Arizona Bald Eagle Nestwatch: 1994 Program Summary

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INTRODUCTION

The bald eagle (*Haliaeetus leucocephalus*) was classified by the U.S. Fish and Wildlife Service (USFWS) in 1978 as endangered in 43 states (including Arizona) and threatened in 5 others. It is not endangered or threatened in Alaska and does not occur in Hawaii. In addition to the Endangered Species Act, the bald eagle is protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. A recovery plan (USFWS 1982) guides management of the southwestern population, which includes Arizona's breeding bald eagles.

The Arizona Bald Eagle Nestwatch Program (ABENWP) was initiated in 1978 (see Beatty et al. 1993). It has three principal goals: conservation, data collection, and education. Because many Arizona bald eagles nest in areas subject to high levels of human activity, closures surround many nest areas. Nestwatchers interact with people in and near these closures, educate them about bald eagle ecology and conservation, and tactfully direct them out of the area. To help agencies make better management decisions, nestwatchers also collect information on eagle ecology, productivity, and behavior in response to human activity. Even so, the most direct benefit of the ABENWP is observation of problems at nest sites. Every year, nests fail and/or nestlings are found in precarious situations. Constant monitoring by nestwatchers often makes it possible to rescue birds in life threatening situations.

This report summarizes the 1994 reports from individual nestwatchers (these reports are confidential documents retained in the AGFD files, and available to cooperating agencies on request). It also includes the major findings at each bald eagle area monitored in 1994. Among the topics discussed are length of observation, timing of major eagle events, human activity in the breeding area, food habits, wildlife interactions, and management activities by agencies.

STUDY AREA

In 1994, ABENWP personnel monitored bald eagle breeding areas along selected river and stream drainages, and around reservoirs throughout Arizona. With the exception of the newly discovered Luna Breeding Area, in eastern Arizona, all breeding areas (BAs) were in the central part of the state. The most northerly BA was Tower, along the Verde River. The most southerly BA was Orme, at the confluence of the Salt and Verde rivers. The most westerly BA was Alamo Lake, northwest of Wickenburg. The most easterly BA was Luna Lake, near Alpine, Arizona. Elevations of the areas monitored ranged from approximately 1080 ft at Alamo Lake to 8000 ft at Luna Lake.

Most Arizona bald eagles breed in the central part of the state, at elevations of 1080 to 5640 ft. This band is within the Upper and Lower Sonoran Life Zones (Merriam 1898), and includes riparian habitats and transition areas of both zones. Brown (1982) describes the representative vegetation of these zones as including blue palo verde (*Cercidium floridum*), mesquite (*Prosopis* spp.), ironwood (*Olneya tesota*), saguaro (*Carnegiea gigantea*), cholla (*Opuntia* spp.), Fremont cottonwood (*Populus fremontii*), Goodding willow (*Salix gooddingii*), Arizona sycamore (*Platanus wrightii*), and tamarisk or salt cedar (*Tamarix pentandra*; this is a non-native species), with juniper (*Juniperus* spp.) and pinyon (*Pinus* spp.) in the transition areas.

The bald eagle BA at Luna Lake is the only one in the Southwest known from Montane-Conifer Forest, and the Transition Life Zone (Driscoll et al. 1995). According to Brown (1982), Montane-Conifer Forest in Arizona is characterized by blue spruce (*Picea pungens*), Engelmann spruce (*Picea engelmannii*), white fir (*Abies concolor*), Douglas fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), quaking aspen (*Populus tremuloides*), gambel oak (*Quercus gambelii*), and common juniper (*Juniperus communis*). Riparian vegetation in this BA includes narrowleaf cottonwood (*Populus angustifolia*), thinleaf alder (*Alnus tenuifolia*), Bebb willow (*Salix bebbiana*), and coyote willow (*Salix exigua*).

METHODS

Beginning in late summer and early fall 1994, we advertised for potential nestwatchers in the AOU Ornithological Newsletter, at the Raptor Research Foundation's annual conference, and through job placement services at colleges and universities nationwide. Public discussions, referrals from previous nestwatchers, and distribution of ABENWP brochures also contributed to the pool of applicants. Nestwatchers were hired as private consultants to AGFD.

Meetings were held in the first week in February to orient and educate the nestwatchers. On 2 February 1994, we took the nestwatchers to the Bartlett BA to prepare them for the field and to explain the data forms they would use. We also addressed protocol for handling bald eagle "emergencies," such as nest failures, eaglets falling out of the nest, and birds getting tangled in monofilament. The following day, a formal orientation meeting was hosted by agency contributors to discuss Arizona bald eagle history, ecology, and the role nestwatchers play in managing the species. At this meeting, nestwatch partners were selected.

After the first ten days in the field, we reconvened the nestwatchers to review problems or questions about data forms and writing final reports. Additional problems were discussed on an individual basis in the field or at the office. Informal "get-togethers" or off-day trips initiated by nestwatchers also allowed for discussion about the program and other eagle matters. These evening meetings also enhanced teamwork and unity among the nestwatchers.

BAs were selected for monitoring based upon the level of human activity near nest sites. The sites monitored included: all territories that were active in 1994 and which had legal closures (Bartlett, Cliff,

Ladders, Lake Pleasant, 76, and Tower); sites that had high levels of human activity in 1994, but which had no closures (Cibecue, Fort McDowell, Luna, and Orme); sites that are fairly accessible and/or have a history of problems such as heat stress, nest parasites, and/or persistent presence of monofilament (Hunt et al. 1992) (Alamo, Ive's Wash--below Alamo Dam, Redmond, Sheep, and Tonto); and a BA of particular interest to agencies (Pinto).

Field work began the first week of February and continued until the nest failed, or the eaglets fledged in May and June. Sites were watched primarily in teams of two. Personnel maintained a ten-day on, four-day off schedule. Each work period included weekends and Fridays, when heavy recreation use tends to impact eagles the most. Half of each ten-day period (weekends and every other Friday) was devoted to data collection, as nests were monitored from dawn-to-dusk. The other half of each ten-day period was spent collecting supplemental eagle data. The four-day off period occurred every other Monday-Thursday.

Data were recorded by observation, opportunistically, throughout the study period. Territories with constant recreational pressure and special eagle concerns were monitored every day either throughout the season or during peaks of human activity (e.g. Tonto). Due to early nesting habits of some eagles, nestwatchers were placed at some BAs prior to February (e.g. Alamo, Bartlett, and Tonto). Audubon Society members assisted in observing the Ladders and Tower breeding areas on the nestwatchers' days-off.

Bald eagle data were recorded from distant observation points in the nest areas. Each observation point was selected to provide optimal viewing with the least impact on breeding eagles. Spotting scopes (15-45x, supplied by ABENWP contributors) and binoculars were used to view eagles. All observations were recorded in a notebook, on field forms documenting human activity in the breeding area, wildlife interactions, prey deliveries, forage events, and wildlife sightings. Nest behavior was recorded each field day and entered on daily summary forms.

Human activity, and the associated eagle behavior, were recorded within a 1 km radius of an eagle or eagle nest. We also documented all aircraft below the ~600 m (2000 ft) Federal Aviation Administration (FAA) recommended ceiling within 1 km of an eagle/nest.

We classified bald eagle responses to human activity into seven categories: none, watched, restless, flushed, left area, unknown, and bird not in area. "No response" indicated an eagle performed its normal activities without acknowledging nearby human activity. "Watched" indicated an eagle looked at a human activity without displaying any other observable reaction. "Restless" was recorded when an eagle vocalized, moved noticeably on its perch, or displayed any overt reaction to human activity without leaving its perch. If an eagle left its perch quickly, in response to human activity, we recorded "flush." A "left area" response indicated an eagle responded to human activity by leaving the immediate area in a less hurried manner than a "flush." Response "unknown" was recorded if we were unable to view a response by an eagle known to be present in the area. "Bird not in area" was recorded if an eagle was not present at the nest when a human activity occurred.

At Alamo Lake, we attempted to describe boating activity and eagle responses in more detail than in the past by employing boat counts on weekends and alternate Wednesdays and Fridays. Every 30 minutes, boats were counted for the entire north end of Alamo Lake (an arbitrary line from Woody's Cove north across the lake) and within a 100 m radius around an eagle's perch. If an eagle was not perched at the lake, its general location was recorded (soaring, at nest, etc). If the bird could not be found, "out-of-view" was marked. In addition to the 30-minute boat counts, whenever an eagle "flushed" or "left area" in response to a boat, we duplicated the information recorded for boat counts, including the distance to the boat that disturbed the eagle.

We also attempted to describe the amount and type of watercraft activity at the southern end of the Lake Pleasant closure buoy line. Although the southern buoy line was within 1 km of the eagle nest, we did not record all watercraft activity in the "human activity" section of the field forms. Because of the heavy boat traffic and our inability to see the eagles from the buoy line, it quickly became redundant to fill in line after line of human activity information where the eagle's response was "unknown." Instead, in the human activity section we described boating compliance at the buoy line and noted the boats that passed beyond our ability to contact them. We simply recorded all watercraft (boat or jet-ski) that approached the buoy line and whether they entered the closure. If the boats entered the closure and passed the nestwatchers, they were recorded in the human activity section and the associated eagle behavior (observed or not) was also recorded.

As with the Lake Pleasant and Alamo BAs, we attempted to describe human activity at the new Luna BA with 30-minute counts of recreation activity. We began using this method on April 7 when we realized the level of activity would overwhelm the methods used in less heavily recreated areas. Recreation at Luna was thus divided into three categories: cars in parking lot, people on shore, boats on lake. Because the eagle response to recreation activity was often "none" or "watched," we only recorded recreation activities that elicited a significant response (restless, flush, left area).

Nestwatchers also recorded bald eagle interactions with other wildlife and tried to identify frequency, type, and species of prey delivered to the nest. All observed foraging events were recorded. Nestwatchers were given nest maps with river kilometer designations and nest numbers, and a guide to the fish commonly preyed upon by Arizona bald eagles (see Hunt et al. 1992).

Nestwatchers provided their own transportation, supplies, binoculars, food, and housing on days off. Twenty-three nestwatchers participated in the ABENWP in 1994.

RESULTS AND DISCUSSION

PROGRAM

To increase the nestwatchers' understanding prior to their arrival in Arizona, we sent copies of data forms and completed ABENWP summary reports. Our goal was to prepare them for the types of information to be collected and familiarize them with the formats and terms used.

We held the annual "burnt weenie" social in the evening of the first orientation day in 1994. Nestwatchers were thus able to socialize and find a compatible work partner themselves. In previous years, the social occurred the evening before nestwatchers left for the field, after partners had been selected. Moving the event seem to facilitate work partner selection.

Since monitoring is concentrated in the nest area, our results are biased. Observations restricted to the nest area will bias any conclusions about forage locations or habitat use over an entire eagle pair's range. However, this information will still help identify where to focus management activities in the nest area. Since eagles are most often found perching and roosting near the nest during incubation and the early nestling stage, it is logical to focus management on these locations. However, important eagle foraging areas, perches, and roosts away from the nest should not be ignored.

INTERVENTION

Tonto Breeding Area

Two eaglets hatched on 28 February. On 17 April, one eaglet (48 days old) fell from nest tree #2 and was discovered below the nest. After coordinating with AGFD personnel, the eaglet was carefully placed in a large box and taken to Liberty Wildlife Rehabilitation Center. Upon examination, the bird was alert and appeared not to be bleeding internally but was unable to stand and use its legs. It was x-rayed at a nearby veterinary hospital and found to have broken its vertebrae. Although the prognosis was poor, there was a possibility of recovery because the bird was still young (M. Mosby pers. comm.). However, the eaglet eventually died on 22 April from toxemia, due to a shut down of its excretory system caused by the broken vertebrae. The remaining eaglet fledged on 18 May.

BREEDING AREAS

Information collected by nestwatchers is summarized from nestwatch reports written at the end of the season (AGFD files).

Alamo Breeding Area

Observation period

The Alamo BA was observed from 9 January to 9 May. It was monitored for 806 hours over 91 days, including 577 hours on 48 dawn-to-dusk days.

Eagle activity

The eagles rebuilt nest #2 between October and December 1993, prior to egg laying. They laid eggs in cliff nest #4 on 25 January. One eaglet hatched on 1 March and fledged on an unknown date after the last day of observation, 9 May. It was 70 days old when observation was terminated. The male and female eagle were in adult plumage and each wore a USFWS band on the right tarsus.

Human activity

Nestwatchers tried to describe the amount of boating activity at the north end of Alamo Lake and determine if the eagles' use of the lake was affected. From dawn-to-dusk on weekends and every other Friday and Wednesday, they counted boats at the upper end of the lake every 30 min. If an eagle was perched on the lake, they recorded the number of boats within 100 m of its perch. If a bird was not on the lake, they recorded its general location/activity (at nest, soaring, etc.). If an eagle was flushed by a boat, they duplicated the information recorded every 30 min (boats at north end, number of boats within 100 m) and the boat's distance from the eagle's perch when the bird was disturbed. They also recorded other activities within 1 km or flying below 600 m (2000 ft) within 1 km of an eagle, along with the bird's behavior.

Boat counts were conducted on 46 days throughout the breeding season, from 22 January to 8 May. Eight counts were on Wednesdays and seven on Fridays. Boats were counted on 15 complete weekends. On one weekend, boats were only counted on Sunday. Some counts were interrupted by poor weather (rain and fog).

As expected, boating activity was slow from January through February, peaked in April, and dropped off in May. Until the weekend of 26-27 February, the highest number of boats recorded at one time was five. Beginning in March and continuing until 1 May, weekend boating activity was at its highest. The days of 12 and 26 March and 2 and 16 April were the heaviest. On 12 March, a minimum of 30 boats were at the north end of the lake continuously from 8:30am to 2:00pm (range=2-46, mean=24). On 2 April, at least 23 boats (range=4-48, mean=27) were continuously present from 7:00am to 6:00pm. The heaviest day was 16 April when more than 30 boats (range=5-66, mean=36) were present continuously from 6:00am to 2:00pm.

Boating activity at the north end of Alamo Lake was much lower on Wednesdays in comparison to the numbers recorded for weekends. Never were more than 20 boats recorded on the lake at one time. The most heavily boated Wednesday was 6 April. At least 11 boats were continuously at the north end from 8:00am to 1:30pm (range=1-20, mean=9).

The seasonal and weekly fluctuations were primarily caused by weather and fish activity. More anglers began visiting the lake in March as the fishing improved and weather became more pleasant. Anglers did not use the lake often after high temperatures became unbearable in May. Weekend use was highest, probably because people had free time to spend recreating. Fishing tournaments also increased boat density on the lake.

When eagles responded to boats, nestwatchers only recorded "flushed" or "left area" responses and disregarded the "none," "watched," and "restless" categories. Eagles flushed (n=16) or left their perch due to boats (n=7) on 23 occasions (Table 1). Boats approaching within 50 m (190 ft) of an eagle's perch almost always caused birds to flush. However, toward the end of the breeding season, a few instances (n<5) were observed where boats approached closer than 50 m (190 ft) and the eagles remained perched.

A main objective at this BA was to determine if the presence of boats would deter eagles from using the

lake. Arbitrarily, we determined that "heavy" boat use of the northern end of Alamo Lake was 15 boats or more. There were 18 days between 6 March and 1 May when a minimum of 15 boats occurred on the lake. Over these 18 days, a total of 125 boat counts occurred when there was "heavy" boat use and 154 counts when 14 or fewer boats were at the north end.

Eagles tended to avoid the lake when there was "heavy" boat use, but there was not an overwhelming difference. When there were fewer than 15 boats at the north end, eagles were found on the lake on 101 of 154 counts (65.6%). When there were 15 or more boats at the north end, eagles were found on the lake on 51 of 101 counts (50.5%). Additionally, eagles were found foraging on the lake on eight occasions during times of "heavy" boat use.

Probably the most interesting discovery in 1994 was the small number of boats recorded within 100 m of an eagle perched on the lake. Out of 433 half-hour counts when an eagle was on the lake, there were only 13 instances when a boat was within 100 m of an eagle. On 12 occasions, one boat was within 100 m, and on one occasion three boats were within 100 m.

This could mean that, regardless of the number of boats at the north end of the lake, eagles may be more affected by the number of boats near hunting perches and foraging areas. This would be consistent with the discoveries of McGarigal et al. (1991) at bald eagle foraging areas on the Columbia River Estuary, Oregon. McGarigal et al. found that a few strategically placed boats could effectively displace a pair of bald eagles from a high use foraging area. Of course, the more boats on the lake, the more likely the foraging area will be disturbed.

If displacement from boating activity occurs at Alamo Lake, disturbance of this type would likely increase as hunting snags fall down. This is a small lake, and the two pairs of eagles partition the upper end for nearly all the prey they capture. During the breeding season, the two pairs can often be found displaying their territoriality near an imaginary line bisecting the lake at Woody's Cove (Hunt et al. 1992, Beatty 1993, Beatty and Driscoll 1994). As more snag perches in the lake are lost, the pairs may find it difficult to partition the same resource successfully. This of course would be complicated by disruption of foraging activities by boats. Eventually, this could lead to reduced success of breeding attempts and possible nest failure if the adult eagles do not acquire enough food. Presently, however, there appear to be enough resources available for the eagles to acquire prey and reproduce at Alamo Lake.

The heavy recreation recorded in past years occurred this year only on weekends from March through April (approximately 25 days, including Fridays). But, should road access improve, boating and/or fishing tournaments increase, and/or snag perches fall down, these eagles might require intensive management. These problems would also be complicated by scant regeneration of native riparian trees (potential nest snags) at and around Alamo Lake.

Table 1. Human activity and behavior by bald eagles, Alamo Breeding Area 1994, Arizona.

	Eagle Behavior Toward Human Activity[1]

Type									
	N	W	R	F	L	B	?	D-D total[2]	Total
Boaters	0	0	0	16	7	0	0	19 (33.9%)	23 (27.3%)
Military Jets	22	0	0	0	0	0	3	15 (26.8%)	25 (29.8%)
Small Planes	18	0	0	0	0	0	1	13 (23.2%)	19 (22.6%)
Sonic Booms	4	0	0	0	0	0	2	2 (3.6%)	6 (7.1%)
Shooters	3	0	0	0	1	0	0	3 (5.4%)	4 (4.8%)
Large Military Planes	2	0	0	0	0	0	0	0	2 (2.4%)
Campers	2	0	0	0	0	0	0	2 (3.6%)	2 (2.4%)
Researchers	0	0	1	0	0	0	0	0	1 (1.2%)
Helicopters	0	0	0	0	0	0	1	1 (1.8%)	1 (1.2%)
Hiker	0	0	1	0	0	0	0	1 (1.8%)	1 (1.2%)
Total	51	0	2	16	8	0	7	56 (100%)	84 (100%)

[1]Eagle behavior: N=None, W=Watched, R=Restless, F=Flushed, L=Left Area, B=eagle not in area, ?=Unknown.
[2]D-D total=Information collected on dawn-to-dusk observation days.

All other activities at Alamo Lake that occurred below 600 m (2000 ft) and/or within 1 km of a bird or nest were recorded. Aircraft activity (military jets [n=25], small planes [n=19], large military planes [n=2], helicopters [n=1]and sonic booms [n=6]) represented 39 percent of all activities and 54 percent of all non-aquatic activities recorded. In contrast to previous years, when hundreds of military jets were recorded flying directly over the lake (Beatty 1993, Beatty and Driscoll 1994), jets often flew the length of the lake, west toward Alamo Dam south of the lake and further than 1 km from the nest. The birds did not respond to the aircraft activity. Although cliff nest #4 is in a remote section of Alamo Lake, the sole hiker recorded near the eagles climbed toward the nest, apparently ignorant of the eagle's presence. The eagle remained at the nest incubating the egg, but was noticeably restless.

Food habits

A total of 79 forage attempts were observed in 1994 (Table 2). Fish were captured in 65 out of 69 attempts; birds were captured in 5 of 8 attempts. The prey type from two unsuccessful forages could not be determined. The male was successful in 43 of 49 forage attempts. The female was successful in 18 of 20 attempts. An Alamo adult of unknown sex made nine successful prey captures in 10 attempts.

Carrion was often observed being acquired by the eagles. A total of 31 fish and 3 birds, representing 43 percent of all observed forage attempts were determined to be carrion. These 34 items represent a

minimum number due to the difficulty of observing the status of every prey item. However, the number is more than likely higher due to the high percentage of success that eagles had in capturing prey (70 of 79 attempts, 89%). Angler released fish, spring kill tilapia, and natural spawning mortality contributed to the pool of carrion.

Wintering bald eagles were observed capturing food on Alamo Lake between 25 January and 25 February. All eight attempts were by subadult bald eagles; seven were successful.

Table 2. Observed forage events and success by bald eagles, Alamo Breeding Area 1994, Arizona.

Sex	Prey Types							
	Fish		Birds		Unknown		Total	
	E[1]	S-U[2]	E	S-U	E	S-U	E	S-U
Male	43	40-3	5	3-2	1	0-1	49	43-6
Female	18	17-1	2	1-1	0	0-0	20	18-2
Unknown	8	8-0	1	1-0	1	0-1	10	9-1
Total	69	65-4	8	5-3	2	0-2	79	70-9

[1]E = Forage events observed; each number represents a forage event for an item not the number of strikes to capture it.
[2]S-U = Successful captures of prey - unsuccessful capture of prey.

Only 28 prey deliveries were observed (Table 3), as the eagle's nest was 4 km (2.5 mi) from the observation point and the nestwatchers often lost sight of the birds as they flew from the lake. The male was observed delivering 25 items and the female two items. On one occasion, the sex of the Alamo adult delivering the prey could not be determined. Twenty-two of the deliveries were fish, two were birds, and four could not be determined. Species observed being captured and delivered to the nest were flathead catfish (n=1), channel catfish (n=3), largemouth bass (n=2), carp (n=1), and American coot (n=1) (Table 4.).

Table 3. Observed prey types delivered to nest by bald eagles, Alamo Breeding Area 1994, Arizona.

Sex	Prey Types

	Fish	Birds	Unknown	Total
Male	19	2	4	25 (89.0%)
Female	2	0	0	2 (7.0%)
Unknown	1	0	0	1 (4.0%)
Total	22 (79.0%)	2 (7.0%)	4 (14.0%)	28 (100%)

Table 4. Observed prey species delivered to nest by bald eagles, Alamo Breeding Area 1994, Arizona.

Sex	Prey Types[1]								
	Fish					Birds		Unknown	Total
	FCT	CCF	CRP	LBS	FSH	ACT	BRD	UNK	
Male	1	3	1	2	13	1	1	3	25
Female	0	0	0	0	2	0	0	0	2
Unknown	0	0	0	0	1	0	0	0	1
Total	1	3	1	2	16	1	1	3	28

[1]Prey types: FCT=flathead catfish, CCF=channel catfish, CRP=carp, LBS=largemouth bass, FSH=unknown fish, ACT=American coot, BRD=unknown bird, UNK=unknown.

Wildlife interactions

Alamo bald eagles were observed interacting with great blue herons, osprey, red-tailed hawks, peregrine falcons, common ravens, golden eagles, northern harriers, American white pelicans, wintering bald eagles, Ive's Wash bald eagles, and unknown species of birds.

The eagles were successful pirating one prey item apiece from the following species: subadult bald eagle, osprey, peregrine falcon, and northern harrier. The Alamo male dove at a peregrine that had captured a shorebird. On the second stoop, the falcon dropped the bird into the lake. The male retrieved the bird from the lake's surface and took it to the nest.

Interactions with the Ive's Wash bald eagles at a territory line bisecting the lake near Woody's Cove

have been a common observation (Beatty 1993, Beatty and Driscoll 1994). As in previous years, members of each pair often perched at the territorial boundary in a ceremonial "stare-down." The events were sometime combined with an aerial display before the birds landed on a different perches along the boundary line. Vocalizations and pursuit flights were also commonly observed when the eagles were involved in territorial "disputes."

Management activities

Due to a higher lake level, the channel allowed boating access to the base of the nest tree. To prevent disruption of the breeding attempt, buoys were placed across a small channel about 100 m (328 ft) wide. The buoys were removed after the egg in cliff nest #4 hatched.

Bob Hall of BLM, Dave LaPointe and Bill Ballinger of Arizona State Parks, and Greg Beatty of AGFD discussed, prior to the breeding season, protocol for nestwatchers using State Park facilities such as telephones and bathrooms.

Luke Air Force Base obviously made a concerted effort to avoid low-level flights over the surface of Alamo Lake.

Bartlett Breeding Area

Observation period
The Bartlett BA was observed from 14 January to 2 June, for 998 hours over 102 days, including 48 dawn-to-dusk days.

Eagle activity
Incubation began in cliff nest #1 on 29 January. One eaglet hatched between 8 and 10 March and fledged on 31 May.

Both breeding Bartlett eagles were unbanded birds in adult plumage.

Human activity
A total of 400 human activities were recorded at Bartlett from 19 different types of recreation in 1994 (Table 5). Aircraft (small planes, helicopters, jets) were recorded the most (n=313), followed by canoes/kayaks (n=21), drivers (n=12), and agency workers (n=11). The eagles responded significantly toward 16 activities throughout the season. Small planes and helicopters caused eagles to be "restless" four times and to flush twice. Agency workers and researchers made eagles "restless" once and flush three times. The sound of gunshot and a shooter caused eagles to be "restless" on three occasions. A hiker, angler, and horseback rider each caused eagles to respond once.

Although a large number of small planes (n=253), helicopters (n=59) and military jets (n=1) flew through the nest area below the recommended 600 m (2000 ft) ceiling, the eagles significantly responded to only six instances. Eagles nearly always responded to aircraft when they flew below 500 ft. Small planes above 500 ft elicited little response by the eagles. However, eagles were observed to pay attention to helicopters flying above 500 ft and further than 1 km from the nest.

Vehicles were found entering the southern end of the breeding area from Needle Rock and north of the nest from Riverside campground. Low river flows allowed vehicles the ability to cross the river at will. A jeep was recorded doing "donuts" on the flats across the river from the nest cliffs. Other vehicles (4x4s, dune buggies and dirt bikes) entered and parked in the closure near the nest. All of these groups were contacted and left the nest area.

Approximately 75 people were contacted within the Bartlett BA closure. These people were associated with the following activities: driving, hiking, angling, shooting and boating. Although some recreationists responded negatively when contacted (a group discharged multiple rounds of gunfire in protest), most people expressed support for the eagles. Some people annually return to the Bartlett BA to see the eagles and check their status.

Table 5. Human activity and behavior by bald eagles, Bartlett Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Human Activity[1]								
	N	W	R	F	L	B	?	D-D total[2]	Total
Small plane	158	64	2	1	0	0	28	188 (67.6%)	253 (63.1%)
Helicopter	15	31	2	1	0	0	10	28 (10.1%)	59 (14.7%)
Canoe / kayak	5	13	0	0	0	0	3	19 (6.8%)	21 (5.2%)
Driver	3	5	0	0	0	0	4	11 (4.0%)	12 (3.0%)
Agency worker	10	0	0	1	0	0	0	3 (1.1%)	11 (2.7%)
Gunshot	3	4	1	0	0	0	0	4 (7.4%)	8 (2.0%)
Researcher	1	3	1	2	0	0	0	3 (1.1%)	7 (1.7%)
Hiker	3	1	1	0	0	0	1	5 (1.8%)	6 (1.5%)
Shooter	0	2	2	0	0	0	1	5 (1.8%)	5 (1.2%)
Rafter	0	3	0	0	0	0	1	3 (1.1%)	4 (1.0 %)
Angler	2	1	0	1	0	0	0	2 (0.7%)	4 (1.0 %)
Horseback rider	0	0	0	0	1	0	1	2 (0.7%)	2 (0.5%)
Dog	1	1	0	0	0	0	0	1 (0.4%)	2 (0.5%)
Tuber	1	1	0	0	0	0	0	2 (0.7%)	2 (0.5%)
Sonic boom	1	0	0	0	0	0	0	0	1 (0.2%)
Cycler	0	0	0	0	0	0	1	1 (0.4%)	1 (0.2%)
ATV	1	0	0	0	0	0	0	1 (0.4%)	1 (0.2%)
Construction	0	1	0	0	0	0	0	0	1 (0.2%)
Military jet	1	0	0	0	0	0	0	0	1 (0.2%)
Total	205	130	9	6	1	0	50	278 (100%)	401 (100%)

[1]Eagle behavior: N=None, W=Watched, R=Restless, F=Flushed, L=Left Area, B=eagle not in area, ?=Unknown.

[2]D-D total=Information collected on dawn-to-dusk observation days.

Food habits

The eagles were observed attempting to capture live prey and forage on carrion on 37 occasions (Table 6). All observed attempts were along a 2.5 km stretch of river below the cliffs that support nests #1 and #2. On 28 March, suckers were observed spawning in the riffles below the nest cliffs. The eagles were subsequently observed foraging more often in this location. The male was observed foraging 25 times (16 successful). The female was successful in every forage attempt observed (n=12). Eagles were also observed flying downriver toward the Needle Rock area and toward Bartlett Lake, where foraging has been observed in the past (Hunt et al. 1992). All observed forages were for fish.

Table 6. Observed forage events and success by bald eagles, Bartlett Breeding Area 1994, Arizona.

Sex	Prey Types					
	Fish		Carrion Fish		Total	
	E[1]	S-U[2]	E	S-U	E	S-U
Male	25	16-9	0	0-0	25	16-9
Female	11	11-0	1	1-0	12	12-0
Total	36	27-9	1	1-0	37	28-9

[1]E = Forage events observed; each number represents a forage event for an item not the number of strikes to capture it.

[2]S-U = Successful captures of prey - unsuccessful capture of prey.

Table 7. Observed prey types delivered to nest by bald eagles, Bartlett Breeding Area 1994, Arizona.

Sex	Prey Types			
	Fish	Birds	Unknown	Total
Male	32	3	5	40 (80.0%)
Female	10	0	0	10 (20.0%)
Total	42 (82.0%)	3 (6.0%)	5 (10.0%)	50 (100%)

The Bartlett eagles were observed delivering 50 items to the nest (Table 7). The male delivered 40 prey items and the female brought 10. Fish comprised 84 percent (n=42) of all observed prey deliveries. Species identified in the nest were: suckers (n=5), carp (n=3), unidentified catfish (n=5), unidentified fish (n=29), American coot (n=1), unidentified bird (n=2) and unknown items (n=5) (Table 8).

Table 8. Observed prey species delivered to nest by bald eagles, Bartlett Breeding Area 1994, Arizona.

Sex	Prey Types[1]							
	Fish				Birds		Unknown	Total
	SKR	CRP	CFS	FSH	ACT	BRD	UNK	
Male	4	3	3	22	1	2	5	40
Female	1	0	2	7	0	0	0	10
Total	5	3	5	29	1	2	5	50

[1]Prey types: SKR=sucker, CRP=carp, CFS=catfish species, FSH=unknown fish, ACT=American coot, BRD=unknown bird, UNK=unknown.

Management activities

Road access to the Riverside campground (on weekdays) and the Bartlett BA was blocked off by two locked gates due to construction activity at Bartlett Dam. The gate nearest the nest area protected a heavy machinery lay-down area. These gates, although erected for other purposes, reinforced the existing Bartlett BA closure.

Nestwatch activities began in January due to the early nesting habits of the Bartlett eagles.

Cibecue Breeding Area

Observation period
The Cibecue BA was observed from 15 March to 4 June. Observations totalled 380 hours over 39 days, including 232 hours on 14 dawn-to-dusk days.

Eagle activity
Incubation in cliff nest #3 began prior to 25 February. At least one eaglet hatched between 18 March and 11 April. The eaglet fledged between 23 and 28 May.

Both resident eagles were in adult plumage. The male wore a silver USFWS band on its left tarsus. The adult female was unbanded. On 25 February, we noticed the female eagle had a dark spot on the left side of the neck below the beak. This coloration was absent on the right side of the neck. The tail and other parts of the head were white. The spot was in an odd location, and appeared to be dirt or possibly blood from a carcass. The dark splotch faded over the next couple of months, confirming our suspicions.

Human activity
A total of 134 human activities were recorded at the Cibecue BA in 1994 (Table 9). Almost 70 percent were recorded on weekends. The most common activities recorded were vehicular traffic (n=87, 64.9%), rafting (n=16, 11.9%), and kayaking (n=9, 6.7%). The eagles responded significantly three times. They flushed twice to rafters and left the area due to a kayaker.

In comparison to years with higher flows, 1994 did not provide many opportunities for private or commercial boaters to run the river. As a result, less vehicle and boating activity (often related due to shuttle trips) was recorded. In 1992, when the river ran higher, 135 boats and 105 vehicles were recorded in just nine days before the breeding attempt failed (Beatty 1992).

Vehicle traffic was restricted to the main dirt road traveling through the Salt River Canyon. The road was within 1 km of the nest. A spur road from the main road down to the river below the eagle nest was closed by the White Mountain Apache Game and Fish Department. This closure was effective in preventing the public from approaching the eagles and disrupting nesting.

Although few boaters traveled through the canyon compared to previous years, rafters and kayakers were responsible for causing the eagles to disrupt their normal behavior on three occasions. Twice the eagles flushed as boaters yelled while they went through the small rapids. The eagles left their perch another time when a pair of kayakers floated near a low cliff perch.

Food habits
The Cibecue eagles were observed attempting seven forages and delivering 29 items to the nest. All forage attempts were performed by the adult female. Of items delivered to the nest, 23 were fish, 2 were mammals, and 4 were unknown.

Table 9. Human activity and behavior by bald eagles, Cibecue Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Human Activity[1]								
	N	W	R	F	L	B	?	D-D total[2]	Total
Camper	2	0	0	0	0	0	0	1 (1.1%)	2 (1.5%)
Rafter	6	3	0	2	0	1	4	10 (11.1%)	16 (12.0%)
Kayak	3	2	0	0	1	0	3	8 (8.9%)	9 (6 .8%)
Small Plane	2	0	0	0	0	0	3	2 (2.2%)	5 (3.8%)
Driver	56	1	0	0	0	2	27	59 (65.6%)	86 (64.7%)
ATV	0	0	0	0	0	0	2	0	2 (1.5%)
Cycler	1	0	0	0	0	0	0	1 (1.1%)	1 (0.8%)
Hiker	3	0	0	0	0	0	1	3 (3.3%)	4 (3.0%)
Agency Personnel	0	0	0	2	0	0	0	0	2 (1.5%)
Photographer	2	0	0	0	0	0	0	2 (2.2%)	2 (1.5%)
Birder	0	0	0	0	0	0	1	1 (1.1%)	1 (0.8%)
Tuber	0	1	0	0	0	0	0	1 (1.1%)	1 (0.8%)
Angler	1	0	0	0	0	0	0	1 (1.1%)	1 (0.8%)
Rancher	1	0	0	0	0	0	0	1 (1.1%)	1 (0.8%)
Total	77	7	0	4	1	3	41	90 (100%)	133 (100%)

[1]Eagle behavior: N=None, W=Watched, R=Restless, F=Flushed, L=Left Area, B=eagle not in area, ?=Unknown.
[2]D-D Total=Information collected on dawn-to-dusk observation days.

All forage attempts by the female occurred in pocket water or run habitat directly in front of the nest cliff between kilometers 177.8 and 178.5. Two of seven attempts were successful in capturing fish (Table 10).

Of the 29 observed prey deliveries, 12 were by the male, 11 by the female, and 6 by a resident adult of unknown sex. Prey types delivered were fish (n=23), mammals (n=2), and unknown (n=4) (Table 11). The observation point was distant from the nest, and the nestwatchers could not see into the nest bowl,

so only one prey item was identified (channel catfish).

Table 10. Observed forage events and success by bald eagles, Cibecue Breeding Area 1994, Arizona.

Sex	Prey Types			
	Fish		Total	
	E[1]	S-U[2]	E	S-U
Male	0	0-0	0	0-0
Female	7	2-5	7	2-5
Total	7	2-5	7	2-5

[1]E = Forage events observed; each number represents a forage event for an item not the number of strikes to capture it.
[2]S-U = Successful captures of prey - unsuccessful capture of prey.

Table 11. Observed prey types delivered to nest by bald eagles, Cibecue Breeding Area 1994, Arizona.

Sex	Prey Types			
	Fish	Mammals	Unknown	Total
Male	10	1	1	12 (41.4%)
Female	8	1	2	11 (37.9%)
Unknown	5	0	1	6 (20.7%)
Total	23 (79.3%)	2 (6.9%)	4 (13.8%)	29 (100%)

Wildlife interactions

The Cibecue bald eagles were observed interacting with red-tailed hawks, common ravens, turkey vultures, and an unknown raptor.

Management activities

The White Mountain Apache Game and Fish Department closed the road leading down to the river at Salt Banks below nest #3 with a sign and gate. The sign indicated the area was closed because it was a bald eagle breeding area.

Cliff Breeding Area

Observation period
The Cliff BA was observed from 4 February to 26 March, for 256 hours over 39 days, including 174 hours on 19 dawn-to-dusk days.

Eagle activity
Incubation began in pinnacle nest #4 on 6 February. At least one eaglet hatched on 13 March. The eaglet was last seen alive on 23 March. On 25 March the nest was left unattended for nearly the entire day. The male was observed eating a "flexible grey blob" that seemed to be the dead eaglet. On 26 March the nest was closely investigated and no sign of an eaglet was discovered.

Through the last five days of observation, the Cliff eagles displayed unusual behavior at the nest. Beginning on 22 March, the female aggressively chased the male away from the nest. The next day, the male was observed diving at the nest (to steal food) immediately after the female delivered a prey item. The female was again later observed chasing the male from the nest area. This was the last day the eaglet was seen alive. On 24 March the female again aggressively chased the male away from the nest on five occasions. On one instance when the male entered the nest, the female dove at it, knocking the bird backwards off the nest.

On 25 March, the eagles abandoned the breeding attempt after a series of aggressive interactions. During the morning, the male was chased from the nest on three occasions by the female. In the afternoon, the male removed a dehydrated fish from the nest and ate it along the river shore. Soon afterward, the male returned to the nest and ate the "flexible grey blob." The grey object in the nest seemed to be the dead eaglet. The nest was left unattended for more than eight hours on this day. On 26 March, both the female and the male were seen in the nest area, but no aggressive interactions were observed. The nest was inspected from a close distance, but no eaglet was observed.

The male was in adult plumage and had a black VID band on its left tarsus and a USFWS band on its right. The bird also wore a radio-telemetry backpack attached in 1988 (Hunt et al. 1992). These identifying features allowed us to positively identify the bird as the resident male and not mistake it for an intruder during the aggressive interactions between the resident adults. The adult female was also in adult plumage and wore a USFWS band on its left tarsus.

Human activity
A total of 61 human activities were observed at the Cliff BA during the 39 days of observation (Table 12). Aircraft (jets, small planes, helicopters) represented 62 percent of all activities recorded. Eagles commonly responded with a "none" or "watched" behavior to aircraft. The only disturbed behavior recorded was a "restless" response toward a small plane flying approximately 1000 ft overhead. The remaining terrestrial activities did not cause the eagles to respond significantly.

Table 12. Human activity and behavior by bald eagles, Cliff Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Human Activity[1]								
	N	W	R	F	L	B	?	D-D total[2]	Total
Small plane	10	5	1	0	0	0	2	9 (33.3%)	18 (29.5%)
Military jet	4	1	0	0	0	0	8	1 (3.7%)	13 (21.3%)
Hiker	12	0	0	0	0	0	0	8 (29.6%)	12 (19.7%)
Helicopter	1	3	0	0	0	0	3	2 (7.4%)	7 (11.5%)
Angler	3	0	0	0	0	0	1	3 (11.0%)	4 (6.6%)
Rancher	3	0	0	0	0	0	0	2 (7.4%)	3 (4.9%)
Canoe	0	2	0	0	0	0	0	1 (3.7%)	2 (3.3%)
Camper	0	0	0	0	0	0	1	1 (3.7%)	1 (1.6%)
Horseback rider	1	0	0	0	0	0	0	0	1 (1.6%)
Total	34	11	1	0	0	0	15	27 (100%)	61 (100%)

[1]Eagle behavior: N=None, W=Watched, R=Restless, F=Flushed, L=Left Area, B=eagle not in area, ?=Unknown.
[2]D-D Total=Information collected on dawn-to-dusk observation days.

Although aircraft were not recorded as causing a significant response, they were frequently recorded flying over the nest area. Military jets flying route VR-239 out of Luke Air Force Base were observed traveling south of their flight corridor (west to east across Horseshoe Reservoir) and moving directly over the nest area. Small planes were recorded 18 times in the nest area and helicopters seven times.

Terrestrial activity was focused at the northern fenced boundary of the eagle closure. People commonly drove to the fence, got out, crossed the fence, and left. Other types of activities recorded were ranching, canoeing, fishing, horseback riding, camping, and hiking. Eighteen people were contacted at the Cliff BA, 12 inside the closure. All people contacted inside the closure were receptive and cooperative once they were informed about the presence of eagles.

Food Habits

A total of six forage attempts in the immediate nest area (all successful) were observed at the Cliff BA in 1994 (Table 13). Three fish and three unknown items were captured. Four prey deliveries were

observed. All four prey deliveries were fish. A smallmouth bass and a green sunfish\bluegill were positively identified in the nest (Table 14).

Table 13. Observed forage events and success by bald eagles, Cliff Breeding Area 1994, Arizona.

Sex	Prey Types							
	Fish		Carrion		Unknown		Total	
	E[1]	S-U[2]	E	S-U	E	S-U	E	S-U
Male	1	1-0	1	1-0	1	1-0	3	3-0
Female	1	1-0	0	0	1	1-0	2	2-0
Unknown[3]	1	1-0	0	0	0	0	1	1-0
Total	3	3-0	1	1-0	2	2-0	6	6-0

[1]E = Forage events observed; each number represents a forage event for an item not the number of strikes to capture it.
[2]S-U = Successful captures of prey - unsuccessful capture of prey.
[3]Unknown = Undetermined sex of resident adult that captured a prey item.

Table 14. Observed prey species delivered to nest by bald eagles, Cliff Breeding Area 1994, Arizona.

Sex	Prey Types[1]			
	Fish			Total
	SUN\BG	SMB	FSH	
Male	0	1	0	1
Female	1	0	2	3
Total	1	1	2	4

[1]Prey types: SUN\BG=green sunfish\bluegill, SMB=smallmouth bass, FSH=unknown fish.

Wildlife interactions
The Cliff eagles were observed interacting with common ravens, red-tailed hawks, great blue herons, other bald eagles, and unknown raptors.

Management activities
The fence at the northern boundary of the closure was reconstructed (after it was destroyed by river flooding in 1993) by the Cave Creek Ranger District of the Tonto National Forest with a Heritage grant from the Arizona Game and Fish Department.

Ive's Wash Breeding Area

Observation period
The Ive's Wash BA was periodically visited by Alamo nestwatchers throughout the breeding season. The site was monitored on 20 days, for 68 hours.

Eagle activity
Incubation began in cliff nest #3 just prior to 10 January. One eaglet hatched between 4 and 10 February and fledged between 21 and 24 April. Both Ive's Wash adult eagles were in adult plumage and wore no bands.

Human activity
Due to the short amount of time the Ive's Wash BA was monitored, little human activity was recorded. Military jets (n=18) and a sonic boom (n=1) were observed/heard in the nest area. Boats on the lake were observed flushing eagles on three occasions.

The absence of military jets over the eagle's foraging and nest area at the northern end of Alamo Lake was a dramatic change from previous years (Beatty 1992, Hunt et al. 1992, Beatty and Driscoll 1994). However, jets still entered the Bill Williams drainage at Alamo Dam and traveled over the Ive's Wash nest area. No eagle reactions to these overflights were observed, due the great distance between the observation point and the nest.

No terrestrial activity was recorded near the nest in 1994, largely due to the change in the river channel from the 1993 floods. High water releases from Alamo Dam created a wider and deeper river channel in the canyon below the dam. The water blocked foot passage along the river, providing a natural barrier to casual recreation.

Food habits
One forage attempt was observed by an Ive's Wash adult, on Alamo Lake in Woody's Cove. The focus was on the Alamo eagles, so little attention was paid to foraging Ive's Wash eagles. However, the high frequency of the Ive's Wash eagles' presence on Alamo Lake confirms previous observations and prey remains from the nest that foraging is primarily done at the lake (Beatty 1992, Hunt et al. 1992, Beatty and Driscoll 1994).

Wildlife interactions
Ive's Wash eagles were observed interacting in the nest area with nearby nesting common ravens and red-tailed hawks. At the northern end of the lake, Ive's Wash birds were commonly observed in territorial disputes with the Alamo eagles (Beatty 1992, Beatty and Driscoll 1994). See the Alamo Breeding Area section for more details on Ive's Wash/Alamo interactions.

Management activities

The Ive's Wash nest tree in Woody's Cove was inundated in 1993 (Driscoll et al. 1994). After a drop in water level and re-emergence of the nest snag, no nest remained. We re-examined the snag in October and December 1993 and found that the eagles had not rebuilt the Woody's Cove nest. We concluded that it was not necessary to install the buoyed boat closure around the nest snag and cove.

Ladders Breeding Area

Observation period
The Ladders BA was observed from 4 February to 30 May, for 778 hours over 83 observation days, including 484 hours over 44 dawn-to-dusk days.

Eagle activity
Incubation began in cliff nest #3 on 18 February. Two eaglets hatched on approximately 25 March. One eaglet fledged between 3 and 6 June. The second fledged between 10 and 18 June.

The resident female was unbanded, in adult plumage. It replaced the previous female, which occupied the site from at least 1987. The male was also unbanded and in adult plumage (Hunt et al. 1992, Beatty and Driscoll in prep.).

Human activity
A total of 627 human activities were recorded at the Ladders BA in 1994 (Table 15). The largest proportion (n=501, 80.0%) of activities were aircraft (small planes and helicopters). Other than response to researchers, the eagles were recorded significantly responding to two activities, a boat and a hiker.

A large blue tarp was used as protection in a small shelter at the observation point approximately 150 m from the nest. The bright tarp seemed to attract planes flying overhead that would then circle the nest area and investigate. The nestwatchers switched to a camouflaged tarp in March. The change in tarp color was successful, as eight planes circled the area in February and only two planes investigated the observation point over the remainder of the season.

Canoeing, rafting, and kayaking are popular sports that peak during the bald eagle breeding season. Of the 100 groups of boats that floated through the nest area, 38 disembarked within the closure (disembarking is not allowed). After nestwatchers discovered that two groups had disembarked below the nest at the Chasm Creek/Verde River confluence, on 4 March they posted small (18 inch x 12 inch) signs at the confluence with general "sensitive bald eagle habitat\no-entry" eagle information. For the remainder of the season, the sole group that disembarked at the Chasm Creek/Verde River confluence did so to read the posted sign. Other groups disembarked prior to approaching the nest and others disembarked near Sycamore Canyon (approximately 700 m downriver of the nest). These boating groups did not elicit a response from the eagles, due to their distance from the nest.

Seven groups of boaters were contacted during the season. All were aware of the closure and responded favorably. However, excuses for disembarking were that they did not know where the closure ended and/or the effective dates. Yet, this information was provided at the beginning of the closure at "The Falls," where people have to portage around the water obstacle. A sign just below Sycamore Canyon marks the end of the closure.

Table 15. Human activity and behavior by bald eagles, Ladders Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Human Activity[1]								
	N	W	R	F	L	B	?	D-D total[2]	Total
Small plane	391	44	0	0	0	34	6	336 (76.2%)	475 (75.8%)
Canoe / kayak	69	21	0	1	0	0	0	70 (15.9%)	91 (14.5%)
Helicopters	16	7	0	0	0	0	0	16 (3.6%)	26 (4.1%)
Researcher	2	6	3	2	0	0	0	6 (7.4%)	13 (2.1%)
Rafts	3	6	0	0	0	0	0	7 (1.4%)	9 (1.4%)
Hikers	2	4	1	0	0	0	0	4 (0.9%)	7 (1.1%)
Agency workers	1	1	0	0	0	0	0	0	2 (0.3%)
Camper	1	0	0	0	0	0	1	1 (0.2%)	2 (0.3%)
Horseback rider	2	0	0	0	0	0	0	1 (0.2%)	2 (0.3%)
Total	487	89	4	3	0	34	10	441 (100%)	627 (100%)

[1]Eagle behavior: N=None, W=Watched, R=Restless, F=Flushed, L=Left Area, B=eagle not in area, ?=Unknown.
[2]D-D total=Information collected on dawn-to-dusk observation days.

Food habits

Nine forage attempts were observed at the Ladders BA in 1994 (Table 16). All forage attempts occurred in the immediate nest area. The male was observed foraging on eight occasions. The eagles were observed trying to capture fish, fish carrion, and a small mammal.

A total of 57 prey deliveries to the nest were observed (Table 17). The prey types delivered were fish (n=47), mammals (n=7), and unknown items (n=3). The male delivered 44 (77.6%) prey items and the female 13 (22.4%) items. Species identified in the nest were suckers (n=8), bass species (n=1), carp (n=7), channel catfish (n=6), flathead catfish (n=2), unknown catfish (n=1), unknown fish (n=22), rabbit species (n=2), unknown mammals (n=5), and unknown items (n=3) (Table 18).

Wildlife interactions

Ladders bald eagles were observed interacting with other bald eagles, golden eagles, peregrine falcons, common ravens, great blue herons, red-tailed hawks, turkey vultures, and ospreys. Aggressive

interactions with golden eagles were observed on three occasions. The most significant occurred on 4 April, when an immature golden eagle landed in the nest with the brooding female. The bald eagle and golden eagle locked talons and tumbled from the nest together for 100 ft before breaking apart. The female pursued the golden eagle out of view. On two other occasions, golden eagles were driven to the ground by the bald eagles.

Peregrine falcons interacted with the Ladders eagles on five occasions. A pair of peregrines stooped on the incubating female eagle on 8 March. Later that day a peregrine mobbed the male as it returned to the nest. On 13 March, a peregrine pursued the female. The male chased a peregrine on 27 March and the female soared with one on 16 May.

Table 16. Observed forage events and success by bald eagles, Ladders Breeding Area 1994, Arizona.

Sex	Prey Types					
	Fish		Mammals		Total	
	E[1]	S-U[2]	E	S-U	E	S-U
Male	7	5-2	1	1-0	8	6-2
Female	1	1-0	0	0-0	1	1-0
Total	8	6-2	1	1-0	9	7-2

[1]E = Forage events observed; each number represents a forage event for an item not the number of strikes to capture it.
[2]S-U = Successful captures of prey - unsuccessful capture of prey.

Table 17. Observed prey types delivered to nest by bald eagles, Ladders Breeding Area 1994, Arizona.

Sex	Prey Types			
	Fish	Mammals	Unknown	Total
Male	34	7	3	44 (77.2%)

Female	13	0	0	13 (22.8%)
Total	47 (82.5%)	7 (12.3%)	3 (5.2%)	57 (100%)

Table 18. Observed prey species delivered to nest by bald eagles, Ladders Breeding Area 1994, Arizona.

Sex	Prey Types[1]										
	Fish							Mammals		Unknown	Total
	SKR	BAS	CRP	CCF	FCF	CFS	FSH	RAB	MAM	UNK	
Male	5	0	2	5	2	1	19	2	5	3	44
Female	3	1	5	1	0	0	3	0	0	0	13
Total	8	1	7	6	2	1	22	2	5	3	57

[1]Prey types: SKR=sucker, BAS=bass species, CRP=carp, CCF=channel catfish, FCF=flathead catfish, CFS=catfish species, FSH=unknown fish, RAB=rabbit species, MAM=unknown mammal, UNK=unknown.

Management activities

Nestwatchers placed "Sensitive bald eagle habitat/no entry" signs (18 inch x 12 inch) at the Chasm Creek/Verde River confluence and 500 m upriver of the nest. USFS moved the "end of closure" sign 500 m downriver of the Sycamore Canyon/Verde River confluence.

Audubon volunteers monitored the site on the nestwatchers' days off.

A short segment filmed by Salt River Project (SRP) about the ABENWP was shown on Channel 12 news. Audubon volunteers and AGFD and SRP personnel were included in the program.

Luna Breeding Area

Observation period
Observation began on 24 March, soon after the breeding area was discovered. The initial pair of nestwatchers continued monitoring until 22 May. During that period, the site was watched for 366 hours over 44 days, including 267 hours on 22 dawn-to-dusk days. Following the departure of the initial nestwatch team, the Luna BA was monitored from 27 May to 10 June by three additional nestwatchers.

Eagle activity
The breeding area was discovered on 11 March by J. Copeland of the Alpine Ranger District and T. Myers of the Apache-Sitgreaves National Forest. The nest (ponderosa pine tree nest #1) was built by great-blue herons and most recently occupied by ospreys in 1993. One eaglet hatched between 28 March and 1 April. It fledged between 18-27 June and was last observed soaring in the breeding area on 26 July. The adult male was observed at the lake in July and September 1994. This is the first confirmed successful bald eagle breeding attempt in the White Mountains of Arizona.

The male (in adult plumage) was discovered wearing a blue patagial marker on its left wing and a USFWS band on the left tarsus. After consulting on these marker types with the Bird Banding Lab in Laurel, Maryland, we concluded that this bird was from Texas or Missouri. AGFD biologists trapped the eagle on 7 May and read its USFWS band. They concluded that it had hatched in Southeast Texas, below Houston, in 1988 and was marked as a nestling. It was six years old in 1994. We placed a black VID band on the male's right tarsus. This bird is the first eagle breeding in Arizona known to have originated outside the state.

The female was also in adult plumage, but wore no band identification. We trapped the female while trying to capture the male. We then placed a black VID band on her right tarsus and a USFWS band on the left.

Human activity
Because of the small size of Luna Lake, the regularity with which eagles used the lake, and the constant levels of recreation, we employed a method of recording the types and levels of human activity that occurred at Luna Lake (similar to what we tried to accomplish at the Alamo BA in 1994). Separately, we recorded activities that caused eagles to respond significantly (restless, flush, and left area) and disregarded the "no response" and "watched" categories. We discovered that the most common activities and locations of people were: "cars in parking lot," "people on shore," and "boats on the lake." These three types of activities were tallied every 30 minutes from dawn to dusk on every weekend and every other Friday. An hourly average of each activity was calculated to describe how each type fluctuated throughout the day in April and May.

Table 19. Human activity and behavior by bald eagles, Luna Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Human Activity[1]						
	R	F	L	T	?	D-D total[2]	Total
Boater	0	1	1	0	0	1 (7.7%)	2 (9.1%)
Driver	0	1	1	0	0	2 (15.4%)	2 (9.1%)
Agency worker	0	1	0	0	0	0	1 (4.5%)
Researcher	0	1	2	2	0	2 (15.4%)	5 (22.7%)
Cattle	0	0	2	0	0	0	2 (9.1%)
Small plane	0	0	0	0	3	3 (23.1%)	3 (13.6%)
Horse-back rider	0	0	0	0	1	0	1 (4.5%)
Military jet	0	0	0	0	6	5 (38.5%)	6 (27.3%)
Total	0	4	6	2	10	13 (100%)	22 (100%)

[1]Eagle behavior: R=Restless, F=Flushed, L=Left Area, T=trapped, ?=Unknown.
[2]D-D total=Information collected on dawn-to-dusk observation days.

"People on the shore" was the most common activity recorded at Luna Lake. The maximum number recorded at one time was 24. On the average, during the month of April, people slowly accumulated until a peak of about seven people was reached at 12:00pm. Shoreline activity then slowly decreased until sundown. In May, shoreline activity reached a mean daily peak of nearly 13 people during the 10:00am hour. Activity then dropped to just below 8 people near 1:00pm, but climbed back to about 10 people at 4:00pm. Most of the shoreline activity were anglers on the southern shore near the boat ramp and the southeastern shoreline near the dam.

Eagles were not recorded responding significantly to shoreline recreationists, however eagles did avoid perches with a high presence of human activity. In the early morning and evening when shoreline activity was minimal, eagles did perch on short pine trees on the southern shore near the boat ramp. When activity increased and boats were launched or people fished the shore, eagles avoided these locations and perched in places free of human activity (north shore, etc.).

Vehicles were the second most common activity recorded. The pattern for the average amount of vehicles at Luna closely mirrored the pattern for shoreline activity. Vehicles reached their average peak (mean=6) near 11:00am in April. In May, vehicles showed up in highest numbers (mean=14) at

10:00am. Vehicles then left the area with a dip at 2:00pm, but an afternoon surge peaked at 4:00pm. The maximum number of vehicles recorded at one time was 19.

Boating represented the smallest numbers of the three types of activity recorded. Eleven boats on the lake were the most recorded at one time. Boating was relatively slow during the month of April as the highest average density was two boats at 9:00am and 10:00am. During May, the density of boats peaked at 9:00am, with an average of just over five. Similar to all recorded activity in May, boating dropped at 1:00pm, but climbed in the afternoon to a mean of three boats at 3:00pm.

Eagles were recorded responding significantly to only 10 activities throughout the breeding season (Table 19). Because of the relatively small lake (154 acres) and the abundance of activities that tend to surround it, we expected eagles to be disturbed more frequently at Luna Lake. Other than agencies or researchers causing eagles to flush or leave and area on four instances, only boaters (n=2), drivers (n=2), and cattle (n=2) caused eagles to respond significantly. Eagles were observed responding to our presence (when approaching the nest to band the eaglet) by circling and vocalizing when we approached within 1/8 mi of the nest area.

The closed campgrounds, signed fences and the "closed to all entry" wildlife area on the west side of the lake appeared to greatly contribute to successful management of the immediate nest area. However, the birds' ability to tolerate existing activities on their hunting grounds was also apparent. Eagles were frequently observed hunting and successfully foraging close to people on the shoreline or boats on the lake. The lack of human activity along the north shore and presence of perch trees allowed the eagles to remain inconspicuous and undisturbed while searching for food. Eagles were also observed using the closed wildlife area to hunt for food. This often involved perching on the ground, rocks, on short fences, or in shallow water among tall grasses.

We did not collect human activity information at Luna Lake and the birds' responses after campgrounds at the northeastern side of the lake began to be used regularly on Memorial Day weekend (27-30 May). These campgrounds were partially closed until May 9, and largely remained unoccupied until Memorial Day. Group site A, located about 1/4 mi from the eagle nest was closed until the eaglet fledged. The only entry was by official personnel informed of the eagles' presence. Replacement nestwatchers were on site from Memorial Day until monitoring was finished 14 days later.

When human activity increased on Memorial Day weekend, activities focused on educating the public instead of collecting eagle information. Fliers describing sensitive eagles issues and areas to avoid were posted on each campground bathroom, handed-out at each camp and given to campground hosts to distribute. Fliers instructed campers to seek out nestwatchers in the parking lot for more information and the chance to view the birds.

The public's response to the eagles was positive. On weekends, nestwatchers talked with 15-20 people per day about eagle ecology and the danger from discarded monofilament. Although some responses were described as neutral, most visitors expressed support and none were overtly negative. Some local residents even dropped by the parking lot regularly to check on the status of the eaglet. All in all, the

support for this endangered species appeared to be unusually positive by visitors and residents of Alpine.

Food habits

Eagles were observed foraging 93 times throughout the 1994 season (Table 20). The male performed 83 of the forage attempts and was successful on 36 occasions. The female was observed hunting on ten occasions. Nearly all forage attempts occurred at Luna Lake.

The male was the only member of the pair observed foraging for birds (n=49). It was successful 13 times. Different strategies for catching birds (mostly American coots) were used. A common tactic was to fly at a flock of coots, separate a bird from the group and repeatedly stoop upon it. The male also attempted to capture birds that tried to escape or hide in large patches of aquatic grasses/reeds near the southwest end of the lake. Kiting above the grasses and plunging into the shallow water or hopping among the grass patches to flush out or find a bird were observed.

The longer the male eagle spent trying to capture a particular bird, the greater the success (Table 21). Of 41 attempts for waterfowl on the lake surface, the male failed in all but 2 of 26 attempts when less than 10 minutes was spent trying to capture a bird. However, when the male spent greater than 11 minutes foraging for a bird, the success ratio increased to 10 out of 15 attempts. Thirty minutes was the longest time spent trying to capture a particular bird.

Forage attempts for fish (n=41) by the male and female were often by pirating from ospreys (n=18) or picking up carrion trout (n=21) (Table 24). Only two live fish were reported captured. Early in the nesting season, fish were rarely observed being captured by the eagles. However, with the increased food demand by the eaglet and fish stocking on 3 and 11 May, the eagles attempted to capture fish much more often. Eighty percent of all attempts for fish (n=33) were observed after 6 May. Eagles could be observed picking up small fish from the surface. More than likely, some stocked fish died after stocking and others became available after being captured, injured, and thrown back by anglers. At times the fish were delivered to the nest and on other instances they were eaten by the adult on the wing. Eagles were successful in pirating prey from ospreys on 5 out of 18 observed events.

A total of 42 prey deliveries were observed at the Luna nest. The male was responsible for 85.7 percent (n=36) of all deliveries. Prey brought to the nest were trout species (n=18), sucker (n=2), American coot (n=14), unknown birds (n=2), unknown mammals (n=3), and unknown items (n=3). The two suckers were left over bait placed on shore by AGFD personnel after capturing the adult birds (Tables 22 and 23).

Wildlife interactions

Eagles were involved interacting with ospreys, American crows, common ravens, red-tailed hawks, golden eagles, peregrine falcons, turkey vultures, Canada geese, black-crowned night herons, other bald eagles, and an unknown raptor. Ospreys were interacted with most frequently. Eagles often pursued ospreys after they captured food.

In a few instances, eagles were mobbed by ospreys and peregrine falcons. After the adult male was captured by AGFD biologists and released, it began to soar over the lake. Two peregrines flying high over the lake briefly pursued the soaring eagle. This incident is similar to what occurred at the Ladders BA in 1989 (Hunt et al. 1992), when a peregrine struck the adult male in the head, causing its death. This may reflect the falcon's awareness of an apparent injury or weakness in the eagle and an opportunity to remove a potential predator.

Table 20. Observed forage events and success by bald eagles, Luna Breeding Area 1994, Arizona.

Sex	Prey Types							
	Birds		Fish		Unknown		Total	
	E[1]	S-U	E	S-U-?[2]	E	S-U	E	S-U-?
Male	49	13-36	31	22-8-1	3	1-2	83	36-46-1
Female	0	0-0	10	5-5-0	0	0-0	10	5-5-0
Total	49	13-36	41	27-13-1	1	1-1	93	41-51-1

[1]E = Forage events observed; each number represents a forage event for an item not the number of strikes to capture it.
[2]S-U-? = Successful captures of prey - unsuccessful capture of prey - unknown outcome.

Table 21. Duration and outcome of observed forage attempts by bald eagles for birds on the surface of Luna Lake, Luna Breeding Area 1994, Arizona.

Outcome	Duration of Forage Attempt (in minutes)					
	1-5	6-10	11-15	16-20	21-25	26-30
Successful	1	1	5	2	0	3
Unsuccessful	18	6	3	0	1	1
# Attempts	19	7	8	2	1	4

Table 22. Observed prey types delivered to nest by bald eagles, Luna Breeding Area 1994, Arizona.

Sex	Prey Types				
	Fish	Birds	Mammals	Unknown	Total
Male	17	15	1	3	36 (85.7%)
Female	3	1	2	0	6 (14.3%)
Total	20 (47.6%)	16 (38.1%)	3 (7.1%)	3 (7.1%)	42 (100%)

Table 23. Observed prey species delivered to nest, Luna Breeding Area 1994, Arizona.

Sex	Prey Types[1]						
	Fish		Mammals	Birds		Unknown	Total
	TS	SU[2]	UNK	ACT	UB	UNK	
Male	17	0	1	13	2	3	36
Female	1	2	2	1	0	0	6
Total	18	2	3	14	2	3	42

[1]Prey types: TS=trout species, SU=sucker, UNK=unknown, ACT=American coot, UB=unknown bird.
[2]SU: Suckers were left over bait placed on shore by AGFD personnel.

Table 24. Disposition of observed fish captured and success of bald eagles on Luna Lake, Luna Breeding Area 1994, Arizona.

	Disposition of Prey

Sex								
	Pirate		Carrion		Alive		Total	
	E[1]	S-U-?[2]	E	S-U	E	S-U	E	S-U-?
Male	13	5-7-1	17	16-1	1	1-0	31	22-8-1
Female	5	0-5-0	4	4-0	1	1-0	10	5-5-0
Total	18	5-12-1	21	20-1	2	2-0	41	27-13-1

[1]E = Forage events observed.
[2]S-U-? = Successful captures of prey - unsuccessful capture of prey - unknown outcome.

Management activities

Signs defining a sensitive bald eagle area that is being monitored were placed along a barbed wire fence and gates just east of the nest area. This fence ran north to south separating the campground from the nest area.

The campgrounds at the northeast end of the lake were kept closed until early May by three locked gates. The camp site closest to the eagle nest, Group Site A, remained closed until the eaglet fledged.

Fliers describing how the public can help, the significance of the Luna Lake pair, and Luna Lake bald eagle facts were posted on all bathrooms, distributed to all campers, given to campground hosts for distribution, and provided to the Alpine Ranger District and AGFD Region II office to circulate just prior to Memorial Day weekend.

Both adult eagles were trapped and banded with black color VID bands. The male's USFWS band indicated the bird originated from Southeast Texas, below Houston. This is the first documented breeding eagle in Arizona that originated from outside the state.

A blood sample (0.8cc) was collected from the nestling for comparison against other samples from Arizona eagles collected from 1987-1989 (Hunt et al. 1992). The blood was sent to Montana State University for analysis by Dr. E. Vyse, who also examined samples from 1987-1989.

Region I personnel removed aquatic plants at the west end of the lake to prevent an imbalance in the water chemistry and massive fish die-offs.

KTVK Channel 3 shot portions of their bald eagle "Copperstate Chronicles" at the Luna BA. The show will be available to almost 700 schools statewide and aired statewide in October 1994.

Pinal Breeding Area

Observation period
The Pinal BA was observed opportunistically by the Sheep, Pinto, and Tonto nestwatchers on weekdays. Observations occurred on 13 days between 18 February and 24 May.

Eagle activity
Eagles laid eggs in cliff nest #3 prior to 1 February, but abandoned the breeding attempt by 24 February. A second clutch of eggs was laid in cliff nest #1 prior to 18 March. Two nestlings hatched prior to 15 April, but one of the eaglets died between 6 and 12 May. The remaining nestling fledged between 8 and 21 June. The site was checked again on 12 July, but no eagles were observed. This is the second known successful fledging from a second clutch of eggs.

The female was in adult plumage and wore a black VID band on the right tarsus, a USFWS band on the left tarsus, and a radiotelemetry backpack. The male was also in adult plumage and wore a USFWS band on the right leg.

Human activity
A total of 108 activities were recorded near the Pinal BA eagles, which were using cliff nest #1 (Table 25). Considering how infrequently the site was monitored, this represents a lot of casual recreation. Most of the activities recorded were vehicles stopping at the Hwy 288 Salt River bridge pull-out (n=77). Many of the people in these vehicles walked to the river, but few strayed far from their transportation. Vehicles crossing the bridge but not stopping were not recorded. Rafts floating down the Salt River were the second most frequent activity (n=20).

All terrestrial activities recorded were focused near the Hwy 288 bridge, but none caused eagles to significantly respond. Hiking up the Salt River, anglers, and rafters were the main activities in this area. Although a great deal of the activity occurred close to nest #1, most was out of the eagles' sight. Difficulty in hiking along the steep banks of the Salt River and the effort required to hike over steep hillsides to get near the eagle's nest prevent most recreationists from getting to a position from which they can disturb the birds. However, the sheer volume of visitors at the Hwy 288 Salt River bridge makes cliff nest #1 the Pinal BA nest most vulnerable to disturbance from casual human activity.

Food habits
Pinal eagles were observed unsuccessfully foraging once at the Diversion Dam along the Salt River above Roosevelt Lake. Eagles were observed on three of the four days we inspected the dam, indicating that this location continues to be used by the Pinal eagles (Hunt et al. 1992).

Seven prey deliveries were observed delivered to nest #1 (Table 26). Six items were delivered by the male and one by the female. All six identified items were fish; one was a carp.

Table 25. Human activity and behavior by bald eagles, Pinal Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Human Activity[1]						
	N	W	R	F	L	?	Total
Drivers	77	0	0	0	0	0	77 (71.2%)
Hiker	3	1	0	0	0	0	4 (3.7%)
Angler	1	0	0	0	0	0	1 (0.9%)
Agency personnel	0	0	0	2	0	0	2 (1.9%)
Rafts	20	0	0	0	0	0	20 (6.6%)
Small planes	2	0	0	0	0	0	3 (4.9%)
Helicopter	1	1	0	0	0	0	2 (3.3%)
Total	104	1	1	2	0	0	108 (100%)

[1]Eagle behavior: N=None, W=Watched, R=Restless, F=Flushed, L=Left Area, ?=Unknown.

Table 26. Observed prey species delivered to nest by bald eagles, Pinal Breeding Area 1994, Arizona.

Sex	Prey Types		
	Fish	Unknown	Total
Male	5	1	6
Female	1	0	1
Total	6	1	7

Wildlife interactions

Pinal eagles were frequently observed interacting with nearby (within 100 m) nesting peregrine falcons. The proximity of the nests caused the falcons to aggressively pursue the eagles when the eagles arrived or left the nest. The peregrines would also dive at eagles perched at the nest. The interactions varied from a brief dive lasting seconds to nearly a hundred dives lasting 40 minutes. It was estimated that the peregrines dove at eagles hundreds of times spanning several hours during the short time the site was monitored.

The falcons sometimes pursued the eagles until both species were out of view. The peregrines commonly made contact with the eagles by hitting a wing as the eagle rolled upside down in mid-air, showing its talons. While perched at or near the nest, eagles sometimes lunged at the stooping falcon, with their beak open.

At times, eagles were delayed from delivering prey to the nest by the falcons. Eagles were sometimes forced to the ground by a diving peregrine after arriving in the nest area with food. If the eagle tried to take-off with the food, the falcon would stoop on it, keeping it perched on the ground.

Pinto Breeding Area

Observation period
The Pinto BA was monitored from 11 February to 6 March. Because the Tonto BA had to be watched every day, Pinto nestwatchers split time between the two sites. They monitored the Tonto BA every other Monday through Thursday on the Tonto nestwatchers' days-off, and the Pinto BA every other Friday and weekends. Observations at Pinto totalled 112 hours over 13 days, including 103 hours on 9 dawn-to-dusk days.

Eagle activity
At least two eggs were laid in cottonwood tree nest #2 prior to 1 February. At least one nestling hatched on about 25 February. The nestling(s) died and the site failed between 12 and 18 March.

The adult-plumaged female had a black VID band on its left tarsus, a USFWS band on the right, and a telemetry backpack. We could not determine whether the adult-plumaged male was the same bird that occupied the site in 1993. The 1993 male had a USFWS band on its left tarsus.

Human activity
Twelve human activities were recorded within a 1 km radius of the Pinto nest tree (Table 27). Vehicles, ATVs, small planes and military jets caused a "watched" response on nine occasions.

Table 27. Human activity and behavior by bald eagles, Pinto Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Human Activity[1]							
	N	W	R	F	L	?	D-D total[2]	Total
Drivers	3	2	0	0	0	0	5 (41.7%)	5 (41.7%)
ATV	0	3	0	0	0	0	3 (25.0%)	3 (25.0%)
Small plane	0	3	0	0	0	0	3 (25.0%)	3 (25.0%)
Military jet	0	1	0	0	0	0	1 (8.3%)	1 (8.3%)
Total	3	9	0	0	0	0	12 (100%)	12 (100%)

[1]Eagle behavior: N=None, W=Watched, R=Restless, F=Flushed, L=Left Area, ?=Unknown.
[2]D-D total=Information collected on dawn-to-dusk observation days.

The Pinto nest tree is protected by dense thickets of tamarisk, although a road from School House Point ending at the shoreline passes within 500 m of the nest tree. Activity at nearby Campaign Bay was not

recorded because it is just outside the 1 km radius from the nest. Campaign Bay received use from hunters, ATVs, anglers, hikers and picnickers.

Food habits

No forage attempts were observed, but the eagles were observed returning from the direction of Roosevelt Lake on all four prey deliveries observed to the nest. Two unknown fish, one unknown rattlesnake species, and an unknown item were observed entering the nest (Table 28).

Table 28. Observed prey species delivered to nest by bald eagles, Pinto Breeding Area 1994, Arizona.

Sex	Prey Types			
	Fish	Rattlesnake	Unknown	Total
Male	1	0	1	2
Female	1	1	0	2
Total	2	1	1	4

Lake Pleasant Breeding Area

Observation period
The Lake Pleasant BA was observed from 8 February to 5 June. Early season monitoring was performed by only one observer. Beginning 1 April, the site was monitored by a pair of nestwatchers. Observation of eagle behavior and activities totaled 741 hours over 83 days. A total of 41 days were dawn-to-dusk days where eagles were observed for 463 hours.

Observations occurred mostly from land across the large bay from cliff nest #2. Nestwatchers were asked to spend a large portion of their time in a boat at the closure's buoy line at the south end contacting the public. As a result, eagle observations were often conducted by only one observer while the other team member was at the closure boundary. The split in nestwatch effort occurred mostly on Fridays, weekends and holidays when boating was heaviest.

Eagle activity
Incubation in cliff nest #2 was first observed on 31 January. The hatching of two eaglets occurred between 1 and 4 March. Both eaglets fledged successfully on 30 May.

The adult male that occupied the Pleasant BA in 1994 has occupied the site since 1991. This bird wore a blue VID band on its left tarsus and silver USFWS band on its right. The bands were placed on the bird as a nestling at the Horse Mesa BA in 1987 (Hunt et al. 1992). In 1994, the male was in its seventh year. The female was an unbanded bird in adult plumage.

Human activity
A total of 577 human activities were recorded at the Pleasant BA in 1994. Just over half (53 percent) of all activities recorded were watercraft that had traveled past nestwatchers at the southern end of the buoyed closure (Table 29). The types of watercraft represented were boats (fishing, speed, enforcement, sailboat) (n=276), canoes (n=2), and jet skis (n=26). Aircraft represented the second largest group (47 percent) recorded. Types of aircraft recorded were small planes (n=165), jets (n=74), helicopters (n=24) and ultralights (n=5). Additionally, 4731 watercraft were recorded at the southern buoy line (Table 29). Clearly, the increase in the lake's water storage (about 40 ft to its maximum at 1702 ft) and improved boating facilities in 1994 resulted in much higher pressure at the eagle closure compared to 1993 (Beatty and Driscoll 1994).

As expected, watercraft activity at Lake Pleasant was relatively light from February through March. Watercraft pressure continued to increase from April into June (Table 30). The peak of activity was the final week of monitoring, from 27 May to June 5, when 1056 watercraft were recorded at the southern buoy line. The lightest week at the buoy line was recorded during the initial week of monitoring, from 8-13 February. Throughout the season, only one boat entered from the Agua Fria arm at the closure's north end.

The Lake Pleasant public apparently did not learn to avoid the closure since boats consistently entered

the closed area throughout the season. During the last 5 work periods from April to June, 6.9 percent, 5.8 percent, 8.1 percent, 9.0 percent, and 5.0 percent of all recorded watercraft that approached the buoy line entered the closure respectively (Table 31).

Jet-skis were nearly absent in the breeding area from February to the end of April. However, when jet-skis were allowed access to the entire lake due to a change in the personal watercraft rule, observations quickly increased. The number of jet-skis recorded jumped from five in the middle of April to 104 by the end of May. Jet-skis were also more apt to enter the closure in comparison to boats. Over the last 3 work periods 18 percent, 13.6 percent, and 10.6 percent of all jet-skis observed entered the closure (Table 31).

The response to human activity was largely unknown (n=273, 48%) due to the nestwatchers attempting to decipher aircraft identification numbers or trying to contact boaters. However, when the bird's response could be determined the "none" (n=145) and "watched" (n=150) responses were most common.

On 11 occasions the eagles were observed responding significantly to human activity. Helicopters (n=3) and jet-skis (n=2) caused eagles to flush the most. Other causes were boaters (n=1), small planes (n=3), and researchers (n=2). One helicopter was observed flying within 150 ft of a perched eagle. Twice, jet-skis were observed riding within 150 and 75 ft of a newly fledged eaglet causing it to flush. Agency personnel identifying the breeding eagles and banding young caused eagles to be restless and circle the nest area.

Nestwatchers found the eagles perched at the west end of the nest cliff facing south toward the buoy line. The birds would sometimes perch high on the cliff and at other times on a small island close to the water's surface. Both of these perches had the closure's southern boundary in view. Nestwatchers discovered that although eagles were aware of the nearby boating activity, it did not seem to alter their normal behavior. However, when we disembarked in a boat twice during the season at the nest cliff's west end, eagles were quickly agitated and began to vocalize and circle the nest area. These two observations indicate that the closure's southern boundary is a sufficient distance from the nest area that heavy boating activity at buoy line will not affect the eagles adversely.

The high level of watercraft activity (n=4731) that occurred at the southern end of the closure throughout the season reinforces the need for continued monitoring, education, and enforcement at Lake Pleasant. Although compliance for the closure was nearly 92 percent, there still were 375 watercraft that were recorded entering the closure. With facilities continually improving and the close proximity of the lake to Phoenix, it would appear that the level of activity observed in 1994 will be repeated in future seasons. If the eagles are not monitored and/or the closure is lifted, it is then likely that any breeding attempt would be in jeopardy of failing.

Table 29. Human activity and behavior by bald eagles, Lake Pleasant Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Human Activity[1]								
	N	W	R	F	L	B	?	D-D total[2]	Total
Boater	84	87	0	1	0	0	104	154 (44.3%)	276 (47.8%)
Small plane	38	35	2	1	0	0	89	123 (35.4%)	165 (28.6%)
Military jet	7	13	0	0	0	0	54	40 (11.5%)	74 (12.8%)
Jet-ski	11	2	0	2	0	0	11	7 (2.0%)	26 (4.5%)
Helicopter	3	7	0	3	0	0	11	15 (4.3%)	24 (4.2%)
Ultralight	0	5	0	0	0	0	0	4 (1.1%)	5 (0.9%)
Driver	1	0	0	0	0	0	2	3 (0.9%)	3 (0.5%)
Canoe	1	1	0	0	0	0	0	1 (0.3%)	3 (0.5%)
Agency personnel	0	0	1	1	0	0	0	0	2 (0.3%)
Total	145	150	3	8	0	0	271	347 (100%)	577 (100%)

Table 30. Watercraft activity and behavior by bald eagles, Lake Pleasant Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Watercraft[1]								
	N	W	R	F	L	B	?	D-D total[2]	Total
Recreational	47	61	0	1	0	0	87	99 (64.2%)	196 (71.0%)
Sheriff/Ranger	23	22	0	0	0	0	15	46 (29.9%)	60 (21.7%)
Agency worker	13	4	0	0	0	0	2	8 (5.2%)	19 (6.9%)
Sailboat	1	0	0	0	0	0	0	1 (0.6%)	1 (0.4%)
Total	84	87	0	1	0	0	104	154 (100%)	276 (100%)

[1]Eagle behavior: N=None, W=Watched, R=Restless, F=Flushed, L=Left Area, B=eagle not in area, ?=Unknown.

[2]D-D total=Information collected on dawn-to-dusk observation days.

Table 31. Watercraft compliance at southern closure boundary, Lake Pleasant Breeding Area 1994, Arizona.

Date	Watercraft Activity at Southern Closure Boundary[1]				
	BAB	JAB	BIC	JIC	Total
February 8-13	19	2	13	2	36
February 18-27	290	0	34	0	324
March 4-13	175	0	42	0	217
March 18-25	72	0	8	0	80
April 1-10	473	0	35	0	508
April 15-24	743	5	46	0	794
April 29 - May 8	652	40	52	9	753
May 13-22	813	63	77	10	963
May 27 - June 5	906	93	46	11	1056
9 work periods	4143	203	353	32	4731

[1]Watercraft activity: BAB=boats at buoys, JAB=jet-skis at buoys, BIC=boats inside closure, JIC=jet-skis inside closure.

Food habits

A total of 36 forage attempts were observed at Pleasant BA in 1994 (Table 32). The male was successful in capturing 5 items in 18 tries. The female was successful in 4 of 8 attempts and resident eagles of unknown sex were successful in 4 of 10 forage attempts. With the exception of one capture of a snake by the resident female, all observed forages were for fish.

All observed forage attempts occurred from mid-April to the beginning of June in the immediate nest area. Five attempts occurred near the closure's southern buoy line within 60 yards of the closest boat. One successful capture occurred within 20 ft of a boat.

Early in the season, eagles were frequently observed flying north out-of-view. As the season progressed into April, eagles were discovered foraging near the nest area. Similar to other pairs of eagles nesting on reservoirs in Arizona (Hunt et al. 1992), the Pleasant eagles may be capturing more accessible fish along the Agua Fria River early in the year, then shifting with the increased fish availability on the lake as the

water temperature and fish activity increases.

Table 32. Observed forage events and success by bald eagles, Lake Pleasant Breeding Area 1994, Arizona.

Sex	Prey Types					
	Fish		Reptile		Total	
	E[1]	S-U-?[2]	E	S-U	E	S-U-?
Male	18	5-13-0	0	0	18	5-13-0
Female	7	3-3-1	1	1-0	8	4-3-1
Unknown[3]	10	4-3-3	0	0	10	4-3-3
Total	35	12-19-4	1	1-1	36	13-19-4

[1]E = Forage events observed; each number represents a forage event for an item not the number of strikes to capture it.
[2]S-U-? = Successful captures of prey - unsuccessful capture of prey - unknown outcome.
[3]Unknown = Undetermined sex of resident adult that captured a prey item.

Thirty prey deliveries to the nest were observed in 1994 (Table 33). The male delivered 20 items, the female 4, and resident eagles of undetermined sex delivered 6 items. Fish were identified arriving on 23 occasions, with bluegill/green sunfish (n=4), white bass (n=4), and largemouth bass (n=1) positively identified in the nest. Eagles also delivered a ringtail cat and an unknown snake species to the nest (Table 34). The great distance the nest is from the observation point made it difficult to observe prey deliveries and determine prey species.

Table 33. Observed prey types delivered to nest by bald eagles, Lake Pleasant Breeding Area 1994, Arizona.

Sex	Prey Types				
	Fish	Mammals	Reptiles	Unknown	Total
Male	17	1	0	2	20 (66.7%)
Female	4	0	0	0	4 (13.3%)
Unknown[1]	2	0	1	3	6 (20.0)

Total	23 (76.7%)	1 (3.3%)	1 (3.3%)	5 (16.7%)	30 (100%)

[1]Unknown: undetermined sex of resident adult that delivered a prey item.

Wildlife interactions

Lake Pleasant bald eagles were observed interacting with common ravens, turkey vultures, great-blue herons, red-tailed hawks, great horned owls, an unidentified gull, and unidentified raptors. They most frequently interacted with ravens nesting nearby. The single great horned owl interaction occurred on 24 March. Both eagles pursued the owl for five minutes after the bird flew over the eagle's nest.

Table 34. Observed prey species delivered to nest by bald eagles, Lake Pleasant Breeding Area 1994, Arizona.

Sex	Prey Types[1]							
	Fish				Mammals	Reptile	Unknown	Total
	SUN	LBS	WBS	FSH	RNGTL	SNK	UNK	
Male	4	1	3	9	1	0	2	20
Female	0	0	1	3	0	0	0	4
Unknown[2]	0	0	0	2	0	1	3	6
Total	4	1	4	14	1	1	5	30

[1]Prey types: SUN=sunfish, LBS=largemouth bass, WBS=white bass, FSH=unknown fish, RNGTL=ringtail cat, SNK=unknown snake, UNK=unknown item

[2]Unknown: undetermined sex of resident adult that delivered a prey item

Management activities

A boat provided earlier in the year by USFWS and later in the year by the Bureau of Reclamation (USBR) (with nestwatch funds) allowed nestwatchers to contact the large number of people approaching and trying to enter the closure.

Buoys were placed across the Agua Fria River north of the nest area and at the Agua Fria mouth to Lake Pleasant south of the nest by USBR and Maricopa County Parks in December and removed 15 June 1994. After observing many boats try to pass through the closure along the west bank at the southern end, a larger, more conspicuous buoy was placed in this area.

Maricopa County Parks included the eagle closure on a map and in the text in a double-sided, one sheet informational hand-out describing new facilities, warnings etc.

Video was shot to be incorporated into the television show "Copperstate Chronicles" by KTVK Channel 3. Besides being shown statewide, it will be distributed to schools throughout Arizona.

Redmond Breeding Area

Observation period
The Redmond BA was monitored for 42 days from 4 February to 1 April. A total of 399 hours were spent watching the nest, including 227 hours on 20 dawn-to-dusk days.

Eagle activity
One egg was laid in pinnacle nest #5 between 14 and 17 February and hatched on 26 March. Nestwatchers left for their days off on the evening of 27 March and returned to the site on 1 April to find the nest empty. The eaglet lived to be only 2-5 days old before dying.

Both adult plumaged eagles were new to the Redmond territory in 1994. We checked the BA in October 1993 and observed a banded eagle, but could not decipher any color or symbol. During the breeding season, we identified a blue VID band (symbol V) on the male, identifying its origin as Horse Mesa BA in 1987. The female had a silver USFWS band on its right tarsus.

Table 35. Human activity and behavior by bald eagles, Redmond Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Human Activity[1]							
	N	W	R	F	L	?	D-D total[2]	Total
Rafts	14	13	0	0	0	0	20 (58.8%)	27 (51.0%)
Military jet	2	4	0	0	0	0	4 (11.8%)	6 (11.3%)
Kayak / canoe	8	4	0	0	0	0	7 (20.6%)	12 (22.6%)
Helicopter	1	3	0	0	0	1	1 (2.9%)	5 (9.4%)
Sonic Boom	0	1	0	0	0	0	0	1 (1.9 %)
Small plane	0	1	0	0	0	0	1 (2.9%)	1 (1.9%)
Gunshot	1	0	0	0	0	0	1 (2.9%)	1 (1.9%)
Total	26	26	0	0	0	1	34 (100%)	53 (100%)

[1]Eagle behavior-N=None, W=Watched, R=Restless, F=Flushed, L=Left Area, ?=Unknown.
[2]D-D total=Information collected on dawn-to-dusk observation days.

Human activity
A total of 53 human activities were observed at the Redmond BA in 1994 (Table 35). Watercraft (n=39) and aircraft (n=12) comprised 96 percent of all observed activities. All eagle behavior was

recorded as either "none" or "watched." Watercraft activity (rafters, canoes/kayaks) increased dramatically during the last ten day work period in late March. Of all boating activity recorded, 87 percent occurred between 18 and 27 March. The onset of warmer weather and desirable boating conditions more than likely were the cause for the increase.

Food habits

Redmond eagles were observed foraging three times during the short time the site was monitored. One attempt was an unsuccessful try for a common merganser. The remaining two instances were eagles feeding on unidentified carrion. While incubating, the eagles brought food to the nest on 12 occasions. Prey types identified were birds (n=4), mammals (n=1) and unknown items (n=7). A rabbit and quail of undetermined species were specifically identified in the nest.

The breeding failures at the Redmond BA during the 1990s and the small amount of fish observed entering the nest may indicate that the eagles are having difficulty acquiring food during the crucial incubation and early nestling phase when an eagle's foraging time is limited by its duties at the nest. It is curious that since the new diversion dam above Roosevelt Lake was constructed in 1989, Redmond eagles have only fledged one bird. From 1990-1994, eagles laid eggs in just 3 out of 5 breeding seasons. From 1975-1989, eagles only failed to lay eggs in one season and produced 16 young. The effectiveness of the new diversion dam combined with an overabundance of large predatory flathead catfish (K. Young pers. comm) may be limiting the diversity in species and size class available to eagles.

Wildlife interactions

Redmond bald eagles were observed interacting with other bald eagles, red-tailed hawks, golden eagles, and turkey vultures. On 5 March, a four year old bald eagle with a band of unknown color (left tarsus) and a USFWS band (right tarsus) flew through the breeding area, perched and then was pursued by the resident female.

76 Breeding Area

Observation period
Observation of the 76 BA began on 5 February and continued until 22 March. Observations for this time period totaled 34 days with 17 being from dawn-to-dusk. A total of 253 hours of monitoring occurred with 190 hours happening on dawn-to-dusk days. Observations continued by a different team of nestwatchers from 3 April until 22 May. Information presented is only for the time spent observing by the first team.

Eagle activity
Incubation began in cottonwood nest tree #2 on 4 February 1994. Hatching of two eaglets occurred on 12 March. Both eaglets fledged successfully between 23 May and 6 June.

The male was in adult plumage and had a USFWS band on its left tarsus. This bird has occupied the territory since 1988. The female was also in adult plumage but was unbanded.

Human activity
Little human activity was observed at the 76 BA in 1994. Nine activities were recorded: driver (n=1), small planes (n=5), gunshot (n=1), rancher (n=1), and a horse-back rider (n=1) (Table 36.).

Deteriorating road conditions approaching the closure's southern boundary and the closure gate greatly limits human activities in the breeding area. The only significant response recorded was the male eagle which left a perch in response to a 76 ranch hand working on a fence 1.5 km downriver from the nest.

Nestwatchers encountered some difficulty leaving through the closure's southern gate on 27 February. The gate was rammed by a vehicle, twisting the gate's locked pin and leaving the nestwatchers unable to exit. Through the USFS radio, an AGFD Wildlife Manager dispatched to the site was able to remove the pin and unlock the gate.

Food habits
Six forage attempts were observed within 1 km upriver of the nest. Five of the attempts occurred on the bank of the river for a mammal (n=1) and unknown items (n=4) (Table 37). Three prey deliveries were observed entering the nest, one fish and two unknown items.

Wildlife interactions
The 76 eagles were observed interacting with other bald eagles, red-tailed hawks, common ravens, American kestrels, Cooper's hawks, and an unknown raptor.

Management activities
The closure gate was locked on December 1.

Table 36. Human activity and behavior by bald eagles, 76 Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Human Activity[1]					
	N	W	L	?	D-D total[2]	Total
Driver	0	0	0	1	0	1 (11.1%)
Small plane	3	1	0	1	4 (66.7%)	5 (55.6%)
Gunshot	1	0	0	0	1 (16.7%)	1 (11.1%)
Rancher	0	0	1	0	0	1 (11.1%)
Horse-back rider	1	0	0	0	1 (16.7%)	1 (11.1%)
Total	5	1	1	2	6 (100%)	9 (100%)

[1]Eagle behavior-N=None, W=Watched, L=Left Area, ?=Unknown.
[2]D-D total=Information collected on dawn-to-dusk observation days.

Table 37. Observed forage events and success by bald eagles, 76 Breeding Area 1994, Arizona.

Sex	Prey Types							
	Fish		Mammals		Unknown		Total	
	E[1]	S-U	E	S-U	E	S-U-?[2]	E	S-U-?
Male	0	0-0	0	0-0	3	0-2-1	3	0-2-1
Female	1	1-0	1	1-0	0	0-0-0	2	2-0-0
Unknown[3]	0	0-0	0	0-0	1	0-0-1	1	0-0-1
Total	1	1-0	1	1-0	1	0-2-2	6	2-2-2

[1]E = Forage events observed; each number represents a forage event for an item not the number of strikes to capture it.
[2]S-U-? = Successful captures of prey - unsuccessful capture of prey - unknown outcome.
[3]Unknown = Undetermined sex of resident adult that captured a prey item.

Sheep Breeding Area

Observation period
The Sheep BA was monitored for 184 hours over 18 days from 11 March to 15 April. Eleven days and 147 hours were spent monitoring on dawn-to-dusk days. Because of the need to monitor the Tonto BA every single day, nestwatchers split their observations between the Sheep BA and the Tonto BA.

Eagle activity
Eagles laid eggs at the Sheep BA for the first time since 1988. Eggs were laid in nest #1 prior to 3 March. A three-year old male occupied the territory with a six-year old female. The eagles sat on the eggs until sometime between 13 and 15 April when they abandoned the breeding attempt. The birds spent a minimum of 41 days incubating. Of the 184 hours that the birds were observed incubating the female spent 60 percent (n=6581 minutes) of the time on the eggs. The male spent 39 percent (n=4296 minutes) of the time incubating. The nest was unattended for 163 minutes (1 percent). Just over half of the observed unattended time was recorded during the last three days of incubation prior to abandonment. The partitioning of incubation duties for the Sheep pair in 1994 are similar to other studies of incubating bald eagles (Stalmaster 1987).

The female was in its sixth year and spent its third year occupying the Sheep BA. It is identified by a green VID band on the left leg, a USFWS band on the right leg and a telemetry backpack placed on as a nestling (Hunt et al. 1992). This bird hatched from the 76 BA in 1988. Although the female is in its sixth year, remnants of its subadult plumage remain in the head and tail.

The male was three-years old and wore a USFWS band on the right tarsus. It replaced an unbanded adult plumaged bird which occupied the territory for the past two seasons. This is the first documented instance of a three-year old breeding in Arizona. The male's beak was tan, with a dark band near the tip. It had a white triangle in the middle of its back. The outer tail feathers were white and the middle tail feathers were a dirty gray. A dark terminal band existed as the end of the tail. The bird had a dark mask around the eyes and back of its head. The dark streaking trailed down the back of its head and cheeks the length the neck to join the body. A dark collar existed on the birds chest which blended into a tawny chest and mottled brown and white belly. These characteristics are very similar to the White Belly II plumage described in Clark (1987).

Human activity
A small amount of human activity was recorded at Sheep in 1994, however the types of activity recorded and the easy access to the nest makes any future nesting attempt vulnerable to deleterious disturbances. Activities recorded were drivers (n=3), campers (n=2), agency personnel (n=1), helicopters (n=2), and small planes (n=11) (Table 38).

The proximity of the Sheep BA to Hwy 188 and local human activity creates potential dilemmas for the success of the site. Highway 188 travels within 1/2 mi of the lone nest tree in the breeding area. A dirt road (USFS Road 270) leads from the highway and ends at a high bank approximately 75 ft above the flood plain (the main observation point). From the presence of six fire rings along the road, shotgun

shells, litter, and bullet riddled appliances, the area is regularly used for nighttime recreation, overnight camping and target practice. The unobstructed access to the nest tree leaves it equally approachable by the curious as the ignorant. Additional roads in the flood plain near the nest area are accessible by ATV, four-wheel drive vehicle, and horseback.

Table 38. Human activity and behavior by bald eagles, Sheep Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Human Activity[1]							
	N	W	R	F	L	?	D-D total[2]	Total
Driver	2	1	0	0	0	0	3 (20.0%)	3 (15.8%)
Camper	2	0	0	0	0	0	0	2 (10.5%)
Agency personnel	0	0	0	1	0	0	0	1 (5.3%)
Helicopter	0	0	1	1	0	0	1 (6.7%)	2 (10.5%)
Small plane	3	7	0	0	0	1	11 (73.3%)	11 (57.9%)
Total	7	8	1	2	0	1	15 (100%)	19 (100%)

[1]Eagle behavior-N=None, W=Watched, R=Restless, F=Flushed, L=Left Area, ?=Unknown.
[2]D-D Total=Information collected on dawn-to-dusk observation days.

Food habits
A mammal pirated from a Cooper's hawk by the adult female was the only forage attempt observed.

Wildlife interactions
Sheep bald eagles were observed interacting with other bald eagles, common ravens, a European starling, and a woodpecker species.

The Sheep eagles did seem to respond to other species in the nest area with a bit of "nervousness." This appeared to be attributed to the bird's breeding inexperience. Incubating eagles would whip their heads about and watch intensely in response to great blue herons and common ravens in the area.

Yet, there were instances that would normally cause eagles to respond aggressively which elicited little behavior by the eagles. On 12 March a subadult bald eagle entered the breeding area and spent 25 minutes perched within 15 m of both the Sheep birds without a response. Additionally, a peregrine falcon perched in the nest tree while the eagles were incubating without an eagle response.

Management activities

USBR purchased land planned for a gravel operation near the Sheep nest area.

The Tonto Creek Riparian Unit (TCRU) project by USFS and USBR began its fencing and grazing restrictions and plant monitoring in 1994.

Tonto Breeding Area

Observation period
Observation at the Tonto BA began on 25 February and continued until 22 May. From early February to fledging, the site was monitored every day. Nestwatchers monitoring the Pinto and Sheep BAs watched the site on the Tonto nestwatchers days off. A total of 868 hours over 108 days were spent watching the site. Over 37 dawn-to-dusk days, 466 hours were spent monitoring.

Eagle activity
Incubation began in cottonwood nest tree #2 just prior to 1 February. Two eaglets hatched on 28 February. On 17 April, one eaglet fell from the nest and was rushed to Liberty Wildlife Rehabilitation Center. The bird broke its vertebrae in the fall. The eaglet died on 22 April from toxemia due to paralysis of its excretory system caused by the broken vertebrae (M. Mosby pers. comm). The remaining eaglet fledged successfully on 18 May.

The adult female wore a blue VID band on the left leg and a USFWS band on the right. It hatched from the Horseshoe BA in 1987 (Hunt et al. 1992). The bird was in its seventh year and has occupied the breeding area since the territory was initiated in 1992. The adult male also wore a blue VID band on its left tarsus and a USFWS band on the right leg. The male hatched from the Pinal BA in 1987 (Hunt et al. 1992) and entered the Tonto BA in 1993.

Human activity
A total of 255 human activities were recorded at the Tonto BA in 1994 (Table 39). The majority (n=169, 66.3%) of these incidents were vehicles driving along USFS road 661 traveling from A+ Road to Indian Point campground. The remaining 86 activities came from 11 different types of activities. Eagles responded significantly to the following types of activities: small planes, gunshots,agency personnel, anglers and tubers.

Vehicles were the largest group represented in the 1994 data set. However, vehicles were conspicuously absent from the information recorded in 1993 (Beatty and Driscoll 1994). Although high water restricted fording A+ Road and Tonto Creek in early 1993, activity along the road traveling to Indian Point Campground was present and increased toward the end of the nesting cycle. It is likely that collection of vehicle information was neglected in 1993. Vehicles did not cause the eagles to respond in 1994.

Gunshots from hunters and recreationists disturbed the eagles on three occasions. After approaching within 200 m of the nest on 26 January, two hunters discharged 4 shots causing an eagle to flush from its perch and not return for two hours. Later on 21 February, three individuals hiked below the nest and discharged a rifle. The incubating eagle flushed from the nest to a perch in the nest tree. An old corral about 1 km northwest of nest #2 was used for target practice on 24 April, and 7 and 19 May. These shooting events lasted two to three hours and in one case the individuals were intoxicated. Shots were fired in the direction of the nest tree and caused the eagles to quickly snap their heads around to the direction of the noise.

Table 39. Human activity and behavior by bald eagles, Tonto Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Human Activity[1]								
	N	W	R	F	L	B	?	D-D total[2]	Total
Driver	169	0	0	0	0	0	0	113 (67.6%)	169 (66.3%)
Small plane	23	1	0	1	0	0	14	27 (16.2%)	39 (15.1%)
Helicopter	4	0	0	0	0	0	7	3 (1.8%)	11 (4.3%)
Gunshot	3	3	1	1	1	0	1	5 (3.0%)	10 (4.0%)
Dogs	5	3	0	0	0	0	0	5 (3.0%)	8 (3.1%)
ATV	0	5	0	0	0	0	0	4 (2.4%)	5 (2.0%)
Hiker	3	0	0	0	0	0	0	2 (1.2%)	3 (1.2%)
Agency personnel	0	0	0	2	0	0	0	1 (0.6%)	2 (0.8%)
Road grater	0	0	0	0	0	0	2	2 (1.2%)	2 (0.8%)
Horseback rider	0	3	0	0	0	0	0	3 (1.8%)	3 (1.2%)
Military jet	1	0	0	0	0	0	0	1 (0.6%)	1 (0.4%)
Angler	0	0	0	1	0	0	0	1 (0.6%)	1 (0.4%)
Tuber	0	0	0	1	0	0	0	0	1 (0.4%)
Total	208	15	1	6	1	0	24	167 (100%)	255 (100%)

[1]Eagle behavior-N=None, W=Watched, R=Restless, F=Flushed, L=Left Area, B=Bird not in area ?=Unknown.

[2]D-D total=Information collected on dawn-to-dusk observation days.

Food habits

Two forage attempts were observed approximately 150 m southwest from nest #2 in the cottonwood\willow\tamarisk forest at river kilometer 16.1. The adult female was observed retrieving carrion stashed in a crook of a tree. The female was also observed retrieving a dead fish from a tree and delivering it to the nest. All observed prey deliveries where the direction of the forage could be determined were from Roosevelt Lake. However, river fish such as suckers and carp were identified entering the nest.

A total of 55 prey deliveries were documented arriving to the nest (Table 40). The male arrived with 35 (65.7%) of all observed deliveries, the female 16 (29.0%), and a resident adult of undetermined sex brought 4 items (7.3%) to the nest. Prey species and types identified in the nest were black crappie (n=1), suckers (n=5), channel catfish (n=2), carp (n=7), largemouth bass (n=2), unknown fish (n=20), European starling (n=1), American coot (n=1), unknown birds (n=2), unknown snake species (n=1), unknown carrion (n=2),and unknowns (n=11) (Table 41).

Table 40. Observed prey types delivered to nest by bald eagles, Tonto Breeding Area 1994, Arizona.

Sex	Prey Types				
	Fish	Birds	Reptiles	Unknown	Total
Male	24	2	1	8	35 (63.7%)
Female	9	2	0	5	16 (29.0%)
Unknown[1]	4	0	0	0	4 (7.3%)
Total	37 (67.3%)	4 (7.3%)	1 (1.8%)	13 (23.6%)	55 (100%)

Table 41. Observed prey species delivered to nest by bald eagles, Tonto Breeding Area 1994, Arizona.

Prey types[1]											
Fish						Birds			Reptile	Unknown	Total
CPI	SKR	CHC	CRP	LBS	FSH	ES	AC	UB	SNK	UNK	
1	5	2	7	2	20	1	1	2	1	13	55

[1]Prey types: CPI=black crappie, SKR=sucker sp., CHC=channel catfish, CRP=carp, LBS= largemouth bass FSH=unknown fish, ES=European starling, AC=American coot, UB=unknown bird SNK=unknown snake, UNK=unknown item.

[2]Unknown: undetermined sex of resident adult that delivered a prey item.

Management activities

The schedule of the nestwatchers watching the Pinto and Sheep breeding areas was staggered so that they would monitor the Tonto BA on the Tonto nestwatchers' days-off.

On 25 February an electric fence was constructed just east of the nest area to restrict cattle use. This is part of the TCRU management to enhance riparian vegetation along Tonto Creek.

A field trip by USFS, USFWS, BR, and AGFD occurred just prior to the 1994 breeding season to discuss potential closure boundaries, management practices and other issue concerning recreation and the eagles.

1.USFS proposed an enlargement of the camping area and asked USFWS if it would need to re-initiate consultation. USFWS believed it would be necessary.

2.We discussed the potential for having a public viewing station at Cline Terrace Archaeological Site, but nest #2 was not visible from the ruins.

3.ATVs should be restricted from traveling from A+ Road downriver toward the nest area and Roosevelt Lake. This is consistent with the USFS ATV management plan. Posting signs along A+ Road was discussed.

Tower Breeding Area

Observation period
The Tower site was monitored from 4 February to 18 April. A total of 440 hours over 53 days were spent watching the site. There were 25 dawn-to-dusk days that totaled 285 hours of observation. Volunteers from the Audubon Society monitored the site on 13 and 27 March during the nestwatchers' days-off.

Eagle activity
Renovation of nest #1 was observed in October 1993 by an employee of the Verde River Train. We inspected the nest area and indeed found new nest material and bark lining. Incubation of two eggs in nest #1 began between 13 and 17 February. The eagles continued to sit on the eggs long past the 35 day incubation period. On 18 April, 64-69 days into incubation, we collected the addled eggs. Contents of the eggs were removed by the USFWS for the investigation of contaminants.

The female was an unbanded adult plumaged eagle. The male was in its fifth year and wore a purple VID band on its left leg and a silver USFWS band on the right. The symbol on the color VID band (an 8 inside a diamond) identified this eagle as fledging from the Ladders BA in 1989 (Hunt et al. 1992). The five-year old male still possessed a faint eye-stripe from its subadult plumage.

Human activity
Following the discovery of activity at nest #1, USFS, USFWS, and AGFD installed a closure. Recreational activity (hiking, fishing, camping etc.) is focused near the nest area and a commonly used two-track Forest Service road travels within 100 ft of the edge of the cliff above the nest. On 4 March, the east side of the river surrounding nest #1 (~300 acres) was officially closed to all entry.

A total of 525 human activities in 21 different categories were recorded at the Tower BA in 1994 (Table 42). This was the first extensive monitoring of the Tower BA since the site was discovered active in 1993. Small planes (n=209), drivers (n=126), and the Verde River Train (n=95) represented 82 percent of all activities recorded. The eagles activities were disrupted on 13 occasions from the following types of activities: small planes (n=3), drivers (n=1), trains (n=2), helicopters (n=1), agency workers (n=3), cattle/ranchers (n=1), picnickers (n=1), and photographers (n=1).

The rapid nature of installing the closure resulted in few signs and no barriers for the closure's boundaries. Thus, nestwatchers were stationed at the entrance to the road which traveled above the nest on weekends. We believed that activity along this road would be the source of the most disruptive activities because of it close proximity to the nest.

Table 42. Human activity and behavior by bald eagles, Tower Breeding Area 1994, Arizona.

Type	Eagle Behavior Toward Human Activity[1]								
	N	W	R	F	L	B	?	D-D total[2]	Total
Small plane	119	55	1	0	2	23	9	135 (38.8%)	209 (39.8%)
Driver	82	22	0	1	0	14	7	97 (27.9%)	126(24.0%)
Train	16	59	0	0	2	12	6	61 (17.5%)	95 (18.1%)
4x4-vehicle	10	17	0	0	0	2	1	10 (2.9%)	30 (5.7%)
Hiker	11	0	0	0	0	2	1	9 (2.6%)	14 (2.7%)
Horseback rider	5	3	0	0	0	2	1	9 (2.6%)	11 (2.1%)
Helicopter	2	3	1	0	0	1	0	4 (1.1%)	7 (1.3%)
Agency personnel	3	1	0	0	0	1	1	2 (0.6%)	6 (1.1%)
Canoe / kayak	1	1	0	0	0	3	0	4 (1.1%)	5 (1.0%)
Researcher	0	0	0	2	1	1	0	2 (0.6%)	4 (0.8%)
Cattle (rancher)	0	1	1	0	0	1	0	2 (0.6%)	3 (0.6%)
Picnicker	0	1	0	1	0	0	0	2 (0.6%)	2 (0.4%)
Construction	0	1	0	0	0	0	1	2 (0.6%)	2 (0.4%)
Dogs	0	2	0	0	0	0	0	2 (0.6%)	2 (0.4%)
Campers	2	0	0	0	0	0	0	2 (0.6%)	2 (0.4%)
Hunter	1	0	0	0	0	0	1	0	2 (0.4%)
Photographer	0	0	0	0	1	0	0	1 (0.3%)	1 (0.2%)
Swimmer	0	1	0	0	0	0	0	1 (0.3%)	1 (0.2%)
Angler	1	0	0	0	0	0	0	1 (0.3%)	1 (0.2%)
Birder	1	0	0	0	0	0	0	1 (0.3%)	1 (0.2%)
Rancher	1	0	0	0	0	0	0	1 (0.3%)	1 (0.2%)
Total	255	167	3	4	6	62	28	348 (100%)	525 (100%)

[1]Eagle behavior-N=None, W=Watched, R=Restless, F=Flushed, L=Left Area, B=Bird not in area

?=Unknown.
[2]D-D total=Information collected on dawn-to-dusk observation days.

We contacted 21 groups of people totaling more than 60 individuals at the closure's boundary. These groups were either about to enter the closed area or recreate along the river. Only four responses from visitors were classified as negative (one person was counted twice as he returned a week later). The remaining people responded positively (n=6) or in a neutral fashion (n=11). Almost all (n=19) groups of people were contacted on weekends.

The wide variety of activity types (n=21), natural curiosity of recreationists and overall ignorance of eagle behavior makes all breeding attempts at the Tower BA (especially at nest #1) vulnerable to failures from human activity. The presence of photographers above the nest and the disregard of signs exemplifies the potential for disturbances leading to failure. Although the train and maintenance vehicles were present throughout the observation period, they caused little response from the eagles. Pointing out the nesting eagles from the train without identifying the closure, the penalties involved and/or the potential harm to the eagles may draw people to return to the area and disrupt the eagles.

Food habits

Four forage attempts (one successful) were observed by the adult male eagle at Tower in 1994 (Table 43). The bird was successful in capturing a fish in two attempts, but was unsuccessful in forages for a mallard duck and an unknown mammal. The female was not observed foraging, but was seen once eating a fish on shore. All observed attempts were in the immediate nest area. Audubon volunteers reported seeing eagles hunting at nearby Peck's Lake, but no eagle observations were gathered on subsequent visits to the lake. Because eagles were observed flying both upriver and downriver of the nest, it can be assumed that prey is acquired at various locations throughout its territory. However, the failure of the eggs to hatch severely limited our chances to explore the bird's foraging habits.

Table 43. Observed forage events and success by bald eagles, Tower Breeding Area 1994, Arizona.

Sex	Prey Types							
	Fish		Mammals		Birds		Total	
	E[1]	S-U	E	S-U	E	S-U	E	S-U
Male	2	1-1	1	0-1	1	0-1	4	1-3
Female	0	0-0	0	0-0	0	0-0	0	0-0

Total	2	1-1	1	0-1	1	0-1	4	1-3

[1]E = Forage events observed; each number represents a forage event for an item not the number of strikes to capture it.
[2]S-U = Successful captures of prey - unsuccessful capture of prey - unknown outcome.

Wildlife interactions
The Tower bald eagles were observed interacting with other bald eagles, red-tailed hawks, common ravens and a golden eagle. A total of 28 non-resident bald eagle were observed in the Tower nest area. Sightings peaked (22 eagles observed) during the month of February and consistently dropped over the following months until observations terminated in April. The last non-resident eagle was observed on 6 April. A minimum of eight individual wintering bald eagles were identified among the 28 sightings: 5 juveniles, 1 near-adult, and 2 adults. The Tower birds interacted with these intruder eagles on 11 occasions. On three instances the Tower eagles made aggressive contact.

Management activities
A USFS closure (Coconino National Forest) was installed encompassing the east side of the river, nest #1, and the road above the nest.

Signs were erected at the entrance to the two-track USFS road which travels above the nest.

A joint press-release between the USFS and AGFD was announced regarding the Tower closure.

Channel 12 news produced a segment on the Tower closure with representatives from the Coconino National Forest, AGFD Region II and the nestwatchers present.

Summary of Bald Eagle Productivity in 1994

The 1994 bald eagle breeding season was unique, in that at least one egg was laid in every occupied BA (see Tables 44, 45). Of the 33 BAs known, 27 were occupied by eagles and 17 were monitored by nestwatchers. The 13 successful BAs fledged 18 young. The earliest incubation date recorded was January 5; the latest fledging was during the week of June 18-27.

Table 44. 1994 Arizona bald eagle productivity.

Breeding Area	Status [1]	Nest #[2]	Inc Date	# Eggs	Hatch Date	# Young	# Fledged	Fledge Date
Alamo*	S	4	1/24	1+	3/1	1	1	>5/9
Ash	U							
Bartlett*	S	1	1/29	1+	3/8-10	1	1	5/31
Blue Point	S	7	<2/1	3	<3/18	2	2	5/13 & 5/14-27
Camp Verde*	U							
Canyon	F	6	<3/18	1+	<4/15	1+	Failed prior to 5/13	
Cedar Basin	F	3	<4/15	2	Failed prior to 5/13			
Chino	U							
Cibecue*	S	3	<2/25	1+	3/18-4/11	1	1	5/23-28
Cliff*	F	4	2/6	2+	~3/13	1	Nestling died 3/24 or 25	
Coolidge	F	2	<2/1	3	Nest found abandoned, failed prior to 3/18; unknown if young hatched			
Devil's Post	U							
East Verde	F	6	1/5-31	2+	<3/17	1+	Nest failed between 3/17-31	
Ft. McDowell*	F	12	2/8	1	Incubated infertile "runt" egg past hatch date, abandoned 4/6			
Horse Mesa	F	2	<2/1	1+	Nest abandoned prior to 2/11 , 2 adults flying together on 4/11			
Horseshoe	F	10	<3/17	1	Nest failed between 3/17-3/30			
Ive's Wash*	S	3	<1/10	1+	2/4-10	1	1	4/21-24
Ladders*	S	3	2/18	2+	~3/25	2	2	6/3-6 & 6/10-18

Table 44. 1994 Arizona bald eagle productivity.

Breeding Area	Status [1]	Nest #[2]	Inc Date	# Eggs	Hatch Date	# Young	# Fledged	Fledge Date
Lone Pine	F	1	<4/15	1+	Failed prior to 5/13			
Luna*	S	1	<3/11	2+	3/28-31	1+	1	6/18-27
Mule Hoof	U							
Orme*	S	1	1/31-2/1	2+	~3/7	2	2	5/20-27
Perkinsville	U							
Pinal 2nd clutch*	S	1	<3/18	2+	<4/15	2	1	1 young died 5/6-12
Pinal	F	3	<2/1	2	Nest abandoned prior to 2/24			
Pinto*	F	3	<2/1	2+	~2/25	1+	Nestling(s) died 3/12-18	
Pleasant*	S	2	<1/31	2+	3/1-4	2	2	5/30
Redmond	F	5	2/14-17	1	~3/26	1	Nestling died 3/28-4/1	
76*	S	2	2/4	2+	3/12	2	2	5/23-6/6
Sheep*	F	1	<3/3	2+	Incubated past hatch date, abandoned 4/14			
Table Mountain	S	4	<3/13	1+	<4/14	1	1	<6/8
Talkalai	F	5	<3/2	2+	~3/2	2	4 wk old nestling dead in nest on 4/11; nestlings killed by new bird in pair	
Tonto*	S	2	<2/1	2+	~2/28	2	1	5/18-20, 1 bird fell 4/16, died 4/23
Tower*	F	1	2/14-17	2	Incubated past hatch date, collected infertile eggs 4/18			

[1]Breeding area status codes (Postupalsky 1974): U=unoccupied, O=occupied, A=active (eggs or young present), S=successful, F=failed, ?=unknown.

[2]Nest numbers are from Hunt et al. (1992).

*= Sites monitored by 1994 Arizona Bald Eagle Nestwatch Program.

Table 45. 1994 Arizona bald eagle productivity summary.			
Number of Breeding Areas	33	Number of Active Nests	27
Number of Occupied Breeding Areas	27	Number of Failed Nests	15[1]
Number of Eggs	47+	Number of Successful Nests	13
Nest Success = 13 / 27 = 0.48		Number of Young Hatched	27+
Mean Brood Size = 18 / 13 = 1.385		Number of Young Fledged	18
		Productivity = 0.48 x 1.385 = 0.66	

[1]Pinal eagles laid two clutches of eggs - second clutch successful.

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