DRAFT

Sonoran Desert Conservation Plan

SONORAN DESERT CONSERVATION PLAN STEERING COMMITTEE

EDUCATION SESSION #2

June 26, 1999 (6:00 - 8:30 p.m.)
Arizona-Sonora Desert Museum (Gallery)
2021 N. Kinney Road
Tucson, Arizona, 85743

1. _____

The Cactus Ferruginous Pygmy-Owl

The Pygmy-Owl in Arizona
Scott Richardson

THE PYGMY-OWL IN ARIZONA

Scott Richardson, Arizona Game and Fish Department

I am excited to be here tonight and hopefully with all this good information you are getting on pygmy-owls you will go away tonight and think you attended a meeting on everything you wanted to know about pygmy-owls but were afraid to ask, and given the current climate around pygmy-owls in Arizona that may really be the case.

A lot of people are afraid to ask questions about pygmy-owls. I think tonight is good because I think it brings home to you, particularly with the things you have seen in Glenn's and Russell's work that despite what you hear around town, pygmy-owls actually do exist. They are an actual species of wildlife in Arizona that we are concerned about and trying to deal with a very complicated and controversial issues surrounding this species.

We are about three to five years behind Glenn with our research work on pygmy-owls. There are two reasons for that and one of the primary reasons is that we do not have nearly as many owls as Glenn has, and anytime you are trying to gather information on a species when you are working with one or two, or in a really good year, perhaps 30 owls, the ability to gather all this natural history and habitat and home range use, all the things we need to manage this species it is very difficult to gather that in any kind of a rapid way because you needs lots of birds to find out these things.

The second aspect hindering us and as you see slides and pictures of this owl it is difficult to get a perspective of what we are dealing with. It is a very small owl and because of its small size, there are limitations regarding what you can do with the owl without killing them. I wanted to show you what one of these transmitters look like that we are discussing which will give an idea of the size of the pygmy-owl. This is the transmitter that we are attaching to the pygmy-owls to find out all this information.

In reality, once the transmitter is attached to the bird about this much of it sticks out from the bird and is much is much longer than the bird itself. The transmitter covers a lot of the bird. One of the things we have to be very careful about when we are working with the birds to obtain information is that we do not hinder their natural cycles and ability to do what these allow you to do.

The limitations faced by those studying the bird is that we cannot put very much on them because they are so small. These transmitters only weigh about a gram and a half and the restrictions that places on us as we try to find out this information is this battery is only good for about 12 weeks. In order to find long term breeding, dispersal and all the things we need to find out, we only have about 12 weeks and you cannot get all the information you need to know in that 12 week span of time. The birds are pretty smart and in order to extend this 2 week battery life we have to catch them again, and that is not a given.

It is a fascinating species, there is a lot to be learned and as a biologist it is exciting to be able to work on this species because there is not much known about it. Everything you learn is new and exciting. It is frustrating dealing with limitations.

What I would like to do quickly is run through some of the work that we are doing in Arizona. As you will see, it parallels a lot of what Glenn has done, but we are just a little further behind. There is still a lot we do not know about the owl as we begin using new technology like transmitters. We are finding out a lot more but we still have a long way to go so hopefully after I finish up you will know Tucson's status regarding what we are doing.

As part of an advisory role with what the County is doing, their conservation plan and what you folks are charged with as part of the steering committee on that conservation plan, hopefully you will understand what we are dealing with this species as it plugs into the plan, the limitations with date, where we need to go from here and any direction, that you folks as part of this committee, can give us it would greatly be appreciated. If I can have the slides turned on we will run through here real quick and show you some of the things that are occurring in Arizona.

I want to acknowledge the fact that the work and information I will share was done by Game and Fish but was only accomplished through funding from cooperating agencies such as the Forest Service and the U.S. Fish and Wildlife Service, and primarily the funding through the Arizona Game and Fish has been through our Heritage Program.

(Slide)
I would really be remiss if I did not acknowledge people who helped with the work in Arizona because this is pretty typical of a lot of our pygmy-owl work until recently in Arizona. To see us sitting in somebody's front or backyard, climbing up their saguaro to figure out what is occurring with pygmy-owls is a typical picture in northwest Tucson because fortunately or unfortunately, depending upon what your perspective is, most of the owls until just the last couple of years have been found in residential areas in northwest Tucson.

Because of that, they are found on private property and so I want to acknowledge all the private property holders and residents who have allowed us to come in and access their property and do the biological work that we need to do to find out the information that we need to. That is not a small thing because we can be there at three o'clock in the morning or 11:00 o'clock at night or 24 hours a day so we try to be as non-invasive as possible. It really takes a lot of cooperation on the parts of private residents to help us get the work done that needs to be done. Even though I am the one standing up here talking about this, in reality the work was accomplished by some people who do not get paid very much and work a lot of hours. Specifically I would like to acknowledge Dennis Abbate who is a seasonal biologist who is working with me and has been since 1996. More recently, Renee Wilcox who has been working on some the habitat related issues, the report of which you see in your materials. Over the last four or five years I have had summer interns who have worked with me on this project: Colby Henley, Sandy Diddee, Stacy (?) and this year, Sarah Lance who have been working very hard and these poor U of A students are excited to get out and get some field experience and then when they find out they have to get up at two o'clock in the morning and sit and watch some bird feed its young dead lizards and such it can become somewhat of a challenge to them but they do it and the reason we have the information we have in Arizona is because these people are willing to find it out. I just want to acknowledge them for their work. There is a lot of cooperation and people's help that goes into this, it is not just me.

You have heard Glenn talk a lot about the owl. It looks basically the same in Arizona. We have noticed since Glenn has been helping us this year and I would be remiss if I did not acknowledge Glenn because he basically has guided us through our efforts locally. We have drawn on his experiences and knowledge every step of the way here in Arizona. Since he has seen birds in Texas and Arizona so maybe there is some plumage differences between Arizona and Texas birds and of course, he is looking at the genetics of the situation.

These are incredible little birds and you might think, why do we have to worry about this tiny little owl in Arizona? When you think about it, it actually fills an interesting role in the environment, it is more of a diurnal versus nocturnal like our screech owls or elf owls so it feels like a unique niche in the whole Sonoran southeast Arizona scheme of things. Here you can see the eye spots on the back of the head which differentiate it from other small owls in Arizona.

This is a picture of a juvenile fledgling bird. There are differences in coloration and plumage which allow us to differentiate juveniles from adults. In the resource material contained in your packet you will see that we have recently put out a preliminary report on some early work that we have done and habitat information is really a big unknown and a big mystery for us and so that is one of the things we are concentrating on. Historically, they are found along more of these western wet riparian areas, at least that is where a lot of the records are found. We are finding them now, not so much in those but more in upland, dry wash situations and even more so in the Sonoran Desertscrub types of habitats. As Russell alluded, recently we found some birds in some different kinds of areas, even though down south in the Altar Valley with a few sites in more typical riparian types of settings. In the Altar Valley we are finding them in this desertscrub type of habitat.

We have been finding the pygmy-owl frequently in low density residential areas that is becoming typical area to find the pygmy-owl.

(Slide show utilized in discussion)

Questions to consider:

a.What is it that defines pygmy-owl habitat?

b.What levels of human activities allow pygmy-owl habitat to remain in the state it can be utilized?

c.Are we removing a component out of that landscape that is critical for pygmy owls such as understory?

d.What actions can we take to reduce those impacts?

e.Is plant salvaging a possible answer?

f.Do we need to replace the whole vegetative structure and components?

g.Do roads act as barriers for pygmy-owls? We know owls fly very low to the ground and crossing a road could present potentially present a bit of a challenge.

Those are the kinds of questions we are looking at trying to answer with the habitat work we are undertaking.

What is pygmy-owl habitat?

What do we as humans do to impact that?

We go out and sample habitat and as you can see, we are using a lot of the same methodology, at least with regard to the cover board that Glenn had used and we are trying to characterize, what is pygmy-owl habitat? Through the first couple of years of our investigation, we found basically that in these areas where we are finding pygmy-owls that plant species diversity is very high. We measured non-vegetative variables in the habitat and that is somewhat variable.

In the areas where owls are there is not a lot of actual on the ground cover but we need to do additional work to find out if that is simply characteristic of Sonoran Desertscrub or if that is something that characterizes these sites. The vertical structure you saw in Glenn's trees, even though they are much larger than ours, is that vertical structure seems to be important in that there is equally distributive vegetative cover at all layers within the area. More information is needed.

This is just to show you what we were looking at with regard to the non-vegetative characters; things like distances to roads, washes, water, and various structures. One of the real restrictions we have is that we are dealing with an extremely small sample size and it is very difficult to draw any statistically significant conclusions when you are working with such small numbers.

The prey habits, Glenn did a great job and we are finding basically the same kind of things here. This is a picture of a lizard that an owl cached in a tree. We find that oftentimes if they catch prey and they are not hungry or the young are not ready to take them, they will simply cache it in a tree and come back to it later. They have an incredible memory in remembering where those food stores are and in fact, I one time saw a Gila woodpecker take a lizard that a pygmy-owl had cached and the owl knowing that the lizard used to be there spent the next half hour looking for it; he knew it was there. They have great memory of where these things are.

The other incredible thing about pygmy-owls and their prey bases is they are so versatile and they are such great little predators. They will take things as small as hummingbirds and as Glenn talked about, they will also take very large prey up to the size of adult morning doves which outweigh them by two and half times. They are very versatile and very effective predators. We, like Glenn, are looking at some other things to try to determine what their food habits are. Observation is not the best way to do it as Glenn explained so this happens to be the contents from a saguaro cavity that was being used by a pygmy owl that blew over during a windstorm and so we were able to go in there and extract the contents.

Also, owls like other raptors, particularly owls regurgitate pellets after they are done eating which contain the undigestible remains of their prey such as bones and feathers. We have a collection of those started which we will be looking at in more detail what is being preyed upon.

This is the only picture I have of a snake eating something so that is not a pygmy-owl.

We do not have a good idea of what is going on with predation in Arizona, we have not utilized the technology that Glenn has up to this point. Therefore, we do not have a good idea what is out there as far as predators. We do know there are other factors in the desert landscape which present hazards and this is my test for you: can you find the pygmy-owl in this picture? It is right here and this was a fledgling bird that was out of the nest a couple days and he thought he would try his wings out and he did not quite make it and instead landed in a Cholla and he was impaled on this Cholla and if we had not been there, I am positive that bird would have perished. Everything that we know about, the owl comes out of the nest and fledges. What we are seeing this year with a few more birds is we are seeing mortality after they fledge but these saguaros seem to be a pretty suitable nesting site. I think that helps in predator avoidance.

This is a picture of a fledgling and I just put this in to illustrate the unique behavioral adaptation the pygmy-owl have to avoid predators. This is a young bird just out of the nest and we are going up there to catch it and they elongate themselves and stretch themselves up just as tall as they possibly can and I am not kidding you, they are just like a stick. You have a transmitter on a bird, you know it is in the nest but it looks just like a stick. That is another behavioral adaptation they have to avoid predation.

They hide from you, they duck down in the crotch of a tree and it is a pretty interesting bird to study. We are looking at things like productivity and nesting success. This is a group of fledglings in an ironwood tree at one of the nest sites. Beginning last year, we have begun doing more hands on research trying to do transmitter work, banding work and we are using many of the same techniques as Glenn and in fact, he trained us and taught us how to do it.

You can see behind this, you can see the mist net that we use to catch birds and bow traps.

This is a fledgling that we have caught and banded. Because we have the luxury of working with only a handful of birds we are actually trying to individually identify each bird we capture. The Fish and Wildlife Service bands do not do that because it is hard to read the little number on these guys so what we are doing is using color bands to identify each individual and we are finding out interesting information just by utilizing the color bands and it is kind of like a soap opera, you know, Glenn was talking about siblicide. Well we found incest so it is just like a soap opera and that brings up a real interesting point in what we have seen is two generations of incest in the same line and that raises the question about inbreeding and what the affects of that are and hopefully we will ferret some of that out with some of the work that Glenn is doing.

This is a bird that we caught and placed a transmitter, I showed you the transmitter. These guys are very cryptic and to find the bird without a transmitter is almost impossible if they are not vocalizing. You can see the transmitter on the owl and size wise most of the antenna is hanging out below the bird so these birds are small.

With telemetry we are able to gather more on just a few birds than we were able to gather in years of only survey and monitoring so it is a very helpful technique.

Obviously we have gathered a lot of information, you saw we have our report from 1996, that is our most recent report we have out. We will be coming out hopefully within the next month or so with a 1997 and 1998 report which includes much of the telemetry, transmitter and habitat work. We will continue to increase our survey efforts. Obviously, we have to find the birds to work on them, we need to know where they are and how many there are. We need to find out more about habitat. We have done preliminary effort regarding where birds are, we need to sample size where they aren't and do some random comparative sampling on use versus availability and telemetry will help us do that as well. I will look at some additional use areas.

This year in the Altar Valley we are finding some birds down there in some different types of habitats. We need to look at these additional use areas and look at random areas for comparative purposes and then continue our monitoring through observation and telemetry. We are at an exciting point, we are learning a lot but it is frustrating because we have a lot more to learn. Our objective is to gather as much information as fast as possible to feed into the process to make this County plan based on the best available science that we have.

This is an owl at sunset which I thought was appropriate for my last slide.

That brings you up-to-date generally with what is going on in Arizona.

CACTUS FERRUGINOUS PYGMY-OWL SURVEYS AND NEST MONITORING IN THE TUCSON BASIN AREA, ARIZONA - 1996

Dennis Abbate, Contractor
Alexandra Ditty, AGFD Intern
Scott Richardson, Region V Urban Wildlife Specialist
Ron Olding, Region V Wildlife Program Manager

Final Report
Internal Enhancement #U95503
Arizona Game and Fish Department
2221 West Greenway Road
Phoenix, Arizona 85023-4312

November 1996

TABLE OF CONTENTS

CACTUS FERRUGINOUS PYGMY-OWL SURVEYS AND NEST MONITORING IN THE TUCSON BASIN, ARIZONA 1996

INTRODUCTION

The ferruginous pygmy-owl (*Glaucidium brasilianum*) is a small, 6.5 to 7.0 in (16.5 to 17.8 cm) long owl with a long rufous colored tail accented by dark barring. The front view of the head is characterized as smooth and lacking ear tufts while the back of the head has a pair of conspicuous black "eye spots" outlined in white. The cactus ferruginous pygmy-owl (*G.b. cactorum*) is the northernmost subspecies of *G.brasilianum* ranging from southern Arizona and southern Texas south to Michoacan, Nuevo Leon, and Tamaulipas, Mexico (Johnsgard 1988). This species occurs in lower more arid areas than the northern pygmy-owl (*Glaucidium gnoma*) known from forested mountain locations. In Mexico, *G.brasilianum* is known from elevations below 4000 ft (1200 m).

In Arizona, historical records have shown *G.b.cactorum* to inhabit riparian woodlands, nesting in cottonwoods (*Populus fremontii*) and willows (*Salix gooddingii*) (Rea 1983) and also occurring in mesquite thickets (Bent 1938). Much of Arizona's riparian broadleaf habitat has been destroyed or severely altered due to groundwater depletion, woodcutting, grazing, other agricultural practices, dam construction and other development. While some stands of mesquite (*Prosopis spp.*) bosque habitat type have survived, associated broadleaf trees and adjacent saguaro cacti, which could potentially be used for nesting by cactus ferruginous pygmy-owls, are increasingly rare. Recent confirmed reports of cactus ferruginous pygmy-owls (hereafter "pygmy-owl") in Arizona are exclusively from Sonoran desertscrub below 3000 ft (914 m) in elevation and south of Picacho Peak (AGFD survey records 1993-96).

The decline in range and abundance of this species since the 1950's (Phillips et al. 1964, Monson and Phillips 1981, Rea 1983, Johnson and Haight 1985, Hunter 1988, Millsap and Johnson 1988) led to the classification of the pygmy-owl as a Category 2 species by the U.S. Fish and Wildlife Service (USFWS) in 1989. The status of the pygmy-owl was changed to Category 1 candidate species in 1991 (USFWS 1991). The Arizona Game and Fish Department (AGFD) began formal surveys in 1993 to determine the current distribution and population size in the state, identify current specific habitat requirements, and formulate management recommendations (Felly and Corman 1993). In response to a petition, the USFWS proposed listing the ferruginous pygmy-owl as endangered in Arizona in 1994 (USFWS 1994), but work on the listing ceased during a federally imposed moratorium on the listing of new species. The listing proposal is again going forward after the moratorium was lifted in 1996..

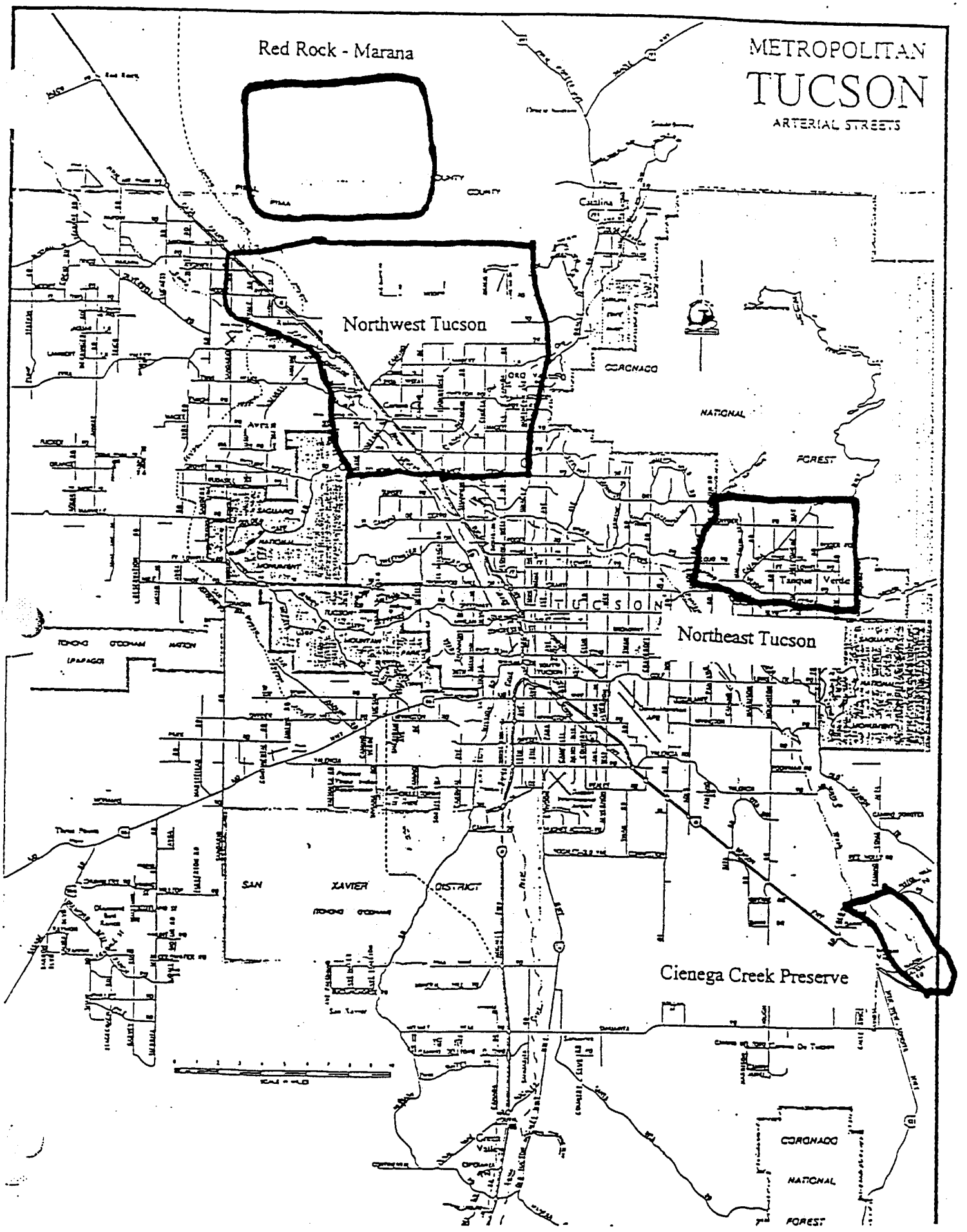

Figure 1. Survey Area Map - General areas surveyed for Cactus Ferruginous Pygmy-Owls

in the mesquite bosque occurs. Desert willow, Fremont cottonwood, and other broadleaf riparian species were dominant in some locations but intermixed with extremely dense mesquite bosque along other sections of the creek bank. Perennial water flows through a major portion of this stretch of the Preserve supporting grasses, sedges, and other strictly water dependent species. Railroad lines located on the upper slopes roughly follow the creek's course. The still higher, rolling hill terrain in the surrounding area is relatively open and is a Sonoran desertscrub transition area with grasses and shrubs increasing while large cacti decrease in abundance. This area is used for occasional livestock grazing with sparse development of private residences outside the Preserve. Elevations covered by this survey route range from 3280 to 3400 ft (1000 to 1036 m).

Red Rock - Marana

The Red Rock - Marana survey area south of the Coronado Wash and west of the Tortolita Mountains is characterized as Sonoran desertscrub habitat with locally dense stands of saguaro and foothill paloverde becoming dominant. Ironwood is commonly found along with these dominant species though not in all localities. A variety of cholla, prickly pear, hedgehog, and fish hook barrel cacti are representative of the understory with creosote bush increasing at lower elevations. Similar to the northwest Tucson survey area, the most abundant small shrub is triangle-leaf bursage. Velvet mesquite and acacia increase in numbers along the many smaller dry washes, with desert willow appearing in the larger washes that drain the foothills to the east. This general area contains a number of small and large ranches with vast areas used for open range livestock grazing. Rural private residences on 3 to 40 acre (1-16 ha) parcels are spread throughout this area and are increasing, along with some potentially higher-density developments. Elevations of the survey locations ranged from 2180 to 2500 ft (664 to 762 m).

METHODS

Surveys for cactus ferruginous pygmy-owls during the 1996 field season were conducted between 22 January and 14 June. Survey efforts were concentrated in northwest Tucson. Initial survey locations were selected based on detections from previous field seasons (1993 to 1995), earlier observations and reports. Survey routes were expanded from these locations once all known detection areas were investigated and additional areas of similar habitat were identified. Our approach during the 1996 season was to narrow the focus of survey efforts providing a more intensive search over a smaller area. With the exception of a few surveys by AGFD Region V personnel in outlying areas, the contract personnel conducted all surveys.

Detection Defined

Detection of a pygmy-owl is defined as the aural detection or visual observation of one or more pygmy-owls during a formal survey, monitoring visit or an unplanned observation. Multiple detections of the same individual or pair of birds are included in the total number of general detections for the 1996 survey season. The actual number of individual birds will be less than the total number of detections since it is likely that the same individuals were observed during more than one visit and occasionally in different locations. Primary detections are distinguished from general detections and are defined as observations of pygmy-owls in new locations that are at least .25 mi (.4 km) from another detection location, or are known to represent new individuals in the current survey year. A pygmy-owl was considered a new individual if it had not been detected during previous surveys in the same year and the nearest neighbor pygmy-owl was still detected near its original location. Primary detections do not include repeated detections of the same individual or pair. Once a pygmy-owl was detected for the first time, location information, weather conditions and other observations were recorded on survey forms which have been revised for the 1996 season (Appendix 2A to 2E). Detection locations were plotted on USGS 7.5 minute topographical maps. Both the legal description and UTM location were recorded on the survey form (Appendix 2A). Locations were considered the same unless birds were detected a minimum of 300 ft (91 m) from the previous location. Locations do not equal detections and there may be more than one location per detection site. Recording separate pygmy-owl locations using the 300 ft criterion allowed differences in vegetation and man-made structures to be reflected in the vegetation sampling measurements of high use areas. It also enabled mapping records to indicate only pygmy-owl locations that were substantially different from initial detection locations.

Detection Site Monitoring

Detection sites were monitored by AGFD personnel, property owners and survey workers. All sites were visited by survey workers every 5 to 10 days to determine occupancy and nesting status. Post detection visit forms were completed for each visit to document the status of each site (Appendix 2B). We also began using a post-detection monitoring protocol. On arrival, the surveyor listens and scans the general area for 5 minutes. If no detection is made, a 15 minute calling and listening sequence described in the general survey protocol is completed. Once a detection is confirmed and the birds general location is determined, survey broadcasts are ended and monitoring begins to assess nesting status, vegetative structure use and behavior. If no detection results, a more complete survey effort in the general area is conducted in an attempt do document the presence of any pygmy-owls.

SURVEY RESULTS

Survey Effort

Pygmy-owl surveys were conducted from 22 January to 14 June 1996 over a total distance of 55.2 mi (88.8 km) using 356 call point locations. Some of these call points were visited more than once, but all replicated points and survey routes are included in the total number of points called and total distance surveyed. We estimated the area of calling coverage at 22.1 mi^2 (57.8 km^2) (Table 1). There were 268 call points surveyed over a distance of 42.4 mi (68 km) when replicated points and repeated survey routes are excluded from calculations. The estimated area of calling coverage for this initial effort was 17.0 mi^2 (44.2 km^2).

Table 1. Cactus ferruginous pygmy-owl 1996 total survey effort and detections in the Tucson Basin area, Arizona.[1]

Month	Survey Hours	Survey Days	Total Distance mi	Total Distance km	Coverage Estimate mi^2	Coverage Estimate km^2	Total Call Points	Detections[2]
January	11.5	6	6.1	9.8	2.4	6.4	36	1
February	35.0	20	13.9	22.4	5.6	14.6	99	8
March	30.5	19	16.6	26.7	6.6	17.4	77	18
April	23.0	12	7.3	11.7	2.9	7.6	60	9
May	20.5	22	8.9	14.3	3.6	9.3	64	4
June	7.0	3	2.4	3.9	1.0	2.5	20	1
Totals	127.5	82	55.2	88.8	22.1	57.8	356	41

[1] The summary of survey effort and detections includes replicated call points and repeated survey routes.

[2] The total number of detections include formal survey results from repeated visits to previous detection locations and detections recorded during casual observations by AGFD personnel. Nest site detections after nesting was confirmed are excluded (see Detection Defined, Page 6).

detections were made in this manner. The remaining primary detections were documented during taped-call broadcast surveys. We recorded a total of 12 hours and 7 minutes of formal survey time both before and after protocol survey hours. These extended experimental survey hours resulted in no pygmy-owl detections.

An informal comparison of morning with evening formal survey and monitoring success indicates 25 pygmy-owl detections during morning surveys and 12 during the evening. Spontaneous calling by pygmy-owls during morning and evening hours accounted for 14 and 5 detections respectively.

Habitat Description of Detection Areas

Formal measurements of site specific habitat characteristics within detection areas is underway but analysis has not been completed. This work will be continued by AGFD personnel during field work during the later part of 1996 and during 1997. In general, cactus ferruginous pygmy-owls during the 1996 season were detected within approximately 300 ft (91 m) of private residences. In an area outside the 1996 survey, at least one pygmy-owl was also detected close to buildings and human activity at Organ Pipe Cactus National Monument (OPNM) (T. Tibbitts, pers. comm.). Three other detections at OPNM were in backcountry locations away from buildings. Many of the Tucson detection locations are within small ranches or horse properties from 3.3 to 10 acres in size with most of the parcels retaining some natural vegetation. Most of these areas are considered semi-rural to suburban. Two locations in the Red Rock - Marana survey area can be described as rural.

All detection sites are within the Arizona upland subdivision of the Sonoran desertscrub biotic community and in the paloverde-cacti mixed scrub series (Brown 1994). The dominant species in most detection locations are saguaro, foothill paloverde, ironwood, and velvet mesquite. Almost all initial visual detections of pygmy-owls were in one of the above three tree species. Whitethorn acacia and catclaw acacia are common especially near washes. Desert hackberry and graythorn increase near washes as well. A number of cholla and prickly pear species are common along with fishhook barrel and hedghog cactus. Creosote bush and desert broom are found sporadically, but sometimes are locally abundant. Desert broom was especially common in disturbed sites. The most abundant low shrub is triangle-leaf bursage.

Dry, braided wash systems and associated vegetation were common in most of these locations. These xeroriparian areas included small arroyos less than 5 ft (1.5 m) in width and larger washes over 20 ft (6 m) in width. In a review of the 17 primary detection locations, 4 were within washes, 6 were within 100 ft (30 m) and 7 detections were more than 100 ft from a dry wash. We were not able to determine if these drainages were used with greater frequency than other areas, but it is something that will be analyzed during future habitat characterization work. Owls were often observed very close to residences

workers. This nest was found using the nesting cavity survey method described in the methods section. No aural response occurred, but the incubating female briefly appeared in the saguaro cavity opening, looked around and then disappeared back inside the cavity. This silent response could be easily missed by one worker if observing from a different position.

Preliminary Results of Pygmy-owl Monitoring by Area Residents

Preliminary analysis of resident observations has provided an additional 85 detections at 6 different locations. These areas were also monitored by survey workers but at different times. One resident has documented sustained pygmy-owl activity through direct observation and aural detection for over one year (1995- 96) with the exception of approximately 1 week. Residents have provided valuable information about the pygmy-owl's daily behavior that might have otherwise gone unrecorded. For example, residents documented frequent water use, which was only detected twice by formal surveys and monitoring. Other information gained from residents includes favorite perches and other high-use areas, owl movements, vocalizations, nesting chronology, diet, prey observations and other general behavioral information. The contributions of these interested and cooperative residents have increased our knowledge of pygmy-owl ecology and assisted workers in finding owls more easily. The importance of private property owner assistance should not be underestimated and every effort should be made to foster and maintain these valuable relationships.

Territorial Vocalizations

The primary pygmy-owl vocalization detected by survey workers during formal surveys was the single pitch "whistle-like" repeated note uttered by suspected territorial males. Calling sequences were composed of one or two notes and up to 98 without a pause. One resident reported a pygmy-owl calling 298 times without a pause. One individual flew in and perched within 10 ft (3 m) of the surveyor calling for the six minute observation period. During this event the one-pitch repeated- note call changed briefly to a chirping or "hiccup" at a slower cadence, then reverted quickly back to the previous one-pitch call. At another location, a resident recorded one pygmy-owl vocalization changing from the typical one-pitch repeated-note call to a much higher metallic or "horn-like" squeak. This vocal change continued for approximately 45 minutes and then returned to the more common call.

Responses of Songbirds and Raptors to Taped-Call Broadcasts

The responses of other birds to pygmy-owl taped-call broadcasts were variable (Table 4). It was often unclear whether changes in bird behavior or vocalizations were in response to the broadcast or the presence of the survey worker. It was common to see birds reacting to the actual presence of an owl once it was detected in the area, but responses to the

Pygmy-Owl Response to Human Presence

Detection locations close to residences and human activities is one indication that cactus ferruginous pygmy-owls are not intimidated by the presence of people or can acclimate to low density urbanization and associated activities. Pygmy-owls were regularly observed by survey workers and residents from a distance of less than 50 ft (15 m). During formal surveys, one pygmy-owl flew in and perched within 10 ft of the surveyor, remaining in this location and calling even after broadcasts were discontinued. Several residents in detection areas reported owls flying in and perching nearby when doing outside work, as though they were curious about the activity. One resident reported watching the female owl at the nest site close to eye level and less than 10 ft (3 m) away when the male flew in and delivered prey in full view of the observer. One surveyor determined the exact location of a calling owl by walking slowly, but directly to the location of the sound. Using this technique, the surveyor was able to approach several owls within 25 ft (7.6 m) or less. However, another worker sometimes found the direct approach only possible to about 20 yards (18 m), then used a zig-zag approach to get closer.

NEST SITE MONITORING RESULTS

Monitoring Effort

A nesting pair of cactus ferruginous pygmy-owls were first discovered by a resident who owns the property where the nest was located. Survey workers had detected pygmy-owl activity in the area but were not able to document more than one bird in the same location. The resident reported observation of 2 pygmy-owls engaged in copulation on 31 March. A suspected nest site cavity was discovered on 8 April. During a nest search of the property, the surveyor stood approximately 20 ft (6 m) from the base of a large multi-armed saguaro and imitated a pygmy-owl call by whistling. A pygmy-owl stuck its head out of the cavity almost immediately and looked around. This suspected female did not respond vocally and quickly disappeared back inside the cavity. The nest site and surrounding area was monitored by two field workers for 237.8 hours over 65 days from 8 April to 20 August (Table 5).

This nesting pair of pygmy-owls successfully fledged 2 young on 4 June. One fledgling disappeared within the first 24 hours. The missing juvenile could not be found and the cause of disappearance was not determined.

several counties of southern Texas in recent years (Waur et al. 1993, Beasom and Trant 1993). Their work appears on track to document the breeding biology of pygmy-owls in Texas. In southern Arizona, the discovery of a recent fledgling at one location in 1995 and the intensive monitoring of a nest in another location during 1996, have allowed a glimpse into the breeding biology of this species in Arizona and permitted reasonable estimates of the nesting chronology. Using 28 to 30 days for incubation and 27 to 30 days for fledging (Scherzinger 1977, Terres 1991), we estimated times for nesting events based on observations of copulation, fledging and adult behavior at the nest (Appendix 3).

During 1996, copulation was observed on 31 March and fledging was confirmed on 4 June. We estimated egg laying from 6 to 11 April and the onset of incubation from 7 to 12 April. Hatching was estimated at 9 May. In 1995, fledging at a different nest was documented on 29 July. We estimated egg laying at 31 May to 5 June and the onset of incubation at 1 to 6 June. Hatching was calculated from 30 June to 3 July. The differences between the 1995 and 1996 nesting chronologies are pronounced and it is unknown whether, or why, the 1995 nesting activity was unusually late (Figure 2). There are no other recent Arizona records for comparison. The 55 days between times of fledging for these two sites may represent a second brood or a second nesting attempt after an initial failure. In any case, both nest sites successfully fledged young and it is not possible to more narrowly define the nesting period at this time. In Texas, Proudfoot (1996) reports the commencement of egg-laying between 12 April and 26 April, but he does not provide dates for hatching or fledging.

Nest Site Vocalizations

Bird vocalizations are extremely difficult to "translate" into words. Therefore, descriptions are subjective and determined not by the observer's ability to aurally discriminate sounds, but in his or her interpretation and translation into language. Because of these differences, it was sometimes difficult to tell whether two workers hearing vocalizations at different times were describing to each other the same or different vocalizations. The following descriptions are based on the observations of two workers.

Female vocalizations were documented from the monitored nest site during two dawn to dusk observation periods and many monitoring sessions of shorter duration. The primary female vocalization was a rapid "chitter" uttered in short bursts or sequences. These were heard periodically throughout the day increasing in frequency once incubation had ended and primarily during the morning and evening high activity periods. This call often appeared to be directed at the male and certainly used for food-begging, but was also frequently heard after recent prey deliveries, after her own successful prey captures, while she was feeding the fledgling and during other events. It appeared to be used to announce her location to the fledgling. On at least one occasion, the male delivered prey to the female while the fledgling remained at another location more than 25 ft (7.6 m) away. The female remained at the delivery location and chittered repeatedly, apparently

calling the fledgling to her to feed. The fledgling flew to the female after a short time and the female began to feed it. On one occasion, the chitter was also heard shortly before and after a nest defense pursuit of a bird and was the first female vocalization during dawn observation periods. In all, we recognized at least 4 female vocalizations or sound combinations: 1) the chitter described above, 2) a single pitch call similar to the male one pitch, but higher, at a slower cadence and possibly with a different tonal quality, 3) the combined chitter and one note at the end of the chitter sequence and 4) chirping - single notes repeated only a few times with a slight pause between notes or, sometimes, called only once. This call seemed to indicate concern or alarm about something and was only documented infrequently.

In addition to the single-note territorial call, males were observed using 3 other vocalizations. One, named flying chirps by a worker, occurred as the male flew off after a prey delivery to the female. It was a series of chirp-like notes, not exactly the same as the female's. It was difficult to detect. Another call, the "alarm" call, was heard only once when a resident approached the owl too closely and it flew off. It was a series of high-pitched "squeaks" that did not change pitch during the note. The third has only been heard at the 1995 nest site, several times by the residents and once by a worker. It is extremely difficult to describe; the best way is as a rough-quality trilling chirp performed rather intensely. It is unlike any other call and the intent of the vocalization is unknown.

A typical prey delivery event during late incubation, nestling and early fledging periods provided the opportunity to observe male and female interaction and the most dramatic vocalizations. An event would begin by the female chittering or the male giving the territorial call, sometimes from a distance. The male would fly to the female's location or nearby and may be silent or may announce his arrival with several one-pitch notes. The female would increase the volume and the chittering sequence frequency once she detected the male's presence. The female vocal intensity reached its peak during the actual prey delivery and diminished once she had possession. The male vocalizations were hard to detect over the female's excited calling, but it was common to hear several "flying chirps" just after prey delivery or as he flew off. During the second week after fledging, intensive vocalizations by the female associated with prey deliveries seemed to decrease. This may have been due in part to fewer deliveries by the male and increased hunting by the female.

Fledgling vocalizations were often difficult to detect due to the pitch and low volume. They were similar to the female's chitter, but much higher in pitch and with a thinner, more metallic tone quality. It was first heard coming from the nestlings in the cavity. Because the sex of the fledglings was undetermined, it is not know if the call was similar to the adult female's because they were female birds or if this is typical nestling/fledgling vocalization, regardless of sex.

Prey Descriptions

We observed 84 prey items captured near or delivered to the nest area (Table 6). Fifty-two of these were captured by the male and only 6 by the female from the onset of incubation to the second week after the young had fledged. In the next month, 10 prey items were captured by the male, 10 by the female and 4 were unknown. The fledgling was seen caching prey on 2 occasions that it had apparently captured itself. We distinguished the adult male and female by differences in vocalizations (see Nest Site Vocalizations, p.16) and behavior during prey exchanges. The female remained in or near the nest cavity often within view of the nest monitors while the male frequently disappeared shortly after prey delivery. The female did most of the feeding, but the male was observed feeding the fledgling on at least 2 occasions. Lizards made up 60.0 percent of observed prey items, while birds and mammals accounted for only 8.3 and 4.8 percent respectively. Cicadas were the only captured insect we could document during nest monitoring and represented 4.8 percent of total items. While the identification of 26.2 percent of observed prey items could not be confirmed, there were indications that several of these unknowns were lizards and cicadas.

Table 6. Cactus ferruginous pygmy-owl prey summary - 1996 nest site Tucson Basin, Arizona.

	April	May	June	July	Total
Observation Days	3	14	24	20	28
% of Diet					
Reptiles (60.0%)	1	24	15	7	47
Birds (8.3%)	0	5	2	0	7
Mammals (4.8%)	0	4	0	0	4
Insects (4.8%)	0	0	4	0	4
Undetermined (26.2%)	0	5	10	7	22
Total	1	38	31	14	84

After this time, identification was based on behavior, the presence of more white on the breast of the juvenile, and the lack of white on the crown if the fledgling was close enough for that characteristic to be observed.

Flight skills and behavior were also good indicators of the young owl. The fledgling flew very little during the first week after fledging and appeared weaker and slower than adults on short trips of generally only 20 ft (6 m) or less. During the first 24 hours after fledging, landing and perching also seemed challenging, as the two young birds slipped and struggled to maintain their balance on perches, getting their wings caught in branches during hops from one level to another. The skills of the surviving fledgling rapidly improved during the second week - increasing the longest flight distance to 100 ft (30 m). Head bobbing and moving the head in circles while perched, a behavior which we observed primarily in the fledgling, also seemed to increase during the second week.

Full tail molt occurs in pygmy-owls and on 25 July, the male was first observed with no tail. The female was not observed for about 3 weeks during this time frame and when she was finally observed on 6 August, her tail was short, showing only 2 black bars of the normal 6-7. Young of the year do not molt their tail until much later (Proudfoot 1996), so if a bird with no tail is observed in late summer, it is probably an adult. A researcher doing work on pygmy-owls in Texas (Proudfoot, pers. comm.) theorizes that tail molt in the parents decreases their foraging success which encourages the dispersal of the young. The last detection of the 1996 fledgling was on 26 July which seems to support this theory.

Differentiation between the adult male and adult female was possible, especially when observed together. The female was a little larger, more rufous on the wings and browner on the back and chest. The "eye spots" on the back of the head seemed blacker and brighter, appearing to stand out more than the male's eye spots. The male appeared more charcoal gray than brown on the back and chest. Early in the season, when the birds were seen very frequently, it was possible to tell the sexes apart, even when observed separately. However, as the season progressed and the birds were seen less often, usually only briefly and at a distance, it became difficult to distinguish them using only visual clues. Changes in light conditions also added to the difficulty of distinguishing the subtle differences in color between the male and female. These differences between the sexes are based on only the pair of birds we were able to monitor, but it appears to be consistent with what is being observed in Texas (Proudfoot 1996).

Water Use

The presence of water may be one characteristic that has attracted pygmy-owls within close proximity of private residences and livestock operations. However, only two observations of direct use of water by owls for drinking or bathing were documented during 1996. On one occasion at the monitored nest, the female jumped in a shallow water dish 2 in (5 cm) deep and 10 in (25.4 cm) in diameter. Her activity in the dish was

early 1996 influence pygmy-owls to move closer to water and more stable prey populations it may support? 3) Does the concentration of potential prey created by bird feeders in suburban settings play a role in recent pygmy-owl detection locations? Initial observations of prey taken by pygmy-owls do not support water and feeders as important factors, though they cannot be ruled out at this time (see Diet, p.28). The above questions can really only be answered by conducting additional survey and monitoring activities.

On several occasions during formal surveys, pygmy-owls known to be present near surveyors did not respond vocally to taped-call broadcasts. Workers in Texas have also indicated lack of response did not necessarily mean absence of pygmy-owls (Wauer et al. 1993, Beasom et al. 1994). These observations suggest that actual numbers of individual pygmy-owls within survey areas may be higher than we were able to detect. In addition, changes in calling patterns or the abrupt end of detections at monitored locations may indicate that there were also more nesting pygmy-owls.

We tested the response of known birds to broadcast calls at three locations. At one, there was no response to taped calls even though the owl had called spontaneously a few minutes before. This occurred in late August during a morning calling period. At the second, there was only a very brief response from a bird that calls very regularly. This was during late summer, the post-fledging period, during a morning calling period. At the last location, we ran six trials between 18 July and 5 August and got responses of varying degree by the male during 5 of the trials. The most intense responses were during the early trials, with the non-response during the later trials. All trials were conducted during the morning. We observed the female only once during a calling trial. She flew about 10 yards toward the tape player and chittered once. The fledgling also responded during two of the trials by moving closer and vocalizing.

Our survey results suggest possible increased calling activity and detection success during the morning hours described in the survey protocol (Appendix 1) from late January to early June. However, these results are inconclusive and require continued testing. Future surveyors should be cautious in interpreting the results of these early observations. In addition, surveys before or after the January to June breeding season may have very different outcomes. At the nest site, the male pygmy-owl called habitually and spontaneously 30-45 minutes before sunrise from mid-May through mid-August, usually for only a few minutes. This was the only time of the day that calling was predictable and lends further support to increased detection success during morning surveys. Again, however, this is based on the observation of only one bird. Unpaired birds, or other paired birds, may behave differently.

Habitat

Development of methodology and work on habitat measurement by AGFD personnel is in progress. The success of the survey season and the requirements of nest site monitoring limited the available time for habitat work. However, general habitat descriptions of the detection sites were completed. Most of the locations and the nest site were photo documented. These photographs are available for viewing at the Arizona Game and Fish Region V office in Tucson.

The general habitat in detection areas contains foothill paloverde and saguaro cacti in large numbers, but it is the presence of medium and large ironwood trees in varying densities that makes these areas stand out, and gives them the characterization commonly known as "ironwood forest". Ironwoods were present in almost every detection location and no detections were recorded in areas that did not have this species nearby. If ironwood is important in Arizona pygmy-owl ecology, its specific role is not understood, but surveys in areas with ironwood may provide increased success in the number of detections. Ironwoods may provide increased thermal cover in the summer and could also be an indicator of frost-free zones, somehow related to the owl's energy budget or thermoregulation abilities during winter. All pygmy-owl detections from 1993 through 1996 have been in Sonoran desertscrub and it appears pygmy-owls occupy this habitat type more often in Arizona than earlier reports had indicated (Hunter 1988).

One of the reasons for the high number of pygmy-owl detections near private residences may be the attraction of both humans and owls to dense stands of trees and greenery. It is common for residents in the detection areas to add to the natural density and complexity of paloverde-cacti mixed-scrub habitat creating a kind of oasis with the addition of water sources and irrigated native and non-native trees. Planting non-native, dense, shade-producing trees such as California pepper trees, aleppo pine, mulberry and magnolia close to homes provides increased cover, shade and potential foraging areas for owls. The frequent use of these densely foliated trees by nesting and individual pygmy-owls for cover, feeding, roosting and prey deliveries, suggests both native and non-native tree species may be suitable for meeting pygmy-owl nesting and lifestyle requirements.

Dense foliage seems to be especially important for use as cover by young owls. The fledgling was observed in the dense, protected areas of trees, usually ironwoods, for the first 10 days after fledging. It was often impossible to see the owl due to its cryptic coloration and the dense vegetation; it was located by its vocalizations. For the next two and a half weeks, workers observed that use of protected perches by the fledgling decreased; however, the time spent on exposed perches remained less than that of the adults for at least a month after fledging.

Diet

The discovery of nesting pygmy-owls early in the breeding season provided the opportunity for direct observation of prey items delivered to the nest and young. Future analysis of collected pellets and prey remains will provide a more complete picture of the diet of this species in Arizona. At present, the large majority of confirmed prey taken during incubation, nestling, and early fledging periods were lizards (60.0%). Other observers also documented individual pygmy-owls eating lizards in 1995 and 1996.

The high percentage of lizards observed may or may not be an accurate reflection of the importance of this prey group. We could only observe prey deliveries and captures during daylight hours when lizards are most active and likely to be captured. Nocturnal mammals may account for a larger percentage of prey items, but at those times of day there was not enough light for observation nor identification. Likewise, birds may be of greater importance during the winter when lizards and small mammals are less active.

In addition, the composition of prey items observed by residents at the 1995 nest site was much different. Of 12 observed prey items, 4 (33%) were lizards, 4 (33%) were mammals, 3 (25%) were birds and 1 (8%) was unknown. These same residents also observed a pygmy-owl catching and eating numerous sphinx moths during a late summer evening. As the temperatures rose in June, we observed the capture and use of cicadas with increasing frequency. At least 3 attempts to capture birds in view of observers were unsuccessful and mammals represented only 4.8 % of the total prey items. These observations may suggest pygmy-owls prefer prey items that are both abundant and easier to catch. Further study will be needed to determine if the differences in prey items at the two nest sites are due to differences in habitat and prey availability, prey preference or season of observation.

Numerous castings (pellets) and several prey remains were collected primarily from the monitored 1996 nest site and one site in the Red Rock - Marana area. After analysis, these items combined with pellets collected during the 1995 survey season and the direct observation of prey items at the 1996 nest site, will help provide insight into the diet of cactus ferruginous pygmy-owls in southern Arizona.

Pygmy-Owl Predation and Mortality

Monitored, adult pygmy-owls during 1996 appeared successful at predator avoidance. Except for calling periods, their use of trees with dense branches, foliage and desert mistletoe (*Phoradendron californicum*) combined with cryptic coloration often made them difficult to detect. The armament of desert trees and shrubs may also act as partial deterrent to predators. Their rapid and low style of flight presents even greater challenges to potential avian predators as they often seem to be within just a few feet or inches of the tops of cacti and desert shrubs. Despite the presence of many other diurnal and nocturnal

it is reasonable to assume that availability of easily accessed cavities for young owls would provide additional protection against heat stress, as well as predators, and increase the chance of survival.

Potential Threats to Pygmy-owls

Several direct and indirect threats to pygmy-owls were recognized during the 1996 season. The monotonous calling by territorial birds sometimes occurred throughout the night and often very early in the morning. The frequent location of these birds close to residences created such an annoyance that some residents in frustration; expressed that they "felt like blasting the thing." Once these residents understood the source of the sound, they were very tolerant. The apparent tolerance of the owls to human activity and the curiosity of at least some birds may also increase the chance encounter with young or less responsible individuals testing their skills with various projectiles. As was mentioned earlier, the presence of domestic cats may present danger to new fledglings spending time near the ground.

Harassment by birders and photographers is another concern. We were able to document this impact on one occasion in 1996 when a pair of pygmy-owls was reported on the Tucson Audubon Bird Hotline. The information apparently also appeared nationally on an Internet site. Within hours, numerous birders were documented in the area looking for the pair. We observed van loads of people and also several people from out of state. Although instructed to refrain from putting these sightings on the hotline, birding networks are well established and it is expected that future sightings will result in at least some birding pressure which could result in disturbance of the birds and annoyance of property owners..

Blading of undisturbed desert areas for urban development and the resulting loss of potential foraging areas, nest sites, and general habitat is the most serious threat, as large land tracts near detection areas are zoned for high density housing. Projects varying in size from a few acres to several thousand acres are already in progress. The potential impacts to this local population of pygmy-owls resulting from habitat loss and fragmentation is significant.

RECOMMENDATIONS

General

1) Continue to use the 1996 revised protocol which extends taped-broadcast calling time to ten minutes and post broadcast listening to five. Consider experimenting with longer broadcasts of 30 to 60 minutes at select call points where pygmy-owls were detected earlier in the breeding season, but were not detected after 3 additional monitoring visits.

9) Consider presenting information on pygmy-owl biology and AGFD survey activities to neighborhood associations or other local groups where pygmy-owl detections have occurred. The objectives of this educational effort would be to enlist the aid of residents in locating new birds, protecting nest sites, guarding against harassment, and to encourage landscaping and land use practices that would support continued pygmy-owl activity in their area.

10) Begin cooperation and regular discussions with Texas A&M University researchers and Texas Parks and Wildlife to share information on research and survey methods. Enlist the aid of these workers in developing capture, handling, banding, and radio tracking techniques and implement these as appropriate and/or funding becomes available.

11) Train surveyors to recognize both male and female calls and to recognize mobbing responses by other birds to the broadcast calls. Areas where owls were not detected, but where mobbing behavior occurs warrant repeated survey efforts.

Management

1) It appears that upland areas characterized by braided wash systems and a structurally diverse vegetation component are important to pygmy-owl populations in the Tucson area. These areas are also currently undergoing rapid residential and some commercial development. The AGFD, local governments and other agencies should carefully evaluate proposed development projects in potential pygmy-owl habitat areas and pursue design and density options which would allow the area to retain habitat components important to pygmy-owls such as densely-vegetated wash areas, water sources and areas with high vegetative structural diversity. If feasible, open space areas of > than 3 acres which have the above characteristics should be incorporated into development designs and preserved. Such open space areas should retain some type of connectivity to adjacent, large areas of undisturbed or protected natural habitat.

2) We are still unsure of the long-term importance of Sonoran upland vegetation types with regard to the needs of pygmy-owls and we do not know what role the few remaining areas of riparian habitat, which historically was the habitat type occupied by pygmy-owls, currently play in protecting the Arizona population of pygmy-owls. More work should be conducted on the habitat requirements of this species looking at currently utilized habitats, as well as historic habitats. In the interim, vegetation types which we believe to be important to the owls, i.e. riparian, mesquite bosque and ironwood forest, should be carefully managed with regard to commercial and residential development, recreation, and livestock grazing so that structural diversity and the contiguous nature of the area is maintained.

LITERATURE CITED

Beasom, S.L. and B. Trant. (eds) 1994. Caesar Kleberg Wildlife Institute's annual report to the Caesar Kleberg Foundation for Wildlife Conservation. Texas A&M University, Kingsville.

Beasom, S. L., J. L. Mays and G. Proudfoot. 1994. Evaluation of Non-response Bias in Pygmy-Owl Elicited-call Surveys; in Caesar Kleberg Wildlife Institute's annual report to the Caesar Kleberg Foundation for Wildlife Conservation. Texas A&M University, Kingsville.

Bent, A.C. 1938. Life histories of North American birds of prey. Part 2. U.S. Natl. Mus. Bull. 170.

Brown, D. E. (ed) 1994. Biotic Communities: Southwestern United States and Northwestern Mexico. University of Utah Press, Salt Lake City.

Felly, D.L. and T.E. Corman. 1993. Spring 1993 cactus ferruginous pygmy-owl surveys in Arizona. Nongame and Endangered Wildlife Program Technical Report. Arizona Game and Fish Department, Phoenix, Arizona.

Hunter, W. C. 1988. Status of the cactus ferruginous pygmy-owl (Glaucidium brasilianum cactorum) in the United States and Northern Mexico. USDI Fish and Wildlife Service, Phoenix, Arizona.

Johnsgard, P.A. 1988. North American owls: biology and natural history. Smithsonian Institution Press. Washington and London.

Johnson, R. R. and L. T. Haight. 1985. Status of the Ferruginous Pygmy-Owl in the Southwestern United States. Abstracts, 103rd Stated Meeting of the American Ornithologist's Union, Arizona State University, Tempe, Arizona.

Lesh, T. D. and T. E. Corman. 1995. Cactus ferruginous pygmy-owl surveys in Arizona: 1993-1995. Nongame and Endangered Wildlife Program Technical Report 76. Arizona Game and Fish Department. Phoenix, Arizona.

APPENDICES

1: 1996 Cactus Ferruginous Pygmy-Owl Revised Survey Protocol

2A: Cactus Ferruginous Pygmy-Owl Survey Form (Revised 1996)

2B: Post-Detection Site/Territory Visit Form 1996

2C: Cactus Ferruginous Pygmy-Owl Observation Sheet

2D: Cactus Ferruginous Pygmy-Owl Nest Site Monitoring Form 1996

2E: Cactus Ferruginous Pygmy-Owl Prey Delivery Log

3: Cactus Ferruginous Pygmy-Owl 1996 Nesting and General Activity Chronology

4: Sunrise and Sunset Table for Tucson, Arizona

APPENDIX 2A: ARIZONA GAME AND FISH DEPARTMENT
CACTUS FERRUGINOUS PYGMY-OWL
1996 SURVEY FORM

Today's survey date (D/M/Y): _____

Survey route name or description: _____
Route surveyed previously: Y N Date of last survey _____
Length of survey route (from topo or atlas map): _____ Number of call points _____
Direction of travel _____

7.5 min. quad: _____ County: _____
Legal description: T_____, R _____, Section(s): _____ Elevation: min _____ max _____
Land ownership: _____

Surveyor(s) name(s): _____ Affiliation: _____

Start time: _____ Starting weather conditions: Temp: _____ Wind: _____ Cloud Cover (%) _____
End time : _____ Ending weather conditions : Temp: _____ Wind: _____ Cloud Cover (%) _____
Total hours: _____ Moon visible during survey: Y N Moon Phase (1/4, 1/2): _____

Survey method used: Tape playback surveyor whistle
Type of player used: (brand and model) _____ Volume setting:_____

Detection? Y N (If CFPO is detected, fill out separate detection form)

Number of woodpeckers heard or seen: _____
Number of saguaros with possible nesting cavities observed along route: _____
Number of starlings (possible competitors) heard or seen: _____

Disturbances during survey (barking dogs, vehicle traffic, construction, ATV's, etc):_____
_____

Are water sources available along this survey route? Yes No Undetermined
Number: ___ Size(s): _____ source type(s):_____(if known)

List other bird species responding to survey calls and describe their behavior:
_____
_____
_____
_____
_____
_____

*Habitat Type:_____
Dominant Vegetation:_____
Other species present: _____
_____
_____
Vegetation comments: _____

*Refer to Brown, David E. (ed.) 1994. Biotic Communities: Southwestern United States and Northwestern Mexico, Univ. of Utah Press

APPENDIX 2C: ARIZONA GAME AND FISH DEPARTMENT

Appendix 3 - continued
CACTUS FERRUGINOUS PYGMY-OWL
NESTING AND GENERAL ACTIVITY CHRONOLOGY
1996 NEST SITE

Date	Description
4 June 96	Actual fledge date.
5 June 96	Two fledglings confirmed - estimated age 28 to 31 days. Both adults also observed. Adult male continues doing most of hunting delivering prey to female and female goes to young and feeds them. First observation of cicada capture and eating by male. On one occasion male flew to a fledgling location and began feeding the fledgling - part of what appeared to be a cicada. Female observed picking up dead passerine nestling that was obviously old and dried out - began feeding on it for a short time.
6 June 96	Both adults observed, but only one fledgling located. One may have perished due to heat or predation. Both adults observed in locations further south for the first time. It is becoming more difficult to keep track of the female.
9 June 96	Day five after fledging - adult male and female observed. One fledgling observed - estimated age 32 - 36 days. We are now confident the second fledging has perished. Male continues to bring prey to female and female feeds fledgling. However, female now chitters from location of prey delivery and fledgling flies to her location to be fed. Both fledgling and adults are using structures over a larger area, but periodically return to structures within 150 feet of the nest cavity.
17 June 96	Fledgling moved to a different group of trees farther from the nest, centered activity around an ironwood.
24 June 96	Fledgling has full tail.
4 July 96	Fledgling began expanding its range.
12 July 96	Fledgling observed with prey it probably caught itself.
13 July 96	Last observed prey delivery to fledgling, last observation of female until 6 August.
17 July 96	Birds beginning to get very difficult to locate.
22 July 96	Fledgling retrieved prey from cache.
25 July 96	Male observed with no tail.
26 July 96	Last detection of fledgling.
6 Aug 96	Last detection of female - tail was 2 bars long.
20 Aug 96	Last day of nest monitoring - only the male was detected an only aurally.