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October 6, 2004

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U.S. FISH & WILDLIFE SERVICE
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Date correction made from Oct 5 to Oct 6, 2004

Secretary Gail Norton
Department of the Interior
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U.S. Fish and Wildlife Service
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Arizona State Director Steve Spangle
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2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4915
Phone: 602.242-0210

Dear Ms. Norton and Messrs. Williams, Hall, and Spangle,

With this correspondence and the attached Petition, the Center for Biological Diversity (CBD), Maricopa Audubon, and the Arizona Audubon Council petition the U.S. Fish and Wildlife Service to (1) Recognize the biologically, behaviorally and ecologically Isolated Southwestern Desert Nesting Bald Eagle (*Haliaeetus leucocephalus*) population as a Distinct Population Segment, (2) to List this population as Endangered, (3) and to Designate Critical Habitat for this population.

We file this Petition pursuant to Section 4 of the Endangered Species Act, (16 U.S.C. 1531 et seq.), pursuant to the U.S. Fish and Wildlife Service's regulations for listing (50 CFR 424.14) and for designating Critical Habitat (424.12), and pursuant to the Administrative Procedures Act (5 U.S.C. 553).

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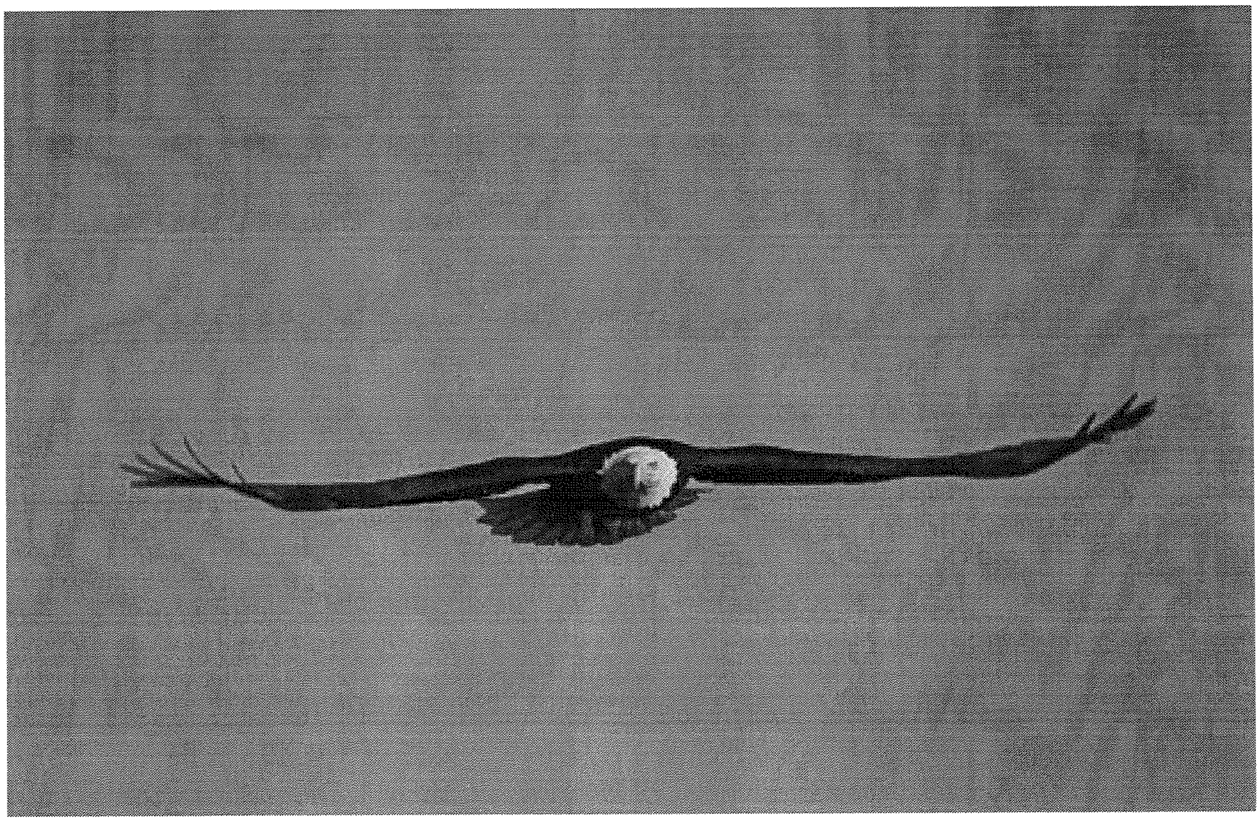
CBD, Maricopa Audubon and the Arizona Audubon Council sincerely believe that increasing protection will be necessary if the Southwestern Desert Nesting Bald Eagle is to survive. In support, we submit this Petition. Please keep us advised of all proceedings in this matter. In 90 days, pursuant to Section 4(b)(3)(A), we expect notification that (1) this Petition presents substantial scientific information indicating that the petitioned action is warranted, and (2) that U.S. Fish and Wildlife Service has commenced a new formal review of Desert Bald Eagle Distinct Population Segment for designation as Endangered with Critical Habitat.

If you have any questions, please contact, Robin Silver, M.D., Board Chair, CBD, P.O. Box 39629, Phoenix, AZ 85069-9382; Phone: 602 246 4170; FAX: 602 249 2576; or Email: rsilver@biologicaldiversity.org.

Sincerely,

Robin Silver, M.D.
Board Chair

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



Bald Eagle, *Haliaeetus leucocephalus*
(© Robin Silver Photography)

Center for Biological Diversity
Dr. Robin Silver
Maricopa Audubon Society
Arizona Audubon Council
October 6, 2004

Executive Summary

Only approximately 166 individuals and less than 60 pairs of biologically, behaviorally and ecologically isolated Southwestern Desert Nesting Bald Eagles survive.[1] Their survival is already dependent, in good part, on heroic human support and management by the Arizona Bald Eagle Nestwatch Program (ABENWP).[2] Even more help will be necessary if the Desert Nesting Bald Eagle is to survive increasing threats to its continued existence.[3]

The Desert Nesting Bald Eagle population is isolated and discrete from other Bald Eagle populations as a consequence of physical, physiological, ecological, and behavioral factors.[4] It persists in an ecological setting unusual and unique for the Bald Eagle.[5] Loss of this discrete population would result in a significant gap in the range of the Bald Eagle.[6]

The biological, behavioral and ecological isolation of this population is superbly documented.[7] This documentation includes the facts that the population (a) persists in the unique ecological setting of the Sonoran life zones of the desert Southwest,[8] (b) is smaller than other Bald Eagles,[9] (c) is behaviorally unique,[10] and (d) is reproductively isolated.[11] The current understanding of genetics does not refute the discrete and isolated nature of the Desert Nesting Bald Eagle.[12]

The Desert Nesting Bald Eagle population is extremely small without prospect for significant expansion.[13] The Arizona Game and Fish Department (AGFD) estimates that 77 individuals occupy 42 Arizona Breeding Areas (BAs).[14] This estimate of the population occupying BAs may be overestimated however owing to the fact that some individuals occupy more than one Breeding Area (BA) simultaneously.[15]

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[1] AGFD 1999a, 2000, 2001a, 2001b, 2001c, 2002a, 2002b, 2003, 2004c, 2004d, unpublished data; Driscoll 1999; CBD 2004e; Personal communication AGFD, New Mexico Department of Game and Fish, and USFWS 2004; SWCBD 1999; USFWS 2003b

[2] AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004c; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1997, 1998; Hunt *et al.* 1992; SWCBD 1999; USFWS 1992b, 1999c, 2003a, 2003b

[3] ADWR 1994, 1999; AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004a, 2004b, 2004c; Arizona Daily Sun 2004; Arizona Republic 2000, 2001, 2003b, 2003c, 2004a, 2004b; CBD 2003b; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Hunt *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; SWRAG 2000; SWCBD 1999; USGS 2000; USFWS 1993b, 1997a, 1997b, 1998, 1999a, 2000a, 2002a, 2003a, 2003b, 2003e; Verde Natural Resources Conservation District 1999

[4] AGFD 1994b, 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Ohmart and Sell 1980; Stalmaster 1987; SWCBD 1999; USFWS 1982, 1997a, 1997b, 1998, 2000a, 2002a, 2003a, 2003b

[5] Ibid.

[6] AGFD 1994b, 1999a, 2000; Hunt *et al.* 1992; SWCBD 1999; USFWS 1982, 1995, 2001a

[7] AGFD 1999a, 2000; Hunt *et al.* 1992; Ohmart and Sell 1980; SWCBD 1999; USFWS 1982, 1997a, 1997b, 1998, 2000a, 2002a, 2003a, 2003b

[8] AGFD 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Hunt *et al.* 1992; Ohmart and Sell 1980; USFWS 1982, 1997a, 1997b, 1998, 2000a, 2002a, 2003a, 2003b;

[9] AGFD 1999a, 2000; Hunt *et al.* 1992; USFWS 1997a, 1997b, 1998, 2002a, 2003b

[10] AGFD 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Stalmaster 1987; USFWS 1997a, 1997b, 1998, 2002a, 2003b

[11] AGFD 1994b, 1999a, 2000; Beatty and Driscoll 1996b; Hunt *et al.* 1992; SWCBD 1999; USFWS 1997a, 1997b, 1998, 2002a, 2003b

[12] CBD 2004e, Hunt *et al.* 1992, SWCBD 1999

[13] AGFD 1993, 1999a, 2000, 2001b, 2001c, 2002b, 2004b; Hunt *et al.* 1992; SWCBD 1999; USFWS 2003a, 2003b

[14] AGFD unpublished data

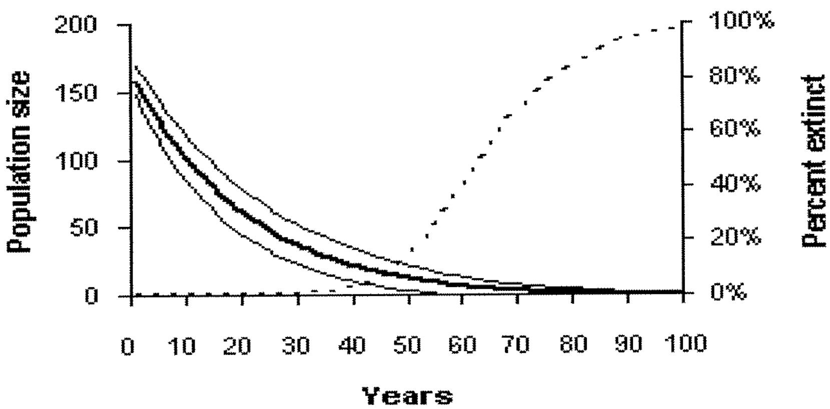
[15] AGFD unpublished data, CBD 2004e

The small size of the Southwestern Desert Nesting Bald Eagle population is, in itself, problematic.[16] Isolated populations of this size are particularly vulnerable to demographic stochasticity and inbreeding depression.[17] They become increasingly vulnerable to environmental threats as the loss of allelic variation closes options for future evolutionary adaptation.[18]

Mortality for breeding adults in the Southwestern Desert Nesting population is excessive.[19] Subadults display an extremely high presence in breeding pairs.[20] Such subadult participation in breeding pairs is of great concern as it is very rare elsewhere.[21] This excessively high presence of Subadults in breeding pairs most likely reflects the population's high adult mortality rates.[22]

Mortality for this population's fledglings is also excessive.[23] Reproductive rates are low for the Southwestern Desert Nesting Bald Eagle in comparison to Bald Eagle populations elsewhere.[24] The most prolific Desert Nesting Bald Eagle breeding areas are showing productivity declines.[25] In particular, breeding areas along the free-flowing rivers are showing productivity declines.[26]

Based on AGFD survival estimates, a new population viability analysis demonstrates a high risk of extinction for this population within the next 57 and 82 years:[27]



Means (+/- S.D.) of population sizes and percent of simulations extinct (dashed line).

[16] CBD 2004e, Franklin 1980, Gilpin and Soule 1986, Hunt *et al.* 1992, Lande 1987, IUCN 2001, Soule 1980, Thomas *et al.* 1990, USFWS 1994a, Wilcox 1987, Wright 1984

[17] Ibid.

[18] Ibid.

[19] AGFD 1999a, 2000; Beatty and Driscoll 1996b; Gerrard *et al.* 1992; Hunt *et al.* 1992; Stalmaster 1987; USFWS 1993b

[20] AGFD 1994b, 1999a, 2000; Hunt *et al.* 1992; SWCBD 1999

[21] Ibid.

[22] Ibid.

[23] AGFD 1999a, 2000; Beatty and Driscoll 1996b; Hunt *et al.* 1992; Mesta *et al.* 1992

[24] AGFD 1999a, 2000; Hunt *et al.* 1992; USFWS 2003b

[25] AGFD 1994b, 1999a, 2000

[26] Ibid.

[27] AGFD 1999a, 2000, 2001a, 2001b, 2001c, 2002a, 2002b, 2003, 2004c, 2004d, unpublished data; Beatty 1990a, 1990b, 1992,1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1997, 1998; CBD 2004e; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Hunt *et al.* 1992

The risk of extinction for this population is undoubtedly even much higher owing to the fact that (1) threats to its continued existence are increasing,[28] and (2) that the inadequacy of existing regulatory mechanisms is contributing to the vulnerability of the population.[29]

Direct human intervention by ABENWP personnel has saved 16% of all Southwestern Desert Nesting Bald Eagle fledglings from 1983 through 1999.[30] In some years these efforts have been "directly responsible for saving up to 60% of a single year's nestlings..."[31] Many more survive owing to indirect human interaction.[32] ABENWP is responsible for both direct and indirect support efforts; however, ABENWP funding is not secure.[33]

Southwestern Desert Nesting Bald Eagle habitat faces imminent and accelerating loss of increasing amounts of habitat vital for long-term survival.[34] Two of the three Desert Nesting Bald Eagle nests on private property are not producing young and are destined to fail.[35] The third faces additional increasing threat owing to impending stream dewatering.[36]

Fish are the dominant food source for the Desert Nesting Bald Eagle.[37] The native fishery with which the Desert Nesting population evolved continues to suffer decline.[38] Of the 20 native fish of the Gila River Basin, one is extinct, six are extirpated, nine are listed as Threatened or Endangered, and nine of the ten others merit greater protection.[39]

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[28] ADWR 1994, 1999; AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004a, 2004b, 2004c; Arizona Daily Sun 2004; Arizona Republic 2000, 2001, 2003b, 2003c, 2004a, 2004b; CBD 2003b; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Hunt *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; SWRAG 2000; SWCBD 1999; USGS 2000; USFWS 1993b, 1997a, 1997b, 1998, 1999a, 2000a, 2002a, 2003a, 2003b, 2003e; Verde Natural Resources Conservation District 1999

[29] ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1994b, 1999a, 2000, 2001a, 2002a, 2003, 2004a, 2004b, 2004c; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1997, 1998; Driscoll 1999; Hunt *et al.* 1992; SWCBD 1999; USFWS 1992b, 1999c, 2003a, 2003b AGFD 1994a, 1999a, 2000; Arizona Daily Star 2004; Arizona Daily Sun 2004; Arizona Republic 1989, 2000, 2001, 2003a, 2003b, 2003c, 2004a, 2004b, 2004c, 2004f; CBD 2003b, 2004c; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Earthjustice 2004a, 2004b, 2004c; Hunt *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; SWCBD 1999; SWRAG 2000; USGS 2000; USFWS 1992d, 1993a, 1993b, 1994c, 1996b, 1996c, 1997a, 1997b, 1998, 1999a, 2000a, 2002a, 2003a, 2003b, 2003e, 2004a, 2004c; Verde Natural Resources Conservation District 1999

[30] AGFD 1999a, 2000; Hunt *et al.* 1992;

[31] USFWS 1992b

[32] AGFD 1999a, 2000, 2001a, 2002a, 2003; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1997, 1998; SWCBD 1999; USFWS 1999c, 2003b

[33] AGFD 1994a, 1999a, 2000; Arizona Republic 2003a, 2004c, 2004f; SWCBD 1999; USFWS 1996c, 2002a

[34] ADWR 1994, 1999; AGFD 1993, 1999a, 2000; Arizona Republic 2000, 2001; Chino Valley Review 2004; Lofgren *et al.* 1990; Krueper 1993; Prescott 2001, Prescott Daily Courier 2004a, 2004b; SWCBD 1999; USFWS 1984, 1985, 1990b, 1992a, 1992d, 1993a, 1994c, 1996b, 1996c, 1997a, 1997b, 1998, 2001a, 2003b, 2003d

[35] AGFD 1994b, 1999a, 2000, 2001a, 2002a, 2003, 2004c

[36] ADWR 1999; Arizona Republic 2000, 2001; Chino Valley Review 2004; Prescott 2001; Prescott Daily Courier 2004a, 2004b; USFWS 2001a

[37] AGFD 1999a, 2000; Hunt *et al.* 1992; Ohmart and Sell 1980;

[38] AGFD 1999a, 2000; CBD 2003b; Desert Fish Team 2003, 2004; Hunt *et al.* 1992; USFWS 2003d

[39] CBD 2003b; Desert Fish Team 2003, 2004;

Toxic substances remain a problem.[40] DDT and its derivatives are still found in Arizona.[41] Pyrroles almost became the next DDT.[42] Heavy metals exposure and contamination of the Desert Nesting Bald Eagle, particularly by mercury, is worrisome.[43]

Fishing line and tackle are found in half of Southwestern Desert Nesting Bald Eagle nests.[44] Deaths in both adults and nestlings have been documented resulting from this exposure.[45] Increasing deaths are expected.[46]

Global warming will increase the Desert Nesting Bald Eagle's challenge of living in an already extremely hostile environment.[47] Global warming and drought are becoming increasing factors.[48] Heat stress is a recognized leading cause of mortality for nestlings.[49] Decreased productivity has already been documented in areas of local drought effects.[50]

Eggshell thinning remains a potential problem for the Desert Nesting Bald Eagle.[51] The cause of documented eggshell thinning is still not known.[52]

Habitual violation of law and lack of agency resolve increasingly threatens protection of the Desert Nesting Bald Eagle.[53] Cattle grazing continues within the riparian habitat critical to the Desert Nesting Bald Eagle.[54] Dam operations do not release water at times necessary for replenishment of riparian nest trees.[55] Low flying aircraft continue and will increasingly continue adversely affecting the population.[56] Flight advisories are not mandatory and are routinely ignored.[57] Dewatering of remnant free-flowing rivers continues.[58] Exotic fish continue to be introduced into native fish habitat.[59]

From 1992 through 2004, the U.S. Fish and Wildlife Service (USFWS) reviewed and approved Federal projects responsible for deaths of up to 95 Desert Nesting Bald

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[40] ADEQ 2004a, 2004b; AGFD 1999a, 2004a, 2004b; American Bird Conservancy 2003, 2004a, 2004b; Arizona Republic 2004d, 2004e; CBD 2004c; Earthjustice 2004a, 2004b, 2004c; Elliott *et al.* 1997; EPA 1998, 1999, 2000, 2003, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f; Pesticide Action Network 1999; University of Arizona 2004; USDA 2001; USFWS 1995

[41] ADEQ 2004a, 2004b; EPA 2003, 2004a; Grubb *et al.* 1990; Hunt *et al.* 1992; King *et al.* 1991; USFWS 2001d; Weimeyer *et al.* 1984

[42] EPA 1999, 2000

[43] ADEQ 2004a, 2004b; AGFD 1999a, 2000, 2004a, 2004b; EPA 2004b; USFWS 2001d

[44] AGFD 1994b

[45] AGFD 1999a, 2000

[46] Ibid.

[47] USFWS 1990c

[48] ADWR 1994; AGFD 1999a, 2000; Arizona Daily Sun 2004; Arizona Republic 2003b, 2003c, 2004a, 2004b, 2004g; CNN 2004; National Geographic 2004; Observer/UK 2004; SWRAG 2000; USFWS 1990c, 2003b

[49] AGFD 1999a, 2000; Driscoll 1999; Hunt *et al.* 1992

[50] USFWS 2003b

[51] AGFD 1999a, 2000

[52] SWCBD 1999

[53] AGFD 1994b; Desert Fishes Team 2003, 2004; SWCBD 1999; USFWS 1992a, 1993a, 1994c, 1996b, 1997b, 1998, 1999a, 2000a, 2003b, 2003d

[54] AGFD 1999a, 2000; Driscoll 1999; USFWS 1997b, 1998, 2002a, 2003b

[55] AGFD 1999a, 2000; USFWS 1997b, 2003b

[56] AGFD 1999a, 2000; USFWS 1993a, 1994c, 1997b, 2002a, 2003b

[57] AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004c; Arizona Republic 1989

[58] ADWR 1999a, 2000; Arizona Republic 2000, 2001; Chino Valley Review 2004; Desert Fishes Team 2003, 2004; Prescott 2001; Prescott Daily Courier 2004a, 2004b; USFWS 1998, 2001a; Verde Natural Resources Conservation District 1999

[59] Desert Fishes Team 2003, 2004

Eagles (adults, fledglings and/or nestlings).[60] Over the 50-year life of these projects, USFWS expects, and has approved, 561 cumulative deaths! [61] Thirty percent of occupied eagle nesting territories in Arizona may be adversely affected by these planned projects.[62]

USFWS has piecemealed the evaluation of these projects to avoid arriving at the obvious conclusion that, cumulatively, these projects will jeopardize the continued existence of the Desert Nesting population.[63] In 1995, a U.S. District Court examined USFWS' similar ruse in attempting to weaken habitat protection for the Mexican Spotted Owl.[64] In that case, the Southwest Center for Biological Diversity (SWCBD, now the Center for Biological Diversity) established the fact that an evaluation claiming non-jeopardy effects by individual projects across a landscape does not accurately reflect the programmatic net jeopardy effect.[65] As a result, USFWS was forced to modify its projects affecting the Mexican Spotted Owl.[66] Ironically, at the same time, USFWS continues to warn of increasing dangers to the survival of the Southwestern Desert Nesting Bald Eagle.[67]

In 1995, the USFWS downlisted the Bald Eagle from Endangered to Threatened Eagles throughout the entire lower 48 states.[68] This action included the downlisting of the Southwestern Desert Nesting Bald Eagle population from endangered to threatened.[69] This action, in itself, significantly weakened protection for the Desert Nesting Bald Eagle.[70]

In 1999, USFWS proposed delisting the Bald Eagle, including the Southwestern Desert Nesting population.[71] USFWS' inclusion of the Desert Nesting population in these efforts is inappropriate.[72] Delisting of the Desert Nesting population violates law and precedent.[73] It lacks scientific merit.[74]

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[60] USFWS 1992d, 1993a, 1994c, 1996b, 1999a, 2000a, 2003b

[61] USFWS 1992d, 1993a, 1994c, 1996b, 1999a, 2000a, 2003a, 2003b

[62] AGFD 1994b

[63] USFWS 1992d, 1993a, 1994c, 1996b, 1999a, 2000a, 2003a, 2003b

[64] Silver v. Thomas 1995

[65] Ibid.

[66] Ibid.

[67] USFWS 1993a, 1994c, 1997a, 1997b, 1998, 2002a, 2003b

[68] USFWS 1995

[69] Ibid.

[70] AGFD 1994a, USFWS 1994c

[71] USFWS 1999c

[72] AGFD 1994a, 1994b; Driscoll 1995; Driscoll et al. 1993; SWCBD 1999; USFWS 1990c, 1992c, 1994a, 1994b

[73] CBD 2004d; ESA Sections 3 & 4; SWCBD 1999;

[74] ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1993, 1994b, 1999a, 2000, 2001a, 2001b, 2001c, 2002a, 2003, 2004a, 2004b, 2004c, unpublished data; Arizona Daily Sun 2004; Arizona Republic 2000, 2001, 2003b, 2003c, 2004a, 2004b; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1997, 1998; CBD 2003b, 2004c; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Driscoll 1999; Driscoll and Beatty 1994; Driscoll *et al.* 1992; EPA 2004b; Franklin 1980; Gerrard and Bortoletti 1988; Gilpin and Soule 1986; Hunt *et al.* 1992; IUCN 2001; Krueper 1993; Lande 1987; Lofgren *et al.* 1990; Mesta *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; Prescott Daily Courier 2004a, 2004b; Soule 1980; Stalmaster 1987; SWRAG 2000; SWCBD 1999; Thomas *et al.* 1990; USGS 2000; USFWS 1982, 1984, 1985, 1990b, 1990c, 1992a, 1992b, 1992d, 1993a, 1993b, 1994a, 1994c, 1995, 1996b, 1996c, 1997a, 1997b, 1998, 1999a, 1999c, 2000a, 2001a, 2001d, 2002a, 2003a, 2003b, 2003d, 2003e; Verde Natural Resources Conservation District 1999; Wilcox 1987; Wright 1984

Anti-conservation attitudes fuel these current delisting efforts without regard for the biological, behavioral and ecological isolation of this population.[75] At the National level these efforts reflect the Bush Administration's historic antipathy for wildlife protection.[76] The Bush administration is now even proposing "to ease export restrictions on American bald eagles" without regard to the discreteness and fragility of the Desert Nesting population.[77]

At the State level these misguided efforts reflect nearly a decade of similar hostility by recent former Arizona Governors Fife Symington and Jane Hull.[78] This hostility continues to be perpetuated by the current Arizona Game and Fish Commissioners.

The Endangered Species Act (ESA) defines "threatened" as any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.[79] The ESA defines "endangered" as any species that is in danger of extinction.[80] The ESA defines "species" as includes any subspecies of fish or wildlife or plants, and any distinct population segment of any species or vertebrate fish or wildlife which interbreeds when mature.[81] A Distinct Population Segment is defined as a population that is (1) biologically, behaviorally and ecologically isolated, (2) persisting in an unusual or unique ecological setting, and (3) whose loss would result in a significant gap in the species' range.[82] The Desert Nesting Bald Eagle population is truly a Distinct Population Segment owing to (1) its biological, behavioral and ecological isolation,[83] (2) its persistence in an ecological setting unusual and unique for the Bald Eagle,[84] and (3) and the fact that loss of this discrete population would result in a significant gap in the range of the Bald Eagle.[85]

Once the Bald Eagle nested along every major river and large lake in the continental United States.[86] The Desert Nesting population is now genuinely in danger of extinction. It is endangered in every sense of the definition of the phrase. The population meets the International Union for the Conservation of Nature (IUCN) criteria for "critically endangered" on the basis of small population size and vulnerability to stochastic extinction.[87] It certainly meets the criteria for USFWS "endangered" status.[88]

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[75] AGFD 1994b, 1999a, 1999b, 2000; Arizona Republic 1996, 1997, 2003d; CBD 2004a, 2004b; Grist Magazine 2004; Nature 2003; Phoenix Gazette 1993; Sierra Vista Herald 1998; U.S. House of Representatives 2002

[76] Arizona Daily Star 2004; Arizona Republic 2003d, 2004d; Associated Press 2004a, 2004b; CBD 2004a, 2004b; Earthjustice 2004a, 2004b, 2004c, 2004c; Grist Magazine 2004; Nature 2003; New York Times 2004; Progressive 2003; Seattle Times 2004; U.S. House of Representatives 2002; USFWS 2004a, 2004c

[77] Arizona Republic 2004h

[78] Arizona Republic 1996, 1997; Phoenix Gazette 1993; Sierra Vista Herald 1998

[79] ESA, Section 3(19)

[80] ESA, Section 3(6)

[81] ESA, Section 3(15)

[82] USFWS 1996a

[83] AGFD 1994b, 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Ohmart and Sell 1980; Stalmaster 1987; SWCBD 1999; USFWS 1982, 1997a, 1997b, 1998, 2000a, 2002a, 2003a, 2003b

[84] Ibid.

[85] AGFD 1994b, 1999a, 2000; Hunt *et al.* 1992; SWCBD 1999; USFWS 1982, USFWS 1995, 2001a

[86] Gerrard and Bortoletti 1988

[87] IUCN 2001

[88] ESA, Section 3(6)

ESA law and USFWS population policy and precedent require Endangered status for the Desert Nesting Bald Eagle Distinct Population Segment.[89]

The habitat essential for the conservation of the Desert Nesting Bald Eagle has been extensively documented.[90] Special management and protection efforts for this habitat must be increased if the Desert Nesting Bald Eagle is to survive.[91] Critical Habitat designation significantly enhances endangered species recovery.[92] Its designation will also help protect and recover the Desert Nesting population.

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[89] CBD 2004d; ESA Sections 3 & 4; SWCBD 1999;

[90] AGFD 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1998; CBD 2004a, 2004c; Desert Fish Team 2003, 2004; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Hunt *et al.* 1992; Ohmart and Sell 1980; SWCBD 1999; USFWS 1982, 1992a, 2000a, 2002a, 2003a, 2003b;

[91] CBD 2004e, SWCBD 1999

[92] CBD 2003c, Rachlinski 2003

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[93] AGFD 1994b, 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Ohmart and Sell 1980; Stalmaster 1987; SWCBD 1999; USFWS 1982, 1997a, 1997b, 1998, 2000a, 2002a, 2003a, 2003b

[94] Ibid.

[95] AGFD 1999a, 2000; Hunt *et al.* 1992; USFWS 1997a, 1997b, 1998, 2002a, 2003b

[96] AGFD 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Stalmaster 1987; USFWS 1997a, 1997b, 1998, 2002a, 2003b

[97] AGFD 1994b, 1999a, 2000; Beatty and Driscoll 1996b; Hunt *et al.* 1992; SWCBD 1999; USFWS 1997a, 1997b, 1998, 2002a, 2003b

[98] CBD 2004e, Hunt *et al.* 1992, SWCBD 1999

[99] ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004a, 2004b, 2004c; Arizona Daily Star 2004; Arizona Daily Sun 2004; Arizona Republic 2000, 2001, 2003b, 2003c, 2004a, 2004b; CBD 2003b, 2004c; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Earthjustice 2004a, 2004b, 2004c; Hunt *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; SWRAG 2000; SWCBD 1999; USGS 2000; USFWS 1993b, 1997a, 1997b, 1998, 1999a, 2000a, 2002a, 2003a, 2003b, 2003e, 2004a, 2004c; Verde Natural Resources Conservation District 1999

[100] AGFD 1993, 1999a, 2000, 2001b, 2001c, 2002b, 2004b; Hunt *et al.* 1992; SWCBD 1999; USFWS 2003a, 2003b

[101] AGFD unpublished data, CBD 2004e

[102] CBD 2004e, Franklin 1980, Gilpin and Soule 1986, Lande 1987, Hunt *et al.* 1992, IUCN 2001, Soule 1980, Thomas *et al.* 1990, USFWS 1994a, Wilcox 1987, Wright 1984

4. Mortality for breeding adults is excessive.[103] (Page 26)

5. The extremely high presence of Subadults in breeding pairs most likely reflects high adult mortality rates.[104] (Page 27)

6. Mortality for fledglings is excessive.[105] (Page 30)

7. The population's survival is dependent, in good part, on heroic human support and management by the Arizona Bald Eagle Nestwatch Program (ABENWP).[106] (Page 31)

8. Reproductive rates are low for the Southwestern Desert Nesting Bald Eagle in comparison to Bald Eagle populations elsewhere.[107] (Page 35)

9. The most prolific Desert Nesting Bald Eagle breeding areas are showing productivity declines.[108] (Page 36)

10. Breeding areas along the free-flowing rivers are showing productivity declines.[109] (Page 38)

11. Desert Nesting Bald Eagle nests on private property are either not producing young or are destined to fail.[110] (Page 39)

12. Southwestern Desert Nesting Bald Eagle habitat faces imminent and accelerating loss of increasing amounts of habitat vital for long-term survival.[111] (Page 39)

13. The native fishery with which the Desert Nesting Bald Eagle population evolved continues to suffer decline.[112] (Page 51)

14. Toxic substances remain a problem.[113] (Page 57)

    a. Pesticides.[114] (Page 57)

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[103] AGFD 1999a, 2000; Beatty and Driscoll 1996b; Gerrard *et al.* 1992; Hunt *et al.* 1992; Stalmaster 1987; USFWS 1993b

[104] AGFD 1994b, 1999a, 2000; Hunt *et al.* 1992; SWCBD 1999

[105] AGFD 1999a, 2000; Beatty and Driscoll 1996b; Hunt *et al.* 1992; Mesta *et al.* 1992

[106] AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004c; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1997, 1998; Hunt *et al.* 1992; SWCBD 1999; USFWS 1992b, 1999c, 2003a, 2003b

[107] AGFD 1999a, 2000; Hunt *et al.* 1992; USFWS 2003b

[108] AGFD 1994b, 1999a, 2000

[109] Ibid.

[110] ADWR 1999; AGFD 1994b, 1999a, 2000, 2001a, 2002a, 2003, 2004c; Arizona Republic 2000, 2001; Chino Valley Review 2004; Prescott 2001; Prescott Daily Courier 2004a, 2004b; USFWS 2001a

[111] ADWR 1994, 1999; AGFD 1993, 1999a, 2000; Arizona Republic 2000, 2001; Chino Valley Review 2004; Lofgren *et al.* 1990; Krueper 1993; Prescott 2001, Prescott Daily Courier 2004a, 2004b; SWCBD 1999; USFWS 1984, 1985, 1990b, 1992a, 1992d, 1993a, 1994c, 1996b, 1996c, 1997a, 1997b, 1998, 2001a, 2003b, 2003d

[112] AGFD 1999a, 2000; CBD 2003b; Desert Fish Team 2003, 2004; Hunt *et al.* 1992; USFWS 2003d

[113] ADEQ 2004a, 2004b; AGFD 1999a, 2004a, 2004b; American Bird Conservancy 2003, 2004a, 2004b; Arizona Republic 2004d, 2004e; CBD 2004c; Earthjustice 2004a, 2004b, 2004c; Elliott *et al.* 1997; EPA 1998, 1999, 2000, 2003, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f; Pesticide Action Network 1999; University of Arizona 2004; USDA 2001; USFWS 1995

[114] American Bird Conservancy 2004a, 2004b; CBD 2004c; EPA 2004c, 2004d, 2004e, 2004f; University of Arizona 2004; USDA 2001; USFWS 1995

b. DDT is still found in Arizona.[115] (Page 57)

c. Chlorfenapyr almost became the next DDT.[116] (Page 58)

d. Heavy metals exposure and contamination of the Desert Nesting Bald Eagle, particularly by mercury, is worrisome.[117] (Page 58)

15. Fishing line and tackle are found in half of Southwestern Desert Nesting Bald Eagle nests.[118] Resulting mortalities in both adults and nestlings have been documented and more are expected.[119] (Page 62)

16. Heat stress is already recognized as a leading cause of mortality for nestlings.[120] Decreased productivity has already been documented in areas of local drought effects.[121] Global warming and drought are becoming increasing factors.[122] (Page 63)

17. Eggshell thinning remains a potential problem for the Southwestern Desert Nesting Bald Eagle.[123] (Page 64)

18. Habitual violation of law and lack of agency resolve increasingly threatens protection of the Southwestern Desert Nesting Bald Eagle.[124] (Page 65)

   a. Cattle grazing continues within the riparian habitat critical to the Desert Nesting Bald Eagle.[125] (Page 66)

   b. Dam operations do not release water at times necessary for replenishment of riparian nest trees.[126] (Page 68)

   c. Dewatering of remnant free-flowing rivers continues.[127] (Page 70)

   d. Exotic fish continue to be introduced in native fish habitat.[128] (Page 74)

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115 ADEQ 2004a, 2004b; EPA 2003, 2004a; Grubb *et al.* 1990; Hunt *et al.* 1992; King *et al.* 1991; USFWS 2001d; Weimeyer *et al.* 1984

116 EPA 1999, 2000

117 ADEQ 2004a, 2004b; AGFD 1999a, 2000, 2004a, 2004b; EPA 2004b; USFWS 2001d

118 AGFD 1994b

119 AGFD 1999a, 2000

120 AGFD 1999a, 2000; Driscoll 1999; Hunt et al. 1992

121 USFWS 2003b

122 ADWR 1994; AGFD 1999a, 2000; Arizona Daily Sun 2004; Arizona Republic 2003b, 2003c, 2004a, 2004b, 2004g; CNN 2004; National Geographic 2004; Observer/UK 2004; SWRAG 2000; USFWS 1990c, 2003b

123 AGFD 1999a, 2000; SWCBD 1999

124 AGFD 1994b; Desert Fishes Team 2003, 2004; SWCBD 1999; USFWS 1992a, 1993a, 1994c, 1996b, 1997b, 1998, 1999a, 2000a, 2003b, 2003d

125 AGFD 1999a, 2000; Driscoll 1999; USFWS 1997b, 1998, 2002a, 2003b

126 AGFD 1999a, 2000; USFWS 1997b, 2003b

127 Desert Fishes Team 2003, 2004; USFWS 1998; Verde Natural Resources Conservation District 1999

128 Desert Fishes Team 2003, 2004

e. Low flying aircraft continue and will increasingly continue adversely affecting the population.[129] Flight advisories are not mandatory and are routinely ignored.[130] (Page 81)

f. USFWS' approval of excessive numbers of Desert Nesting Bald Eagle deaths is excessive.[131] (Page 82))

19. The USFWS, itself, continues to warn of increasing dangers to the survival of the Desert Nesting Bald Eagle.[132] (Page 85)

20. A new Center for Biological Diversity (CBD) population viability analysis, based on AGFD survival estimates, demonstrates a high risk of extinction for this population within the next 57 and 82 years.[133] (Page 96)

IV. ESA law and USFWS population policy and precedent require Endangered status with Critical Habitat for the Desert Nesting Bald Eagle Distinct Population Segment.[134] (Page 106)

1. Loss of this discrete population would result in a significant gap in the range of the Bald Eagle.[135] (Page 106)

2. The Southwestern Desert Nesting Bald Eagle Population is truly a Distinct Population Segment.[136] (Page 106)

3. USFWS' downlisting and delisting efforts including the Desert Nesting population violate law and precedent and lack scientific merit.[137] (Page 115)

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[129] AGFD 1999a, 2000; USFWS 1993a, 1994c, 1997b, 2002a, 2003b

[130] AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004c; Arizona Republic 1989

[131] AGFD 1994b; USFWS 1992d, 1993a, 1994c, 1996b, 1997b

[132] USFWS 1993a, 1994c, 1997a, 1997b, 1998, 2002a, 2003b

[133] AGFD 1999a, 2001a, 2001b, 2001c, 2002a, 2002b, 2003, 2004c, 2004d, unpublished data; Beatty 1990a, 1990b, 1992,1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1997, 1998; CBD 2004e; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Hunt *et al.* 1992

[134] CBD 2004d; ESA Sections 3 & 4; SWCBD 1999;

[135] AGFD 1994b, 1999a, 2000; Hunt *et al.* 1992; SWCBD 1999; USFWS 1982, 1994a, 1995, 2001a

[136] AGFD 1994b, 1999a, 2000, 2004c, 2004d; Beatty 1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1998; CBD 2004e; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Ohmart and Sell 1980; SWCBD 1999; Stalmaster 1987; USFWS 1982, 1997a, 1997b, 1998, 2000a, 2002a, 2003a, 2003b

[137] ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1993, 1994a, 1994b, 1999a, 2000, 2001a, 2001b, 2001c, 2002a, 2003, 2004a, 2004b, 2004c, unpublished data; Arizona Daily Sun 2004; Arizona Republic 2000, 2001, 2003b, 2003c, 2004a, 2004b; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1997, 1998; CBD 2003b, 2004c, 2004d; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Driscoll 1995, 1999; Driscoll and Beatty 1994; Driscoll et al. 1992, 1993; EPA 2004b; ESA Sections 3 & 4; Franklin 1980; Gerrard and Bortoletti 1988; Gilpin and Soule 1986; Hunt *et al.* 1992; IUCN 2001; Krueper 1993; Lande 1987; Lofgren *et al.* 1990; Mesta *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; Prescott Daily Courier 2004a, 2004b; Soule 1980; Stalmaster 1987; SWCBD 1999; SWRAG 2000; Thomas *et al.* 1990; USFWS 1982, 1984, 1985, 1990b, 1990c, 1992a, 1992b, 1992c, 1992d, 1993a, 1993b, 1994a, 1994b, 1994c, 1995, 1996b, 1996c, 1997a, 1997a, 1997b, 1998, 1999a, 1999c, 2000a, 2001a, 2001d, 2002a, 2003a, 2003b, 2003d, 2003e; USGS 2000; Verde Natural Resources Conservation District 1999; Wilcox 1987; Wright 1984

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[138] ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1994b, 1999a, 2000, 2001a, 2002a, 2003, 2004a, 2004b, 2004c; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1997, 1998; Driscoll 1999; Hunt *et al.* 1992; SWCBD 1999; USFWS 1992b, 1999c, 2003a, 2003b AGFD 1994a, 1999a, 2000; Arizona Daily Star 2004; Arizona Daily Sun 2004; Arizona Republic 1989, 2000, 2001, 2003a, 2003b, 2003c, 2004a, 2004b, 2004c, 2004f; CBD 2003b, 2004c; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Earthjustice 2004a, 2004b, 2004c; Hunt *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; SWCBD 1999; SWRAG 2000; USGS 2000; USFWS 1992d, 1993a, 1993b, 1994c, 1996b, 1996c, 1997a, 1997b, 1998, 1999a, 2000a, 2002a, 2003a, 2003b, 2003e, 2004a, 2004c; Verde Natural Resources Conservation District 1999

[139] CBD 2004d; ESA Sections 3 & 4; SWCBD 1999;

II. The Southwestern Desert Nesting Bald Eagle population is biologically, behaviorally, and ecologically discrete from the Bald Eagle nationwide.[140]

1. The Desert Nesting Bald Eagle persists in the unique ecological setting of the Sonoran life zones of the desert Southwest.[141]

This discreet, behaviorally isolated population persists in a unique ecological setting.[142] The Desert Nesting Bald Eagle population breeds predominately in upper and lower Sonoran life zone habitat.[143]

With the exception of a single 8,000 foot elevation nest (Luna BA), all known Arizona BAs are located in the Sonoran Desert in the central part of the State in Upper and Lower Sonoran Desert habitats from elevations of 330 meters (1,080 feet) to 1,720 meters (5,640 feet).[144] They are closely associated with the Salt, Verde, and Gila river drainage waters.[145] Brown (1994) describes the representative vegetation of these areas as including Arizona sycamore (*Platanus wrightii*), blue palo verde (*Cercidium floridum*), cholla (*Opuntia* spp.), Fremont cottonwood (*Populus fremontii*), Gooding willow (*Salix gooddingii*), mesquite (*Prosopis* spp.), saguaro (*Carnegia gigantea*), and salt cedar (*Tamarix pentandra*; exotic). The transition zones between these areas include pinyon (*Pinus* spp.) and juniper (*Juniperus* spp.).[146]

2. The Desert Nesting Bald Eagle is smaller than other Bald Eagles.[147]

Quantitative measures of the physical differences between Southwestern Desert Nesting Bald Eagles and Bald Eagle elsewhere offer evidence of morphological discontinuity.[148]

Arizona males weigh an average of 3.3 kilograms (kg). California males average 4.1 kg. Alaska males average 4.7 kg.[149]

Arizona females average 4.5 kg. California females average 5.1 kg. Alaska females average 5.8 kg.[150]

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[140] AGFD 1994b, 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Ohmart and Sell 1980; Stalmaster 1987; SWCBD 1999; USFWS 1982, 1997a, 1997b, 1998, 2000a, 2002a, 2003a, 2003b

[141] Ibid.

[142] AGFD 1999a, 2000; Hunt *et al.* 1992; SWCBD 1999; USFWS 2000a, 2002a, 2003a, 2003b

[143] AGFD 1999a, 2000; Hunt *et al.* 1992; USFWS 2002a, 2003b;

[144] Beatty 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Hunt *et al.* 1992

[145] Ibid.

[146] Beatty 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992;

[147] AGFD 1999a, 2000; Hunt *et al.* 1992; USFWS 1997a, 1997b, 1998, 2002a, 2003b

[148] Hunt *et al.* 1992

[149] Ibid.

[150] Ibid.

3. The Desert Nesting Bald Eagle is behaviorally unique.[151]

The breeding habitat of Southwestern Desert Nesting Bald Eagles is much drier and hotter than that of any other Bald Eagle population.[152] The habitat utilized by Arizona desert nesting Bald Eagles represents a significant departure from the habitat selection of Bald Eagles in the rest of North America.[153] Southwestern Desert Nesting Bald Eagle's breed earlier, nest earlier and fledge their young sooner than Bald Eagle's elsewhere.[154]

In order to adapt to high summer temperatures and to time breeding cycles to the accessibility and spawn of native fish (primarily Suckers), Southwest Desert Bald Eagles breed in the fall, nest in the winter and fledge in the late spring.[155] Nest initiation occurs from November to February. Two to three eggs are laid and incubated from December to March. The eggs hatch after about 35 days, from February through April. Nestlings are in the nest for 12 weeks until May or June.[156]

Unlike Bald Eagles elsewhere in North America, Southwestern Desert Nesting Bald Eagles utilize cliff nest sites.[157] About one half of the Southwestern Desert Nesting population utilize cliff nest sites. Of 111 known nests, 53 (48%) are on cliffs (or pinnacles).[158] Only in the Aleutian Islands is this unique use of cliff nest sites known.[159]

These behavioral and ecological factors evidence separation of the Southwest population from other Bald Eagle populations. USFWS (2003b) quotes Hunt *et al.* (1992) to summarize the situation:

> "...Arizona bald eagles demonstrate unique behavioral characteristics in contrast to bald eagles in the remaining lower 48 states. Eagle in the Southwest frequently construct nests on cliffs. By 1992, of the 111 nest sites known, 46 were in trees, 36 on cliffs, 17 on pinnacles, 11 in snags, and one on an artificial platform. However, while there were more nests in trees, one study found that cliff nests were selected 73 percent of the time, while tree nests were selected 27 percent of the time. Additionally, eagles nesting on cliffs were found to be slightly more successful in raising young to fledgling though the difference was not significant. Bald eagles in the Southwest are additionally unique in that they establish their breeding territory in December or January and lay eggs in January or February, which is early compared with bald eagle in more northerly areas. It is believed this is a behavioral adaptation so chicks can avoid the extreme desert heat of midsummer.

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[151] AGFD 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Stalmaster 1987; USFWS 1997a, 1997b, 1998, 2002a, 2003b

[152] Beatty 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Hunt *et al.* 1992; USFWS 2003b

[153] Ibid.

[154] Ibid.

[155] AGFD 1999a, 2000; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Stalmaster 1987; USFWS 2003b

[156] Ibid.

[157] Hunt *et al.* 1992

[158] Ibid.

[159] Robin Silver personal communication

> Young eagles will remain in the vicinity of the nest until extreme desert heat of midsummer. Young eagles will remain in the vicinity of the nest until June (Hunt *et al.* 1992)."[160]

AGFD agrees:

> "...We believe that nesting on cliffs and breeding earlier in the season are unique behavioral adaptations for the species in Arizona..."[161]

4. The Desert Nesting Bald Eagle is reproductively isolated.[162]

From 1991 to 1998 (eight years), biologists in Arizona objectively identified 353 individuals participating in Desert Nesting Bald Eagle breeding activity.[163] One of the 353 objectively identified individuals participating in breeding activity was not born from within the Desert Nesting population.[164] In other words, 99.997% of individuals objectively identified while participating in breeding activity in this population came from within the Desert Nesting population.[165] No new data to date refutes these facts.[166]

Since 1977, for 22 years, biologists in Arizona have banded 256 nestlings.[167] One individual has been objectively identified as having emigrated. In other words, 99.6% of individuals born here remain here.[168] No new data to date refutes these facts.[169]

Such percentages evidence reproductive isolation among Desert Nesting Bald Eagles:

> "...*Natal origin of breeding adults.* Bald Eagles hatched in Arizona are the primary source of the state's breeding adults. Based upon the available information, "it is prudent to assume that the Arizona population is indeed isolated and may contain genes and coadapted gene combinations appropriate to local conditions (Hunt *et al.*. 1992)." This aspect of their natural history is important because it places a greater need for the management, success, and survivorship of Bald Eagles...
>
> ...Band returns in the breeding population have supported the theory that Bald Eagles hatched in Arizona breed here (Beatty and Driscoll 1996b, Beatty and Driscoll unpubl. data). From 1991 to 1998, 74.5 percent (353/474) of all

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[160] USFWS 2003b
[161] AGFD 1994b
[162] AGFD 1994b, 1999a, 2000; Beatty and Driscoll 1996b; Hunt *et al.* 1992; SWCBD 1999; USFWS 1997a, 1997b, 1998, 2002a, 2003b
[163] AGFD 1999a, 2000
[164] Ibid.
[165] Ibid.
[166] Personal communication AGFD, USFWS
[167] AGFD 1999a, 2000
[168] Ibid.
[169] Personal communication AGFD, USFWS

breeding adults were identified. In 1991, 21 percent of all identified adults originated from Arizona, while the rest were unknown. In 1998, the percentage of known Arizona origin breeders had more than doubled (53.3%) (Appendix E). During this study period, only one individual was found breeding inside Arizona originating from somewhere else (southeast Texas), and only one was found to emigrate from Arizona (Temecula, California)...

> ... To date, evidence from the banding and identification of breeding adults defends the theory that Arizona's breeding population is not supported or maintained by immigration from other states or regions. Because adults return to the vicinity of their natal area to breed, the large distance between small breeding populations in the Southwest decreases the chance for movement between neighboring populations. Probably most convincing are the results from banding 256 nestlings over 20 years and identifying 372 breeding adults over 8 years. Only one individual from out-of-state entered the breeding population and only one left. Additionally, the proportion of breeding adults with color bands had steadily increased, while the presence of unmarked Bald Eagles has decreased. Thus, continued attention to the survivorship of all Arizona Bald Eagles is vital to the maintenance of our breeding population. We can not depend on immigration to Arizona from nearby states to make up for poor management in Arizona..."[170]

This quotation is from the preamble to the proposed AGFD's Conservation Agreement. Among the conclusions, AGFD concludes:

> "...WITNESSETH...WHEREAS...Arizona supports a biologically isolated population of desert nesting Bald Eagles..."[171]

The rare entry (0.003%) into the population of an individual from outside of the breeding population of the Desert Nesting population has yet to contribute to the gene pool. No fledgling form the Luna nest has entered into breeding activities within the region. Even if such a single entry would take place, it would be functionally insignificant.

In 1994, AGFD cautioned strongly against highlighting the significance of this eagle:

> "We have not been able to establish that eagles nesting in the mountains or more specifically, the one eagle produced from the Luna BA [Breeding Area], contributes to Arizona's pool of desert nesting birds..."
>
> "...Additionally, the future of the Luna BA seems tenuous at best."[172]

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[170] AGFD 1999a, 2000

[171] AGFD 1999a

[172] AGFD 1994b

AGFD (1994b) warned that repopulation in the event of a population crash would be highly unlikely:

> "Because Arizona continues to possess nearly the entire breeding population within the Southwestern Region , concerns remain over retaining the genetic integrity of this population. Presently, all but one breeding bird identified in Arizona has originated from within the state. This bird originated from Southeast Texas and was breeding in a habitat and location previously undocumented for Arizona bald eagles. Should a population crash occur in Arizona, the pool of eagles to repopulate the Southwest could be left to the few pairs in the neighboring states or Mexico. However, at this time, there is no documentation of eagles from these neighboring Southwestern states breeding in Arizona or *vice versa*."[173]

This conclusion has not changed in 2004. There is still not evidence that fledglings from the Luna breeding area have participated in breeding activity elsewhere within the region (Pers. comm. AGFD, USFWS).

Rare entry to other regional Bald Eagle populations is the norm:

> "...To test the idea that bald eagles tend to breed far from their natal sites, questionnaires were sent to and received from researchers studying nine populations of bald eagles...Their responses indicated that only two nestlings out of thousands banded were found to have bred in other areas. One moved 331 km (205 miles) north from its natal site in the Greater Yellowstone Ecosystem (Al Harmata, in litt.); the other traveled 418 km (260 miles) south from its natal site near Charleston, South Carolina to nest in Ocala National Forest, Florida (Tom Murphy, pers. Comm.; Petra Wood, in litt.). In contrast, the tendency for banded nestling to breed within their natal populations is well known..."[174]
>
> "...Our data indicate that bald eagles fledged in Texas exhibit strong fidelity to natal nesting areas for breeding."[175]

USFWS (2003b) quotes from AGFD (1999a, 2000):

> "...the Arizona Game and Fish Department (*in prep.*) concluded that 'evidence from the banding and identification of breeding adults defends the theory that Arizona's breeding population is not supported or maintained by immigration from other states or regions. Because adults return to vicinity of their natal origin to breed, the large distance between small populations in the Southwest decreased the chance for movement between neighboring populations. Probably most convincing are the results from banding 256

[173] Ibid.

[174] Hunt *et al.* 1992

[175] Mabie *et al.* 1994

nestlings over 20 years and identifying 372 breeding adults over 8 years. Only one individual from out-of-state entered the breeding population and one left. Additionally, the proportion of breeding adults with color bands (placed on as nestlings in Arizona" has steadily increased, while the presence of unmarked eagles has decreased. Thus, continued attention to the survivorship of all Arizona bald eagle is vital to maintenance of our breeding population. We can not depend on immigration to Arizona from nearby states to make up for poor management in Arizona.'"[176]

5. <u>The current understanding of genetics does not refute the discrete and isolated nature of the Desert Nesting Bald Eagle.</u>[177]

Review of all information regarding genetic analysis of the Southwestern Desert Nesting Bald Eagle reveals consistent uncertainty. Samples studied to date remain small. Current genetic data support no definitive conclusions concerning isolation or lack of isolation. Because of small sample size and the targeted information studied, authoring researchers caution against conclusive interpretation of their data. The lack of correlation between the degree of environmental adaptation required to survive in a desert environment and our ability to offer genetic explanation only serve to highlight our rudimentary level of understanding of genetics. The current understanding of genetics does not refute the discrete and isolated nature of the Desert Nesting Bald Eagle.[178]

In 1995, in spite of warnings from Bald Eagle biologists, as well as the genetic researchers themselves, USFWS inappropriately cited genetic analysis as a key factor in their 1995 decision to downlist the Desert Nesting population from endangered to threatened.[179] USFWS cited two genetic studies from Hunt *et al.* 1992.[180] Based in large part on this genetic analysis, USFWS claimed that the Desert Nesting Bald Eagle population is not a distinct population segment. USFWS claimed that the Southwestern Desert Nesting Bald Eagle is merely a part of a continuous population throughout the lower 48 states:

> "...genetic evidence does not indicate this population segment to be unique...Though Hunt *et al.* (1992) suggested that the central Arizona population may be reproductively isolated, that publication also stated that, ``neither enzyme electrophoresis nor DNA fingerprinting resolved any specific genetic markers from which Arizona eagles could be differentiated from those of other populations * * *.; Both techniques showed higher levels of genetic heterozygosity in the Arizona samples than the other populations tested * * *, [and] * * * these healthy levels of variation imply that the Arizona eagles are not currently experiencing inbreeding problems and may be capable of

[176] USFWS 2003b
[177] CBD 2004e, Hunt *et al.* 1992, SWCBD 1999
[178] CBD 2004e, Hunt *et al.* 1992, SWCBD 1999
[179] Hunt *et al.* 1992, USFWS 1995
[180] Ibid.

adapting to future environmental change. This, together with the occupancy and reproductive data, suggests that the population may be viable over the long term * * *" and that, in spite of the smaller size of the Arizona eagles, ``We were unable to show a quality of uniqueness among the Arizona eagles that implies the existence of adaptations to the desert environment * * *"Thus, based on new information on immigration and previously known genetic data, the Service believes this population is not reproductively isolated and should be included with the reclassification of the lower 48 States population."[181]

Two genetic studies were commissioned as part of the Hunt *et al.* 1992 review. One study involved enzyme electrophoresis and the other DNA fingerprinting. In the enzyme electrophoresis study,

> "...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. Nei's analysis of genetic distance...vaguely suggested that eagles from Arizona were most similar to those from Maryland. However, all samples in that comparison were close in value, ranging from 0.0288 to 0.0396, whereas the Nei's statistic for some of the samples from outside Arizona appeared to differ more from one another than they did from Arizona (range 0.0003 to 0.0587). 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..."[182]

In the DNA fingerprinting study, similar inconclusive information resulted:

> "...[i]n comparing DNA from Arizona, California, and Florida (breeding adults and nestlings), Dr. Vyse [the primary DNA fingerprinting researcher] was unable to identify constant population-specific DNA markers. However, using combinations of bands, he was able to assign most individuals to their respective populations. Intrapopulation similarity was highest in the Florida samples, suggesting they were the most inbred of the three populations. Using two enzyme probes, the California eagles appeared more inbred than the Arizona birds, but the opposite was the case when using a third probe. The standard error of the mean of similarity coefficients showed a corresponding pattern: again, the Florida eagles appeared more inbred than those in Arizona or California.
>
> Comparing similarity coefficients between populations showed a large difference between the Arizona and Florida eagles, indicating that they are the most distally related of the populations tested. Furthermore, the California

[181] USFWS 1995

[182] Hunt *et al.* 1992

population appeared more closely related to the Florida birds than to the Arizona eagles. Analysis of a fourth sample from Canada indicated a relatively large genetic distance from the other three populations…"[183]

The caution offered by the enzyme electrophoresis researchers was ignored by USFWS in their 1995-downlisting decisions:

> "…We feel caution should be exercised when interpreting these results due to the low numbers of individuals sampled from most states but especially because of the few loci examined…(Zegers *et al.*, 'Enzyme Genetics of Bald Eagles in Arizona')"[184]

Also ignored was the fact that DNA fingerprinting was able to correctly identify individuals to populations in most cases:[185]

> "…Conclusions…patterns of fragments will identify eagles to a specific population…Summary…We were able to identify combinations of restriction fragments that were unique to certain populations, and these combinations can be used to correctly identify population membership of individuals in most cases…' (E.R. Vyse, 'An Analysis of Bald Eagle Population Genetics using DNA Fingerprinting,')"[186]

Hunt *et al.* (1992) offer several explanations for geneticists' findings of heterozygosity that remain plausible in 1999:

> "…DDT did not reduce the southwestern bald eagle population to levels at which alleles would drift to fixation…"
>
> "…ambient levels of heterozygosity in bald eagles living in the southwest may have been high in pristine times because of the shifting selective pressures characteristic of the wet and dry cycles of desert environments…"[187]

With our current levels of knowledge and technological capabilities, we cannot know which of these (or other) explanations is correct. We can only observe near complete (99.997%) reproductive isolation in a population uniquely adapted to a desert environment.

USFWS inappropriately highlights, out of context, a Hunt *et al.* (1992) conclusion of the lack of scientific sensitivity to identify unique markers correlating to adaptation to the desert environment without accompanying qualifiers of Hunt *et al.* (1992).[188]

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[183] Ibid.
[184] Ibid.
[185] Ibid.
[186] Ibid.
[187] Ibid.
[188] USFWS 1995

> "'We were unable to show a quality of uniqueness among the Arizona eagles that implies the existence of adaptations to the desert environment.' (Hunt *et al.*. 1992)"[189]

Examining the Hunt *et al.* (1992) report in detail, it is clear that the researchers were repetitively expressive of the limitations of trying to identify markers of the uniqueness required to survive in such an inhospitable environment.[190] Our level of discernment is still not as sensitive as the differences that we know exist in order to facilitate such unique adaptations.

Caution against drawing conclusions from genetic studies has already been presented. The discussion of the sophistication of adaptability to the combination of high temperature and low humidity of the desert nesting environment is illustrative of the caution that must still be entertained before drawing definitive conclusions about our ability to discern uniqueness besides obvious morphological differences:

> "'...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)..."[191]

The researchers included in Hunt *et al.* (1992) established that both enzyme electrophoresis and DNA fingerprinting could identify individual populations.[192] Unfortunately, the current level of genetic discernment is not sensitive enough to identify the specific genetic differences among populations that survive in extremely diverse environments.

We know that a unique genetic blueprint controls and directs survival in these unique conditions such as the Southwest's extreme heat and low humidity. The fact that our level of genetic understanding is not sophisticated and sensitive enough to objectively identify genetic uniqueness should not be used to deny protection to a population that is obviously surviving in an environment far different than Bald Eagles elsewhere.

In summary, genetic analyses are suggestive of differentiation, but generally inconclusive. FWS based its delisting decision, in good part, on an inappropriate claim that the Desert Nesting Bald Eagle population is not a "distinct population segment" citing as evidence two genetic studies in Hunt *et al.* (1992). However, one of these was statistically inadequate to detect differentiation and the second reported significant

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[189] Ibid.
[190] Hunt *et al.* 1992
[191] Ibid.
[192] Ibid.

differentiation that was ignored by FWS. One allozyme study used only five loci and low sample sizes and unsurprisingly, was unable to resolve Arizona from other populations (MD, FL, WA, CA, TX, MN). DNA fingerprinting analysis isolated population specific DNA markers, and suggested that CA and FL samples were closer to each other than to Arizona. (Hunt *et al.* 1992).[193]

III. Threats to the continued existence of the Desert Nesting population are increasing.[194]

1. The population is extremely small without prospect for significant expansion.[195]

The Bald Eagle once nested along every major river and large lake in the continental United States.[196] Breeding bald eagles are no longer found in all areas of their historic range.[197] The largest remnant of breeding Southwestern Bald Eagles is a small population isolated primarily in central Arizona.[198]

Less than 60 nesting pairs of Southwestern Desert Nesting Bald Eagles survive today.[199] These totals include 42 occupied Breeding Areas in Arizona, three in Utah, three in New Mexico, and possibly three in Sonora Mexico.[200]

The Arizona population is not likely to increase substantially or expand its distribution. There is simply not enough surviving suitable habitat available.

> "...population sizes in Arizona are not expected to increase without riparian habitat and prey base modifications...[201]

2. The population occupying Breeding Areas may be over estimated.[202]

The Arizona Game and Fish Department estimates that 77 individuals occupy the 44 known Arizona Breeding Areas (BAs).[203] This total may be an over estimations owing to the fact that member of breeding pairs recorded as "occupying" but not breeding may also be occupying adjacent, occupied BAs.[204] Males 88J03 and 92J07

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[193] CBD 2004e

[194] ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004a, 2004b, 2004c; Arizona Daily Star 2004; Arizona Daily Sun 2004; Arizona Republic 2000, 2001, 2003b, 2003c, 2004a, 2004b; CBD 2003b, 2004c; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Earthjustice 2004a, 2004b, 2004c; Hunt *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; SWRAG 2000; SWCBD 1999; USGS 2000; USFWS 1993b, 1997a, 1997b, 1998, 1999a, 2000a, 2002a, 2003a, 2003b, 2003e, 2004a, 2004c; Verde Natural Resources Conservation District 1999

[195] AGFD 1993, 1999a, 2000, 2001b, 2001c, 2002b, 2004b; Hunt *et al.* 1992; SWCBD 1999; USFWS 2003a, 2003b

[196] Gerrard and Bortoletti 1988

[197] Stalmaster 1987

[198] Hildebrandt 1981, Hunt *et al.* 1992

[199] AGFD 2004d

[200] AGFD 2004d; Personal communication AGFD, New Mexico Department of Game and Fish, and USFWS

[201] AGFD 1999a, 2000

[202] AGFD unpublished data, CBD 2004e

[203] AGFD 2004d

[204] AGFD unpublished data, CBD 2004e

moved between Breeding Areas. Females can also move. Female 91J08 moved from the Winkelman Breeding Area to the Pinto BA.[205]

It is possible that more adults recorded as "occupying" but not breeding in a BA may have come from adjacent occupied BAs. To account for this source of uncertainty, we recognize that a BA recorded as "occupied" has the high number of observed Eagles of either 1 or 2. If, however, BAs were adjacent to other occupied BAs on the same river system, the minimum possible adult number was zero since the adults observed may have come from occupied adjacent BAs. Figure 1 shows the upper and lower estimates of known adults accounting for this source of uncertainty.

In addition, the searching protocol is not random. Nor can it be unbiased since searchers naturally tend to search more in areas that bald eagles have been known to occupy in the past. This inevitably leads to a better search coverage with each passing year as new BAs are discovered. It is probable that a certain portion of BAs first "discovered" in a particular year could have been present and even occupied in previous years. AGFD underscores the ephemeral nature of the evidence for a BAs existence by reporting that 18 nests in known BAs had disappeared by 2003.[206]

Moreover between 1987-2003 only 16.7% of fledglings were left unbanded, whereas in the same period, at least 40.4% of breeding adults were unbanded.[207] Three possible scenarios offer explanation for this discrepancy. First, unbanded nestlings may suffer less mortality. Banding effects on bird mortalities have been recorded before, however most differences are minor and so this is an unlikely explanation. Second, immigration could account for the discrepancy. This is also an unlikely explanation as Bald Eagle in adjacent areas are also banded at high frequencies, but the only recorded immigration event to date involves the Luna BA male immigrating from Texas.

Finally, a large pool of undiscovered and thus unbanded nestlings could have been present in earlier surveys. This is the most likely explanation of the three possibilities. It corroborates the hypothesis that the population was undercounted in earlier years. Figure 1 offers a more conservative and most likely, more accurate, estimation of adult population size, while reflecting an acknowledged increase in population size. A more accurate estimation of participating breeding Desert Nesting Bald Eagle for 2003 ranges from 62 to 81 individuals:

[205] AGFD unpublished data

[206] AGFD 2004d

[207] AGFD unpublished data

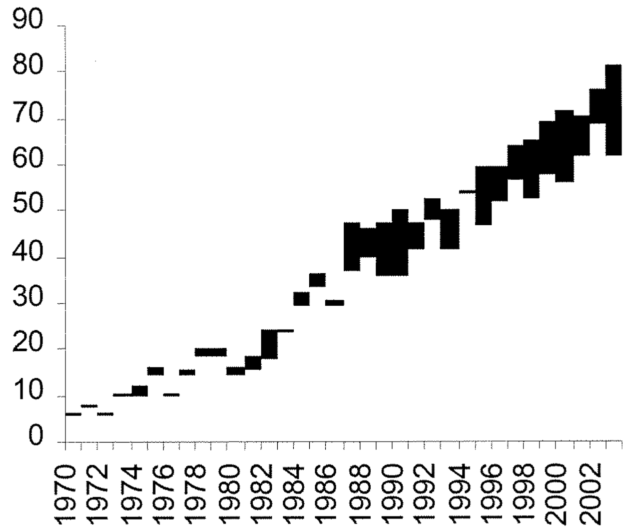

Figure 1. Ranges of estimated numbers of known adults 1970-2003.

3. The small size of the Southwestern Desert Nesting Bald Eagle population is, in itself, problematic.[208]

There are approximately 166 individual Desert Nesting Bald Eagles in Arizona.[209] We arrived at this number using AGFD survival estimates to estimate juvenile numbers in 2003 from nestling numbers in each of the four years prior to 2003.[210]

This population is biologically, behaviorally and ecologically isolated.[211] Any population of 166, or undoubtedly less than 200 total individuals, and any population of less than 60 nesting pairs faces challenges deriving directly from its small size and isolation itself.[212]

The population dynamics of such a population is essentially similar to that one of the isolated Northern Spotted Owl metapopulations examined by the Interagency Scientific Committee on the Northern Spotted Owl lead by Dr. Jack Ward Thomas in 1990. Dr. Thomas and the Interagency Scientific Committee (which included USFWS scientists) examined the effects of widespread habitat destruction on the regional metapopulation(s) of a raptor population:

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[208] CBD 2004e, Franklin 1980, Gilpin and Soule 1986, Lande 1987, Hunt *et al.* 1992, IUCN 2001, Soule 1980, Thomas *et al.* 1990, USFWS 1994a, Wilcox 1987, Wright 1984

[209] AGFD unpublished data, CBD 2004e

[210] CBD 2004e

[211] AGFD 1999a, 2000, 2004c, 2004d; Driscoll 1999; Personal communication AGFD, New Mexico Department of Game and Fish, and USFWS 2004; SWCBD 1999; USFWS 2003b

[212] CBD 2004e, Franklin 1980, Gilpin and Soule 1986, Hunt *et al.* 1992, Lande 1987, IUCN 2001, Soule 1980, Thomas *et al.* 1990, USFWS 1994a, Wilcox 1987, Wright 1984

"Most species persist regionally as metapopulations, sets of populations that are linked by dispersing individuals, allowing for the recolonization of unoccupied habitat patches after local extinction events. Loss of suitable habitat patches, or disturbances in the surrounding landscape matrix, can disrupt metapopulation dynamics and this loss can contribute to the regional extinction of a species...

The Committee has concluded that persistence of the spotted owl is presently at risk in significant portions of its range as a result of continued destruction, and concomitant fragmentation, of its habitat. This loss has included much of the habitat that appears to be superior for the owl...The result of this process has been the fractioning of a formerly more continuous population of spotted owls into smaller, isolated demographic units, many of which are at risk of local extinction because of demographic factors and environmental phenomena."[213]

This situation is directly applicable to that of the biologically, behaviorally and ecologically isolated Desert Nesting Bald Eagle. In such a case, one or a combination of four factors will determine long-term viability:[214]

"Four general categories of analysis (and information) have been applied to the northern spotted owl case and are applicable to the question of long- term survival for raptors generally: demographics, genetics, patch dynamics and environmental change...if a species' long-term survival is shown to be in doubt on the basis of any single aspect, then the question of interactive or higher order effects is moot...For example, if demographic analysis indicates a population is declining at a rate that will result in extinction in 50 years, it is of little consequence to present management considerations that it will fall below the threshold size for avoiding inbreeding depression in 40 years. Similarly, if the environment supporting a population becomes inhospitable, such as through widespread drought, fires, or other natural events, or through the human-conversion of habitat as in the case of the northern spotted owl, the consequences of demographic and genetic processes 40 or 50 years hence are inconsequential.

Standard demographic analysis applies actuarial data (i.e., age-specific fecundity and survival schedules) to population models in order to determine if a population is growing, declining, or just replacing itself, and to protect future bends...Theoreticians place the threshold for a high probability of extinction due to demographic stochasticity at around 20 potentially reproducing individuals (thus 20 females in a sexually reproducing species)...A large population of a typical vertebrate species, like a raptor, if reduced to...a genetically effective size

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[213] Thomas *et al.* 1990

[214] Wilcox 1987

> of 50 [equal to over 61 successfully reproducing pairs (Reed et al. 1986)], may suffer from inbreeding depression. (Barrowclough and Coats 1985, Franklin 1980, Soule 1980) Since inbreeding depression amounts to a depression of fecundity and survivorship, it directly affects the demographic outlook of a population. Demographic stochasticity and inbreeding depression may interact, the effects of one exacerbating those of the other, further hastening the decline of a population (Gilpin, M.E., and M.E. Soule 1986)...Populations that are reduced in size tend to lose genetic variability through "genetic drift"...average individual heterozygosity is reduced...[and] the "pool" of allelic variation in the population overall is reduced. [B]ased on theory, experiments and knowledge of raptor population biology, a population size of roughly a thousand or larger ought to maintain virtually all of the genetic variation of a population (cf. Soule 1980). Below this, variation is lost at a rate proportional to the size of the population...It is well established...that a significant reduction in heterozygosity increases a population's vulnerability to environmental threats and that the loss in allelic variation close options for future evolutionary adaptation.
>
> [R]aptors...consist of so-called metapopulations or populations of populations...Levins (1970) has shown...that to persist, the average rate of extinction of local populations must not exceed that of the colonization of unoccupied patches within a metapopulation...
>
> The ultimate cause of extinction is environmental change that exceeds the adaptive capacity of species...a species whose habitat is being destroyed is obviously doomed..."
>
> "We can identify threats to nest sites, foraging habitat and to the birds themselves, then devise appropriate mitigation. The mitigation of such threats per se does not, however, constitute protection of a viable population. Only by having, in addition, at least an approximate idea of the structure, and genetic and demographic parameters can we assess the long-term prospects for survival. And only then can the cumulative impacts of environmental perturbations be fully considered."[215]

The Desert Nesting Bald Eagle, with population characteristics of extended adult longevity, high juvenile mortality, and intense territoriality, may be poised to enter a geometric population decline consistent with Russell Lande's models of extinction thresholds.[216]

4. <u>Mortality for breeding adults is excessive.</u>[217]

Mortality for Southwestern Desert Nesting Bald Eagle breeding adults is higher than can support a stable population. Basic principles of Conservation Biology require

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[215] Ibid.

[216] Lande 1987

[217] AGFD 1999a, 2000; Beatty and Driscoll 1996b; Gerrard *et al.* 1992; Hunt *et al.* 1992; Stalmaster 1987; USFWS 1993b

that adult mortality must equal recruitment into the breeding population for that population to remain stable. Adult mortality is higher than recruitment for the Southwestern Desert Nesting Bald Eagle.

Gerrard *et al.* (1992) determined breeding adult mortality was between 6.5 and 7.7 percent for a stable population in Saskatchewan. Determining acceptable mortality rates for a stable breeding population is a difficult task.[218] The effect of the loss of breeding adults on a population can be serious. For small populations, this loss can be catastrophic.

From 1987 to 1990, the rate of mortality for breeding adults has averaged average of 16% per year of the breeding population (5.25 breeding adult mortalities per year).[219] From 1991 to 1998, the rate of mortality for breeding adults has been 11.9% per year (5.13 breeding adult mortalities per year).[220]

In his book, The Bald Eagle, Stalmaster warns:

> "...When a hypothetical population of bald eagles is altered by a 10% change in fertility, sterility or survival, the effects are considerably different. A simulation model predicts that a reduction in survival will have the most profound influence. In fact, a population may be reproducing at the maximum rate, but if the survival of full grown birds is poor, the population can rapidly become extinct. It is for this reason that the killing of bald eagles, especially the adults, has a much more dramatic impact than does the disruption of nesting efforts."[221]

The mortality for the Southwestern Desert Nesting Bald Eagle is higher than that necessary to sustain a stable breeding population.[222] High mortality for breeding adults threatens the continuing existence of the population.[223]

5. The extremely high presence of Subadults in breeding pairs most likely reflects high adult mortality rates.[224]

As a result of the high mortality in breeding adults, subadults occupy an excessively high presence in breeding pairs.[225] AGFD notes:

> "...Hunt *et al.* (1992) reported a minimum 16 percent annual mortality rate of breeding Arizona eagles from 1987-1990...combined with the presence of four-year old bald eagles as members of breeding pairs, Hunt *et al.* (1992)

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[218] Gerrard *et al.* 1992
[219] Hunt *et al.* 1992
[220] Beatty and Driscoll 1996b, Beatty and Driscoll unpublished data cited in AGFD 1999a, 2000
[221] Stalmaster 1987
[222] CBD 2004e
[223] Ibid.
[224] AGFD 1994b, 1999a, 2000; Hunt *et al.* 1992; SWCBD 1999
[225] AGFD 1994b

concluded that high adult mortality was likely draining the floating adult population toward a critical level…"[226]

Non-breeding eagles are recruited into the breeding population by either forming a new pair bond with another non-breeding bird, or, more frequently, replacing the mate of another breeding eagle. Non-breeding eagles come from a "floating" segment of individuals recruited into the breeding population. Subadults in breeding Bald Eagle populations is considered rare and worrisome:

"…The phenomenon of near-adult bald eagles as members of breeding pairs has been considered "rare" (Bent 1937). Twelve subadult plumaged birds were observed holding territories in Arizona from 1987-1990. Since 1991, we have continued to observe eagles in subadult plumage as members of breeding pairs (*n*=7, six 4 year-olds and one 3 year-old). Two four-year-old eagles were paired with adult bald eagles in the establishment of two new territories (Beatty and Driscoll unpublished). If a healthy population of floating adult eagles existed, we would expect that full adult plumaged birds would be present at these new territories as well as replacements on known breeding areas…"[227]

AGFD (1994b) continues:

"…Although missing members of pairs are rapidly replaced in Arizona, most known replacements have been young (near-adult or subadult) eagles. Of 39 known vacancies at breeding areas, 15 (38.5) were filled by adults, and 24 (61.5%) by near-adults or subadults…the proportion of young eagles as members of pairs in Arizona is substantially higher than reported for any other Bald Eagle population…The appearance of breeding eagles lacking full-adult plumage suggests an insufficiency of adults in the floating segment…"[228]

AGFD (1999a, 2000) continues to express these same concerns:

"…*Subadult breeding bald eagles.* In Arizona, subadults have been regularly documented as members of breeding pairs (Hunt *et al.* 1992, Beatty and Driscoll 1996b, Beatty and Driscoll unpubl. data). In contrast, Gerrard *et al.* (1992) determined population stability in Saskatchewan was "maintained as a result of the bald eagles deferring first breeding to age six." The persistent presence of three and four year-old breeding bald eagles in Arizona has created concern for the health of the breeding population, especially with the seemingly high occurrence of adult mortality.

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[226] Ibid.

[227] Ibid.

[228] Ibid.

Over the past 11 years, 43 of 108 (39.8%) recruitments into the Arizona breeding population were in subadult plumage. From 1987 to 1990, Hunt *et al.* (1992) identified 39 recruitments into the breeding population, of which 61.5 percent (n=24) were in subadult plumage. From 1991 to 1998, 66 recruitments were identified, 29 percent (n=19) were in subadult plumage (Beatty and Driscoll unpubl. data).

The literature describes few instances or explanations for subadults breeding. Bent (1937) described subadult breeding bald eagles as rare. Hunt *et al.* (1992) surveyed 14 bald eagle biologists throughout North America on the occurrence of breeding subadults and received nine responses. From these biologist's studies, the known incidence of breeding subadults outside Arizona was 0.02 percent. Breeding subadults were observed in New York (Nye 1983) and Kansas (Mulhern *et al.* 1983), but were attributed to reintroducing individuals into areas where the species had been nearly extirpated. Palmer (1988) described subadults in breeding pairs occurring in Florida and the Aleutian Islands.

The occurrence of subadults in the Arizona breeding population was an unrecorded phenomenon when first documented. Hunt *et al.* (1992) believed there were two possible explanations (assuming the absence of emigration or immigration):

1) Arizona's floating adult population could be creating territories at such an accelerated rate that only near-adults are left to fill the gaps left by mortalities in known pairs.
2) High mortality in Arizona breeders is draining itinerant adults, leaving only near-adults to breed.

Based upon Hunt *et al.*'s (1992) hypotheses, we have no clear answer to the continued presence of subadults in breeding pairs. From 1986 to 1991, only two new pairs entered the population, but since 1991, we have documented 13 new pairs. Many of the pioneer pairs included subadults, which were not from a floating adult population. In 10 of new pairs (where age could be determined), subadults were present in 50 percent (n=5). And while we have recorded immigration and emigration into the population, there has only been one observed instance of each."[229]

While AGFD (1999a, 2000) maintains that there is "no clear answer to the continued presence of subadults in breeding pairs", in reality, three facts explain the finding:

1. high adult mortality,[230]

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[229] AGFD 1999a, 2000

[230] AGFD 1999a, 2000; Beatty and Driscoll 1996b; Gerrard *et al.* 1992; Hunt *et al.* 1992; Stalmaster 1987; USFWS 1993b

2. a very small, behavioral and reproductively closed population,[231] and
3. the number of known territories (historic, new, and newly discovered) has changed minimally in the last 12 years.[232]

Logic dictates that the earlier AGFD (1994b) explanation for this disturbing phenomenon still stands:

> "…The appearance of breeding eagles lacking full-adult plumage suggests an insufficiency of adults in the floating segment…"[233]

Professional timidity in the face of challenging politics accounts for AGFD (1999a, 2000) failure to offer explanation similar to that of AGFD (1994b), for the high percentage of subadults in breeding pairs.

6. Mortality for fledglings is excessive.[234]

Most Southwestern Desert Nesting Bald Eagles die prematurely:

> "…Of five known cases of mortality among subadults and near-adults in Arizona, all were human caused. Assuming an Arizona origin of all banded breeders, of the 46 Arizona nestlings banded prior to 1986, a minimum of 18 (39%) survived to breeding age (4-5 years old) and a minimum of four (9%) survived through their twelfth year of life…"[235]

From 1987 through 1998, 97 fledglings have been found dead.[236] During this time (1987 – 1999) the population produced only 214 fledglings.[237] In other words, 41% (97/214) of the fledglings from 1987 through 1998 were found dead.[238] While these figures may include a small number of overlap of pre-1987 fledglings, the fact that few Desert Nesting Bald Eagle survive to adulthood is obvious.[239]

[231] AGFD 1994b, 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Ohmart and Sell 1980; Stalmaster 1987; SWCBD 1999; USFWS 1982, 1997a, 1997b, 1998, 2000a, 2002a, 2003a, 2003b

[232] Hunt *et al.* 1992; AGFD 1999a, 2000

[233] AGFD 1994b

[234] AGFD 1999a, 2000; Beatty and Driscoll 1996b; Hunt *et al.* 1992; Mesta *et al.* 1992

[235] Hunt *et al.* 1992

[236] Hunt *et al.* 1992, Mesta *et al.* 1992, and Beatty and Driscoll 1996b, Beatty and Driscoll unpubl. data in AGFD 1999a, 2000

[237] AGFD 1999a, 2000

[238] AGFD 1999a, 2000; Hunt *et al.* 1992, Mesta *et al.* 1992, and Beatty and Driscoll 1996b, Beatty and Driscoll unpubl. data in AGFD 1999a, 2000; SWCBD 1999

[239] Ibid.

7. The population's survival is dependent, in good part, on heroic human support and management by the Arizona Bald Eagle Nestwatch Program (ABENWP).[240]

The Desert Nesting Bald Eagle would likely already be extinct except for the tireless and heroic efforts of human nest watchers. The amount of risk to which the majority of the most productive nests are exposed is staggering. During the two year period 1996 and 1997, 13,999 human activities and 4000 gunshots were recorded within one half mile from 13 nests![241]

The details:

> "…Unfortunately, signs, education, and the threat of fines do not deter people from entering BAs. Monitoring by nestwatchers has, and continues to be, a crucial component of Arizona bald eagle management. Nestwatchers intercept people and educate them about the species. In 1996 and 1997, 13,999 human activities and nearly 4000 gunshots were recorded within a kilometer of 13 different nests. Hunt *et al.* (1992) determined bald eagles at BAs such as Bartlett, Cliff, and 76 would rarely produce young without the aid of nestwatchers.
>
> Signs and limited enforcement are not effective in keeping these areas free from deleterious human activities. As management has increased at Lake Pleasant (more signs, more media, more brochures, better maps, etc.), failure to comply has also increased. During the first 3 years of monitoring, non-compliance with the closure's southern boundary averaged 5 percent per year. In 1997, it increased to 12 percent. At all BAs with high recreational activity, nestwatchers are needed to help guide activity away from the active nest, and educate people about the bald eagle's needs…"[242]

Since 1983, 16% of all Southwestern Desert Nesting Bald Eagle fledglings have been saved by direct human intervention.[243] In some years these efforts have been "directly responsible for saving up to 60% of a single year's nestlings…"[244]

AGFD (1999a, 2000) describes the program in detail:

> "…Arizona Bald Eagle Nestwatch Program
>
> The ABENWP began as a weekend volunteer effort by the USFS and Maricopa Audubon Society in 1978. Since then, the ABENWP has expanded

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[240] AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004c; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1997, 1998; Hunt *et al.* 1992; SWCBD 1999; USFWS 1992b, 1999c, 2003a, 2003b

[241] AGFD 1999a, 2000

[242] Ibid.

[243] Ibid.

[244] USFWS 1992b

into a multiagency program contracting 20 biologists annually (Beatty 1990a, 1990b, 1992; Beatty and Driscoll 1994a; Beatty *et al.* 1995a, 1995b, 1997, 1998). The primary goals of the ABENWP are public education, data collection, and conservation of the species.

Beginning in February, nestwatchers are stationed at 10 to 15 BAs with the highest recreational pressures. The on-site protection and education provided by nestwatchers has contributed to a high percentage of the bald eagle's success. In addition to monitoring the breeding attempt, nestwatchers can identify individual bald eagles in life-threatening situations, making possible a rescue effort by agency biologists. Since 1983, the ABENWP has helped save 50 nestlings and eggs, representing 16 percent of all young fledged in Arizona during that time (Appendix B, Fig. 3).

The ABENWP also indirectly increases productivity through public contacts, education, and proactive protection. Nestwatchers prevent many potential impacts to the breeding cycle by contacting the recreating public before they enter the BA and inadvertently disturb the breeding adults. Clearly, this aspect of the program is most important because of its dual function: 1. protecting the breeding cycle, 2. educating the public about Arizona's bald eagles. Considering the immeasurable percent the ABENWP affects indirectly, and the 16 percent of productivity they directly affect, it is easy to see the value of this project…"[245]

In 2002, 19% of the fledglings were saved by direct intervention of the nest watchers. (AGFD 2003) USFWS (2003b) continues ABENWP praises:

"The ABENWP coordinates banding of eagles, documents disturbances at nest sites, provides on-site protection, and intervenes as necessary to reduce harassment or as otherwise needed for the benefit of the eagles. This intervention has proven to be very effective in maintaining the southwestern bald eagle population. The ABENWP has "rescued" up to 50 percent of the fledglings produced in a year. These rescue operations include removing fishline and tackle from nestlings and adults, and returning nestlings to their nests after they fell or jumped out of the nest in response to disturbance or to escape extreme heat. Since the 1980's, the ABENWP has rescued 48 eagles and eggs, and documented 52 cases of fishing line or tackle posing a treat to the nesting eagles and eaglets. At least 15 percent of the bald eagle production is due to assistance provided by the Nestwatch program (U.S. Fish and Wildlife Service 1999)."[246]

ABENWP funding is not secure. Currently, ABENWP funding comes from several sources: Heritage Funds, mandatory Federal agency contributions as mitigation

[245] AGFD 1999a, 2000

[246] USFWS 2003b

for ESA takings, and volunteer funding. Heritage Funds come from Arizona State Lottery income. Income from the lottery has been decreasing. Legislative attempts at diverting lottery funds from wildlife protective activities have already occurred and will undoubtedly reoccur in the near future. Support for the Heritage Fund from within the conservation community is wavering owing to the increasing lack of AGFD conservation advocacy, as well as owing to AGFD's overt hostility towards conservation community goals.

Removal of the Bald Eagle from the List of Threatened and Endangered Species will terminate mandatory Federal agency funding for ABENWP. Bureau of Reclamation has already asked for clarification on funding termination for its Roosevelt Lake activities. Bureau of Reclamation's hostile attitude towards the protection of imperiled wildlife (Colorado Squawfish, Gila Topminnow, Huachuca Water Umbel, Humpback Chub, and Southwestern Willow Flycatcher) is well established in the Southwest. Similar hostile attitude has been displayed by the Army Corps of Engineers (Rio Grande Silvery Minnow and Southwestern Willow Flycatcher), Bureau of Land Management (Cactus Ferruginous Pygmy Owl, Desert Tortoise, Huachuca Water Umbel, Loach Minnow, Spikedace, and Southwestern Willow Flycatcher), Bureau of Indian Affairs (Mexican Gray Wolf and Mexican Spotted Owl), Department of Defense (Desert Tortoise, Huachuca Water Umbel, Sonoran Pronghorn, and Southwestern Willow Flycatcher), and the Forest Service (Gila Trout, Gila Topminnow, Loach Minnow, Mt. Graham Red Squirrel, Mexican Spotted Owl, Northern Goshawk, and Spikedace).

USFWS clarification to Bureau of Reclamation confirms that funding continues only "until the bald eagle is delisted."[247] This applies to all mandatory Federal agency funding for ABENWP:

> "Reclamation requested clarification of reasonable and prudent measure number two. Specifically, your memorandum questions how long Reclamation will be required to provide $5000 in funding per breeding season for the Nestwatch Program at the Tonto BA, and suggests a cut-off date of the year 2000, following the breeding season. The purpose of this reasonable and prudent measure is to offset adverse impacts to the bald eagle caused by the recreational facilities [the reasonable and prudent measure comes from a Reclamation action approved by the Service that will result in the loss of more than 20 eagles over the next fifty years]...For this reason, Reclamation is obligated to provide funding to the Nestwatch Program 1) for the life of the Indian Point Recreation facility; or 2) until the bald eagle is delisted; or 3) until such time as it can be clearly demonstrated that the Tonto BA has been abandoned for bald eagle nesting; or 4) until Reclamation can demonstrate that there have been no recreation-related incidents reported by nestwatchers that resulted in abandonment of the nest or loss of young at the Indian Point recreation site for ten consecutive years..."[248]

[247] USFWS 1996c
[248] Ibid.

Other examples of praise for the ABENWP, as well as documentation of the tenuousness of its funding, are abundant. USFWS (2002a) states:

> "The establishment of the Arizona Bald Eagle Management Committee (ABEMC) and Arizona Bald Eagle Nestwatch Program (ABENWP) has been essential to the success of recovery efforts for eagles in the Southwest. The ABENWP coordinates banding of eagles, documents disturbances at nest sites, provides on-site protection, and intervenes as necessary to reduce harassment or as otherwise needed for the benefit of the eagles. This intervention has proven to be very effective in maintaining the southwestern bald eagle population. At least 15 percent of the bald eagle production is due to assistance provided by the Nestwatch program (USFWS 1999). In Arizona, the use of breeding area closures and close monitoring of nest sites through the ABENWP has been and will continue to be essential to the recovery of the species. Ensuring the longevity of the ABENWP is of primary concern to the Service."[249]

AGFD (1994a) states:

> "Presently, there are few binding consultations for any agency to commit funding to existing bald eagle programs under section 7 of the Endangered Species Act. Now, funding assistance by agencies is primarily based upon available funds and where they choose to allocate those dollars.[250]

Other examples of the lack of agency commitment abound. The Arizona Republic (2003a) reports in "Desert bald eagles lagging behind":

> "...Driscoll [James Driscoll, Game and Fish's bald eagle management coordinator] said the state receives $230,000 a year from federal funds and wildlife grants, plus $70,000 from private donations.
>
> He estimated all but one-third of that federal money could be lost after de-listing..."[251]

In "Eagles may fly off U.S. endangered list, proposal upsets state's activists," the Arizona Republic (2004c) reports,

> "The possibility that government funding [for Arizona's eagle program] could end is not far-fetched, says Henry Messing, a biologist who represents the U.S. Bureau of Reclamation on the eagle management panel. Reclamation contributes $120,000 a year to the program.

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249 USFWS 2002a

250 AGFD 1994a

251 Arizona Republic 2003a

'There were some grumblings this year on the budget review committee,' Messing said. Reclamation authorities wonder why they should fund things that are not mandatory.

The bureau will provide funds as long as it has funds, according to Messing, who supports delisting. He looks to SRP as a possible bailout.

John Keane, an environmental analyst at SRP, which contributes $30,000 to $50,000 a year to monitoring eagles, said that's unlikely."

And in "Do eagles still need protection?" the Arizona Republic (2004f) further reports,

"The Bureau of Reclamation and other agencies have questioned whether eagle activities can be funded at current levels if the bird is delisted.

Jeff Humpheys, a U.S. Fish and Wildlife biologist in Arizona, said, 'We'll have to be very aggressive to keep people at the table with their pocketbooks open. The work is done on the cheap, but it's not cheap.'

According to Tom Gatz, assistant supervisor for Northern Arizona at Fish and Wildlife, budget is a major factor for ensuring the eagles' progress during the monitoring period. It becomes a matter of choosing priorities for limited funds, based on which animals are in the most trouble…"

8. <u>Reproductive rates are low for the Southwestern Desert Nesting Bald Eagle in comparison to Bald Eagle populations elsewhere.</u>[252]

Reproductive rates for Southwestern Desert Nesting Bald Eagles are lower than known in Bald Eagle breeding areas anywhere else:

"…Productivity rates in Arizona are lower than those recorded throughout North America. From 1975 to 1984, average productivity rates were 0.92 young per occupied BA (SD=0.36) when the number of BAs was below 20; since then the average has been 0.78 (SD=0.21). Productivity rates in Alaska (1963 to 1970), Florida (1961 to 1970), Washington (1981 to 1985), and Wisconsin (1983 to 1988), averaged 0.96 young per occupied BA (Sprunt *et al.* 1973, McAllister *et al.* 1986, Kozie and Anderson 1991)…"[253]

The February 21, 2003, Intra-Service Biological and Conference Opinion on Issuance of a Section 10(a)(1)(B) permit to Salt River Project for Operation of Roosevelt Lake, AESO/SE 2-21-03-F-0003 states:

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[252] AGFD 1999a, 2000; Hunt *et al.* 1992; USFWS 2003b

[253] AGFD 1999a, 2000

"Productivity rates are lower in Arizona than the rest of the United States. There were 0.92 average young per occupied breeding area in Arizona before 1984 when there were less than 20 breeding areas, and 0.78 average young per occupied breeding area since 1984, as opposed to 0.96 average young per breeding in Alaska, Wisconsin, Florida, and Wisconsin (Arizona Game and Fish Department *in prep*., Sprunt *et al.* 1973, McAllister *et al.* 1986, Kozie and Anderson 1991). The average productivity rate from 1971 to 2002 on the Verde River was 0.92; the average productivity rate for the rest of Arizona was 0.72."[254]

For the group of Desert Nesting Bald Eagles nesting along the upper Salt River the situation is even more precarious:

"...Through fish sampling and electroshocking during the 1980s and 1990s, AGFD (K. Young, pers. comm.) has documented a decrease in native fish in the upper Salt River. Native suckers, a crucial prey species during the breeding season (Hunt *et al.* 1992), once present in the 1980s, are now absent from the unregulated river. The lack of native fish species along this stretch of river may have reduced productivity from 0.67 (26/39) in the 1980s to 0.26 (12/47) in the 1990s. Hunt *et al.* (1992) cited fish diversity as a crucial feature of a suitable breeding location and native suckers as an important prey item in riverine systems..."[255]

9. The most prolific Desert Nesting Bald Eagle breeding areas are showing productivity declines.[256]

Breeding areas responsible for production of the majority of Southwestern Desert Nesting Bald Eagle fledglings are producing less fledglings. AGFD (1994b) states:

"...Biological threats to the population are...productivity declines at the most prolific breeding areas..."[257] (AGFD 1994b)

This is particularly concerning given the fact that good replacement habitat for the declining most prolific breeding areas does not exist. Breeding areas in habitat not as suitable and as productive cannot be expected to make up for the inevitably increasing declines.

In addition, since the majority of the most productive nests are in relatively close proximity to the rapidly growing Phoenix metropolitan area, survivability of these breeding areas is becoming increasingly problematic.

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[254] USFWS 2003b

[255] AGFD 1999a, 2000

[256] AGFD 1994b, 1999a, 2000

[257] AGFD 1994b

AGFD (1999a, 2000) summarizes this problem:

> "...The species' distribution in Arizona is primarily restricted to the Salt and Verde rivers. On the lower parts of these drainages and nearby lakes is where prey is most abundant and the bald eagles are most productive. Not surprisingly, these areas are closest to Phoenix and have the highest amount of recreational activity...The existing productive BAs are the most beneficial to the success of the population. We can not expect pairs breeding in marginal habitat to make up for a loss in productivity at these BAs...
>
> ...Maricopa County's human population is expected to double to more than six million over the next 30 years (AZ Republic 3/25/98). The threats posed to breeding bald eagles by the loss of habitat and a booming human population demanding recreation, real estate, and water, will only increase with time...
>
> ...Recreational pressures are increasing due to the expansion of the Phoenix metropolitan area, and to the scarcity of water-based recreational opportunities in the desert. Bald eagles nesting along the lower Salt and Verde rivers, Tonto Creek, Alamo Lake, Roosevelt Lake, and Lake Pleasant are vulnerable to disturbance and subsequent failure from increased human activity...
>
> ...Future development will affect the suitability of many Arizona BAs due to their proximity to the Phoenix metropolitan area. The effects of encroachment are escalated due to the suitability of habitat and the density of BAs near Phoenix.
>
> Examples of proposed and ongoing development are occurring at the Blue Point, Box Bar, Pleasant, Sheep, and Tonto BAs. A proposed turnaround for river-tubers is being considered below Bulldog Cliffs near the Blue Point BA. A 360-unit housing development and 18-hole golf course are proposed for construction 1.0 miles from the Box Bar BA. The City of Peoria annexed the north shore of Lake Pleasant to develop lakeside resorts. Continued housing, road, and business developments occur along lower Tonto Creek, near the Sheep and Tonto BAs.
>
> Completed projects which may affect bald eagles include campground developments at Roosevelt Lake [loss of 12 nests and eight nestlings or eggs in the next 50 years; nest productivity drops from 50-80% to 35% according to USFWS (1993)] and agriculture at Fort McDowell [45% reduction in nest productivity, 1986-1991 according to USFWS 1992a]. A 100-unit campground with a boat ramp was constructed within 2 miles of the Tonto nest tree; the dirt road leading to the campground was paved 0.25 miles from the nest. Fort McDowell's agricultural development involved the removal of mesquite bosques, cottonwood trees, and upland desert habitat. This may not present short term problems, but the long term change and lack of riparian

regeneration will reduce the area's ability to support the current number of nesting and foraging bald eagles..."[258]

According to Arizona Department of Economic Security estimates, Maricopa County will double to 6.2 million by 2039.[259] Yavapai County, the cities of Prescott and Prescott Valley coveting the waters of the upper Verde, will double by 2021.[260] Cottonwood along the Middle Verde will double by 2022.[261] Payson, affecting Tonto Creek, will double by 2044.[262]

Disturbance from low-flying aircraft in the metropolitan Phoenix area also continues to be an increasing problem.[263] Bald Eagle harassment and deaths have and will continue to occur because of low-flying aircraft.[264] This will be discussed in detail in a later section.

10. Breeding areas along the free-flowing rivers are showing productivity declines.[265]

The Southwest has already lost nearly all of its free-flowing rivers. Rare stretches survive. Nearly every one surviving is imperiled. Not surprisingly, nesting Bald Eagles are found in many of these remnant stretches of free-flowing rivers. Productivity in the breeding areas is declining in these stretches:

> "...Biological threats to the population are...productivity declines at territories along the free-flowing rivers..."[266]

For the group nesting along the upper Salt River the situation is particularly precarious:

> "...Through fish sampling and electroshocking during the 1980s and 1990s, AGFD (K. Young, pers. comm.) has documented a decrease in native fish in the upper Salt River. Native suckers, a crucial prey species during the breeding season (Hunt *et al.* 1992), once present in the 1980s, are now absent from the unregulated river. The lack of native fish species along this stretch of river may have reduced productivity from 0.67 (26/39) in the 1980s to 0.26 (12/47) in the 1990s. Hunt *et al.* (1992) cited fish diversity as a crucial feature of a suitable breeding location and native suckers as an important prey item in riverine systems..."[267]

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[258] AGFD 1999a, 2000
[259] DES 2004a
[260] DES 2004b
[261] Ibid.
[262] Ibid.
[263] AGFD 1999a, 2000; USFWS 1993a, 1994c, 1997b, 2002a, 2003b
[264] AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004c; Arizona Republic 1989
[265] Ibid.
[266] AGFD 1994b
[267] AGFD 1999a, 2000

11. Desert Nesting Bald Eagle nests on private property are either not producing young or are destined to fail.[268]

In spite of the rarity of surviving riparian habitat still capable of supporting breeding Bald Eagles, some private property owners are not motivated or cannot afford to preserve their good fortune. AGFD (1999a, 2000) describes the dismal outlook for the three breeding areas on private land:

> "...Nesting pairs on private land presents difficulties for management or monitoring, especially when ownership and land use practices change frequently. Property has recently been sold or is planning to be sold in Camp Verde and Perkinsville BAs. Current owners of the Perkinsville have refused ground access to monitor the BA. The Winkelman BA is surrounded by housing, recreation, and industry. All three of these BAs are in relatively poor bald eagle habitat, and nestlings have not been produced..."[269]

The Perkinsville BA was successful in 2000, 2001 and 2003.[270] It failed in 2002.[271] The Camp Verde and the Winkelman BAs continue failing. The Perkinsville BA faces increasing threats with impending Upper Verde River dewatering.[272]

12. Desert Nesting Bald Eagle habitat faces imminent and accelerating loss of increasing amounts of habitat vital for long-term survival.[273]

Most of the 47 Southwestern Desert Nesting Bald Eagle breeding areas are located in the Salt River and Verde River drainages near the Phoenix metropolitan area.[274] Habitat loss to the growing Central Arizona population is increasingly problematic.

The Southwest has already lost more than 90% of its historic riparian habitat.[275] This loss of riparian habitat continues owing to increasing development, dewatering via groundwater pumping and diversions, destructive cattle grazing, and lack of vegetation rejuvenating floods. Fifty one percent of all Southwestern Desert Nesting Bald Eagle nests ever known in Arizona have been in riparian trees and snags.[276] The nests of the

[268] ADWR 1999; AGFD 1994b, 1999a, 2000, 2001a, 2002a, 2003, 2004c; Arizona Republic 2000, 2001; Chino Valley Review 2004; Prescott 2001; Prescott Daily Courier 2004a, 2004b; USFWS 2001a

[269] AGFD 1999a, 2000

[270] AGFD 2001a, 2002a, 2004c

[271] AGFD 2003

[272] ADWR 1999a, 2000; Arizona Republic 2000, 2001; Chino Valley Review 2004; Prescott 2001; Prescott Daily Courier 2004a, 2004b; USFWS 2001a

[273] ADWR 1994, 1999; AGFD 1993, 1999a, 2000; Arizona Republic 2000, 2001; Chino Valley Review 2004; Lofgren *et al.* 1990; Krueper 1993; Prescott 2001, Prescott Daily Courier 2004a, 2004b; SWCBD 1999; USFWS 1984, 1985, 1990b, 1992a, 1992d, 1993a, 1994c, 1996b, 1996c, 1997a, 1997b, 1998, 2001a, 2003b, 2003d

[274] AGFD 2004d

[275] AGFD 1993, Krueper 1993, Lofgren *et al.* 1990

[276] Driscoll 1999

most productive BAs are found in riparian trees.[277] Riparian trees are essential for the Desert Nesting population's survival:

> "...RIPARIAN HABITAT...Riparian trees are vital for the continued existence of the most productive BAs in the state..."[278]

Cottonwood trees in these BAs are not being replaced.[279] There is no regeneration owing to lack of the flooding necessary for rejuvenation of riparian vegetation, to development, to cattle grazing.

AGFD (1999a, 2000) summarizes this situation:

> "...Present or threatened destruction, modification, or curtailment of its habitat or range
>
> Arizona supports 40 bald eagle BAs with most being located in the Salt and Verde drainages near Maricopa County. This population is not likely to increase substantially or expand its distribution. In contrast, Maricopa County's human population is expected to double to more than six million over the next 30 years (AZ Republic 3/25/98). The threats posed to breeding bald eagles by the loss of habitat and a booming human population demanding recreation, real estate, and water, will only increase with time.
>
> *Riparian habitat.* Bald eagles at 11 BAs (Box Bar, Coolidge, Doka, Fort McDowell, Perkinsville, Pinto, 76, Sheep, Sycamore, Tonto, and Winkelman) rely solely on riparian trees to nest. Cottonwood trees in these BAs have become overmature, are dying, and are not being replaced. Regeneration of key riparian habitat has not occurred in many areas of the Southwest due to many factors (Stromberg 1993).
>
> These 11 BAs represent a significant portion of the population by collectively contributing 22 percent (82/370) of all recorded fledglings since 1971. The Fort McDowell BA has fledged 34 young, second to only the Blue Point BA (35). Additionally, five of these 11 BAs have been in existence for at least 10 years (10, 13, 15, 17, and 26 years).
>
> It is reasonable to expect in the next two decades, the pairs at 7 of these 11 BAs will have fewer trees in which to nest, roost, loaf, preen, and/or hunt. The Box Bar, Coolidge, Doka, Fort McDowell, and Sycamore BAs currently nest in overmature live trees, dying trees, or snags located below dams with little regeneration. Poorly timed water releases (Stromberg *et al.* 1991), scouring, off-road vehicles, development, grazing, woodcutting, and agriculture threaten the riparian habitat of these areas.

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[277] AGFD 1999a, 2000; Hunt *et al.* 1992

[278] AGFD 1999a, 2000; USFWS 2003b

[279] AGFD 1999a, 2000

Additionally, the increased storage capacity of Roosevelt Lake threatens the few trees at the Pinto and Tonto BAs. Nest trees at both BAs will die due to inundation and the snags will fall over time. Few to no alternate nest trees exist for the Pinto pair and most of the alternate trees available to the Tonto pair are located near housing communities or recreation areas…

Development. Future development will affect the suitability of many Arizona BAs due to their proximity to the Phoenix metropolitan area. The effects of encroachment are escalated due to the suitability of habitat and the density of BAs near Phoenix.

Examples of proposed and ongoing development are occurring at the Blue Point, Box Bar, Pleasant, Sheep, and Tonto BAs. A proposed turnaround for river-tubers is being considered below Bulldog Cliffs near the Blue Point BA. A 360-unit housing development and 18-hole golf course are proposed for construction 1.0 miles from the Box Bar BA. The City of Peoria annexed the north shore of Lake Pleasant to develop lakeside resorts. Continued housing, road, and business developments occur along lower Tonto Creek, near the Sheep and Tonto BAs.

Completed projects which may affect bald eagles include campground developments at Roosevelt Lake [loss of 12 nests and eight nestlings or eggs in the next 50 years; nest productivity drops from 50-80% to 35% according to USFWS (1993)] and agriculture at Fort McDowell [45% reduction in nest productivity, 1986-1991 according to USFWS 1992a]. Completed projects which may affect bald eagles include campground developments at Roosevelt Lake and agriculture at Fort McDowell. A 100-unit campground with a boat ramp was constructed within 2 miles of the Tonto nest tree; the dirt road leading to the campground was paved 0.25 miles from the nest. Fort McDowell's agricultural development involved the removal of mesquite bosques, cottonwood trees, and upland desert habitat. This may not present short term problems, but the long term change and lack of riparian regeneration will reduce the area's ability to support the current number of nesting and foraging bald eagles.

Nesting pairs on private land presents difficulties for management or monitoring, especially when ownership and land use practices change frequently. Property has recently been sold or is planning to be sold in Camp Verde and Perkinsville BAs. Current owners of the Perkinsville have refused ground access to monitor the BA. The Winkelman BA is surrounded by housing, recreation, and industry. All three of these BAs are in relatively poor bald eagle habitat, and nestlings have not been produced.

Individual projects may not present much harm to the continued existence of Arizona breeding bald eagles. However, developers do not focus on the cumulative effects of previous, concurrent, or future projects. Clearly, growth in central Arizona will not cease as accommodations continue to be made for one of the fastest growing urban areas in the country…"[280]

Dewatering of the middle portion of the Verde River is accelerating. Base flows, or stream flow during the driest times of the year, are now reduced to that of a small irrigation ditch.

"RIVER BARELY FLOWS – The Verde River dropped down to 12 cubic feet per second (cfs) on several days during June at the Camp Verde White Bridge gage…Despite the low flows, Verde Valley irrigation ditch mangers report there has been adequate flow to serve their customers' dry season needs…"[281]

Increasing groundwater pumping by the growing population of Cottonwood and Camp Verde now threatens to render this section of the Verde River intermittent. Channelization is also a problem. Both threats are addressed with recent USFWS approval of additional groundwater pumping:

"…The proposed project is the approval, by Reclamation, of CAP water exchange agreements between CWW [Cottonwood Water Works], CVWS [Camp Verde Water System], and the City of Scottsdale…The present proposed project is for CWW and CVWS to assign their CAP water allocation to the City of Scottsdale in return for $3,555,200…which would be used for development of alternative water supplies, primarily from groundwater sources…"[282]

This project's contribution to dewatering and piecemeal destruction of the middle Verde River is obvious. USFWS discussion of the situation is illustrative:

"…*<u>Effects of Groundwater Pumping and Verde River Surface Flow Depletion</u>*…there is a hydrologic connection between the Verde Formation [the deep Verde Formation of the Tertiary Age, underlying the regional aquifer system], the Quaternary alluvial deposits along the river corridor [the alluvium of the Quaternary Age which underlies the Verde River channel and its floodplain], and the surface flows of Verde River (Owen-Joyce, 1984 [Owen-Joyce, S.J. 1984. Hydrology of a stream aquifer system in Camp Verde area, Yavapai County, Arizona. Arizona Department of Water Resources Bulletin 3, Phoenix, Arizona. 60pp.])…The Verde River base flow is provided by groundwater discharge from the alluvium and Verde Formation (ADWR, 1994 [Arizona Department of Water Resources. 1994. Arizona Riparian Protection Program: A report to the Governor, President of the Senate and Speaker of

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[280] AGFD 1999a, 2000

[281] Verde Natural Resources Conservation District 1999

[282] USFWS 1998

the House. Phoenix, Arizona. 507 pp.]). Thus, any withdrawal from either of those portions of the aquifer is expected to eventually deplete Verde River base flows.

Pumping from groundwater aquifers can deplete surface flows in both direct and indirect ways (ADWR, 1994; Glennon, 1995 [Glennon, R.J. 1995. The threat to river flows from groundwater pumping. Rivers 5(2):133-139.]). It can directly deplete surface flow by creating a cone of depression spreading outward from the well that causes surface water to infiltrate the alluvium to fill the resulting dewatered area. It can indirectly deplete surface flow by intercepting groundwater that would have flowed into the stream…

Groundwater pumping in Arizona has been repeatedly demonstrated to result in depletion of surface flows, degradation and loss of riparian habitats, and adverse impacts and local extirpation of aquatic and riparian flora and fauna (Miller, 1961 [Miller, R.R. 1961. Man and the changing fish fauna of the American southwest. Papers of the Michigan Academy of Science, Arts, and Letters XLVI:365-404.]; Hendrickson and Minckley, 1984 [Hendrickson, D.A. and W.L. Minckley. 1984. Cienegas – vanishing climax communities of the American southwest. Desert Plants 6(3):131-175.]; Stromberg, 1993 [Stromberg, J.C. 1993. Fremont cottonwood-Gooding willow riparian forests: a review of their ecology, threats, and recovery potential. Journal of the Arizona-Nevada Academy of Science 26(3):97-110.]; Glennon and Maddock, 1994 [Glennon, R.J. and T. Maddock, III. 1994. In search of subflow: Arizona's futile effort to separate groundwater from surface water. Arizona Law Review 36:567-610.]; Tellman *et al.*, 1997 [Tellman, B., R. Yarde, and M.G. Wallace. 1997. Arizona's changing rivers: how people have affected the rivers. University of Arizona, Tucson, AZ. 198 pp.]). …various studies predict that the accelerating amount of groundwater removal will begin to deplete Verde River flows in the near future (Owen-Joyce and Bell, 1983 [Owen-Joyce, S.J. 1984. Hydrology of a stream aquifer system in the Camp Verde area, Yavapai County, Arizona. Arizona Department of Water Resources Bulletin 2, Phoenix, Arizona. 219 pp.]; ADWR, 1994; Ewing *et al.*, 1994 [Ewing, D.B., J.C. Osterberg, and W.R. Talbot. 1994. Groundwater study of the Big Chino Valley, Technical Report. U.S. Bureau of Reclamation, Denver, Colorado.]; McGavock, 1996 [McGavock, E. 1996. Overview of groundwater conditions in the Verde Valley, Arizona. 9th Annual Symposium of the Arizona Hydrological Society. Prescott, AZ. Sept. 12-14, 1996.])…"

"…Another important and far-reaching result of increased urban/suburban development will be increased channelization of Verde River and its tributaries. Channelization within developed or developing areas is already increasing. This is illustrated by the five formal consultations that have been completed since 1993 on various flood and erosion repair and protection projects…Channelization has many adverse effects to razorback sucker, including direct habitat reduction by shortening of the river channel, loss of backwater larval and juvenile habitats, increased velocities, disruption of food base, and many others..."

"...*Cumulative Effects of human Population Growth*

Growth is projected in Cottonwood to increase by 148% and in Camp Verde to increase by 158% between 1994 and 2040 (Arizona Department of Economic Security 1994). This dynamic growth would lead to increased development, increased contamination, increased wildfires, and increased alteration of the watershed and hydrologic regime.

Cumulative Effects of Economic Development

The growth projected for this region will be manifested through economic development, including housing, golf courses, businesses, industry, roads, schools, and other facilities for the population. These facilities will replace natural vegetation and cover large expanses of the floodplain and watershed with impermeable surfaces. A primary result will be the alteration of the watershed characteristics and changes in the hydrologic and sediment patterns, sources, and volumes..."

Cumulative Effects of Future Visitation/Recreation

If all urban/suburban areas in Arizona continue to grow at the existing and anticipated rate, the Verde Valley and the Verde watershed will continue to experience rapid increases in recreational use of both private and public lands. The increase will be particularly focused on the Verde River and its riparian corridor. Bank compaction and erosion, channel morphology changes, riparian vegetation suppression and loss, increased pollution and trash, construction of picnicking another recreational facilities with the riparian corridor, and many other adverse impacts will destroy or adversely alter razorback sucker habitat and habitat for bald eagle prey species. Bald eagle will be subjected to increasing disturbance effects and may have increased problems with entanglement in monofilament fishing line..."[283]

USFWS (2000a) states,

"Incidental take statement: **Anticipated take: Exceeding this level may require reinitiation of formal consultation.** The Service anticipates one pair of bald eagles and associated eggs and/or young, annually, could be taken as a result of this proposed action. The incidental take is expected to be in the form of harassment of foraging bald eagles during spring and summer months."[284]

[283] USFWS 1998
[284] USFWS 2000a

USFWS (2001a) states,

> "…riparian habitat loss continues on the lower Verde and Salt Rivers as a result of dam operations, livestock grazing, wood cutting, vehicle use in the floodplain, and agriculture.
>
> Various non-Federal actions in addition to those from direct use of CAP water are also cumulative to the CAP impacts to nine listed species. Human population growth in the Gila River basin, particularly in the Phoenix and other urban areas, is predicted to occur into the future (ADES 2001) and will place greater demands on all natural resources in the basin, especially water. Growth and development will continue to result in changes in watershed condition and watershed functioning affecting water quality and quantity, riparian vegetation, channel morphology, and flood characteristics. Groundwater pumping and other water development in outlying areas, particularly where related to CAP allocation exchanges, will result from the increased population growth fueled by CAP. Groundwater pumping in areas such as the upper San Pedro and the Prescott/Chino Valley area threaten the water supply of streams important to spikedace, loach minnow, Gila topminnow, razorback sucker, and bald eagle. As more people live and recreate in the area, opportunities will also increase for nonnative aquatic species to enter the basin."[285]

USFWS (2003b) states:

> "…b. Bald eagle - incidental take of bald eagles using nest or perch trees at Roosevelt, and incidental take of no more than 18 fledgling bald eagles resulting from reduced…productivity of bald eagles at Roosevelt during periods of declining water levels…
>
> Eight of 9 bald eagle breeding areas on the Verde have used trees for nesting sites. Six of these only have trees available for nesting (as opposed to cliff nesting sites). The number of nest trees available for each pair of eagles below Bartlett Dam has been reduced through the increase in territories, degradation of existing trees, and lack of riparian recruitment (McNatt *et al.* 1980, Hunt *et al.* 1992, Briggs 1996, Beauchamp and Stromberg 2001, U.S. Fish and Wildlife Service 2002b). Bartlett cottonwood nest tree #3 was found in 1973, used in 1977 and 1980, and supporting limbs broke underneath the nests in 1978 and 1985 (Hunt *et al.* 1992). No nests were ever again built in the tree and the nest tree fell prior to 1989 (G. Beatty, U.S. Fish and Wildlife Service, personal observation). A few large cottonwood trees exist at the campground below Bartlett Dam (Hunt *et al.* 1992); however, there are none left through the Bartlett nest area downstream to Needle Rock and no

[285] USFWS 2001a

regeneration is occurring (J. Driscoll, AGFD, pers. comm., G. Beatty, U.S. Fish and Wildlife Service, pers. obser.). It is believed that only two to three nest trees are available for the Needle Rock eagles (J. Driscoll, Arizona Game and Fish Department, pers. comm., G. Beatty, U.S. Fish and Wildlife Service, personal observation). The Box Bar Breeding Area has primarily one cottonwood grove for eagles to use for nesting (J. Driscoll, Arizona Game and Fish Department, pers. comm., G. Beatty, U.S. Fish and Wildlife Service, personal observation). The supporting branch for the Box Bar tree nest #2 fell in 1998. In the past, the Fort McDowell eagles nested and perched in trees along most of the lower Verde River from the Forest/Tribal boundary to Highway 87 bridge, but establishment of the Doka and Sycamore breeding areas has reduced the size of Fort McDowell's territory. Fort McDowell has had a total of 17 known nest trees used since the 1970s; currently, nests (#15, #16, and #17) are known to exist in three trees (Hunt *et al.* 1992, J. Driscoll, Arizona Game and Fish Department, pers. comm.). Many of the supporting branches or trees have fallen as the trees have degraded or died (Hunt *et al.* 1992, J. Driscoll, Arizona Game and Fish Department, pers. comm.). The Doka nest snag #1, previously a live cottonwood used by the Fort McDowell eagles, fell after the 2001 breeding season. Sycamore nest tree #1 supporting branches also have fallen. Similar to the lower Salt River, Verde River dams and dam operations degrade existing eagle tree nesting and perching habitat, and retard riparian regeneration that could replace aging and dying trees (Arizona Game and Fish Department *in prep.*, McNatt *et al.* 1980, Hunt *et al.* 1992, Briggs 1996, Beauchamp and Stromberg 2001, U.S. Fish and Wildlife Service 2002b). Operation of Bartlett Dam has altered the hydrological regime of the lower Verde River by reducing the magnitude, frequency and duration of high flow events (Briggs 1996, Beauchamp and Stromberg 2001, U.S. Fish and Wildlife Service 2002b). A consequence of this change is a decrease in the size and complexity of the active channel below Bartlett Dam (Beauchamp and Stromberg 2001, U.S. Fish and Wildlife Service 2002b). A reduction in high flows is concomitant with a reduction in stream power and the ability to re-work sediment (Gordon *et al.* 1992). Periodic high flows on the lower Verde have not been sufficient to maintain or continue these processes as smaller flood flows are restricted (U.S. Fish and Wildlife Service 2002b).

Dams are restricting the flow of sediment, and operations are restricting the dynamic hydrological regime that allows sediment to move past the dam and help maintain and regenerate riparian habitat (U.S. Fish and Wildlife Service 2002b). Other land use activities, such as cattle grazing and vehicles also contribute to degradation of existing eagle nesting, perching, and foraging habitat and retard nest tree regeneration on the lower Verde River (Arizona Game and Fish Department *in prep.*, J. Stromberg, Arizona State University, pers. comm., V. Beauchamp, Arizona State University, pers. comm., Hunt *et al.* 1992, Sommers *et al.* 2002, U.S. Fish and Wildlife Service 2002b). Below Horseshoe Dam on the Tonto National Forest, automobiles access the floodplain at the ford area near K/A ranch and at the old gauging station/cable cross. Below Bartlett Dam, automobile and recreational use in the floodplain occurs at three areas (about a mile downstream from the dam, at Needle Rock, and at Box Bar). Further downstream on the Fort McDowell Yavapai Nation and Salt River Pima Maricopa Indian Community, recreational activity, including vehicles, occurs in the floodplain. These recreational activities, all-terrain vehicles, etc. adversely affect the establishment and maintenance of tree development (Cole and Landres 1995, Flather and Cordell 1995). Additionally, livestock grazing in the Verde River floodplain on the Fort McDowell Yavapai Nation and Salt River Pima Maricopa Indian Community retard the establishment of riparian trees (U.S. Fish and Wildlife Service 2002b). In addition to dam operations (Stromberg 1993), scouring, off-road vehicles, development, grazing, woodcutting, and agriculture threaten existing lower Verde River riparian habitat (Hunt *et al.* 1992, Arizona Game and Fish Department *in prep.*), and inhibit its regeneration. Hunt *et. al* (1992) described the lower Verde River below Bartlett Dam as "cottonwood trees and mesquite bosques in various stages of decay and thinning." Arizona Game and Fish Department (*in prep.*) found that cottonwood trees on the lower Verde River have "become overmature, are dying, and are not being replaced." Many of the large trees present were there prior to construction of the dam (J. Stromberg, Arizona State University, pers. comm.). Directly below Bartlett Dam, the floodplain has been scoured by high flows, leaving rock cobble. Further downstream beginning near Needle Rock, riparian vegetation and larger nesting trees are primarily found on terraces further away from the active channel (U.S. Fish and Wildlife Service 2002b). Some mature cottonwoods on the lands of the Fort McDowell Yavapai Nation can be found perched at least 10 feet above the river bottom atop exposed banks. These banks, unprotected by vegetation, are subjected to infrequent, but heavy floods, causing the banks to erode and the trees to fall. In 1995, the Fort McDowell nest tree, nest, and young were toppled into the river as a result of exposed banks and high flows (G. Beatty, U.S. Fish and Wildlife Service, pers. comm.). Old trees along the entire lower Verde river closer to the active channel that pre-date the dam, have significant root scouring, and as a result of decreased sediment deposition, are not protected and may be more easily toppled during large flood events (J. Stromberg, Arizona State University, pers. comm.). Below Sycamore Creek, salt cedar is flourishing as a result of the interrupted hydrologic regime (U.S. Fish and Wildlife Service 2002b). This creates a significant fire risk to existing nest trees, not previously known to exist along southwestern rivers (U.S. Fish and Wildlife Service 2002b). Hunt *et al.* (1992) made protecting and improving riparian habitat along the lower Verde River their first habitat management recommendation and suggested that losing the Fort McDowell eagles (as result of the loss of nest trees) might be significant to the population. Cottonwood pole planting projects have occurred along the lower Verde River below Bartlett Dam without much overall success in contributing to quality wildlife habitat. Briggs (1996) described a failed U.S. Forest Service effort from 1979. Over 600 cottonwood and willow poles were planted, but 11 years later only 7 trees appeared healthy with the long-term potential of survival. Lowered groundwater levels and water deprivation were believed to be contributing factors in the project's failure. Agencies participating in the Southwestern Bald Eagle Management Committee planted cottonwoods on at least two occasions at the Fort McDowell Yavapai Nation (1988 and 2001). Some cottonwoods from 1988 survived that were located near sources of water (C. Sommers, ERO, pers. comm.), but nearly all that were planted in the floodplain near existing eagle nesting areas died from beavers or lack of groundwater. Hundreds of riparian trees were planted in the floodplain along the Verde River on Salt River Pima Maricopa Indian Community in the mid-1990s, but all trees died (G. Beatty, U.S. Fish and Wildlife Service, pers. comm.). We are unable to attribute a percentage or degree to which activity (dam construction/operation or land uses) has caused more damage to bald eagle habitat on the lower Verde River. Beauchamp and Stromberg (2001) found that operation of the dams has likely affected riparian communities by decreasing recruitment of early successional riparian species (willows and cottonwoods) and expansion of later successional species (e.g. mesquites and saltcedar). McNatt *et al.* (1980) found that Horseshoe and Bartlett dams have led to the demise of cottonwoods on the lower Verde River. This is a common effect of dam construction and operation in the Southwest, and has been observed on numerous river systems (see review in Briggs 1996). Sommers *et al.* (2002) agree that flow alteration has reduced the frequency and density of cottonwood establishment, but they believe land use factors, particularly grazing and recreation, are even more important than dam construction and operation in limiting native riparian plant communities (also see U.S. Fish and Wildlife Service 2002a, pp. 86-89). However, Vanessa Beauchamp (graduate student, Arizona State University, pers. comm. 2002), believes the effects of the dams and their operation are the most important limiting factors in shaping the riparian plant community. What appears to be clear from examples of land and river management activities throughout Arizona and the Southwest (U.S. Fish and Wildlife Service 2002b) is that each activity by itself, and certainly in combination with each other, are capable of degrading existing bald eagle habitat and affecting the development of habitat to maintain existing territories…

Comparison and importance of lower Salt and Verde river bald eagle breeding areas to the rest of Arizona

The lower Salt (below Roosevelt Dam) and lower Verde rivers have been and remain key areas for the recovery and survival of the Arizona and southwestern population of breeding bald eagles. From 1993 to 1999, 40 percent of all known Arizona fledglings were produced from the lower Salt and Verde rivers and, since 2000, 53 percent of the state's productivity originated there (Table 7). Overall, 46 percent of all the Arizona fledglings produced since 1993 hatched from the lower Salt and Verde rivers. Most recently, the lower Verde River has been responsible for 33 percent of all fledglings since 1999. This is an overwhelmingly large proportion of productivity originating from a relatively small portion of the eagle's Arizona range. The lower Verde and Salt rivers in this analysis represent about 140 river miles (Hunt *et al.* 1992), or 40 percent of the combined length of just the Salt and Verde rivers (350 river miles). Eagles also have breeding areas on the Agua Fria, Bill Williams, Little Colorado, San Francisco, San Pedro, and Gila rivers, along Lynx, Tonto, Cibecue, Canyon, and Oak creeks, and forage from tributaries such as the East Verde River, Fossil, West Clear, Carrizo, and Cherry creeks.

Verde River, Horseshoe Reservoir to Salt River confluence, and Salt River downstream of Roosevelt Dam

Operations of the lower Verde and Salt river dams, in conjunction with the presence of the dam structures, will continue to degrade existing bald eagle nesting habitat (including important trees needed for nesting foraging, loafing, feeding, display, and/or sentry perches) and prevent habitat development, maintenance, and regeneration of trees suitable for nesting and perching in the Needle Rock, Box Bar, Fort McDowell, Doka, Sycamore, and Rodeo breeding areas below Bartlett Dam and the Granite Reef Breeding Area below Stewart Mountain Dam (McNatt *et al.* 1980, Briggs 1996, Beauchamp and Stromberg 2001, U.S. Fish and Wildlife Service 2002b, Arizona Game and Fish Department *in prep.*; see the Environmental Baseline). Operation of lower Verde and Salt river dams will continue to alter the hydrological regime of the lower Verde and Salt rivers by reducing the magnitude, frequency, timing, and duration of high flow events (Briggs 1996, Beauchamp and Stromberg 2001, U.S. Fish and Wildlife Service 2002b). As a result, the size and complexity of the active channel below Bartlett and Stewart Mountain dams are likely to continue to decline (Beauchamp and Stromberg 2001, U.S. Fish and Wildlife Service 2002b). Attenuation of high flows is concomitant with a reduction in stream power and the ability to re-work sediment (Gordon *et al.* 1992). The dams will continue to trap sediment, which will further limit opportunities for natural regeneration or managed restoration of riparian habitat (U.S. Fish and Wildlife Service 2002b). Reducing the magnitude, frequency, and duration of high flow events will prevent the establishment of germination sites for cottonwood and willow tree seedlings that require recently deposited, moist, bare sediment (Braatne *et al.* 1996). Continued high summer flows below Bartlett Dam may scour away seedlings that germinated in the spring (Patten 1998), and reduce the longevity of existing trees (J. Stromberg, Arizona State University, pers. comm.). Continued operation of the Verde dams is expected to result in further establishment of salt cedar, which significantly increases the risk of catastrophic fire (J. Stromberg, Arizona State University, pers. comm., U.S. Fish and Wildlife Service 2002b). Reducing the overall amount of riparian vegetation, coupled with periodic scouring floods, accelerates the loss of established trees (J. Stromberg, Arizona State University, pers. comm.). The loss of the dynamic nature of the Verde River below Bartlett Dam and Salt River below Stewart Mountain Dam will continue to cause degradation of the structure and function of the riparian area. Continued grazing along the lower Verde and Salt rivers is expected to exacerbate adverse effects to riparian vegetation through browsing and trampling of seedling and sapling riparian trees (USFWS 2002b). Continued recreation will result in cutting of trees, destruction of seedling beds by campers and off-highway vehicles, and increased risk of fire due to camp fires and other human activities. The Arizona Game and Fish Department's (*in prep.*) draft Bald Eagle Conservation Assessment and Strategy provided a description of what is expected to occur in the future under the current management. They wrote, "it is reasonable to expect in the next two decades, the pairs (below Bartlett Dam) will have fewer trees in which to nest, roost, loaf, preen, and/or hunt. The (lower Verde River) breeding areas currently nest in overmature live trees, dying trees, or snags below dams with little regeneration. Poorly timed water releases, scouring, off-road vehicles, development, grazing, woodcutting, and agriculture threaten the riparian area. Managing agencies must minimize the factors impairing riparian vegetation to maintain the current distribution and abundance of eagles on the lower Verde River..." This document has been reviewed twice by the representatives of the Southwestern Bald Eagle Management Committee, including the U.S. Fish and Wildlife Service, Arizona Game and Fish Department, Reclamation, and SRP (J. Driscoll, Arizona Game and Fish Department, pers. comm.). In the absence of concerted efforts to reverse habitat trends, we expect over the next 50 years that 5 of the lower Verde bald eagle breeding areas dependent on trees for nesting and perching will be lost due to continued riparian habitat degradation, prevention of habitat regeneration, and catastrophic fire. Because the Needle Rock, Box Bar, Fort McDowell, Doka, Sycamore, Rodeo, and Granite Reef breeding areas are in such close proximity, each pair is highly dependent on the existing over-mature trees in each breeding area for nesting and foraging, loafing, feeding, display, and/or sentry perches. As these trees continue to die and fall over, territories will be lost because there is little regeneration or growth of younger trees for replacement and as a result, there are not enough trees for nesting and foraging…

We anticipate that the proposed action will result in incidental take, in the form of harm, of bald eagles using nest or perch trees at Roosevelt Lake in conjunction with the permitted activity and over the life of the permit. Harm is expected due to modification or degradation of habitat due to loss of nest and perch trees from inundation or desiccation, and associated effects. Additionally, we anticipate incidental take of no more than 18 fledgling bald eagles over the life of the permit in conjunction with the permitted activity, resulting from reduced productivity of bald eagles that use Roosevelt Lake for foraging during periods of declining water levels over the life of the Permit."[286]

13. The native fishery with which the Desert Nesting Bald Eagle population evolved continues to suffer decline.[287]

Native Arizona sucker spp. (desert and Sonora) spawn in riffles and are a primary prey item for bald eagles during spring.[288] The Desert Fishes Team (2003) states,

> "...Six species are extirpated from the basin, five others survive in less than 20% of their original range, and one remains in about 40% of its original range. The distribution and abundance of all listed species extant in the basin has declined since their original listing and the trend is continuing. Few successful recovery and conservation actions have occurred during the 36-year period assessed. Although repatriation has been the primary management effort, it has occurred for only a few of the species, and with limited success.
>
> **Recommendations**: All of the federally listed species have existing and adequate biologically based recovery plans. However, few recommendations in those plans have been implemented. Additional planning for these species is unnecessary, but the other species need management plans. On-the-ground implementation of plan actions is paramount to conservation and recovery of the species. Existing recovery and conservation strategies and techniques would, if implemented, contribute substantially to stemming the decline of these fishes. Innovative strategies incorporating new knowledge and data are also important. We believe the control and removal of nonnative fishes and other aquatic flora and fauna is the most urgent and overriding need in preventing the continued decline and ultimate extinction of the native fish assemblage of the Basin.
>
> Like the entire indigenous fish fauna of the American southwest, the native warm water fishes of the Gila River watershed (Basin) in central Arizona and southwest New Mexico, USA, and northern Sonora, Mexico, are critically imperiled. In this report, we assess the status of the twelve federal and state listed, proposed, and/or petitioned warm water species of the Basin.[289] Our assessment concludes that the status of all of these species has continued to

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[286] USFWS 2003b

[287] AGFD 1999a, 2000; CBD 2003b; Desert Fish Team 2003, 2004; Hunt *et al.* 1992; USFWS 2003d

[288] Hunt *et al.* 1992

[289] "The Gila River basin has 20 native fish species. In addition to the twelve species considered here, two native trouts are also Federal and State listed. Because they are the only cold water species, and because as game species they have distinctly separate and more active recovery and conservation programs, we chose not to include them in this status report."

decline notwithstanding federal and state protection. Conservation and recovery efforts have been limited in number and scope, and of little long-term effectiveness in stemming declines of these species.

Reasons for decline of these species are well documented in published literature and recovery plans. Introduction and spread of nonnative aquatic species continues to be a major factor in displacement of native species. Habitat destruction from a variety of human activities has been an equal and interactive factor. We believe the control and removal of nonnative fish and certain other aquatic flora and fauna is the most urgent and overriding need in preventing the continued decline and ultimate extinction of the native fish assemblage of the Basin…

These conclusions and recommendations are the culmination of deliberations of the Desert Fishes Team (Team), an independent group of biologists and parties interested in protecting and conserving native fishes of the lower Colorado River basin. The Team was formed to fill the void left by the 2002 disbanding by U.S. Fish and Wildlife Service of its Desert Fishes Recovery Team, and includes biologists and participants from U.S. Forest Service, Bureau of Reclamation, Bureau of Land Management, University of Arizona, Arizona State University, The Nature Conservancy, independent experts, and others."[290]

The Desert Fishes Team (2004) states:

"The distribution and abundance of all [fish] species present in the basin have declined in modern times. This trend continues and is accelerating. Few conservation actions have occurred during the 37-year period assessed. Although repatriation has been the primary management effort, it has occurred for only a few of the species, and with limited success. Most conservation actions have been directed at listed species, with benefits accruing to non-listed species on an incidental basis…

Like the entire indigenous fish fauna of the American southwest, native warm water fishes of the Gila River basin in Arizona and New Mexico, USA, and Sonora, Mexico, are critically imperiled. In this report, we assess the status of seven warm water species of the basin (*Agosia chrysogaster* longfin dace, *Catostomus insignis* Sonora sucker, *C. latipinnis* flannelmouth sucker, *Elops affinis* machete, *Mugil cephalus* striped mullet, *Pantosteus clarki* desert sucker, *Rhinichthys osculus* speckled dace)[291] that are not listed under the federal Endangered Species Act. We have prepared this report to complement our earlier report on listed warm water species (Desert Fishes Team 2003), and to

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[290] Desert Fishes Team 2003

[291] "The Gila River basin has 21 native fish species, which represents an addition of one species (*Elops affinis*) to the fauna previously reported (Desert Fishes Team 2003, Clarkson 2004). In addition to the seven species considered here, twelve were considered in an earlier report, plus there are two native trouts that are not addressed (Desert Fishes Team 2003)."

bring attention to a fauna that has been overlooked, and which is slowly but clearly diminishing.

Flannelmouth sucker, a freshwater species, has already been lost from the Gila River basin, and is declining elsewhere in its range. Longfin dace, Sonora sucker, desert sucker, and speckled dace are freshwater fishes, and all show moderate declines in distribution in modern times from historical, but remain widespread throughout their historical ranges. Striped mullet and machete are salt-water species and infrequent visitors to the lowermost Gila River only when flows connect the lower Colorado River with the Gulf of California. Passage of the Endangered Species Act in 1973 subsequently resulted in 67% of the Gila River basin's fish species being listed as threatened or endangered. Since then, most management efforts have been directed at recovery for those listed species, with benefits to unlisted species occurring only incidentally. Conservation efforts for unlisted species have been limited in number and scope, and have primarily accrued from efforts to promote listed species.

There have been no conservation efforts for flannelmouth sucker in the Gila River basin. Immediate efforts should be made to restore it through stocking into suitable habitats. Conservation efforts for longfin dace, Sonora sucker, desert sucker, and speckled dace have been limited in number and scope, and of slight long-term effectiveness in stemming their declines. Increased management efforts on their behalf should be instituted. Machete and striped mullet would benefit from restoration of flows in the lower Colorado River.

All species suffer from anthropogenic disruption and fragmentation of watersheds. These actions intensify the accumulative impact of isolated populations becoming extirpated with little potential for re-colonization from adjacent sources (Fagan 2002). Thus, efforts to restore locally extirpated populations are essential to prevent a downward spiral of loss over a metapopulation or watershed level. A community approach when dealing with transplants or range extensions for all fish, including federally listed or proposed species should be followed (Jackson *et al.* 1987). This would allow nonlisted species to be considered for repatriation and protection along with threatened and endangered species where and when appropriate.

***Catostomus insignis* Sonora sucker.** Sonora sucker was widespread and abundant in the Gila and Bill Williams drainages, although it was not collected in the Gila River downstream of the Salt River. It occurs in small to moderate size streams and small rivers up to about 6,500' elevation, and even water delivery canals in the Phoenix metropolitan area. It is an obligate riverine species, and does not persist in impoundments. Its biology and ecology have been described (Minckley and Alger 1968, Minckley 1973b, 1981, Clarkson and Minckley 1988, Sublette *et al.* 1990, Rinne 1992, James 1993, U.S. Fish and Wildlife Service 1994, Robinson *et al.* 1998, Propst 2002, Eby *et al.* 2003, Bonar *et al.* 2004, Anon 2004a).

Modern occurrences of Sonora sucker show it remains in 93 (73%) of the 127 locations in which it was recorded… It has a low probability of local extirpation (Fagan *et al.* 2002), however, fragmentation of range and isolation of populations could further reduce its occurrence in a watershed. Reasons for decline include dewatering and alteration of habitats, and introduction of nonnative fish that prey upon the species.

There have been few transplants into formerly occupied habitats… Sonora sucker was successfully repatriated into O'Donnell Creek after that stream was renovated to remove nonnative fish, and was stocked in an artificial channel at a casino/resort in the Phoenix metropolitan area. A single individual stocked by Arizona Game and Fish Department into Arnett Creek did not survive, likely due to the stream drying during an extended drought. Because of the incorrect assumption that Sonora sucker is ubiquitous, no conservation actions directly focused on it have been made except for the transplants… Instead, it has benefited indirectly from recovery and conservation actions taken for co-occurring listed species. Protection of existing populations is necessary to prevent its further decline. A program of repatriation into historically occupied habitats is recommended to ensure its continued existence across its range. Additionally, removal of nonnative species from many of its habitats will be required for the species to persist in rivers and larger streams… We recommend Sonora sucker be listed under the Endangered Species Act as threatened because of losses from many localities in the Gila River basin, continuing anthropogenic disturbances to its habitats, and chronic impacts of nonnative species. This is consistent with previous recommendations from the Desert Fishes Recovery Team and federal agencies (Minckley 1993, U.S. Fish and Wildlife Service 1994b).

***Catostomus latipinnis* Flannelmouth sucker.** Flannelmouth sucker inhabited the large, strongly flowing rivers of the Colorado River system, including the Gila, Salt, and San Pedro in Arizona. By the end of the 19th century, it had disappeared from the Gila and San Pedro rivers, but persisted in the Salt River into the 1960's… It remains in the Colorado River, but with a much-reduced range. Little is known of its biology in the Gila River basin, but see (Minckley 1973b, 1985, Sublette *et al.* 1990, James 1993, Gido *et al.* 1997, Weiss *et al.* 1998, Bezzerides and Bestgen 2002, Mueller and Wydoski 2004, Anon 2004a).

Flannelmouth sucker no longer occurs in the Gila River basin, a result of dewatering, reservoir construction and other habitat alterations, and introduction of nonnative predatory fishes (Chart and Bergersen 1992, Marsh and Douglas 1997). Because the species has disappeared from major portions of the lower Colorado River basin, it is considered to have a high probability of local extirpation (Fagan *et al.* 2002), and indeed is disappearing from its range elsewhere (Bezzerides and Bestgen 2002)

There have been no efforts to reintroduce flannelmouth sucker into waters of the Gila River basin… However, a stocking into the Colorado River to control nuisance aquatic insects near the communities of Bullhead City and Laughlin had the unexpected result of establishing a population (Mueller and Wydoski 2004). A conservation strategy for this species and others has been described for the lower Colorado River (Minckley *et al.* 2003), and there is an ongoing multi-state effort to formulate management direction for flannelmouth sucker (Anon 2004b)… Flannelmouth sucker should be restored to the Gila River basin… Because it has disappeared from the basin and is declining elsewhere, we recommend flannelmouth sucker be listed under the Endangered Species Act as endangered. This is consistent with previous recommendations from the Desert Fishes Recovery Team and federal agencies (Minckley 1993, U.S. Fish and Wildlife Service 1994b).

***Pantosteus clarki* Desert sucker.** Desert sucker occupies small to medium size mountain streams and creeks in the Gila River basin, and canals of the Phoenix metropolitan area. It occupies a wide range of elevation but achieves its greatest abundance in hard-bottomed streams of intermediate elevation. Historically, it was not recorded from the Gila River downstream of the Salt River. Primitive people along the Verde River used it as food. Information on its biology and ecology can be found in the following manuscripts: Minckley and Alger 1968, Minckley 1973b, 1981, 1985, Fisher 1979, Fisher *et al.* 1981, Schreiber and Minckley 1981, Wier *et al.* 1983, Bestgen *et al.* 1987, Clarkson and Minckley 1988, Ivanyi 1989, Sublette *et al.* 1990, Rinne 1992, James 1993, U.S. Fish and Wildlife Service 1994, Ivanyi *et al.* 1995, Mueller 1996, Robinson *et al.* 1997, Robinson *et al.* 1998, Stefferud and Stefferud 2003, Eby *et al.* 2003, Bonar *et al.* 2004, and Anon 2004a.

Desert sucker remains in 137 (74%) of the 186 locations in which it has been recorded… Dewatering and alteration of habitats and introduction of nonnative species have caused its decline throughout its historical range. Because desert sucker has not disappeared from any significant portion of its range, it is considered to have a low probability of local extirpation (Fagan *et al.* 2002).

There has been one documented repatriation, which failed due to stream desiccation during long-term drought… Other activities that indirectly benefited desert sucker were done for recovery of listed species… Monitoring of populations and repatriation into previously occupied habitats should be instituted, and remaining populations protected to ensure maintenance of the species… Removal of nonnative fishes from larger streams and rivers will be necessary to ensure the continued existence of the species as an integral part of the native fish assemblage. Because it has disappeared from a large number of localities in the Gila River basin, continuing anthropogenic impacts on its habitats, and nonnative species continually impact individuals through predation, we recommend that desert sucker be listed under the Endangered Species Act as threatened, as previously recommended by others (Minckley 1993, U.S. Fish and

Wildlife Service 1994).

The entire native fish fauna of the Gila River basin is biologically imperiled, as are many other obligate aquatic taxa (Williams *et al.* 1989, Warren, Jr. and Burr 1994, Arizona Game and Fish Department 1996, U.S. Fish and Wildlife Service 1999a, 1999b, Desert Fishes Team 2003, Clarkson 2004, Clarkson *et al.* 2004). Nonnative species continue to expand in range and abundance, and habitat deterioration through water development and watershed alteration present a consistent threat to habitats (Miller 1961, Minckley and Deacon 1968, Minckley and Rinne 1991, Tyus and Saunders, III 2000).

Increased attention to the health and vigor of these species and their populations is necessary to prevent a slow but inexorable slide towards loss of metapopulations and local extirpation. We recommend 1) Endangered Species Act protection be extended to longfin dace, Sonora sucker, flannelmouth sucker, desert sucker, and speckled dace, 2) an aggressive program be implemented to convert individual streams and complexes within watersheds to refuges for native species through barriers, removal of nonnative species, and repatriation of native fishes, 3) anthropogenic factors that negatively affect habitats be modified to reduce impacts on native fishes, and 4) existing populations of native species be protected and systematic monitoring of their populations be implemented. Few successful recovery and conservation actions have occurred during the past several decades for these fish. Technologies and processes exist to improve the status of these species and should be put into practice. Other innovative techniques and applications, such as development and licensing of species-specific piscicides and design of transgenic fishes to eliminate or reduce populations of nonnative species, should be investigated and deployed as appropriate.

Effective leadership on the part of state and federal agencies responsible for species and habitats will be necessary to stem the decline of these species. We encourage attempts to proactively manage these species along with listed endangered and threatened species via a holistically planned, multi-agency program that will benefit the entire assemblage of native fishes and other native aquatic fauna and flora of the Gila River basin.[292]

[292] Desert Fishes Team 2004

14. Toxic substances remain a problem:[293]

a. Pesticides[294]

The Bald Eagle continues to be threatened by the use of several pesticides, including the insecticides carbofuran, endosulfan, fenthion, phorate, and terbufos.[295] All are still found in Arizona,[296] though the manufacturer of fenthion has "voluntarily" offered to remove fenthion from the market.[297] Hundreds of Bald Eagle deaths have been linked to carbofuran nationwide.[298] In 1992, USFWS requested that EPA cancel all registrations for carbofuran, but to no avail.[299]

Documents secured under the Freedom of Information Act reveal that Bush Administration EPA officials have been meeting secretly with pesticide companies to weaken endangered species protections from pesticides.[300] A lawsuit was filed to stop these activities.[301]

In spite of the lawsuit, the EPA has issued new rules resulting from these secret meetings.[302] These new rules weaken the protection of endangered species from pesticides.[303] A lawsuit has been filed attempting to stop this weakening of protection for endangered species.[304]

b. DDT and its derivatives are still found in Arizona.[305]

DDT and its derivatives are still found in Arizona.[306] For many years, anecdotal evidence has persisted concerning DDT use by Arizona farmers and ranchers securing inexpensive supplies in Mexico for use in Arizona. Now there is proof that DDT has been found in the Sycamore BA on the lower Verde River:

> "...we did discover toxic levels of DDE [a breakdown product of DDT] in an addled egg from 1997 (Sycamore BA)..."[307]

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[293] ADEQ 2004a, 2004b; AGFD 1999a, 2004a, 2004b; American Bird Conservancy 2003, 2004a, 2004b; Arizona Republic 2004d, 2004e; CBD 2004c; Earthjustice 2004a, 2004b, 2004c; Elliott *et al.* 1997; EPA 1998, 1999, 2000, 2003, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f; Pesticide Action Network 1999; University of Arizona 2004; USDA 2001; USFWS 1995

[294] American Bird Conservancy 2004a, 2004b; CBD 2004c; EPA 2004c, 2004d, 2004e, 2004f; University of Arizona 2004; USDA 2001; USFWS 1995

[295] American Bird Conservancy 2004a, 2004b; CBD 2004c; USFWS 1995

[296] EPA 2004c, 2004d, 2004e, 2004f; University of Arizona 2004; USDA 2001

[297] American Bird Conservancy 2003

[298] American Bird Conservancy 2004b

[299] Ibid.

[300] Earthjustice 2004a

[301] Ibid.

[302] Arizona Daily Star 2004, USFWS 2004a, 2004c

[303] Earthjustice 2004b

[304] Earthjustice 2004c

[305] ADEQ 2004a, 2004b; AGFD 1999a, 2000; EPA 2002, 2003, 2004a; Grubb *et al.* 1990; Hunt *et al.* 1992; King *et al.* 1991; USFWS 2001d; USGS 2004; Weimeyer *et al.* 1984

[306] Ibid.

[307] AGFD 1999a, 2000, USGS 2004

Mexico instituted a ban on DDT in 1997 to take place over a 10-year period; however, it still may be in use along the Arizona/Mexico border.[308] DDT and its derivatives are still found in Arizona waterways.[309]

c. Chlorfenapyr almost became the next DDT.[310]

New toxic chemicals are now being introduced without adequate testing even though their use results in known and potential adverse effects on riparian species. An example is the class of toxins called Pyrroles. Chlorfenapyr is one of these chemicals.[311] Chlorfenapyr has never been evaluated for potential effects on imperiled species. Its known effects on Mallards include 41% decline in the number of eggs, 44% decline in the number of viable embryos, and 56% decline in the number of normal hatchlings.[312]

Nonetheless, "emergencies" facilitated premature use of chlorfenapyr in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee and Texas.[313] Undoubtedly, it would have been used by the cotton growers of the Gila River Valley or the Rio Grande Valley suffering similar "emergency," but for the fact that it was denied registration by the EPA.[314]

d. Heavy metals exposure and contamination of the Desert Nesting Bald Eagle, particularly by mercury, is worrisome.[315]

Toxic levels of mercury have been found in eggs from the Southwestern Desert Nesting Bald Eagle population's two rivers, the Verde River and the Salt River. Mercury contamination has also been found in the Tonto Creek BA and the Gila River. Tonto Creek joins the Salt River at Roosevelt Lake. AGFD (1999a, 2000) describes the situation:

> "...Mercury is present at levels sufficiently high to cause failure in eggs along the Verde, Salt, and Gila rivers...
>
> ...we discovered elevated and toxic levels of the mercury in seven Arizona eggs from four different BAs on the Verde, Salt, and Gila rivers and Tonto Creek...
>
> ...Heavy metal tests performed on Arizona bald eagle eggs collected from 1977 to 1985, revealed mercury concentrations above those reported for most

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308 EPA 2002

309 EPA 2003

310 EPA 1998, 1999, 2000; Pesticide Action Network 1999

311 EPA 1998

312 EPA 1998, Pesticide Action Network 1999

313 EPA 1999, Pesticides Action Network 1999

314 EPA 2000

315 ADEQ 2004a, 2004b; AGFD 1999a, 2000, 2004a, 2004b; EPA 2004b; USFWS 2001d

other North American populations (Grubb *et al.* 1990). Fish collected from Arizona BAs in 1988 by the USFWS (King *et al.* 1991) found elevated mercury concentrations in samples from Alamo Lake, Lake Pleasant, the lower Verde River, the Salt River, and Tonto Creek.

Thirteen Arizona bald eagle eggs collected from 1994 to 1997 were analyzed for heavy metals (Beatty *et al.* unpubl. data). Seven eggs from the Tower, 76, Pinal, and Winkelman BAs had toxic levels of mercury ranging from 2.11 to 8.02 ppm. Elevated levels of mercury between 1.5 and 2.0 ppm were found in three eggs from the Tower and Horseshoe BAs. Lesser concentrations between 1.0 and 1.5 ppm were found in three eggs from the Sycamore, Fort McDowell, and Box Bar BAs. In white-tailed eagles, concentrations of mercury in eggs above 2 parts per million (ppm) (dry weight) were known to impair hatching (Newton 1979), while Ohlendorf (1993) determined mercury concentration in bird tissue greater than 1.5 to 4.5 ppm (dry weight) was toxic…" [316]

USFWS (2001d) adds,

"…Concentrations of heavy metals in bald eagle eggs are a concern in Arizona. Thirteen Arizona bald eagle eggs collected from 1994 to 1997 contained from 1.01 to 8.02 ppm dry weight mercury (Beatty *et al.* unpubl. data). Concentrations in the egg are highly correlated with risk to reproduction. Adverse effects of mercury on bald eagle reproduction might be expected when eggs contain about 2.2 ppm mercury or more. Five of 10 eggs approached or exceeded the 2.2 ppm threshold concentration. What is especially alarming is that mercury concentrations in addled eggs appears to be increasing over time. Addled bald eagle eggs collected in Arizona in 1995-97 contained more than two- to six-times higher concentrations of mercury than eggs collected in 1982-84 (appx. 0.39-1.26 ppm) (K. King pers. comm.).

Bald eagles are generalized predator/scavengers adapted to edges of aquatic habitats. Their primary foods, in descending order of importance, are fish (taken both alive and as carrion), waterfowl, mammalian carrion, and small birds and mammals. Although there are no data for bald eagles and mercury within the Navajo Nation, bald eagles elsewhere in Arizona are exposed to mercury. King *et al.* (1991) detected elevated levels of mercury in prey items of the bald eagle. Individual concentrations ranged from 0.06 to 0.97 ug/g Hg and highest mean levels were recovered in fish from Lake Pleasant (0.41 ug/g), Salt River (0.21 ug/g), and Alamo Lake (0.19 ug/g). The highest means were above the National Contaminant Biomonitoring Program (NCBP) 85th percentile of 0.17 ug/g and a recommended no observable effects concentration for piscivorous birds of 0.1 ug/g (Eisler 1987). Arizona bald

[316] AGFD 1999a, 2000

eagle eggs collected between 1977 and 1985 reported elevated levels of mercury when compared to other North American locations (Grubb *et al.* 1990). Subsequently, thirteen eggs were collected from 1994 to 1997 and revealed mercury concentrations ranging from 2.11 to 8.02 ppm (Beatty *et al.* unpublished data). Mercury tissue burdens ranging from 1.5 to 4.5 ppm (dry weight) in birds are toxic (Ohlendorf 1993) and eggs containing 2.3 ppm (dry weight) mercury or more will demonstrate adverse effects (Wiemeyer *et al.* 1984). Embryos of birds are extremely sensitive and vulnerable to relatively minute concentrations of mercury in the egg.

Both organic and inorganic mercury bioaccumulate, but methylmercury accumulates at greater rates than inorganic mercury. Most mercury in fish or wildlife organisms is in the form of methylmercury (Bloom 1989) as this form is more efficiently absorbed (Scheuhammer 1987) and preferentially retained (Weiner 1995). And almost all of the mercury in bird eggs is methylmercury (Wolfe *et al.* 1998). Reproductive effects may extend beyond the embryo to adversely effect the juvenile survival rates. Mercury in the eggs of mallards caused brain lesions in hatched ducklings. The adult mallards were fed 3.0 ppm methylmercury dicyandiamide over two successive years. Mercury was accumulated in the eggs to an average of 7,180 and 5,460 ng/g on a wet weight basis in 2 successive years. Lesions included demyelination, neuron shrinkage, necrosis and hemorrhage in the meninges overlying the cerebellum (Heinz and Locke 1975). Diet is the primary route of methylmercury uptake by fish in natural waters, contributing more than 90 percent of the methylmercury accumulated. The assimilation efficiency for uptake of dietary methylmercury in fish is probably 65 to 80 percent or greater. To a lesser extent, fish may obtain mercury from water passed over the gills, and fish may also methylate inorganic mercury in the gut (Wiener and Spry 1996). Developing embryos are the most vulnerable life stage to mercury exposure.

Concentrations in the egg are typically most predictive of mercury risk to avian reproduction, but concentrations in liver have also been evaluated for predicting reproductive risk. The documented effects of mercury on reproduction range from embryo lethality to sublethal behavioral changes in juveniles at low dietary exposure. Reproductive effects in birds typically occur at only twenty percent of the dietary concentrations which produce lethal effects in adult birds (Scheuhammer 1991).

...EPA has committed, as a Conservation Measure, that the human health criteria for mercury be changed by January 2002. Even with the adoption of new human health criteria, the Service anticipates the criteria will not be sufficiently protective of the potential for maternal transfer of harmful concentrations of mercury to vertebrate eggs and embryos. Food chain transfer is the most important exposure pathway in all ecosystems (EPA 1997). Methylmercury is one of the rare compounds which not only bioaccumulates but also biomagnifies across trophic levels such that BAFs for methylmercury are commonly in the millions for top trophic level fish. Listed wildlife species which are high trophic level predators include the bald eagle and California condor. California condor are still dependent on managed feeding stations; otherwise, they feed upon large carcasses of elk, deer, or other mammals (USDI 1996a) and not aquatic species associated with the Navajo Nation. Because fish and wildlife typically have more restricted diets than humans, they are more susceptible to local contamination. Wildlife, particularly piscivorous wildlife, are often at greatest risk from mercury exposure within any ecosystem (EPA 1997). Even with appropriate bioaccumulation factors for evaluating human fish consumption, the use of humans as the surrogate species to represent the bioaccumulation hazards presented to wildlife is not scientifically supported.

Reproduction is one of the most sensitive toxicological responses, with effects occurring at very low dietary concentrations. Effects of mercury on reproduction are currently likely in bald eagles as demonstrated by concentrations of mercury observed the potential prey of bald eagles in Arizona (King *et al.* 1991). Embryos of birds are extremely sensitive and vulnerable to relatively minute concentrations of mercury in the egg. Almost all of the mercury in bird eggs is methylmercury (Wolfe *et al.* 1998). Adverse reproductive effects due to methylmercury are offset by Conservation Measures #1, #2, #3 which recommend toxicological research on piscivorous birds and fishes." [317]

USFWS (2003b) adds,

"Concentrations of heavy metals in bald eagle eggs are a concern in Arizona. Thirteen Arizona bald eagle eggs collected from 1994 to 1997 contained from 1.01 to 8.02 ppm dry weight mercury (Beatty *et al.* unpubl. data). Concentrations in the egg are highly correlated with risk to reproduction. Adverse effects of mercury on bald eagle reproduction might be expected when eggs contain about 2.2 ppm mercury or more. Five of 10 eggs approached or exceeded the 2.2 ppm threshold concentration. Mercury concentrations in addled eggs appears to be increasing over time. Addled bald eagle eggs collected in Arizona in 1995-97 contained more than two- to six-times higher concentrations of mercury than eggs collected in 1982-84 (appx. 0.39-1.26 ppm) (K. King pers. comm.)." [318]

[317] USFWS 2001d

[318] USFWS 2003b

15. Fishing line and tackle are found in half of Southwestern Desert Nesting Bald Eagle nests.[319] Resulting mortalities in both adults and nestlings have been documented and more are expected.[320]

Half of all breeding areas in Arizona contain fishing line and tackle. Fishing line and tackle are confirmed to have killed at least two nestlings:

> "...We have continued to observe monofilament and fishing hooks attached to adult and nestling eagles. Fishing tackle has been found at half of all the breeding areas in Arizona and has killed two nestlings..."[321]

AGFD (1999a, 2000) offers details:

> "...*Fishing line.* Fishing line and tackle have been found in nests and entangling the bald eagles (Appendix C). Since 1986, 62 separate instances and 19 BAs have had fishing line and/or tackle in nests or entangling individuals (Hunt *et al.* 1992, Beatty 1992, Beatty and Driscoll 1994a, Beatty *et al.* 1998, Beatty and Driscoll unpubl. data). Two Arizona nestlings are known to have died due to entanglement in fishing line (Beatty 1992, Hunt *et al.* 1992).
>
> Bald eagles come into contact with fishing line most commonly by catching dead or dying fish with the material still attached. They may also bring fishing line to the nest as nest material. However, the species can encounter fishing line in a variety of other ways. An adult became entangled in discarded fishing line while perched on the shoreline (Beatty *et al.* 1998). Another adult swallowed fishing line (and possibly a hook) while feeding on a dead fish (Beatty *et al.* 1998). Adults have brought dead shorebirds and waterfowl to the nest, dead from fishing line entanglement (Hunt *et al.* 1992, Beatty *et al.* 1998). In one instance, an angler cast a hook and line directly into a snag nest (Beatty and Driscoll unpubl. data). The persistent occurrence of this litter in nests is a testament to the level of recreational pressures existing in many BAs..."[322]

As the human population of central Arizona increases, so will the accompanying recreational demands on riparian areas. This will inevitably lead to even greater incidences of fishing line and tackle in nests. Consequently, the Southwestern Desert Nesting Bald Eagle will continue suffering increasing adverse effects.

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[319] AGFD 1994b
[320] AGFD 1999a, 2000
[321] AGFD 1994b
[322] AGFD 1999a, 2000

16. Heat stress is already recognized as a leading cause of mortality for nestlings.[323] Decreased productivity has already been documented in areas of local drought effects.[324] Global warming and drought are becoming increasing factors.[325]

Adaptation to the Southwest's combination of high temperature and low humidity illustrates one of the characteristics that demonstrate the uniqueness of the Southwestern Desert Nesting Bald Eagle population. The sophistication of this adaptability with respect to genetic protection for desert egg survival has already been addressed in the genetics section (page 21).

In spite of the Desert Nesting Bald Eagle's adaptive prowess to its unique desert ecological niche, the desert heat can still be challenging. In fact, heat stress is the leading cause of known nestling mortalities.[326] USFWS (1990b) describes the situation in 1989 that will most likely become more common:

> "We have experienced 2 years of a hot, dry cycle. In 1989 Arizona deserts experienced a total of 143 days of temperatures above 100ºF and in 1990 we experienced a record-breaking 122ºF during a summer heat wave.
>
> It is extremely difficult for adult eagles to incubate eggs or brood young nestlings successfully under these conditions. Older nestlings find it difficult to survive these temperatures. In a few cases they have fallen from the nest cliff while attempting to reach shade. They have also fledged prematurely from nests without shade. In both cases these young eagles seldom survive. If predictions hold true, this hot, dry cycle will continue for quite a few years and, as a result, will continue to cause a depressed production of young eagles from this small population."[327]

Researchers have studied and documented the challenge already faced by the Desert Nesting Bald Eagle with respect to the desert heat. AGFD (1999a, 2000) reports:

> "...Hunt *et al.* (1992) recorded 46 Arizona bald eagle mortalities from 1987 to 1990 (21 adults, 2 subadults, 23 nestlings)...Twenty-three nestlings died: 7 prefledged due to heat stress...
>
> We have recorded an additional 99 Arizona bald eagle mortalities (41 adults, 7 subadults, 51 nestlings) since 1991 (adults from 1991 to 1998, subadults and nestlings from 1993 to 1998) (Beatty and Driscoll 1996b, Beatty and

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[323] AGFD 1999a, 2000; Driscoll 1999; Hunt et al. 1992

[324] USFWS 2003b

[325] ADWR 1994; AGFD 1999a, 2000; Arizona Daily Sun 2004; Arizona Republic 2003b, 2003c, 2004a, 2004b, 2004g; CNN 2004; National Geographic 2004; Observer/UK 2004; SWRAG 2000; USFWS 1990c, 2003b

[326] Hunt *et al.* 1992

[327] USFWS 1990b

> Driscoll unpubl. data)...A total of 51 nestlings died:...4 were heat stress related..."[328]

Drought and intense heat are part of the baseline challenges this population has faced historically. As global warming increases, however, temperatures will increase and drought cycles will become more frequent. The decreasing water levels at Roosevelt Lake owing to drought are already having a negative effect:

> "The effects of decreasing the surface area of Roosevelt Lake on bald eagle productivity from 1993 to 2001, were subtle, but clear and consistent... Eagles from the Pinal Breeding Area laid eggs annually and raised 2 eaglets from 1993 to 1997, however eggs were laid only twice and only one eaglet was reared over the next 5 year period. The Pinto Breeding Area produced 6 eaglets, laid eggs 5 times, and failed twice from 1993 to 1997. Yet from 1998 to 2002, the Pinto eagles only laid eggs 3 times and raised 4 eaglets. Since 1990, these were the first 2 years (1998 and 2000) the Pinto eagles had not laid eggs. The Dupont Breeding Area has been a poor performer, but has performed worse as the years progressed. In 1997 and 1998, eagles laid eggs twice and produced one eaglet. Over the next 4 years, eggs were only laid once, no eaglets were produced, and the breeding area was reported as unoccupied in 2002. The drop in reproductive performance is not that of a complete crash in eagle occupancy or reproduction (like those territories at San Carlos Lake in 2002). But the effects were consistent from 1993 to 2001: eagles with dependency on Roosevelt Lake for food reproductively were less productive as the lake's surface area declined.[329]

17. <u>Eggshell thinning remains a potential problem for the Southwestern Desert Nesting Bald Eagle.</u>[330]

Eggshell thinning remains a potential problem in the Southwest. AGFD (1999a, 2000) summarizes the findings:

> "... *Eggshell thinning.* Wiemeyer *et al.* (1984) related moderate eggshell thinning greater than 10 percent to difficulties in reproduction for other bald eagle populations. Anderson and Hickey (1972) stated a population would experience reproductive problems when eggshell thinning has become severe (15 to 20%) for a period of years.
>
> Eggshell fragments (n=265 sets) from 32 Arizona bald eagle BAs were collected, measured, and averaged by nest, from 1977 to 1997. These means were then compared with a mean from Baja California (0.591 mm), the closest

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[328] AGFD 1999a, 2000

[329] USFWS 2003b

[330] AGFD 1999a, 2000; SWCBD 1999

known bald eagle population to Arizona with pre-DDT eggshell measurements to calculate percent thinning.

Since 1977, four different studies have collected and analyzed Arizona bald eagle eggshells. From 1977 to 1985, Grubb *et al.* (1990) collected 32 eggshell sets from 14 BAs with a mean eggshell thickness of 0.539 mm (range 0.470 to 0.597 mm, SE 0.030) and 8.8 percent thinning. Hunt *et al.* (1992) collected 71 sets from 23 BAs from 1987 to 1990. They found a mean thickness of 0.562 mm (range 0.455 to 0.651 mm, SE 0.042) and a thinning of 4.9 percent. Mesta *et al.* (1992) collected 27 sets from 18 BAs in 1991 and 1992, and measured a mean thickness of 0.552 mm (range 0.508 to 0.634 mm) with 6.6 percent thinning. More recently, from 1993 to 1997, 135 sets of eggshell fragments were collected from 27 BAs. A mean thickness of 0.534 mm (range 0.462 to 0.605 mm, SE 0.031) was measured with 9.7 percent thinning (Driscoll and Beatty unpubl. data).

Since 1993, the annual percent thinning exceeded 10 percent in 1994 and 1995. In 1993, the mean was 0.552 mm/6.5 percent thinning (n=13, SD 0.031). But in 1994 and 1995, thinning was higher with a mean of 0.528 mm/10.6 percent (n=20, SD 0.029) and 0.530 mm/10.3 percent (n=15, SD 0.031), respectively. Thinning in 1996 and 1997 dropped just below 10 percent, with a mean of 0.532 mm/9.9 percent (n=20, SD 0.033), and 0.532 mm/9.9 percent (n=22, SD 0.031), respectively (Appendix D)…"[331]

The exact cause for the eggshell thinning is not known at this time. Organochlorines and heavy metals have been associated with eggshell thinning. Hunt *et al.* (1992) reports:

"…The USFWS recently analyzed data on heavy metals and organochlorines in fish in central Arizona (King *et al* 1991). Chlordane and DDE were the most frequently detected organochlorines in fish sampled near eagle nests, but the levels were below that associated with eggshell thinning in bald eagles. However, trace elements, especially mercury, were elevated, as were aluminum, arsenic, copper, and zinc…"[332]

18. <u>Habitual violation of law and lack of agency resolve increasingly threatens protection of the Southwestern Desert Nesting Bald Eagle.</u>[333]

On February 7, 1990, USFWS published a Notice of Intent in the Federal Register to downlist the Bald Eagle from Endangered to Threatened throughout its

[331] AGFD 1999a, 2000

[332] Hunt *et al.* 1992

[333] AGFD 1994b; Desert Fishes Team 2003, 2004; SWCBD 1999; USFWS 1992a, 1993a, 1994c, 1996b, 1997b, 1998, 1999a, 2000a, 2003b, 2003d

range in the continuous U.S.[334] Efforts to downlist are evident from at least 1989.[335] The attitudinal change accompanying the downlisting contributes to the increasing threats to the continued existence of the Desert Nesting population.[336] This attitude is a factor in perpetuation of the following:

a. Cattle grazing continues within the riparian habitat critical to the Desert Nesting Bald Eagle.[337]
b. Dam operations do not release water at times necessary for replenishment of riparian nest trees.[338]
c. Dewatering of remnant free-flowing rivers continues.[339]
d. Exotic fish continue to be introduced in native fish habitat.[340]
e. Low flying aircraft continue and will increasingly continue adversely affecting the population.[341] Flight advisories are not mandatory and are routinely ignored.[342]
f. USFWS' approval of excessive numbers of Desert Nesting Bald Eagle deaths is excessive.[343]

The attitudinal change that took place in 1990, has now become so blatant that the Assistant Secretary of the Interior is even publicly promoting the Bush Administration desire "to ease restrictions on American bald eagles" without regard for the fragility and imperiled status of the Desert Nesting Bald Eagle.[344]

a. Cattle grazing continues within the riparian habitat critical to the Desert Nesting Bald Eagle.[345]

Cattle still graze riparian areas, impeding growth of replacement cottonwood nest trees.[346] AGFD (1999a, 2000) says:

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[334] USFWS 1990a

[335] USFWS 1990c

[336] ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004a, 2004b, 2004c; Arizona Daily Star 2004; Arizona Daily Sun 2004; Arizona Republic 2000, 2001, 2003b, 2003c, 2004a, 2004b; CBD 2003b, 2004c; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Earthjustice 2004a, 2004b, 2004c; Hunt *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; SWRAG 2000; SWCBD 1999; USGS 2000; USFWS 1993b, 1997a, 1997b, 1998, 1999a, 2000a, 2002a, 2003a, 2003b, 2003e, 2004a, 2004c; Verde Natural Resources Conservation District 1999

[337] AGFD 1999a, 2000; Driscoll 1999; USFWS 1997b, 1998, 2002a, 2003b

[338] AGFD 1999a, 2000; USFWS 1997b, 2003b

[339] Desert Fishes Team 2003, 2004; Verde natural Resources Conservation District 1999, USFWS 1998

[340] Desert Fishes Team 2003, 2004;

[341] AGFD 1999a, 2000; USFWS 1993a, 1994c, 1997b, 2002a, 2003b

[342] AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004c; Arizona Republic 1989

[343] AGFD 1994b; USFWS 1992d, 1993a, 1994c, 1996b, 1997b

[344] Arizona Republic 2004h

[345] AGFD 1999a, 2000; Driscoll 1999; USFWS 1997b, 1998, 2002a, 2003b

[346] Ibid.

"*Riparian habitat.* Bald eagles at 11 BAs (Box Bar, Coolidge, Doka, Fort McDowell, Perkinsville, Pinto, 76, Sheep, Sycamore, Tonto, and Winkelman) rely solely on riparian trees to nest. Cottonwood trees in these BAs have become overmature, are dying, and are not being replaced. Regeneration of key riparian habitat has not occurred in many areas of the Southwest due to many factors (Stromberg 1993).

These 11 BAs represent a significant portion of the population by collectively contributing 22 percent (82/370) of all recorded fledglings since 1971. The Fort McDowell BA has fledged 34 young, second to only the Blue Point BA (35). Additionally, five of these 11 BAs have been in existence for at least 10 years (10, 13, 15, 17, and 26 years).

It is reasonable to expect in the next two decades, the pairs at 7 of these 11 BAs will have fewer trees in which to nest, roost, loaf, preen, and/or hunt. The Box Bar, Coolidge, Doka, Fort McDowell, and Sycamore BAs currently nest in overmature live trees, dying trees, or snags located below dams with little regeneration. Poorly timed water releases (Stromberg *et al.* 1991), scouring, off-road vehicles, development, grazing, woodcutting, and agriculture threaten the riparian habitat of these areas."[347]

USFWS says:

"Yet, riparian habitat loss continues on the lower Verde and Salt Rivers as a result of dam operations, livestock grazing, wood cutting, vehicle use in the floodplain, and agriculture."[348]

"Some of the continuing threats and disturbances to bald eagles include…overgrazing and related degradation of riparian vegetation…"[349]

"…livestock grazing in the Verde River floodplain on the Fort McDowell Yavapai Nation and Salt River Pima Maricopa Indian Community retard the establishment of riparian trees."[350]

"Continued grazing along the lower Verde and Salt rivers is expected to exacerbate adverse effects to riparian vegetation through browsing and trampling of seedling and sapling riparian trees."[351]

"Other land use activities, such as cattle grazing…also contribute to degradation of existing eagle nesting, perching, and foraging habitat and retard nest tree regeneration on the lower Verde River (Arizona Game and

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347 AGFD 1999a, 2000

348 USFWS 2001a

349 USFWS 2002a, 2002b, 2003b

350 USFWS 2003b

351 USFWS 2002b, 2003b

Fish Department *in prep.*, J. Stromberg, Arizona State University, pers. comm., V. Beauchamp, Arizona State University, pers. comm., Hunt *et al.* 1992, Sommers *et al.* 2002, U.S. Fish and Wildlife Service 2002b)."[352]

"Sommers *et al.* (2002) agree that flow alteration has reduced the frequency and density of cottonwood establishment, but they believe land use factors, particularly grazing and recreation, are even more important than dam construction and operation in limiting native riparian plant communities (also see U.S. Fish and Wildlife Service 2002a, pp. 86-89). However, Vanessa Beauchamp (graduate student, Arizona State University, pers. comm. 2002), believes the effects of the dams and their operation are the most important limiting factors in shaping the riparian plant community. What appears to be clear from examples of land and river management activities throughout Arizona and the Southwest (U.S. Fish and Wildlife Service 2002b) is that each activity by itself, and certainly in combination with each other, are capable of degrading existing bald eagle habitat and affecting the development of habitat to maintain existing territories."[353]

b. Dam operations do not release water at times necessary for replenishment of riparian nest trees.[354]

AGFD (1999a, 2000) says:

"…Poorly timed water releases (Stromberg *et al.* 1991), scouring, off-road vehicles, development, grazing, woodcutting, and agriculture threaten the riparian habitat of these areas [Box Bar, Coolidge, Doka, Fort McDowell, and Sycamore BAs]."[355]

USFWS says:

"Yet, riparian habitat loss continues on the lower Verde and Salt Rivers as a result of dam operations…"[356]

"Some of the continuing threats and disturbances to bald eagles include entanglement in monofilament fish line and fish tackle; overgrazing and related degradation of riparian vegetation; malicious and accidental harassment, including shooting, off-road vehicles, recreational activities (especially watercraft), and low-level aircraft overflights; alteration of aquatic and riparian systems for water distribution systems and maintenance of

[352] USFWS 2003b
[353] Ibid.
[354] AGFD 1999a, 2000; USFWS 1997b, 2003b
[355] AGFD 1999a, 2000
[356] USFWS 2001a

existing water development features such as dams or diversion structures…"[357]

"Similar to the lower Salt River, Verde River dams and dam operations degrade existing eagle tree nesting and perching habitat, and retard riparian regeneration that could replace aging and dying trees (Arizona Game and Fish Department *in prep.*, McNatt *et al.* 1980, Hunt *et al.* 1992, Briggs 1996, Beauchamp and Stromberg 2001, U.S. Fish and Wildlife Service 2002b).

Operation of Bartlett Dam has altered the hydrological regime of the lower Verde River by reducing the magnitude, frequency and duration of high flow events (Briggs 1996, Beauchamp and Stromberg 2001, U.S. Fish and Wildlife Service 2002b). A consequence of this change is a decrease in the size and complexity of the active channel below Bartlett Dam (Beauchamp and Stromberg 2001, U.S. Fish and Wildlife Service 2002b). A reduction in high flows is concomitant with a reduction in stream power and the ability to re-work sediment (Gordon *et al.* 1992). Periodic high flows on the lower Verde have not been sufficient to maintain or continue these processes as smaller flood flows are restricted (U.S. Fish and Wildlife Service 2002b).

Dams are restricting the flow of sediment, and operations are restricting the dynamic hydrological regime that allows sediment to move past the dam and help maintain and regenerate riparian habitat (U.S. Fish and Wildlife Service 2002b)…

Beauchamp and Stromberg (2001) found that operation of the dams has likely affected riparian communities by decreasing recruitment of early successional riparian species (willows and cottonwoods) and expansion of later successional species (e.g. mesquites and saltcedar). McNatt *et al.* (1980) found that Horseshoe and Bartlett dams have led to the demise of cottonwoods on the lower Verde River. This is a common effect of dam construction and operation in the Southwest, and has been observed on numerous river systems (see review in Briggs 1996)…"

"…However, Vanessa Beauchamp (graduate student, Arizona State University, pers. comm. 2002), believes the effects of the dams and their operation are the most important limiting factors in shaping the riparian plant community. What appears to be clear from examples of land and river management activities throughout Arizona and the Southwest (U.S. Fish and Wildlife Service 2002b) is that each activity by itself, and certainly in combination with each other, are capable of degrading existing bald eagle habitat and affecting the development of habitat to maintain existing territories…

[357] USFWS 2003b

Operations of the lower Verde and Salt river dams, in conjunction with the presence of the dam structures, will continue to degrade existing bald eagle nesting habitat (including important trees needed for nesting foraging, loafing, feeding, display, and/or sentry perches) and prevent habitat development, maintenance, and regeneration of trees suitable for nesting and perching in the Needle Rock, Box Bar, Fort McDowell, Doka, Sycamore, and Rodeo breeding areas below Bartlett Dam and the Granite Reef Breeding Area below Stewart Mountain Dam (McNatt *et al.* 1980, Briggs 1996, Beauchamp and Stromberg 2001, U.S. Fish and Wildlife Service 2002b, Arizona Game and Fish Department *in prep*.; see the Environmental Baseline). Operation of lower Verde and Salt river dams will continue to alter the hydrological regime of the lower Verde and Salt rivers by reducing the magnitude, frequency, timing, and duration of high flow events (Briggs 1996, Beauchamp and Stromberg 2001, U.S. Fish and Wildlife Service 2002b). As a result, the size and complexity of the active channel below Bartlett and Stewart Mountain dams are likely to continue to decline (Beauchamp and Stromberg 2001, U.S. Fish and Wildlife Service 2002b). Attenuation of high flows is concomitant with a reduction in stream power and the ability to re-work sediment (Gordon *et al.* 1992). The dams will continue to trap sediment, which will further limit opportunities for natural regeneration or managed restoration of riparian habitat (U.S. Fish and Wildlife Service 2002b). Reducing the magnitude, frequency, and duration of high flow events will prevent the establishment of germination sites for cottonwood and willow tree seedlings that require recently deposited, moist, bare sediment (Braatne *et al.* 1996). Continued high summer flows below Bartlett Dam may scour away seedlings that germinated in the spring (Patten 1998), and reduce the longevity of existing trees (J. Stromberg, Arizona State University, pers. comm.). Continued operation of the Verde dams is expected to result in further establishment of salt cedar, which significantly increases the risk of catastrophic fire (J. Stromberg, Arizona State University, pers. comm., U.S. Fish and Wildlife Service 2002b). Reducing the overall amount of riparian vegetation, coupled with periodic scouring floods, accelerates the loss of established trees (J. Stromberg, Arizona State University, pers. comm.). The loss of the dynamic nature of the Verde River below Bartlett Dam and Salt River below Stewart Mountain Dam will continue to cause degradation of the structure and function of the riparian area.[358]

c. Dewatering of remnant free-flowing rivers continues.[359]

Dewatering of the middle portion of the Verde River is accelerating:

"RIVER BARELY FLOWS – The Verde River dropped down to 12 cubic feet per second (cfs) on several days during June at the Camp Verde White Bridge

[358] Ibid.

[359] Desert Fishes Team 2003, 2004; Verde natural Resources Conservation District 1999, USFWS 1998

gage…Despite the low flows, Verde Valley irrigation ditch mangers report there has been adequate flow to serve their customers' dry season needs…"[360]

Increasing groundwater pumping by the growing population of Cottonwood and Camp Verde threatens to render this section of the Verde River intermittent:

"…The proposed project is the approval, by Reclamation, of CAP water exchange agreements between CWW [Cottonwood Water Works], CVWS [Camp Verde Water System], and the City of Scottsdale…The present proposed project is for CWW and CVWS to assign their CAP water allocation to the City of Scottsdale in return for $3,555,200…which would be used for development of alternative water supplies, primarily from groundwater sources…"[361]

USFWS (1998) continues:

"…*Effects of Groundwater Pumping and Verde River Surface Flow Depletion*…there is a hydrologic connection between the Verde Formation [the deep Verde Formation of the Tertiary Age, underlying the regional aquifer system], the Quaternary alluvial deposits along the river corridor [the alluvium of the Quaternary Age which underlies the Verde River channel and its floodplain], and the surface flows of Verde River (Owen-Joyce, 1984 [Owen-Joyce, S.J. 1984. Hydrology of a stream aquifer system in Camp Verde area, Yavapai County, Arizona. Arizona Department of Water Resources Bulletin 3, Phoenix, Arizona. 60pp.])…The Verde River base flow is provided by groundwater discharge from the alluvium and Verde Formation (ADWR, 1994 [Arizona Department of Water Resources. 1994. Arizona Riparian Protection Program: A report to the Governor, President of the Senate and Speaker of the House. Phoenix, Arizona. 507 pp.]). Thus, any withdrawal from either of those portions of the aquifer is expected to eventually deplete Verde River base flows.

Pumping from groundwater aquifers can deplete surface flows in both direct and indirect ways (ADWR, 1994; Glennon, 1995 [Glennon, R.J. 1995. The threat to river flows from groundwater pumping. Rivers 5(2):133-139.]). It can directly deplete surface flow by creating a cone of depression spreading outward from the well that causes surface water to infiltrate the alluvium to fill the resulting dewatered area. It can indirectly deplete surface flow by intercepting groundwater that would have flowed into the stream…

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[360] Verde Natural Resources Conservation District 1999)

[361] USFWS 1998

Groundwater pumping in Arizona has been repeatedly demonstrated to result in depletion of surface flows, degradation and loss of riparian habitats, and adverse impacts and local extirpation of aquatic and riparian flora and fauna (Miller, 1961 [Miller, R.R. 1961. Man and the changing fish fauna of the American southwest. Papers of the Michigan Academy of Science, Arts, and Letters XLVI:365-404.]; Hendrickson and Minckley, 1984 [Hendrickson, D.A. and W.L. Minckley. 1984. Cienegas – vanishing climax communities of the American southwest. Desert Plants 6(3):131-175.]; Stromberg, 1993 [Stromberg, J.C. 1993. Fremont cottonwood-Gooding willow riparian forests: a review of their ecology, threats, and recovery potential. Journal of the Arizona-Nevada Academy of Science 26(3):97-110.]; Glennon and Maddock, 1994 [Glennon, R.J. and T. Maddock, III. 1994. In search of subflow: Arizona's futile effort to separate groundwater from surface water. Arizona Law Review 36:567-610.]; Tellman *et al.*, 1997 [Tellman, B., R. Yarde, and M.G. Wallace. 1997. Arizona's changing rivers: how people have affected the rivers. University of Arizona, Tucson, AZ. 198 pp.]). ...various studies predict that the accelerating amount of groundwater removal will begin to deplete Verde River flows in the near future (Owen-Joyce and Bell, 1983 [Owen-Joyce, S.J. 1984. Hydrology of a stream aquifer system in the Camp Verde area, Yavapai County, Arizona. Arizona Department of Water Resources Bulletin 2, Phoenix, Arizona. 219 pp.]; ADWR, 1994; Ewing *et al.*, 1994 [Ewing, D.B., J.C. Osterberg, and W.R. Talbot. 1994. Groundwater study of the Big Chino Valley, Technical Report. U.S. Bureau of Reclamation, Denver, Colorado.]; McGavock, 1996 [McGavock, E. 1996. Overview of groundwater conditions in the Verde Valley, Arizona. 9th Annual Symposium of the Arizona Hydrological Society. Prescott, AZ. Sept. 12-14, 1996.])..."

Cumulative Effects of human Population Growth

Growth is projected in Cottonwood to increase by 148% and in Camp Verde to increase by 158% between 1994 and 2040 (Arizona Department of Economic Security 1994). This dynamic growth would lead to increased development, increased contamination, increased wildfires, and increased alteration of the watershed and hydrologic regime.

Cumulative Effects of Economic Development

The growth projected for this region will be manifested through economic development, including housing, golf courses, businesses, industry, roads, schools, and other facilities for the population. These facilities will replace natural vegetation and cover large expanses of the floodplain and watershed with impermeable surfaces. A primary result will be the alteration of the watershed characteristics and changes in the hydrologic and sediment patterns, sources, and volumes..."[362]

USFWS (2001a) adds:

"Groundwater pumping in areas such as the upper San Pedro and the Prescott/Chino Valley area threaten the water supply of streams important to spikedace, loach minnow, Gila topminnow, razorback sucker, and bald eagle."[363]

Prescott is out of water.[364] Prescott and Prescott Valley plan to dewater the Upper Verde:[365]

"City officials unveiled a plan for a pipeline that could carry water from the Big Chino Basin to several communities in the Prescott area..."[366]

"Verde Valley fears Prescott will dry river...he [Cottonwood Mayor Ruben Jauregui] and others living in the towns of Cottonwood and Clarkdale and the Camp Verde area wonder if one of the state's last major year-round free flowing rivers will be little more than a dry wash in the future.

That's because on the other side of Mingus Mountain to the southwest, the rapidly growing Prescott, Prescott Valley and Chino Valley area is moving ahead with plans to build a pipeline near the headwaters of the Verde in the Big Chino Basin.

The cities would then pump more the 4.5 billion gallons of water annually allotted to them by state law 20 years ago.

The pumping could begin by the end of next year. A recent report by the U.S. Geological Survey that about 80 percent of the Verde's headwaters come from the Big Chino basin has set off alarms throughout the Verde Valley..."[367]

"New draft study supports Big Chino contribution to river...U.S. Geological Survey scientists offered an overview of their new draft study Wednesday that adds a new layer of understanding of the upper Verde River system...she [Laurie Wirt] is even more confident that the Big Chino supplies at least 80 percent of the upper Verde's flow, with nearly all the rest coming from the Little Chino sub-basin to the south where Prescott sits."[368]

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[362] USFWS 1998
[363] USFWS 2001a
[364] ADWR 1999
[365] ADWR 1999; Arizona Republic 2000, 2001; Chino Valley Review 2004; Prescott 2001; Prescott Daily Courier 2004a, 2004b; USFWS 2001a
[366] Arizona Republic 2000
[367] Arizona Republic 2001
[368] Chino Valley Review 2004

"Updated study still says Prescott pumping will impact river...
PRESCOTT VALLEY – A geologist and hydrologist who analyzed the potential impacts of Prescott's plan to pump groundwater from the Big Chino Sub-basin conclude that the pumping would reduce the flow of the Verde River.

U.S. Geological Survey Scientist Emeritus Ed Wolfe, a geologist, and retired U.S.G.S. hydrologist Bill Meyer previously made the same conclusion when they conducted a free analysis of the impacts of Prescott's plan to pump from the CV Ranch northwest of Paulden... If Prescott follows through with its plan to pump 8,717 acre-feet of groundwater annually from the neighboring Big Chino Sub-basin into its Little Chino Sub-basin, the city will reduce the flow of the river by 6 percent in five years and at least 36 percent (8.9 cubic feet per second) in 100 years, the scientists concluded. [369]

d. Exotic fish continue to be introduced in native fish habitat.[370]

AGFD (1999a, 2000) says:

"Native fish populations. Fish diversity in Arizona is a crucial component to suitable breeding habitat (Hunt et al. 1992). Along the free-flowing and regulated portions of the Salt, Verde, and Gila rivers and Tonto Creek, maintaining native sucker populations is especially important. Non-native fish have out-competed, predated upon, and subsequently replaced native fish in many parts of our central Arizona rivers (Rinne and Minckley 1991)[371]

USFWS (2001a) says:

"...nonnative species were imported by humans, starting with common carp in 1885 (Gilbert and Scofield 1898). Since that time, at least 50 species of nonnative fish have been introduced (AZ State Univ., Geographic Information Systems database of fish records 2001) into the Gila River basin, and there are other records of incidental occurrences of another 10 to15. Many nonnative invertebrates, amphibians, reptiles, plants, and disease organisms have also been introduced. These species have been purposefully introduced through sport, bait, biocontrol, and ornamental fish use and releases through aquaculture, aquarium, and generalized "bait bucket" activities. They have also been accidentally introduced through interbasin water transfers, aquarium and pet releases, and inclusion with other species being purposefully stocked. Nonnative aquatic species have had major detrimental impacts on native aquatic fauna and have been a major factor in the listing of

[369] Prescott Daily Courier 2004b

[370] Desert Fishes Team 2003, 2004;

[371] AGFD 1999a, 2000; Rinne and Minckley 1991

spikedace, loach minnow, Gila topminnow, razorback sucker, desert pupfish, Colorado squawfish, Gila trout, and Apache trout (Stefferud 1984, USFWS 1975, 1985a, 1986a, 1986b, 1986c, 1987, 1991). Species which depend upon the aquatic fauna, such as bald eagle, have also experienced serious adverse effects from nonnative aquatic species (AGFD 2000)...

For all of the above 9 species [Gila topminnow, razorback sucker, desert pupfish, Colorado squawfish, spikedace, loach minnow, bald eagle, Gila trout, Apache trout], controlling the nonnative species threat is essential, in varying degrees, to the survival of the species. This includes 1) stabilizing the existing nonnative aquatic species component in the listed species habitats through prevention of introduction and spread of nonnative species into previously unoccupied areas, and 2) removing or reducing existing nonnatives species populations. Even for the listed species in good and increasing status, failure to accomplish these objectives is likely to result in eventual extirpation and/or extinction...

The effects of CAP to the nine listed species is additive to the already highly deteriorated environmental baseline of the Gila River basin aquatic ecosystem. The status of most of the nine species is poor and declining. Remaining habitats are highly altered, making many of them conducive to colonization by nonnative species, which may be able to use different habitats than the natives. Many of the former habitats of the eight fish are now occupied by nonnative species to the exclusion of any occupation by the native species. Unless nonnative aquatic species can be controlled and further incursions prevented, recovery is not likely for any of these species and their continued existence may be in peril. For the bald eagle, the southwestern population could suffer declines from existing levels if nonnative aquatic species that are deleterious to their preferred prey, which includes nonnatives, are not controlled.

Nonnative aquatic species include fishes, aquatic and semi-aquatic mammals, reptiles, amphibians, crustaceans, molluscs (snails and clams), insects, zoo- and phytoplankton, parasites, disease organisms, algae, and aquatic and riparian vascular plants. They may affect native fish and other aquatic fauna, including the eight fish species considered in this opinion, through predation (Meffe *et al.* 1983, Meffe 1985, Marsh and Brooks 1989, Propst *et al.* 1992, Rosen *et al.* 1995, Rinne 1999), competition (Schoenherr 1974, Lydeard and Belk 1993, Baltz and Moyle 1993, Douglas *et al.* 1994), aggression (Meffe 1984, Dean 1987), habitat disruption (Hurlbert *et al.* 1972, Ross 1991, Fernandez and Rosen 1996), introduction of diseases and parasites (Sinderman 1993, Clarkson *et al.* 1997, Robinson *et al.* 1998), and hybridization (Dowling and Childs 1992, Echelle and Echelle 1997). They may affect native fish-eating species, including bald eagle, through alteration of their food base (AGFD 2000, McClelland *et al.* 1983, Claudi and Leach 2000). Nonnative plants can reduce available habitat with abundant growth (e.g.

water cress), potentially cause loss of surface water (e.g. salt cedar), or alter ecosystem dynamics (McKnight 1993, Stromberg and Chew 1997, Lovich and DeGouvenain 1998).

All of the nine listed species are highly vulnerable to adverse effects from nonnative aquatic species. The Gila basin had a naturally depauperate aquatic fauna and native aquatic species, including the eight fish considered here, did not evolve with any significant predation or competition (Carlson and Muth 1989). This evolutionary history makes them highly vulnerable to adverse effects from nonnative species. The bald eagle, although it will readily use many nonnative fish as food, may be adversely affected if the fish fauna becomes dominated by nonnative species less available to capture, such as has occurred with flathead catfish replacement of native fishes in the upper Salt River (AGFD 2000). It may also be affected if nonnative-induced habitat changes make prey capture problematic, such as if giant salvinia reaches Lake Pleasant and covers the reservoir to the level experienced elsewhere (USGS 2001). Giant salvinia is a floating plant recently introduced into the Colorado River and which has a very high likelihood of entering the CAP aqueduct in the near future. For more information on giant salvinia, see the background document.

Introduction and spread of nonnative species is among the most serious and rapidly growing environmental problems today (Elton 1958, MacDonald *et al.* 1986, Coblentz 1990, McKnight 1993, Rosenfeld and Mann 1992, Simberloff *et al.* 1997, Claudi and Leach 2000). It is documented as a factor adversely affecting bald eagle in portions of its range in the southwest and elsewhere (McClelland *et al.* 1983, AGFD 2000, Claudi and Leach 2000). It is also well documented as a major factor in the decline of southwestern native fishes, including the eight considered in this opinion (Miller 1961, Propst *et al.* 1986, Propst *et al* 1988, Carlson and Muth 1989, Miller *et al.* 1989, Aquatic Nuisance Species Task Force 1994, Cohen and Carlton 1995, Lassuy 1995). Minckley (1991:145) succinctly summarized the situation for the aquatic fauna when he said, "Native fishes of the American West will not remain on earth without active management, and I argue forcefully that control of nonnative warmwater species is the single most important requirement for achieving that goal...

CAP is an interbasin water transfer that will, like most interbasin water transfers, transport nonnative species across basin and subbasin boundaries (Davies *et al.* 1992, Meador 1992, 1996, Stefferud and Meador 1998, Claudi and Leach 2000)... CAP has already transported nonnative striped bass into the Gila basin (AGFD unpub. data) and likely already has, or soon will, introduce Asian clam into the Santa Cruz subbasin (USFWS 1999b). In addition to direct transport of nonnative aquatic species, the CAP system provides a means of spread for species introduced through aquaculture, the aquarium trade, sport fish stocking, biological control, and bait-bucket transfer

(Figure 3). Unauthorized stocking and "bait bucket" spread of species by the public is significantly increased by CAP through increased access by the public to nonnative species and to open waters, such as the aqueduct, recharge projects, created wetlands, and other features of CAP (Claudi and Leach 2001). Aquatic habitats created by CAP water, or water made available by other use of CAP water, provide enhanced habitat and opportunities for stocking nonnative aquatic species Nonnative grass carp and mosquitofish have already been introduced directly into the CAP and interconnected features (such as recharge areas) for biological control, and introduction of black carp has been proposed (Bawden 1994, FWS unpub. data, J.Garza, CAWCD, pers. comm., Oct. 1997). Due to objections by the Service and Reclamation, that proposal has since been dropped (CAWCD 2001). Aquaculture in the aqueduct has been considered, but is not planned at the present time.

Nonnative species will leave CAP and enter the Gila River basin waters through connections with other canal systems, irrigation releases, groundwater recharge, bait-bucket transfer, water storage in Lake Pleasant, recreational lakes, and accidental releases due to technical failures or emergencies. Ponded waters from CAP or CAP in-lieu water will form habitat highly suited for nonnatives and will be stocked with nonnative species, intentionally or unintentionally, serving as sources for nonnative dispersal into surrounding waters. "Artificial waters seem to serve as stepping stones for exotic species as they spread geographically." (Blinn and Cole 1991:110)

CAP has a project life of 100 years. Over that lengthy period the Service is certain that more than the 1 to 2 species that have already moved via CAP, will be introduced or assisted in their spread by CAP. CAP is an aquatic "highway" reconnecting human-isolated fragments of the Gila basin surface water and substantially enhancing the ability of aquatic species to move throughout the system. This connection will not benefit native fish, but will benefit nonnative aquatic species by providing enhanced opportunities for movement between the Colorado River and Gila basin and between subbasins of the Gila River.

Over the 100-year project life substantial changes are expected in the project, including water use, technology, human population, available nonnatives, climate trends, and other factors. Therefore, this analysis uses a broad scale approach, focusing on existing data on movement of species already occurring through the CAP aqueduct and connected canal systems (Grabowski *et al.* 1984, Mueller 1989, 1997, Clarkson 1998,1999, and 2001, Bettaso 2000)...and through other interbasin water transfers... In addition, we assessed information on existing specifics of CAP and the Gila River basin aquatic ecosystem to determine that nothing about CAP indicates it is sufficiently different from other interbasin water transfers to support a presumption that it would not fit into the general pattern illustrated in Table 4.

[not included] Although significant impediments to species movement through the CAP system exist (CAWCD 1995) they do not prevent such movement (e.g. striped bass, white bass, Asian clam) nor are they any greater than those overcome by species moving through interbasin water transfers elsewhere (Rubinoff and Rubinoff 1968, Guiver 1976, Laurenson and Hocutt 1985, Swift *et al.* 1993).

Nonnative species are extremely hard, if not impossible, to remove once established (Aquatic Nuisance Species Task Force 1994). If possible, control or removal can be costly, such as the predicted annual costs of $90 million for ruffe control (Great Lakes Fishery Commission 1992, as cited in Courtenay 1995). It may also entail use of toxic substances that may be unpopular with the public and may affect many species besides the target nonnative (DeMarais *et al.* 1993, Inchausty and Heckmann 1997, Finlayson *et al.* 2000). Therefore, survival and recovery of the spikedace, loach minnow, Gila topminnow, razorback sucker, desert pupfish, Colorado squawfish, Apache trout, and Gila trout, and the continued success of bald eagle, require proactive prevention of the invasion or spread of nonnatives to the maximum extent possible...

Spikedace, loach minnow, Gila topminnow, razorback sucker, and bald eagle are all expected to be seriously adversely affected by introduction and spread of nonnative aquatic species through the CAP. The degree of vulnerability of their populations and presently unoccupied recovery areas to CAP mediated nonnatives is variable. Some, such as Aravaipa Creek and those in the middle Gila River above Ashurst Hayden Dam are close to, and have direct routes from, the CAP aqueduct. Others, such as those in the upper Salt River drainage, have a number of dams intervening between that area and the aqueduct and will be affected by CAP only indirectly through nonnative spread due to bait bucket transport of species made more accessible by CAP, or by species that can move overland and use CAP as a staging area in their colonization efforts. The four fish live primarily in medium-to-warmer water habitats that are likely to be successfully colonized by nonnative aquatic species moving out from the CAP aqueduct or its related facilities. The nesting population of bald eagle in the Gila basin lives, and feeds on fish, along similar warmer water habitats...

Bald eagle...Take of bald eagle is anticipated, in the form of harm, through alteration of the quantity and quality of the food base which impairs feeding. Take may also occur if nonnative species, such as giant salvinia, hinder accessibility of fish to eagle capture...

Construction and maintenance of fish barriers on the upper Verde River and lower Fossil Creek, where eagle territories are nearby and wintering eagles exist, may result in take of bald eagles through harassment or harm by hindrance of access to feeding areas, and other disruptions of breeding, feeding, or sheltering. Take as a result of nonnative species removal projects is not considered here. Such projects will require additional section 7 consultation…

The level of take from nonnative introduction and spread is not quantifiable at this time because it is indeterminable what the cause and effect relationship may be to eagle populations from the future introduction of a nonnative aquatic organism (i.e. plants, vertebrates, invertebrates). Although some level of take can reasonably be expected to occur, the level could range from insignificant to catastrophic, depending on what type of nonnative organism enters the streams and waters where eagles are located. Thus, the identification of a new nonnative species to these systems presents a danger/risk that if not immediately ameliorated could result in excessive take."[372]

The Desert Fishes Team (2003) says:

"Like the entire indigenous fish fauna of the American southwest, the native warm water fishes of the Gila River watershed (Basin) in central Arizona and southwest New Mexico, USA, and northern Sonora, Mexico, are critically imperiled. In this report, we assess the status of the twelve federal and state listed, proposed, and/or petitioned warm water species of the Basin.[373] Our assessment concludes that the status of all of these species has continued to decline notwithstanding federal and state protection. Conservation and recovery efforts have been limited in number and scope, and of little long-term effectiveness in stemming declines of these species.

Reasons for decline of these species are well documented in published literature and recovery plans. Introduction and spread of nonnative aquatic species continues to be a major factor in displacement of native species. Habitat destruction from a variety of human activities has been an equal and interactive factor. We believe the control and removal of nonnative fish and certain other aquatic flora and fauna is the most urgent and overriding need in preventing the continued decline and ultimate extinction of the native fish assemblage of the Basin…"[374]

Desert Fishes Team (2004) says:

"Modern occurrences of Sonora sucker show it remains in 93 (73%) of the 127 locations in which it was recorded… It has a low probability of local extirpation (Fagan *et al.* 2002), however, fragmentation of range and isolation of populations

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[372] USFWS 2001a

[373] "The Gila River basin has 20 native fish species. In addition to the twelve species considered here, two native trouts are also Federal and State listed. Because they are the only cold water species, and because as game species they have distinctly separate and more active recovery and conservation programs, we chose not to include them in this status report."

[374] Desert Fishes Team 2003

could further reduce its occurrence in a watershed. Reasons for decline include dewatering and alteration of habitats, and introduction of nonnative fish that prey upon the species...

Additionally, removal of nonnative species from many of its habitats will be required for the species to persist in rivers and larger streams… We recommend Sonora sucker be listed under the Endangered Species Act as threatened because of losses from many localities in the Gila River basin, continuing anthropogenic disturbances to its habitats, and chronic impacts of nonnative species. This is consistent with previous recommendations from the Desert Fishes Recovery Team and federal agencies (Minckley 1993, U.S. Fish and Wildlife Service 1994b)…

Flannelmouth sucker no longer occurs in the Gila River basin, a result of dewatering, reservoir construction and other habitat alterations, and introduction of nonnative predatory fishes (Chart and Bergersen 1992, Marsh and Douglas 1997)…

Desert sucker remains in 137 (74%) of the 186 locations in which it has been recorded… Dewatering and alteration of habitats and introduction of nonnative species have caused its decline throughout its historical range. Because desert sucker has not disappeared from any significant portion of its range, it is considered to have a low probability of local extirpation (Fagan *et al.* 2002).

There has been one documented repatriation, which failed due to stream desiccation during long-term drought… Other activities that indirectly benefited desert sucker were done for recovery of listed species… Monitoring of populations and repatriation into previously occupied habitats should be instituted, and remaining populations protected to ensure maintenance of the species… Removal of nonnative fishes from larger streams and rivers will be necessary to ensure the continued existence of the species as an integral part of the native fish assemblage. Because it has disappeared from a large number of localities in the Gila River basin, continuing anthropogenic impacts on its habitats, and nonnative species continually impact individuals through predation, we recommend that desert sucker be listed under the Endangered Species Act as threatened, as previously recommended by others (Minckley 1993, U.S. Fish and Wildlife Service 1994).

The entire native fish fauna of the Gila River basin is biologically imperiled, as are many other obligate aquatic taxa (Williams *et al.* 1989, Warren, Jr. and Burr 1994, Arizona Game and Fish Department 1996, U.S. Fish and Wildlife Service 1999a, 1999b, Desert Fishes Team 2003, Clarkson 2004, Clarkson *et al.* 2004). Nonnative species continue to expand in range and abundance, and habitat deterioration through water development and watershed alteration present a consistent threat to habitats (Miller 1961, Minckley and Deacon 1968, Minckley and Rinne 1991, Tyus and Saunders, III 2000)…

Increased attention to the health and vigor of these species and their populations is necessary to prevent a slow but inexorable slide towards loss of metapopulations and local extirpation. We recommend 1) Endangered Species Act protection be extended to longfin dace, Sonora sucker, flannelmouth sucker, desert sucker, and speckled dace, 2) an aggressive program be implemented to convert individual streams and complexes within watersheds to refuges for native species through barriers, removal of nonnative species, and repatriation of native fishes, 3) anthropogenic factors that negatively affect habitats be modified to reduce impacts on native fishes, and 4) existing populations of native species be protected and systematic monitoring of their populations be implemented. Few successful recovery and conservation actions have occurred during the past several decades for these fish. Technologies and processes exist to improve the status of these species and should be put into practice. Other innovative techniques and applications, such as development and licensing of species-specific piscicides and design of transgenic fishes to eliminate or reduce populations of nonnative species, should be investigated and deployed as appropriate."[375]

e. Low flying aircraft continue and will increasingly continue adversely affecting the population.[376] Flight advisories are not mandatory and are routinely ignored.[377]

As the metropolitan Phoenix population grows, low level aircraft traffic increases also:

"...*Low-flying aircraft*. BAs near the metropolitan Phoenix area not only receive a high level of human activity from the ground, but disturbance from low-flying private aircraft has also increased. Although more concentrated around cities with airports, this activity has been observed in the remote BAs not normally subjected to human activity. With an increased human populations and an increase in demand for tourism flights, this activity has a potential to affect statewide productivity. Low-flying private aircraft can have a detrimental affect on the breeding cycle by flushing an incubating adult which could cause the eggs to break. Although we have not directly linked a nest failure to low-flying personal aircraft, the adults reaction to this activity is cause enough for concern.

In addition to low-flying private aircraft, low-flying military and Emergency aircraft is a concern for BAs on the lower Salt and Verde rivers, and under military training routes (MTR). Apache helicopters from the Boeing test area,

[375] Desert Fishes Team 2004

[376] AGFD 1999a, 2000; USFWS 1993a, 1994c, 1997b, 2002a, 2003b

[377] AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004c; Arizona Republic 1989

Maricopa County's Sheriff Department, and Emergency AirEvac helicopters have been recorded less than 150 feet over active nests. Additionally, most of Arizona is low-level flight training for the U.S. Air Force, and a maze of MTR's cover the state. Although this type of aircraft may not bother bald eagles due to their fast nature, the resulting noise and sonic booms can flush an incubating adult.

In previous years, AGFD has worked with the Federal Aviation Administration and the Arizona Department of Transportation to establish a 2000 foot above ground level (AGL) advisory along the Salt and Verde drainages. Even though the advisory is marked on the Arizona Aeronautical Maps, most pilots disregard the advisory. The AGFD has also worked with Luke A.F.B. to modify their MTR's to avoid bald eagle BAs…"[378] (AGFD 1999a)

USFWS evaluated the 1994, Department of the Air Force proposal to widen and/or realign segments of military training routes in Arizona. USFWS, acknowledged the loss of nine eagles or eggs and 18 disturbances per breeding season. Cumulatively, over the 50-year period this will result in the loss of 450 eagles or eggs and in 900 disturbances.[379]

f. USFWS' approval of Desert Nesting Bald Eagle deaths is excessive.[380]

To date, even with ESA protection, USFWS has approved Federal activities responsible for the deaths of at least 29 Southwestern Desert Nesting Bald Eagles in the last decade.[381] These activities will cumulatively result in 491 taking deaths over the next 50 years.[382] According to AGFD (1994b) 30 percent of occupied eagle nesting territories in Arizona may be adversely affected by these planned projects:

"…Overall, 30 percent of all occupied territories (n=27) in 1994…may be adversely affected by currently planned projects…"[383]

An AGFD (1994a) memo is very illustrative:

"The Service [USFWS] said the change in status is complex on paper and striking in the reduced protection a bird has under section 9. "Take" under threatened status does not include protection of the bird's habitat as it does under endangered status. Additionally, the downlisted status could alter the perception of "recovery" by agencies resulting in lack of proactive management and support for existing programs.

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378 AGFD 1999a, 2000

379 USFWS 1994c

380 AGFD 1994b; USFWS 1992d, 1993a, 1994c, 1996b, 1997b

381 USFWS 1992d, 1993a, 1994c, 1996b, 1997b

382 USFWS 1992d, 1993a, 1994c, 1996b

383 AGFD 1994b

The definition of "take" is different between endangered and threatened status in section 9 beginning at part 9.2e. The Endangered Species Act (ESA) delegates protection of a threatened species to other federal acts protecting the species in question. The ESA offers no additional protection of its own. In the case of bald eagles the protection would fall under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. What these acts lack is the protection of habitat for the bald eagle. This makes permits (grazing, recreation, water-use) easier to acquire and increases the difficulty in reaching a jeopardy decision when writing biological opinions.

The definition of "take" under the Endangered Species Act allows the Service more flexibility when addressing habitat loss and cumulative effects. The Service is faced with making a "jeopardy" or "non-jeopardy" decision based upon whether a project will affect the continued existence of the bald eagle in the Southwest. If the answer is "no," "reasonable and prudent measures" are identified to reduce incidental take. These measures are mandatory, but may not significantly alter the timing, scope or other aspects of the project. In these cases, the USFWS does not have the authority to significantly alter projects for the benefit of the species. When a project does warrant a "jeopardy" decision, the Service can alter a project for the benefit of the bird. By reducing the bird's status to threatened, the Service's ability to reach jeopardy determinations based on loss of habitat and therefore its ability to alter projects for the benefit of the eagle will be greatly reduced...

The beginning of section 7a.1 states that "all federal agencies shall...carry out programs for the conservation of endangered species and threatened species listed..." This is to occur regardless of any decision made by the USFWS or an outcome of a consultation. In reality, agencies only perform these activities when forced and view a non-jeopardy decision as a permit to move forward often with little regard for endangered species.

Presently, there are few binding consultations for any agency to commit funding to existing bald eagle programs under section 7 of the Endangered Species Act. Now, funding assistance by agencies is primarily based upon available funds and where they choose to allocate those dollars. The Service believes that if eagles are downlisted, the perception of "recovery" could result in reduced support for programs which support proactive management and protection. Approximately 63 percent ($101,000) of all bald eagle dollars comes from agencies other than AGFD. A reduction in these programs would result in reduced productivity of breeding bald eagles...

Not only does habitat protection assist the bald eagle, but it contributes to protection of riparian vegetation, streams and the animals living in those ecosystems. Clearly, our most precious habitat in Arizona is riparian. Eagles are a barometer for the health of these systems. In central Arizona, the most successful and dependable nesting sites of the past have shown declines. Downlisting the species to threatened not only reduces the protection for the eagle, but also for the entire central Arizona river ecosystem. Stating that the eagle is no longer endangered indirectly suggests that central Arizona rivers are also less endangered and are able to withstand additional development...

The bird becomes less "recoverable" as development persists in central Arizona. As populations increase in rural Arizona and the Phoenix metropolitan area, so does the demand for development, easier access, more recreation, and improved facilities. The Service takes into account these foreseeable trends when arriving at their decisions under endangered status. If habitat protection is removed from consideration when evaluation a project because the bald eagle is downlisted to threatened, we can expect a decline in the Arizona bald eagle population."[384]

On February 7, 1990, USFWS published a Notice of Intent in the Federal Register to downlist the Bald Eagle from Endangered to Threatened throughout its range in the contiguous U.S.[385] Efforts to downlist where evident at least from 1989.[386] By 1994, the attitudinal change was very graphic.[387] On November 16, 1994, USFWS provided to the Department of the Air Force the license to (1) destroy nine Desert Nesting Bald Eagles or their eggs, and to (2) perpetrate 18 disturbances per breeding season. Over the 50-year life of the project, USFWS provided the Air Force license to cumulatively destroy 450 eagles or eggs and cause 900 disturbances.[388] USFWS provided the Air Force with such license without acknowledging the fact that such an enormous loss to a small, ecologically, behaviorally, and reproductively isolated population would jeopardize its survival![389]

The attitudinal change that took place in 1990, has become so blatant that the Assistant Secretary of the Interior is even publicly promoting the Bush Administration desire "to ease export restrictions on American bald eagles" without regard for the fragility and imperiled status of the Desert Nesting Bald Eagle:[390]

> "...It [the USFWS] also is proposing [to the United Nations' Convention on International Trade in Endangered Species] to ease export restrictions on American bald eagles because their populations have dramatically improved in the contiguous 48 states, Manson [Assistant Interior Secretary Craig Manson] said."[391]

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[384] AGFD 1994a
[385] USFWS 1990a
[386] USFWS 1990c
[387] USFWS 1994c
[388] Ibid.
[389] Ibid.
[390] Arizona Republic 2004h
[391] Ibid.

19. The USFWS, itself, continues to warn of increasing dangers to the survival of the Desert Nesting Bald Eagle.[392]

Section 7 of the ESA requires that all Federal agencies consult with USFWS concerning all activities that may adversely affect species on the List of Threatened and Endangered Species. While USFWS now proposes to remove the Southwestern Desert Nesting Bald Eagle from this List, it continues to confirm that the Southwestern Desert Nesting population will increasingly face expanding dangers.

The January 21, 1993, USFWS Biological Opinion for the U.S. Bureau of Reclamation A-Cross Road, Indian Point Recreation Site, Tonto Creek Riparian Unity, and Roosevelt Lake operating levels, states:

> "...Environmental Baseline...while significant recovery has probably taken place ["Following the banning of domestic use of DDT in 1972"], the bald eagle remains somewhat tenuously established in the Southwest. Various reports and records suggest that nesting bald eagles may have been more widely distributed in Arizona in the past. Historic records strongly suggest approximately 20 bald eagle BAs which are not known to have been occupied in the last decade (Hunt *et al.* 1992 [Hunt, W.G., D.E. Driscoll, E.W. Bianchi, and R.E. Jackson. 1992. Ecology of bald eagles in Arizona, Parts I-V. Report to the U.S. Bureau of Reclamation, Contract 6-CS-30-04470. BioSystems Analysis, Inc. Santa Cruz, California.]). These records may indicate that factors are at work which limit further recovery or population expansion. Those factors would compound the stresses of a naturally harsh environment for breeding bald eagles. Especially near population centers, eagle breeding sites face continually increasing threats from malicious and accidental harassment, including shooting, off-road vehicles (ORVs), low aircraft overflights, loss of nesting and foraging habitat from riparian degradation, and lethal entanglement in fishline (Hunt *et al.* 1992).
>
> The Southwest bald eagle population is exposed to increasing hazards, from a regionally increasing human population. These include extensive loss and modification of riparian breeding and foraging habitat through clearing, changes in groundwater levels, and changes in water quality. Hazards also include increasing human disturbance from urban, rural and recreational encroachment into breeding habitat. These include a host of threats documented by Stahlmaster (1987) [Stahlmaster. M.V. 1987. The bald eagle. Universe books. New York, New York. 227 pp.], such as shooting; collision with vehicles, aircraft, transmission lines and structures; poisoning; and electrocution.
>
> Much of the Southwest bald eagle population is exposed to the pressures described above. Half of Arizona's 30 known breeding sites are located on

[392] USFWS 1993a, 1994c, 1997a, 1997b, 1998, 2002a, 2003b

rivers and near reservoirs that are easily and frequently accessed by the public, providing the potential for these threats. The Arizona Bald Eagle Nestwatch Program (ABENWP), administered by AGFD, continues to document disturbance at nest sites, and frequently intervenes to reduce these impacts. This intervention has proven not only effective, but perhaps crucial in maintaining the southwestern population. While the effects of impact prevention (e.g. public education) are difficult to quantify, measurements of other intervention are available. Up to 50% of some years' eagle reproduction has been salvaged by ABENWP "rescue" operations. These include removing fishline and tackle from nestlings, returning nestlings into nests after they fell or jumped out in response to disturbance or to escape extreme heat, and rescuing eggs or young from nests that were being inundated by rising reservoir water levels...

...These authors [Hunt *et al.* 1992] found that nest success was highest (85%) in BAs on free-flowing creeks, and averaged near 50% at a BA providing only a reservoir, with no river or creek habitat...

The Tonto BA is located in an area where it is exposed to many of the threats discussed above. Current human activity levels at and adjacent to the Tonto BA are moderate to high (Young and Holleran 1992 [Young, J.T. and E.J. Holland. 1992. Nestwatchers' report: Tonto nest. Arizona Bald Eagle Nestwatch Program, Arizona Game and Fish Department, Phoenix, Arizona. 43 pp.], BOR 1992 [U.S. Bureau of Reclamation. 1992. A biological assessment of the possible impacts of CAP Plan 6 and Safety of Dams activities on the Tonto Creek bald eagle territory, Roosevelt Lake. Department of the Interior, Bureau of Reclamation. Lower Colorado Region, Arizona Projects Office. Phoenix, Arizona. 24 pp.])...

...whether or not this (the Tonto BA) and other BAs will persist with increasing human activities remains unclear. In recent years, Tonto and several other BAs have become established on lower river reaches, while the historic BAs discussed above, generally on upper watersheds, remain unoccupied. This may be because habitat conditions, specifically riparian habitats, remain too degraded to support BAs in upper watersheds (D. Driscoll, pers. comm.).

Improper livestock grazing has resulted in widespread degradation and loss of riparian habitats in the western United States. These effects include changes in vegetation structure, composition and quantity, and widespread changes in watershed hydrology. Livestock grazing in riparian habitats typically results in reduction of riparian vegetation (especially palatable broadleaf plants lie willows and cottonwood saplings) and is often the most serious cause of riparian degradation (Carothers 1977 [Carothers, S.W. 1977. Importance, preservation, and management of riparian habitats: an overview. In R.R. Johnson and D.A. Jones (eds.), Importance, preservation, and management of riparian habitats: a symposium. Gen. Tech. Rep. RM-42. USDA Forest

Service, Denver, Colorado.], Rickard and Cushing 1982 [Rickard, W.H. and C.E. Cushing. 1982. Recovery of streamside woody vegetation after exclusion of livestock grazing. J. Range Manage. 43:295-299.], Rea 1983 [Rhea, A.M. 1983. Once a river: bird life and habitat changes on the middle Gila. University of Arizona Press, Tucson, Arizona. 295 pp.], Cannon and Knopf 1984 [Cannon, R.W. and F.L. Knopf. 1984. Species composition of a willow community relative to seasonal grazing histories in Colorado. Southwestern Nat. 29:234-237.], Klebenow and Oakleaf 1984 [Klebenow, D.A. and R.J. Oakleaf. 1984. Historical avifaunal changes in the riparian zone of the Truckee River, Nevada. Pp. 203-209 in California riparian Systems (R.E. Warner and K.M. Hendrix, eds.). University of California Press, Berkeley], General Accounting Office 1988 [Public rangelands: Some riparian areas restored but widespread improvement will be slow. General Accounting Office, U.S. Government. Washington, D.C.], Clary and Webster 1989 [Clary, W.P., and B.F. Webster. 1989. Managing grazing of the riparian areas in the Intermountain Region. Gen. Tech. Rep. INT-263. Ogden Utah. USDA Forest Service, Intermountain Research Station. 11 pp.], Schultz and Leininger 1990 [Schultz, T.T., and W.C. Leininger. 1990. Differences in riparian vegetation structure between grazed areas and exclosures. J. Range. Manage. 43:295-299.]).

Before intensive, unrestricted livestock grazing, lower Tonto Creek once presented a lush gallery riparian forest with water flowing through a series of sloughs, where large fish were found (Packard 1984, in USFS 1991 [U.S. Forest Service. 1991. Biological evaluation: Tonto Creek Riparian Unit. Tonto Basin Ranger District, Tonto National Forest, Roosevelt, Arizona. 15 pp.]). Lower Tonto Creek is now seriously degraded, with little riparian forest and extensive areas of bare fluvial rubble (Hunt *et al.* 1991, BOR/USFS 1991). Bald eagle habitat on lower Tonto Creek is currently in a degraded condition (Hunt *et al.* 1992). Cottonwood regeneration is poor, and remaining potential nest trees exist in decadent stands, nearing senescence (BOR/USFS 1991 [U.S. Bureau of Reclamation, and Tonto National Forest. 1991. Resource development plan for Tonto Creek Riparian Unit: wildlife mitigation, Theodore Roosevelt Dam. U.S. Bureau of Reclamation, and Tonto National Forest, Phoenix, Arizona. Contract No. 1-07-32-L2695, Agreement No. 12-03-91-026. 30 pp.])...

...From 1950 to 1992, the Base and lower portion of the nest tree have been inundated 20 times, for periods ranging from 6 to 204 days with an average of 88 days (BOR 1992)...Because of their close proximity, elevations are expected to be similar to those for Tonto #1 nest and tree [for Tonto #2 nest]...[The proposed (and subsequently approved) action allows the lake level from 2136 feet to 2151 feet.]...

...Cumulative Effects of the Proposed Action...Future Federal actions are subject to the consultation requirements established in Section 7 and, therefore, are not considered cumulative in the proposed action.

The Tonto BA occurs on Federal Land and is primarily affected by factors controlled or permitted by Federal agencies. However, the Service anticipates that some cumulative effects will occur. As the urban human population of central Arizona continues to grow, increased recreational use of Roosevelt Lake is likely to affect the Tonto BA. These effects, chiefly disturbance, are expected to be facilitated by continued private developments along Tonto Creek, upstream of the Tonto BA..."[393]

The November 16, 1994, USFWS Biological Opinion on Proposal to Widen and/or Realign Segments of Four of the Nine Military Training Routes in Arizona states:

"...The southwestern bald eagle population is exposed to increasing hazards from a regionally increasing human population. These include extensive loss and modification of riparian breeding and foraging habitat through clearing, changes in groundwater levels and the natural hydrograph, and changes in water quality. Hazards also include increasing human disturbance from urban and rural encroachment and recreation (e.g., collisions with vehicles, aircraft, transmission lines and structures, poisoning, electrocution, shooting; Stahlmaster 1987 [Stalhlmaster, M.V. 1987. The bald eagle. Universe Books. New York, New York. 227 pp.]...Following the banning of domestic use of the pesticide DDT in 1972, the Arizona bald eagle population has increased. However, while significant recovery has taken place, the bald eagle remains somewhat tenuously established in the Southwest. Approximately 20 historic site records strongly suggest the historic presence of bald eagle nest sites that have not been occupied during the last decade (Hunt *et al.* 1992 [Hunt, W.G., D.E. Driscoll, E.W. Bianchi, and R.E. Jackson. 1992. Ecology of bald eagles in Arizona. Part A: Population overview. Report to U.S. Bureau of Reclamation, Contract 6-GS-30-04470. Biosystems Analysis, Inc., Santa Cruz, California]). These observations suggest factors are at work that are currently limiting further recovery or population expansion. These factors may compound the stresses of a naturally harsh environment for breeding bald eagles. Particularly near population centers, eagle breeding sites face continually increasing threats from malicious and accidental harassment, including shooting, off-road vehicles (ORVs), low aircraft overflights, loss of nesting and foraging habitat from riparian degradation, and lethal entanglement in fishline (Hunt *et al.* 1992).

Much of the southwestern bald eagle population is exposed to the pressures described above. Half of Arizona's 34 known breeding sites are located on rivers and near reservoirs that are easily and frequently accessed

[393] USFWS 1993a

by the public, providing the potential for these threats. The Arizona Bald Eagle Nest Watch Program (ABENWP) continues to document disturbance at nest sites and frequently intervenes to reduce harassment. This intervention has proven not only effective, but perhaps crucial in maintaining the southwestern population. Up to 50% of a given year's reproduction has been salvaged by ABENWP "rescue" operations. These include removing fishline and tackle from nestlings and returning nestlings to nests after they fell or jumped out in response to disturbance, or to escape extreme heat. Protection of breeding and feeding areas is crucial t maintaining the growth the population has experienced since 1972. Riparian wetland and other wetland habitats must be maintained or enhanced for this species to continue to move toward recovery..."

"...Bald eagles are particularly susceptible to disturbance both on breeding and wintering grounds (Mansi *et al.* 1987 [Manci, K.M., D.N. Gladwin, R. Villella, and M.G. Cavendish. 1987. Effects of aircraft noise and sonic booms on domestic animals and wildlife: a literature synthesis. National Ecology Research Center, Fort Collins, CO. 158 pp.], Lamp 1989 [Lamp, R.E. 1989. Monitoring the effects of military air operations at Naval Air Station Fallon on the biota of Nevada. Nevada Department of Wildlife, 90 pp.], Ehrlich *et al.* 1992 [Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1992. Birds in jeopardy: the imperiled and extinct birds of the United States and Canada, including Hawaii and Puerto Rico. Stanford University Press, Stanford, California. 259 pp.]). Observations obtained by nest watchers for ABENWP have documented numerous instances where low-level jet aircraft using MTRs have startled nesting bald eagles an chicks, and passed within close proximity (both above and below) to eagles flying around nesting and foraging areas. The elevation and lateral distance at which low-level flights occur near bald eagle nesting areas is of particular concern because eagles regularly fly to 610 m (2,000 ft) above the surrounding landscape. This puts eagle at risk of collision with low-flying aircraft traveling at speeds that do not enable pilots to avoid bird strikes. The Draft EA documents 62 bird strikes on six MTRs for the period 1990-1993, but gives no data on the species affected. The potential for collisions with eagles also puts pilots and aircraft at considerable risk..."[394]

The March 24, 1997, USFWS Biological Opinion for rerouting of an existing Navapache Power powerline on the Blue River in Greenlee County, Arizona, states:

"...Although not considered a separate subspecies, bald eagles in the southwestern United States are considered a distinct population for the purposes of recovery efforts and section 7 consultation under the Act (USFWS, 1982 [U.S. Fish and Wildlife Service. 1982. Bald eagle recovery plan (southwestern population). Albuquerque, NM. 65 pp.]; 1986b [U.S. Fish

[394] USFWS 1994c

and Wildlife Service. 1986b. Memorandum from Director to Regional Directors, re: Jeopardy standard under the Endangered Species Act. Washington, D.C. March 6, 1986.]). Southwestern bald eagles constitute a distinct population, distinguishable by morphology, breeding chronology and geographic isolation. Southwestern bald eagles are also distinct behaviorally, frequently nesting on cliffs, a phenomenon rare or absent outside this geographic region. The southwestern bald eagle nests early, with eggs laid in January or February. This is believed to be a behavioral adaptation to avoid the extreme desert heat of midsummer. The young eagles remain in the vicinity of the nest until June (Hunt *et al.*, 1992 [Hunt, W.G., D.E. Driscoll, E.W. Bianchi, and R.E. Jackson. 1992. Ecology of bald eagles in Arizona, Parts I-V. Report to the U.S. Bureau of Reclamation, Contract 6-CS-30-04470. BioSystems Analysis, Inc. Santa Cruz, California.])...The majority of the population inhabits Arizona, distributed along the Salt, Verde, Gila and Bill Williams rivers and several major tributaries. Although the status of the southwestern population is on an upward trend, the population remains small and under threat from a wide variety of factors..."[395]

The December 29, 1997, USFWS Biological Opinion for the safety of dams modifications at Horse Mesa Dam located on the Salt River states:

"...Arizona bald eagles demonstrate unique behavioral characteristics in contrast to bald eagles in the remaining lower 48 states. Eagles in the Southwest frequently construct nests on cliffs. By 1992, of the 111 nests known, 46 were in trees, 36 on cliffs, 17 on pinnacles, 11 in snags, and one on an artificial platform...Bald eagles in the southwest are additionally unique in that they lay eggs in January or February, which is early compared with bald eagles in other areas. It is believed that this is a behavioral adaptation to allow chicks to avoid the extreme desert heat of midsummer..."

"...The establishment of the Southwestern Bald Eagle Management Committee (SWBEMC) and Arizona Bald Eagle Nestwatch Program (ABENWP) has been essential to the success of recovery efforts for eagles in the Southwest...The ABENWP coordinates banding of eagles, documents disturbances at nest sites, provides on-site protection, and intervenes as necessary to reduce harassment or as otherwise needed for the benefit of eagles. This intervention has proven to be very effective in maintaining the southwestern bald eagle population. The ABENWP has "rescued" up to 50 percent of the fledglings produced in a year. These rescue operations include removing fishline and tackle from nestlings and adults, and returning nestlings to their nests after they fell or jumped out of the nest in response to disturbance or to escape extreme heat..."

[395] USFWS 1997a

"…the Arizona population remains small and under threat from a variety of factors. Threats persist largely due to the proximity of bald eagle breeding areas to major human population centers and recreation areas. Additionally, because water is a scarce resource in the Southwest, recreation is concentrated long available water courses. Some of the continuing threats and disturbances to bald eagles include entanglement in monofilament fish line and fish tackle; overgrazing and related degradation of riparian vegetation; malicious and accidental harassment, including shooting, off-road vehicles, recreational activities (especially watercraft), and low-level aircraft overflights; alteration of aquatic and riparian systems for water distribution systems and maintenance of existing water development features such as dams or diversion structures; collisions with transmission lines; poisoning; and electrocution. In Arizona, the use of breeding area closures and close monitoring of nest sites through the ABENWP has been and will continue to be essential to the recovery of the species…"

"…The series of dams and reservoirs along this portion of the Salt River has greatly altered the rivers hydrologic regime and greatly affected aquatic and riparian habitats associated with the river. In the bald eagle breeding areas associated with Roosevelt Lake in the broad valley of the Tonto Basin, eagles generally place their nests in large cottonwood trees. The narrow, steep canyons where Apache, Canyon, and Saguaro lakes have been created, limit the potential for establishing stands of large cottonwood and willow trees…"[396]

The March 30, 1998, USFWS Biological Opinion for assignment to the City of Scottsdale of CAP [Central Arizona Project] water allocations belonging to Cottonwood Water Works, Inc. (CWW) an the Camp Verde Water System, Inc. (CVWS), states:

"…Arizona bald eagles are considered distinct behaviorally from bald eagles in the remaining lower 48 states in that they are frequently construct nests on cliffs. Of 111 nests known in 1992, 46 were in trees, 36 on cliffs, 17 on pinnacles, 11 in snags, and one on an artificial platform…Bald eagles in the southwest are additionally unique in that they lay eggs in January or February, which is early compared with bald eagles in other areas. It is believed that this is a behavioral adaptation to allow chicks to avoid the extreme desert heat of midsummer…"

"…the population remains small and under threat from a variety of factors. Threats persist largely due to the proximity of bald eagle breeding areas to major human population centers. Additionally, because water is a scarce resource in the southwest recovery region, recreation is concentrated long available water courses. Some of the threats and disturbances to bald eagle include entanglement in monofilament (fishing line) and fishing hooks,

[396] USFWS 1997b

overgrazing and related degradation of riparian vegetation, shooting, alteration of water systems for water distribution systems, maintenance of existing water development features such as dams or diversion structures, and disturbance from recreation. The use of breeding area closures and close monitoring through the Bald Eagle Nestwatch program have been and will continue to be essential to the recovery of this species…"

"…Groundwater pumping in Arizona has been repeatedly demonstrated to result in depletion of surface flows, degradation and loss of riparian habitats, and adverse impacts and local extirpation of aquatic and riparian flora and fauna (Miller, 1961 [Miller, R.R. 1961. Man and the changing fish fauna of the American southwest. Papers of the Michigan Academy of Science, Arts, and Letters XLVI:365-404.]; Hendrickson and Minckley, 1984 [Hendrickson, D.A. and W.L. Minckley. 1984. Cienegas – vanishing climax communities of the American southwest. Desert Plants 6(3):131-175.]; Stromberg, 1993 [Stromberg, J.C. 1993. Fremont cottonwood-Gooding willow riparian forests: a review of their ecology, threats, and recovery potential. Journal of the Arizona-Nevada Academy of Science 26(3):97-110.]; Glennon and Maddock, 1994 [Glennon, R.J. and T. Maddock, III. 1994. In search of subflow: Arizona's futile effort to separate groundwater from surface water. Arizona Law Review 36:567-610.]; Tellman *et al.*, 1997 [Tellman, B., R. Yarde, and M.G. Wallace. 1997. Arizona's changing rivers: how people have affected the rivers. University of Arizona, Tucson, AZ. 198 pp.]). …various studies predict that the accelerating amount of groundwater removal will begin to deplete Verde River flows in the near future (Owen-Joyce and Bell, 1983 [Owen-Joyce, S.J. 1984. Hydrology of a stream aquifer system in the Camp Verde area, Yavapai County, Arizona. Arizona Department of Water Resources Bulletin 2, Phoenix, Arizona. 219 pp.]; ADWR, 1994; Ewing *et al.*, 1994 [Ewing, D.B., J.C. Osterberg, and W.R. Talbot. 1994. Groundwater study of the Big Chino Valley, Technical Report. U.S. Bureau of Reclamation, Denver, Colorado.]; McGavock, 1996 [McGavock, E. 1996. Overview of groundwater conditions in the Verde Valley, Arizona. 9th Annual Symposium of the Arizona Hydrological Society. Prescott, AZ. Sept. 12-14, 1996.])…"

"…*Cumulative Effects of human Population Growth*

Growth is projected in Cottonwood to increase by 148% and in Camp Verde to increase by 158% between 1994 and 2040 (Arizona Department of Economic Security 1994). This dynamic growth would lead to increased development, increased contamination, increased wildfires, and increased alteration of the watershed and hydrologic regime.

Cumulative Effects of Economic Development

The growth projected for this region will be manifested through economic development, including housing, golf courses, businesses, industry, roads, schools, and other facilities for the population. These facilities will replace natural vegetation and cover large expanses of the floodplain and watershed with impermeable surfaces. A primary result will be the alteration of the watershed characteristics and changes in the hydrologic and sediment patterns, sources, and volumes...

Cumulative Effects of Future Visitation/Recreation

If all urban/suburban areas in Arizona continue to grow at the existing and anticipated rate, the Verde Valley and the Verde watershed will continue to experience rapid increases in recreational use of both private and public lands. The increase will be particularly focused on the Verde River and its riparian corridor. Bank compaction and erosion, channel morphology changes, riparian vegetation suppression and loss, increased pollution and trash, construction of picnicking another recreational facilities with the riparian corridor, and many other adverse impacts will destroy or adversely alter razorback sucker habitat and habitat for bald eagle prey species. Bald eagle will be subjected to increasing disturbance effects and may have increased problems with entanglement in monofilament fishing line..."[397] (USFWS 1998)

The April 19, 2002, USFWS Biological Opinion on the Apache Trout Enhancement Project, AESO/SE 2-21-02-F-101, states:

"...the Arizona population remains small and under threat from a variety of factors. 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 rural areas (USFWS 1999). The bald eagle population in Arizona is exposed to increasing hazards from the regionally increasing human population. These include extensive loss and modification of riparian breeding and foraging habitat through clearing of vegetation, changes in groundwater levels, and changes in water quality. Threats persist in Arizona largely due to the proximity of bald eagle breeding areas to major human population centers and recreation areas. Additionally, because water is a scarce resource in the Southwest, recreation is concentrated along available water courses. Some of the continuing threats and disturbances to bald eagles include entanglement in monofilament fish line and fish tackle; overgrazing and related degradation of riparian vegetation; malicious and accidental harassment, including shooting, off-road vehicles, recreational activities (especially watercraft), and low-level aircraft overflights; alteration of aquatic and riparian systems for water distribution systems and maintenance of existing water development features such as dams or diversion structures; collisions with transmission lines; poisoning; and electrocution (Stahlmaster

[397] USFWS 1998

1987). Contamination of Arizona bald eagles by heavy metals has also become a major concern.[398]

The February 21, 2003, USFWS Intra-Service Biological and Conference Opinion on Issuance of a Section 10(a)(1)(B) permit to Salt River Project for Operation of Roosevelt Lake, AESO/SE 2-21-03-F-0003 states:

"Productivity rates are lower in Arizona than the rest of the United States. There were 0.92 average young per occupied breeding area in Arizona before 1984 when there were less than 20 breeding areas, and 0.78 average young per occupied breeding area since 1984, as opposed to 0.96 average young per breeding in Alaska, Wisconsin, Florida, and Wisconsin (Arizona Game and Fish Department *in prep.*, Sprunt *et al.* 1973, McAllister *et al.* 1986, Kozie and Anderson 1991). The average productivity rate from 1971 to 2002 on the Verde River was 0.92; the average productivity rate for the rest of Arizona was 0.72.

Threats

Even though the bald eagle has been reclassified to threatened, and the status of the birds in the Southwest is on an upward trend, the Arizona population remains small and under threat from a variety of factors. 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 rural areas (U.S. Fish and Wildlife Service 1999). The bald eagle population in Arizona is exposed to increasing hazards from the regionally increasing human population. These include extensive loss and modification of riparian breeding and foraging habitat through clearing of vegetation, changes in groundwater levels, and changes in water quality. Threats persist in Arizona largely due to the proximity of bald eagle breeding areas to major human population centers and recreation areas. Additionally, because water is a scarce resource in the Southwest, recreation is concentrated along available water courses. Some of the continuing threats and disturbances to bald eagles include entanglement in monofilament fish line and fish tackle; overgrazing and related degradation of riparian vegetation; malicious and accidental harassment, including shooting, off-road vehicles, recreational activities (especially watercraft), and low-level aircraft overflights; alteration of aquatic and riparian systems for water distribution systems and maintenance of existing water development features such as dams or diversion structures; collisions with transmission lines; poisoning; and electrocution (Beatty *et al.* 1999; Stalmaster 1987). In Arizona, the use of breeding area closures and close monitoring of nest sites through the ABENWP has been and will

[398] USFWS 2002a

continue to be essential to the recovery of the species. Ensuring the longevity of the ABENWP is of primary concern to the Service (U.S. Fish and Wildlife Service 1999).

It is not known if the population of bald eagles in Arizona declined as a result of DDT contamination because records were not consistently kept during that time period. However, the possibility for contamination was present as DDT was used in Arizona and Mexico. Use of DDT in Mexico could potentially have contaminated waterfowl that then migrated through Arizona in addition to directly affecting juvenile and subadult eagles that traveled into Mexico. Many of the nest sites in Arizona are in rugged terrain not suitable for agricultural development, and may therefore have avoided the direct effects of DDT (Hunt *et al.* 1992). Concentrations of heavy metals in bald eagle eggs are a concern in Arizona. Thirteen Arizona bald eagle eggs collected from 1994 to 1997 contained from 1.01 to 8.02 ppm dry weight mercury (Beatty *et al.* unpubl. data). Concentrations in the egg are highly correlated with risk to reproduction.

Adverse effects of mercury on bald eagle reproduction might be expected when eggs contain about 2.2 ppm mercury or more. Five of 10 eggs approached or exceeded the 2.2 ppm threshold concentration. Mercury concentrations in addled eggs appears to be increasing over time. Addled bald eagle eggs collected in Arizona in 1995-97 contained more than two- to six-times higher concentrations of mercury than eggs collected in 1982-84 (appx. 0.39-1.26 ppm) (K. King pers. comm.)...

The Arizona Game and Fish Department's (*in prep.*) draft Bald Eagle Conservation Assessment and Strategy provided a description of what is expected to occur in the future under the current management. They wrote, "it is reasonable to expect in the next two decades, the pairs (below Bartlett Dam) will have fewer trees in which to nest, roost, loaf, preen, and/or hunt. The (lower Verde River) breeding areas currently nest in overmature live trees, dying trees, or snags below dams with little regeneration. Poorly timed water releases, scouring, off-road vehicles, development, grazing, woodcutting, and agriculture threaten the riparian area. Managing agencies must minimize the factors impairing riparian vegetation to maintain the current distribution and abundance of eagles on the lower Verde River..." This document has been reviewed twice by the representatives of the Southwestern Bald Eagle Management Committee, including the U.S. Fish and Wildlife Service, Arizona Game and Fish Department, Reclamation, and SRP (J. Driscoll, Arizona Game and Fish Department, pers. comm.).

In the absence of concerted efforts to reverse habitat trends, we expect over the next 50 years that 5 of the lower Verde bald eagle breeding areas dependent on trees for nesting and perching will be lost due to continued riparian habitat degradation, prevention of habitat regeneration, and catastrophic fire. Because the Needle Rock, Box Bar, Fort McDowell, Doka, Sycamore, Rodeo, and Granite Reef breeding areas are in such close proximity, each pair is highly dependent on the existing over-mature trees in each breeding area for nesting and foraging, loafing, feeding, display, and/or sentry perches. As these trees continue to die and fall over, territories will be lost because there is little regeneration or growth of younger trees for replacement and as a result, there are not enough trees for nesting and foraging. Some multi-storied vegetation is developing along the Verde River between Sycamore Creek and the Fort McDowell Yavapai Nation/Salt River Pima Maricopa Indian Community boundary in the Sycamore and Rodeo breeding areas, possibly as a result of the introduction of sediment and nutrients from Sycamore Creek (W. Graf, University of South Carolina, pers. comm., J. Stromberg, Arizona State University, pers. comm.). Unfortunately, due to the proximity of Highway 87 and the growth of salt cedar, fire is a great risk to the longevity of this vegetation (J. Stromberg, Arizona State University, pers. comm., U.S. Fish and Wildlife Service 2002b)."[399]

20. A new CBD population viability analysis, based on AGFD survival estimates, demonstrates a high risk of extinction for this population within the next 57 and 82 years.[400]

The first widespread survey of Desert Nesting Bald Eagles in Arizona was done in 1975.[401] The authors estimated that they surveyed 90% of potential habitat in Arizona, New Mexico and along the Colorado River, but did not offer estimates for probabilities of missed Breeding Areas (BAs). They found 21 BAs, 18 adults, and 5 fledglings.[402] In 2003, AGFD reported 47 BAs, 42 occupied with 77 adults and 25 fledglings.[403]

In February 2003, CBD concluded, and presented publicly, that in spite of rising population figures, the Desert Nesting Bald Eagle population would likely face extinction within 60 to 100 years.[404] We based this finding on published AGFD data and Hunt *et al.* (1992).[405]

In response, AGFD agreed to share unpublished data in order to work cooperatively to improve the predictability of the population model for the Desert

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[399] USFWS 2003b

[400] AGFD 1999a, 2001a, 2001b, 2001c, 2002a, 2002b, 2003, 2004c, 2004d, unpublished data; Beatty 1990a, 1990b, 1992,1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1997, 1998; CBD 2003a, 2004e; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Hunt *et al.* 1992

[401] Rubink and Podborny 1976

[402] Ibid.

[403] AGFD 2004d

[404] Arizona Republic 2003a, CBD 2003a

[405] AGFD 1999a, 2001a, 2001b, 2001c, 2002a, 2002b; Beatty 1990a, 1990b, 1992, 1993, 1994, 1996a, 1996b; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1997, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Hunt *et al.* 1992

Nesting Bald Eagle.[406] Our 2003 conclusion concerning likely extinction probability remains unchanged in 2004.[407]

Despite debate concerning the utility of population models, extinction time distributions from stochastic population models remain the best available means to translate all the uncertainties and variables in vital rates into a range of population outcomes.[408] Using AGFD median estimates for juvenile and adult survival, we now estimate that the Desert Nesting Bald Eagle population faces a high risk of extinction ("median years to extinction") in the next 57 to 82 years.[409]

For purposes of the population model, and consistent with documented observations, the Desert Nesting Bald Eagle is treated as a closed population not demographically linked to other populations. Exchanges with other populations are extremely rare as shown by band returns, direct observation, genetics, morphology and behavior.[410]

All available data on numbers of known BAs, numbers of occupied BAs and numbers of fledglings since 1970 as well as survival estimates were taken from published and unpublished records of AGFD and others.[411] Vital rate estimates were entered into the Vortex version 9 model (www.vortex9.org) to produce corresponding ranges of extinction time and extinction probability estimates.

Specific IDs of sexes were lacking in most cases. The estimate of total adults at BAs was halved to estimate total adult female population, assuming a 50% adult sex ratio. For the purposes of population modeling, we assumed that "birth" was represented by number of nestlings rather than eggs laid, as counts of numbers of eggs are less accurate than those of nestlings. Nestling counts are also more useful than using fledgling counts. Most BAs except in core areas around the Salt-Verde confluence, have been monitored by flights. Nestlings are scored as having fledged if they reach 8 weeks of age.[412] This overestimates actual fledging, as nestlings scored as having fledged may have died after the observation. Only more intensive search could resolve if an individual had died rather than fledged. Nestling counts do also carry some uncertainty, however. Accordingly, nestlings counts were given minimum and maximum numbers for each year and BA. The maximum count was set equal to the high number of eggs (eg. for 1+ nestlings or eggs if nestlings unknown, high nestling number set to 2). There was no significant time trend in the low estimate of the number of young per BA, but the high estimate showed significant positive trend. The number of fledglings per BA does show significant declining trend with time, however (Fig. 2). This indicates a declining trend in survival of nestlings to fledgling stage.

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[406] AGFD personal communication

[407] CBD 2004e

[408] Brook *et al.* 2002

[409] CBD 2004e

[410] AGFD 1994b, 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Ohmart and Sell 1980; Stalmaster 1987; SWCBD 1999; USFWS 1982, 1997a, 1997b, 1998, 2000a, 2002a, 2003a, 2003b

[411] AGFD 1999a, 2000, 2001a, 2001b, 2001c, 2002a, 2002b, 2003, 2004c, 2004d, unpublished data; Beatty 1990a, 1990b, 1992,1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1997, 1998; CBD 2004e; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Hunt *et al.* 1992

[412] AGFD unpublished data

Fecundity in the lower Verde and Salt BAs was inflated artificially by AGFD's stocking of exotic rainbow trout and by Salt River Project's release of native fish captured from irrigation canals into this area.[413] To test for this effect, we divided BAs into 2 groups, those on the lower Salt River or lower Verde River up to Horseshoe Dam, and those outside this area.

[413] AGFD 2004d

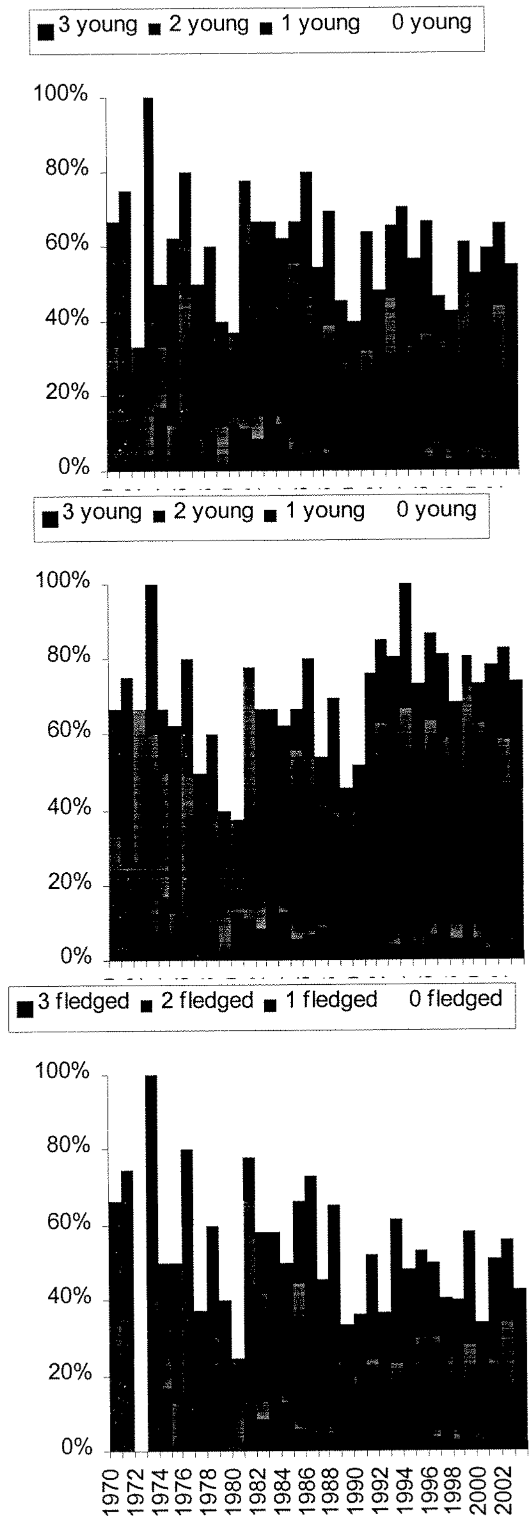

Figure 2. Percent of occupied, failed or successful BAs producing no, one, two or three young, low (top) and high (middle) estimates in each year and producing one two or three fledglings (bottom). Ordinal logistic regressions on year not significant for low young estimates, but significant and positive for high young estimates and significant and negative for fledgling production (P=0.038).

Lower estimates of productivities (nestlings/occupied BA) were significantly different between the two groups, being 50% higher in the Lower Verde/Salt cluster than at all other BAs (two-tailed t-test P=0.01). Productivity estimates were 1.23 for the Lower Verde/Salt cluster and 0.866 elsewhere. Upper estimates were not significantly different. The number of fledglings/occupied BA were also found to be significantly different (45% greater) in the Lower Verde/Salt cluster (two-tailed t-test P=0.03). The productivity of non-supplemented BAs was lower than the average of 0.96 young per occupied BA found in other states (AGFD 1999), while the productivity of supplemented BAs was substantially higher.

The lower Verde/Salt cluster of BAs were excluded for purposes of estimation of natural un-supplemented fecundity (Table 1). Using low estimates of nestling numbers and high estimates of adult numbers we derived low estimates for percent females producing nestlings in each year. Using high estimates of nestling numbers and low estimates of adult numbers, we derived high estimates of percent females producing nestlings in each year. Environmental standard deviations (ESD) were estimated by the method of Akcakaya (2002)[414] (Table 1).

Vortex does not allow for an age-specific fecundity schedule. All adults are assumed to have the same fecundity. We used the modal rather than the earliest observed age of reproduction. Males have been recorded reproducing at 3 (sub-adults), with modal age of 4. Females have been recorded reproducing at 4, with modal age of 5. The oldest observed reproducing male was 22 years old (87M25 in 2003), and the oldest observed female 16 (87F26 in 1997 and 87J15 in 2003). A 25-year age of final reproduction was used for modeling purposes.

We estimated survival from nestling to fledgling using high and low estimates of nestling numbers. Nestling survival to fledging (low estimate) declined significantly with time (ordinal logistic regression P<0.001). The high estimate also declined with time but was only marginally significant (ordinal logistic regression P=0.127). Accordingly only the most recent period 1993-2003 was used to estimate nestling-fledgling survival for modeling purposes. The respective estimates of 47.3 (0.8% ESD) and 76.6 (7.9% ESD) were necessarily associated with the high and low estimates of percent of females successfully breeding (Table 1).

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[414] Akcakaya 2002

Table 1: Fecundity parameter estimates 1970-2003, excluding the lower Salt and Verde BA cluster

Parameter	Low	High
% females producing nestlings	53.46% (18.24% ESD)	72.98% (26.27% ESD)
% females producing nestlings (ignoring Occupied BAs, avg nestling estimates)		75.95% (15.23% ESD)
% successful females producing 1 nestlings	40.73	27.16
% successful females producing 2 nestlings	54.84	66.67
% successful females producing 3 nestlings	4.43	6.17

We did not attempt to derive independent estimates for post-fledging survival because the record of resightings available to us may not have been complete. AGFD estimated age and stage specific survival from resightings of marked nestlings using the program MARK.[415] Because resighting observations were restricted to BAs, survival of juveniles can only be determined after a cohort has reached adulthood so that they can be resighted at breeding areas.

Some adult aged individuals not sighted at a breeding area may yet be alive and may form part of the non-breeding "floater" population. If they are presumed dead when not resighted as adults, survival to adult stage is underestimated. This is not a significant problem for population modeling, however, as floaters are non-breeding and do not appear at breeding areas. Although their survivorship may have been underestimated, fecundity is overestimated in a compensatory way by ignoring "floaters" and calculating fecundity based on the population found at breeding areas.

The AGFD best fitting model estimated survival from fledging to age 4 (maturity) at 0.28(0.147-0.466, 95% CI). For adults, annual survival was estimated at 0.877 (0.785-0.936, 95% CI).[416]

The latter estimate may underestimate survival of all adults either occupying or breeding in BAs. Adults actually breeding (producing eggs) were significantly more likely to have a known age and identity, and therefore to be used in survival estimation than adults at BAs scored only as "occupied." Conversely adults in occupied BAs were less likely to be recognized and so would more often be presumed dead. This is a problematic bias as the count of adults at occupied BAs was included in calculation of the percent of females breeding successfully. One way around this bias is to only count adults at successful or failed BAs and ignore adults at occupied BAs for purposes of fecundity estimation. This inflates fecundity but in a fashion that compensates somewhat for the downward bias in survival estimation. Rather than use minimum and maximum numbers of nestlings to bracket this estimate, the average of the two was used. This estimate is shown in Table 1.

Although AGFD found consistently lower male survival, they did not find it was statistically significant. Observed nestling sex ratio determined during banding

[415] AGFD unpublished data

[416] Ibid.

averaged 65% males.[417] Thus male mortality would have to be higher than females to result in a 50:50 adult sex ratio at breeding areas. Such a sex ratio must apply to the population at breeding areas, although there may be more males in the floater population. Therefore mortality estimates were sex-corrected to result in a 50% sex ratio in the adult population (Table 2). Use of uncorrected mortalities resulted in underestimation of female numbers and overestimation of extinction risk.

A phenomenon peculiar to Desert Nesting Bald Eagles that corroborates AGFD's high adult mortality estimates is the unusually high proportion of sub-adults attempting to breed. From 1987 to 1990, Hunt *et al.* (1992) counted 39 individuals recruited into the breeding pool, of which 61.5% (n=24) were in subadult plumage. From 1991 to 1998, of 66 such recruits, 29% (n=19) were in subadult plumage.[418] No subadult breeding has produced fledglings. Outside Arizona, the known incidence of subadults attempting to breed is rare (0.02%).[419] AGFD has suggested that this phenomenon results from "an insufficiency of adults in the floating segment" of the population, most likely due to high adult mortality.[420]

Juvenile mortality is also unusually high. From 1987 to 1999, there were 214 fledglings.[421] However, 97 or 41% of this number of fledglings were subsequently found dead. This corroborates the high level of mortality of juveniles (mean 72%, lower 95% CI 54%) estimated by AGFD.

We used AGFD survival estimates to estimate juvenile number in 2003 from nestling numbers in each of the four years prior to 2003. We arrive at an estimated population size of 166 Desert Nesting Bald Eagles in Arizona by combining our estimate of juvenile numbers with AGFD estimates of adults and nestling numbers. We started our simulations from stable rather than observed age/sex distribution. We ran multiple simulations of Vortex with parameter combinations to bracket the greatest range of uncertainty in the data. In addition, five simulations varied key parameters by 10% to examine sensitivity of the model to a fixed 10% change in vital rates (Table 2).

The baseline scenario used the low estimate of annual proportions of females breeding and proportions of breeding females with 1, 2 or 3 young (Table 1), the high estimate of nestling to fledging survival and the AGFD estimates of juvenile and adult survival. Nearly 100% of simulated populations went extinct within 100 years (Fig. 3, top graph).

The "Bias correction" scenario counted female adults, excluding "occupied" BAs, and excluding the lower Verde/Salt cluster. The numbers of nestlings were calculated as the average of low and high estimates. This correction was done to account for the possibility that survival to adult stage had been underestimated by the bias toward resightings at breeding nests. However, this bias correction did not appreciably change predicted extinction time or probability (Table 2, Figure 3, middle graph).

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[417] Ibid.

[418] Ibid.

[419] Hunt *et al.* 1992

[420] AGFD 1994b

[421] AGFD 1999a, 2000

The "Hi Fec." scenario used the maximum estimates of nestling numbers in each BA and year, but excluding the lower Verde/Salt cluster (Table 1). However, this required the use of the low estimate of nestling to fledgling survival, which was based on the high nestling estimate. Extinction time projections were worse than baseline under this scenario (Table 2).

The "Hi Sjuv" scenario used the upper 95% confidence interval of juvenile survival (fledging to age 4) as reported by AGFD.[422] This resulted in a dramatic reduction in extinction risk to 15% in 100 years with a lambda close to stationary value of 1.0 (Table 2). Models utilizing upper 95% confidence intervals are controversial owing to the fact that they are at the margin or high end of the range of known variation in survival estimates. They are best-case scenarios.[423]

The "Hi Sad" scenario used the upper 95% confidence interval of adult survival as reported by AGFD.[424] This also resulted in a dramatic reduction in extinction risk to just 4% in 100 years with a lambda close to stationarity, but nevertheless with a slow average population decline over the model timeframe (Table 2, Figure 3, bottom graph).

Inclusion of 10% ESD for mortality estimates, as opposed to the baseline of zero, resulted in a fourfold increase in extinction risk for the "Hi Sad" scenario from 4% to 16%, without any change in lambda (Table 2).

A nestling sex ratio of 50% was used instead of the 65% observed, with concomitant removal of sex differentials in mortalities. This did not greatly alter the results of the baseline scenario (Table 2).

Simulations increasing % successful females, % with 2 nestlings, % nestling survival, % juvenile survival and % adult survival by 10% in turn, showed that juvenile and adult survival were the most critical parameters for the model, confirming qualitative arguments by Stalmaster (1987) among others. These parameters are expected to be more important simply because their influence extends across so many year classes.

The foregoing analysis was based on the assumption of indefinite continuation of the same environmental conditions and vital rates that have prevailed in recent years. However this assumption is not justified by available evidence. The risk of extinction for this population is undoubtedly even much higher owing to the fact that threats to its continued existence are increasing.[425]

No catastrophes, no heavy metal toxicity, no declines in habitat extent and quality (i.e., native fish decline, habitat loss, lack of nest tree recruitment, urban sprawl, stream dewatering), no habitat carrying capacity, and no inbreeding factors were included in the simulations. All of these factors aggravate extinction risk.

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[422] AGFD unpublished data

[423] CBD 2004e

[424] AGFD unpublished data

[425] ADWR 1994, 1999; AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004a, 2004b, 2004c; Arizona Daily Sun 2004; Arizona Republic 2000, 2001, 2003b, 2003c, 2004a, 2004b; CBD 2003b; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Hunt *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; SWRAG 2000; SWCBD 1999; USGS 2000; USFWS 1993b, 1997a, 1997b, 1998, 1999a, 2000a, 2002a, 2003a, 2003b, 2003e; Verde Natural Resources Conservation District 1999

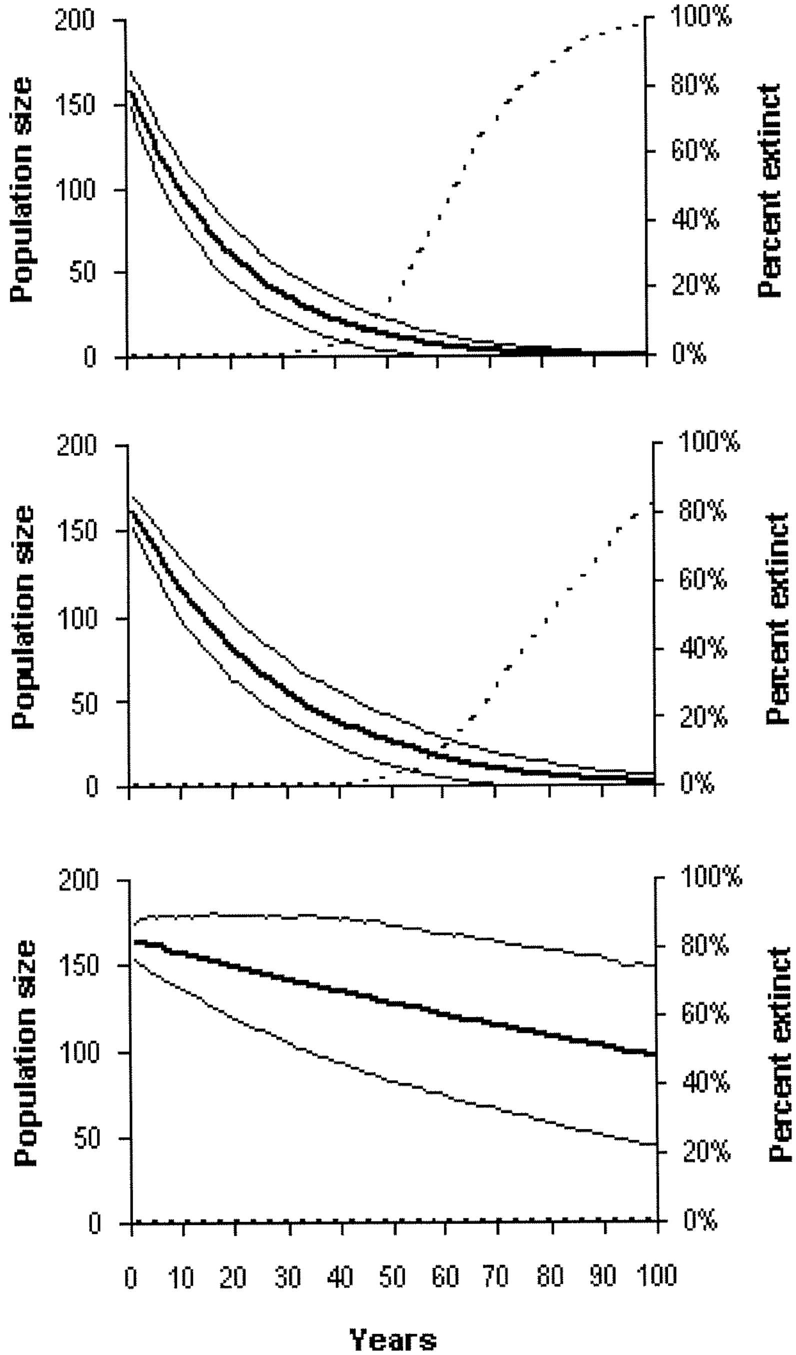

Figure 3. Means (+/- S.D.) of population sizes and percent of simulations extinct (dashed line) for top: baseline scenario; middle: bias corrected scenario; and bottom: upper 95% CI of adult survival.

TABLE 2. Vortex simulations, parameters and results. All simulations were run 1000 times for 100 model years. Blank cells indicate parameters same as baseline.

Model	Base-line	Bias correct-ion	Hi Fec.	Hi Sjuv	Hi Sad	Hi Sad+EV	50% males	1.1x fec.	1.1x 2 fledg	1.1x Snest	1.1x Sj	1.1 x Sad
Population initial	166											
K	250											
Age females mature	5											
Age males mature	4											
High breeding age	25											
% females breeding	53.5%	76.0%	74.0%					58.9%				
EV in % breeding	18.2%	15.2%	26.3%									
% w 1 nestlings	40.7%	33.9%	27.2%						36.6%			
% w 2 nestlings	54.8%	60.7%	66.7%						60.3%			
% w 3 nestlings	4.5%	5.4%	6.2%						3.1%			
Nestling sex ratio %males	65.0%						50.0 %					
FEMALES												
Mortality Nestling->1	40.5%	49.3%	63.3%	32.4%			44.3 %			34.6%	34.6%	
EV in Mort N->1	0.0%					10.0%						
Mortality 1->2	22.3%			11.8%			27.3 %				14.6%	
EV in Mort 1->2	0.0%					10.0%						
Mortality 2->3	22.3%			11.8%			27.3 %				14.6%	
EV in Mort 2->3	0.0%					10.0%						
Mortality 3->4	22.3%			11.8%			27.3 %				14.6%	
EV in Mort 3->4	0.0%					10.0%						
Mortality 4->5+	12.3%				6.4%	6.4%						3.5%
EV in Mort 4->5+	0.0%					10.0%						
MALES												
Mortality Nestling->1	49.0%	53.9%	68.5%	42.1%			44.3 %			43.9%	43.9%	
EV in Mort N->1	0.0%					10.0%						
Mortality 1->2	33.5%			24.4%			27.3 %				26.8%	
EV in Mort 1->2	0.0%					10.0%						
Mortality 2->3	33.5%			24.4%			27.3 %				26.8%	
EV in Mort 2->3	0.0%					10.0%						
Mortality 3->4	33.5%			24.4%			27.3 %				26.8%	
EV in Mort 3->4	0.0%					10.0%						
Mortality 4->5+	12.3%				6.4%	6.4%						3.5%
EV in Mort 4->5+	0.0%					10.0%						
RESULTS												
Lambda	0.952	0.967	0.947	0.995	0.995	0.995	0.96	0.96	0.953	0.96	0.984	1.016
Median years to extinction	66	82	57	>100	>100	>100	73	74	67	74	>100	>100
% extinct 100 yrs	96.5%	82.2%	99.5%	15.0%	4.0%	16.0%	89.1 %	89.2%	95.5%	89.6%	12.6%	0.0%

IV. ESA law and USFWS population policy and precedent require Endangered status with Critical Habitat for the Desert Nesting Bald Eagle Distinct Population Segment.[426]

1. Loss of this discrete population would result in a significant gap in the range of the Bald Eagle.[427]

For more than 20 years, USFWS has recognized the fact that the Southwest represents a significant portion of the Bald Eagle range.[428] It follows logically then that loss of the Desert Nesting population would result in a significant gap in the range of the Bald Eagle.

Several authors have speculated about the consequences of this population's loss.[429] CBD can find no credible evidence that Bald Eagles elsewhere possess the ability to adapt to the unique and hostile environmental habitat in which the Desert Nesting population has evolved. Hunt et al. (1992) says,

> "...were the [Southwestern Desert Nesting Bald Eagle] population extirpated, there is no firm reason to believe that bald eagles released into Arizona from elsewhere would posses the adaptations required to increase their numbers. Furthermore, releases to augment a reduced population in Arizona might be deleterious because of genetic disruption of existing adaptations.[430]

Similarly, AGFD (1994b) says,

> "...Because Arizona continues to possess nearly the entire breeding population within the Southwestern Region, concerns remain over retaining the genetic integrity of this population...Should a population crash occur in Arizona, the pool of eagles to repopulate the Southwest could be left to the few pairs in the neighboring states or Mexico. However, at this time, there is no documentation of eagles from these neighboring Southwestern states breeding in Arizona or *vice versa*."[431]

2. The Southwestern Desert Nesting Bald Eagle Population is truly a Distinct Population Segment.[432]

The Desert Nesting Bald Eagle population is isolated and discrete from other Bald Eagle populations as a consequence of physical, physiological, ecological, and

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[426] CBD 2004d; ESA Sections 3 & 4; SWCBD 1999;
[427] AGFD 1994b, 1999a, 2000; Hunt *et al.* 1992; SWCBD 1999; USFWS 1982, 1994a, 1995, 2001a
[428] Hunt *et al.* 1992; USFWS 1982, 1994a, 1995, 2001a
[429] AGFD 1994b, Hunt *et al.* 1992
[430] Hunt *et al.* 1992
[431] AGFD 1994b
[432] AGFD 1994b, 1999a, 2000, 2004c, 2004d; Beatty 1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1998; CBD 2004e; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Ohmart and Sell 1980; SWCBD 1999; Stalmaster 1987; USFWS 1982, 1997a, 1997b, 1998, 2000a, 2002a, 2003a, 2003b

behavioral factors.[433] We have already documented the facts that the population (a) persists in the unique ecological setting of the Sonoran life zones of the desert Southwest,[434] (b) is smaller than other Bald Eagles,[435] (c) is behaviorally unique,[436] (d) is reproductively isolated,[437] that the current understanding of genetics does not refute its discrete and isolated nature,[438] and that its loss would result in a significant gap in the range of the Bald Eagle.[439]

"[B]ald eagles in the southwestern United States have been considered as a distinct population for the purposes of consultation and recovery efforts under the Act."[440] USFWS population policy reads as if the Desert Nesting population were its model:

> "...SUMMARY: The Fish and Wildlife Service and the National Marine Fisheries Service (Services) have adopted a policy to clarify their interpretation of the phrase ``distinct population segment of any species of vertebrate fish or wildlife" for the purposes of listing, delisting, and reclassifying species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et. seq.) (Act).
>
> Policy
>
> Three elements are considered in a decision regarding the status of a possible DPS as endangered or threatened under the Act. These are applied similarly for addition to the lists of endangered and threatened wildlife and plants, reclassification, and removal from the lists:
>
> 1. Discreteness of the population segment in relation to the remainder of the species to which it belongs;
> 2. The significance of the population segment to the species to which it belongs; and
> 3. The population segment's conservation status in relation to the Act's standards for listing (i.e., is the population segment, when treated as if it were a species, endangered or threatened?).
>
> Discreteness: A population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions:

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433 AGFD 1994b, 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Ohmart and Sell 1980; Stalmaster 1987; SWCBD 1999; USFWS 1982, 1997a, 1997b, 1998, 2000a, 2002a, 2003a, 2003b

434 AGFD 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Hunt *et al.* 1992; Ohmart and Sell 1980; USFWS 1982, 1997a, 1997b, 1998, 2000a, 2002a, 2003a, 2003b;

435 AGFD 1999a, 2000; Hunt *et al.* 1992; USFWS 1997a, 1997b, 1998, 2002a, 2003b

436 AGFD 1999a, 2000; Beatty 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1998; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Stalmaster 1987; USFWS 1997a, 1997b, 1998, 2002a, 2003b

437 AGFD 1994b, 1999a, 2000; Beatty and Driscoll 1996b; Hunt *et al.* 1992; SWCBD 1999; USFWS 1997a, 1997b, 1998, 2002a, 2003b

438 CBD 2004e, Hunt *et al.* 1992, SWCBD 1999

439 AGFD 1994b, 1999a, 2000; Hunt *et al.* 1992; SWCBD 1999; USFWS 1982, USFWS 1995, 2001a

440 USFWS 2003b

1. It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation...

Significance: If a population segment is considered discrete under one or more of the above conditions, its biological and ecological significance will then be considered in light of Congressional guidance (see Senate Report 151, 96th Congress, 1st Session) that the authority to list DPS's be used "* * * sparingly" while encouraging the conservation of genetic diversity. In carrying out this examination, the Services will consider available scientific evidence of the discrete population segment's importance to the taxon to which it belongs. This consideration may include, but is not limited to, the following:

1. Persistence of the discrete population segment in an ecological setting unusual or unique for the taxon,
2. Evidence that loss of the discrete population segment would result in a significant gap in the range of a taxon...
Because precise circumstances are likely to vary considerably from case to case, it is not possible to describe prospectively all the classes of information that might bear on the biological and ecological importance of a discrete population segment.

Status: If a population segment is discrete and significant (i.e., it is a distinct population segment) its evaluation for endangered or threatened status will be based on the Act's definitions of those terms and a review of the factors enumerated in section 4(a). It may be appropriate to assign different classifications to different DPS's of the same vertebrate taxon."[441]

CBD has reviewed all USFWS listings of Distinct Population Segments.[442] USFWS has listed 39 populations as Distinct Population Segments since the USFWS (1996a) DPS rule:[443]

Common	Scientific	Final
Mexican duck (U.S. DPS)	Anas diazi (U.S. DPS)	1967 03-11-67 (32 FR 04001)
Gray wolf (Eastern DPS)	Canis lupus (Eastern DPS)	1967 03-11-67 (32 FR 04001)
Gray wolf (Southeastern DPS)	Canis lupus (Southeastern DPS)	1967 03-11-67 (32 FR 04001)
Gray wolf (Western DPS)	Canis lupus (Western DPS)	1967 03-11-67 (32 FR 04001)
Bald eagle (Continental U.S. DPS)	Haliaeetus leucocephalus (Continental U.S. DPS)	1967 03-11-67 (32 FR 04001)

441 USFWS 1996a

442 CBD 2004d

443 Ibid.

Columbian white-tailed deer (Columbia River DPS)	Odocoileus virginianus leucurus (Columbia River DPS)	1967 03-11-67 (32 FR 04001)
Columbian white-tailed deer (Douglas County DPS)	Odocoileus virginianus leucurus (Douglas County DPS)	1967 03-11-67 (32 FR 04001)
Gila topminnow (U.S. DPS)	Poeciliopsis occidentalis (U.S. DPS)	1967 03-11-67 (32 FR 04001)
Yuma clapper rail (U.S. DPS)	Rallus longirostris yumanensis (U.S. DPS)	1967 03-11-67 (32 FR 04001)
Everglade snail kite (FL DPS)	Rostrhamus sociabilis plumbeus (FL DPS)	1967 03-11-67 (32 FR 04001)
Gray Whale (non-Northeast Pacific DPS)	Eschrichtius robustus pop. 1	1970 06-02-70 (35 FR 08491)
Gray whale (northeast Pacific DPS)	Eschrichtius robustus pop. 3	1970 06-02-70 (35 FR 08491)
Brown pelican (southeastern DPS)	Pelecanus occidentalis (southeastern DPS)	1970 10-13-70 (35 FR 16047)
Brown pelican (western DPS)	Pelecanus occidentalis (western DPS)	1970 10-13-70 (35 FR 16047)
Light-footed clapper rail (U.S. DPS)	Rallus longirostris levipes (U.S. DPS)	1970 10-13-70 (35 FR 16047)
Grizzly bear (Continental U.S. DPS)	Ursus arctos horribilis (Continental U.S. DPS)	1975 07-28-75 (40 FR 31734)
Bahama swallowtail butterfly (U.S. DPS)	Heracilides andraemon bonhotei (U.S. DPS)	1976 04-28-76 (41 FR 17736)
Gray wolf (Southwest DPS)	Canis lupus (Southwest DPS)	1976 04-28-76 (41 FR 17740)
Pine barrens treefrog (Florida DPS)	Hyla andersonii (Florida DPS)	1977 11-11-77 (42 FR 58754)
Woodland caribou (Selkirk DPS)	Rangifer tarandus caribou (Selkirk DPS)	1983 01-14-83 (48 FR 01722) EM; 1983 10-25-83 (48 FR 49245) EM; 1984 02-29-84 (49 FR 07390) F
Wood stork (U.S. breeding DPS)	Mycteria americana Wood stork (U.S. breeding DPS)	1984 02-28-84 (49 FR 07332)
Mariana fruit bat (Guam DPS)	Pteropus mariannus mariannus (Guam DPS)	1984 08-27-84 (49 FR 33881)
Least tern (Interior DPS)	Sterna antillarum (Interior DPS) (=Sterna antillarum athalassos)	1985 05-28-85 (50 FR 21784)
Flattened musk turtle (Black Warrior River DPS)	Sternotherus depressus (Black Warrior River DPS)	1987 06-11-87 (52 FR 22418)
Audubon's crested caracara (Florida DPS)	Polyborus plancus audubonii (=Caracara cheriway audubonii) (Florida DPS)	1987 07-06-87 (52 FR 25229)
Gopher Tortoise (western DPS)	Gopherus polyphemus (western DPS)	1987 07-07-87 (52 FR 25376)
Roseate tern (Caribbean DPS)	Sterna dougallii dougallii (Caribbean DPS)	1987 11-02-87 (52 FR 42064)
Roseate tern (Northeast DPS)	Sterna dougallii dougallii (Northeast DPS)	1987 11-02-87 (52 FR 42064)
Desert tortoise (Mojave DPS)	Gopherus agassizii pop. 1	1989 08-04-89 (54 FR 32326) EM; 1990 04-02-90 (55 FR 12178) F
Steller sea-lion (eastern DPS)	Eumetopias jubatus (eastern DPS)	1990 04-05-90 (55 FR 12645) EM; 1990 11-26-90 (55 FR 49203) F

Steller sea-lion (western DPS)	Eumetopias jubatus (western DPS)	1990 04-05-90 (55 FR 12645) EM; 1990 11-26-90 (55 FR 49203) F
Chinook salmon (Sacramento River winter run DPS)	Oncorhynchus tshawytscha pop. 7	1990 04-06-90 (55 FR 12831) EM; 1990 11-30-90 (55 FR 49623) F
Rice rat (Lower Florida Keys DPS)	Oryzomys palustris natator (=Oryzomys palustris pop. 3)	1991 04-30-91 (56 FR 19809)
Sockey salmon (Snake River DPS)	Oncorhynchus nerka pop. 1	1991 11-20-91 (56 FR 58619)
Chinook salmon (Snake River fall run DPS)	Oncorhynchus tshawytscha pop. 2	1992 04-22-92 (57 FR 14653)
Chinook salmon (Snake River spring-summer run DPS)	Oncorhynchus tshawytscha pop. 8	1992 04-22-92 (57 FR 14653)
Marbled murrelet (OR, WA, CA DPS)	Brachyramphus marmoratus marmoratus (OR, WA, CA DPS)	1992 06-22-92 (57 FR 27848)
Western snowy plover (Pacific DPS)	Charadrius alexandrinus nivosus (Pacific DPS)	1993 03-05-93 (58 FR 12864)
White sturgeon (Kootanai River DPS)	Acipenser transmontanus pop. 1	1994 09-06-94 (59 FR 45989)
Coastal cutthroat trout (Umpqua River DPS)	Oncorhynchus clarki clarki (Umpqua River DPS)	1996 08-09-96 (61 FR 41514)
Coho salmon (Central California DPS)	Oncorhynchus kisutch pop. 4	1996 10-31-96 (61 FR 56138)
Copperbelly water snake (northern DPS)	Nerodia erythrogaster neglecta (northern DPS)	1997 01-29-97 (62 FR 04183)
Cactus ferruginous pygmy owl (AZ DPS)	Glaucidium brasilianum cactorum (AZ DPS)	1997 03-10-97 (62 FR 10730)
Steller's eider (AK breeding DPS)	Polysticta stelleri (AK breeding DPS)	1997 06-11-97 (62 FR 31748)
Coho salmon (southern OR and northern CA DPS)	Oncorhynchus kisutch pop. 2	1997 06-18-97 (62 FR 33038)
Steelhead trout (Southern California DPS)	Oncorhynchus mykiss pop. 10	1997 08-18-97 (62 FR 43937)
Steelhead trout (Upper Columbia River DPS)	Oncorhynchus mykiss pop. 12	1997 08-18-97 (62 FR 43937)
Steelhead trout (Snake River DPS)	Oncorhynchus mykiss pop. 13	1997 08-18-97 (62 FR 43937)
Steelhead trout (Central California DPS)	Oncorhynchus mykiss pop. 8	1997 08-18-97 (62 FR 43937)
Steelhead trout (South-central California coast DPS)	Oncorhynchus mykiss pop. 9	1997 08-18-97 (62 FR 43937)
Bog turtle (Northern DPS)	Clemmys muhlenbergii ((=Glyptemys muhlenbergii) Northern DPS)	1997 11-04-97 (62 FR 59605)
Bighorn sheep (Peninsular ranges DPS)	Ovis canadensis pop. 2	1998 03-18-98 (63 FR 13134)
Steelhead trout (Lower Columbia River DPS)	Oncorhynchus mykiss pop. 14	1998 03-18-98 (63 FR 13347)
Steelhead trout (Central Valley DPS)	Oncorhynchus mykiss pop. 11	1998 03-19-98 (63 FR 13347)
Coho salmon (Oregon Coast DPS)	Oncorhynchus kisutch pop. 3	1998 08-10-98 (63 FR 42587)
Chinook salmon (Lower Columbia River DPS)	Oncorhynchus tshawytscha pop. 1	1999 03-24-99 (64 FR 14308); 1999 08-02-99 (64 FR 41835)

Chinook salmon (Upper Columbia River spring run DPS)	Oncorhynchus tshawytscha pop. 12	1999 03-24-99 (64 FR 14308); 1999 08-02-99 (64 FR 41835)
Chinook salmon (Puget Sound DPS)	Oncorhynchus tshawytscha pop. 15	1999 03-24-99 (64 FR 14308); 1999 08-02-99 (64 FR 41835)
Chinook salmon (Upper Willamette River DPS)	Oncorhynchus tshawytscha pop. 23	1999 03-24-99 (64 FR 14308); 1999 08-02-99 (64 FR 41835)
Chum salmon (Hood Canal summer run DPS)	Oncorhynchus keta pop. 2	1999 03-25-99 (64 FR 14508); 1999 08-02-99 (64 FR 41835)
Chum salmon (Columbia River DPS)	Oncorhynchus keta pop. 3	1999 03-25-99 (64 FR 14508); 1999 08-02-99 (64 FR 41835)
Steelhead trout (Upper Willamette River winter run DPS)	Oncorhynchus mykiss pop. 33	1999 03-25-99 (64 FR 14517); 1999 08-02-99 (64 FR 41835)
Sockey salmon (Ozette Lake DPS)	Oncorhynchus nerka pop. 2	1999 03-25-99 (64 FR 14528); 1999 03-25-99 (64 FR 14507)
California bighorn sheep (Sierra Nevada DPS)	Ovis canadensis pop. 3	1999 04-20-99 (64 FR 19300) EM; 2000 01-03-00 (65 FR 00020) F
Steelhead trout (Middle Columbia River DPS)	Oncorhynchus mykiss pop. 17	1999 08-02-99 (64 FR 41835)
Lake Erie water snake (off-shore DPS)	Nerodia sipedon insularum	1999 08-30-99 (64 FR 47126)
Chinook salmon (Central Valley spring run DPS)	Oncorhynchus tshawytscha pop. 11	1999 09-16-99 (64 FR 50393)
Chinook salmon (California Coast DPS)	Oncorhynchus tshawytscha pop. 17	1999 09-16-99 (64 FR 50393)
Bull trout (U.S. DPS)	Salvelinus confluentus (U.S. DPS)	1999 11-01-99 (64 FR 58909)
California tiger salamander (Santa Barbara DPS)	Ambystoma californiense (Santa Barbara DPS)	2000 01-19-00 (65 FR 03095) EM; 2000 09-21-00 (65 FR 57241) F
Canada lynx (U.S. DPS)	Lynx canadensis (U.S. DPS)	2000 03-24-00 (65 FR 16051)
Steelhead trout (Northern California DPS)	Oncorhynchus mykiss pop. 16	2000 06-07-00 (65 FR 36074)
Atlantic salmon (U.S. DPS)	Salmo salar pop. 5	2000 11-17-00 (65 FR 69459)
Pygmy rabbit (Columbia Basin DPS)	Brachylagus idahoensis pop. 2	2001 11-30-01 (66 FR 59734) EM; 2003 03-05-03 (68 FR 10388) F
Mississippi gopher frog (DPS)	Rana capito sevosa (Mississippi DPS) (=Rana sevosa)	2001 12-04-01 (66 FR 62993)
Mountain yellow-legged frog (Southern California DPS)	Rana muscosa pop. 1	2002 07-02-02 (67 FR 44382)
California tiger salamander (Sonoma County DPS)	Ambystoma californiense (Sonoma County DPS)	2002 07-22-02 (67 FR 47726) EM; 2003 03-19-03 (68 FR 13497) F
Smalltooth sawfish (U.S. DPS)	Pristis pectinata (U.S. DPS)	2003 04-01-03 (68 FR 15674)

USFWS' (1996a) discussion accompanying the Federal Register notice of DPS policy is also supportive of DPS designation for the Desert Nesting Bald Eagle population. USFWS responses to questions regarding the policy follow:

"[Question:] Only Full Species are Genetically Distinct From one Another, and Listing Should Only be Extended to These Genetically Distinct Entities.

[USFWS' response:] ...Restricting listings to full taxonomic species would render the Act's definition of species, which explicitly includes subspecies and DPS's of vertebrates, superfluous. Clearly the Act is intended to authorize listing of some entities that are not accorded the taxonomic rank of species, and the Services are obliged to interpret this authority in a clear and reasonable manner.

[Question:] The Services Should Focus on Genetic Distinctness in Recognizing a Distinct Population Segment. Conversely, Some Respondents Believed There Should be No Requirement That a DPS be Genetically Differentiated or Recognizable for it to be Protected by the Act.

[USFWS' response:] ...The Services understand the Act to support interrelated goals of conserving genetic resources and maintaining natural systems and biodiversity over a representative portion of their historic occurrence. The draft policy [59 FR 65885, December 21, 1994] was intended to recognize both these intentions, but without focusing on either to the exclusion of the other. Thus, evidence of genetic distinctness or of the presence of genetically determined traits may be important in recognizing some DPS's, but the draft policy was not intended to always specifically require this kind of evidence in order for a DPS to be recognized...Thus in determining whether the test for discreteness has been met under the policy, the Services allow but do not require genetic evidence to be used. At least one respondent evidently understood the draft policy to require that genetic distinctness be demonstrated before a DPS could be recognized, and criticized the draft on that basis. As explained above, this was never intended.

[Question:] The Elements Describing Reasons for Considering a Population Segment Significant Should be Laid Out Comprehensively, Rather Than Presented as an Open-Ended Set of Examples as in the Draft Policy.

[USFWS' response:] The Services appreciate the need to make a policy on this subject as complete and comprehensive as possible, but continue to believe that it is not possible to describe in advance all the potential attributes that could be considered to support a conclusion that a particular population segment is "significant" in terms of the policy. When a distinct population is accepted or rejected for review pursuant to a petition or proposed for listing or delisting, the Services intend to explain in detail why it is considered to satisfy both the discreteness and significance tests of the policy.

[Question:] In Assessing the Significance of a Potential Distinct Population Segment, the Services Should Focus on its Importance to the Status of the

Species to Which it Belongs. Alternatively, the Services Should Emphasize the Importance of a Potential DPS to the Environment in Which it Occurs.

[USFWS' response:] Despite its orientation toward conservation of ecosystems, the Services do not believe the Act provides authority to recognize a potential DPS as significant on the basis of the importance of its role in the ecosystem in which it occurs. In addition, it may be assumed that most, if not all, populations play roles of some significance in the environments to which they are native, so that this importance might not afford a meaningful way to differentiate among populations. On the other hand, populations commonly differ in their importance to the overall welfare of the species they represent, and it is this importance that the policy attempts to reflect in the consideration of significance.

[Question:] Complete Reproductive Isolation Should be Required as a Prerequisite to the Recognition of a Distinct Population Segment.

[USFWS' response:] The Services do not consider it appropriate to require absolute reproductive isolation as a prerequisite to recognizing a distinct population segment. This would be an impracticably stringent standard, and one that would not be satisfied even by some recognized species that are known to sustain a low frequency of interbreeding with related species…

[Question:] The Occurrence of a Population Segment in an Unusual Setting Should Not Be Used as Evidence for its Significance.

[USFWS' response:] The Services continue to believe that occurrence in an unusual ecological setting is potentially an indication that a population segment represents a significant resource of the kind sought to be conserved by the Act [Endangered Species Act]. In any actual cases of a DPS recognized in part on this basis, the Services will describe in detail the nature of this significance when accepting a petition or proposing a rule.

[Question:] The Services Should Stress Uniqueness and Irreplaceability of Ecological Functions in Recognizing DPS's.

[USFWS' response:] The Services consider the Act to be directed at maintenance of species and populations as elements of natural diversity. Consequently, the principal significance to be considered in a potential DPS will be the significance to the taxon to which it belongs. The respondent appears to be recommending that the Services consider the significance of a potential DPS to the community or ecosystem in which it occurs and the likelihood of another species filling its niche if it should be extirpated from a particular portion of its range. These are important considerations in general for the maintenance of healthy ecosystems, and they often coincide with conservation programs supported by the Act. Nevertheless, the Act is not intended to establish a comprehensive biodiversity conservation program, and it would be improper for the Services to recognize a potential DPS as significant and afford it the Act's substantive protections solely or primarily on these grounds.

[Question:] Congress did not Intend to Require That DPS's be Discrete. In a Similar Vein, Congress did not Require That a Potential DPS be Significant to be Considered Under the Act.

[USFWS' response:] With regard to the discreteness standard, the Services believe that logic demands a distinct population recognized under the Act be circumscribed in some way that distinguishes it from other representatives of its species. The standard established for discreteness is simply an attempt to allow an entity given DPS status under the Act to be adequately defined and described. If some level of discreteness were not required, it is difficult to imagine how the Act could be effectively administered or enforced. At the same time, the standard adopted does not require absolute separation of a DPS from other members of its species, because this can rarely be demonstrated in nature for any population of organisms. The standard adopted is believed to allow entities recognized under the Act to be identified without requiring an unreasonably rigid test for distinctness. The requirement that a DPS be significant is intended to carry out the expressed congressional intent that this authority be exercised sparingly as well as to concentrate conservation efforts undertaken under the Act on avoiding important losses of genetic diversity.

[Question:] A Population Should Only be Required to be Discrete or Significant, But Not Both, to be Recognized as a Distinct Population Segment.

[USFWS' response:] The measures of discreteness and significance serve decidedly different purposes in the policy, as explained above. The Services believe that both are necessary for a policy that is workable and that carries out congressional intent. The interests of conserving genetic diversity would not be well served by efforts directed at either well defined but insignificant units or entities believed to be significant but around which boundaries cannot be recognized.

[Question:] Requiring That a DPS be Discrete Effectively Prevents the Loss of Such a Segment From Resulting in a Gap in the Distribution of a Species. Essentially, if Distinct Populations are Entirely Separate, the Loss of One Has Little Significance to the Others.

[USFWS' response:] If the standard for discreteness were very rigid or absolute, this could very well be true. However, the standard adopted allows for some limited interchange among population segments considered to be discrete, so that loss of an interstitial population could well have

> consequences for gene flow and demographic stability of a species as a whole. On the other hand, not only population segments whose loss would produce a gap in the range of a species can be recognized as significant, so that a nearly or completely isolated population segment could well be judged significant on other grounds and recognized as a distinct population segment."[444]

The ongoing, current applicability of USFWS (1996a) has been reiterated this July 2004.[445]

3. USFWS' downlisting and delisting efforts including the Desert Nesting population violate law and precedent and lack scientific merit.[446]

The July 6, 1999, proposal to remove the Southwestern Desert Nesting Bald Eagle from the ESA List of Threatened and Endangered Species implies that accomplishment of Recovery Plan goals provides the primary basis for delisting. For the Southwest Recovery Region, the proposal reads:

> "…Recovery within recovery regions has also been successful…*Southwestern Recovery Region*…Reclassification Goals: 10 – 12 young per year over a 5-year period: population range has to expand to include one or more river drainages in addition to the Salt and Verde Systems…"[447]

Much has been learned in the nearly twenty years since the production of the Southwest Region Bald Eagle Recovery Plan.[448] The Recovery Plan has not been updated to include current knowledge.

Status reviews continue to express concern of the tenuous nature of the Southwestern Desert Nesting Bald Eagle's existence.[449] Nothing has changed biologically since these warnings and recommendations were originally offered.[450] In fact, the threats to the continued existence of this population have now increased.[451]

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[444] USFWS 1996a

[445] USFWS 2004b

[446] ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1993, 1994a, 1994b, 1999a, 2000, 2001a, 2001b, 2001c, 2002a, 2003, 2004a, 2004b, 2004c, unpublished data; Arizona Daily Sun 2004; Arizona Republic 2000, 2001, 2003b, 2003c, 2004a, 2004b; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1997, 1998; CBD 2003b, 2004c, 2004d; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Driscoll 1995, 1999; Driscoll and Beatty 1994; Driscoll et al. 1992, 1993; EPA 2004b; ESA Sections 3 & 4; Franklin 1980; Gerrard and Bortoletti 1988; Gilpin and Soule 1986; Hunt *et al.* 1992; IUCN 2001; Krueper 1993; Lande 1987; Lofgren *et al.* 1990; Mesta *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; Prescott Daily Courier 2004a, 2004b; Soule 1980; Stalmaster 1987; SWCBD 1999; SWRAG 2000; Thomas *et al.* 1990; USFWS 1982, 1984, 1985, 1990b, 1990c, 1992a, 1992b, 1992c, 1992d, 1993a, 1993b, 1994a, 1994b, 1994c, 1995, 1996b, 1996c, 1997a, 1997a, 1997b, 1998, 1999a, 1999c, 2000a, 2001a, 2001d, 2002a, 2003a, 2003b, 2003d, 2003e; USGS 2000; Verde Natural Resources Conservation District 1999; Wilcox 1987; Wright 1984

[447] USFWS 1999c

[448] USFWS 1992

[449] AGFD 1999a, 2000; CBD 2004e, SWCBD 1999

[450] AGFD 1999a, 2000; CBD 2004e, SWCBD 1999: USFWS 1990c

[451] ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004a, 2004b, 2004c; Arizona Daily Star 2004; Arizona Daily Sun 2004; Arizona Republic 2000, 2001, 2003b, 2003c, 2004a, 2004b; CBD 2003b, 2004c; Chino Valley

After the 1990, Bald Eagle reclassification meetings, USFWS raptor biologist Robert Mesta writes:

> "…Although this region (Southwest) has met its recovery goals, both the recovery team and the FWS have recommended against downlisting because of threats to habitat, small size of population, and adverse climatic conditions…
>
> …In our original recommendation we asked that the southwest recovery team be reactivated…I believe it is imperative that the existing plan be updated to accurately reflect the current status and needs of the southwest population…"[452]

During the five-year regional species review accomplishing recovery plan goals were qualified:

> "…Subject: 5 Year Species Review; June 11, 1992…Species…Bald eagle…Comments…BEs have exceeded all recovery goals in SW, but only by continuing intensive management. Without those measures, extirpation is foreseeable."[453]

Similarly, on September 8, 1992, USFWS states:

> "…Bald Eagle…The ABENWP [Arizona Bald Eagle Nestwatch Program] has been directly responsible for saving up to 60% of a single year's nestlings from natural and human-caused threats…As the ABENWP has made clear, accidental and malicious disturbance at the nest site is a significant threat. Loss and modification of habitat is also a threat, as urban and rural expansion continues in Arizona…Recovery Needs: Continuation of the ABENWP, in addition to protection afforded by Sections 7 and 9 of the Act, are likely to be the most important and effective recovery actions. With these actions, the southwestern bald eagle is likely to remain stable or continue to increase in numbers. Without them, however, decline and loss of habitat are likely."[454]

The 1993, USFWS Bald Eagle Status Review of the Southwestern Desert Nesting population states:

> "…***New Information*** places recovery goals and current status in new perspective. Since 1988, extensive research and surveys have refined our

Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Earthjustice 2004a, 2004b, 2004c; Hunt *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; SWRAG 2000; SWCBD 1999; USGS 2000; USFWS 1993b, 1997a, 1997b, 1998, 1999a, 2000a, 2002a, 2003a, 2003b, 2003e, 2004a, 2004c; Verde Natural Resources Conservation District 1999

[452] USFWS 1990c

[453] USFWS 1992b

[454] USFWS 1992c

knowledge of distribution, demographics, and general ecology. (This research largely resulted from a Section 7 Reasonable and Prudent Alternative, under which the Bureau of Reclamation funded in excess of $3 million in research and monitoring. [the Section 7 Reasonable and Prudent Alternative was non-discretionary owing to protection pursuant to the Endangered Species Act].) Important points:...Productivity follows boom-bust pattern...High adult mortality...Increasing threats: habitat loss in highest quality habitat, disturbance/persecution in highest quality habitat...Nestwatch program (AZ) instrumental in recovering and maintaining population...*Discussion*: Nesting bald eagles remain very rare in the Southwest...Current population still smaller than historic...it is recognized that a prolonged hot/dry cycle (which reduces productivity), coupled with persistent high adult mortality, could quickly cause the population to be endangered again. At present, the Arizona Bald Eagle NestWatch Program is crucial in maintaining population. Virtually all regional authorities agree that without ABENWP, the population would be endangered...because of small population size and increasing or static threats, delisting is very unlikely."[455]

AGFD (1999a, 2000) concludes similarly:

"...The 1982 Southwestern Bald Eagle Recovery Plan

For recovery planning and management purposes, the USFWS divided the bald eagle population in the lower 48 states into five recovery regions. The Southwestern Recovery Region consists of Arizona, New Mexico, Oklahoma and Texas west of the 100th Meridian, and the Colorado River along the Arizona-California border.

The Southwestern Bald Eagle Recovery Plan goals were to (a) establish breeding birds in one or more river drainages in addition to those of the Salt and Verde rivers, (b) have 10 to 12 young produced annually for a five-year period, and (c) identify important winter habitat. These goals have long been surpassed. Occupied bald eagles BAs now exist on the Salt, Verde, Bill Williams, Agua Fria, Gila, San Francisco and Little Colorado rivers. Annual productivity has averaged 19 young since 1982. Mid-winter counts have been performed in most years since 1982, and the important winter habitats are reasonably well known.

The goals of the Southwestern Recovery Plan were met within three years of its drafting. This is not surprising since little was known about bald eagles in the southwestern region when the plan was written. Productivity and mortality rates were not documented, and the effects of human disturbance, entanglement in fishing line, and natural parasites in nests were unknown.

[455] USFWS 1993b

The Recovery Plan acknowledged these gaps in knowledge, and called for subsequent revision of recovery goals and objectives as new information emerged. No revisions were written and no delisting goals were established..."[456]

4. The inadequacy of existing regulatory mechanisms are contributing to the vulnerability of the Desert Nesting Bald Eagle population.[457]

We have already established that the Desert Nesting population's survival is dependent, in good part, on heroic human support and management by the Arizona Bald Eagle Nestwatch Program (ABENWP).[458] We have also documented that ABENWP funding is not secure.[459]

AGFD (1994a) states:

"Presently, there are few binding consultations for any agency to commit funding to existing bald eagle programs under section 7 of the Endangered Species Act. Now, funding assistance by agencies is primarily based upon available funds and where they choose to allocate those dollars. The Service believes that if eagles are downlisted, the perception of "recovery" could result in reduced support for programs which support proactive management and protection. Approximately 63 percent ($101,000) of all bald eagle dollars comes from agencies other than AGFD. A reduction in these programs would result in reduced productivity of breeding bald eagles..."[460]

USFWS' 1995 downlisting of the Southwestern Desert Nesting Eagle from Endangered to Threatened significantly weakened its protection.[461] AGFD (1994a) documents USFWS own summary of the mechanical and attitudinal weakening effects of the downlisting:[462]

"The Service [USFWS] said the change in status is complex on paper and striking in the reduced protection a bird has under section 9. "Take"

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[456] AGFD 1999a, 2000

[457] ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1994b, 1999a, 2000, 2001a, 2002a, 2003, 2004a, 2004b, 2004c; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1997, 1998; Driscoll 1999; Hunt *et al.* 1992; SWCBD 1999; USFWS 1992b, 1999c, 2003a, 2003b AGFD 1994a, 1999a, 2000; Arizona Daily Star 2004; Arizona Daily Sun 2004; Arizona Republic 1989, 2000, 2001, 2003a, 2003b, 2003c, 2004a, 2004b, 2004c, 2004f; CBD 2003b, 2004c; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Earthjustice 2004a, 2004b, 2004c; Hunt *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; SWCBD 1999; SWRAG 2000; USGS 2000; USFWS 1992d, 1993a, 1993b, 1994c, 1996b, 1996c, 1997a, 1997b, 1998, 1999a, 2000a, 2002a, 2003a, 2003b, 2003e, 2004a, 2004c; Verde Natural Resources Conservation District 1999

[458] AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004c; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1997, 1998; Hunt *et al.* 1992; SWCBD 1999; USFWS 1992b, 1999c, 2003a, 2003b

[459] AGFD 1994a, 1999a, 2000; Arizona Republic 2003a, 2004c, 2004f; SWCBD 1999; USFWS 1996c, 2002a

[460] AGFD 1994a

[461] AGFD 1994a, USFWS 1994c, USFWS 1995

[462] AGFD 1994a

under threatened status does not include protection of the bird's habitat as it does under endangered status. Additionally, the downlisted status could alter the perception of "recovery" by agencies resulting in lack of proactive management and support for existing programs.

The definition of "take" is different between endangered and threatened status in section 9 beginning at part 9.2e. The Endangered Species Act (ESA) delegates protection of a threatened species to other federal acts protecting the species in question. The ESA offers no additional protection of its own. In the case of bald eagles the protection would fall under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. What these acts lack is the protection of habitat for the bald eagle. This makes permits (grazing, recreation, water-use) easier to acquire and increases the difficulty in reaching a jeopardy decision when writing biological opinions.

The definition of "take" under the Endangered Species Act allows the Service more flexibility when addressing habitat loss and cumulative effects. The Service is faced with making a "jeopardy" or "non-jeopardy" decision based upon whether a project will affect the continued existence of the bald eagle in the Southwest. If the answer is "no," "reasonable and prudent measures" are identified to reduce incidental take. These measures are mandatory, but may not significantly alter the timing, scope or other aspects of the project. In these cases, the USFWS does not have the authority to significantly alter projects for the benefit of the species. When a project does warrant a "jeopardy" decision, the Service can alter a project for the benefit of the bird. By reducing the bird's status to threatened, the Service's ability to reach jeopardy determinations based on loss of habitat and therefore its ability to alter projects for the benefit of the eagle will be greatly reduced...

The beginning of section 7a.1 states that "all federal agencies shall…carry out programs for the conservation of endangered species and threatened species listed…" This is to occur regardless of any decision made by the USFWS or an outcome of a consultation. In reality, agencies only perform these activities when forced and view a non-jeopardy decision as a permit to move forward often with little regard for endangered species…

Presently, there are few binding consultations for any agency to commit funding to existing bald eagle programs under section 7 of the Endangered Species Act. Now, funding assistance by agencies is primarily based upon available funds and where they choose to allocate those dollars. …

Not only does habitat protection assist the bald eagle, but it contributes to protection of riparian vegetation, streams and the animals living in those ecosystems. Clearly, our most precious habitat in Arizona is riparian. Eagles are a barometer for the health of these systems. In central Arizona, the most successful and dependable nesting sites of the past have shown declines. Downlisting the species to threatened not only reduces the protection for the

> eagle, but also for the entire central Arizona river ecosystem. Stating that the eagle is no longer endangered indirectly suggests that central Arizona rivers are also less endangered and are able to withstand additional development…
>
> The bird becomes less "recoverable" as development persists in central Arizona. As populations increase in rural Arizona and the Phoenix metropolitan area, so does the demand for development, easier access, more recreation, and improved facilities. The Service takes into account these foreseeable trends when arriving at their decisions under endangered status. If habitat protection is removed from consideration when evaluating a project because the bald eagle is downlisted to threatened, we can expect a decline in the Arizona bald eagle population.[463]

The accuracy of this memo can be documented extensively as downlisting contributes to the increasing threats to the continued existence of the Desert Nesting population.[464] The effects of the downlisting include:

a. Cattle grazing continues within the riparian habitat critical to the Desert Nesting Bald Eagle.[465]
b. Dam operations do not release water at times necessary for replenishment of riparian nest trees.[466]
c. Dewatering of remnant free-flowing rivers continues.[467]
d. Exotic fish continue to be introduced in native fish habitat.[468]
e. Low flying aircraft continue and will increasingly continue adversely affecting the population.[469] Flight advisories are not mandatory and are routinely ignored.[470]
f. USFWS' approval of Desert Nesting Bald Eagle deaths is excessive.[471]

From 1992 through 2004, USFWS reviewed and approved Federal projects responsible for deaths of up to 95 Desert Nesting Bald Eagles (adults, fledglings and/or nestlings).[472] Over the 50-year life of these projects, USFWS expects, and has

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463 AGFD 1994a

464 ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004a, 2004b, 2004c; Arizona Daily Star 2004; Arizona Daily Sun 2004; Arizona Republic 2000, 2001, 2003b, 2003c, 2004a, 2004b; CBD 2003b, 2004c; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Earthjustice 2004a, 2004b, 2004c; Hunt *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; SWRAG 2000; SWCBD 1999; USGS 2000; USFWS 1993b, 1997a, 1997b, 1998, 1999a, 2000a, 2002a, 2003a, 2003b, 2003e, 2004a, 2004c; Verde Natural Resources Conservation District 1999

465 AGFD 1999a, 2000; Driscoll 1999; USFWS 1997b, 1998, 2002a, 2003b

466 AGFD 1999a, 2000; USFWS 1997b, 2003b

467 Desert Fishes Team 2003, 2004; Verde natural Resources Conservation District 1999, USFWS 1998

468 Desert Fishes Team 2003, 2004;

469 AGFD 1999a, 2000; USFWS 1993a, 1994c, 1997b, 2002a, 2003b

470 AGFD 1999a, 2000, 2001a, 2002a, 2003, 2004c; Arizona Republic 1989

471 AGFD 1994b; USFWS 1992d, 1993a, 1994c, 1996b, 1997b

472 USFWS 1992d, 1993a, 1994c, 1996b, 1999a, 2000a, 2003b

approved, 561 cumulative deaths! [473] Thirty percent of occupied eagle nesting territories in Arizona may be adversely affected by these planned projects.[474]

USFWS has piecemealed the evaluation of these projects to avoid arriving at the obvious conclusion that, cumulatively, these projects will jeopardize the continued existence of the Desert Nesting population.[475] In 1995, a U.S. District Court examined USFWS' similar ruse in attempting to weaken habitat protection for the Mexican Spotted Owl.[476] In that case, we established the fact that an evaluation claiming non-jeopardy effects by individual projects across a landscape does not accurately reflect the programmatic net effect.[477] As a result, USFWS was forced to modify its projects affecting the Mexican Spotted Owl.[478]

5. <u>ESA law and USFWS population policy and precedent require Endangered status with Critical Habitat for the Desert Nesting Bald Eagle Distinct Population Segment.</u>[479]

The Endangered Species Act is clear:

> "DEFINITIONS...SEC. 3. For the purposes of this Act- ...(5)(A) The term "critical habitat" for a threatened or endangered species means- (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and, (ii) which may require special management considerations or protection; and (iii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species...(B) Critical habitat may be established for those species now listed as threatened or endangered species for which no critical habitat has heretofore been established as set forth in subparagraph (A) of this paragraph. (C) Except in those circumstances determined by the Secretary, critical habitat shall not include the entire geographical area which can be occupied by the threatened or endangered species...
>
> DEFINITIONS...SEC. 3. For the purposes of this Act- ...(6) The term "endangered species" means any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose

[473] USFWS 1992d, 1993a, 1994c, 1996b, 1999a, 2000a, 2003a, 2003b

[474] AGFD 1994b

[475] USFWS 1992d, 1993a, 1994c, 1996b, 1999a, 2000a, 2003a, 2003b

[476] Silver v. Thomas 1995

[477] Ibid.

[478] Ibid.

[479] CBD 2004d; ESA Sections 3 & 4; SWCBD 1999;

protection under the provisions of this Act would present an overwhelming and overriding risk to man...(15) The term "species" includes any subspecies of fish or wildlife or plants, and any distinct population segment of any species or vertebrate fish or wildlife which interbreeds when mature.

DETERMINATION OF ENDANGERED SPECIES AND THREATENED SPECIES...Sec. 4...(a) GENERAL.- (1) The Secretary shall by regulation promulgated in accordance with subsection (b) determine whether any species is an endangered species or a threatened species because of any of the following factors: (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; (E) other natural or manmade factors affecting its continued existence...(3) The Secretary, by regulation promulgated in accordance with subsection (b) and to the maximum extent prudent and determinable- (A) shall, concurrently with making a determination under paragraph (1) that a species is an endangered species or a threatened species, designate any habitat of such species which is then considered to be critical habitat;

DETERMINATION OF ENDANGERED SPECIES AND THREATENED SPECIES...Sec. 4...(b) BASIS FOR DETERMINATIONS.- ...(1)(A) The Secretary shall make determinations required by subsection (a)(1) solely on the basis of the best scientific and commercial data available to him after conducting a review of the status of the species and after taking into account those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species, whether by predator control, protection of habitat and food supply, or other conservation practices, within any area under its jurisdiction, or on the high seas...(B) In carrying out this section, the Secretary shall give consideration to species which have been- (i) designated as requiring protection from unrestricted commerce by any foreign nation, or pursuant to any international agreement; or (ii) identified as in danger of extinction, or likely to become so within the foreseeable future, by any State agency or by any agency of a foreign nation that is responsible for the conservation of fish or wildlife or plants...(2) The Secretary shall designate critical habitat, and make revisions thereto, under subsection (a)(3) on the basis of the best scientific data available and after taking into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat. The Secretary may exclude any area from critical habitat if he determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species concerned...(C) A final regulation designating critical habitat of an endangered species or a threatened species shall be published concurrently with the final regulation implementing the determination that such species is endangered or threatened, unless the Secretary deems that- ...(i) it is essential to the conservation of such species that the regulation implementing such determination be promptly published; or (ii) critical habitat of such species is not then determinable, in which case the Secretary, with respect to the proposed regulation to designate such habitat, may extend the one-year period specified in subparagraph (A) by not more than one additional year, but not later than the close of such additional year the Secretary must publish a final regulation, based on such data as may be available at that time, designating, to the maximum extent prudent, such habitat."

The Southwestern Desert Nesting Population is a Distinct Population Segment.[480] It is in danger of extinction throughout its range.[481]

It is in danger of extinction throughout its range owing to the following three factors:

1. Its habitat faces present and threatened destruction, modification, or curtailment.[482]

2. Existing regulatory mechanisms are inadequate.[483]

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[480] AGFD 1994b, 1999a, 2000; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1997, 1998; CBD 2004e; Driscoll and Beatty 1994; Driscoll *et al.* 1992; Gerrard and Bortoletti 1988; Hunt *et al.* 1992; Ohmart and Sell 1980; SWCBD 1999; Stalmaster 1987; SWCBD 1999; USFWS 1982, 1995, 1997a, 1997b, 1998, 2000a, 2001a, 2002a, 2003a, 2003b

[481] ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1993, 1994a, 1994b, 1999a, 2000, 2001a, 2001b, 2001c, 2002a, 2002b, 2003, 2004a, 2004b, 2004c, unpublished data; American Bird Conservancy 2003, 2004a, 2004b; Arizona Daily Star 2004; Arizona Daily Sun 2004; Arizona Republic 1989, 1996, 1997, 2000, 2001, 2003a, 2003b, 2003c, 2003d, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2004g, 2004h; Associated Press 2004a, 2004b; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a, 1996b; Beatty *et al.* 1995a, 1995b, 1997, 1998; CBD 2003b, 2004a, 2004b, 2004c, 2004e; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Driscoll 1995, 1999; Driscoll and Beatty 1994; Driscoll et al. 1992, 1993; Earthjustice 2004a, 2004b, 2004c, 2004c; Elliott *et al.* 1997; EPA 1998, 1999, 2000, 2003, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f; Franklin 1980; Gerrard and Bortoletti 1988; Gerrard *et al.* 1992; Gilpin and Soule 1986; Grist Magazine 2004; Grubb *et al.* 1990; Hunt *et al.* 1992; Lande 1987; Lofgren *et al.* 1990; King *et al.* 1991; Krueper 1993; IUCN 2001; Mesta *et al.* 1992; National Geographic 2004; Nature 2003; New York Times 2004; Observer/UK 2004; Ohmart and Sell 1980; Pesticide Action Network 1999; Phoenix Gazette 1993; Prescott 2001; Prescott Daily Courier 2004a, 2004b; Progressive 2003; Seattle Times 2004; Sierra Vista Herald 1998; Soule 1980; Stalmaster 1987; SWCBD 1999; SWRAG 2000; Thomas *et al.* 1990; U.S. House of Representatives 2002; University of Arizona 2004; USDA 2001; USGS 2000; USFWS 1982, 1984, 1985, 1990b, 1990c, 1992a, 1992b, 1992c, 1992d, 1993a, 1993b, 1994a, 1994b, 1994c, 1995, 1996b, 1996c, 1997a, 1997b, 1998, 1999a, 1999c, 2000a, 2001a, 2001d, 2002a, 2003a, 2003b, 2003d, 2003e, 2004a, 2004c; Verde Natural Resources Conservation District 1999; Weimeyer *et al.* 1984; Wilcox 1987; Wright 1984

[482] ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1993, 1994b, 1999a, 2000, 2001a, 2002a, 2003, 2004a, 2004b, 2004c; American Bird Conservancy 2003, 2004a, 2004b; Arizona Republic 2000, 2001, 2004d, 2004e; Chino Valley Review 2004; Desert Fishes Team 2003, 2004; Elliott *et al.* 1997; EPA 1998, 1999, 2000, 2003, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f; Grubb *et al.* 1990; Hunt *et al.* 1992; King *et al.* 1991; Lofgren *et al.* 1990; Krueper 1993; Pesticide Action Network 1999; Prescott 2001, Prescott Daily Courier 2004a, 2004b; SWCBD 1999; University of Arizona 2004; USDA 2001; USFWS 1984, 1985, 1990b, 1992a, 1992d, 1993a, 1994c, 1995, 1996b, 1996c, 1997a, 1997b, 1998, 2001a, 2001d, 2003b, 2003d; Verde natural Resources Conservation District 1999; Weimeyer *et al.* 1984

[483] ADEQ 2004a, 2004b; ADWR 1994, 1999; AGFD 1994b, 1999a, 2000, 2001a, 2002a, 2003, 2004a, 2004b, 2004c; Beatty 1990a, 1990b, 1992, 1993; Beatty and Driscoll 1994, 1996a; Beatty *et al.* 1995a, 1995b, 1997, 1998; Driscoll 1999; Hunt *et al.* 1992; SWCBD 1999; USFWS 1992b, 1999c, 2003a, 2003b AGFD 1994a, 1999a, 2000; Arizona Daily Star 2004; Arizona Daily Sun 2004; Arizona Republic 1989, 2000, 2001, 2003a, 2003b, 2003c, 2004a, 2004b, 2004c, 2004f; CBD 2003b, 2004c; Chino Valley Review 2004; CNN 2004; DES 2004a, 2004b; Desert Fishes Team 2003, 2004; Earthjustice 2004a, 2004b, 2004c; Hunt *et al.* 1992; National Geographic 2004; Observer/UK 2004; Ohmart and Sell 1980; Prescott 2001; SWCBD 1999; SWRAG 2000; USGS 2000;

site is a significant threat. Loss and modification of habitat is also a threat, as urban and rural expansion continues in Arizona...Recovery Needs: Continuation of the ABENWP, in addition to protection afforded by Sections 7 and 9 of the Act, are likely to be the most important and effective recovery actions. With these actions, the southwestern bald eagle is likely to remain stable or continue to increase in numbers. Without them, however, decline and loss of habitat are likely."[488]

Driscoll *et al.* (1993) similarly concludes:

"The present rate of adult mortality in the Arizona bald eagle population and the high percentage of young eagles recruited into breeding pairs, creates a situation akin to walking the blade of a sword. If environmental or other factors result in low productivity for several years, those cohorts may be insufficient to fill the vacancies left by adult mortalities four years in the future, at which point, the Arizona bald eagle population would decline without immigration from outside the state."[489]

USFWS (1994a) adds:

"...current information indicates that the population is at risk and remains in danger of extinction due to excessively low survival rates and the need for intensive management, particularly at nest sites...

...In addition to threats common with other Recovery Regions, such as human disturbance and availability of adequate nesting and feeding habitat, the bald eagles of the Southwestern Recovery Region are subjected to a high adult rate of mortality, isolation, heat stress, and nest parasites. The Arizona Bald Eagle Nestwatch Program has significantly increased survival of young by minimizing human disturbance during important incubation periods, and by removing harmful material such as parasites and fishing line debris from nests. However, the high death rate of adults and nestlings which may cause inbreeding to adversely affect the population's long-term survival, remain limiting; this population continues to require intensive management, particularly around each nest site.

Hunt et al. (1992) estimate a minimum annual mortality rate of 16 to 22 percent of adult breeding birds and believe it to be much higher. Bald eagles commonly live 20 years in the wild and up to 50 years in captivity (Stalmaster 1987). In the Southwestern region, adult life expectancy may not exceed 10-12 years (Hunt et al. 1992)...

Research to date indicates there has been no immigration to this population of bald eagles. According to Hunt et al., this small population is

[488] USFWS 1992c

[489] Driscoll et al. 1993

isolated and thus is subject to the genetic, demographic, and environmental threats known to be associated with small populations. For these reasons, the population is in continued need of strict protection and intensive management...

Service Action: Retain as endangered. Despite attaining all recovery plan goals, current information indicates that the population is at risk and remains in danger of extinction due to excessively low survival rates and the need for intensive management, particularly at nest sites."[490]

In 1999, SWCBD (1999) observes:

"Removal of the Southwestern Desert Nesting Bald Eagle from the List of Threatened and Endangered Species is akin to signing their death warrant. The Southwestern Desert Nesting Bald Eagle remains dangerously small. It has not yet recovered to the point of long-term viability. Less than 60 breeding pairs of this behaviorally isolated population survive.

The Southwestern Desert Nesting Bald Eagle survives the desert heat with the unique adaptation of nesting in the winter and fledging in the spring before the summer heat peaks. The Desert Nesting population breeds in isolation with 99.997% of objectively identified breeding individuals coming from the southwestern population. With high mortality rates of fledglings, with productivity rates lower than those recorded elsewhere in North America, and with large percentage of subadults prematurely entering the breeding population, the status of the Southwestern Desert Nesting Bald Eagle remains tenuous.

Some years, many of the surviving fledglings do so purely owing to human emergency treatment actions. This mostly consists of removing fishing line, hooks, and lures from nestling eagles. Half of all breeding areas contain fishing tackle. Thousands of potentially dangerous actions, including shooting, are documented each year already. Funding of this protective program is not secure.

In addition, the Desert Nesting population faces the threats of dam and reservoir management, of increasing habitat encroachment by development, of continued habitat destruction by grazing, and of unavailability of replacement nest trees. Agricultural, mining, industrial, as well as municipal water consumption increasingly compete for the same water the Bald Eagles require for survival.

Obviously, challenges for this population are formidable. Only Endangered Species Act protection mandates enforceable evaluation of these planned projects. Only the Endangered Species Act provides enforceable protection for the Southwest Bald Eagle and the habitat necessary to its survival."[491]

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[490] USFWS 1994a

[491] SWCBD 1999

CBD, Maricopa Audubon and the Arizona Audubon Council now sincerely believe that increasing protection will be necessary if the Southwestern Desert Nesting Bald Eagle is to survive. In support, we submit this 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.

Please keep us advised of all proceedings in this matter. In 90 days, pursuant to Section 4(b)(3)(A), we expect acknowledgement of the fact that (1) this Petition presents substantial scientific information indicating that the petitioned action is warranted, and (2) that USFWS has commenced a formal review of the Desert Nesting Bald Eagle Distinct Population Segment for designation as Endangered with Critical Habitat.

If you have any questions, please contact, Robin Silver, M.D., Board Chair, Center for Biological Diversity, P.O. Box 39629, Phoenix, AZ 85069-9382; Phone: 602 246 4170; FAX: 602 249 2576; or Email: rsilver@biologicaldiversity.org.

Sincerely,

Robin Silver, M.D.
Board Chair

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