DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R2–ES–2008–0059; 4500030113]

Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Sonoran Desert Area Bald Eagle as Threatened or Endangered

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Notice of 12-month petition finding.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), announce a 12-month finding on a petition to list the Sonoran Desert Area population of bald eagle (*Haliaeetus leucocephalus*) as threatened or endangered under the Endangered Species Act of 1973, as amended (Act). After review of the best available scientific and commercial information, we find that listing the Sonoran Desert Area population of bald eagle does not qualify as a distinct population segment (DPS) and listing the Sonoran Desert Area population of bald eagle is not warranted at this time.

DATES: The finding announced in this document was made on May 1, 2012.

ADDRESSES: This finding is available on the Internet at *http://www.regulations.gov* at Docket Number FWS–R2–ES–2008–0059. Supporting documentation we used in preparing this finding is available for public inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service, Southwest Regional Office, 500 Gold Ave. SW., Room 6034, Albuquerque, NM 87102. Please submit any new information, materials, comments, or questions concerning this finding to the above address.

FOR FURTHER INFORMATION CONTACT: Michelle Shaughnessy, Assistant Regional Director, Southwest Regional Office (see **ADDRESSES**); by telephone at 505–248–6920; or by facsimile at 505–248–6788. If you use a telecommunications device for the deaf (TDD), please call the Federal Information Relay Service (FIRS) at 800–877–8339.

SUPPLEMENTARY INFORMATION:

Background

Section 4(b)(3)(B) of the Act (16 U.S.C. 1531 *et seq.*) requires that, for any petition to revise the Federal Lists of Endangered and Threatened Wildlife and Plants that contains substantial scientific or commercial information indicating that listing may be warranted, we make a finding within 12 months of the date of our receipt of the petition. In this finding we will determine that the petitioned action is: (1) Not warranted, (2) warranted, or (3) warranted, but the immediate proposal of a regulation is precluded by other pending proposals to determine whether species are threatened or endangered (warranted but precluded). Section 4(b)(3)(C) of the Act requires that we treat a petition for which the requested action is found to be warranted but precluded as though resubmitted on the date of such finding, that is, requiring that we make a subsequent finding within 12 months. Such 12-month findings must be published in the **Federal Register.**

This document constitutes our revised 12-month finding on a petition to list the Sonoran Desert Area bald eagle. In this document, the Sonoran Desert Area population is the name given to the entity under evaluation for designation as a distinct population segment (DPS). For the purposes of this assessment, the Sonoran Desert Area population includes all bald eagle territories within Arizona, the Copper Basin breeding area in California near the Colorado River, and the territories of interior Sonora, Mexico, that occur within the Sonoran Desert and adjacent transitional communities. For more detail on the boundary of the DPS, see the discussion below under *Determination of the Area for Analysis.*

Previous Federal Action

Bald eagles (*Haliaeetus leucocephalus*) gained protection under the Bald Eagle Protection Act (16 U.S.C. 668–668d) in 1940 and the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703–712) in 1972. A 1962 amendment to the Bald Eagle Protection Act added protection for the golden eagle (*Aquila chrysaetos*), and the amended statute became known as the Bald and Golden Eagle Protection Act (BGEPA). On February 14, 1978, the Service listed the bald eagle as an endangered species under the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq.*) in 43 of the contiguous States, and as a threatened species in the States of Michigan, Minnesota, Wisconsin, Oregon, and Washington (43 FR 6230). On July 12, 1995, we published a final rule to reclassify the bald eagle from endangered to threatened in the 43 States where it had been listed as endangered and retain the threatened status for the other 5 States (60 FR 36000).

On July 6, 1999, we published a proposed rule to delist the bald eagle throughout the lower 48 States due to recovery (64 FR 36454). On February 16, 2006, we reopened the public comment period to consider new information received on our July 6, 1999 (71 FR 8238), proposed rule to delist the bald eagle in the lower 48 States. On October 6, 2004, we received a petition from the Center for Biological Diversity (CBD), the Maricopa Audubon Society, and the Arizona Audubon Council requesting that the ''Southwestern desert nesting bald eagle population'' be classified as a distinct population segment (DPS) under the Act, that this DPS be reclassified from a threatened species to an endangered species, and that we concurrently designate critical habitat for the DPS under the Act. We announced in our 90-day finding on August 30, 2006 (71 FR 51549), that the petition did not present substantial scientific or commercial information indicating that the petitioned action may be warranted.

On January 5, 2007, the CBD and the Maricopa Audubon Society (Plaintiffs) filed a lawsuit in the U.S. District Court for the District of Arizona challenging the Service's 90-day finding that the bald eagles nesting in the Sonoran Desert area of central Arizona did not qualify as a DPS, and further challenging the Service's 90-day finding that the population should not be uplisted to endangered status.

On July 9, 2007 (72 FR 37346), we published the final delisting rule for bald eagles in the lower 48 States due to recovery. This final delisting rule also included the bald eagles located in the Sonoran Desert. On August 17, 2007, the CBD and the Maricopa Audubon Society filed a Motion for Summary Judgment in their January 5, 2007, lawsuit. In early 2008, several Native American Tribes submitted *amicus curiae* (''friend of the court'') briefs in support of the August 17, 2007, Motion for Summary Judgment. The San Carlos Apache Tribe, Yavapai-Apache Nation, and Tonto Apache Tribe submitted *amicus curiae* briefs to the court on January 29, 2008; the Salt River Pima-Maricopa Indian Community submitted an *amicus curiae* brief to the court on February 4, 2008; and the Fort McDowell Yavapai Nation submitted an *amicus curiae* brief to the court on February 7, 2008.

On March 5, 2008, the court made a final decision in the challenge to the Service's 2006 90-day finding, ruling in favor of the CBD and the Maricopa Audubon Society. The court order (*Center for Biological Diversity* v. *Kempthorne,* CV 07–0038–PHX–MHM (D. Ariz)), dated March 6, 2008, required the Service to conduct a status review of the Desert bald eagle population pursuant to the Act to determine whether that population may qualify as a DPS, and if so, whether listing that DPS as threatened or endangered pursuant to the Act is warranted. The court enjoined the Service's application of the July 9, 2007 (72 FR 37346), final delisting rule with respect to the bald eagles nesting in the Sonoran Desert area of central Arizona pending that status review and 12-month finding on the Plaintiffs' petition.

On May 1, 2008, to conform with the court's March 6, 2008, order, we published a final rule listing the potential Sonoran Desert bald eagle DPS as threatened under the Act (73 FR 23966). On May 20, 2008, we published a **Federal Register** notice (73 FR 29096) initiating a status review for the bald eagles nesting in the Sonoran Desert area of central Arizona.

On February 25, 2010, the Service published its 12-month finding on the October 6, 2004, petition, as required by the March 5, 2008, court order (75 FR 8601). The Service found that the bald eagles nesting in the Sonoran Desert area did not qualify as a DPS and, therefore, were not a listable entity under the Act. Concurrent with publication of our 12-month finding, the Service filed a motion for dissolution of the court's injunction. Plaintiffs asked the Court for leave to file a supplemental complaint challenging the merits of the new 12-month finding. By order dated September 30, 2010, the court denied the Plaintiffs' request to file a supplemental complaint, and dissolved the injunction. This had the effect of reinstating the provisions of the delisting rule for the bald eagles nesting in the Sonoran Desert area of central Arizona, thereby removing the bald eagles nesting in the Sonoran Desert area of central Arizona from the List of Endangered and Threatened Wildlife. (*Center for Biological Diversity, et al.* v. *Salazar, et al.,* 07–cv–00038–PHX–MHM, 2010 U.S. Dist. LEXIS 72664 (D. Ariz. Sept. 30, 2010). On September 2, 2011, the Service published a final rule to comply with the court's September 30, 2010, order.

On October 5, 2010, CBD and the Maricopa Audubon Society (Plaintiffs) filed a new lawsuit in the U.S. District Court for the District of Arizona, challenging the Service's February 25, 2010, 12-month finding that the bald eagles nesting in the Sonoran Desert area did not qualify as a DPS. On January 5, 2011, the court granted the San Carlos Apache Tribe of Arizona's November 24, 2010, motion to intervene as Intervenor-Plaintiff. On March 1, 2011, the court granted the Salt River Pima-Maricopa Indian Community's January 12, 2011, motion to intervene as Intervenor-Plaintiff.

On November 30, 2011, the court granted Plaintiffs' motions for summary judgment to the extent they asserted the Service's 12-month finding was procedurally flawed. The court order (*Center for Biological Diversity* v. *Kempthorne,* CV 10–2130–PHX–DGC (D. Ariz)) required the Service to produce a new 12-month finding by April 20, 2012, based on information gathered in the status review already conducted. The court order also directed the Service to address issues identified in the order in the new 12-month finding, specifically whether the Service has adopted a new interpretation of the DPS policy and provide a reasoned explanation for why loss of the desert eagle would not result in a significant gap in the range (assuming the Service reached this conclusion in its new 12-month finding).

Public Information

As noted above, on May 20, 2008, the Service published a notice to initiate a 12-month status review for the Sonoran Desert population of bald eagle in central Arizona and northwestern Mexico, and a solicitation for new information (73 FR 29096). To allow adequate time to consider the information, we requested that information be submitted on or before July 7, 2008. On January 15, 2009, a second **Federal Register** notice (74 FR 2465) was published announcing the continuation of information collection for the 12-month status review. In order to allow us adequate time to consider and incorporate submitted information, we requested that we receive information on or before July 10, 2009. Between May 2008 and February 2010, we received 31 responses via *http://www.regulations.gov,* and 5 letters by U.S. mail.

Tribal Information

In accordance with Secretarial Order 3206, the Service acknowledges our responsibility to consult with federally recognized Tribes on a government-to-government basis. Over the course of the previous bald eagle status review, we corresponded and met with various Tribes in Arizona, all of whom support protection of the bald eagle under the Act. On July 2, 2008, the Service and Tribal representatives from four Western Apache Tribes and one Nation (White Mountain Apache, San Carlos Apache, Tonto Apache Tribes, and Yavapai-Apache Nation) met to hear testimony from cultural authorities on a variety of subjects, including the history of the eagle in Arizona and the importance of the eagle to the Apache people. At the request of Tribal representatives, this meeting was recorded and incorporated into the administrative record for the 12-month finding. On July 3, 2008, the Service met with members of the Salt River Pima-Maricopa Indian Community, Gila River Indian Community, Tohono O'Odham Nation, Ak-Chin Indian Community, Tonto Apache Tribe, Fort McDowell Yavapai Nation, the Hopi Tribe, Pascua Yaqui Tribe, Zuni Tribe, and the InterTribal Council of Arizona. This meeting was held in Phoenix, Arizona, and a court reporter recorded the meeting minutes. Members of the Tribes and nations present, however, did not consider this meeting to constitute government-to-government consultation pursuant to Secretarial Order 3206. On July 20, 2009, an official consultation meeting between the Service and Salt River Pima-Maricopa Indian Community occurred. Written comments were provided by the Western Apache Tribes and Nation and the Salt River Pima-Maricopa Indian Community on July 10, 2009.

Although comments from the Native American communities were provided in writing, much of the knowledge about the bald eagle was offered during the above-referenced face-to-face meetings. Native American knowledge about the eagle is passed down orally from one generation to the next, which is often referred to in the literature as traditional ecological knowledge. Traditional ecological knowledge refers to the knowledge base acquired by indigenous and local peoples over many hundreds of years through direct contact with the environment. Traditional knowledge is based in the ways of life, belief systems, perceptions, cognitive processes, and other means of organizing and transmitting information in a particular culture. Traditional ecological knowledge includes an intimate and detailed knowledge of plants, animals, and natural phenomena; the development and use of appropriate technologies for hunting, fishing, trapping, agriculture, and forestry; and a holistic knowledge, or ''world view,'' which parallels the scientific discipline of ecology (Inglis 1993, p. vi).

Testimony by the Western Apache Tribes and Nation and Salt River Pima-Maricopa Indian Community clearly demonstrates the importance of the bald eagle to their culture, its relevance to their well-being, and their respect for its power. Their testimony also demonstrates the Western Apache and Salt-River Pima Maricopa knowledge base of the bald eagle and its habitat. The Native American relationship with the bald eagle in the Sonoran Desert Area predates modern Western scientific knowledge of the bald eagle by thousands of years (Lupe *et al.* pers. comm. 2008, p. 1). Given the expertise and traditional ecological knowledge about the bald eagle in the Southwest demonstrated by the Western Apache Tribes and Nation and Salt-River Pima Maricopa Indian Community, we have incorporated this information into our status review and 12-month finding.

Species Information

The bald eagle *(Haliaeetus leucocephalus)* is the only species of sea eagle regularly occurring in North America (60 FR 35999; July 12, 1995). Literally translated, *H. leucocephalus* means white-headed sea eagle. Bald eagles are birds of prey of the Order Falconiformes and Family Accipitridae. They vary in length from 28 to 38 inches (in) (71 to 96 centimeters (cm)), weigh between 6.6 and 13.9 pounds (lbs) (3.0 and 6.3 kilograms (kg)), and have a 66- to 96-in (168- to 244-cm) wingspan. Distinguishing features of adult bald eagles include a white head, tail, and upper- and lowertail-coverts; a dark-brown body and wings; and yellow irises, beak, legs, and feet. Immature bald eagles are mostly dark brown and lack a white head and tail until they reach approximately 5 years of age (Buehler 2000, p. 2).

Biology and Distribution

In many Western Apache groups, the bald eagle is called *Istłgáí,* which translates to ''the white eagle'' and is distinguished from the golden eagle, which is called *Itsa Cho* or ''the big eagle.'' The bald eagle was first described in Western culture in 1766 as *Falco leucocephalus* by Linnaeus. This South Carolina specimen was later renamed as the southern bald eagle, subspecies *Haliaeetus leucocephalus leucocephalus* (Linnaeus) when Townsend identified the northern bald eagle as *Haliaeetus leucocephalus alascanus* in 1897 (Buehler 2000, p. 4). By the time the bald eagle was listed throughout the lower 48 States under the Act in 1978, ornithologists no longer recognized the subspecies (American Ornithologists Union 1983, p. 106).

The bald eagle ranges throughout much of North America, nesting on both coasts from Florida to Baja California, Mexico, in the south, and from Labrador to the western Aleutian Islands, Alaska, in the north. Fossil records indicate that bald eagles inhabited North America approximately 1 million years ago, but they may have been present before that (Stalmaster 1987, p. 5). An estimated quarter to a half million bald eagles lived on the North American continent before the first Europeans arrived.

Though once considered endangered, the bald eagle population in the lower 48 States has increased considerably in the last thirty years. Regional bald eagle populations in the Northwest, Great Lakes, Chesapeake Bay, and Florida have increased five-fold in the past 20 years. Bald eagles are now repopulating areas throughout much of the species' historical range that were unoccupied only a few years ago.

The bald eagle is a bird of aquatic ecosystems. It frequents estuaries, large lakes, reservoirs, major rivers, and some seacoast habitats. Fish is the major component of its diet, but waterfowl, gulls, and carrion are also eaten. The species may also use prairies if adequate food is available. Bald eagles typically nest in trees, but have also been documented nesting on cliffs, on the ground, in mangroves, in caves, and in manmade structures (e.g., cell phone towers). Trees must be sturdy and open to support a nest that is often 5 feet (ft) (1.52 meters (m)) wide and 3 ft (0.91 m) deep. Adults tend to use the same breeding areas year after year, and often the same nest, though a breeding area may include one or more alternate nests. Nest shape and size vary, but typical nests are approximately 4.9 to 5.9 ft (1.5 to 1.8 m) in diameter and 2.3 to 4.3 ft (0.7 to 1.2 m) tall (Stalmaster 1987, p. 53). In winter, bald eagles often congregate at specific wintering sites that are generally close to open water and offer good perch trees and night roosts.

Bald eagles are long-lived. One of the longest-living bald eagles known in the wild was reported near Haines, Alaska, as 28 years old (Schempf 1997, p. 150). In 2009, a female eagle nesting at Alamo Lake in Arizona turned 30 years old (J. Driscoll, Arizona Game and Fish Department (AGFD), pers. comm. 2009). In captivity, bald eagles may live 40 or more years. It is presumed that once they mate, the bond is long-term. Variations in pair bonding are known to occur. If one mate dies or disappears, the other will accept a new partner.

Bald eagle pairs begin courtship about a month before egg-laying. In the southern portion of its range, courtship occurs as early as September, and in the northern portion of its range, as late as May. The nesting season lasts about 6 months. Incubation lasts approximately 35 days, and fledging takes place at 11 to 12 weeks of age. Parental care may extend 4 to 11 weeks after fledging (Hunt *et al.* 1992, p. C9; Wood *et al.* 1998, pp. 336–338). The fledgling bald eagle is generally dark brown except the underwing linings, which are primarily white. Between fledging and adulthood, the bald eagle's appearance changes with feather replacement each summer. Young, dark bald eagles may be confused with the golden eagle, *Aquila chrysaetos.* The bald eagle's distinctive white head and tail are not apparent until the bird fully matures, usually at 4 to 5 years of age.

The migration strategies for breeding, nonbreeding, and juvenile or subadult age classes of bald eagles will vary depending on geographic location. Young eagles may wander widely for years before returning to nest in natal areas. Northern latitude bald eagles winter in areas such as the Upper Mississippi River, Great Lakes shorelines, and river mouths in the Great Lakes area. For midcontinent bald eagles, wintering grounds may be the southern States, and for southern latitude bald eagles, whose nesting may begin in the winter months, the nonbreeding season foraging areas may be the Chesapeake Bay or Yellowstone National Park during the summer. Eagles seek wintering (nonnesting) areas offering an abundant and readily available food supply with suitable night roosts. Night roosts typically offer isolation and thermal protection from winds. Carrion and easily scavenged prey provide important sources of winter food in terrestrial habitats far from open water.

The first major decline in the bald eagle population probably began in the mid to late 1800s. Widespread shooting for feathers and trophies led to extirpation of eagles in some areas. Shooting also reduced part of the bald eagle's prey base. Populations of big game animals like bison, which were seasonally important to eagles as carrion, were severely reduced. Hunters also reduced the numbers of waterfowl, shorebirds, and small mammals. Ranchers used carrion treated with strychnine, thallium sulfate, and other poisons as bait to kill livestock predators and ultimately killed many eagles as well. These were the major factors, in addition to loss of nesting habitat from forest clearing and development, which contributed to a reduction in bald eagle numbers through the 1940s. In 1940, Congress passed the Bald Eagle Protection Act (16 U.S.C. 668–668d). This law prohibits the take, possession, sale, purchase, barter, or offer to sell, purchase or barter, transport, export or import, of any bald eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16 U.S.C. 668(a)). ''Take'' includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb (16 U.S.C. 668c; 50 CFR 22.3). The Bald Eagle Protection Act and increased public awareness of the bald eagle's status resulted in partial recovery or at least a slower rate of decline of the species in most areas of the country.

In the late 1940s, the use of dichloro-diphenyltrichloroethane (DDT) and other organochlorine compounds became widespread. Initially, DDT was sprayed extensively along coastal and other wetland areas to control mosquitoes (Carson 1962, pp. 28–29, 45–55). Later farmers used it as a general crop insecticide. As DDT accumulated in individual bald eagles from ingesting prey containing DDT and its metabolites, reproductive success plummeted. In the late 1960s and early 1970s, it was determined that dichlorophenyl-dichloroethylene (DDE), the principal breakdown product of DDT, accumulated in the fatty tissues of adult female bald eagles. DDE impaired calcium release necessary for normal eggshell formation, resulting in thin shells and reproductive failure.

In response to this decline, the Secretary of the Interior, on March 11, 1967 (32 FR 4001), listed bald eagles south of the 40th parallel as endangered under the Endangered Species Preservation Act of 1966 (16 U.S.C. 668aa–668cc). Bald eagles north of this line were not included in that action primarily because the Alaskan and Canadian populations were not considered endangered in 1967. On December 31, 1972, the Environmental Protection Agency banned the use of DDT in the United States. The following year, Congress passed the Endangered Species Act of 1973 (16 U.S.C. 1531–1544).

Nationwide bald eagle surveys, conducted in 1973 and 1974 by the Service, other cooperating agencies, and conservation organizations, revealed that the eagle population throughout the lower 48 States was declining. The Service responded in 1978 by listing the bald eagle throughout the lower 48 States as endangered except in Michigan, Minnesota, Wisconsin, Washington, and Oregon, where it was designated as threatened (43 FR 6233, February 14, 1978).

Between 1990 and 2000, the bald eagle population had a national average productivity of at least one fledgling per nesting pair per year. As a result, the bald eagle's nesting population increased at a rate of about eight percent per year during this time period. Since 1963, when the Audubon Society estimated that there were 417 nesting pairs, bald eagle breeding in the lower 48 States has expanded to more than 9,789 nesting pairs (60 FR 36001, July 12, 1995; 64 FR 36457, July 6, 1999). By 2007, bald eagles bred in each of the lower 48 States, with the greatest number of breeding pairs occurring in Minnesota (1,313), Florida (1,133), Wisconsin (1,065), and Washington (848) (72 FR 37349, July 9, 2007).

Regional bald eagle populations in the Northwest, Great Lakes, Chesapeake Bay, and Florida have increased five-fold from the late 1970s to the late 1990s. Bald eagles are now repopulating areas throughout much of the species' historical range that were unoccupied only a few years ago (64 FR 36454; July 6, 1999). The nationwide recovery of the bald eagle is due in part to the reduction in levels of persistent organochlorine pesticides (such as DDT) and habitat protection and management actions.

Historical and Current Status of the Sonoran Desert Area Population and Adjacent Areas

Below we present a discussion of eagle presence, nesting and breeding productivity in the Sonoran Desert Area population and throughout the entirety of each State surrounding the Sonoran Desert Area population in order to provide context for our evaluation of whether the Sonoran Desert Area is a distinct population segment of bald eagles. As described above, the Sonoran Desert Area refers to all Sonoran Desert bald eagle territories within Arizona, the Copper Basin breeding area along the Colorado River just into California, and the territories of interior Sonora, Mexico that occur within the Sonoran Desert and adjacent transitional communities. Bald eagles in Baja California are not included in our definition of the Sonoran Desert Area population because: (1) They are associated with a marine, rather than inland, environment (see Figure 1); (2) there is no documentation of Baja bald eagles interchanging with those in the Sonoran Desert Area; and (3) currently extant nests in Baja are limited to the Magdalena Bay region along the coast of the Pacific Ocean (Arnaud *et al.* 2001, p. 136; and King 2006, p. 4), in a coastal, rather than inland, climate.

Arizona

Hunt *et al.* (1992, pp. A11–A12) summarized the earliest records from the literature for bald eagles in Arizona. Coues noted bald eagles in the vicinity of Fort Whipple (now Prescott) in 1866, and Henshaw reported bald eagles south of Fort Apache in 1875. Bent (1937, pp. 321–333) reported breeding eagles at Fort Whipple in 1866 and on the Salt River Bird Reservation (since inundated by Roosevelt Lake) in 1911. Breeding eagle information was also recorded in 1890 near Stoneman Lake by S.A. Mearns. Additionally, there are reports of bald eagles along rivers in the White Mountains from 1937, and reports of nesting bald eagles along the Salt and Verde Rivers as early as 1930. Hunt *et al.* (1992, pp. D41–D46, D291–D326, Figures D4.0–1, D5.0–1, F3, F4, and F5) determined from reports and personal communications dating back to 1866 that historically there were 28 known breeding areas, 22 known and probable nest sites, and at least 60 unverified reports of possible nests/nest sites and unverified reports of bald eagles located across the State of Arizona. Many of the 60 possible nests/nest sites reported by Hunt *et al.* (1992) could be a collection of nests belonging to the same breeding territory. These reported locations ranged to the boundaries of the State from the Grand Canyon near Lake Powell, to the lower Colorado River where it separates Arizona and California, to the upper San Pedro River near the international border with Mexico, and east near the boundary with New Mexico (Hunt *et al.* 1992, Figures D4.0–1, D5.0–1, F3, F4, and F5).

More recent survey and monitoring efforts have increased our knowledge of bald eagle distribution in Arizona (these data take into account productivity for breeding areas throughout Arizona, and are not restricted to the Sonoran Desert population of bald eagles evaluated under the petition). The number of known breeding areas in Arizona in 1971 was 3; the number known in 2009 was 59. The number of bald eagle pairs occupying these sites increased from 3 in 1971 to 48 in 2009. The number of young hatched increased from a low of zero in 1972 to a high of 55 in 2006 (Driscoll *et al.* 2006, pp. 48–49; McCarty and Johnson 2009, p. 8, in draft). Productivity has also changed at the bald eagle breeding areas since the 1970s. Between 1975 and 1984, average annual productivity was 0.95 young per occupied breeding area. Between 1987 and 2005, average annual productivity was 0.78 young per occupied breeding area (derived from Table 7, pp. 48–50 in Driscoll *et al.* 2006).

Hunt *et al.* (1992, p. A155) conclude that it is likely that bald eagles nested on rivers throughout the Southwest before habitat modification occurred, as reports on the nature of river systems and the assemblage of prey fishes both seem conducive to nesting success and suggest ''richer and more extensive habitat in the lower desert'' than would have been available on the Mogollon

Plateau, where bald eagles are known to have occurred historically. Recent reoccupation of some of these historical breeding areas by bald eagles lends credibility to these reports. We evaluated a subset of the Allison *et al.* (2008, pp. 17–18) data to determine the status of 43 breeding areas within the Sonoran Desert Area of Arizona and concluded that 16 (37 percent) were pioneer breeding areas, or occupied for the first time. An additional 27 (63 percent) were either reoccupied, meaning they were known to have been occupied in the past, then vacated, and subsequently reoccupied, or are considered to have been existing before their discovery (Allison *et al.* 2008, pp. 15–16).

The Salt River Pima-Maricopa Indian Community states that the O'odham have inhabited the Sonoran Desert and have known eagles since ''time immemorial'' (Anton and Garcia-Lewis 2009, p. 1). Although anthropologists debate what this means, at least one noted archaeologist has documented detailed evidence of cultural remains in the nearby Pinacate area that date back more than 40,000 years (Hayden and Dykinga 1988, p. XIV). A local, informal consensus of 10,000 years is less controversial (Toupal 2003, p. 11). Bald eagles have been documented historically within the culture of the Four Southern Tribes of Arizona, which includes the Salt River Pima-Maricopa Indian Community, Ak-Chin Indian Community, Gila River Indian Community, and Tohono O'odham Nation (Anton and Garcia-Lewis 2009, p. 2). Because eagles are considered to have equal or greater standing to humans, eagle burials were carried out identical to human burial practices (Anton and Garcia-Lewis 2009, p. 2), and bald eagle burials have been recovered from archaeological sites ancestral to the O'odham culture. In addition, eagles are extremely prominent in the O'odham song culture (Anton and Garcia-Lewis 2009, p. 2). A paired set of songs recorded by Underhill (1938, p. 109) for a Tohono O'odham eagle purification ceremony recognized the bald eagle as the ''white-headed eagle.''

More recent evidence exists to demonstrate the importance and use of bald eagles in Apache culture. Herrington *et al.* (1939, pp. 13–15) noted the use of eagle feathers in religious practices and ceremonial dances. The Apache Tribes have documented numerous artifacts that were collected from the Tribes at Cibecue and East Fork/Whiteriver on the White Mountain Apache Reservation and on the San Carlos Reservation between 1901 and 1945. These Tribes note that these artifacts were made, in part, with eagle feathers, and include hats or caps; shields; medicine rings, shirts, and strings; amulets; war bonnets; armbands; hair ornaments; and wooden figurines and crosses. The Tribes note that these ceremonial items are of deep historical and ongoing importance, such that they are actively pursuing their return from the museums to the Tribes. The existence of these items demonstrates the use of eagle feathers by the Tribes for at least the last 100 years (Apache Tribes 2009, Tabs 6–10).

Traditional ecological knowledge from the Apache tribes report more breeding bald eagles 150 years ago than are present today. Specifically, tribal representatives note that many areas that were considered nesting sites on the San Carlos Apache Reservation such as Warm Springs Canyon, Black River Canyon, and Salt Creek Canyon no longer contain active bald eagle nests. Bald eagles are no longer found at four out of seven areas that have Apache place-names that reference bald eagles (Lupe *et al.* pers. comm. 2008, p. 4). The traditional ecological knowledge shared by the Tribes at a July 2, 2008, meeting indicates that historically more bald eagles were observed below Coolidge Dam and at Talkalai Lake than currently exist.

Nevada

There are few historical or current breeding records for the State of Nevada. The lone historical record describes bald eagles that nested in a cave on an island at Pyramid Lake in northwestern Washoe County in northwestern Nevada in 1866 (Service 1986, p. 7; Detrich 1986, p. 11; S. Abele, Service, pers. comm. 2008a; 2008b). Over 100 years later, the next verified nesting record occurred in 1985 along Salmon Falls Creek in Elko County in northeastern Nevada near the Idaho border. More modern nesting records are limited to approximately five breeding sites associated with human-made water impoundments. Reproductive performance and persistence of bald eagle pairs in Nevada has been varied. No breeding has been observed at the Salmon Falls site since 1985.

Colorado

According to the Northern Bald Eagle Recovery Plan, bald eagles in Colorado historically nested in the mountainous regions up to 10,000 ft (3,048 m). Successful nesting records exist for nests found in southwestern and west-central Colorado. Bald eagles were considered common residents in the 1940s and 1950s in and around Rocky Mountain National Park (Service 1983, p. 12). For southwestern Colorado, there were no verified records of nesting bald eagles in the 1960s (Bailey and Niedrach 1965 in Stahlecker and Brady 2004, p. 2). The first confirmed record for southwestern Colorado occurred in 1974 at Electra Lake (Winternitz 1998 in Stahlecker and Brady 2004, p. 2). In 1974, the Colorado Division of Wildlife reported that only a single nesting pair was known (Colorado Division of Wildlife 2008, p. 1). However, by 1981, there were five known occupied bald eagle territories in the State of Colorado (Service 1983, p. 23), and from the early 1980s to 2008, the known bald eagle population increased to nearly 80 territories, of which 60 are currently known to be active. Concentrations of breeding eagles are found east of the Continental Divide within the South Platte River watershed, on the Yampa River, on the White River, and on the Colorado River. Greater than 40 territories are monitored annually, with near 70 percent nest success, 1.19 young fledged per occupied site, and 1.72 young fledged per successful site (Colorado Division of Wildlife 2008, p. 1).

New Mexico

Available information indicates there was no specific, first-hand information on bald eagles nesting anywhere in New Mexico prior to 1979. Unverified reports (Bailey 1928, p. 180; Ligon 1961, p. 75) suggest one or two pairs may have nested in southwestern New Mexico, on the upper Gila River and possibly the San Francisco River, prior to 1928. These second-hand reports lacked specifics and may have referred to other species (Williams 2000, p. 1).

Since completion of the 1982 Recovery Plan, seven bald eagle territories have been discovered, five in northern New Mexico in Colfax and Rio Arriba Counties and two in southwestern New Mexico in Sierra and Catron Counties. Four have been recently occupied, and productivity has been fair with young produced in at least 6 to 15 years, depending on the territory (H. Walker, New Mexico Department of Game and Fish, pers. comm. 2008).

Southern California

Throughout southern California, historical bald eagle records are known from the Channel Islands and mainland counties along the Pacific Ocean (Detrich 1986, pp. 9–27). Prior to 1900, three bald eagle territory records were known (Detrich 1986, pp. 10–13). From 1900 to 1940, reports of 24 to 60 nest sites existed on islands off the coast of California, and are believed to have been extirpated from the islands soon after 1958 (Detrich 1986, pp. 18, 24). In inland areas in southern California, at least eight bald eagle pairs were known from Santa Barbara, Ventura, Los Angeles, Orange, and San Diego counties between 1900 and 1940, with indications of presence prior to this timeframe (Detrich 1986, pp. 13–19). By 1981, largely due to adverse changes to bald eagle habitat and the effects of the pesticide DDT on reproduction, no breeding eagles were detected on the southern California mainland (Detrich 1986, pp. 32, 33, 36, 39; California Department of Fish and Game 2008, p. 2).

Beginning in 1980, bald eagles were translocated to Santa Catalina Island as chicks or eggs from wild nests on the mainland, or from captive breeding. Pairs of bald eagles have been breeding on the island since 1987. In a subsequent relocation effort between 1987 and 1995 in the central coast mountains of Monterey Bay, 66 eaglets were translocated and released. A nesting pair first formed from those releases in 1993, and there are currently three nesting pairs (California Department of Fish and Game 2008, pp. 2–3). Releases of birds occurred through 2000, with no releases conducted between 2002 and 2008 (Ventana Wildlife Society 2009, p. 1). Currently, there are approximately six pairs of bald eagles on Catalina Island, with an additional three pairs at Santa Cruz Island, and one pair at Santa Rosa Island. There are approximately 35 to 40 bald eagles around the Northern Channel islands, and another 20 birds around Catalina, for a total of approximately 60 birds among the Channel Islands (A. Little, pers. comm. 2008).

Presently, mainland southern California nesting bald eagles occur at inland isolated manmade reservoirs. Bald eagle breeding sites can be found in northwestern San Luis Obispo County (San Antonio and Nacimiento Lakes), central Santa Barbara County (Lake Cachuma), southwestern San Bernardino County (Silverwood Lake), extreme eastern San Bernardino County near the Colorado River (Copper Basin Lake), southwestern Riverside County (Hemet and Skinner Lakes), and central San Diego County (Lake Henshaw) (AGFD 2008, California Department of Fish and Game 2008, pp. 2–3; Driscoll and Mesta in prep. 2005, p. 110; Ventana Wildlife Society 2008, p. 1). Nesting attempts at Silverwood and Hemet Lakes are considered sporadic (Service 2005, p. 110). At Skinner Lake, reproduction efforts in the mid-1990s were affected by DDT, and the nest area subsequently burned down (Driscoll and Mesta in prep. 2005; AGFD 2008). Nest sites in northwestern San Luis Obispo County appear to be very productive, producing eaglets in all but one year from 1993 to 2006 (Ventana Wildlife Society 2008, p. 7). For 2001 to 2008, two or three young have fledged annually from the Copper Basin breeding area, with the exception of 2004 when the nest was blown down (M. Melanson, Metropolitan Water District of Southern California, pers. comm. 2006a, 2007, 2008). The blue aluminum leg bands of one of the adult bald eagles at the Copper Basin site indicate that the bird likely originated in Arizona (M. Melanson, Metropolitan Water District of Southern California, pers. comm. 2006b).

Utah

Bald eagles were recorded as ''more or less frequent'' by Allen in 1871 (p. 164) in the vicinity of Ogden in northern Utah. Throughout Utah, there are seven historical records between 1875 and 1928, with five records of nesting bald eagles, and two other records of nonbreeding bald eagle observations, all located between Great Salt Lake and Utah Lake in northern Utah. In 1967, a nest was found to the south in Wayne County at Bicknell, and in 1972, an additional nest was located at Joes Valley Reservoir in San Pete County in central Utah, but it has since fallen. Additional records from the 1970s were of nests along the Colorado River at Westwater Canyon in 1975, and at the head of Westwater Canyon between 1973 and 1977. Beginning in 1983, nesting attempts occurred at three nesting territories in southeastern Utah. Two of the territories were along the Colorado River near the eastern border of Utah, with the third near Castle Dale in the center of the State (Boschen 1995, pp. 7–8). Three known nest sites (Cisco, Bitter Creek, and Castle Dale) were reported following survey work completed in 1994. These three nest sites produced an average of approximately 1.4 nestlings, with 1.05 successfully fledged between 1983 and 1994 (Boschen 1995, p. 103). Approximately 11 breeding areas were known, considered active, and monitored between 1983 and 2005 (Darnell, Service, pers. comm. 2008).

West Texas

Historically, there were five nesting records for bald eagles in Texas, and they were all west of the 100th Meridian in Texas. Lloyd (1887, p. 189) reported nesting in Tom Green and Concho counties in 1886. Oberholser (1974, p. 246) and Boal (2006, p. 46) reported eggs collected in Potter County near Amarillo by E.W. Gates in 1916. Oberholser (1974, in Service 1982, p. 8) additionally reported eggs collected by Smissen in 1890 in Scurry County south of Lubbock. Oberholser also reported an undated sight record of breeding eagles in Armstrong County near Amarillo. Kirby (pers. comm., in Service 1982) reported an active nest in nearby Wheeler County in 1938, and indicated it had been active for approximately 20 years. Throughout the 1980s and early 1990s there were no known breeding bald eagles in western Texas (Mabie *et al.* 1994, p. 215; Service 1982, p. 9). In 2004 and 2005, two adult bald eagles and a nestling were observed at a nest in the southern Great Plains of the Texas Panhandle. One young was produced in 2004, and two in 2005. No leg bands were readily observable on the adult eagles (Boal *et al.* 2006, pp. 246–247).

Sonora, Mexico

Bald eagle territories were first recorded in Sonora, Mexico, along the Rio Yaqui drainage in 1986 (Brown *et al.* 1986, pp. 7–14). Since that time, seven bald eagle breeding areas have been verified, and they were all located in the Sonoran Desert Area of Sonora (Brown *et al.* 1986, pp. 7–14; Brown *et al.* 1987b, pp. 1–2, 1987b, p. 279; Brown 1988, p. 30; Brown and Olivera 1988, pp. 13–16; Brown *et al.* 1989, pp. 13–15; Brown *et al.* 1990, pp. 7, 9; Mesta *et al.* 1993, pp. 8–12; Russell and Monson 1998, pp. 62–63; Driscoll and Mesta 2005 in prep., pp. 78–90). Four of these bald eagle breeding areas have remained occupied (Driscoll and Mesta, in prep., pp. 78–90). However, reproductive performance of these nests has been relatively poor. Only a single nestling was recorded fledging in 2000 and 2001, and no successful nests were observed in 1999, 2002, and 2005 (Driscoll and Mesta in prep., p. 43). In 2008, no occupancy was detected at bald eagle territories (R. Mesta, Service, pers. comm. 2008). A bald eagle pair was observed in 2009; however, the previously used cliff nest is gone, and a new nest was not confirmed. Illegal drug activity in the area has increased human presence, making survey work difficult to accomplish. The area is also affected by extensive water withdrawals, and drought and dam operations, leaving the future of this site uncertain (R. Mesta, Service, pers. comm. 2009).

Distinct Vertebrate Population Segment Analysis

Section 3(16) of the Act defines ''species'' to include ''any species or subspecies of fish and wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature'' (16 U.S.C. 1532(16)). To interpret and implement the distinct vertebrate population segment provisions of the Act and congressional guidance, the Service and the National Marine Fisheries Service (now the National Oceanic and Atmospheric Administration—Fisheries Service), published the *Policy Regarding the Recognition of Distinct Vertebrate Population Segments* (DPS Policy) in the **Federal Register** on February 7, 1996 (61 FR 4722). The DPS Policy sets forth a three-step process: the Policy requires the Service first to determine whether a vertebrate population is discrete and, if the population is discrete, then to determine whether the population is significant. Lastly, if the population is determined to be both discrete and significant, then the DPS Policy requires the Service to evaluate the conservation status of the population to determine whether the DPS falls within the Section 3(16) definition of an ''endangered species'' or ''threatened species.''

In accordance with our DPS Policy, this section details our analysis of whether the vertebrate population segment under consideration for listing qualifies as a DPS, specifically, whether: (1) The population segment is discrete from the remainder of the species to which it belongs: and (2) the population is significant to the species to which it belongs. Discreteness refers to the ability to delineate a population segment from other members of a taxon based on either: (1) Physical, physiological, ecological, or behavioral factors; or (2) international boundaries that result in significant differences in control of exploitation, management, or habitat conservation status, or regulatory mechanisms that are significant in light of section 4(a)(1)(B) of the Act.

Under our DPS Policy, if we have determined that a population segment is discrete under one or more of the discreteness conditions, we consider its significance to the larger taxon to which it belongs in light of Congressional guidance (see Senate Report 151, 96th Congress, 1st Session) that the authority to list DPSs be used ''sparingly'' while encouraging the conservation of genetic diversity. In carrying out this examination, we consider available scientific evidence of the population's importance to the taxon to which it belongs. This consideration may include, but is not limited to, the following categories of information: (1) The persistence of the population segment in an ecological setting that is unusual or unique for the taxon; (2) evidence that loss of the population segment would result in a significant gap in the range of the taxon; (3) evidence that the population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside of its historical range; and (4) evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics.

The first step in our DPS analysis was to identify the boundaries of the potential population—that is, the areas where the population we are evaluating occurs. The petition from CBD, the Maricopa Audubon Society, and the Arizona Audubon Council requested listing for the ''Southwestern desert nesting bald eagle population.''

Determination of the Area for Analysis

The March 6, 2008, court order directed the Service to conduct a status review of the ''Desert bald eagle population.'' The population referenced in the court order consists of those bald eagles in the Sonoran Desert of the Southwest that reside in central Arizona and northwestern Mexico. While we had specific information from the petitioner with respect to elevational parameters, bald eagle breeding areas, the Upper and Lower Sonoran Life Zones, and the State of Arizona, ambiguity remained with respect to where the boundaries of ''central Arizona'' are and which transition areas outside of the Upper and Lower Sonoran Life Zones to include. Because of these ambiguities and lack of a specific map in the petition, we were left to interpret them, primarily at the perimeters of those areas.

In responding to the 2008 court order, we published a rule on May 1, 2008, reinstating threatened status under the Act to the bald eagle in the Sonoran Desert Area of central Arizona in eight Arizona counties: (1) Yavapai, Gila, Graham, Pinal, and Maricopa Counties in their entirety; and (2) southern Mohave County (that portion south and east of the centerline of Interstate Highway 40 and east of Arizona Highway 95), eastern LaPaz County (that portion east of the centerline of U.S. and Arizona Highways 95), and northern Yuma County (that portion east of the centerline of U.S. Highway 95 and north of the centerline of Interstate Highway 8). We limited the reinstatement of threatened status to these areas because Sonoran Desert bald eagles were only listed under the Act in Arizona (and not in Mexico) at the time of the petition. Therefore, the court's order enjoining our final delisting decision applied only to those eagles that reside in the Sonoran Desert of central Arizona.

For the February 25, 2010, status review, we revisited the issue of where the population we are evaluating occurs, based on a more in-depth review of information received from the public, Tribes, and information in our files at that time. We determined that an appropriate delineation for the analysis includes all Sonoran Desert bald eagle territories within Arizona, the Copper Basin breeding area along the Colorado River just into California, and the territories of Sonora, Mexico, that occur within the Sonoran Desert and adjacent transitional communities. This expanded boundary was developed using vegetation community boundaries, elevation, and breeding bald eagle movement. This interpretation combines geographic proximity and recognized Sonoran Desert vegetation and transition life zones. We determined the transition areas based on our knowledge of their proximity to the Sonoran Desert itself, excluding territories more properly classified as montane or grassland habitat. Bald eagles in Baja California, Mexico, occur in an area where the Sonoran Desert vegetation community abuts a coastal environment. We excluded bald eagles in this area because they depend on marine resources rather than inland fisheries. We based delineation of the potential DPS on the best available scientific information, including the parameters provided by CBD (i.e., bald eagle territories, elevation, life zones, and transition areas), and the resulting expanded area for the population includes known bald eagle breeding areas within the Sonoran Desert vegetation community and transition areas, as defined by Brown (1994, pp. 181–221), except Baja California.

As noted above, we included Sonoran desert bald eagle territories in Sonora, Mexico, as part of the potential DPS because that area has the same vegetation and climate as the Sonoran Desert areas in Arizona. Bald eagles in Sonora use Sonoran Desert and transition vegetation communities as do bald eagles in the Sonoran Desert areas of Arizona and southern California. In addition, breeding season chronology in both areas appears to be similar (Driscoll *et al.* 2005 in prep., pp. 31–32), occurring between December and June. Bald eagles in Sonora also nest in riparian trees and cliffs, as they do in Arizona (Driscoll *et al.* 2005 in prep., p. 31).

When based strictly on vegetation or elevation lines, the expanded area where the population occurs is irregular and complex, and would be difficult to interpret. For this reason, we delineated the area of the population with more easily identifiable road, county, and state lines.

Boundaries of the Potential DPS

In analyzing the potential DPS under this 12-month status review, we considered habitat use by bald eagles breeding in the southwestern United States and Sonoran Desert areas in Mexico, vegetation communities in which breeding areas occur, and elevation levels at which breeding areas occur, as we did at the 90-day petition finding stage. However, we have reevaluated all potential areas that may meet the criteria described below, including areas considered in the 90-day finding. As a result, in this review, we did not restrict the potential DPS to the State of Arizona, and have instead expanded the area covered by our previous analysis so that this analysis includes portions of southeastern California along the Colorado River, Arizona, and Sonora, Mexico. We now refer to this expanded potential DPS area as the ''Sonoran Desert Area population,'' which replaces the term ''Sonoran Desert Area of central Arizona,'' as described in our May 1, 2008, **Federal Register** rule (73 FR 23966) listing the Sonoran Desert bald eagle as threatened.

To determine which areas should be included within the expanded boundary for the Sonoran Desert Area, we considered three factors: (1) The Sonoran Desert vegetation community (Brown 1994, pp. 180–221; Brown and Lowe 1994, map); (2) an elevational range for known breeding areas within the Sonoran Desert (excluding Baja California); and (3) movement patterns of breeding bald eagles both into and out of the Sonoran Desert Area. We included within the boundary portions of the Sonoran Desert, including its subdivisions and ''transition areas.'' Subdivisions of the Sonoran Desert include the Lower Colorado River Valley, Arizona Upland, Vizcaino, Central Gulf Coast, Plains of Sonora, and Magdalena (Brown 1994, pp. 190–221). Transition areas are those vegetation communities adjacent to the Sonoran Desert community. Brown (1994, p. 181) includes as transition areas semidesert grasslands, Sinaloan thornscrub, and chaparral. The majority of the breeding areas within the boundary occur in the Arizona Upland Subdivision of the Sonoran Desert. Exceptions include those breeding areas in the transition communities (where 14 of 61 breeding areas are located) of Interior Chaparral, Plains & Great Basin Grassland, Semidesert Grassland, and Sinaloan Thornscrub (Brown 1994). These communities are most often adjacent to the Arizona Upland Subdivision of the Sonoran Desert, where bald eagles in these areas forage at least partially within the desertscrub.

We also based the boundary on those portions of the Southwest within the elevational range of 984 to 5,643 ft (300 to 1,720 m). This elevational range encompasses all known bald eagle breeding areas within the Sonoran Desert in the United States and Sonora, Mexico. Using Geographic Information Systems, the appropriate elevational ranges were overlapped with the Sonoran Desert vegetation community to determine where both criteria were met.

We also considered information on movement of bald eagles into and out of the Sonoran Desert, as determined through banding and monitoring information. Specifically, we included within the boundary those bald eagles known to originate in or breed in the Sonoran Desert and transition areas, excluding Baja California. The banding and monitoring information used to determine eagles originating or breeding in the Sonoran Desert Area is described in detail below.

Figure 1 below illustrates the boundary developed based on vegetation community, elevation, and breeding bald eagle movement. The boundary was modified from following strictly elevational or vegetation lines to follow more easily identifiable road, county, and state lines.

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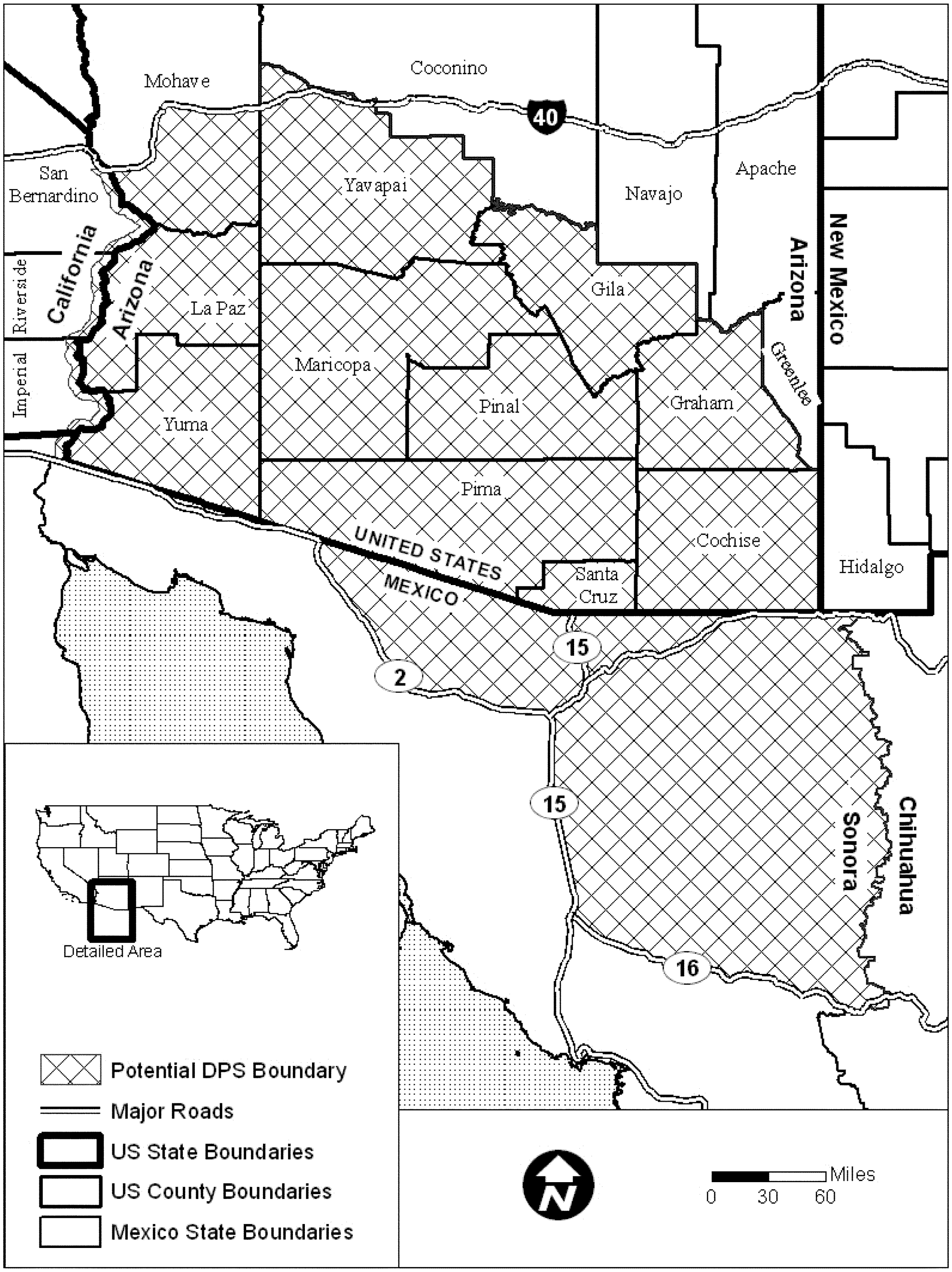
Figure 1. Boundary of potential Sonoran Desert Area distinct population segment (DPS)



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The northern perimeter of the expanded potential DPS boundary in Arizona is the same as the potential DPS boundary that we used in our May 1, 2008, **Federal Register** notice (73 FR 23966). This boundary follows the southern edges of Coconino and Navajo Counties, and portions of Apache County. It follows the Graham County line south on the east side until it reaches the Cochise County boundary.

On the west, the boundary drops south along the Mohave-Yavapai boundary until it reaches Interstate 40. The boundary then follows Interstate 40 west until its intersection with the State boundary. It continues west 5 miles (mi) (8 kilometers (km)) and then south along a line drawn 5 mi (8 km) west of and parallel to the Colorado River until it reaches Highway 2 in Sonora, Mexico.

The southern boundary of the expanded potential DPS follows Highway 2 in Mexico east until its intersection with Highway 15. It follows Highway 15 until its intersection with

Highway 16. The southern boundary continues along Highway 16 until it reaches the State boundary between Sonora and Chihuahua. The eastern boundary of the expanded potential DPS follows the State line between Sonora and Chihuahua north until it reaches the international boundary between the United States and Mexico at New Mexico, and continues west to the State boundary between Arizona and New Mexico. The eastern boundary then continues north along Cochise County, turning slightly west along the northern edge of Cochise County before rejoining the northern perimeter.

Bald eagles within the boundary that constitutes the expanded area for the potential DPS include those that occur within the appropriate vegetation communities and elevational range. It therefore includes the breeding area located in southeastern California, because it is within the Lower Colorado River subdivision of the Sonoran Desert. In addition, the bald eagles at that breeding area originated at the Horseshoe Breeding Area in Arizona. We have included part of Sonora, Mexico, within the expanded area for the potential DPS because bald eagles occur in Sonoran Desert and transitional communities there, as do those in Arizona and California. As discussed above, we have excluded from the expanded potential DPS bald eagles occurring in Baja California, Mexico, because that area is associated with a marine, rather than inland, environment.

Arizona has additional bald eagle breeding areas outside of the expanded potential DPS boundary. These breeding areas include Canyon de Chelly, Luna, Becker, Crescent, Greer, Woods Canyon, and Lower Lake Mary. These breeding areas were excluded because they are not located within the Sonoran Desert.

Discreteness

Under the DPS Policy, a population segment of a vertebrate taxon may be considered discrete if it satisfies either one of the following conditions:

(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.

(2) It is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

Banding and Monitoring Information

Bird banding and resighting are important tools used to answer questions regarding the biology and movement of individual birds (U.S. Geological Survey 2008, p. 1). The techniques used on bald eagles in the Southwest are consistent with marking technique standards (Varland *et al.* 2007, pp. 222–228). Within this analysis, we use banding and resighting data for bald eagles to determine if bald eagles in the Sonoran Desert Area are markedly separate from other breeding populations of bald eagles. Specifically, we use banding and resighting data to determine if bald eagles originating in areas outside the Sonoran Desert Area have moved into the Sonoran Desert Area to breed (immigration), or if bald eagles originating in the Sonoran Desert Area have moved out of the Sonoran Desert Area to breed (emigration).

We used bald eagle banding and resighting information collected between 1987 and 2007 as this is the time period during which banding and resighting efforts were most thorough in the Southwest. Banding of bald eagle nestlings began prior to this time in Arizona, starting in approximately 1977, and multiple researchers contributed to early banding efforts (Hildebrandt and Ohmart 1978; Haywood and Ohmart 1980, 1981, 1982, 1983; Grubb 1986), as summarized in Hunt *et al.* 1992 (pp. C181–C202). However, early banding efforts were opportunistic, and the bands used at that time were difficult to read without capturing birds or recovering dead birds. As a result, little resight information was gained. Beginning in 1987, biologists increased efforts to band all nestlings and improved the effectiveness of banding and resighting by using color visual identification bands, which are more easily identified (Hunt *et al.* 1992, pp. C181–C202; Driscoll *et al.* 2006, p. 26). In total, the banding and resighting effort for bald eagles in Arizona has continued for 30 years with the last 20 years using the more informative color bands.

To determine the movement of breeding bald eagles in our target time period of 1987 to 2007, we relied on data from two datasets. The first dataset, called the Bird Banding Lab (BBL) dataset, is derived from data collected and collated by the U.S. Geological Survey Bird Banding Laboratory (U.S. Geological Survey 2008). The BBL dataset consists of over 19,000 records for bald eagles throughout the species' range, including those banded in the Southwest. The second dataset, called the AGFD dataset, is derived from data compiled and used by Allison *et al.* (2008) in a demographic analysis for bald eagles in Arizona.

Because our analysis focused on determining whether or not there is immigration or emigration of bald eagles to and from the Sonoran Desert Area, we analyzed bald eagles banded as nestlings and resighted as adults. Using only those birds banded as nestlings ensures that the origin of the banded birds is known, and that young birds originating in other areas are not included in the analysis. Using only resight information for breeding bald eagles eliminates data associated with juvenile migrants, which would not contribute to the breeding population. Generally, age five is accepted as the age at which adult bald eagles breed throughout most of the species' range. For this reason, when evaluating the nationwide BBL dataset, we considered bald eagles 5 years of age or older as breeding adults. However, for the AGFD dataset, where there are numerous instances of bald eagles breeding at 4 years of age in Arizona (Allison *et al.* 2008), we considered bald eagles 4 years of age or older as breeding adults.

Immigration Into the Sonoran Desert Area

For purposes of this analysis, immigration is defined as the movement of individuals that were banded as nestlings outside of the Sonoran Desert Area and then are subsequently resighted as breeding birds inside the Sonoran Desert Area. In our analysis of the likelihood of bald eagle immigration into the Sonoran Desert Area from areas in closest proximity to the Sonoran Desert Area, we used data from the AGFD and the broader BBL dataset and considered bald eagle banding and resighting information from the States in proximity to the Sonoran Desert Area, including California, Colorado, Nevada, New Mexico, Texas, and Utah, as well as birds in Arizona but outside of the Sonoran Desert Area (see Table 1).

TABLE 1—RECORDS FOR BALD EAGLES BANDED AS NESTLINGS IN AREAS OUTSIDE THE SONORAN DESERT AREA AND RESIGHTED AS BREEDING BIRDS FROM 1987 TO 2007

[U.S. Geological Survey 2008; K. McCarty, AGFD, pers. comm. 2009; Driscoll *et al.* 2006, p. 49]

State where banded	Number of nestlings banded in areas in close proximity to the Sonoran Desert area 1987–2002	Number of banded nestlings resighted as breeding birds 1987–2007	States where banded eagles were resighted	Number of resightings in the Sonoran Desert area
Arizona outside the Sonoran Desert Area	12	0		0
California	103	13 (12.6%)	British Columbia, CA, WA	0
Colorado	152	7 (4.6%)	CO, WY	0
Nevada	0	0 (0%)		0
New Mexico	0	0 (0%)		0
Texas	64	5 (7.8%)	AZ, CA, NE, NM, TX	0
Utah	6	0 (0%)	UT	0
Total	337	25 (7.4%)		0

Available data from 2008 are not as thorough, but they are consistent with the findings from the data reported. Further, the Texas bird resighted in Arizona occurs at a high-elevation nest outside of the Sonoran Desert Area. Note: We know of no banding information for birds banded in Mexico outside the Sonoran Desert Area.

Using the AGFD dataset, Allison *et al.* (2008, p. 25) indicate that anticipated survival rates for fledglings to age four is 28 percent. It should be noted that the mortality rates derived by Allison *et al.* (2008, p. 4) are based on modeling; however, the model was based on data collected over a 10-year period from 1993 to 2003.

The information summarized in Table 1 indicates that 337 bald eagles were banded as nestlings between 1987 and 2002 (the latest year for which a banded cohort could reach 5 years of age by 2007) in the areas outside of but in proximity to the Sonoran Desert Area. Applying the survival rate of 28 percent to the 337 bald eagles reported banded as nestlings in Table 1, we would anticipate that approximately 94 nestlings would have survived to age four. Only 25 of the banded nestlings were resighted as breeding birds, and the fate of the remaining 69 nestlings is unknown. However, none of the 25 banded nestlings were resighted as breeding birds within the Sonoran Desert Area (see Table 1).

While the number of banded and resighted birds in Table 1 is small, given the intensive effort in Arizona to identify the origins of banded breeding birds, we believe some inference is possible suggesting that the probability of nestlings originating outside of the Sonoran Desert Area and immigrating into the Sonoran Desert Area to breed is low.

There is no known immigration from the Canyon de Chelly, Lower Lake Mary, Becker, Woods Canyon, Crescent, Greer, and Luna Lake breeding areas located at higher elevations within Arizona outside of the Sonoran Desert Area. To date, 29 nestlings produced at these breeding areas have been banded. Twenty-five of these were banded at the Luna breeding area during 1994–2000, 2002–2005, and 2007, with 22 of them fledging successfully (K. McCarty, AGFD, pers. comm. 2009). As of 2008, none of these banded offspring are known to have entered the breeding population of bald eagles in the Sonoran Desert Area (AGFD 2008a, pp. 1–2). The male bird at the Crescent breeding area is from the Luna breeding area (the female is unbanded) (Jacobson *et al.* 2004, p. 16). Similarly, the male bird at the Greer breeding area is from the Luna breeding area, and the female is unbanded (McCarty and Jacobson 2008, p. 9). Lower Lake Mary fledged four young in 2005 and 2006, and the young were banded. The Woods Canyon and Greer breeding areas were first detected in 2008, and no young fledged that year from either breeding area. Six young have successfully fledged from Canyon de Chelly as of this date, none of which were banded (AGFD 2006, pp. 1–2; AGFD 2007, pp. 1–2; Jacobson *et al.* 2007, pp. 16–19; AGFD 2008a, pp. 48–49; AGFD 2008, unpubl. data; AGFD 2009, pp. 1–2).

Biologists, primarily R. Mesta, estimate that, due to difficulty in accessing territories in Sonora, Mexico, they are able to monitor approximately 40 to 60 percent of the known nest sites each year, and 20 to 30 percent of the known birds are observed while visiting these territories. Approximately 80 percent of the birds detected have been examined for auxiliary markers, such as colored bands, and biologists believe that if marked bald eagles were occupying known territories after 1990, they would likely have been detected. However, they note that, in years in which surveys are conducted, breeding areas are visited only once and for a short period of time, which would make it easy to miss an individual eagle. They note that, in 1992, an adult at the Fig Tree breeding area had a yellow wing tag (potentially indicating it had originated in Texas or Florida) that could not be read, but no one has observed the bird since ((Driscoll and Mesta 2005, in prep., p. 62; R. Mesta, Service, pers. comm. 2008, Ortego *et al.* 2009, p. 10).

Emigration From the Sonoran Desert Area

Emigration is defined here as the movement of individuals originating in the Sonoran Desert Area to areas outside the Sonoran Desert Area where they are resighted as birds of breeding age. Our analysis of data from the BBL dataset found that 41 of the 42 nestlings (97.6 percent) banded within the Arizona portion of the Sonoran Desert Area were subsequently resighted within the Sonoran Desert Area. Only one eagle (2.4 percent) of breeding age was resighted outside of the Sonoran Desert Area, near Temecula, California (see Table 2). The BBL dataset shows that there were 371 bald eagles banded in Arizona between 1987 and 2007. With anticipated survival rates from fledgling to 4 years of age at 28 percent, we estimate that approximately 104 nestlings should have survived to age four. While we know that 42 were resighted, the fate of the remaining 62 birds is unknown.

TABLE 2—BALD EAGLES BANDED IN ARIZONA BETWEEN 1987 AND 2002 AND RECAPTURED OR RESIGHTED AS BIRDS OF BREEDING AGE

[U.S. Geological Survey 2008]

State	Number of birds (percent recovered)	Notes
Within the Sonoran Desert Area:		
Arizona	40 (95.2%)	
Sonora, Mexico	1 (2.4%)	Records indicate this bird was an adult entangled in fishing line at El Novillo Reservoir in Sonora. There was no breeding area at the reservoir, and the bird was not subsequently detected at a breeding area.
Subtotal	41 (97.6%)	
Outside of the Sonoran Desert Area:		
California	1 (2.4%)	This bird established a breeding area in California near Temecula. Birds in this breeding area were not successful in reproducing, and the nest site subsequently burned down (AGFD 2008a, p. 6).
Colorado	0 (0%)	
Nevada	0 (0%)	
New Mexico	0 (0%)	
Oklahoma	0 (0%)	
Texas	0 (0%)	
Utah	0 (0%)	
Subtotal	1 (2.4%)	
Total	42 (100%)	

With respect to emigration, data in the AGFD dataset, a separate dataset from the BBL discussed above, illustrate the fate of 89 of 314 nestlings banded within the Sonoran Desert Area. Only 1 of the 89 birds was documented breeding outside the Sonoran Desert Area. Fifty returned to breed in the Sonoran Desert Area, 1 bred (unsuccessfully) in California, and 38 were known to have died before breeding (see Table 3) (Allison *et al.* 2008, p. 19). Allison *et al.* (2008, p. 7) note that, from 1987 through 2003, 83 percent of known fledglings in the Sonoran Desert Area were banded. Traditional ecological knowledge about bald eagles supports these data on emigration. Western Apache informants having expert knowledge of bald eagles in the Sonoran Desert Area testified that adult eagles do not leave Arizona.

TABLE 3—DISPOSITION OF ARIZONA BALD EAGLES BANDED AS NESTLINGS FROM 1987 TO 2003

[Allison *et al.* 2008, p. 19]

Fate of nestlings	Number of eagles
Dead before fledging	123
Unbanded Nestlings	62
Banded Nestlings—Fate Unknown	225
Banded Nestlings—Fate Known:	
Dead before Breeding	38
Bred in Arizona	50
Bred in California	1
Total	499

Banding and resighting efforts have not been as intensive in the areas in close proximity to the Sonoran Desert Area as they have been in Arizona, including the Sonoran Desert Area. We sent a questionnaire to bald eagle biologists in surrounding States in 2008 in an attempt to determine the level of banding and monitoring efforts in some of these regions. In response to the questionnaire, we determined that surveys for breeding birds occur annually at Santa Cruz and Santa Rosa Islands off the coast of California, as well as in southern California at Lake Hemet. In survey efforts for these areas, all known territories and 100 percent of the known birds are visited, and no birds have bands or markers from Arizona (Hoggan 2008, pp. 1–2; P. Sharpe, pers. comm. 2008). Additionally, less-formal monitoring occurs in other areas in California through a variety of agencies and interested groups, including the U.S. Forest Service, the California Department of Fish and Game, the Ventana Wildlife Society, and the Channel Islands Live! Web site with similar results (i.e., no birds with bands from Arizona have been reported). In addition, sites known to support breeding pairs, such as the Copper Basin site, are monitored regularly.

Six New Mexico territories have been monitored closely since their discovery in 1979, with no bands or markers from Arizona observed (S. Williams, pers. comm. 2008). Since 1974, the Colorado Division of Wildlife has monitored nesting activity; State personnel currently monitor approximately 40 of their 80 nests each year and band eaglets at approximately one-third of those nests (Colorado Division of Wildlife 2008, p. 1). No bands or markers from Arizona were observed.

We have received no data for Utah or Nevada. Information on bald eagles banded within Arizona but outside the Sonoran Desert Area is summarized above under the ''Immigration into the Sonoran Desert Area'' discussion above.

The data from areas in close proximity to the Sonoran Desert Area are not as thorough as those collected in

Arizona, including in the Sonoran Desert Area. However, the banding and monitoring effort for breeding bald eagles in Arizona over a 30-year period has revealed only one breeding bird to date that immigrated into Arizona (Luna Lake, outside the Sonoran Desert Area). We anticipate that, if immigration is occurring at such a low level, the same could be true of emigration as there are no known barriers that would favor emigration over immigration.

Conclusion on Banding Data

We find that the data on banding and resighting, while not extensive for areas in proximity to the Sonoran Desert Area, are collectively sufficient to document that bald eagles in the Sonoran Desert Area experience limited or rare reproductive interchange with bald eagles outside the Sonoran Desert Area. Bald eagle banding and resighting studies have been ongoing for greater than 30 years in Arizona, with the last 20 years using the more informative color bands. As reported in the BBL dataset, of the 79 nestlings banded in Arizona and later resighted, 1 emigrated to California, outside of the Sonoran Desert Area, and never successfully reproduced. This finding indicates that 97.6 percent of the bald eagles banded and resighted as breeding birds originated and returned to breed in the Sonoran Desert Area, with only 2.4 percent (one bird) of breeding birds resighted in other areas (Table 2). Similarly, the AGFD dataset indicates that, for the nestlings banded between 1987 and 2003 in areas outside of but in close proximity to the Sonoran Desert Area and resighted as breeding birds, none have immigrated to breed in the Sonoran Desert Area.

While it is not possible to band and resight all bald eagles as breeding birds, the information provided suggests that the majority of breeding bald eagles within the Sonoran Desert Area population originated in the Sonoran Desert Area population, and have not been known to emigrate elsewhere to become part of a breeding population.

Data have been collected over a substantial time period under this effort, during which only one instance of a possible immigration and only one instance of emigration have been observed within the Sonoran Desert Area. We believe it is reasonable to conclude that in rare instances, immigration or emigration of an occasional bald eagle may occur; however, we consider the results from this 20-year period sufficient to document a marked separation of breeding populations. Our DPS Policy does not require complete isolation, and allows for some limited interchange among population segments considered to be discrete (61 FR 4722; February 7, 1996). Based on the results of these banding and resighting data in Arizona and in neighboring States, we conclude that the Sonoran Desert Area bald eagles are not interbreeding with other populations, although some intermixing may occur at a very small rate. We conclude that the best scientific data available indicates a marked separation of Sonoran Desert Area bald eagles from bald eagles outside of the Sonoran Desert Area.

Natal Dispersal and Fidelity

Bald eagles are known to return close to their place of birth to breed (Stalmaster 1987, p. 41). To illustrate the potential for breeding bird exchange between populations, the Service examined the records of bald eagles that were banded as nestlings and recovered 5 or more years later at breeding age. We analyzed data associated with the eagles in the lower 48 States to derive a median dispersal distance of 43 mi (69 km) from their natal site to their breeding area. Known nesting sites were then buffered by 43 mi (69 km) to determine the amount of breeding bird exchange that typically occurs (Service 2008, pp. 17–18). Based on this analysis, Sonoran Desert Area bald eagles in the United States are separated from other southwestern populations by distances exceeding the median dispersal distance of 43 mi (69 km) for the species. The higher-elevation breeding areas in Arizona are an exception to this separation, as they are less than 43 mi (69 km) from Sonoran Desert Area bald eagles; however, we believe these birds to be reproductively and markedly separate from Sonoran Desert Area bald eagles, as described in the discussions on immigration above, because no banded offspring from these higher-elevation areas have been known to enter the breeding population of bald eagles in the Sonoran Desert Area.

Observations of actual dispersal behavior support the same conclusion as that derived from the modeling exercise discussed above. Hunt *et al.* (1992, p. A144) surveyed biologists studying nine bald eagle populations throughout North America, consisting of more than 2,000 breeding pairs of bald eagles. Of those breeding pairs, only two adults were observed to breed outside of their natal area. Mabie *et al.* (1994, p. 218) similarly concluded through their study in Texas and the Greater Yellowstone ecosystem that bald eagles tend to breed near their natal area. Gerrard *et al.* (1992, pp. 159, 164) observed four marked adults in Saskatchewan, Canada, and determined that they bred within 15.5 mi (25 km) of their natal territory.

Natal dispersal patterns for Sonoran Desert Area bald eagles are similar to those in the studies discussed above. Data from 21 female and 35 male bald eagles in Arizona indicate that adult females dispersed an average of 68.1 mi (109.7 km) from their natal areas, while males dispersed an average of 28.0 mi (45.1 km) from their natal areas to breed (Allison *et al.* 2008, p. 30), but remained within the Sonoran Desert Area.

This information about natal dispersal patterns supports our conclusion above, based on the banding and monitoring data, that there is a marked separation of Sonoran Desert Area bald eagles from bald eagles outside of the Sonoran Desert Area.

Lack of Population Sources

The immigration of adult bald eagles into the Sonoran Desert Area population from populations in relatively close proximity to the Sonoran Desert Area is likely limited by small population sizes in surrounding States, and their separation from the Sonoran Desert Area by long distances, over unoccupied habitats. There are currently eight known breeding areas in southern California in addition to populations on Santa Cruz and Santa Rosa Islands off the coast of California (California Department of Fish and Game 2008, pp. 2–3; Ventana Wildlife Society 2008, p. 1). Colorado has a somewhat larger population, with approximately 80 active breeding areas (Colorado Division of Wildlife 2008, p. 1). Nevada has approximately one inactive and five active breeding territories. Two territories, Carson River and Lahontan Reservoir, last had eagles detected in 2002 and 2006, respectively. The occupancy of two others is not yet confirmed. The remaining breeding area produced only two young from 1996 to 2007 (K. Kritz, Service, pers. comm. 2008). Utah has approximately 10 active territories and one inactive breeding territory (N. Darnall, Service, pers. comm. 2008). For New Mexico, the population of bald eagles consists of four currently occupied territories (H. Walker, NMDGF, pers. comm. 2009). West Texas currently has one active breeding territory west of the 100th Meridian. This territory has been active since 1994 (C. Boal, pers. comm. 2009).

Marked Separation as a Consequence of Ecological Factors

A final factor markedly separating Sonoran Desert Area bald eagles is the unsuitability of habitat in areas surrounding the Sonoran Desert Area for occupancy by breeding birds. The majority of the bald eagle population in the Sonoran Desert Area occurs in central Arizona within the riparian areas of the Sonoran Desert as described in Brown (1994, pp. 180–221) and adjacent vegetation communities. Across the western United States, there are large geographic areas where breeding bald eagles are rarely found. These areas are associated with the Great Basin and Mohave Deserts, indicating that conditions in these desert biotic communities are not suitable for occupancy. In contrast, the Sonoran Desert and its subdivisions, where nesting bald eagles within the Sonoran Desert Area are located, are suitable for breeding areas because of the availability of water, prey, and trees suitable for nesting and perching. The Sonoran Desert scrub vegetation community is unique from other desert scrub formations in North America in its tropical and subtropical influences. Within the community, the riparian or riverine habitat occupied by breeding bald eagles is limited to areas where there is sufficient winter precipitation to support vegetation along streams (Brown 1994, p. 269).

Western Apache traditional ecological knowledge corroborates these data regarding bald eagles within the Sonoran Desert Area being ecologically separated from other populations. Three Apache place names use the term Itsa Bigow (''bald eagle's home''). Apaches use the term gowa (meaning ''home'') referring to the eagle's entire habitat, as opposed to the term bit'oh (''its nest''). According to Basso (1996), the Western Apaches' perception of the land works in specific ways to influence Apaches' awareness of themselves. The process of ''place naming'' documents where and how Apaches learned about the environment and how they incorporated these names into social and environmental ethics (Basso 1996). This concept is further exemplified by the Apache word ''ni''; this expression translates to mean both ''mind'' and ''land,'' and thus the two words cannot be separated (Chairman Ronnie Lupe, pers. comm., 2008). The Apache bald eagle place names evoke an entire area or ecosystem of which the bald eagle is an intrinsic part. The place names include entire mountainsides composed of chaparral, pinyon-juniper woodland, and ponderosa pine forests, always in proximity to water (i.e., riparian areas) (Lupe *et al.* pers. comm. 2008).

Bald eagles, including those in the Sonoran Desert Area, typically nest within 1 mi (1.6 km) of water. Bald eagles require cliff ledges, rock pinnacles, or large trees or snags in which to construct nests (Driscoll *et al.* 2006, pp. 19–20). Those areas most immediately surrounding the Sonoran Desert Area fall within the Great Basin and Mohave Deserts, which contain no known breeding eagles or suitable habitat. These areas lack the appropriate bald eagle habitat parameters of water, fish, and nesting areas. Nonbreeding bald eagles from other populations would have to migrate through these areas to reach the Sonoran Desert Area. Therefore, we believe these desert areas result in a discontinuity of distribution of breeding birds, rather than as a barrier to dispersal, and serve to further isolate Sonoran Desert Area bald eagles from those in other populations.

Bald eagles nesting at high elevation in Arizona in areas in proximity to the Sonoran Desert Area occupy Petran Montane Conifer Forest and Plains, and Great Basin Grassland above the Mogollon Rim (Brown and Lowe 1994, map). These eagles are not believed to have originated from within the Sonoran Desert Area, as described above. Similarly, bald eagles occupying these areas are not known to have occupied Sonoran Desert habitat within the Sonoran Desert Area. These high-elevation areas appear to be unsuitable to Sonoran Desert Area bald eagles, as indicated by the lack of emigration to these areas by eagles originating in the Sonoran Desert Area.

Conclusion on Discreteness

Based on the available information in the petition, scientific literature, traditional ecological knowledge, and information in our files at the time of the February 25, 2010, finding, we have determined that the Sonoran Desert Area population of bald eagles is markedly separate from other populations of the species due to a lack of immigration to, and emigration from, surrounding bald eagle populations, and the fact that the areas immediately surrounding the Sonoran Desert Area lack the appropriate bald eagle habitat parameters of water, fish, and nesting areas and contain no known breeding bald eagles. Therefore, we have determined that the Sonoran Desert Area population meets the requirements of our DPS Policy for discreteness. Banding studies and resighting efforts demonstrate that breeding bald eagles in the Sonoran Desert Area are largely geographically separate from those in surrounding areas. Limited source populations and unsuitable habitat in surrounding areas further separate bald eagles in the Sonoran Desert Area from those in other areas. Although not absolute, we believe this separation to be marked, and to meet the intent of the DPS Policy for discreteness.

Significance

Since we have determined that the bald eagles in the Sonoran Desert Area meet the discreteness element of the DPS Policy, we now consider the population's biological and ecological significance based on ''the available scientific evidence of the discrete population segment's importance to the taxon to which it belongs'' (DPS Policy, 61 FR at 4725). We make this evaluation in light of congressional guidance that the Service's authority to list DPSs be used ''sparingly'' while encouraging the conservation of genetic diversity (DPS Policy, 61 FR at 4722; S. Rep. No. 96–151 (1979)). The DPS Policy describes four classes of information, or considerations, to take into account in evaluating a population segment's biological and ecological importance to the taxon to which it belongs. As precise circumstances are likely to vary considerably from case to case, the DPS Policy does not state that these are the only classes of information that might factor into a determination of the biological and ecological importance of a discrete population.

As specified in the DPS Policy (DPS Policy, 61 FR at 4722), consideration of the population segment's significance may include, but is not limited to, the following classes of information:

(1) Persistence of the population segment in an ecological setting that is unusual or unique for the taxon;

(2) evidence that loss of the population segment would result in a significant gap in the range of the taxon;

(3) evidence that the population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside of its historic range; and

(4) evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics.

Significance of the discrete population segment is not necessarily determined by existence of one of these classes of information standing alone. Rather, information analyzed under these considerations is evaluated relative to the biological or ecological importance of the discrete population to the taxon as a whole. Accordingly, all relevant and available biological and ecological information is analyzed for importance to the taxon as a whole.

Persistence of the Population Segment in an Unusual or Unique Ecological Setting

Under the DPS Policy the first consideration in determining whether a population is significant to the taxon to which it belongs is ''persistence of the population segment in an ecological setting unusual or unique for the taxon.'' Bald eagles are highly adaptable, wide-ranging habitat generalists. Across the range of the species, there is no ''usual'' ecological setting, in terms of the elevation, temperature, prey species, nest tree species, or type of water source, for the taxon. The bald eagle is capable of inhabiting areas throughout North America, so long as a sufficient food source persists. This contrasts with a situation where a portion of the range of a particular species exhibits one set of similar habitat characteristics but the distinct population segment utilizes a different set of habitat characteristics. For bald eagles, there are many options for suitable habitat. Though the Sonoran Desert Area may represent a unique set of habitat characteristics, we cannot say it is unusual or unique for the bald eagle such that persistence there is significant to the bald eagle as a whole.

In order to address the court's September 30, 2011, order, we reviewed previous DPS determinations that described the Service's analysis of whether the population's persistence in an unusual or unique ecological setting was significant to the taxon as a whole. A number of DPS determinations provided little detail—either regarding which of the four considerations identified in the DPS Policy had formed the basis for the determination, or regarding how the Service had analyzed the ''unusual or unique ecological setting'' consideration; this tended to be the case with determinations that were completed in the ensuing years after the DPS Policy was adopted. Subsequently, as the determinations provided more detail about the significance analysis, the analyses of ''unusual or unique ecological setting'' began to include discussions not only of whether there were any unusual habitat characteristics, but also of whether persistence among those habitat characteristics was unusual or unique for the taxon and made that population significant to the taxon as a whole. Elements that the Service often considered in these analyses included: (1) The extent to which there was evidence of adaptations—whether direct evidence of physical changes or indirect evidence of changes in life-history traits—that could be significant to the conservation of the taxon as a whole; and (2) the extent to which the taxon was a habitat generalist that could adapt to diverse ecological settings. In addition to those elements, we also considered the extent to which other populations of the species could or could not persist in the particular ecological setting such that the persistence of this population in that setting is biologically or ecologically important to the taxon as a whole. Consideration of these elements has been incorporated in the way the Service has interpreted ''persistence in an ecological setting unusual or unique for the taxon'' under the DPS Policy in previous DPS determinations.

General information about the biology and life history of the bald eagle can be found in the *Species Information* section above. The bald eagle is able to occupy a broad range of vegetation communities and ecosystems throughout North America. The bald eagle is distributed across the North American continent (stretching from the Aleutian Islands to Baja California, Mexico, and from northeastern Canada to Florida). The bald eagle breeds at elevations ranging from sea level to mountains as high as 10,000 feet. It also occupies a range of aridity; the bald eagle is known to live in some of the driest areas in the United States and in some of the wettest.

Bald eagles occur throughout North America wherever there is a sufficient source of prey. Habitat structure and proximity to a sufficient food source are usually the primary factors that determine suitability of an area for nesting (Grier and Guinn, p. 44). Nesting generally occurs along rivers, lakes, and seacoasts in proximity to a sufficient source of prey. Bald eagles primarily eat fish, but they will also eat amphibians, reptiles, other birds, small mammals, and carrion (dead animals) including carcasses of large mammals (*e.g.,* cows, elk, deer). Bald eagles typically nest in trees, but have also been documented nesting on cliffs, on the ground, in mangroves, in caves, and in manmade structures (e.g., cell phone towers). Bald eagles are not limited to nesting in or near any particular species of tree, nor are they limited to eating any particular species or even class of prey.

The bald eagle has also been shown to be highly adaptable to changes in the landscape. Data suggest that eagles across many parts of their range are demonstrating a growing tolerance of human activities in proximity to nesting and foraging habitats. Eagles in these situations continue to successfully reproduce in settings previously considered unsuitable. For example, in Florida, some bald eagle pairs have shown adaptation to human presence by nesting in residential subdivisions and commercial and industrial parks, and on cell phone towers and electric distribution poles. A common thread throughout these urban and suburban landscapes is the availability of ample food sources such as natural lakes, rivers, and ponds; artificial stormwater retention ponds; and public landfills (Millsap *et al.* 2002, p. 10). In light of this success in diverse habitats, the bald eagle appears to be highly adaptable to a variety of habitat conditions based on food availability.

According to Hunt *et al.* (1992, p. A163) and Glinski (1998, p. 52), bald eagle nesting habitats in Arizona are among the most unusual nesting habitats occupied by the species, with many of the nests located in open desert under conditions of high heat and low humidity. On its face, this suggests that the Sonoran Desert Area is an ecological setting that is unusual or unique for the species. However, as discussed above, we must assess persistence in this unique or unusual ecological setting in terms of the biological or ecological importance of the population's persistence to the species as a whole.

Consistent with previous DPS determinations, we took into account the ''unusual or unique ecological setting'' consideration by first evaluating whether there was any evidence of adaptations—whether direct evidence of physical changes or indirect evidence of changes in life-history traits—that could be significant to the conservation of the taxon as a whole. The DPS Policy does not require evidence of adaptation to a unique or unusual ecological setting in order to make a finding of significance; however, direct evidence of adaptation to an ecological setting could be a strong indication that persistence of the population segment in that ecological setting is significant to the taxon as a whole. The ecological setting of the Sonoran Desert is characterized by hot and dry summers. We examined a number of characteristics of bald eagles in the Sonoran Desert Area to determine if there was any direct or indirect evidence of adaptations to that ecological setting such that persistence of that population is significant (i.e., biologically or ecologically important) to the bald eagle as a whole. For example, we evaluated whether it is significant to the bald eagle as a whole that individuals in the Sonoran Desert Area population are possibly smaller than those in other populations or that the egg shell porosity for the Sonoran Desert Area population differs from egg shell porosity for other populations. In addition, we evaluated whether there may have been changes in timing of breeding, specialized feeding on desert fish, cliff nesting, or juvenile migration characteristics that make persistence of the population in the Sonoran Desert Area significant to the taxon.

Bald eagles in the Sonoran Desert Area are smaller in size than many other bald eagles. One theory presented for this difference is that the smaller size indicates an adaptation to the hotter, drier Sonoran Desert environment. In fact, Hunt *et al.* (1992, p. A165) suggest that the smaller size of Arizona bald eagles was significant enough that the introduction of foreign genes into the population might disrupt coadapted gene complexes (a group of genetic traits that have high fitness when they occur together, but which without each other have low fitness) specific to the population.

However, we have found general differences in the size of bald eagles in the northern latitudes and birds in the southern latitudes. For instance, Stalmaster (1987, pp. 16–17) notes that northern eagles are much larger and heavier than their southern counterparts. This is consistent with Bergmann's Rule, which holds that animal size increases with increasing latitude due to changes in climate. Consistent with this rule, Hunt *et al.* (1992, pp. A158–A161) report that bald eagles in Arizona are smaller than those in Alaska and the Greater Yellowstone Region. Supporting this conclusion, Gerrard and Bortolotti (1988, p. 14) note that bald eagles in Florida, which is farther south than Arizona, are the smallest, with a gradation of large to small from north to south within the Florida populations. This information suggests that small size is not an adaptation unique to the Sonoran Desert but is rather part of the natural variability of the taxon as a whole.

Another theory presented of possible adaptation from the taxon as a whole is the possible differences in egg shell porosity of Arizona bald eagles from bald eagles in other parts of the range of the species. Hunt *et al.* (1992) discuss pores in eggshells of bald eagles in Arizona. Hunt *et al.* (1992) note that the pores of the eggs assessed are one to two orders of magnitude smaller than those in California bald eagle eggs. Some of the public comments received during the public comment period for our prior status review questioned whether or not these pores may have an effect on water loss from bald eagle eggs in the arid environment.

However, Hunt *et al.* (1992) did not reach any conclusions as to the significance this difference in egg shell porosity may have to Arizona eagles. No other reported studies analyzed the potential significance of this finding. Furthermore, the Hunt *et al.* (1992) study consisted of an extremely small sample size of only four eggs. Given the small sample size of this study, and the lack of analysis in the study, it would not be scientifically robust to draw any conclusions from the Hunt *et al.* (1992) study. As a result, we do not consider the potential difference of egg shell porosity to be evidence of adaption to the Sonoran Desert.

Therefore, based on our review of information as it relates to body size and eggshell porosity, it does not appear that there is direct evidence of an adaptation of the bald eagle to the Sonoran Desert Area. Additionally, we did not find any evidence of other traits or factors that would indicate evidence of an adaptation to the Sonoran Desert Area.

Next we discuss differences in life-history traits that may be an indirect indication of an adaptation to the Sonoran Desert Area that could indicate the population's persistence there is significant to the taxon as a whole. The life-history traits may include timing of breeding, feeding habits, nest site selection, and juvenile migration.

We assessed whether bald eagles in the Sonoran Desert Area breed earlier than many other bald eagles, a change in life history trait that could indicate there has been an adaptation to the Sonoran Desert Area setting such that persistence there is significant to the taxon as a whole. As discussed in the *Species Information* section above, bald eagle pairs begin courtship about a month before egg-laying. In the south, courtship occurs as early as September, and in the north, as late as May. The nesting season lasts about 6 months.

However, as with bald eagle size variation, a general examination by latitude reveals differences between bald eagles in northern and southern regions. Timing of various breeding events in bald eagles is tied to the latitude of the nesting area, with eagles at more northern latitudes breeding at later dates (Stalmaster 1987, p. 63). Gerrard and Bortolotti (1988, p. 76) note that bald eagles in Florida lay eggs from early November to mid-December. Henry *et al.* (1993, p. 208) report that Baja California bald eagles are already incubating by mid January, which indicates a mid-December to early-January egg-laying period. In Louisiana, bald eagles lay eggs between October and mid-March, but most clutches are complete by late December (Service 1989).

The timing of breeding chronology for the bald eagles in the Sonoran Desert Area is consistent with this latitudinal variation. Specifically, the breeding chronology of Florida birds (further south than the Sonoran Desert Area eagles) is even earlier than those in the Sonoran Desert Area. Therefore, we find it unlikely that the breeding chronology of bald eagles in the Sonoran Desert Area is a life-history trait that is biologically or ecologically important to the species as a whole.

We assessed whether there was evidence that bald eagles in the Sonoran Desert Area specialized on desert fishes. The most common fishes eaten by bald eagles in Arizona are: Sonora (*Catostomus clarki*) and desert suckers (*Catostomus insignis*); channel (*Ictalurus punctatus*) and flathead catfish (*Pylodictis olivaris*); common carp (*Cyprinus carpio*); largemouth (*Micropterus salmoides*), smallmouth (*Micropterus dolomieui*), yellow (*Morone mississippiensis*), and white bass (*Morone chrysops*); and black crappie (*Pomoxis nigromaculatus*) (Service 1982, p. 11; Driscoll *et al.* 2006, p. 6). However, although bald eagles are opportunistic feeders whose diet is mostly made up of fish, they will eat birds, amphibians, reptiles, small mammals, and carrion. Specifically, a study found that the diet of eagles in Arizona based on prey remains contained 76 percent fish, 14 percent mammals, and 10 percent birds (Hunt *et al.* 2002, p. 249). The same study found that of 10 breeding areas where prey remains were analyzed, suckers were the most common prey in only three breeding areas (Hunt *et al.* 2002, p. 250). Suckers often spawn in riffles, the shallowest of the riverine habitats, and may be consistently exposed to attack at this stage of their life cycle (Minckley 1973, pp. 162, 169; Hunt *et al.* 1992, p. A57). Water temperature is the catalyst for fish spawning and, therefore, also causes differences in timing of fish availability within breeding areas. When suckers (who spawn early) and carp or catfish (who spawn later) are common, the result may be a prolonged availability of food for eagles (Hunt *et al.* 1992, p. A70). Suckers are the first of essential species to become most available to eagles while they are incubating eggs or feeding small young. The movement of carp into shallow water to forage generally occurs seasonally after suckers have finished spawning (Hunt *et al.* 1992, p. A70). Because an eagle's foraging time is reduced due to the necessity of incubation or the care of newly hatched nestlings unable to regulate their own body temperature, the sucker's place in the sequencing of available prey may be of added importance for successful reproduction for eagles relying on free-flowing and regulated streams. Additionally, there are no other fish species used by bald eagles within the Sonoran Desert Area along rivers that have the same spawning schedule and accessibility to nesting eagles. Although native Sonoran and desert suckers seem to be important to bald eagles in the Sonoran Desert Area, not only for how they become available, but also for when they become available, there are no data to suggest that bald eagles specialize on suckers or that foraging on suckers is the result of a unique adaptation to the desert environment that is biologically or ecologically important to the species as a whole.

We considered whether cliff nesting is an adaptation to the conditions in the Sonoran Desert Area that indicates that this population's persistence there is biologically or ecologically important to the taxon as a whole. Hunt *et al.* (1992, p. A-ii) report that, in the Sonoran Desert Area, when both tree and cliff nests were available, eagles nonrandomly chose cliffs rather than trees, indicating that Sonoran Desert Area bald eagles may have a preference for cliff nests.

Stalmaster (1987, p. 121) noted that cliff nesting is common in Arizona, but he also noted that exceptions to tree nests occur in other areas. Gerrard and Bortolotti (1988, p. 41) note that bald eagles in other areas may nest on cliffs if suitable trees are not available. This is supported by Buehler (2000), who states that bald eagles use ground nests (a category in which he includes nests built on cliff sides) in treeless regions such as Alaska, north Canada, islands off the coast of California, and Arizona. Bald eagles are also known to nest on cliffs on the Channel Islands off California (NOAA 2006). Bald eagles in areas of Alaska where there are no suitable nest trees also are known to nest on cliffs, sea stacks, hillsides, and rock promontories (Sherrod *et al.* 1976, p. 153). It is likely that up to 10 percent of the bald eagles in Alaska nest on the ground (Schempf pers. comm. 2007). Additionally, ground nesting has also been documented in limited situations in northwestern Minnesota and Florida (Hines and Lipke 1991, pp. 155–157; Shea *et al.* 1979, pp. 3–5). Eagles can also nest in a variety of unconventional situations, such as utility poles, abandoned heavy equipment, mangroves, cacti (in Baja), and root wads washed up on sandbars.

Additionally, bald eagles, across their range, will use whatever high nest sites are available near the aquatic areas they inhabit. In the Sonoran Desert Area these sites often happen to be cliffs, but eagles in the Sonoran Desert Area have also nested in cottonwood, willow, sycamore, pinyon pine, and ponderosa pine trees. Many Sonoran Desert Area eagle pairs have built and used both tree and cliff nests within their territories. This behavior demonstrates the flexibility in nest site selection that bald eagles have throughout the entire geographic range of the eagle, suggesting that nest site selection in the Sonoran Desert area is not likely ecologically or biologically important to the taxon as a whole.

We also considered whether the juvenile migration characteristics of Arizona bald eagles may suggest adaptation to the Sonoran Desert Area that is biologically or ecologically important to the taxon as a whole. Juvenile bald eagles from Arizona migrate north in the spring and return to natal territories in the fall (Hunt *et al.* 1992, p. A–v).

Hunt *et al.* (2009, p. 125) indicates that juvenile bald eagles from Arizona exhibit similar migrating characteristics to each other, and that the similarity of these characteristics, which were exhibited while migrating solitarily, is evidence of genetic control of migration. In other words, juvenile bald eagles behave similarly even while migrating individually. Kerlinger (1989, p. 57) discusses that natural selection has likely shaped the migratory strategy of birds. Natural selection likely exerts pressure over time to emphasize the survival of successful migration strategies and, therefore, successful genes. In other words, birds that make errors in migration are eliminated from the population, and do not go on to reproduce and pass their genes to the next generation. Thus, the birds that do survive migration and reproduce successfully may become more genetically similar. Accordingly, there is a belief that the migration characteristics of bald eagles in the Sonoran Desert Area demonstrates adaptation in this population with respect to juvenile migratory behaviors.

Bald eagles as a species exhibit a ''complex pattern of migration dependent on age of the individual (immature or adult), location of breeding site (north vs. south, interior vs. coastal), severity of climate at breeding site (especially during winter but also possibly during summer), and year-round food availability'' (Buehler 2000). For example, bald eagles in northeastern North America migrate south in the fall and return north in the spring, whereas bald eagles in Florida move north in late spring and early summer and return south in the fall (Kerlinger 1989, p. 12). This wide variety of migration strategies employed throughout the range of the species further demonstrates the flexibility of the species and further suggests that migrating characteristics of bald eagles in the Sonoran Desert area are not likely ecologically or biologically important to the taxon as a whole.

Finally, we consider whether there may be other considerations that make persistence in the Sonoran Desert significant to the bald eagle as a whole. We conclude that, if other populations of the bald eagle could not persist in the Sonoran Desert ecological setting, that might be an indication that the population has adapted in a way that could be significant to the bald eagle as a whole. We currently have no direct evidence proving or disproving the ability of other bald eagles to persist in the Sonoran Desert area. As mentioned above, the best available information suggests that in fact there has been very little immigration into the Sonoran Desert area. Nevertheless, an adult bald eagle located at a Sonora, Mexico breeding area in 1992 possibly originated from Texas or Florida. This could indicate that, in the rare instances in which eagle immigrate to the Sonoran Desert Area from other areas, they are able to persist there. Moreover, based on the general adaptability shown by eagles throughout their range, there is no reason to suspect that eagles from outside the Sonoran Desert Area would not be successful in the Sonoran Desert Area over time.

In summary, the combination of a highly adaptable species persisting in a varied habitat base leads us to conclude that the particular variations displayed in the Sonoran Desert Area population do not make that population more ecologically or biologically important than any other individual population. Therefore, while the Sonoran Desert Area represents a unique set of habitat characteristics, persistence of that population of bald eagles among those habitat characteristics is not significant (i.e., biologically or ecologically important) to the taxon as a whole. This is consistent with the Service's prior interpretations of the DPS Policy, and, as such, the Service has not adopted a new interpretation of the DPS Policy.

Significant Gap in the Range of the Taxon

The second consideration under the DPS Policy in determining whether a population is significant to the taxon to which it belongs is ''evidence that loss of the discrete population segment would result in a significant gap in the range of a taxon'' (61 FR 4725). We therefore evaluated whether a hypothetical extirpation of the Sonoran Desert Area bald eagle would leave a significant gap in the range because of: (1) The size of the Sonoran Desert Area population in relation to the size of the taxon as a whole; (2) an unlikelihood that other populations would immigrate and repopulate that part of the range; (3) distinctive traits or genetic variation among the Sonoran Desert Area bald eagle; (4) the size of the range of the Sonoran Desert Area population in relation to the size of the range of the taxon as a whole; or (5) the role that the geographical location where the Sonoran Desert Area population occurs plays with respect to the status of the bald eagle as a whole.

Bald eagles in the Sonoran Desert Area are neither numerous nor constitute a significant percentage of the total number of bald eagles throughout the range of the taxon. In 2009, 48 pairs were documented in the Arizona portion of the Sonoran Desert Area (ADFG 2009a, p. 8), which is where most of the birds in the Sonoran Desert Area population occur. This represents less than one half of 1 percent of the current estimated number of breeding pairs of bald eagles in the lower 48 States. Because the taxon as a whole also includes bald eagles in Canada and Alaska, the number of breeding pairs in the Sonoran Desert Area represents much less than one half of a percent of the number of breeding pairs throughout the range of the species. In addition, the Arizona portion of the Sonoran Desert Area did not support a large proportion of the bald eagle population historically. A small number, estimated at 15–20 breeding pairs, historically bred in this area (Tilt 1976, p. 15). Given the historical and current population number of bald eagles throughout the range of the taxon, the Sonoran Desert Area population of bald eagles represents a relatively small number of breeding pairs in comparison.

Loss of the Sonoran Desert Area bald eagles would be likely to create some gap in the range of the taxon. As discussed in the *Discreteness* section above, available evidence indicates that little immigration into this population has occurred. The small number of bald eagles and large distances between neighboring populations currently limit immigration and emigration between them, and bald eagles in the neighboring populations would have to increase their population size and expand their distribution to occupy the gaps, such that loss of the Sonoran Desert Area population would be likely to create a gap. Therefore, it is unknown whether bald eagles would naturally repopulate the Sonoran Desert Area if extirpated.

However, it is not clear that any gap created in the range would be significant to the taxon as a whole. As discussed above, bald eagles in the Sonoran Desert Area are neither numerous nor constitute a significant percentage of the total number of bald eagles throughout the range of the taxon. Moreover, as discussed previously, there has been no evidence of distinctive traits or genetic variations among the Sonoran Desert Area population that suggests that loss of the population would have a negative effect on the bald eagle as a whole. For instance, we found no indication that bald eagles in the Sonoran Desert Area have a specialized prey base of native desert fishes, nor did we find any direct evidence for adaptation based on difference egg shell porosity or body size.

Further, the actual amount of suitable bald eagle habitat in the Sonoran Desert Area is in general limited and represents a minute fraction of the total suitable habitat available for bald eagles throughout their range. The limited size of the current and historical bald eagle population in the Sonoran Desert Area directly reflects that fact.

Finally, the Sonoran Desert Area itself does not play any particular role in the life history of the bald eagle such that loss of that part of the range would have a significant effect on the status of the species. For example, the Sonoran Desert Area is not the sole breeding or rearing location for bald eagles, nor is the Sonoran Desert Area only one of two parts of the species range such that loss of eagles in one part would result in a significant gap. As stated above, bald eagles are highly adaptable and are found across a wide range of habitats in North America.

Having reviewed the best available scientific information with respect to the biological or ecological significance of the Sonoran Desert Area bald eagles, we have determined that loss of eagles in the Sonoran Desert Area would not represent a significant gap in the range of the bald eagle as a whole.

In conclusion, while the loss of the Sonoran Desert Area bald eagle would likely result in some gap in the range of the taxon, we find that the gap does not constitute a significant gap in the range, such that information reviewed under this element does not suggest that Sonoran Desert Area bald eagles are biologically or ecologically significant to the taxon as a whole.

Natural Occurrence of a Taxon Abundant Elsewhere as an Introduced Population

The third consideration under the DPS Policy is ''evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic range'' (61 FR 4725). As discussed above, naturally occurring bald eagles occur throughout much of their historical range in North America; thus, the Sonoran Desert Area population does not represent the only surviving natural occurrence of the bald eagle throughout the range of the taxon in North America.

Genetic Characteristics

As stated in the DPS Policy, in assessing the significance of a discrete population, the Service considers evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics (61 FR 4725).

Limited studies have been completed assessing the genetic characteristics of Sonoran Desert Area bald eagles in comparison to bald eagles throughout the rest of the range. Hunt *et al.* (1992, pp. E–96 to E–110) contains two studies that represent the genetic work completed on the Arizona bald eagle population, which includes the majority of bald eagles in the Sonoran Desert Area. Vyse (reported in Hunt *et al.* 1992, pp. E–96 to E–104) completed a DNA fingerprinting analysis of eagles from California, Arizona, and Florida, and was unable to identify population-specific genetic markers; however, the author notes that the results obtained could easily be explained by sampling procedures. Zegers *et al.* (reported in Hunt *et al.* 1992, pp. E–105 to E–110) conducted an enzyme electrophoresis analysis, and concluded that, although ''the bald eagle population in Arizona may have some genetic uniqueness, it is not significantly different from any other population. * * *'' The authors go on to question the reliability of the results because of the low numbers of individuals sampled from most States and because of the few loci examined. In summary, Hunt *et al.* (1992, p. A–163) note that neither study detected alleles or gene fragments that were not detected in other populations. In conclusion, neither study resolved any specific genetic markers with which Arizona bald eagles could be differentiated from other populations. Therefore, given the assumptions and cautions in using the data, we have determined that the best available data do not support a conclusion that bald eagles in the Sonoran Desert Area have genetic characteristics that are markedly different from other bald eagles.

DPS Conclusion

On the basis of the best available information, we conclude that the Sonoran Desert Area population of the bald eagle is discrete, but it is not significant (i.e., biologically or ecologically important) to the taxon as a whole. We have reviewed the best available scientific information, and the evidence relative to natal site fidelity in breeding birds, the limited number of eagles in neighboring States, and the results of 30 years of monitoring data indicating that few, if any, eagles immigrate to or emigrate from the Sonoran Desert Area bald eagle population. We conclude that the best available scientific information with respect to the discreteness requirements of the DPS Policy warrant considering the Sonoran Desert Area bald eagle population as discrete from other bald eagle populations in North America.

We considered the four classes of information listed in the DPS Policy as possible considerations in making a determination as to significance, as well as all other information that might be relevant to making this determination for the Sonoran Desert Area population. The adaptability of the bald eagle allows its distribution to be widespread throughout the North American continent in a variety of habitat types. Further, the Sonoran Desert Area bald eagles do not appear to exhibit any direct or indirect adaptation or behavioral advantage that would indicate its persistence in the Sonoran Desert Area is biologically or ecologically important to the taxon as a whole. Moreover, we considered the other three considerations that the DPS Policy sets out for evaluating significance, and none of them provides evidence that the population is significant to the bald eagle as a whole: Loss of the population would not result in a significant gap in the range; the population does not represent the only surviving natural occurrence of the bald eagle; and the population's genetic characteristics do not differ markedly from those of other bald eagle populations.

We conclude that the discrete Sonoran Desert Area population of bald eagle does not meet the significance criterion of the DPS Policy, as detailed above and, therefore, is not a DPS pursuant to our DPS Policy. As a result, the Sonoran Desert Area population of bald eagles is not a listable entity under section 3(16) of the Act.

The DPS Policy sets forth a three-step process for determining whether a vertebrate population as a separate entity warrants listing: (1) Determine whether the population is discrete; (2) if the population is discrete, determine whether the population is significant to the taxon as a whole; and (3) if the population is both discrete and significant, then evaluate the conservation status of the population to determine whether it is endangered or threatened (typically presented as a 5-factor analysis of the threats to the discrete population (threats assessment) followed by a determination of whether the population meets the definition of ''endangered species'' or ''threatened species''). Although we have determined that the Sonoran Desert Area population of the bald eagle does not qualify as a DPS and, therefore, is not a listable entity because it is not significant to the taxon as a whole. However, we provide below a threats assessment of the Sonoran Desert Area population of the bald eagle and a determination of its conservation status. The DPS Policy neither requires nor prohibits completion of a threats assessment once we have determined that a population does not qualify as a DPS. Nevertheless, in this instance, we concluded that completing a threats assessment—and detailing the nature, scope, and likely effect of the threats to the population and the species—would provide us and the public with valuable information for understanding the status of the population.

Summary of Information Pertaining to the Five Factors

As discussed above, the bald eagle is known to have bred in every State and province in the United States and Canada except Hawaii (Johnsgard 1990, p. 145; Hunt *et al.* 1992, p. A9). Gerrard and Bartolotti (1988, p. 2) noted that, at the time Europeans first arrived on North America, bald eagles were believed to have nested on both coasts, along all major rivers and large lakes in the interior from Florida to Baja California in the south, and north to Labrador and Alaska. In general, three factors seem to determine the distribution and abundance of bald eagles and other raptors (*i.e.,* birds of prey): (1) An adequate and accessible supply of food, (2) availability of nest sites, and (3) suitable foraging habitat (Johnsgard 1990, pp. 15–17). Specifically, the bald eagle needs areas for nesting, perching, roosting, and foraging (Stalmaster 1987, pp. 119–131) and a reasonable degree of freedom from disturbance during the nesting season (Johnsgard 1990, p. 145). Hunt *et al.* (1992, p. A–v) goes further to suggest that the features of bald eagle habitat in Arizona that render it suitable for breeding include: (1) Nesting substrate offering security from large predators and human disturbance; and (2) two or more of the following fish taxa occurring in substantial numbers: carp, suckers (spp.), catfish (spp.), and perciforms (from the order Perciformes). Factors that appear to increase habitat quality include: (1) Reservoirs supporting warm water fisheries; (2) reservoir inflow areas; and (3) areas of river habitat containing fast, shallow water, moderate slope, turbulence, and exposed substrate that are maintained under a wide variety of flows.

Observations of bald eagles in Arizona are mentioned in the literature as early as 1866 by Coues in the vicinity of Fort Whipple (now Prescott). Henshaw reported bald eagles south of Fort Apache in 1875. The first bald eagle breeding information was recorded in 1890 near Stoneman Lake by S.A. Mearns. Additionally, Bent reported the presence of breeding eagles on the Salt River Bird Reservation, which was inundated by Roosevelt Lake in 1911. There are also reports from the 1930's of bald eagles nesting along rivers in the White Mountains and along the Salt and Verde Rivers in central Arizona (Hunt *et al.* 1992, pp. A11–A12).

The bald eagle population of the Southwest Recovery Region, as identified in the Service's final recovery plan for the species, reaches all of New Mexico and Arizona, throughout Oklahoma and Texas west of the 100th meridian, and the area of California bordering the Lower Colorado River (Service 1982, p. 1). The vast majority of the breeding bald eagles from this population are found within the State of Arizona, most of which are located within the Sonoran Desert Area. The occurrence of breeding bald eagles in the State of New Mexico is very limited (USFS 2004, p. 153). In 2001, the New Mexico Department of Game and Fish (NMDGF) reported the occurrence of four bald eagle nest sites, all on private lands, in New Mexico.

Nationwide, bald eagles are known to nest primarily along seacoasts and lakeshores, as well as along banks of rivers and streams (Stalmaster 1987, p. 120). In Arizona, bald eagle breeding areas (eagle nesting sites and the area where eagles forage) are located in close proximity to a variety of aquatic sites, including reservoirs, regulated river systems, and free-flowing rivers and creeks. In Arizona, nests are placed mostly on cottonwood trees, cliff edges, and rock pinnacles and may be used year after year. However, living and dead junipers, pinyon pines, sycamores, willows, and ponderosa pines, and artificial structures also have supported eagle nests (Driscoll *et al.* 2006, p. 4). In 1992, of 111 known nests in Arizona within 28 breeding areas, 48 percent were on cliffs or pinnacles, 51 percent were on trees or snags, and one percent was on artificial structures. For breeding areas where both cliff and tree nests were available, cliff nests were selected 73 percent of the time, while tree nests were selected 27 percent of the time (Hunt *et al.* 1992, p. A17). Additionally, eagles nesting on cliffs were found to be slightly more successful in raising young to fledgling, though the difference was not statistically significant (Hunt *et al.* 1992, p. A17).

In the Sonoran Desert Area, essential bald eagle activities such as nesting, perching, roosting, and foraging occur from and in the large woody tree component of the riparian habitat found along rivers and streams. Eagles nesting in trees within the Sonoran Desert Area are less susceptible to heat stress and parasites than those nesting in cliff or pinnacle nests, but are more vulnerable to disturbance from the ground and from inundation during flooding (Hunt *et al.*1992, p. A17). Eaglets (young eagles) in tree nests are less likely to die from premature fledging. An abundance of trees provides more perching locations to capture prey, more locations to place nests, and greater opportunities to partition resources in order to increase territory density (Hunt *et al.*1992, pp. Aii, A21, A135).

The importance of riparian trees is demonstrated along the lower Verde River in Arizona, where the densest population of nesting bald eagles (seven territories along 30 river kilometers (18.6 miles)) exclusively uses cottonwood trees for nest placement. In Arizona, the majority of nests are located in the Upper and Lower Sonoran Life Zones (zones of plant and animal life associated with a given elevation), including the riparian habitats and transition areas of both zones (Hunt *et al.* 1992, p. A17). Representative vegetation of these life zones includes Arizona sycamore (*Platanus wrightii*), blue palo verde (*Parkinsonia florida*), cholla (*Opuntia* and *Cylindropuntia* spp.), Fremont cottonwood (*Populus fremontii*), Gooding willow *(Salix gooddingii*), mesquite (*Prosopis* spp.), saguaro (*Carnegiea gigantea*), and tamarisk or salt cedar (*Tamarix pentandra;* an exotic species) (Brown 1994, p. 200).

Bald eagles primarily eat fish, but they will also eat amphibians, reptiles, birds, small mammals, carrion (dead animals), and carcasses of large mammals (cows, elk, deer, etc.). Their food habits can change daily or seasonally, but when a choice is available, bald eagles invariably select fish over other prey. Bald eagles will scavenge, steal, or actively hunt to acquire food. Carrion constitutes a higher proportion of the diet for juveniles and subadults than it does for adult eagles. Bald eagles are primarily sit-and-wait hunters, perching in trees in order to detect available prey (Stalmaster 1987, p. 104). Food strongly influences bald eagle productivity (young fledged per occupied territory) (Newton 1979, pp. 95–96, 101–106; Hansen 1987, p. 1389). A female's health in the months preceding egg-laying can affect egg production, and prey availability during the breeding cycle affects the survivorship of nestlings and post-fledging juveniles. Any factor affecting the adults' ability to acquire food can influence productivity and adult survival (Newton 1979, pp. 95–96, 101–106).

The most common fishes eaten in Arizona are Sonora *(Catostomus clarki*) and desert suckers (*Catostomus insignis*); channel (*Ictalurus punctatus*) and flathead catfish (*Pylodictis olivaris*); common carp (*Cyprinus carpio*); largemouth (*Micropterus salmoides*), smallmouth (*Micropterus dolomieui*), yellow (*Morone mississippiensis*), and white bass *(Morone chrysops*); and black crappie (*Pomoxis nigromaculatus*). Less common are roundtail chub (*Gila robusta*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), tilapia, and rainbow trout (*Oncorhynchus mykiss*) (Service 1982, p. 11; Driscoll *et al.* 2006, p. 6). The introduction of predatory flathead catfish in the late 1970s nearly extirpated native fish populations on the upper Salt River (Driscoll *et al.* 2006, p. 19). Flathead catfish, while available as bald eagle prey when smaller, grow to large sizes (up to 50 pounds, or 22.6 kilograms) making them unavailable as a prey item (*i.e.,* too large for bald eagles to take). Flathead catfish populations have increased while other fish species have decreased (Driscoll *et al.* 2006, p. 19).

The Arizona Game and Fish Department (AGFD) notes that apparent changes in eagle productivity observed from before 1985 and after 1985 could be the result of a difference in monitoring protocols. Starting in 1985, their protocol incorporated monthly helicopter surveys of all breeding areas. The AGFD noted that the average productivity rate of 0.78 observed in Arizona between 1987 and 2005 is consistent with that observed in other areas of the species' range with larger populations, including Minnesota, British Columbia, Interior Alaska, and Washington (Driscoll *et al.* 2006, p. 5). Due to rugged terrain, the earliest formal surveys in Arizona—in the 1970's—only detected bald eagle breeding areas that were easily accessible (*e.g.,* along rivers and streams) (Driscoll *et al.* 2006, p. 9). Following intensive survey efforts over the last 25 years, the AGFD is aware of more breeding areas, and habitat conditions within them varies greatly. As a result, the AGFD is currently tracking productivity in breeding areas with a variety of habitat conditions, rather than tracking productivity in only those breeding areas that were easily detected. While the number of breeding areas detected in subsequent surveys in Arizona has increased, there is no expectation that pairs using these breeding areas would demonstrate increased reproductive performance. Productivity data between 1987 and 2008 indicates less variability. For example, in 1971, with only three known breeding areas, productivity was 1.33; in 1972 productivity was 0.0; and in 1973 productivity was 1.4. By comparison, with more breeding areas known, productivity now varies by only 0.20 to 0.30 units (Driscoll *et al.* 2006, pp. 48–50; AGFD 2007, pp. 33–34; AGFDa 2008, pp. 38–39).

The Sonoran Desert Area population consists of those bald eagles that breed predominantly within central and southern Arizona; Sonora, Mexico (Sonora); and portions of southeastern California along the Colorado River as described in detail above (see Distinct Population Segment). Based on opportunistic monitoring of the single nest located in southern California at the Copper Basin breeding area conducted since 2001 (Melanson 2006a, 2007, 2008, pers. comm.), we have limited information on potential threats to this breeding area, and demographic data from this site was not collected using the same protocol established in Arizona. We include information from this breeding area in the following threats analysis where appropriate. Information on breeding success in Sonora is limited. Bald eagle territories were first recorded in Sonora along the Rio Yaqui drainage in 1986 (Brown *et al.* 1986, pp. 7–14). Since that time, a total of eight bald eagle breeding areas have been verified (Driscoll and Mesta 2005, in prep.). Surveys there irregularly occur due to difficulties in accessing breeding areas. However, given the limited number of breeding areas and the infrequency of breeding noted during survey years, the overall impact of productivity from Sonora bald eagles to the total productivity of the Sonoran Desert Area population of the bald eagle is minimal.

Historical records, literature, past reports, and interviews with agency personnel and other people knowledgeable about bald eagles in Arizona indicated that there was one known breeding area by the 1920s, two by the 1930s, four by the 1940s, five by the 1950s, six by the 1960s, and eight by the 1970s (Hunt *et al.* 1992, pp. C56–C61). The number of known breeding areas within the Sonoran Desert Area increased from a low of three in 1971 to a high of 52 in 2009. In addition, there were seven breeding areas located within Arizona but outside of the Sonoran Desert Area in 2009. From 1985 to 2009, productivity within the Sonoran Desert Area has ranged from a low of 0.54 in 1990 and 1992 to a high of 1.17 in 2008. The mean annual productivity for this time period in the Sonoran Desert Area was 0.81 (AGFD 2004, pp. 30–31; AGFD 2005, pp. 34–35; AGFD 2006a, pp. 35–36; AGFD 2007, pp. 33–34; AGFD 2008a, pp. 38–39; Allison *et al.* 2008, pp. 17–18; AGFD 2009a, pp. 42–43). For comparison, productivity in North America averaged 0.34 in three declining bald eagle populations, as compared to 0.75 in seven stable populations and 1.03 in four increasing populations (Swenson *et al.* 1986, p. 25).

Productivity data alone does not provide a clear indication of the status of a population without considering the additional influence of other demographic variables (e.g., survival, number of breeding areas). When all of this data is considered together, as is done through a population viability analysis (see Factor A discussion), estimates of population growth and extinction probabilities can be generated. For bald eagles nesting in the Sonoran Desert Area of Arizona, a population viability analysis conducted by the Service resulted in an estimated annual population growth rate of two percent, and none of the model iterations resulted in extinction of the population (Millsap 2009, in prep.) (see Factor E, Demographic Factors discussion).

Five-Factor Analysis

Pursuant to section 4 of the Endangered Species Act of 1973, as amended, we must determine whether any species, subspecies, or DPS of vertebrate taxa is an endangered or threatened species because of any of the following five factors: (A) Present or threatened destruction, modification, or curtailment of habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The Endangered Species Act identifies the five factors to be considered, either singly or in combination, to determine whether a species may be threatened or endangered. Our evaluation of these threats in terms of the petitioned action to list the Sonoran Desert Area population of the bald eagle as a distinct population segment (DPS) is presented below. Throughout this finding we refer to the Sonoran Desert Area population of the bald eagle, because that is the petitioned entity; however, we have determined that this population does not constitute a DPS and, therefore, is not a listable entity. Even though we have made this determination, we conducted the five-factor analysis below as an exercise to review the status of the Sonoran Desert Area population of the bald eagle.

In considering what factors might constitute a threat, we must look beyond the mere exposure of the species to the factor to determine whether the species responds to the factor in a way that causes actual impacts to the species. If there is exposure to a factor, but no response, or only a positive response, that factor is not a threat. If there is exposure and the species responds negatively, the factor may be a threat and we then attempt to determine how significant a threat it is. If the threat is significant, it may drive or contribute to the risk of extinction of the species such that the species warrants listing as threatened or endangered as those terms are defined by the Endangered Species Act. This does not necessarily require empirical proof of a threat. The combination of exposure and some corroborating evidence of how the species is likely to be negatively affected could suffice. The mere identification of factors that could affect a species negatively is not sufficient to compel a finding that listing is appropriate; we require evidence that these factors are operative threats that act on the species to the point that the species meets the definition of ''threatened species'' or ''endangered species'' under the Endangered Species Act.

The following analysis considers all known threats to bald eagles in the Sonoran Desert Area, as described below. Factors that are believed to have affected or continue to affect bald eagles in the Sonoran Desert Area include the degradation or loss of riparian habitat; loss of surface flows from groundwater pumping and surface water diversions; demographic factors; declining prey base; contaminants, pollutants, and eggshell thinning; climate change; and human disturbance. It is important to recognize that in most areas where bald eagles occur, two or more factors may be acting in combination in their influence on individuals of the population, the entire local population, or the suitability of habitat.

Within the Sonoran Desert Area, bald eagles on the Verde River accounted for 44 percent of total productivity between 1971 and 2008 while breeding areas on the Salt River accounted for an additional 34 percent of total productivity. In total, 78 percent of bald eagle productivity in the Sonoran Desert Area, exclusive of Sonora, is tied to breeding areas along these two river systems. Therefore, the following analysis places emphasis on threats to breeding areas along these two river systems. We also included threats to other river systems—including the Agua Fria, Bill Williams, and Gila Rivers—in our analysis of threats to bald eagles in the Sonoran Desert Area.

In our analysis of Factors A through E below, we describe current threats, as well as threats that we anticipate will increase, or will be realized in the future. For populations within Arizona, our analysis benefitted from the availability of specific research, monitoring, and other studies. The analysis of these factors as they pertain to the status and threats to the bald eagle in mainland Sonora is broader in scope, focusing on regional or statewide areas, because there has been less work completed for the bald eagle in this area. In some instances, we include a discussion on more refined geographic areas of Mexico when supported by the literature.

Traditional Ecological Knowledge

We included traditional ecological knowledge from Native American tribes in our consideration of threats to the Sonoran Desert Area population of bald eagle. Traditional ecological knowledge includes an intimate and detailed knowledge of plants, animals, and natural phenomena; the development and use of appropriate technologies for hunting, fishing, trapping, agriculture, and forestry; and a holistic knowledge, or ''world view,'' that parallels the scientific discipline of ecology (Bourque *et al.* 1993, p. vi). Native people depended upon the animals and plants of these environments for food, clothing, shelter, and companionship and as a result developed strong ties to the fish and land animals, the forests, and the grasslands (Pierotti and Wildcat 1999, pp. 192–195). We include bald eagle traditional ecological knowledge provided to us by the White Mountain Apache Tribe, San Carlos Apache Tribe, Tonto Apache Tribe, Yavapai-Apache Nation, Salt River-Pima Maricopa Indian Community, Tohono O'odham Nations, and Fort McDowell Yavapai Nation.

Traditional ecological knowledge from the White Mountain Apache Tribe, San Carlos Apache Tribe, Tonto Apache Tribe, and Yavapai-Apache Nation (collectively referred to as Western Apache) indicates that bald eagles are absent from many nest sites where they were once observed. Feathers originating from native, living, wild bald eagles are obtained year round for ceremonial purposes. Part of the ritual use of these feathers requires obtaining power from the place in which the eagle lives, and, thus, these places are considered extremely powerful and are known to the user. The task of obtaining feathers is only accomplished by certain individuals who have cultural knowledge and the traditional ecological knowledge of these places. This knowledge is gained from years of experience through observation, which is then orally transferred to the next generation. Western Apache traditional ecological knowledge suggests that irresponsible urban expansion, agriculture, mining, and resultant climate change have brought the earth, and bald eagle habitat, to a crisis point. Traditional ecological knowledge additionally suggests that the riparian systems on which bald eagles depend have been severely damaged, and continue to be threatened with upland watershed decline, the region's dwindling water resources, multiple sources of pollution, water rights conflicts, and the spread of nonnative fauna species (Lupe *et al.* 2008, pers. comm.). Tribal information is consistent with published information documenting the modification and destruction of aquatic and riparian communities in the southwestern United States (Medina 1990, p. 351; Sullivan and Richardson 1993, pp. 35–42; Fleischner 1994, pp. 630–631; Stromberg *et al.* 1996, pp. 113, 123–128; Belsky *et al.* 1999, pp. 8–12; Webb and Leake 2005, pp. 305–310).

Traditional ecological knowledge from the Western Apache reports a decline of the bald eagle population and nesting sites throughout Arizona over the past 150 years. Bald eagle nests are no longer present in sites where they were known to the Western Apache, including Warm Springs Canyon, Black River Canyon, Paymaster Canyon, and Salt Creek Canyon on the San Carlos Reservation. According to traditional ecological knowledge of the Western Apache, more bald eagles were previously observed below Coolidge Dam and at Talkalai Lake than currently exist. In addition, bald eagles are no longer present in the canyon above Clarksdale, Box Canyon, Fossil Creek, Courthouse Butte around the Sedona area; Mazatzal Mountains near Payson; and Hackberry Mountain southeast of Camp Verde (Sparks 2009, entire). According to transcripts from a government-to-government consultation meeting held on July 3, 2008, the Fort McDowell Yavapai Nation reported up to 15 bald eagle nests historically occurred on their reservation lands, and now there are four. Western Apache experts with traditional ecological knowledge about the bald eagle note atmospheric changes, and alteration in bee, wasp, and hornet populations, as a few of the many key factors in bald eagle habitat decline. Declines and shifts in distribution and abundance in bald eagles in Arizona may have occurred within the last 150 years from areas where habitat and riverine systems may no longer exist (Mearns 1890, p. 53; Hunt *et al.* 1992, Ai, A10–A12; Mighetto *et al.* 2009, pp. 6–8). For example, Mighetto *et al.* (2009) reported eagles historically occupying areas around Window Rock, Lake Mead, Anderson Mesa near Big Horse Lake, Stoneman Lake, Fort Apache, and Mt. Graham, but they no longer exist in these locations.

The Salt River Pima-Maricopa Indian Community believes the Bald and Golden Eagle Protection Act (see discussion under Factor D below) will not provide the necessary level of protection needed to keep the bald eagle in the Sonoran Desert Area viable. The Community further believes that habitat protection is uncertain based on the new regulatory definition of ''disturb,'' which is untested in the courts. The Western Apache have expressed similar concern that habitat will not be protected. The Western Apache Tribes and Nation have indicated that, within reservation boundaries, there may be inadequate resources to address these threats. They indicate that the incentive for poaching bald eagles is high in Apache communities, primarily due to desperate economic conditions. A single bald eagle can be sold for more than $5,000. The Western Apache believe that even a perceived loss of protection for the bald eagle could bring about an increase in poaching activities. Tribal law enforcement agencies, already facing funding shortages, would be unable to respond properly to such threats (Lupe *et al.* pers. comm. 2008).

A. Present or Threatened Destruction, Modification, or Curtailment of the Species' Habitat or Range

Within Arizona, bald eagles are listed as a Tier 1a ''species of greatest conservation need'' in the State's ''Comprehensive Wildlife Conservation Strategy'' (AGFD 2006b, p. 155). Additional provisions are in place for the management of bald eagles. The management of bald eagles in Arizona is also overseen by the Southwestern Bald Eagle Management Committee, which is a multiparty committee initiated in 1984 that focuses on coordination of bald eagle conservation efforts in Arizona across various land ownerships. The AGFD, in 2006, developed the ''Conservation Assessment and Strategy for the Bald Eagle in Arizona,'' which described the current threats to bald eagles in Arizona and identified the best management practices necessary to maintain their distribution and abundance post-delisting. The ''Conservation Assessment and Strategy for the Bald Eagle in Arizona'' has been implemented following the signing of a Memorandum of Understanding in 2007. As a result, the AGFD continues to conduct bald eagle winter counts, monitor bald eagle distribution and productivity, support the ABENWP, and conduct other activities identified in the ''Conservation Assessment and Strategy for the Bald Eagle in Arizona.'' The AGFD believes that these conservation efforts will sufficiently manage the threats to bald eagles in the Sonoran Desert Area of Arizona absent the protections under the Endangered Species Act (AGFD 2008b, p. 6).

A number of potential threats to bald eagle habitat in the Sonoran Desert Area have been identified by the petitioners, the AGFD, and the Service. In our review of the best scientific and commercial data available, activities that are potentially affecting bald eagles and their habitat in the Sonoran Desert Area include urban and rural development, livestock grazing, groundwater pumping, and surface water diversions, in that each of these activities (or a combination of these activities, acting in concert) could degrade or remove riparian habitat. Because bald eagles rely on aquatic ecosystems as a source of fish for survival and reproduction and trees for nesting, any loss or degradation of riparian habitat is of particular concern (Stalmaster 1987, pp. 159, 170–171). The ''Conservation Assessment and Strategy for the Bald Eagle in Arizona'' identified riparian degeneration as a management challenge for 25 of 45 known breeding areas (or 58 percent) located within the Sonoran Desert Area of Arizona at that time (Driscoll *et al.* 2006, pp. 51–53). Additionally, the potential loss of surface flows within sections of the Gila, Salt, Verde, Agua Fria, or Bill Williams Rivers would likely have negative impacts on the density and distribution of prey and the health and persistence of riparian vegetation. Below we present information about these factors, and discuss the magnitude and extent of the impacts from these factors on the Sonoran Desert Area population of the bald eagle.

Degradation and Loss of Riparian Habitat

Riparian communities are sensitive to even low levels (less than 10 percent) of urban development within a watershed (Wheeler *et al.* 2005, p. 154). Development along or in proximity to riparian zones can alter the nature of stream flow dramatically, changing once-perennial streams into ephemeral streams, which has direct consequences on the riparian community (Medina 1990, pp. 358–359). The distribution of breeding bald eagles in the Sonoran Desert Area follows major watersheds, with the highest productivity occurring along the Salt and Verde Rivers, and some of the breeding areas along these rivers are located in close proximity to metropolitan areas. The conversion of perennial streams into ephemeral (lasting a short time) streams or loss of open space can directly affect bald eagles along these rivers (Medina 1990, pp. 358–359; Ewing *et al.* 2005, p. 11). Loss of water and conversion to ephemeral streams eliminates or reduces the quality of riparian habitat, including the trees on which bald eagles depend for nesting and perching. Loss of open space or clearing of habitat for development removes vegetation directly, either in the watershed or in the riparian areas themselves, making the areas less suitable for bald eagles by removing key habitat components (*e.g.,* water, large trees).

The influence of urbanization and development can be observed within the greater Phoenix, Arizona, area, where impacts have modified riparian vegetation, structurally altered stream channels, facilitated nonnative fish species introductions, and dewatered large reaches of formerly perennial rivers where the bald eagle historically occurred (portions of the Gila and Salt Rivers). Urbanization on smaller scales can also affect habitat suitability for the bald eagle. Regional development and subsequent land use changes spurred by increasing human populations along lower Tonto Creek and within the Verde Valley may negatively affect the suitability of this habitat for bald eagles by reducing the quantity and quality of aquatic resources for native fish and reducing the width of riparian habitat (Paradzick *et al.* 2006, pp. 89–90). Studies conducted in other portions of the range of the bald eagle in North America, such as the Chesapeake Bay, indicated that human development and low availability of suitable perch trees combined to affect bald eagle use of shoreline habitat (Chandler *et al.* 1995, pp. 328–330). Bald eagles there preferred shoreline segments that contained more suitable perch trees, more forest cover, and fewer buildings. However, to have a significant effect, urbanization and development must be occurring at a scale and intensity that results in a risk to the Sonoran Desert Area population of the bald eagle at the population level. The ''Conservation Assessment and Strategy for the Bald Eagle in Arizona'' identified development as a management concern in 4 of 45 bald eagle breeding areas (or 9 percent) located within the Sonoran Desert Area of Arizona at that time (Driscoll *et al.* 2006, pp. 51–53). Although urbanization and development may be affecting breeding areas at a localized level, it does not appear that they are currently a threat at the population level, because the population remains stable or increasing.

The effects of urban and rural development on riparian habitat are expected to increase as human populations increase. Arizona increased its population by 394 percent from 1960 to 2000, and is second only to Nevada as the fastest growing State in terms of human population (Social Science Data Analysis Network (SSDAN) 2000, p. 1). Over the same time period, population growth rates increased in Arizona counties where the bald eagle occurs: Maricopa (463 percent), Yavapai (579 percent), Gila (199 percent), Graham (238 percent), Apache (228 percent), and La Paz (142 percent) (SSDAN 2000). Population growth trends in Arizona are expected to continue into the future. The Phoenix metropolitan area, founded in part due to its location at the junction of the Salt and Gila Rivers, is currently a population center of 3.63 million people. Arizona is predicted to have the sixth largest net increase in population (slightly over two million people) in the nation between 1995 and 2025 (U.S. Department of Commerce 1997, p. 1). The human population in Maricopa County alone is expected to reach five million people by 2025 (City of Phoenix 2004, p. 18), and the county stands to lose up to an estimated 347.2 square miles of open space that are currently in the path of development (Ewing *et al.* 2005, p. 11).

The human population in two towns along the Verde River, Cottonwood and Camp Verde, is expected to grow by approximately 70 and 77 percent, respectively, between 2006 and 2040 (Arizona Department of Administration 2012). The town of Chino Valley, at the headwaters of the Verde River, grew by 22 percent between 2000 and 2004; Gila County, which includes portions of the Salt River and Tonto Creek, grew by 20 percent between 2000 and 2003 (U.S. Census Bureau 2006). Human population growth is expected to continue to affect the riparian and aquatic communities of the Verde Valley through increased demand for water, increased runoff, shortened return intervals on flood events, water quality impacts, and increased recreational impacts where bald eagles are concentrated (Girmendock and Young 1997, p. 57; American Rivers 2006, p. 30; Paradzick *et al.* 2006, p. 89).

The human population and associated recreational developments in the Sonoran Desert Area, which are often tied to water bodies and riparian areas, are expected to continue to grow into the future. In the Sonoran Desert Area, an expanding human population has led to higher recreational use of riparian areas, as evidenced along reaches of the Salt and Verde Rivers in proximity to the Phoenix metropolitan area. Recreational impacts can include direct habitat losses for development of recreational facilities and infrastructure or indirect loss of habitat as a result of human disturbance (see Factor E for further discussion). Developments within occupied breeding areas include a turnaround for river tubing near Bulldog Cliffs (Salt River) and lakeside resorts on the north shore of Lake Pleasant. Additional developments that may affect bald eagle breeding areas include: a four-lane boat launch and a 1,000 person per day recreation area on Bartlett Lake; a new day use and emergency boat launch constructed on the lower Salt River; a new RV park constructed within 1300 feet (396.2 meters) of a nest on the lower Verde River; and a 100-unit campground and boat ramp along Tonto Creek (Driscoll *et al.* 2006, p. 14).

In many of the breeding areas within the Sonoran Desert Area of Arizona, effects from development have been mitigated through the implementation of seasonal closures and monitoring by the Arizona Bald Eagle Nest Watch Program (ABENWP). The ABENWP, managed by the AGFD, closely monitors breeding bald eagles in areas with high recreational pressure. This program was initiated in 1978 with the goals of public education, data collection, and conservation of the species. Nest watchers collect behavioral data, contact and educate the public in the vicinity of breeding areas, and identify potential threats to the breeding success of bald eagles. Funding for the ABENWP comes from a variety of sources, including State Wildlife Grants, donations, AGFD Heritage Funds (State lottery), matching funds for Federal grants, and contributions from Federal agencies. As a result of the bald eagle being delisted, there is the potential that the ABENWP could face funding shortages or that the bald eagle could receive less priority from partner agencies; however, there is currently no indication that either of these scenarios has occurred or will occur in the future.

The AGFD's Projects Evaluation Program is available for Federal agencies or companies with a Federal nexus. This program can be used to evaluate the impacts of planned or future projects in areas where there may be a species of concern. The AGFD believes the program will help to ensure bald eagles and their habitat are considered and evaluated for possible effects from development projects (Driscoll *et al.* 2006, p. 14). In the future, similar levels of development and modification as those described above can be expected as recreational facilities age and recreational pressures increase with increasing human populations. However, as evidenced by the continued reproductive success (*e.g.,* pairs continue to produce young) of the above affected breeding areas, the ability of the bald eagle in the Sonoran Desert Area to adapt to increases in the human population and habitat modifications is an indication that these actions are not posing a significant risk at the population level.

Livestock grazing has been a prevalent industry in the Southwest for 200 years or more. Poorly managed livestock grazing has damaged approximately 80 percent of stream, cienega (spring), and riparian ecosystems in the western United States (Kauffman and Krueger 1984, pp. 433–435; Weltz and Wood 1986, pp. 367–368; Waters 1995, pp. 22–24; Pearce *et al.* 1998, p. 307; Belsky *et al.* 1999, p. 1). Overgrazing by domestic livestock has been a significant factor in the modification and loss of riparian habitats in the arid western United States (Schultz and Leininger 1990, p. 295; Belsky *et al.* 1999, pp. 1–3). If not properly managed, livestock grazing can significantly alter watershed hydrology; water quality; aquatic and riparian ecology; and the structure and composition of riparian plant communities. Excessive grazing can also prevent the establishment of seedlings (Carothers 1977, p. 2; Glinski 1977, pp. 119–121), which limits the growth of future nest and roost trees for bald eagles (Driscoll *et al.* 2006, p. 4). Important features of bald eagle habitat—such as large trees for roosting and nesting, sufficient flows, water temperatures, and water quality—are most affected by improper livestock grazing in riparian areas. Currently, active grazing is occurring within the Verde River floodplain in the Verde Valley, lower Verde River, and upper Salt River.

The impacts of improper livestock grazing have been reduced on many streams, in part through consultations completed under section 7 of the Endangered Species Act and in part through improved grazing management practices. Some of the consultations were for other species that use the same streams as habitat or for foraging (e.g., Southwestern willow flycatcher (*Empidonax trailii extimus*), razorback sucker (*Xyrauchen texanus*), spikedace (*Meda fulgida*), loach minnow (*Tiaroga cobitis*)). Therefore, despite the delisting of the bald eagle, impacts from livestock grazing on streams will continue to be minimized through consultations conducted for those other species and their designated critical habitats. Along many portions of the Verde River and Tonto Creek, livestock grazing has currently been discontinued. Riparian recovery, at least in response to a reduction in grazing pressure, may therefore be underway in some of these areas. Improper livestock grazing may still be an added stressor on those systems where it continues to occur (absent a separately listed species), where trespass or unauthorized cattle are grazing, or where habitat is already degraded due to other factors.

In Mexico, while the magnitude and significance of adverse effects to riparian communities related to development lags behind the United States due to slower population and economic growth, impacts to riparian and aquatic communities are currently occurring with increasing significance (Conant 1974, pp. 471, 487–489; Contreras Balderas and Lozano 1994, pp. 379–381; va Landa *et al.* 1997, p. 316; Miller *et al.* 2005, pp. 60–61; Abarca 2006, pers. comm.; Rosen 2006, pers. comm.). Mexico's population increased by 245 percent from 1950 to 2002, and is projected to grow by another 28 percent by 2025 (EarthTrends 2003, pp. 1–2). As a result of the North American Free Trade Agreement, the number of maquiladoras (export assembly plants) is expected to increase by as many as 3,000 to 4,000 (Contreras Balderas and Lozano 1994, p. 384). To accommodate Mexico's increasing human population, rural areas are largely devoted to food production based on traditional methods, which has led to serious losses in vegetative cover and soil erosion (va Landa *et al.* 1997, p. 316). In addition, changes in land legislation within Mexico related to free market policies and local agricultural production methods may result in the loss of land management practices that protect the natural environment (Ortega-Huerta and Kral 2007, p. 1). Much of the riparian woodland in the broad floodplains along the Rio Bavispe has been cleared for agriculture and pasturelands. Similarly, portions of the riparian habitat along the Rio Yaqui have also been affected by agriculture, and heavy livestock grazing has occurred throughout the Rio Yaqui and Rio Bavispe (Brown *et al.* 1986, pp. 3, 5). In one breeding area along the Rio Yaqui, the nest failed in 1986 due to the construction of a fence in preparation for agricultural development. The nest was then destroyed in 1987 as a result of a fire set to clear the land for agriculture (Driscoll and Mesta 2005, in prep.).

Several recent development projects in Mexico have affected bald eagle breeding areas. In 1998, a new road was created from the Town of Sahuaripa to the Rio Yaqui/Sahuaripa confluence, which was followed by a cement property marker placed above the eagle's cliff nest in 1999 (Driscoll and Mesta 2005, p. 58). From 2000 to 2002, construction and completion of a new highway bridge occurred immediately at the Sahuaripa bald eagle nest, which had formerly been the most successful mainland Sonora bald eagle territory. Associated with the bridge construction, development of worker living quarters, an equipment staging area, and a construction material borrow site near the nest resulted in further habitat degradation. The placement and development of the new road and bridge generated increased human activity (e.g., fishing, swimming, picnics), and development of four ranch buildings in the Sahuaripa breeding area. In 2009, this pair was located in the vicinity of the Sahuaripa breeding area, and it is likely that they have relocated to a new site below the bridge (Mesta 2009, pers. comm.).

Despite the increase in human population and associated impacts to the riparian habitat on which the bald eagle depends, the known number of breeding areas within the Sonoran

Desert Area has increased from a low of three in 1971 to a high of 52 in 2009, and the population has expanded into areas not previously occupied. As a result of this growth, the density of breeding areas along sections of the Salt and Verde Rivers has increased in recent years. AGFD survey data showed that the bald eagle population in Arizona continued to grow during approximately the same time period that Arizona experienced a 394 percent increase in human population (*e.g.,* from 1960 to 2000). While the magnitude of the effects described above may be moderate in localized areas, they are not occurring at all breeding areas or throughout the range of the Sonoran Desert Area population of the bald eagle. In addition, the eagle population has continued to increase at the same time that urbanization and the loss of riparian habitat have increased. Therefore, the urbanization and loss of riparian habitat are not affecting bald eagles at such a scale or magnitude that they constitute a threat at the population level.

At this time, there is no indication of additional or new impacts to riparian areas that would accelerate or increase the current pressures to riparian habitat beyond what is currently occurring. Based upon what we know about how impacts to these key features can affect bald eagles, it would not be unreasonable to anticipate that if there is continued degradation of habitat, especially key features such as trees, at some point reproductive performance or breeding area occupancy could be affected. At what point and to what extent continued human population growth, associated resource use, and degradation of riparian habitat will manifest itself in effects to the Sonoran Desert Area population of the bald eagle is unknown. Unlike species with a narrow habitat requirement, the bald eagle uses broader landscapes, and as a result, some change to habitat is not expected to impede their ability to adjust and use the available landscape features successfully. As a result, the best available information does not suggest the increase in human population occurring in Arizona now and predicted to continue into the future will result in declines to the Sonoran Desert Area population of the bald eagle.

Loss of Surface Flows From Groundwater Pumping and Surface Water Diversions

Increased urbanization and population growth also results in an increase in the demand for water and, therefore, water development projects. American Rivers (2006, p. 30) found that municipal water use in central Arizona increased by more than 39 percent between 1998 and 2006, and that the demand for water will only increase as the human population increases. Water for development and urbanization is often supplied by groundwater pumping and surface water diversions from sources that include reservoirs and Central Arizona Project's (the steward of central Arizona's Colorado River water entitlement) allocations from the Colorado River. The impacts of groundwater pumping on surface water flows are of particular concern along the Salt and Verde Rivers (University of Arizona 2004, p. 69), as well as the Gila River, all of which occur within the Sonoran Desert Area. Most of the recent bald eagle breeding areas have become established along the Salt and Verde Rivers (Allison *et al.* 2008, pp. 17–18), and elimination of key habitat elements (e.g., water, prey base, large trees) could affect the ability of bald eagles to continue to reproduce and expand along these river systems.

The Verde River was identified as one of the country's most endangered rivers of 2006 (American Rivers 2006, pp. 30–31) due to groundwater pumping. As a result of rapidly growing communities in Arizona, groundwater pumping has caused portions of the Verde River to have limited or no flow during portions of the year (Stromberg *et al.* 1996, pp. 113, 124–128; Rinne *et al.* 1998, p. 9; Voeltz 2002, pp. 45–47, 69–71). Specifically, more than 6 miles of perennial stream segments on the Verde River have been lost since approximately 1950, and water levels near Sullivan Lake in the headwaters of the Verde River have declined by greater than 80 feet since 1947 (Wirt 2006, pp. 5–6).

Because of increasing demands for water and decreasing groundwater levels, the State Legislature adopted the Arizona Groundwater Management Act (A.R.S. § 45–555) in 1980. The Arizona Groundwater Management Act designated four Active Management Areas where groundwater supplies are critical or imperiled for whole or multiple groundwater basins. The Arizona Groundwater Management Act limits existing uses of groundwater within an Active Management Area, and restricts new uses (Marder 2009, p. 183). The City of Prescott is out of compliance with the Arizona Groundwater Management Act, and, in order to achieve compliance, has had to secure new resources, teaming up with Prescott Valley in developing a plan to pump water from the Big Chino Aquifer. This plan and the associated well field development and water transfer is commonly known as the Big Chino Ranch Project. In 1992, the Arizona Legislature adopted A.R.S. 45–555(E), which explicitly authorizes the City of Prescott to pump up to 14,000 acre-feet per year from the Big Chino Aquifer. In addition, the town of Chino Valley has plans for their own groundwater pumping, which would be located in the Big Chino aquifer, and would allow the development of approximately 20,000 new homes (Marder 2009, pp. 183–187).

Many scientists, conservationists, and water providers, such as the Salt River Project, are in agreement that groundwater pumping has already had an impact on the Verde River and that—given the plans of Prescott, Prescott Valley, and Chino Valley—further reductions in the Verde River instream flows are inevitable (Marder 2009, p. 187). The proposed groundwater pumping and inter-basin transfer project is projected to deliver 2.8 billion gallons of groundwater annually from the Big Chino sub-basin aquifer to the rapidly growing area of Prescott Valley for municipal use (McKinnon 2006, p. 1). It is estimated that 80 to 85 percent of base flow in the upper Verde River comes from the Big Chino aquifer, and it is possible that that these groundwater withdrawals could dewater the upper 24 miles of the Verde River (Wirt and Hjalmarson 2000, p. 44; Wirt 2005, p. G7; Blasch *et al.* 2006, updated 2007, pp. 1–2). The loss of water on the upper Verde River would affect fish populations and consequently productivity in at least one bald eagle breeding area (Driscoll *et al.* 2006, p. 15).

The effects of large-scale groundwater pumping associated with the proposed Big Chino Water Ranch Project and its associated 30-mile pipeline have yet to be realized in the Verde River. It is uncertain that this project will occur given the legal and administrative challenges it faces; however, Prescott, Prescott Valley, and Chino Valley have invested millions of dollars in planning and property acquisition, and the pumping has already been authorized by State law. In 2009, a Memorandum of Understanding was signed between the Town of Chino Valley and the Service that may help to mitigate some of the impacts of their groundwater withdrawals in the future. The Town of Chino Valley has agreed that, as it develops its water development plan, it will confer with the Service to assess potential impacts to the Verde River and its native species and habitats, and will cooperate with the Service to remove or reduce impacts (Service 2009, p. 2).

Additional groundwater withdrawal projects that may affect the Verde River include developments associated with the proposed consolidation of checkerboard land ownership in the Big Chino Valley. Authorized by Title I of Public Law 109–110 in November 2005, the Yavapai Ranch Limited Partnership will acquire 15,400 acres of land within Prescott National Forest in the Big Chino Valley, consolidating private ownership of 30,440 acres. At full buildout, the development could result in water use of an additional 1,039 acre-feet pumped from the Big Chino aquifer. Existing groundwater withdrawals for the Big Chino sub-basin between 1990 and 2003 averaged 11,840 acre-feet (Blasch *et al.* 2006, updated 2007, p. 82). Those withdrawals—in conjunction with proposed pumping from the City of Prescott, Town of Prescott Valley, and the Yavapai Ranch—would exceed the total rate of recharge to the Big Chino aquifer of approximately 21,500 acre-feet.

The middle Verde River has experienced low flows that have at times resulted in only 5,982 acre-feet of runoff into Horseshoe reservoir, considerably less than the normal of 7,478 acre-feet (Verde Natural Resources Conservation District 1999, p. 1). Multiple diversions and groundwater pumping are likely contributing to low flows in this portion of the Verde River (Miller 1961, pp. 398–399; Owen-Joyce and Bell 1983, pp. 33–37; Sullivan and Richardson 1993, pp. 96, 124; Stromberg 1993, p. 101; Glennon and Maddock 1994, pp. 578–585; Glennon 1995, pp. 133–134; Tellman *et al.* 1997, pp. 46–49).

In Tonto Creek, which feeds into Roosevelt Lake on the Salt River, groundwater pumping is one of the factors that contribute to a loss of surface flows during part of the year between the winter and spring runoff and summer monsoon (Abarca and Weedman 1993, p. 2). However, Tonto Creek supports only two bald eagle breeding areas, both of which continue to produce young on a regular basis. In addition, the adults from one of these breeding areas may acquire additional resources from Roosevelt Lake during years of high water or during the winter (Service 2003, p. 63).

Groundwater pumping has also led to identification of the Gila River as the nation's seventh most endangered river in 2008 (American Rivers 2008, p. 33). Congress, through the Arizona Water Rights Settlement Act of 2004 (Pub. L. 108–451, 118 Stat. 3478, December 10, 2004), allocated up to $128 million for implementation of water projects designed to meet New Mexico's future water needs (NMISC 2006, pp. 6–7). The State of New Mexico must provide notice to the Secretary of the Interior by December 2014 whether or not it will use the allocation to develop water projects.

The New Mexico Interstate Stream Commission has proposed a project that would divert up to 14,000 acre-feet of water from the Gila River and its tributary, the San Francisco River, annually. The project would also require a diversion structure, pumping station, power station, a pipeline or canal system, and potentially an offsite dam and reservoir. The amount of water diverted would negatively affect groundwater wells, impair the river's natural flows, impede the growth of riparian vegetation, and negatively affect native fish and birds (American Rivers 2008, p. 33). While existing water rights of the San Carlos Apache Tribe would ensure that adequate flows remain in the Gila River to allow for the San Carlos Reservoir in Arizona to be at least partially filled, a reduction in flows would mean that less water would be available for storage in the reservoir, and, consequently, less water would be released from the reservoir into areas on the Gila River downstream of the reservoir.

Decreased flows from the reservoir could negatively affect the prey base (fish) and habitat for the three bald eagle breeding areas located downstream. However, it is important to note that the adults at only two of these breeding areas rely solely on free-flowing sections of the Gila River for foraging resources, and neither of them has ever produced young (Allison *et al.* 2008, pp. 17–18). The adults at the third breeding area use the San Carlos Reservoir as their primary foraging area and are less likely to be affected by decreased flows in the Gila River.

The construction and management of reservoirs may result in adverse effects to the river ecosystem. However, the presence of reservoirs, dams, or regulated river reaches did not appear to have a negative effect on bald eagle reproduction in a sample of 21 bald eagle territories studied in Arizona in the 1980's (Hunt *et al.* 1992, p. A-iv). The presence and management of reservoirs can lead to sediment entrapment, reductions in total annual flow and annual flood peaks, changes in the timing and size of high and low flows, altered surface area due to water releases, and altered short-term fluctuations. These in turn cause changes to plant species, including a loss of some species, and a decrease in recruitment of new vegetation (Service 2002, pp. I9–I12). However, eagle populations have not been shown to decline as a result of reservoirs, and may even benefit over the long term. For example, some reservoir storage has also created habitat for bald eagles in places where they may not have occurred, even before large-scale human development. Reservoirs provide additional habitat diversity, especially in a desert ecosystem, and may create a more stable food source for bald eagles during the winter months due to congregations of waterfowl. The creation of reservoirs usually coincides with the introduction of exotic species of fish, some of which (*e.g.,* catfish, bass, carp) can deplete native fishes. However, these exotic species make up a large portion of bald eagle diets in the Sonoran Desert Area, both in Arizona and Sonora (Hunt *et al.* 1992, pp. A25–A26; Hunt *et al.* 2002, pp. 249–251).

Similarly, eagle populations do not necessarily decline as a result of changes in vegetation due to the presence or management of reservoirs. Downstream from reservoirs, regulated flows have caused declines of riparian cottonwood and willow forests throughout the western United States (Service 2002, p. I12). The timing of water releases from many dams has also impeded riparian regeneration, destroyed riparian habitat and stream banks, and can influence the abundance, distribution, and diversity of fish species (Stromberg *et al.* 1996, p. 114; Poff *et al.* 1997, pp. 769–770). Although the persistence of riparian trees is not a management concern in most breeding areas upstream of dams or where appropriate cliffs are available, within some breeding areas located below dams, existing trees have become old, are dying, and are not being replaced (AGFD 2008, p. 9). This is in part due to modification of flood regimes by dams, which leads to a lack of sediment deposition, seed dispersal, and timing of flows adequate for seed germination.

When reservoir management leads to reduced surface area by releasing water and lowering the level of the reservoir, bald eagles established there may have fewer perches for foraging, loafing, feeding, and display (Stalmaster 1987). Similar impacts may also occur in Mexico, where water for agriculture is supplied through dams, specifically timed water releases, diversions, and surface water pumping (Driscoll and Mesta 2005, in prep.). Inundation from dams and reservoirs can have similar impacts, and can also eliminate spawning fish runs and remove nest sites, foraging areas, and gravel bars that accumulate carrion (Hunt *et al.* 1992, p. A46). The continuous drop of lake levels at Roosevelt Lake from almost 100 percent storage capacity to near 10 percent between 1993 and 2001 was shown to have a negative effect on productivity at five bald eagle breeding areas that relied on the lake for foraging resources (Service 2003, pp. 65–67). Yet even with the drop in lake size, occupancy rates remained high, and young continued to be produced from the affected breeding areas. On the Verde River below Bartlett Reservoir, the release of cold water from the reservoir and other management activities contributed to this area's having the greatest increase in the number of bald eagle breeding areas in Arizona from 1994 to 2002 (Service 2003, pp. 72–73). Therefore, the best available information suggests that reservoir management may result in short-term, localized impacts to some bald eagle breeding areas in the Sonoran Desert Area by negatively affecting productivity, but these impacts are not resulting in a reduction of the eagle population.

Congress passed the Arizona Water Settlement Act approving the Gila River Indian Community Water Rights Settlement Agreement in 2004. In 2005, the Secretary of the Interior signed the Gila River Indian Community Water Rights Settlement Agreement confirming the Community's claim to 653,500 acre-feet of water per 10-year period, providing Federal funding for water development projects, assuring rights to use existing water delivery systems, and adding protections for the Community's groundwater supplies (DOI 2005, p. 4; ADWR 2006, p. 3–2). Potential projects to be developed, and the impacts any projects are likely to have on the Gila River, are not yet known; however, passage of the law in 2004 and development of the Gila River Indian Community Water Rights Settlement Act make certain that some level of diversion or pumping will occur in the future. We do not anticipate that such projects would have a population-level effect on the Sonoran Desert Area bald eagle population. As mentioned above, there are only two bald eagle breeding areas that rely solely on free-flowing sections of the Gila River for foraging resources, and neither of them has ever produced young (Allison *et al.* 2008, pp. 17–18).

In the Sonoran Desert Area, flood control has led to channelization, bank stabilization, and levees. These engineering activities affect riparian systems by preventing overbank flooding, reducing the extent of the floodplain, reducing water tables adjacent to streams, increasing stream velocity and the intensity of extreme floods, and generally reducing the volume and width of wooded riparian habitats (Szaro 1989, pp. 77–80; Poff *et al.* 1997, pp. 769–770). Southwestern streams are known for their ''flashy'' (*i.e.,* rapid changes in water levels following heavy rains) hydrology. In the past 30 years, 100-year flood events have occurred twice in Arizona, in 1983 and 1993. Other major floods occurred in Arizona in 1926, 1942, 1962, 1966, 1970, and 1974 (Arizona Geological Survey 1984, p. 1; USGS 1989, pp. 1–2; Arizona Geological Survey 1993, p. 1). This flooding history may be an indication that similar events are likely to occur in the Sonoran Desert Area in the foreseeable future, and, as a result, flood control measures will also likely continue to be implemented. These flood control measures and their associated impacts to riparian systems can decrease the amount of suitable habitat available to bald eagles for perching and nesting. On the other hand, the creation of berms, dams, and diversions has benefited some breeding pairs of bald eagles in the Sonoran Desert Area by making prey species more available, but these activities, in addition to water table pumping on rivers and creeks with limited flow, could at the same time be making prey species less available by reducing the size of bald eagle foraging areas (Driscoll *et al.* 2006, pp. 14–15).

A decrease in, or complete loss of, surface flows within portions of the Verde, Salt, or Gila Rivers could result in a loss of riparian habitat and a reduction or loss of prey (e.g., fish) at a localized level (for the affected breeding areas). The breeding areas associated with the Verde River are responsible for 22 percent of the total productivity within the Sonoran Desert Area. Because of the importance of river systems, particularly the Verde River, to the Sonoran Desert Area population of the bald eagle, accurately quantifying the potential effects of lost surface flows at the population level would be valuable. Statistical methods can be used to quantitatively estimate population growth and extinction probabilities for a species under different demographic and environmental scenarios. The simplest type of model to perform this can be referred to as a simple population viability analysis (PVA). A simple PVA quantitatively estimates population growth and extinction probabilities for a single population (Dennis et al. 1991, p. 116). The only PVA analyzing the potential impacts from the loss of surface flows to the Sonoran Desert Area population of the bald eagle was conducted in 2009. The Service used a PVA to analyze the potential impact that complete loss of surface flows on the upper Verde River would have on bald eagles breeding in the Sonoran Desert Area of Arizona. The preliminary results of this analysis indicated that, even with the hypothetical loss of breeding areas along the Verde River, the bald eagle population as a whole would remain stable (Millsap 2009, in prep.). This suggests that the loss of surface flows within portions of the Verde River may be a threat of moderate magnitude at a localized or regional scale, but the impact to Sonoran Desert Area bald eagles at the population level is predicted to be low.

Summary of Factor A

The Service has identified potential threats to the Sonoran Desert Area population of the bald eagle from the present or threatened destruction, modification, or curtailment of the Sonoran Desert Area population of the bald eagle. These threats include the degradation and loss of riparian habitat and the loss of surface flows from groundwater pumping and surface water diversions. There is little doubt that the human population in Arizona, specifically within areas occupied by bald eagles, will continue to grow into the future. Associated with this growth, there will likely be an increase in development and modifications to some of the habitat on which bald eagles depend for nesting, roosting, perching, and foraging.

Although available information indicates that urban and rural development, livestock grazing, groundwater pumping, and surface water diversions have likely resulted in historical and continued loss of habitat and negative impacts to specific breeding areas or individual eagles, there is no indication that ongoing impacts are affecting the Sonoran Desert Area population of the bald eagle at the population level. Thus, they are not significantly contributing to the risk of extinction of the population.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

We do not have any evidence of risks to the Sonoran Desert Area population of the bald eagle from overutilization for commercial, scientific, or educational purposes, and we have no information to indicate that this factor will become a threat to the species in the future.

C. Disease or Predation

We do not have any evidence of risks to the Sonoran Desert Area population of the bald eagle from disease or predation, and we have no information to indicate that this factor will become a threat to the species in the future.

D. Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether existing regulatory mechanisms are inadequate to address the threats to the Sonoran Desert Area population of the bald eagle discussed under Factors A and E. Section 4(b)(1)(A) of the Endangered Species Act requires the Service to take 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 * * *.'' We interpret this language to require the Service to consider relevant Federal, State, and Tribal laws, plans, regulations, Memoranda of Understandings (MOUs), Cooperative Agreements, and other such mechanisms that may minimize any of the threats we describe in threat analyses under all five factors, or otherwise enhance conservation of the species. We give strongest weight to statutes and their implementing regulations, and management direction that stems from those laws and regulations. An example would be the terms and conditions attached to a grazing permit that describe how a permittee will manage livestock on a BLM allotment. They are nondiscretionary and enforceable, and are considered a regulatory mechanism under this analysis. Other examples include State governmental actions enforced under a State statute or constitution, or Federal action under statute. Some other agreements (MOUs and others) are more voluntary in nature; in those cases we analyze the specific facts for that effort to ascertain the extent to which it can be relied on in the future, and how effective it is, and will continue to be, at mitigating the threat.

Having evaluated the significance of the threat as mitigated by any such conservation efforts, we analyze under Factor D the extent to which existing regulatory mechanisms are inadequate to address the specific threats to the species. Regulatory mechanisms, if they exist, may preclude the need for listing if we determine that such mechanisms adequately address the threats to the species such that listing is not warranted. Within its distribution in the Sonoran Desert Area, the bald eagle occurs on lands managed by a myriad of Federal and State agencies, Native American tribes, local municipalities, and private lands. In this section, we review existing State and Federal regulatory mechanisms to determine whether they effectively reduce or remove threats to the Sonoran Desert Area population of the bald eagle. Specifically, the regulatory mechanisms discussed below address some of the effects to bald eagles from the direct take of individuals, as well as the indirect take through disturbance, loss of riparian habitat, and development.

Federal laws and regulatory mechanisms protecting bald eagles throughout the United States include the Migratory Bird Treaty Act (MBTA, 16 U.S.C. 703–712), Bald and Golden Eagle Protection Act (BGEPA, 16 U.S.C. 668 *et seq.*), Executive Order 13186, the Lacey Act Amendments of 1981 (16 U.S.C. 3372–3378), Section 404 of the Clean Water Act (CWA, 33 U.S.C. 1251 *et seq.*), Fish and Wildlife Coordination Act (16 U.S.C. 661–666c), National Environmental Protection Act (NEPA, 42 U.S.C. 4321 *et seq.*) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). For more information regarding these regulatory mechanisms, please refer to the February 16, 2006, **Federal Register** notice (71 FR 8238) reopening the comment period on the proposed rule to delist the bald eagle in the lower 48 States. Below we summarize the protections provided to bald eagles under the NEPA, MBTA, BGEPA, and CWA.

All Federal agencies are required to comply with NEPA for projects they fund, authorize, or carry out. Additionally, activities on non-Federal lands are subject to NEPA if there is a Federal nexus, such as permitting by the U.S. Army Corps of Engineers or the Federal Energy Regulatory Commission. The Council on Environmental Quality's regulations for implementing NEPA (40 CFR parts 1500–1518) state that environmental impact statements shall include a discussion on the environmental impacts of the various project alternatives (including the proposed action), any adverse environmental effects that cannot be avoided, and any irreversible or irretrievable commitments of resources involved (40 CFR part 1502). The NEPA itself is a disclosure law that provides an opportunity for the public to submit comments on the particular project and propose other conservation measures that may directly benefit listed or sensitive fish and wildlife species; however, it does not require subsequent minimization or mitigation measures by the Federal agency involved. Although Federal agencies may include conservation measures for listed species as a result of the NEPA process, there is no requirement that impacts to the Sonoran Desert Area population of the bald eagle from actions analyzed under NEPA would be precluded. Any such measures are typically voluntary in nature and are not required by the statute.

The MBTA implements various treaties and conventions between the United States and other countries and, unless permitted by regulations, it provides that it is unlawful to pursue; hunt; take; capture; kill; possess; offer to sell, barter, purchase, deliver; or cause to be shipped, exported, imported, transported, carried, or received any migratory bird, part, nest, egg, or product, manufactured or not. The BGEPA, originally passed in 1940, prohibits the take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit. ''Take'' is defined as to ''pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb'' a bald or golden eagle. To provide a consistent framework in which to implement the BGEPA after bald eagle delisting, on June 5, 2007, the Service clarified its regulations implementing the BGEPA (72 FR 31132). These modifications to the implementing regulations for the BGEPA established a regulatory definition of ''disturb,'' a term specifically prohibited as ''take'' by the BGEPA.

As per the regulatory definition, ''disturb'' means to ''agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, injury to an eagle; a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.'' The BGEPA was initially designed to protect eagles from intentional take, and lawfully permit intentional take for such purposes as education, depredation, research, and Native American religious purposes. However, the regulatory definition of ''disturb'' described above may have the added benefit of providing indirect protection of bald eagle habitat (*e.g.,* if destruction of habitat results in disturbance).

In 2009, the Service promulgated new permit regulations under the authority of the BGEPA for the limited take of bald eagles and golden eagles ''for the protection of * * * other interests in any particular locality'' where the take is compatible with the preservation of the bald eagle and the golden eagle, is associated with and not the purpose of an otherwise lawful activity, and cannot practicably be avoided (74 FR 46836). The Service has interpreted ''compatible with the preservation of the bald and golden eagle'' to mean allowing take that is consistent with the goal of stable or increasing breeding populations. We will evaluate permit applications based on whether: (1) The take is necessary to protect a legitimate interest in a particular locality; (2) the take is associated with, but is not the purpose of the activity; (3) the take cannot practicably be avoided (or for programmatic authorizations, the take is unavoidable); and (4) the applicant has minimized impacts to eagles to the extent practicable, and for programmatic authorizations, the taking will occur despite application of Advanced Conservation Practices developed in coordination with the Service. Although the effects of implementing these regulations have not been realized, the Service's goal of a stable or increasing breeding population of bald and golden eagles indicates a commitment to their conservation and management into the future.

As discussed earlier in this document, bald eagle activities such as nesting, perching, roosting, and foraging in the Sonoran Desert Area occur from and in the large woody tree component of the riparian habitat found along rivers and streams, and section 404 of the CWA regulates fill in wetlands and streams that meet certain jurisdictional requirements. Activities that result in fill of jurisdictional wetland and stream habitat require a section 404 permit. The Service can review permit applications and provide recommendations to avoid and minimize impacts and to implement conservation measures for fish and wildlife resources, including the bald eagle. However, incorporation of Service recommendations into section 404 permits is at the discretion of the U.S. Army Corps of Engineers. In addition, not all activities in wetlands or streams involve fill, and not all wetlands or streams fall under the jurisdiction of the U.S. Army Corps of Engineers. Regardless, earlier in this finding we evaluated threats to the Sonoran Desert Area population of the bald eagle where effects to riparian habitat may occur. We found no information indicating that the degradation or loss of riparian habitat is acting on the species to the point that the species itself may be at risk, nor is it likely to become so in the future.

In Mexico, the bald eagle is listed at the species level as ''En Peligro de Extincion,'' or In Danger of Extinction, by the Secretaria de Medio Ambiente y Recursos Naturales (SEDESOL 2001, p. 20). Species in danger of extinction are ''those whose areas of distribution or size of their populations in the national territory have diminished drastically putting at risk their biological viability in their entire natural habitat, due to factors such as the destruction or drastic modification of the habitat, unsustainable exploitation, disease or depredation, among others'' (SEDESOL 2001, p. 4). This classification coincides partly with the International Union for Conservation of Nature's categories of ''in critical danger'' and ''in danger of extinction.'' This designation prohibits taking of the species, unless specifically permitted, as well as any activity that intentionally destroys or adversely modifies its habitat. Additionally, in 1988, the Mexican Government passed the General Law of Ecological Equilibrium and Environmental Protection that is similar to NEPA in the United States. This Mexican statute requires an environmental assessment of private or government actions that may affect wildlife or their habitat. However, while these laws in Mexico prohibit intentional destruction or modification of the bald eagle's habitat, they do not appear to be adequate to preclude impacts to the species' habitat. Currently, we know of no regulatory mechanisms or conservation planning in place that specifically targets the conservation of bald eagle habitat in Mexico. Legislation in Mexico has removed regulations that promoted intact protection of important riparian and aquatic habitats. Based upon the lack of conservation detected through existing regulations over the last 20 years of monitoring bald eagles in the mainland of Sonora, we anticipate there will continue to be future limitations to the regulatory mechanisms in Mexico.

Despite concerns expressed through an apparent lack of adequate protection for the bald eagle in Mexico, Federal regulatory mechanisms in place in the Sonoran Desert Area in Arizona, where most of the breeding areas are located, appear to be adequate to alleviate some of the threats to the population. The apparent lack of protection for bald eagles in Mexico may contribute to localized or regional impacts to bald eagle breeding areas in that country. However, these impacts only have the potential to affect the eight known breeding areas located in Mexico, which would not be sufficient to result in impacts at the population level.

Summary of Factor D

The Sonoran Desert Area population of the bald eagle is protected by many Federal laws and other regulatory mechanisms. Whether or not the population is listed under the ESA, the take of bald eagles in the United States—including the Sonoran Desert Area population—will continue to be prohibited under the MBTA, BGEPA, and the Lacey Act. While legislation in Mexico prohibits intentional destruction or modification of the bald eagle's habitat, and prohibits take, the legislation does not appear to be adequate to preclude impacts to the species' habitat. Nevertheless, even if this apparent lack of protection for habitat has impacts upon the bald eagles in Sonora, those impacts would only be localized or regional in scope, and would not affect the Sonoran Desert Area bald eagle as a population level.

After reviewing the best available commercial and scientific information, we conclude that the inadequacy of existing regulatory mechanisms does not significantly contribute to the risk of extinction of the Sonoran Desert Area population of the bald eagle, because the bald eagle is protected by many Federal laws and other regulatory mechanisms and our analysis of Factors A and E concluded that there are no significant threats to the population.

E. Other Natural or Manmade Factors Affecting Its Continued Existence

Demographic Factors

Three different demographic models have been completed for the bald eagle in Arizona; two of those models specifically analyzed only those bald eagles nesting in the Sonoran Desert Area of Arizona (Allison *et al.* 2008, pp. 26–38; Silver and Taylor 2008, pp. 17–25; and Millsap 2009, in prep.). The analysis associated with the first model estimated, based on resightings of eagles at breeding areas, that juvenile mortality increased substantially over the period of time between 1975 and 2007. If juvenile mortality is at the high levels estimated and it stays at those levels, the model estimated the probability of extinction for the Sonoran Desert Area population of the bald eagle in Arizona by 2075 at 69.5 percent. This analysis assumed that juvenile mortality would continue to occur unabated at that level and concluded that, should fish stocking on the Salt and Verde Rivers be decreased or the management efforts carried out under the ABENWP be discontinued, the probability of extinction would be even higher. However, if juvenile mortality could be reduced to the average mortality value of the entire period of study, the extinction risk would be reduced to four percent by 2075 (Silver and Taylor 2008, pp. 2, 25–26, 52–55).

In the Arizona-wide model, the AGFD conducted its own demographic analysis of the bald eagle in Arizona in 2008. This analysis incorporated data from all breeding areas in Arizona, including six that were located outside of the Sonoran Desert Area. The model developed by the AGFD concluded that—depending on the age at first reproduction, sex ratios, and the proportion of females that breed each year—future annual declines in breeding will likely range between 3.6 and 5.5 percent. This is consistent with a stable or declining population (Allison *et al.* 2008, p. ii). In the same analysis however, simple counts of bald eagles breeding in Arizona each year indicated that the breeding segment has been increasing at an average rate of 4.0 percent per year from 1987 to 2003 (Allison *et al.* 2008, p. 26). The discrepancies between the demographic model and the count-based estimates may reflect incorrect assumptions about newly discovered breeding areas, idiosyncrasies of their data, low estimates of survival, emigration, shifting age of first reproduction from an expanding population, or recruitment of breeders from unmarked populations. The AGFD concluded that their work did not determine whether or not the bald eagle population in Arizona, including the Sonoran Desert Area, was stable, but instead identified gaps in data that limit the ability to accurately predict population stability through demographic models (Allison *et al.* 2008, pp. ii, 30–31).

The Service reviewed the above-mentioned models conducted by the AGFD and Silver and Taylor (2008, pp. 17–26). A concern with these models is that both have led to estimates of the annual rate of population change (or replacement rate (λ)) that are less than 1.0, indicative of a declining population, whereas actual counts of occupied territories have increased almost annually since 1983 (Allison *et al.* 2008, p. 20). Although there are many factors that might contribute to this discrepancy, the Service believes the most likely factor is that juvenile and subadult bald eagle survival is underestimated. Underestimation of survival rates for nonbreeding age classes and cohorts of raptors in mark-recapture studies is common (Kenward *et al.* 2000, p. 277; Millsap and Allen 2006, p. 1396), and both Silver and Taylor (2008, p. 24) and Allison *et al.* (2008, pp. 14, 33) recognized this as a possible reason for the incongruence between model-based results and reality. This can bias results from the fact that most detections of marked bald eagles occur once birds settle on a territory and begin breeding. Bald eagles marked as nestlings do not typically settle on a territory for 4 years or longer, and probabilities of detection are confounded by potential for long-distance natal dispersal, rates of which may differ between the sexes. As evidence of the potential that this bias exists for the Arizona study, the juvenile and subadult annual survival rate for the selected model in Allison *et al.* (2008) was 73 percent. Annual survival estimates from studies employing radio or satellite telemetry, which do not have the same resighting bias for juvenile and subadult bald eagles, ranged from an average of 95 percent in Virginia (Buehler *et al.* 1991, pp. 610–611), to 85 percent (Wood and Collopy 1995, pp. 83–85) in one Florida study and 84 percent in another (Millsap *et al.* 2004, pp. 1025–1027).

The Service has concerns about using model results that are inconsistent with known historic population trajectories to evaluate extinction risk. However, we believe it is reasonable to conclude that biased juvenile and subadult survival rates are the main reason for the discrepancy, and a logical fix is to iteratively adjust these rates until the annual rate of population change reaches the observed value and then to evaluate extinction risk using models that incorporate these demographic estimates. Using the adjusted survival rates, in 2009 the Service developed a third model, which specifically analyzed the Sonoran Desert Area population of bald eagles in Arizona (Millsap 2009, in prep.). For the baseline model, productivity was set at 0.76, nonadult survival (*i.e.,* fledgling to age four) was set at 0.805, adult survival was set at 0.88, and the number of suitable breeding territories was set at 42. Under this scenario, none of the 100 iterations in the model resulted in extinction, and the annual rate of population change was equal to 1.02 (i.e., the population was growing at an annual rate of 2 percent) (Millsap 2009, in prep.).

Mortality rates of bald eagles in Arizona appear to be consistent with those reported for other populations of bald eagles. An average of 16 percent adult mortality was reported between 1987 and 1990 (5.25 breeding adults annually) (Hunt *et al.* 1992, p. A137) for bald eagles in Arizona. This mortality rate is within the range reported for other populations, which ranged from 5 to 17 percent (Allison *et al.* 2008, p. 25). Nestling mortality rates of 22.6 and 25 percent have been reported in Arizona (Driscoll *et al.* 1999, p. 222; Allison *et al.* 2008, p. 33). In mainland Sonora, over 20 years of monitoring, 14 nestlings died (26 percent) of the 54 nestlings known to have hatched (Driscoll and Mesta 2005, in prep.). These rates are higher than the 15 percent reported in rangewide studies (Stalmaster 1987, p. 143). However, the higher rate of mortality reported in Arizona may be in part attributable to more intensive monitoring and consequently better detection of mortalities through the ABENWP. Subadult survival in Arizona is generally lower than that reported elsewhere, but this should be considered apparent survival, since estimates may include losses due to emigration as well as mortality.

Two adult bald eagles and two nestlings were discovered dead below nests within the mainland Sonora population in 1988 and 1993 (Driscoll and Mesta 2005, in prep.). Both of these dead adults are likely the result of aggressive interactions with other bald eagles. The two nestlings found dead were located within the crop of one of the dead adult eagles. In Arizona, intruding eagles have killed nestlings and fought with breeding eagles (Hunt *et al.* 1992, p. A146), and a breeding eagle killed and ate its own nestling while still in the nest (Beatty *et al.* 1995, p. 21). While the existence of these intruding eagles identifies the presence of an important ''floating'' population, these aggressive interactions may be a result of all serviceable breeding areas being occupied, therefore necessitating ''stealing'' of a territory (Hunt *et al.* 1992, p. A146). As a result, with only a few territories known to be occupied by bald eagles in mainland Sonora, these incidents could be an indication that additional suitable territories are not available. However, due to the difficulty of surveying and monitoring bald eagle nest sites in Sonora, we are not certain that this type of conclusion can be supported at this time.

The Sonoran Desert Area population of the bald eagle in Arizona had a mean estimated productivity rate of 0.80 between 1987 and 2003. Four other populations documented by Allison *et al.* (2008, p. 31) had estimates of productivity equal to or lower than that reported here, while the remainder of the populations had higher rates. Exact comparisons of productivity reported between studies are difficult, as different methods were used to measure productivity, and these studies occurred over different time periods. Studies in Arizona were more intensive and, therefore, more likely to document mortality of nestlings and fledglings beyond 8 weeks of age. This resulted in lower productivity and nest success estimates than would be obtained under a conventional protocol (Allison *et al.* 2008, pp. 31–32).

In general, bald eagles in the Sonoran Desert Area of Arizona had lower fledgling success than bald eagles elsewhere, but this has not resulted in depressed productivity compared to other regions. The occupancy rate of known breeding areas in Arizona was about 90 percent, which is the same as that reported for Florida (Millsap *et al.* 2004, p. 1023). These high occupancy rates may indicate that the populations are large enough to saturate available breeding areas (Stalmaster 1987, p. 141). If this is the case, further growth of the breeding population would be limited by the lack of available nesting and foraging habitat. However, as mentioned above in the Factor A discussion, the known number of breeding areas within the Sonoran Desert Area has increased from a low of three in 1971 to a high of 52 in 2009, and the population has expanded into areas not previously occupied. This may indicate that the population has not yet reached the point of saturation. Allison *et al.* (2008, p. 32) noted that mechanisms such as habitat saturation, density dependence, or continuing external threats to productivity cannot be assumed at this point, and that low productivity levels by themselves should not be used to interpret the status of the species in Arizona. By themselves, productivity estimates are difficult to interpret, because low productivity in a population may indicate a population decline or, conversely, a recovered population.

Declining Prey Base

Appropriate prey resources are essential for the presence and distribution of bald eagle breeding areas, and similarly for the success of breeding attempts. Stalmaster (1987, p. 131) found that foraging areas are the most essential components of the habitat used by bald eagles, and they must provide an adequate amount of food in a fairly consistent fashion. He further noted that food may be abundant and nutritious, but if prey species are not accessible, they have no value to an eagle. Stalmaster (1987, pp. 170–171) noted that food must show a high level of continuity in its distribution, both in time and space, to have the maximum benefit. Eagles are able to fast for long periods; however, disruptions in prey abundance may cause excessive nestling mortality, increase susceptibility to disease, or reduce the general health of the bird.

Bald eagles rely on aquatic ecosystems as a source of a continuous and accessible supply of fish for survival and reproduction (Stalmaster 1987, pp. 159, 170–171). Dams can affect both the habitat and prey base of bald eagles by altering the flows of water and sediment in a stream (Service 2002, p. I8). River damming, regulation, and diversion can interrupt, reduce, or prevent the availability of fish to bald eagles. Conversely, dams can provide an additional source of food for bald eagles from fish that are killed in turbines, float downstream, and are scavenged (Stalmaster 1987, pp. 131, 159). As mentioned above under Factor A, reservoirs provide additional habitat diversity, especially in a desert ecosystem, and may create a more stable food source for bald eagles during the winter months due to congregations of waterfowl. The creation of reservoirs usually coincides with the introduction of exotic species of fish, some of which (*e.g.,* catfish, bass, carp) can deplete native fishes. However, these exotic species make up a large portion of bald eagle diets in the Sonoran Desert Area, both in Arizona and Sonora (Hunt *et al.* 1992, pp. A25–A26; Hunt *et al.* 2002, pp. 249–251).

Native fishes have been declining rapidly across the desert Southwest over the last century, and the desert aquatic environments in which they have evolved have been altered by various chemical, physical, and biological impacts. Within Arizona, populations of native fishes have been reduced by dam construction, altered flow regimes, loss of surface water, riparian vegetation degradation, and the introduction of various nonnative species. Introduction of nonnative fishes has had detrimental effects on native fishes through competition, hybridization, alteration of habitat, disease transfer, and predation (Bonar *et al.* 2004, p. 3; Minckley and Deacon 1991, pp. 15–17). As a result of competition and predation, nonnative fish have replaced native fish in many central Arizona rivers (Rinne and Minckley 1991, p. 40), and competition with nonnative fishes is now the most consequential factor preventing conservation and recovery of native fishes in the Southwest (Meffe 1985, pp. 184–185; Minckley and Deacon 1991, pp. 15–17; Marsh and Pacey 2005, p. 62).

Unlike bald eagles that rely primarily on dead and dying fish collected from the surface of lakes, bald eagles in the Sonoran Desert Area that forage primarily in free-flowing streams (and regulated stretches) rely upon capturing live fish (Hunt *et al.* 1992, p. A55). Hunt *et al.* (1992, p. A70) cited fish diversity as a crucial feature of suitable bald eagle breeding locations and native Sonoran and desert suckers as an important prey item in riverine systems. Other important fish species included exotic carp and channel catfish (Hunt *et al.* 1992, A26).

Various fish species become available to bald eagles as prey in different ways and at different times. Live fish become vulnerable to attack when they enter shallow water or swim near the surface. Within the Sonoran Desert Area, the most vulnerable species in shallow water are the bottom-feeders (e.g., Sonora sucker, desert sucker, carp, channel catfish, flathead catfish) because of their downward visual orientation (Hunt *et al.* 1992, p. A44). Species that spawn in shallow water such as carp and suckers are especially vulnerable. Of the 134 depth measurements at strike points where Sonoran Desert Area bald eagles captured fish, 70 (52 percent) were in water 20 cm (7.9 in) or less in depth, and 92 percent were in water less than 100 cm (39.4 in) deep (Hunt *et al.* 1992, p. A55).

Bald eagles in the Sonoran Desert Area are able to successfully exploit a wide range of prey including nonnative fish, but there is a specific sequence in the timing of prey availability such that one species rarely dominates the diet of an eagle pair throughout an entire breeding season. Pulses of increased prey availability occur throughout the breeding season. This diversity of their foraging suggests that threshold levels of prey, as well as habitat variation, may be requisite to nest site selection and nestling success (Hunt e*t al.* 1992, p. A70).

Within the sequencing of increased prey availability to bald eagles nesting in riparian environments within the Sonoran Desert Area, native Sonoran and desert suckers seem to be important, not only for how they become available but also for when they become available. Suckers often spawn in riffles, the shallowest of the riverine habitats, and may be consistently exposed to attack at this stage of their life cycle (Minckley 1973, pp. 162, 169; Hunt *et al.* 1992, p. A57). Water temperature is the catalyst for fish spawning and, therefore, also causes differences in timing of fish availability within breeding areas. For example, the fact that suckers spawn early and carp (and catfish) spawn later in the eagles' breeding season may be of considerable advantage to nesting pairs of eagles. When both species are common, the result may be a prolonged availability of food for eagles (Hunt *et al.* 1992, p. A70). Suckers are the first of essential species to become most available to eagles while they are incubating eggs or feeding small young. The movement of carp into shallow water to forage generally occurs seasonally after suckers have finished spawning (Hunt *et al.* 1992, p. A70). Because an eagle's foraging time is reduced due to the necessity of incubation or the care of newly hatched nestlings unable to regulate their own body temperature, the sucker's place in the sequencing of available prey may be of added importance for successful reproduction for eagles relying on free-flowing and regulated streams. Additionally, there are no other fish species used by bald eagles within the Sonoran Desert Area along rivers that have the same spawning schedule and accessibility to nesting eagles.

In the mid-1990s, an increase in nesting failure of previously successful bald eagle breeding areas along the free-flowing upper Salt River led to an examination of fish species diversity along this portion of the river. The introduction of predatory flathead catfish in the late 1970s nearly extirpated native fish populations, including previously abundant suckers. Flathead catfish, while available as bald eagle prey when smaller, grow to large sizes (up to 50 pounds), making them too large to be of use as prey. Large flathead catfish have also been observed preying upon smaller flathead catfish. The situation on the Salt River allowed observation of how the absence (or significant reduction) of a previously abundant prey species disrupted the temporal sequencing of prey availability and may have affected bald eagle productivity. The productivity of breeding areas along the upper Salt River decreased from the 1980s to the 1990s, and an increase in predatory catfish may have contributed to this decline (Driscoll *et al.* 2006, p. 19).

A similar trend in productivity (e.g. decline from the 1980s to the 1990s) was observed in the entire Sonoran Desert Area population of bald eagles during this time period, and it is possible that other factors may have contributed to the decline observed in the upper Salt River breeding areas. However, low productivity continues to occur in the upper Salt River breeding areas, while productivity has increased in other portions of the Sonoran Desert Area. Overall, productivity of bald eagles within the Sonoran Desert Area, even with the reductions observed in the upper Salt River, is consistent with that observed in other areas of the species' range (Driscoll *et al.* 2006, p. 5). It is possible that changes in fish populations (among other manmade impacts to streams) may be affecting the likelihood of expansion of bald eagles into currently unoccupied sections of other Sonoran Desert Area rivers.

On the free-flowing middle Verde River between Camp Verde and Horseshoe Lake, two previously productive bald eagle breeding areas are now observed to fail with consistency. For the first 39 years of their existence up to 1999, they were successful a combined 26 times. Since 2000, in a combined 18 nest years, they were successful only once (Driscoll *et al.* 2006, pp. 35–36, 48–50; AGFD 2007, pp. 33–34; AGFD 2008a, pp. 38–39). However, during the same time period, two other breeding areas located on this section of the Verde River have been successful a combined 14 times. Investigations into the distribution, abundance, and proportion of native and nonnative fish species along this length of the Verde River found native species the least abundant and nonnative the most abundant in this section of the Verde River. The conclusion for this distribution was that the low densities of native fish may be caused by continual predation since the early 1900s (Bonar *et al.* 2004, p. 3). Hunt *et al.* (1992, p. A46) also concluded that the rarity of suckers in river sections upstream of the reservoirs is also partially a result of sucker populations being overwhelmed by large numbers of carp and catfish from the reservoirs. Other predatory exotic fish, like smallmouth bass, may also contribute to the predation of native fish in this section of the Verde River.

It is informative to observe where bald eagles have established breeding areas and whether there is any relationship between those locations and the locations where impacts to prey resources may have already occurred prior to the modern day monitoring of bald eagle territories. For example, as discussed above, the majority of bald eagle productivity in the Sonoran Desert Area, exclusive of Sonora, is tied to breeding areas along the Salt and Verde Rivers. The Gila River and Lower Colorado River within the Sonoran Desert Area both provide miles of river with similar attributes to the Salt and Verde Rivers (e.g., presence of large-bodied fishes, cliffs and large trees for nesting, perennial flow, and existing bald eagle breeding areas). Five productive bald eagle breeding areas exist along or adjacent to these waterways. However, unlike the Salt and Verde Rivers, where eagles exist upstream and downstream of reservoirs, no bald eagle breeding areas are solely associated with the regulated mainstem Colorado River or the free-flowing Gila River above San Carlos Lake within the Sonoran Desert Area. All of their foraging areas are primarily associated with reservoirs (San Carlos Lake, Talkalai Lake, and Copper Basin/Gene Wash Reservoir). While two breeding areas were established along the regulated Gila River below Coolidge Dam at San Carlos Lake since the mid- to late-1990s, these pairs have never been successful (and only laid eggs five times) in their 23 combined nest years. These observed patterns and lack of success along the free-flowing and regulated sections of the Gila and Colorado Rivers within the Sonoran Desert Area are indicative that conditions are not conducive to successful nesting, and, based upon similar patterns observed along the upper Salt and Verde Rivers, lack of prey diversity may be a contributing factor.

Similar to bald eagles in the Sonoran Desert Area of Arizona, fish species eaten by nesting eagles in Mexico are a combination of nonnative and native fishes. Identified fish found in prey remains collected from nests were nonnative channel catfish, carpsucker (*Carpiodes carpio*), carp, tilapia (Tilapia sp.), largemouth bass, and native Yaqui catfish (*Ictalurus pricei*) and Yaqui sucker (*Catostomus bernardini*) (Driscoll and Mesta 2005, in prep.). Nonnative species, such as bullfrogs and sport and bait fish, have been introduced throughout Mexico, and continue to disperse naturally, broadening their distributions (Conant 1974, pp. 487–489; Miller *et al.* 2005, pp. 60–61; Luja and Rodriguez-Estrella 2008, pp. 17–22). The damming and regulation of Mexican rivers and the addition of nonnative fishes are expected, over time, to continue to provide conditions favorable to nonnative fish and declines in native fish (Unmack and Fagan 2004, p. 233).

Minckley and Miller (in Miller *et al.* 2005, p. 61) noted that Mexico's critical need for domestic, irrigation, and industrial water supplies and electrical power are being met through the impoundment of both major and minor rivers. They conclude that dams have remarkably harmful effects on riverine systems and native fishes, and that they result in the establishment of nonnative fishes, which is considered the single greatest challenge to survival of native fish species. Unmack and Fagan (2004, p. 233) noted that the current status of nonnative fishes in the Yaqui Basin is remarkably similar to what was evident from the Gila Basin in Arizona and that, without strong action, the native fish of the Yaqui Basin will become increasingly imperiled over the next several years. While nesting bald eagles can take advantage of the variety of fishes along rivers, including introduced catfish and carp (Hunt *et al.* 1992, pp. Aii, Aiii), it is unclear to what extent nonnative fishes may be affecting the reproductive success of bald eagles in Mexico.

The ''Conservation Assessment and Strategy for the Bald Eagle in Arizona'' identifies the need to concentrate efforts on restoring native fish populations and fish diversity to stabilize bald eagle productivity and enhanced survival (Driscoll *et al.* 2006, pp. 51–53). However, efforts to accomplish increased fish diversity along regulated and free-flowing streams within the Sonoran Desert Area are difficult, complex, and require considerable funding, time, and public support. Even then, there is uncertainty over their success. For example, stocking of Colorado pikeminnow and razorback suckers has occurred within the Sonoran Desert Area on the Verde, Salt, Gila, and lower Colorado Rivers with little to no success. The Service is not aware of any management actions designed to improve the diversity of native Sonoran or desert suckers along the mainstem of these rivers within the Sonoran Desert Area, whereas sportfish stocking of nonnative species such as catfish and largemouth bass continue to be widespread in Arizona.

There is little evidence to suggest that without active management the balance of native and nonnative fish will be maintained or improved. At present, nonnative fish stocking continues with stocking schedules posted online, including schedules for stocking of the Salt and Verde Rivers. Each year, the AGFD stocks more than three million fish—including rainbow, Apache, brook, and cutthroat trout; largemouth bass; and channel catfish—in approximately 160 of Arizona's lakes, rivers, and streams (AGFD 2009b, p. 1). The stocking program is supported with Federal funds through the Federal Aid in Sport Fish Restoration Program, along with State funds from the sale of licenses and trout stamps. The Service is undergoing consultation in coordination with AGFD on the proposed stocking program for the next 10 years. The consultation will include an assessment of anticipated impacts of stocking of nonnative fish and their impacts on prey diversity for bald eagles into the future.

Based upon continued sportfish stocking, we anticipate continued increases in nonnative fish and reduced abundance and distribution of native fish on central Arizona rivers and reservoirs within the Sonoran Desert Area. Regarding recovery of native fishes in the southwestern United States, Clarkson *et al.* (2005, pp. 20, 23) noted, ''no amount of habitat restoration can successfully advance biological recovery unless preceded or accompanied by elimination of nonnatives.'' They further noted that nonnative species already occupy reservoirs and the few natural lakes in the Southwest, and that it is impractical to eliminate these fishes from lake habitats. They noted that medium and small warm-water streams and stream systems may be suitable for recovery of native fishes. However, for the most part, these are not the streams that support bald eagles. For those pairs relying on prey from regulated or free-flowing streams, the loss of fish diversity may be causing negative effects to reproduction at the localized level.

Despite this apparently continuing decrease in fish diversity, the best available information suggests that the scope and intensity of the effect this decrease in diversity is having or will have on the Sonoran Desert Area population of the bald eagle does not appear to be sufficient to result in population-level effects. While previously successful breeding areas located on the middle Verde River and upper Salt River have declined in productivity in recent years, these breeding areas continue to be occupied, and young are occasionally produced; new breeding areas and other non-riverine sites are producing eagles; and overall productivity rates within the Sonoran Desert Area are within the range of rates observed in other bald eagle populations. Therefore, after a review of the best available commercial and scientific information, we conclude that a declining prey base does not constitute a significant threat to the Sonoran Desert Area population of the bald eagle at the population level.

Contaminants, Pollutants, and Eggshell Thinning

As a barometer of environmental health at the top of the food chain, bald eagles are susceptible to impacts from contaminants that can accumulate in the bodies of fish (Newton 1979, pp. 230–231) and pollutants that can affect prey (Newton 197, p. 259). Water pollution was identified in a list of threats to aquatic biota in Mexico by Miller *et al.* (2005, pp. 60–61), and, clearly, contaminants such as organochlorides (*e.g.,* Dichlorodiphenyldichloroethylene (DDE), Dichlorodiphenyltrichloroethane (DDT)) and heavy metals (e.g., mercury, lead) continue to be threats to bald eagles. These contaminants can typically be associated with agriculture, urbanization, mining, and other resource uses (Newton 1979, pp. 230, 254–255). Similarly, pollution that kills or reduces fish populations directly affects the abundance, diversity, or availability of food needed for bald eagle reproduction.

The AGFD and the Service analyzed 27 addled bald eagle eggs in Arizona from 1994 to 2004 that showed mercury levels ranging from 0.55 to 8.02 parts per million (ppm). Of these eggs, 10 were classified as toxic (exceeding 2.0 ppm), 11 had elevated levels (1.5 to 2.0 ppm), and four had lesser concentrations (1.0 to 1.5 ppm). The 10 eggs classified as toxic came from breeding areas located on the Salt, Verde, and Gila Rivers and Tonto Creek (Driscoll *et al.* 2006, p. 21). While eggs tested for mercury were addled and did not produce young, successful production of young has occurred at all of these breeding areas following the year or years in which mercury was detected (viable eggs are not collected and tested for mercury). For example, a breeding area located on Tonto Creek had the highest ever recorded mercury level for eggs from Arizona in 1995, but the pair successfully produced young in 1996 through 2001, 2007, and 2008. Assuming mercury was the cause of nest failure, these data indicate that high levels of mercury in eggs at a given nest site may cause nest failure for one season, but future reproduction may not be affected.

Lead poisoning is an additional stressor for breeding areas within the Sonoran Desert Area. Lead poisoning in bald eagles has been linked to ingestion of lead gunshot, consumption of lead sinkers, and secondary consumption of lead-contaminated prey. Research indicates that toxic liver lead levels for bald eagles rangewide is somewhere between 6.0 and 10.0 ppm (Pattee *et al.* 1981, pp. 808–809; Driscoll *et al.* 2006, p. 20). From 1998 to 2004, 22 bald eagles (or 39 percent of all documented mortalities rangewide) had liver lead levels averaging 32.9 ppm and ranging from 0 to 9 times the toxic threshold. Only one of the eagles confirmed to have lead poisoning was fledged from a nest in Arizona. Because bald eagles travel large distances, the ingestion of lead could occur in any area along their migration, making it difficult to determine the source of the poisoning (Driscoll *et al.* 2006, pp. 20–21).

Organochlorides continue to be detected in bald eagle eggs within the Sonoran Desert Area, with a recent measurement of DDE at 4.23 ppm wet weight in one egg from a breeding area on the lower Verde River in 2002. A reduction in productivity is known to occur when DDE values in bald eagle eggs are between 3 and 5 ppm (wet weight) (Wiemeyer *et al.* 1984, p. 541). This level has been reached in eggs collected from three breeding areas along the Verde River and one located on Tonto Creek. The most complete DDE data set over time is from a breeding area located on the upper Verde River, where DDE concentrations declined from 3.2 ppm in 1994 to 0.91 ppm in 2001. Following DDE levels of 3.20 ppm (wet weight), this breeding area produced young in 1996 through 2003, and 2005 through 2007. At another breeding area located on the upper Salt River, young have been produced since DDE levels of 4.17 ppm (wet weight) were found in 2001. At one breeding area located on the lower Verde River, DDE levels of 7.00 ppm (wet weight) were detected from an egg collected in 1997, but the breeding area produced young in 1998, 1999, and 2001 through 2008. Similarly, another breeding area in the same area, with DDE levels of 4.23 ppm in 2002, produced young in 2004 and 2006 through 2008 (Driscoll *et al.* 2006, p. 22).

DDT is known to cause eggshell thinning. For bald eagles, eggshell thinning greater than 10 percent can cause difficulties in reproduction (Wiemeyer *et al.* 1984, p. 543). The AGFD found five separate occasions on which eggshell thinning in Arizona equaled or exceeded 10 percent between 1993 and 2004 (Driscoll *et al.* 2006, p. 23). However, the AGFD concluded that other factors may have a greater influence on productivity than DDT, but that egg collection and eggshell measurements will continue to ensure that the effects of DDT and other organochlorides are monitored. The Service agrees with this conclusion, and believes that eggshell thinning warrants further study and monitoring; however, at this time, the Service is not aware of any data to indicate eggshell thinning at the levels cited is resulting in lost reproduction.

In mainland Sonora, bald eagle eggs collected in the late 1980s were analyzed for metabolized DDE. Organochloride levels were well below concentrations that reduce productivity, and eggshell thickness was near pre-DDT levels (Driscoll and Mesta 2005, in prep.). In addition to pesticides, other contaminants may be in use near bald eagle breeding areas in mainland Sonora. Gold mines are located sporadically along the Rio Yaqui. Many of the mines are old and inoperable, but some have been reopened, with strychnine used to leach gold from the ore. These mines are often adjacent to the rivers in arroyos where runoff could lead to stream contamination (Driscoll and Mesta 2005, in prep.). Based upon increasing human populations and proximity of agriculture and mining to rivers where eagles nest or could nest in the future, the current and future impacts of contaminants and pollution on bald eagle health and reproduction in Mexico are unknown.

In addition to monitoring bald eagle eggs, the Service has been evaluating the effects of mercury, organochlorides, and other pesticides for many years. The AGFD and the Service have developed a protocol for identifying, documenting, and processing all bald eagle carcasses found in Arizona, which will allow for the continued monitoring of mortality factors, including lead poisoning and other contaminants.

Based on the above information, contaminants, pollutants, and eggshell thinning have likely resulted in historical and continued impacts to the reproductive success of bald eagles in the Sonoran Desert Area. Specifically, organochlorides and mercury have been detected within the Sonoran Desert Area at levels that are known to affect productivity, but all of the affected breeding areas have continued to produce young. Many of these are among the most productive breeding areas located within the Sonoran Desert Area. Bald eagles in the Sonoran Desert Area are potentially exposed to contaminants and pollutants throughout their range. However, the impact from these threats has been of low magnitude, and does not persist for long periods of time. The best scientific information suggests that contaminants, pollutants, and eggshell thinning do not constitute a significant threat to the Sonoran Desert Area population of the bald eagle at the population level.

Fishing Line and Tackle

Fishing line and tackle have been found in bald eagle nests, and have entangled bald eagles within the Sonoran Desert Area of Arizona. In response to this problem, the AGFD developed a monofilament recovery program in 2002. Although this program is voluntary, it has helped to educate anglers and reduce the amount of improperly disposed monofilament. Fishing line entanglement is most frequent on the lower Verde River (19 percent of occurrences), the upper Salt River (17 percent of occurrences), and Alamo Lake (14 percent of occurrences) (Driscoll *et al.* 2006, p. 18). Bald eagles encounter fishing line primarily by catching dead or dying fish with fishing line or tackle still attached, and they may also collect it for use as nest material (Hunt *et al.* 1992, p. A135; AGFD 1998, p. 5). For probable causes of mortality in bald eagles in Arizona between 1987 and 2005, monofilament was the cause of one adult mortality and two nesting mortalities (Driscoll *et al.* 2006, pp. 17–18). It was ranked as the fifteenth most common cause of mortality, and responsible for 3 out of 281 deaths, or approximately 1.1 percent (Driscoll *et al.* 2006, p. 25). Although monofilament has been shown to affect bald eagles within the Sonoran Desert Area of Arizona, it represents a minor threat, because the magnitude of the effects to the bald eagle is small (*i.e.,* representing 1.1 percent of known mortality). We attribute the limited effect that monofilament is having on bald eagles within the Sonoran Desert Area of Arizona to the active management of the ABENWP, which we anticipate will continue. Additionally, wildlife personnel entering nests to conduct annual banding are instrumental in removing large quantities of monofilament (Driscoll *et al.* 2006, p. 11).

Climate Change

Our analyses under the Endangered Species Act include consideration of ongoing and projected changes in climate. The terms ''climate'' and ''climate change'' are defined by the Intergovernmental Panel on Climate Change (IPCC). ''Climate'' refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term ''climate change'' thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (*e.g.,* habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

Seager *et al.* (2007, pp. 1181–1184) analyzed 19 computer models that used many different variables to estimate the future climatology of the Southwestern United States and northern Mexico in response to predictions of climatic patterns. All but one of the 19 models predicted a drying trend within the Southwest; one predicted a trend toward a wetter climate. Researchers created 49 projections using 19 models, and all but 3 predicted a shift to increasing aridity (dryness) in the Southwest as early as 2021–2040. Recently published projections of potential reductions in natural flow on the Colorado River Basin by the mid-21st century range from approximately 43 percent by Hoerling and Eischeid (2007, p. 35) to approximately six percent by Christensen and Lettenmaier (2006, pp. 3727–3729). The U.S. Climate Change Science Program (CCSP), in a recent report on climate change, concluded for the Southwest that ''subtropical aridity is likely to intensify and persist due to future greenhouse warming'' (CCSP 2008, p. 2).

The anticipated effects from climate change in the Southwest can be separated into three general predictions. First, climate change is expected to shorten periods of snowpack accumulation, as well as lessen snowpack levels. With gradually increasing temperatures and reduced snowpack (due to higher spring temperatures and reduced winter-spring precipitation), annual runoff will be reduced (Smith *et al.* 2003, p. 226; Garfin 2005, p. 42), consequently reducing groundwater recharge. Second, snowmelt is expected to occur earlier in the calendar year, because increased minimum winter and spring temperatures could melt snowpacks sooner, causing peak water flows to occur much sooner than the historical spring and summer peak flows (Smith *et al.* 2003, p. 226; Stewart *et al.* 2004, pp. 217–218, 224, 230; Garfin 2005, p. 41) and reducing flows later in the season. Third, the hydrologic cycle is expected to become more dynamic on average, with climate models predicting increases in the variability and intensity of rainfall events. This will modify disturbance regimes by changing the magnitude and frequency of floods.

Climate change will likely cause an increase in river temperatures in drier climates. This will in turn result in periods of prolonged low flows and stream drying and an increased demand for water storage and conveyance systems (Rahel and Olden 2008, pp. 521–522, 526). Warmer water temperatures across temperate regions are predicted to expand the distribution of existing aquatic nonnative species by providing more suitable habitat. These species are often tropical in origin and adaptable to warmer water temperatures. This conclusion is based upon studies that compared the thermal tolerances of 57 fish species with predictions made from climate models (Mohseni *et al.* 2003, p. 389).

We are uncertain about the magnitude of the threat posed by climate change, because we do not currently understand all potential impacts of climate change on bald eagles or the human population. However, based on the best information available, we conclude that climate change is not a significant threat, because the extent to which the bald eagle will respond to climate change is unclear. We have to date not detected climate change-related impacts to the Sonoran Desert Area population of the bald eagle; moreover, bald eagles in the Sonoran Desert Area, and elsewhere within their range, have been shown to be highly adaptable (e.g., feed on a variety of prey, nest in many types of structures, breed in a variety of habitats throughout their range). This life-history trait contributes to the ability of the Sonoran Desert Area population of the bald eagle to continue to exist even under some of the possible effects from climate change.

Human Disturbance

Small planes and helicopters are the most common human activities in bald eagle breeding areas in Arizona (Driscoll *et al.* 2006, p. 18). From 1998 to 2005, low-flying aircraft were responsible for 37.1 percent (n = 23,905) of all human activities and 25.3 percent (n = 1,273) of the significant responses (*e.g.,* restless, flushed, and left the area) by a breeding pair. For the period from 1998 to 2005, significant responses to low-flying aircraft ranged from 10.6 percent to 44.1 percent of all significant responses by a breeding pair. The potential impacts from an eagle responding to low-flying aircraft include the inadvertent cracking of an egg as a result of flushing an incubating adult or premature fledging. Driscoll *et al.* (2006, p. 18) concluded that, while no direct link of a nest failure to low-flying private aircraft has occurred, this activity will increase with the demand for tourism flights, especially in remote breeding areas. In addition to private aircraft, many Sonoran Desert Area breeding areas are located near military training routes used by the Department of Defense. The Salt River Pima-Maricopa Indian Community is also concerned with military helicopter flights disturbing nesting bald eagles. While high-speed aircraft may not disturb bald eagles when an appropriate buffer distance is maintained, noise disturbance and sonic booms can cause a reaction (Ellis *et al.* 1991, p. 53; Grubb *et al.* 1997, pp. 216–217).

Driscoll *et al.* (1999, p. 220) noted that, of 24 eggs (in 13 clutches) for which we knew the cause of mortality, 11 involved human disturbance (over a 7-year period). The ABENWP has recorded a three-fold increase in the average number of human activities that occur within 1 km (0.6 miles) of all monitored bald eagle breeding areas in the last 16 years (Driscoll *et al.* 2006, p. 16). Anticipated human population growth, as described above, will lead to an increased demand in water-based recreation in areas currently supporting breeding areas. Monitoring and seasonal closures by the ABENWP around some breeding areas help to minimize these impacts. However, not all breeding areas are covered by these measures. In addition, disturbance from recreational activities may affect the ability of bald eagles to forage, as adults need foraging areas without constant human disturbance in order to capture prey.

Recreation outside of nesting areas may limit foraging opportunities and affect adult, nestling, and juvenile survival, as well as egg production (Driscoll *et al.* 2006, p. 17). It is anticipated that increasing recreational pressures will continue to occur on the lower Gila River, San Carlos River, Salt River, Verde River, Tonto Creek, Alamo Lake, and Lake Pleasant. The ''Conservation Assessment and Strategy for Bald eagles in Arizona'' identified 'human activity' as a management challenge for 36 of 45 breeding areas (or 80 percent) located within the Sonoran Desert Area at that time (Driscoll *et al.* 2006, pp. 51–53). However, human activity within close proximity to nests does not in itself necessarily result in negative effects to the productivity of a bald eagle breeding area.

As an example of the ability of the bald eagle to adapt to human activity, a 5-year study in Florida of rural (< 5 percent intensive human use within 1,500 meters) and suburban (> 50 percent intensive human use within 1,500 meters) bald eagle nests did not detect a significant difference between the two groups in occupancy rates or productivity. These results suggest that bald eagles in their study area may have adapted to, or at least tolerated, increasing human populations and disturbance (Millsap *et al* 2004, p. 1023). However, the authors caution that their results merely point out that some eagles can successfully coexist with intensive human activity, but this should not be interpreted to mean that all eagles can. Within the Sonoran Desert Area of Arizona, the bald eagle breeding areas located in closest proximity to the Phoenix metropolitan area on the lower Verde and Salt Rivers are also some of the most productive (Allison *et al.* 2008, pp. 17–18). Therefore, we conclude that human disturbance is not a significant threat to the Sonoran Desert bald eagle population.

Summary of Factor E

We evaluated a number of other factors that could affect the continued existence of the Sonoran Desert Area population of the bald eagle: Demographic factors; declining prey base; contaminants, pollutants, and eggshell thinning; fishing line and tackle; climate change; and human disturbance. After analyzing the best available information regarding these potential threats and the data regarding how eagles have responded to these factors, we concluded that none of them poses a significant threat to the Sonoran Desert Area bald eagle at a population level.

Three models have been completed that analyzed the future risk of extinction to the Sonoran Desert Area population of the bald eagle taking into consideration a number of demographic variables. The results of the model that best matched observed population trajectories—because it used an adjusted survival rate for juvenile and subadult eagles—suggest that the Sonoran Desert Area population of the bald eagle is not at a risk of extinction in the future. In addition, observed mortality rates, productivity, and survival rates for bald eagles within the Sonoran Desert Area are all within the range of observed values for other bald eagle populations throughout the United States.

The availability of an adequate and accessible supply of prey is essential to the success of breeding bald eagles in the Sonoran Desert Area. The presence of reservoirs, dams, or regulated rivers does not appear to have had a negative impact on bald eagle reproduction, and may be providing a more stable food source for bald eagles than would otherwise be available in the Sonoran Desert ecosystem. Native fish populations have been declining in the Sonoran Desert Area of Arizona due to the introduction of nonnative fish and alterations to their habitat. Declining populations of native fish along portions of the Salt and Verde Rivers may be a factor contributing to a localized reduction in productivity for pairs of bald eagles nesting in these areas. However, bald eagles are capable of exploiting a wide range of prey species, and nonnative fishes make up a large portion of their diet within the Sonoran Desert Area.

Several breeding areas within the Sonoran Desert Area have experienced high levels of mercury or organochlorides. The productivity of pairs at those breeding areas indicates that, while nest failure may occur when those levels are detected, young continue to be produced in subsequent years. Several bald eagles have died of lead poisoning while in Arizona, but only one of these eagles is known to have fledged from a nest in Arizona. The long distance traveled by migrating eagles could mean that the ingestion of lead is occurring outside of Arizona. The protocol developed by AGFD and the Service for identifying, documenting, and processing bald eagle carcasses will allow for the continued monitoring of mortality factors, including lead poisoning and other contaminants. Based on the best available information, the Service concludes that the effects of contaminants should continue to be monitored, but they are currently not a significant threat to the Sonoran Desert Area population of the bald eagle.

Fishing line and tackle have been found in bald eagle nests, and have entangled bald eagles within the Sonoran Desert Area of Arizona. However, fishing line is ranked as the fifteenth most common cause of mortality, responsible for only 1.1 percent of known mortalities. Our review of the best available information indicates that fishing line is not a significant threat to the Sonoran Desert Area population of the bald eagle.

Bald eagles in the Sonoran Desert Area depend on aquatic ecosystems for survival, and those aquatic ecosystems are predicted to be at risk due to drying under climate change scenarios. Potential drought associated with changing climatic patterns may adversely affect streams, rivers, and reservoirs—not only reducing water characteristics and availability, but also altering food availability. These changes may in turn exacerbate existing threats to bald eagles and their habitat in the Sonoran Desert Area. However, to date no impacts to bald eagles from climate change have been recorded, and it is unclear whether the bald eagle will adapt to these changes or respond at a population level.

Human disturbance to nesting and foraging bald eagles from small planes, helicopters, military aircraft, and recreational activities has occurred in the past, is occurring now, and will likely continue to occur within the Sonoran Desert Area. The activities of the ABENWP and seasonal closures of breeding areas have helped to mitigate this impact at the local level, and will continue to be implemented into the future. As stated above, there has not been any indication that human disturbance has led to the failure of bald eagle breeding attempts, or to population-level effects.

After reviewing the best available commercial and scientific information, based on our analysis above, we conclude that demographic factors; a declining prey base; contaminants, pollutants, and eggshell thinning; fishing line and tackle; climate change; and human disturbance are not significantly contributing to the risk of extinction of the Sonoran Desert Area population of the bald eagle at the population level.

Finding

In making this finding, as directed by the court, we used the information contained in our 2010 administrative record which included information provided by the petitioners, as well as other information in our files, and otherwise available. The information we reviewed included information submitted by the public and the Tribes, and available published and unpublished scientific and commercial information. Additionally, we had information from Federal, State, and Tribal land managers, along with recognized experts in conservation and bald eagle biology. This 12-month finding reflects and incorporates information from our 2010 administrative record that we received from the public and through consultation, literature research, and field visits. Based on the rationale detailed above, we find that bald eagle population in the Sonoran Desert Area is discrete from other bald eagle populations, but is not significant to the bald eagle as a whole, and therefore is not a valid DPS, pursuant to the DPS Policy (61 FR 4722).

Next, we reviewed our 2010 administrative record regarding the past, present, and future threats faced by the Sonoran Desert Area population of the bald eagle. This status review identified threats to the Sonoran Desert Area population of the bald eagle under Factors A and E. The primary threats to the Sonoran Desert Area population of the bald eagle—the activities that the population has responded to most significantly—are from the degradation and loss of riparian habitat and the loss of surface flows from groundwater pumping and surface water diversions (Factor A). In the Sonoran Desert Area, bald eagle breeding areas are located in close proximity to a variety of aquatic sites, including reservoirs, regulated river systems, and free-flowing rivers and creeks. The essential components of these sites for bald eagles are the availability of trees for roosting, perching, hunting, and nesting, and access to prey, primarily fish. The decline of riparian habitat stems specifically from direct loss from development and indirect impacts from the loss of surface flows.

With respect to each kind of threat, the best available information has confirmed a response to the threat, such as a decrease in breeding rates or survival rates. However, the potential for population-level impacts to bald eagles throughout their range—including in the Sonoran Desert Area—from the degradation or loss of riparian habitat and the loss of surface flows from groundwater pumping and surface water diversions has been reduced by the regulatory mechanisms in place within the United States and locally, the strong ability of bald eagles to adapt to changes in their environment, the widespread distribution of bald eagles along rivers within the Sonoran Desert Area, and the availability of reservoirs. Additional potential threats to the Sonoran Desert Area population of the bald eagle include demographic factors; declining prey base; contaminants, pollutants, and eggshell thinning; fishing line and tackle; climate change; and human disturbance. However, based on the best available information none of these poses a significant threat at a population level.

We must also evaluate whether these combined potential threats present a significant threat to the Sonoran Desert Area bald eagle population. If these threats were acting, either independently or cumulatively, in such a manner as to likely cause a significant risk of extinction to the population, we would expect to see them expressed in terms of the demographic factors that we reported in our analysis. In fact, all of the rates (e.g., mortality, survival, productivity, and occupancy) associated with the demographic factors for the Sonoran Desert Area population of the bald eagle were within the range of values observed in other populations of the bald eagle in the United States. More importantly, simple counts of bald eagles breeding in Arizona each year indicated that the breeding segment increased at an average rate of 4.0 percent per year from 1987 to 2003 (Allison *et al.* 2008, p. 26). Therefore, although the threats described above vary in their scope and intensity, the Service considers the overall threat to the Sonoran Desert Area population of the bald eagle from these factors to be low.

On the basis of the best scientific and commercial data available, we find that listing the Sonoran Desert Area population of the bald eagle as threatened or endangered is not warranted. We arrive at this determination because, despite the presence of these same threats for decades, the Sonoran Desert Area population of the bald eagle remains stable or increasing. In our analysis, we have indicated that some of the threats are likely to increase in the future. However, we do not have any information to suggest that these are significant threats or threats that could cause the Sonoran Desert Area population of the bald eagle to be in danger of extinction, or likely to become so in the foreseeable future.

We encourage interested parties to continue to gather data that will assist with the conservation of the species. If you wish to provide information regarding the bald eagle, you may submit your information or materials to the Field Supervisor, Arizona Ecological Services Office (see **ADDRESSES** section above). The Service continues to strongly support the cooperative conservation of the Sonoran Desert Area bald eagle.

References Cited

A complete list of all references cited herein is available at *http://www.regulations.gov* at Docket No. FWS–R2–ES–2008–0059, upon request, from the Southwest Regional Office of the U.S. Fish and Wildlife Service (see **ADDRESSES** section above).

Author

The primary authors of this notice are the staff of the Southwest Region of the U.S. Fish and Wildlife Service.

Authority

The authority for this section is section 4 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Dated: April 17, 2012.

Daniel M. Ashe,

Director, Fish and Wildlife Service.

[FR Doc. 2012–10016 Filed 4–30–12; 8:45 am]

BILLING CODE 4310–55–P