the fledglings remain near the nest, often in proximity to each other, and utilize dense, thorny shrubs and trees for cover. Over time, the size of the area the fledglings use increases while the amount of contact with the adults decreases. Approximately two months after fledging, the young disperse from the nest site (Proudfoot 1996). Preliminary data indicate that adults maintain their pair bond following the dispersal of the juveniles and appear to mate for life (Proudfoot unpubl. data).

5. Ecological relations

Hunting and prey base

Pygmy-owls are known as fierce hunters capable of killing prey twice their own size (Terres 1991, Sick 1993). Early accounts describe the cactus ferruginous pygmy-owl attacking young chickens and adult birds the size of robins (Breninger 1898, Bent 1938, Johnsgard 1988). Recently, this owl was observed killing mourning doves (*Zenaida macroura*) and large desert spiny lizards (*Sceloporus magister*) in Arizona (Richardson unpubl. data). In Texas, it feeds on large prey such as eastern meadowlarks (*Sturnella magna*) and hispid cotton rats (*Sigmodon hispidus*) (Proudfoot and Beasom 1997). When hunting, ferruginous pygmy-owls typically perch and scan their surroundings (Breninger 1898, Abbate et al. 1996). Once prey is detected, they strike it from above or engage in a short flight pursuit (Abbate et al. 1996). Sick (1993) argues that the "eye spots" of the ferruginous pygmy-owl's nape feathers trick the other birds into flying in front of it rather than behind it. The owl can then strike the unsuspecting prey in a sudden, dashing flight.

The cactus ferruginous pygmy-owl is a prey generalist (Table 1-1). Its prey base includes birds, lizards, insects, small mammals (Bendire 1888, Sutton 1951, Sprunt 1955, Earhart and Johnson 1970, Oberholser 1974), snakes (Sprunt 1955), and frogs (Proudfoot and Beasom 1997). In Texas, thirty-six prey species representing five classes have been recorded (Proudfoot and Beasom 1997). In Arizona, prey items were primarily reptiles but also included birds, mammals, and insects (Table 1-2). The cactus ferruginous pygmy-owl is an opportunistic predator: it takes advantage of seasonal opportunities such as the emergence of insects or the presence of nestlings in nearby nests (Abbate et al. 1996). After a meal, the owl may cache prey remains in a tree, cavity, or ball of mistletoe (*Phoradendron* sp.) (Sprunt 1955, Abbate et al. 1996, Proudfoot 1996).

The cactus ferruginous pygmy-owl is referred to as the "terror of small birdlife" (Sprunt 1955). Thus, it is not surprising that this owl is commonly mobbed by a wide variety of other bird species (Gilman 1909, Sutton 1951, Sprunt 1955).

Table 1-1. List of identified prey species in the diet of cactus ferruginous pygmy-owls in Texas and Arizona. The list of prey species for Texas is from Proudfoot and Beasom (1997) and for Arizona from Richardson (unpubl. data).

Prey category	Texas	Arizona
Amphibians	narrow-mouth toad (*Gastrophryne olivacea*)	—
Birds	Bewick's wren (*Thryomanes bewickii*) blue grosbeak (*Guiraca caerula*) brown-crested flycatcher (*Myiarchus tyrannulus*) eastern meadowlark (*Sturnella magna*) Nashville warbler (*Vermivora ruficapilla*) northern cardinal (*Cardinalis cardinalis*) northern mockingbird (*Mimus polyglottos*) pyrrhuloxia (*Cardinalis sinuatus*)	cactus wren (*Campylorhynchus brunneicapillus*) Gambel's quail (*Callipepla gambelii*) house finch (*Carpodacus mexicanus*) mourning dove (*Zenaida macroura*) verdin (*Auriparus flaviceps*)
Mammals	common evening bat (*Nycticeius humeralis*) hispid cotton rat (*Sigmodon hispidus*) hispid pocket mouse (*Chaetodipus hispidus*) house mouse (*Mus musculus*) northern pygmy-mouse (*Baiomys taylori*) Texas kangaroo rat (*Dipodomys compactus*)	Bailey's pocket mouse (*Chaetodipus baileyi*) Merriam's kangaroo rat (*Dipodomys merriami*)
Reptiles	four-lined skink (*Eumeces tetragrammus*) ground skink (*Scincella lateralis*) Great Plains skink (*Eumeces obsoletus*) keeled earless lizard (*Holbrookia propinqua*) rose-bellied lizard (*Sceloporus variabilis*) six-lined racerunner (*Cnemidophorus sexlineatus*) Texas horned lizard (*Phrynosoma cornutum*) Texas spiny lizard (*Sceloporus olivaceus*) Texas spotted whip-tail (*Cnemidophorus gularis*)	desert spiny lizard (*Sceloporus magister*) western whiptail lizard (*Cnemidophorus tigris*) zebra-tailed lizard (*Callisaurus draconoides*)
Invertebrates[a]	cicada (Cicadidae) click-beetle (Elateridae) cone-nosed blood sucker (Reduviidae) dragonfly (Aeshnidae) grasshopper (Acrididae and Tettigoniidae) lighting bug (Lampyridae) preying mantis (Mantidae) round-headed katydids (Phaneropterinae) true katydids (Pseudophyllinae) walking stick (Heteronemiidae)	butterfly (Lepidoptera) cicada (Cicadidae) grasshopper (Orthoptera) sphinx moth (Sphingidae)

[a] Invertebrates are identified to the order or family level only.

Table 1-2. Diet of cactus ferruginous pygmy-owls in Arizona, 1996-1998. Based on visual observations of one nesting pair in 1996, one nesting pair in 1997, and three nesting pairs in 1998. Each percentage of the diet is calculated by dividing the number of individual prey items in a taxonomic group by the total number of prey items. Data compiled from Abbate et al. (1996) and from Richardson (unpubl. data).

Prey category	1996 (% of Diet)	1997 (% of Diet)	1998 (% of Diet)
Reptiles	47 (56%)	23 (43%)	36 (35%)
Birds	7 (8.3%)	20 (38%)	28 (27%)
Mammals	4 (4.8%)	1 (2%)	7 (7%)
Insects	4 (4.8%)	1 (2%)	3 (3%)
Undetermined	22 (26.2%)	8 (15%)	28 (27%)
Total	84 (100%)	53 (100 %)	102 (100%)

Predation avoidance

Cryptic coloration, use of trees with a dense foliage and spines, a perch-and-wait hunting strategy, and a low, rapid flight may all represent predator avoidance adaptations of the cactus ferruginous pygmy-owl. In Arizona, reactions of nesting cactus ferruginous pygmy-owls to Harris's hawks (*Parabuteo unicinctus*) approaching or perching in proximity to the nest site were regularly observed. Typically, the response of the owls was to cease vocalizations and remain motionless until the hawks had left (Richardson unpubl. data).

Other ecological relations

Although many aspects of the cactus ferruginous pygmy-owl's biology are related to predator avoidance and food habits, other types of interactions with the local avifauna have also been documented (Fig. 1-4). As an obligate cavity nester, this owl is dependent on medium-sized woodpeckers such as the Gila woodpecker (*Melanerpes uropygialis*) (Gilman 1909, Rea 1983) and flickers (*Colaptes* spp.) in Arizona, and the golden-fronted woodpecker (*Melanerpes aurifrons*) in Texas. Use of cactus ferruginous pygmy-owl nest boxes by brown-crested flycatchers (*Myiarchus tyrannulus*), golden-fronted woodpeckers, eastern screech owls (*Otus asio*), and European starlings (*Sturnus vulgaris*) was documented in Texas. In Arizona, purple martins (*Progne subis*), ash-throated flycatchers (*Myiarchus cinerascens*), elf owls (*Micrathene whitneyi*), western screech owls (*Otus kennicottii*), Gila woodpeckers, northern flickers, starlings, house sparrows (*Passer domesticus*) and house finches (*Carpodacus mexicanus*) all use saguaro cavities and represent potential competitors for nest cavities. Species such as the Gila woodpecker and the greater roadrunner (*Geococcyx californianus*) have been observed raiding pygmy-owl prey caches, indicating another potential source of competition with the local avifauna (Richardson unpubl. data).

6. Mortality

Natural causes

Little is known about the rate or causes of mortality of cactus ferruginous pygmy-owls in Arizona or Texas. Due to its small size, however, the cactus ferruginous pygmy-owl may be very susceptible to predation. In Texas, several cases of mortality by a great-horned owl (*Bubo virginianus*), Harris's hawk, and Cooper's hawk (*Accipiter cooperi*) have been documented, and raccoon and bullsnake depredation of nestlings is common (Proudfoot and Johnson in press).

While the use of dense, thorny cover may reduce the threat of predation for fledglings, their initial inexperience and lack of coordinated flight leads to other types of mortality. From 1995 through 1998, 18 fledglings were monitored in Arizona. Within 24 hours of fledging, one juvenile disappeared (Abbate et al. 1996); another was rescued on the ground after being injured by a curve-billed thrasher (*Toxostoma curvirostre*) (Abbate et al. 1996); three were impaled on cholla or other cacti, but worked free or were rescued, and one was removed from a road and placed in a nearby tree (Richardson unpubl. data). In Texas, one fledgling ended up on the ground after colliding with a tree and was placed back in the tree by the observer. Mortality among fledglings before and during dispersal averaged 38% (Proudfoot unpubl. data).

Although little is known about the prevalence and impact of diseases on the survival and recruitment of the cactus ferruginous pygmy-owl, several pathogens may affect this bird. In South America, the ferruginous pygmy-owl is sometimes infected with blood parasites (hematozoa) such as *Haemoproteus* and *Leucocytozoon* (Bennett et al. 1982). One *Haemoproteus* species can be lethal in quails and one *Leucocytozoon* species has been known to kill geese, ducks, grouse, and turkeys (Clarke 1938, Fallis 1945, Cook 1971a, 1971b, Harris 1972). In owls, hematozoa are thought to be pathogenic, causing anemia, bacterial diarrhea, and septicemia (Hunter et al. 1987). Blood smears obtained from cactus ferruginous pygmy-owls did not detect the presence of hematozoa in the Texas population (Proudfoot and Radomski 1997). Samples from Arizona are under analysis (Proudfoot et al. unpubl. data).

The protozoal disease trichomoniasis represents a potential threat to the cactus ferruginous pygmy-owl in the Tucson area. The parasite is readily transmitted from prey to predator (Stabler 1951) and the owl's local prey include mourning doves and house finches (Table 1-1), both of which occur in high concentrations in urban Tucson and are known carriers of the disease. In addition, trichomoniasis has been documented in nearly every raptor in the Tucson area. In particular, it is found in other small birds of prey, such as the American kestrel (*Falco sparverius*), western screech owl, and burrowing owl (*Athene cunicularia*). High nestling mortality due to this disease has been observed in Cooper's hawks in metropolitan Tucson (Boal and Mannan 1996).

Nothing is known about the influence of starvation on the mortality of adults. As in other owl species (see Miller 1989), death by starvation probably has a higher incidence in juveniles than in adults. Finally, one dead cactus ferruginous pygmy-owl with cholla embedded in both feet was found floating in Dripping

Springs at Organ Pipe Cactus National Monument in November 1972 (T. Tibbitts pers. comm.).

Human-related deaths

The incidence and impact of direct and indirect human-related deaths among wild birds are not well known. Casualties caused by pest control, pollution, collisions with cars, TV towers, and glass windows, electrocution by power lines, and cat predation are often underestimated, although likely increasing in occurrence due to human population growth (Banks 1979, Klem 1979, Churcher and Lawton 1987). Even where human-related deaths are uncommon, they may still substantially affect populations of rare birds.

Given the propensity for cactus ferruginous pygmy-owls to occur in residential areas in Arizona, human-related factors may be a significant cause of owl mortality there. A cactus ferruginous pygmy-owl nesting near a house was rescued after colliding with an automobile window. Although it survived, it showed evidence of cranial hemorrhage (Richardson unpubl. data). Cats may be another local cause of mortality. In Texas, one adult owl and one fledgling were killed by a domestic cat. In Arizona, children were observed shooting pellet or BB guns near a nest site (Richardson unpubl. data); hence, shooting should also be considered a potential cause of owl mortality within urban areas.

7. Home range and territoriality

Estimates of both home range and territory size for the cactus ferruginous pygmy-owl are based on limited information. In other owl species, home-range and territory size may vary as much as tenfold or more among areas or individuals (Hayward 1983, Cramp 1985, Zabel et al. 1992). Initial results from ongoing research in Texas suggest that the home range of cactus ferruginous pygmy-owls may expand substantially during dry years (Proudfoot unpubl. data).

In Texas, cactus ferruginous pygmy-owls defend their territories year round. Areas used outside the breeding season varied between 19 and 116 ha (Proudfoot 1996). During incubation, adult males used 1.34 to 8.52 ha (average 4.1) (Proudfoot 1996). In Arizona, one female used an area approximately 0.2 ha in size during the prefledging period. This area increased to about 14 ha between fledging and juvenile dispersal and was also used by the fledglings (Abbate et al. 1996). Estimates of territory size in Arizona have ranged between .01 and 4 ha (Hunter 1988, Millsap and Johnson 1988, Felley and Corman 1993). In Organ Pipe National Monument, owl territories appear linear along washes (Hunter 1988). Recent studies using telemetry have begun in Arizona to gather additional information on territory and home range sizes (Richardson unpubl. data).

In south Texas, the status of the cactus ferruginous pygmy-owl as a year-round resident is clearly established (Proudfoot in press). In Arizona and western Mexico, owls are seen throughout the year (Bendire 1888, Rea 1983:169, Russell and Monson 1998). However, Russell and Monson (1998) report a larger number of sightings during the spring and summer compared to the winter in northern but not southern Sonora. Therefore, small scale migration for some individuals cannot be completely ruled out. In the last two years, telemetry has been used to study pygmy-owl movements in Arizona, but more information is needed before any conclusion regarding this issue is made.

8. Summary

Ongoing studies in Arizona and Texas have increased our understanding of the natural history of the cactus ferruginous pygmy-owl (e.g., breeding biology, prey base). However, significant gaps in the knowledge of the pygmy-owl's status and biology (i.e., demographics, seasonal movements and fledgling dispersal, habitat requirements and preferences, competition for cavities with other species, and factors influencing home-range and territory size) exist in Arizona, and the taxonomic relationship between the Arizona and Texas owl populations is uncertain. Hence, additional research is critical to the conservation of this species. The importance of research for the management and recovery of the Arizona owl population is addressed in Chapter 6.

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