ARIZONA BALD EAGLE NESTWATCH PROGRAM: 1998 SUMMARY REPORT

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Technical Report 139
Nongame and Endangered Wildlife Program
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April 1999

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RECOMMENDED CITATION

Beatty, G.L., J.T. Driscoll, and J.G. Koloszar. 1999. Arizona Bald Eagle Nestwatch Program: 1998 summary report. Nongame and Endangered Wildlife Program Technical Report Number 139. Arizona Game and Fish Department, Phoenix, Arizona.

ACKNOWLEDGMENTS

We used field reports by the following nestwatchers to generate this report: Sarah Billig and Tom Wolfe, Bartlett Breeding Area; Chris Buelow, Jenna Garvey, Carey Hill, Laurie Houchins, and Michael VanAntwerp, Box Bar Breeding Area; Devin Biggs and Wyatt Nimitz, Fort McDowell Breeding Area; Wendy Peacock and David Tidhar, Horseshoe and Luna Breeding Area; Jennifer Jones and Devlin Madrone, Ladders Breeding Area; Robert Chapman and David Hood, Pleasant Breeding Area; Beth Cable and Troy Rintz, 76 Breeding Area; Scott Brownwood and Gary Cress, Sycamore Creek Breeding Area; Nicole Molitor and Carol Strojny, Tonto Breeding Area; and Jason Beason and Kerry Noonan, Tower Breeding Area.

We acknowledge and appreciate the assistance of the following people: Carvel Bass, Army Corps of Engineers; Amy Heuslein, Bureau of Indian Affairs; Bob Hall, Bureau of Land Management; Henry Messing, Bureau of Reclamation; Marilyn Ethelbah, Clinton Pattea, and Darrel Russell, Fort McDowell Indian Community; Gary Hyduke and Tom Valencia, Maricopa County Parks; Ron Chiago and Ivan Makil, Salt River Pima Indian Community; John Keane, Salt River Project; Amanda Moors and Paul Nosie, Jr., San Carlos Apache Game and Fish Department; Tom Gatz and Mary Richardson, U.S. Fish and Wildlife Service; Janey Agyagos, Jerry Bradley, Jim Copeland, Patti Fenner, Terry Myers, Mike Ross, Bob Shields, and Albert Sillas, U.S. Forest Service; Joe Jojola and Cynthia Westfall, White Mountain Apache Game and Fish Department; Rich Glinski, Dan Groebner, Mike Ingraldi, Terry Johnson, Susi MacVean, Amy Mazurcyk, and Shelly Shepherd, Arizona Game and Fish Department.

PROJECT FUNDING

Funding for this project was provided by: the Arizona Game and Fish Department's Heritage Fund; Arizona's Nongame Wildlife Checkoff; Army Corps of Engineers, Luke Air Force Base, Salt River Project; U.S. Bureau of Reclamation #7-FC-32-0090; U.S. Fish and Wildlife Service, Project W-95-M (Jobs 1 and 4) under the Federal Aid in Wildlife Restoration Act (Pittman-Robertson Act), and Project E5 (Job 34) under Title VI of the Endangered Species Act; and U.S. Forest Service, Tonto National Forest #3-92-12-043.

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INTRODUCTION

In 1978, the U.S. Fish and Wildlife Service (USFWS) classified the bald eagle (*Haliaeetus leucocephalus*) as endangered in 43 states (including Arizona) and threatened in five others. In 1995, the USFWS (1995) downlisted the bird to threatened in all recovery regions of the lower 48 states. It is not endangered or threatened in Alaska and does not occur in Hawaii. Yet, the bald eagle retains protection under the Endangered Species Act, 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.

Many Arizona bald eagle breeding areas (BA) are subjected to human activities that can affect breeding success. Consequently, as information on certain BAs became clearer, the demand for progressive management increased. Protective efforts began in 1978, when the U.S. Forest Service (USFS) and two Maricopa Audubon Society volunteers monitored a nest. Soon this monitoring effort expanded into the Arizona Bald Eagle Nestwatch Program (ABENWP).

As we discovered more BAs, interagency coordination became more important. To provide oversight, managing agencies formed the Southwestern Bald Eagle Management Committee (SWBEMC) in 1984. The SWBEMC is a cooperative effort among federal, state, and county agencies, private groups, and Native American Tribes committed to bald eagle conservation. In 1986, on behalf of the SWBEMC, the USFWS assumed coordination responsibilities for the ABENWP and expanded its scope. The USFWS passed the lead to the Arizona Game and Fish Department (AGFD) in 1991.

The ABENWP has three principal goals: conservation, data collection, and education. Because of a high recreation level along central Arizona rivers, seasonal closures surround many nest areas. Nestwatchers interact with people who enter these closures, educate them, distribute pamphlets, and direct them out of the area. To help agencies make better decisions, nestwatchers also collect information on eagle ecology, productivity, and behavior in response to human activities. Possibly, the most tangible benefit of the ABENWP is determining when eagles are in life threatening situations. Constant monitoring makes it possible to intervene and rescue birds in those situations.

This report summarizes the most significant discoveries at each BA monitored in 1998. Among the topics discussed are length of observation, timing of breeding events, human activity, food habits, and management activities.

STUDY AREA

ABENWP personnel monitored bald eagle breeding areas along creeks, reservoirs, and rivers throughout Arizona (Fig. 1). All monitored BAs (except the Luna BA) were in the central part of the state. The most northerly BA was Tower, near Clarkdale, and the most southerly was Winkelman, along the Gila River. The most westerly BA was Lake Pleasant, along the Agua Fria River, and the most easterly BA was Luna, near the town of Alpine. Elevations of the monitored areas ranged from 439 m (1440 ft) at the Sycamore BA to 2409 m (7900 ft) at the Luna BA.

Most Arizona bald eagles breed in the central part of the state at elevations of 329 m (1080 ft) to 1719 m (5640 ft). This portion of the state is within the Upper and Lower Sonoran Life Zones (Merriam 1898), which include riparian habitats and transition areas of both zones. The representative vegetation includes Arizona sycamore (*Platanus wrightii*), blue palo verde (*Cercidium floridum*), cholla (*Opuntia* spp.), Fremont cottonwood (*Populus fremontii*), Goodding willow (*Salix gooddingii*), mesquite (*Prosopis* spp.), saguaro (*Carnegiea gigantea*), and tamarisk (*Tamarix pentandra*) (Brown 1982). Pinyon pine(*Pinus* spp.) and juniper (*Juniperus* spp.) are found in the transition areas.

The Luna BA is one of two known Arizona BAs found at high elevation. This BA is within the Montane-Conifer Forest zone characterized as having ponderosa pine (*Pinus ponderosa*), white fir (*Abies concolor*), Douglas fir (*Pseudotsuga menziesii*), and quaking aspen (*Populus tremuloides*) (Brown 1982).

METHODS

In late summer and early fall 1997, AGFD advertised for nestwatchers through the American Ornithologists Union's Newsletter, and job placement services at colleges and universities nationwide. Public discussions, the Internet, word-of-mouth, and brochures also contributed to the pool of applicants. AGFD hired nestwatchers as private consultants.

After selection of personnel, three meetings were held to orient nestwatchers. The first meeting prepared nestwatchers for the field, explained data forms and bald eagle emergency protocol (eaglets falling out of the nest, entanglement in fishing line, and so on). The following day we discussed Arizona's bald eagle history, ecology, and the role nestwatchers play in management. At the end of the meeting, nestwatch partners were selected. The last meeting took place after the first week in the field. We reconvened and answered questions about data forms and the content of final reports. We discussed any additional problems on an individual basis in the field or at the office.

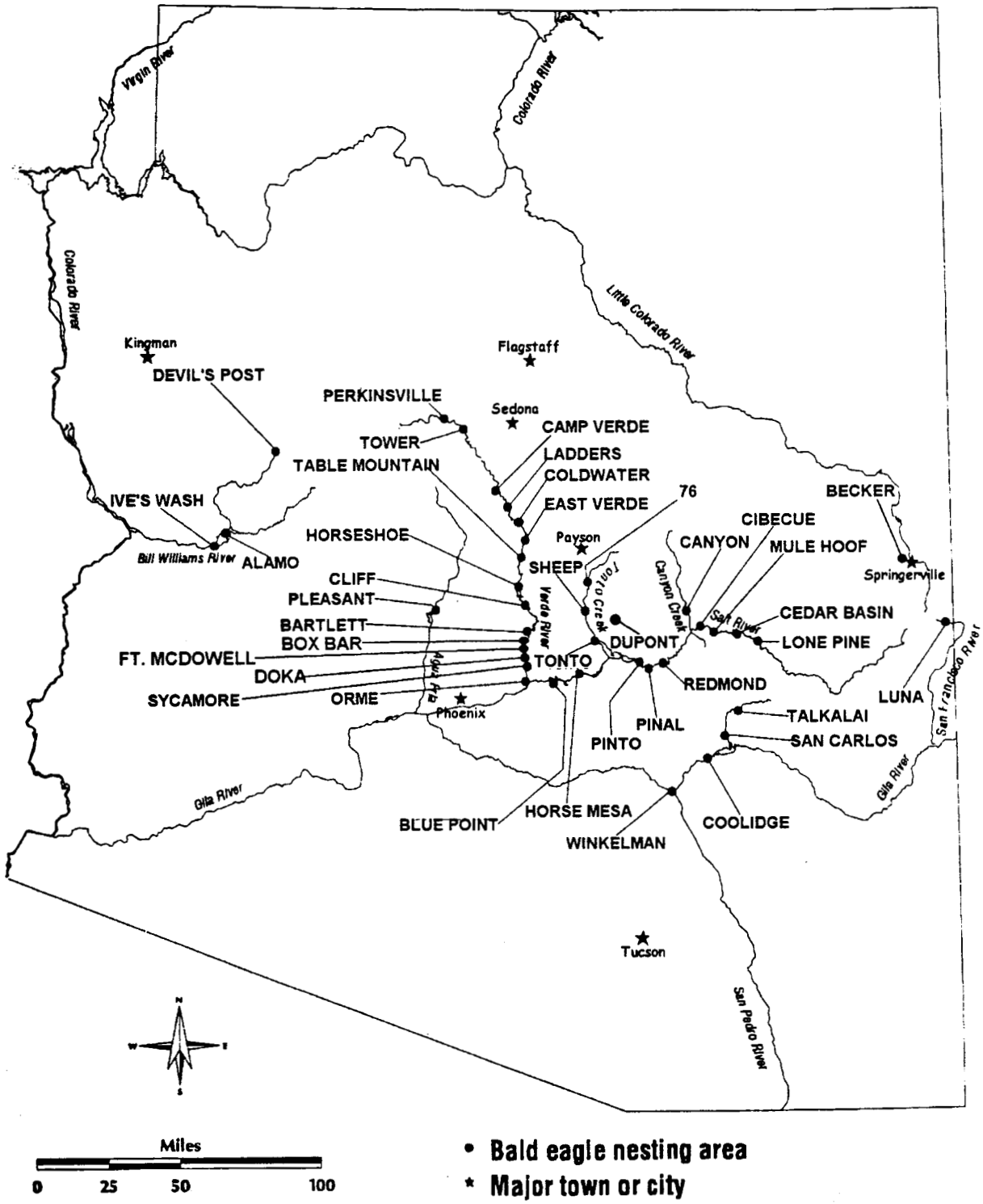

Figure 1. Location of known Arizona bald eagle breeding areas, 1998.

We selected the BAs to be monitored based upon the level of human activity near the nest area. Monitored BAs included all active BAs with legal closures (Bartlett, Box Bar, Ladders, Lake Pleasant, Luna, 76, and Tower) and a few BAs without closures, but with high levels of human activity (Fort McDowell, Horseshoe, Sycamore, Tonto, and Winkelman).

Field work began the first week of February after orientation, and continued until the eaglets fledged in May and June. Teams of two maintained a ten-day on, four-day off schedule. Each work period included weekends and Fridays to cover heavy recreational days. Nestwatchers devoted half of each ten-day period (weekends and every other Friday) to dawn-to-dusk data collection. The other half was spent collecting supplemental data on eagle behavior. A four-day off period occurred every other Monday through Thursday. Due to constant human activity, nestwatchers monitored the Box Bar BA everyday with a two to five person team.

Nestwatchers recorded all bald eagle data from observation points within the nest area. We selected observation points to provide optimal viewing, while minimizing impact to eagles. Nestwatchers used spotting scopes (15x to 45x) and binoculars to view eagles. They recorded observations of foraging events, human activity, low-flying aircraft, nesting behavior, prey deliveries, wildlife interactions, and wildlife sightings on field forms.

Within an arbitrary 1.0 km (3300 ft) radius of an eagle or nest, nestwatchers recorded all human activities and the associated eagle behavior. We classified bald eagle behavior in response to human activity into seven categories: none, watched, restless, flushed, left area, unknown, and bird not in area. Nestwatchers recorded "no response," if eagles performed their normal activities without acknowledging a human activity. They marked "watched", if an eagle looked at an activity without displaying any other observable reaction. If an eagle vocalized, moved noticeably on its perch, or displayed any overt reaction without leaving its perch, they recorded "restless." If an eagle left its perch quickly in response to the human activity, they recorded a "flush." A "left area" response refers to an eagle that became intolerant and left the area. They recorded "unknown" if an eagle's response could not be seen and marked "bird not in area" if an eagle was not present when an activity occurred.

Nestwatchers documented all aircraft below the 600 m (2000 ft) Federal Aviation Administration (FAA) recommended ceiling within 1.0 km (3300 ft) of an eagle/nest (and the birds associated behavior). They estimate the height of an aircraft using elevations of known landmarks (such as the nest or a nearby cliff) derived from topographic maps. We sent the low-flying aircraft forms (describing identification numbers and flight paths) to USFWS law enforcement if an aircraft was regularly flying through a BA at exceedingly low levels ($<$175 m or 500 ft), and/or caused an eagle to respond significantly.

At the southern end of the Lake Pleasant closure, nestwatchers documented the amount and type of watercraft activity. They recorded all boats or jet-skis approaching the buoy line and compliance with the closure. If watercraft entered the closure and were able to get past the nestwatchers, they

were considered "inside the closure." Conversely, watercraft which nestwatchers could contact, or approached the buoy line and complied, were "at the closure."

Nestwatchers recorded human activity differently at the Luna Lake and Box Bar BAs. Due to constant activity within 1.0 km (3300 ft) of both nests, they were unable to record all activities and the eagle's subsequent response to each one. Instead, they recorded only activities that occurred within the legal closures (Luna Lake closure was new in 1998) and the bird's associated behavior.

Nestwatchers recorded all aspects of the bald eagle's natural history. They documented interactions with other wildlife; foraging events; frequency, type, and species of prey delivered to the nest; and eagle nesting behavior (time incubating, attending the nest, and feeding the young). In this report, we discuss only the eagle's food habits (foraging events and prey deliveries). To record information accurately, nestwatchers used nest maps with river kilometer designations and a guide to commonly taken fish species (Hunt and others 1992).

Nestwatchers provided their own transportation, gas, supplies, binoculars, and food. They also provided their own housing on days off. A total of 23 nestwatchers participated in the ABENWP in 1998.

RESULTS AND DISCUSSION

PROGRAM

Since nestwatchers concentrated their efforts within the nest area, this bias must be considered when extrapolating conclusions about foraging locations or habitat utilization. Nevertheless, information gathered by this approach helps inform managing agencies about the breeding pair's habits, potential conflicts, and necessary management activities. Further, since eagles are commonly found in the nest area during the breeding season, it is logical to concentrate management in this area. Certainly, important foraging areas, perches, and roosts away from the nest should not be ignored.

Nestwatchers monitored 13 BAs in 1998: Bartlett, Box Bar, Doka, Fort McDowell, Horseshoe, Ladders, Luna, Pleasant, 76, Sycamore, Tonto, Tower, and Winkelman. We only monitored the Doka and Winkelman BA for a short time, and because of minimal information, their results are not discussed. The final status of the monitored nests was: 1 occupied, 2 failed, and 10 successful (Postupalsky 1974). Sixteen young fledged from 10 successful sites.

INTERVENTION

Box Bar Breeding Area

After falling from the nest on May 11, the Box Bar eaglet was returned on May 13. The nestling fell from the nest at 11 weeks (flying age), but remained on the ground until we picked it up on

May 13. The eaglet was placed in a large snag near the nest to keep it away from ground predators (that is coyotes) and to give it height for flying. Unfortunately, when we returned to the observation point, the snag and eaglet could not be seen. Consequently, we decided to move the young bird to a different location. While trying to recapture the eaglet, it jumped from the snag and landed (very poorly) on the ground. Based upon the apparent lack of flying skills, we returned it to the nest where it fledged on May 18.

Fort McDowell Breeding Area

The Ft. McDowell nestling fell from the nest on three occasions before being diagnosed with cataracts. The 44 day old eaglet first fell on March 28. While on the ground, it did not appear alert. We took the bird to The Phoenix Zoo where Dr. Kathy Orr discovered a cracked coracoid (collarbone). Because of the eagle's young age, we determined it would be best to return it to the nest; the bone would heal before it was ready to fly. We returned the nestling on March 29, however, it fell again on March 30. We took it to Liberty Wildlife Rehabilitation for rehydration and food, and returned it on April 1. Again, the nestling fell on April 5. Following a close inspection, we concluded the nestling was blind. Dr. Orr confirmed our suspicion and diagnosed it as having cataracts. The nestling died in captivity on April 11 of unknown causes, however, we suspect the repeated falls or the source of the cataracts contributed.

The behavior of this eaglet was, upon retrospect, indicative of its blindness. The eaglet was constantly checking its footing in the nest by lifting its feet up and down. Because it regularly sought shade from a branch at the edge of the nest, it repeatedly fell. We observed it on more than one occasion lose its balance after placing its foot over the edge of the nest. It also was not responsive when the adults arrived with food. Typically, eaglets rush to the adult, lower their heads, and beg. However, when the adult would arrive with food, the eaglet did not respond. Therefore, the adult did not try to feed. Yet, throughout the day it was obvious the eaglet was hungry because of its begging.

This is the first recorded instance of cataracts in an Arizona eagle. Based upon nestwatchers observations, the eaglet could see during its first five weeks of life, but lost its sight during its sixth week. Dr. Orr believes cataracts can develop quickly. Following its death, she performed tests for Newcastle disease and encephalitis (a cause of cataracts in nestling flamingos at The Phoenix Zoo). Results were negative. Tissue was sent to the National Wildlife Health Center in Madison, Wisconsin for further analysis.

Ladders Breeding Area

One of the Ladders eaglets fell from the nest on May 2. The bird was found in good health below the nest on May 3 and replaced. It later fledged on either May 17 or 23.

San Carlos Breeding Area

Nest monitors from the San Carlos Apache Tribe thought both San Carlos eaglets had fledged between May 11 and 13. However, they saw only one of the juveniles on May 13. On May 15, we

discovered the second juvenile on the ground below the nest. Due to its lack of flying ability and an unusual protrusion on its keel, we took the juvenile to Dr. Kathy Orr at The Phoenix Zoo. The juvenile was rehabilitated for a broken keel and released back into the breeding area on June 30.

BREEDING AREA SUMMARIES

Productivity Overview

The 1998 Arizona bald eagle breeding season was the fourth consecutive year in which over 20 nestlings fledged (21 fledged). Yet, only 14 of the 36 occupied sites were successful (Appendix A, Tables 1, 2), which resulted in a rather low overall nest success (n=0.39).

The increase in the number of BAs during the 1990s appears to have stabilized the production of annual fledglings. Throughout the 1970s and 1980s, the number of fledglings fluctuated from 0 (1972) to 24 (1988). However, since 1993, the annual number of fledglings produced has varied between 18 and 25 (mean=22).

Bartlett Breeding Area

Observation Period.-- Observation dates ..... February 6 to May 17
Total monitoring days/hours ..... 70 days/676 hours
Eagle Identification.-- Male ..... Unbanded eagle in adult plumage.
Female ..... Unbanded eagle in adult plumage.

Nestwatchers observed a fishhook lodged in the beak of one nestling on April 10. The eaglet apparently removed the hook by itself within 30 minutes. Within a day or two after fledging, we could not find the juveniles along the river. Nestwatchers later found them in Indian Springs Wash, a steep-canyoned drainage behind the nest.

Human activity.--Nestwatchers recorded 150 human activities (Appendix B, Table 3). Aircraft (small planes, helicopters, and jets) (n=69) and watercraft (canoes, kayaks and rafters) (n=47) represented 77.3% of all recorded human activity. The remaining 22.7% (n=34) were of seven different terrestrial types.

Two activities elicited a significant response from the bald eagles. A small plane caused the adults to be restless, and the adult male flushed when two men appeared on the cliff above its perch. The men, traveling in their jeep, were reportedly lost and found themselves on the road above the nest.

A noteworthy human activity, which was absent this year, was recreational shooting. Since 1993, nestwatchers have recorded gunshots every year except 1995 (high river flows during the breeding season minimized human activity). In 1997, USFS restricted target shooting along the lower Verde River. This year, it seems the shooting restrictions combined with high river flows (above 1000 cubic feet per second from March through April) eliminated recreational shooting and decreased other terrestrial human activity.

Food Habits.--Nestwatchers observed 18 foraging attempts in the nest area (Appendix B, Table 4). The male was successful in 9 of 15 foraging attempts. The female made three successful attempts. However, early in the season, they observed the eagles returning from the Needle Rock area (downstream about 5 km/3 mi from the nest) with food. As the season progressed, more fish were caught in the nest area and from the reservoir (largemouth bass, black crappie, and so forth).

The eagles delivered 123 prey items to the nest (Appendix B, Table 5). The male delivered 75.6% (n=93) and the female delivered 24.4% (n=30). Fish comprised 87.8% (n=108) of the prey. Fish identified in the nest include suckers (n= 27), channel catfish (n= 19), largemouth bass (n= 10), black crappie (n= 9), bluegill (n= 2), carp (n= 1), and sunfish (n= 1) (Appendix B, Table 6). Birds and mammals identified were American coot (n= 2), grebes (n= 1), squirrels (n= 2), and western cottontail (n= 1).

Management Activities.--1. The Tonto National Forest closed an area surrounding the nest.

Box Bar Breeding Area

Observation Period.-- Observation dates ..... February 6 to May 22
Dawn-to-dusk hours ..... 537 hours
Total monitoring days/hours ..... 102 days/1068 hours

Eagle Identification.-- Male ..... Blue VID band left leg - USFWS band right, adult plumage.
Female ...Blue VID band left leg - USFWS band right, near-adult plumage.

One eaglet fell from the nest on May 11 (see Intervention Section). The bird fell from the nest at 11 weeks (flying age), but remained on the ground until we picked it up on May 13. Based upon the apparent lack of flying skills, we returned it to the nest where it fledged on May 18.

Human Activity.--Nestwatchers recorded 241 human activities within the closure (Appendix C, Table 7). Aircraft (small planes and helicopters) represented 58.9% (n=142) of all recorded activities. The remaining 99 activities fell into 11 categories. Due to the proximity of the Rio Verde Riding Club's stable, horseback riding represented the most regular and frequent terrestrial activity inside the closure (n=23).

Twenty-seven activities inside the closure caused the eagles to respond significantly (restless, flush, left area). Out of all the monitored sites, nestwatchers recorded this pair being disturbed the most. Activities causing a significant response were aircraft (n=6), horseback riders (n=4), OHVs (n=5), hikers (n=5), agency workers (n=4), shooters (n=1), and construction (n=2).

Proximity to an activity was not correlated with the level of an eagle's response. Horseback riders 300 m (1000 ft) from an eagle caused the birds to flush. However, on another occasion, horseback riders only caused the eagles to watch after approaching within 25 m (80 ft). Hikers within the closure caused eagles to flush at various distances within 500 m (1600 ft).

The 241 recorded human activities may underestimate the actual amount of activity in the nest area, but does reflect activity within the closure. Due to the large volume of people, it was impossible to track each activity and the bird's associated response. Additionally, nestwatchers could not see the west side of the river, and did not record visitors to the observation point.

To inform recreationists of the eagles, the closure, and to document the level of human activity entering the core nest area, we stationed nestwatchers on FS Road 160 (just west of the parking area). In 27 monitoring days (primarily on weekends and holidays), 1322 vehicles entered the core nest area (Appendix C, Table 8). The most vehicles were recorded in April (n=622).

Management of the Box Bar BA required two teams (five people). All five people were present on weekends. Two people at FS Road 160 recorded vehicles and educated people; the other three collected data and educated people visiting the Rio Verde Ranch observation point.

There was a distinct difference in attitude between the behavior of people at FS Road 160 and at the observation point. Generally, people were indifferent at FS Road 160, wanting to know only where they could or could not go. Some were angry about the USFS day-use fee and believed nestwatchers were there to enforce the mandatory charge. Those who showed interest were invited to the observation point to see the eagles. Nestwatchers estimated that nearly 1000 residents and friends from the nearby community of Rio Verde visited the observation point. It was clear the eagles, the nestwatchers, and the scopes were a fascinating attraction.

This site continues to be the most difficult BA to manage. Where typically two monitors are sufficient, over the last two seasons it is apparent that the four people, daily monitoring, and contacting recreationists along FS Road 160 are required. This effort will become more important as homes are built along Dynamite Road and at Rio Verde Ranch (a 360-unit housing complex and 18-hole golf course are proposed for development across the river from the nest).

Food Habits.--Nestwatchers observed 37 foraging attempts in the nest area between river kilometers 24.0 and 24.7 (Appendix C, Table 9). The male foraged 23 times and was successful in 21. The female was successful in all 14 foraging events. Fish were captured 34 times.

Although the river flows fluctuated due to heavy rainfall and water releases from Bartlett Dam, the eagles seemed to adapt. One river braid in the nest area remained slow and shallow during high flows. Nestwatchers observed the eagles foraging there 24 times (successful 23 times). Each attempt originated from the same snag perch and the strike point into the river was 10 meters away.

Nestwatchers observed 106 prey deliveries to the nest (Appendix C, Table 10). The male (n=47) and female (n=58) delivered similar amounts. Fish (n=72) were the most common prey type delivered. Prey items identified in the nest were suckers (n=23), largemouth bass (n=3), carp (n=2), back crappie (n=1), catfish (n=1), rats (n=1), and rabbits (n=1) (Appendix C, Table 11).

Management Activities.--1. The USFS, Cave Creek Ranger District, enlarged the closure to the north. 2. Nestwatchers were active in educating people through contact along FS Road 160, local horseback tours, and from the local Rio Verde community. 3. Due to heavy recreation, we used two nestwatch teams to monitor the site every day. 4. We enlisted the support of the Rio Verde Ranch to allow nestwatchers to camp and monitor from their property. 5. A newspaper article on the ABENWP at Box Bar appeared in The Arizona Republic's "Rep" entertainment guide. 6. AGFD purchased closure and interpretive signs.

Fort McDowell Breeding Area

Observation Period.-- Observation dates ..... February 6 to April 5
Dawn-to-dusk days/hours ..... 50 days/245 hours
Total monitoring days/hours ..... 43 days/405 hours

Eagle Identification.-- Male .....Blue VID band left leg - USFWS band right, near-adult plumage.
Female ..... Unbanded eagle in adult plumage.

Both Fort McDowell eaglets died before fledging. One eaglet disappeared at three weeks old. The other eaglet developed cataracts and died in captivity (see Intervention Section).

Human Activity.--Nestwatchers recorded 369 human activities (Appendix D, Table 12). The majority (86.2%) of activity was low flying aircraft (small planes, helicopters, and military jets). Fifty-one terrestrial activities represented eight different types (drivers, gunshots, agency workers, woodcutters, OHVs, anglers, picnickers, and boaters).

Thirteen activities caused the eagles to either be restless (n=1) or flush (n=12). Our banding and rescue activities caused the birds to flush on five occasions. Drivers traveling along the river and within 75 m (150 ft) of a bird caused a flushed response. While low-flying aircraft were the most common occurrence, they only elicited a significant response three times.

An increase in Fort McDowell's police force helped maintain a safer place for the eagles to breed. We took the officers to the nest areas, introduced them to the nestwatchers, and made them aware of the program's goals. In addition, Fort McDowell restricted non-tribal recreational use of the river area. The combination of the new restrictions and increased patrol efforts helped eliminate many vagrants and illegal activities.

Nestwatchers contacted 52 groups of people. While they categorized most as being friendly and attentive, some ignored their guidance. These individuals often flushed the eagles.

Food Habits.--Nestwatchers observed 53 prey deliveries to the nest (Appendix D, Table 13). The male (n=29) and female (n=24) delivered similar quantities of prey and nearly all prey types were fish (92.5%). They identified suckers (n=29), carp (n=1), and channel catfish (n=1). The remaining prey items were either unknown fish (n=18), unknown birds (n=2), or unknowns (n=2) (Appendix D, Table 14). Nestwatchers did not see any foraging attempts.

Management Activities.--1. A meeting between AGFD and Fort McDowell before the breeding season helped educate Tribal police about eagles and the nestwatcher's duties. 2. Fort McDowell restricted non-tribal use of the river area.

Horseshoe Breeding Area

Observation Period.--	Observation dates	February 8 to March 27
	Dawn-to-dusk days/hours	16 days/194 hours
	Total monitoring days/hours	35 days/341 hours
Eagle Identification.--	Male	Unbanded eagle in adult plumage.
	Female	USFWS band right leg, adult plumage.

On March 25, nestwatchers found the 16 day-old eaglet dead in the nest. While the cause is unknown, circumstances indicate the eaglet may have succumbed to heat while being poorly shaded. During the period in which the eaglet died, temperatures climbed to over 80 degrees in less than a week. In addition, the adults switched their typical parental roles and the male was brooding 60% of the day. His inexperience in caring for small young, the unseasonably high temperatures, and the eaglet's inability to thermoregulate probably led to its death.

Human Activity.--Nestwatchers recorded 731 human activities at the Horseshoe BA (Appendix E, Table 15). Traffic (drivers/automobiles=532, OHV=28, dune buggy=2, cyclist=1) on FS Road 269 represented 77% (n=563) of all activity, and aircraft (small planes=128, helicopters=10, military jets=5) contributed to 19.6%. The remaining 3.4% (n=25) is of seven activity types.

Although there were high amounts of road traffic and aircraft, few people approached the nest area. Those that did came from a diverse background for a variety of reasons. Archaeologists entered the nest area to investigate stolen Native American artifacts. Javelina hunters traveled along Tangle Creek, and seven separate hiking groups from the Anasazi Youth Foundation walked along the creek. Hikers (n=3) and hunters (n=1) caused eagles to flush four times. Helicopters (n=1), military jets (n=1), and researchers (n=2) also caused significant reactions by the eagles.

Human activity from the Anasazi Youth Foundation was recorded for the first time in 1998. The foundation provides guidance to troubled youths through wilderness experiences and survival skills. They traditionally travel down Tangle Creek in January, but were delayed due to poor weather. Nestwatchers recorded them in the nest area on seven different occasions (four times within 200m/600ft) between March 7 and 24. Nestwatchers contacted the coordinators three times to explain how their activities could be compatible with the breeding pair. However, discussions generated little cooperation.

Food Habits.--Nestwatchers recorded only a few (n=16) prey deliveries (Appendix E, Table 16). The male delivered 14 prey items (87.5%), while the female brought 2 items to the nest (12.5%). Fish represented the most common prey type (75.0%). Prey items identified were channel catfish (n=4), black crappie (n=1), and bass (n=1). Nestwatchers recorded no foraging attempts.

Management Activities.--1. We contacted the Anasazi Youth Foundation by telephone and discussed the conflict between their hiking routes and the eagles. 2. We contacted the Cave Creek Ranger District, Tonto National Forest and informed them about the Foundation's use of the nest area. We requested a stipulation to avoid the nest area by a half mile be inserted into any future special use permit.

Ladders Breeding Area

Observation Period.--	Observation dates	February 7 to June 2
	Dawn-to-dusk days/hours	42 days/565 hours
	Total monitoring days/hours	82 days/898 hours
Eagle Identification.--	Male	Unbanded eagle in adult plumage.
	Female	Unbanded eagle in adult plumage.

The Ladders pair fledged three eaglets for the first time since 1972. One eaglet fell from the nest on May 2 (See Intervention Section) and was returned in good health the following day.

Human Activity.--Nestwatchers recorded 431 human activities (Appendix F, Table17). Watercraft (kayaks, canoes, and rafts) and aircraft (small planes and helicopters) comprised the bulk (96.5%) of all recorded activity. Other activity types were hikers (n=4), researchers (n=4), agency workers (n=3), ranchers (n=1), bicyclists (n=1), hunters (n=1), and an angler (n=1).

Because of the high river flows, 222 groups of boaters (representing 625 individual craft) floated through the nest area. River use was highest in March (89 boats) and April (73 boats). A variety of watercraft floated through the area: 290 kayaks, 143 personal inflatable rafts, 83 canoes, 80 rafts, and 29 catamarans. Nestwatchers recorded boaters disembarking within the closure on eight occasions. While the eagles commonly paid attention to the watercraft (206 watched responses), in only one instance did the eagles leave the area.

Food Habits.--Nestwatchers observed eagles foraging 11 times between river kilometers 162.6 and 163.2 (Appendix F, Table 18). The male foraged eight times and the female three. Nine attempts were successful. Ten of the 11 foraging attempts were for fish; five were catfish. The sole foraging attempt for mammals was the retrieval of a dead ringtail cat from the river.

Nestwatchers recorded 102 prey deliveries to the nest (Appendix F, Table 19). Fish represented the most common prey type (n=88), followed by mammals (n=6), birds (n=4), and unknowns (n=4). Prey identified in the nest were channel catfish (n=14), suckers (n=6), and a ringtail cat (n=1) (Table 20).

Management Activities.--1. The Prescott and Coconino national forests closed an area surrounding the nest.

Luna Breeding Area

Observation Period.-- Observation dates ..... April 3 to June 21
Dawn-to-dusk days/hours ..... 20 days/270 hours
Total monitoring days/hours ..... 59 days/563 hours

Eagle Identification.-- Male ..... Black VID band left leg - USFWS band right leg, adult plumage.
Female ... Black VID band left leg - USFWS band right leg, adult plumage.

Human Activity.--Nestwatchers recorded 47 human activities in the new USFS closure (Appendix G, Table 21). Aircraft (small planes and military jets) represented 59.6% (n=28) of all activity recorded. The remaining 19 terrestrial activities were agency workers (n=7), hikers (n=5), researchers (n=3), gunshots (n=1), boaters (n=1), anglers (n=1), and a birder (n=1).

The eagles flushed in response to six activities: agency workers (n=2), researchers (n=2), boaters (n=1), and an angler (n=1). Recreation resource managers maintaining a water pump in the closure flushed eagles twice. Nestwatchers contacted the agency workers and advised them of the least disturbing route to the pump. We flushed the eagles twice while banding the eagles and searching for the fledged eaglets.

Although nestwatchers recorded only 47 human activities inside the closure, a wealth of human activity occurred around the nest area. This activity originated from boating, angling, and camping at the lake, the town of Alpine, and highway 180. May was the most heavily recreated month for boats (n=23, May 2), vehicles in the parking lot (n=32, May 23), and people on the shoreline (n=71, May 23).

Food Habits.--Nestwatchers observed 54 foraging attempts (Appendix G, Table 22). The eagles were successful 34 times, unsuccessful 17 times, and had an unknown outcome 3 times. Birds were taken the most (n=25), followed by fish (n=18), mammals (n=1), and unknowns (n=10). Forty-six foraging attempts occurred within the wildlife closure on the west side of Luna Lake. Nestwatchers saw 53 prey deliveries of two types, birds (n=21) and fish (n=19) (Appendix G, Table 23). The only two species distinguished were American coot (n=18) and trout (n=19) (Appendix G, Table 24).

Management Activities.--1. Nestwatchers posted fliers and distributed them to the campground hosts and the public at the observation point. The fliers described the sensitive nature of nesting eagles and how the public can help. 2. The USFS created a legal closure around the nest along the north side of the lake. 3. The USFS posted signs along a fence separating the campground from the nest area. The signs informed the public that their presence could affect the eagles. 4. Due to the unusual circumstances surrounding juvenile mortality in the last two years, we kept nestwatchers at the site well into the post-fledging portion of the breeding season. 5. We established the nestwatcher's observation point at the parking lot near the boat ramp so they could inform and educate the public about the eagles. 6. The USFS, Alpine Ranger District, closed access to Group Site A at the campground until the eaglets fledged.

Pleasant Breeding Area

Observation Period.-- Observation dates ..... February 8 to May 10
Dawn-to-dusk days/hours ..... 36 days/457 hours
Total monitoring days/hours ..... 69 days/754 hours
Eagle Identification.-- Male ..... Blue VID band left leg - USFWS band right leg, adult plumage.
Female ..... Unbanded eagle in adult plumage.

Human Activity.--Nestwatchers recorded 434 human activities within the closure (Appendix H, Table 25). Watercraft (boats, jet-skis, and official boats) was the predominant activity (94.2%). Nestwatchers recorded no activities, other than banding the eaglets, which caused a significant response (restless, flush, or left area).

Nestwatchers documented the number of watercraft approaching the southern boundary and their compliance (Appendix H, Table 26). A total of 7324 boats and 826 jet-skis approached the closure and an additional 67 official boats approached and entered the closure to patrol the area. The 8217 watercraft doubled the 3928 nestwatchers recorded in 1997 (Beatty and others 1998). However, 4% non-compliance to the closure in 1998 is similar to 5% from 1994 to 1996 (Beatty and others 1995a, 1995b, 1997) and dissimilar to 12% noncompliance in 1997 (Beatty and others 1998).

As expected, the behavior of people inside the closure was positive and negative. There were those apologetic and interested in the eagles, whereas others were angry, provided a poor excuses or were verbally abusive. Jet-ski riders and anglers were the most frequent violators. Some jet-skis sped up and down the closure boundary line reading each "no-entry" buoy before racing into the closure and past the nestwatchers. Anglers often tried to sneak past the nestwatchers monitoring the boundary. Once the anglers discovered the nestwatchers trying to contact them, they would often speed away toward the lake or further into the closure.

Food Habits.--Nestwatchers observed 39 foraging attempts in the nest area (Appendix H, Table 27). The male and the female foraged 20 and 17 times, respectively. On two occasions, they hunted in tandem for waterfowl. The eagles were successful 17 of 23 times at capturing fish. They were unsuccessful in their attempts to pirate prey from a great blue heron or to capture waterfowl.

Nestwatchers saw 50 prey deliveries to the nest (Appendix H, Table 28). The male delivered an overwhelming portion of the prey (84%). Fish comprised 66% of the prey delivered, followed by birds (8%), mammals (6%), and unknown items (20%). Prey items identified were largemouth bass (n= 14), bluegill (n= 5), channel catfish (n= 2), white bass (n= 1), black crappie (n= 1), shad (n= 1), American coot (n= 3), and squirrels (n= 2) (Appendix H, Table 29).

Management activities.--1. Maricopa County Parks and AGFD placed closure signs (developed by Nongame Branch and purchased with Heritage Funds) at boat ramps and at roads entering the nest area. 2. Maricopa County Parks and Recreation marked the closure with buoys at the northern and southern boundaries. 3. We stationed nestwatchers at the closure's southern buoy boundary on

weekends and every other Friday to educate recreationists about eagles and contact violators entering the closure's boundary. 4. Two television news stations broadcast three segments to help educate the public about the eagles and the closure.

76 Breeding Area

Observation Period.-- Observation dates ..... February 13 to June 3
Dawn-to-dusk days/hours ..... 40 days/496 hours
Total monitoring days/hours ..... 71 days/756 hours
Eagle Identification.-- Male ..... USFWS band on left leg, adult plumage.
Female ..... Unbanded eagle in adult plumage.

Human Activity.--Nestwatchers recorded few human activities (Appendix I, Table 30). They saw 14 activities of 9 different activity types. Typically, we expect to see javelina hunters and ranchers wander through the closure a time or two during the season, however, watercraft floating down Tonto Creek is always unusual. Nestwatchers recorded a rafter and a canoe this year, reflecting the high rainfall and riverflow central Arizona waterways received. The only significant response recorded was a flushed response when we banded the nestlings.

Food Habits.--Nestwatchers witnessed three foraging attempts in the nest area. The male was successful in one of two tries, and the female was observed once successfully pirating food from a common raven.

Nestwatchers recorded the eagles arriving at the nest 58 times with prey (Appendix I, Table 31). The male delivered 69% (n=40) of all the observed prey. Fish made up 67.2% of the prey types, followed by mammals (6.9%), birds (1.7%), and unknowns (24.1%). Prey identified in the nest were carp (n=7), channel catfish (n=2), and a cottontail rabbit (n=1) (Appendix I, Table 32).

Management Activities.--1. The Tonto National Forest closed an area surrounding the nest. 2. Representative Richard Kyle was our guest when we banded the nestlings.

Sycamore Breeding Area

Observation Period.-- Observation date ..... February 6 to June 3
Dawn-to-dusk days/hours ..... 42 days/550 hours
Total monitoring days/hours ..... 90 days/987 hours
Eagle Identification.-- Male ..... Blue VID band left leg - USFWS band right, adult plumage.
Female ..... Blue VID band left leg - USFWS band right, adult plumage.

Human Activity.--Nestwatchers recorded a large (n=570) and diverse (15 types) amount of human activity (Appendix J, Table 33). Aircraft (small planes and helicopters) comprised 63.9% (n=364) of all recorded activity.

Before the 1998 breeding season, Fort McDowell Indian Community made land management changes benefiting eagles. The entire reservation was closed to non-tribal members, and they hired their own police force. Nestwatcher's safety and eagle awareness prompted a meeting between AGFD, tribal police, and operators of the Pira del Sol recreation area. Consequently, Pira del Sol horseback tours avoided nest locations and tribal police increased their patrols in nest areas. Additionally, we gave nestwatchers cellular telephones to contact tribal police to report violators.

Terrestrial activities cause the most response from the eagles. Twenty-five activities caused the eagles to be restless (n=3), flush (n=14), or leave the area (n=8). Activity centered around a "beach area" gravel bar to the north (river kilometers 10.6 to 10.8), across the river (river kilometers. 9.5 to 9.8), and occasionally along dirt roads around the nest. The activities causing a significant response were drivers (n=8), commercial rafters (n=4), and OHVs (n=4).

Food Habits.--Nestwatchers observed 11 foraging attempts in the nest area between river kilometers 9.3 and 9.6, and one each at river kilometers 9.0 and 10.4 (Appendix J, Table 34). The twelve foraging attempts for fish were successful.

Nestwatchers saw the eagles arrive at the nest with 72 prey items (Appendix J, Table 35). The female delivered 46 items, while the male delivered 26. Prey types delivered were fish (n=57), birds (n=6), mammals (n=2), and unknowns (n=7). Prey items nestwatchers identified in the nest were suckers (n=24), rainbow trout (n=13), carp (n=11), American coot (n=2), ducks (n=1), and squirrels (n=2) (Appendix J, Table 36).

Management Activities.--1. A meeting between AGFD and Fort McDowell before the breeding season helped educate Tribal police about eagles and the nestwatcher's duties. 2. Fort McDowell restricted non-tribal use of the river area.

Tonto Breeding Area

Observation Period.-- Observation dates ..... February 7 to May 10
Dawn-to-dusk days/hours ..... 35 days/440 hours
Total monitoring days/hours ..... 69 days/698 hours

Eagle Identification.-- Male ..... Blue VID band left leg - USFWS band right, adult plumage.
Female ..... Blue VID band left leg - USFWS band right, adult plumage.

Human Activity.--Nestwatchers recorded 171 human activities (Appendix K, Table 37). Aircraft (small planes, helicopters, and jets) represented 95.9% (n=164) of all activities. Rain and the inability to traverse A-cross road until mid-April reduced the amount of terrestrial activity. Additionally, the location of the nestwatcher's observation point (same elevation as the nest) made it difficult to detect ground activity.

Eagles responded significantly to four activities. Low flying planes caused a restless response three times. The adult eagles also flushed, circled, and vocalized during banding.

Food Habits.--Nestwatchers recorded 84 prey deliveries (Appendix K, Table 38). The male delivered 69% (n=58) of the prey to the nest. Prey types identified in the nest were fish (n=16) and birds (n=3). Nestwatchers classified most prey types as unknown (74.0%) and could not identify any prey to species due to a limited view from their observation point.

Management Activities.--1. Nestwatchers gave an eagle presentation to the local elementary school and wrote an article for the local newspaper.

Tower Breeding Area

Observation Period.-- Observation dates ..... February 6 to May 20
Dawn-to-dusk days ..... 37 days
Total monitoring days/hours ..... 76 days/728 hours

Eagle Identification.-- Male .....Purple VID band left leg - USFWS band right, adult plumage.
Female ..... Unbanded eagle in adult plumage.

Human Activity.--Aircraft (n=103) and railroad activity (n=262) were the more common of the 403 activities nestwatchers recorded (Appendix L, Table 39). Small planes (n=97), helicopters (n=6), tourist/cargo trains (n=149), and railroad maintenance vehicles (n=113) represented 90.6% of all recorded human activity. The remaining 38 human activities were of 11 activity types.

While nestwatchers recorded a great deal of human activity, only four instances caused the eagles to respond significantly. Railroad traffic caused eagles to flush twice, and a small plane flushed an eagle once. Although railroad activity was present on a daily basis, the consistent nature of the activity and distance from the nest caused eagles to do little more than just watch (n=169). Our banding activities caused the eagles to flush.

Food Habits.--Nestwatchers recorded 18 foraging attempts (11 times successful) between river kilometers 247.0 and 249.5 (Appendix L, Table 40). The male foraged 6 times, the female 11 times, and an unidentified Tower resident once. Fish (n=16), a bird (n=1), and an unknown item (n=1) were the prey types eagles tried to capture.

Nestwatchers observed 69 prey deliveries (Appendix L, Table 41). The male delivered 58% (n=40) of all the prey, where 73.9% (n=51) were fish. Birds (n=6), mammals (n=2), and unknowns (n=10) represented the remaining deliveries. Prey items nestwatchers identified in the nest were suckers (n=10), carp (n=2), and an American coot (n=2) (Appendix L, Table 42).

Management Activities.--1. The Coconino National Forest closed an area, posted signs, and locked gates at access points surrounding the nest area.

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APPENDIX A: 1998 BALD EAGLE REPRODUCTION SUMMARIES

Table 1. Arizona bald eagle productivity for 1998.

Breeding Area	BA Status[1]	Nest #[2]	Incubation Date	# Eggs	Hatch Date	# Young	# Fledged	Fledge Date
Alamo	F	4	2/20-3/1	1+	Failed 2/21 to 3/14, eaglets may have hatched			
Bartlett*	S	2	1/5-22	2+	2/22	2	2	5/14 & 15
Becker	O							
Blue Point	F	7	1/6-28	1+	Failed 1/28 to 2/23			
Box Bar*	S	2	1/14-26	2+	2/23	2	2	5/18 & 23
Camp Verde	U							
Canyon	O							
Cedar Basin	F	3	<4/3	1+	Failed between 4/3 and 5/15			
Cibecue	O							
Cliff	O							
Coldwater	F	8	<3/25	1+	Failed 3/25 to 4/18, eaglets may have hatched			
Coolidge	F	2	2/10-3/2	2	Failed 3/13, injured male, female abandoned incubation - raven ate eggs			
Devil's Post	U							
Doka*	S	1	<1/5	1+	1/17 -2/24	1	1	4/25
Dupont	S	2	1/28-3/2	1+	3/2-4/3	1	1	>6/12
East Verde	F	6	1/27-3/2	2+	Failed 3/2-4/8, eaglets may have hatched			
Ft. McDowell*	F	16	1/5-27	2+	2/12	2	One died 3/2-5, blind eaglet died 4/11	
Horse Mesa	F	4	1/6-28	1+	Failed between 3/25 and 4/3			
Horseshoe*	F	11	1/27-2/8	2	3/9	1	Eaglet died 3/25	
Ive's Wash	O							
Ladders*	S	3	1/27-2/6	3+	3/3-5	3	3	5/17 & 5/23
Lone Pine	O							
Luna*	S	1	<2/19	1+	<3/18	1	1	5/22
Mule Hoof	U							
Orme	S	1	1/28-2/27	1+	<4/3	1	1	5/29-6/12

[1]Breeding area status codes (Postapulsky 1974) - U=unoccupied, O=occupied, S=successful, F=failed.
[2]Nest numbers are from Hunt and others 1992, and SRP's bald eagle nesting areas in Arizona atlas.
*= Sites monitored by 1998 Arizona Bald Eagle Nestwatch Program.

Table 1. continued

Breeding Area	B.A. Status[1]	Nest #[2]	Incubation Date	# Eggs	Hatch Date	# Young	# Fledged	Fledge Date
Perkinsville	O	Nest #3 fell between 1/27 and 3/2						
Pinal	O							
Pinto	O							
Pleasant*	S	2	1/5-25	1+	2/26	1	1	5/17
Redmond	S	5	1/28-3/2	2	3/11-4/3	2	1	>6/12, 1 died 4/21-5/7
San Carlos	S	2	1/6-28	2+	2/10-3/2	2	2	5/11-5/13
76*	S	3	2/14	2+	3/21	2	2	>6/12
Sheep	O							
Sycamore*	S	2	1/5-27	1+	~2/27	1	1	5/30
Table Mountain	F	4	3/2-3/25	1+	Failed between 3/25 and 4/17			
Talkalai	O							
Tonto*	S	2	1/6-23	1+	2/24-25	1	1	5/13-6/9
Tower*	S	8	1/27-2/6	2+	3/2-5	2	2	5/2-6/1
Winkelman*	O							

[1]Breeding area status codes (Postapulsky 1974) - U=unoccupied, O=occupied, S=successful, F=failed.
[2]Nest numbers are from Hunt and others 1992, and SRP's bald eagle nesting areas in Arizona atlas.
*= Sites monitored by 1998 Arizona Bald Eagle Nestwatch Program.

Table 2. Arizona bald eagle productivity summary for 1998.

Number of Breeding Areas	39	Number of Active Breeding Areas	24
Number of Occupied Breeding Areas	36	Number of Failed Nests	10
Number of Eggs	38+	Number of Successful Nests	14
Nest Success = 14/36	0.39	Number of Young Hatched	25+
Mean Brood Size = 21/14	1.5	Number of Young Fledged	21
		Productivity = 0.39 x 1.5	0.59

APPENDIX B: BARTLETT BREEDING AREA SUMMARIES

Table 3. Observed human activity and bald eagle behavior, Bartlett BA, AZ, 1998.

Type	N[1]	W	R	F	Total
Agency Worker	9	-	-	-	9 (6.0%)
Birder	7	-	-	-	7 (4.6%)
Canoe/Kayak	18	17	-	-	35 (23.3%)
Driver	2	-	-	1	3 (2.0%)
Fisherman	5	1	-	-	6 (4.0%)
Helicopter	15	10	-	-	25 (16.7%)
Hiker	6	-	-	-	6 (4.0%)
Jet	-	2	-	-	2 (1.3%)
OHV	2	-	-	-	2 (1.3%)
Photographer	1	-	-	-	1 (0.6%)
Rafter	7	5	-	-	12 (8.0%)
Small Plane	29	12	1	-	42 (28.0%)
Total	101	47	1	1	150 (100%)

[1]Eagle behavior, N=none, W=watched, R=restless, F=flushed.

Table 4. Observed foraging events and success, Bartlett BA, AZ, 1998.

	Fish		Unknown		Total	
Sex	E[1]	S-U[2]	E	S-U	E	S-U
Male	10	8-2	5	1-4	15	9-6
Female	3	3-0	-	-	3	3-0
Total	13	11-2	5	1-4	18	12-6

[1]E=A single foraging event for a food item, not the amount of strikes to capture an item.
[2]S-U=Successful - unsuccessful captures of prey.

Table 5. Observed prey types delivered to nest, Bartlett BA, AZ, 1998.

Sex	Fish	Mammals	Birds	Unknown	Total
Male	84	3	2	4	93 (75.6%)
Female	24	1	1	4	30 (24.4%)
Total	108 (87.8%)	4 (3.3%)	3 (2.4%)	8(6.5%)	123 (100%)

Table 6. Observed prey items delivered to the nest, Bartlett BA, AZ, 1998.

Sex	LB[1]	BC	BG	S	C	CC	SF	UF	G	AC	SQ	WC	UM	Unk	Total
Male	10	7	2	19	1	13	1	31	1	1	1	1	1	4	93
Female	-	2	-	8	-	6	-	8	-	1	1	-	-	4	30
Total	10	9	2	27	1	19	1	39	1	2	2	1	1	8	123

[1]Prey items, LB= largemouth bass, BC=black crappie, BG=bluegill, S=suckers, C=carp, CC=channel catfish, SF=sunfish, UF=unknown fish, G=grebes, AC=American Coot, SQ=squirrels, WC=western cottontail, UM=unknown mammals, Unk=unknown.

APPENDIX C: BOX BAR BREEDING AREA SUMMARIES

Table 7. Observed human activity and bald eagle behavior, Box Bar BA, AZ, 1998.

Type	N[1]	W	R	F	L	B	U	Total
Agency worker	1	-	2	2	-	-	1	6 (2.5%)
Angler	4	-	-	-	-	-	1	5 (2.1%)
Camper	1	-	-	-	-	-	-	1 (0.4%)
Canoe/Kayak	13	5	-	-	-	-	3	21 (8.7%)
Cattle	2	-	-	-	-	-	-	2 (0.8%)
Construction	-	-	2	-	-	-	-	2 (0.8%)
Driver	3	4	-	-	-	-	1	8 (3.3%)
Helicopter	20	11	1	2	-	-	8	42 (17.4%)
Hiker	-	2	1	4	-	-	2	9 (3.7%)
Horseback rider	8	5	1	3	-	-	6	23 (9.5%)
OHV	3	10	1	3	1	-	-	18 (7.5%)
Shooter	2	-	-	1	-	-	1	4 (1.7%)
Small plane	52	28	2	1	-	2	15	100 (41.5%)
Total	109	65	10	16	1	2	38	241 (100%)

[1]Eagle behavior, N=none, W=watched, R=restless, F=flushed, L=left area, B=birds not in area, U=unknown.
[2]D-D total=Observations on dawn-to-dusk days.

Table 8. Vehicles along FS Road 160 entering the Box Bar BA, AZ, 1998.

Date	Vehicles	Date	Vehicles	Date	Vehicles	Date	Vehicles	Date	Vehicles	Date	Vehicles
2/7	20	2/28	57	3/14	6	4/11	59	4/26	98	5/23	41
2/10	1	3/1	68	3/21	47	4/12	112	5/2	44	5/24	45
2/12	1	3/7	4	3/22	62	4/18	67	5/3	80	1322 Vehicles	
2/22	39	3/8	56	4/4	58	4/19	77	5/9	48		
2/27	10	3/13	3	4/5	116	4/25	45	5/10	58		

Table 9. Observed foraging events and success, Box Bar BA, AZ, 1998.

Sex	Fish		Unknown		Total	
	E[1]	S-U[2]	E	S-U	E	S-U
Male	13	13-0	1	1-0	14	14-0
Female	21	19-2	2	2-0	23	21-2
Total	34	32-2	3	3-0	37	35-2

[1]E=A single foraging event for a food item, not the amount of strikes to capture an item.
[2]S-U=Successful - unsuccessful captures of prey.

Table 10. Observed prey types delivered to nest, Box Bar BA, AZ, 1998.

Sex	Fish	Mammals	Unknown	Total
Male	31	1	15	47 (44.3%)
Female	40	1	17	58 (54.7%)
Unknown	1	-	-	1 (0.9%)
Total	72 (67.9%)	2 (1.8%)	32 (30.2%)	106 (100%)

Table 11. Observed prey items delivered to the nest, Box Bar BA, AZ, 1998.

Sex	S[1]	BC	LB	C	UC	R	RT	Total
Both Adults	23	3	3	2	3	3	3	40

[1]Prey items, S=suckers, BC=black crappie, LB=largemouth bass, C=carp, UC=unknown catfish, R=rats, RT=rabbits

APPENDIX D: FT. MCDOWELL BREEDING AREA SUMMARIES

Table 12. Observed human activity and bald eagle behavior, Ft. McDowell BA, AZ, 1998.

Type	N[1]	W	R	F	D-D total[2]	Total
Agency workers	-	-	-	5	3 (1.2%)	5 (1.4%)
Boater	-	1	-	-	1 (0.4%)	1 (0.3%)
Drivers	1	14	-	4	12 (5.0%)	19 (5.1%)
Fishermen	-	1	1	-	2 (0.8%)	2 (0.5%)
Gunshots	11	4	-	-	11 (4.6%)	15 (4.1%)
Helicopters	21	24	-	2	10 (4.1%)	47 (12.7%)
Military jets	-	1	-	-	1 (0.4%)	1 (0.3%)
OHV	-	4	-	-	3 (1.2%)	4 (1.1%)
Picnickers	-	1	-	-	0	1 (0.3%)
Small planes	211	58	-	1	196 (81.3%)	270 (73.2%)
Woodcutter	4	-	-	-	2 (0.8%)	4 (1.1%)
Total	248	108	1	12	241 (100%)	369 (100%)

[1]Eagle behavior, N=none, W=watched, R=restless, F=flushed.
[2]D-D total=Observations on dawn-to-dusk days.

Table 13. Observed prey types delivered to the nest, Ft. McDowell BA, AZ, 1998.

Sex	Fish	Birds	Unknown	Total
Male	25	2	2	29 (54.7%)
Female	24	-	-	24 (45.3%)
Total	49 (92.5%)	2 (3.8%)	2 (3.8%)	53 (100%)

Table 14. Observed prey items delivered to the nest, Ft. McDowell BA, AZ, 1998.

Sex	S[1]	CP	CC	UF	UB	Unk	Total
Male	13	-	1	11	2	2	29
Female	16	1	-	7	-	-	24
Total	29	1	1	18	2	2	53

[1]Prey items, S=suckers, CP=carp, CC=channel catfish, UF=unknown fish, UB=unknown birds, Unk=unknown.

APPENDIX E: HORSESHOE BREEDING AREA SUMMARIES

Table 15. Observed human activity and bald eagle behavior, Horseshoe BA, AZ 1998.

Type	N[1]	W	R	F	U	D-D total[2]	Total
Archaeologist	-	1	-	-	-	0	1 (0.1%)
Canoe/Kayak	3	1	-	-	-	3 (0.6%)	4 (0.5%)
Cattle	-	-	-	-	2	2 (0.4%)	2 (0.3%)
Cyclist	-	-	-	-	1	1 (0.2%)	1 (0.1%)
Driver (automobile)	151	348	-	-	33	366 (74.1%)	532 (72.8%)
Dune Buggy	1	1	-	-	-	0	2 (0.3%)
Gunshots	-	2	-	-	-	0	2 (0.3%)
Helicopter	-	6	-	1	3	3 (0.6%)	10 (1.4%)
Hiker	1	5	-	3	3	1 (0.2%)	12 (1.6%)
Hunter	-	-	-	1	1	0	2 (0.3%)
Military jet	-	2	1	-	2	4 (0.8%)	5 (0.7%)
OHV	2	26	-	-	-	22 (4.5%)	28 (3.8%)
Researcher	-	-	-	2	-	0	2 (0.3%)
Small plane	42	69	-	-	17	92 (18.6%)	128 (17.5%)
Total	200	461	1	7	62	494 (100%)	731 (100%)

[1]Eagle behavior, N=none, W=watched, R=Restless, F=flushed, U=unknown.
[2]D-D total=Observations on dawn-to-dusk days.

Table 16. Observed prey items delivered to the nest, Horseshoe BA, AZ, 1998.

Sex	CC[1]	BC	B	UF	Unk	Total
Male	1	-	1	8	4	14 (87.5%)
Female	1	1	-	-	-	2 (12.5%)
Total	2	1	1	8	4	16 (100%)

[1]Prey items, CC=channel catfish, BC=black crappie, B= unknown bass, UF=unknown fish, Unk=unknown.

APPENDIX F: LADDERS BREEDING AREA SUMMARIES

Table 17. Observed human activity and bald eagle behavior, Ladders BA, AZ, 1998.

Type	N[1]	W	R	F	L	U	D-D total[2]	Total
Agency worker	-	1	1	-	1	-	1 (0.6%)	3 (0.7%)
Angler	-	1	-	-	-	-	1 (0.6%)	1 (0.2%)
Bicyclist	-	1	-	-	-	-	1 (0.6%)	1 (0.2%)
Helicopter	2	10	1	1	1	-	7 (2.1%)	15 (3.5%)
Hiker	-	3	-	-	1	-	3 (0.9%)	4 (0.9%)
Hunter	-	1	-	-	-	-	0	1 (0.2%)
Rancher	-	1	-	-	-	-	1 (0.6%)	1 (0.2%)
Researcher	-	1	2	1	-	-	2 (0.9%)	4 (0.9%)
Small plane	15	149	5	-	-	10	132 (40.7%)	179 (41.5%)
Watercraft	11	206	-	-	1	4	176 (54.3%)	222 (51.5%)
Total	28	374	9	2	4	14	324 (100%)	431 (100%)

[1]Eagle behavior, N=none, W=watched, R=restless, F=flushed, L=left area, U=unknown.
[2]D-D total=Observations on dawn-to-dusk days.

Table 18. Observed foraging events and success, Ladders BA, AZ, 1998.

	Fish		Mammal		Total	
Sex	E[1]	S-U[2]	E	S-U	E	S-U
Male	3	3-0	-	-	3	3-0
Female	7	5-2	1	1-0	8	6-2
Total	10	8-2	1	1-0	11	9-2

[1]E=A single foraging event for a food item, not the amount of strikes to capture an item.
[2]S-U=Successful - unsuccessful captures of prey.

Table 19. Observed prey types delivered to nest, Ladders BA, AZ, 1998.

Sex	Fish	Mammals	Birds	Unknown	Total
Male	54	6	3	4	67 (65.7%)
Female	32	-	1	-	33 (32.4%)
Unknown	2	-	-	-	2 (2.0%)
Total	88 (86.3%)	6 (5.9%)	4 (3.9%)	4 (3.9%)	102 (100%)

Table 20. Observed prey items delivered to the nest, Ladders BA, AZ, 1998.

Sex	S[1]	CC	UF	UB	RC	UM	Unk	Total
Both Adults	6	14	68	4	1	5	4	102

[1]Prey items, S=suckers, CC=channel catfish, UF=unknown fish, UB=unknown birds, RC=ringtail Cat, UM=unknown mammals, Unk=unknown.

APPENDIX G: LUNA BREEDING AREA SUMMARIES

Table 21. Observed human activity and bald eagle behavior, Luna BA, AZ, 1998.

Type	N[1]	W	F	B	U	D-D total[2]	Total
Agency Worker	1	1	2	3	-	1 (3.4%)	7 (14.9%)
Birder	1	-	-	-	-	0	1 (2.1%)
Boater	-	-	1	-	-	0	1 (2.1%)
Fisherman	-	-	1	-	-	1 (3.4%)	1 (2.1%)
Gunshot	1	-	-	-	-	1 (3.4%)	1 (2.1%)
Hiker	1	1	-	3	-	0	5 (10.6%)
Jet	-	3	-	3	1	7 (24.1%)	7 (14.9%)
Researcher	-	-	2	1	-	2 (6.9%)	3 (6.4%)
Small Plane	6	5	-	6	4	17 (58.6%)	21 (44.7%)
Total	10	10	6	16	5	29 (100%)	47 (100%)

[1]Eagle behavior, N=none, W=watched, F=flushed, B=bird not in area, U=unknown.
[2]D-D total=Observations on dawn-to-dusk days.

Table 22. Observed foraging events and success, Luna BA, AZ, 1998.

	Birds		Fish		Mammals		Unknown		Total	
Sex	E[1]	S-U-?[2]	E	S-U-?	E	S-U-?	E	S-U-?	E	S-U-?
Male	16	10-5-1	7	5-2-0	1	1-0-0	2	0-2-0	26	16-9-1
Female	3	0-3-0	2	2-0-0	-	-	2	0-2-0	7	2-5-0
Unknnown	6	6-0-0	9	6-2-1	-	-	6	4-1-1	21	16-3-2
Total	25	16-8-1	18	13-4-1	1	1-0-0	10	4-5-1	54	34-17-3

[1]E= A single foraging event for a food item, not the amount of strikes to capture an item.
[2]S-U-?=Successful capture of prey - unsuccessful captures of prey - unknown outcome.

Table 23. Observed prey types delivered to the nest, Luna BA, AZ, 1998.

Sex	Birds	Fish	Unknown	Total
Male	10	7	3	20 (37.7%)
Female	2	2	2	6 (11.3%)
Unknown	9	11	7	27 (50.9%)
Total	21 (39.6%)	20 (37.7%)	12 (22.6%)	53 (100%)

Table 24. Observed prey items delivered to the nest, Luna BA, AZ, 1998.

Sex	UT[1]	UF	AC	UB	Unk	Total
Male	6	1	9	1	3	20
Female	2	-	2	-	2	6
Unknown	11	-	7	2	7	27
Total	19	1	18	3	12	53

[1]Prey items, UT=unknown trout, UF=unknown fish, AC=American Coot, UB=unknown birds, Unk=unknown.

APPENDIX H: PLEASANT BREEDING AREA SUMMARIES

Table 25. Observed human activity and bald eagle behavior, Pleasant BA, AZ, 1998.

Type	N[1]	W	F	U	Total
Agency boats	-	-	-	67[2]	67 (15.4%)
Agency worker	-	-	1	-	1 (0.2%)
Boats	-	-	-	270[2]	270 (62.2%)
Camper	1	-	-	-	1 (0.2%)
Driver	1	-	-	-	1 (0.2%)
Hanglider	0	1	-	-	1 (0.2%)
Helicopter	-	2	-	1	3 (0.7%)
Jet-ski	-	-	-	72[2]	72 (16.6%)
Small plane	7	10	-	2	19 (4.4%)
Total	9	13	1	411	434 (100%)

[1]Eagle behavior, N=none, W=watched, F=flushed, U=unknown.
[2]No behavior recorded for watercraft that entered closure.

Table 26. Watercraft compliance at southern buoy closure boundary, Pleasant BA, AZ, 1998.

Date	BAC[1]	BIC	JAC	JIC	OBIC	Total
February 7 to 15	543	13	-	-	2	558
Feb. 20 to March 1	416	11	11	-	7	445
March 7 to 15	675	20	24	2	3	724
March 20 to 29	1167	28	59	4	8	1266
April 4 to 12	1135	47	57	3	19	1261
April 17 to 26	1360	50	217	20	14	1661
May 1 to 10	1258	55	254	30	10	1607
May 15 to 23	500	46	132	13	4	695
Total	7054	270	754	72	67	8217

[1]BAC=boats at closure, BIC=boats inside closure, JAC=jet-skis at closure, JIC=jet-skis inside closure, OBIC=official boats inside closure.

Table 27. Observed foraging events and success, Pleasant BA, AZ, 1998.

Sex	Fish		Birds		Unknown		Total	
	E[1]	S-U[2]	E	S-U	E	S-U	E	S-U
Male	16	13-3	4	0-4	-	-	20	13-7
Female	7	3-4	8	0-8	2	0-2	17	3-14
Both	-	-	2	0-2	-	-	2	0-2
Total	23	16-7	14	0-14	2	0-2	39	16-23

[1]E=A single foraging event for a food item, not the amount of strikes to capture an item.
[2]S-U=Successful - unsuccessful captures of prey.

Table 28. Observed prey types delivered to the nest, Pleasant BA, AZ, 1998.

Sex	Fish	Birds	Mammals	Unknown	Total
Male	28	1	3	10	42 (84.0%)
Female	5	3	-	-	8 (16.0%)
Total	33 (66.0%)	4 (8.0%)	3 (6.0%)	10 (20.0%)	50 (100%)

Table 29. Observed prey items delivered to the nest, Pleasant BA, AZ, 1998.

Sex	LB[1]	BG	CC	WB	BC	SH	UF	AC	SQ	UM	Unk	Total
Male	13	3	2	1	1	1	7	1	2	1	10	42
Female	1	2	-	-	-	-	3	2	-	-	-	8
Total	14	5	2	1	1	1	10	3	2	1	10	50

[1]Prey items, LB=largemouth bass, BG=bluegill, CC=channel catfish, WB=white bass, BC=black crappie, SH=shad, UF=unknown fish, AC=American coot, SQ=squirrels, UM=unknown mammals, Unk=unknown.

APPENDIX I: 76 BREEDING AREA SUMMARIES

Table 30. Observed human activity and bald eagle behavior, 76 BA, AZ, 1998.

Type	N[1]	W	F	B	U	D-D total[2]	Total
Canoe/kayak	-	-	-	-	1	1 (14.3%)	1 (7.1%)
Helicopter	1	1	-	-	-	2 (28.5%)	2 (14.3%)
Hiker	1	-	-	-	-	0	1 (7.1%)
Horseback rider/hunter	1	-	-	-	-	1 (14.3%)	1 (7.1%)
Jet (military)	1	1	-	1	-	1 (14.3%)	3 (21.4%)
Rafter	-	-	-	-	1	1 (14.3%)	1 (7.1%)
Rancher	-	1	-	-	-	0	1 (4.2%)
Researchers	-	-	1	-	-	1 (14.3%)	1 (7.1%)
Small plane	2	-	-	1	-	0	3 (21.4%)
Total	6	3	1	2	2	7 (100%)	14 (100%)

[1]Eagle behavior, N=none, W=watched, F=flushed, B=bird not in area, U=unknown.
[2]D-D total=Observations on dawn-to-dusk days.

Table 31. Observed prey types delivered to the nest, 76 BA, AZ, 1998.

Sex	Fish	Birds	Mammals	Unknown	Total
Male	28	-	4	8	40 (69.0%)
Female	11	1	-	6	18 (31.0%)
Total	39 (67.2%)	1 (1.7%)	4 (6.9%)	14 (24.1%)	58 (100%)

Table 32. Observed prey items delivered to the nest, 76 BA, AZ, 1998.

Sex	C[1]	CC	UF	WC	UM	UB	Unk	Total
Male	6	2	20	1	3	-	8	40
Female	1	-	10	-	-	1	6	18
Total	7	2	30	1	3	1	14	58

[1]Prey items, C=carp, CC=channel catfish, UF=unknown fish, WC=western cottontail, UM=unknown mammal, UB=unknown bird, Unk=unknown.

APPENDIX J: SYCAMORE BREEDING AREA SUMMARIES

Table 33. Observed human activity and bald eagle behavior, Sycamore BA, AZ, 1998.

Type	N[1]	W	R	F	L	U	D-D total[2]	Total
Agency worker	0	1	-	2	-	-	1 (0.3%)	3 (0.5%)
Angler	8	1	-	-	1	-	10 (2.8%)	10 (1.8%)
Canoe	3	1	-	-	-	-	4 (1.1%)	4 (0.7%)
Driver	26	9	-	6	2	5	46 (12.8%)	48 (8.4%)
Gunshot	1	1	1	-	-	-	3 (0.8%)	3 (0.5%)
Helicopter	63	17	2	-	-	10	28 (7.8%)	92 (16.1%)
Hiker	7	1	-	-	-	1	6 (1.7%)	9 (1.6%)
Horseback rider	7	2	-	-	-	-	4 (1.1%)	9 (1.6%)
OHV	24	6	-	4	-	-	24 (6.7%)	34 (6.0%)
Picnicker	8	4	-	1	-	-	10 (2.8%)	13 (2.3%)
Rafter	26	5	-	-	4	2	23 (6.4%)	37 (6.5%)
Small plane	227	20	-	-	-	25	171 (47.5%)	272 (47.7%)
Swimmer	4	1	-	-	1	-	4 (1.1%)	6 (1.1%)
Tribal police vehicle	21	6	-	1	-	-	24 (6.7%)	28 (4.9%)
Woodcutter	0	2	-	-	-	-	2 (0.6%)	2 (0.4%)
Total	475	77	3	14	8	43	360 (100%)	570 (100%)

[1]Eagle behavior, N=none, W=watched, R=restless, F=flushed, L=left area, U=unknown.
[2]D-D total=Observations on dawn-to-dusk days.

Table 34. Observed foraging events and success, Sycamore BA, AZ, 1998.

Sex	Fish		Unknown		Total	
	E[1]	S-U[2]	E	S-U	E	S-U
Male	4	4-0	-	-	4	4-0
Female	4	4-0	-	-	4	4-0
Unknown	4	4-0	1	0-1	5	4-1
Total	12	12-0	1	0-1	13	12-1

[1]E=A single foraging event for a food item, not the amount of strikes to capture an item.
[2]S-U=Successful - unsuccessful captures of prey.

Table 35. Observed prey types delivered to the nest, Sycamore BA, AZ, 1998.

Sex	Fish	Bird	Mammal	Unknown	Total
Male	17	3	2	4	26 (36.1%)
Female	40	3	0	3	46 (63.9%)
Total	57 (79.2%)	6 (8.3%)	2 (2.8%)	7 (9.7%)	72 (100%)

Table 36. Observed prey items delivered to the nest, Sycamore BA, AZ, 1998.

Sex	S[1]	RT	C	UF	AC	DK	UB	SQ	Unk	Total
Male	5	4	3	5	1	1	1	2	4	26
Female	19	9	8	4	1	0	2	0	3	46
Total	24	13	11	9	2	1	3	2	7	72

[1]Prey items, S=suckers, RT=rainbow trout, C=carp, UF=unknown fish, AC=Amercian coot, DK=ducks UB=unknown bird, SQ=squirrel, Unk=unknown.

APPENDIX K: TONTO BREEDING AREA SUMMARIES

Table 37. Observed human activity and bald eagle behavior, Tonto BA, AZ, 1998.

Type	N[1]	W	R	F	D-D total[2]	Total
Helicopter	11	5	-	-	7 (5.9%)	16 (9.4%)
Military jet	1	-	-	-	1 (0.8%)	1 (0.6%)
Ranch dog	3	1	-	-	3 (2.5%)	4 (2.3%)
Rancher	-	2	-	-	1 (0.8%)	2 (1.2%)
Researcher	-	-	-	1	1 (0.8%)	1 (0.6%)
Small plane	122	22	3	-	105 (89.0%)	147 (86.0%)
Total	137	30	3	1	118 (100%)	171 (100%)

[1]Eagle behavior, N=none, W=watched, R=restless, F=flushed.
[2]D-D total=Observations on dawn-to-dusk days.

Table 38. Observed prey types delivered to the nest, Tonto BA, AZ, 1998.

Sex	Fish	Birds	Unknown	Total
Male	12	2	44	58 (69.0%)
Female	4	-	21	25 (29.8%)
Unknown	-	1	-	1 (1.2%)
Total	16 (19.0%)	3 (3.6%)	65 (77.4%)	84 (100%)

APPENDIX L: TOWER BREEDING AREA SUMMARIES

Table 39. Observed human activity and bald eagle behavior, Tower BA, AZ, 1998.

Type	N[1]	W	F	U	D-D total[2]	Total
Agency worker	6	1	-	-	2 (0.8%)	7 (1.7%)
Angler	1	-	-	-	1 (0.4%)	1 (0.2%)
Birder	1	-	-	-	1 (0.4%)	1 (0.2%)
Canoe/Kayak	3	1	-	-	3 (1.2%)	4 (1.0%)
Driver	14	-	-	-	10 (3.9%)	14 (3.5%)
Helicopter	5	1	-	-	3 (1.2%)	6 (1.5%)
Hiker	2	-	-	-	2 (0.8%)	2 (0.5%)
Horseback rider	-	2	-	-	0	2 (0.5%)
OHV	2	-	-	-	2 (0.8%)	2 (0.5%)
Photographer	-	-	-	1	1 (0.4%)	1 (0.2%)
Rafter	-	2	-	-	2 (0.8%)	2 (0.5%)
Researcher	-	2	-	-	1 (0.4%)	2 (0.5%)
RR vehicle	35	73	1	4	75 (29.2%)	113 (28.0%)
Small plane	46	44	1	6	46 (17.9%)	97 (24.1%)
Tourist train	50	96	1	2	108 (42.0%)	149 (37.0%)
Total	165	222	3	13	257 (100%)	403 (100%)

[1]Eagle behavior, N=none, W=watched, F=flushed, U=unknown.
[2]D-D total=Observations on dawn-to-dusk days.

Table 40. Observed foraging events and success, Tower BA, AZ, 1998.

Sex	Fish		Birds		Unknown		Total	
	E[1]	S-U[2]	E	S-U	E	S-U	E	S-U
Male	4	2-2	1	0-1	1	1-0	6	3-3
Female	11	8-3	0	0-0	0	0-0	11	8-3
Unknown	1	0-1	0	0-0	0	0-0	1	0-1
Total	16	8-3	1	0-1	1	1-0	18	11-7

[1]E=A single foraging event for a food item, not the amount of strikes to capture an item.
[2]S-U=Successful - unsuccessful captures of prey.

Table 41. Observed prey types delivered to the nest, Tower BA, AZ, 1998.

Sex	Fish	Bird	Mammal	Unknown	Total
Male	29	5	1	5	40 (58.0%)
Female	22	1	1	5	29 (42.0%)
Total	51 (73.9%)	6 (8.7%)	2 (2.9%)	10 (14.5%)	69 (100%)

Table 42. Observed prey items delivered to the nest, Tower BA, AZ, 1998.

Sex	S[1]	C	UF	AC	UB	UM	Unk	Total
Male	6	0	23	0	3	1	5	40
Female	4	2	16	2	1	1	5	29
Total	10	2	39	2	4	2	10	69

[1]Prey items, S=suckers, C=carp, UF=unknown fish, AC=Amercian coot, UB=unknown bird, UM=unknown mammal, Unk=unknown.