THE DESERT-NESTING BALD EAGLE
DISTINCT POPULATION SEGMENT ANALYSIS
AND POPULATION VIABILITY ANALYSIS

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EXECUTIVE SUMMARY

- The desert nesting bald eagle population is a Distinct Population Segment based on the best available science, *Endangered Species Act* law, and US Fish and Wildlife (FWS) policy and precedent.
- Best fitting models of mortality reveal that juvenile mortality increased substantially over the entire observation period (1975 to 2007). Female adults have a lower annual mortality than males.
- Simulations of populations using estimates of observed vital rates replicated the apparent pattern of population growth tolerably well until about 2000 when subsequent growth exceeded the envelope predicted from observed vital rates (Fig 1).
- The apparent growth in numbers of occupied breeding areas for desert nesting bald eagles in Arizona since 1975 may overestimate actual growth by undercounting in earlier years due to lower levels of effort and experience. New Native American ethnographic evidence suggests there was a historically larger population than previously thought.
- If juvenile mortality is truly at the high levels estimated from resightings of eagles at breeding areas and stays at such levels, the probability of extinction by 2075 is estimated to be 69.5% (Fig. 1).
- A hypothesized differential effect of prey supplementation (exotic fish stocking) on the core Salt and Verde River breeding areas was supported by higher estimates of fecundity and nestling survival in those breeding areas compared with those in the rest of the state. Cessation of prey supplementation would increase extinction risk to an estimated 80.5% by 2075.
- The Nestwatch program, whereby volunteers monitor breeding pairs and ensure closures to public access are effective, was significantly positively associated with numbers of fledglings per occupied Breeding Area (BA), an effect distinct from that thought to be due to fish supplementation. Cessation of the Nestwatch program would increase extinction risk to an estimated 75% by 2075.
- If the present high levels of juvenile mortality could be reduced even to the average over the entire period of study, extinction risk would be dramatically reduced to less than 4% by 2075.
- More detailed study of juvenile mortality and its causes is urgently needed to ascertain the scale of the extinction threat posed to the desert nesting bald eagle population due to high apparent mortality rates.
- The high probability of extinction for the desert nesting bald eagle identified in this study does not include escalating risks to habitat and the predicted worsening of the drought in the southwestern US due to global warming.
- The high probability of extinction for the desert nesting bald eagle identified in this study does not include increasing risks to habitat and the predicted increasing Southwest drought caused by global warming.

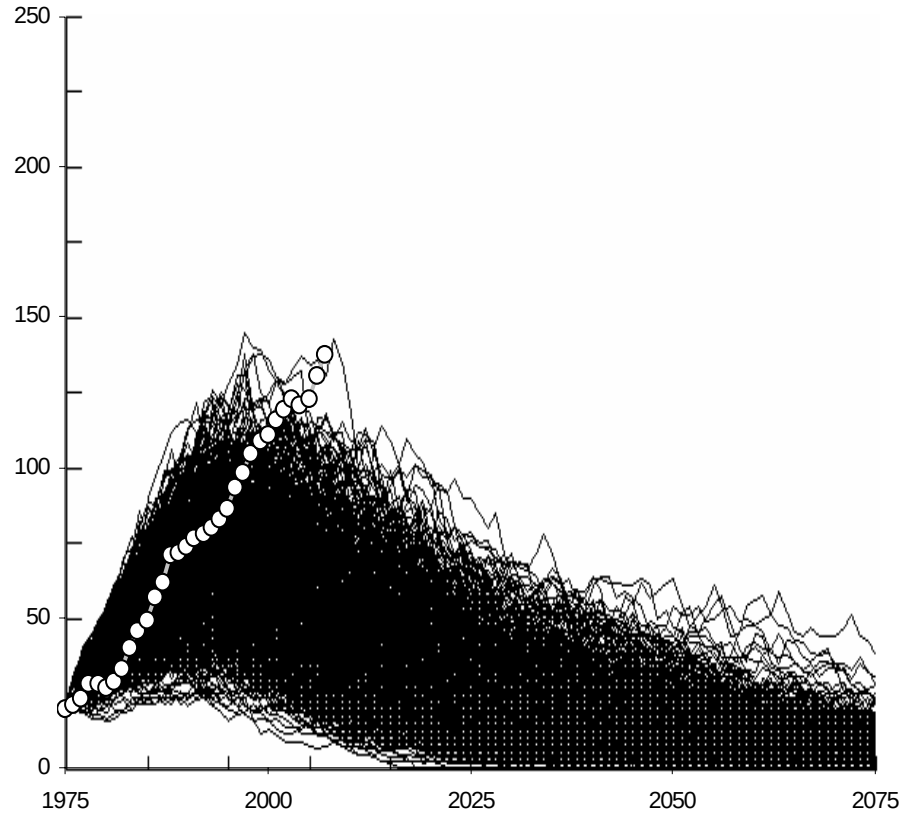


Fig 1.
Population sizes of Arizona desert nesting bald eagles: open circles show 3 year moving averages of population sizes imputed from observed numbers of occupied BAs (representing 33.44% of the total population); black lines show 1000 simulated populations using vital rates estimated as detailed in text.

INTRODUCTION

The bald eagle is the national symbol of the United States. It is a primarily fish eating eagle that nests near water in trees. In Arizona, it frequently utilizes ledges on pinnacles and canyon walls for nesting. Destruction and dewatering of streams, poisoned baiting by ranchers resulted in significant decline of bald eagles following European arrival particularly in the arid Western states.

In the 1960s, the widespread use of DDT resulted in further declines, even after a total ban on DDT in 1972. DDT is a persistent bio-accumulating pesticide whose breakdown products interfere with eggshell production in birds.

Originally listed under the *Endangered Species Preservation Act* in 1967, the bald eagle was transferred to the new endangered species list in 1973 when the *Endangered Species Act* 1973 came into force.

In 1994, FWS proposed to reclassify the bald eagle from endangered to threatened in all of the lower 48 states except in certain portions of the American Southwest and in adjacent Mexico. [USFWS 1994 (July 12, 1994)] FWS reported an increase in the numbers of occupied "breeding areas" (BAs) observed in the lower 48 states following the ban on DDT and the adoption of recovery plans from 1982-1986. In 1963 National Audubon Society reported 417 active nests with 0.59 young per nest. In 1994, a collection of agencies reported 4,450 occupied BAs with 1.16 young per occupied BA. On the basis of this data, FWS down listed the bald eagle nationwide to "threatened" in 1995. [USFWS 1995 (July 12, 1995)]

In the final rule to down list the bald eagle nationwide to threatened, the desert nesting population was denied continued distinct population status. [USFWS 1995 (July 12, 1995)] The 1995 down listing Final Rule treatment of the desert nesting population was "based on new information on immigration and previously known genetic data."

The “new information on immigration” was not new. (Driscoll *et al.*, AGFD 2006) It was not biologically significant. [USFWS 1994 (July 12, 1994), AGFD 1994, Driscoll *et al.*, AGFD 2006]

The single immigration entry in 1994 of the Luna Breeding Area (“BA”) male was well known among desert nesting bald eagle biologists prior even to publication of USFWS’ July 12, 1994, Proposed Rule. The immigrant male was discovered and recognized as an immigrant participating in breeding and nesting in March 1994 and was definitively identified as an immigrant from Southeast Texas by May 7, 1994. [Beatty *et al.* 1995, Driscoll *et al.* (1998), AGFD 2006] At that time, it represented a non-biologically significant contribution (0.7 %) to the known breeding interactions. (AGFD 2006) FWS has corrected the basis for this errant, 1995 Final Rule at least four times. [USFWS (January 27, 2003, February 21, 2003, April 27, 2004, July 9, 2007)]

The “previously known genetic data” had already been qualified as suggestive, but inadequate and non-conclusive in 1992 by the authors of the studies themselves and by the compilers of the summary review. (Hunt *et al.* 1992, Vyse 1992, Zegers *et al.* 1992) Genetic studies of desert nesting bald eagle in comparison to bald eagle elsewhere have established that DNA fingerprinting can identify individual populations. (Vyse 1992) The results suggest genetic uniqueness but are not conclusive. (Hunt *et al.* 1992, Vyse 1992, Silver *et al.* 2004,) FWS agrees. [USFWS (February 21, 2006)]

In 1999, FWS proposed to delist the bald eagle nationwide, citing growth of the population and reduction of threats throughout the United States and accomplishment of regional recovery goals, including those of the Southwestern Recovery Region. [USFWS 1999 (July 7, 1999)] The proposal recognized only "one population of bald eagles in the lower 48 states."

On October 6, 2004, the Center for Biological Diversity, Maricopa Audubon, and Arizona Audubon Council filed the Petition to (1) Recognize the Biologically, Behaviorally And Ecologically Isolated Southwestern Desert Nesting Bald Eagle Population (*Haliaeetus leucocephalus*) as a Distinct Population Segment, (2) to List this Population as Endangered, (3) and to Designate Critical Habitat for this Population. (Silver *et al.* 2004) (“Petition”) On August 30, 2006, FWS rejected the Petition citing failure to “provide substantial scientific or commercial information indicating that the petitioned action may be warranted.” The Petition’s requested Distinct Population Segment (“DPS”) status for the desert nesting bald eagle was rejected with the statement:

> "As with all populations of bald eagles throughout the lower 48 States, suitable riparian habitat, or other comparable aquatic habitat, is an essential prerequisite to successful eagle reproduction in the desert Southwest (USFWS 1982). Riparian ecosystems occupied by nesting bald eagles in the Sonoran life zones of the desert Southwest, therefore, do not constitute a unique setting for the species." [USFWS 2006 (August 30, 2006)]

Until August 30, 2006, for more than three decades, FWS recognized desert nesting bald eagle persistence in an ecological setting unique for the taxon; specifically, arid southwestern desert habitat. [USFWS 1975, 1976 (January 20, 1976), 1976 (October 1976), 1978 (September 7, 1978), 1982, 1983 (February 3, 1983), 1983 (March 8, 1983), 1984 (November 15, 1984), 1985 (March 21, 1985), 1997 (March 24, 1997), 1998 (March 30, 1998), 1999 (March 26, 1999), 2000 (June 25, 2000), 2001 (April 17, 2001), 2001 (December 26, 2001), 2003 (January 27, 2003), 2003 (February 21, 2003), 2006 February 21, 2006, 2006 (March 24, 2006); Gillespie 1989; Hunt *et al.* 1992; Driscoll *et al.* 1998].

On July 9, 2007, FWS removed Endangered Species Act listing protection ("delisting") from the bald eagle nationwide, including the desert nesting population, again recognizing only one population of bald eagles in the lower 48 states and no distinct population segments. The delisting of the desert nesting population focused on FWS' new opinion of the alleged non-uniqueness of nesting in an arid setting and consequent inability to qualify as a distinct population segment meriting continued listing and protection. [USFWS (July 9, 2007)].

Subsequently, documents secured by the Center for Biological Diversity via the *Freedom of Information Act* established that FWS based its rejection of DPS status and its new opinion on non-uniqueness on the "marching orders" of senior FWS administrators. [USFWS (July 18, 2006c); US District Court 2008]

FWS' conclusion reflects USFWS' Listing Program Chief Doug Krofta's statement that "[w]e've been given an answer now we need to find an analysis that works. . . . Need to fit argument in as defensible a fashion as we can." [USFWS (July 18, 2006c); US District Court 2008]

In this paper, we examine FWS' claims that the desert nesting bald eagle population is (1) is not a Distinct Population Segment, based on the new FWS opinion that (a) it does not persist in an ecological setting that is unusual or for the taxon, (b) that the population's loss will not result "in a significant gap in the range of the taxon," and that (c) the population does not differ "markedly from other populations of the species in its genetic characteristics." and (2) that the desert nesting population has recovered.

We develop a stochastic model of population dynamics to determine extinction time distributions based on the available range of estimates of life table parameters. Such population viability analysis is essential to the evaluation of the status and the recovery of a population.

We find that:

> (1) the desert nesting bald eagle qualifies for designation as a Distinct Population Segment under the Endangered Species Act,
>
> (2) that current life table data, independent of increasing threats to habitat, suggests that the desert nesting bald eagle population faces an appreciable risk of extinction in the near future, and.
>
> (3) that this population will need increased protection, including *Endangered Species Act* protection, to survive.

IS THE DESERT NESTING BALD EAGLE A DISTINCT POPULATION SEGMENT?

The term "Distinct Population Segment" ("DPS") is a legal term based on scientific criteria. The defining authority comes from FWS' December 21, 1994, draft and February 7, 1996, final "Policy Regarding the Recognition of Distinct Vertebrate Population." [USFWS 1994 (December 21, 1994), 1996 (February 7, 1996)]

In order to be recognized as a DPS, a population must first be recognized as a "discrete" population. If the population is discrete, then significance of the discrete population to the species as a whole must be considered.

The desert nesting bald eagle is discrete. It is reproductively, geographically, behaviorally, and biologically isolated from the bald eagle elsewhere. In spite of FWS' July 12, 1995 [USFWS 1995 (July 12, 1995)], conclusion to the contrary, discreteness of the desert nesting population is no longer an issue. [USFWS (January 27, 2003, February 21, 2003, April 27, 2004, July 9, 2007)]

In order to be considered "significant" to the species as a whole, the discrete population must persist "in an ecological setting unusual or unique for the taxon," the population's loss must result "in a significant gap in the range of the taxon," or the population "differs markedly from other populations of the species in its genetic characteristics." [USFWS 1994 (December 21, 1994), 1996 (February 7, 1996)]

DOES THE DESERT NESTING BALD EAGLE PERSIST IN AN ECOLOGICAL SETTING UNUSUAL OR UNIQUE FOR THE TAXON?

The Desert Nesting Bald Eagle persists in an ecological setting unique for the taxon; specifically, arid southwestern desert habitat. [USFWS 1975, 1976 (January 20, 1976), 1976 (October 1976), 1978 (September 7, 1978), 1982, 1983 (February 3, 1983), 1983 (March 8, 1983), 1984 (November 15, 1984), 1985 (March 21, 1985), 1997 (March 24, 1997), 1998 (March 30, 1998), 1999 (March 26, 1999), 2000 (June 25, 2000), 2001 (April 17, 2001), 2001 (December 26, 2001), 2003 (January 27, 2003), 2003 (February 21, 2003); Spofford 1976; Ohmart and Sell 1980; Gillespie 1989; Hunt *et al.* 1992; Hunt 1998; Driscoll et al 1998]

No other Bald Eagle population on Earth survives under such conditions of high heat and low humidity. [USFWS 1976 (January 20, 1976), 1978 (September 7, 1978), 1982, 1983 (February 3, 1983), 1983 (March 8, 1983), 1985 (March 21, 1985), 1997 (March 24, 1997), 1998 (March 30, 1998), 1999 (March 26, 1999), 2000 (June 25, 2000), 2001 (April 17, 2001), 2001 (December 26, 2001), 2003 (January 27, 2003), 2003 (February 21, 2003), 2006 February 21, 2006; Spofford 1976; Hunt 1998; Gillespie 1989; Hunt *et al.* 1992; Driscoll et al 1998]

For more than three decades, FWS recognized the uniqueness of such an unusual ecological setting. [USFWS 1975, 1976 (January 20, 1976), 1976 (October 1976), 1978 (September 7, 1978), 1982, 1983 (February 3, 1983), 1983 (March 8, 1983), 1984 (November 15, 1984), 1985 (March 21, 1985), 1997 (March 24, 1997), 1998 (March 30, 1998), 1999 (March 26, 1999), 2000 (June 25, 2000), 2001 (April 17, 2001), 2001 (December 26, 2001), 2003 (January 27, 2003), 2003 (February 21, 2003), 2006 February 21, 2006, 2006 (March 24, 2006); Gillespie 1989; Hunt *et al.* 1992; Driscoll *et al.* 1998]

On April 4, 2006, however, FWS Regional Director Benjamin Tuggle either personally directed or acted as a conduit for the direction to FWS field staff that the desert nesting population should not be recognized as a DPS. [USFWS (April 4, 2006)] This order was subsequently confirmed as "marching orders." It resulted in FWS' Listing Program Chief Doug Krofta's admission that "now we need to find an analysis that works." [USFWS (July 18, 2006c); US District Court 2008]

Thirty years of FWS' recognition of the uniqueness of the arid southwest desert nesting in a unique ecological setting was precipitously and summarily discarded. [USFWS 2006 (August 30, 2006), 2007 (July 7, 2007)] The US District Court recognized FWS' action as "arbitrary and capricious." (US District Court 2008)

FWS' "analysis that works" resulted in FWS' new opinion that nesting in the arid southwestern desert habitat is suddenly no longer unique for bald eagle. FWS rationalizes its new opinion with the following statement:

> "…The Sonoran Desert bald eagle population inhabits a desert ecosystem characterized by hot and dry summers that, on its face, seems to represent an ecological setting that is highly unusual or unique for the species. However, bald eagles in the Sonoran Desert population essentially use the same ecological niche as those in other parts of the lower 48 States population. Bald eagles in the Sonoran Desert feed primarily on fish, consistent with bald eagles in other parts of the range. Habitat structure and proximity to a sufficient food source are usually the primary factors that determine suitability of an area for nesting (Grier and Guinn 2003, p. 44). Nationwide, bald eagles are known to nest primarily along seacoasts and lakeshores, as well as along banks of rivers and streams (Stalmaster 1987, p. 120). Similar to the remainder of the population, bald eagle breeding areas

(eagle nesting sites and the area where eagles forage) in the Sonoran Desert are located in close proximity to a variety of aquatic sites, including reservoirs, regulated river systems, and free flowing rivers and creeks…" [USFWS (July 7, 2007)]

FWS' new rejection of DPS status for desert nesting bald eagle based on "proximity to a variety of aquatic sites" as the defining and limiting habitat description is not consistent with past and subsequent FWS' DPS designation for other populations. FWS' new use of a species' most general and least specific common habitat characteristic to reject DPS status threatens past DPS evaluations and has serious implications for all future DPS evaluations. Taken to the extreme, DPS designation for any population of fish can now be precluded simply owing to the fact that all fish live in water.

Examples of FWS' new DPS standard's inconsistency abound. Examination of a few representative examples in detail is instructive.

On July 10, 2003, FWS defined unique ecological setting differently than for desert nesting bald eagle when it granted DPS status to west coast fisher. In evaluating west coast fisher at the 90-day petition finding stage, FWS concluded,

> "The West Coast population also may be markedly separated from other populations as a result of ecological factors, as they use forest types that differ in species composition, tree size, and habitat structure as compared to those used by fishers in the northeastern United States, eastern Canada, and the Great Lakes region (Buskirk and Powell 1994; Powell and Zielinski 1994)… Fishers in the West Coast population persist in an ecological setting that may be unusual in comparison to the rest of the taxon, with a different climate, topography, and habitat than are found in the majority of its range." [USFWS 2003 (July 10, 2003)]

On April 8, 2004, FWS' opinion for west coast fisher was unchanged,

> "Fishers in the West Coast population persist in an ecological setting that is unusual in comparison to the rest of the taxon, with a different climate, topography, and habitat than that found in the majority of its range. The forests inhabited by fishers on the west coast lack the extensive broadleaf hardwood component that is common in the eastern portions of the species' range. The Pacific coast's wet winter followed by a dry summer is unique in comparison to climate types in the east and Canada, and produces distinctive sclerophyll forests of hardleaved evergreen trees and shrubs (Smith *et al.* 2001). This climate is characterized by mild, wet winters and warm, dry summers (Bailey 1995), while the climate in the animal's range in the Rocky Mountains consists of cold winters and cool, dry summers, and in the Great Lake States, eastern Canada, and the northeast United States it is characterized by cold winters, and warm, wet summers. Fishers on the west coast primarily occur in habitat in steep, mountainous terrain, while those in the Great Lakes region, eastern Canada, and the northeastern United States inhabit level terrain or low lying glaciated mountains. Releases of eastern fishers into western forests have generally been unsuccessful; Powell and Zielinski (1994) state that, ''Roy's (1991) results [unsuccessful attempts to reintroduce Minnesota fishers to Montana] indicate that many fishers from eastern North America may lack behaviors, and perhaps genetic background, to survive in western ecological settings.'' USFWS 2004 (April 8, 2004)

If FWS had used its new desert nesting bald eagle DPS rejection rationale, the west coast fisher would not be recognized as a DPS owing simply to the fact that all fishers live in forests.

Similarly, FWS defined unique ecological setting differently than for desert nesting bald eagle when it granted DPS status for mountain yellow-legged frog. On July 2, 2002, in granting endangered status for the mountain yellow-legged frog DPS, FWS recognized its existence in an ecological setting unique to its taxon. FWS compared the mountainous habitat of the southern California and Sierra Nevada populations. FWS concluded that the mountainous ecological setting of the mountain yellow-legged frog in southern California is unique for the taxon:

> "The rugged canyons of the arid mountain ranges of southern California bear little resemblance to the alpine lakes and streams of the Sierra Nevada. The different ecological settings between mountain yellow-legged frogs in southern California and those in the Sierra Nevada distinguish these populations from each other." [USFWS 2002 (July 2, 2002)]

If FWS had used its new desert nesting bald eagle DPS rejection rationale, the southern California mountain yellow-legged frogs would not be recognized as a DPS owing simply to the fact that it breeds in water like all other mountain yellow-legged frogs.

On May 7, 2001, FWS defined unique ecological setting differently than for desert nesting bald eagle when it granted DPS status for Columbia Basin western sage grouse. FWS found that the Colombia Basin constitutes a unique ecological setting because of its geological, climactic, edaphic [soil] and plant community components:

> "Persistence in an unusual or unique ecological setting—The broad shrub steppe biome historically occupied by greater sage grouse across their range consists of a number of variable habitat types that grade from one to the next, and which may be considerably different between the regions occupied by the species (Miller and Eddleman 2000)… The population segment of western sage grouse that remains in Washington occurs entirely within the Columbia Basin and is the only representation of the taxon within this ecosystem… A number of significant differences are found between the Columbia Basin and the balance of historic western sage grouse range in central and southern Oregon (Table 1). In general, the Columbia Basin is lower in elevation, contains deeper soils of varying origin, and has been influenced by different geological processes. These structural differences, combined with regional climatic conditions, significantly influence the broad plant associations found within each ecosystem (Daubenmire 1988, Franklin and Dyrness 1988)… Finally, there are significant differences in the type and distribution of sagebrush taxa among the ecosystems historically occupied by western sage grouse…The significance of this population segment is primarily due to its persistence in the unique ecological setting of the Columbia Basin…" [USFWS 2001 (May 7, 2001)]

If FWS had used its new desert nesting bald eagle DPS rejection rationale, the Columbia Basin western sage grouse would not have been recognized as a DPS owing simply to the fact that it lives in steppes like all other sage grouse.

FWS' new desert nesting bald eagle standard for DPS rejection based on the use of a species' most general and least specific common habitat characteristic has not been similarly employed to reject DPS status for multiple other bird populations. FWS' news DPS standard was not applied for:

- riparian habitat and yellow-billed cuckoo [USFWS 2001 (July 21, 2001)];
- "shrub steppe biome" and the Washington population of western sage grouse DPS [USFWS 2001 (May 7, 2001)];
- "coastline" and the Alaska breeding Steller's eider DPS [USFWS 1997 (June 11, 1997)];
- "coastal beaches" and the Pacific DPS of western snowy plover [USFWS 1993 (March 5, 1993)];
- "older forest stands by the coastline" by the Oregon, Washington, and California Marbled murrelet DPS [USFWS 1992 (October 1, 1992)];
- "open country" and the Florida DPS of Audubon's crested caracara [USFWS 1987 (July 6, 1987)];
- coastal marine island habitat and the Caribbean roseate tern DPS [USFWS 1987 (November 2, 1987)];
- coastal marine island habitat and Northeast roseate tern DPS [USFWS 1987 (November 2, 1987)];
- "swamps" and the US breeding Wood stork population DPS [USFWS 1984 (February 28, 1984)];
- aquatic habitat and Interior least tern DPS [USFWS 1985 (May 28 1985)];
- coast beaches and mudflats and California least tern DPS [USFWS 1970 (October 13, 1970)];
- coastal marine environment and the eastern DPS of brown pelican [USFWS 1970 (October 13, 1970)];

- coastal and inland marine habitat and California/Caribbean/Western Gulf Coast brown pelican DPS [USFWS 1970 (October 13, 1970)];
- coastal salt marshes by US DPS of light-footed clapper rail [USFWS 1967 (March 11, 1967)];
- "marshes" and Yuma clapper rail in the US [USFWS 1967 (March 11, 1967), 1983 (February 4, 1983)]; and
- lowland swamps and marshes and Florida everglade snail kite DPS [USFWS 1967 (March 11, 1967)].

FWS' new desert nesting bald eagle standard for DPS rejection based on the use of a species' most general and least specific common habitat characteristic has not been similarly employed to reject DPS status for multiple mammal populations. FWS' news DPS standard was not applied for:

- "remote islands and points of land along the Alaska coastline" and Eastern and Western Steller sea lion DPS [USFWS 1990 (November 26, 1990), 1997 (May 5, 1997)];
- ocean habitat by Southern resident killer whale DPS [USFWS 2005 (November 18, 2005), 2006 (April 4, 2007)];
- "marine habitat" or for "nearshore marine environment" and the Southwest Alaska DPS of Northern sea otter [USFWS 2004 (February 11, 2004), 2005 (August 9, 2005)];
- "dense, shrub steppe habitats" or for "semi-arid, shrub steppe region" and Columbia Basin pygmy rabbit DPS [USFWS 2001 (November 30, 2001), 2003 (March 5, 2003)];
- "southern boreal forest" or "boreal forest" and the lower 48 Canada lynx DPS [USFWS 2000 (March 24, 2000), 2003 (July 3, 2003)];
- "marine habitats" by southern sea otter [USFWS 1977 (January 14, 1977), 2003 (February 24, 2003)];
- "peninsular mountain ranges" and for Southern California peninsular ranges and desert bighorn sheep DPS [USFWS 1998 (March 18, 1998)];
- mountainous "rocky terrain" and Sierra Nevada DPS of the California bighorn sheep [UFWS 2000 (January 3, 2000)];
- "fresh and salt water marshes" and the lower Florida Keys DPS of silver rice rat [USFWS 1991 (April 30, 1991)];
- "forest region" and the population of woodland caribou found in Washington, Idaho, and southern British Columbia [USFWS 1983 (January 14, 1983), 1984 (February 29, 1984)];
- "Pacific Ocean coastal habitat and the gray whale eastern DPS [USFWS 1970 (October 13, 1970), 1991 (November 22, 1991)]; and
- "riparian areas" and the Douglas County and Columbia River Columbian white-tailed deer DPS [USFWS 1999 (May 11, 1999)].

FWS' new desert nesting bald eagle standard for DPS rejection based on the use of a species' most general and least specific common habitat characteristic has not been similarly employed to reject DPS status for multiple herp populations. FWS' news DPS standard was not applied for:

- "desert" and the Mojave population of desert tortoise [USFWS 1990 (April 2, 1990)];
- "sandy soils in transitional (forest and grassy) areas" and the western DPS of gopher tortoise [USFWS 1987 (July 7, 1987)];
- "bottom land forests and shrub swamps" and the northern DPS of copperbelly water snake [USFWS 1997 (January 29, 1997)];
- "lower coastal plain" and the Mississippi gopher frog DPS [USFWS 2001 (December 4, 2001)]; and
- "marsh habitat" and the northern bog turtle DPS [USFWS 1997 (November 4, 1997)].

FWS' new desert nesting bald eagle standard for DPS rejection based on the use of a species' most general and least specific common habitat characteristic has not been similarly employed to reject DPS status for multiple fish populations. FWS' new DPS standard was not applied for:

- Oregon coast DPS of Coho salmon (73 FR 07815),
- lower Columbia River DPS of Coho salmon (70 FR 37160),
- southern Oregon and northern California DPS of Coho salmon (62 FR 33038),
- central California DPS of Coho salmon (61 FR 56138),
- California coast DPS of Chinook salmon (64 FR 50393),
- Central Valley spring run DPS of Chinook salmon (64 FR 50393),
- upper Columbia River spring run DPS of Chinook salmon (64 FR 14308),
- upper Willamette River DPS of Chinook salmon (64 FR 14308),
- Puget Sound DPS of Chinook salmon (64 FR 14308),
- lower Columbia River DPS of Chinook salmon (64 FR 14308),
- Snake River spring-summer run DPS of Chinook salmon (57 FR 14653),
- Snake River fall run DPS of Chinook salmon (57 FR 14653),
- Sacramento River winter run DPS of Chinook salmon (54 FR 32085),
- Gulf of Maine DPS of Atlantic salmon (65 FR 69459),
- Hood Canal summer run DPS of Chum salmon (64 FR 14508),
- Columbia River DPS of Chum salmon (64 FR 14508),
- Ozette Lake DPS of Sockeye salmon (64 FR 14528),
- Snake River DPS of Sockeye salmon (56 FR 58619),
- Puget Sound DPS of Steelhead trout (72 FR 26722),
- northern California DPS of Steelhead trout (65 FR 36074),
- middle Columbia River DPS of Steelhead trout (64 FR 41835),
- upper Willamette River winter run DPS of Steelhead trout (64 FR 14517),
- Central Valley DPS of Steelhead trout (63 FR 13347),
- lower Columbia River DPS of Steelhead trout (63 FR 13347),
- upper Columbia River DPS of Steelhead trout (62 FR 43937),
- Snake River DPS of Steelhead trout (62 FR 43937),
- South-Central California coast DPS of Steelhead trout (62 FR 43937),
- southern California DPS of Steelhead trout (62 FR 43937),
- central California DPS of Steelhead trout (62 FR 43937),
- Umpqua River DPS of Coastal cutthroat trout (61 FR 41514),
- southern DPS of North American green sturgeon (71 FR 17757),
- Kootenai River DPS of White sturgeon (59 FR 45989),
- Arkansas River DPS of Arkansas River shiner (63 FR 64772),
- US DPS of Bull trout (63 FR 31647), and

- US DPS of Smalltooth sawfish (66 FR 19414).

FWS' new filter of species' commonality disqualified desert nesting bald eagle from DPS recognition based on "proximity to a variety of aquatic sites." [USFWS (July 7, 2007)] Following FWS' new desert nesting bald eagle "aquatic proximity" test, fish populations such as these listed above no longer qualify for DPS recognition and *Endangered Species Act* protection.

DOES LOSS OF THE DESERT NESTING BALD EAGLE RESULT IN A SIGNIFICANT GAP IN THE RANGE OF BALD EAGLE NATIONWIDE?

FWS' 1978 Memorandum concerning "Nomination for Critical Habitat Determination – Bald Eagle Nesting in Southwestern United States states:

> "The areas delineated contain the only known active nesting territories for bald eagles in an area encompassing all of Oklahoma, Utah, Nevada, New Mexico, Arizona, west Texas, and southern California. In addition, this population occupies a southwest desert habitat not found elsewhere and utilizes nest sites unique to the species in the contiguous United States. This is all that are known to remain of nesting bald eagles in the broad area previously described." [USFWS (September 7, 1978)]

This statement was graphically illustrated in FWS' 1976 "Status of the bald eagle in the U.S. South of Canada" and by Ohmart and Sell (1980) (Fig 2).

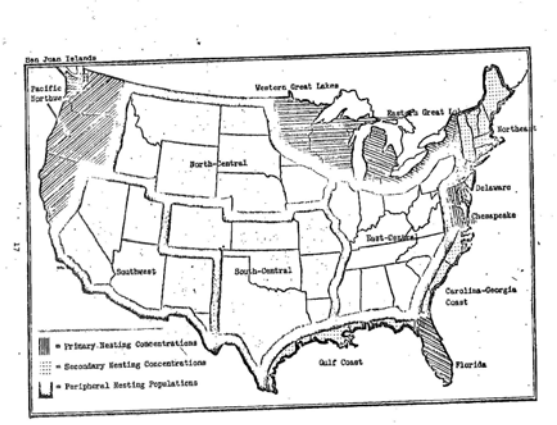


Figure 1.--Bald eagle nesting population reference areas.

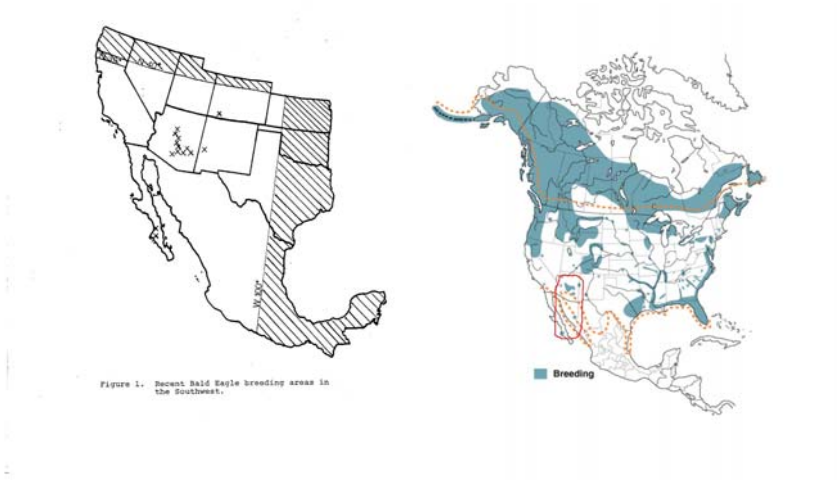
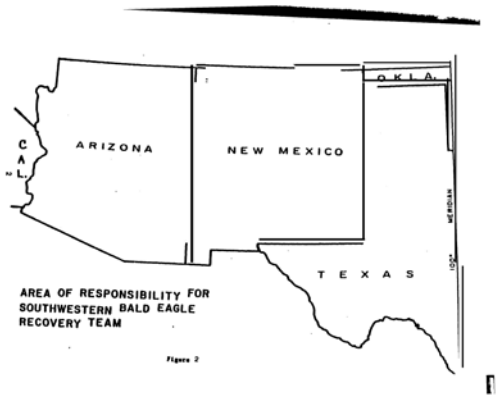


Fig 2. **Top**: bald eagle distribution in the lower 48 United States reproduced from USFWS 1976 (October 1976). **Below left**: the Arizona desert nest bald eagle population shown as an isolated population by Ohmart and Sell (1980). **Below right**: distribution shown by Buehler (2000) in the Birds of North America with the arid southwest desert nesting area highlighted.

Confirmation that the desert nesting bald eagle represents a substantive geographic portion of the range of the bald eagle in the lower 48 states is also found in Hunt *et al.* 1992; AGFD (November 3, 1994); and USFWS (July 12, 1994), (June 2005), (November 7, 2005), (February 21, 2006), (March 24, 2006), (July 18, 2006b), (July 18, 2006c).

The FWS' Southwestern recovery region was set up explicitly to reflect the population's significance, its relationship to the bald eagle nationwide, its behavioral isolation (early nesting as an adaptation to the desert heat; utilization of cliffs or rock pinnacles for nesting) and its geographical isolation. (Horjesi 2006; Ohmart 2006; Witzeman 2006; USFWS 1975, October 1976, 1982; Magill 2006) The Southwestern Region bald eagle recovery region includes Arizona, New Mexico, southeastern California immediately along the Colorado River, and west Texas and west Oklahoma west of the 100th meridian:



FWS' administrative geography, on the other hand, differs significantly from FWS' Southwestern bald eagle recovery region. FWS administrative geography includes the entirety of the States of Arizona, New Mexico, Texas and Oklahoma in its Region 2, Southwest Region:

The Southwestern region bald eagle recovery region does NOT include Oklahoma except for its panhandle and Texas east of the 100th meridian as does FWS Region 2, Southwest administrative region.

DPS analyses of the significance of a portion of the range for other populations similarly listable to the desert nesting bald eagle without FWS administrative "marching orders" are telling. In 2003, for western gray squirrel, FWS stated:

> "Within the distribution of every species there exists a peripheral population, an isolate or subpopulation of a species at the edge of the taxon's range. The population is the basic evolutionary and ecological functional unit. The local population is where responses to environmental challenges occur, where adaptations arise, and where genetic diversity is maintained and reshuffled each generation. A species can continue to exist even though many of its populations are destroyed, resulting in a loss of biodiversity and what may be unique genetic or phenotypic traits. Peripheral populations are often located at a species' ecological limits where unique genetic combinations are exposed to and tested by *environmental circumstances that may not be found elsewhere in the range of the species*. When a peripheral population is isolated from gene flow from other populations, the isolated peripheral population may become highly adapted to local conditions. Distinctive traits found in peripheral populations can be important for the survival and evolution of a species as a whole (Meffe *et al.* 1997)." [USFWS (June 10, 2003)]

Hunt *et al.* (1992) had earlier arrived at an almost identical conclusion for desert nesting bald eagle owing to the population's highly unique environment compared with bald eagle elsewhere and owing to the specific arid desert adaptations important for the survival and evolution of a species as a whole:

> "…The desert environment is truly extreme for the species. Circumstantial evidence suggests that heat stress may impact brood survivorship of some years…, and would no doubt exert powerful selection for genes appropriate to such an environment…" (Hunt *et al.* 1992)

While cursory, macro-genetic analyses have yet to definitively identify the specific genetic areas responsible for arid desert survival adaptation in the desert nesting bald eagle population, much work has been done in other birds, particularly with the lark family (*Alaudidae*). In 2004, Dr. Irene Tieleman reviewed the physiological, behavioral and demographic adaptations of larks along an aridity gradient at the International Symposium on Ecology and Conservation of Steppe-land Birds. Dr. Tieleman concluded:

> "Increasing aridity is correlated with lower levels of basal metabolic rate (BMR) and total evaporative water loss (TEWL) in larks. This pattern cannot be explained by the evolutionary history of larks, or by acclimatization, and is most likely attributable to genetic adaptation." (Tieleman 2004)

Earlier Dr. Tieleman and her colleagues had found:

> "A test of the relationship between BMR and aridity using phylogenetic independent constraints was consistent with our previous analysis: BMR decreased with increasing aridity.."
>
> A combination of low BMR and low TEWL could be favorable in birds from dry hot environments because it reduces food and water requirements and minimizes heat production...
>
> In summary, decreasing levels of BMR and TEWL in larks correlate with increasing aridity. These physiological traits may have adaptive significance in the current environment, and natural selection is a likely process to explain our findings." (Tieleman *et al.* 2002)

FWS has had 26 years to follow up on the suggestive 1992 studies of Hunt *et al.* (1992), Vyse (1992), and Zegers *et al.* (1992). Unique genetic markers correlating to desert nesting bald eagle unique behavioral and environmental adaptations are almost certain to be identified with any modicum of effort.

Free of "marching orders" constraining the desert nesting bald eagle DPS evaluation, FWS and NMFS granted DPS designation in good part on loss of significant portion of the range. Similarities to the relation between the desert nesting bald eagle and bald eagle nationwide are evident:

- On January 29, 1997, FWS concluded that loss of the peripheral isolated population of copperbelly water snake would be significant. [USFWS 1997 (January 29, 1997)]
- On November 4, 1997, FWS concluded that loss of a discrete population of bog turtle could reduce the geographic size of the taxon's range. [USFWS 1997 (November 4, 1997)]
- On May 7, 2001, FWS found that "[l]oss of the population segment of western sage grouse that remains within the Columbia Basin would represent a significant gap in the historic range." [USFWS 2001 (May 7, 2001)]
- On July 25, 2001, FWS found that a gap to be significant in part because the loss of the western yellow-billed cuckoos would reduce the species current range by "more than 20 percent." [USFWS 2001 (July 25, 2001)]
- On July 2, 2002, FWS concluded that the loss of the southern California mountain yellow-legged frogs on the periphery of the species' range would create a significant gap in the range of the taxon that "could have significant conservation implications" because it may be "genetically and morphologically divergent from central populations." [USFWS 2002 (July 2, 2002)]
- On March 5, 2003, FWS concluded that a significant gap in the range of the Columbia Basin pygmy rabbit would be caused by the loss of the northernmost extent of the range. [USFWS 2003 (March 5, 2003)]
- On April 1, 2003, NMFS found a smalltooth sawfish population significant because it occupies the northernmost habitat of the species in the western hemisphere. [NMFS (April 1, 2003)]
- On April 21, 2006, FWS concluded that loss of the Pacific Coast western snowy plover population would constitute loss of a significant portion of its range because interbreeding between Pacific Coast western snowy plovers and interior nesting western snowy plovers is very low and there is no evidence that interior plovers would reestablish a population in the westernmost extent of the taxon's breeding range. [USFWS 2006 (April 21, 2006)]

Even FWS' August 30, 2006 rejection of the Petition to list the desert nesting population as a DPS, FWS admits that

- "should the Sonoran Desert bald eagle population experience a rapid decline, there are few eagles in neighboring southwestern states or Mexico which could serve as a source population for the Sonoran Desert bald eagle population,"

- "the information from Harmata *et al.* (1999, p. 788) and Hunt *et al.* (1992, p. A-144) supports…the probability that adult bald eagle[s] will not immigrate to the Sonoran Desert bald eagle population from surrounding southwestern states or farther," and
- "a decision to release birds into Arizona from elsewhere should be considered only as a last resort, as the introduction of foreign genes into the Sonoran Desert population might disrupt coadapted gene complexes specific to the desert population." [USFWS 2006 (August 30, 2006)]

Nothing in the FWS administrative record supports FWS denial of the arid southwestern desert as a significant portion of the bald eagle range in the lower 48 states. [USFWS (July 12, 1994), (June 2005), (November 7, 2005), (February 21, 2006), (March 24, 2006), (July 18, 2006b), (July 18, 2006c)] On March 5, 2008, the US District Court confirmed this fact:

> "The administrative record demonstrates that FWS scientists found on multiple occasions that 'the [Desert eagle] persists in ecological setting unusual/unique for the taxon,' and the 'loss [of Desert eagles] would . . . result in a significant gap in the range of the species.'" PSOF ¶¶ 26, 27 [CBD 2008]; AR 311-13 [USFWS 2006 (March 24, 2006)], 1976-78 [USFWS 2006 (July 18, 2006a)]. (US District Court 2008)

DOES THE DESERT NESTING BALD EAGLE DIFFER MARKEDLY FROM OTHER POPULATIONS OF THE SPECIES IN ITS GENETIC CHARACTERISTICS?

Genetic studies on desert nesting bald eagle suggest genetic uniqueness but are not conclusive. (Hunt *et al.* 1992, Silver *et al.* 1992, Vyse 1992) FWS agrees. [USFWS (February 21, 2006)]

On November 15, 1984, FWS stated,

> "The premise that this population is reproductively isolated is supported by preliminary electrophoretic analyses of blood samples from eagles in Arizona, Washington, and Alaska…" [USFWS 1984 (November 15, 1984)]

Two genetic studies were commissioned as part of the Hunt *et al.* (1992) review. One study involved the relatively insensitive method of detection of genetically distinct "allozymes" through protein enzyme electrophoresis. (Zegers *et al.* 1992) The other, DNA fingerprinting, is more sensitive. (Vyse 1992)

The allozyme study of Zegers et al. (1992) found:

> "…no significant heterogeneity of allele frequency was detected between the Arizona group and the six other samples (Maryland, Florida, Washington, California, Texas, or Minnesota), or did we find alleles unique to any population." (Zegers *et al.* 1992)

However, Zegers *et al.* (1992) warned,

> We caution against interpreting these results as significant because of the few number of polymorphic loci examined (n=5). Interestingly, however, the Arizona population showed the highest level of genetic heterozygosity among the samples tested…" (Zegers *et al.* 1992)

Hunt *et al.* (1992) also cautioned:

> "…Evolutionary changes involving eggshell morphology, embryonic metabolism, and the adaptations of nestling to heat stress and dehydration might involve a relatively small number of genes. It is very highly unlikely that such genes would be detectable in the broad studies of genetic variation reported in Sections E6 [E.R. Vyse, 'An Analysis of Bald Eagle Population Genetics using DNA Fingerprinting'] and E7 ['(Zegers *et al.*., 'Enzyme Genetics of Bald Eagles in Arizona,'] (neither of which display great numbers of loci)]…"

In the 1992, DNA fingerprinting study, Vyse (1992) found,

> "…we did find that combinations of fragments patterns were, in most cases, useful to correctly classify individuals into proper population when individual similarity values were clustered using UPGMA [algorithm from Sneath and Sokal 1973]…In summary, we found no constant, population-specific markers for bald eagles, but were able to correctly classify individuals into their respective populations a majority of the time. This indicated that our methods do have the ability to classify individuals when used in a multi-variate manner."

Hunt *et al.* (1992) concluded,

> "…[t]he desert environment is truly extreme for the species. Circumstantial evidence suggests that heat stress may impact brood survivorship of some years…, and would no doubt exert powerful selection for genes appropriate to such an environment…"

In the interim 26, years, no further comparative genetics studies have been conducted on desert nesting bald eagle.

The lack of correlation between the degree of environmental adaptation required for survival in a desert environment and our inability to offer concise genetic explanation only serves to highlight our rudimentary level of understanding of bald eagle genetics. Studies of similarly unique adaptability to an arid environment in larks is likely applicable.

The family of larks (*Alaudidae*) also occupies environments ranging from hyper-arid deserts to moist areas. Lark biologists have concluded, "Increasing aridity is correlated with lower levels of basal metabolic rate (BMR) and total evaporative water loss (TEWL) in larks. This pattern cannot be explained by the evolutionary history of larks, or by acclimatization, and is most likely attributable to genetic adaptation." (Tieleman 2004) Extrapolation of these findings to bald eagle is both logical and appropriate.

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As Hunt *et al.* (1992) concluded,

> "…[t]he desert environment is truly extreme for the species. Circumstantial evidence suggests that heat stress may impact brood survivorship of some years…, and would no doubt exert powerful selection for genes appropriate to such an environment…"

DPS Summary

The federal court summarizes the situation with respect to desert nesting bald eagle DPS designation:

> "**I. FACTUAL BACKGROUND**
>
> Desert bald eagles are a discrete population of bald eagles that nest in the Sonoran Desert in central Arizona and northwestern Mexico. Administrative Record ("AR") 3538 [USFWS (August 30, 2006)], 3731 [Silver 2005]. They represent the entire bald eagle population known to breed in the Southwestern United States, and they demonstrate unique behavioral characteristics in contrast to the greater population of bald eagles in the contiguous 48 states. AR 5898-99 [USFWS 1984 (November 15, 1984)]; AR 6408 [USFWS 2003 (January 27, 2003)]. Desert bald eagles inhabit a desert ecological setting, a desert riparian habitat that is drier, warmer, and less vegetated than is typical for the bald eagle species. AR 3539 [USFWS (August 30, 2006)], 3594 [Silver *et al.* 2004]; AR 4142 [Hunt *et al.* 1992]. They breed in upper and lower Sonoran life zones; and they are smaller and lighter than most other bald eagles. AR 3542 [USFWS (August 30, 2006)], 3594 [Silver *et al.* 2004]. Desert bald eagles also possess behavioral distinctions, such as frequent cliff nesting and early season breeding. AR 3541 [USFWS (August 30, 2006)], 3595-96 [Silver *et al.* 2004]; AR 6165 [USFWS 1999 (July 6, 1999)],

6408 [USFWS 2003 (January 27, 2003)]. In addition, Desert bald eagles are reproductively isolated, and perhaps genetically distinct, from other bald eagle populations. AR 3542 [USFWS (August 30, 2006)], 3596-98 [USFWS (August 30, 2006)]; AR 3542 [USFWS (August 30, 2006)]. Indeed, "[b]ecause of the limited distribution and small size of the Southwest bald eagle population, its geographic location and relative isolation, and the unique ecological conditions to which it has adapted, this population is both unique and important." AR 5899 [USFWS 1984 (November 15, 1984)]…"

III. Discussion…D. The FWS's Negative 90-Day Finding Was Arbitrary and Capricious

The Arizona Ecological Services' Phoenix Field Office, Region 2 ("FWS Arizona Field Office"), analyzed Plaintiffs' petition to evaluate its reliability and to determine whether the FWS had data in its files to refute the information in the petition. (DSOF ¶C(2)); AR 308-316. The administrative record demonstrates that FWS scientists found on multiple occasions that "the [Desert eagle] persists in ecological setting unusual/unique for the taxon," and the "loss [of Desert eagles] would . . . result in a significant gap in the range of the species." PSOF ¶¶ 26, 27; AR 311-13, 1976-78. Indeed, the record indicates that each time FWS biologists from the FWS's Arizona Field Office assessed whether listing the Desert bald eagle population as a DPS may be warranted, they found that "no information in [the FWS's] files refutes" Plaintiffs' petition and that the information in the petition "appears to be substantial." PSOF ¶28; AR 162-67, 215-22, 271-77, 308-16, 1976-79, 1990-91." (US District Court 2008)

POPULATION VIABILITY ANALYSIS (PVA)

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Are stochastic population models appropriate and reliable?

PVAs are both appropriate and reliable for the analysis of extinction risk for small populations in danger of extinction. Extinction time distributions from stochastic population models are the best available means to translate the uncertainty and variability in vital rates into a range of population outcomes. (Brook *et al.* 2002)

To date, FWS chooses to ignore the value and validity of a PVA for desert nesting bald eagle. [USFWS 2006 (August 30, 2006)]. In doing so, FWS has failed to utilize the best scientific data available. (Lande 1988; Hiraldo *et al.* 1996; Real and Manosa 1997; Saether *et al.* 2000; Whitfield *et al.* 2004; Katzner *et al.* 2006)

Beissinger and Westphal (1998) and Ellner *et al.* (2002) criticize the low precision of stochastic (involving or containing random variable or variables) population viability models for forecasting extinction risk; however these criticisms apply only to the extent that data are poor and models do not incorporate uncertainty. Brook *et al.* (2002) dismiss the "alternatives" advocated by critics of PVA, noting that correctly applied, PVAs have the advantage of accounting for all sources of uncertainty.

It is common to cite λ (lambda), the deterministic intrinsic rate of population increase as calculated from available life table data. Lambda is equal to 1 for a stable population and below 1 for a declining population. The interpretation of lambda is difficult however, without some measures of precision and uncertainty. Even for lambda of one, high stochastic variance in vital rates can lead to appreciable risk of extinction.

Extinction time distributions from stochastic population models are the best available means to translate life table information along with all associated uncertainties into a range of projected population outcomes.

Estimation of model parameters

Available data on known bald eagle breeding attempts in Arizona since 1970 were compiled from successive reports of the Arizona Game and Fish Department (AGFD) (Appendix 1).

Resighting data on banded eagles (Appendix 3) was used to derive estimates of mortality rates as shown in Appendix 2.

Fecundity and survival parameter estimates were estimated from these data and entered into the Vortex version 9 model (www.vortex9.org) to produce corresponding ranges of extinction time and extinction probability estimates under various scenarios.

Adult numbers

Estimates of bald eagle numbers in Arizona have been steadily increasing since surveys began in 1970s (Fig 3). There are problems of both under-estimation and over estimation of bald eagle numbers.

At least some breeding areas (BAs) first discovered in a particular year could have been present and even occupied in previous years, leading to possible underestimation of earlier population sizes. Evidence supporting this possibility includes:

- Standardized searching routes were established in 1995. These were reviewed and in 2006, 23 routes were dropped and 12 new routes added leading to an immediate increase in eagle sightings and numbers of BAs (Jacobsen et al. 2007, p 3).
- Although numbers of adults at occupied BAs increased significantly with time from 1991-2007 (regression $P<0.001$), total numbers of adults sighted did not (regression $P=0.32$) (Fig. 3), suggesting either that more adults have been breeding in recent years, or that breeding pairs were simply missed in earlier years.
- From 1987-2003 83% of all known fledglings were banded, whereas only 59.6% of breeding adults were found to be banded over the same period. Banded fledglings appeared to be under represented in the adult pool (AGFD unpubl. data). Three hypotheses could explain this discrepancy:
    - First, unbanded nestlings could have suffered lower mortality than banded nestlings. Banding effects on bird mortalities have been recorded before, however most differences are minor and so this is an unlikely explanation.
    - Second, immigration of unbanded eagles could account for the discrepancy. This is also an unlikely explanation as bald eagles in adjacent areas are also banded at high frequencies and yet the only recorded immigration event has been from Texas to the Luna BA which is on the edge of the known DNBE range.
    - Finally, a pool of undiscovered and thus, unbanded nestlings may have been present in earlier surveys. This latter explanation is the most likely of the three and suggests that some BAs may have been missed in earlier years.

Canaca *et al.* (2004) underscored the ephemeral nature of the evidence for a BAs existence by reporting that 18 nests in known BAs had disappeared by 2003.

The first comprehensive survey in 1975 estimated that 90% of potential habitat in Arizona, New Mexico and Colorado River had been surveyed (Rubink and Podborny 1976). This survey found 21 BAs, 18 adults, and 5 fledglings.

Accordingly, 1975 was used as base year for simulations.

In the 2007 survey, 48 of 53 known BAs were occupied or active, the largest number yet recorded. There were 94 or more adults at these BAs and these produced 42 fledglings (Fig. 3; Jacobsen et al. 2007, Table 3).

For some occupied but non-breeding BAs in some years, only one adult was observed. In others no adults were observed since it is sufficient to observe nest rebuilding to score a nest as "occupied." In all such cases the lower estimate of adult number was set to 1. Otherwise for all BAs occupied or breeding the upper estimate of adult number is 2. If adults move between BAs in the same year there is potential for double counting. However, there is no known instance of a positively identified individual appearing at more than one BA in the same year, and so double counting was considered to be a negligible source of uncertainty.

Fig.3 shows the high and low estimates of adult numbers at BAs accounting for this source of uncertainty. The high estimate is simply twice the number of occupied or active BAs since at most two adults would be present at an occupied BA, although only one may have been observed.

The "high" estimates shown in Fig3 are only based on counting two adults at each occupied or active breeding area. Even assuming that surveys for BAs were exhaustive, additional uncertainty in estimating adult numbers comes from the presence of "floaters", non breeding adults undetected by surveys of BAs. These numbers are considerably higher than the number based on sightings at BAs.

Sightings of adults at BAs represented on average 34.1% (17.6-50.2, 95% C.I.) of all adult sightings. This fraction increased slightly over time (regression P=0.07) (Fig 3).

By using adult sightings at BAs to estimate the breeding adult population, and ignoring non-breeding floaters underestimates actual adult numbers. This leads to over-estimation of fecundity, the number of eggs laid per adult female.

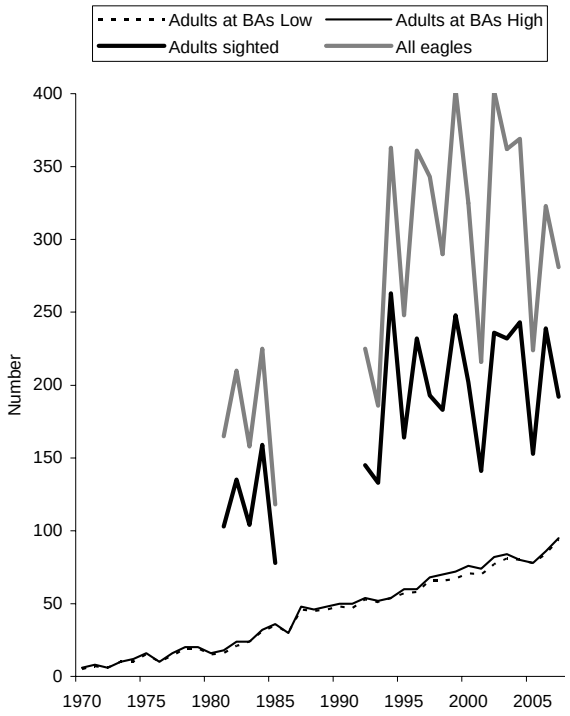

Fig 3. Numbers of bald eagle adults sighted at breeding areas in Arizona upper and lower estimates, and sightings of eagles from all surveys 1970- 2007 (JACOBSEN ET AL. 2007, Table 2).

However, this is compensated by over-estimation of juvenile to adult mortality that results from confining resight effort to breeding areas, so that non-breeding adults outside BAs are not resighted (Appendix 2).

Adult female numbers

The adult female population was simply estimated as the number of occupied BAs, that is those at which some breeding effort was discovered. As discussed above, possible undercounting of BAs in earlier years and the existence of an unobserved adult "floater" population means that this underestimates actual adult female population, and so overestimates fecundity.

Starting population size and carrying capacity

The starting population was chosen as 23 in the base year of 1975 as reported for the entire southwest by Rubink and Podborny (1976). Stable age distributions were used in simulations, since actual distributions were unknown.

Carrying capacity was set arbitrarily to 250. Carrying capacity was only relevant if density-dependent reproduction and mortality were modeled, which they were not. There was no evidence of a decline in proportions of females successfully breeding or numbers of fledglings per female as might be expected with an approach toward carrying capacity.

Sex ratio at birth

There were 72 birds banded as nestlings for which sex was determined by resighting them as adults at BAs. Of these, 46 were males (63%) and 27 females. The eight birds banded as adults were excluded from this estimate since they were not banded as nestlings. The binomial probability of resighting 27 or fewer females given a 50:50 actual sex ratio was P=0.012.

The higher apparent male sex ratio among resighted adults banded as nestlings may be explained in large part from the much higher resighting probability estimated for adult males relative to females in the best fitting model (Appendix 2).

Apparent adult mortality (survival to ages 5+) took just the opposite pattern, significantly higher for males than for females (Appendix 2). Model simulations based on a 50% sex ratio at birth (i.e. fledging) produced highly female biased adult populations as a result of the difference in adult mortalities.

Sex ratios at birth were adjusted to 60% male, so as to produce a 50% adult sex ratio in simulated populations. With this parameter setting, adult females (aged 4 and up) represented 33.44% of the total simulated population. This ratio was used to impute total populations size from the number of adult females in Fig. 1.

Age at first breeding

For purposes of population modeling, we assumed that "births" took place at fledging.

The median observed age at maturity is typically used in Vortex as the parametric age at maturity rather than youngest observed breeding age (4 for females).

A total of 28 females had known ages at first observed fledging. The range of ages was very wide from 4 to 27. The modal age was 6 and the median age 9 (Fig.3).

Many of the older females in this set may nevertheless have fledged young successfully but unobserved in earlier years.

The modal age of 6 rather than median age was used as age of first breeding in simulations, mindful of this source of error.

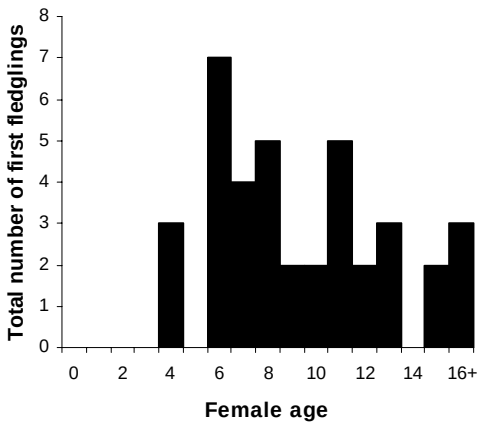

Fig 4. Age specific fecundity as fledglings produced by females in their first successful breeding year.

Fecundity

For the purposes of population modeling, we assumed that "birth" was represented by number of fledglings produced per occupied BA. Numbers of fledglings was generally much better known that numbers of eggs and young.

Two activities were hypothesized to influence breeding success, nestling survival and thus ultimately, fecundity.

- Fish supplementation around the Salt-Verde confluence
- Nestwatch program

Fish supplementation at the Salt-Verde BAs

The lower Verde and Salt River BAs were predicted to have artificially higher productivity as a result of stocking with exotic rainbow trout and release of native fish captured from irrigation canals into this area by the Salt River Project (Canaca et al 2004).

To test this "prey supplementation" hypothesis, we divided BAs into 2 groups, those on the lower Salt River up to Saguaro Lake or lower Verde River up to Bartlett Lake, and those outside this “Salt/Verde” or “SV” cluster.

Nestwatch program

In 1978, Maricopa Audubon Society volunteers began monitoring bald eagles breeding near Bartlett Reservoir to understand the effects of recreation on breeding behavior and success. This effort eventually expanded to other breeding areas, formalizing as the Arizona Bald Eagle Nestwatch Program (ABENWP).

In 1986, the USFWS assumed coordination of the ABENWP on behalf of the Southwestern Bald Eagle Management Committee (SWBEMC), and expanded its scope. In 1991, after passage of the Heritage Initiative, the USFWS transferred the lead to the AGFD (Jacobsen et al. 2007).

Records of which BAs were monitored through Nestwatch were available online from AGFD website.

A BAs was scored as monitored in those years 1993+ that they were shown as monitored from the records. Incidental or casual monitoring was not counted.

Numbers of fledglings per occupied BA in the period 1993-2007 (defined here as “fecundity”) were regressed on year, Salt-Verde cluster (in/out), Nestwatch (in/out) or on BA identity within SVC or outside of it using GLM in Stata 8.

Fecundity was significantly higher in fish-supplemented Salt-Verde cluster BAs than outside (Fig 5) and significantly higher in Nestwatch monitored BAs than in unmonitored BAs (Fig 6).

In addition there remained substantial significant differences among BAs in fecundity after accounting for Nestwatch and fish supplementing effects. There was no significant net effect of time on fecundity (Table 1).

Table 1: Nested analysis of covariance of fledglings per occupied BA for the period 1993-2007 on Year, whether the BA was Nestwatch monitored, whether it was in or out of the Salt-Verde cluster (SVC) and on BA identity generally nested within SVC.

Source	Partial SS	df	MS	F	P
Year	.128257357	1	.128257357	0.21	0.6482
Nestwatch (in/out)	3.20087709	1	3.20087709	5.20	0.0230*
Salt-Verde cluster (in/out)	7.70355807	1	7.70355807	12.52	0.0004***
BAs within SVC	76.7779643	52	1.47649931	2.40	0.0000***
Residual	302.14994	491	.615376659		

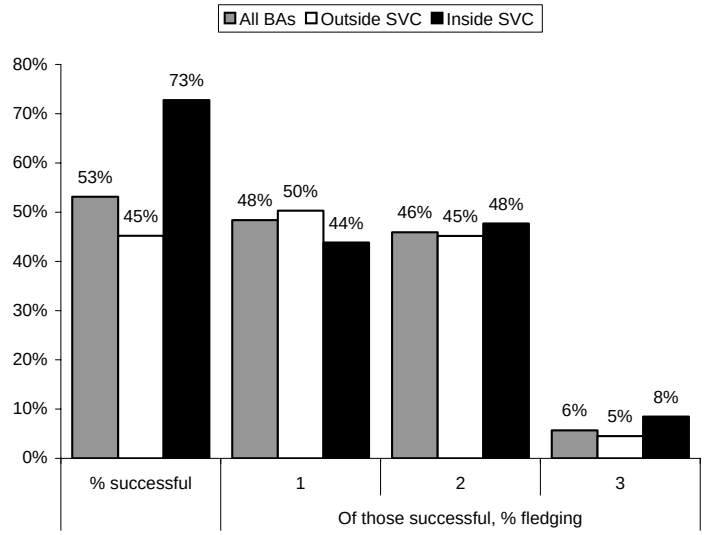

Fig 5. Average annual fecundity distributions for all BAs, BAs in the Salt Verde cluster (SVC) and those outside the cluster for the entire period of study.

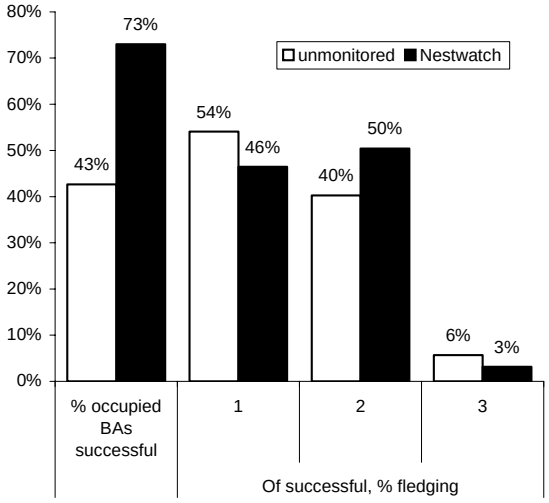

Fig 6. Average annual fecundity distributions for BAs monitored under Nestwatch and unmonitored over the period 1993-1997.

Resightings of banded DNBEs (Appendix 3) were analyzed using the program MARK as shown in Appendix 2. The age/sex specific apparent mortality estimates for the best fitting model are shown in table 4.

These are apparent mortality estimates, and include the probability of death or emigration. True mortality rates can only be reliably determined by band recoveries on dead birds, and recovery effort of carcasses is not sufficient or systematic enough to allow any reliable estimation.

However, it is reasonable to conclude that apparent mortality is close to actual mortality since there have been only three reported resightings of Arizona birds outside of Arizona.

For purposes of modeling the Arizona population, failure to be resighted at a breeding area was considered biologically equivalent to death, since such adults were not breeding. If they left the Arizona population they were no longer in the breeding adult pool of the population.

Even if unsighted birds emigrated, they were not replaced at any significant level by immigrants from other populations. There has only been one confirmed immigrant joining the breeding pool in the 31 years of observation.

Population simulations

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Populations were simulated from 1975 to 2075 using Vortex (www.vortex9.org) using parameters as shown in Table 2.

No catastrophes, changes in carrying capacity or inbreeding depression were included in the simulations. These are all expected to aggravate extinction risk.

Each scenario was simulated 1000 times for 100 years from 1975.

The baseline scenario used a function for juvenile mortality mimicking the patterns from resight data of sharp increase from zero to 38.4% over the period of study (Appendix 2).

Juvenile mortality was assumed to continue unabated at this high level. Fecundity was as observed over the entire period, incorporating all BAs (Fig. 5). Other parameters were as discussed above.

Three key management interventions were also compared with the baseline.

1. Terminating food supplementation. Under this scenario, fecundity in all BAs would decline in 2008 to that observed in BAs outside of the Salt-Verde cluster (Fig 5).
2. Terminating the Nestwatch program. Under this scenario, fecundity in all BAs would decline in 2008 to that observed in BAs when they were not being monitored (Fig 6).
3. Reducing juvenile mortality. Under this scenario, from 2008 onwards unspecified intervention would return juvenile annual mortality to the average estimated for the entire record of 26.6%.

The baseline scenario despite early growth rapidly declined toward extinction due to the observed increase in juvenile mortality. If juvenile mortality continues at this high level, 69.5% of simulated populations go to extinction within the century (Fig 1, Table 2).

Terminating food supplementation simply worsened this scenario, increasing extinction rates to 80.6% of simulated populations (Table 2).

Terminating Nestwatch also worsened this scenario, increasing extinction rates to 75% of simulated populations (Table 2).

If it were possible to return juvenile mortality to that observed on average over the entire record, extinction risk would be greatly reduced to just 3.8% in 100 years (Table 2). However, in the absence of clear understanding as to cause of the apparent rise in juvenile mortality over the period of study, it is difficult to see what action would achieve this result. Certainly, delisting the population will remove the major means of reducing ongoing threats that are implicated in high juvenile mortalities as discussed in the next section.

Table 2. PVA simulation parameters and results

Parameters	Baseline, juvenile mortality remains high	Stop food supplementation of Salt Verde BAs in 2008	End Nestwatch in 2008	Return juvenile mortality to long term average in 2008
Starting year	1975			
Population initial	23			
K	250			
Age females mature	6			
Age males mature	6			
Max. breeding age	30			
Breeding system	Monogamy			
Sex ratio % males at "birth" (fledging)	60%			
% females success (Fig 4)	53.1%	Drop to 45.2% at yr 33	Drop to 43% at yr 33	
EV in % success.	12.5%			
% 1 fledglings	48.4%			
% 2 fledglings	45.9%			
% 3 fledglings	5.7%			
Annual mortality 0->4	increasing from 0 to upper limit of 38.4% over first 25 years			Reduce to 26.6% (overall average) in 2008 and later years
Mortality 4->5	0%			
Annual mortality to ages 5+ (male)	9.5%			
Annual mortality to ages 5+ (female)	5.9%			
RESULTS				
Mean population 2007	51	51	52	50
Median time to extinction	89	83	85	>100
Percent simulations extinct in 2075	69.5%	80.6%	75%	3.8%

ASSESSMENT OF THREATS

The PVA is based on the assumption of indefinite continuation of the same environmental conditions that have prevailed in recent years. The PVA does not consider increasing threats to habitat apart from the observed increase in apparent mortality of juveniles and sub-adults.

Available evidence does not support such a conservative assumption. In particular, the lower estimate of nestling survival outside of the supplemented Salt/Verde cluster BAs was found to decline significantly with time for reasons yet to be determined (Taylor and Silver 2006). The Salt/Verde cluster includes Bartlett, Blue Point, Box Bar, Bulldog, Doka, Fort McDowell, Granite Reef, Needle Rock, Orme, Rock Creek, Rodeo, and Sycamore BAs.

Silver *et al*. (2004) presents substantial information concerning increasing threats to the desert nesting bald eagle, including AGFD 1999 (September 1999), 2000 (October 2000); and USFWS 2001 (April 17, 2001). On April 7, 2007, a review of increasing threats was also presented to the Arizona Game and Fish Commission, with copies to FWS. (Silver 2007)

In Taylor and Silver 2006, we presented an assessment of increasing threats including, decline in habitat extent and quality (including decline of native fish, lack of nest tree recruitment, urban sprawl, proposed and ongoing developments are affecting the Blue Point, Box Bar, Pleasant, Sheep, and Tonto BAs, stream dewatering, global warming, toxic contaminants [organochlorines, mercury], as well as chronic lack of agency resolve and the inadequacy of the original Recovery Plan. Nonetheless, FWS refuses to admit the existence of increasing threats. [USFWS 2006 (August 6, 2006)] The US District Court finds this action "arbitrary and capricious":

> "Desert bald eagles also face a number of external threats such as habitat loss due to human development, loss of riparian trees and snags, recreational disturbance, declining prey base, grazing, water diversions, dams, and mining. AR 3545-46, 3550-53." (US District Court 2008)

In the interim, since filing of the October 6, 2004 Petition (Silver *et al*. 2004), review of the literature, current events documentation and FWS' own files confirm that threats are increasing.

Senescence and non-recruitment of nest trees is an increasing problem. The use of riparian trees and snags is now known to be even more widespread than known in 2004. Silver *et al.* (2004) documented 51% prevalence in the use of riparian trees and snags; however, the total is now known to be 59.5% according to the Arizona Game and Fish Department. [AGFD 2006 (June 16, 2006)] In 2006, AGFD expressed concern for 13 BAs relying solely on riparian trees without the presence of any other nesting substrate. These BAs include Becker, Box Bar, Doka, Fort McDowell, Granite Reef, Needle Rock, Pinto, Rodeo, 76, Sheep, Sycamore, Tonto, and Winkelman. These 13 BAs "have collectively contributed 24% (n=606) of all recorded fledglings from 1971 to 2005…" (Driscoll *et al.* 2006)

Global warming resulting in prolonged drought in the Southwest is an increasing problem. [USFWS 1990 (October 15, 1990); Backlund *et al.* 2008; Borenstein 2008; Karl *et al.* 2008; National Science and Technology Council Committee on the Environment and Natural Resources 2008; Wheeler 2008] Global warming highlights the essential adaptive ability inherent in the desert nesting population. (Hunt *et al.* 1992, Silver *et al.* 2004)

Some threats are increasing as the result of result of urban development and growing human population in the greater Prescott and greater Phoenix area. (Dodder Nellans 2008) Prescott and Prescott Valley continues to move forward with its plan to import water from the Big Chino Valley:

> "Prescott and Prescott Valley plan to begin construction by about 2007 and have the pipeline complete by 2009." (Barks 2006)

Prescott's and Prescott Valley's plan will dewater the upper Verde River and destroy the heart of desert nesting bald eagle habitat in Arizona. (Wirt and Langenheim 2005, Driscoll *et al.* 2006) The U.S. Geological Survey

estimates that approximately 80 to 86 percent of the Upper Verde River's base flow (the stream flow during the driest time of the year) comes from the Big Chino aquifer. (Wirt and Langenheim 2005)

Prescott's dewatering of the upper Verde River will definitely harm at least six nests, Perkinsville, Tower, Oak Creek, Beaver, Ladders, and Coldwater. It "may affect" three others, East Verde Horseshoe and Table Mountain. (Driscoll *et al.* 2006)

Review of FWS' files reveal documents expressing a conclusion that contrasts with FWS' August 6, 2006, denial of the existence of increasing threats to the desert nesting bald eagle and its habitat [USFWS 2006 (August 6, 2006)]. [USFWS 2001 (April 17, 2001), 2002 (June 11, 2002), 2002 (August 30, 2002), 2002 (December 2002), 2003 (January 27, 2003), 2004 (March 1, 2004), 2004 (March 8, 2004), 2004 (April 27, 2004), 2004 (September 3, 2004), 2005 (November 2, 2005), 2006 (May 3, 2006), 2006 (June 17, 2006), 2006 (June 27, 2006), 2006 (September 26, 2006), 2008 (April 1, 2008)]

Table 3. Comparison of FWS assessment of threats and assessment of threats based on Arizona specific data.

Threat	FWS (1999) assessment of threat	Assessment of threat status in DNBE range (this paper)
The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range	"no indications that availability of these habitats will limit the bald eagle population in the near future." (64 FR 36458)	Development continues to destroy DNBE habitat. Native fish species endangered and in decline. Nest tree recruitment faces >100 year gap. (see text for more details)
Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes	"no legal commercial or recreational use of bald eagles" (64 FR 36458)	International trade in bald eagle products has been permitted once again by the successful US bid to down list bald eagles to Appendix II of the Convention on International Trade in Endangered Species or CITES at the 2004 Conference of Parties. Excessive incidental death due to low level flights, ORVs, human presence, toxicants, electrocution, roadkills, fishing tackle entanglement, continues.
Disease and Predation	" not considered to be a significant threat" (64 FR 36458)	Mortalities are aberrantly high particularly for nestlings and juveniles. No information is available to determine the role of disease in these elevated mortalities.
The Inadequacy of Existing Regulatory Mechanisms	Bald and Golden Eagle Protection Act prohibits take. Migratory Bird Treat Act also prohibits take. Lacey Act bans commerce.	Bald and Golden Eagle Protection Act, Migratory Bird Act, Lacey Act have no provisions for habitat protection.
	Clean Water Act prevents pollution of waterways	Clean Water Act does not prevent physical destruction of habitat or dewatering of streams.
	Federal Insecticide Act regulates pesticides	Federal Insecticide Act does not require cleanup of existing contamination.
	National Environmental Policy Act (NEPA) requires agencies to document environmental impacts of federal	NEPA requires disclosure of impacts, not the avoidance of environmental harm.
	projects. CITES prohibits international trade (64 FR 36459)	Down listing to CITES App II now reopens potential for commercial trade.
	FWS proposes a Conservation Agreement to substitute for ESA protection	Draft Conservation Agreement is legally non-binding "Nothing in this MOA shall obligate the cooperators to expend appropriations or to enter into any contract or other obligations" (AGFD 1999).

Table 3 (cont'd).

Threat	FWS (1999) assessment of threat	Assessment of threat status in DNBE range (this paper)
Other Natural or Manmade Factors Affecting Its Continued Existence: Disturbance	"Human disturbance of bald eagles is a continuing threat which may increase as numbers of bald eagles increase and human development continues to expand into the rural areas." (64 FR 36461)	Intensified developments around BAs include: -river-tubing (*Blue Point* BA). -360-unit housing subdivision and golf course (*Box Bar* BA). -lakeside resort development (*L. Pleasant* BA) Disturbance from shooting and recreation such as ORVs close to nests and non-compliance with BA closures is increasing (from 5 to 12% in 1997 at *L. Pleasant* BA) (AGFD 1999). AGFD has an overflight advisory for the Verde and Salt drainages but "most pilots disregard the advisory" (AGFD 1999). Air Force expansion of training routes in Arizona was predicted to result cumulatively, over a 50 year period in the loss of 450 eagles or eggs and 900 disturbances. (USFWS 1994).
	FWS recognizes risk of loss Nestwatch program with delisting but proposes continuation of support under Conservation Agreement.	The Nestwatch program as shown above has a significant positive effect on nest success. Delisting will end mandatory federal funding for Nestwatch and increase extinction risk.
Other Natural or Manmade Factors Affecting Its Continued Existence: Harmful chemicals	Since ban, DDT in fish has declined. Lead in birdshot banned in 1991 (64 FR 36460)	DDE and Mercury still found in DNBE eggs in toxic levels. Eggshell thinning has increased in recent decades (see text for details).
Other Natural or Manmade Factors Affecting Its Continued Existence: Entanglement in fishing tackle	Since 1980s, 52 instances of threat by tackle (FWS 1999).	From 1986 to 1999, 62 instances at 19 BAs of fishing line and/or tackle in nests or entangling individuals. Two nestlings deaths caused by fishing entanglement. This threat is bound to increase with increased population and urban sprawl (AGFD 1999)

CONCLUSIONS

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Until, August 30, 2006, for more than three decades, the US Fish and Wildlife Service recognized desert nesting bald eagle persistence in an ecological setting unique for the species; specifically, arid southwestern desert habitat. On July 9, 2007, FWS removed Endangered Species Act listing protection ("delisting") from the bald eagle nationwide, including the desert nesting population. The delisting of the desert nesting population focused on FWS' new opinion of the alleged non-uniqueness of nesting in an arid setting and consequent inability of to qualify as a distinct population segment meriting continued listing and protection.

Subsequently, documents secured by the Center for Biological Diversity via the *Freedom of Information Act* established that FWS based its rejection of DPS status and its new opinion on non-uniqueness on the "marching orders" of senior FWS administrators.

Review of FWS records show that FWS' novel treatment of the desert nesting bald eagle is not consistent with years of analogous DPS evaluations. As the Court finds,

> "Indeed, '[b]ecause of the limited distribution and small size of the Southwest bald eagle population, its geographic location and relative isolation, and the unique ecological conditions to which it has adapted, this population is both unique and important.'" (US District Court 2008)

Although the desert nesting bald eagle population has grown since the beginning of surveys in the 1970s, the true scale of population growth remains uncertain due to possible undercounting of breeding areas in previous surveys. Despite population increases since 1970, available fecundity and survival estimates indicate that the population is likely to decline toward extinction in the near future.

Population simulations indicate a critical need for more accurate assessment of juvenile survival, as populations could decline to extinction rapidly if juvenile mortality remains at the levels estimated over the last decade from resighting records. Populations would be stable if juvenile mortality could be returned to the lower mortalities estimated over the entire record of resightings.

The desert nesting bald eagle population remains very small and vulnerable to extinction risk from stochastic environmental fluctuations alone or in combination with directional environmental changes from habitat degradation and global warming.

Prey supplementation by fish releases in the lower Salt and Verde rivers is clearly linked to increased fecundity and nestling survival for BAs in that "cluster." Consequently, the population may appear to be recovering under "natural" conditions, when in fact any observed recovery may be resulting in part from an artificial abundance of prey, coupled with constant human intervention in the form of the Nestwatch Program. Simulations using the significantly lower fecundity estimates of non-supplemented or unmonitored BAs show faster declines to extinctions.

Prevailing habitat conditions and threats do not appear to be conducive to population persistence in the absence of such interventions. A review of threats suggests that the FWS delisting justification was even more inappropriate. The desert nesting bald eagle remains critically endangered by fishing line, low level aircraft flight harassment and other forms of human disturbance, decline of native fish prey base, decline of suitable nesting substrate as mature riparian forests lack replacement, dewatering of streams, global warming and habitat loss.

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We find that:

(1) the desert nesting bald eagle qualifies for designation as a Distinct Population Segment under the Endangered Species Act,

(2) that current life table data, independent of increasing threats to habitat, suggests that the desert nesting bald eagle population faces an appreciable risk of extinction in the near future, and.

(3) that this population will need increased protection, including *Endangered Species Act* protection, in order to survive.

APPENDIX 1: BA MONITORING RECORDS

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
1970	Bartlett	1	0	S			3	1	1	1	
1970	Fort McDowell	1	0	S			2+	2	2	2	
1970	Ladders	0	0	O			0			0	
1971	Bartlett	1	0	S			3	1	1	1	
1971	Blue Point	1	0	S			2+	2	2	2	
1971	Fort McDowell	1	0	S			1+	1	1	1	
1971	Ladders	0	0	O			0			0	
1972	Bartlett	1	0	F			1+	0	2	0	
1972	Blue Point	1	0	F			2+	2	2	0	
1972	Fort McDowell	1	0	U						U	
1972	Ladders	0	0	F			1+	0	0	0	
1973	Bartlett	1	0	S			2+	2	2	2	
1973	Blue Point	1	0	U						U	
1973	Cibecue	0	0	S			1+	1	1	1	
1973	East Verde	0	0	S			2+	2	2	2	
1973	Fort McDowell	1	0	S			1+	1	1	1	
1973	Ladders	0	0	S			1+	1	2	1	
1974	Bartlett	1	0	F			1+	0	2	0	
1974	Blue Point	1	0	U						U	
1974	East Verde	0	0	S			3	3	3	3	
1974	Fort McDowell	1	0	S			1+	1	1	1	
1974	Ladders	0	0	U						U	
1974	Mule Hoof	0	0	S			2+	2	2	2	
1974	Redmond	0	0	O			0			0	
1974	Seventy-six	0	0	O			0			0	
1975	Bartlett	1	0	S			1+	1	1	1	
1975	Blue Point	1	0	U						U	
1975	Cibecue	0	0	S			1+	1	1	1	
1975	East Verde	0	0	S			1+	1	1	1	
1975	Fort McDowell	1	0	S			2+	2	2	2	
1975	Horseshoe	0	0	F			2	0	0	0	
1975	Ladders	0	0	U						U	
1975	Mule Hoof	0	0	F			1+	0	0	0	
1975	Redmond	0	0	F			1+	1	1	0	
1975	Seventy-six	0	0	O			0			0	
1976	Bartlett	1	0	F			1+	0	0	0	
1976	Blue Point	1	0	U						U	
1976	Cibecue	0	0	U						U	
1976	East Verde	0	0	S			2+	2	2	2	

[1] Salt Verde cluster?

[2] Nestwatch for this BA in this year?

[3] U- unoccupied, O-occupied, evidence of a nesting attempt, F- failed, laid eggs but not fledglings, S- produced fledglings

[4] X means unknown, U means unbanded

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
1976	Fort McDowell	1	0	S			2+	1	1	1	
1976	Horseshoe	0	0	S			2+	2	2	2	
1976	Ladders	0	0	U						U	
1976	Mule Hoof	0	0	U						U	
1976	Redmond	0	0	S			2+	2	2	2	
1977	Bartlett	1	0	S			2+	2	2	2	
1977	Blue Point	1	0	U						U	
1977	Cibecue	0	0	F			1+	1	1	0	
1977	Devil's Post	0	0	O			0			0	
1977	East Verde	0	0	S			2+	2	2	2	
1977	Fort McDowell	1	0	S			2+	2	2	2	
1977	Horseshoe	0	0	F			2	0	0	0	
1977	Ladders	0	0	F			1	0	0	0	
1977	Mule Hoof	0	0	U						U	
1977	Redmond	0	0	O			0			0	
1978	Bartlett	1	0	S			2+	2	2	1	
1978	Blue Point	1	0	U						U	
1978	Cedar Basin	0	0	S			2+	2	2	2	
1978	Cibecue	0	0	S			3	3	3	2	
1978	East Verde	0	0	F			2	0	0	0	
1978	Fort McDowell	1	0	S			2+	2	2	2	
1978	Horseshoe	0	0	F			2	0	0	0	
1978	Ladders	0	0	O			0			0	
1978	Mule Hoof	0	0	F			1+	0	0	0	
1978	Pinal	0	0	S			1+	1	2	1	
1978	Redmond	0	0	S			2+	2	2	1	
1979	Bartlett	1	0	S			1+	1	1	1	
1979	Blue Point	1	0	O			0			0	
1979	Cedar Basin	0	0	F			1+	0	0	0	
1979	Cibecue	0	0	F			1+	0	0	0	
1979	East Verde	0	0	U						U	
1979	Fort McDowell	1	0	S			2+	2	2	2	
1979	Horseshoe	0	0	F			1+	0	0	0	
1979	Ladders	0	0	F			1+	0	0	0	
1979	Mule Hoof	0	0	F			1+	0	0	0	
1979	Pinal	0	0	S			2+	2	2	2	
1979	Pleasant	0	0	U						U	
1979	Redmond	0	0	S			2+	2	2	1	
1980	Blue Point	1	0	O			0			0	
1980	Cedar Basin	0	0	U						U	
1980	Cibecue	0	0	F			3	3	3	0	
1980	East Verde	0	0	S			2+	2	2	2	
1980	Fort McDowell	1	0	F			1+	0	0	0	
1980	Horseshoe	0	0	F			2	0	0	0	
1980	Ladders	0	0	S			2+	2	2	2	
1980	Mule Hoof	0	0	U						U	
1980	Pinal	0	0	F			2+	0	0	0	
1980	Pleasant	0	0	U						U	
1980	Redmond	0	0	F			1+	0	0	0	
1981	Blue Point	1	0	S			3+	3	3	3	
1981	Cedar Basin	0	0	O			0			0	
1981	Cibecue	0	0	U						U	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
1981	East Verde	0	0	S			2+	2	2	2	
1981	Fort McDowell	1	0	S			2+	2	2	2	
1981	Horseshoe	0	0	O			0			0	
1981	Ladders	0	0	S			2+	2	2	2	
1981	Mule Hoof	0	0	U						U	
1981	Pinal	0	0	S			2+	2	2	1	
1981	Pleasant	0	0	U						U	
1981	Redmond	0	0	S			2+	2	2	2	
1981	Seventy-six	0	0	S			2+	2	2	2	
1982	Blue Point	1	0	S			3+	3	3	3	
1982	Cedar Basin	0	0	O			0			0	
1982	Cibecue	0	0	S			1+	1	1	1	
1982	East Verde	0	0	S			2+	2	2	2	
1982	Fort McDowell	1	0	S			2+	2	2	2	
1982	Horseshoe	0	0	S			2+	2	2	2	
1982	Ladders	0	0	F			2	0	0	0	
1982	Mule Hoof	0	0	O			0			0	
1982	Pinal	0	0	F			1+	1	1	0	
1982	Pleasant	0	0	U						U	
1982	Redmond	0	0	S			2+	2	2	2	
1982	Seventy-six	0	0	S			1+	1	1	1	
1982	Sheep	0	0	O			0			0	
1983	Blue Point	1	0	S			3	3	3	3	
1983	Cedar Basin	0	0	F			1+	0	0	0	
1983	Cibecue	0	0	F			2+	0	0	0	
1983	East Verde	0	0	F			1+	1	1	0	
1983	Fort McDowell	1	0	S			3	3	3	3	
1983	Horse Mesa	0	0	F			1+	0	0	0	
1983	Horseshoe	0	0	S			1+	1	1	1	
1983	Ladders	0	0	S			2+	2	2	2	
1983	Mule Hoof	0	0	U						U	
1983	Pinal	0	0	S			1+	1	1	1	
1983	Pleasant	0	0	U						U	
1983	Redmond	0	0	S			2+	2	2	2	
1983	Seventy-six	0	0	S			2+	2	2	1	
1983	Sheep	0	0	F			2+	0	0	0	
1984	Ash	0	0	S			2+	1	1	1	
1984	Blue Point	1	0	S			2	2	2	2	
1984	Cedar Basin	0	0	F			1+	0	0	0	
1984	Cibecue	0	0	S			3	3	3	3	
1984	Cliff	0	0	F			2	2	2	0	
1984	East Verde	0	0	S			1+	1	1	1	
1984	Fort McDowell	1	0	S			3	3	3	3	
1984	Horse Mesa	0	0	F			2+	0	0	0	
1984	Horseshoe	0	0	S			2+	2	2	2	
1984	Ladders	0	0	F			1+	0	0	0	
1984	Lone Pine	0	0	F	X	X	2	0	0	0	
1984	Mule Hoof	0	0	U						U	
1984	Pinal	0	0	S			1+	1	1	1	
1984	Pleasant	0	0	F			1+	0	0	0	
1984	Redmond	0	0	F			2+	2	2	0	
1984	Seventy-six	0	0	S			2+	2	2	2	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
1984	Sheep	0	0	O			0			0	
1985	Ash	0	0	S			2+	2	2	2	
1985	Blue Point	1	0	S			2	2	2	1	
1985	Cedar Basin	0	0	F			1+	0	0	0	
1985	Chino	0	0	S			2+	2	2	2	
1985	Cibecue	0	0	S			2+	2	2	1	
1985	Cliff	0	0	S			2	2	2	2	
1985	Coolidge	0	0	F			2	0	0	0	
1985	East Verde	0	0	S			2	2	2	2	
1985	Fort McDowell	1	0	S			3	3	3	3	
1985	Horse Mesa	0	0	F			1+	0	0	0	
1985	Horseshoe	0	0	S			2+	2	2	2	
1985	Ladders	0	0	S			2+	2	2	2	
1985	Lone Pine	0	0	F	X	X	1+	0	0	0	
1985	Mule Hoof	0	0	U						U	
1985	Pinal	0	0	S			1+	1	1	1	
1985	Pleasant	0	0	F			1+	0	0	0	
1985	Redmond	0	0	S			2	2	2	2	
1985	Seventy-six	0	0	S			1+	1	1	1	
1985	Sheep	0	0	O			0			0	
1986	Ash	0	0	U						U	
1986	Blue Point	1	0	U						U	
1986	Cedar Basin	0	0	F			1+	0	0	0	
1986	Chino	0	0	F			1	0	0	0	
1986	Cibecue	0	0	S			2+	2	2	1	
1986	Cliff	0	0	F			1+	0	0	0	
1986	Coolidge	0	0	S			2+	1	1	1	
1986	East Verde	0	0	S			2+	2	2	2	
1986	Fort McDowell	1	0	S			2+	2	2	2	
1986	Horse Mesa	0	0	S			3	2	2	2	
1986	Horseshoe	0	0	S			2+	2	2	2	
1986	Ladders	0	0	S			2+	2	2	2	
1986	Lone Pine	0	0	S	X	X	1+	1	1	1	
1986	Mule Hoof	0	0	U						U	
1986	Orme	1	0	S			UNK	1	3	1	
1986	Pinal	0	0	U						U	
1986	Pleasant	0	0	U						U	
1986	Redmond	0	0	S			1+	1	1	1	
1986	Seventy-six	0	0	S			1+	1	1	1	
1986	Sheep	0	0	F			2+	2	2	0	
1987	Alamo	0	0	O	X	FWS	0			0	
1987	Ash	0	0	U						U	
1987	Bartlett	1	0	O	U	X	0			0	
1987	Blue Point	1	0	S	1983-04M	X	3+	3	3	3	
1987	Canyon	0	0	S			1+	1	2	1	
1987	Cedar Basin	0	0	F			3	0	0	0	
1987	Chino	0	0	F			2+	0	0	0	
1987	Cibecue	0	0	F	X	X	1+	1	1	0	
1987	Cliff	0	0	O	1984-11M	FWS	0			0	M ID INFERRED
1987	Coolidge	0	0	S	X	X	2+	2	2	2	
1987	Devil's Post	0	0	O			0			0	
1987	East Verde	0	0	S	1987-14M	LF01	2	1	1	1	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
1987	Fort McDowell	1	0	S	X	X	1+	1	1	1	
1987	Horse Mesa	0	0	S	X	U	2+	2	2	2	
1987	Horseshoe	0	0	S	X	1987-17F	3	3	3	3	
1987	Ive's Wash	0	0	S	X	X	1+	1	2	1	
1987	Ladders	0	0	F	X	X	2+	2	2	0	
1987	Lone Pine	0	0	F	X	X	1+	0	0	0	
1987	Mule Hoof	0	0	U						U	
1987	Orme	1	0	S	X	X	2+	2	2	2	
1987	Pinal	0	0	S	FWS	1987-25F	2+	2	2	2	
1987	Pleasant	0	0	O	X1	X1	0			0	
1987	Redmond	0	0	S	X	X	3+	2	2	2	
1987	Seventy-six	0	0	F	X	X	3	0	0	0	
1987	Sheep	0	0	F	X	FWS	1+	0	0	0	
1987	Table Mountain	0	0	O	X	X	0			0	
1988	Alamo	0	0	S	X	U	1+	1	1	1	
1988	Ash	0	0	U						U	
1988	Bartlett	1	0	S	1988-03M	CF01	UNK	2	3	2	
1988	Blue Point	1	0	S	1983-04M	DF02	3+	3	3	3	
1988	Canyon	0	0	S			1+	1	1	1	
1988	Cedar Basin	0	0	F			2	0	0	0	
1988	Chino	0	0	U						U	
1988	Cibecue	0	0	O	1988-10M	U	0			0	
1988	Cliff	0	0	S	1984-11M	FWS	2+	2	2	2	
1988	Coolidge	0	0	S	X	X	2+	2	2	2	
1988	Devil's Post	0	0	O			0			0	
1988	East Verde	0	0	S	1987-14M	X	2+	2	2	2	
1988	Fort McDowell	1	0	F	X	FWS	2+	0	0	0	
1988	Horse Mesa	0	0	S	U	U	1+	1	1	1	
1988	Horseshoe	0	0	S	1988-17M	1987-17F	1+	1	1	1	
1988	Ive's Wash	0	0	S	19U--ADN	X	1+	1	1	1	
1988	Ladders	0	0	S	X	1988-19F	2+	2	2	2	
1988	Lone Pine	0	0	S	X	X	2+	2	2	2	
1988	Mule Hoof	0	0	U						U	
1988	Orme	1	0	S	19U--ADN	X	1+	1	1	1	
1988	Pinal	0	0	F	FWS	1987-25F	2	1	1	0	
1988	Pinto	0	0	O	FWS	1987-26F	0			0	
1988	Pleasant	0	0	U						U	
1988	Redmond	0	0	S	1988-28M	X	2+	2	2	1	
1988	Seventy-six	0	0	S	FWS	X	2+	2	2	2	
1988	Sheep	0	0	F	FWS-NAD	FWS	2+	0	0	0	
1988	Table Mountain	0	0	F	X	X	1+	0	0	0	
1989	Alamo	0	0	S	X	FWS	2+	1	1	1	
1989	Ash	0	0	U						U	
1989	Blue Point	1	0	F	1983-04M	U	2+	0	0	0	
1989	Canyon	0	0	S			1+	1	1	1	
1989	Cedar Basin	0	0	F			1+	0	0	0	
1989	Chino	0	0	U						U	
1989	Cibecue	0	0	S	U	U	2+	2	2	1	
1989	Cliff	0	0	F	1984-11M	FWS	3+	1	1	0	
1989	Coolidge	0	0	O	X	X	0			0	
1989	Devil's Post	0	0	O			0			0	
1989	East Verde	0	0	S	1987-14M	X	2+	2	2	2	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
1989	Fort McDowell	1	0	S	X	FWS	2+	2	2	2	
1989	Horse Mesa	0	0	F	U	U	1+	0	0	0	
1989	Horseshoe	0	0	F	1988-17M	1987-17F	2+	1	1	0	
1989	Ive's Wash	0	0	S	U	X	2+	2	2	1	
1989	Ladders	0	0	S	1989-19M	1988-19F	2+	2	2	2	
1989	Lone Pine	0	0	O	X	X	0			0	
1989	Mule Hoof	0	0	U						U	
1989	Orme	1	0	O	U	U-NAD	0			0	
1989	Perkinsville	0	0	O	19U--ADN	FWS-NAD	0			0	
1989	Pinal	0	0	S	FWS	1987-25F	2+	2	2	1	
1989	Pinto	0	0	F	FWS	1987-26F	1+	0	0	0	
1989	Pleasant	0	0	O	X1	X1	0			0	
1989	Redmond	0	0	F	1988-28M	X	2	2	2	0	
1989	Seventy-six	0	0	O	FWS	X	0			0	
1989	Sheep	0	0	O	X	FWS	0			0	
1989	Table Mountain	0	0	F	X	X	1+	0	0	0	
1990	Alamo	0	0	S	FWS	FWS	2+	2	2	2	
1990	Ash	0	0	U						U	
1990	Blue Point	1	0	O	1983-04M	U-SAD	0			0	
1990	Canyon	0	0	S			2+	2	2	2	
1990	Cedar Basin	0	0	F			1+	0	2	0	
1990	Chino	0	0	U						U	
1990	Cibecue	0	0	F	U	U-NAD	1+	1	2	0	
1990	Cliff	0	0	O	1984-11M	FWS	0			0	
1990	Coolidge	0	0	O	U	U	0			0	
1990	Devil's Post	0	0	O			0			0	
1990	East Verde	0	0	F	X	U	1+	0	2	0	
1990	Fort McDowell	1	0	F	U	FWS	1+	0	0	0	
1990	Horse Mesa	0	0	S	U	U	2+	2	2	2	
1990	Horseshoe	0	0	S	1988-17M	1987-17F	2+	2	2	2	
1990	Ive's Wash	0	0	F	U	U	1+	0	0	0	
1990	Ladders	0	0	F	1990-19M	1988-19F	2	0	0	0	
1990	Lone Pine	0	0	F	X	X	1+	0	2	0	
1990	Mule Hoof	0	0	O			0			0	
1990	Orme	1	0	S	U	U	2	1	1	1	
1990	Perkinsville	0	0	O	X	FWS	0			0	
1990	Pinal	0	0	S	FWS	1987-25F	2+	2	2	2	
1990	Pinto	0	0	O	FWS	1987-26F	0			0	
1990	Pleasant	0	0	O	19U--ADN	FWS	0			0	
1990	Redmond	0	0	S	1988-28M	U	1+	1	1	1	
1990	Seventy-six	0	0	S	FWS	U	1+	1	1	1	
1990	Sheep	0	0	O	X	X	0			0	
1990	Table Mountain	0	0	S	U	U	1+	1	2	1	
1991	Alamo	0	0	S	FWS	FWS	2+	2	2	2	
1991	Ash	0	0	U						U	
1991	Bartlett	1	0	F	1988-03M	U	2+	1	1	0	
1991	Blue Point	1	0	S	1983-04M	FWS	2+	2	2	2	
1991	Canyon	0	0	F			1+	0	2	0	
1991	Cedar Basin	0	0	O			0			0	
1991	Chino	0	0	U						U	
1991	Cibecue	0	0	S	FWS	U	2+	2	2	2	
1991	Cliff	0	0	O	1984-11M	FWS	0			0	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
1991	Coolidge	0	0	S	U	U	1+	1	1	1	
1991	Devil's Post	0	0	O			0			0	no mention 91 report
1991	East Verde	0	0	F	X	U	1+	0	2	0	
1991	Fort McDowell	1	0	S	U	FWS	2	1	1	1	
1991	Horse Mesa	0	0	S	U	U	3+	3	3	3	
1991	Horseshoe	0	0	F	U	1987-17F	3+	2	2	0	2 clutches
1991	Ive's Wash	0	0	S	U	U	2+	2	2	2	
1991	Ladders	0	0	S	U	1988-19F	2	2	2	2	
1991	Lone Pine	0	0	S	X	X	1+	1	1	1	
1991	Mule Hoof	0	0	O			0			0	
1991	Orme	1	0	S	U	U	1+	1	1	1	
1991	Perkinsville	0	0	O	X	FWS	0			0	
1991	Pinal	0	0	S	FWS	1987-25F	1+	1	1	1	
1991	Pinto	0	0	F	FWS	1987-26F	2	0	2	0	
1991	Pleasant	0	0	O	1987-04J	U	0			0	
1991	Redmond	0	0	F	1988-28M	U	2	2	2	0	
1991	Seventy-six	0	0	S	FWS	U	1+	1	1	1	
1991	Sheep	0	0	U						U	
1991	Table Mountain	0	0	S	U	U	1	1	1	1	
1992	Alamo	0	0	S	FWS	FWS	2+	2	2	2	
1992	Ash	0	0	U						U	
1992	Bartlett	1	0	S	U	U	1+	1	1	1	
1992	Blue Point	1	0	S	1983-04M	FWS	2+	2	2	2	
1992	Camp Verde	0	0	F	U	U	2	0	2	0	
1992	Canyon	0	0	S			1+	1	1	1	
1992	Cedar Basin	0	0	F			2	0	2	0	
1992	Chino	0	0	U						U	
1992	Cibecue	0	0	F	FWS	U	1+	1	2	0	
1992	Cliff	0	0	F	1984-11M	FWS	1+	0	2	0	
1992	Coolidge	0	0	S	U	U	1+	1	2	1	
1992	Devil's Post	0	0	U						U	GF says no nest reworking or adults but scored as O
1992	East Verde	0	0	S	U	U	2+	2	2	1	
1992	Fort McDowell	1	0	F	U	U	2	1	2	0	
1992	Horse Mesa	0	0	F	U	U	1+	0	2	0	
1992	Horseshoe	0	0	F	U	1987-17F	1+	0	2	0	F ID INF.
1992	Ive's Wash	0	0	S	U	U	2+	2	2	2	
1992	Ladders	0	0	S	U	1988-19F	2+	2	2	2	
1992	Lone Pine	0	0	F	X	X	1+	0	2	0	
1992	Mule Hoof	0	0	O			0			0	
1992	Orme	1	0	S	U	U	2	2	2	1	
1992	Perkinsville	0	0	O	U	FWS	0			0	
1992	Pinal	0	0	F	FWS	1987-25F	2	1	1	0	
1992	Pinto	0	0	F	FWS	1987-26F	3+	0	3	0	
1992	Pleasant	0	0	F	1987-04J	U-NAD	1	0	1	0	
1992	Redmond	0	0	O	X	X	0			0	GF only reports nest found- no adults
1992	Seventy-six	0	0	S	FWS	U	1+	1	1	1	
1992	Sheep	0	0	O	U	1988-11J	0			0	
1992	Table Mountain	0	0	F	U	U	1+	0	2	0	
1992	Tonto	0	0	F	U	1987-15J	1	0	1	0	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
1993	Alamo	0	1	S	FWS	FWS	3+	2	2	1	2 clutch 1st lost 2nd fostered to Ives Wash
1993	Ash	0	0	U						U	
1993	Bartlett	1	1	S	U	U	2+	2	2	1	
1993	Blue Point	1	0	S	1983-04M	FWS	3+	3	3	2	
1993	Camp Verde	0	1	O	X1	X1	0			0	
1993	Canyon	0	0	S			1+	1	1	1	
1993	Cedar Basin	0	0	F			1+	0	2	0	
1993	Cibecue	0	0	F	FWS	U	1+	0	2	0	
1993	Cliff	0	1	O	1984-11M	FWS -SAD	0			0	
1993	Coolidge	0	0	S	U	U	2+	2	2	2	
1993	Devil's Post	0	0	U						U	
1993	East Verde	0	0	S	U	U	2+	2	2	1	
1993	Fort McDowell	1	1	S	U	U	2+	2	2	2	
1993	Horse Mesa	0	0	S	U	U	2+	1	1	1	
1993	Horseshoe	0	0	O	1988-03J	FWS	0			0	
1993	Ive's Wash	0	1	S	U	U	1+	2	2	2	1 FOSTERED FROM ALAMO
1993	Ladders	0	1	F	U	1988-19F	2+	2	2	0	
1993	Lone Pine	0	0	F	X	X	1+	0	2	0	
1993	Mule Hoof	0	0	U						U	
1993	Orme	1	1	S	U	U	2	2	2	1	
1993	Perkinsville	0	0	U						U	
1993	Pinal	0	0	S	FWS	1987-25F	3+	2	2	1	
1993	Pinto	0	1	S	FWS	1987-26F	1+	1	1	1	
1993	Pleasant	0	0	S	1987-04J	U	1+	1	1	1	
1993	Redmond	0	0	O	X	X	0			0	GF no adult count
1993	Seventy-six	0	1	F	FWS	U	2	0	2	0	
1993	Sheep	0	1	O	U	1988-11J	0			0	
1993	Table Mountain	0	0	S	U	U	2+	2	2	2	
1993	Tonto	0	1	S	1987-18J	1987-15J	2+	2	2	2	
1993	Tower	0	1	S	1989-08J	U	2	1	1	1	M ID INF.
1994	Alamo	0	1	S	FWS	FWS	1+	1	1	1	
1994	Ash	0	0	U						U	
1994	Bartlett	1	1	S	U	U	1+	1	1	1	
1994	Blue Point	1	0	S	1983-04M	FWS	3	2	2	2	
1994	Camp Verde	0	0	U						U	
1994	Canyon	0	0	F			1+	1	2	0	
1994	Cedar Basin	0	0	F			2	0	2	0	
1994	Chino	0	0	U						U	
1994	Cibecue	0	1	S	FWS	U	1+	1	1	1	
1994	Cliff	0	1	F	1984-11M	FWS	2+	1	1	0	
1994	Coolidge	0	0	F	U	U	3	0	3	0	
1994	Devil's Post	0	0	U						U	
1994	East Verde	0	0	F	U	U	2+	1	2	0	
1994	Fort McDowell	1	1	F	U	U	1	0	1	0	
1994	Horse Mesa	0	0	F	U	U	1+	0	2	0	
1994	Horseshoe	0	0	F	1988-03J	FWS	1	0	1	0	M ID INF.
1994	Ive's Wash	0	1	S	U	U	1+	1	1	1	
1994	Ladders	0	1	S	U	U	2+	2	2	2	
1994	Lone Pine	0	0	F	X	X	1+	0	2	0	
1994	Luna	0	1	S	1994-21M	1994-21F	2+	1	2	1	
1994	Mule Hoof	0	0	U						U	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
1994	Orme	1	1	S	U	U	2+	2	2	2	
1994	Perkinsville	0	0	U						U	
1994	Pinal	0	0	S	FWS	1987-25F	4+	2	2	1	2 clutch, 1st failed
1994	Pinto	0	1	F	FWS	1987-26F	2+	1	2	0	
1994	Pleasant	0	0	S	1987-04J	U	2+	2	2	2	
1994	Redmond	0	1	F	1987-05J	FWS	1	1	1	0	
1994	Seventy-six	0	1	S	FWS	U	2+	2	2	2	
1994	Sheep	0	1	F	FWS-SAD	1988-11J	2+	0	3	0	
1994	Table Mountain	0	0	S	U	U	1+	1	1	1	
1994	Talkalai	0	0	F	U	U	2+	2	2	0	
1994	Tonto	0	1	S	1987-18J	1987-15J	2+	2	2	1	
1994	Tower	0	1	F	1989-08J	U	2	0	2	0	
1995	Alamo	0	1	S	FWS	FWS	2+	2	2	2	
1995	Ash	0	0	U						U	
1995	Bartlett	1	1	S	U	U	2+	2	2	2	
1995	Blue Point	1	0	S	1983-04M	FWS	2+	2	2	2	
1995	Box Bar	1	0	O	1990-03J	1991-06J	0			0	
1995	Camp Verde	0	0	U						U	
1995	Canyon	0	0	O			0			0	
1995	Cedar Basin	0	0	O			0			0	
1995	Chino	0	0	U						U	
1995	Cibecue	0	0	S	FWS	U	2	1	1	1	
1995	Cliff	0	1	O	X	X	0			0	
1995	Coolidge	0	1	S	U	U	2+	2	2	2	
1995	East Verde	0	0	S	U	U	2	1	1	1	
1995	Fort McDowell	1	1	F	U	U	1+	1	2	0	
1995	Horse Mesa	0	0	S	U	X (PURPLE)	1+	1	1	1	
1995	Horseshoe	0	1	F	U	FWS	1+	0	2	0	
1995	Ive's Wash	0	1	S	1988-05J	1991-12J	1+	1	1	1	
1995	Ladders	0	1	O	U	U	0			0	
1995	Lone Pine	0	0	O	X	X	0			0	
1995	Luna	0	1	S	1994-21M	1994-21F	1+	1	1	1	
1995	Mule Hoof	0	0	U						U	
1995	Orme	1	0	S	U	U	2+	2	2	2	
1995	Perkinsville	0	0	U						U	
1995	Pinal	0	0	F	FWS	1990-05J	1	0	1	0	F ID INF.
1995	Pinto	0	1	S	1988-04J	1987-26F	2+	2	2	2	
1995	Pleasant	0	0	S	1987-04J	U	2+	2	2	2	
1995	Redmond	0	0	S	1987-05J	FWS	2+	2	2	1	
1995	San Carlos	0	0	S	1990-04J	1989-12J	2	2	2	2	
1995	Seventy-six	0	1	F	FWS	U	2	0	2	0	
1995	Sheep	0	0	O	1991-14J	1988-11J	0			0	M ID INF.
1995	Table Mountain	0	0	S	U	U	2+	2	2	2	
1995	Talkalai	0	0	F	U	1988-10J	1+	0	2	0	
1995	Tonto	0	1	S	1987-18J	1987-15J	1+	1	2	1	
1995	Tower	0	1	F	1989-08J	U	2	0	2	0	
1995	Winkelman	0	0	O	X1	X1	0			0	
1996	Alamo	0	0	F	1992-02J	FWS	2+	0	3	0	CBD- swapped M & F ids since 1992-02J scored as male in 2006 at Alamo
1996	Bartlett	1	0	S	U	U-NAD	2+	2	2	2	
1996	Blue Point	1	0	S	1983-04M	FWS	2+	2	2	2	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
1996	Box Bar	1	1	F	1990-03J	1991-06J	2+	1	1	0	2 clutches
1996	Camp Verde	0	0	U						U	
1996	Canyon	0	0	O			0			0	
1996	Cedar Basin	0	0	F			2	0	2	0	
1996	Chino	0	0	U						U	
1996	Cibecue	0	0	O	X	X	0			0	
1996	Cliff	0	0	O	X1	X1	0			0	
1996	Coolidge	0	0	F	1991-13J	U	1+	0	2	0	
1996	Devil's Post	0	0	U						U	
1996	East Verde	0	0	S	U	U	2	1	1	1	
1996	Fort McDowell	1	1	O	U	U	0			0	
1996	Horse Mesa	0	0	S	U	X (PURPLE)	2+	2	2	2	
1996	Horseshoe	0	1	S	U	FWS	3	1	1	1	
1996	Ive's Wash	0	0	S	1988-05J	1991-12J	1+	1	1	1	
1996	Ladders	0	1	S	U	U	2	1	1	1	
1996	Lone Pine	0	0	F	X	X	1+	0	2	0	
1996	Luna	0	0	S	1994-21M	1994-21F	2+	2	2	2	
1996	Mule Hoof	0	0	U						U	
1996	Orme	1	0	F	U	U	2	1	2	0	
1996	Perkinsville	0	0	U						U	
1996	Pinal	0	0	F	FWS	1990-05J	1+	1	2	0	
1996	Pinto	0	0	S	1988-04J	1987-26F	3+	3	3	3	
1996	Pleasant	0	0	F	1987-04J	U	2+	2	2	0	
1996	Redmond	0	0	F	1987-05J	FWS	1	1	1	0	
1996	San Carlos	0	1	S	1990-04J	1989-12J	2	1	1	1	
1996	Seventy-six	0	1	S	1988-30M	U	2+	2	2	1	
1996	Sheep	0	1	S	1991-14J	1988-11J	2+	2	2	2	
1996	Table Mountain	0	0	S	U	U	3+	2	2	2	
1996	Talkalai	0	0	F	U	1988-10J	1+	0	2	0	
1996	Tonto	0	1	S	1987-18J	1987-15J	2+	2	2	2	
1996	Tower	0	1	S	1989-08J	U	2+	2	2	2	
1996	Winkelman	0	1	F	1992-07J	1991-08J	2	0	2	0	
1997	Alamo	0	0	F	1992-02J	FWS	1+	0	2	0	CBD- swapped M & F ids since 1992-02J scored as male in 2006 at Alamo
1997	Bartlett	1	1	F	U	U	1+	0	2	0	
1997	Becker	0	0	O	X	X	0			0	REP no mention adults
1997	Blue Point	1	0	S	1983-04M	1997-04F	3+	3	3	3	F ID inferred
1997	Box Bar	1	1	O	1994-06J	1991-06J	2	0	0	0	eggs fostered to San Carlos, treated as O rather than F
1997	Camp Verde	0	0	U						U	
1997	Canyon	0	0	O			0			0	GF says new nest material but no adults obs
1997	Cedar Basin	0	0	F			1+	0	2	0	
1997	Chino	0	0	U						U	
1997	Cibecue	0	0	O	X	X	0			0	
1997	Cliff	0	0	O	X1	X1	0			0	
1997	Coolidge	0	0	S	U	U	2+	2	2	2	
1997	Devil's Post	0	0	U						U	
1997	Dupont	0	0	F	1988-07J	U	1+	0	2	0	
1997	East Verde	0	0	F	U	U	1+	0	2	0	
1997	Fort McDowell	1	1	S	1993-10J	U	2+	2	2	1	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
1997	Horse Mesa	0	0	S	U	X (PURPLE)	1+	1	1	1	
1997	Horseshoe	0	1	S	U	FWS	2	2	2	2	
1997	Ive's Wash	0	0	F	1988-05J	1991-12J	1	0	1	0	F&M ID INF.
1997	Ladders	0	1	F	U	U	3+	2	2	0	
1997	Lone Pine	0	0	F	X	X	1+	0	2	0	
1997	Luna	0	1	S	1994-21M	1994-21F	3+	3	3	3	F ID INF.
1997	Mule Hoof	0	0	U						U	
1997	Orme	1	0	S	U	U	2+	2	2	2	
1997	Perkinsville	0	0	O	X	X	0			0	
1997	Pinal	0	0	F	FWS	1990-05J	1+	0	2	0	
1997	Pinto	0	0	F	1988-04J	1987-26F	2+	0	3	0	
1997	Pleasant	0	1	S	1987-04J	U	2+	2	2	2	
1997	Redmond	0	0	F	1987-05J	FWS	2+	1	1	0	
1997	San Carlos	0	0	S	1990-04J	1989-12J	2+	1	1	1	2 clutches 1 failed, second fostered from Box Bar F ID INF.
1997	Seventy-six	0	1	S	1988-30M	U	2+	2	2	2	
1997	Sheep	0	0	O	X	1988-11J	0			0	F ID INF
1997	Sycamore	1	0	F	1992-06J	1990-02J	1	0	1	0	
1997	Table Mountain	0	0	S	U	U	2+	2	2	1	
1997	Talkalai	0	0	O	U	1988-10J	0			0	F ID INF.
1997	Tonto	0	1	S	1987-18J	1987-15J	2+	2	2	2	
1997	Tower	0	1	S	1989-08J	U	2+	1	1	1	
1997	Winkelman	0	0	F	1992-07J	1991-08J	1	0	1	0	F&M ID INF.
1998	Alamo	0	0	F	1992-02J	FWS	2+	0	3	0	CBD- swapped M & F ids since 1992-02J scored as male in 2006 at Alamo
1998	Bartlett	1	1	S	U	U	2+	2	2	2	
1998	Becker	0	0	O	U	U	0			0	
1998	Blue Point	1	0	F	1983-04M	1997-04F	1+	0	2	0	
1998	Box Bar	1	1	S	1991-09J	1994-07J	2+	2	2	2	
1998	Camp Verde	0	0	U						U	
1998	Canyon	0	0	U						U	
1998	Cedar Basin	0	0	F			1+	0	2	0	
1998	Cibecue	0	0	O	X1	X1	0			0	
1998	Cliff	0	0	O	X	X	0			0	
1998	Coldwater	0	0	F	1992-07J	U	1+	0	2	0	
1998	Coolidge	0	0	F	1993-03J	U	2	0	2	0	
1998	Devil's Post	0	0	U						U	
1998	Doka	1	0	S	1994-05J	U	1+	1	1	1	
1998	Dupont	0	0	S	1988-07J	U	1+	1	1	1	
1998	East Verde	0	0	F	1988-03J	U	2	0	2	0	M ID INFERRED
1998	Fort McDowell	1	1	F	1993-10J	U	2+	2	2	0	
1998	Horse Mesa	0	0	F	19U--ADN	X (PURPLE)	1+	0	2	0	
1998	Horseshoe	0	1	F	U	FWS	1+	0	2	0	
1998	Ive's Wash	0	0	O	1988-05J	1991-12J	0			0	
1998	Ladders	0	1	S	U	U	3+	3	3	3	
1998	Lone Pine	0	0	O	X1	X1	0			0	
1998	Luna	0	1	S	1994-21M	1994-21F	2+	1	1	1	
1998	Mule Hoof	0	0	U						U	
1998	Orme	1	0	S	U	U	1+	1	1	1	
1998	Perkinsville	0	0	O	X1	X1	0			0	
1998	Pinal	0	0	O	FWS		0			0	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
1998	Pinto	0	0	O	1994-04J	1991-08J	0			0	F&M ID INF.
1998	Pleasant	0	1	S	1987-04J	U	1+	1	1	1	
1998	Redmond	0	0	S	1987-05J	FWS	2	2	2	1	
1998	San Carlos	0	0	S	1990-04J	1989-12J	2+	2	2	2	
1998	Seventy-six	0	1	S	1988-30M	U	2+	2	2	2	
1998	Sheep	0	0	O	X	1988-11J	0			0	F ID INF
1998	Sycamore	1	1	S	1992-06J	1990-02J	1+	1	1	1	
1998	Table Mountain	0	0	F	X	X	1+	0	2	0	
1998	Talkalai	0	0	O	U	1988-10J	0			0	F ID INF.
1998	Tonto	0	1	S	1987-18J	1987-15J	1+	1	1	1	
1998	Tower	0	0	S	1989-08J	U	2+	2	2	2	
1998	Winkelman	0	0	O	X	X1	0			0	
1999	Alamo	0	0	F	1992-02J	FWS	1+	0	2	0	CBD- swapped M & F ids since 1992-02J scored as male in 2006 at Alamo
1999	Bartlett	1	1	S	U	U	2+	2	2	1	
1999	Becker	0	0	F	X	X	1+	0	2	0	
1999	Blue Point	1	0	S	1995-04J	1997-04F	1+	1	1	1	Male ID inferred
1999	Box Bar	1	1	F	1991-09J	1994-07J	1+	1	2	0	
1999	Camp Verde	0	0	U						U	
1999	Canyon	0	0	O			0			0	
1999	Cedar Basin	0	0	O			0			0	
1999	Cibecue	0	0	S	X	X	2+	2	3	1	
1999	Cliff	0	0	O	X	X	0			0	
1999	Coldwater	0	0	F	1992-07J	X	2+	0	3	0	2 clutches
1999	Coolidge	0	0	F	1993-03J	U	1+	0	2	0	M ID INFERRED
1999	Devil's Post	0	0	U						U	
1999	Doka	1	1	S	1994-05J	U	2+	2	2	2	
1999	Dupont	0	0	O	X1	X1	0			0	
1999	East Verde	0	0	S	1988-03J	U	2+	2	2	2	
1999	Fort McDowell	1	1	S	1993-10J	U	2+	2	2	1	
1999	Granite Basin	0	0	F	X	X	1+	0	2	0	
1999	Horse Mesa	0	0	S	X	X	2+	2	3	1	
1999	Horseshoe	0	0	S	U	FWS	2+	2	2	2	
1999	Ive's Wash	0	0	O	X	X	0			0	
1999	Ladders	0	0	S	U	U	2+	2	2	2	
1999	Lone Pine	0	0	S	X	X	2+	2	2	2	
1999	Luna	0	1	S	1994-21M	1994-21F	2+	2	2	1	
1999	Mule Hoof	0	0	U						U	
1999	Orme	1	1	S	U	U	2+	1	1	1	2 clutches 1st failed
1999	Perkinsville	0	0	U						U	
1999	Pinal	0	0	O	FWS	X	0			0	
1999	Pinto	0	0	S	1994-04J	1991-08J	2+	2	2	2	
1999	Pleasant	0	1	S	1987-04J	U	2+	2	2	1	
1999	Redmond	0	0	F	1987-05J	1989-02J	1+	0	2	0	F ID INF.
1999	San Carlos	0	0	O		1989-12J	0			0	
1999	Seventy-six	0	0	S	1988-30M	U	1+	1	1	1	
1999	Sheep	0	1	S	1994-12J	1988-11J	2+	2	2	1	
1999	Suicide	0	0	S	1993-09J	1992-13J	2+	2	3	2	F & M ID INF.
1999	Sycamore	1	1	S	1992-06J	1990-02J	2+	2	2	2	
1999	Table Mountain	0	0	S	X	X	1+	1	2	1	
1999	Talkalai	0	0	F	U	1988-10J	1+	0	2	0	F ID INF.

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
1999	Tonto	0	1	S	1987-18J	1987-15J	2+	2	2	2	
1999	Tower	0	1	S	1989-08J	U	2+	2	2	2	
1999	Winkelman	0	0	U						U	
2000	Alamo	0	0	S	1992-02J	FWS	1+	1	1	1	CBD- swapped M & F ids since 1992-02J scored as male in 2006 at Alamo
2000	Bartlett	1	1	F	U	1993-05J	2	0	2	0	
2000	Becker	0	0	O	X	X	0			0	2 adults per Allison, report no info
2000	Blue Point	1	0	F	1995-04J	1997-04F	1+	0	2	0	Male ID inferred
2000	Box Bar	1	1	S	1991-09J	1994-07J	2+	2	2	2	
2000	Camp Verde	0	0	U						U	
2000	Canyon	0	0	O			0			0	
2000	Cedar Basin	0	0	O			0			0	
2000	Cibecue	0	0	O	X1	X1	0			0	
2000	Cliff	0	0	O	X1	X1	0			0	
2000	Coldwater	0	0	F	X	X	2+	2	2	0	
2000	Coolidge	0	0	F	1993-03J	U	1+	1	1	0	
2000	Devil's Post	0	0	U						U	
2000	Doka	1	1	S	1994-05J	U	2+	2	2	2	
2000	Dupont	0	0	F	X	X	1+	1	2	0	
2000	East Verde	0	0	O	1988-03J	X	0			0	M ID INFERRED
2000	Fort McDowell	1	1	S	1993-10J	U	2+	2	2	2	M ID INFERRED
2000	Granite Basin	0	0	O	X	X	0			0	
2000	Horse Mesa	0	0	S	X	X	2+	2	2	1	
2000	Horseshoe	0	1	S	U	FWS	2	2	2	2	
2000	Ive's Wash	0	0	O	X1	X1	0			0	
2000	Ladders	0	0	O	U	U	0			0	
2000	Lone Pine	0	0	F	X	X	2+	2	2	0	
2000	Luna	0	1	S	1994-21M	X	3+	3	3	1	M ID INF.
2000	Mule Hoof	0	0	U						U	
2000	Orme	1	1	F	U	U	2+	2	2	0	
2000	Perkinsville	0	0	S	1996-15J	1994-13J	1+	1	1	1	
2000	Pinal	0	0	F	FWS	1989(BLUE)	2+	2	2	0	
2000	Pinto	0	0	O	X	X	0			0	
2000	Pleasant	0	1	S	1987-04J	U	2+	2	2	2	
2000	Redmond	0	0	S	1987-05J	1989-02J	1+	1	1	1	
2000	Rodeo	1	0	F	X	1995-??J	UNK	0	3	0	Allison has F, report has no mention
2000	San Carlos	0	0	F	X	X	1+	0	2	0	
2000	Seventy-six	0	0	S	1988-30M	U	2+	2	2	2	
2000	Sheep	0	1	F	1994-12J	1988-11J	1+	1	2	0	
2000	Suicide	0	0	S	1993-09J	1992-13J	3+	3	3	3	
2000	Sycamore	1	1	F	1992-06J	1990-02J	1+	0	2	0	F&M ID INF.
2000	Table Mountain	0	0	F	X	X	1+	0	2	0	
2000	Talkalai	0	0	F	U	1988-10J	1+	0	2	0	F ID INF.
2000	Tonto	0	1	F	1987-18J	1987-15J	2	0	2	0	
2000	Tower	0	1	S	1989-08J	U	2+	2	2	2	
2000	Winkelman	0	0	U						U	
2001	Alamo	0	0	F	1992-02J	FWS	2	0	2	0	CBD- swapped M & F ids since 1992-02J scored as male in 2006 at Alamo

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
2001	Bartlett	1	1	F	U	1995-07J	1+	0	2	0	CDB swap sexes as 1995-07J Id'd as female in later years
2001	Becker	0	0	O	X	X	0			0	1 adult fr Allison- report does not say
2001	Blue Point	1	0	S	1995-04J	1997-04F	3+	3	3	1	F&M ID inferred
2001	Box Bar	1	1	S	1991-09J	1994-07J	2+	2	2	2	
2001	Camp Verde	0	0	U						U	
2001	Canyon	0	0	U						U	
2001	Cedar Basin	0	0	O			0			0	
2001	Cibecue	0	0	O	X	X	0			0	
2001	Cliff	0	0	O	X	X	0			0	
2001	Coldwater	0	0	F	X	X	1+	0	2	0	
2001	Coolidge	0	0	F	1993-03J	U	1+	0	2	0	
2001	Devil's Post	0	0	U						U	
2001	Doka	1	0	S	1994-05J	U	2+	2	2	2	
2001	Dupont	0	0	O	X	X	0			0	
2001	East Verde	0	0	F	1988-03J	X	1+	0	2	0	M ID INFERRED
2001	Fort McDowell	1	1	S	1993-10J	U	2+	2	2	2	M ID INFERRED
2001	Granite Basin	0	0	F	X	X	1+	0	2	0	
2001	Horse Mesa	0	0	S	X	X	2+	2	2	1	
2001	Horseshoe	0	0	S	U	FWS	2	2	2	2	
2001	Ive's Wash	0	0	O	X1	X1	0			0	
2001	Ladders	0	1	S	U	U	2+	2	2	1	
2001	Lone Pine	0	0	S	U	U	2+	2	2	1	
2001	Luna	0	1	F	X	X	1+	1	1	0	
2001	Mule Hoof	0	0	U						U	
2001	Orme	1	0	S	U	U	1+	1	1	1	
2001	Perkinsville	0	0	S	1996-15J	1994-13J	1+	1	1	1	
2001	Pinal	0	0	U						U	
2001	Pinto	0	0	S	1994-04J	1991-08J	2+	2	2	2	F&M ID INF.
2001	Pleasant	0	1	S	1987-04J	U	2+	2	2	2	
2001	Redmond	0	0	S	1987-05J	1989-02J	1+	1	1	1	F ID INF.
2001	Rock Creek	1	0	O			0			0	
2001	Rodeo	1	0	F	X	1995-??J	1+	0	2	0	
2001	San Carlos	0	0	O	X1	X1	0			0	
2001	Seventy-six	0	0	S	1988-30M	U	2+	2	2	2	
2001	Sheep	0	0	F	1994-12J	1988-11J	2+	2	2	0	
2001	Suicide	0	0	S	1993-09J	1992-13J	2+	2	2	2	
2001	Sycamore	1	1	S	1992-06J	U	2+	2	2	2	M ID INF.
2001	Table Mountain	0	0	F	X	X	1+	1	1	0	
2001	Talkalai	0	0	S	U	1988-10J	1+	1	1	1	
2001	Tonto	0	1	S	1987-18J	1987-15J	2	1	1	1	
2001	Tower	0	0	S	1989-08J	U	2	1	1	1	
2001	Winkelman	0	0	U						U	
2002	Alamo	0	0	S	1992-02J	FWS	1+	1	1	1	CBD- swapped M & F ids since 1992-02J scored as male in 2006 at Alamo
2002	Bartlett	1	1	F	U	1995-07J	1+	1	1	0	CDB swap sexes as 1995-07J Id'd as female in later years
2002	Becker	0	0	O	X1	X1	0			0	
2002	Blue Point	1	0	S	1995-04J	1997-04F	2+	2	2	2	
2002	Box Bar	1	1	S	1994-06J	1994-07J	2+	2	2	1	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
2002	Camp Verde	0	0	U						U	
2002	Canyon	0	0	U						U	
2002	Cedar Basin	0	0	O			0			0	
2002	Cibecue	0	0	F	X	X	1+	0	2	0	
2002	Cliff	0	0	O	X	X	0			0	
2002	Coldwater	0	0	S	X	X	2+	2	2	2	
2002	Coolidge	0	0	F	U	U	2+	2	2	0	
2002	Devil's Post	0	0	U						U	
2002	Doka	1	0	S	1994-05J	U	2+	2	2	2	
2002	Dupont	0	0	U						U	
2002	East Verde	0	0	F	1988-03J	1989(BLUE)	2	0	2	0	
2002	Fort McDowell	1	1	S	1993-10J	U	2+	2	2	2	
2002	Granite Basin	0	0	O	X	X	0			0	
2002	Granite Reef	1	0	S	U	1989(BLUE)	2+	2	2	2	
2002	Horse Mesa	0	0	S	X	X	1+	1	1	1	
2002	Horseshoe	0	0	S	X	FWS	2+	2	2	2	
2002	Ive's Wash	0	0	O	X1	X1	0			0	
2002	Ladders	0	1	S	U	U	2+	2	2	2	
2002	Lone Pine	0	0	F	X	X	1+	0	2	0	
2002	Luna	0	1	S	1994-21M	1994-21F	2+	2	2	2	
2002	Lynx	0	1	F	U	1995-09J	1+	0	2	0	
2002	Mule Hoof	0	0	U						U	
2002	Needle Rock	1	1	S	1998-06J	FWS	2+	1	1	1	
2002	Oak Creek	0	0	S	X	X	2+	2	2	2	
2002	Orme	1	1	S	U	U	2+	2	2	2	
2002	Perkinsville	0	0	F	1996-15J	1994-13J	1	0	1	0	
2002	Pinal	0	0	S	1987-25M	1990-05J	1	1	1	1	
2002	Pinto	0	0	F	1994-04J	1991-08J	1+	0	2	0	F&M ID INF.
2002	Pleasant	0	1	S	1987-04J	U	1+	1	1	1	
2002	Redmond	0	0	F	1987-05J	1989-02J	2	0	2	0	
2002	Rock Creek	1	0	S			1+	1	1	1	
2002	Rodeo	1	0	S	U	1995-??J	2	1	1	1	
2002	San Carlos	0	0	F	1989(BLUE)	1989(BLUE)	1+	1	1	0	
2002	Seventy-six	0	0	O	X1	X1	0			0	
2002	Sheep	0	0	S	1994-12J	1988-11J	2+	2	2	2	
2002	Suicide	0	0	F	1993-09J	1992-13J	3+	3	3	0	
2002	Sycamore	1	1	S	1992-06J	U	2+	2	2	1	
2002	Table Mountain	0	0	O	X1	X1	0			0	
2002	Talkalai	0	0	S	U	1988-10J	2+	2	2	2	
2002	Tonto	0	1	S	1987-18J	1987-15J	2+	2	2	2	
2002	Tower	0	1	S	1989-08J	U	2+	2	2	2	
2002	Winkelman	0	0	U						U	
2003	Alamo	0	0	O	X	X	0			0	
2003	Bartlett	1	0	S	U	1995-07J	1+	1	1	1	CDB swap sexes as 1995-07J Id'd as female in later years
2003	Becker	0	0	U						U	
2003	Blue Point	1	0	F	1995-04J	1997-04F	1	0	1	0	
2003	Box Bar	1	1	S	1994-06J	1994-07J	1+	1	1	1	
2003	Bulldog	1	1	S	FWS	1989(BLUE)	2+	2	2	2	
2003	Camp Verde	0	0	U						U	
2003	Canyon	0	0	U						U	
2003	Cedar Basin	0	0	U						U	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
2003	Cibecue	0	0	F	X	X	1+	0	2	0	
2003	Cliff	0	0	O	X	X	0			0	
2003	Coldwater	0	0	S	X	X	2+	2	2	1	
2003	Coolidge	0	0	S	U	U	2+	2	2	1	
2003	Crescent	0	0	F	1989(BLUE)	U	1+	0	2	0	
2003	Doka	1	0	S	1994-05J	U	1+	1	1	1	
2003	Dupont	0	0	F	X	X	1+	0	2	0	
2003	East Verde	0	0	O	X	X	0			0	
2003	Fort McDowell	1	1	F	1993-10J	U	1+	0	2	0	
2003	Granite Basin	0	0	O	X1	X1	0			0	
2003	Granite Reef	1	0	F	U	1989(BLUE)	2+	2	2	0	
2003	Horse Mesa	0	0	S	X	X	2+	2	2	2	
2003	Horseshoe	0	0	S	U	FWS	1+	1	1	1	
2003	Ive's Wash	0	0	O	X	X	0			0	
2003	Ladders	0	1	S	1998-17J	U	2+	2	2	2	
2003	Lone Pine	0	0	O	X	X	0			0	
2003	Luna	0	1	S	1994-21M	1994-21F	1+	1	1	1	
2003	Lynx	0	1	F	1998-??J	1995-09J	1+	0	2	0	
2003	Needle Rock	1	1	S	1998-06J	X	1+	1	1	1	
2003	Oak Creek	0	0	S	1989(BLUE)	1996-14J	1+	1	1	1	
2003	Orme	1	1	S	X	X	1+	1	1	1	
2003	Perkinsville	0	0	S	1996-15J	1994-13J	2+	2	2	2	
2003	Pinal	0	0	F	1987-25M	1990-05J	1+	0	2	0	
2003	Pinto	0	0	O	X	X	0			0	
2003	Pleasant	0	1	S	1987-04J	U	1	1	1	1	
2003	Redmond	0	0	O	X1	X1	0			0	
2003	Rock Creek	1	0	F			1+	1	1	0	
2003	Rodeo	1	0	F	U	1997-14J	2+	2	2	0	
2003	San Carlos	0	0	O	X1	X1	0			0	
2003	Seventy-six	0	0	O	X	U	0			0	
2003	Sheep	0	0	F	1994-12J	1988-11J	1+	1	1	0	
2003	Suicide	0	1	S	1993-09J	1992-13J	3	3	3	3	
2003	Sycamore	1	1	S	1992-06J	U	2	2	2	2	
2003	Table Mountain	0	0	F	X	X	2	0	2	0	
2003	Talkalai	0	0	O	X	X	0			0	
2003	Tonto	0	1	F	1987-18J	1987-15J	2	1	2	0	
2003	Tower	0	1	S	1989-08J	U	2	2	2	1	
2003	Winkelman	0	0	U						U	
2004	Alamo	0	0	F	X	X	1+	0	1	0	
2004	Bartlett	1	1	S	U	1995 (BLUE)	2+	2	2	2	U for unbanded, female may be 1995 Tonto nestling id'd as Bartlett male
2004	Becker	0	0	U						U	
2004	Blue Point	1	0	S	X	X	2+	2	2	2	
2004	Box Bar	1	1	S	1994-06J	1994-07J	2+	2	2	2	94 pleasant siblings
2004	Bulldog	1	0	S	X	X	2+	2	2	2	
2004	Canyon	0	0	U						U	
2004	Cedar Basin	0	0	O	X	X	0			0	
2004	Cibecue	0	0	F	X	X	1	0	1	0	
2004	Cliff	0	0	U						U	
2004	Coldwater	0	0	S	X	X	1+	1	1	1	
2004	Coolidge	0	1	F	U	U	1+	1	1	0	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
2004	Crescent	0	1	S	97 Luna nestling	U	1+	1	1	1	
2004	Doka	1	0	S	X	X	2+	2	2	2	
2004	Dupont	0	0	U						U	
2004	East Verde	0	0	S	X	X	2+	2	2	1	
2004	Fort McDowell	1	0	S	X	X	2+	1	1	1	
2004	Granite Basin	0	0	U						U	
2004	Granite Reef	1	0	F	X	X	2	0	2	0	
2004	Horse Mesa	0	0	F	X	X	1+	0	2	0	
2004	Horseshoe	0	0	S	X	X	1+	2	2	2	
2004	Ive's Wash	0	0	S	X	X	3	3	3	3	
2004	Ladders	0	1	S	1998-17J	U	2+	2	2	1	M 98 seventy-six
2004	Lone Pine	0	0	S	X	X	2	1	1	1	
2004	Luna	0	1	S	88 Texas nestling	FWS	2+	2	2	2	
2004	Lynx	0	0	S	X	X	1+	1	1	1	
2004	Needle Rock	1	0	S	X	X	1+	1	1	1	
2004	Oak Creek	0	0	F	X	X	1+	1	1	0	
2004	Orme	1	1	S	U	U	2+	2	2	2	
2004	Perkinsville	0	0	F	X	X	1+	1	1	0	
2004	Pinal	0	0	S	X	X	1+	1	1	1	
2004	Pinto	0	1	S	94 blue pt nestling	1991 Alamo	2+	2	2	2	
2004	Pleasant	0	1	S	1987-04J	U	1+	1	1	1	M 87 horse mesa
2004	Redmond	0	0	S	X	X	2	1	1	1	
2004	Rock Creek	1	0	F	X	X	1+	0	2	0	
2004	Rodeo	1	0	S	U	X	2+	2	2	1	male is unbanded polygomous fron Orme
2004	San Carlos	0	1	S	2000 doka	89 bartlett	1+	1	1	1	
2004	Seventy-six	0	0	F	X	U	1+	0	2	0	
2004	Sheep	0	0	F	X	X	1+	1	1	0	
2004	Suicide	0	0	S	X	X	3	3	3	3	
2004	Sycamore	1	0	S	X	X	2+	2	2	2	
2004	Table Mountain	0	0	F	X	X	1+	1	1	0	
2004	Talkalai	0	0	S	X	X	1+	1	1	1	
2004	Tonto	0	1	S	1987-18J	1987-15J	2+	2	2	2	M 87 pinal, F 87 horseshoe
2004	Tower	0	1	F	88 ladders	U	1+	1	1	0	
2004	Winkelman	0	0	U						U	
2005	Alamo	0	0	F	X	X	1+	0	2	0	
2005	Bartlett	1	0	F	X	X	2+	2	2	0	
2005	Becker	0	0	U						U	
2005	Blue Point	1	0	S	X	X	3	3	3	3	
2005	Box Bar	1	1	S	1994-06J	1994-07J	2+	1	1	1	94 pleasant siblings
2005	Bulldog	1	0	S	X	X	2+	2	2	2	
2005	Canyon	0	0	U						U	
2005	Cedar Basin	0	0	U						U	
2005	Cibecue	0	0	F	X	X	1+	1	1	0	
2005	Cliff	0	0	U						U	
2005	Coldwater	0	0	S	X	X	2+	2	2	2	
2005	Coolidge	0	1	O	U	U	0			0	
2005	Crescent	0	0	F	X	X	1+	1	2	0	
2005	Doka	1	0	S	X	X	2+	2	2	2	
2005	Dupont	0	0	U						U	
2005	East Verde	0	0	O	X	X	0			0	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
2005	Fort McDowell	1	0	F	X	X	1+	0	2	0	
2005	Granite Basin	0	0	U						U	
2005	Granite Reef	1	0	S	X	X	2	1	1	1	
2005	Horse Mesa	0	0	S	X	X	1+	1	1	1	
2005	Horseshoe	0	0	F	X	X	1+	0	2	0	
2005	Ive's Wash	0	0	S	X	X	1+	1	1	1	
2005	Ladders	0	1	S	1998-17J	U	2+	2	2	1	M 98 seventy-six
2005	Lone Pine	0	0	S	X	X	1+	1	1	1	
2005	Lower Lake Mary	0	1	F	U	U	1+	1	1	0	fledgling fell from nest, tested pos. for west nile virus
2005	Luna	0	1	S	88 Texas	FWS	2+	2	2	2	
2005	Lynx	0	0	S	X	X	1+	1	1	1	
2005	Needle Rock	1	1	S	1998-06J	FWS	2+	2	2	1	M 98 orme
2005	Oak Creek	0	0	F	X	X	1	0	1	0	
2005	Orme	1	1	S	U	U	2+	2	2	2	
2005	Perkinsville	0	0	S	X	X	1+	1	1	1	
2005	Pinal	0	0	S	X	X	2	2	2	2	
2005	Pinto	0	1	S	FWS	FWS	2+	2	2	2	
2005	Pleasant	0	1	F	1987-04J	2000 box bar	2+	0	3	0	M 87 horse mesa, F 2000 box bar - granddaughter of male, 2 clutches
2005	Redmond	0	0	O	X	X	0			0	
2005	Rock Creek	1	0	S	X	X	1+	1	1	1	
2005	Rodeo	1	0	F	X	X	2+	2	2	0	
2005	San Carlos	0	1	S	2000 doka	89 bartlett	1+	1	1	1	
2005	Seventy-six	0	0	U						U	
2005	Sheep	0	0	S	X	X	2+	2	2	2	
2005	Suicide	0	0	S	X	X	3	3	3	3	
2005	Sycamore	1	0	S	X	X	2+	2	2	2	
2005	Table Mountain	0	0	F	X	X	1	0	1	0	
2005	Talkalai	0	0	S	X	X	1+	1	1	1	
2005	Tonto	0	1	S	1987-18J	1987-15J	1+	1	1	1	M 87 pinal, F 87 horseshoe
2005	Tower	0	1	S	88 ladders	U	2+	2	2	1	
2005	Winkelman	0	0	U						U	
2006	Alamo	0	0	S	1992-02J	1989-01F	1	1	1	1	
2006	Bartlett	1	1	S		1995-07J	2	2	2	2	
2006	Beaver	0	0	S	1997-01J		1	1	1	1	
2006	Becker	0	0	U						U	
2006	Blue Point	1	0	S		1997-04F	2	1	1	1	
2006	Box Bar	1	1	S	1994-06J	1994-07J	1	1	1	1	
2006	Bulldog	1	0	F			2	2	2		
2006	Canyon	0	0	U						U	
2006	Canyon De Chelly	0	0	S			2	2	2	2	
2006	Cedar Basin	0	0	O			0				
2006	Cibecue	0	0	S			1	1	1	1	
2006	Cliff	0	0	U						U	
2006	Coldwater	0	0	S			1	1	1	1	
2006	Coolidge	0	0	F			2	0			
2006	Crescent	0	1	F			1	1	1		
2006	Doka	1	0	S			1	1	1	1	
2006	Dupont	0	0	U						U	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
2006	East Verde	0	0	F			1	0			
2006	Fort McDowell	1	0	S			2	2	2	1	
2006	Granite Basin	0	0	U						U	
2006	Granite Reef	1	0	S	2000-02J	1991-06J	2	1	1	1	
2006	Horse Mesa	0	0	S			1	1	1	1	
2006	Horseshoe	0	0	S			3	3	3	1	
2006	Ive's Wash	0	0	F		1999-12J	1	1	1		
2006	Ladders	0	1	S	1998-17J		2	2	2	2	
2006	Lone Pine	0	0	S			3	3	3	3	
2006	Lower Lake Mary	0	0	S			3	3	3	3	
2006	Luna	0	0	F	1994-21M	1994-21F	1	0			
2006	Lynx	0	0	S	1998-03J	1995-09J	2	2	2	2	
2006	Needle Rock	1	1	S			2	2	2	2	
2006	Oak Creek	0	0	S	1993-19J	1996-14J	1	1	1	1	
2006	Orme	1	1	S			3	2	2	1	
2006	Perkinsville	0	0	S			1	1	1	1	
2006	Pinal	0	0	F			2	1	1		
2006	Pinto	0	1	S	1994-04J	1991-08J	2	2	2	2	
2006	Pleasant	0	1	O			0				
2006	Redmond	0	0	F			1	0			
2006	Rock Creek	1	0	O							
2006	Rodeo	1	0	S			1	1	1	1	
2006	San Carlos	0	1	S	2000-05J	1989-12J	2	2	2	2	
2006	Seventy-Six	0	0	F		2001-12J	1	1	1		
2006	Sheep	0	0	O	1994-12J		0				
2006	Suicide	0	1	F	1993-09J		3	3	3		
2006	Sycamore	1	0	S			2	2	2	2	
2006	Table Mountain	0	0	O			0				
2006	Talkalai	0	0	F		1997-17J	2	0			
2006	Tonto	0	1	S	1987-18J	1987-15J	2	2	2	2	
2006	Tower	0	0	S	1989-08J		2	2	2	1	
2006	Winkelman	0	0	U						U	
2006	Yellow Cliffs	0	0	S	2000-24J		1	1	1	1	
2007	Alamo	0	0	S		1989-01F	2	2	2	2	
2007	Bartlett	1	0	F		1995-07J	2	2	2		
2007	Beaver	0	0	S			2	2	2	2	
2007	Becker	0	0	U						U	
2007	Blue Point	1	0	F			1	0			
2007	Box Bar	1	1	S	1994-06J	1994-07J	2	2	2	2	
2007	Bulldog	1	0	F			2	2	2		
2007	Burro Creek	0	0	F			2	0			
2007	Canyon	0	0	U						U	
2007	Canyon De Chelly	0	1	S			2	2	2	2	
2007	Cedar Basin	0	0	O			0				
2007	Cibecue	0	0	F			1	0			
2007	Cliff	0	0	F	2001-03J		1	0			
2007	Coldwater	0	0	S			2	2	2	2	
2007	Coolidge	0	0	F			1	1	1		
2007	Crescent	0	1	S	1997-12J		2	2	2	2	

Year	BA	SVC[1]	NW[2]	Status[3]	Male[4]	Female	Eggs	Nestlings range		Fledglings	NOTES
2007	Doka	1	0	F			1	1	1		
2007	Dupont	0	0	U						U	
2007	East Verde	0	0	F			1	0			
2007	Fish Creek	0	0	F			1	0			
2007	Fort McDowell	1	0	F			2	2	2		
2007	Granite Basin	0	0	F			1	1	1		
2007	Granite Reef	1	0	S	2000-02J	1991-06J	1	1	1	1	
2007	Horse Mesa	0	0	F			1	0			
2007	Horseshoe	0	0	S			2	1	1	1	
2007	Ive's Wash	0	0	F		1999-12J	2	2	2		
2007	Ladders	0	1	S	1998-17J		3	3	3	2	
2007	Lone Pine	0	0	S			2	2	2	2	
2007	Lower Lake Mary	0	0	O			0				
2007	Luna	0	1	S	1994-21M	1994-21F	1	1	1	1	
2007	Lynx	0	0	S	1998-03J	1995-09J	2	2	2	1	
2007	Needle Rock	1	1	S	1998-14J		1	1	1	1	
2007	Oak Creek	0	0	S	1993-19J	1996-14J	2	2	2	1	
2007	Orme	1	1	S			3	3	3	3	
2007	Perkinsville	0	0	F			1	1	1		
2007	Pinal	0	0	O			0				
2007	Pinto	0	1	F			2	2	2		
2007	Pleasant	0	1	S	1987-04J		1	1	1	1	
2007	Redmond	0	0	F			1	0			
2007	Rock Creek	1	0	U						U	
2007	Rodeo	1	0	S			2	2	2	2	
2007	San Carlos	0	1	S	2000-05J	1989-12J	2	2	2	1	
2007	Seventy-Six	0	0	S		2001-12J	1	1	1	1	
2007	Sheep	0	0	F	1994-12J		1	0			
2007	Suicide	0	0	S	1993-09J	1992-13J	3	3	3	2	
2007	Sullivan Lake	0	0	F			1	0			
2007	Sycamore	1	0	S			2	2	2	2	
2007	Table Mountain	0	0	F			1	0			
2007	Talkalai	0	0	S		1997-17J	2	2	2	2	
2007	Tonto	0	1	S	2002-14J	1987-15J	2	2	2	2	
2007	Tower	0	1	S	1989-08J		2	2	2	2	
2007	Winkelman	0	0	U						U	
2007	Yellow Cliffs	0	0	S	2000-24J		2	2	2	2	

APPENDIX 2: SURVIVAL ANALYSIS

Data on resightings were as provided by AGFD. Some resightings were inferred and not necessarily confirmed by a positive band identification. For example, same color banded, same sex birds appearing in consecutive years at the same BA were considered the same bird, even though the exact ID could not be ascertained in one or other of the years.

Of 458 banded nestlings, 410 or 89.5% fledged. Of these only two individuals were resighted in the third year after fledging (1991-03J and 1994-06J).

All individuals marked two years before the right-censoring horizon of 2007 or later (2005+) were uninformative for survival or resight probability estimation and were removed from analysis, leaving 354 individuals with usable encounter histories over 31 years from 1977 to 2007 inclusive (See Appendix 3). All resighting effort that identified eagles from bands occurred at breeding areas. The earliest resight found in the dataset was a single individual at year 3. Hence there was fixed zero resighting probability for the first 2 years after fledging.

The recapture only subroutine of Program MARK was used for model fitting with a logit link function. Models followed an age-cohort design.

Sex was determinable for resighted individuals, but not for all fledglings and thus not be used as an independent variable in models of juvenile mortality, only for adult survival and resighting.

There were 79 individuals eventually resighted at BAs, including eight individuals banded as breeding adults. Natal year had to be imputed for these eight adults using the median age at first resighting (5 years) of the observed distribution for the other 71 adults.

We hypothesized that survival of both young adult and adult groups would be linear functions (on the logit scale) of sex, year of fledging, and whether the natal BA, or for adults, breeding BA was in the Salt-Verde cluster (SVC). BAs inside SVC receive artificially enriched abundances of fish and have higher productivities. This whether the Natal or Breeding BA of an eagle was in SVC was considered potentially important for juvenile and adult survival.

Independent variables were entered as individual covariates as follows:

- Sex (-1=male, 0=unknown, 1= female)
- Natal year (1977-2007, rescaled from 0-1).
- Nbac or whether natal BA in Salt/Verde cluster (-1 no, 0 if unknown, 1 yes[5])
- Rbac or whether the last BA at which the eagle was resighted fell in Salt/Verde cluster.

Based on preliminary graphical analysis (Taylor and Silver 2006) the effects hypothesized were:

- Survival lower in more recent years
- Survival lower for individuals fledging from BAs outside Salt-Verde (SV) cluster
- Adult female survival higher than male
- Adult and young adult survival share same effects from independent variables, but with different intercepts.

Hypotheses for resight probabilities (denoted P) were:

- Female P no different from male;
- P increases with time due to improving observer knowledge and intensity of effort;
- P lower for individuals with natal BAs or breeding BAs outside SV cluster where monitoring effort was assumed to be less intense.

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5 The Salt Verde cluster includes the following BAs: Bartlett, Blue Point, Box Bar, Bulldog, Doka, Fort McDowell, Granite Reef, Needle Rock, Orme, Rock Creek, Rodeo, Sycamore.

Age class definitions were also varied in stepwise fashion to test the fit of the hypothesized age structure of juveniles age 0-3, young adults 4-5 and adults 6+.

Model fitting

Hypotheses as detailed above, were developed stepwise from the basic two parameter model (constant survival and resight probabilities).

Best-fitting models were selected on minimal Akaike Information Criterion (AIC).

The best fitting age models for both adult and juvenile apparent survival had uniform survival to ages 1-4 (because individuals were not generally resighted until after age 3), survival to age 5 fixed and uniform survival to ages 6 and up (Table 1).

Juvenile survival (ages 1-4) was found to be significantly correlated with year fledged, but not with natal BA. In contrast there was no correlation of resight probabilities with time.

Best model AIC was 1322.97. A generic age specific model fixed after age seven had AIC of 1383.55. A completely time varying model had much larger AIC of 2213.80.

Table 1. Apparent survival and resighting probabilities and age structure of best fitting model

Parameter	Fitted estimate	Lower 95%	Upper 95%	AGFD (unpubl) estimate	Female	Male	SVC	Outside SVC
Annual survival, to ages 1-4; fledged 1977-1987	100%	fixed		73%				
Annual survival, to ages 1-4; fledged 1989-1995	75.80%	70.62%	80.31%	73%				
Annual survival, to ages 1-4; fledged 1996-2003	61.74%	55.50%	67.61%	73%				
Annual survival, age 4 to 5	100%	fixed		88%				
Annual survival, to ages 6+	92.47%	89.64%	94.58%	88%	1.60%	-2.00%		
Resight, to ages 1-2	0	fixed		0 fixed				
Resight, age 2- 3	1.59%	0.40%	6.18%	0 fixed	-0.43%	0.59%	0.31%	-0.26%
Resight, age 3- 4	20.20%	12.89%	30.22%	22%	-4.66%	5.63%	3.05%	-2.74%
Resight, age 4- 5	50.85%	39.60%	62.01%	44%	-7.93%	7.89%	4.48%	-4.49%
Resight, age 5- 6	61.81%	49.83%	72.51%	70%	-7.76%	7.20%	4.15%	-4.33%
Resight, to ages 7+	79.58%	75.03%	83.48%	88%	-5.68%	4.70%	2.77%	-3.08%
Resight, to ages 8+				95%				

The best fitting model was a categorical period model juvenile survival at 1 for the fledging years 1977-1987, rather than linear trend model, with three periods of approx. equal length (Table 1).

It was recognized that the inclusion of the 8 individuals banded as adults in the early period could result in overestimation of survival in the early period, since banding was conditioned on a resighting of these animals. If all animals were banded only as adults then, of necessity, “resights” from birth are retrospective and 100% certain for all individuals. This should produce a falsely inflated juvenile survival estimate.

However, removal of these records from the analysis did not change the basic model, with early period juvenile survival fixed at 1.

Discussion

The original hypotheses were supported or not supported as follows (Table 1):

- Survival lower in more recent years- SUPPORTED
- Survival lower for individuals fledging from BAs outside Salt-Verde (SV) cluster- Not supported
- Adult female survival higher than male- SUPPORTED
- Adult and young adult survival share same effects from independent variables, but with different intercepts.- Not supported

Hypotheses for resight probabilities (denoted P) were:

- Female P no different from male- Not supported, the best model had females harder to resight than males.
- P increases with time due to improving observer knowledge and intensity of effort- Not supported.
- P lower for individuals with natal BAs or breeding BAs outside SV cluster where monitoring effort was assumed to be less intense.- SUPPORTED, adults from Natal BAs in SVC more likely to be resighted.

Departures from model assumptions

Validity of survival analysis using these recaptures models is dependent on several assumptions. These are discussed in turn:

1) Equal catchability: every marked animal present at time survey is done has the same probability of resighting

In fact this assumption was violated, since marked animals not breeding in a given year were very unlikely to be resighted for a given year. Also some BAs were more likely to be successful than others and so individuals at them more likely to be resighted than others with less consistent success. The resulting under-estimation of survival for the entire juvenile and adult population was compensated however, by counting only birds seen at BAs as adults in the breeding pool and thus over-estimating fecundity.

2) Marks are reliable and are not easily lost.

This assumption was likely to be met. Banding of large birds is well developed technology and has a low rate of natural loss.

3) The time taken to resight is small relative to the interval for which probabilities are being measured (a year).

This assumption is also not well satisfied, since observations of breeding attempts and monitoring of nest success typically extends up to half a year from January to May.

Comparison with earlier AGFD estimates

AGFD (unpubl.) analyzed post-fledging survival for bald eagles banded or marked between 1987 and 2003 (Table 2). It is uncertain to what extent the data used by AGFD overlap with this study, as AGFD did not provide a list of individuals included in that analysis.

AGFD did report marginally significant sex and time differences, and did not consider hypotheses to do with the Salt-Verde cluster.

The AGFD selected model had 3 age groups for survival probabilities: Ages 1-3 (fixed at 1, with zero resighting probability), Age 4, Ages 5+, with more age groups for resighted probabilities, similar to those found in this analysis (Table 1).

When this model was fitted to the juvenile model data set used in this study, the AIC was significantly greater than for the best fitting model of this study.

The chief differences between this analysis and the earlier analysis of AGFD were:

- Survival estimates were higher for adults in this study with substantial sex differences (Table 1).
- There were substantial time differences in juvenile mortality reported in this study (Table 1).
- There were sex and natal BA differences in resight probability reported in this study (Table 1).

Is the downward trend in juvenile survival real?

There is no obvious explanation for downward trend in juvenile survival over the period of study apart from a real decline in mortality. There was no evidence of time dependence in resight probability.

It must be recalled that the survival estimated is actually apparent survival.

There are several reasons why apparent survival might be less than actual survival:

- Birds emigrated as juveniles. Juvenile birds are known to migrate north to Canada and return to Arizona. If this is the case we might expect band recoveries or resightings outside of Arizona. However, band resightings are confined to neighboring states which are thought to be on the edges of the DNBE range and are rare events. Even if birds did emigrate permanently however, they are effectively "dead" to the Arizona population for breeding purposes.
- Birds did not die, but joined a non-breeding "floater population." If this is the case we would expect progressive delay in average time to first resighting at a BA, since birds would be spending more time in the floater population before attempting to breed. However, age at first resighting showed no significant time trend.
- Resighting effort has fallen off, so birds are surviving at same rate but simply less likely to be resighted. Resight probabilities however, showed no significant time trend in model fitting.
- Birds are dying at higher rate. Increased mortality in recent years seems to be the only conclusion that can be drawn from the data.

The discovery of new BAs has flattened off since about 2000, so one possibility is that increased juvenile mortality (and nestling mortality found by Taylor and Silver 2006) may indicate arrival of the population at carrying capacity with heavy competition for limited food and suitable breeding areas. However there is not indication of a time trend in fecundity that one might expect with approach to carrying capacity.

The remaining possibility is that environment and habitat have deteriorated, with a resulting increase in juvenile mortalities.

APPENDIX 3: RESIGHTINGS DATA

ID	Encounters starting 1979	Sex	Natal year[6]	NatalBA	SVC-natal[7]	Most recent resight BA	SVC-breeding
1987-14M	00000100001111000000000000000000	M	1982	Unknown	0	East Verde	-1
1987-17F	00000100001111100000000000000000	F	1982	Unknown	0	Horseshoe	-1
1987-25F	00000100001111111100000000000000	F	1982	Unknown	0	Pinal	-1
1988-17M	00000010000111000000000000000000	M	1983	Unknown	0	Horseshoe	-1
1988-19F	00000010000111111000000000000000	F	1983	Unknown	0	Ladders	-1
1988-28M	00000010000111100000000000000000	M	1983	Unknown	0	Redmond	-1
1994-21F	00000000000001000011111100111111	F	1989	Unknown	0	Luna	-1
1994-21M	00000000000001000011111010111111	M	1989	Unknown	0	Luna	-1
1988-10M	10000000000100000000000000000000	M	1977	Bartlett	1	Cibecue	-1
1989-01F	00100000000011111111101011111	F	1979	Fort McDowell	1	Alamo	-1
1983-04M	00100011101111111111111000000000	M	1979	Fort McDowell	1	Blue Point	1
1984-11M	00100000111111111110000000000000	M	1979	Redmond	-1	Cliff	-1
1985-01F	00100000000000000000000000000000	U	1979	Bartlett	1		0
1987-25M	00001000001111111111000101111000	M	1981	Redmond	-1	Pinal	-1
1987-26F	00001000000111111111100000000000	F	1981	Bartlett	1	Pinto	-1
1988-30M	00000010000111111111111111000000	M	1983	Fort McDowell	1	Seventy-Six	-1
1997-04F	00000001000000000000011110111110	F	1984	East Verde	-1	Blue Point	1
1988-03M	00000001000111100000000000000000	M	1984	Blue Po1t	1	Bartlett	1
1990-19M	00000001000001000000000000000000	M	1984	Horseshoe	-1	Ladders	-1
1987-04J	00000000001000111111111111111101	M	1987	Horse Mesa	-1	Pleasant	-1
1987-15J	00000000001000111111111111111111	F	1987	Horseshoe	-1	Tonto	-1
1987-18J	00000000001000001111111111111110	M	1987	P1al	-1	Tonto	-1
1987-05J	00000000001000000111111111101000	M	1987	Horse Mesa	-1	Redmond	-1
1987-01J	00000000001000000000000000000000	U	1987	Orme	1		0
1987-02J	00000000001000000000000000000000	U	1987	Orme	1		0
1987-03J	00000000001000000000000000000000	U	1987	Fort McDowell	1		0
1987-06J	00000000001000000000000000000000	U	1987	Coolidge	-1		0
1987-07J	00000000001000000000000000000000	U	1987	Coolidge	-1		0
1987-10J	00000000001000000000000000000000	U	1987	Blue Po1t	1		0
1987-11J	00000000001000000000000000000000	U	1987	Blue Po1t	1		0
1987-12J	00000000001000000000000000000000	U	1987	Blue Po1t	1		0
1987-13J	00000000001000000000000000000000	U	1987	Horseshoe	-1		0
1987-16J	00000000001000000000000000000000	U	1987	Redmond	-1		0
1987-19J	00000000001000000000000000000000	U	1987	P1al	-1		0
1987-20J	00000000001000000000000000000000	U	1987	East Verde	-1		0
1988-11J	00000000000100011111001111111100	F	1988	Seventy-Six	-1	Sheep	-1
1988-03J	00000000000100001000001100101000	M	1988	Ladders	-1	East Verde	-1
1988-05J	00000000000100000011110000000000	M	1988	Ive's Wash	-1	Ive's Wash	-1
1988-10J	00000000000100000011000011100000	F	1988	Seventy-Six	-1	Talkalai	-1
1988-04J	00000000000100000011100000000000	M	1988	Orme	1	Pinto	-1
1988-07J	00000000000100000000110000000000	M	1988	Cliff	-1	Dupont	-1

[6] The first 8 birds with grey background were marked as adults, and hence natal year is imputed to the observed median.

[7] Salt Verde cluster. See text.

ID	Encounters starting 1979	Sex	Natal year[6]	NatalBA	SVC-natal[7]	Most recent resight BA	SVC-breeding
1988-01J	00000000000100000000000000000000	U	1988	Alamo	-1		0
1988-02J	00000000000100000000000000000000	U	1988	Ladders	-1		0
1988-06J	00000000000100000000000000000000	U	1988	Cliff	-1		0
1988-08J	00000000000100000000000000000000	U	1988	Coolidge	-1		0
1988-09J	00000000000100000000000000000000	U	1988	Coolidge	-1		0
1988-12J	00000000000100000000000000000000	U	1988	Blue Po1t	1		0
1988-13J	00000000000100000000000000000000	U	1988	Blue Po1t	1		0
1988-15J	00000000000100000000000000000000	U	1988	Horseshoe	-1		0
1988-16J	00000000000100000000000000000000	U	1988	Lone P1e	-1		0
1989-08J	00000000000010001111111111111111	M	1989	Ladders	-1	Tower	-1
1989-12J	00000000000010000011111100001111	F	1989	Bartlett	1	San Carlos	-1
1989-02J	00000000000010000000000110101000	F	1989	Ive's Wash	-1	Redmond	-1
1989-01J	00000000000010000000000000000000	U	1989	Alamo	-1		0
1989-04J	00000000000010000000000000000000	U	1989	Fort McDowell	1		0
1989-05J	00000000000010000000000000000000	U	1989	Fort McDowell	1		0
1989-06J	00000000000010000000000000000000	U	1989	East Verde	-1		0
1989-07J	00000000000010000000000000000000	U	1989	East Verde	-1		0
1989-09J	00000000000010000000000000000000	U	1989	Ladders	-1		0
1989-10J	00000000000010000000000000000000	U	1989	P1al	-1		0
1989-11J	00000000000010000000000000000000	U	1989	Bartlett	1		0
1989-19M	00000000000010000000000000000000	M	1989	Unknown	0		0
1990-05J	00000000000001000011100101111100	F	1990	Horseshoe	-1	Pinal	-1
1990-04J	00000000000001000011110000000000	M	1990	Horse Mesa	-1	San Carlos	-1
1990-02J	00000000000001000000111100000000	F	1990	Alamo	-1	Sycamore	1
1990-03J	00000000000001000011000000000000	M	1990	Horse Mesa	-1	Box Bar	1
1990-01J	00000000000001000000000000000000	U	1990	Alamo	-1		0
1990-06J	00000000000001000000000000000000	U	1990	Horseshoe	-1		0
1990-07J	00000000000001000000000000000000	U	1990	P1al	-1		0
1990-08J	00000000000001000000000000000000	U	1990	P1al	-1		0
1990-09J	00000000000001000000000000000000	U	1990	Seventy-Six	-1		0
1990-10J	00000000000001000000000000000000	U	1990	Orme	1		0
1990-11J	00000000000001000000000000000000	U	1990	Redmond	-1		0
1991-08J	00000000000000100001011011111110	F	1991	Alamo	-1	Pinto	-1
1991-06J	00000000000000100011100000000011	F	1991	Fort McDowell	1	Granite Reef	1
1991-12J	00000000000000100011110000000000	F	1991	Blue Po1t	1	Ive's Wash	-1
1991-09J	00000000000000100000011110000000	M	1991	P1al	-1	Box Bar	1
1991-14J	00000000000000100011000000000000	M	1991	Ladders	-1	Sheep	-1
1991-03J	00000000000000100100000000000000	M	1991	Horse Mesa	-1	Sheep	-1
1991-13J	00000000000000100001000000000000	M	1991	Blue Po1t	1	Coolidge	-1
1991-01J	00000000000000100000000000000000	U	1991	Horse Mesa	-1		0
1991-02J	00000000000000100000000000000000	U	1991	Horse Mesa	-1		0
1991-04J	00000000000000100000000000000000	U	1991	Ive's Wash	-1		0
1991-05J	00000000000000100000000000000000	U	1991	Ive's Wash	-1		0
1991-07J	00000000000000100000000000000000	U	1991	Alamo	-1		0
1991-10J	00000000000000100000000000000000	U	1991	Coolidge	-1		0
1991-11J	00000000000000100000000000000000	U	1991	Seventy-Six	-1		0
1991-15J	00000000000000100000000000000000	U	1991	Ladders	-1		0
1991-17J	00000000000000100000000000000000	U	1991	Cibecue	-1		0
1991-18J	00000000000000100000000000000000	U	1991	Cibecue	-1		0

ID	Encounters starting 1979	Sex	Natal year[6]	NatalBA	SVC-natal[7]	Most recent resight BA	SVC-breeding
1991-19J	00000000000000010000000000000000	U	1991	Table Mounta1	-1		0
1991-20J	00000000000000010000000000000000	U	1991	Lone P1e	-1		0
1991-21J	00000000000000010000000000000000	U	1991	Orme	1		0
1992-02J	00000000000000001000111110100010	M	1992	Alamo	-1	Alamo	-1
1992-06J	00000000000000001000011111110000	M	1992	Orme	1	Sycamore	1
1992-13J	00000000000000001000000011111001	F	1992	East Verde	-1	Suicide	-1
1992-07J	00000000000000001000101100000000	M	1992	Coolidge	-1	Coldwater	-1
1992-01J	00000000000000001000000000000000	U	1992	Alamo	-1		0
1992-03J	00000000000000001000000000000000	U	1992	Ive's Wash	-1		0
1992-04J	00000000000000001000000000000000	U	1992	Ive's Wash	-1		0
1992-08J	00000000000000001000000000000000	U	1992	Blue Po1t	1		0
1992-09J	00000000000000001000000000000000	U	1992	Blue Po1t	1		0
1992-10J	00000000000000001000000000000000	U	1992	Ladders	-1		0
1992-11J	00000000000000001000000000000000	U	1992	Ladders	-1		0
1992-12J	00000000000000001000000000000000	U	1992	Seventy-Six	-1		0
1992-14J	00000000000000001000000000000000	U	1992	Bartlett	1		0
1993-09J	00000000000000000100000011111111	M	1993	Blue Po1t	1	Suicide	-1
1993-10J	00000000000000000100011110110000	M	1993	Blue Po1t	1	Fort McDowell	1
1993-19J	00000000000000000100000000011111	M	1993	Tower	-1	Oak Creek	-1
1993-04J	00000000000000000100001011000000	M	1993	Bartlett	1	Coolidge	-1
1993-05J	00000000000000000100000010000000	F	1993	East Verde	-1	Bartlett	1
1993-01J	00000000000000000100000000000000	U	1993	Alamo	-1		0
1993-02J	00000000000000000100000000000000	U	1993	Ive's Wash	-1		0
1993-03J	00000000000000000100000000000000	U	1993	Pleasant	-1		0
1993-06J	00000000000000000100000000000000	U	1993	P1al	-1		0
1993-07J	00000000000000000100000000000000	U	1993	Fort McDowell	1		0
1993-08J	00000000000000000100000000000000	U	1993	Fort McDowell	1		0
1993-11J	00000000000000000100000000000000	U	1993	Tonto	-1		0
1993-12J	00000000000000000100000000000000	U	1993	Tonto	-1		0
1993-13J	00000000000000000100000000000000	U	1993	P1to	-1		0
1993-15J	00000000000000000100000000000000	U	1993	Orme	1		0
1993-16J	00000000000000000100000000000000	U	1993	Horse Mesa	-1		0
1993-17J	00000000000000000100000000000000	U	1993	Coolidge	-1		0
1993-18J	00000000000000000100000000000000	U	1993	Coolidge	-1		0
1993-20J	00000000000000000100000000000000	U	1993	Alamo	-1		0
1993-21J	00000000000000000100000000000000	U	1993	Table Mounta1	-1		0
1993-22J	00000000000000000100000000000000	U	1993	Table Mounta1	-1		0
1994-07J	00000000000000000010001111111111	F	1994	Pleasant	-1	Box Bar	1
1994-12J	00000000000000000010000111111111	M	1994	Seventy-Six	-1	Sheep	-1
1994-04J	00000000000000000010001101111110	M	1994	Blue Po1t	1	Pinto	-1
1994-06J	00000000000000000010010000111111	M	1994	Pleasant	-1	Box Bar	1
1994-05J	00000000000000000010001111110000	M	1994	Blue Po1t	1	Doka	1
1994-13J	00000000000000000010000011111000	F	1994	Seventy-Six	-1	Perkinsville	-1
1994-01J	00000000000000000010000000000000	U	1994	Ive's Wash	-1		0
1994-03J	00000000000000000010000000000000	U	1994	Tonto	-1		0
1994-08J	00000000000000000010000000000000	U	1994	Alamo	-1		0
1994-09J	00000000000000000010000000000000	U	1994	Bartlett	1		0
1994-10J	00000000000000000010000000000000	U	1994	Orme	1		0
1994-11J	00000000000000000010000000000000	U	1994	Orme	1		0

ID	Encounters starting 1979	Sex	Natal year[6]	NatalBA	SVC-natal[7]	Most recent resight BA	SVC-breeding
1994-14J	00000000000000000010000000000000	U	1994	Table Mounta1	-1		0
1994-15J	00000000000000000010000000000000	U	1994	Ladders	-1		0
1994-16J	00000000000000000010000000000000	U	1994	Ladders	-1		0
1994-17J	00000000000000000010000000000000	U	1994	Cibecue	-1		0
1994-18J	00000000000000000010000000000000	U	1994	Luna	-1		0
1994-19J	00000000000000000010000000000000	U	1994	P1al	-1		0
1995-04J	00000000000000000001000111111100	M	1995	Pleasant	-1	Blue Point	1
1995-07J	00000000000000000001000001110011	F	1995	Tonto	-1	Bartlett	1
1995-09J	00000000000000000001000000110111	F	1995	P1to	-1	Lynx	-1
1995-01J	00000000000000000001000000000000	U	1995	Alamo	-1		0
1995-02J	00000000000000000001000000000000	U	1995	Alamo	-1		0
1995-03J	00000000000000000001000000000000	U	1995	Pleasant	-1		0
1995-05J	00000000000000000001000000000000	U	1995	Blue Po1t	1		0
1995-06J	00000000000000000001000000000000	U	1995	Blue Po1t	1		0
1995-08J	00000000000000000001000000000000	U	1995	P1to	-1		0
1995-10J	00000000000000000001000000000000	U	1995	East Verde	-1		0
1995-11J	00000000000000000001000000000000	U	1995	Redmond	-1		0
1995-14J	00000000000000000001000000000000	U	1995	Horse Mesa	-1		0
1995-15J	00000000000000000001000000000000	U	1995	Table Mounta1	-1		0
1995-16J	00000000000000000001000000000000	U	1995	Table Mounta1	-1		0
1995-17J	00000000000000000001000000000000	U	1995	Ive's Wash	-1		0
1995-18J	00000000000000000001000000000000	U	1995	Coolidge	-1		0
1995-19J	00000000000000000001000000000000	U	1995	Coolidge	-1		0
1995-20J	00000000000000000001000000000000	U	1995	Luna	-1		0
1996-15J	00000000000000000000100011111100	M	1996	Tower	-1	Perkinsville	-1
1996-14J	00000000000000000000100000011111	F	1996	Tower	-1	Oak Creek	-1
1996-01J	00000000000000000000100000000000	U	1996	Blue Po1t	1		0
1996-02J	00000000000000000000100000000000	U	1996	Blue Po1t	1		0
1996-03J	00000000000000000000100000000000	U	1996	P1to	-1		0
1996-04J	00000000000000000000100000000000	U	1996	P1to	-1		0
1996-05J	00000000000000000000100000000000	U	1996	P1to	-1		0
1996-08J	00000000000000000000100000000000	U	1996	East Verde	-1		0
1996-09J	00000000000000000000100000000000	U	1996	Sheep	-1		0
1996-10J	00000000000000000000100000000000	U	1996	Sheep	-1		0
1996-11J	00000000000000000000100000000000	U	1996	Tonto	-1		0
1996-12J	00000000000000000000100000000000	U	1996	Tonto	-1		0
1996-13J	00000000000000000000100000000000	U	1996	Ladders	-1		0
1996-17J	00000000000000000000100000000000	U	1996	Table Mounta1	-1		0
1996-19J	00000000000000000000100000000000	U	1996	Horseshoe	-1		0
1996-21J	00000000000000000000100000000000	U	1996	Seventy-Six	-1		0
1996-22J	00000000000000000000100000000000	U	1996	Luna	-1		0
1996-23J	00000000000000000000100000000000	U	1996	Luna	-1		0
1996-25J	00000000000000000000100000000000	U	1996	Bartlett	1		0
1996-26J	00000000000000000000100000000000	U	1996	Bartlett	1		0
1997-17J	00000000000000000000010000001111	F	1997	Horseshoe	-1	Talkalai	-1
1997-12J	00000000000000000000010000001101	M	1997	Luna	-1	Crescent	-1
1997-14J	00000000000000000000010000010000	F	1997	Coolidge	-1	Rodeo	1
1997-01J	00000000000000000000010000000010	M	1997	Tonto	-1	Beaver	-1
1997-02J	00000000000000000000010000000000	U	1997	Tonto	-1		0

ID	Encounters starting 1979	Sex	Natal year[6]	NatalBA	SVC-natal[7]	Most recent resight BA	SVC-breeding
1997-03J	0000000000000000000010000000000	U	1997	Fort McDowell	1		0
1997-04J	0000000000000000000010000000000	U	1997	Fort McDowell	1		0
1997-05J	0000000000000000000010000000000	U	1997	Pleasant	-1		0
1997-06J	0000000000000000000010000000000	U	1997	Pleasant	-1		0
1997-07J	0000000000000000000010000000000	U	1997	Blue Po1t	1		0
1997-08J	0000000000000000000010000000000	U	1997	Blue Po1t	1		0
1997-09J	0000000000000000000010000000000	U	1997	Blue Po1t	1		0
1997-10J	0000000000000000000010000000000	U	1997	Orme	1		0
1997-11J	0000000000000000000010000000000	U	1997	Orme	1		0
1997-13J	0000000000000000000010000000000	U	1997	Luna	-1		0
1997-15J	0000000000000000000010000000000	U	1997	Coolidge	-1		0
1997-16J	0000000000000000000010000000000	U	1997	Tower	-1		0
1997-18J	0000000000000000000010000000000	U	1997	Horseshoe	-1		0
1997-19J	0000000000000000000010000000000	U	1997	Box Bar	1		0
1997-20J	0000000000000000000010000000000	U	1997	Seventy-Six	-1		0
1997-21J	0000000000000000000010000000000	U	1997	Seventy-Six	-1		0
1997-22J	0000000000000000000010000000000	U	1997	Table Mounta1	-1		0
1997-24J	0000000000000000000010000000000	U	1997	Luna	-1		0
1998-03J	0000000000000000000001000011111	M	1998	Pleasant	-1	Lynx	-1
1998-17J	0000000000000000000001000011111	M	1998	Seventy-Six	-1	Ladders	-1
1998-14J	0000000000000000000001000001101	M	1998	Orme	1	Needle Rock	1
1998-06J	0000000000000000000001000110000	M	1998	Tonto	-1	Needle Rock	1
1998-09J	0000000000000000000001000001000	F	1998	Tower	-1	Lynx	-1
1998-02J	0000000000000000000001000000000	U	1998	Sycamore	1		0
1998-04J	0000000000000000000001000000000	U	1998	Box Bar	1		0
1998-05J	0000000000000000000001000000000	U	1998	Box Bar	1		0
1998-07J	0000000000000000000001000000000	U	1998	San Carlos	-1		0
1998-08J	0000000000000000000001000000000	U	1998	San Carlos	-1		0
1998-10J	0000000000000000000001000000000	U	1998	Tower	-1		0
1998-11J	0000000000000000000001000000000	U	1998	Ladders	-1		0
1998-12J	0000000000000000000001000000000	U	1998	Ladders	-1		0
1998-13J	0000000000000000000001000000000	U	1998	Ladders	-1		0
1998-15J	0000000000000000000001000000000	U	1998	Luna	-1		0
1998-16J	0000000000000000000001000000000	U	1998	Seventy-Six	-1		0
1998-18J	0000000000000000000001000000000	U	1998	Redmond	-1		0
1999-12J	0000000000000000000000100001111	F	1999	Blue Po1t	1	Ive's Wash	-1
1999-02J	0000000000000000000000100000000	U	1999	Fort McDowell	1		0
1999-03J	0000000000000000000000100000000	U	1999	Tonto	-1		0
1999-04J	0000000000000000000000100000000	U	1999	Tonto	-1		0
1999-05J	0000000000000000000000100000000	U	1999	Sycamore	1		0
1999-06J	0000000000000000000000100000000	U	1999	Sycamore	1		0
1999-07J	0000000000000000000000100000000	U	1999	Horseshoe	-1		0
1999-08J	0000000000000000000000100000000	U	1999	Horseshoe	-1		0
1999-09J	0000000000000000000000100000000	U	1999	Tower	-1		0
1999-10J	0000000000000000000000100000000	U	1999	Tower	-1		0
1999-11J	0000000000000000000000100000000	U	1999	Pleasant	-1		0
1999-13J	0000000000000000000000100000000	U	1999	P1to	-1		0
1999-14J	0000000000000000000000100000000	U	1999	P1to	-1		0
1999-15J	0000000000000000000000100000000	U	1999	East Verde	-1		0

ID	Encounters starting 1979	Sex	Natal year[6]	NatalBA	SVC-natal[7]	Most recent resight BA	SVC-breeding
1999-16J	0000000000000000000000100000000	U	1999	East Verde	-1		0
1999-17J	0000000000000000000000100000000	U	1999	Seventy-Six	-1		0
1999-18J	0000000000000000000000100000000	U	1999	Sheep	-1		0
1999-19J	0000000000000000000000100000000	U	1999	Luna	-1		0
1999-21J	0000000000000000000000100000000	U	1999	Ladders	-1		0
1999-22J	0000000000000000000000100000000	U	1999	Ladders	-1		0
1999-23J	0000000000000000000000100000000	U	1999	Orme	1		0
1999-24J	0000000000000000000000100000000	U	1999	Bartlett	1		0
1999-26J	0000000000000000000000100000000	U	1999	Cibecue	-1		0
2000-05J	0000000000000000000000010001111	M	2000	Doka	1	San Carlos	-1
2000-02J	0000000000000000000000010000111	M	2000	Fort McDowell	1	Granite Reef	1
2000-24J	0000000000000000000000010000011	M	2000	P1al	-1	Yellow Cliffs	-1
2000-03J	0000000000000000000000010000100	F	2000	Box Bar	1	Pleasant	-1
2000-01J	0000000000000000000000010000000	U	2000	Fort McDowell	1		0
2000-04J	0000000000000000000000010000000	U	2000	Box Bar	1		0
2000-06J	0000000000000000000000010000000	U	2000	Pleasant	-1		0
2000-07J	0000000000000000000000010000000	U	2000	Pleasant	-1		0
2000-08J	0000000000000000000000010000000	U	2000	Seventy-Six	-1		0
2000-09J	0000000000000000000000010000000	U	2000	Seventy-Six	-1		0
2000-10J	0000000000000000000000010000000	U	2000	Suicide	-1		0
2000-11J	0000000000000000000000010000000	U	2000	Suicide	-1		0
2000-12J	0000000000000000000000010000000	U	2000	Suicide	-1		0
2000-13J	0000000000000000000000010000000	U	2000	Horseshoe	-1		0
2000-14J	0000000000000000000000010000000	U	2000	Horseshoe	-1		0
2000-15J	0000000000000000000000010000000	U	2000	Redmond	-1		0
2000-18J	0000000000000000000000010000000	U	2000	Luna	-1		0
2000-19J	0000000000000000000000010000000	U	2000	Tower	-1		0
2000-20J	0000000000000000000000010000000	U	2000	Tower	-1		0
2000-22J	0000000000000000000000010000000	U	2000	Alamo	-1		0
2001-12J	0000000000000000000000001000011	F	2001	Horseshoe	-1	Seventy-Six	-1
2001-03J	0000000000000000000000001000001	M	2001	Box Bar	1	Cliff	-1
2001-01J	0000000000000000000000001000000	U	2001	Fort McDowell	1		0
2001-02J	0000000000000000000000001000000	U	2001	Fort McDowell	1		0
2001-04J	0000000000000000000000001000000	U	2001	Box Bar	1		0
2001-05J	0000000000000000000000001000000	U	2001	Tonto	-1		0
2001-06J	0000000000000000000000001000000	U	2001	P1to	-1		0
2001-07J	0000000000000000000000001000000	U	2001	P1to	-1		0
2001-08J	0000000000000000000000001000000	U	2001	Pleasant	-1		0
2001-09J	0000000000000000000000001000000	U	2001	Pleasant	-1		0
2001-10J	0000000000000000000000001000000	U	2001	Talkalai	-1		0
2001-11J	0000000000000000000000001000000	U	2001	Tower	-1		0
2001-13J	0000000000000000000000001000000	U	2001	Horseshoe	-1		0
2001-14J	0000000000000000000000001000000	U	2001	Suicide	-1		0
2001-15J	0000000000000000000000001000000	U	2001	Suicide	-1		0
2001-16J	0000000000000000000000001000000	U	2001	Orme	1		0
2001-17J	0000000000000000000000001000000	U	2001	Seventy-Six	-1		0
2001-18J	0000000000000000000000001000000	U	2001	Seventy-Six	-1		0
2001-19J	0000000000000000000000001000000	U	2001	Ladders	-1		0
2001-21J	0000000000000000000000001000000	U	2001	Redmond	-1		0

ID	Encounters starting 1979	Sex	Natal year[6]	NatalBA	SVC-natal[7]	Most recent resight BA	SVC-breeding
2001-22J	00000000000000000000000001000000	U	2001	Lone P1e	-1		0
2002-14J	00000000000000000000000000100001	M	2002	Talkalai	-1	Tonto	-1
2002-01J	00000000000000000000000000100000	U	2002	Sycamore	1		0
2002-03J	00000000000000000000000000100000	U	2002	Fort McDowell	1		0
2002-04J	00000000000000000000000000100000	U	2002	Fort McDowell	1		0
2002-05J	00000000000000000000000000100000	U	2002	Box Bar	1		0
2002-07J	00000000000000000000000000100000	U	2002	Tonto	-1		0
2002-08J	00000000000000000000000000100000	U	2002	Tonto	-1		0
2002-09J	00000000000000000000000000100000	U	2002	Alamo	-1		0
2002-10J	00000000000000000000000000100000	U	2002	Pleasant	-1		0
2002-11J	00000000000000000000000000100000	U	2002	Orme	1		0
2002-12J	00000000000000000000000000100000	U	2002	Orme	1		0
2002-13J	00000000000000000000000000100000	U	2002	Rodeo	1		0
2002-15J	00000000000000000000000000100000	U	2002	Talkalai	-1		0
2002-16J	00000000000000000000000000100000	U	2002	Sheep	-1		0
2002-17J	00000000000000000000000000100000	U	2002	Sheep	-1		0
2002-18J	00000000000000000000000000100000	U	2002	Tower	-1		0
2002-19J	00000000000000000000000000100000	U	2002	Tower	-1		0
2002-20J	00000000000000000000000000100000	U	2002	Needle Rock	1		0
2002-21J	00000000000000000000000000100000	U	2002	Luna	-1		0
2002-22J	00000000000000000000000000100000	U	2002	Luna	-1		0
2002-23J	00000000000000000000000000100000	U	2002	Ladders	-1		0
2002-24J	00000000000000000000000000100000	U	2002	Ladders	-1		0
2002-25J	00000000000000000000000000100000	U	2002	Granite Reef	1		0
2002-26J	00000000000000000000000000100000	U	2002	Granite Reef	1		0
2002-27J	00000000000000000000000000100000	U	2002	Horseshoe	-1		0
2002-28J	00000000000000000000000000100000	U	2002	Horseshoe	-1		0
2002-29J	00000000000000000000000000100000	U	2002	P1al	-1		0
2003-01J	00000000000000000000000000010000	U	2003	Sycamore	1		0
2003-02J	00000000000000000000000000010000	U	2003	Sycamore	1		0
2003-03J	00000000000000000000000000010000	U	2003	Needle Rock	1		0
2003-04J	00000000000000000000000000010000	U	2003	Box Bar	1		0
2003-05J	00000000000000000000000000010000	U	2003	Suicide	-1		0
2003-06J	00000000000000000000000000010000	U	2003	Suicide	-1		0
2003-07J	00000000000000000000000000010000	U	2003	Suicide	-1		0
2003-08J	00000000000000000000000000010000	U	2003	Luna	-1		0
2003-09J	00000000000000000000000000010000	U	2003	Pleasant	-1		0
2003-10J	00000000000000000000000000010000	U	2003	Tower	-1		0
2003-12J	00000000000000000000000000010000	U	2003	Orme	1		0
2003-13J	00000000000000000000000000010000	U	2003	Bartlett	1		0
2003-14J	00000000000000000000000000010000	U	2003	Horseshoe	-1		0
2003-15J	00000000000000000000000000010000	U	2003	Ladders	-1		0
2003-16J	00000000000000000000000000010000	U	2003	Ladders	-1		0
2003-18J	00000000000000000000000000010000	U	2003	Coolidge	-1		0
2004-01J	00000000000000000000000000001000	U	2004	Box Bar	1		0
2004-02J	00000000000000000000000000001000	U	2004	Box Bar	1		0
2004-03J	00000000000000000000000000001000	U	2004	Lynx	-1		0
2004-04J	00000000000000000000000000001000	U	2004	Ive's Wash	-1		0
2004-05J	00000000000000000000000000001000	U	2004	Ive's Wash	-1		0

ID	Encounters starting 1979	Sex	Natal year[6]	NatalBA	SVC-natal[7]	Most recent resight BA	SVC-breeding
2004-06J	00000000000000000000000000001000	U	2004	Ive's Wash	-1		0
2004-07J	00000000000000000000000000001000	U	2004	Luna	-1		0
2004-08J	00000000000000000000000000001000	U	2004	Luna	-1		0
2004-09J	00000000000000000000000000001000	U	2004	Orme	1		0
2004-10J	00000000000000000000000000001000	U	2004	Orme	1		0
2004-11J	00000000000000000000000000001000	U	2004	Pleasant	-1		0
2004-12J	00000000000000000000000000001000	U	2004	Horseshoe	-1		0
2004-13J	00000000000000000000000000001000	U	2004	Horseshoe	-1		0
2004-14J	00000000000000000000000000001000	U	2004	Suicide	-1		0
2004-15J	00000000000000000000000000001000	U	2004	Suicide	-1		0
2004-16J	00000000000000000000000000001000	U	2004	Suicide	-1		0
2004-17J	00000000000000000000000000001000	U	2004	Bartlett	1		0
2004-18J	00000000000000000000000000001000	U	2004	Bartlett	1		0
2004-20J	00000000000000000000000000001000	U	2004	P1al	-1		0
2004-21J	00000000000000000000000000001000	U	2004	Needle Rock	1		0
2004-24J	00000000000000000000000000001000	U	2004	Redmond	-1		0
2004-26J	00000000000000000000000000001000	U	2004	Ladders	-1		0
2004-27J	00000000000000000000000000001000	U	2004	Talkalai	-1		0
2004-29J	00000000000000000000000000001000	U	2004	Lone P1e	-1		0
2005-01J	00000000000000000000000000000100	U	2005	Lynx	-1		0
2005-02J	00000000000000000000000000000100	U	2005	Box Bar	1		0
2005-03J	00000000000000000000000000000100	U	2005	Orme	1		0
2005-04J	00000000000000000000000000000100	U	2005	Orme	1		0
2005-05J	00000000000000000000000000000100	U	2005	Tower	-1		0
2005-08J	00000000000000000000000000000100	U	2005	Needle Rock	1		0
2005-09J	00000000000000000000000000000100	U	2005	Luna	-1		0
2005-10J	00000000000000000000000000000100	U	2005	Luna	-1		0
2005-11J	00000000000000000000000000000100	U	2005	Granite Reef	1		0
2005-12J	00000000000000000000000000000100	U	2005	P1al	-1		0
2005-13J	00000000000000000000000000000100	U	2005	P1al	-1		0
2005-14J	00000000000000000000000000000100	U	2005	Talkalai	-1		0
2005-15J	00000000000000000000000000000100	U	2005	Ive's wash	-1		0
2005-17J	00000000000000000000000000000100	U	2005	Ladders	-1		0
2005-18J	00000000000000000000000000000100	U	2005	Lone P1e	-1		0
2006-01J	00000000000000000000000000000010	U	2006	Lynx	-1		0
2006-02J	00000000000000000000000000000010	U	2006	Lynx	-1		0
2006-03J	00000000000000000000000000000010	U	2006	Beaver	-1		0
2006-04J	00000000000000000000000000000010	U	2006	Horseshoe	-1		0
2006-05J	00000000000000000000000000000010	U	2006	Needle Rock	1		0
2006-06J	00000000000000000000000000000010	U	2006	Needle Rock	1		0
2006-07J	00000000000000000000000000000010	U	2006	Orme	1		0
2006-09J	00000000000000000000000000000010	U	2006	Oak Creek	-1		0
2006-10J	00000000000000000000000000000010	U	2006	Tower	-1		0
2006-13J	00000000000000000000000000000010	U	2006	Granite Reef	1		0
2006-14J	00000000000000000000000000000010	U	2006	Lone P1e	-1		0
2006-15J	00000000000000000000000000000010	U	2006	Lone P1e	-1		0
2006-16J	00000000000000000000000000000010	U	2006	Ladders	-1		0
2006-17J	00000000000000000000000000000010	U	2006	Ladders	-1		0
2006-18J	00000000000000000000000000000010	U	2006	Cibecue	-1		0

ID	Encounters starting 1979	Sex	Natal year[6]	NatalBA	SVC-natal[7]	Most recent resight BA	SVC-breeding
2006-19J	00000000000000000000000000000010	U	2006	Yellow Cliffs	-1		0
2006-21J	00000000000000000000000000000010	U	2006	Bartlett	1		0
2006-22J	00000000000000000000000000000010	U	2006	Lower Lake Mary	-1		0
2006-23J	00000000000000000000000000000010	U	2006	Lower Lake Mary	-1		0
2006-24J	00000000000000000000000000000010	U	2006	Lower Lake Mary	-1		0
2006-25J	00000000000000000000000000000010	U	2006	Bulldog	1		0

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