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Chapter 5:

Research on the Ferruginous Pygmy-Owl in Southern Texas: Methodology and Applications

Using broadcasted conspecific calls, nest boxes, miniature-video cameras, a fiberoptic stratascope, and radio-telemetry, researchers from Caesar Kleberg Wildlife Research Institute conducted studies to assess the viability and profile the natural history of ferruginous pygmy-owls in Texas (Mays 1996, Proudfoot 1996a, Proudfoot and Beasom 1996, Proudfoot and Beasom 1997, Proudfoot and Radomski 1997). Techniques used were specifically designed or adapted to address the concerns of this species (e.g., minimizing risks of nest abandonment resulting from nest inspection). In this chapter, we summarize research methods used to study ferruginous pygmy-owls in Texas and provide current information regarding its status there.

1. Status of ferruginous pygmy-owls in Texas

Prior to 1920, the ferruginous pygmy-owl was considered a common resident of riparian areas in the lower Rio Grande Valley of Texas (Figs. 5-1 and 5-2) (Oberholser 1974). However, by the early 1970s, over 90% of this habitat was cleared for urban and agricultural expansion, reducing the size of the ferruginous pygmy-owl population (Oberholser 1974). During the Texas Breeding Bird Atlas Project, 1987-1992, two confirmed nest sites were recorded below Falcon Dam in Starr County, Texas, and six probable sites were recorded between the Rio Grande River and the 27th parallel (Proudfoot in press). Wauer et al. (1993) expressed concern that repeated disturbance by bird-watchers (e.g., broadcast of conspecific calls during the breeding season) may negatively affect the Falcon Dam population. In 1993, no ferruginous pygmy-owls were detected from broadcast surveys conducted along the Lower Rio Grande River and, although the absence of detection may have been influenced by bird-watchers, Tewes (1993) concluded that the cause is more likely a lack of suitable habitat. Although this information suggests ferruginous pygmy-owls are rare in Texas, recent studies have located and monitored 99 ferruginous pygmy-owl nests in Kenedy County from January 1994-June 1999 (Proudfoot unpubl. data). In addition, Mays (1996) estimated from 745 to 1,823 individuals may occur in Kenedy County, Texas and Wauer et al. (1993) estimated 1,308 ferruginous pygmy-owls may occur in the live oak (*Quercus virginiana*)-mesquite (*Prosopis glandulosa*) habitat in Brooks, Kenedy, and Willacy counties, Texas (Fig. 5-2). Hence, although the ferruginous pygmy-owl is listed as endangered in Arizona (U.S. Fish and Wildlife 1997) and was proposed for listing as threatened in Texas (U.S. Fish and Wildlife 1994), a viable population may still exist in Texas. In Texas, the ferruginous pygmy-owl has no protection under the Endangered Species Act (U.S. Fish and Wildlife 1997).

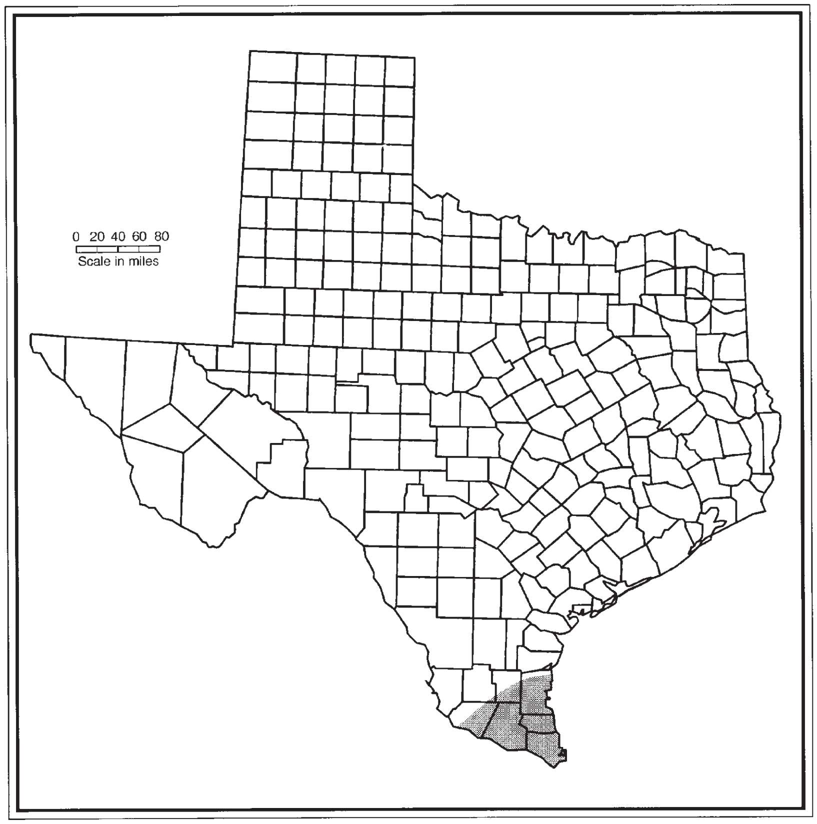

Figure 5-1. Known distribution of ferruginous pygmy-owls in Texas.

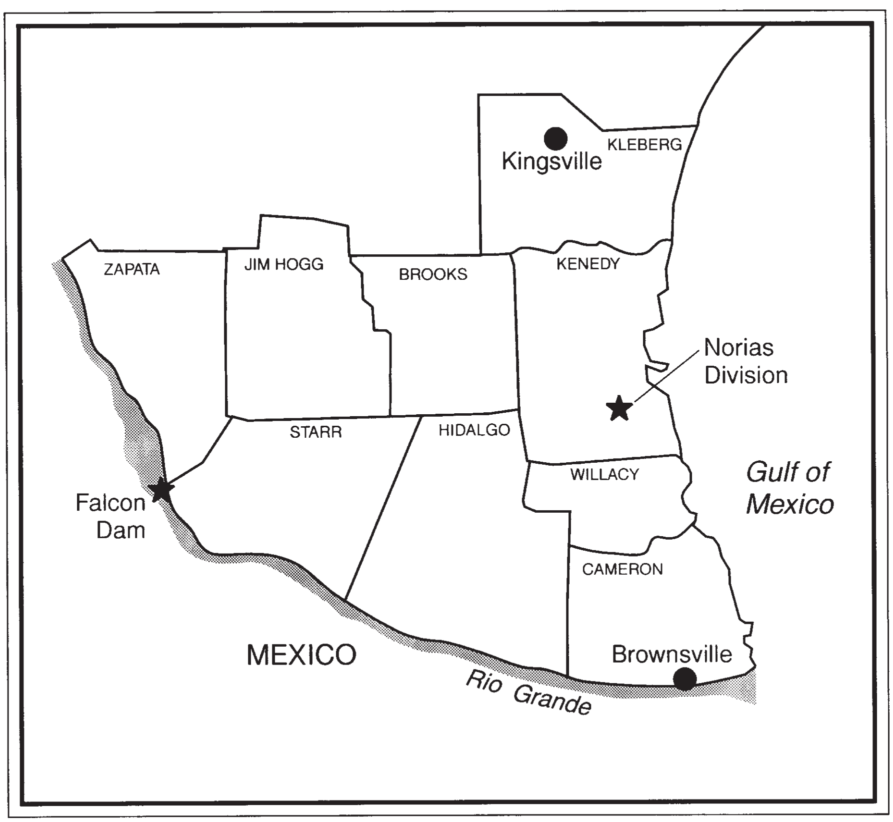

Figure 5-2. Southern tip of Texas, locations of the Norias Division and Falcon Dam.

2. Study area

The Norias Division of the King Ranch encompasses 97,877 ha of rangeland in the historical Wild Horse Desert (Fig. 5-2). The climate is subtropical with mean annual temperature of 24° C and mean annual precipitation of 68 cm. Macro-vegetation types on Norias include coastal grassland, live oak-mesquite woodland, and honey mesquite savanna. The introduction of sheep and cattle in the 18th century may have affected natural succession on Norias and contributed to an increase in the dispersal of live oak seeds, resulting in the fusion of scattered oak groves into a continuous block of live oak-mesquite forest encompassing about 30,000 ha (Johnston 1963). However, the distribution of major vegetation types on Norias has remained essentially the same for the past century (Wauer et al. 1993).

3. Materials for locating and studying ferruginous pygmy-owls

Broadcast equipment and use of parabolic microphone

Broadcasted conspecific calls are commonly used to locate and survey forest-dwelling raptors (Allaire and Landrum 1975, Johnson et al. 1981, Marion et al. 1981, Forsman 1983, Hayward and Garton 1983, Lynch and Smith 1984, McGarigal and Fraser 1985, Smith et al. 1987, Ganey 1990, Stahlecker and Rawinski 1990). To assess the effectiveness of this technique for ferruginous pygmy-owls, Proudfoot and Beasom (1996) compared elicited versus non-elicited (stop-and-listen) call-counts and recorded a >3-fold increase in detection using elicited call-counts. This study suggests the use of broadcasted conspecific calls may be a viable tool for locating and surveying ferruginous pygmy-owls in Texas. Broadcast equipment used (MS512MR Johnny Stewart Wildlife Caller, Waco, TX) for this and coexistent ferruginous pygmy-owl research (Mays 1996) is capable of producing 95-100 dB at a distance of 1 m from the speaker, which meets minimum output criteria recommended for broadcast surveys (Fuller and Mosher 1987). To maximize the effectiveness of broadcast surveys and detection of responding ferruginous pygmy-owls, recent studies (Proudfoot unpubl. data) incorporate use of a Bionic Ear (Silver Creek Industries, Manitowoc, WI) parabolic microphone. Using this system, responding ferruginous pygmy-owls were detected at distances >600 m. In addition, heretofore unreported calls of females and juveniles (e.g., alarm and distress) were recorded (Proudfoot et al. unpubl. data).

Mist nets and bow nets

Ferruginous pygmy-owls were captured using a combination of techniques, most of which are commonly used for numerous raptors (Tordoff 1954, Kenward and Marcstrom 1983, Bloom 1987). Two or three mist nets (Item No. CTX, Avinet, Inc. Dryden, NY) were placed in various configurations (e.g., V shape, triangular, or open-ended box) in proximity (e.g., <75 m) to known ferruginous pygmy-owl locations. In the center of the mist net configuration a portable tape-recorder was used to broadcast conspecific-calls. It was assumed the territorial defensive behavior of the owl would draw them into the net responding to the call. To capture responding owls that did not display enough aggressive behavior (e.g., females) to become caught in mist nets, self-triggering baited bow nets (Bird Traps, Czechoslovakia) were placed on the interior and exterior (≤5 m) of the mist net configuration. Caged laboratory mice were used for bait (Proudfoot 1996a). Using these techniques, 149 adult ferruginous pygmy-owls were captured from March 1994-June 1999 (Proudfoot et al. unpubl. data).

Radiotransmitters

Radio-telemetry is considered a valuable tool for the study of elusive species (Neudorf and Pitcher 1997). From spring 1994-fall 1997, radio-transmitters were established on 28 adult and 26 juvenile ferruginous pygmy-owls. To diminish the possibility of nest abandonment, transmitters were not established on adult females prior to two-weeks posthatch. A backpack harness was used to attach the transmitters. Transmitter frequencies were from 150.00-150.40 MHz, mass was from 1.5-2.0 g, and antennae were 16 mm long. Although the use of radio-transmitters has fostered some concern (e.g., affecting behavior and foraging and reproductive success) (Ramakka 1972, Perry 1981, Kenward 1987, Massey et al. 1988, Croll et al. 1996), no difference in behavior was observed between radio-tagged and non-radio-tagged owls nor in productivity of breeding pairs (Proudfoot unpubl. data). Similar studies report comparable results (Gilmer et al. 1974, Brigham 1989, Hill and Talent 1990, Morris and Burness 1992, Neudorf and Pitcher 1997).

Nest boxes

Recent studies using artificial nest structures include economic and ethological research (Korpimaki 1985, Brawn and Balda 1988, Hayward et al. 1992). Alleviating many logistical problems (e.g., knowledge of potential nests, access to eggs, nestlings, and adults), nest boxes may aid study of nesting requirements, limiting factors, and productivity (Lack 1966, Enemar and Sjostrand 1972, Hogstad 1975, Waters et al. 1990). In addition, because artificial nest structures are mobile and associated with reduced predation (Miller 1989, Sonerud 1985, 1989), they may be established to augment recovering populations.

In October 1992, to ascertain selectivity of ferruginous pygmy-owls for specific nest-box configurations, 36 nest boxes were constructed from 14.7 x 1.9 cm rough cut cedar. Box depth varied from 31-46 cm and entrance size varied from 4.5-6.4 cm in diameter. To encourage their use, nest boxes were established in areas known to be occupied by ferruginous pygmy-owls. Four nest boxes designed for black-bellied whistling-ducks (*Dendrocygna autumnalis*) provided another variation in box depth (44 cm), floor surface area (294 cm^2), and entrance hole diameter (9.8 cm). Nest boxes were established in eight groups of five boxes, each box varying in depth and entrance size (Proudfoot 1996a).

In April 1993, three nest boxes from different groups were used by ferruginous pygmy-owls. Nest boxes used were 31, 44, and 46 cm in depth, with 4.5, 5.1, and 5.8 cm entrance diameters, respectively (Proudfoot 1996a). Expanding ferruginous pygmy-owl nest box studies to include habitat selection, nest box placement criteria, nestling development, predation, and productivity, 40 nest boxes were constructed in the mean configuration used by ferruginous pygmy-owls in 1993 and established throughout the study area (Fig. 5-3).

From 1993-1997, 15 nest boxes were used by ferruginous pygmy-owls and 21 nests were located in natural cavities. Number of young fledged/nest attempt was 3.47 and 1.96 for nest boxes and natural nest cavities, respectively. Nest depredation noticeably affected productivity of natural cavities and, at artificial nest structures, increased in association to nest box age (Proudfoot et al. unpubl. data).

Optic equipment

To minimize observer stress and disturbance to nest-cavity occupants, a miniature video-camera system was used to inspect natural and artificial nest cavities (Proudfoot 1996b). Containing a light source and powered by one 9 V DC battery, the camera system transferred a black-and-white image via video patch cable to a hand held monitor (Sony Watch-Cam, Sony Electronics, Inc., Itasca, IL). Mounted at the end of a 10 m telescoping aluminum pole, this system allowed observers to inspect nest cavities from the ground (see Proudfoot 1996b for detailed description). Although efficient, limitations of this system (i.e., 49 cm depth of field and 60° field of view) restricted use to cavities of cylindrical configuration <49 cm in depth. Therefore, in summer 1994, a flexible fiber optic stratascope (FS-490X108 Schott Fiber Optics Inc., Southbridge, MA) was used to complement the miniature video-camera system. The stratascope lens and light source are contained in a flexible stainless steel housing 1.3 cm in diameter x 246 cm in length. This system was used to inspect cavities that exceeded the limits of the aforementioned monitoring system and occasionally to qualify occupancy determinations made using the camera system.

To obtain information on ferruginous pygmy-owl food habits and nestling behavior, two miniature color video-cameras (XC-42 Computar, Chugai Boyeki Corp., New York, NY) were established in the top of occupied nest boxes to record nestling activity. The image was relayed via video patch cable to a cam-corder (Canon A1, Canon Inc., Japan) placed in proximity to the nest site. This system obtained about 105 hours of video footage and did not seem to affect nestling development, age of fledging, or productivity (Proudfoot and Beasom 1997).

In spring 1997, five miniature video-cameras equipped with infrared light-emanating diodes and time lapse recording units (Model AG-1070DC,

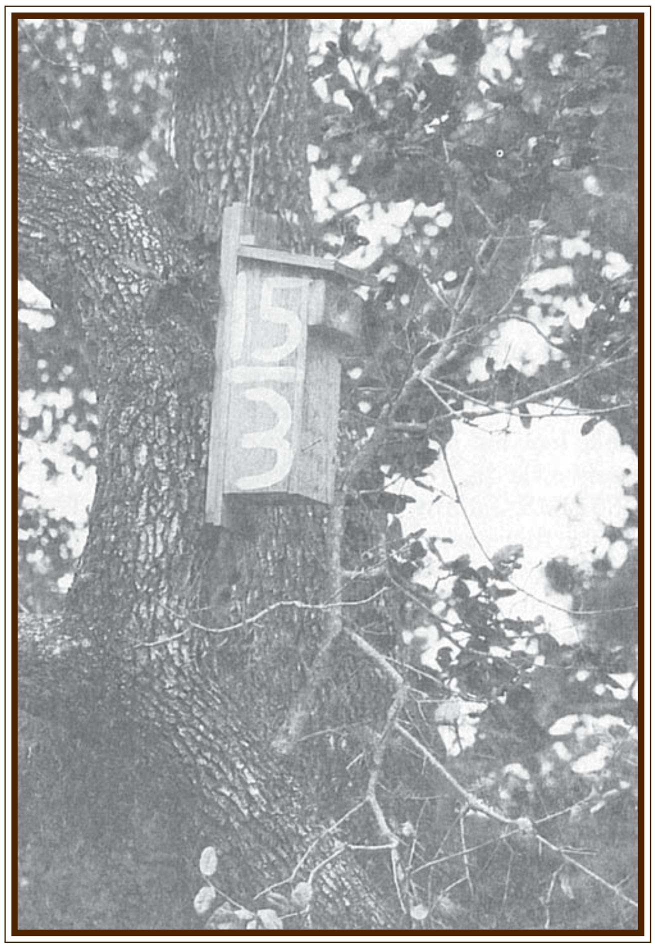

Figure 5-3. Ferruginous pygmy-owl nest box on live-oak tree in Texas. Photograph by Jean-Luc Cartron.

Panasonic Inc., Japan) were established to obtain information on ferruginous pygmy-owl nesting activity. Cameras were established ≤1.5 m from cavity entrances. Time lapse recording systems operated 24 hours/day seven days/week from incubation-fledging, obtaining >4,500 hours of information (Proudfoot unpubl. data).

4. Applications and methodology

Use of radio-telemetry for developing survey protocols

The effectiveness of broadcast surveys may be influenced by weather conditions, time of broadcast (AM, PM), physiological state of individuals being surveyed, degree of competition among males for nest sites, and mating success (Hayward et al. 1992). Other factors may include sensitivity to broadcasted or imitated calls (Tewes 1993), environmental characteristics, and effective broadcast radius (i.e., maximum distance between broadcast station and targeted individual that will invoke a response without affecting responsiveness). Therefore, it is essential to appropriately address regulatory empirical factors (i.e., time of broadcast, distance between broadcast stations, and acceptable weather conditions) before conducting surveys.

To determine the effective broadcast radius for ferruginous pygmy-owls in Texas, nine adult males (four in 1995 and five in 1996) were fitted with radio-transmitters (L. L. Electronics, Mahomet, IL) and their response distance to broadcasted conspecific calls was tested. Because spontaneous calling bouts of ferruginous pygmy-owls are usually crepuscular (Gilman 1909), testing was restricted to 30 min before and after sunset, as determined by the U.S. Naval Observatory, Washington, D.C. No testing was conducted when winds exceeded 19-24 kph (12-15 mph) or when precipitation occurred (Proudfoot 1996a).

Using a three-element Yagi antenna and portable radio-receiver (L. L. Electronics, Mahomet, IL) one observer tracked a radio-tagged pygmy-owl until obtaining visual contact and relayed its location in relation to its distance from established points (e.g., wind mills, nest trees, fences, gates, etc..) to a second observer via two-way radio. The second observer calculated distance to the owl and used compass bearings and pacing to obtain the distance desired for testing. A portable tape recorder was used by the second observer to broadcast conspecific calls toward the targeted individual. Broadcasting continued for three minutes, during which any movement toward the broadcast station or vocalization was recorded. Because the characteristic call of pygmy-owls is a simple series of interrupted single notes, continued broadcast should not hamper detectability (Proudfoot and Beasom 1996). Radio-telemetry was used to substantiate movement or vocal response of the targeted individual (Proudfoot 1996a).

In 1995, all ferruginous pygmy-owls tested at 400 and 500 m (n = 4) responded by moving toward the broadcast station and vocalizing. At 600 m, three individuals responded with movement and vocal defense; the fourth only responded vocally. Due to time constraints, only one ferruginous pygmy-owl was tested at 700 m in 1995, and it responded by moving toward the broadcast station and vocalizing (Proudfoot 1996a).

In 1996, two of five birds tested at 700 m moved toward the broadcast station and vocalized. A third bird responded vocally at 700 m with limited movement toward the broadcast station and vocalization at 600 m. The fourth bird responded vocally at 600 m and moved toward the broadcast station and vocalized at 550 m. The fifth bird responded vocally at 550 m and moved toward the broadcast station and vocalized at 250 m.

Habitat preferences

Tracking 54 radio-tagged ferruginous pygmy-owls in Texas showed preferential habitat use and seasonal variation in areal use (Proudfoot unpubl. data). To compare habitat use to habitat availability, 37 ferruginous pygmy-owls were tracked almost daily for the life of the transmitters (90+ days) and at each visual sighting, a 0.04-ha circular plot was established to determine habitat composition of areas used (Stoddard and Stoddard 1987). Trees >2 m in height and ≥2.5 cm in diameter at breast height (dbh) that occurred within the 0.04-ha plot were counted, identified according to species, and measured for dbh. Density board values were estimated to determine understory cover. A single board measuring 205 x 8.9 x 1.9 cm, with eight equal-sized panels of alternating white and orange color was placed at the center of each plot and observed from the outer edge from four cardinal directions. Each panel was rated between zero and six for percentage of the panel covered by vegetation (0 = 0%, 1 = >0-5%, 2 = 6-25%, 3 = 26-50%, 4 = 51-75%, 5 = 76-95%, 6 = 96-100%). Mean cover values, number of trees/ha, and dbh of trees within circular plots were compared to study area composition data obtained in a systematic-random sample of 219 0.04-ha plots to determine ferruginous pygmy-owl habitat selection (Stoddard and Stoddard 1987, Proudfoot 1996a). Habitat use was disproportionate to its availability. Ferruginous pygmy-owls used areas containing significantly ($P < 0.05$) fewer small trees (<25 cm dbh) and more large trees (>26 cm dbh), with moderate-dense understory (50-100% cover) (Proudfoot 1996a). Results from this study were used to gauge habitat potential for detecting ferruginous pygmy-owls during broadcast surveys and for establishment of nest boxes (Proudfoot et al. upubl. ms.).

Home range

To calculate areal use, Universal Transverse Mercator (UTM) coordinates of radio-tagged ferruginous pygmy-owls were analyzed for 95 and 100% minimum convex polygons. A TELEM88 home-range analysis program (Dept. of Fish and Wildlife, Virginia Polytechnic Institute and University, Blacksburg, VA.) was used to conduct the analysis. Starting from known UTM locations, observers tracked radio-tagged ferruginous pygmy-owls using compass bearings and pacing (Stoddard and Stoddard 1987) to calculate the geographic location of each individual detected. Owls were tracked almost daily during the lives of the transmitters (90+ days) (Proudfoot 1996a). The results of this study are in Chapter 1.

Assessment of cavity availability

Because studies on cavity nesting species may be influenced by the availability of cavities (Waters et al. 1990), observers surveyed the study area to estimate the number of natural cavities/ha. Transects (400 x 6 m) (n = 104) to locate natural cavities were established at 400-m intervals perpendicular to roads that intersect the study area. Compasses were used to orient transects and lines were laid with a topometric hip-chain (Forestry Suppliers, Inc., Jackson, MS) to establish boundaries. Trees were temporarily marked with a chalk tree marker (Forestry Suppliers, Inc., Jackson, MS) (Proudfoot 1996a, Proudfoot unpubl. data). To obtain information on possible interspecific competition, cavities with entrances >3.8 cm in diameter were inspected for occupancy with the nest box monitoring system (Proudfoot 1996b). Cavity entrance diameters were estimated by comparing the size of the entrance to the size of the camera housing (3.6 x 2.2 cm). The above ground height of cavity entrances was estimated (+ or – 15 cm) from markings placed on the telescoping pole that supported the camera. Trees containing cavities were identified to species and dbh measured. The number of cavities/ha in the study area was estimated by multiplying the mean number of cavities/ha in the area sampled by the size (ha) of the study area (Proudfoot 1996a).

Transects encompassed 24.96 ha (an estimated 13,995 trees) and contained 261 natural cavities (10.5/ha). One hundred and twenty cavities (46%) (4.8/ha) were of the entrance hole diameters used by ferruginous pygmy-owls, suggesting that the study area supports a large number of cavities. Although none of the cavities inspected contained avian occupants (Proudfoot 1996a), possibly because surveying preceded nesting for many species in the area, the potential for competition is indicated by the fact that several species were found occupying nest boxes (see Chapter 1).

Nest monitoring

Using the miniature video-camera and stratascope, nest boxes and natural cavities occupied by ferruginous pygmy-owls were periodically inspected to obtain information on laying sequence, clutch size, incubation period, and hatching sequence (Proudfoot 1996ab). In addition, food habits and nestling activities were monitored by establishing miniature video-cameras in the top of nest boxes (Proudfoot 1996a, Proudfoot and Beasom 1997). To document nestling development, nestlings from seven nest boxes were photographed on alternating days from one day posthatch to fledging (Proudfoot 1996a, Proudfoot unpubl. data). Development information may aid conservation of this species by providing investigators an estimation of time available to conduct needed research (e.g., banding and marking [essential tools in avian management]).

Demographic study

The empiric determination of demographic parameters can be used to calculate minimum recruitment standards for a population (Gehlbach 1994). However, to obtain information for such an analysis requires long-term study, and although ongoing ferruginous pygmy-owl research is addressing the required parameters, insufficient information exists for sound analysis.

Food habit study

Analysis of prey remains, visual observation, and analysis of video footage recorded inside active nest boxes were used to obtain information on ferruginous pygmy-owl food habits. Prey remains were identified using dichotomous keys (Jones and Manning 1992, Chaney 1993) and university reference collections. Visual observations were conducted from blinds established <5 m from four nest sites; observation time was about 105 hours. Video footage, obtained from miniature video-cameras established in the top of two active nest boxes, provided images of prey items brought to the nest by adults. About 104 hours of video footage was analyzed (Proudfoot 1996a, Proudfoot and Beasom 1997).

Thirty-six prey species from five classes (i.e. Insecta, Reptilia, Mammalia, Aves, and Amphibia) were identified in the diet of ferruginous pygmy-owls from Texas. Analysis of prey remains (eight nest sites) identified more individual prey items (184) and prey species (28) than visual observations (40 individuals and 11 species), or analysis of video footage (103 individuals and 12 species). Comparison of prey items identified/prey item brought to the nest site showed analysis of video footage exceeded visual observation in prey identification by 28%.

Hematozoa study

Hematozoa may cause septicemia, marginal anemia, and neonatal bacterial diarrhea (Hunter et al. 1987), reducing survivability and recruitment. To determine presence of hematozoa from ferruginous pygmy-owls in Texas, blood smears were obtained from 63 (14 females, 45 males, four nestlings) individuals and analyzed. Results revealed no hematozoa (Proudfoot and Radomski 1997).

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