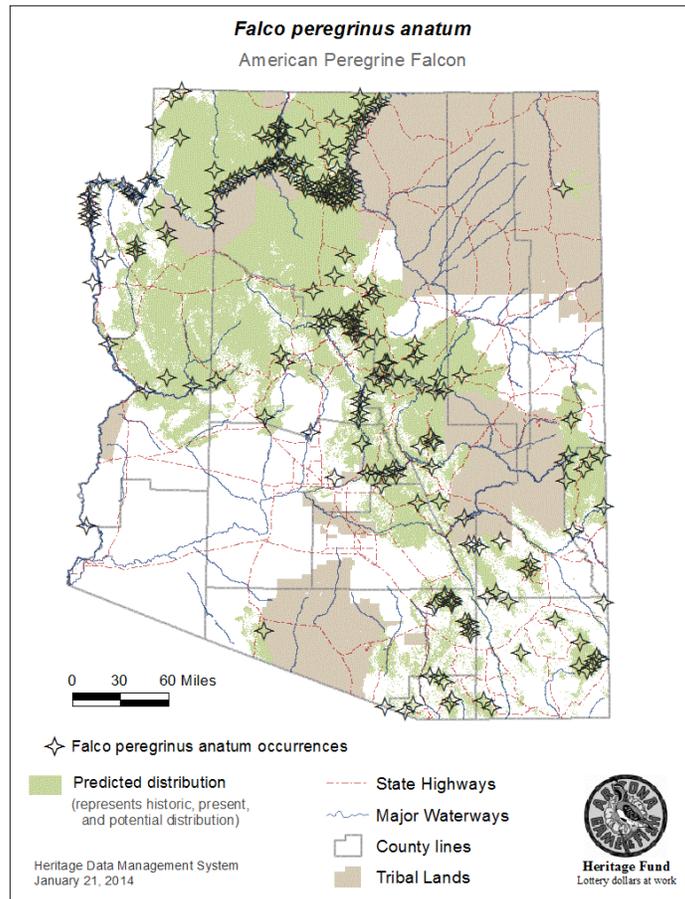


AMERICAN PEREGRINE FALCON CONSERVATION GUIDELINES

INTRODUCTION

In North America, these falcons breed from Alaska and Canada south to western Mexico, including Baja California. In Arizona, the species has been documented to nest over a wide range of elevations in the state from 460 ft (140 m) within Topock Gorge along the lower Colorado River close to 9000 ft (2743 m) near Greer in the White Mountains. The Grand Canyon region supports the greatest concentration of breeding Peregrine Falcons in Arizona, where it was reported that the population may exceed 150 pairs (Snyder and Snyder, 1991). They have also been regularly documented from Lake Powell to Lake Mead, along the Mogollon Rim from the upper Verde River drainage and Sedona area to the New Mexico border. There are also noted sizable populations in the mountains and canyons of southwestern Arizona and northern Navajo and Hopi tribal lands. Major land owners within American Peregrine falcon habitat include the Bureau of Land Management (BLM), National Park Service (NPS), U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), Arizona State Land Department (ASLD), Tribal, non-governmental organization lands, and private lands.

Figure 1. Distribution of American Peregrine falcon in Arizona.



History

Peregrine falcon populations declined precipitously following World War II, the cause being attributed to the use of Organochlorines in pesticides, such as DDT. As a result, the USFWS listed the American Peregrine falcon as endangered on June 2, 1970, under the precursor of the Endangered Species Act (USFWS 1970: 35 FR 16047). In addition, use of DDT was banned in Canada in 1970 and in the United States in 1972 (USEPA 1972) and restriction of other similar pesticides soon ensued (USFWS 1999). Following listing, the American Peregrine falcon Rocky Mountains/Southwest Population Recovery Plan was established, outlining specific objectives to be met for delisting of the species. After years of surveys, monitoring and research, it was determined that the necessary objectives had been met, and that the species had been extensively recovered, and the species was delisted (USFWS 1999).

As evidenced by specific species surveys, Peregrine falcons are doing well in Arizona. Ward (1993) reported 179 known breeding areas, and Glinski (1988) indicated there were over 200 breeding pairs. Recent Arizona Game and Fish Department estimates suggest that there could be as many as 300 or more occupied breeding areas in the state, as many remote areas, particularly in the Grand Canyon region, still remain to be completely surveyed (Corman and Wise-Gervais 2005).

Although no longer federally listed as endangered, Arizona will continue to regulate take for falconry and other purposes, and other federal laws still apply, such as the Migratory Bird Treaty Act (MBTA, 16 USC §§703–712) the National Forest Management Act (16 U.S.C. 1600), and the Federal Land Management and Policy Act (43 U.S.C. 1701). Additionally, localized protection has been established; for example, the Prescott National Forest implemented a raptor management plan, which includes seasonal rock climbing restrictions to prevent disturbance of raptor nests from rock climbing activities. Pesticides will continue to be registered with the Environmental Protection Agency (EPA). Under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136), the EPA requires environmental testing of all new pesticides. Testing the effects of pesticides on representative wildlife species prior to pesticide registration is specifically required (USFWS 1999). Peregrines are also protected internationally by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), in Appendix I.

GENERAL BIOLOGY

Adult plumage is variable in both color and pattern. Most birds have a dark blue-gray dorsum, and light breast with variably dark barring. A distinctive dark "helmet" covers the head to the nape of the neck, down the side of face in dark malar stripes. Juveniles have a dark brownish dorsum and "helmet," and light underparts are heavily streaked with brown. Males are usually bluer on the back and tend to have less barring on the breast. Wings are pointed and 99 cm (39 in) long in males and 117 cm (46 in) in females. Total length of males averages 36-41 cm (14-16 in) and weight of males averages 0.45-0.68 kg (J.0-1.5Ib). Females average 41-46 cm (16-18 in) in total length and weigh 0.72-0.95 kg (J.6-2.1Ib). Females are up to 33 percent longer than males. These birds have

direct flapping flight and vertical "stoops" or plunges used in pursuit of flying prey. Several calls are used, with the most common being a constant "*kak kak kak*" given to intruders near the eyrie or when the bird is irritated. During courtship, the nesting call is a whining wail that progresses into a prolonged "*kaak kaak*." This nesting call is used by females to solicit food from the males (Glinski 1998). Peregrines live anywhere from 4-5 years, and in some cases, up to 10-12 years. Studies have shown that mortality in the first year of life can be as high as 60-80%. Commonly, many are lost during initial flight attempts while others are lost during the first migration period. Generally, only one or two of every ten birds reaches maturity.

Reproduction

Peregrine falcons generally mate for life, but will accept a new partner if the current mate dies. Migratory pairs may separate for winter, while resident pairs maintain pair-bonds (in Arizona, resident birds are not uncommon). Both resident and migratory birds go through courtship rituals every spring. Males court females with aerobatic flight displays and repeated calls and courtship feeding is often used to strengthen the pair bond. Females are usually dominant and often aggressive toward the male partner. Once pair-bonded, the male selects several nest sites, from which the female chooses. Nesting sites, called eyries, usually consist of a shallow depression scraped into a ledge on the side of a cliff. With greater frequency, these birds are becoming urban, in which case, ledges in the side of a building are used. The pair may select a new nest site along the same cliff face each year, or if successful, the same nest site may be used for many years. Birds are generally sexually mature at age two, although breeding has been documented at one year of age. Under normal conditions only one clutch of eggs is laid per year, although if the first clutch is lost before hatching or the chicks die in the first few days, another attempt may be made. Once mature, females usually lay every year until they die.

In Arizona, Peregrine falcons return to breeding areas from mid-February to mid-March. Egg laying occurs anytime from mid-March through mid-May, and may even occur in June at higher elevations. There is usually only one clutch, although a replacement clutch is often laid within 14 days if the first is lost (Newton 1979). Female Peregrine Falcons often become lethargic approximately 5 days before egg-laying (White et al. 2002). Usually 3-4 eggs are laid, but as few as 2 and as many as 6 eggs can be laid (Baicich and Harrison 1997). Incubation lasts approximately 33-35 days (or about 32 according to Glinski 1998), occasionally longer if there are lengthy or frequent periods of interrupted incubation (White et al. 2002). Nestlings move around the nest at around 4 weeks, and fledge at 5-6 weeks or 35-42 days, from May to August but remain dependent on the parents for more than 5 weeks following nest departure (White et al. 2002, Glinski 1998). Captive breeding is relatively easy, and groups such as the Peregrine Fund has had good success with hacking captive bred birds into the wild in other areas. No captive bred birds were hacked in Arizona (K. Jacobson, 2015 pers. comm.).

Movement

While some of Arizona's Peregrine falcons will remain near their nesting cliffs year-round, others migrate south or move to lowlands for the winter. They will return to their breeding cliffs between mid-February to mid-March (Glinski 1998). Peak migration

through Arizona is from early September through October; however, some begin to appear in lowlands by late July or August.

On a local scale, flight speeds of more than 60 miles per hour allow Peregrine falcons to hunt large areas, up to 17 miles away from the eyrie in some cases (Porter and White 1973), and they take advantage of prey availability in agricultural lands, meadows, river bottoms, marshes, and lakes (USFWS 1984).

HABITAT REQUIREMENTS

Figure 2. Image of good habitat.



Within Arizona, pairs breed wherever sufficient prey is available in areas with cliffs, such as the Mogollon Rim, Grand Canyon, and Colorado Plateau (Figure 1). Optimum Peregrine habitat is generally considered to be steep, sheer cliffs with a mean height of 200 to 300 feet (USFS 2015) overlooking woodlands, riparian areas, or other habitats supporting avian prey species in abundance, in areas of Sonoran, Mohave, and Great Basin desertscrub up through areas of Rocky Mountain and Madrean Montane Conifer Forest (Figure 2). They prey primarily on birds found in wetlands, riparian areas, meadows, parklands, croplands, mountain valleys, and lakes within a 10 to 20 mile radius from the nest site. Habitat vegetation is not as important as topographic relief and abundance of prey in determining the areas which nesting Peregrine Falcons will occupy (Corman and Wise-Gervais 2005). In all habitat types the presence of an open expanse for hunting is critical (Glinski 1998).

Wintering Component

Wintering habitat during the non-breeding season can consist of high areas for perching and observing prey, such as tall transmission towers and urban skyscrapers, and areas that include a high-density of birds for prey, such as sewage ponds, canals, agricultural fields,

dairies, railroad tracks, apartment complexes, and farms; studies suggest daily travel distances can exceed 80 km from wintering home ranges as birds forage in outlying areas such as lakes (Garrison and Glinski 1992).

Nesting Component

In Arizona, most known Peregrine Falcon eyries are on cliff faces, canyon wall, spires and occasionally on steep rocky ridges or mountain outcrops. Males often explore many ledges, pockets, crevices, or small caves and usually make several shallow scrapes or bowls prior to the female making the final selection (Ponton 1983). They are, however, adaptable nesters; in addition to cliffs, they have been found on tall buildings, live trees and snags, cranes, and bridges, as long as abundant prey is nearby (Buchanan et al. 2014). Glinski (1998) reports on one Peregrine Falcon pair in Arizona that nested in an abandoned Golden Eagle nest placed on a ledge. Nest sites are often used year-after-year or alternate sites within a breeding area may be used in intermittent years. Within the Grand Canyon where Peregrine Falcons reach their highest nesting density, Brown (1991) found the average distance between eyries was 4.2 mi (6.8 km), with a minimum distance of 1.8 mi (2.9 km).

Optimal eyrie features must include protection from the weather, and tall cliffs that provide better perches as vantage points to keep watch against potential intrusions from conspecifics (reduced competition), predation, or to optimize aerial hunting (stronger updrafts, better sightlines). Distance to other nesting Peregrine falcons had a direct effect on whether to occupy an otherwise suitable cliff site (Wightman and Fuller 2006, Abbate 2012). Peregrine falcons near major water sources in Arizona generally nest low on cliffs, while pairs nesting far from water tend to nest higher (Luensmann 2010).

Land use and modifications to habitat are probably the biggest man-made threats to Peregrine falcons in Arizona. Due to the remoteness of most eyries, nesting locations are less likely to be affected, but foraging areas that can affect the quality or quantity of prey can have a direct impact to whether suitable nesting habitat is occupied (USFWS 2004).

- Nesting cliffs have a mean height of 200-300 feet. Arizona cliffs mostly vertical (80-90°), and all cliffs were at least 70° overall, with vertical sections below the eyrie (Ellis 1982).
- Nests in the Southwest that face south or west are often on deeply recessed ledges with a boulder or vegetation on the ledge or with overhanging rock that provides afternoon shade (Ellis 1982).
- Elevation- up to 9,000 feet (2,700 m) (Ellis 1982).
- Distance to water- within 3 miles (5 km) of permanent or near permanent surface water (Ellis 1982).
- Rainfall requirements- 6 to >30 inches (150-760 mm) of annual rainfall unless near extensive permanent water (Ellis 1982).
- Vegetation- primarily Fremont cottonwood-Goodding willow (*Populus fremontii*-*S. gooddingii*) woodlands were common in the Colorado River Delta. Upland terraces were vegetated with mesquite (*Prosopis* spp.) bosques. Marshlands associated with oxbows, backwaters, and seepages were common. More recently,

cottonwood-willow woodlands covered a limited area, upland areas were developed for agriculture, and some marshlands were partially maintained by agricultural runoff (Hinojosa-Huerta et al. 2005). Smoketree (*Psoralea argemone*) is also a major shrub species along large drainages along the western edge of the Sonoran Desert. Desert ironwood (*Olneya tesota*) and blue paloverde (*Parkinsonia florida*) are locally dominant (Ohmart and Anderson 1982).

- Distance to hunting- habitats supporting high concentrations of birds within a 10-mile (16 km) radius of nesting sites are considered essential (Luensmann 2010).
- Eyries are typically on broad, open cliff ledges or in shallow caves and range from 32 to 86 feet² (3-8m²) in area with scrapes 7 to 9 inches (17-22cm) in diameter and 1 to 2 inches (3-5 cm) deep (Ratcliffe 1993).

Food Component

Peregrines feed almost exclusively on birds, although they have been known to prey also upon bats (Glinski 1998), other small to medium mammals (Ellis et al. 2004; Hunter et al. 1988), fish (Hetzler 2013), carrion (Buchanan 1991), and even invertebrates (Stevens et al. 2009; Ellis et al. 2004). Usually individuals prey from above by folding wings and diving, sometimes at speeds of up to 200mph (320km/h). Peregrines do not grab the prey in mid-air but rather the impact itself is usually deadly. The victim is then allowed to tumble and is either picked up again in mid-air or retrieved from the ground. The average success rate in hunting seems to be in the 20-40% range.

MONITORING

Habitat

No formal state-wide monitoring of Peregrine falcon habitat is currently being conducted in Arizona, although site-specific monitoring occurs in conjunction with land management activities (USFS 2015).

Habitat monitoring protocols for raptor species can be found in the “Habitat Sampling” section beginning on page 153 of the Raptor Research and Management Techniques (Bird and Bildstein 2007). The section contains terminology needed for understanding how to measure raptor habitat, it also gives considerations when making a study design or choosing survey techniques. Additionally, descriptions of variables that can be measured for different purposes and brief comments on how to measure each variable can be found on pages 159-162.

Populations

The Delisting Monitoring Requirement of the ESA was established using the Monitoring Plan, and called for monitoring within six regions in the United States in five sampling periods, every three years, from 2003 to 2015 (USFWS 2003). Monitoring was to provide sufficient comparative data and trend information on territory occupancy, nest success and productivity. The goal was to measure effects from threats such as contaminants. USFWS is to review all the available information to determine if monitoring should be continued (USFWS 2003).

Under the monitoring plan territories were established randomly, if whole-range monitoring was not already being done, with each territory to be visited a minimum of two times at four-hours each, although more would be ideal. The goal of each visit was to determine occupancy, nest success, and productivity. The initial visit was to occur during late courtship, egg-laying, or early incubation in order to determine occupancy; if occupancy was negative, a second visit of four hours was required, ideally three to four weeks later, to confirm negative occupancy. The second visit of those territories with confirmed occupancy occurred during the early nestling state to determine the age of the nestlings. The third and/or consecutive visits for confirmed occupied territories needed to be made during the late nestling state, when young are 28-42 days old, in order to determine nest success and productivity (USFWS 2003).

The Monitoring Plan for the American Peregrine Falcon (USFWS 2003) includes guidelines on how to analyze data, such as calculating territory occupancy and nest success, also guidelines for collecting, preparing, and shipping egg and feather samples. These can be found in the “Methods” section, under subsection G. Monitoring Protocol, page 13.

According to the Monitoring Protocol, USFWS regards the Raptor Research and Management Techniques (Bird and Bildstein 2007) guide to be the standard when designing studies of raptor species. This guide outlines how to design a raptor survey and specific guidelines such as assessing nesting success and productivity or capture and marking techniques. It discusses different survey designs and what measurements should be taken depending on the objective of the study.

KEY THREATS

- Land use activities causing habitat loss, modification and fragmentation including but not limited to energy and communication infrastructure, dams and water management, forestry practices, agricultural practices, urbanization. When habitats are altered, the species that depend on those areas are displaced and may not find suitable habitat in surrounding areas. The results can be the loss of suitable prey, perching sites, and/or nesting sites.
 - Land use and modifications to habitat are probably the biggest man-made threats to Peregrine falcons in Arizona. Due to the remoteness of most eyries, nesting locations are less likely to be affected, but foraging areas that can affect the quality or quantity of prey can have a direct impact to whether suitable nesting habitat is occupied (USFWS 2004).
- Direct impacts (mortality) can occur from energy development and structures including electrocution from powerlines or collision with wind turbines.
- Release of toxins into the environment that can be consumed by the species, including pesticides or industrial contaminants. These can cause direct mortality or have indirect effects on population success.
- Climate change/drought: Peregrine falcons are flexible in habitat use, which will help them cope with climate change effects, but they are potentially vulnerable to shifts in prey levels. Also, their proximity to water is important, and they may be impacted by future drought.

- Recreational climbing causing mortality or abandoned nesting.

STANDARD MITIGATION MEASURES

Habitat Loss, modification or fragmentation from land use activities

- Managed activities, like trail clearing, logging, road construction, fire control measures and controlled burning, mining, and construction should, if possible, occur during the non-breeding season, or not occur within a ½ mile buffer zone of known eyrie locations, keeping in mind that Peregrine falcons appear more sensitive to above-eyrie disturbances to those that occur below the eyrie (Ellis 1982).
- Restrict human activities within approximately ½ mile of occupied nesting site March 1 through August 15. The ½ mile protection distance may vary depending on local topography, potential for disturbance, and location of important habitat components. Coordinate with local biologists to monitor nesting success to determine if restrictions are effective.
 - Restrict prescribed fire within 1 mile (0.6 km) of cliffs with occupied eyries and within 2 miles (3 km) from the base of cliffs with occupied eyries (Ellis 1982).
- Manage agricultural lands in habitat to maintain or improve species richness; an increase in the agricultural land area allocated to monoculture, such as corn or soybeans, could mean a decrease in the quality of hunting habitats (Lapointe et al. 2013).
- In areas where suitable nesting (i.e. cliffs) and foraging habitat occurs, but suitable nest sites are lacking or have been destroyed, cliff enhancement has been proven successful (Boyce et al. 1982).
- Peregrine falcons using man-made structures in metropolitan centers are often aided by alterations/enhancements to the chosen eyrie, to make the nesting areas safer for nestlings (Bell et al. 1996), such as artificial nest boxes, raised edges to platforms, or the addition of pea gravel to the existing structure, which provides nesting substrate.

Direct impact from energy structures

- To minimize electrocution risks, power poles should be constructed to meet current APLIC standards and old poles that pose electrocution risk should be retrofitted with raptor protective devices. For guidance, refer to *Suggested Practices for Avian Protection on Power Lines: State of the Art in 2006* (APLIC 2006).
- The USFWS has developed *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* (USFWS 2003) that are to be followed to avoid collision with turbines as well as evaluating and planning mitigation measures. Refer to this source for:
 - Site development recommendations
 - Turbine development and operation recommendations
 - How to rank site by their potential impact on wildlife using Potential Impact Index (PII)

- Determining pre-construction study needs
- Conducting post-construction studies and determining post-construction monitoring needs

Exposure to toxins in the environment

- Develop a pest management program that allows pesticides to be applied strategically and with caution. A pest management program should include:
 - Proper sanitation practices
 - Removal of food sources for pests
 - Use appropriate biological control
- In cases where the use of pesticides is necessary, they should be used in accordance with their legally binding labels.
- Granular formulations that are toxic to avian species should be limited because they are sometimes mistaken as grain by birds

Climate Change/Drought

- As climate change/drought dries up previously wet habitats, artificial waters will become more important (Bagne and Finch 2013). Peregrines are adept hunters of water-loving birds and are known to drink and bathe frequently, so maintaining water will be a key component to maintaining optimal habitat (White et al. 2002).

Recreational Climbing

- To avoid potential nest abandonment, implementing restrictions on climbing activities near nesting areas is recommended. Restrictions and closures of this type should be site specific, following seasonal or temporal parameters appropriate for the individual location.
- To maintain support and compliance of regulations, seasonal monitoring should occur to ensure only sites that are occupied by the species are closed.

If you have questions regarding site specific management recommendations, consult the AGFD Raptor Management Program

http://www.azgfd.gov/w_c/nongameandendangeredwildlifeprogram/Raptors/RaptorManagementProgram.shtml

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